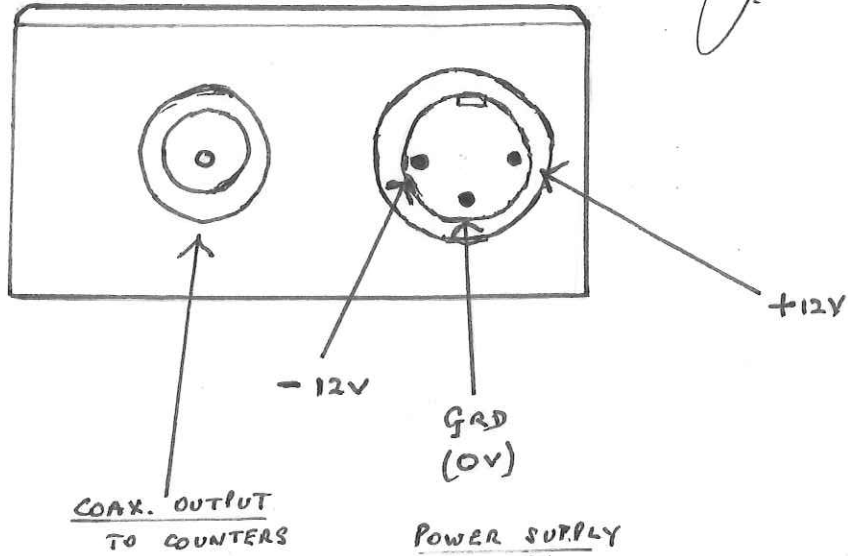


AMPLIFIER / DISCRIMINATOR MODULE

Received from  
Watson 1988 Feb. 20.  
£25.  
=



POWER SUPPLY  
3 pin latching  
DIN SOCKET.  
(130 mA).

INPUT COAXIAL SHOULD  
BE NOT LONGER THAN  
6 INCHES  
FROM P.M.T

DISCRIMINATOR : TURNING SCREW  
CLOCKWISE INCREASES  
DISCRIMINATION VOLTAGE.  
(SET AT 150 mV on TEST)



# 4-Phase Unipolar Stepper Motor Drive Board 332-098

### Technical specification:

Size standard Euro card 168 x 100 x 15  
 Mating edge connector standard 32-way DIN 41612 socket e.g. RS 471-503 or 467-453  
 Supply (board and motor) 15-30V d.c. +10% max. unregulated smoothed

### Current consumption:

a) board only 60mA  
 b) motor windings dependent on motor used-up to 2A/phase max.

On-board auxiliary output 12V d.c. 50mA max. regulated

Switching logic control inputs Level '0' 0V } CMOS and open collector T.T.L. compatible

Level '1' 12V }  
 Level '1' full step  
 Level '0' half step

a) full/half step

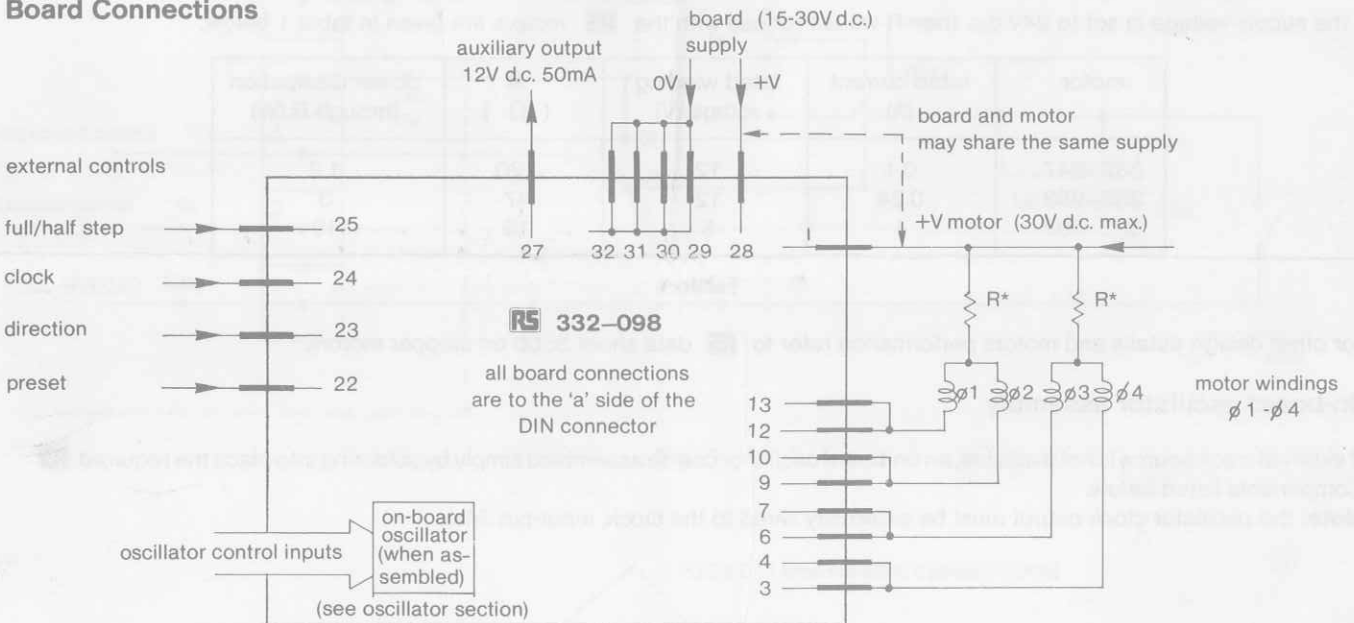
b) direction

c) clock

d) preset

1Hz-25kHz, 10µs min. pulse width negative edge triggered  
 Active Level '0' sets motor drive states to Q1, & Q3 OFF, Q2 & Q4 ON (full step mode) Q1, Q2 & Q3 OFF, Q4 ON (Half step mode) - see fig. 1. Automatic preset at switch-on

### Board Connections



$$*R = \frac{+V \text{ motor} - \text{rated winding voltage}}{\text{rated winding current}}$$

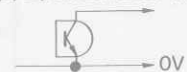
Fig. 1

Max. power dissipated through R = (rated motor current)<sup>2</sup> x R. If the power dissipation is high it is advisable to arrive at the required value of R by using a network of series or parallel resistors. (The use of higher wattage resistors and heat sinks may be required).

Max. current consumption (motor & board) = 2 x (current per phase) + 60mA. Thus ensure power supply cables used are sufficiently rated.

External control signals e.g. full/half step, direction etc. as well as the oscillator (if fitted) stop/run signal can be applied to the circuit in any of the methods of fig. 2.

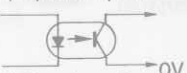
(a) Open collector T.T.L.



(b) C.M.O.S. (Operating @ +12V)



(c) Opto-coupler



(d) Simple switch



Fig. 2

74LS05 - see page 282 of Maplin guide.

## Connection to RS stepper motors

When the windings of the RS Stepper Motors are assigned ( $\varnothing 1 - \varnothing 4$ ) as shown in Fig. 3, they can be connected to the board according to Fig. 1.

RS 332-947  
and  
RS 332-953

RS 332-082

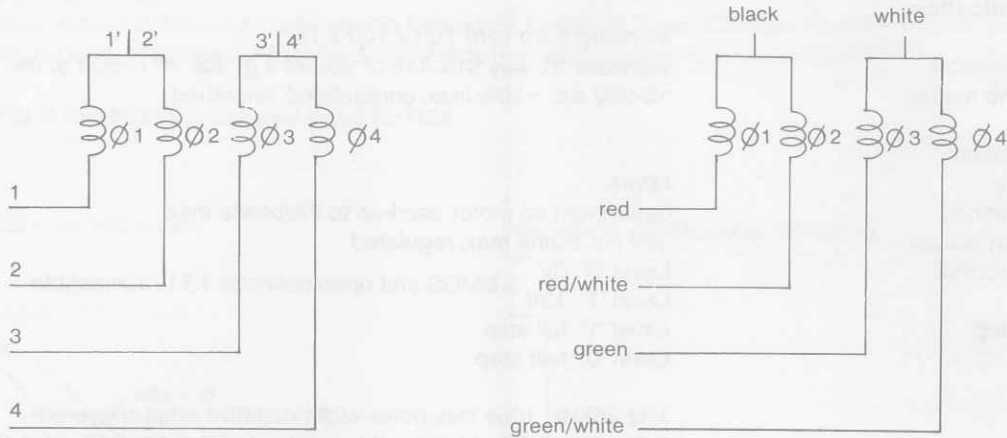


Fig. 3

If the supply voltage is set to 24V d.c. then R values for use with the RS motors are given in table 1 below:

motor	rated current (A)	rated winding voltage (V)	R ( $\Omega$ )	power dissipation through R (W)
332-947	0.1	12	120	1.2
332-953	0.24	12	47	3
332-082	1	5	19	19

Table 1

For other design details and motors performance refer to RS data sheet 5550 on stepper motors.

## On-board oscillator assembly

If external clock source is not available, an on-board oscillator can be assembled simply by soldering into place the required RS Components listed below.

**Note:** the oscillator clock output must be externally wired to the clock, input-pin 24a).

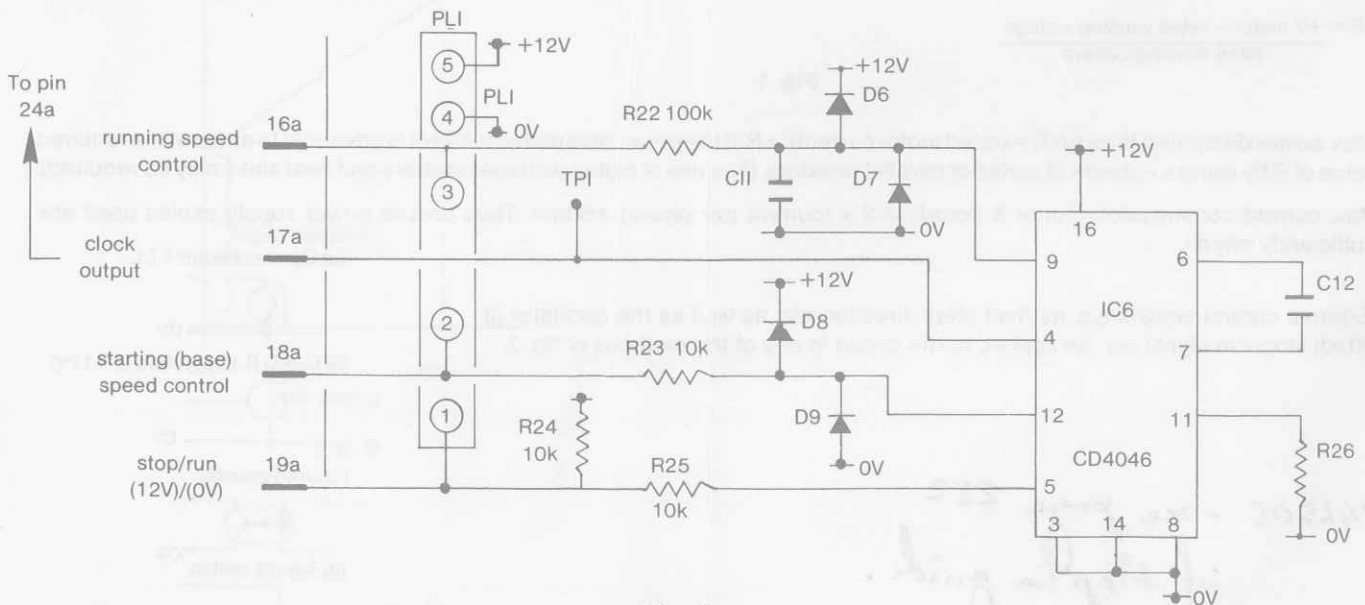


Fig. 4

R22	100K $\Omega$ resistor	RS 131-491	1 off
R23, 24, 25	10K $\Omega$ resistor	RS 131-378	3 off
D6, 7, 8, 9	signal diode	RS 271-606	4 off
IC6	CMOS I.C.	RS 306-645	1 off
R26, C11 & C12	(value depends on application)		1 off each

If oscillator remote controls are required (e.g. front panel controls) then plug PL1 (5-way RS inter-p.c.b. 467-576) can be added together with mating cable shell RS 467-627 and crimp terminals RS 467-598.

### 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:

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

### Oscillator controls (external)

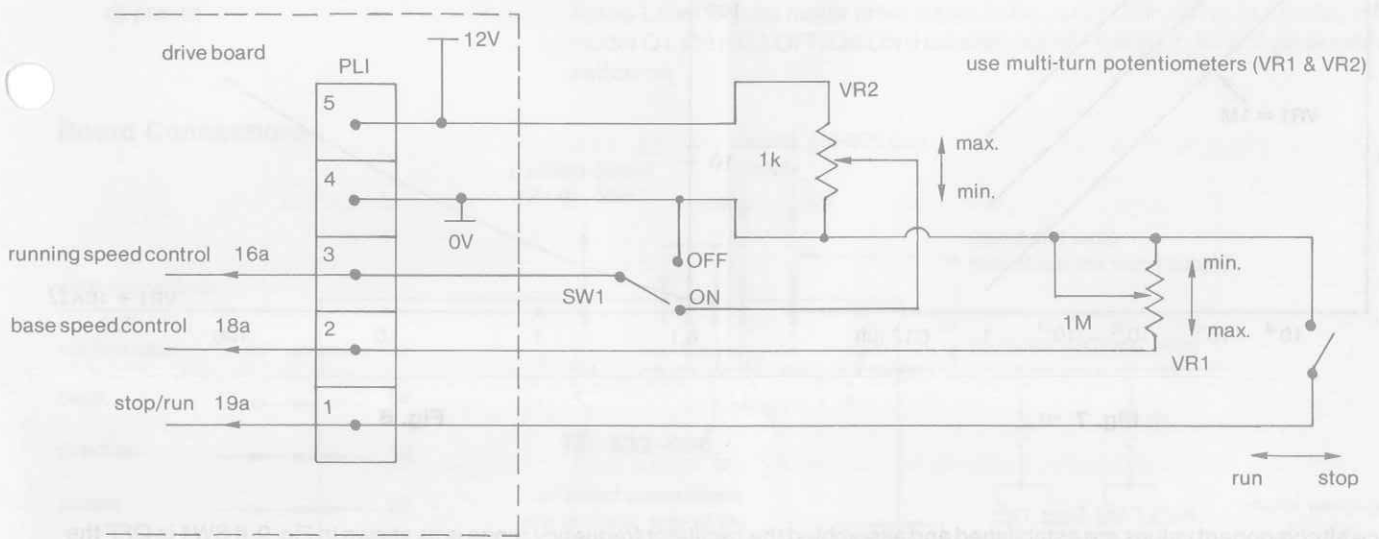


Fig. 5

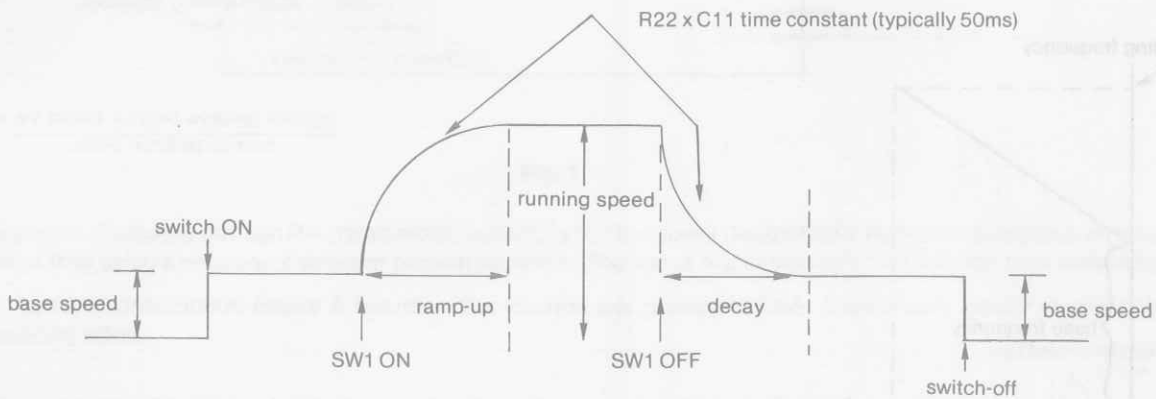


Fig. 6 Motor speed-ramping characteristic

**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  

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

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

For A 7.5° stepper motor  

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

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

## Oscillator frequency setting

Recommended component values

VR1 0 – 1M $\Omega$

VR2 1K $\Omega$

R26 10K $\Omega$  – 1M $\Omega$

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  $\frac{VR1 + R23 \text{ (fixed at } 10k \Omega \text{)}}{R26}$

R26

and thus using Fig. 8 establish the required value for R26.

base frequency (R26 =  $\infty$  VR2 = min.)

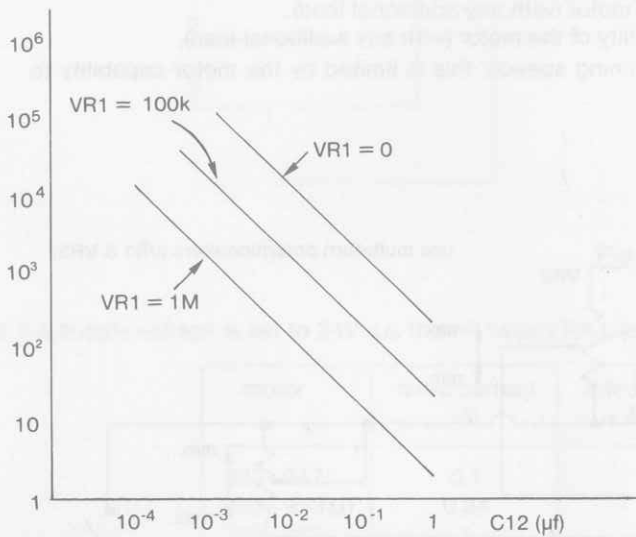


Fig. 7

max. running frequency/base frequency

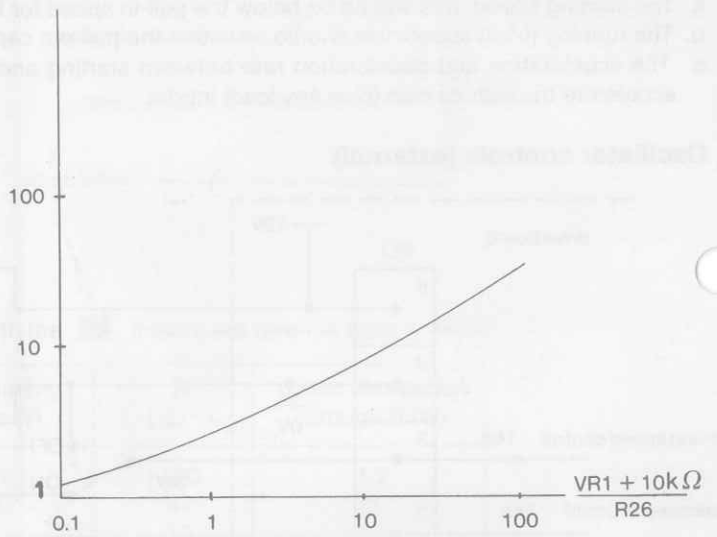


Fig. 8

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 R22 x C11 time constant) to a frequency determined by VR2 setting.

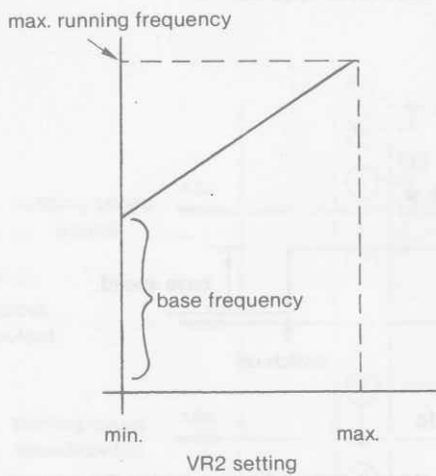


Fig. 9