Model P700 Stepper Motor Driver

General Specification

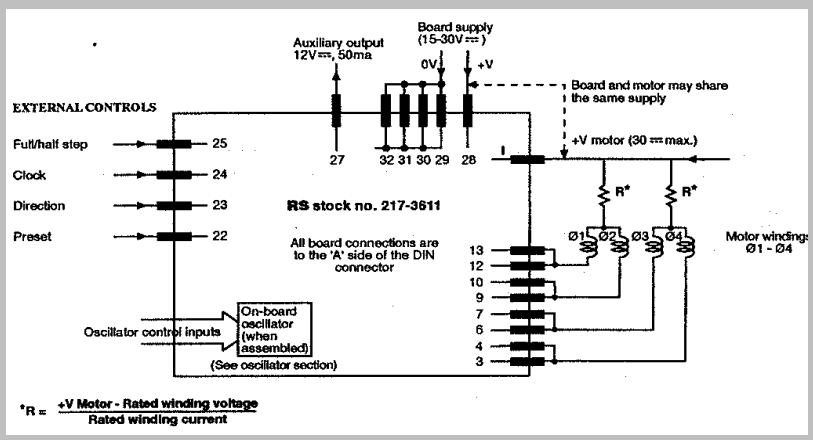
Model P700 is a unipolar stepper motor drive board in standard Eurocard format with a 32-way DIN edge connector. It offers a low cost solution for driving 4-phase stepper motors in full stepping or half stepping modes, providing up to 2A per phase. The circuit layout incorporates the facility for retrofitting an on-board oscillator.

Technical Specification

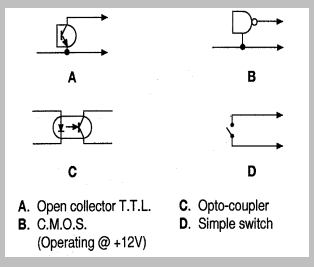
PCB Format:	Standard Eurocard (168x100mm) with 32-way DIN 41612 edge connector
PCB and Motor Supply:	15-30V dc + 10% maximum, unregulated, smoothed
PCB Current Drawn:	Up to 60mA
Motor Drive Current:	Up to 2A/phase
On-board auxiliary output:	12V dc, 50mA maximum regulated output
Switching logic control:	CMOS and open collector TTL compatible; level '0': 0V, level '1': 12V
Inputs:	Direction of rotation
	Full step or half step modes (level '1' or '0')
	Clock frequency from 1Hz-30kHz, 10µs minimum pulse width, negative edge triggered
Preset input:	In full step mode, active level '0' sets motor drive states to phases 1+3 off; 2+4 on
	In half step mode, active level '0' sets motor drive states to phases 1+2+3 off; 4 on

Board Connections

Maximum power dissipated through R=(rated motor current)^2 x R.
If the power dissipation is high it is advisable to achieve the required value of R by using a network of series or parallel resistors. (Higher wattage resistors and heat sinks may be required).
Maximum current consumption (motor + board) = 2 x current per phase + 60mA. Power supply cables require adequate rating.

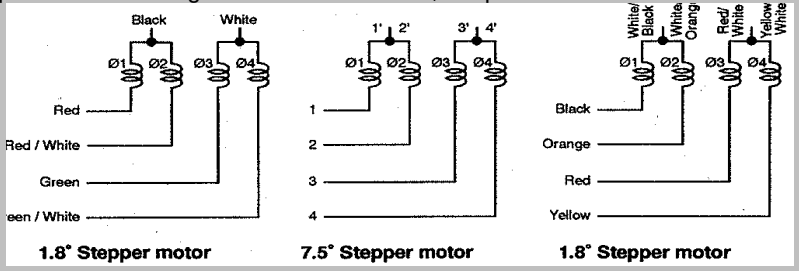


External control signals, e.g., full/half step mode, direction, oscillator stop/run signal, can be applied to the circuit as per methods A-D .



Connection to Stepper Motors

For stepper motors windings are as shown below, the phases should be connected to the P700 as above.



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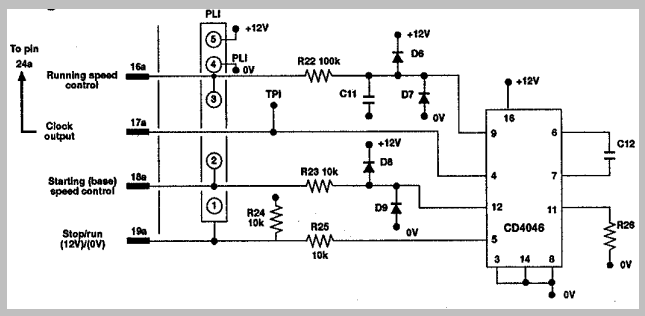
On-board Oscillator Assembly

If an external clock source is not available, soldering the components listed below into place can assemble an on-board oscillator. The oscillator clock output must be externally wired to the clock, input pin 24a. If oscillator remote controls are required, e.g. front panel controls, then plug PLI (5-way inter-pcb) can be added, together with mating cable shell and crimp terminals.

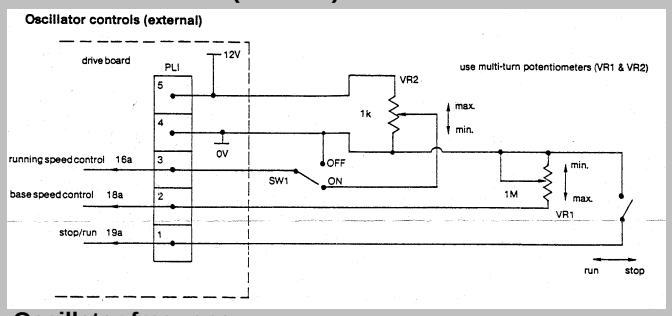


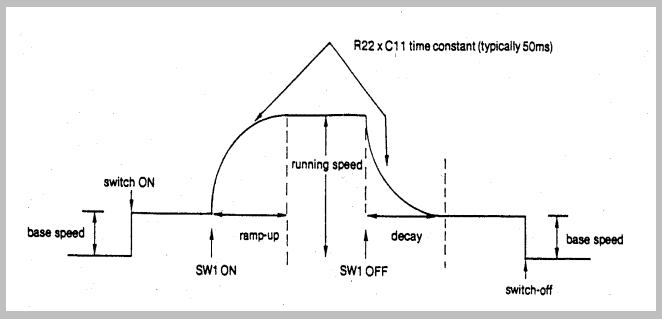
R22	100kΩ resistor	1 off
R23,24,25	10kΩ resistor	3 off
D6,7,8,9	signal diode	4 off
IC6	CMOS i.c.	1 off
R26, C11, C12	application dependent	each 1 off

Starting (base) and running speed control

The on-board oscillator can be arranged to start at a fixed frequency (= fixed motor speed) and then ramp up to a final value (=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. The motor decelerates automatically on switch-off.
Three parameters need to be determined for any application:
i) starting speed: this should be below the pull-in speed for the motor and any additional load,
ii) running (final) speed: this should be within the pull-out capability of the motor and any additional load,
iii) acceleration and deceleration rate between starting and running speeds: this is limited by the motor capability to accelerate through its own inertia and any additional load.

Oscillator controls (external)





Oscillator frequency

Oscillator frequency corresponds directly to motor speed in steps/s or half steps/s, dependant on motor drive mode.
For a 1.8° stepper motor: speed in rpm = (60/200) x speed in steps/s or (60/400) x speed in half steps/s
For a 7.5° stepper motor: speed in rpm = (60/48) x speed in steps/s or (60/96) x speed in half steps/s

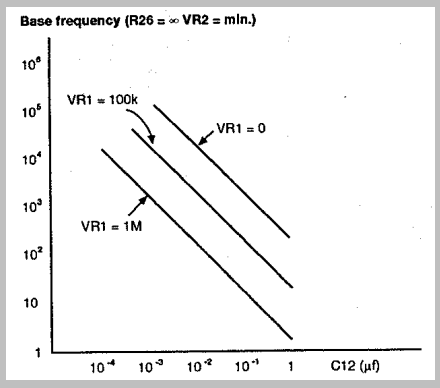
Recommended component values:
VR1 0-1MΩ
VR2 1kΩ
R26 10kΩ-1MΩ
C12 >100pf

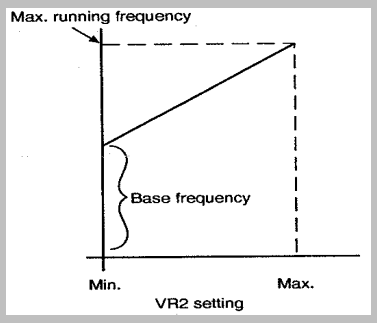
Determine the base frequency and maximum running frequency.

Using the adjacent figure, choose values for C12 and VR1 to match the base frequency.

Calculate the ratio of maximum running frequency/base frequency.

Determine the value of R26 from the equation:
R26 = (VR1+10kΩ)/ratio of max running frequency to base frequency.





Once all component values are established and assembled the oscillator range is as shown.

When SW1 is off, the oscillator runs at base frequency.

When SW1 is on, the oscillator increases to a frequency determined by the VR2 setting at a rate dependent on the R22 x C11 time constant.

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