

RSSM2
STEPPER MOTOR DRIVER CARD
OPERATING GUIDE

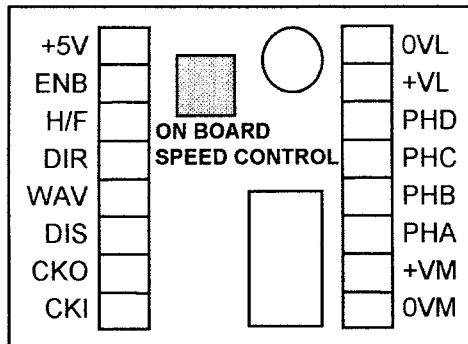
Issue 3.3 SEPT 1996

Description

The RSSM2 driver card is designed to drive a stepper motor in unipolar mode, (either with or without forcing resistors connected between motor commons and +volts). Full, half or wave mode, are selected, as is direction and speed external clock via the logic connections. [Speed can also be derived from an adjustable on board clock.] An enable and disable input allow for a variety of start/stop control options to be implemented. The stepper motor must have four phases and either five, six or eight wires.

The RSSM2 card has two terminal blocks, and a trimmer pot. The first block is for connection of the motor and power supplies, the second block being for logic connection. The trimmer pot adjusts the speed of the on board clock. The logic inputs, outputs are generally TTL LS and CMOS (12 Volt max) compatible and are fitted with various series and pull up, or down resistors. (See tables below).

The phase outputs are open drain power MOSFET (source to 0VM) with a fast diode between drain and +VM.



Connector Block One

0VM	Motor 0V (Connected internally to '0VL')
+VM	Motor +Volts, 9-40 VDC smoothed * ** #
PHA	Motor winding Phase A (up to 2 Amp) #
PHB	Motor winding Phase B #
PHC	Motor winding Phase C #
PHD	Motor winding Phase D #
+VL	Logic/Control +Volts, 9-24VDC *
0VL	Logic 0V (Connected internally to '0VM')

Connector Block Two

CKI	Step Rate Input, 0-2000 Hz (or half steps if selected).
CKO	Output. 20-600 Hz approx. (adjusted by on board trim pot)
DIS	Input. 'CKI' enabled when low.
WAV	Input. Motor stepped in wave mode when high
DIR	Input. Motor direction (clockwise when low)
H/F	Input. Half or full step select. Full step when low (Also 'WAV' = Low)
ENB	Input. 'CKI' Enabled when high
+5V	Output. +5V at up to 20mA with on board 180 R resistor in series (Can be used for tying inputs high)

Notes

- * Can be the same power supply. (motor volts then 9 = 24Vdc max.)
- ** 470 μ F capacitor on board is OK smoothing for low current motors.
- # Max motor discharge voltage +55 Volts peak.
- Inputs Signal voltages are referenced to 'OVL' <1.5V = LOW >3.5V = HIGH
Max., input = 12VDC and Min., input = -0.6V
'ENB' is pulled high. All others input are pulled low if left unconnected.
(Input impedance approx. 10K.) 'CKI' Operates on rising edge.
- Outputs 'CKO' 0-5 Volt square wave via 1K series resistor .
'+5V' 5 Volts via 180R resistor.
- PHA-PHD Phase Orientation. Direction etc., May vary for different motors

Power

20mA Logic +VL (Plus +5V Out)

Up to 4 Amp motor +VM (two windings driven) (2 amp per winding).

HALF STEP SEQUENCE*

	PHA	PHB	PHC	PHD
1	ON	ON	OFF	OFF
2	OFF	ON	OFF	OFF
3	OFF	ON	ON	OFF
4	OFF	OFF	ON	OFF
5	OFF	OFF	ON	ON
6	OFF	OFF	OFF	ON
7	ON	OFF	OFF	ON
8	ON	OFF	OFF	OFF

FULL STEP SEQUENCE*

	PHA	PHB	PHC	PHD
1	ON	ON	OFF	OFF
2	OFF	ON	ON	OFF
3	OFF	OFF	ON	ON
4	ON	OFF	OFF	ON

* STEP SEQUENCE IS REVERSED
WHEN 'DIR' IS CHANGED

WAVE STEP SEQUENCE*

	PHA	PHB	PHC	PHD
1	ON	OFF	OFF	OFF
2	OFF	ON	OFF	OFF
3	OFF	OFF	ON	OFF
4	ON	OFF	OFF	ON

* STEP SEQUENCE IS REVERSED
WHEN 'DIR' IS CHANGED

* = OR UNCONNECTED
H = HIGH LOGIC
L = LOW LOGIC
X = DON'T CARE

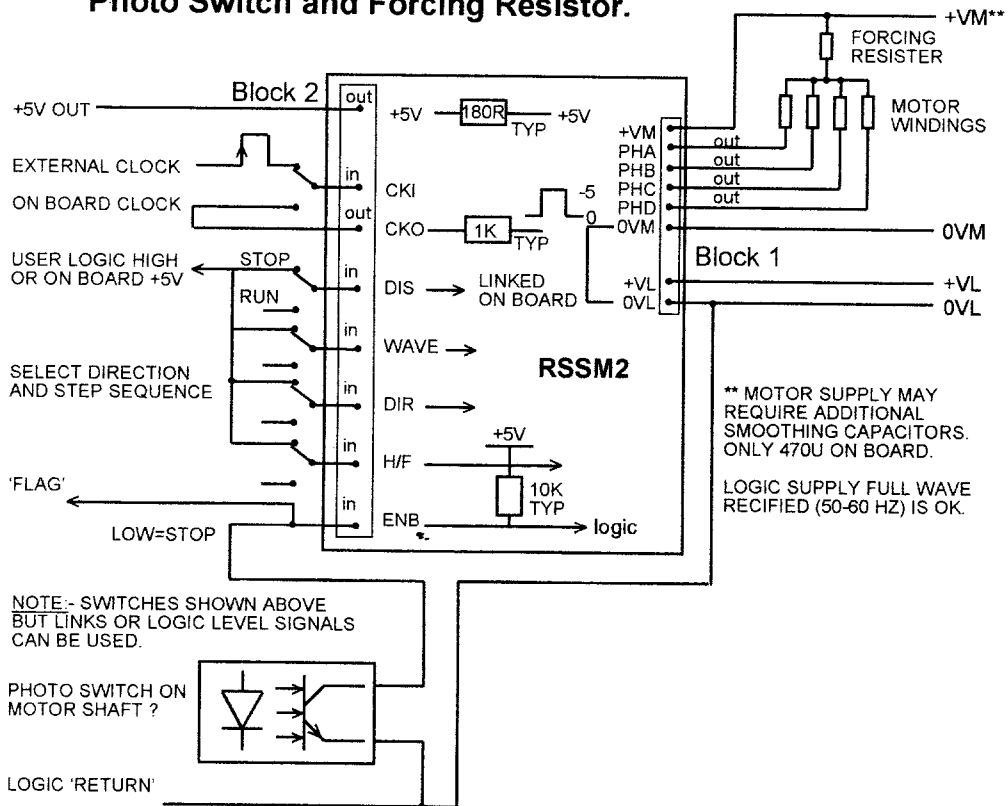
CKI, ENABLE & DISABLE

CKI	ENB	DIS	
X	L	X	NO EFFECT
X	X	H	NO EFFECT
	H*	L*	NO EFFECT
	H*	L*	NEXT STEP

STEP SEQUENCE SELECT

DIR	WAVE	H/F	
X	L*	H	HALF
X	L*	L*	FULL
X	H	X	WAVE
H	X	X	ANTI CLK
L*	X	X	CLK WISE

Typical connection including possible Photo Switch and Forcing Resistor.



Motor use and connection

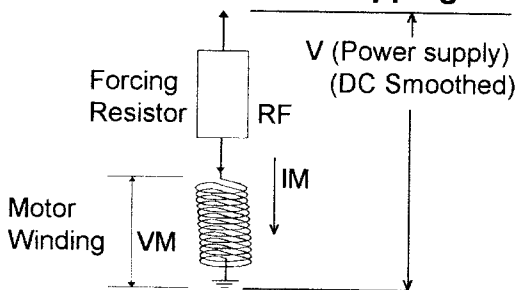
For low speed applications the motor can be simply connected between the phase and +VM terminals of the RSSM2, and then the correct motor voltage (check on the motor rating plate or motor manufactures data) can be connected to the +VM and 0VM terminals. Motors with a rated winding current of up to 2Amps can be used in this way. It should be noted that a stepper motor running at maximum rated current may become very hot and need to be cooled. Please note that different motor manufactures specify motors in various different ways. For the best performance the motor power supply should be as smooth (low ripple) as possible. A large electrolytic capacitor, with a low ESR is recommended.

For higher speed applications forcing resistors and winding discharge components can be added. The forcing resistor allows a higher motor voltage to be used. This voltage appears (mostly) across the motor at the start of each step, 'over coming' the motor's inductance and 'forcing' current into the winding. The discharge component restricts the winding current at the end of the step. A number of points need to be considered. Firstly the increased size of motor power supply required. Secondly the size and power rating of the forcing resistor and discharge components. It may be worth using a larger motor, running at less than full power and the lower winding inductance will help with step speed. This is not a 'waste' as in most applications to obtain the required running torque the holding torque will be very large. (Plus the de-rated motor will not become so hot). When using winding discharge components (placed between the motor power supply, +V and +VM on the RSSM2) at no time must the voltage at +VM or PHA-D exceed +55V peak referenced to 0VM.

For further information see motor and distributor application notes. Also the manufacturer's have a number of worked examples available. A basic calculation for a forcing resistor is shown as follows.

Forcing Resistor for use with unipolar drive and stepping motor.

Circuit



- 1/. Value of Forcing Resistor (R_F). From Ohms Law.
 $R_F = (V/I_M) - R_M$ [Ohms]
 R_M = motor winding resistance. (see below)
- 2/. Power rating of Forcing Resistor.
 $W = I_M \times (V - V_M)$ [Watts]
- 3/. V_M = motor voltage rating. (see plate on motor)
 I_M = motor current rating. (see plate on motor)
 Therefore $R_M = V_M/I_M$

Example.

$$I_M = 200\text{mA} \quad (\text{motor plate})$$

$$= 0.2 \text{ Amp}$$

$$V_M = 12 \quad (\text{motor plate})$$

$$\text{Therefore } R_M = 12/0.2 = 60R$$

$$V \text{ (power supply)} = 24 \text{ Volts. (for instance)}$$

$$\text{Therefore } R_F = 24/0.2 - 60 = 60R$$

$$\text{Power of } R_F = 0.2 \times (24 - 12)$$

$$= 2.4 \text{ Watts}$$

Therefore use 2.5 Watt (**will get very hot !**) or better.

4 Watt resistor at 68R (next preferred value higher).

Temperature Range

5 - 35 deg. C. (> 1 amp per winding). 5 - 65 deg. C. (<1 amp per winding).

Dimensions

61mm x 46mm x 15mm high

Warnings.

Turn OFF power supply before connecting or disconnecting any wiring, circuitry, motor etc., to the RSSM2 board. DISCONNECTING THE MOTOR WITH THE POWER ON WILL DESTROY THE RSSM2. The RSSM2 will get hot with higher current motor connected. Motor windings can generate very high discharge voltages.

Warranty

The manufacturer 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 the manufacturer 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 the manufacturer's 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.