MODERN TECHNOLOGY, INC.
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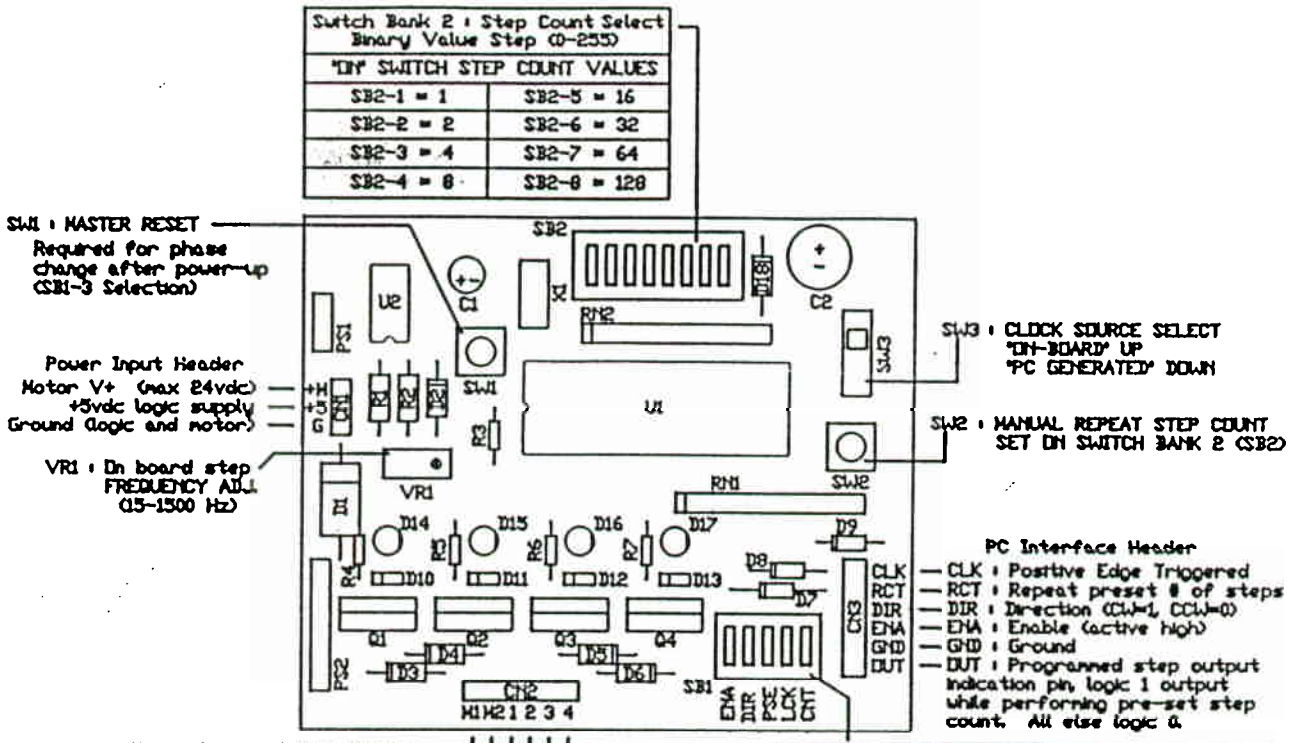
MTSD-V1 Unipolar Stepper Motor Driver



Switch Bank 1 : Mode Select Settings		
SWITCH #	OFF	ON
SB1-1	PAUSE	ENABLE
SB1-2	FORWARD	REVERSE
SB1-3	1 PHASE	2 PHASE
SB1-4	LOCKED MOTOR DURING PAUSE	FREE MOTOR DURING PAUSE
SB1-5	CONTINUOUS RUN	STEP # OF COUNTS SET ON SB2

Power Requirements:

Logic Voltage Supply: 5 volts dc @ 20 milliamps
Motor Voltage Supply: Maximum of 24 volts dc
1.85 amps total current draw from board

Features:

* Stand Alone or External Controller Operation
* Single or Dual Phase Drive
* Adjustable On-board Step Clock (15-1500 Hertz)
* Continuous Run or Pre-settable Step Count (0-255 steps)
* Push Button Pre-set Step Count Repeat
* External Clock Input Pin (10 KHz max)
* OUTPUT Pin to Identify Step Count Completion
* Board Dimensions: 3.125" x 2.75" x .875"

System Power:

The MTSD-V1 requires 5 volts dc (5% tolerance) at approximately 20 milliamps for logic control operation. The motor supply voltage should be selected to be compatible with the voltage rating of the particular motor being used.

The MAXIMUM motor voltage allowed is 24 volts dc. Regardless of the motor voltage, the MAXIMUM amount of current is to be 1.85 amps total draw. This allows 1.85 amps of current draw per winding in single phase mode, or 0.925 amps current draw per winding in dual phase mode.

The SIP power input header connector, CN1, is located on the upper left hand side of the driver board. The pins are designated +M (motor voltage), +5 (logic power), and G (ground).

The SIP motor output header connector for the motor, CN2, is located at the bottom of the driver board. The first two pins (left to right) are designated M1 and M2. These are the +Vdc connections for the two sets of motor windings. The remaining pins 1, 2, 3, and 4 are the connections for the individual motor windings. The motor winding energization sequence corresponds to this 1-4 numbering during clockwise motor rotation.

NOTE: As a safety precaution, the driver board will not operate unless switch SB1-1 (disable/enable) is in the "OFF" position at power-up, or after a system reset has occurred (push button SW1).

Stand Alone Operation:

Before power is applied, the first step in setting up the driver board for stand alone use is to make sure that switch SW3, located at the upper right hand side of the board, is in the "up" position. This switch controls the step clock source. In the "up" position, the on-board clock is selected. This clock rate is adjustable from 15 to 1500 hertz with trim-pot VR1.

Switch bank SB1 controls the options available during stand alone operation. It is located at the bottom right hand side of the controller. Before powering up the driver board, the options of SB1-3, SB1-4, and SB1-5 should be selected. It is possible to change these options while power is applied, but a system reset by push button SW1 may be required.

The following is a listing of the dip switch positions vs. functions for SB1.

SWITCH	OFF	ON
SB1-1	DISABLE	ENABLE
SB1-2	CLOCKWISE	COUNTER-CLOCKWISE
SB1-3	1 PHASE	2 PHASE
SB1-4	LOCKED MOTOR	FREE MOTOR (during disable)
SB1-5	CONTINUOUS RUN	PRE-SET STEP COUNT (0-255 steps)

If SB1-5 is in the "on" position, the number of steps performed is dictated by the binary number represented at switch bank 2 (SB2). In the "on" position, SB2-1 represents 1, SB2-2 represents 2, SB2-3 represents 4, etc. This allows a step count choice of 0-255 steps per sequence. Once a step count sequence has been completed, it can be repeated using push button switch SW2.

The options of disable/enable and clockwise/counter-clockwise rotation may be changed at random.

Programmable Controller Operation:

Operating the MTSD-V1 with an external controller is essentially the same as in the stand alone mode, with the exception of controlling one or more of the available drive options with logic levels rather than a dip switch.

A logic level external clock input pin is also available for greater step count and speed flexibility. To use an external clock source, SW3 should be set in the "down" position. It is, however, possible to use the on board step clock during controller applications by leaving SW3 in the "up" position.

To further facilitate process control, an OUTPUT pin has been provided to identify the start and stop of a pre-set step count. At the start of a step count sequence this pin is set to a logic 1. Upon completion of the sequence this pin is cleared to a logic 0, letting the controller know that a new sequence can be initiated at the RCT (recount) pin.

The options that are not accessed by the external controller are 1 or 2 phase (SB1-3), locked or free motor during disable (SB1-4), and continuous or pre-set step count (SB1-5). These options should be set as desired before powering up the driver board.

The following is a listing of the logic level vs. function for interface connector CN3.

Pin	Logic 0	Logic 1
OUTPUT	DONE WITH STEP COUNT	PERFORMING STEP COUNT
GND	-	-
ENA	DISABLE	ENABLE
DIR	CLOCKWISE	COUNTER-CLOCKWISE
RCT	WAIT	START RE-COUNT AT PULSE FALLING EDGE
CLK	WAIT	ADVANCE 1 PHASE CHANGE

The simplest use of the driver board with a controller would be to use the on-board step clock (SW3 UP), and have the driver board set in continuous run mode (SB1-5 OFF). This would require only 2 logic signals from the controller, ENA (disable/enable) and DIR (CW/CCW).

Taking control one step further would be to set the driver board into step count mode (SB1-5 ON). The controller would then need to supply a 3rd logic level at the RCT (recount) pin. This would allow repetition of a pre-set step count set at SB2 (0-255) in either the CW or CCW direction. The RCT (recount) pin requires a positive pulse (logic 0,1,0) before the next step count will be initiated.

In order to monitor whether or not the driver board was completed with the pre-set step count, the controller could monitor the OUTPUT pin logic level. While the step count is in progress, it will be at a logic 1. When completed with the step count, it will be at logic 0. During continuous run operation (SB1-5 OFF) the OUTPUT pin will remain at logic 0. DO NOT USE THE OUTPUT PIN TO CONNECT TO THE PARALLEL PORT OF A PERSONAL COMPUTER! THIS PIN IS CAPABLE OF SOURCING OR SINKING IN EXCESS OF 25 MILLIAMPS, AND DAMAGE TO THE PORT MAY RESULT!

The last and most flexible step would be to incorporate the CLK (clock) pin with the controller. This requires that SW3 be in the "DOWN" position, and that the driver board be set in continuous run mode (SB1-5 OFF). A positive clock pulse (logic 0,1,0) will advance the phase sequence one step. Note that the MAXIMUM external clock rate is 10 KHz. By using nested loops in the external controllers software program, it is possible to vary the clock rate and perform various step sequences. This also eliminates the need for monitoring the OUTPUT pin since the number of steps performed is contained within the controllers program.

Limited 1 Year Warranty
Modern Technology will repair or replace, at its option, any manufacturing and/or material defects for a period of 1 year from date of purchase.

Limitation of Liability
Modern Technology assumes no responsibility or liability for damage caused, or allegedly caused, by the use or misuse and/or modification of any product or information sold by Modern Technology.

Example of Using a Personal Computer for Driver Board Control Using Basic Language

The first step is to assemble an interface cable for connection to the parallel port on the pc. The following is a suggested list of parts that are available from Digi-Key.

Part #	Description
046-0008-ND	Male DB25 to RJ11 Jack (6 contact)
H3663-07-ND	7', 6 conductor Single Ended Modular Cable
A3014-ND	5 Position Single Row Modu Housing
A3003-ND	Modu Housing Contacts

Remove about 1" of the pvc jacket from the bare end of the modular cable. Strip the insulation from the first 5 conductors (white-yellow). The blue conductor is not used in this example. Crimp the housing contacts onto the individual conductors and insert them into the Modu housing in the following order: white-position 1, black-position 2, red-position 3, green-position 4, and yellow-position 5. (Position 1 is designated on the side of the connector housing)

The male DB25 to RJ11 should be wired internally as follows:

Wire/Pin	DB25 Position
white	25
black	2
red	3
green	4
yellow	5
blue	NC

Note: The green wire that is connected to the RCT (recount) pin is not incorporated in the following software example.

Assemble the DB25 to RJ11 adaptor and insert the RJ11 plug end into the adaptor. Place the 5 position Modu housing onto the driver board interface connector CN3, making sure that position 1 is placed onto the GND (ground) terminal, with position 5 placed onto the CLK (clock) terminal.

DO NOT USE THE OUTPUT PIN TO CONNECT TO THE PARALLEL PORT OF THE PC! THIS PIN IS CAPABLE OF SOURCING OR SINKING IN EXCESS OF 25 MILLIAMPS, AND DAMAGE TO THE PORT MAY RESULT!

Set SW3 (clock select) in the "down" position.

Set dip switches SB1-1, SB1-2, and SB1-5 to the "OFF" position. SB1-3, PSE (phase) and SB1-4, LCK (locked/free motor during disable) can be set as desired.

Since this example is using an external clock, the pre-set step count value set at SB2 is not needed. These dip switch settings can be ignored.

Using the parallel port on a pc for control makes the task of writing software to fit a particular application reasonably simple. The parallel port, LPT1, is located at address 888. The only BASIC command that is needed is OUT. With this command, the eight bits of port 888 can be set at a logic 0 or logic 1 depending upon the number sent out to it.

Bit desired at logic 1	Command line
NONE	OUT 888,0
1	OUT 888,1
2	OUT 888,2
3	OUT 888,4
4	OUT 888,8
5	OUT 888,16
6	OUT 888,32
7	OUT 888,64
8	OUT 888,128

Note: Only bits 1, 2, and 4 are needed to control one driver board. The remaining bits can be used to control another board in an application requiring more than 1 motor.

Setting more than 1 bit to a logic 1 level requires nothing more than sending out the sum of the two or more bit values to port 888. If both bits 1 and 4 are desired high, the command would be: OUT 888,9

Example Program: When run, this program will have the stepper motor perform 100 steps clockwise at a rate of approximately 50 hertz, pause, and then perform 200 steps counter-clockwise at a rate of approximately 500 hertz.

```
10 OUT 888,0                    (SET ALL PARALLEL PORT BITS TO "0")
20 OUT 888,1                    (DRIVER ENABLED)
30 FOR X = 1 TO 100             (SET STEP COUNT VALUE)
40 OUT 888,9                    (DRIVER ENABLED, CLOCK HIGH)
50 OUT 888,1                    (DRIVER ENABLED, CLOCK LOW)
60 FOR Y=1 TO 100 : NEXT Y      (CREATE DELAY BEFORE NEXT CLOCK PULSE)
70 NEXT X                       (CONTINUE WITH STEP COUNT TILL DONE)
80 FOR Y=1 TO 10000 : NEXT Y    (PAUSE)
90 OUT 888,3                    (DRIVER ENABLED, CCW DIRECTION)
100 FOR X = 1 TO 200            (SET STEP COUNT VALUE)
110 OUT 888,11                  (DRIVER ENABLED, CCW, CLOCK HIGH)
120 OUT 888,3                   (DRIVER ENABLED, CCW, CLOCK LOW)
130 FOR Y=1 TO 25 : NEXT Y      (CREATE DELAY BEFORE NEXT CLOCK PULSE)
140 NEXT X                      (CONTINUE WITH STEP COUNT TILL DONE)
150 OUT 888,0                   (SET ALL PARALLEL PORT BITS TO "0")
160 END
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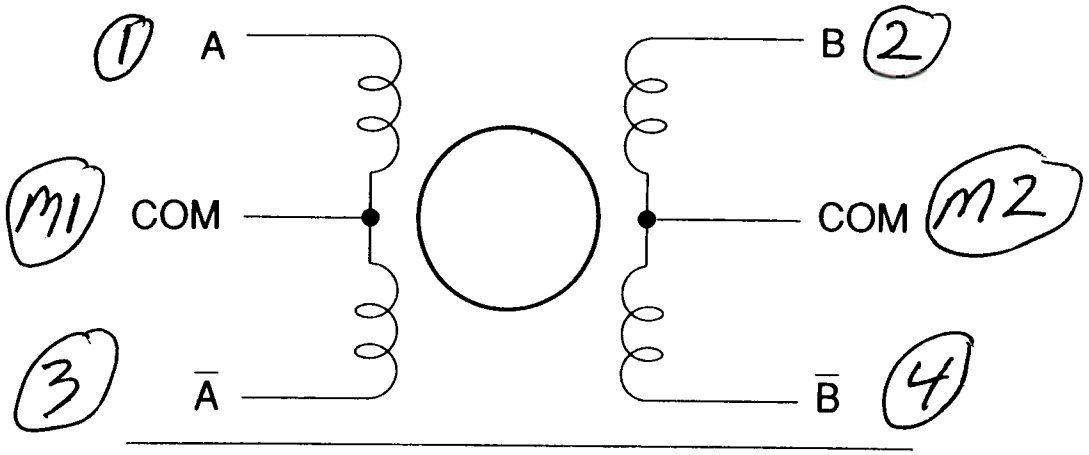
All that is required to change the number of steps performed is to change the value of X. All that is required to change the step rate is to change the value of Y.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