Using the X-Y Stepper Module

INTRODUCTION

The X-Y Stepper Module is a complete 2-axis driver board intended to drive two bipolar stepper motors, activate a solenoid or DC motor, and sense the status of four limit switches– all under MCU control. The design is based on the popular PBL3717 stepper motor driver chip, capable of controlling up to 1-Amp stepper motors when adequately heat-sinked. *Caution! Exceeding the ratings may destroy the chips.*

Designed on an Adapt12 form-factor card (3.25" x 2.25"), interface to the controlling MCU is made via a standard 50-pin connector (2 x 25), and is compatible with all Adapt11 and Adapt12 family cards. It is not directly usable with MicroCore-11 or MicroStamp11, since it requires more control pins than those products provide. Port assignments are selectable via jumpers on the board so that they may be changed to suit the user's needs.

Screw-terminal blocks are provided for motor connections, and LEDs indicate motor activity, as well as the activation of the solenoid. Digital control is effected by means of two port lines for each axis, and limit switches can be sensed via four input port lines. An additional output port line activates a logic-level MOSFET capable of driving an inductive DC load up to 3 Amps. Each axis has a direction control line, and a step control line. The optimum stepper waveforms are generated by the Stepper Motor chip, making the control software very simple to implement. See the PBL3717 data sheet for detailed applications information.

STEPPER MOTOR CONTROL

A bipolar stepper motor can be controlled by attaching one phase to each of the two motor control channels. By alternately enabling the coils, and reversing current direction, the motor shaft is made to step through rotation. The maximum speed at which this step sequence may practically be repeated is governed by the physical characteristics of the motor being used. Stepping is achieved by asserting the STEP control line for the desired axis, after the direction has been selected by means of the DIR control line.

POWER SUPPLY CONSIDERATIONS

The X-Y Stepper Module has an EXT PWR connector (TB3) which provides the driver chip with the motor supply voltage. The voltage you connect will depend on the rating of the motors being driven. The stepper motor driver chips also require 5 Volts for their logic, which must be supplied by the MCU board via the 50-pin header P1 (the motor board does not include a 5V regulator).

If the solenoid has the same voltage rating as the stepper motors, the solenoid supply can be taken from terminal 1 of TB4. The solenoid return would be connected to pin 2 of TB4 (closest to Q1). If a different voltage is to be used for the solenoid, feed it directly to the solenoid, and bring the solenoid return line to pin 2 of TB4. Make sure the solenoid power supply ground is connected to the motor power supply ground.

SOFTWARE

The program **xysmdemo.asm** (see support.technologicalarts.com/docs) is one example of how stepper motor control can be accomplished. Written in 68HC11 assembly language, this program uses the Real-time Interrupt (RTI) feature of the MCU as a 4-millisecond time-base to create the step waveforms to control current through the two phases of a bipolar stepper motor. The program simply steps the motor through continuous rotation. A slower step speed can be achieved simply by increasing the step-timer variable (each increment corresponds to 4 ms per step). For a far slower step rate, the RTI can be set up to interrupt at a much longer interval. Refer to the 68HC11 Reference Manual for details.

To achieve a higher step rate, a time-base other than the RTI should be used Some possibilities are: the MCU hardware timer system (using an Output Compare interrupt, for example), or a software delay loop.

Check the webpage mentioned above for additional software examples or applications information that may become available.