μ-stepper control board
rev 1.1

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1 Operation Description

This is a simple and complete microstepper motor driver board based on the popular couple NJU39610-NJM3772 from JRC.

The board can handle any standard stepper motor with current up to 1000mA per winding and voltage as much as 45V, can be directly controlled with TTL standard level for the basic operation such as Direction, Speed, CW and CCW jog mode.

Using a standard motor driven with this board resolution is improved by a factor 64, 32, 16 or 8 as required for any application.

For every positive transition of the CLOCK IN the motor moves by one step, the motion direction is decided by the TTL level of DIR input.

The maximum CLOCK IN frequency allowed is generally a mechanic limit of the used motor.

The core of the system is the microcontroller U1 from Atmel wich provide the digital coded sine/cosine wave functions for the DA converter U2, once converted data from microcontroller U2 provide the analog signals for the power driver U3.

The digital sine/cosine wave functions shown in figure 1 are stored in two 256-points arrays, this permit to reach a maximum resolution of

$$Res = \frac{4}{n-points} = \frac{1}{64} \text{ step}$$

if the resolution is set to 1/64 step, for a standard 200-steps motor, one revolution is resolved in

$$Res[rad] = \frac{4}{n-points} \cdot \frac{2\pi}{motor-steps} \simeq 0.5 \ mrad \text{ per step}$$

The AT-MEGA8 Timer/Counter 1 (TCNT1) is used to syncronize the external clock and the sine/cosine tables writing, the TCNT1 can be clocked by an external clock source on the T1 pin and executes an interrupt service routine every clock rising edge.

The manual control is performed checking the Jog pins periodically through the Timer/Counter 2 (TCNT2) used in compare interrupt mode, the Jog speed depend on the OCR2 value.

To avoid machanical damages the m.c. performs the limit switches check, in order to avoid over heating of the motor in steady state a software watchdog is implemented to switch to the power-safe mode: when the watchdog counter reach zero Q1 lowers the current set by R11 by an amount of 1/5 if the motor. If the user is not interested in this function can easily remove R10.

It is possible to change the jog velocity and the watchdog time by editing respectively the JOG ACCELERATION section and the WDG_MAX constant in the firmware sources.

The maximum winding current for the motor can easily be changed tuning R11 to set IMax.

2 Tables

Table 1: J1 pin functions

1	VMM	Motor Power Supply
2	MB1	Motor out B CH1
3	MA1	Motor out A CH1
4	MB2	Motor out B CH2
5	MA2	Motor out A CH2
6	GND	GND

Table 2: J2 pin functions

1	+5V	Positive supply voltage
2	GND	GND
3	Tx	RS232 transmit line (RS232 level)
4	Rx	RS232 recieve line (RS232 level)
5	CCW	Pull to GND to move motor CCW
6	CW	Pull to GND to move motor CW
7	FC CW	Limit switch for CCW (Switch close to VCC to operate)
8	FC CCW	Limit switch for CW (Switch close to VCC to operate)
9	CKL	Clock in (TTL level)
10	DIR	Direction (TTL level)
11	RES0	Resolution bit0 (refer to S1 table)
12	RES1	Resolution bit1 (refer to S1 table)

Table 3: JP1 Table - Resolution setting

jumper 2-4	jumper 1-3	step-resolution
open	open	1/64
open	close	1/32
close	open	1/16
close	close	1/8

Table 4: JP2 Table - Limit switches selection

jumper 2-4	jumper 1-3	FC_CW	FC_CCW
open	open	ON	ON
open	close	ON	OFF
close	open	OFF	ON
close	close	OFF	OFF

Table 5: JP3 pin functions

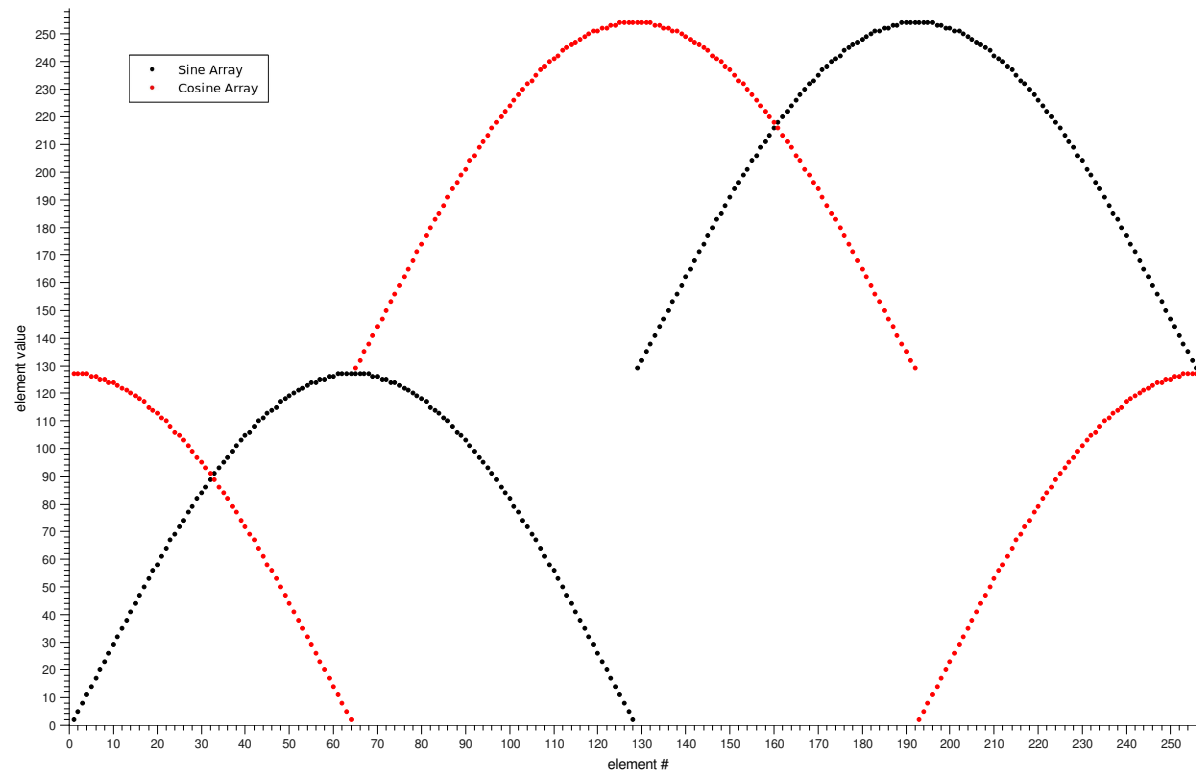| 1	MODE	Mode Selection (not used)
2	GND	GND power motor

Figure 1: wave functions arrays