Delphi Application designed to control stepper motors

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Abstract: The paper presents an application created in Borland Delphi 7 that is running an stepper motor through a circuit consists of a continuous power source and drivers for that motor. The application allows control motor speed, torque type, direction of rotation, the number of steps and the number of rotations. This work resolve the issue via the use of the PIC and other detection circuits for motor drivers. In fact the driver is powered from a DC source of 24 V, and ordered computer parallel port through which pulses to give the movement motor.

1. STEPPER MOTOR

A stepper motor is a brushless, synchronous electric motor that can divide a full rotation into a large number of steps. The motor's position can be controlled precisely, without any feedback mechanism. Stepper motors are similar to switched reluctance motors, which are very large stepping motors with a reduced pole count, and generally are closed-loop commutated.

A unipolar stepper motor has logically two windings per phase, one for each direction of current. Since in this arrangement a magnetic pole can be reversed without switching the direction of current, the commutation circuit can be made very simple (eg. a single transistor) for each winding. Typically, given a phase, one end of each winding is made common: giving three leads per phase and six leads for a typical two phase motor. Often, these two phase commons are internally joined, so the motor has only five leads.
A microcontroller or stepper motor controller can be used to activate the drive transistors in the right order, and this ease of operation makes unipolar motors popular with hobbyists; they are probably the cheapest way to get precise angular movements.

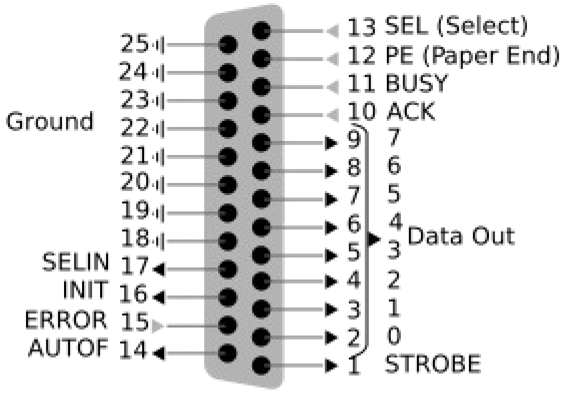
A stepperr motor performance is strongly dependent on the drive circuit. Torque curves may be extended to greater speeds if the stator poles can be reversed more quickly, the limiting factor being the winding inductance. To overcome the inductance and switch the windings quickly, one must increase the drive voltage. This leads further to the necessity of limiting the current that these high voltages may otherwise induce.[1]

2. PARALEL PORT

The Parallel Port is the most commonly used port for interfacing home made projects. This port will allow the input of up to 9 bits or the output of 12 bits at any one given time, thus requiring minimal external circuitry to implement many simpler tasks. The port is composed of 4 control lines, 5 status lines and 8 data lines. It's found commonly on the back of your PC as a D-Type 25 Pin female connector. There may also be a D-Type 25 pin male connector. This will be a serial RS-232 port and thus, is a totally incompatible port.

Below is a table of the "Pin Outs" of the D-Type 25 Pin connector and the Centronics 34 Pin connector. The D-Type 25 pin connector is the most common connector found on the Parallel Port of the computer, while the Centronics Connector is commonly found on printers. The IEEE 1284 standard however specifies 3 different connectors for use with the Parallel Port. The first one, 1284 Type A is the D-Type 25 connector found on the back of most computers. The 2nd is the 1284 Type B which is the 36 pin Centronics Connector found on most printers.

EEE 1284 Type C however, is a 36 conductor connector like the Centronics, but smaller. This connector is claimed to have a better clip latch, better electrical properties and is easier to assemble. It also contains two more pins for signals which can be used to see whether the other device connected, has power. 1284 Type C connectors are recommended for new designs, so we can look forward on seeing these new connectors in the near future.[2]



Imgage 1. Pin Assignments of the D-Type 25 pin Parallel Port Connector

Pin No (D-Type 25)	Pin No (Centronics)	SPP Signal	Direction In/out	Register	Hardware Inverted
1	1	nStrobe	In/Out	Control	Yes
2	2	Data 0	Out	Data	
3	3	Data 1	Out	Data	
4	4	Data 2	Out	Data	
5	5	Data 3	Out	Data	
6	6	Data 4	Out	Data	
7	7	Data 5	Out	Data	
8	8	Data 6	Out	Data	
9	9	Data 7	Out	Data	
10	10	nAck	In	Status	
11	11	Busy	In	Status	Yes
12	12	Paper-Out / Paper-End	In	Status	
13	13	Select	In	Status	
14	14	nAuto-Linefeed	In/Out	Control	Yes
15	32	nError / nFault	In	Status	
16	31	nInitialize	In/Out	Control	
17	36	nSelect-Printer / nSelect-In	In/Out	Control	Yes
18 - 25	19-30	Ground	Gnd		

Table 1. Pin Assignments of the D-Type 25 pin Parallel Port Connector

3. DRIVERS

The ULN2003 is a monolithic high voltage and high current Darlington transistor arrays. It consists of seven NPN darlington pairs that features high-voltage outputs with common-cathode clamp diode for switching inductive loads. The collector-current rating of a single darlington pair is 500mA. The darlington pairs may be parrleled for higher current capability. Applications include relay drivers, hammer drivers, lampdrivers, display drivers(LED gas discharge), line drivers, and logic buffers. The ULN2003 has a 2.7kW series base resistor for each darlington pair for operation directly with TTL or 5V CMOS devices.[3]

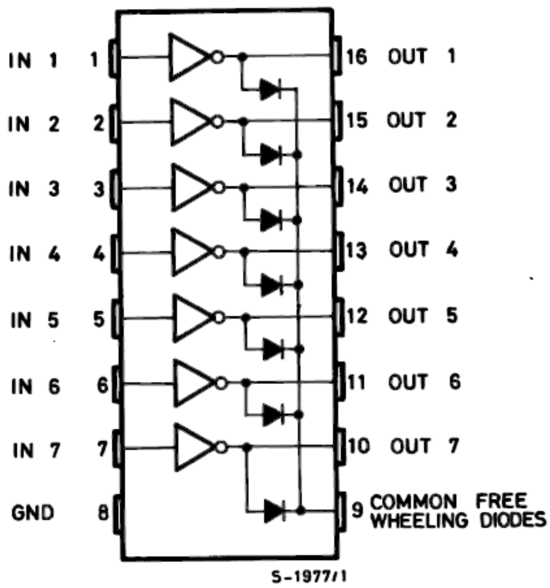


Image 2. Pin connection

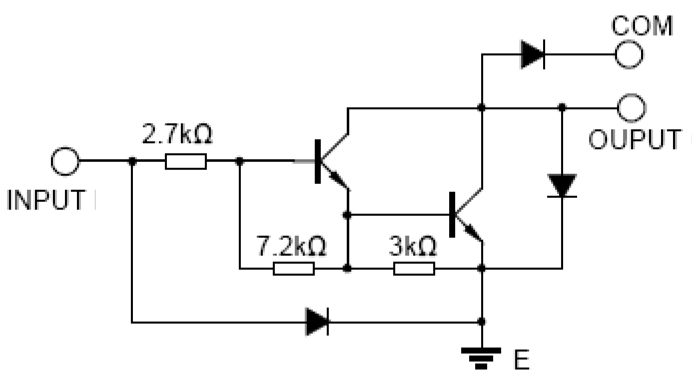


Image 3. Schematic (each darlington pair)

4. DELPHI APPLICATION

The application designed to command the parallel port is implemented in Borland Delphi 7. This application allows the user to command stepping motor driver with the help of several options:

4.1 THE CONTROL OF THE MOTOR DIRECTION

The engine can be configured to move in a direction of Backward or Forward and it can be changed at any time

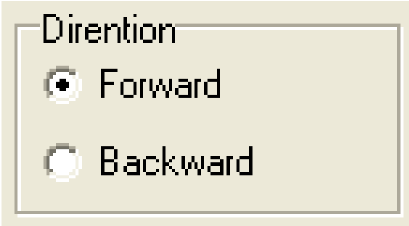


Image 4. The direction control

4.2 THE STEPPING MOTOR

The application allows the motor running with either of the three types of engine torque specific stepper motors

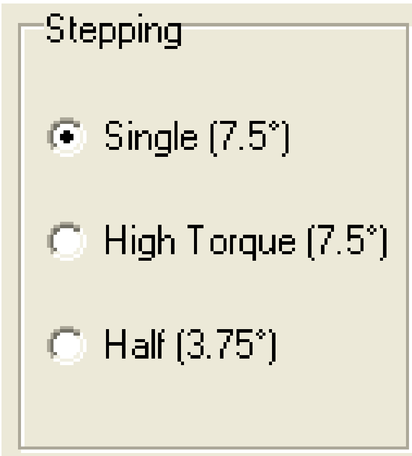


Image 5. The stepping control

4.3 THE SPEED CONTROL

Speed can be controlled with this option, which defines the period of time between the two stationary consecutive steps

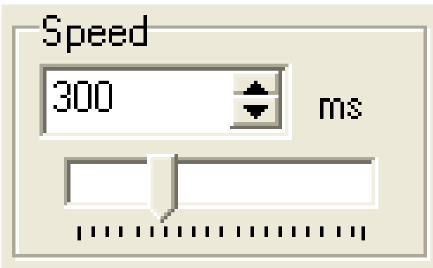


Image 6. The control of the speed

4.4 THE CONTROL OF THE STEPS NUMBER

The software controls both the number of motor running steps and the number or complete rotations, regardless of the type of torque selected

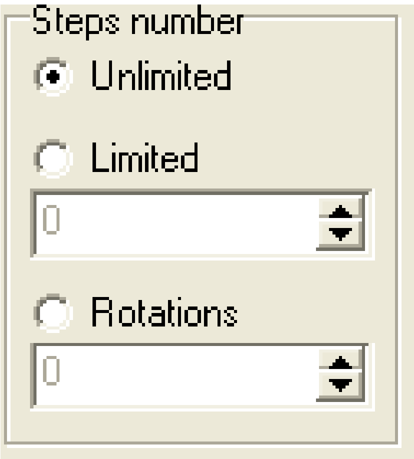


Image 7. The control of the steps number

4.5 THE GUI

The application has an attractive graphical user interface. This is intuitive and easy to use

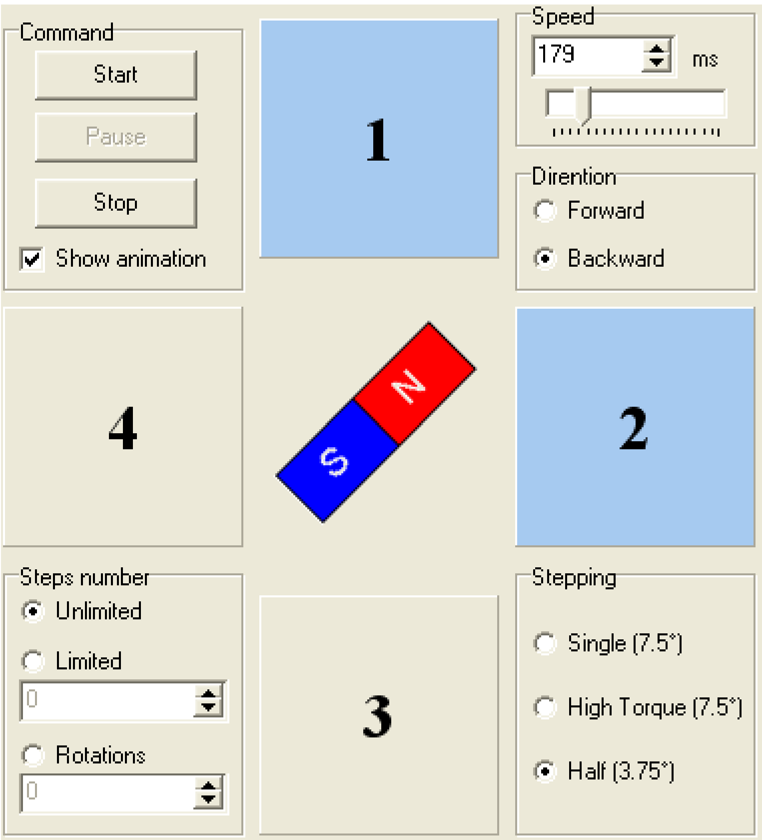


Image 8. The control of the steps number

5. THE ELECTRONIC BOARD

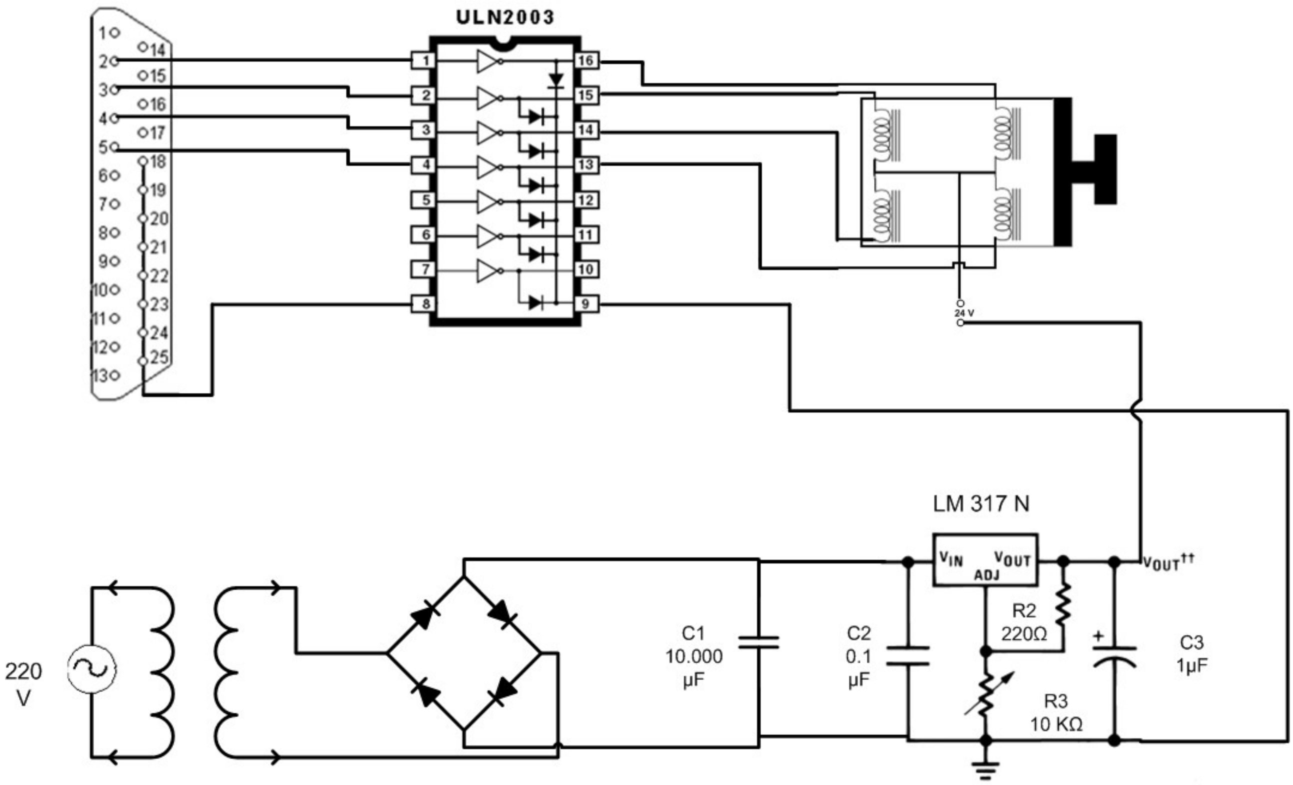


Image 9. The electronic board

6. REFERENCES:

[1]. www.wikipedia.com
[2]. http://www.beyondlogic.org/spp/parallel.htm
[3]. http://www.datasheetcatalog.com/datasheets_pdf/U/L/N/2/ULN2003.shtml