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APPLICATION OF STEPPING ENGINE FOR LINEAR POSITIONING

VYUŽITÍ KROKOVÉHO MOTORU PRO LINEÁRNÍ POLOHOVÁNÍ

Abstract

This contribution describes the electronic unit for generating signals of control stepping motor. The control unit is based on standalone-chip series PIC. The stepping motor is driving unit of positioning mechanism with ultrasonic sensor. The module communicates with application at PC helping by the of RS 232 or USB interface. The configuration of unit control can be executed from the application, which is created in the Visual Basic 6 environment. Here is possible to set up speed, direction and number of step of stepping engine. Protocol is designed as half duplex.

Abstrakt

Příspěvek popisuje jednotku pro generování řídicích signálů krokového motoru. Základem této jednotky je jednočipový počítač řady PIC. Krokový motor je pohonnou jednotkou polohovacího mechanismu s ultrazvukovou sondou. Modul komunikuje s aplikací v PC pomocí RS232 nebo USB rozhraní. Konfigurace řídicí jednotky se může provádět z aplikace, která je vytvořená v prostředí Visual Basic 6. Zde je možno nastavit rychlost, směr a počet kroků krokového motoru. Protokol je navržen jako poloviční duplex.

1 INTRODUCTION

The goal of this contribution is attestation of possibility of stepping engine setting for positioning of ultrasonic sensor. This ultrasonic sensor will be use for building of 3D image from 2D image (slices) at the area of carotid arteries. The range of measurement is limited to maximally 2 cm with 0,1 mm accuracy. The control and the configuration are realized by helping of RS-232 interface. For movement co-ordination (setting of ultrasonic sensor position) and measurement of atherosclerosis slice in the area of artery is realized with the help of PC or notebook, whom default interface is usually USB. Therefore here is used converter, which allows RS-232 interface connection to USB interface. In contribution is describes in details mechanism for ultrasonic sensor position setting.

2 DECISION PROCEDURE

- Definition of function for individual modules of control system.
- Design of connection diagram of individual modules for required function.
- Design of printed circuits into the templates with constant size.

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- Creating of modules.
- Activation of modules.
- Program creation in MS visual studio 6.0 development environment.
- Assembler source code creation in development environment MPLAB.
- Running all application in parts.
- Hardware and software testing.

3 HARDWARE

Communications with interface of unit for control of stepping engine is realized with usage of standard RS-232, which is the part of anyone PC. Interface unit consists of three modules - communication, control and power. The protocol is designed so that he is applicable for communication, which is limited to half duplex.

The base of communication module is integrated circuit MAX232 or FT232BM or MAX485. Integrated circuit MAX232 is intended for RS-232 interface. Integrated circuit FT232BM is intended for USB interface. Scheme of connection is at the fig.1.

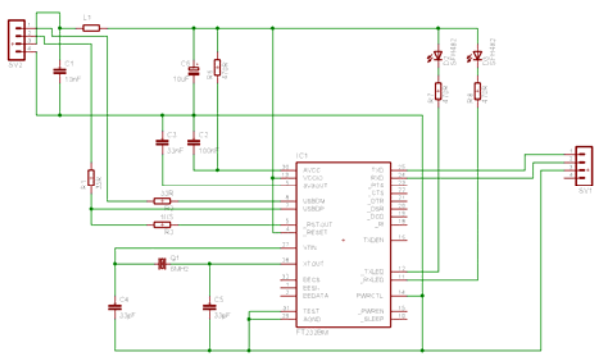

Fig. 1 Connection diagram of communication module with FT232BM

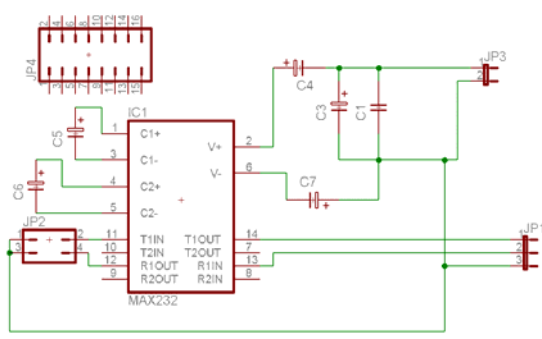

Fig. 2 Connection diagram of communication module with MAX232

The base of control unit is standalone-chip of PIC family. The module supports communication helping by serial transfer. Using of standalone-chip not supports USART module. Therefore it has been used for communication standard TTL input/output. Communication logic is realized with using of communication subroutines. Control logic for stepping engine is realized also helping by one of the procedures. Connection scheme of control unit is in the fig. 3.

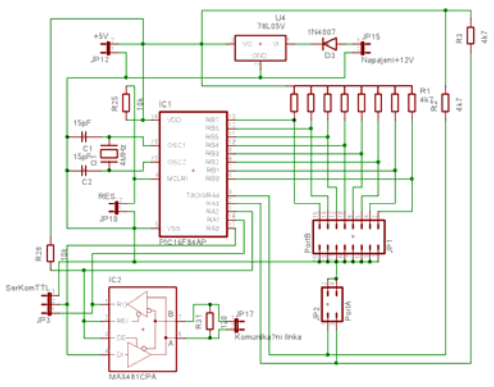

Fig. 3 Connection diagram of control unit

The power unit consists of four power transistors. These transistors switch individual coils of stepping engine by algorithm, which is located in control unit. The galvanic separation is realized helping by optical gate.

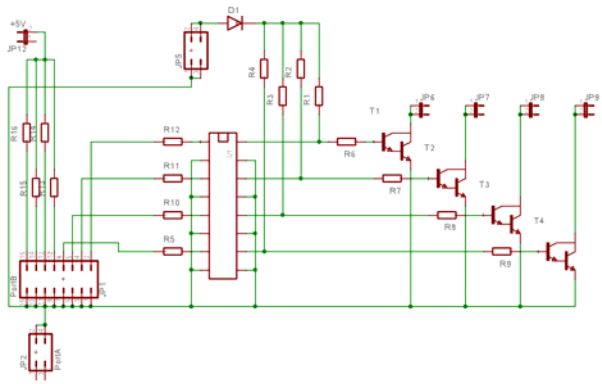

Fig. 4 Connection diagram of power unit

All threes modules are connected by common bus. This hardware resolution is advanced for possibility of another expansion without physical changes in modules. This modular principle can be used for example for larger distance between computers and control unit for stepping engine, then is not going to used module for RS-232 connection, but the module for RS485 connection. Also the protocol is adjusted to this fact. If here is performed small modification at main program in the standalone-chip, it is possible to use the communication interface (RS-485) placed directly in control unit.

4 MODULES CONNECTION TO PC

The whole control chain consists in computer (notebook), communication interface (RS-232, RS-485 and USB) and control unit for generating control pulses for stepping engine and power module. The power module switch individual coils of stepping engine. The stepping engine is power

unit for positioning device, which is based on bullet screw. This measuring circuit is described in fig. 5.

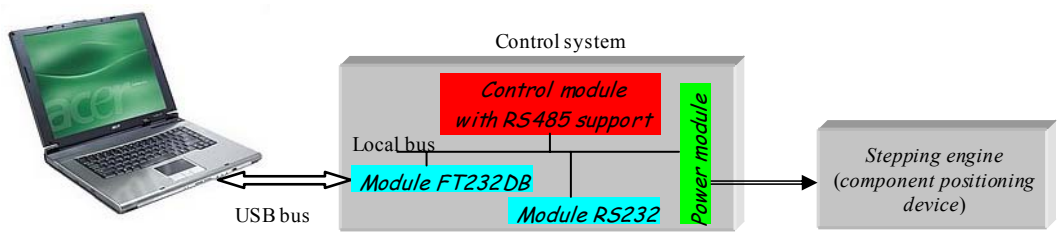

Fig. 5 Control chain

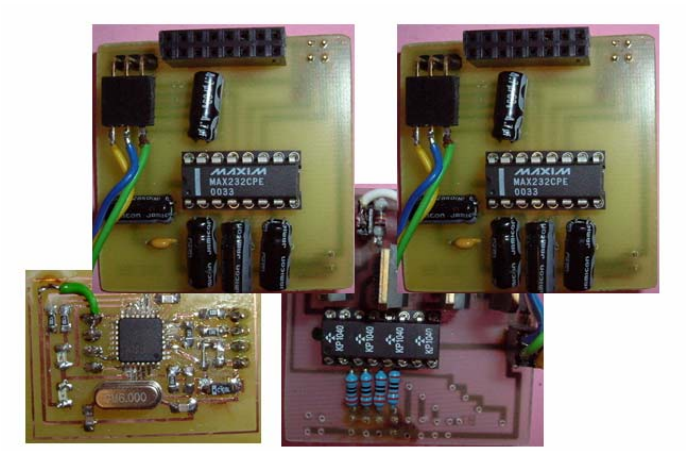

Fig. 6 Individual modules of control system

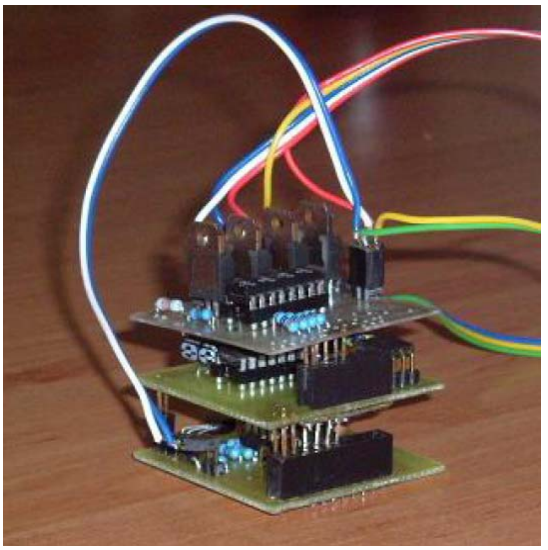

Fig. 7 Modules of control system

5 COMMUNICATIONS PROTOCOL

The system must enable execution, suspension and return to initial position of the positioning device. The speed of shift is constant. The possibility of positioning device movement with min. angular turning has been tested. This is defined by angle of one step of engine. Thanks to these requirements has been created communication protocol. Protocol allows the position settings of the endpoint of positioning device. The application located at computer or notebook makes the rendering of position. Number of steps of stepping engine is sending through the communication interface.

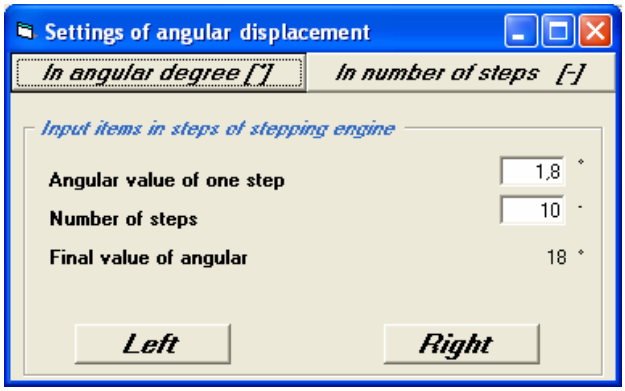

Fig. 8 Window of development application in VB6.0

6 CONCLUSIONS

The possibilities of hardware for creating of control pulses generating for stepping engine were verified. The stepping engine is driving unit for positioning device of ultrasonic sensor. Were creating electrical modules for communication, power gain and control, software for control unit on the base of standalone-chip family PIC16F84A, and software at Visual Studio 6.0 environment for communication and control from computer were created. For standalone-chip PIC family programming was used MPLAB development environment of MICROCHIP Company. Communication interface is RS-232, RS-485 or USB. The whole device is realized as modular with the possibility of the next upgrade.

ACKNOWLEDGEMENT

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