Remote Control and Synchronization of a Stepper Motor

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Abstract — **The aim of this diploma project was to create a remote synchronization of a stepper motor. The project covers whole development including installation, commissioning and programming. The software implementation is made in several tasks via PLC open. The remote visualization is available too. The software was created in the Automation Studio development environment.**

Keywords — Motion control, PLC open, stepper motor, Automation Studio.

I. INTRODUCTION

This project deals with remote synchronization of a stepper motor.

The objective of this task is to get knowledge of positioning options of two stepper motors controlled by PLC. Control of stepper motors is allowed using the control program and especially using the software visualization.

The hardware of this task is composed of two stepper motors, 24 V power supply and PLC with I/O cards.

Software contains the control part for motors and the part of visualisation for easy control by PC, which allows settings of important positioning parameters and basic diagnostics.

II. PRINCIPLE OF THE TASK

Two equally sized disks are attached on two stepper motors. Both discs have drilled three holes on the edge. The holes have the same pitch. Both disks are partly overlapped. Student will have to move motors so that the holes will be overlapped on these disks using a few limited movements. Access to the task is to be remote; therefore a manual positioning is not possible. Student will have software visualisation with basic positioning functions for the control.

The stepper motors have a encoder with 1024 pulses per rotation. Stepper motor modules allow microstepping 51 200 microsteps per rotation. In accordance with the PLCopen dimensionless unit 3600 units per rotation for measuring was used. Therefore 1 unit is 0,1°.

III. CONSTRUCTION OF THE TASK

Complete construction is shown in Fig.1.

Used components:

- 2 biphasic stepper motors 80MPD1.300S014-01
- 24 V B&R Power supply PS1100
- PLC B&R X20CP1484-1
- B&R I/O module X20SM1436 and X20DM9324
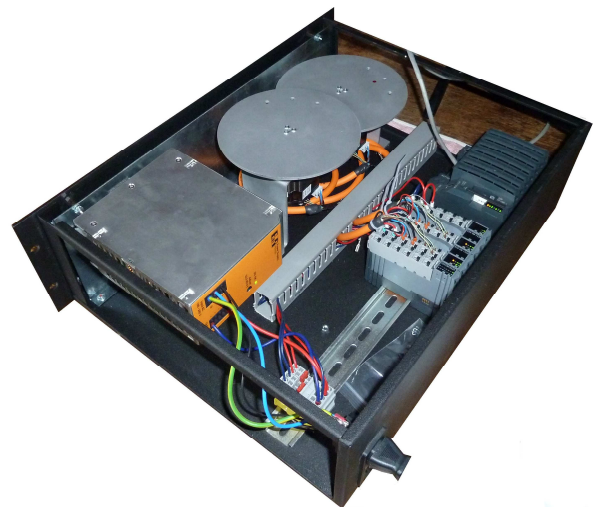- Rack, discs, DIN rails, cables

Figure 1: Construction of the task

IV. SOFTWARE

The software was created in a structured text in the Automation studio development environment. Control part was created as first and then the part of visualisation.

A. Control program

The conception of this control program is shown in Fig. 2 Program base from B&R was used for simplification. The option for separate or simultaneous motor control and basic diagnostics is also included here.
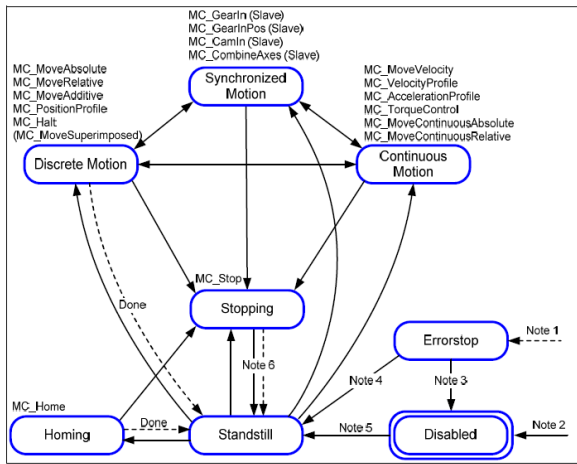
Figure 2: Flowchart of the control program [1]

B. Visualisation

The visualisation consists of three pages, which are discussed in detail in the following chapters.

1) Motion page: This page is for control and is divided to these sections:

- Motor option – activation and motor selection.

- Parameter settings – velocity, acceleration, deceleration, position and distance settings.

- Control – absolute and relative positioning and homing.

- Move type – positive, negative, shortest way and current motion.

- Legend – description of colours, which indicate state of motors.

- Status – state of motors and actual position.

On this page there are also two circles representing two disks. If the motor is active, in home state, or in error state, the status is displayed in the middle of these circles. Three holes are shown at the edge of these circles. These holes show exact position of overlapping holes and approximate disk position.
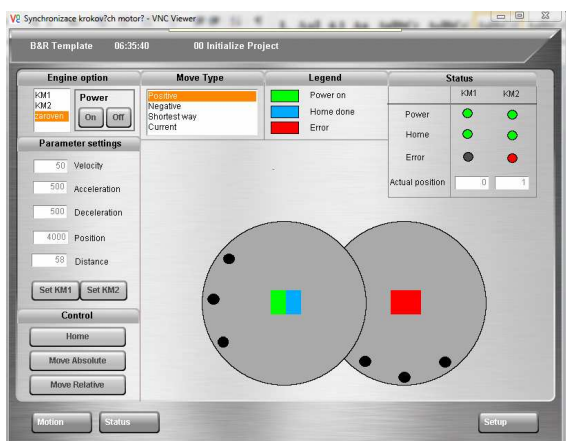

Figure 3: Motion page

2) Status page: This page shows error states of the motor axes and set parameters at both motors. There are two windows for the motors and a button for the error acknowledgement. If the error is not acknoledged, axes are blocked. A simple table is used for showing the parameter sets.
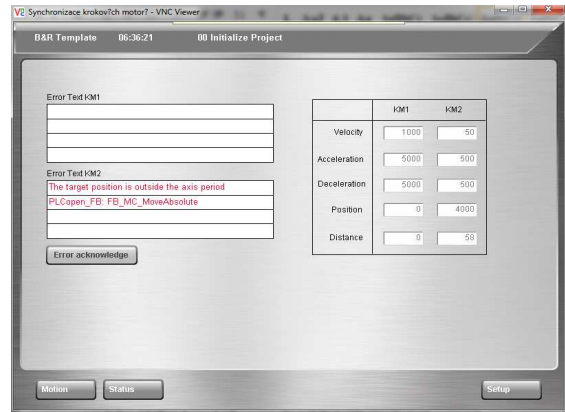

Figure 4: Status page

3) Setup page: There is a written actual date and time with the IP address. Because there were two similar devices built with different homing positions, there is an option to choose proper configuration for each entity.
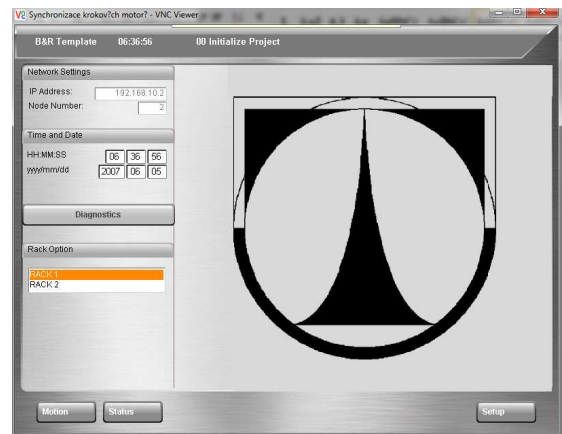

Figure 5: Setup page

V. REMOTE CONTROL

VNC (Virtual Network Computing) was used for the remote control. System consists of client, server and communication protocol. Client is a program VNCviewer installed at PC. The VNC server is standard service of the modern PLC system. We can control PLC via communication protocol RFB (Remote Frame Buffer). The connection is Ethernet based.

VI. Conclusion

Results of this project are two similar devices placed in a rack, on which students can get basic information and experience about positioning of the cyclic axis.

The second level is programming of the proper motion task or motion sequence. The basic principles of the PLCopen motion control are needed. The simple visualisation helps students at the beginning of programming and commissioning. The diagnostic tool includes error visualisation and error description is implemented too.

Acknowledgment

References

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