

Roman PAVLAS*

DIGITIZING OF TRACKING CONTROL ON A MODELLING YARD

DIGITALIZACE ŘÍZENÍ PROVOZU NA MODELOVÉM KOLEJIŠTI

Abstract

The aim of this contribution is focused on digitizing of modelling yard. In introduction is out of print actual state of yard and technology used on that. In next parts is effected analysis accessible technology for digitizing modelling yard and election ones of them. Digital control caused that the locomotives are able to act on a section of the yard independently. This paper was created with support of grants project Nř F1a 2148 - FR VS and Specificical research.

Abstrakt

Třma pŕıspřevku je zamřeno do oblasti digitalizace modelovřho kolejiřtř. V řvodu je popsán vřchozı stav kolejiřtř a pouzıtř technologie. V dalřıch řástech je provedena analřza dostupnřch technologiı pro digitalizaci modelovřho kolejiřtř a vřbřr jednř z nich. Digitální řızenı sluzı k tomu, že lokomotivy jsou schopny pohybovat se nezávisle na sekcıch kolejiřtř. Pŕıspřvek byl vytvořen s podporou grantu FRVř ř. F1a 2148 a Specifickřho vřzkumu.

1 INTRODUCTION

The milestone in branch of railway's clay-modelling was using of digital control. This control caused that the locomotives are able to act on a section of the yard independently. Until the locomotives were controlled by the help of operating power supply of single yard sections, the engine of locomotives was directly linked to the power supply in given section and act according to polarity and sizes of tension in it.

At digital control the tracks are power supply by constant pension, in which actuating signal is modulated. Every engine processes this signal and acts according to direction given to the engine with the correct address.

2 THE INITIAL STATE OF MODELLING YARD

2.1 Description of railroads situation

Yard (see Fig. 1) consists of basic bearing portfolio, clay-modelling blocks, rail segments and next equipment, as constructions and stop-go lights (semaphores). The model is made up in gauge 1:120, which is modelling size TT gauge of way rails 12 mm. The all model is located into the wooden case with transparent cover.

Independent yard is divided into many separate power supply segments, because of the possibilities of analog drive of more sets at the same time, independently from each other. In the yard there are 2 main circuits, running shed, train, lay - by and furcate highway shoulder track in the section of the station.

* Ing., Ph.D., Department of Control Systems and Instrumentation, Faculty of Mechanical Engineering, VřB – Technical University of Ostrava, 17. listopadu 15, Ostrava-Poruba, tel. (+420) 59 732 3585, e-mail roman.pavlas@vsb.cz



Fig. 1 The global view to the modelling yard

The yard is divided into the 10 separately operated sections:

- 4 sections on of the chief circle,
- 4 sections in the railway station,
- 2 sections in the place of locomotive depots,
- 1 section on highway lay-by track,
- 1 section on siding crossing track.

Individual sections are power supply by tension about sizes 0 – 12 V, whereas by the change of track polarity direction of locomotives' travel is determined. These sections are operated by the help of PLC over modulus of discrete inputs. The stop-go light is associated to each section and this stop-go light is operated concurrently with each section. Signalling matches standard signalling on real traction generating station system. However, compared to real system the trains do not respond right on the semaphore, but only on semaphore turned-on light notation corresponding to the state of the running on modelling yard.

2.2 Control System

Running on yard is controled by the help of PLC firm ABB series 800xA. This PLC is modular, physical divided into 2 groups of modulus. One group of modulus is on the side of drive at PLC (see Fig. 2) and alternative group of modulus is placed in the yard (see Fig. 3). These groups communicate together by the help of ProfiBus interface. For the purposes of drive modelling yard are these modulus used (included both insider modulus) [ABB 2004A]:

- CPU's modulus AC800M type PM860,
- communications enlargement ProfiBus CI854A,
- modulus for interface I/O cards to busbar ProfiBus CI830,
- input modulus DI801,
- output modulus DO801,
- power supply SD821 and SD823.



Fig. 2 CPU's and ProfiBus modules



Fig. 3 Power supply, ProfiBus and I/O modules

3 DEVELOPMENT OF DIGITAL CONTROL

3.1 Basics of digital control

For a digital control of modelling yard there an independent busbar called DCC (Digital Command Control) exists, which makes it possible to control both locomotives, so also accessories, like signalling, crossing etc. A part of busbar DCC for driven engines is called LocoNet® [Modelling club Zababov 2007].

This busbar works on principle of variables longitude of pulse on modulated one to the power supplied tension of the yard. To the yard a signal is modulated by the help of digital central unit. Every engine has an integrated decoder inside that is able to separate an actuating signal from the power supplied tension and respond according to it. Every engine has its own address and so more engines can be driven together. A designed architecture of digital operating standard DCC, we can see on Fig. 4.

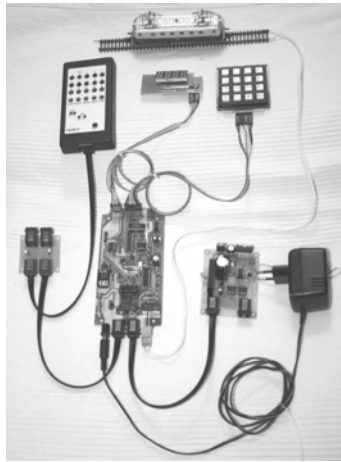


Fig. 4 Sample connection digital modelling

3.2 Development of digital units

Some parts of digital control set are professional components. For successful functionality of digital control in our conditions was necessary to develop some digital components – printed circuit boards.

On Fig. 5 is shown design of main boards – digital central unit and on Fig. 7 we can see view to this unit. Design and view of second boards – digital central unit is shown on Fig. 6 and Fig. 8 [Modelling club RailNet 2007].

3.3 Digitalization of Taurus BR 182 locos

The aim of digitizing of locomotives was not only digitizing of drive, but also a possibility to independent operating of positional lighting that had to light forward in yellow and to the back in red. Next function had to be an independent switching on of the main headlight.

Engine had already advanced preparation for digitizing and on the board it had a connector for interface of loco-decoder (see Fig. 9).

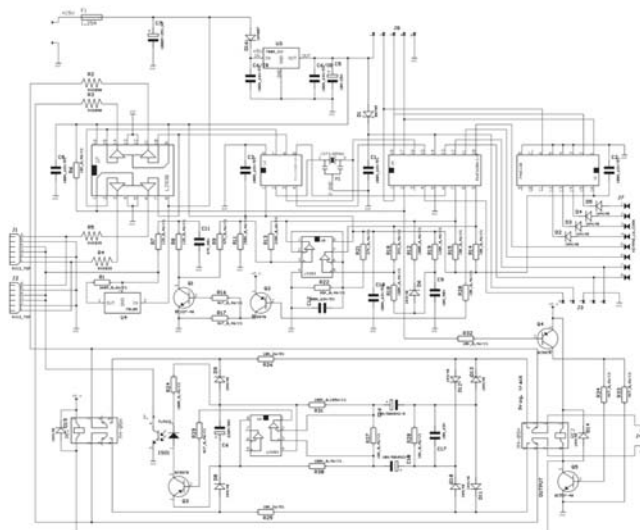


Fig. 5 Design of digital central unit's

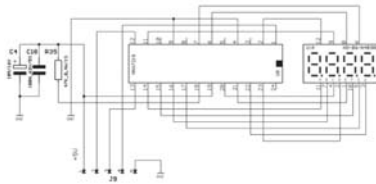


Fig. 6 Design of display-board's

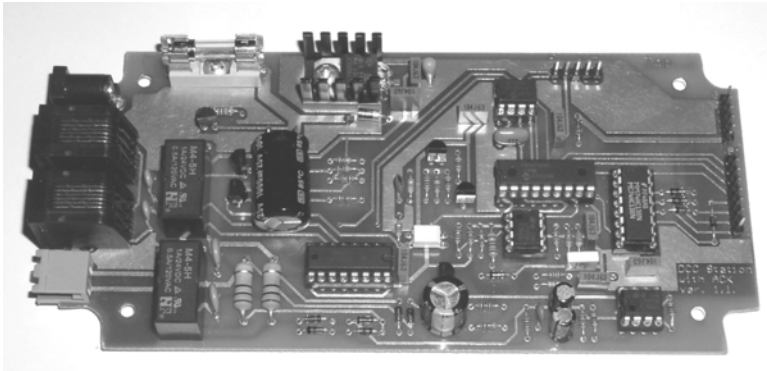


Fig. 7 Digital central unit



Fig. 8 Display-board

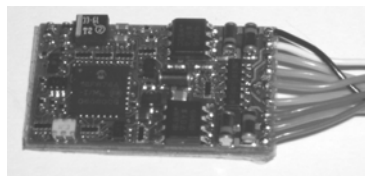


Fig. 9 Loco-decoder

The principle of the lighting serial version is by the help of two light bulbs, that are started from the power supply of the rails and direction of lightening is warranted front - end diode (there always the bulb of direction ride shines). It was needed to design a printed circuit enemy - occupied of technology SMD (see Fig. 10) and adjust both undercart, so a body of locomotives (see Fig. 11).

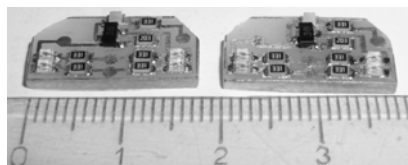


Fig. 10 SMD technology for lighting

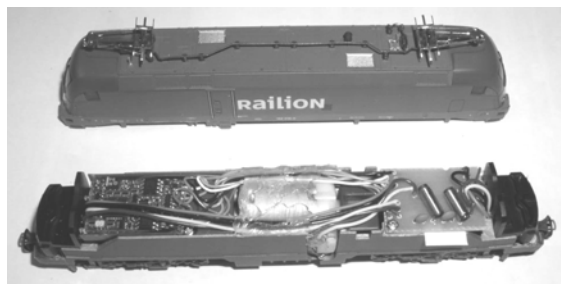


Fig. 11 Digitalized loco (Taurus BR 182)

As follows the digitizing of locomotives is full and the engine is in extenso functional and ready for running on modelling yard. It is possible on it abstractedly to start positional lights, whereas the positional lamps are alight forward in yellow and to the back in red. These lights are dependent on an elected direction of the locomotive movement (even if the engine is immobile). Otherwise it is possible to start service headlight (it is possible to start only with positional lights and only on the side of travel direction). The engine distinguishes 128 high - speed levels for every travel direction.

4 CONCLUSIONS

Proposition and to made a multi-controller are another shaped steps for developing of this problems. This multicontroller should contain 5 drivers which will not have buttons, but will communicate by the help of interface RS - 232. By the help of this interface it should communicate with PLC so, that the simultaneous control will be kept and a switch between a digital and an analog controlling should start on a mere change of software in PLC and by the switch on/switch off of the central digital controlling.

Next step should be about composition of digital controlling of the cover, on which the all control parts for programming of loco-decoders and adding of measurement addresses of single drivers should be placed.

REFERENCES

- [1] ABB 2004A. *Control and I/O - Basic Control Software – Introduction and Configuration*. [online]. Västerås (Sweden): Automation Technologies, October 2004 [cit. 2006-05-08]. Nõ of document: 3BSE035980R4001. Accesible from www: < URL: http://www.abb.com/controlsystems/./3BSE035980R4001_CIO_BasicSW.pdf >.
- [2] FREIWALD SOFTWARE 2006. *RAILROAD & CO - TrainController - Users Guide*. [online]. Egmating, Germany : Freiwald Software, 2006, version 5.8 September 2006. 263 s. Accesible from www: < URL: <http://www.freiwald.com> >.
- [3] JAKUBASCH, H. 1983. *Modellbahn – Elektronik*. Berlin : Transpress Verlag für Verkehrswesen, 1983.
- [4] MODELLING CLUB RailNet 2007. *Digitlization of loco*. [online]. RailNet : 2007. Accesible from www: < URL: <http://www.railnet.sk> >.
- [5] MODELLING CLUB Zababov 2007. *Digital Command Control (DCC)*. [online]. Zababov : 2007. Accesible from www: < URL: <http://www.zababov.cz> >.

Reviewers:

doc. Mgr. Milan Adámek, Ph.D., Tomas Bata University in Zlín

Ing. Milan Javůrek, CSc., University of Pardubice