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ScienceDirect

Procedia Computer Science 104 (2017) 393 – 399

Procedia Computer Science

ICTE 2016, December 2016, Riga, Latvia

Object Controller of Electric Drive of Point Machine with Expanded Set of Diagnostic Tools

Mareks Mezitis[a], Vladimirs Karevs[a,]*, Julija Freimane[a]

[a] *Institute of Transport, Riga Technical University, Riga, Azenes street 12a, Riga, LV-1048, Latvia*

Abstract

The schemotechnical solutions of object controllers (OCs) cannot be generally accessible due to their technological value. At the same time, OCs are an integral part of computer-based interlocking systems (CBIS), and study of their operation is required to determine the prospects of development and training of the service staff of CBIS.
To replenish the insufficient information, the analysis has been carried out per the description of CBIS EBILOCK 950 and the circuit-based technical solution for high-power outputs of MOT OC for three-phase e-motors of alternating current is offered.
The proposed schemotechnical solution comprises also a set of diagnostic tools (DT). This set enables to follow the technical condition of power elements of MOT OC, as well as the technical condition of the object of control and diagnosing (OCD), which increases the penetration depth of DT.
Application of the expanded set of DT in high-power outputs of MOT OC, allows to ensure more efficient maintenance process of point machine. The maintenance efficiency is achieved through use of technical diagnosis of OCD and determines the maintenance frequency, ensuring the timeliness of preventive work.

Peer-review under responsibility of organizing committee of the scientific committee of the international conference; ICTE 2016

Keywords: Electric drive; Object controller; Diagnostic tools; Maintenance; Point machine

* Corresponding author. Tel.: +371-29531374.
E-mail address: vladimir.karevs@rtu.lv

Peer-review under responsibility of organizing committee of the scientific committee of the international conference; ICTE 2016
doi:10.1016/j.procs.2017.01.151

1. Introduction

The MOT OC of are used for control and adjustment of the point machine's position and enable to control one-phase, three-phase, direct current e-motors (see Fig. 1)[5]. MOT has circuits of internal diagnostics and diagnostics for OCD. The result or diagnosis is presented at the level of messages delivered to the engineer's workplace FEU[1].

As to the informative character, the error codes of OC is a confirmation of occurrence of the event that has led to a complete loss by OC or OCD the ability to operate in predictable way. After detecting is made, from the symptom the possible event is determined out of the known selection having its own unique code. Special manuals or programs are used to decipher the codes. Error codes are classified as to the actions of the staff A, B, C, D, E[1].

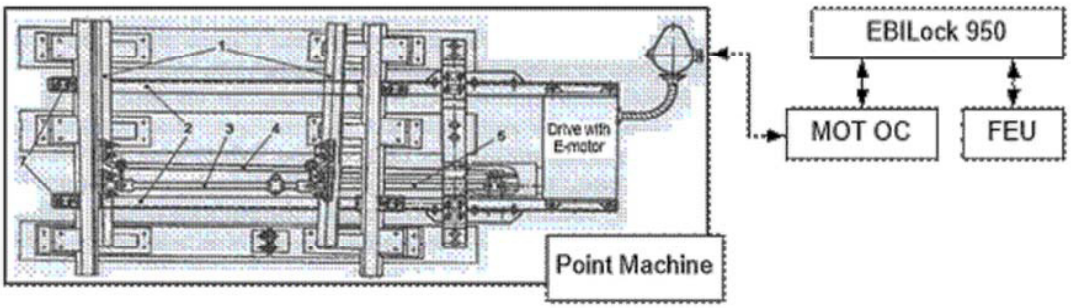

Fig. 1. MOT OC, Point Machine and FEU of EBILOCK 950.

It must be noted that the depth of diagnosing is limited by the necessity to confirm that the OCD has not lost its ability to operate in predictable way. DT of MOT EBILock 950 detect the failure or damage of the power elements of MOT OC and malfunction of OCD. Thus, the maintenance of OCD is performed after this detection as repairs and restoration.

Optimization of maintenance of point machines in addition to periodical schedule requires information about the evolution of their electrical parameters, which is possible only after expansion of the set of DT of MOT.

One must point out the possibility of transition to preventive maintenance according to the technical condition, which enables coordination in selecting the priority of maintenance for point machines, which is particularly vital during the winter period.

The error codes formed by expanded DT are included into Class C[1], namely, useful information upon performance of maintenance.

2. Schemotechnical solution of high-power outputs

Now we turn to the proposed schemotechnical solution for the high-power output of MOT (see Fig. 2), which is capable to ensure the necessary set of controlling and diagnosing actions.

The proposed schemotechnical solution takes into account the requirements of safe control. These safety requirements include guaranteed disconnection of supply circuits when there is loss of control over the point machine's position. To fulfil the requirements of safe control, in addition to the circuit of protecting relay K1 separate relays K2, K3 are used in the automatic equipment for selecting the direction of rotation.

When OCD loses the ability to operate in a predictable way (the point machine does not chance position after order), the MOT OC to the engineer's workplace FEU transmits the error codes 20/21/22, 24/21/24. Upon the loss of control over the point machine's position, the error code 26 is transmitted[1]. The high-power output is composed of the following (see Fig. 2):

- Elements of over-current protection FUSE_A, FUSE_B, FUSE_C
- Elements of over-voltage protection VAR_A, VAR_B, VAR_C, R0