USING THE EASY PROGRAMABLLE LOGIC CONTROLLERS TO THE MINING CONVEYORS BELT IN JILT OPEN PIT

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ABSTRACT. *The usage of the programmable logic controllers (PLC's) in the controlled drives of the open pit coalmines machinery is tracking the productivity growth, decreasing the specific electric power consumption and the rational use of the machinery.*

KEY WORDS: *open pit, automation, programmable logic controllers, electrical energy*

1. INTRODUCTION

Each automation (control) has the objective to rise the competitively of the product or process, as direct through the cost and quality as well as indirect through the improving the work conditions, into a modern economy.

The control involve the drive if some dynamic systems with continuous stages. The driving of these systems is made with PC equipped with performing analogical input / output modules. There are some situations where the inputs, outputs and some systems stages can be modelling through binary variables, using programmable logic controllers (PLC).

In a modern open pit coal mine the technological, mechanical, electrical and economical elements of the production process are in a direct interdependency, the modernization of any of these components (mainly the electrical one) is necessary.

In the scientific research evolution for the automation of the conveyor belts and its control, the challenge is the implementation of a rational mode of operation and the optimizing of the working parameters, for obtaining superior techno-economical indicators, especially the power saving. This goal is very important, as the electric energy cost has significantly increased in the last years, being expansive than a few years ago.

The surface and depth expansion of the open pit coal mines mechanization and automation of the technological processes in continuous flow for extraction, transport and stockpiling, has determined the increase of rated capacity and productivity growth of the mining machinery.[1]

The main link ascertaining the open pit productivity and the cost price per lignite mass ton is the excavating process respectively the bucket wheel being the leading element. The usage of the programmable logic controllers (PLC's) in power electronics in the controlled drives of the open pit coalmines machinery is tracking the productivity growth, decreasing the specific electric power consumption and the rational use of the machinery.

2. ABOUT LIGNITE OPEN PIT TECHNOLOGY

The lignite open pits activity is only justified in some conditions when the lignite costs are attractive in the market competition. To assure the lignite competition with another primary energy fuels it is necessary the correlation between transport, excavation activity with the market requests for increase the economic efficency, incrase the productivity and for reduction the stuff and energy consumption.[2]

Eelctrical energy consumption is an important part on the lignite structure cost so it must achieve a detailed study about losses of energy and to establish a measurements plan. The following measurements and programme on short and average time are applied: limitation of peak loading which is based on the direct relations between programmed mechanical torque to be used and the effective mechanical torque; electromagnetical monitoring to determ some levels for electrical measurements to be used; the adjustable electrical drives used in the open pit`s equipments through power electronics and adequated comand represent a method to diminuate the electrical energy consumption and the financial effort is not important because the actual motors are kept in function working with static converters;

The energy production based on lignite has the following advantages:

- the production costs are approximately the fuel oil production costs;
- diminution of hydrocarbons imports through ht own resources using;
- the investments for lignite are smaller than nuclear energy investments at the same installed power;
- assuring the occupation work forces like an important social aspect;

- the dependence of electrical energy import is eliminated, it can even produce thermal energy in cogeneration;
- the environmental problems are solving with actual used technologies.

The power supply from the open pit coal mine machinery consists of electrical cables from 20/6 kV transformer station rigged with 4 or 6 MVA transformers providing about 1263,3 MVA rated capacity (Fig.1).

The bucket wheel excavator is continuous flow complex machinery that excavates the coal using the buckets fitted on the wheel and in the same time conveys the material to the transportation facility. The working element – bucket wheel executes horizontal and vertical movements, the basic one being the rotation.

The bucket wheel turns and in the same time swivels so a bucket moves on a helical trajectory (helix). The asynchronous motors in schortcut or induction motors are frequently used in electrical drives for open pits machines. The motor `s power are from 100 to 630 kW and the open pits costumers are supplied from transformer stations about 2x4MVA, 20/6 kV using different electrical cables.

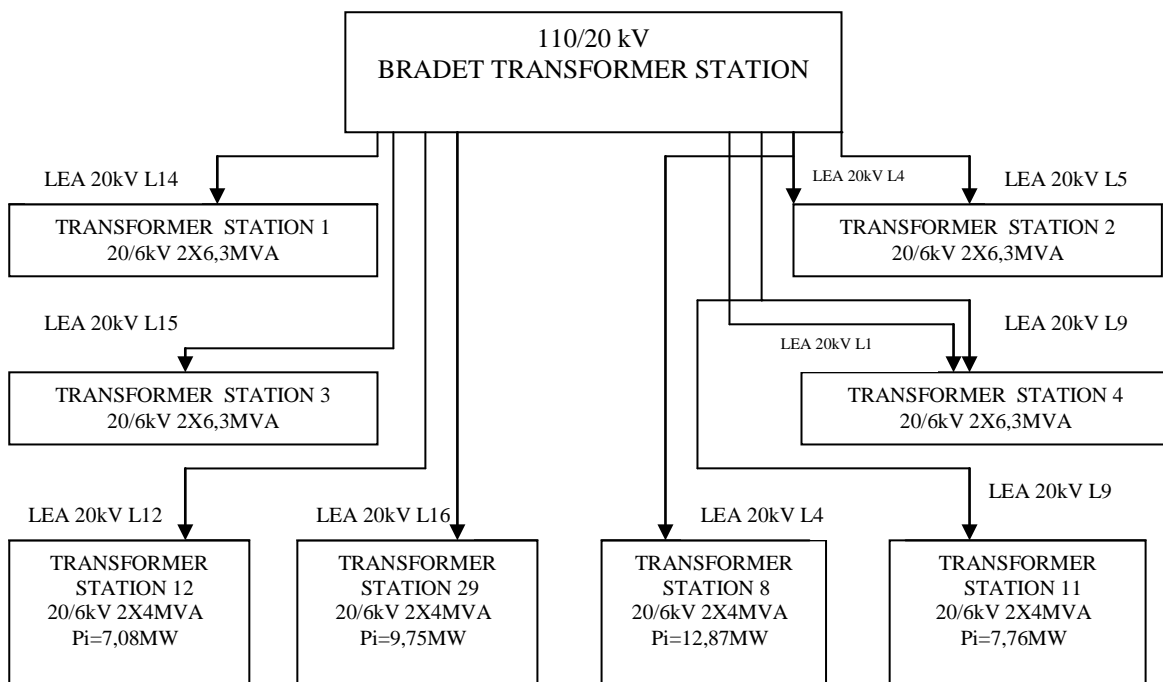## ELECTRICAL POWER SUPPLY SCHEME Jilt Sud Open pit

Fig. 1. Power supply station

The lignite open pits from Oltenia are equipped with technologies in continuous flux characterized by: the lignite deposits are excavated by bucket wheel excavators (BWE) with the following capacities 470 l, 1300 l, 1400 l, 2000 l and productivity about 1680 m^3/h - 6500 m^3/h; the belt conveyer has the productivity about 1400 -12500 m^3/h ; the laying down machines have capacity about 2500 -12500 m^3/h.

An efficient, economic transport system is a key element in the viability of coal open pit in Romania. The development of the power semiconductor elements has revolutionized the field of electric power control and has permitted the improvement and the diversification of the electric energy converter. As electronic power components improve in reliability and decrease in size, the cost and size of variable drives will continue to decrease but their maintenance requirements fall into three basic categories: keep it clean; keep it dry; and keep the connections tight.

3.   THE USED TECHNOLOGIES IN AUTOMATION

For applying automation it can use some opportunities:

- using a cable technology using electrical, pneumatically or hydrometrically relays (for problems where the automation complexity is weak);
- using usually integrate circuits or specially integrated circuits for realise some dedicated systems;
- using PLC (for problems which demand average automation complexity and it is necessary the flexibility) ;
- using PC (for la high complexity degree problems.

The each presented opportunities domain is in dependence with the automation complexity and the number of identically equipments too (fig. 2).

Moeller Group has develop the AP Easy like a relays concentrator for be able to a wide possibilities and applications. It is manufacturing in a large variety numbered for 400 to 800 in dependence to different cycle times or the number of accepted webs.

The most completed of these are the 800 series which is a professional relays concentrator, it is intelligent and offers a large characteristics set: 256 lines of webs, PID function, the control function, arithmetical function, input encoder, PWM output, etc.[4] These APs have the connection capacity to *ASi, PROFIBUS, CANopen* webs. The programmed language is Ladder Diagram.
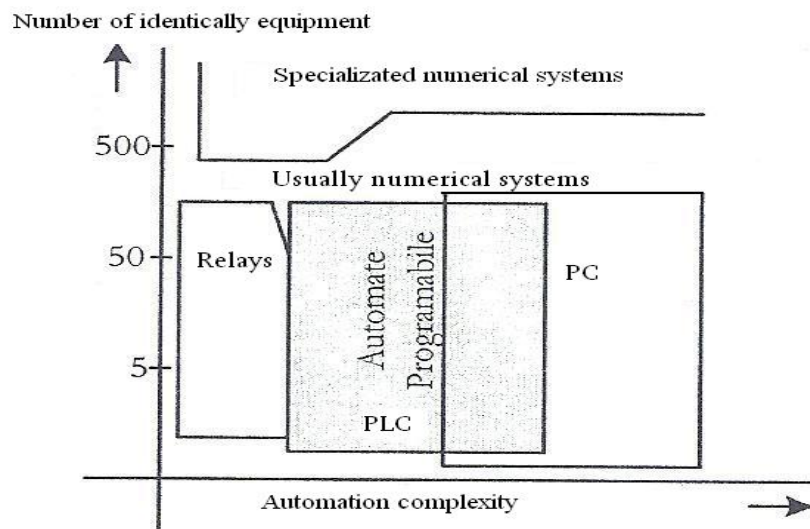

Fig. 2. The automation achievement

PROFIBUS (PROcess Field Bus) represents a AP webs standard EN50170. PROFIBUS technology has a modular structure with technologies which are choose and are combination in concordance with the application requirements. The PROFIBUS has three levels as shown in the (fig.3).[3]

Line drivers and receivers are commonly used to exchange data between two or more points (nodes) on a network. Reliable data communications can be difficult in the presence of induced noise, ground level differences, impedance mismatches, failure to effectively bias for idle line conditions, and other

hazards associated with installation of a network. The connection between two or more elements (drivers and receivers) should be considered a transmission line if the rise and/or fall time is less than half the time for the signal to travel from the transmitter to the receiver. Standards have been developed to insure compatibility between units provided by different manufacturers, and to allow for reasonable success in transferring data over specified distances and/or data rates. The Electronics Industry Association (EIA) has produced standards for RS485, RS422, RS232, and RS423 that deal with data communications.[3]
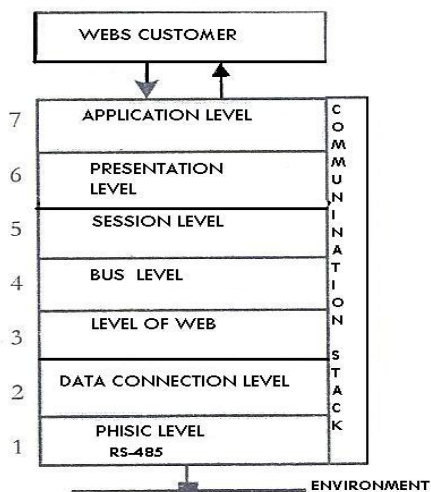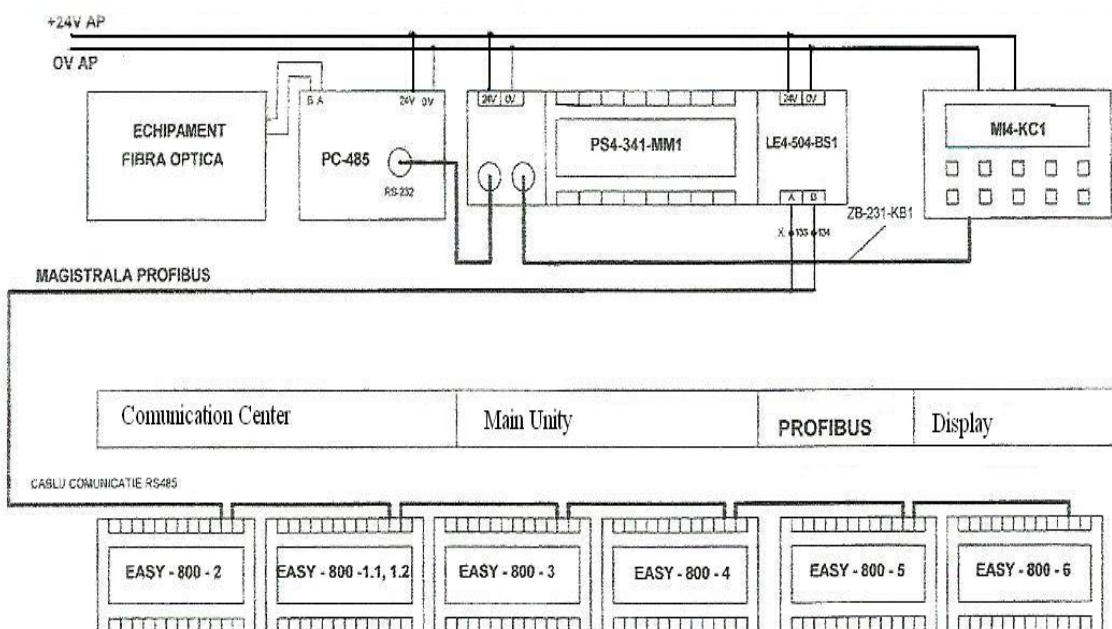
Fig. 3. PROFIBUS levels

Fig. 4 Data communication web

4. CONCLUSIONS

Main objective of Romania`s growth during the next years consists in assuring the sustainable social and economic development, so assuring the strategy for energy sector.

Romanian energy sector`s operation with efficiency parameters imposed by modern world will be mainly realized through the following politicies: establishment and improvement the framework of energy industry, renewable energy sources management, safety supply, energy impact on environment, co-generation, promotion of efficiency in energy use

An efficient, economic transport system is a key element in the viability of coal open pit in Romania. The development of the power semiconductor elements has revolutionized the field of electric power control and has permitted the improvement and the diversification of the electric energy converter. As electronic power components improve in reliability and decrease in size, the cost and size of variable drives will continue to decrease.

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