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Zelio Logic Control System for Horizontal Hydraulic Press

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Abstract

Summary Modernization of control system of Horizontal hydraulic press of model 2240D with the usage of programmable logical controller, namely intellectual relay Zelio Logic is considered. The consequence of technological operations fulfillment such as pressing, non-formal control algorithm, choice motivation of PLC model SR3B261B, control program fragment in the FBD language is given.

Keywords: Press, input, output, algorithm, the controller program, logical controller, software, language

1. Introduction

The development and mass industrial usage of microprocessor control units (MCU) and microprocessor control systems (MCS) is one of the most important directions of scientifictechnological progress in the sphere of automation of stationary and mobile objects in industrial production, transport and communication. Functionally finished MCU on the base of which the majority of information and control systems are built today are the most interesting ones among a lot of other means of MP technique for the specialists dealing with the automation of industrial objects. MCU can be directly built up into the technological units, assembly complexes, stationary and mobile objects. Thus, control quality of a technological process is essentially, greatly increased, the consumption of energy, raw materials is saved, and the industrial production and product quality is greatly increased. By nowadays the majority of up-to-date systems of industrial automation are built on the basis of highly-reliable and easily-arranged programmable logic controllers (Programmable logic controllers) PLC and industrial computers (Industrial Computers) IC. Both of them are adapted to work under hard production conditions and they differ from others that PLC are aimed only at direct control of industrial equipment (that is to solve the tasks only in the mode of “tough real time”), but IC along with the control tasks solve the tasks of processing and visualizing of a great amount of information at high levels of complex integrated systems of automation of industrial production (Korop, 2011). The diversity of PLC and IC models, functional possibilities and technological characteristics allows us to consider them as multipurpose means with the help of which practically all tasks of industrial automation can be solved. The development of control system of hydraulic press 2240D on the basis of programmable controller-intellectual relay Zelio Logic is investigated in this work. Developing control systems the intellectual relay Zelio Logic model SR 3B261B and programmable software Zelio Soft have been used. The program is written in FBD language. The aim of work is to develop and adjust control system of horizontal hydraulic press 2240D.

2. Objects and Problems

Fluid power systems square measure designed by objective. The primary downside to be solved in planning the system is transposing the specified performance of the system into system hydraulic pressure. Stroke Length 200 mm (W. P. 200 bar) Hydraulic Cylinder Dia 200 X 80 X 200 mm.

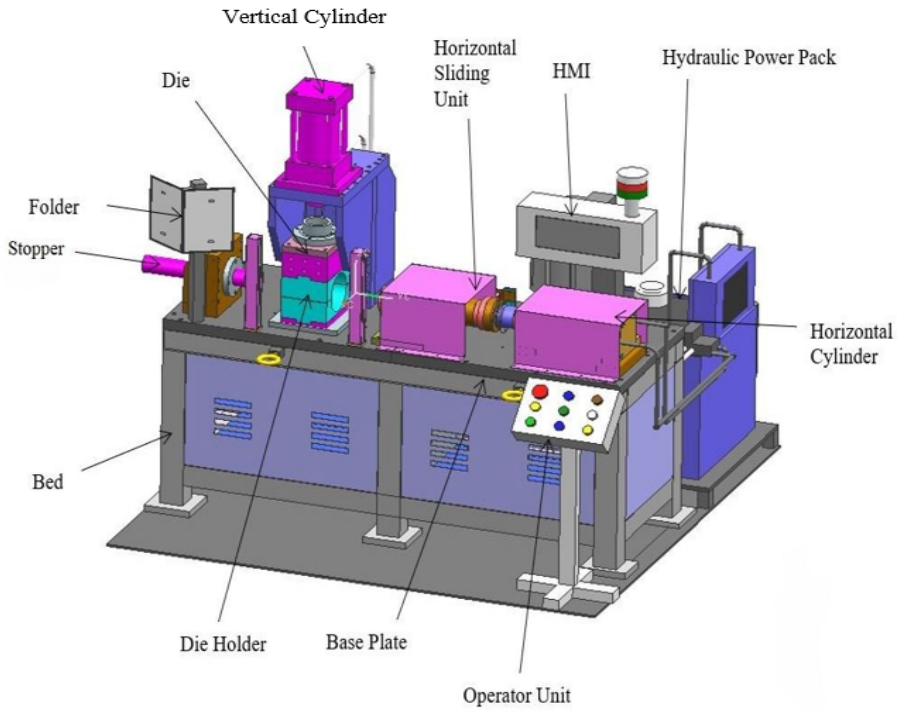

Figure 1. Horizontal Hydraulic press

Developing the control system all necessary modes of press working and blocking are realized. The analysis of designed circuit interaction showed that it is necessary to have a controller with 16 discrete inputs (a punch and die up-down, a Pusher down, a Pusher up, a Cross-piece at the bottom, a Cross-piece at the top, a Pusher at the bottom, a Pusher at the top, Switching on the hydro-power station, Switching off the hydro-power station, Pressure relay, Pusher position). To give the commands the controller must have 9 discrete outputs (a Cross –piece down, a Cross – piece up, a Pusher up, a Pusher down, Electromagnets YM 5, 6, Pressure release, Electro-magnet YM 4, High pressure of M1, Control of M3. In accordance with necessary number of input and output signals the model of Intellectual relay Zelio Logic SR3B261B is chosen. Input signals are connected to the ports of microcontroller I1 – IG, and output signals are connected to out ports Q1 – Q9. The location of electrical equipment in the control cabinet is shown on figure 2.

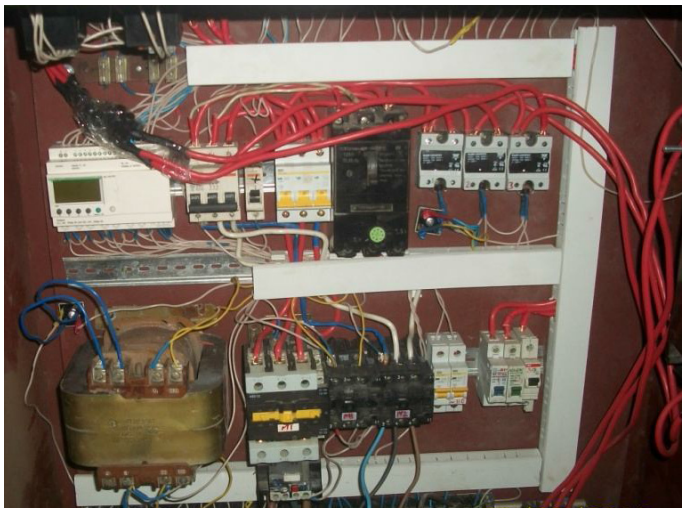

Figure 2. The location of electrical equipment in the control cabinet

3. Algorithm of Press Control

Initial position: a cross piece is at the top (transducer SQ1); a pusher is at the bottom (transducer SQ2). A worker lays down weighted hot polymeric mass PP or PE into a press. Then he presses button SA1 (a cross piece is going down). YM1 is switched on, the controller Q1 is out. The cross piece is moving down till the transducer SQ3 operation (a cross piece is at the bottom). As a result, outputs Q5, Q6 of a micro controller are activated switching on the electro magnets YM5, YM6 and creating high pressure. Press influences the pipe and the force given by an electro-contacted manometer. Initial position: a cross piece is at the top (transducer SQ1); a pusher is at the bottom (transducer SQ2). A worker lays down weighted hot polymeric mass PP or PE into a mould of a press. Then he presses button SA1 (a cross piece is going down). YM1 is switched on, the controller Q1 is out. The cross piece is moving down till the transducer SQ3 operation (a cross piece is at the bottom). As a result, outputs Q5, Q6 of a micro controller are activated switching on the electro magnets YM5, YM6 and creating high pressure. Press influences the pipe the force given by an electro-contacted manometer. A cross piece is hosted till the transducer operation of a cross piece upper position SQ1 – input I7. Q2 –YM2 is switched off, a cross piece stops. The operator presses SA4 buttons (input I4), switches output Q3 –YM3, a pusher is moving upward during the given time, by this the hosting height is determined which is given by using four buttons. The operator extracts the product from a Upper and then lowers a pusher down. The cycle may be repeated. The protection of press working area is realized using photo-electric transducers.

3.1 Control Program

The program fragment is written in FBD language, and it is given on fig.3

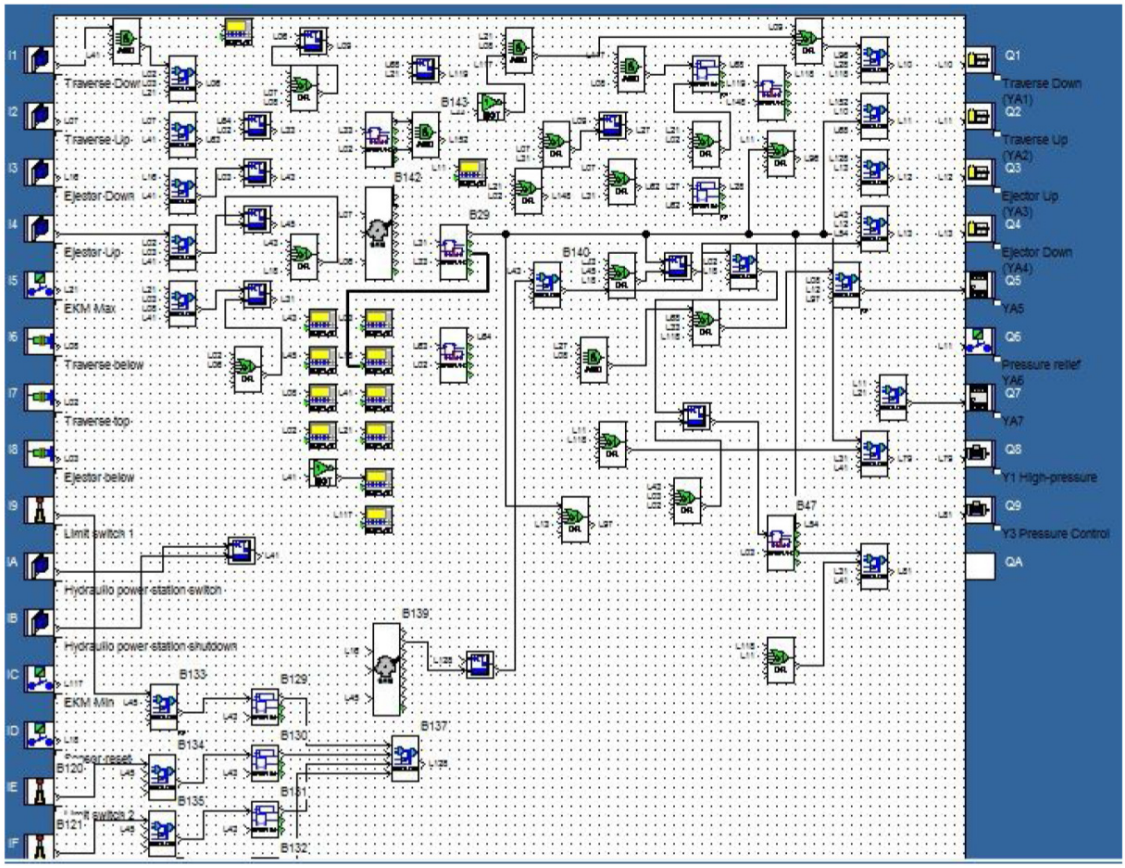

Figure 3. The control program fragment in FBD language

Developing the control system program software Zelio Soft (2004) has been used. Programming has been done in the language of functional blocks (FBD) providing the flexibility of programming and high productivity. Zelio Soft performs the checking of coordination, makes syntaxes checking and checks the correctness of data introducing; all this helps correct all errors immediately. The program is tested in real time, and in this case the module can be either connected to the PC or not. Control window shows the input or output conditions of a module in the sphere of applied program. LCD display on a chosen controller model and usage of DISPLAY function allowed us to show constantly the condition of operated mechanisms what makes the adjusting of control system considerably easier.

4. Conclusions

On the basis of considered principles to fulfill technological operations of product of pipe pressing, studying the principle hydraulic circuit design of 2240D press, the circuit which has existed earlier on the relay-contact elements, designing the cyclorama of its work, defining necessary quantity of input and output signals we can come to the conclusion that it is possible to use a programmable controller, namely intellectual relay Zelio Logic. The fixing of input and output signals to the corresponding ports of intellectual relays is done; the control program in FBD language is developed. The principle circuit of control system is designed and the adjusting of its work is performed. The usage of intellectual relay Zelio Logic allowed us to reduce the sizes of the control system cabinet and the usage of software Zelio Soft and programmable software in FBD language allowed us to develop and adjust the control system quickly.

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