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Hardware configuration of the unitronics m90 controllers

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Summary. The paper presents selected issues related to designing of automation systems and hardware configuration of the Unitronics M90 controllers. The paper discusses several advantages of this series of controllers as devices of universal applications in non-complex control systems maintaining a simple configuration and programming tool.

Key words: PLC controller, automated control process, microchip system, programming.

INTRODUCTION

The Unitronics M90 controller is designed for automation of devices and processes in industry and home applications. The M90 controller is a useful tool in every location where a simple operator instrument panel is a basic requirement and the costs are limited. The controllers designed for industry applications are adapted for heavy-duty conditions [5, 7].

M90 is the smallest controller series by Unitronics fitted with extension ports. Thanks to such ports the controller can be extended by further inputs and outputs.

The most typical applications of this series of controllers are: control of assembly lines, packaging machinery, material conveyance systems, production machinery and building automatics.

Typical equipment of the M90 controllers [19, 21]:
- In/out: discrete (two-state), analog,
- Real time clock RTC,
- Fast counter up to 10 kHz,
- 15 programmable buttons,
- integrated operator instrument panel HMI,
- CANbus protocol support.

For the programming of the M90 controllers Unitronics developed a dedicated programming environment - U90 Ladder. This is complete software that enables hardware configuration of the controller, design of the control software in the ladder language, control of the operator instrument panel and communication with the controller [20].

DEVELOPING OF THE SYSTEM PROJECT

The description of the individual stages of the process of programming of the controller has been presented on the example of designing of an automated system of control of a package counter [1, 11].

In the presented example it was assumed that the machine counts the packages that are subsequently grouped in bulk packages. In the machine a photo-resistor is fitted that that sends a box sensing signal to the controller. The signal from the photo-resistor is also used to detect jamming of the conveyor or lack of packaging in the machine.

In order for the technician to operate the machine he has to log on to the system first. The technician can set the machine operating parameters through a keyboard:
- number of boxes in the bulk packaging,
- hours during which the machine will remain in standby.

During the operation of the machine on the display of the controller messages will appear regarding [6, 17, 21]:
- the number of counted boxes,
- completing of the bulk packaging,
- errors in machine operation.

Information related to the individual projects is saved in generated project files with the extension of **u90**. Hence, the project begins with the creation of a file through selecting the icon **New** or menu *Project*.

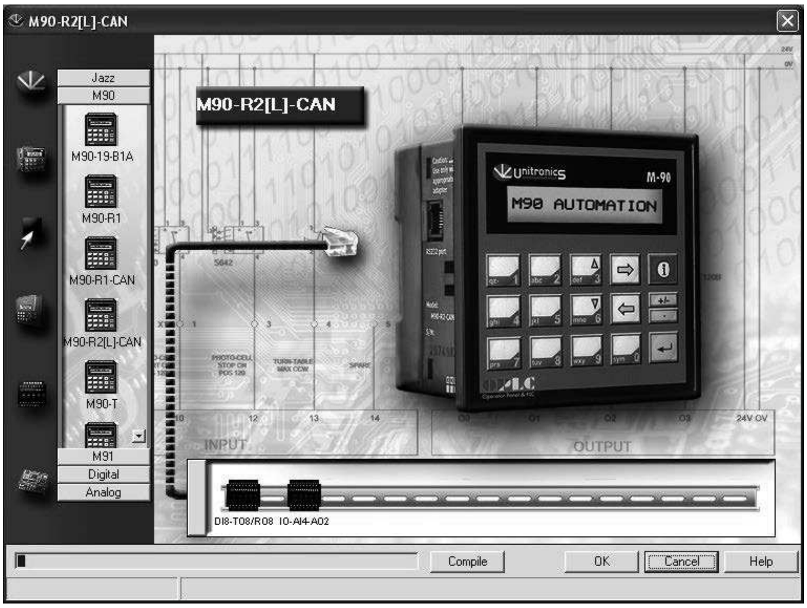

Fig. 1. Hardware configuration window of the M90 controller

During operation only one project can be open. Prior to opening of the project file a window will pop up in the system confirming the saved changes to the open project [8, 20].

When opening a new project file a controller configuration window will pop up– M90 Hardware Configuration (Fig. 1).

From the list of base models we choose the right model of the M90 controller. The mark of the model appears above the icon of the controller. Individual base models are different in terms of the number of available functions.

An example model M90-R2-CAN has 10 digital PNP inputs, 2 analogue 0÷10V inputs, 6 relay outputs and 1 input of the HSC fast impulse counter.

As we can see a low-cost controller has its limitations - the presented model supports only digital PNP inputs and analogue 0÷10V ones.

Let us assume that in our project we need to use the measurement sensors that require an NPN connection with a typical analogue 4÷20 mA input. We would have to replace the base model with a model that supports the required types of input signals i.e. M91 models (as long as the number of input/output signals is sufficient to service the project).

In the presented example we will continue with the base model M90 and will show the additional features resulting from the model being equipped with the extension ports. In the hardware configuration window of the controller we will extend the project by additional two mixed modules (digital and analogue): DI8-TO8/RO8 and IO-AI4-AO2 [3, 7, 10].

The digital module DI8-TO8/RO8 has 8 PNP/NPN inputs, 1 HSC counter and 8 PNP transistor outputs.

The analogue module IO-AI4-AO2 has 4 analogue inputs both voltage and current and 2 analogue outputs.

The system extended in such a way supports input and output signals in both positive and negative logic.

Below the screenshots of the selected configuration windows have been presented.

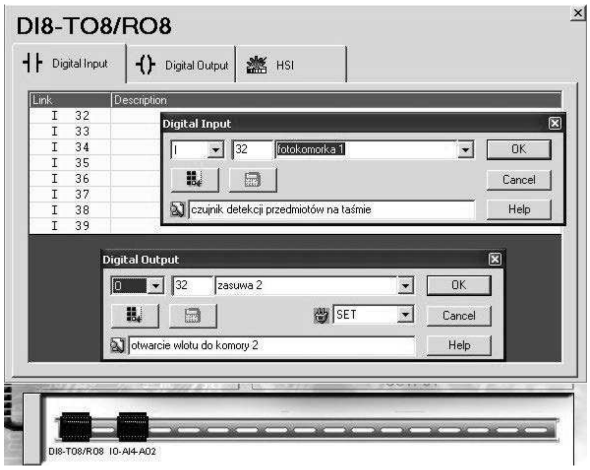

Fig. 2. DI8-TO8/RO8 module configuration window

As we can see in Fig. 2 the numbering of the IN/OUT signals for the first module of extensions starts from number 32 an for the subsequent modules 64 and so forth. Such a numbering system ensures clarity of the numbers in addressing of the IN/OUT signals.

Fig. 3. Defining of the output signal for the control of the valve

In the case of output signals there is a possibility of defining of the signal level after a possible system reset (in this case the flap is closed) [2, 12, 15].

In the example project the boxes need to be counted and subsequently sorted to appropriate collective chambers. For the counting of the boxes the function of additional module of the impulse counter was used that counts the impulses from the photo-resistor. The information on the number of counted boxes is saved in the MI2 record available under the variable name *Counter* (Fig. 4).

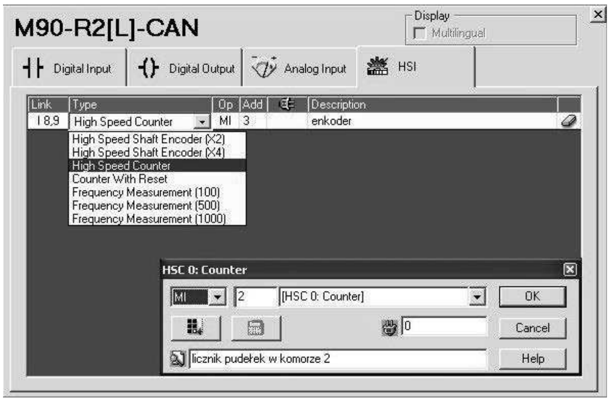

Fig. 4. HSC counter configuration

For the control of the speed of the conveyor a signal from the encoder is used from which the impulses are counted by the HSC counter available in the base model. The information on the number of counted impulses is saved in the MI3 record available under the variable name *encoder* [4, 16].

Regarding the analogue signals, also in the base model there is a limitation –only voltage signals are supported. Hence, to control the power of the heater the current output should be used, which is available in the additional module (Fig. 5).

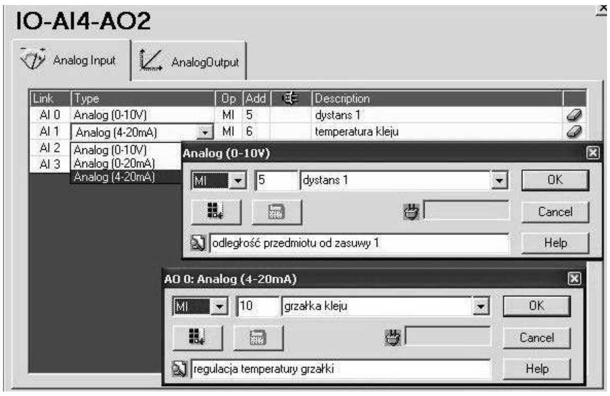

Fig. 5. Configuration of the analogue signals

Some of the hardware devices need to be additionally software-initiated. The example could be the necessity of resetting of the counter.

Counter initiation [9, 18]

Before the counter starts operation, we need to set its initial value (assign it a zero value).

Fig. 6 shows a fragment of the software in a ladder language responsible for the initiation of the element counter:

– a connector sensing the growing slope associated with bit MB 5. Bit MB 5 assumes the value of 1 after confirming of the identification number of the operator.

– The variable recording function block (Store) that will enter "0" to the variable MI2.

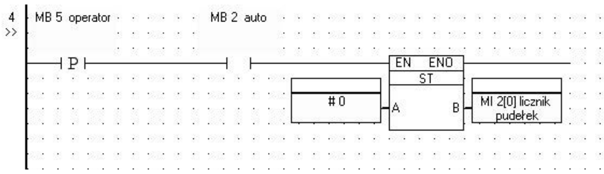

Fig. 6. Initiation of the box counter

- Configuration of the Modbus connection

In the discussed project of the control system, an additional possibility was assumed of the data transmission from the process to a master unit through a Modbus RTU protocol [13, 14].

To this end, in each controller participating in the combination, after a correct initiation of the communication port, the connection needs to be configured as Modbus Master and Slave.

Below a fragment of the software responsible for the configuration of the protocol as Modbus Master has been presented.

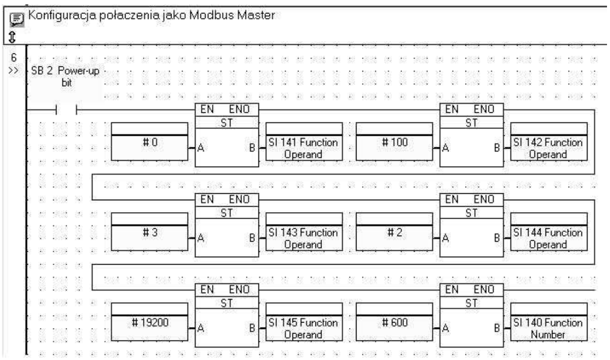

Fig. 7. Configuration of the Modbus RTU protocol as Master

CONCLUSIONS

In the paper the authors discussed selected fragments of the example system design with the M90 controller. The presented material shows some positive features of this series of controllers as universal devices for application in non-complex control systems maintaining a simple tool for configuration and programming.

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KONFIGURACJA SPRZĘTOWA STEROWNIKÓW UNITRONICS SERII M90

Streszczenie. W pracy zostały zaprezentowane wybrane zagadnienia dotyczące projektowania systemu automatyki i konfiguracji sprzętowej sterowników Unitronics z serii M90. W podanym materiale zaprezentowano atuty tej serii sterowników, jako urządzeń uniwersalnych do zastosowania w nierozbudowanych systemach sterowania, przy zachowaniu prostego w obsłudze narzędzia do konfiguracji i programowania systemu.

Słowa kluczowe: sterownik PLC, proces automatycznej kontroli i sterowania, system mikroprocesorowy, programowanie.