A Generical programming controller with NSC COP8FLASH

Um controlador programável genérico com NSC COP8FLASH

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Abstract

This work proposes a useful generical programming controller (GPC), with its default configuration dedicates to industrial applications, based on COP8FLASH Microcontroller Family, with N-entries for sensoring and N-exits to actuate in any process. In these experiments is used a National Semiconductor COP8 In System Emulator with Flash software to emulate a proposed architecture and simulate its functionality (MetaLink COP8WA10020). It was observed that proposed architecture satisfies all expectations about its versatility. This proposed architecture was simulated in a Flash Assembler Environment and worked as expected. Then, this technology presents some features which make it a good solution when practical and versatile programming features are requested.

Keywords

COP8 family, flash memory, microcontroller.

Introduction

This work proposes a useful generical programming controller (GPC), with its default configuration dedicates to industrial applications, based on COP8FLASH Microcontroller Family, with N-entries for sensoring and N-exits to actuate in any process.

According to its basic construction and its internal programming, this circuit can be easily adjusted for activities far beyond of industrialist frontiers. Like this, being used in advising of vital functions for bioelectric medicine, private and / or heritage security, positioning of engines, and others.

The first idea is that support circuits must be responsible to distinguish its apply. Support circuits are that here to be named sensor and actuator intending facilitate a generical view of the system capabilities.

The capture of its output signal and its direction to system input, called feedback, make possible a self-tuning for the circuit compensating consequently any attenuation in output signal or the same way in saturation instance.

Materials and Methods

In these experiments is used a National Semiconductor COP8 In System Emulator with Flash software to emulate a proposed architecture and simulate its functionality (MetaLink COP8WA10020).

Results and Discussions

This design starts on a generical programmable architecture and theirs blocks are built on National Semiconductor chipset. The figure 1 shows the proposed architecture for the generical programming controller.

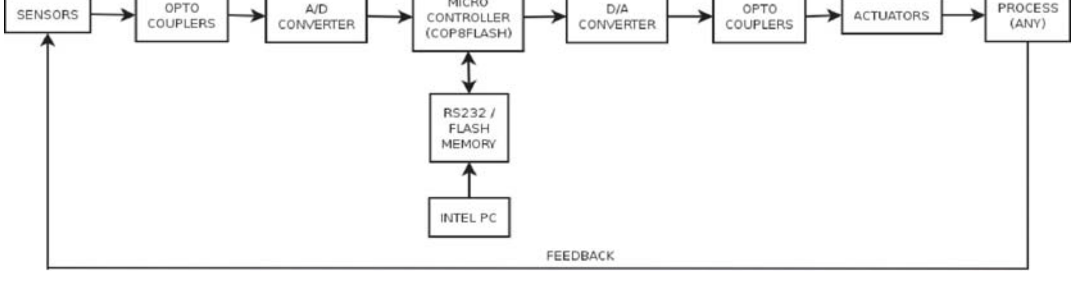


Figure 1 – Architecture of the generical programming controller

All blocks viewed on figure 1 are described folowing.

Microcontroller

The COP8CDR9 Flash microcontroller is the controller architecture main device. The figure 2 illustrates a typical package marking format for this microcontroller family.

Some of its features includes Virtual EEPROM, A/D, High Speed Timers, USART and Brownout Reset. The most interesting feature for this specific work is its capability to be an in-system re-programmable controller with large memory and low EMI (NSC, 2000-3). The figure 3 shows its pin set with some representative blocks.

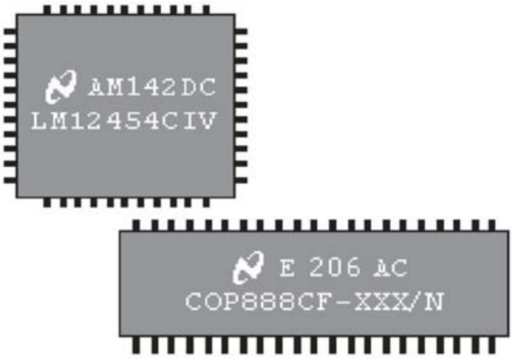


Figure 2 – Typical package marking format (National Semiconductor)

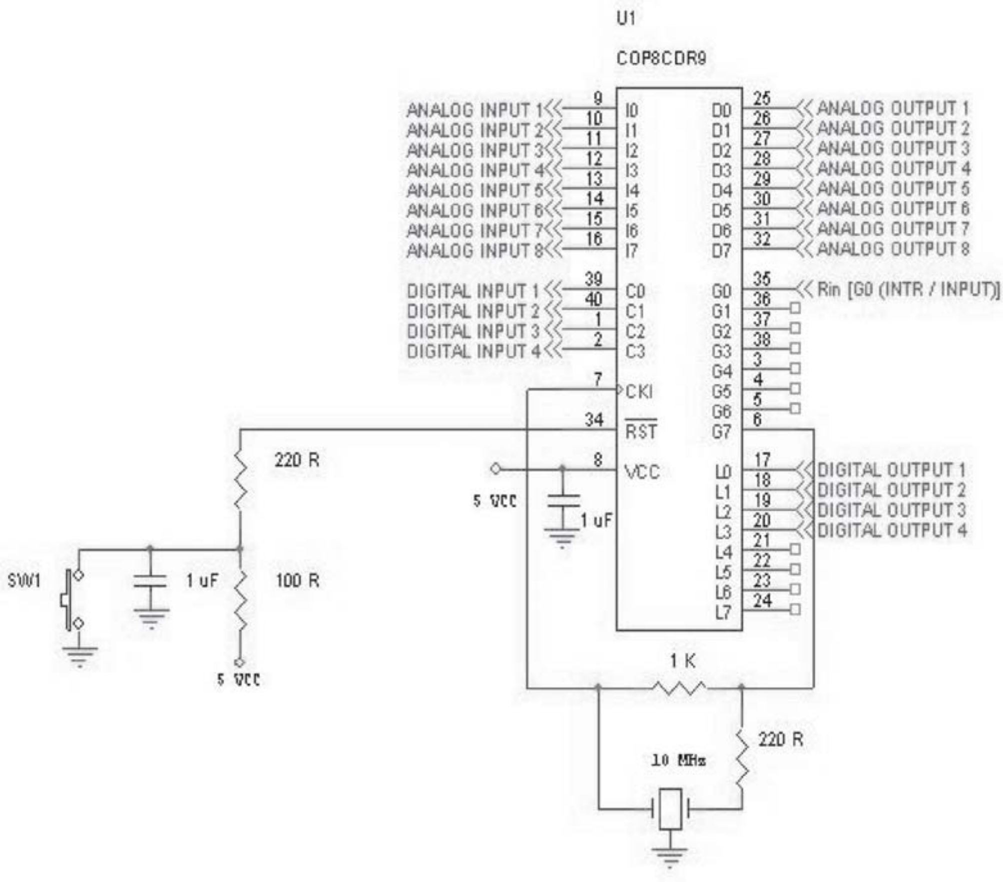


Figure 3 – COP8CDR9 pin set

In this proposed configuration, there is one 8-bit analog input by I-register, four digital inputs, C0-3, by C-register, one 8-bit analog output by D-register and four digital outputs by L-register, expansible to eight lines. Its G-register maintains its configuration word, which is written in the system start.

Sensors

Sensors can be any device useful by controller uses (i.e., oxygen cell for bioelectric medicine or ultrasonics for heritage or industrial applications).

Actuators

Actuators are complementary to sensors. They can be any device which acts in the process (i.e., a servomotor moving a tripper in industrial application or an alarm – visual and sound – in a neonatal unit).

A/D Converter and Opto-Couplers

Analog input is deriving from an analog sensor through an ADC0800 Analog-to-Digital Converter which produces an 8-bit CMOS signal (0-10 V) and 2 MM74C901 convert it to TTL signal, which it would be read by I0-7. In analog case, the photo-transistor opto-coupler is a H11AA814. It is a photo-darlington with 2 internal diodes to preserve its wave attributes.

The figure 4 shows the programming controller analog input formed by Opto-Coupler, A/D Converter and CMOS to TTL Converter.

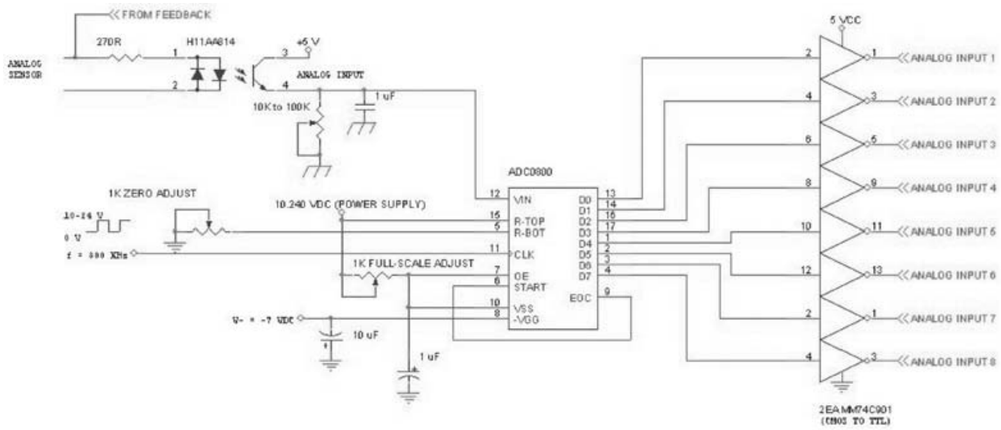
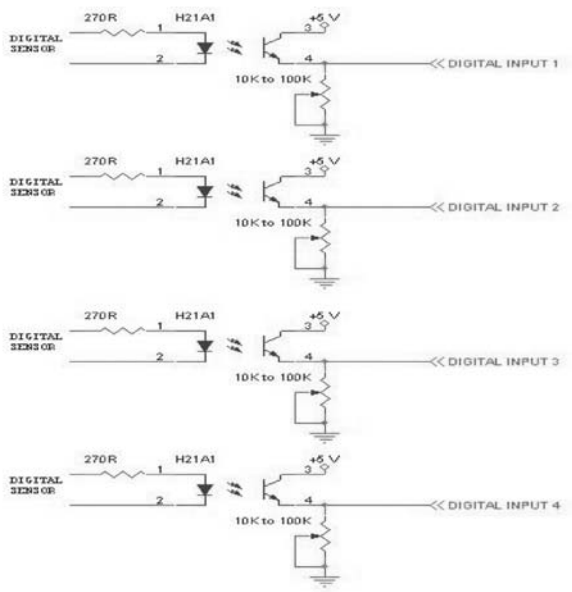


Figure 4 – Generical programming controller analog input

Digital inputs are captured directly from digital sensors to C0-3, but like analog input, there is a 4-pin photo-transistor opto-coupler to connect external circuit to COP8CDR9-based circuit, as a security reason. Like this any over-voltage and/or over-current doesn't 'trespass' to main circuit. For digital signal is adopted an opto-coupler with only one diode, a H11AA815 model.

The figure 5 shows digital inputs for generical programming controller and its opto-couplers concerning.



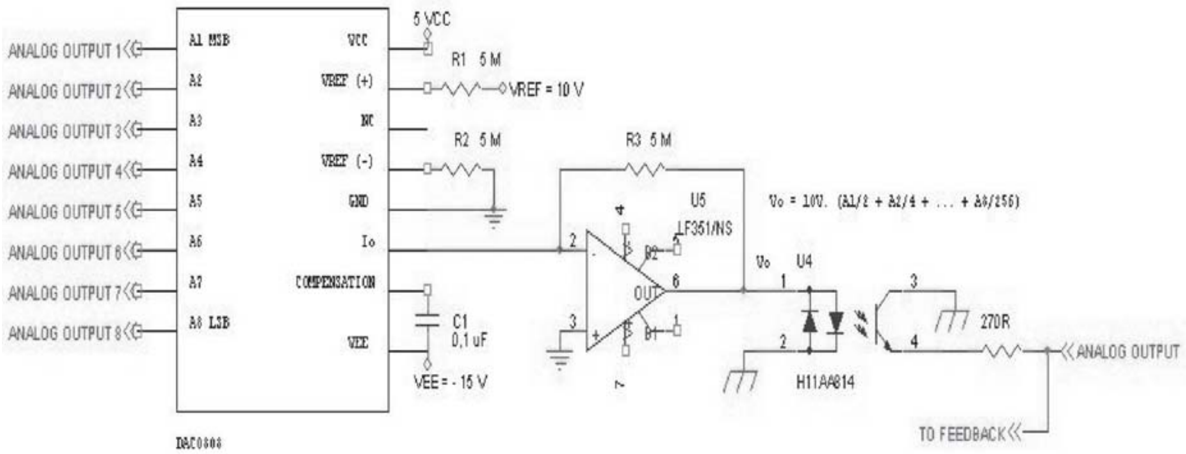


Figure 6 – GPC analog output circuit

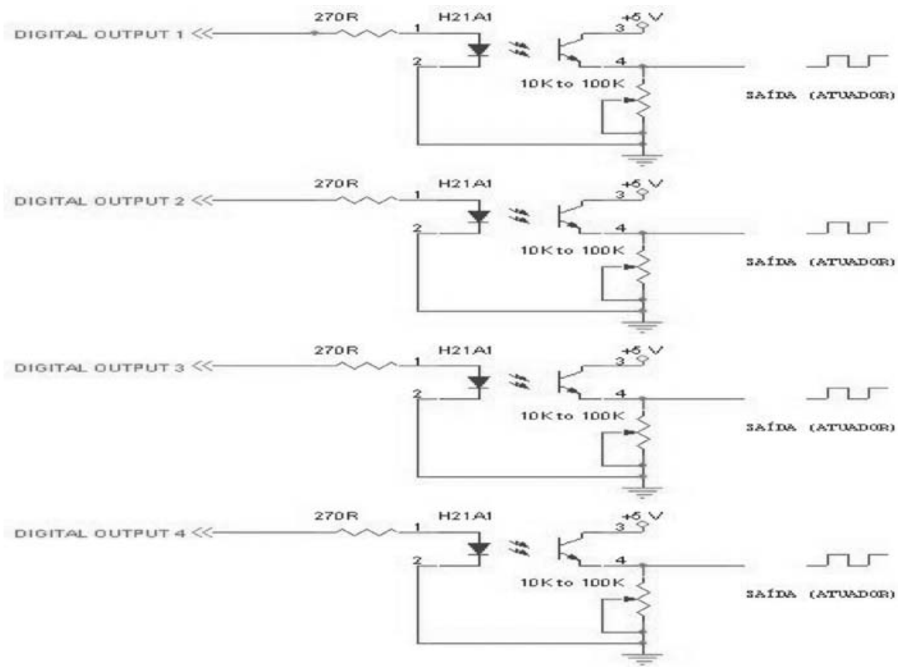


Figure 7 – GPC digital outputs

Opto-coupler desciption

The H11B815 consists of a gallium arsenide infrared emitting diode driving a silicon Darlington photo-transistor in a 4-pin dual in-line package. Its feature of high voltage isolation through input and output, nearly 5300 VRMS, is the main motion for this choice. H24A series is a device housed in a low-cost plastic package with lead spacing compatible with a dual in-line package (NSC, 2000-1; NSC, 2000-4; FSC, 2000-1; FSC, 2000-2; FSC, 2000-3).

Feedback

Feedback is a PID Control action based on LF351/NS circuit to compensating attenuation in analog output signal (NSC, 2000-8).

The figure 8 shows its configuration.

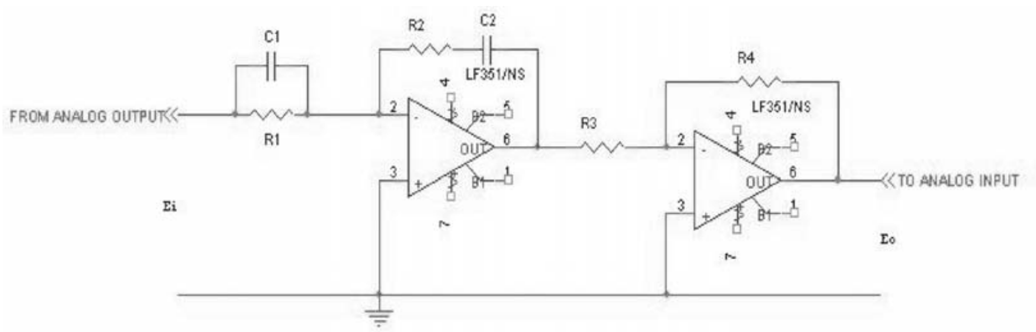


Figure 8 – GPC feedback: PID Control Action

The circuit from figure 8 has a particular feature: in the first operational amplifier there are differentiation and integration actions in the same device, where R_1 and C_2 are integration circuit part and C_1 and R_2 are differentiation circuit part. The other is an inverting amplifier.

The complete circuit has a PID Control Action such as equation 1.

$$G(s)=\frac{E_o(s)}{E_i(s)}$$
$$\left[\frac{R_4}{R_3}\right]*\left[\frac{R_2}{R_1}\right]*\left[(R_1\cdot C_1\cdot s+1)*\frac{R_2\cdot C_2\cdot s+1}{R_2\cdot C_2\cdot s}\right] \quad (1)$$

Communication Interface

Communication interface is based on a DS14C232 circuit which captures serial data from a phone jack and takes it to G0 in COP8CDR9 for programming flash memory from PC (NSC, 2000-7).

The figure 9 shows the communication interface for the generical programming controller.

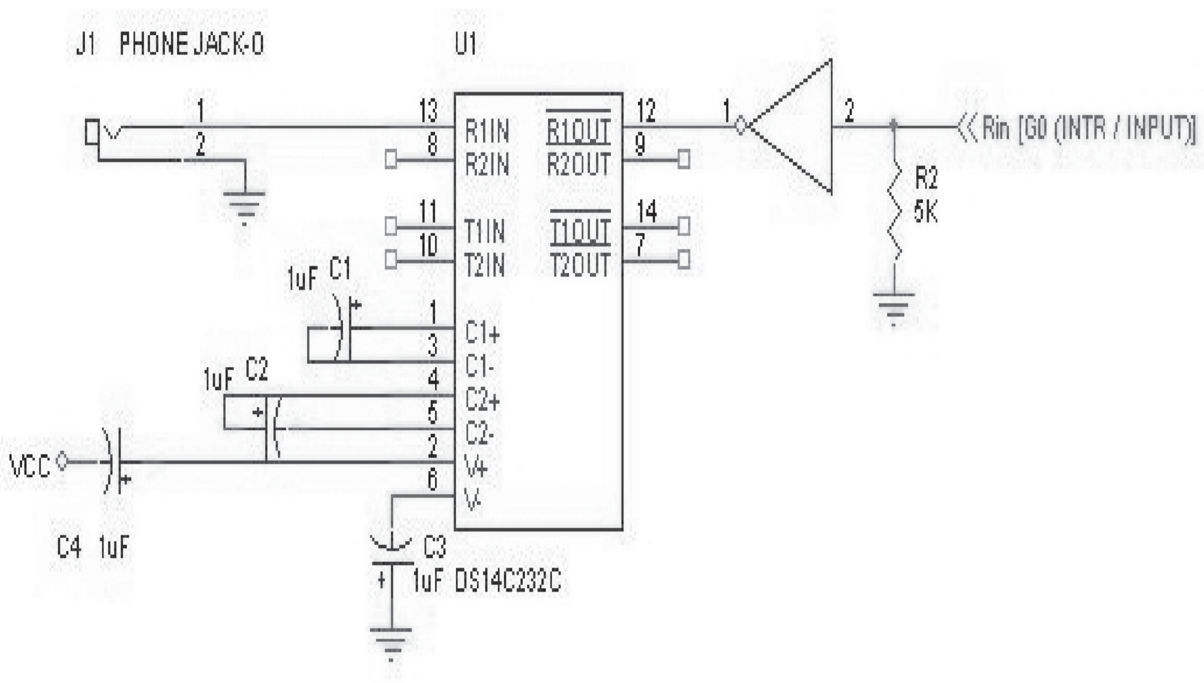


Figure 9 – GPC communication interface circuit

Programming

The programming depends of its application and uses a National Semiconductor's Assembler Language (NSC, 2001). But there are common lines to configure the beginning sets and in Program File is these basic-lines to any activity. Figure 10 shows a basic flowchart for these experiments.

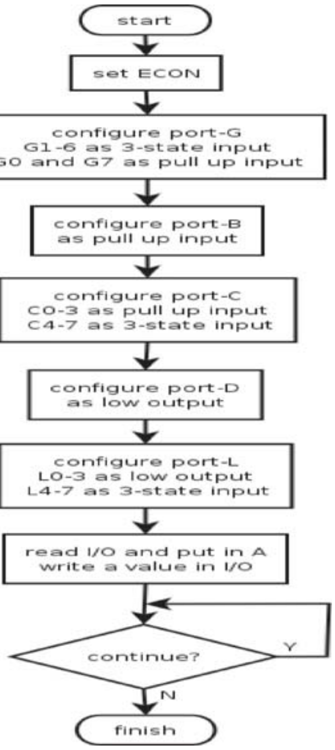


Figure 10 – A basic program flow chart

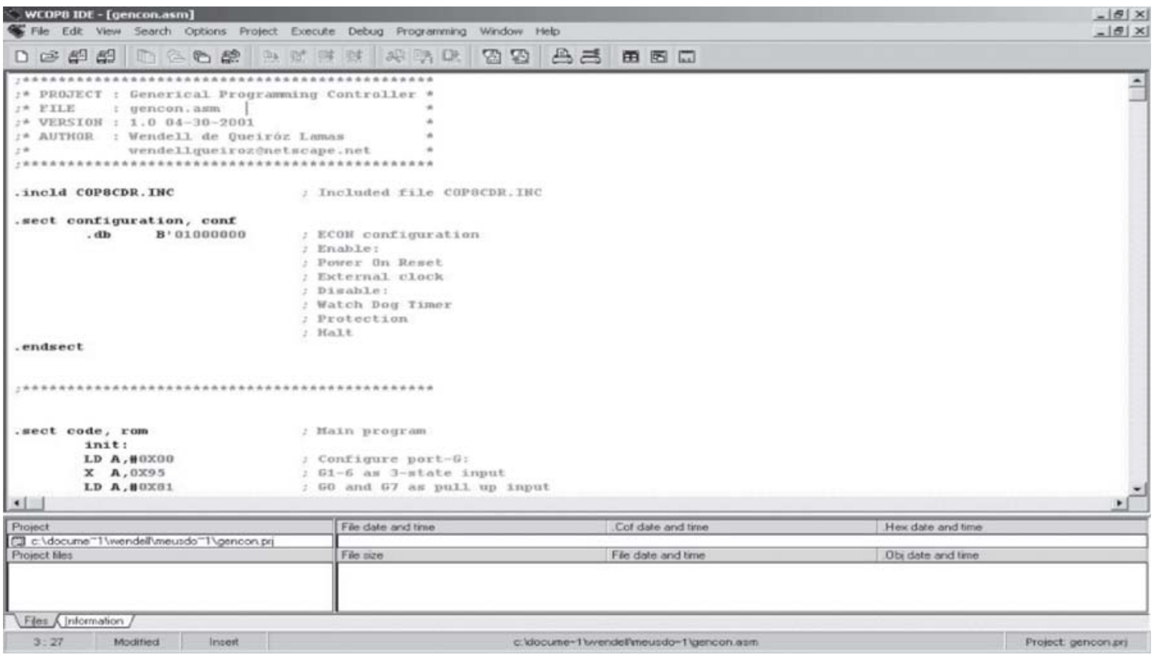


Figure 11 – WPCOP8 IDE window

Other import tool from COP8FLASH kit is COP8 Metalink ICE software. This software simulates a COP8FLASH controller and its possible to view transfer from memory to registers, its content, error messages, etc.

Figure 12 shows COP8 Metalink ICE software frame.

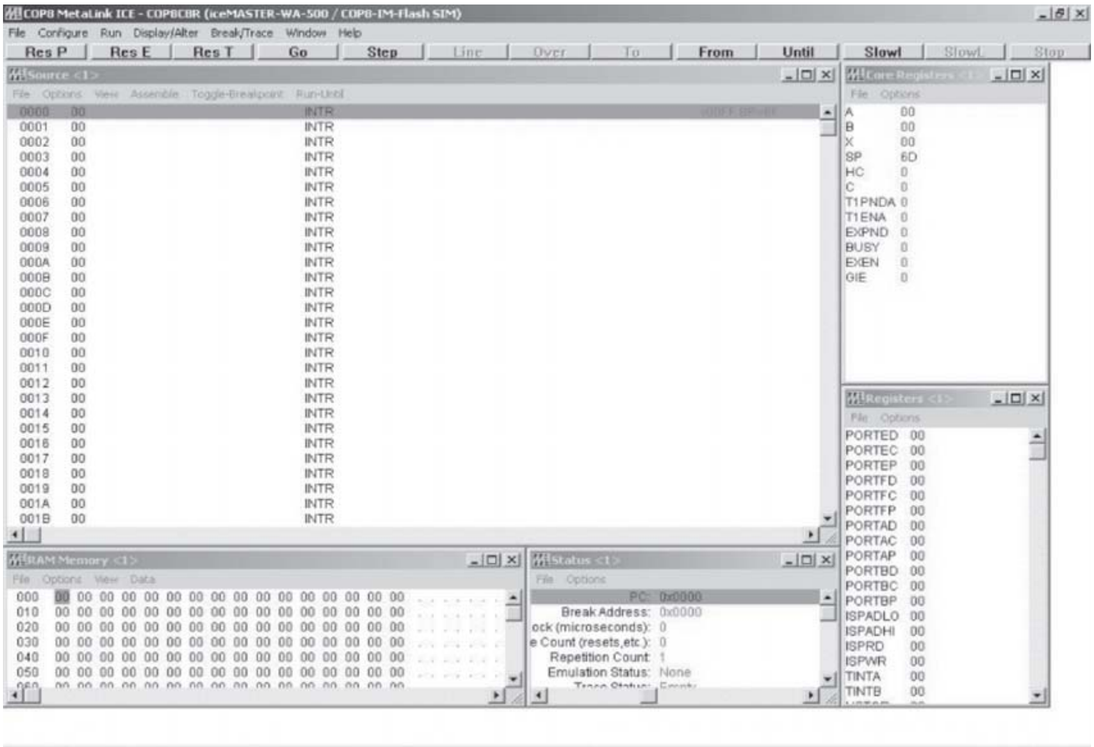


Figure 12 – COP8 Metalink ICE window

Following its programming and simulation, proceedings are transfered to COP8 In System Emulator MetaLink COP8WA10020.

First of all, I/O port must be set with DriverLINX Port I/O, which window is showed in figure 13.

Emulator MetaLink COP8WA10020.

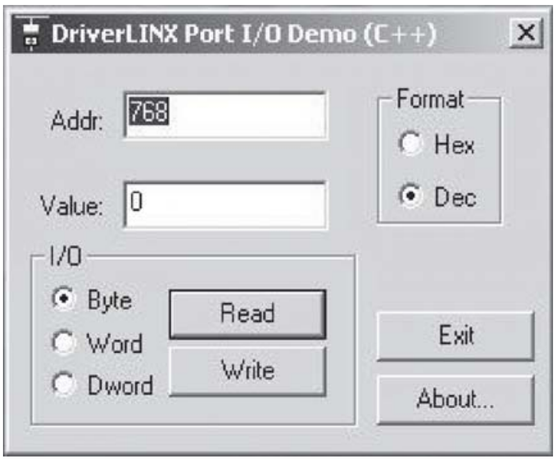


Figure 13 – DriverLINX port I/O frame

To finish, there are two options: transferring its programming or programming on line.

Figure 14 shows a transferring window of COP8 Metalink ICE and figure 15 shows a window of FLASHWIN software used for programming direct in COP8FLASH family kit.

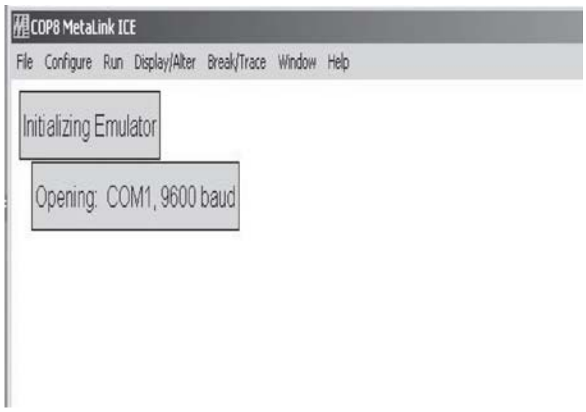


Figure 14 – COP8 Metalink ICE transferring window

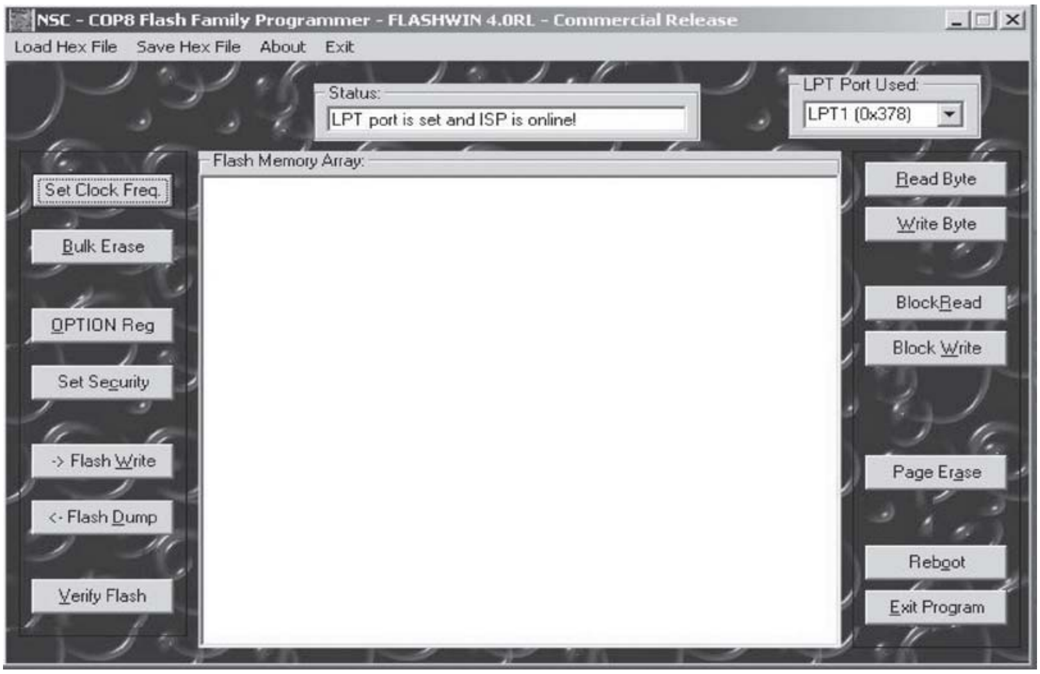


Figure 15 – FLASHWIN software window

Conclusions

It was observed that proposed architecture satisfies all expectations about its versatility. This proposed architecture was simulated in a Flash Assembler Environment and worked as expected.

Then, this technology presents some features which make it a good solution when practical and versatile programming features are requested.

Resumo

Este trabalho propõe um controlador programável genérico adaptável a várias utilizações, com sua configuração padrão dedicada a aplicações industriais, baseado na família de microcontroladores COP8FLASH, com N-entradas para sensoriamento e N-saídas para atuar em qualquer processo. Nestas experiências é usado um simulador de sistema baseado em COP8 com memória flash para emular uma arquitetura proposta e simular sua funcionalidade (MetaLink COP8WA10020). Foi observado que a arquitetura proposta satisfaz todas as expectativas sobre sua versatilidade. Esta arquitetura proposta foi simulada em um ambiente de programação Flash Assembler e trabalhou como esperado. Então, esta tecnologia apresenta várias características que fazem dela uma ótima solução quando são pedidas características de programação práticas e versáteis.

Palavras-Chaves

Família de microcontroladores COP8, memória flash, microcontrolador.

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