Fakulta strojní VŠB – TUO

Department of Control Systems and Instrumentation

Automatic Control Devices
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(Materials for write notes)

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Fakulta strojní VŠB – TUO

Department of Control Systems and Instrumentation

Lecture No. 4

Control systems based on PLC, IPC, uP, … .

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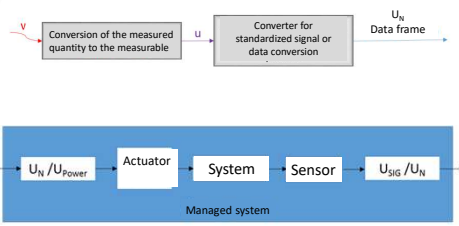
What do you find out?

- Regulators
- Control systems
  - PLC
  - IPC
  - uP
- Internal structure of control systems
- Internal structure of I/O cards
- Control systems interface
- Properties of control systems
- … .

Internal structure of the sensor

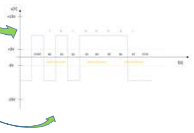


Evaluation and standardized signals

voltage [V]
0 ÷ 5
0 ÷ 10
-5 ÷ 5
-10 ÷ 10

logical level	voltage [V]
Log „1"	2,6 ÷ 5,12
Log „0"	0,4 ÷ 0,8

current [mA]
0 ÷ 20
4 ÷ 20

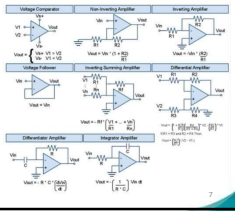


Evaluation and standardized signals

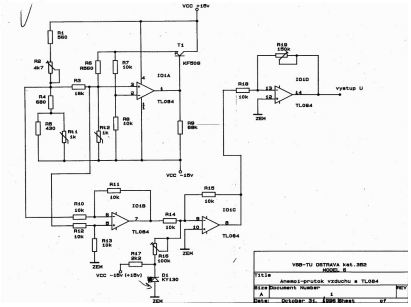
- Use of circuit elements (resistors, OA, capacitors, ...)
- ....

Evaluation and standardized signals

- Passive circuit elements



Examples - anemometer

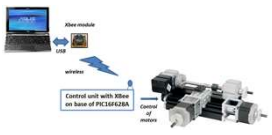


Evaluation and standardized signals

- Data transmission in the form of a protocol description of the frame example

Command 2B	Virtual step 4B	Weight 8B	Direction 8B	Checksum 2B

Command 2B	Number of steps processed 8B	Direction 8B	Motor status 2B	Checksum 2B



HUMUSOFT

MF 624

multifunction I/O card for PCI bus

Introduction

MF 624 is a multifunction I/O card offering most of the functions required in process control or measurement applications. MF 624 offers A/D conversion, D/A conversion, digital input, digital output, quadrature encoder input, timers, counters, PWM, pulse and frequency measurements. The card contains eight 14-bit analog input channels with simultaneous sample & hold circuit and very short conversion time, eight 14-bit analog output channels, eight digital inputs and eight digital outputs, four encoder inputs with differential line receivers and four counters/timers. Encoders and counters are 32-bit wide. MF 624 has 32-bit architecture for maximum performance.

Analog inputs and outputs offer bipolar ranges ±10 V which suits most measurement and control applications.

The card is designed for standard data acquisition and control applications and optimized for use with the Real Time Toolbox for MATLAB®. Because of the small size and low power consumption MF 624 can be used not only in the desktop computers but also in portable computers and notebooks with docking station.

Applications

Specifications

Analog Input

Channels:	8 single-ended channels
A/D converter:	14-bit, simultaneous sampling
Conversion time:	1.6 µs 1 channel, 1.9 µs 2 channels, 2.5 µs 4 channels, 3.5 µs 8 channels
Input range:	±10 V
Input Impedance:	10^{10} Ω
Trigger mode:	software, timer, external

Analog Output

Channels:	8 channels, 14-bit
Output Range:	±10 V
Output current:	10 mA max.
Setting time:	31 µs FS change to ±1/2 LSB.

Digital I/O

Input lines:	8, TTL compatible
Output lines:	8, TTL compatible

Timer/Counter

Number of channels:	4
Resolution:	32 bit, 20 ns
Modes:	PWM, counter, pulse generation

Encoder Inputs

Input channels:	4, single ended or differential
Inputs:	A, B, Index
Input frequency:	max 2.5 MHz
Resolution:	32-bit

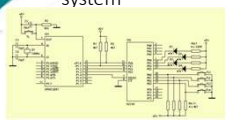
General

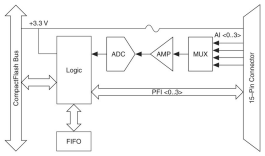
Power consumption:	500 mA @ +5 V 150 mA @ +12 V 150 mA @ -12 V
Operating temperature:	0 to 70 °C (32 to 148 °F)
I/O Connector:	2 x 20, 2.54 mm
Interface:	PCI 5V or 3.3V

Driver Support

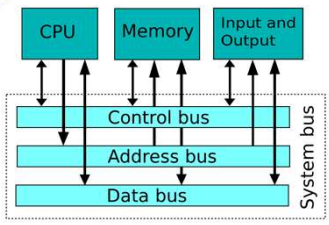
Microsoft Windows
32 and 64 bit C programming

Description of the I/O system





- Internal bus
- …



Programming Guide

Address	Read	Write
BADR0+0x4C	**INTCSR**	**INTCSR**
BADR0+0x54	**GPIOC**	**GPIOC**

Table 2. BADR0 Memory Map

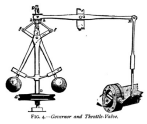
Address	Read	Write
BADR1+0x00	**ADDATA** - A/D data	**ADCTRL** - A/D control
BADR1+0x02	**ADDATA** - A/D data mirror	
BADR1+0x04	**ADDATA** - A/D data mirror	
BADR1+0x06	**ADDATA** - A/D data mirror	
BADR1+0x08	**ADDATA** - A/D data mirror	
BADR1+0x0A	**ADDATA** - A/D data mirror	
BADR1+0x0C	**ADDATA** - A/D data mirror	
BADR1+0x0E	**ADDATA** - A/D data mirror	
BADR1+0x10	**DIN** - Digital input	**DOUT** - Digital output
BADR1+0x20	**ADSTART** - A/D SW trigger	**DA0** - DA 0 data
BADR1+0x22		**DA1** - DA 1 data
BADR1+0x24		**DA2** - DA 2 data
BADR1+0x26		**DA3** - DA 3 data
BADR1+0x28		**DA4** - DA 4 data
BADR1+0x2A		**DA5** - DA 5 data
BADR1+0x2C		**DA6** - DA 6 data
BADR1+0x2E		**DA7** - DA 7 data

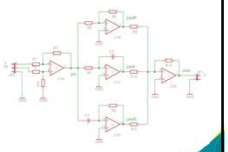
Table 3. BADR1 Memory Map

Regulators

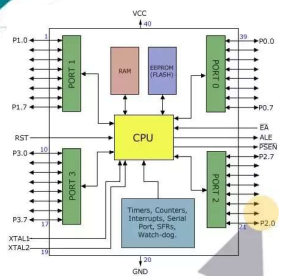
devices for processing measured (regulated) quantity, control systems

- **Mechanical regulators**
- **…**



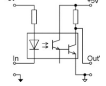
Description of the I/O control system



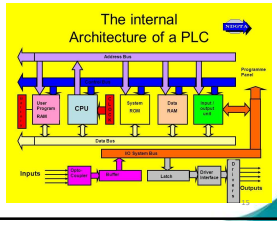

```
;*****************************************************************
;přepnutí portu na čtení tlačítek, výstup na pásku - bit RA3

čtení   MOVLW   hFFA        ;naplnění registru W
        MOVWF   fTRIS       ;přesun do registru PSR - naprázdno adresa
        MOVLW   B'11110111' ;naplnění registru W - RA3 jako výstup, ostatní piny jako vstupy
        MOVWF   F0          ;přesun do registru naprázdno adresování
        MOVLW   hFFA        ;naplnění registru W
        MOVWF   fTRIS       ;přesun do registru PSR - naprázdno adresa
        MOVLW   B'11111111' ;naplnění registru W - všechny piny jako vstupy
        MOVWF   F0          ;přesun do registru naprázdno adresování

        GOTO                ;návrat
```


PLC





- **Modular –**



IPC

Compact

…

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Ten commandments IPC

- **Robustness** –
- **Dust resistance** –
- **Impact resistance**–
- **Water resistance** –
- **Temperature resistance** –

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Desatero průmyslových počítačů

- **Spolehlivost** –
- **Expediency** –
- **Compactness** –
- **Time guarantee** –
- **Functionality** –

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What was the content of the lecture

- Regulators
- Control systems
  - PLC
  - IPC
  - uP
- Internal structure of control systems
- Internal structure of I/O cards
- Control systems interface
- Properties of control systems
- … .

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Thank you for your attention …