PICPLC4 v6™

User manual

All MikroElektronika´s development systems represent irreplaceable tools for programming and developing microcontroller-based devices. Carefully chosen components and the use of machines of the last generation for mounting and testing thereof are the best guarantee of high reliability of our devices. Due to simple design, a large number of add-on modules and ready to use examples, all our users, regardless of their experience, have the possibility to develop their project in a fast and efficient way.

Development System

MikroElektronika
SOFTWARE AND HARDWARE SOLUTIONS FOR EMBEDDED WORLD ...making it simple

TO OUR VALUED CUSTOMERS

I want to express my thanks to you for being interested in our products and for having confidence in mikroElektronika.
The primary aim of our company is to design and produce high quality electronic products and to constantly improve the performance thereof in order to better suit your needs.

Nebojsa Matic
General Manager

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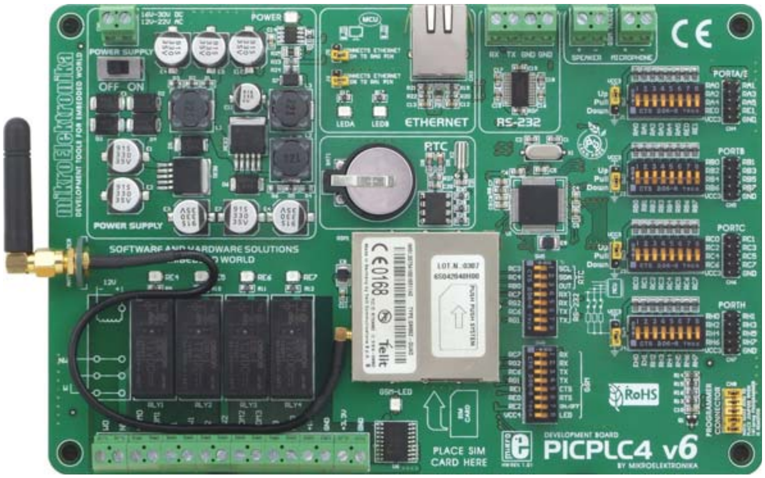
Introduction to PICPLC4 v6 Development System

The *PICPLC4 v6*™ development system provides a development environment for experimenting with industrial devices. Connection between the development system and these devices is established by means of relays. In addition, the *PICPLC4 v6* features additional modules which also enable the microcontroller to be connected to external devices. The *PICPLC4 v6* may be used as a stand-alone controller which communicates to remote devices through communication modules. Numerous modules, such as RS-232 communication module, real-time clock, ethernet controller, GSM module etc. are provided on the board and allow you to easily experiment with your microcontroller.



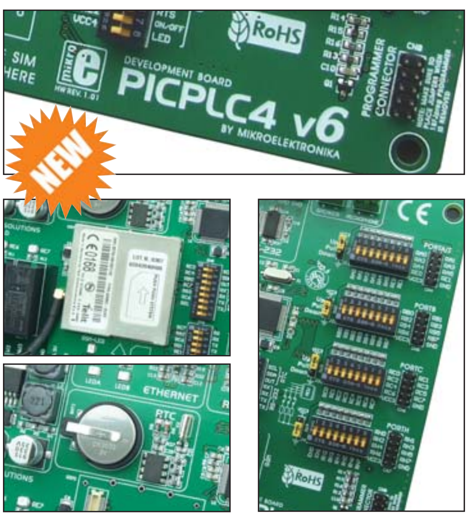
Development system may be used as a stand-alone controller in industrial devices

Development system for PIC microcontroller based devices

Built-in microcontroller provided on the board is programmed by means of the external *18FJprog*™ programmer

Owing to the GSM module it is possible to establish communication between the development system and other devices which use GSM standard

Connection to remote PCs is established via LAN network and a built-in module for ethernet communication



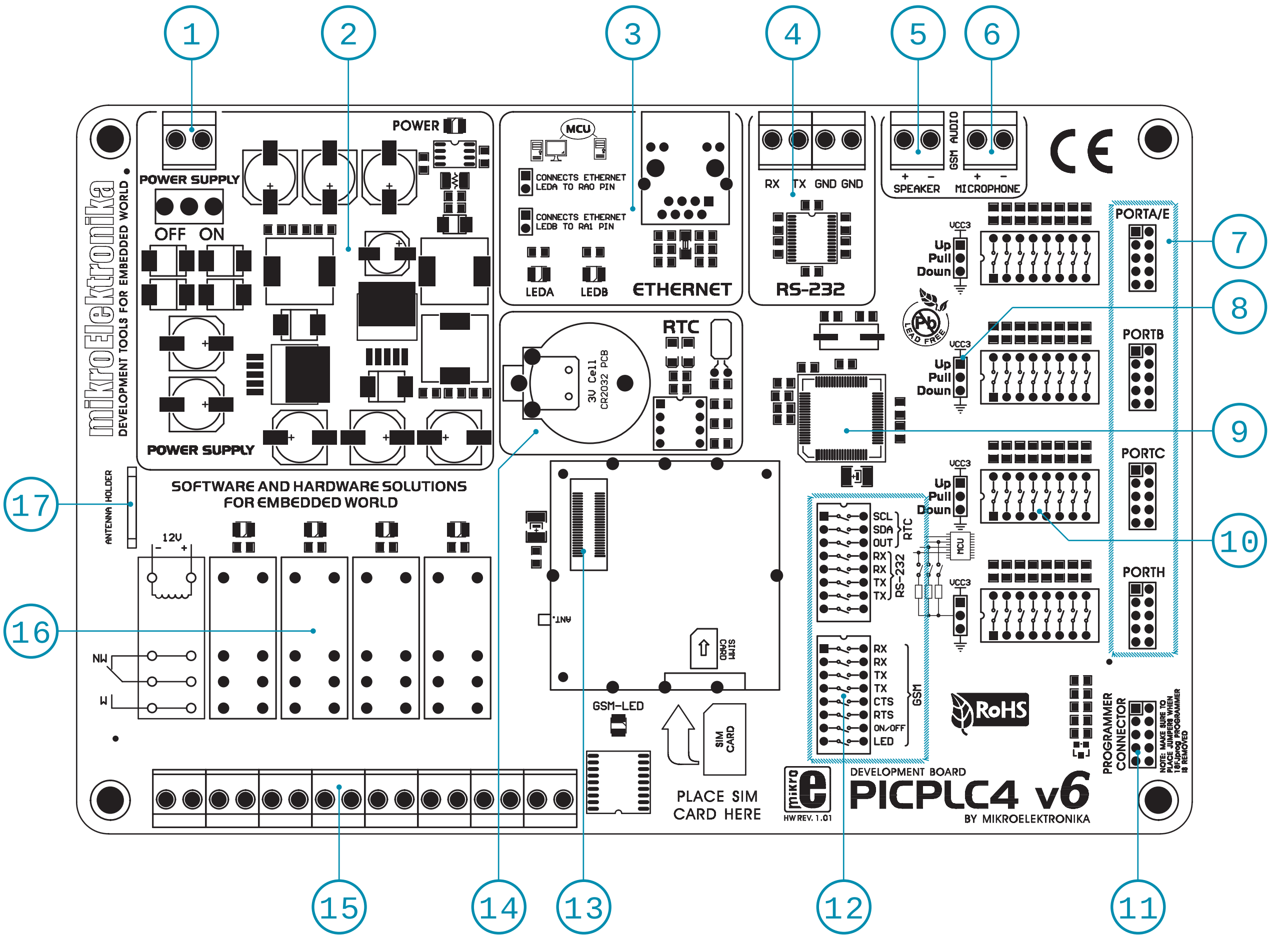
The *Lv18PICflash*™ program provides a complete list of all supported microcontrollers. The latest version of this program with updated list of supported microcontrollers can be downloaded from our website at **www.mikroe.com**

Package contains:

Development system:	PICPLC4 v6
CD:	product CD with relevant software
Cables:	USB cable
Documentation:	Manual for PICPLC4 v6, quick guide for installing USB drivers and electrical schematic of the development system

System specification:

Power supply:	over the CN1 connector (12-22V AC or 16-30V DC)
Power consumption:	~20mA when all on-board modules are off
Dimension:	21,4 x 14cm (8,4 x 5,5inch)
Weight:	~300g (0.65lbs)



Key Features

1. Power supply connector CN1
2. Power supply voltage regulator
3. Ethernet module
4. RS-232 communication module
5. Connector for speaker
6. Connector for microphone
7. I/O port connectors
8. Jumper for pull-up/pull-down resistor selection
9. PIC18F87J60 microcontroller
10. DIP switch to enable pull-up/pull-down resistors
11. CN8 connector for external programmer
12. DIP switches to enable/disable on-board modules
13. Connector for GSM module
14. Real-time clock
15. Connectors for relays
16. Relays
17. Connector for GSM antenna

1.0. PIC18F87J60 Microcontroller

There is a PIC18F87J60 microcontroller in 80-pin TQFP package soldered on the development system. This microcontroller is provided with an on-board ethernet module which enables connection between the development system and LAN (local area network) over the ethernet connector. In addition to the ethernet module, the microcontroller also features other modules intended for USART communication, PWM control, serial communication, parallel communication, A/D conversion etc.

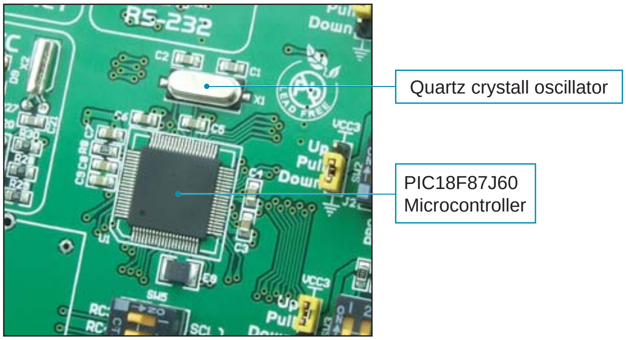


Figure 1-1: PIC18F87J60 microcontroller

The PIC18F87J60 microcontroller can communicate to external devices via either SPI or I^2C connection, whereas the USART module enables it to be connected to two communication modules RS-232 and RS-485. The microcontroller also features a 10-bit analog to digital converter capable of using up to 16 available channels (I/O pins).

For the clock frequency stabilization, the microcontroller employs an external quartz crystal with a frequency of 25MHz. In addition to it, the microcontroller also features an internal clock frequency stabilizer with a frequency of 31kHz.

2.0. Programming the Microcontroller

In order to enable the microcontroller provided on the development system to be programmed, it is necessary to provide an external programmer *18FJprog*. This programmer is placed over a 2x5 male connector CN8 on the development system.

Step 1:

Prior to starting the process of programming, it is necessary to connect the development system to the power supply source. Follow the instructions given in figure 2-1 to establish this connection properly.

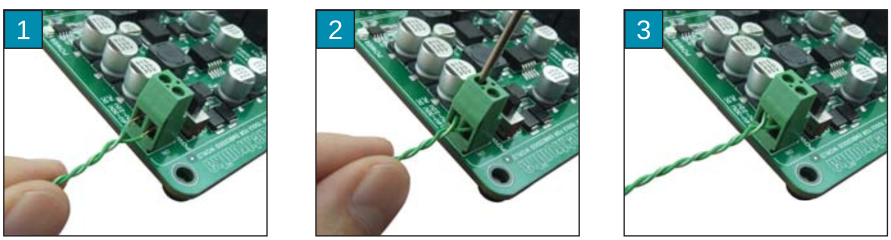


Figure 2-1: Connecting power supply source

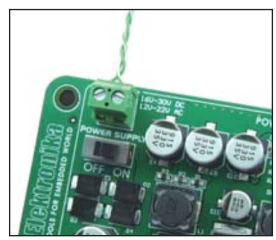


Figure 2-2: Power supply

Step 2:

Prior to connecting the *18FJprog* external programmer, the appropriate driver necessary for the proper operation of this programmer must be installed. In addition, it is also necessary to install the *Lv18PICflash* program used for loading a .hex file from the PC to the microcontroller. The driver and the *Lv18PICflash* program are provided on the product CD that you get along with the development system. They can also be downloaded from our website at www.mikroe.com

Step 3:

When the development system is connected to the power supply source and the appropriate driver is successfully installed, it is necessary to place a 2x5 female connector provided on the *18FJprog* programmer on the 2x5 male connector CN8 provided on the development system, as shown in Figure 2-3.

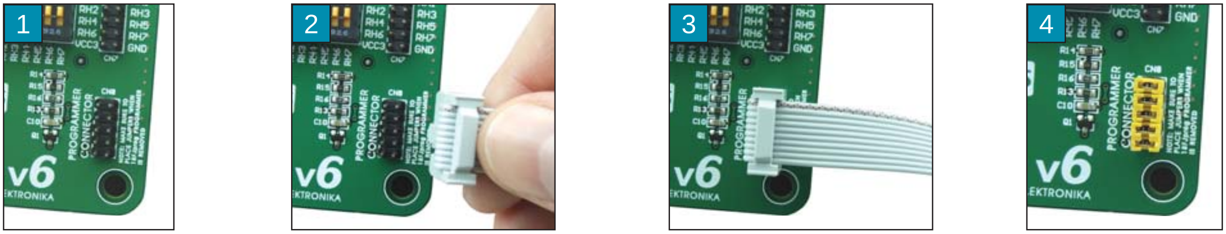


Figure 2-3: Connecting programmer

When the external programmer *18Fjprog* is connected to the development system, it is necessary to connect it to a PC via USB cable. One end of the cable with a connector of the USB A type should be connected to a PC, whereas the other end of the cable provided with a connector of the USB B type should be connected to the programmer.

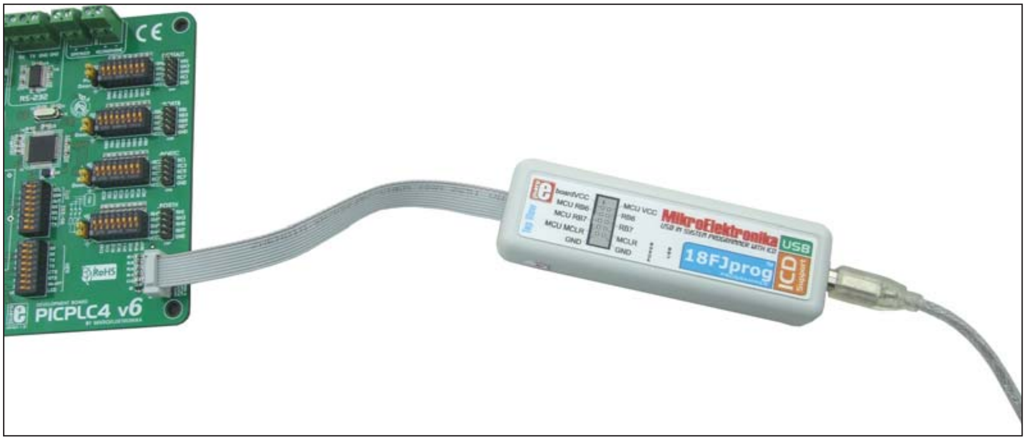


Figure 2-4: *18FJprog* programmer connected to the development system

During the programming, the programmer is used for loading a hex. file into the microcontroller via RB6, RB7 and MCLR microcontroller pins. When the programmer is connected to the development system, these pins cannot be used as I/O pins since they are used for programming. In order to use them as I/O pins, it is necessary to place jumpers over the pins of the 2x5 male connector CN8, as shown in Figure 2-3 (4).

Figure 2-5: *18FJprog* programmer

3.0. Power Supply

The *PICPLC4 v6* development system is connected to the power supply source via the CN1 connector. The power supply voltage can be either DC or AC. A DC power supply voltage can be in the range of 16V to 30V, whereas the AC power supply voltage can range between 12V and 22V. Have in mind that the on-board programmer cannot operate without being connected to the power supply source although it is connected to a PC via the USB cable.

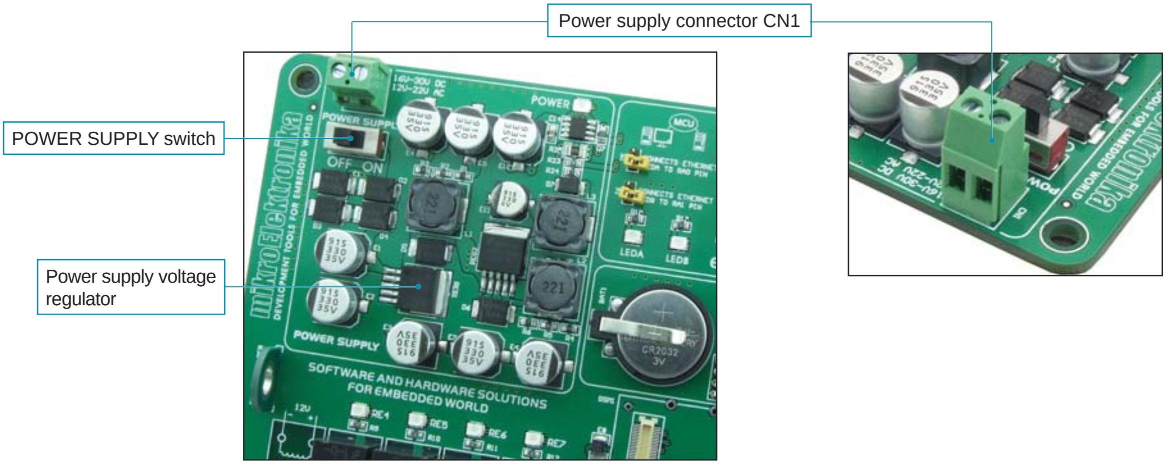


Figure 3-1: Power supply

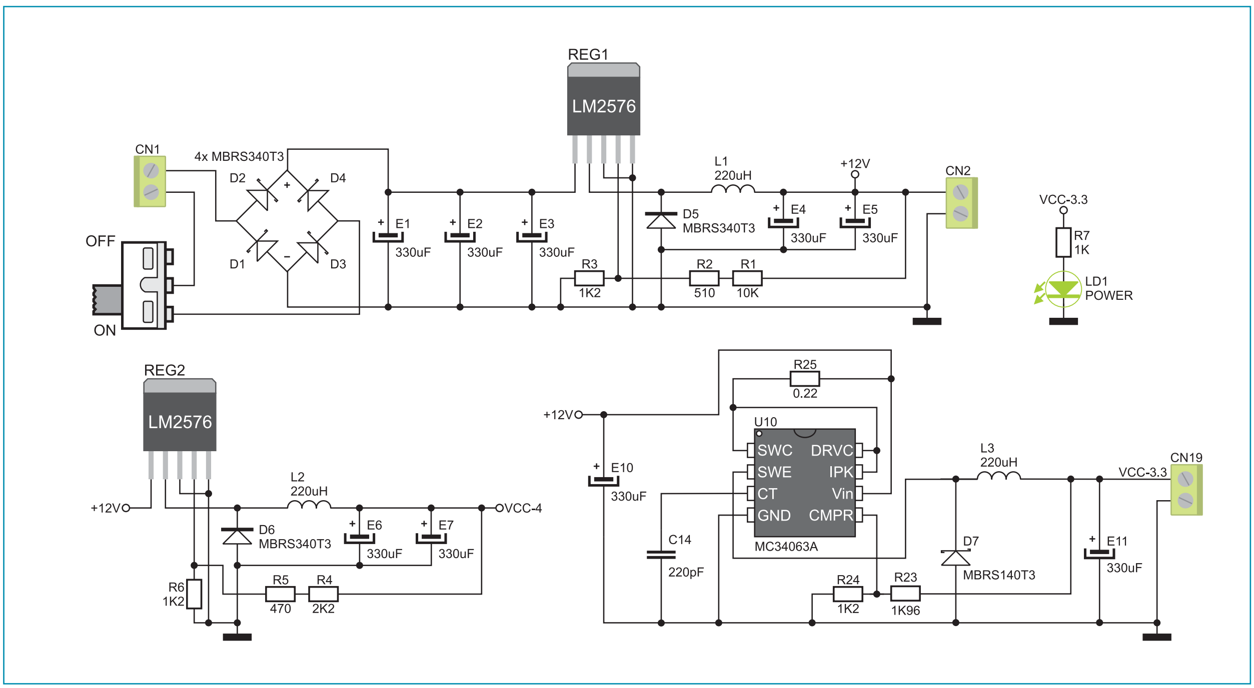


Figure 3-2: Power supply connection schematic

4.0. RS-232 Communication Module

USART (*Universal Synchronous/Asynchronous Receiver/Transmitter*) is one of the most common ways of exchanging data between the PC and peripheral units. The RS-232 serial communication is performed through CN17 and CN18 connectors and the microcontroller USART module. There is one RS-232 port provided on the *PICPLC4 v6*. Use switches 4-7 on the DIP switch SW5 to enable this port. Which of these switches is to be used depends on the microcontroller pin which is fed with an RS-232 communication signal. In case pins RC7 and RC6 are used, it is necessary to set switches 4 (RX) and 6 (TX) on the DIP switch SW5 to ON position. In case pins RG2 and RG1 are used, it is necessary to set switches 5 (RX) and 7 (TX) on the DIP switch SW5 to ON position. The microcontroller pins used for the RS-232 communication are marked as follows: RX - *receive data line* and TX - *transmit data line*. Data rate goes up to 115 kbps.

In order to enable the USART module of the microcontroller to receive input signals which meet the RS-232 standard, it is necessary to adjust voltage levels using an IC circuit such as MAX3238E.

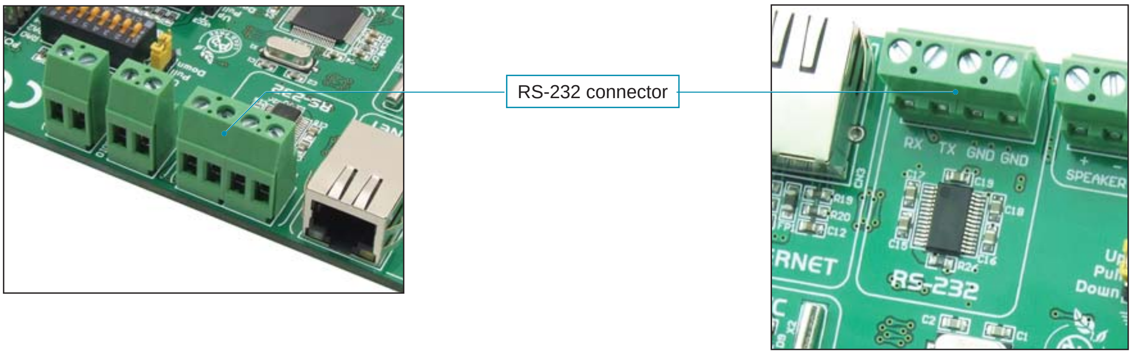


Figure 4-1: RS-232 module

Port RS-232 is connected to the microcontroller

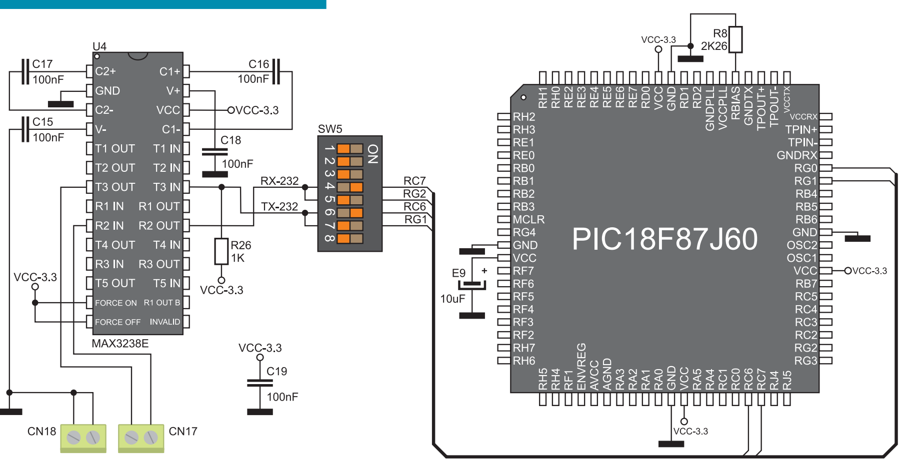


Figure 4-2: RS-232 module connection schematic

5.0. Ethernet Module

The function of the ethernet connector provided on the *PICPLC4 v6* development system is to connect it to LAN. Ethernet communication is enabled on the development system owing to the ethernet module built into the PIC18F87J60 microcontroller. The ethernet connector and the microcontroller are connected via the following microcontroller pins TPOUT+, TPOUT-, TPIN+ and TPIN-. By placing jumpers J5 and J6, LEDs marked as LEDA and LEDB will be enabled. These two LEDs are used to indicate whether the ethernet module is active during communication between the microcontroller and some other device connected to LAN.

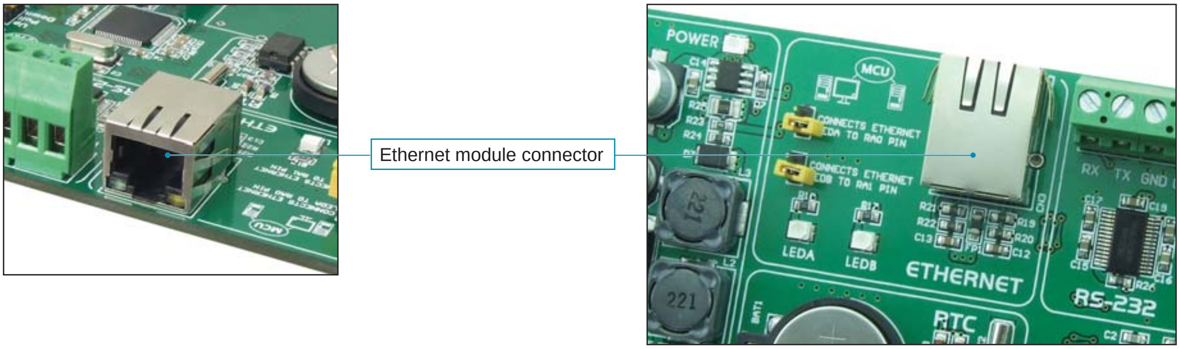


Figure 5-1: Ethernet module

Ethernet module is connected to the microcontroller

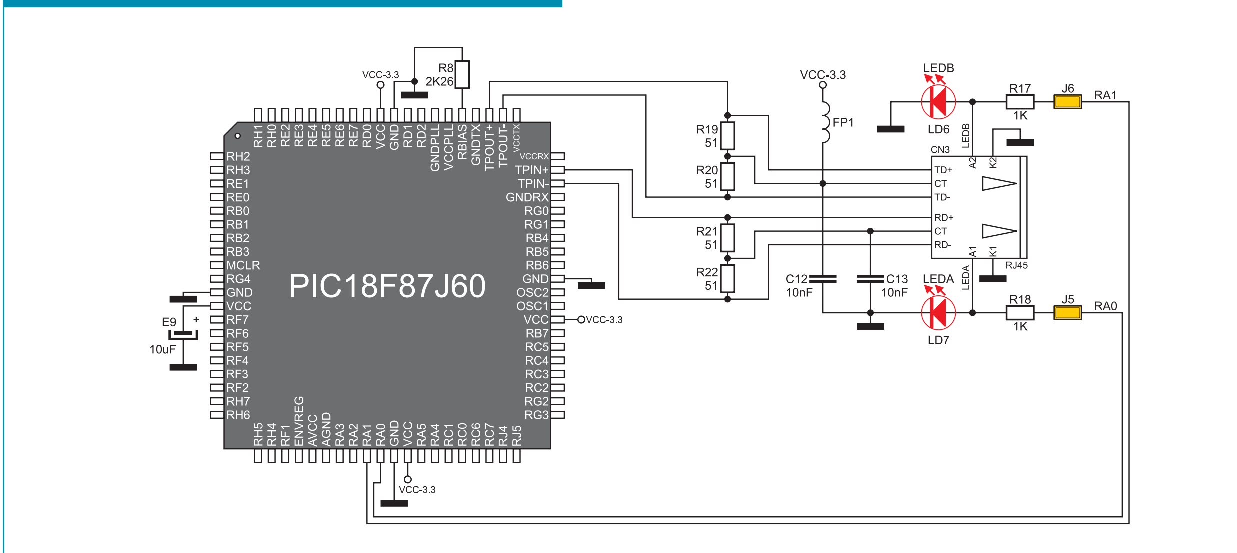


Figure 5-2: Ethernet module connection schematic

6.0. GSM Connector

Owing to a built-in connector for GSM module, the *PICPLC4 v6* development system is capable of communicating with the outside world using GSM network. A GM862-QUAD GSM module from Telit can be ordered with the development system. This module features a slot for placing a SIM card as well as a connector for external antenna. For the GSM module to be connected to the microcontroller, it is necessary to set switches 1-8 on the DIP switch SW6 to the ON position.

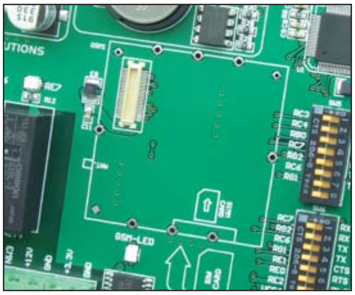


Figure 6-1: GSM connector

Figure 6-2: GSM module

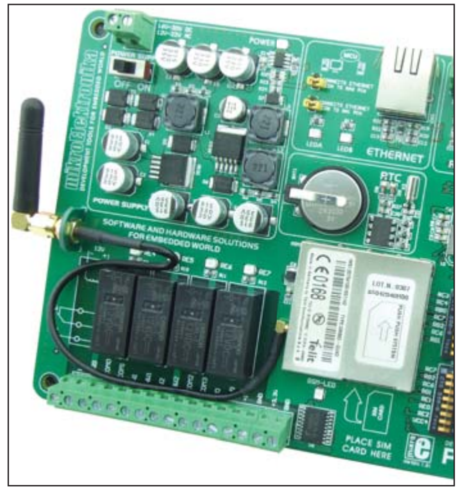


Figure 6-4: GSM module with antenna

In case that the GSM module is employed for the audio communication, it is necessary to plug in a speaker and a microphone into appropriate connectors, as shown in Figure 6-3. In addition to the audio signal transmission, the GSM module can be used for sending data in accordance with the GPRS standard used in mobile applications.

Figure 6-3: Audio connectors

GSM module is connected to the microcontroller via DIP switch SW6

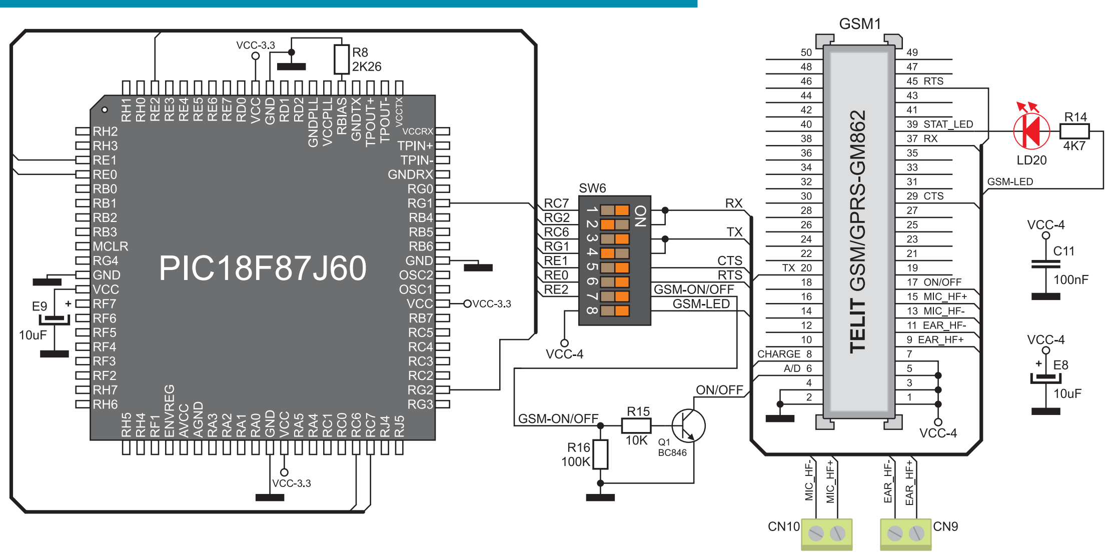


Figure 6-5: Microcontroller and GSM connector connection schematic

7.0. Real-Time Clock (RTC)

A real-time clock is widely used in alarm devices, industrial controllers, consumer devices etc. As a result of the built-in PCF8583 circuit, the *PICPLC4 v6* development system is capable of keeping the real time. The main features of the real-time clock are as follows:

- clock with calendar
- I^2C serial interface
- universal counter used as an alarm
- ability to change the time format (12/24h)

The real-time clock provided on the *PICPLC4 v6* development system is used to generate an interrupt at pre-set time. In order to establish connection between the microcontroller and the real-time clock it is necessary to set switches 1, 2 and 3 on the DIP switch SW5 to the ON position.

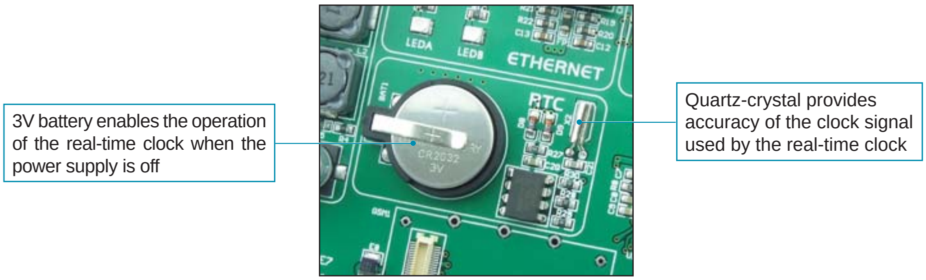


Figure 7-1: Real-time clock

Real-time clock is connected to the microcontroller via pins RC4, RC3 and RB0

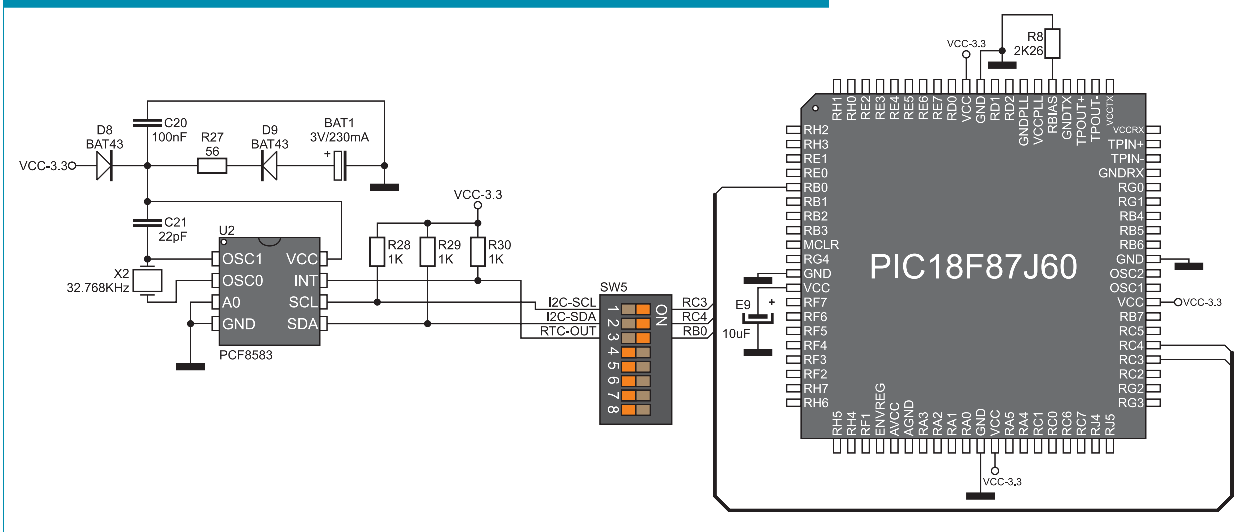


Figure 7-2: Real-time clock and microcontroller connection schematic

8.0. Relays

Industrial devices usually utilize more power than the microcontroller can provide via its I/O ports. To enable the microcontroller to be connected to such devices, the development system is provided with 4 relays by means of which it is possible to provide up to 250V power supply. Each relay has one normally-open (W0, W1...), one normally-closed (NW0, NW1...) contact and one common contact (COM0, COM1...). These relays are run by the microcontroller.

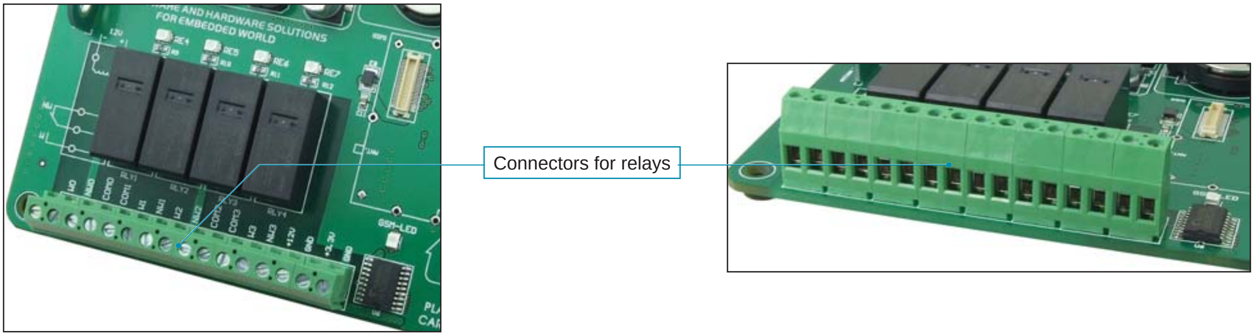


Figure 8-1: Relays with relevant connectors

Relays are connected to the microcontroller via a relay driver ULN2803

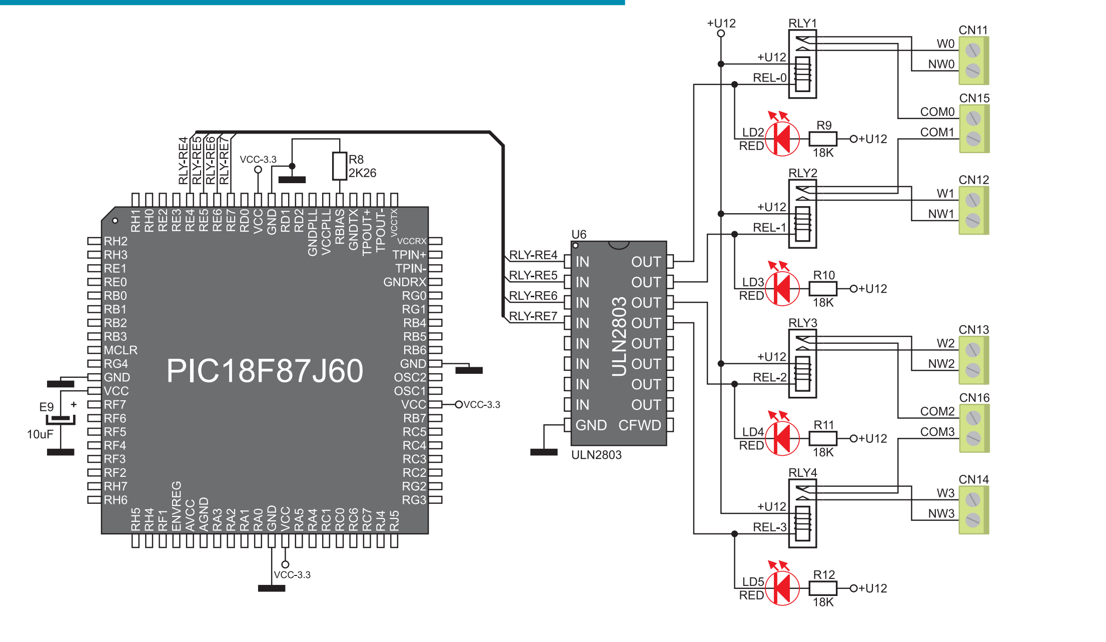


Figure 8-2: Relays and microcontroller connection schematic

9.0. Input/Output Ports

Along the right side of the development system, there are four 10-pin connectors which are linked to the microcontroller's I/O ports. DIP switches SW1-SW4 enable each connector pin to be connected to a pull-up/pull-down resistor. It depends on the position of jumpers J1-J4 whether the port pins are to be connected to pull-up or pull-down resistors.

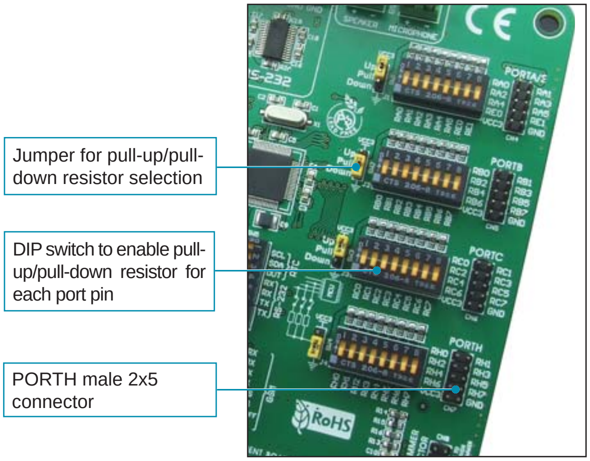


Figure 9-1: I/O ports

Pull-up/pull-down resistors enable you to set the logic level on all microcontroller's input pins when they are in idle state. This level depends on the position of the pull-up/pull-down jumper. When this jumper is in pull-up position, the input pins will be supplied with the 3.3V power supply voltage, which means that they will be driven high (logic one (1)). When this jumper is in pull-down position, the input pins will be supplied with 0V, i.e. they will be fed with a logic zero (0).

In order to provide some of the microcontroller pins with a desired logic level, it is necessary to enable connection between that pin and the resistor using the appropriate DIP switch.

Refer to Figure 9-4. Port PORTC pins are driven low (0). It means that jumper J3 is in pull-down position, whereas switches on the DIP switch SW3 are in ON position.

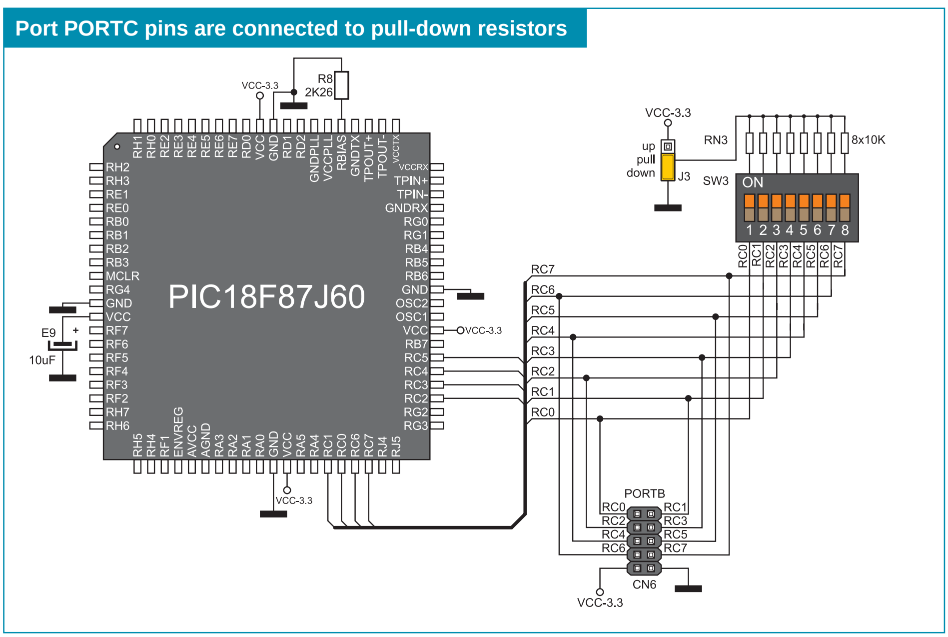


Figure 9-4: Port PORTC connection schematic

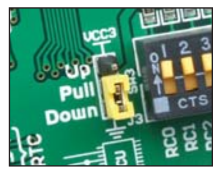


Figure 9-2: J3 in pull-down position

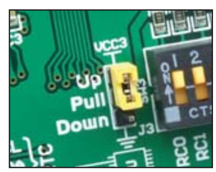


Figure 9-3: J3 in pull-up position

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