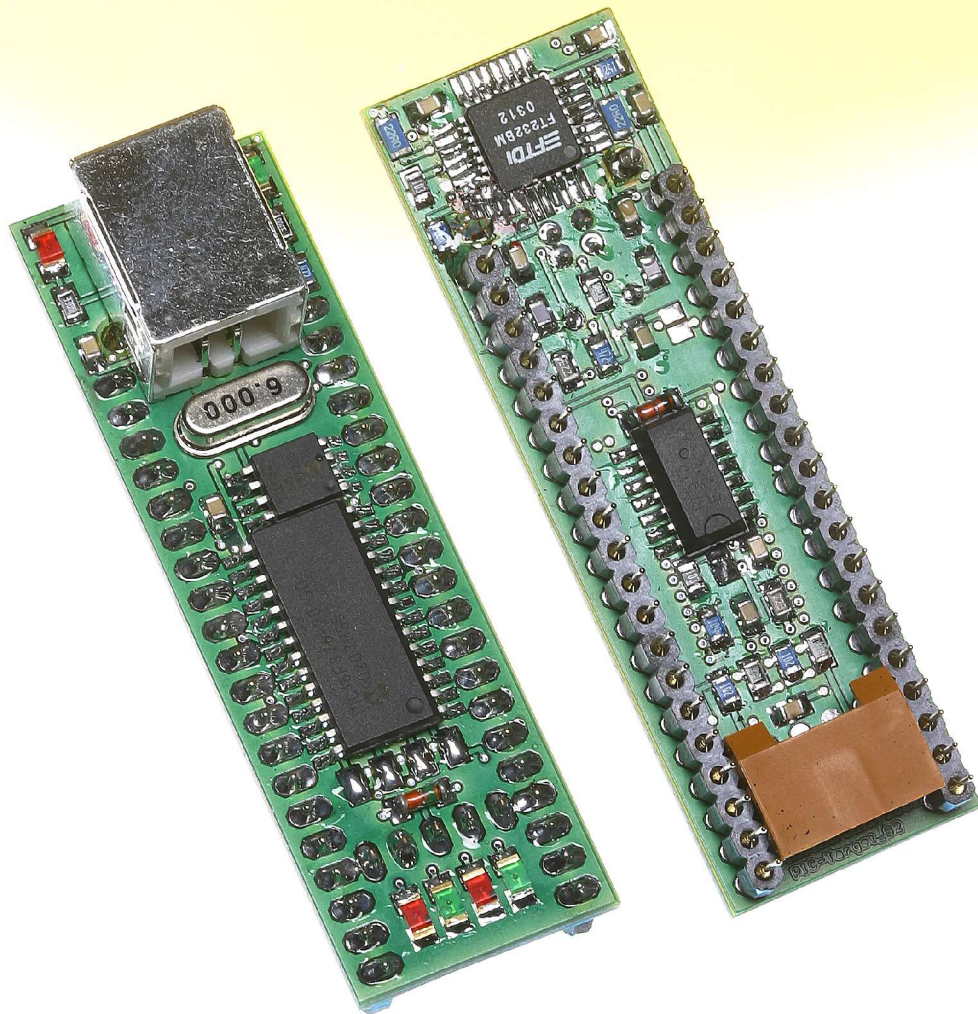


MiniFlex-USB User Documentation:



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History

Issue	Date	Reason For Changes
01	20031001	Initial issue

References

[1]

Introduction

Congratulations - with your new MiniFlex-USB you have acquired a modern, universal Microcontroller module designed to shorten your hardware development time, and increase your efficiency. Please read this user documentation completely, before you start programming. For more valuable tips as well as the latest documentation see our homepage at <http://www.inventronik.de> .

Safety restrictions

Inventronik is proud to supply you with a high-quality device, nevertheless we cannot guarantee that this module works under all possible conditions without failure. Do not use this product in applications, where damage in the module could lead to direct danger for humans ,e.g. medical systems, protection devices or such. This product is conceived exclusively for use with a 5Volt power supply. Higher voltages can lead to malfunction and/or the total loss of the module. **Please only use certified 5Volt power supplies.**

Shipping List

This package contains the following parts:

- 1 Microcontroller module MiniFlex-USB
- 1 USB cable
- 1 Programming cable for In-System-Programming
- 1 Product-CD with data sheets, documentation and software

User Documentation (Hardware)

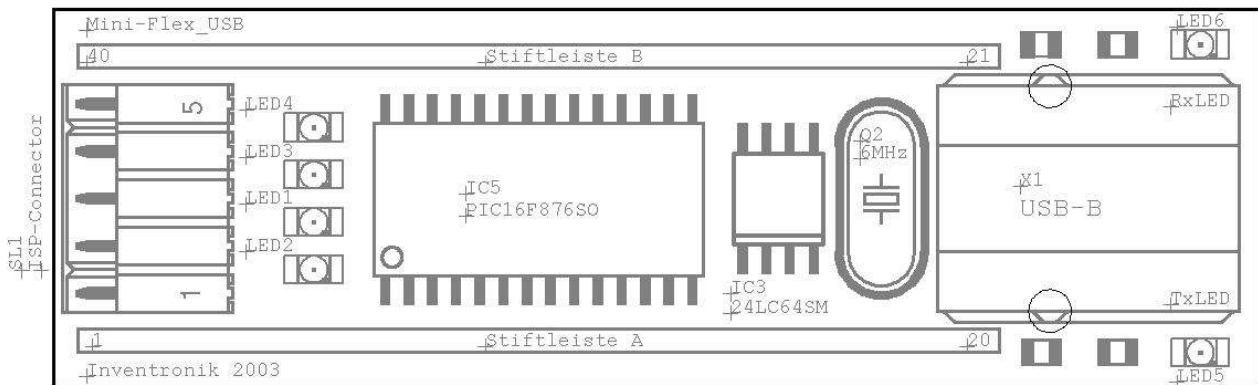


Figure 1: Module layout of the MiniFlex-USB (top view)

Description of the module

The MiniFlex-USB is based on the microcontroller PIC16F876 from Microchip. This PIC Microcontroller family is commonly characterised by the availability of excellent developers tools (assembler, C-compiler, IDEs etc..) and many on-line resources (code examples, example applications). The on-board periphery consists of a RTC4513 (Seiko) real-time clock, a 64Kbit I2C-EEPROM and a USB Controller from FTDI. All relevant data sheets for these components can be found on the product CD.

The programming of the microcontroller is done through an in-system-programming interface. This allows programming of the module while inserted. Firmware updates are particularly simple, you don't have to remove the module and plug it into the programmer.

The on-board USB-controller allows an easy-to-setup communication between PC and microcontroller module. On the product CD you'll find some example applications, which illustrate this usage. Please read the appropriate README files.

The module is suitable for almost any kind of small microcontroller tasks. For example:

- PC-USB applications
- Data logger for A/D measurement
- time-controlled applications
- simple regulations
- user interaction using a LCD and some keys

Preparing module configuration

You don't need to change any of the present configuration jumpers before you start with the MiniFlex-USB, however 6 jumpers are available, as represented in illustration 2. The jumpers differ from to usual wired links (plastic outline) in such a way that each jumper consists of two pads. Addition of a soldering bridge onto the pads closes the connection. Removing the solder-tin will open the connection again.

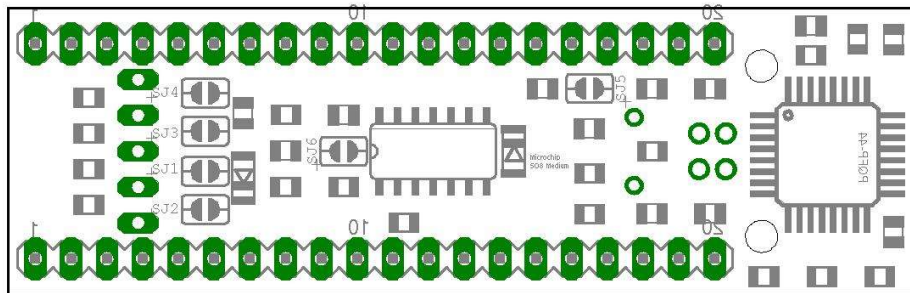


Figure 2: Location of the configuration jumper

The jumpers have the following functions: SJ1 to SJ4: with a closed jumper (factory settings) the four light emitting diodes LED-1 to LED-4 are assigned to the appropriate pin on the microcontroller (PIC pins). Please open these jumpers, if you want to use these pins in your application.

Jumper	Corresponding LED	Corresponding PIC-Pin
SJ1	LED-1 (green)	RB0 (Pin 31)
SJ2	LED-2 (red)	RB7 (Pin 28)
SJ3	LED-3 (green)	RC7 (Pin 18)
SJ4	LED-4 (red)	RA0 (Pin 2)

Table 1: Assignment of the light emitting diodes and their jumper to the PIC pins

SJ5: By default this jumper is opened and the write protection of the I2C-EEPROMS is disabled. Closing this jumper disables write access to the I2C-EEPROM.

SJ6: By default this jumper is opened and this enables real-time clock (RTC) on the module. In closed condition, the pins RB4 to RB6 of the microcontroller are available for other functions.

LEDs:

The MiniFlex-USB module has six light emitting diodes. LED-1, LED-2 and LED-4 are free for your use. They can be configured with the appropriate jumper. The LED-3 indicates data exchange (received) between the USB-chip and the microcontroller. It serves primarily to verify the correct configuration of the PIC-USB port pin. The two LEDs located beside the USB-connector indicate the sending and the receiving activity to the USB-interface.

MiniFlex-USB Connections

The connection between the microcontroller module and your PC takes place with the two provided cables. The first cable connects the PC and MiniFlex-USB with the USB cable.

The second cable is used for programming the MiniFlex-USB. This cable is equipped on one side with a plug that fits into the socket on top of the module, the other side is the connector for the programming device. If you don't use the Inventronik PIC-burner, it is likely that you have to build your own connection to your PIC programmer. The cable connector includes all necessary signals, for programming. The colors of the cable are as follows:

Connector-Pin	PIC-Pin	Color	Signal name	Description
1	20	yellow	+5V	Supply
2	8,19	orange	GND (0V)	Supply
3	1	red	MCLRn	Reset
4	27	brown	PGD	Data
5	28	black	PGC	Speed (takt)

Table 2: Assignment of the In-System-Programming plug

In case you don't want to build your own programming device, Inventronik offers an easy-to-use PIC burner (see end of this documentation).

Pin row assignment

The module has two rows of pins (20 pins on each side; DIL-40-Outline). The following table shows the signals on each row:

Pin-Number	Function / Alternative Function
1 (Connector A)	Power supply: +5V
2 (Connector A)	Power supply: +5V
3 (Connector A)	System Reset: /CLR (active low)
4 (Connector A)	PIC pin: RA0 / LED-4 (if SJ4 closed)
5 (Connector A)	PIC pin: RA1
6 (Connector A)	PIC pin: RA2
7 (Connector A)	PIC pin: RA3
8 (Connector A)	PIC pin: RA4
9 (Connector A)	PIC pin: RA5
10 (Connector A)	Clock: CLKIN (the same for PIC and the FTDI)
11 (Connector A)	Clock: CLKOUT (Clock output of the FTDI)
12 (Connector A)	LED-Output: RX-LED of the FTDI
13 (Connector A)	LED-Output: TX-LED of the FTDI
14 (Connector A)	Output of the RTC(Real-Time-Clock): STDP(see datasheet)
15 (Connector A)	Power supply of the RTC: +3V ... +5V (Lithium battery)
16 (Connector A)	USB Connector: D+ (also avail. on the USB plug)
17 (Connector A)	USB Connector: D- (also avail. on the USB plug)
18 (Connector A)	USB Power supply +5V: see USB specification
19 (Connector A)	Power supply: Ground, 0V, GND
20 (Connector A)	Power supply: Ground, 0V, GND
21 (Connector B)	Power supply: Ground, 0V, GND
22 (Connector B)	Power supply: Ground, 0V, GND
23 (Connector B)	PIC pin: RC0
24 (Connector B)	PIC pin: RC1
25 (Connector B)	PIC pin: RC2
26 (Connector B)	PIC pin: RC3 I2C clock of the EEPROM (if SJ5 closed)
27 (Connector B)	PIC pin: RC4 I2C data of the EEPROM (if SJ5 closed)
28 (Connector B)	PIC pin: RC5
29 (Connector B)	PIC pin: RC6 / USB Tx-Data
30 (Connector B)	PIC pin: RC7 / LED3 (if SJ3 closed) / USB Rx-Data
31 (Connector B)	PIC pin: RB0 / LED1 (if SJ1 closed)
32 (Connector B)	PIC pin: RB1
33 (Connector B)	PIC pin: RB2
34 (Connector B)	PIC pin: RB3
35 (Connector B)	PIC pin: RB4 / Data connector of the RTC (if SJ6 closed)
36 (Connector B)	PIC pin: RB5 / Clock connector of the RTC (if SJ6 closed)

Pin-Number	Function / Alternative Function
37 (Connector B)	PIC pin: RB6 / ISP-Data
38 (Connector B)	PIC pin: RB7 / LED-2 (if SJ2 closed) / ISP-Clock
39 (Connector B)	Power supply: +5V
40 (Connector B)	Power supply: +5V

Table 3: Module pin row assignment

Getting started with the MiniFlex-USB

The MiniFlex-USB needs a 5-Volt power supply. Please connect this to the appropriate pins (see table 3).

IMPORTANT: only use certified power supplies.

Be sure you use the correct polarity. The modules are not protected against wrong polarity or over-voltage. Inventronik does not repair or replace damaged modules in case damages are caused by using an incorrect power supply.

Mechanical dimensions of the Miniflex-USB

The following illustration shows the most important dimensions of the MiniFlex-USB. All dimensions are in mm.

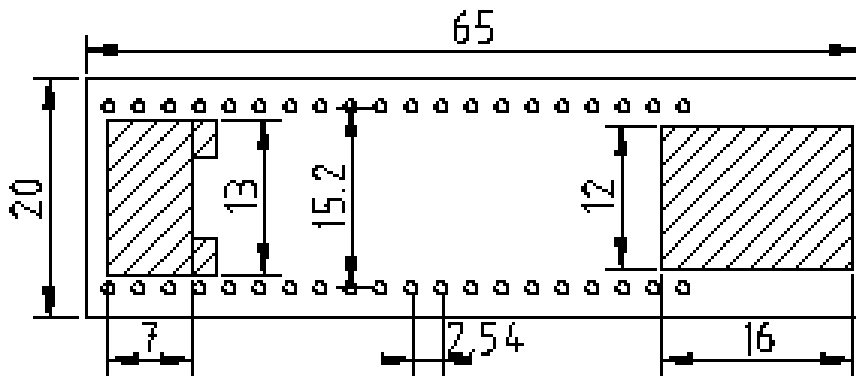


Figure 3: Dimensions of the MiniFlex USB

Technical Specifications for the MiniFlex-USB

Microcontroller:

- Type: PIC16F876 RISC-CPU
- Working Frequency: 6MHz
- Flash-PROM: 8K (x14) words
- RAM: 368 Bytes
- EEPROM: 256 Bytes (internal)

USB:

- Transmission rate: USB 2.0 conform, limited by PIC application.

Real-Time-Clock (RTC)

- Supply voltage with battery operation: 2.7V bis 5.0V
- Power input with battery operation: <5uA

Power supply:

- Supply voltage: 5V \pm 10%, regulated DC voltage.
- Power consumption: approx. 50mA, without any load on the output pins.

Miscellaneous:

- Temperature range: 0°C bis +70°C
- Board size: 65mm x 20mm
- Height: 22mm
- Weight: 20g

Further information

All data sheets for the MiniFlex-USB components can be found on the product CD. If you have specific questions about the MiniFlex-USB that are not answered in this documentation, please visit our online help system at <http://www.inventronik.de>. There you will find a forum, where we are happy to assist you and where special applications for the MiniFlex-USB can be discussed.

MiniFlex-USB Software

Overview

The MiniFlex-USB software provides C-source code examples. To compile these examples you will need the C-Compiler from CCSC (<http://www.ccscinfo.com>). These examples are intended to illustrate the programming of the module. In addition we offer a monitor program (for Windows 98/ME/2000/XP), which helps make the first steps towards USB communication. Following are detailed steps necessary for the USB device driver installation for Windows PCs and describe the start-up with a Linux PC.

First Steps (for Windows 98/ME/2000/XP)

We assume you want to test the module right away. To accelerate this process we provide a small test application (the source code of this application is included on the product CD). After you have installed the virtual serial driver on your PC you should be able to communicate with your MiniFlex-USB.

Installing a driver for a virtual USB/RS232 port

The MiniFlex-USB needs to be connected with a power supply and the USB cable, after which you will be asked to select a USB<->Serial driver (and finally the USB-Serial-Port driver). You'll find these drivers on the product CD (in the directory Windows\USB Driver).

Why is this driver needed?

The driver maps the USB interface on your PC to a virtual serial RS-232-C interface. Programming a RS-232-C interface is much easier than programming the USB interface. You don't have to know about the complicated USB protocols and you can use many well tested programming libraries with serial communication support. Exchanging data via USB is really easy this way.

Please note: that the driver version on the product is not certified by Windows XP (a warning appears).

Screenshots of the installation process

After connecting the MiniFlex-USB to your PC, a dialog window opens (see figure 4).



Figure 4: Windows hardware facility assistant

Don't use automatic installation here. Please use the 2nd option in the dialog window to allow selection of the appropriate directory. Press „Next“ to continue and following dialog appears:



Figure 5: Selection of the driver directory

Please choose the location of the driver. You will find it on the product CD in the folder (Windows\USB Driver). The installation procedure ends with the last dialog window. This will be the the „USB Serial Port“ installation. After that the virtual serial COM is ready for use.



Figure 6: Finish the driver installation; Serial converter

PCs are normally equipped with multiple COM ports so the virtual COM port is not mapped to a specific port number (e.g. COM3). Windows has its own scheme for the distribution of virtual port numbers. How to find the right COM port is discussed later in this documentation.



Figure 7: Finish the driver installation; USB serial port driver

3rd Party Software-Support

As an interesting side-note: FTDI (<http://www.ftdichip.com>), the manufacturer of the RS-232<->USB-Chips, offers a DLL that doesn't relay on a virtual serial COM port. Instead, it has an API to communicate with the USB chip. We have never tried it and of course we can't offer any support for using this API.

Verifying the COM-Ports

Next you should find out which COM port is used for the virtual serial interface. The COM port in use depends on the number of COM ports already available in your PC. To figure it out you'll have to open the device manager (system/hardware) and open connectors (COM and LPT). The USB Serial Port shows up (here COM4 is used for the USB Serial Port).

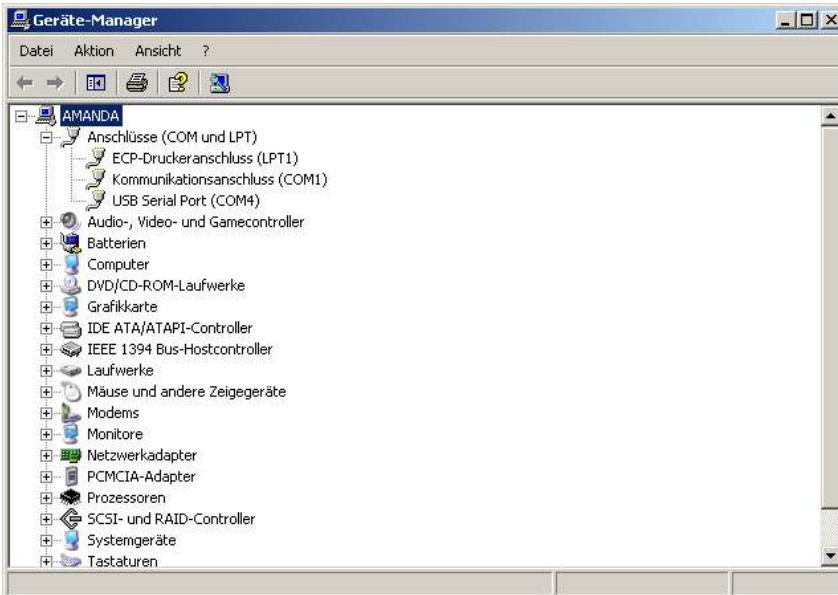


Figure 8: USB Serial Port (COMx)

Execution of the monitor program

We provide a simple Windows program, that sends and receives ASCII commands. The program is stored on the CD in the folder (Windows\Utils\SimpleRS232Mon.exe) and does not need any DLLs, or installation procedures. If you want to use it, simply copy the program to your harddrive.

After you start the program „SimpleRS232Mon.exe“ you must select the virtual serial interface COMx with the parameters:

baudrate=19200

data bits=8

stop bits=1

parity=none

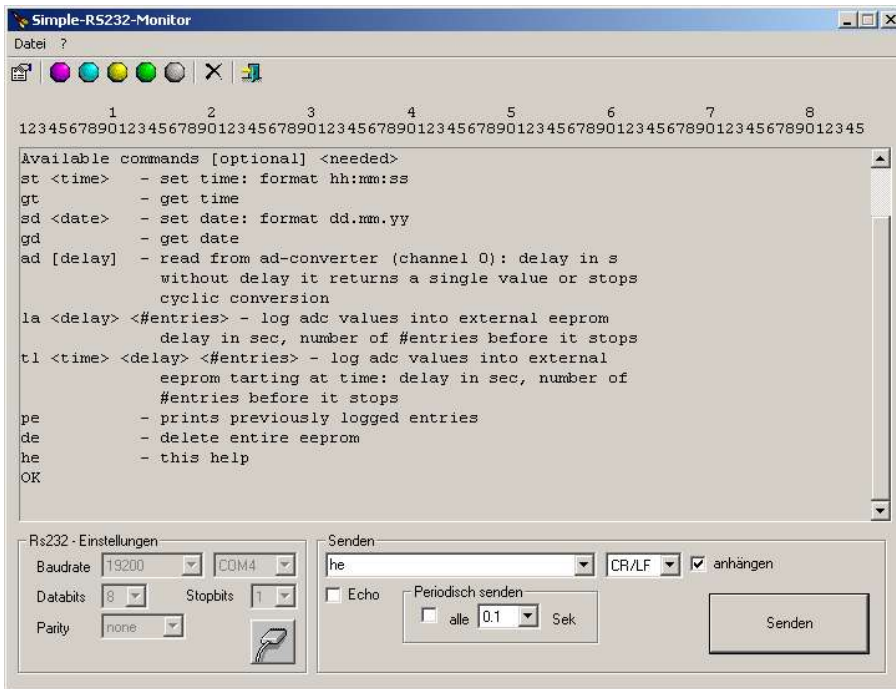


Figure 9: SimpleRS232Mon.exe (currently there is no english version available)

The MiniFlex-USB module uses these settings to communicate with the USB chip. If you need higher transfer rates, you have to program them on the microcontroller side too. Pressing the connector button opens the communication channel to the MiniFlex-USB. Now you should be able to send short commands to the PIC application (2 character commands).

For example 'he' followed by a CR/LF (enter key), will send you a description of all available commands of the application.

Other commands are: st <time>: set time; with a date format 'hh:mm:ss' (hh-hours, mm-minutes, ss-seconds) sets the time of the RTC.

To ask the RTC for the current time you can use the command: gt - get time

You'll find a complete command summary in the C-source code section on the product CD.

First Steps (Linux Kernel 2.4.x)

Linux already includes support of virtual serial interfaces in all the usual distributions with the Kernel-2.4.x. In order to be able to access the MiniFlex-USB with a monitor program (terminal emulation), Linux offers various alternatives. We show you how to get connected with the terminal program „minicom“. However most terminal programs are capable of communication with the module (e.g. seyon).

As root user, start minicom with the option s: „minicom -s“. This option starts minicom in setup mode and allows you to change port settings. Starting the program looks like this:

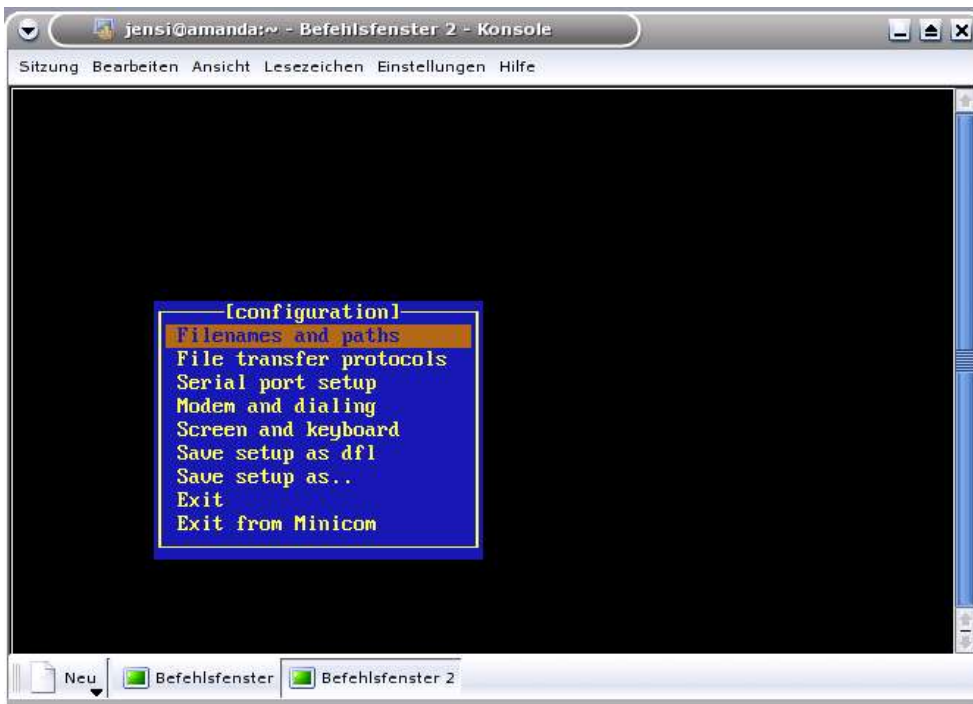


Figure 10: Minicom Setup 1

The menu „Serial port setup“ allows you to change all necessary interface settings. The next screen shows what to do:

1. Type 'A' - Serial Device. For the US B interface you have to select „/dev/ttyUSBx“ (x stands for 0, 1, 2...). We had luck and our interface was the first one „/dev/ttyUSB0“.
2. Next type 'E' - Bps/Par/Bits to adjust interface parameters. Change the parameters to 19200, 8N1.
3. A RETURN brings you back to the previous menu. With 'Exit' you can leave the setup mode.

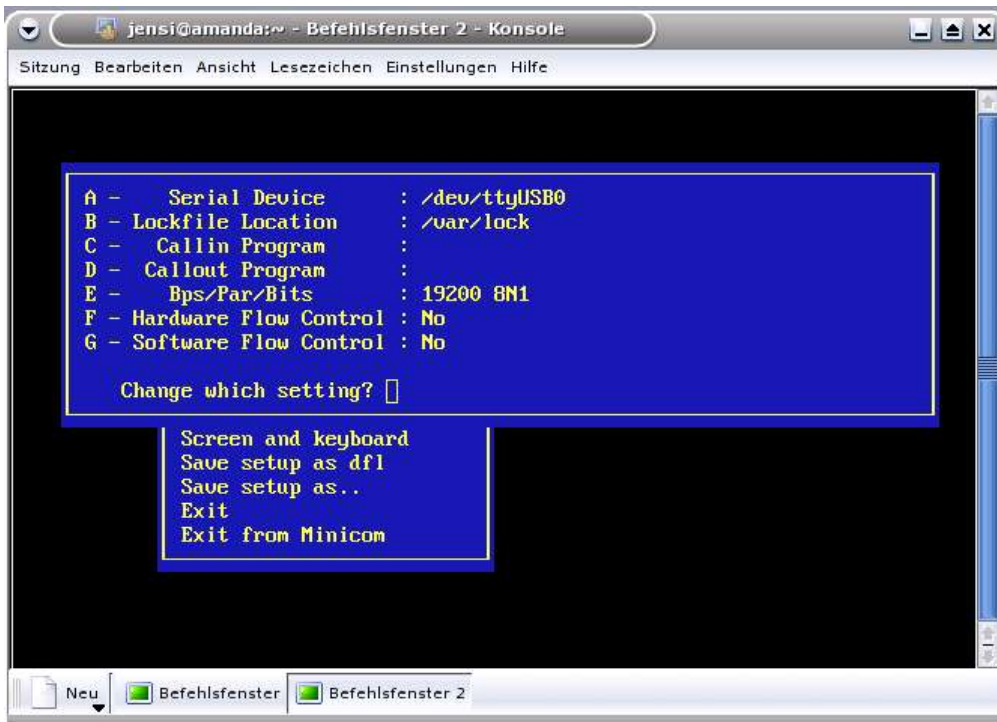


Figure 11: Minicom Setup 2

Now you should be able to type in a simple command. For example: 'he' followed of a CR/LF. This command returns a list of commands available for the sample application.

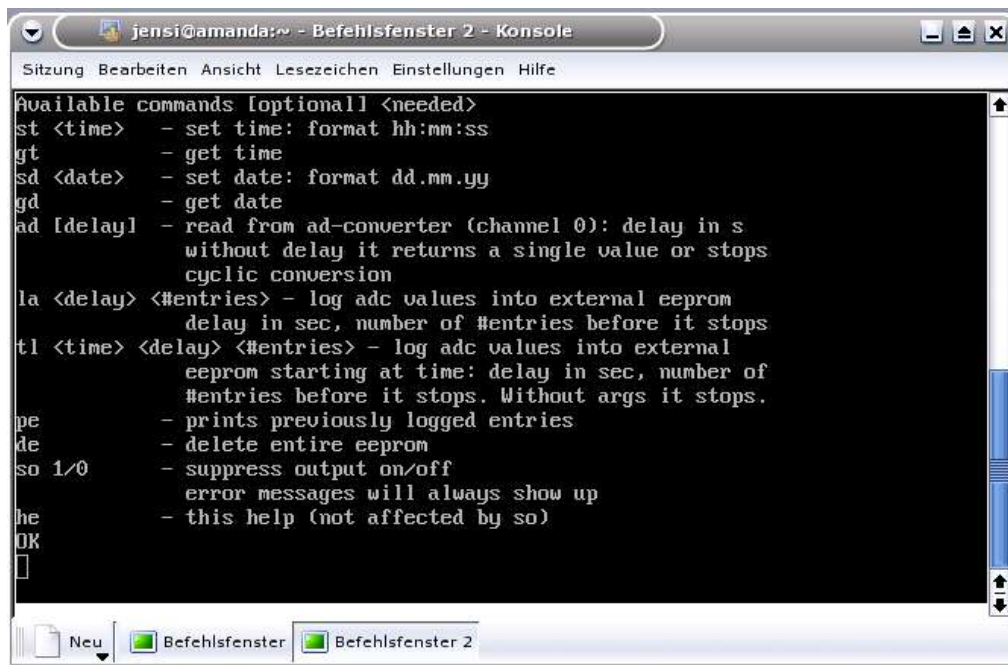


Figure 12: Communication with the MiniFlex via Minicom

The MiniFlex-Programmer

Introduction

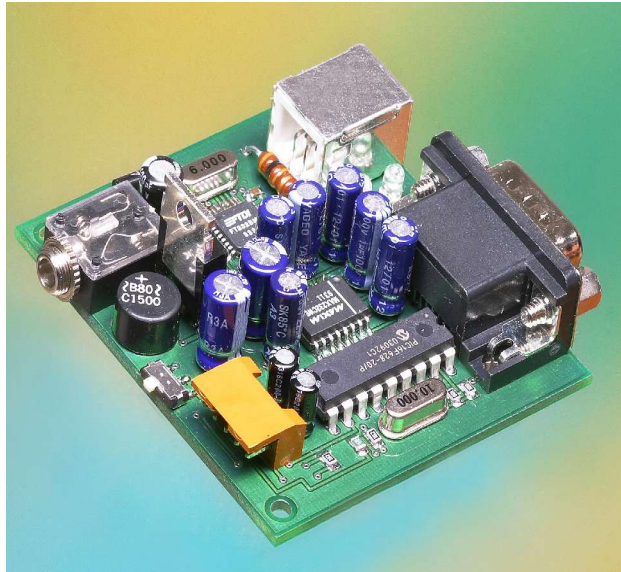


Figure 13: Programmer "MiniFlex-Prog"

Programming of the MiniFlex-USB is done, as mentioned, in circuit by using its in circuit interface. Inventronik offers a programmer complete with customised software optimised for the MiniFlex-USB.

Figure 13 shows the programming device. The connection to the MiniFlex-USB is established through a 5-pin ISP cable. For voltage supply a jack is intended. The equipment is supplied via the provided power supply. Voltage between 8V and 12V can be used independent of polarity. Additionally, an AC power supply may also be used. On the PC side the programming device can be operated through a RS232-C interface (serial interface) or through the USB interface. The circuit board size is 62mm x 60mm x 25mm.

There is programming software for Windows operating systems and for Linux as well as operating system independent software written in Python. The GUI (graphical user interface) has been developed with the GUI-Toolsets wxPython. All required Python files are found on the product CD which came with your MiniFlex-USB. For Windows OS there is PIC-programming software (as .exe) which can be operated without installing Python.

Installation of the MiniFlex-Prog

Simply connect the provided power supply and the programmer jack to your MiniFlex-Prog (see Figure 14). Attach the Prog with the MiniFlex-USB target using the provided 5 pole cable. The brown connectors are encoded, so it is not possible to plug this cable in incorrectly. Finally, don't forget to connect it all to your PC.

The USB-cable is provided. If you want to use the serial RS232-C interface use a zero-modem cable. Please pay attention to the required voltage on the power supply (110V vs. 230V). It is not necessary to supply the MiniFlex-USB during programming, it is done via the programmer. The power consumption of the MiniFlex-USB with its connected peripheral components may not exceed 400mA. The installation of the programmer is now finished.

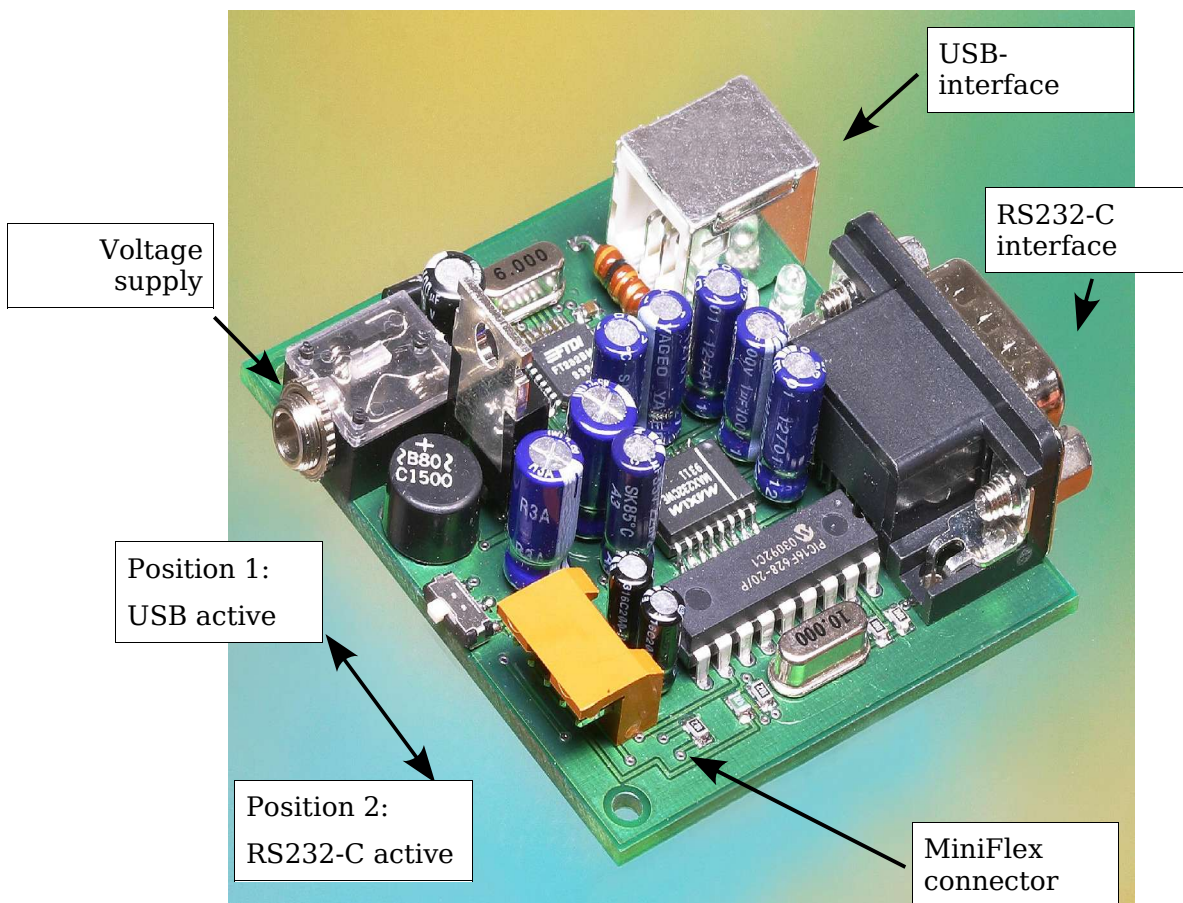


Figure 14: Connectors of the MiniFlex-Prog

Security advice

Please note: Overloading the power supply can lead to overheating, malfunction or damages. An overload is produced through excessive current consumption from the MiniFlex-USB. To avoid this condition please use an appropriate external power supply.

Be careful that no metal parts cause short circuits to the pins or the circuit board. Operate the MiniFlex-USB only on an electrically insulated grounded plane.

Configuration of the programmer

The Configuration of the programmer is done with switch S1 as shown in Figure 14. This switch determines, whether the programmer is operated on the USB interface or the RS232-C interface of the PC:

Switch in position 1 (the knob is located near the jack): The programmer works via the PC's USB-port.

Switch in position 2 (the knob is located near the brown target connector): The programmer works via the PC's RS232-C-port.

There is no further configuration required.

Software Installation

1. RS232-C interface

It is not necessary to configure the RS232-C concerning start-bits, stop-bits, baudrate etc. This is done automatically during invocation of the programmer software.

2. Virtual USB-COM interface

The installation of the virtual COM port has been described in detail in chapter „MiniFlex-USB Software“. The installation is only necessary if you want to operate the programmer through the USB interface.

3. The MiniFlex-Prog software wxXWisp

The installation of wxXWisp is also described in the chapter „MiniFlex-USB Software“. For Windows you will find an executable (.exe) on the product CD. Please copy the directory „Windows\MiniFlex-Prog\Executables“ to your harddrive. The program „wxXWisp.exe“ is capable of controlling your MiniFlex-Prog. Please note: Starting this program can be a little slow because the Python Interpreter has to be loaded through DLLs.

If you are using this program under Linux then the following software packets are required: Python (Version 2.2.2), glib, gtk+ und wxPython (für Python 2.2) . The necessary Python source code can be found in the directory (Linux\MiniFlex-Prog\Source).

After successful installation of the interfaces and wxXWisp you have a comfortable development tool at your command. Inventronik wishes you much fun and success in the development of your projects.

Operation of the MiniFlex-Prog

After invoking wxXWisp (.py/.exe) you can see a mostly self-explanatory program interface. The next figure shows the functions provided by wxXWisp.



Figure 15: Programmer software wxXWisp

In the menu „Properties“ you can select the interface (USB or RS232) you are using and the language you prefer for your wxXWisp GUI. If you decide to use the USB port, please read the chapter „Verifying the COM-Ports“ if you have trouble finding the right virtual COM port.

To program your MiniFlex-USB, press the button „Open HEX-file“ and chose a file you have generated with your assembler/compiler to download to the PIC flash prom.

You have not to erase the old program code on the MiniFlex-USB before programming. The old code will simply be replaced by the new one. It is also not necessary to verify the code because this is done automatically. The only time you need to use the “erase” button is when you want an empty MiniFlex-USB.

To specify a default HEX file for the „Open HEX-file“ command, check the box “burn previously opened HEX file”.

With the option „Save HEX-file“ it is possible to read the HEX file from the MiniFlex-USB unless the flash prom is read-protected (this can be selected in the compiler/assembler options).

The buttons „erase“ and „execute“ are used to erase the flash prom content and to start (reset) the program on the MiniFlex-USB.

Technical Data of the MiniFlex-Prog

Voltage Supply:	8V to 12V DC or AC
Current consumption:	100mA
Maximum of equipped current:	400mA (via the programming cable)
Supported Interfaces:	USB and RS232
Software requirements:	Linux; Windows 98, ME, 2000, XP
PIC support:	12F629, 12F675, 16F630, 16F676, 16C84, 16F84, 16F84A, 16F627, 16F628, 16F818, 16F819, 16F72, 16F73, 16F74, 16F76, 16F77, 16F870, 16F871, 16F872, 16F873, 16F874, 16F876, 16F877, 16F873A, 16F874A, 16F876A, 16F877A, 18F252, 18F242, 18F442, 18F452, 18F1220, 18F1320, 18F2220, 18F2320, 18F4220, 18F4320
Size:	about 62mm x60mm x25mm (l x b x h)
Weight:	about 50g

Attachment

Copyright

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Liability

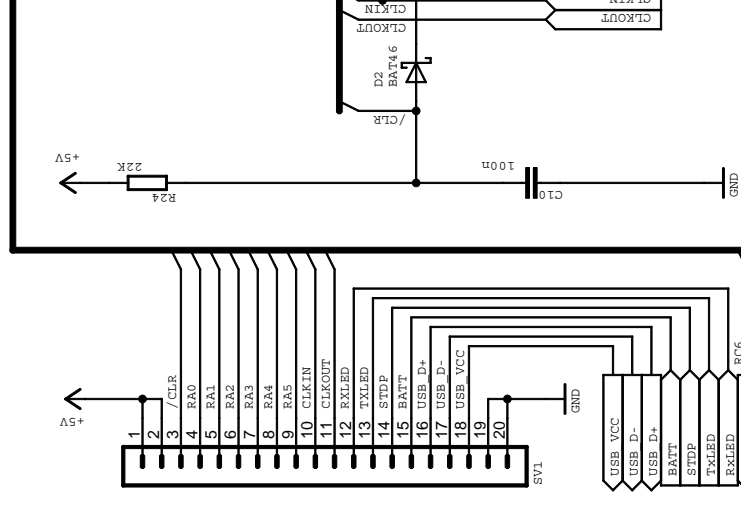
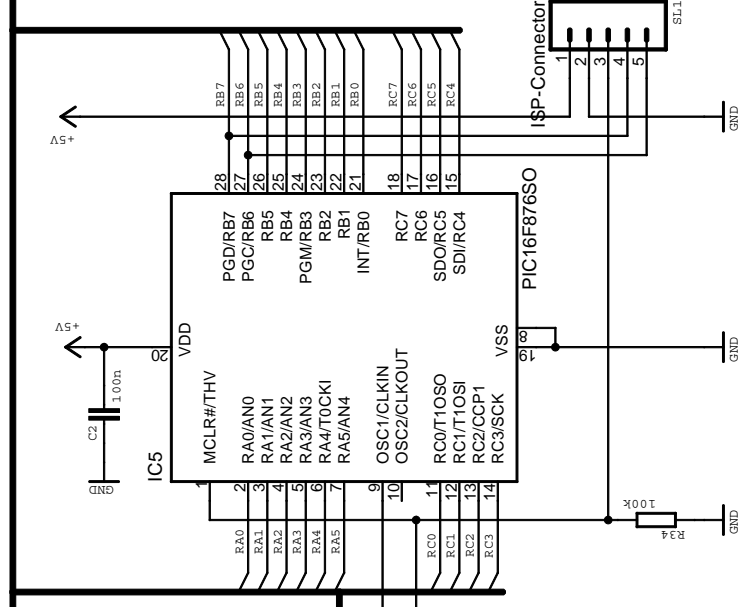
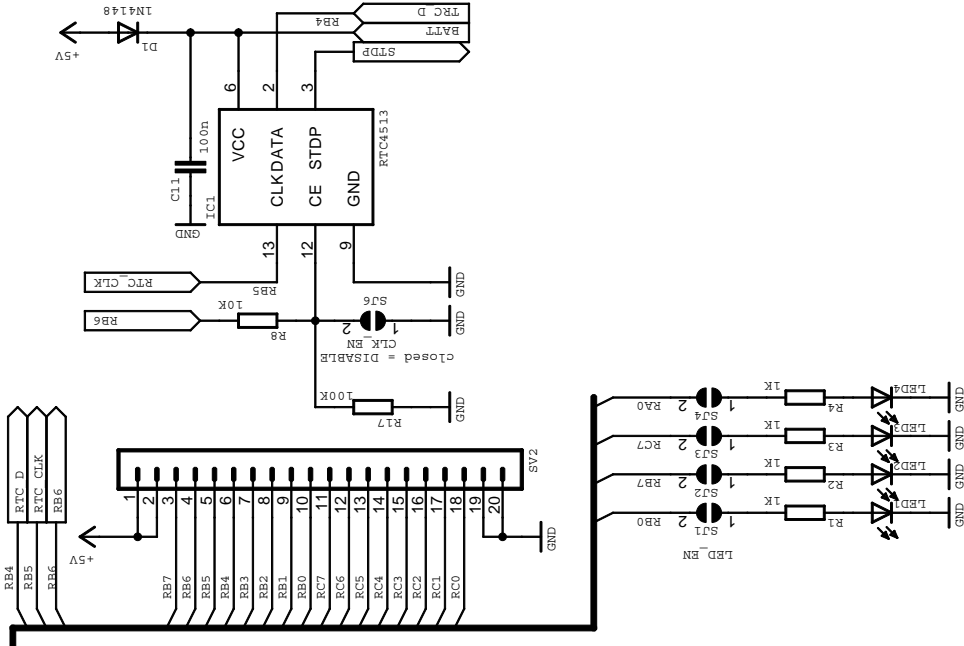
Inventronik does not accept any liability for the use of the MiniFlex-USB or the provided software, or software downloaded from our Internet site whether they be used together or separately. The company Inventronik likewise does not accept any form of liability if, by the use of these products, patent or license rights of a third-party are injured. The company Inventronik reserves the right to make and instigate technical changes with an eye towards product improvements at will and without previous announcement, this includes changes and supplements to this documentation.

Trademark

The label names or registered trade marks mentioned in this document serve only as identification and are property of their respective owners.

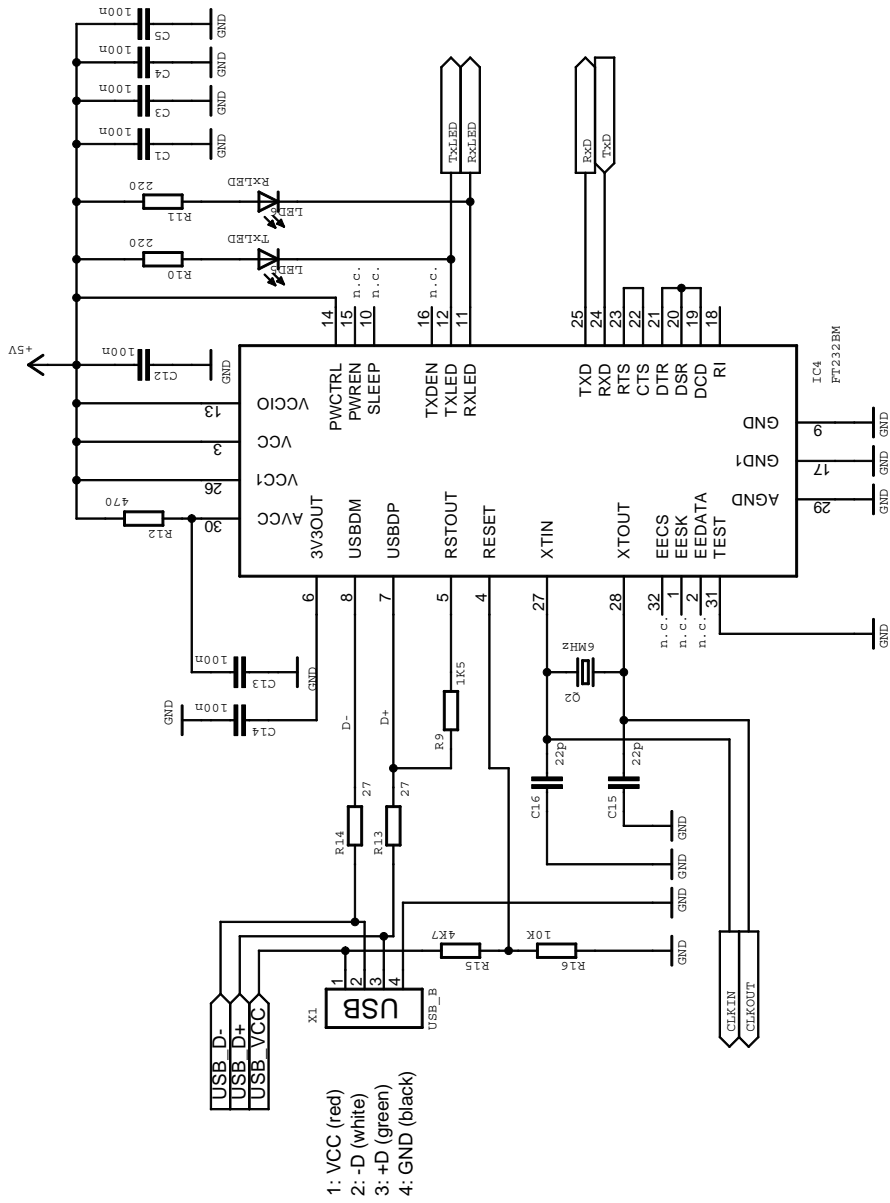
Terms of the warranty (guarantee)

Inventronik grants a warranty of two years, precluding the appropriate handling of the product. The warranty expires immediately if the product is mishandled or manipulated.



Inventronik GmbH, 2003
 PIC, RTC, Storage
 TITLE: miniflex-usb
 Document Number: MiniFlex_ED_08-2003
 WF, JC, Änderungen vorbehalten
 Date: 10/09/2003 12:04:39
 Sheet: 1/2

REV: 1.1



- 1: VCC (red)
- 2: -D (white)
- 3: +D (green)
- 4: GND (black)

Inventronik GmbH, 2003	
USB	
TITLE: miniflex-usb	
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