Microcontroller Software Installation and Operating Instructions

This document explains the installation and operation of the microcontroller software, and should be used as a companion to the experiment manual. You will find a section about installation of the USB adapter at the end.

Installation

The software for the Microcontroller experiment kit can either be run from the CD or copied to your hard drive and run from there. You can start using the software from the CD right away. However, you will not be able to save any of your own programs on the CD, and you won't be able to change any of the sample programs that are already on it. So it makes sense to copy all the software onto your computer's hard drive.

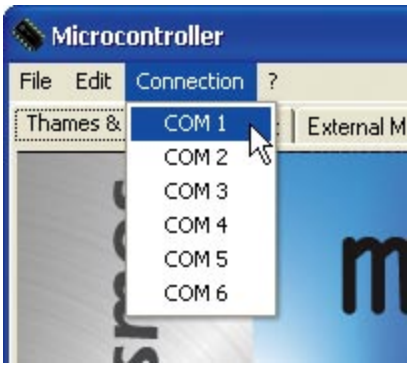
If your PC has a serial port, use that for the infrared interface connection. Some newer PCs and laptops only have a USB port. In that case, you must use the USB adapter, which requires its own installation. You will find detailed instructions for using the USB adapter later on in this guide.

Insert the Microcontroller CD into your computer's CD drive. Open the CD with the file manager so that you can see its contents.

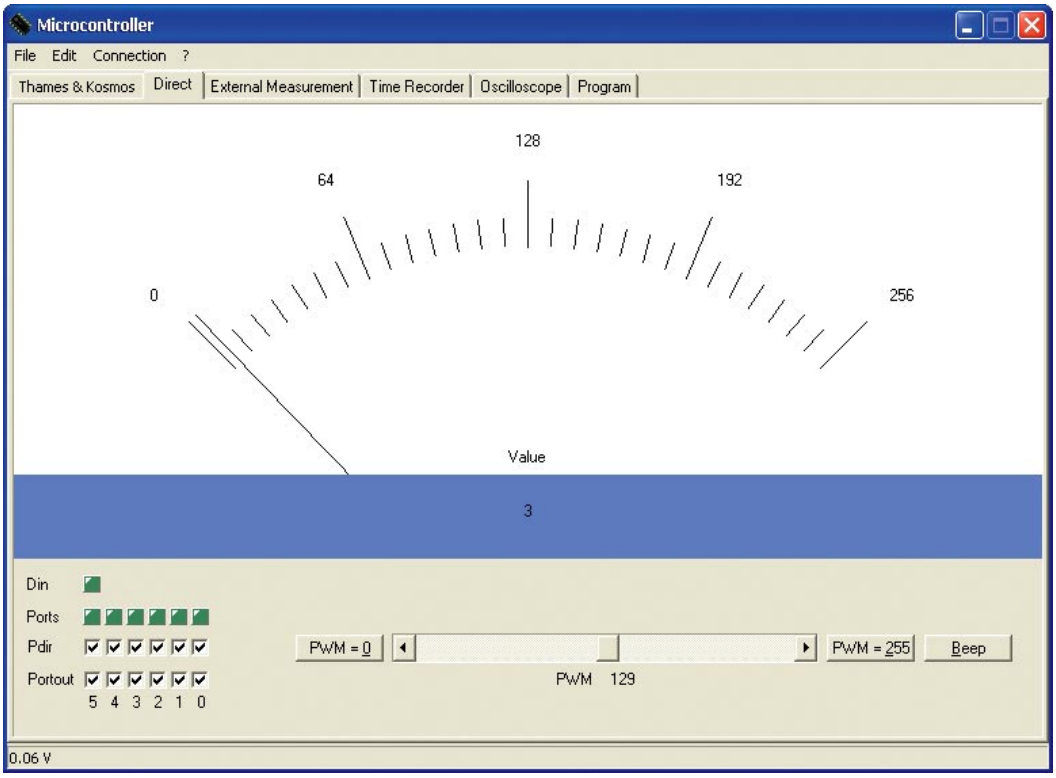
Quick Start from the CD

For your first test, start the Microcontroller.exe program directly off the CD by double clicking it. The start screen will appear along with a message that a connection port has to be selected after the first start.

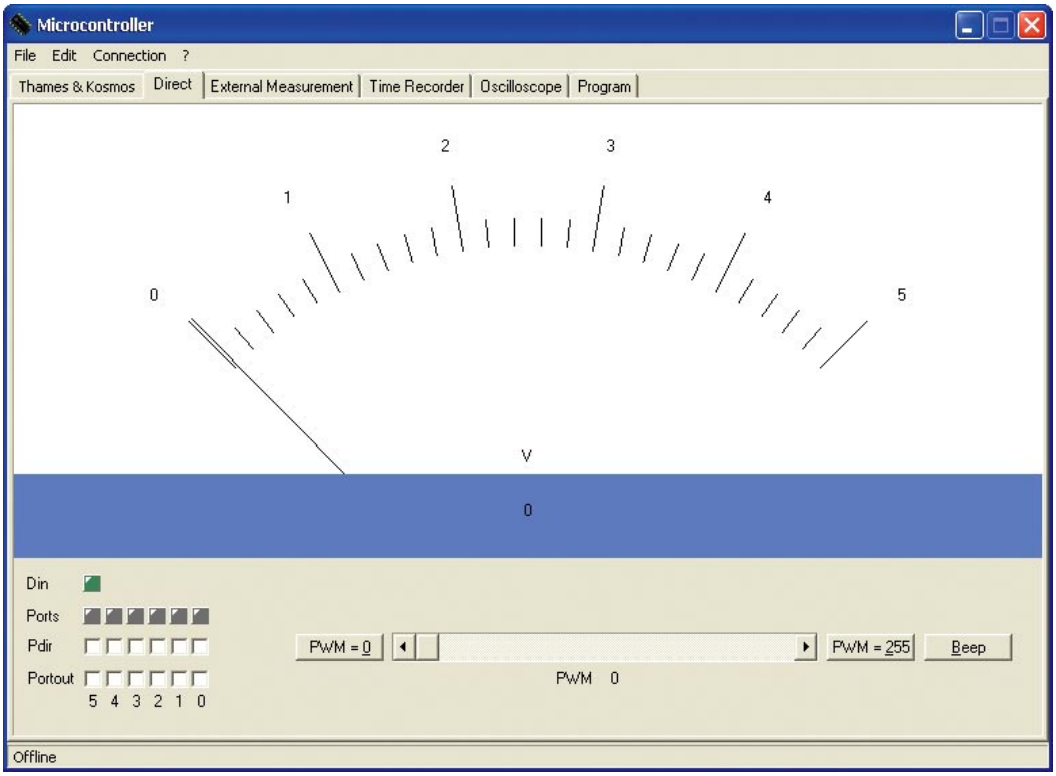
To select the connection port, click on the Connection tab and select the serial port to be used. In most cases, it will be COM1. If the selection is successful, a check will appear in front of COM1.



Now select the Direct tab. If your microcontroller is set up correctly (for example, the set up shown in Experiment 1) and everything is working properly, the software will display a voltage at the bottom of the Direct window. Now you can operate your microcontroller as described in the experiment manual.



You can tell there is a problem if no data are displayed. Also, on the bottom left, the message “Offline” will be displayed, meaning that there is no connection to the device.



Troubleshooting the Connection

If your microcontroller software is not displaying a voltage in the Direct window, there is a connection problem. Some possible sources of the problem are:
• The device is not turned on, has a weak battery, or the battery is not installed correctly.
• A COM port was used that was different from the one selected in the software.
• The infrared adapter is not aimed accurately at the microcontroller.
• The infrared adapter was placed too far away or too close.
• Extremely bright or flickering light is interfering with the data transfer.
• There is an object between the infrared adapter and the microcontroller.
• The microcontroller circuit is not assembled and connected correctly.
• The COM port is being used by another application, or even another open Microcontroller window. Close all Microcontroller windows and restart.

A blinking red indicator light will tell you that the microcontroller is working properly. The light is located on the top side of the microcontroller module, on the side that does not have the infrared components. If the light is off, make sure the battery is installed correctly and that the unit is on (switched to "I", not "O"). Also, make sure that the fuse inside the unit is installed correctly and not blown.

If the light is not blinking, try adjusting the microcontroller unit's position in the 16 metal clips it is sitting in. Make sure there is contact between the microcontroller's prongs and each clip.

However, it is possible that if the battery is weak, there is sufficient voltage for the microcontroller indicator light to blink, but not enough for the data transfer between PC and microcontroller. Try again with a new battery or use a wall power adapter.

A note about using power from an outlet: Use a regular wall plug power adapter with a transformer that can be set to different voltages. Set it to 9 V. Use a barrel connector with an outer diameter of 5.5 mm and inner diameter of 2.5 mm, and select the polarity so that the minus pole is on the inside and the plus pole is on the outside. A so-called "switch mode" power supply should not be used, as it can interfere with some of the experiments.

Copying the software to your hard drive

Make a new folder called "Microcontroller" in your hard drive or on your desktop. Select all of the files on the Microcontroller CD and drag them into the new folder. This will copy them to your drive.

Creating a shortcut on your desktop will let you start the software quickly and easily. To do that, right click on the program in the file manager and select Copy. Then right click on the desktop and select Paste Shortcut. That creates an icon for the program on the desktop. Now all you'll need to do is double click on it to start the program.

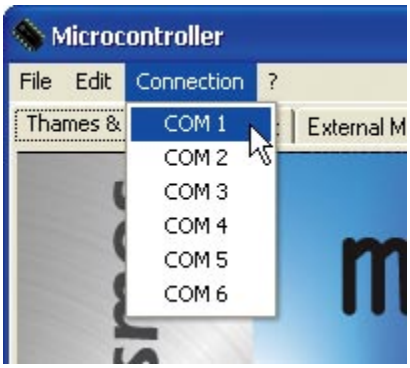
Microcontroller software operating instructions

After starting the software, a start screen appears with a picture of the experiment kit. In the upper menu bar, you will find the File and Edit menus, which are mainly used for your programs. The Connection menu item is needed for the connection with a PC port. The question mark shows information about this program version.

Beneath the menu bar, you will find six tabs, which you can use to call up the individual basic functions:

Thames & Kosmos:	The start screen
Direct:	Direct-connection measurements and controls in real-time
External Measurement:	Long-term measurements without the PC
Time Recorder:	Long-term measurements on the screen
Oscilloscope:	Investigation of fast processes
Program:	Editing your own programs

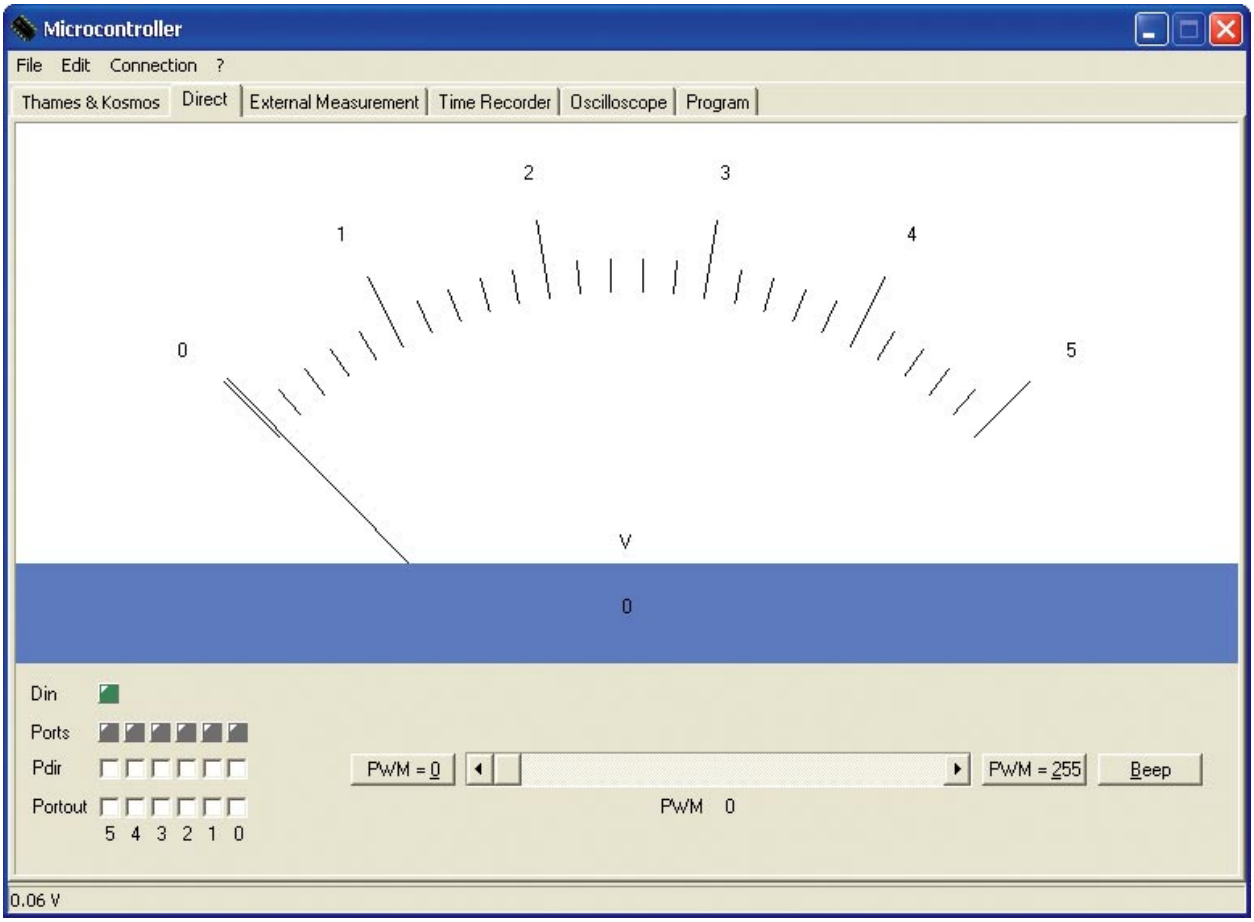
The first time you start up the program, a dialog will remind you that you have to select a COM port. This step may also be required again later, if you want to use a different connection to your PC. Many PCs only have one serial port, which is called COM1. It is recognizable by its 9-pin socket, which fits the infrared interface perfectly. If your PC has more than one serial port, you have to select COM1, COM2, or some other port. If your PC does not have a serial port, you will have to use the USB adapter, which creates a virtual COM port which is assigned a COM number, such as COM3, by the operating system. USB set up is on page 17.



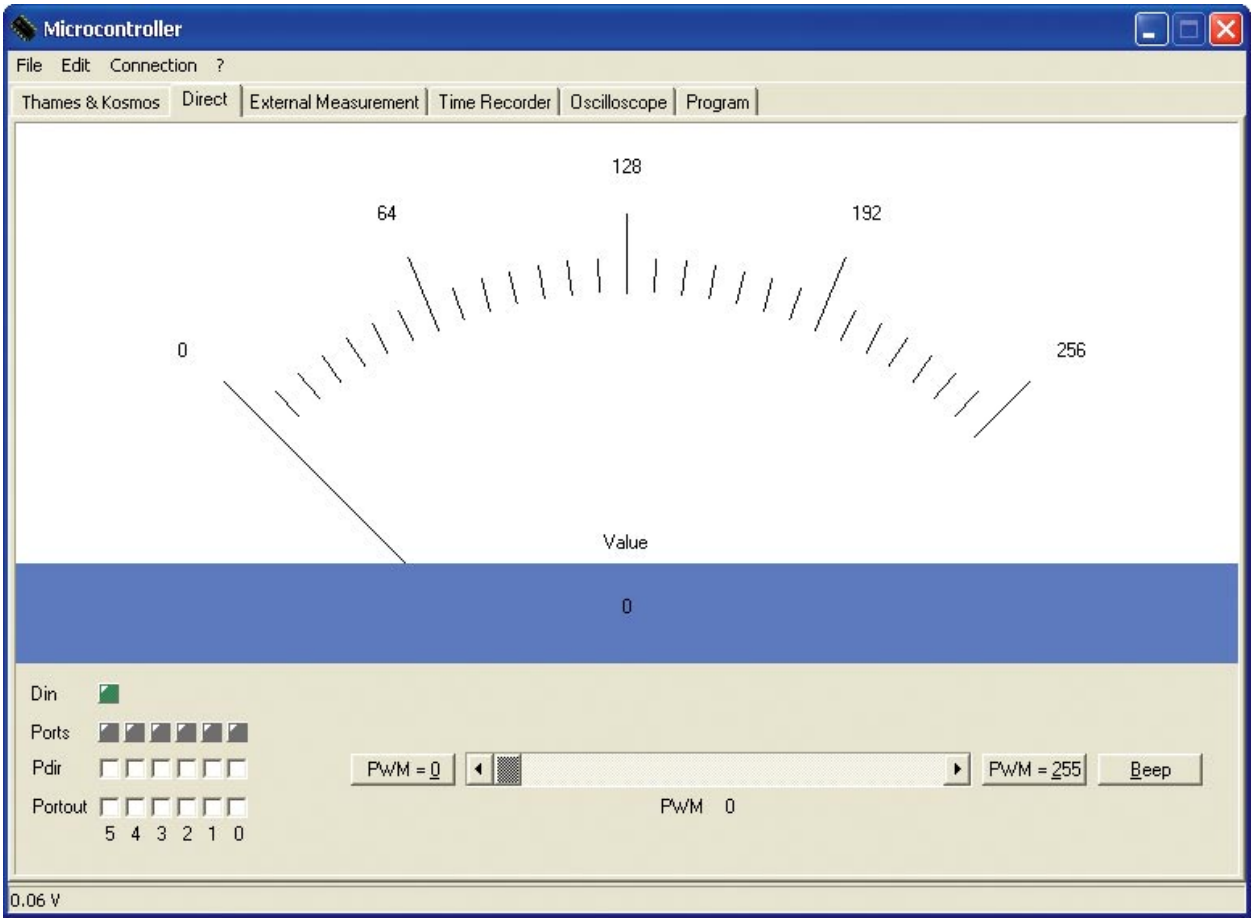
If you are not sure what the connected port is called, you can just try one. Select one of the ports by left clicking with the mouse. If you then open the Connection window again, a check mark will show that this port exists in the computer. Whether this is the port that is really being used is something you can only find out by performing the actual hardware test, which will now be described.

Direct

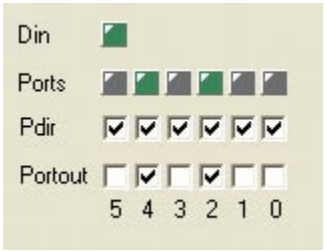
Assemble your microcontroller unit as in Experiment 1 in the experiment manual. Turn on your microcontroller and point the infrared adapter toward the device. Click on the Direct tab. You will see an instrument gauge, several LED displays, and other operating elements. If a connection has been established, the program will indicate a voltage reading and show the state of the port terminals. If there is no connection, the status bar at the lower edge will indicate “Offline.” This may be due to an incorrect connection setting, which you can check by trying out a different COM number.



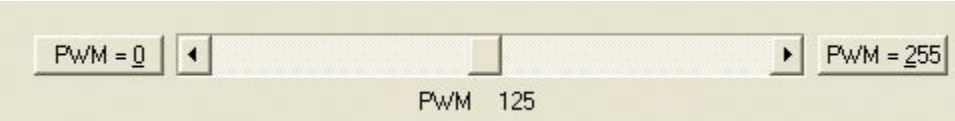
The instrument gauge shows the voltage, in volts, at the Analog-In input. Under the Volt symbol, the digital value of the input current is also displayed as a number in the 0...255 range. In the status bar, you will also see a small digital voltage display. Click on the Volt symbol to switch the instrument to a digital value display. Another click on Value switches you back to a voltage display in volts.



The Din and Ports LEDs display the states of the microcontroller's digital circuits. A gray LED shows the zero state (off), a green LED the one state (on).



Click in the Pdir boxes to switch the ports to the output direction. The Portout boxes can then be used to turn on individual outputs.



The PWM slider bar is initially set to zero. Move the slider by dragging it with the mouse. That changes the brightness of an LED connected to the PWM port of the microcontroller. The PWM=0 and PWM=255 buttons move the slider all the way to the left or right. Instead of the mouse, you can also use the “0” and “2” keys.

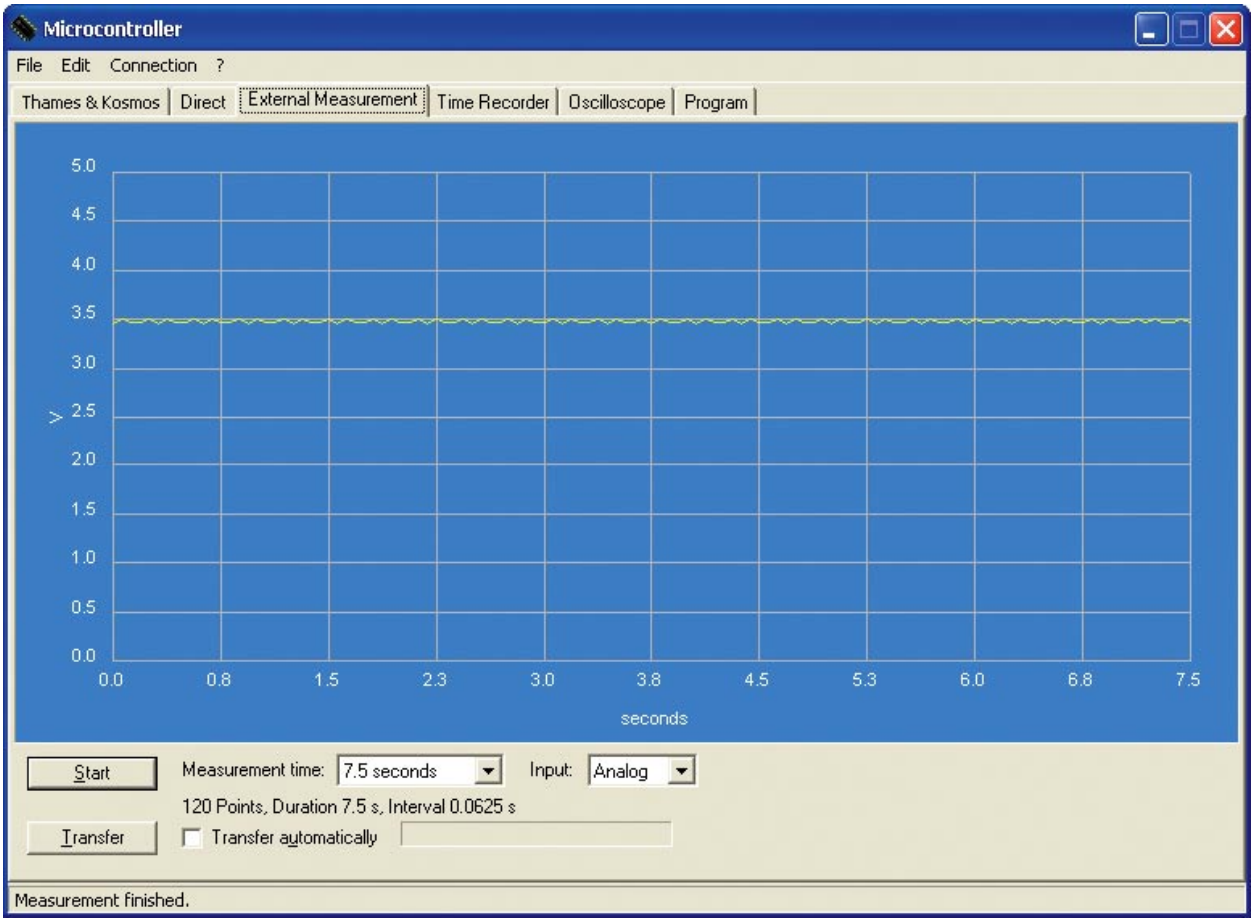
A click on the Beep button produces a beep sound if the piezo transducer (the speaker) is connected to the Beep output. Instead of the mouse, you can also use the “B” key.

Whenever you turn on the Direct mode, a program running in the microcontroller or a measurement started with External Measurement and still running is automatically stopped. On the other hand, a long-term measurement started previously in the Time Recorder can continue to run in the background. So you can switch between Direct and Time Recorder to view measurement data alternately on the instrument gauge and in the graph chart.

External Measurement

Select the External Measurement tab. A graph will appear showing time on the X-axis and voltage on the Y-axis. A measurement is started from the PC, but then it runs by itself, so the microcontroller can perform measurements far away from the PC. 125 individual measurement readings are stored, and only after the end of the measurement period are they transferred to the PC and displayed.

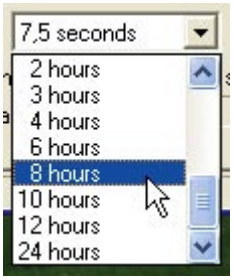
If another program is running on the microcontroller, it is automatically stopped at the beginning of the measurement. If another measurement that was already started in the Time Recorder has not yet ended, a “Time Recorder still active” message appears. In that case, the measurement must first be ended in the Time Recorder. That prevents a measurement from being inadvertently ended.



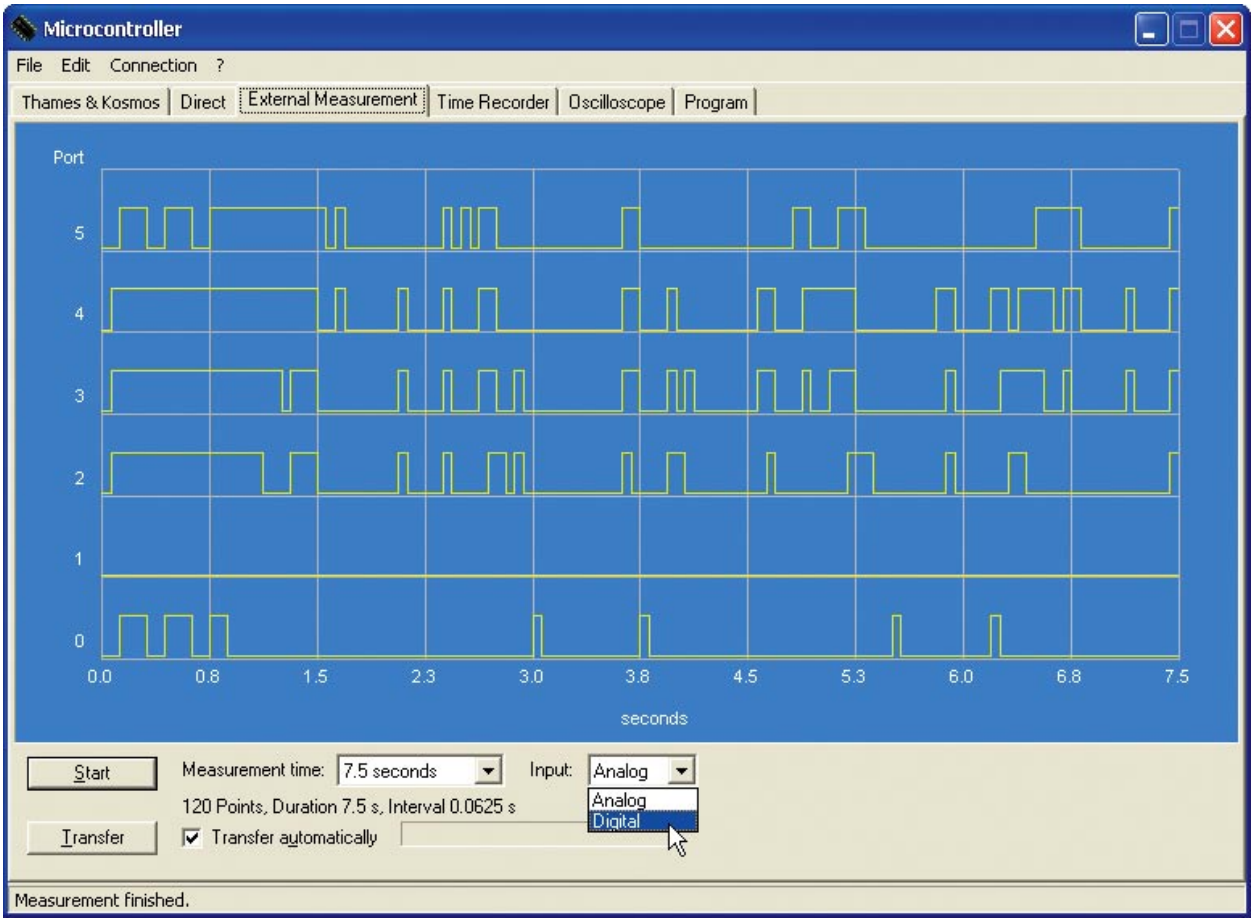
The basic measurement setting is a measurement duration of 7.5 seconds at the analog input. Click on Start or press the “S” key to start the measurement. That transfers the settings to the device and starts the measurement. The status bar displays the time remaining for the measurement. The microcontroller’s ready indicator shows that a measurement is in progress.

At the end of the measurement, click on Transfer or press the “A” key. That transfers the measurement data from the microcontroller’s memory for display on the screen.

The “Transfer automatically” setting transfers the measurement data automatically at the end of measurement. This setting makes sense if the microcontroller is within the range of the infrared interface during measurement or at the end of measurement.



The measurement time selection window permits times up to 24 hours. Click on the desired setting.



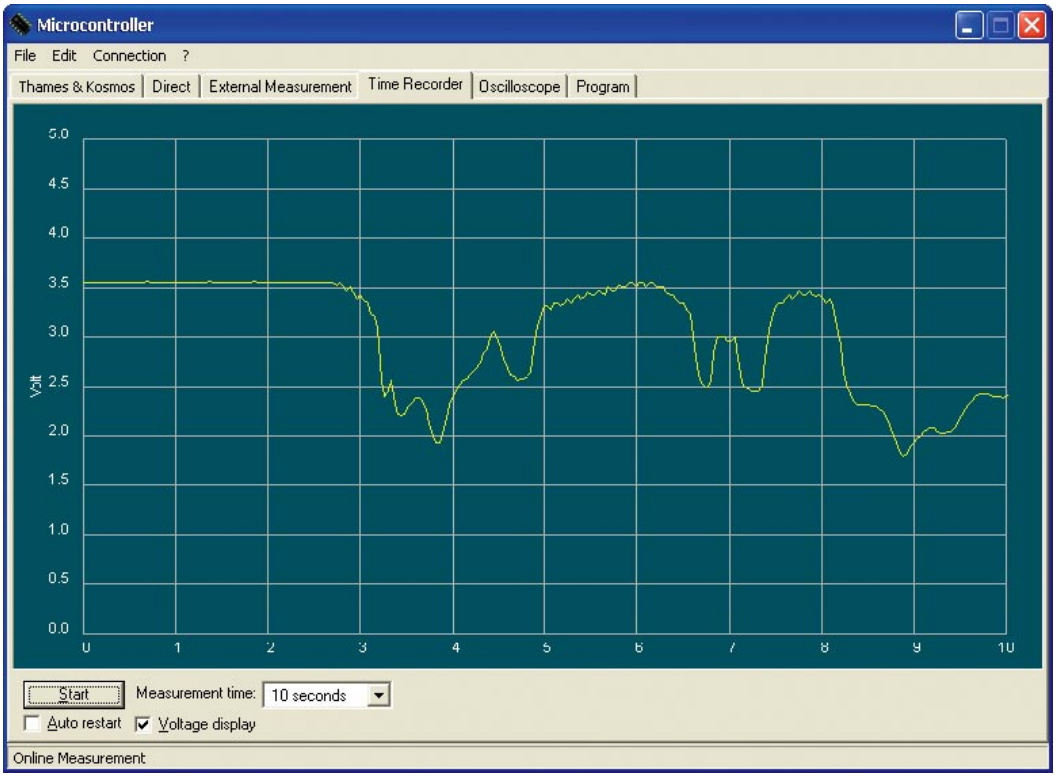
Instead of the analog input, the states of the D0 through D5 ports can also be measured and displayed.

Measurement data can be copied as a list of numbers into the Windows clipboard with Edit/Copy. Then you can paste them into another program with Edit/Paste. In this way, you can document or perform further processing on measurement data using programs such as Word or Excel. The same copy function works for measurement data from the Time Recorder and the Oscilloscope.

Time Recorder

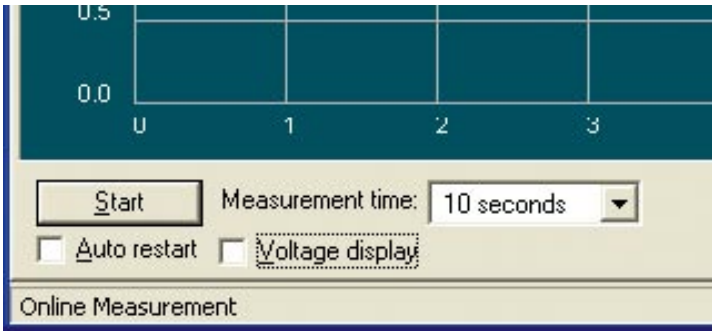
The Time Recorder carries out online measurements, with each measurement value requested individually from the PC. During this time, the microcontroller cannot be moved away from the PC, but you can get larger quantities of data and finer displays than with External Measurement.

A program still running in the microcontroller is stopped at the start of a measurement. The same applies to a measurement already started with External Measurement. But you can access the Time Recorder and view the graph without ending another process, because the microcontroller will only return to its initial state once you press the Start button.



Select the desired measurement duration and click on the Start button or press the “S” key. The measurement chart will be plotted simultaneously with the actual measurement. So you will be able to see any changes in voltage immediately.

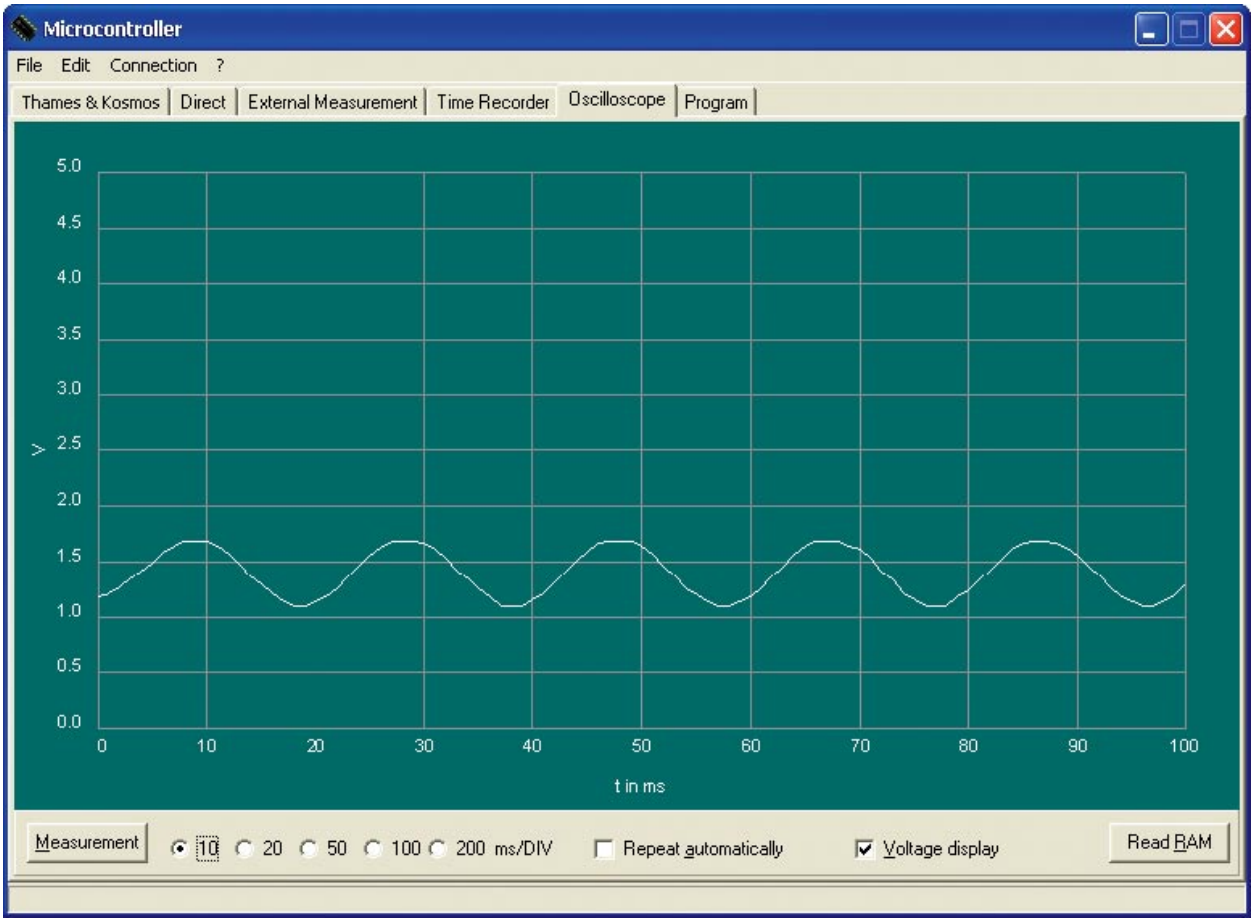
The “Voltage display” setting can be turned off in order to display the corresponding digital data. With “Auto restart,” a new measurement is started after each completed measurement.



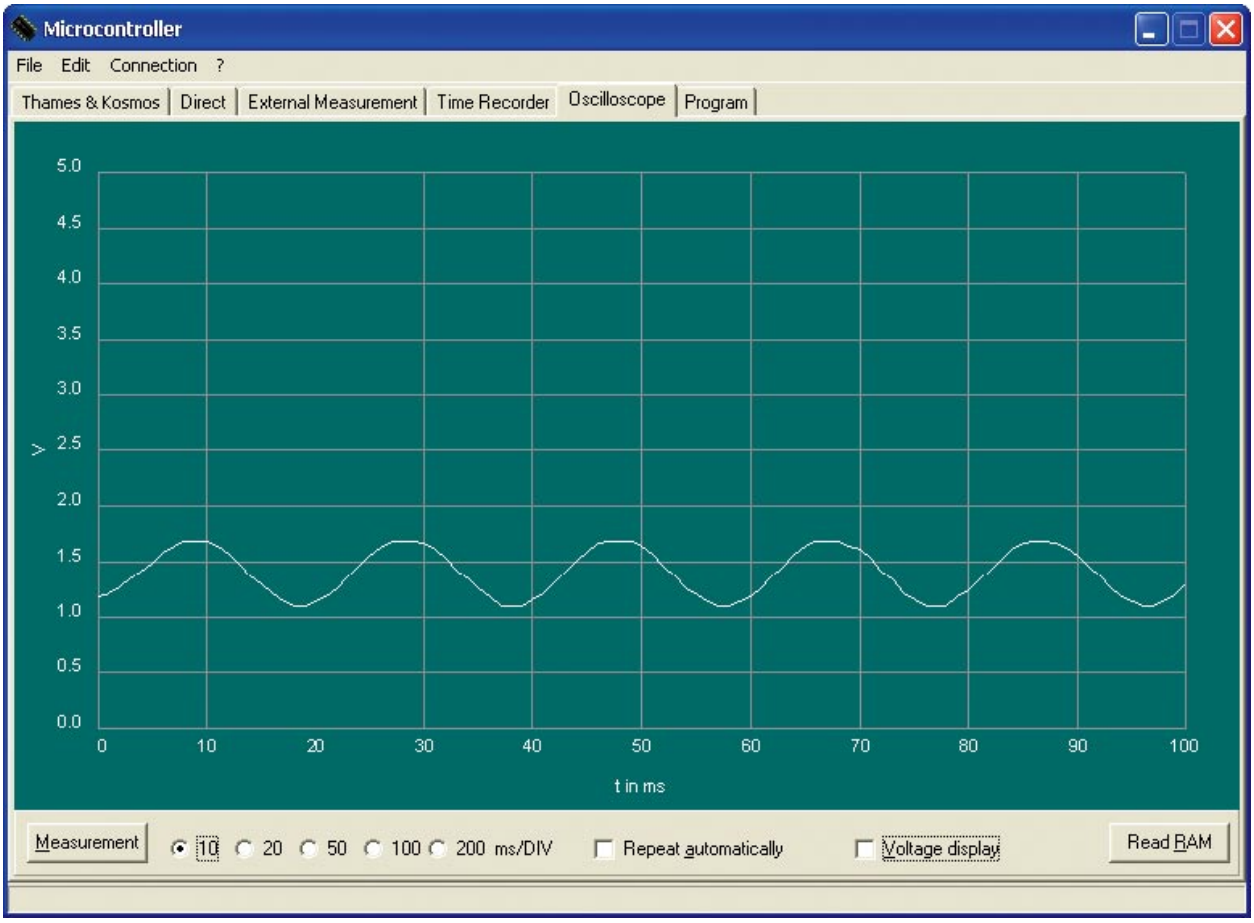
Oscilloscope

The Oscilloscope also records voltage processes, but more quickly. Thus, the time axis is labeled not in seconds or minutes, but in milliseconds, or thousandths of a second.

If another program is running in the microcontroller, it will only be ended once you click on Measurement. The same applies to an ongoing measurement that was started with External Measurement. But you can view an existing measurement graph in Oscilloscope without ending other processes.



Select the time setting in ms/DIV, or milliseconds per scale division. With the 10 ms/DIV setting, the entire measurement lasts 100 milliseconds, or a tenth of a second. Then the measurement data are transferred and displayed in the graph. Measurements can be individually actuated with the Measurement button or with the “M” key. The “Repeat automatically” setting lets you switch to a long-term measurement.



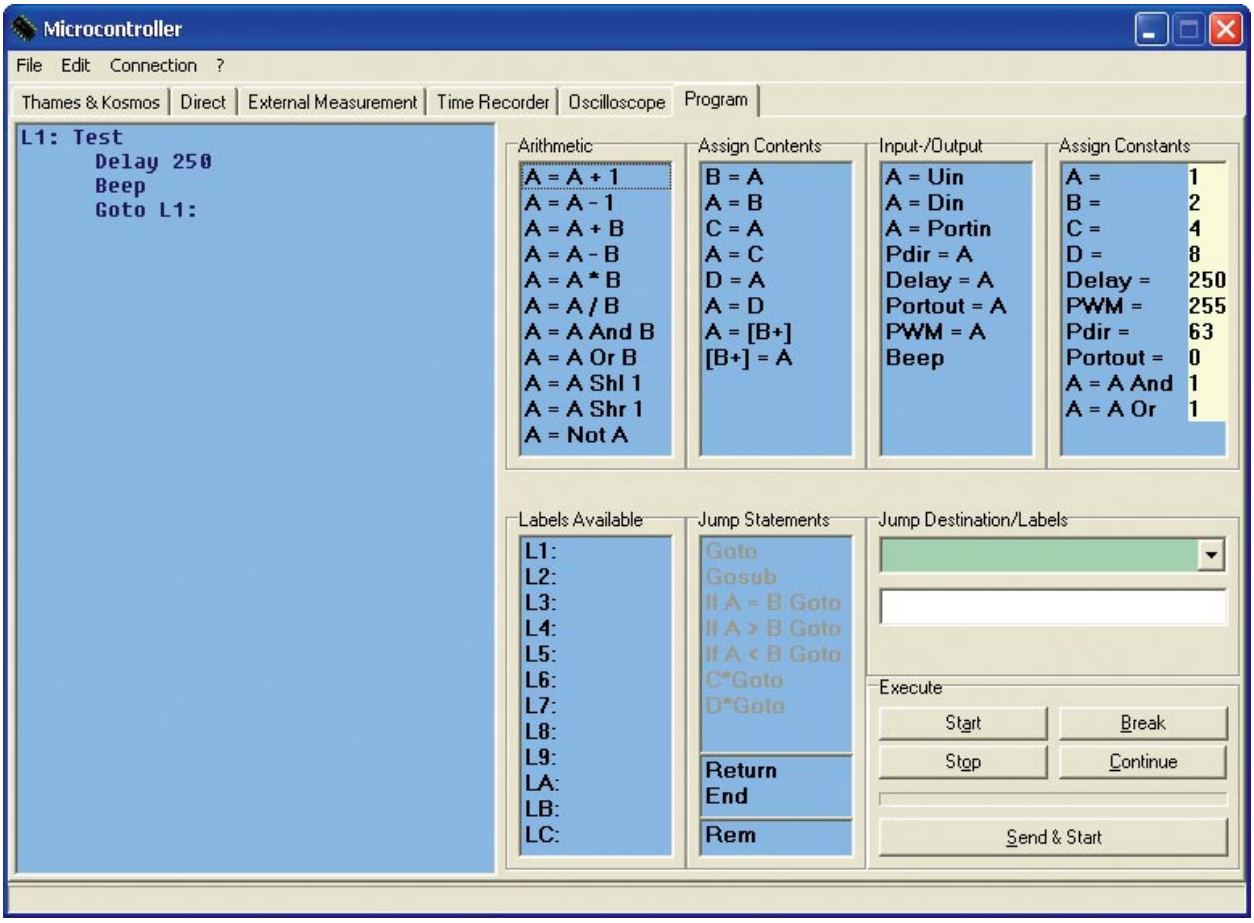
Measurement values may be displayed either in volts or as digital number values.

The Oscilloscope uses the microcontroller's RAM as a temporary storage, which can also be used in your own programs. The Read RAM button or the "R" key lets you read out and display the current RAM contents.

Program

With the Program tab, you can create your own programs or load existing programs from the "Program Files" folder. Programs can be transferred, tested, stopped, temporarily interrupted and continued.

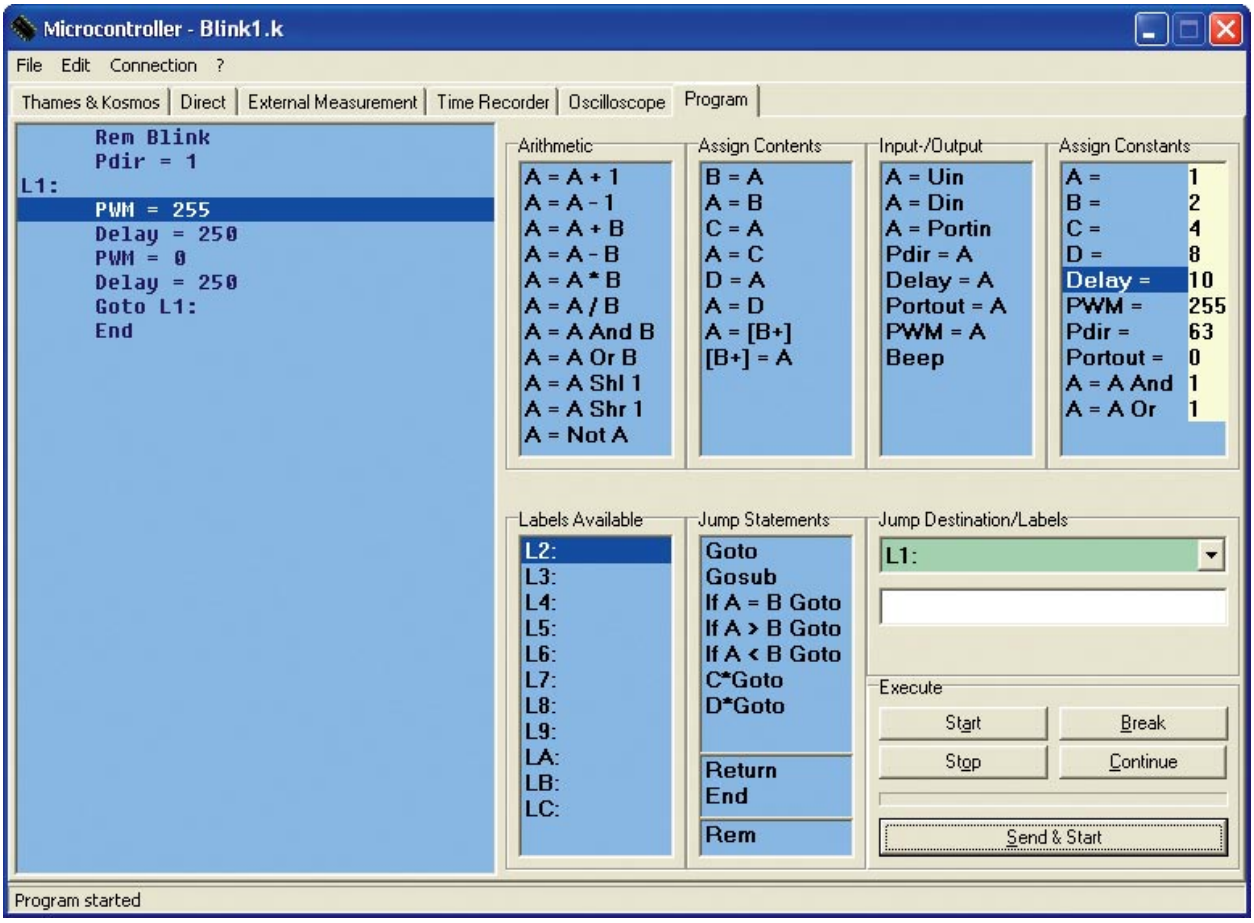
Programs can be edited while another measurement is in progress. Only when a program is transferred and started are other processes interrupted.



First load an existing program from the CD or your hard drive. Select File/Open and then choose a desired program with the ".k" extension. For example, you could load the "Blink.k" program. It will appear on the left in the editor window. Then click on the Send & Start button. That loads the program in the microcontroller, checks it, and starts it. The ready indicator on the microcontroller module now displays an uninterrupted light.

Click on Stop to end the program. The ready indicator will blink again.

A click on Break interrupts a program in progress. Click on Continue and it will resume.



You can save a program in the editor onto the hard drive with File/Save. When you do that, you can give it a new name. If you want to use the old name, you will be asked whether you really want to overwrite the old program. Overwriting can make sense if you want to change a program or enhance it.

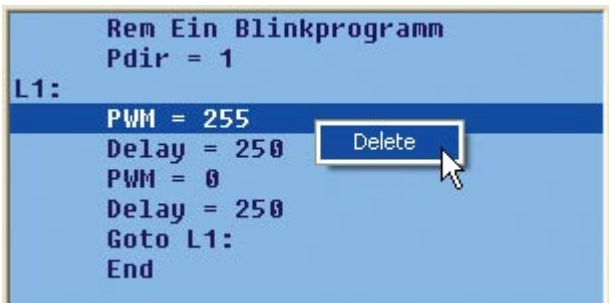
Writing and editing programs

Delete the loaded program with File/New. That will remove the source text from the editor window. Now there will only be a single program line with the End command in the text. Your own commands will be inserted before End.

There are two methods for inserting a command:

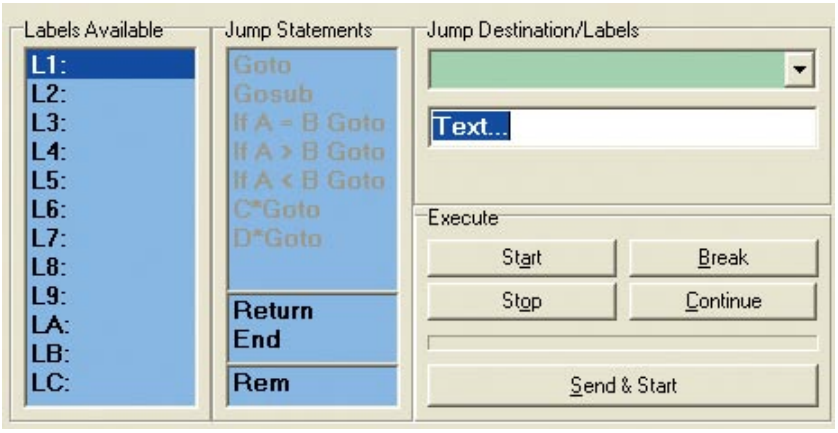
1. Double click on the desired command. It will then be inserted in front of the already-highlighted line.
2. Drag the command to the desired location by holding down the left mouse button.

A line can be erased by right clicking on it.



Commands from the “Assign constants” group have an extra field with a number. Click in this field to re-enter individual digits or the entire number. Note that only numbers between 0 and 255 can be used.

A label from the L1 through LC group can be transferred into the list like a command. But you can also add an additional annotation to it. To do that, click once on the desired label to highlight it. That will activate the text entry window. Type the desired text into the window. Then, you can move the label into the list by double clicking or dragging.



The Goto Jump Statements group is only activated when at least one label has been transferred into the program. At the same time, a list of Jump Destinations appears. Select a destination, which is then, for example, inserted behind Goto.

An annotation is designated by Rem. Click once on Rem, which will activate the text entry window. Then type in the desired annotation.

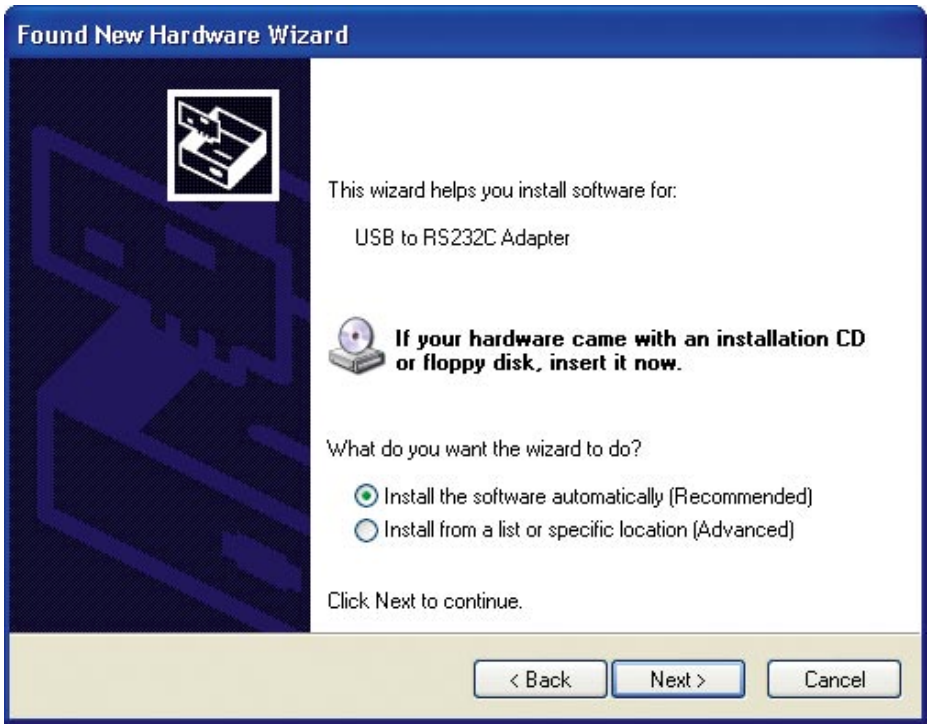
Entire program texts can be moved to the clipboard with Edit/Copy. Then, in a word-processing program, you can use Edit/Insert to transfer them into a piece of text.

Installing the USB adapter

If your PC does not have a serial port and it has Windows 2000, Windows XP, or a newer operating system, you must insert the USB adapter between the USB port and the infrared adapter.

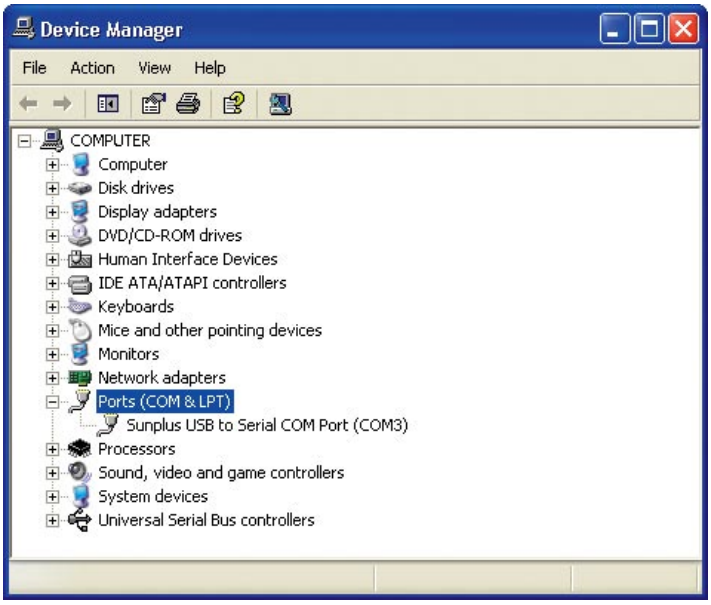
Connect the USB adapter to a free USB port on your computer. The first time the adapter is connected, the "Found New Hardware Wizard" will appear. You will then be asked whether you want to look for information on the Internet. Select "No, not this time." Then click "Next."

Then select the “Install software automatically” setting and insert the CD so that Windows can find the driver files. Then click again on “Next.”

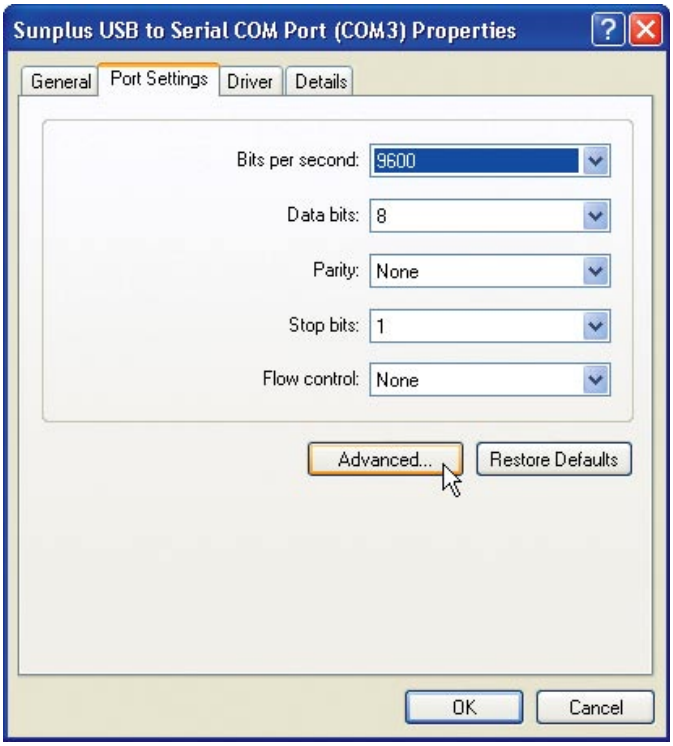


The hardware wizard will then find the driver files for the “Sunplus USB to Serial COM Port” device on your CD. Then click “Finish.” Windows will install the driver.

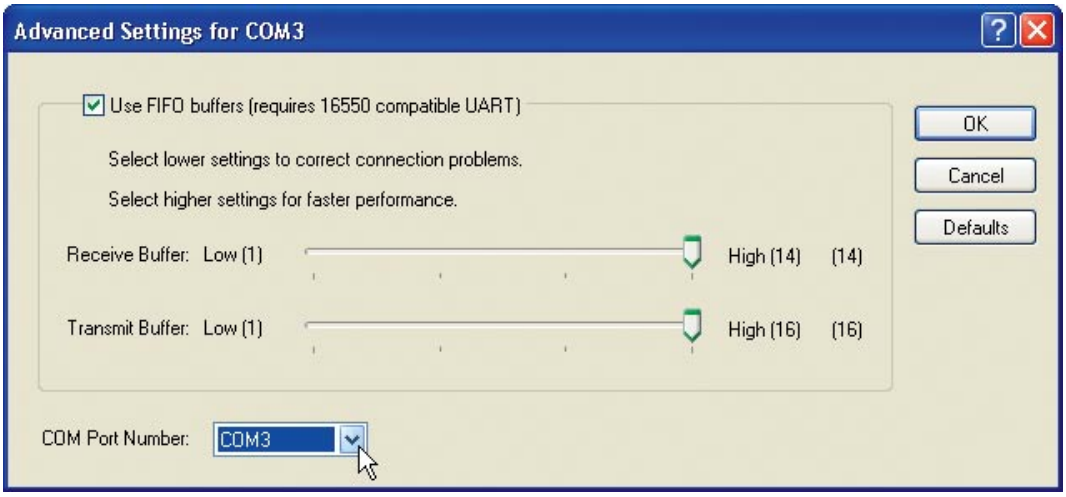
Now the driver is installed. In the Device Manager, it can be found under “Connections.” Here, for example, the “Sunplus USB to Serial COM Port” is entered as COM3. You can access the Device Manager by going to the Start menu, selecting Control Panels, opening the System control panel, clicking on the Hardware tab, and clicking the Device Manager button.



Only if the COM number is higher than 6 will it have to be changed. This can happen if other USB adapters are already being used on the PC. If it is necessary to change the COM number, double click on the port. Now the properties of the device will be displayed.



Select the “Connection settings” tab, and then “Advanced....” Then you can assign the device a new COM number such as COM3.



Now your USB adapter is ready. Connect the infrared adapter and select the COM3 port in the Connection menu in the Microcontroller software.