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## **Measuring, Controlling and Regulating with labworldsoft**

### **Rapid and easy networking of lab devices from different manufacturers**

The user now has a suitable software package for operating, controlling and/or regulating devices of different manufacturers together.

Devices used in laboratories usually come from different manufacturers. If the user wishes to link these devices together, Interface problems frequently arise that can only be solved by EDP experts, if they can be solved at all. This problem has been recognized and a software package has been developed that allows users to operate devices together and finally concentrate on their actual scientific and operations tasks instead.

The software has been designed so that as little time as possible is required for interface configuration. The aim is for the solution to a specific operational or scientific task to occupy the foreground instead.

In addition, it is possible to use a great number of whatever interface devices may be present in the laboratory in this new software system, which currently includes representatives of 27 leading laboratory manufacturers with their ranges of controllable devices. Devices with voltage or current output (analog signals) can also transfer their measured values to the software system with the aid of the Datacontrol DC 2 A/D converter (analog/digital). In addition it is also possible to connect up to 4 devices with an A/D converter.

With the aid of a multi-serial card, as many as eight serial interface devices can be operated simultaneously.

## Hardware and software requirements

The hardware and software requirements are easy to fulfill based on current PC standards. labworldsoft Version 2.6 requires no more than a 486 PC running at 33 MHz or faster with 8 MB of RAM as well as a mouse. In addition, the system must have a VGA monochrome display with 16 grayscale or greater or a color display.

The program can be run under Windows 3.1x, Windows 95 and Windows 98.

## The measurement process plan

The individual devices and the desired functions are arranged on the screen in the form of function blocks (modules), and are linked with each other by arrows (Fig. 1). This results in a new configuration or measurement process plan.

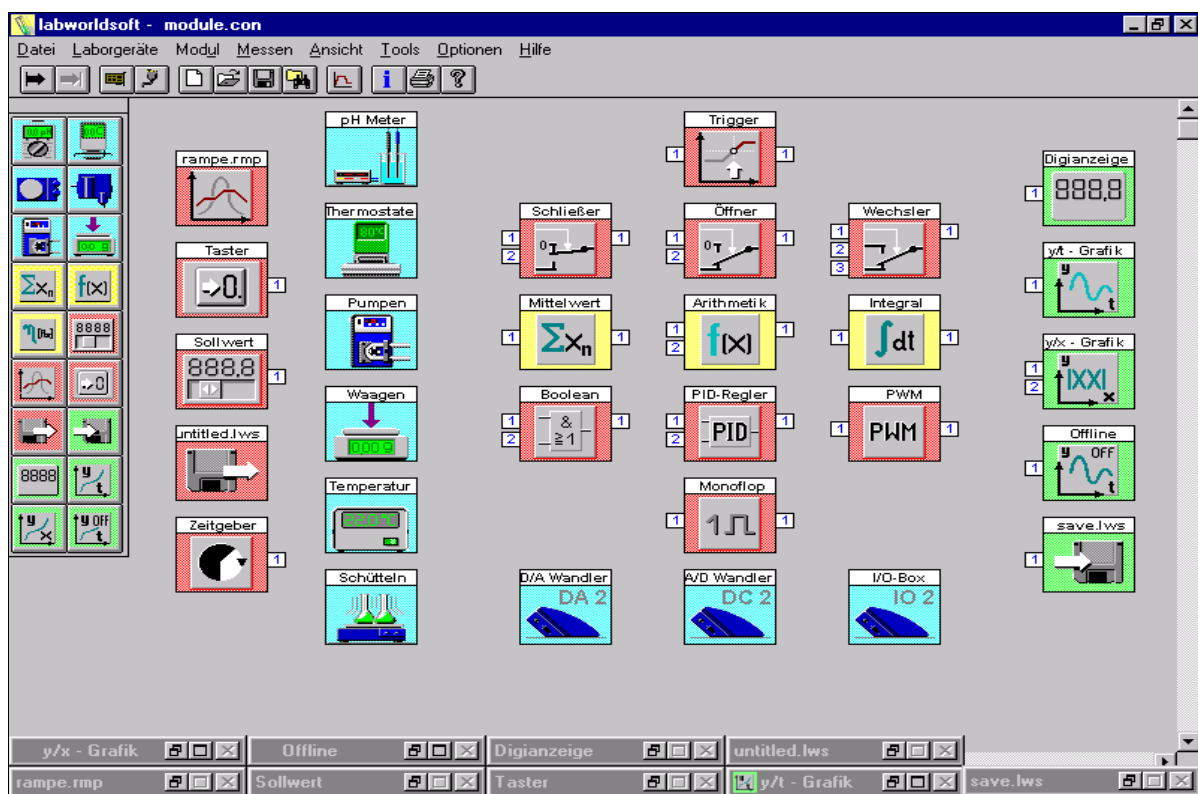


Figure 1: Selection of a few possible modules to create a measurement process plan.

All available function blocks are represented by icons and are shown in different colors depending on the category to which they belong. Blue modules represent laboratory devices that are physically present (hardware). Yellow modules are used for arithmetic operations and to derive average values. Red modules are used for manual and automatic control (ramps) of devices. The modules required for control and regulation tasks also belong to this group. Green modules are used for numeric or graphic display of measured values and to store these values in either .lws format (labworldsoft-format) or .txt format (ASCII code). This makes it possible to further process the data with other programs as well. It is also possible to use a documentation window. The information entered there is then saved and available in Word format (.doc).

Each module is equipped with a “Help” button in addition to other features. This makes the corresponding online Help quickly available at any time.

## Control and regulation

To give an idea of the possibilities of control and regulation blocks, five practical examples in the following section will give you an overview of some possible applications of the software.

### Metering with a pump as a function of the pH level.

The pH level of a solution must only fall within a certain range. The desired limit values are specified in the trigger module. If these values are exceeded, a relay receives a signal in response to which a pump is activated. It pumps in a second solution until the pH level again lies within the desired range between the limit values (Figure 2). It is particularly interesting here that the trigger and relay are not physically present. Instead they are used virtually to a certain extent.

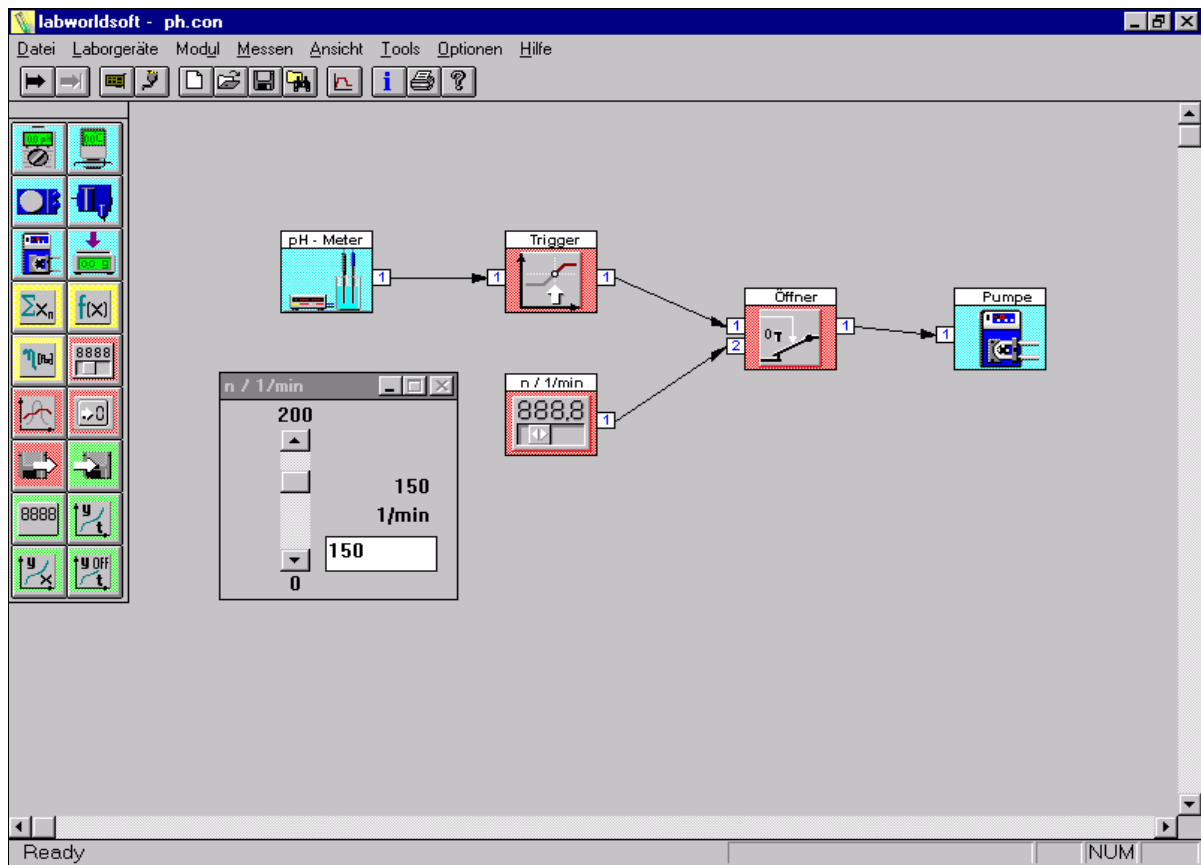


Figure 2: Configuration for controlling a pump as a function of the pH level.

### Regulating a heater bulb

labworldsoft can be used to turn on or off any device without an RS-232 interface and analog output, for example a heater bulb or a solenoid valve, based on a threshold value being exceeded.

A temperature sensor is placed in the medium to be heated and returns a signal through the software to the actual value input of the PID function block. The target value is sent to the target value input of the PID function block with a virtual slide controller. The PID controller signal is converted into the corresponding switch-on and switch-off times by means of a virtual pulse width modulator.

The user can adjust the proportional, integral and differential section of the controller manually, thus adapting the control system specially to each application. Between the power plug of the heater bulb and the Datacontrol I/O 2 is an output switch which separates or connects the power supply from the heater bulb depending on the switch-on and switch-off times of the PID function block (Figure 3).

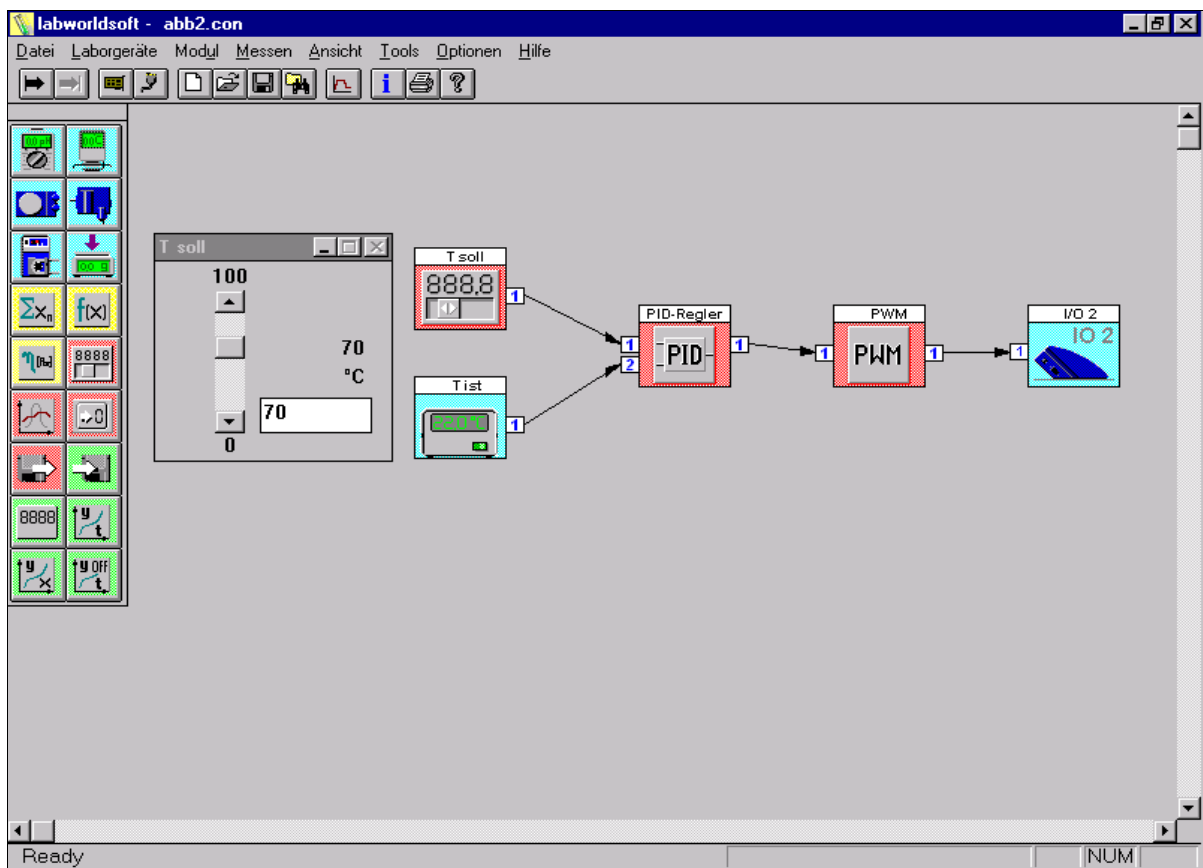


Figure 3: Configuration for regulating a heater bulb via PID, PWM and Datacontrol I/O 2.

**Controlling the speed of a stirrer as a function of the measured torque.**

In this example the torque is set by a target value transmitter and the speed of the stirrer is regulated accordingly by the PID function block. The torque thus remains constant even if the viscosity of the medium changes (Figure 4).

For reasons of safety it is also possible to limit the maximum permissible speed with the actuating variable.

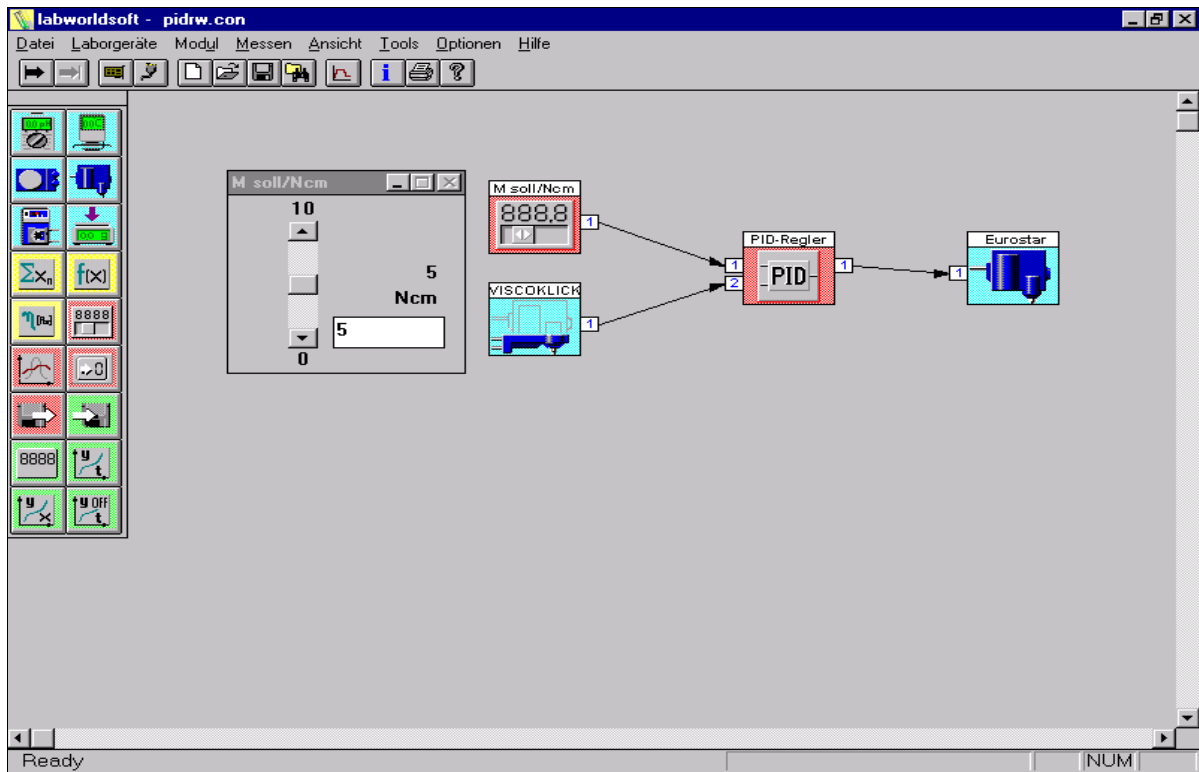


Figure 4: Configuration for controlling speed as a function of torque.

**End a stirring process after a constant torque for a certain period of time**

Using the “Derivative” function block, the software determines whether a constant torque is present. A sliding average is then taken for fifty values and passed on by a trigger. If the results fall within the required threshold range and (Boolean operation!) if they fall within the trigger range for the time specified by the timer module, the relay module is switched to 0. The stirring process is ended (Figure 5).

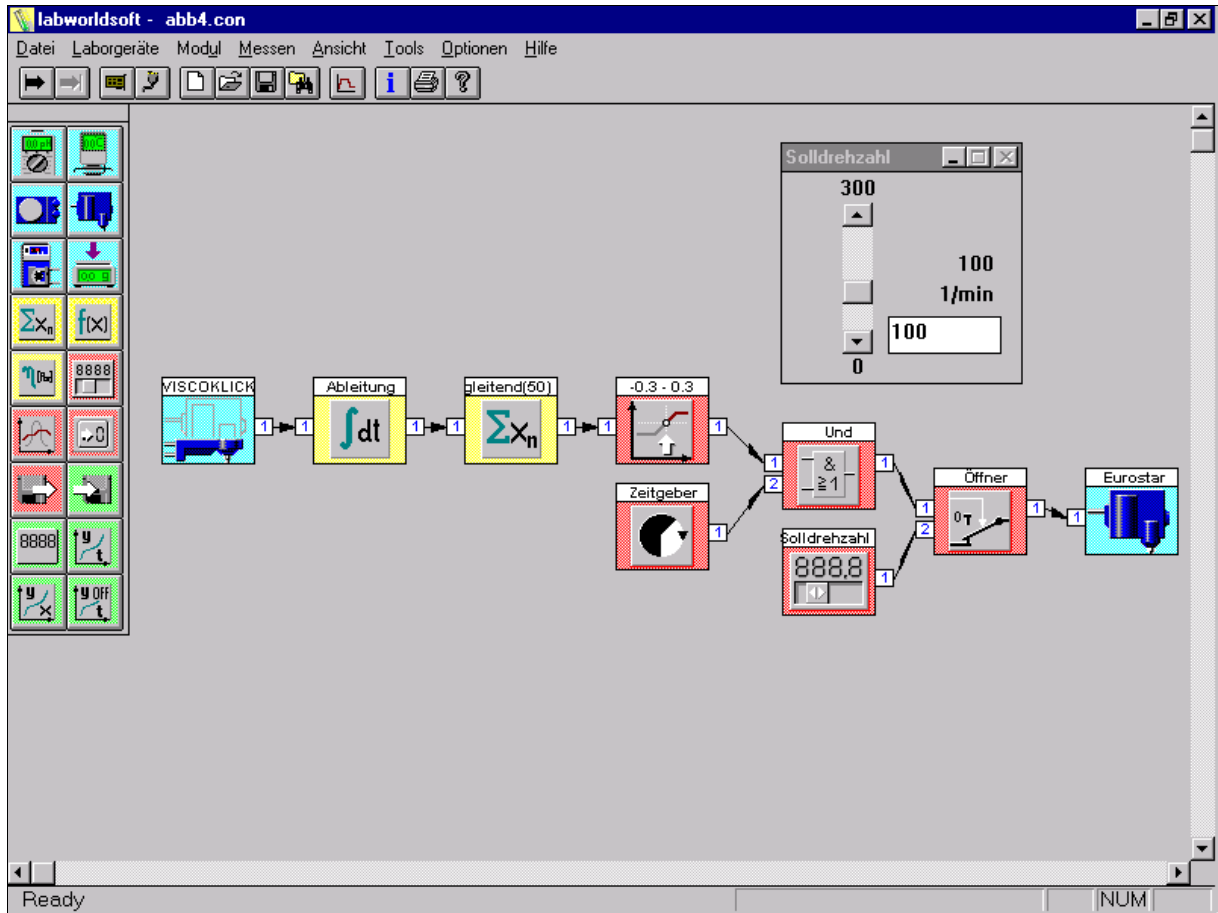


Figure 5: Configuration for detecting a constant torque.

### Mini-plant

Because of its versatility, the software also offers the possibility of operating a mini-plant, for example. Figure 6 shows a sample configuration for a laboratory reactor with peripheral devices. The speed of the stirrer, the target temperature of a thermostat and a metering pump are controlled here.

In addition to other processes, the torque and temperature of the medium are recorded and are represented in a y/t graph (Figure 7). It is also possible to extend this system with additional external sensors or valves by using Datacontrol I/O 2.

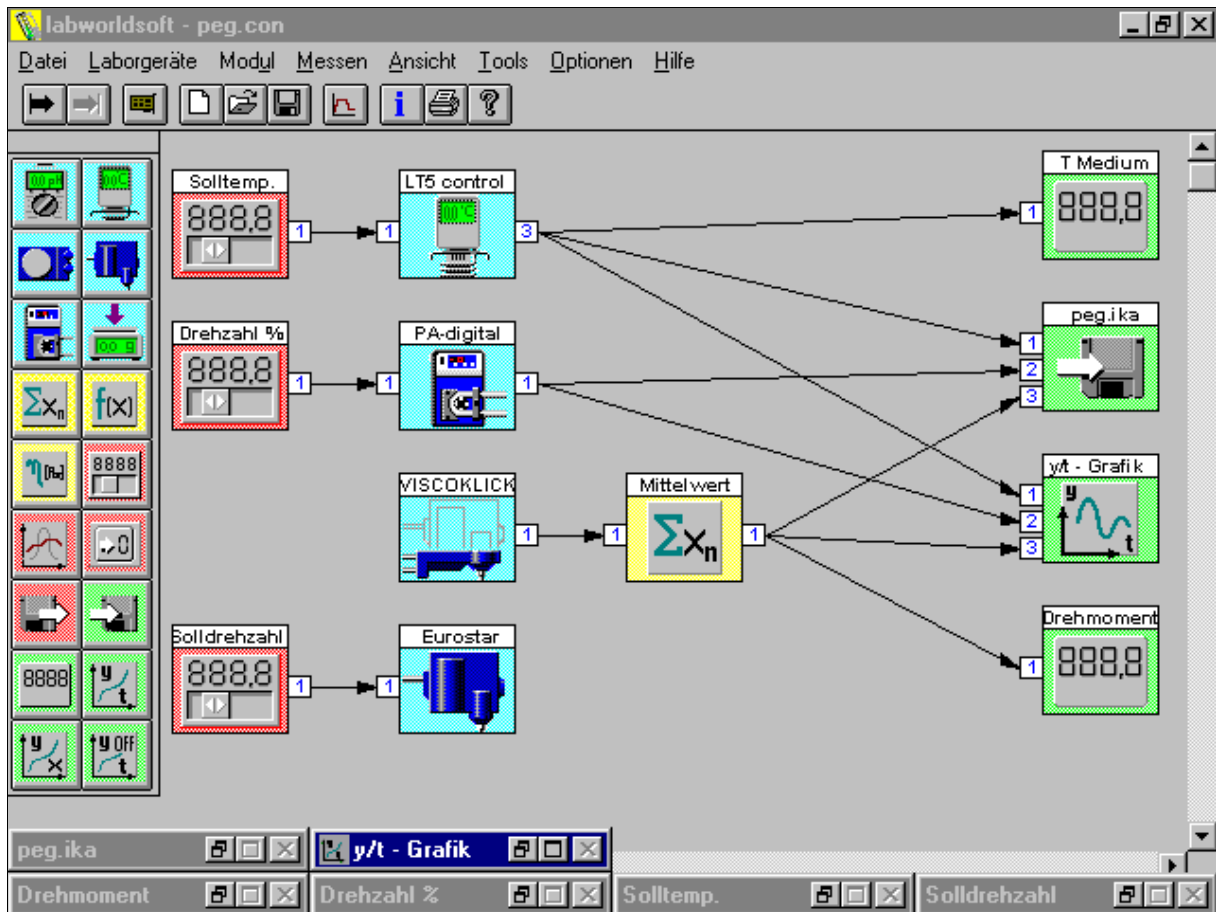


Figure 6: Configuration of a laboratory reactor with peripheral devices.

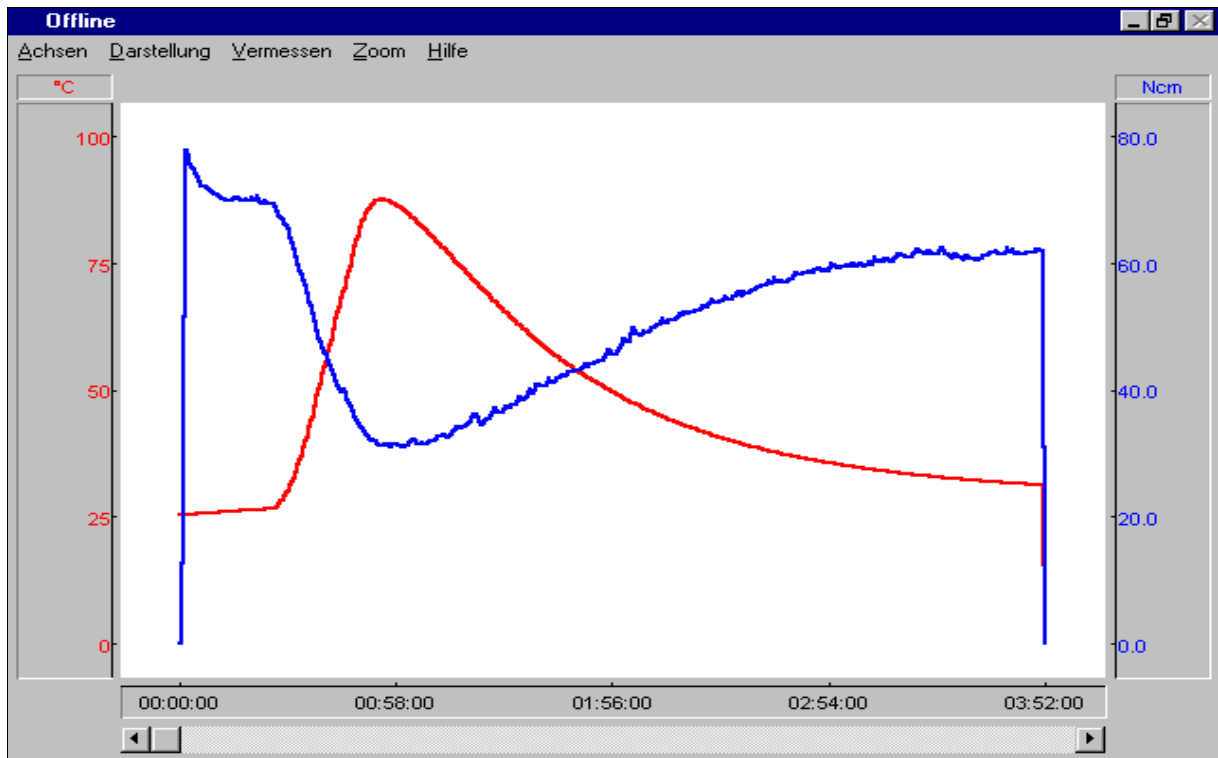


Figure 7: y/t graph: change in torque (change in viscosity) of the medium with the temperature.

### Simulation of process plans

Another possibility of labworldsoft is testing or verifying programmed configurations via simulations. In this process the function blocks of the devices are replaced by target value transmitters or ramps and digital displays. This makes it possible to implement control and regulation tasks that were previously not easy to solve and does it without triggers, relays, controllers, etc. being physically present in the laboratory.

### Trial version of labworldsoft

You can download a trial version of labworldsoft over the Internet at no cost (<http://www.labworld-online.com>, in the labworldsoft building). This version is fully functional for a period of 30 days. In addition, the manual is available here in .pdf-format (Acrobat Reader).

### A quick look ahead

Integrating additional laboratory manufacturers has made labworldsoft more and more versatile. Taking special needs of the customer into consideration gives the software an even more user-friendly shape. It will also be possible to run the next version under Windows NT.