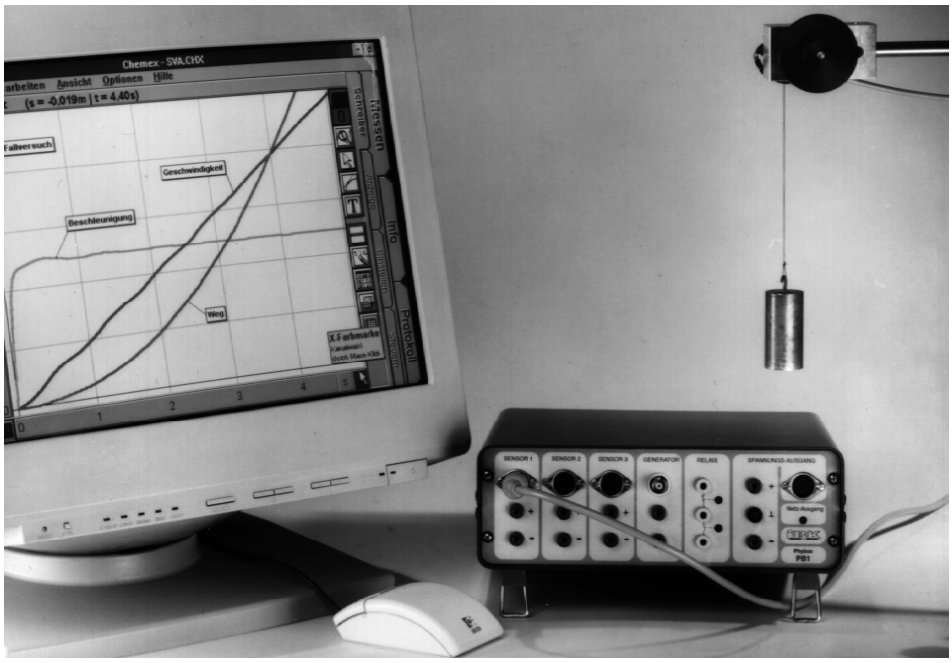
Phybox/Phymex

PC- Measuring and Experimental System

PC utilization as a universal Measuring and Experimental facility
Progress and enhancement in technical/ scientific studies

Methodology and content in education are subject to continuous change. This comes along with changes in education facilities. That challenge requires flexibility by educators as well as the manufacturers' understanding of continuous innovation in the market for educational equipment. The all purpose measuring and experimental system Phybox/ Phymex illustrates such innovation. Phybox/ Phymex is a state-of-the-art, computer controlled measuring system consisting of the universal interface Phybox and the software Phymex. In development, emphasis was put on clarity and user friendly operation including installation. An integrated on-line reference tool gives guidance throughout the software, and together with WYSIWYC (What You See Is What You Change) support, provides immediate and secure operation of the system even by computer newcomers.

- Ingenious microprocessor controlled interface (Phybox)
- WYSIWYC - "What You See Is What You Change",
  user-friendly processing software Phymex with Windows features
- Operation on a serial port giving easy installation
- Standard outlet to drive external current and voltage sources
- Integrated word processor for documentation
- Mathematical processing of measured values
- Universal measuring instrument (DMM, Functiongenerator, Oscilloscope, Universalcounter,.....) with analog and/ or digital full display
- 8 channel x/y or y/t recorder



Innovative teaching method: Smartly linked hardware and software are important to today's scientific education needs. Far reaching market requirements can be met through the utilization of modern computer controlled instruments, supporting teachers in creating a high-tech educational environment.

Phybox/Phyx

What do students expect from scientific lessons?

The illustration of scientific relationships in updated, clear, easy to understand and mainly experimental form.

What is the teacher's desire?

Interested, participating students and modern teaching equipment conveniently supporting him/her in the creation of consistently exciting and effective lessons.

What is our contribution?

PC measuring interface Phybox, processing software Phymex, sensors and experimental instruction documentation. This is a modern and convenient teaching and experimental system for physics — motivating students and simplifying the teachers job.

The right tools for scientific education up-todate.

With a PC in the classroom and the multi-media capable operating system WINDOWS you are entering into a new period of scientific education. By means of the PC controlled measuring system Phybox/ Phymex, both slow and quick processes can automatically be recorded. The experimental process may be observed step-by-step on the screen and discussed with the students at the same time. Whether used as analog or digital demonstration voltmeter with full-display, amperemeter, thermometer or multiple channel recorder etc., various measuring and control features open opportunities for the operation of the measuring system in virtually all feasible experiments, even in high current and high voltmeter applications.

Measuring spectrum

Voltmeter (DC & AC TRMS)
Amperemeter (DC & AC TRMS)
Ohmmeter (DC & AC)
Conductometer (DC & AC)
Wattmeter (DC & AC)
Functiongenerator
Power Supply
Control amplifier
Frequency counter
Event counter

Timer:
- Start-Stop
- Start-5*Stop
- Chain time
- Period time
- Pulse period
- On/Off time

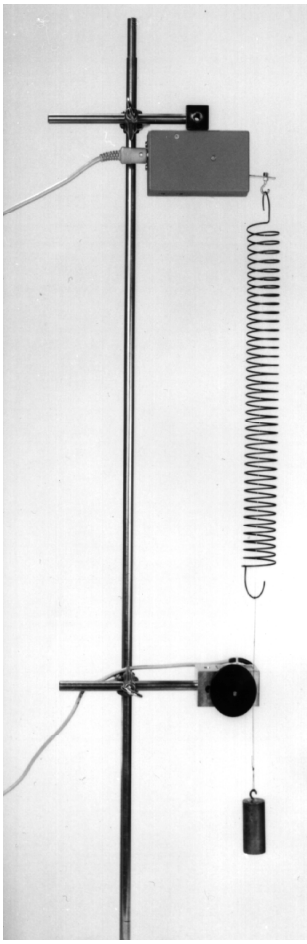
Oscilloscope
X/Y-recorder
Y/t-recorder

Two-position controller
Dynamometer
Pressuremeter
Magnetic field gauge
pH-Meter
Redox gauge
Luxmeter
Thermometer
s,v,a gauge
Geiger counter

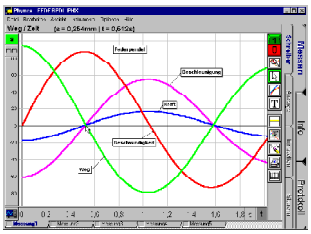
Sensors are essential instruments in any kind of measurement application. IBK offers a wide range of sensor technologies, developed for practical operation and durability, and fitted to your specific needs.

Experiments

The following lis only a partial listing of the system's numerous application areas!



Spring Pendulum demonstration
used sensors:
Position sensor DDG7
(s-v-a measurement)
Force sensor DKS
(measurement of spring-resiliency)



Electro-Physics

- Voltage divider	
- Characteristics	of diodes, resistors, NTC's, PTC's etc.
- Family of characteristics	of transistors
- Characteristics with hystersis	of NTC, PTC, incandescent bulb
- Switching characteristics of a choke	
- Switching characteristics of a capacitor	
- Capacitor charging/discharging	
- Lead-accid cell charging/discharging	
- Apparent resistance	of capacitor and choke over the frequency
- Amplitude characteristic	of a RC, CR, RL, LR, LC combination
- Power, Apparent power	of RC consumer
- Rotary current	

Magnetism

- B/I hystersis characteristic	of different cores, at variable frequency
- Eddy current	in dependence of the frequency
- transformer	
- induction	of a magnet that crossed a coil
- Laws of distance	

Mechanics

- Force - Extension - Curve	of different wires
- Impact tests s,v,a	
- Inclined position s,v,a	
- Coupled pendants	
- Bounce time of a contact	
- Spring pendants s,v,a,F	

Kinematics

- p/V law
- p/T law

Thermodynamics

- Heating curves	temperatur-time-curve at heat exchange
- Change of condition	illustrated with e.g. paraffin

Optics

- Illumination level	
- Illumination level / power	of a incandescent bulb
- Laws of distance	

Radioactivity

- Activity and shielding	of different samples
- Law of distance	

Akustics

- Oscillation	interference of two tuning forks
- Oscillation build up of a tuning fork	at a strike with different materials

Phybox - The Universal PC-Measuring Interface

Sensor 1 / Sensor 2 / Sensor 3

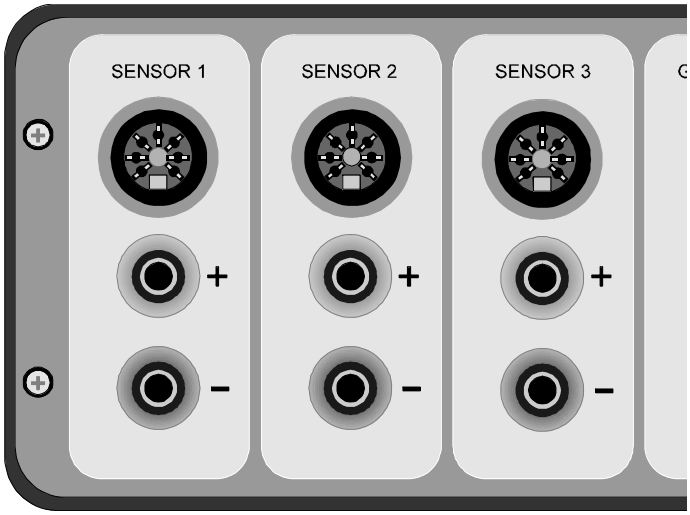
Phybox has combined analog and digital sensor inputs. Thus digital sensors (like photoelectric barrier or position sensors) and analog sensors (like force sensors and pressure sensors) can be connected alternatively at the same input. In addition, there is another way to do analog measurement with digital analysis, which is given in the following example. In recording oscillation characteristics of a tuning fork, interest is focused on the temporal voltage variation and oscillation frequency. That task can easily be accomplished by Phybox. Simply connect a microphone to a port for sensor input to record analog voltage. A sensor inlet specified counter determines the signal's frequency.
In classical analog applications Phybox can also be used as a convenient oscilloscope. Differential inlets enable voltage measurements without regard to direct mass. Autoranging replaces awkward manual measuring range selection. Independence of the measuring range displayed on-screen leaves the right choice under your control.
Real measurements of effective values and dynamic oversampling for measurement of signals even with a high noise level may be carried out through three given universal sensor inlets as well as start/ stop measurement, on/off times, event counting with/ without gate signal, length of period measurements, etc.. You may connect up to six air track light barriers to these sensor inputs.

Generator

The generator output of Phybox is a switchable analog voltage output combined with current and voltage measurement. This combination is more versatile and reduces experimental installations. Conventional measurement of current/ voltage characteristics is reduced to the components connection, as both measurements are carried out inside the facility. To measure the off-time characteristic of inductivity, simply connect the inductivity to the generator's output and set the generator to a suitable direct voltage, which is turned off after a short time. Recording of the current and voltage is done by Phybox.
Additional features of the generator:
Output of sine, rectangle or triangle-signals in combination with current and voltage measurement, as well as output deactivation following a pre-given number of periods.
Measurement of (apparent) impedance above the frequency, on/off-oscillation characteristic of LC-oscillation circles, etc. The generator's output measurement source can further be used for current or high-Ohm mass related voltage measurement.

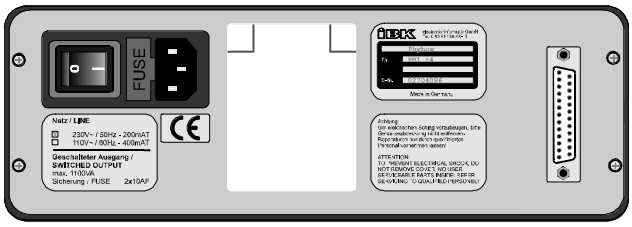
Relay

Maximal load of the switching relay on the front panel is 5A. 2 LED's signalize the contacts prevailing setting. Built in varistors avoid arcs at the contact when switching inductive currents, limiting active voltage to 42V.
The circuit's-criteria is determined by the software, adjusting on/off values as well as any input value settings.
Examples for applications:
- two-point control, e.g. lead accumulator charge - discharge
- critical value alarm by e.g. buzzer
- experiment control, e.g. excitation of a holding magnet



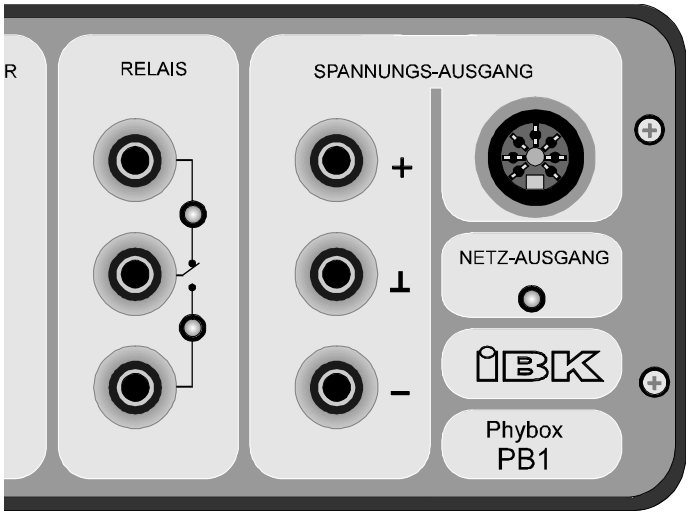
Rear Panel

Located on the rear of Phybox a plug-in socket gives the power supply. The power supply is combined with the facilities fuse and on/off switch. In addition a Schuko socket with protection lid and fuse for the mains relay/ mains output, as well as a 25 pin Sub-D plug for the R232-serial port is available. It ships with power cord and serial port cable including a 9/25-pin-adapter.



Voltage Output

A programmable symetric voltage output, limited to 0V to + 15V at a maximal load of 300mA, provides a voltage resource for general needs in laboratories. An integrated protective circuit guarantees steadfastness against short-circuits and current back-flow.
External sources for current and voltage, including high current and high voltage power-supply units, made by well-known manufacturers, can be remote controlled by a built-in standard serial port (90V ... + 10V). As an option, increase the output's dynamic by equipping it with additional converter and programmable output filter. With up to 1MHz output phase at improved stability and bipolarized output control, even external output amplifiers may be operated.



Mains Relay/ Mains Output

The mains output can be turned on/off through the software. For that reason the built-in Schuko socket is set at 6.3AT. With the mains voltage at 230V an output of up to 1100VA can be sourced.
The mains output allows control of mains voltage users by software, e.g. heater plates for temperature control, stiring devices ,etc..
The circuits setting is displayed on the front plate by LED.

RS232 Schnittstelle

Phybox and PC communicate over the serial interface RS232. Hardware and software are in coordination with each other and work on each operatable serial PC interface. Speed of communication is optimized automatically.
Advantages for the user:
- connect to any serial interface
- start Phymex
- get started, ... with maximal-speed

Technical Data

Input: Sensor (3x)

Measuring range	8 measuring ranges from 0 to 0.25/0.5/1/2/4/8/16 and 32V
Measuring range switching	Automatically (autoranging)
Resolution	10 bit (optional 12bit)
Scanning rate	0...100kHz (one channel) (optional 0...1MHz)
Time measurement	Measurement of signal frequency, Impulse counting absolute, Impulse length measurement, Start-Stop-Measurement, Rotation transmission analysis (s,v,a)
Calibration	Zero point and amplification - through PC-autocalibration
Differential Measurement	
- Common-mode voltage	0 ... ± 50V
- Common-mode rejection	70dB DC ... 10kHz
- Input resistance	300kW
Input Sensors	7-pole DIN socket (Analog in, GND; ±15V; Clock-Signal; Digital in-/out - bidirectional TTL); 2 banana-jacks, parallel to 7pol. DIN analog input

Output: Generator

Voltage Range	-10V ... 10V
Outlet	±200mA current source/load, high-Ohm
Resolution	12 bit
Signal Forms	DC, sine, triangle, square, sawtooth, arbitrary (option)
Signal Frequency	0 ... 50kHz
Signal Filter	0 ... 50kHz tunable, 5th Bessel
Output Rate	0 ... 1MHz
Connectors	2 banana-jacks parallel to BNC-jack
Integrated Measuring	8 voltage measuring ranges from 0 to 0.125/0.25/0.5/1/2/4/8 and 16V 8 current measuring ranges (load current) from 0 to 2.5/5/10/20/40/80/160 and 320mA 8 current measuring ranges (reverse current) from 0 to 0.062/0.125/0.25/0.5/1/2/4 and 8mA expandable via ext. shunts x10, x100

Output: Voltage

Voltages	0 ... 15V, 0 ... -15V, GND
Load rating	300mA, protected against short-circuit,
Connections	3 banana-jacks (+; GND; -) 7-pole DIN jack to control external power-supplies or amplifiers. (optional 1MHz, 12bit)

Output: Relay

Contacts	1x opener, 1x closer, change-over switch
Load rating	5A / 42V
Status Display	by 2 LED´s
Connections	3 banana-jacks

Output: Mains Relay

Load Rating	5A / 230V - 1100VA
Status Display	by LED on the front panel
Outlet	Schuko-socket with protective cover and country specific adapter fine-wire fuse 6.3AT on rear panel, software controlled
Status Display	by LED on front panel

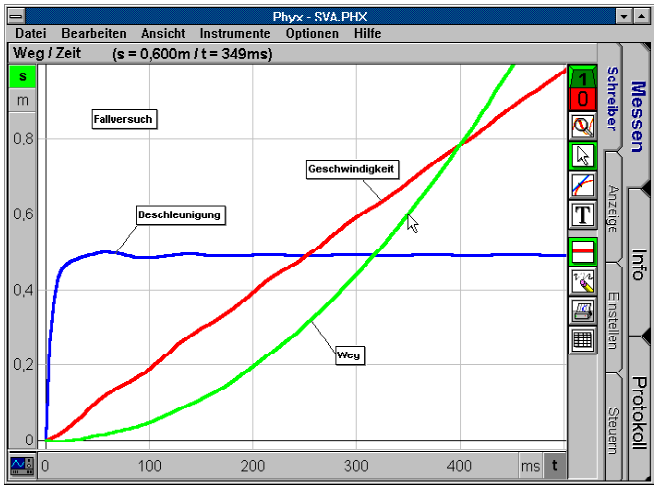
PC-serial interface

Kind of serial interface	Serial, optically coupled isolator 9600 to 153600 Baud
Connection	PC- compatible 25pole SubD-plug

General

Mains Connection	115/230VAC ± 10%, 47...63Hz, 50VA, (115/230VAC internal plug and socket device) plug-in socket with fuse
Ambient temperature	+32°F to +104°F
Dimensions W x H x D	245 x 85 x 180mm (9.65 x 3.35 x 7.09in)
Weight	approx. 3.5kg (7.7lb.)

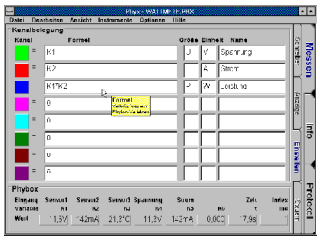
Phymex - The user friendly processing software for measurement, control and documentation in co-operation with Phybox.



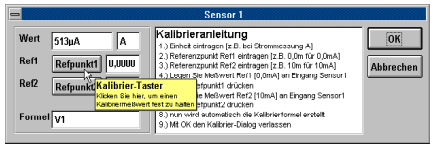
Learning and operating the processing software Phymex is an unusually quick process even for newcomers. Reliable, easy guidance with help-textboxes assists the user throughout the experiment. Avoid stressful translations by simply choosing your language at the menu bar. Phymex has all the outstanding features of the Windows Interface. Click the mouse on one of the groups to switch between functions (WYSIWYC). The display group contains digital and/or analog instruments, a recorder group comprises over a 8-channel x/y - y/t-recorder, and the control group provides control fields in bargraph formats with movable on/off tabs. Any input and measured values may be mathematically linked in the control group. Input data as well as the converted input can both be displayed on screen at the same time. An integrated documentation software allows quick and convenient documentation along the proceeding experiment, and the experiment's result may be expressed in writing and graphical form. Simply push a button to automate the insertion of charts and curves into documentation followed by further text processing work to analyse and describe the experiment. Completed experimental instructions are saved together with all settings and calibration data, protected by password. Stored experiments are assigned to an icon and may therefore be opened and repeated again by mouse click.

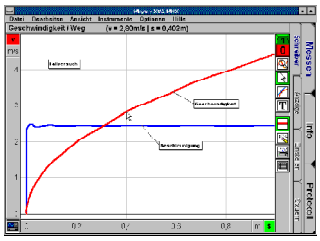
Measuring and Controlling

Measured analog and digital signals acquired by sensors and converted into computer-readable signals by the interface Phybox are transfered to the computer through a serial interface. The PC then analyzes the signals by means of appropriate software. In Phymex a processing software is offered that completes the circle of measuring and controlling data.
Phymex provides several methods for data connection, calculation and display. Just by clicking on a particular "index card/ group" you can quickly and conveniently select required functions comprising a recorder, settings (calibration), display and control.

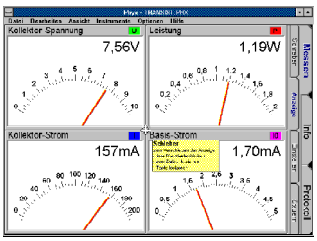


Settings/ Calibration In an array all Phybox inlets can be assigned to any of the 8 channels, differentiated through colour, as you like. You may assign unit (e.g. V for Volt), symbol (e.g. U for voltage) and name (e.g. voltage) to any channel. To connect software channel and inlet, define formulas e.g. K1 for Phybox inlet 1, or K1*K2 representing inlet1 * inlet2. Calibration of the measuring chain (Sensor - Phybox) is a half-automated and fast process by a two-point-calibration. As an option, calibration formulas may be used.

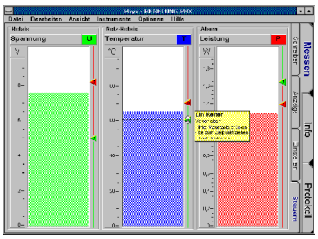




Recorder This function allows up to 8 channels to be freely assigned to the Y-axis, and one channel or the time base to the X-axis. The recorder may be operated either in the X/ Y or Y/t mode. During recording the representation mode may be switched. It is also possible to scale the measuring range of X and Y axis up/ down while the recorder is activated. Simply click at the upper/ lower end of the scale next to the axis. In order to find the zero point of an axis, shift the scale with your mouse. Tools located on the right of the recorder provide options that are activated by mouse click. These are bolded lines, sector magnification, curve line out / tangent, curve documentation with tags, and pasting the analyzation into documentation in either graphics or table formats.



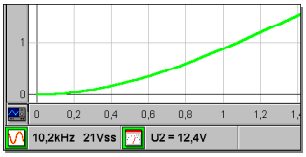
Display Each of the four displays available may be switched from analog to digital and/ or analog&digital display mode. By moving the port, the center-point of all displays, display size, and the number of displays shown (to two or one) can be changed. Thus, the opportunity is given to create a screen covering full-display, analog or digital. To select the measuring range, click the mouse on either upper or lower end of scale. The zero point's location can be displaced by shifting the scales with the mouse. A click on the upper right colour-field opens the channel selection mode. One of those channels can be assigned to the display.

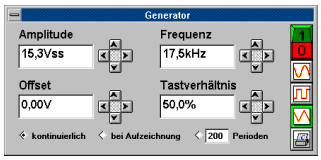


Control Activate the control function to do control work. Components available are a relay outlet with switch contact at the Phybox front-plate, in the rear a 230V alternating voltage outlet on a security socket, as well as an optical alarm messager. The assignment of required measuring channels to any of these control channels is done with a mouse click. Critical control limits may be set on any bargraph control field by a ON (green) and OFF (red) tab as you like. To change the measuring range of the bargraph control field follow the instructions described in the recorder and display mode, and click the mouse on the upper or lower end of the scale. For zero-point adjustments shift the scales with the mouse.

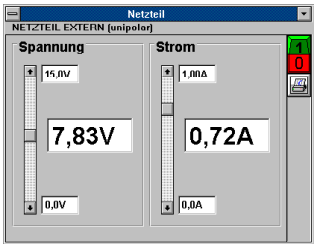
Instruments

Optional insertable instruments complete Phymex. After the instruments are activated in the menu they are displayed as windows, providing tools to adjust the settings. As a shortcut they are assigned to instrument buttons located on the screen bottom. The most important operation parameters stay visible with it. Instrument buttons are activated/ deactivated with a single mouse click. For a screen-sized display, use a double-click.



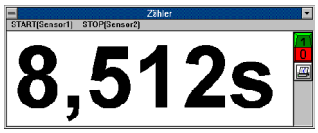


Signal Generator: It allows convenient operation of the Phybox generator outlet. The selection holds sine, rectangle or triangle signal. Amplitude, offset, frequency and scan ratio are adjustable at any time. The Scan ratio works rectangle to impulse and triangle to sawtooth profile. It is based on short/ long period operation (lasting x periods). If deactivated, the Phybox generator operates in a high-Ohm condition, being of use for the observation of off-oscillation characteristics.



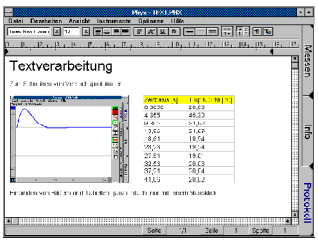
Power Pack: The instrument's job is to control the Phybox internal power supply or external facilities connected to the standard serial port.

Counter: Using Phybox as a classical digital counter, the counter instrument offers a graphical user-surface, modern and easy to handle. Provided are On/Off, frequency-, period length-, impulse length-, summarized on/off period length measurement, as well as event counter with or without gate function.



Documentation

A Phymex integrated processing software offers further convenience in its operation. Without having to switch to external programs, documentation of the experiment is given. Also, an information group is provided in which you may add images of usual formats, e.g. by using Photo CD, scanner or drawing software to create BMP, PCX, GIF, TIFF, TARGA and WMF graphics.



Info As a source for helpful information for the experiment's preparation, processing and documentation, an information group is provided. In it you may describe the experiment's installation work, leave notes for required facilities and materials, give hints for the experiment's processing, and besides all that, you can integrate visualizing images. All this information is stored with defined settings, calibration data, measuring results, and experiment documentation. Protected by a personal password any saved experiments can be held for later use.

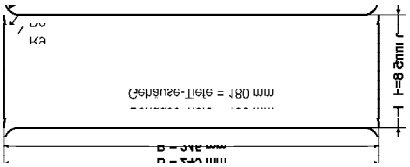
Records Manual recording and documentation of an experiment's result is often too time consuming. Phymex automatically records the experiment's data during processing and offers the possibility of a subsequent professional analyzation and documentation. A single mouse click pastes data tables or signal curves into records. In the same way, analog and digital displays can be inserted into the records. The processing software is the tool for the creation of additional explanations completed with external drawings, if requested. At this point printouts can be made in any number required - even in colour if desired!

Phybox/Phymex

System Requirements

Hardware: PC 486 and up with 2 serial ports
Software: Windows* 3.1 and later

Dimensions and Weight Phybox



Weight : approx. 3,5kg (7.7lb.)

Item

Phybox	Universal-Interface for Physics
Phymex	Physics Experimental Software

Scedule of Parts (standard version)

Hardware and software manual, power cord, serial PC connection cable (2m) with 9/25 pole adapter, country-specific adapter for mains relay/mains output.

Special Accessories

DDG	Position Sensor
DKS	Force Sensor
DDS	Pressure Sensor
DTA	NiCrNi-Theromcouple Converter
DTD	Wire-Wound Thermoelement
DTG	NiCrNi Bar Element
DTF	Temperature Probe
DHS	Hall Sensor
DLM	Luxmeter
DRS	Current Shunt
DHV	High-Voltage Source
DZR1	Geiger-Mueller Counter Tube
DZR2	Geiger-Mueller Counter Tube
DGL	Photogate

Kabel

BNC	BNC cable, lenght 1m
DIN	DIN cable, 7-pins, lenght 1.5m
SSt	Tripod-pole (length 15cm , 10mm diameter)
PB-TB	carry frame

*) Windows is a software product of Microsoft

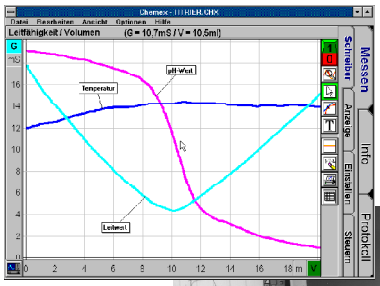
Ideal Supplement to the Physics System:

Chembox / Chemex - the compact Chemistry Measuring and Experimental System

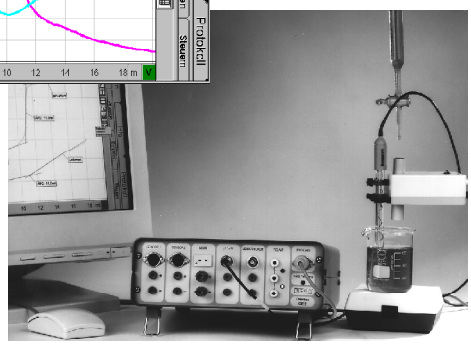
In addition to the Physics System Phybox/Phymex, IBK offers a special Chemistry Teaching and Experimental System consisting of software and hardware, as well as corresponding chemistry sensors.

Chemistry Sensors

DTF	Temperature Probe
DPH	pH-Probe
DRX	Redox-Probe
DTZ	Stactometer
DLS	Conductivity Probe



Exprimental Software Chemex



Chemistry-Interface Chembox CB2

Order Address

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Phone ++49 8677 9618 0
Fax ++49 8677 9618 27

1.96 hp Data are subject to error without notice. errors excepted.