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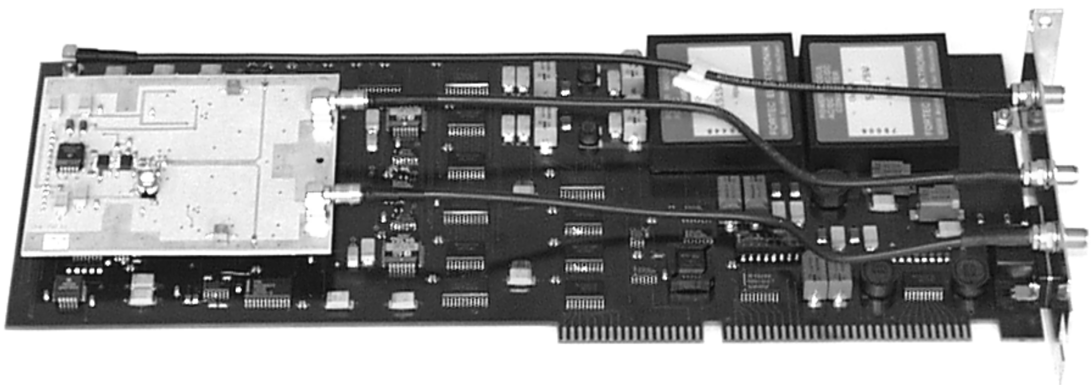
PCS-150 PCI-200
PCS-150A PCI-200A
Sampling / Boxcar Modules



- **PC Modules for Signal Recording by Sampling or Boxcar Method**
- **Two Signal Channels with Synchronous Sampling**
- **PCS-150: Gate Width 120 ps**
- **PCI-200: Gate Width 2 ns to 50 ns**
- **Delay Resolution down to 10 ps**
- **Variable or Fixed Delay**
- **Signal Averaging for SNR Improvement**
- **External or Internal Trigger**
- **All Functions Controlled by Software**

Table of Contents

Introduction

The PCS-150 and the PCI-200 are PC plug-in modules for signal recording by the sampling or boxcar technique. They are intended for the measurement of repetitive signals with high bandwidth and time resolution. The PCS-150A and PCI-200A are improved versions of the PCS-150 and PCS-200.

To record the signal, a sequential sampling technique is used. By using a high speed linear gate, one sample is taken from the signal in each signal period. To record the signal as a function of time, the sample point is shifted over the signal in small time increments.

To measure the signal value at a selected point of the signal, the sampling point can also be fixed. In this case the signal voltage at the selected moment as a function of an externally varied parameter is recorded.

Furthermore, the PCS-150 / PCI-200 modules are able to record sequences of waveforms. The results are stored in subsequent memory blocks.

In all modes the signal-to-noise ratio (SNR) the of the result can be enhanced by repeatedly sampling each signal point and averaging the samples.

The PCS-150 / PCI-200 modules contain two signal channels which are controlled by a common gate pulse. This enables the module to record two input signals at the same time.

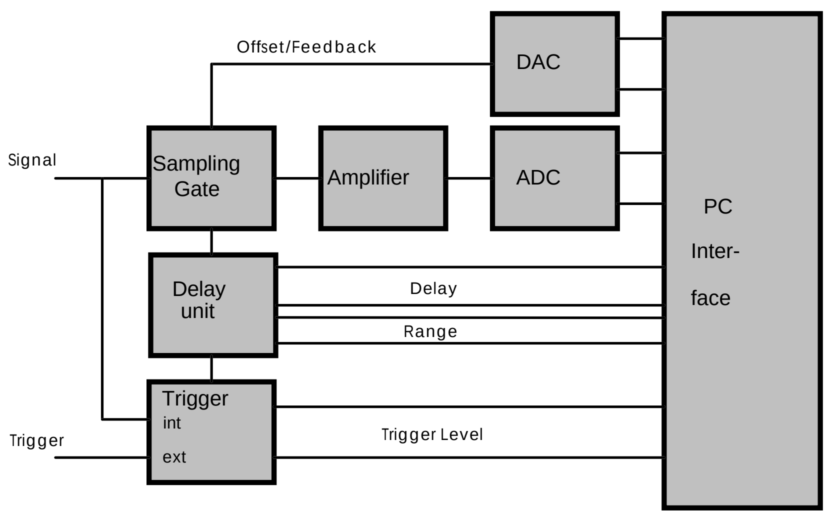
The gate width of the PCS-150 is <150 ps (typically 120 ps), the gate width of the PCI-200 can be selected from 2 ns to 50 ns.

The trigger pulse can be either derived from the signal of the channel A, or an external trigger pulse can be used.

All functions are controlled by the software delivered with the module. The software controls the measurement procedure, provides the selection of operation modes and measurement parameters and performs the display, evaluation and storage of the results.

Principle

The principle of the PCS-150 / PCI-200 modules is shown in the figure below.



Principle of the PCS-150 / PCI-200 Module (one signal channel shown only)

The gate circuit samples the input signal with a gate width in the ps range (PCS-150) or with a variable gate width between 2 ns and 50 ns (PCI-200).

To synchronise the signal sampling with the signal pulse sequence a trigger pulse can either be taken from the external trigger input or derived from the signal of channel A. To control the temporal location of the sample point in relation to the signal, a variable delay unit is used. By controlling the delay value by the device software, the sample point can be scanned across the input signal.

The signal delivered by the gate circuit is amplified to the appropriate level and converted by the AD converter with a resolution of 12 bit. The data word from the AD converter is read via the PC interface and processed by the device software. The AD converter input covers the entire input voltage range of the gate circuit from -500mV to +500mV. Switching the range down to 200, 100 or 50mV is performed by the signal processing software. The resolution in these ranges is therefore reduced (9 bit in the 50mV range). The resolution is, however, always finer than the noise of the gate circuit. Thus the accuracy is not affected by the resolution of the ADC.

To adjust the baseline of the input signal an offset signal is provided by the DA converter DAC. In the 'Feedback' mode this signal is used to improve the linearity of the gate circuit. In this mode the gate circuit is operated within a control loop which automatically cancels the signal value by an opposite offset value. As a result, the nonlinearity of the gate circuit does not appear in the measurement data.

The control of the whole system is accomplished by the device software. The software sets the measurement parameters (trigger level, delay range, channel gain and offset), controls the measurement procedure (delay control, offset/feedback loop) and displays the measurement data on the screen. For the basic operation modes (sampling oscilloscope, boxcar integrator with scanned or fixed delay) a comfortable system software for Windows 3.1, 95, 98 and NT is delivered with the module. To facilitate customer programming for special applications, DOS and WINDOWS function libraries are available.

Specification

		PCS-150	PCS-150A	PCI-200	PCI-200A
Principle		Sequential sampling with software control			
Number of signal channels		2		2	
Gate width		< 150 ps (typ. 120ps)		2 ns to 50 ns	
Input impedance		50 Ω		50 Ω	
Input voltage range (full scale)		±50mV, ±100mV, ±200mV, ±500mV			
Internal noise		1mV (rms)		100uV (rms)	
Amplitude Resolution	for input range	±50mV	±100mV	±200mV	±500mV
(all modules)	no averaging	512	1024	2048	4096
	4 samples averaged	2048	4096	8192	16384
	>128 samples averaged	16 bit			
Averaging		1...4096 Samples / Step			
Delay Range		10ns to 20us	10ns to 50us	10ns to 20us	10ns to 50us
Delay Resolution	Delay Range 10ns	min. 2.44 ps			
(all modules)	Delay Range 100ns	min. 24.4ps			
	Delay Range 1us	min. 244ps			
Time Axis Resolution		max.10 bit or 1024 points / curve			
Timebase Jitter (rms),	Delay Range 10ns	15 ps	4 ps	15 ps	4 ps
(typical values)	Delay Range 100ns	30 ps	8 ps	8 ps	8 ps
	Delay Range 1us	200 ps	40 ps	200 ps	40 ps
First Sample Delay (ns)	Delay Range 10ns	18 ns			
(all modules, typical values)	Delay Range 100ns	30 ns			
	Delay Range 1us	180 ns			
Trigger		external or internal on channel A			
Trigger Input Impedance		50 Ω			
Trigger Threshold		-1 V to +1 V			
Threshold Offset		<30mV			
Trigger Frequency (Vtrig > 100mV)		0 to 500 MHz			
Input connectors		SMA, 50 Ohm			
Dimensions		PC module 120 x 337 mm			
PC Bus		ISA 16 Bit			
Power consumption		approx. 10 W at 5V			

Accessories: Preamplifiers up to 2 GHz, PIN and Avalanche Photodiode Modules, Optical Trigger Devices, Step Motor Controllers. Please contact Becker & Hickl for individual data sheets.

Maximum Values

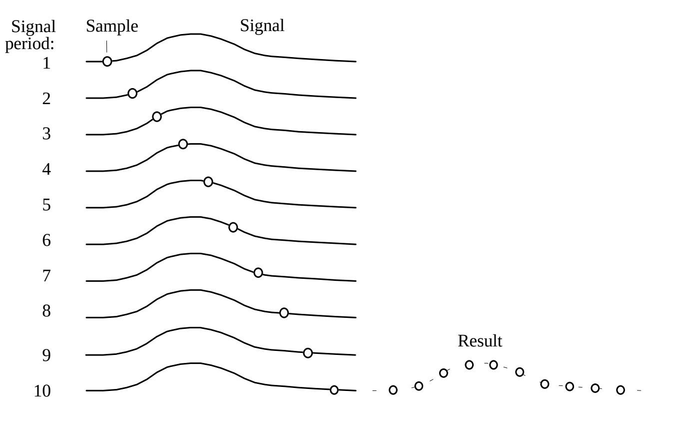
Exceeding maximum values may cause damage to the device. Damage due to exceeding of maximum values is not covered by warranty.

	PCS-150 / PCS-150A	PCI-200 / PCI-200A
Channel A and B input voltage	DC 3V, Pulse 10V (1us, duty cycle 1:100)	DC 1V or 200mA, Pulse 1A (1us, duty cycle 1:100)
External trigger input voltage	DC: +/- 4V, Pulse: +/- 20V (1us, duty cycle 1:100)	
Load at Power Supply Outputs	± 5V: 150 mA ± 15V: 100 mA	
Power Supply Voltage	-0.5 V to 5.6 V	
Ambient temperature	65 °C	

Operation Modes

Sampling

The principle of the sampling method is shown in the next figure.



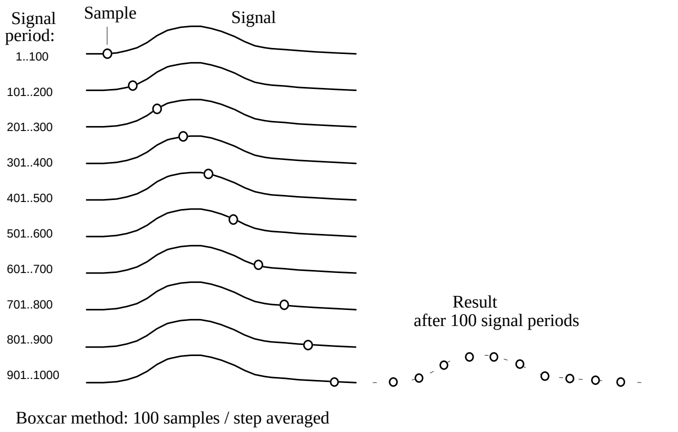
Sampling Method

In each signal period one sample is taken from the signal. From period to period the sample location is shifted by a small amount, to sample a somewhat later point of the signal. After n signal periods n samples have been taken to recover the waveform of the signal. If the sample point is shifted in sufficiently small steps the signal bandwidth is determined by the gate width only. Because the processing time of the particular samples does not affect the time resolution, the sampling method provides a very high bandwidth and an extremely high virtual sample rate at a moderate hardware effort. In fact, the virtual sample rate and the signal bandwidth can be 10 to 100 times higher than with digital oscilloscopes of comparable price.

To improve the signal to noise ratio the sampling method can be combined with signal averaging. For that purpose, the procedure described above is repeated several times and the obtained curves are averaged. Averaging of n curves improves the signal to noise ration by a factor of $n^{1/2}$.

Boxcar

The boxcar method is based on the same principle as the sampling method. It differs only in the strategy used for signal averaging. While the sampling method immediately proceeds to the next signal point and averages the complete curves, the boxcar method averages the samples of one signal point first and than proceeds to the next point. The method is shown in the next figure.

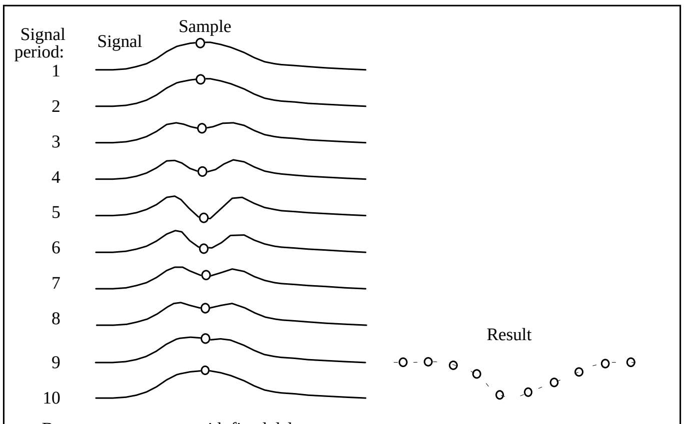


Boxcar method: 100 samples / step averaged

At each sample point several (in the figure 100) samples are taken and averaged with the same delay setting. When the averaging for this signal point is complete the delay is increased. The SNR improvement is $n^{1/2}$. The practical difference compared to the sampling method is the different effect of a possible amplitude or time drift of the signal.

Boxcar with Fixed Delay

In some applications not the waveform of the signal is of interest, but only the signal value at a particular point of the signal. This value has to be recorded as a function of the time or any other externally variable parameter. For such applications the PCS-150 and PCI-200 modules can be operated in the fixed delay mode. The principle is shown in the next figure.



Boxcar measurement with fixed delay

In the example shown the signal has a different shape in the signal periods 3 to 8. This results in a different sample value at the fixed sample point. In the result the sample value as a function of the signal period number is displayed. The method can be combined with a signal averaging as in the boxcar method.

Installation

General Requirements

The computer must be a 386, 486 or Pentium machine. There must be a free ISA slot to insert the PCS-150 or PCI-200 module.

For the DOS software (PCS-150 and PCI-200 only) 560 k of free DOS memory is required. The computer should have a pointing device (mouse or trackball) with the appropriate DOS driver installed. For the Windows software a PC with 200 MHz and 16 Mb memory ore more is recommended.

Software Installation (DOS Software)

The DOS software is available only for the older PCS-150 and PCI-200 modules. It requires 560k conventional memory. Should there not be sufficient conventional memory you should remove unused drivers from the autoexec.bat or config.sys. You also may shift drivers into the upper memory area. If you use DOS 6 (or later) this can be done in a very convenient way by using the program 'MemMaker'.

The installation disk contains all necessary files packed in the PCSINST.EXE file. The installation is very simple:

- Create a directory for the PCS / PCI software and prompt into this directory. If you want to update an older PCS / PCI version, prompt into this directory.
- Insert the installation disk into drive a or b.
- Call a:install (or b:install). This will start a batch file which copies all software components into the current directory.
- To check whether the installation is correct, call 'PCS'. The software will start in the normal way. If the PCS or PCI module is not inserted yet, the software will start in a simulation mode.

Software Installation (Windows Software)

Since Jan. 2000 the PCS and PCI modules come with the ‘PCS Standard Software’ a comfortable software package that allows for measurement parameter setting, measurement control, step motor control, loading and saving of measurement and setup data, and data display and evaluation. For data processing with other software packages a conversion program to the ASCII format is included.

The PCS Standard Software works with the older PCS-150 and PCI-200 modules and with the new PCS-150A and PCI-200A modules.

Two versions of the PCS Standard Software are delivered with the module - one is for Windows 3.1, the other for Windows 95/98 and Windows NT. To facilitate the development of user-specific software a DLL library for Windows 95 and Windows NT is available on extra order.

The installation of the PCS Standard Software is simple. Start WINDOWS, put the installation disk into drive A or B and start setup.exe.

The PCS software is based on 'LabWindows/CVI' of National Instruments. Therefore the so-called 'CVI Run-Time Engine' is required to run the PCS software. The 'Run-Time Engine' contains the library functions of LabWindows CVI and is loaded together with the PCS software. The installation routine suggests a special directory to install the Run-Time Engine. If the required version of the Run-Time Engine is already installed for another application, it is detected by the installation program and shared with the existing LabWindows CVI applications.

Hardware Installation

Upgrading PCs with measurement modules often causes problems such as system crashes, malfunctions of special hardware or software components or other mysterious effects. To our experience such problems normally arise from interrupt and memory conflicts between different components. Therefore, the PCS and PCI modules have been designed without using interrupts and direct memory access. Thus the installation (usually) does not cause any problems.

To install the device, switch off the computer and insert the PCS or PCI module into a free slot. To avoid damage due to electrostatic discharge we recommend to touch the module at the metallic back shield. Then touch a metallic part of the computer with the other hand. Than insert the module into a free slot of the computer. Keep the modules as far as possible apart from loose cables or other computer modules to avoid noise pick up. Do not connect any signals to the module at the beginning.

When the module is inserted switch on and start the PMS software. If no error is returned, you can expect that the module works correctly.

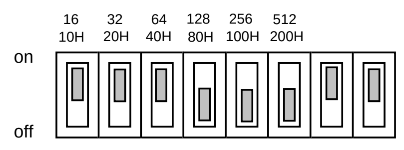
Changes of the module address of the PCS or PCI (see section below) are not normally required. However, for the operation together with other bh modules in one computer the module addresses must be different, and the changed address value must be declared in the PCS150.INI file (see ‘Changing the Module Address).

Should there be any malfunction after installing the PCS or PCI either the capacity of the power supply is exceeded or - which is more likely - another module in the PC has the same I/O address as the PCS or PCI. In this case change the module address as described under 'Module Address'. If there are only the standard modules (hard disk, floppy drives, COM ports, LPTs, VGA) in your computer the default address range (380h to 398h for one PMS modules) should be free.

Changing the Module Address

To change the module address of the device the setting of the DIP switches on the PCS or PCI module must changed and the new address must be typed into the file PCS150.INI (Windows software) or CONFIG.DAT (DOS software).

The meaning of the DIP switches is shown in the figure below. Each switch represents a particular address value (power of two). The actual address is the sum of all values that are switched on. The value is active if the switch is in **OFF** position, i.e. directs down to the connector of the board. The right two switches have no effect.



DIP switch for address setup (380H = 896 selected)
Board connector is at the bottom

The PCS Windows software (PCS Standard Software or DLL functions) reads the addresses of the PCS or PCI module from the configuration file PCS150.INI. Therefore, the DIP switch setting and the addresses in PCS150.INI must be the same. The PCS150.INI file is shown in the table below. It can be edited with any ASCII editor (e.g. Norton Commander).

```
[pcs_base]
;    Only pcs_base section with baseadr item has to be included in .ini file
;    Other parameters are optional (default values are used)
baseadr= 0x380          ;base I/O address
simulation = 0          ; 0 - hardware mode(default) ,
                        ; >0 - simulation mode (see pcs_def.h for possible values)
 [pcs_module]
meas_mode= 2            ;measurement mode 0- Sampling , 1- Boxcar ,2- Fixed(default)
ch_A_used= 1            ;0 -not used ,1 - used(default)
ch_B_used= 1            ;0 -not used ,1 - used(default)
offset_A= 0             ;offset of channel A [mV] ( should be in range -500 , 500)
                        ;      (default =0)
offset_B= 0             ;offset of channel B [mV] ( should be in range -500 , 500)
                        ;      (default =0)
trig_slope=1            ; 0 - positive(default) , 1 - negative
trig_source=0           ; 0 - internal , 1 - external(default)
threshold= -100         ;trigger threshold [mV] (-1000 , 1000) (default=0.0)
del_range=1000          ;delay range [ns] ( 10 - 20000) (default=10.0)
ini_delay=0             ;initial delay [ns] ( 0 - del_range)(default=0.0)
time_per_step=0.24      ;time per step [ns]
                        ;  ( 0.001 - 160 ,depends on actual delay range)
                        ;(default -will be calculated from delay range and steps)
steps=1024              ;number of steps per curve (64,128,256,512,1024(default))
feedback=0              ; 1 - feedback used, 0 - not used(default)
samples=1               ;number of samples averaged(default=1)
gate_width = 5.0        ; gate width [ns] for module PCI-200 (default=2.0 ns )
```

The DOS software reads the modules address from the file CONFIG.DAT shown in the table below.

PID INTERN	T DEFAULT	MINIMUM	MAXIMUM
000 PR_HARD I	1	0	1
001 PR_BASE I	**896**	0	1024
002 PR_ERRSCR I	1	0	1
003 PR_ERRFIL I	1	0	1
004 PR_AUTCFG B	1	0	1
005 PR_PDEV X	0	0	2

The address is written as a decimal number after the designator 'PR_BASE'. Make sure that you insert the new address in the correct line and column. We recommend to make a copy of config.dat before making any changes.

Using the Software without PCS or PCI Hardware

You can use the PCS-150 / PCI-200 software also without the hardware. The software will display a warning that the module is not present. If you accept this warning the software will start in a special mode with the measurement being simulated. You can load, display and store data and do everything except a true measurement. To force the software to simulate one of the PCS-150, PCS-150A, PCI-200 or PCI-200A modules a command line parameter can be added in the Windows call:

PCS-150: -s150	PCS-150A: -s151
PCI-200: -s200	PCI-200A: -s201

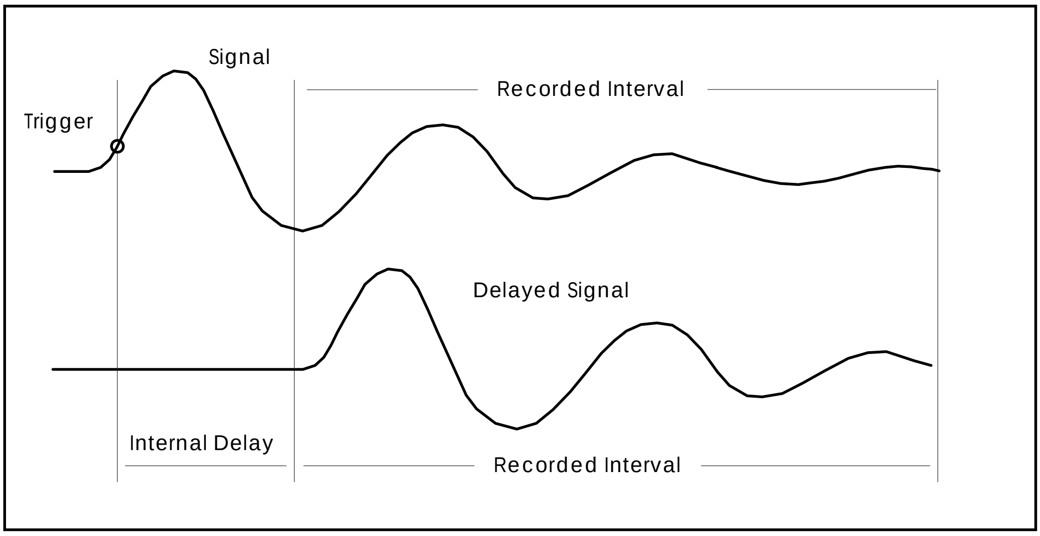
Building up and putting into operation measurement apparatus

The next sections give some hints how to put the PCS-150 and PCI-200 modules into operation. The input signals of the device are described and the application of the module is demonstrated for some typical examples.

Trigger Signal

The PCS-150 / PCI-200 needs a trigger signal as a reference for the temporal location of the signal. The trigger signal can be derived either from the channel A signal or it can be taken from the external trigger input.

The trigger signal must appear at least 20ns (we recommend 40ns) preceding the signal in order to compensate the internal delay of the trigger circuit and the delay unit.



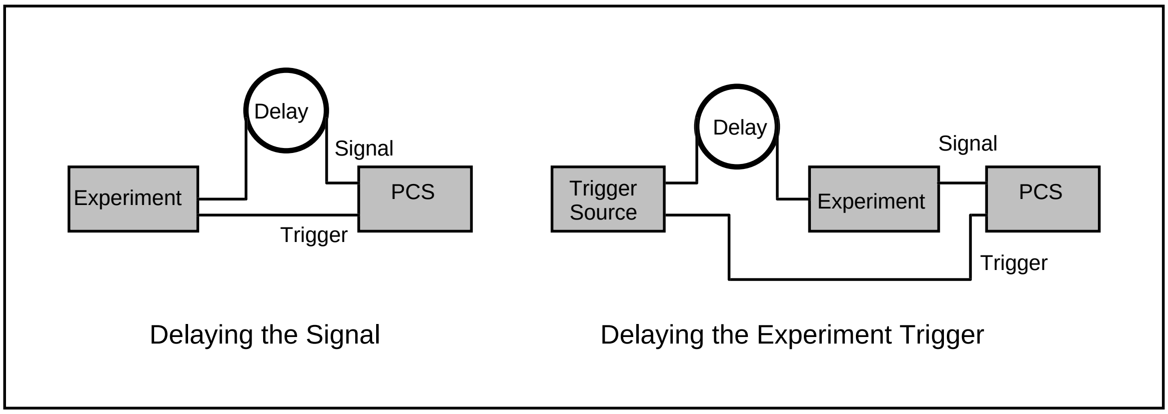
The following formula gives an approximation of the internal delay that can be expected:

$$DEL_{int} = 18\ ns + 0.15 * DelRange$$

If your signal has a repetition rate of more than 50MHz this delay is no problem. If the trigger is too late, simply the next signal period is displayed. For signals with low repetition rates, however, trigger and signal must be in the correct time relation. This can be achieved by two different ways:

The simplest way is to use the external trigger input and to delay the measured signals through delay lines by 20...40ns. 4...8m of high quality 50 Ohm cable is required for that purpose.

The second way is a delayed triggering of the experiment. This can be achieved by an external delay generator or simply by delay cables. The signals from the experiment are fed directly to the PCS-150 or PCI-200 and the external trigger input is connected to the output of the generator that triggers the experiment. The second method avoids signal distortions by the delay lines in the signal path.



The amplitude of the trigger signal should be in the range of 50mV to 1V. It should be stable and free of noise. If the amplitude is too small, noise or radio interference may cause a jitter that degrades the time resolution of the measurement. If the amplitude is too high, the trigger signal can interfere with the input signals. Trigger amplitudes in excess of 1.5V are clipped internally. DC values up to 4V and pulse amplitudes up to 20V will not cause damage to the device.

Input Signals

The input signals of the two channels have to be connected to the inputs A and B. Both channels are equivalent. The internal trigger signal can, however, be derived from channel A only.

The maximum input voltage that can be measured is -500mV to +500mV. If your signal has a higher amplitude, please use 50 Ohm attenuator pads in front of the input. For signal amplitudes smaller than 50mV preamplifiers are available from Becker & Hickl. These preamplifiers get their power supply directly from the PCS-150 or PCI-200 module.

To utilise the full bandwidth of the PCS-150, input signal cables of high quality are required. For cable lengths up to 1m the common RG58 can be used without much loss of bandwidth. For delay lines of 4...8m length the influence of the RG58 cable is clearly visible. It can, however, be still tolerated for many applications. Please take into regard, that cables deteriorate with time due to oxidation.

The signal inputs of the PCS-150 withstand DC voltages up to +/-3V. Pulse amplitudes can be as high as +/-10V. Higher amplitudes may damage the input gate.

The PCI-200 module has clipping diodes which short the input at a voltage of ±1.5 V. No damage will occur as long as the input current remains below 200mA (DC) or 1A (pulse, 1ms)

According to our own experience, most danger arises from charged cables that are connected to the inputs. This often happens in optical short-time measurements, when detectors with supply voltages from 100 V to several kV are used. Do not connect such detectors to the PCS-150 or PCI-200 when the detector supply voltage is switched on! Do not use cables or connectors with bad contacts! If you cannot avoid overvoltage at the inputs, we can guard the PCS-150 inputs with clipping diodes on your demand. These will, however, slightly increase the rise time and the input reflection factor of the module.

Power Supply and Control Outputs

To use the PCS-150 or PCI-200 with accessories like preamplifiers or light detectors the supply voltages are available at a 15 pole Sub-D connector. The pins are connected as shown below:

1	+5V (via 1Ω guard resistor, 150 mA max.)
2	EXT1*
3	EXT2*
4	EXT3*
5	GND
6	-5V (via 1Ω guard resistor, 150 mA max.)
10	+15V (100mA max.)
11	-15V (100mA max.)
15	GND

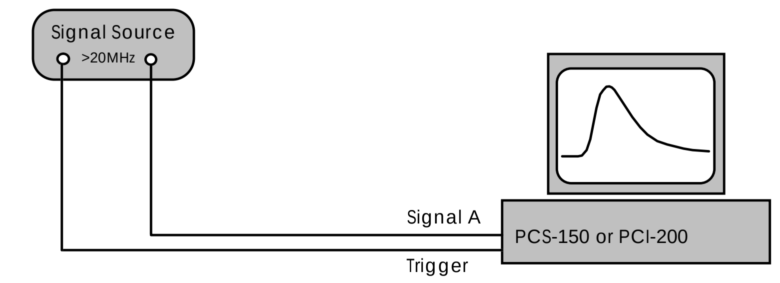
* EXT1, EXT2 and EXT3 are uncomitted TTL control outputs. These signals exist in the PCS-150A and in the PCI-200A modules only.

Please be careful not to connect devices to the connector that are not intended for it. This can damage the connected device or the PCS / PCI module.

Application Examples

Sampling Oscilloscope

The PCS-150 / PCI-200 can be used as a normal sampling oscilloscope. The precondition is (as with any other sampling oscilloscope) that the input signals have a sufficiently high repetition rate. The following figure shows a simple measurement setup.



Signal Recording in the Sampling Oscilloscope Mode

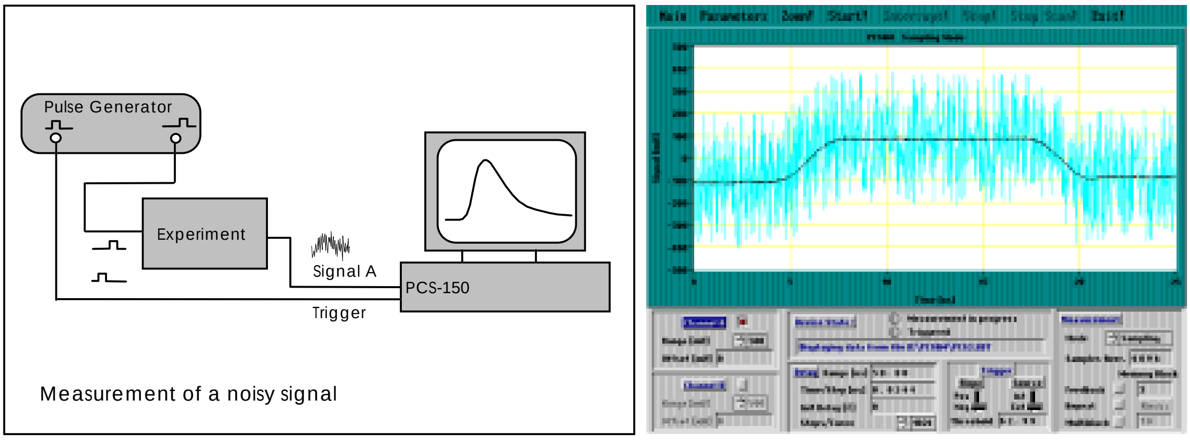
We recommend to use the shown setup or a similar one when you put the PCS-150 or PCI-200 module into operation first time. The signals should have a repetition rate of 20MHz to 100MHz and amplitudes between 100mV and 500mV. The signals should be roughly symmetrical to the baseline. If you have one signal only, connect it to channel A. Due to the high repetition rate triggering can be either external or internal using the A signal itself as a trigger source.

For putting the PCS-150 or PCI-200 into operation a setup/data file 'startup.sdt' is included in the software. This file contains the basic settings for the application as a sampling oscilloscope. Please load this file using 'Main' and 'Load'. On the screen two curves will appear, the data of which are from the startup.sdt file. The system parameters will be set in a way that a reasonable measurement can be done in the shown setup. Now start the measurement by selecting 'Start'. 'Device state' should change to 'triggered' and your input waveforms should appear on the screen.

Boxcar Integrator: Measurement of noisy signals

The next figure shows an example for the measurement of a noisy signal. The investigated device (experiment) is excited by a pulse generator. The experiment delivers a noisy output signal on each input pulse. Due to the noise the signal from the experiment cannot be used for triggering the PCS-150 / PCI-200. Therefore, the module is triggered externally by the same pulse generator that triggers the experiment. To compensate the internal delay of the PCS-150 / PCI-200, the experiment trigger is delayed in relation to the PCS-150 / PCI-200 trigger.

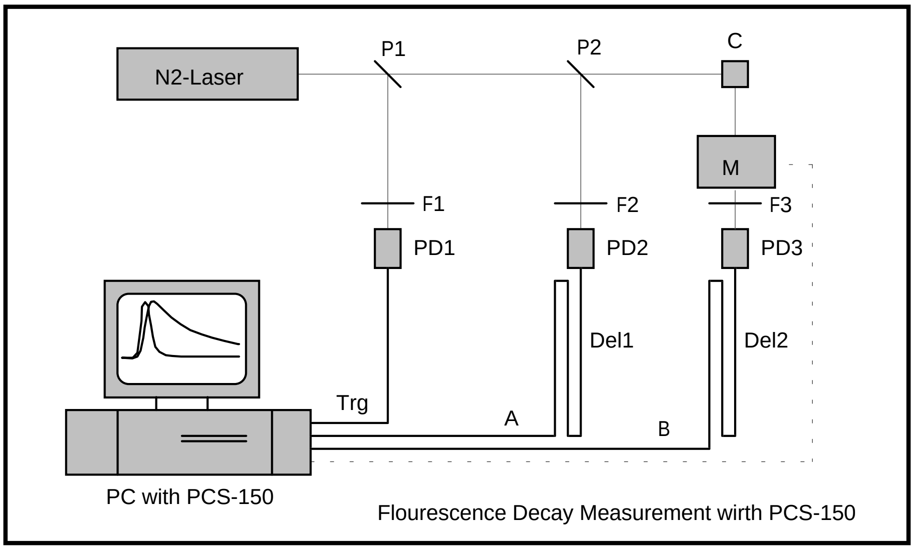
The trigger source in the PCS-150 / PCI-200 is switched to 'external'. After starting the measurement the device state should change to 'triggered'. If not, set trigger slope and trigger level to the correct values according to the trigger signal. When the waveform appears on the screen (use the 'repeat' mode) it is brought to the desired time scale and location by changing 'Delay Range', 'Time/Step' and 'Initial Delay'. Than 'Samples Averaged' is set to a value high enough to obtain the desired SNR improvement. 'Repeat' is switched off and the measurement is started again. The measurement will stop automatically when it is complete. Depending on the setting of 'Display Mode' intermediate results can be displayed during the measurement. For very noisy signals and high values of 'Samples Averaged' we recommend to use 'Display after each step' (See section 'Display Parameters').



The figure above shows an example for the noise suppression which is achieved by signal averaging. By averaging 4096 samples per delay step the signal-to-noise ratio improved by a factor of 64.

Fluorescence Decay Measurements

A typical application field of Boxcar integrators are optical short time measurements. In the following figure a simple setup for the measurement of fluorescence decay functions is shown.

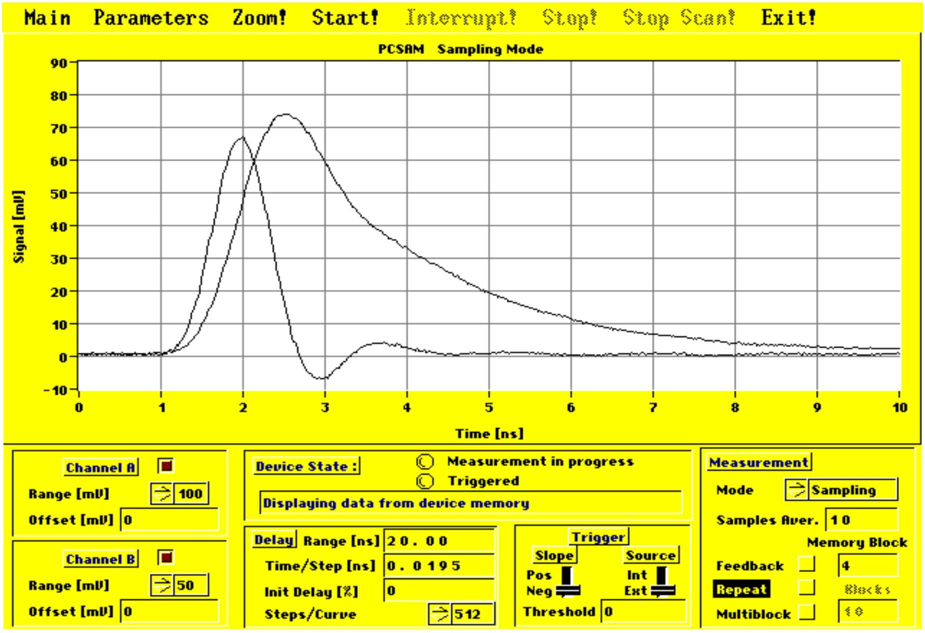


The nitrogen laser generates short light pulses with a repetition rate of 10...100Hz. The light pulses excite the sample cell C. The fluorescence light from the sample cell is detected by the photodiode PD3. The signal is fed to channel B of the PCS-150. P1 and P2 are glass plates which reflect a part of the laser radiation to the photodiodes PD1 and PD2 (Photodiode modules are available from Becker & Hickl). The signal from PD1 is used as a trigger for the PCS-150. It is connected to the external trigger input. The signal from PD2 is used to record the shape of the excitation pulse.

The filters F1..F3 are used to adjust the signal amplitudes. The monochromator M selects an appropriate wavelength of the fluorescence light.

Because a nitrogen laser cannot be triggered with sufficient accuracy, a delayed triggering of the experiment is not applicable. Therefore, the input signals are delayed by delay lines DEL1 and DEL2.

The apparatus shown records fluorescence decay functions, time resolved fluorescence spectra or multiple decay curves at different wavelengths i.e. the complete wavelength-time behaviour of the fluorescence. For recording decay functions the sampling or boxcar mode is used. To suppress noise and amplitude fluctuations of the laser pulses 'Samples averaged' is chosen as high as possible with regard to the measuring time. The measurement delivers the decay function at the selected wavelength and the shape of the exciting laser pulse. A typical result is shown in the figure below.



Recording of time resolved spectra is achieved in the 'Fixed Delay' mode of the PCS-150. The sample point is set to the desired point of the decay function using the parameter 'Initial Delay'. Instead of the sample point the wavelength of the monochromator is scanned during the measurement, thus recording of the fluorescence intensity at the selected time as a function of the wavelength.

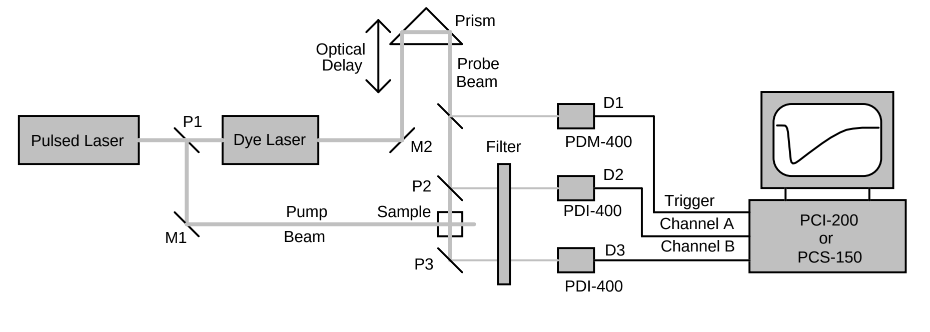
The operation mode 'Block Increment' can be used to obtain the entire wavelength-time dependence of the fluorescence. In this mode the device performs subsequent measurements of the input waveform using the sampling or boxcar method. The curves are stored in different memory blocks. By scanning the wavelength, full information about the fluorescence behaviour of the sample is obtained.

For experiment control (in the present case for driving the monochromator) a step motor control module is available from Becker & Hickl. This module can be used together with the PCS-150 software.

Transient Absorption Measurements

To measure the absorption of molecules in excited states the sample is pumped with a strong laser pulse, and, after a variable delay, the absorption of a second ‘probe’ pulse is measured. The lifetime of the excited state is derived from dependence of the measured absorption on the delay between the pump and the probe pulse.

In the figure below a simple arrangement for transient absorption measurements is shown.



Transient Absorption Measurement

The output of a high power pulsed laser (i.e. N2 laser, excimer laser or frequency multiplied diode laser pumped YAG) is divided into two parts. One part is used to pump the sample, the other part pumps a dye laser which generates a light pulse of the appropriate wavelength to probe the absorption of the excited molecules in the sample. The detector D1 is a fast PDM-400 photodiode module which generates a trigger pulse for the PCI-200 Boxcar Module. The absorption in the sample is measured by the detectors D2 and D3. D1 and D2 are PDI-400 integrating photodiode modules and deliver energy proportional output pulses of some 100ns duration. The amplitudes of these pulses are recorded by the two signal channels of the PCI-200 Boxcar module. The PCI-200 is run in the ‘Fixed Delay’ mode. Thus, it records a curve consisting of subsequent averages over a selectable number of D2 and D3 intensity values. If the optical delay is continuously changed during the measurement and the quotient A/B is displayed the result shows the decay of the absorption of the excited state species in the sample.

Instead of the PCI-200 also the PCS-150 module can be used. However, due to its small gate width the PCS-150 has a higher noise so that the accuracy is lower than with the PCI-150.

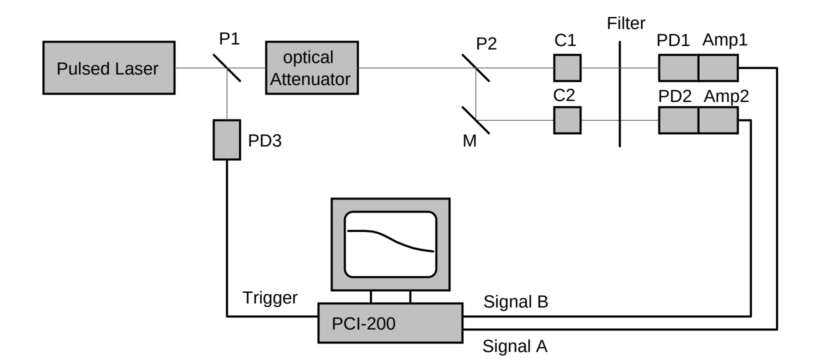
Nonlinear Optical Absorption Measurements

A typical example for the fixed delay mode and the wide gate width of the PCI-200 is given in the next figure. The shown setup is used for the measurement of the intensity-dependence of the light absorption in organic dyes.

A high power pulsed laser (i.e. nitrogen laser or pulsed dye laser) generates short pulses (1ns) with high energy (1mJ). The intensity is controlled by a suitable optical attenuator. The beam is split into two parts by the glass plate P2. The main part of the light is focused into the sample cell C1. The other part is fed through the reference cell C2. Both light signals are fed through a filter to the photodiodes PD1 and PD2. The photodiodes are connected to low noise high input impedance preamplifiers (Amp1, Amp2) delivering energy proportional output pulses of some 100ns duration. Both signals are recorded by the two signal channels of the PCI-200. The trigger pulse for the PCI-200 is generated by the photodiode PD3.

Due to the long duration of the signal pulses, delay lines in the signal path are not necessary. The gate width and the delay of the PCI-200 are set to sample a signal portion near the peak of the input pulses.

The main problem in non-linear optical absorption measurements is, that an absorption accuracy of less than one percent over several orders of magnitude is required. To reach the required absorption accuracy, the shown setup uses a second signal path trough a reference cell and the photodiode PD3. By using a common replaceable filter for both channels the signal intensity can be held inside the useful input voltage range of the PCI-200 without degrading the accuracy of the measured absorption values.



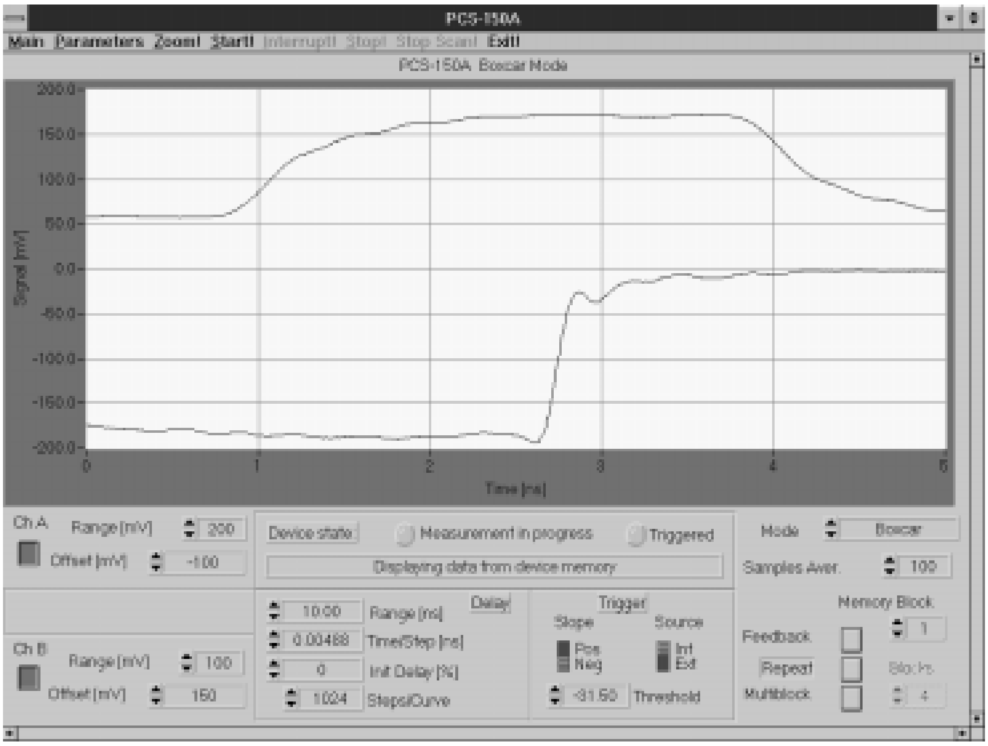
Measurement of non-linear absorption

The measurement delivers pairs of signal values from which the intensity and the ratio of small signal and large signal absorption can be derived. By referring the A value (large signal absorption) to the B value (intensity and small signal absorption) the influence of the laser instability and the error of the optical attenuator do not appear in the measured absorption values. The apparatus is able to measure absorption variations as small as 1 %.

Software

Overview

After starting the PCS/PCI software the main menu shown below appears.



The main window contains the following features:

Menu Bar

Main Parameters Zoom Start Interrupt Stop StopScan Exit

Under these items the following functions are accessible:

Main:	Load, Save, Print, DOS Shell
Parameters:	Display Parameters, Trace Parameters, Adjust Parameters
Zoom:	Evaluation of curves
Start:	Start measurement
Interrupt:	Interrupt measurement, measurement may be re-started
Stop:	Abort measurement
StopScan:	Stop scanning of sample point
Exit:	Exit program

Curve Window

In the curve window the results, the data in the memory or arithmetic combinations of both are displayed. The resulting curves are referred to as 'traces'. Trace definition, trace style and the scaling of the coordinates are determined by the 'Trace Parameters' and the 'Display Parameters'.

Device State

'Device state' informs about the current action of the device. The most important state information are 'Measurement in Progress' and 'Triggered'.

System Parameters

The essential parameters of the measurement are accessible directly from the main menu.

Channel A, B:	Range and offset settings for the two signal channels
Delay:	Range, step width and starting point of the delay, number of curve points
Trigger:	Trigger slope, external or internal trigger, trigger threshold
Measurement:	Operation mode, Number of samples averaged, memory block, repeat/single, number of blocks in the multiblock mode

System Parameters

Channel A, Channel B

Both channels can be switched to an active or inactive state. If you do not use one of the channels, you should switch it off. This increases the maximum trigger rate of the device and consequently reduces the measurement time.

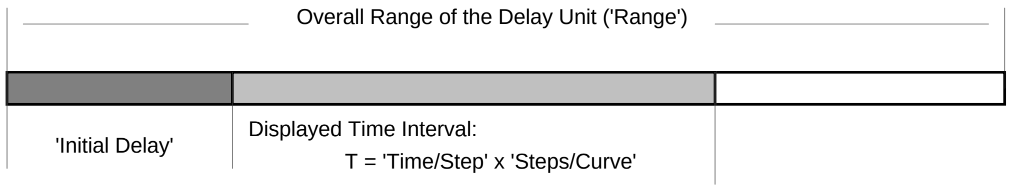
The input voltage range of the channels is selected by the parameter 'Range'. 'Range' acts on the display only, not on the stored data. The data is stored in a format covering the maximum range of -500mV to +500mV. Consequently you need not stop a measurement if the curve exceeds the curve window in one of the smaller ranges, provided the signal remains smaller than 500mV. Since there is only one common ordinate scale for both channels, the scale is set to the greater 'Range' value. To display signals with strongly different amplitudes different trace definitions can be used (see 'Trace Parameters').

The curves can be shifted in Y-direction using the 'Offset' value. 'Offset' can be changed by the keys 'up' and 'down' or by typing in a numerical value.

Delay

Under 'Delay' the settings for the time scale of the measurement are available.

The time scale can be changed in 1-2-5 steps using the keys 'up' and 'down'. In this case also the values of 'Time/Step' and 'Initial Delay' are changed in a reasonable way. However, Range, Time/Step and Initial Delay can also be set separately. The meaning of these parameters is illustrated in the figure below.



Relation between Range, Time / Step and Initial Delay

'Range' is the available overall range of the delay unit. It contains the 'Initial Delay' from the trigger to the first sample and the measured time span resulting from 'Time/Step' and 'Steps/Curve'. The sum of both parts must be smaller than the 'Range' value of the delay unit.

The internal resolution of the delay is 12 bit. Consequently, there are 4096 discrete delay values available inside the 'Range' value. If you type in a particular parameter value it is automatically corrected to the next smaller available value. In order to obtain a high accuracy and a fine graduation it is recommended to chose a 'Range' value as small as possible.

'Steps/Curve' sets the number of points in the recorded curve. This parameter can be set from 64 to 1024.

Trigger

With 'Source' the trigger source is switched to 'external' or 'internal'. At 'external' the trigger signal comes from the trigger input connector, at 'internal' the trigger signal is derived from the signal in channel A.

'Slope' selects the active trigger slope.

The trigger threshold is selected by 'Threshold'. Values from -1V to +1V are available. The value can be selected either by the 'up' and 'down' keys or by typing in a numerical value.

Measurement

Under 'Measurement' measurement control parameters are arranged.

'Mode' is the operation mode. You can chose between 'Sampling', 'Boxcar' and 'Fixed Delay'. The operation modes are described in section 'Operation Modes'.

'Samples Averaged' determines the number of samples which are averaged to yield one point of the result curve.

'Memory Block' is the destination of the measured data in the memory. In the memory space is provided for 128 curves. The memory is divided into 64 blocks that hold the curves of channel A and channel B each. By changing 'Memory Block' measurement data can be directed into 64 different memory blocks.

'Feedback' controls the operation mode of the sampling gate. With 'Feedback' switched off the signal samples are simply the samples delivered by the sampling gate. With 'Feedback' switched on the gate circuit is operated within a control loop. In this mode the gate 'floats' with the signal. This is achieved by regulating the feedback/offset voltage of the gate in a way that the output signal of the gate becomes zero. As a result, the gate does not sample the full input voltage, but only the difference between subsequent samples. This considerably improves the linearity and gain stability of the circuit. In standard applications the 'Feedback' mode often provides a better linearity and a higher amplitude accuracy. However, if the subsequent samples have no correlation (if the signal is lost in noise) or if the correlation between the samples has to be investigated the non-feedback mode yields better results.

'Repeat' selects whether the measurement is repeated or stopped after completion. If the device is used as an oscilloscope 'Repeat' is normally 'on'.

'Multiblock' activates the measurement of a sequence of waveforms. With 'Multiblock' switched on the measurement is repeated automatically, and the data is stored into subsequent memory blocks. The measurement starts with block 1 and ends at a block number selected with 'Blocks'. Data in the used memory block is overwritten.

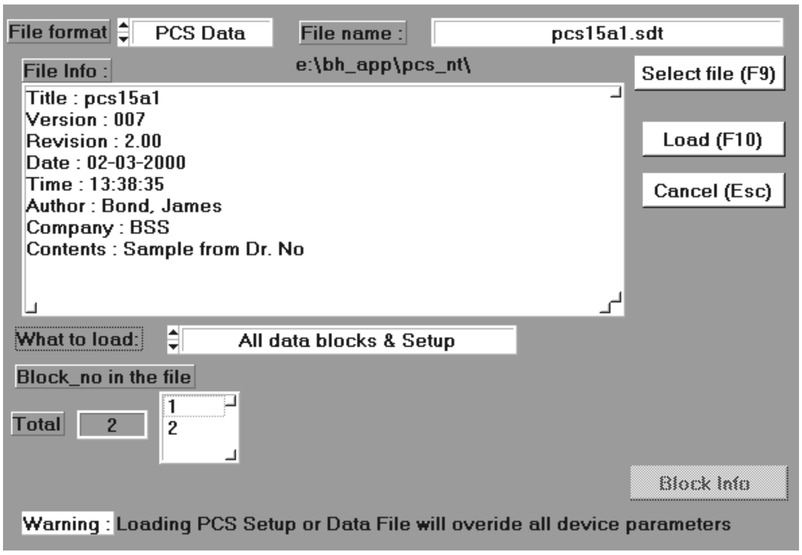
Functions in the Menu Bar

Main

Under 'Main' the functions for loading and saving data and the print functions are available. Printer Selection' selects the type of the printer. With 'DOS Shell' you can change to DOS without leaving the SPC software.

Load (Windows Software)

The 'Load' menu is shown in the figure below.



In the 'Load' menu the following functions are available:

Data and Setup File Formats

You can chose between 'PCS Data' and 'PCS Setup'. The selection refers to different file types.

With 'PCS Data', files are loaded that contain both measurement data and system parameters. Thus the load operation restores the complete system state as it was in the moment of saving.

If you chose 'PCS Setup', files are loaded that contain the system parameters only. The load operation sets the system parameters, but the actual measurement data is not influenced. Files for 'PCS Data' have the extension '.sdt', files for 'PCS Setup' the extension '.set'.

File Name / Select File

The name of the data file to be loaded can be either typed into the 'File Name' field or selected from a list. To select the file from the list, 'Select File' opens a dialog box that displays the available files. These are '.sdt' files or '.set' files depending on the selected file format. Furthermore, in the 'Select File' box you can change to different directories or drives.

File Info, Block Info

After selecting the file an information text is displayed which was typed in when the data was saved. With 'Block Info' information about single data blocks (curves) is displayed. The blocks are selected in the 'Block no in the file' list.

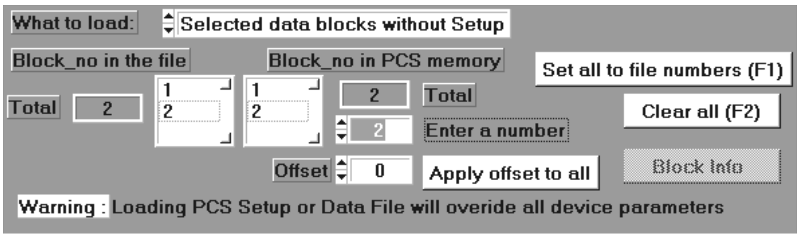
Load, Cancel

Loading of the selected file is initiated by 'Load'. 'Cancel' rejects the loading and closes the 'Load' menu.

Loading selected Parts of a Data File

Under 'What to Load' the options 'All data blocks & setup', 'Selected data blocks without setup' or 'Setup only' are available. The default setting is 'All data blocks & setup', which loads the complete information from a previously saved data file. 'Setup only' loads the setup data only, the measurement data in the memory remains unchanged.

With 'Selected data blocks without setup' a number of selected curves out of a larger .sdt file can be loaded. If this option is used the lower part of the 'Load' menu changes as shown in the figure below.



The list 'Block no in the file' shows the curves available in the file. Under 'Block no in the memory' the destination of the data blocks (curves) in the memory is shown. With 'Set all to file numbers' the destination in the memory can be set to the same block numbers as in the file. To set the destination of the data to locations different from the block numbers in the file, block numbers in the 'Block no in the memory' list can be selected and replaced by block numbers selected from the 'New location' list. 'Clear all' clears the 'Block no in the memory' list.

‘Block Info’ opens a new window which gives information about the data in a selected data block. An example for the block information window is given in the section ‘Trace Parameters’.

When partial information is loaded from a data file care should be taken that 'Operation Mode' and 'Number of Points' be identical with the current setting.

Load (DOS Software)

In the 'Load' menu the following functions are available:

File Format

You can chose between 'PCS Data' and 'PCS Setup'. The selection refers to different file types. With 'PCS Data' files are loaded that contain measurement data and system parameters as well. Thus the complete state is restored as it was in the moment of saving. If you chose 'PCS Setup' files are loaded that contain the system parameters only. The actual measurement data is not influenced. Files for 'PCS Data' have the extension '.sdt', files for 'PCS Setup' the extension '.set'.

File Name

Selecting of 'File Name' opens a menu that displays the available files. These are '.sdt' files or '.set' files depending on the selected file format. The desired file is selected from a list of file names. Furthermore, you can change to different directories or drives.

File Info

After selecting the file an information text is displayed which has been typed in when the data was saved.

Load (F10), Cancel (ESC)

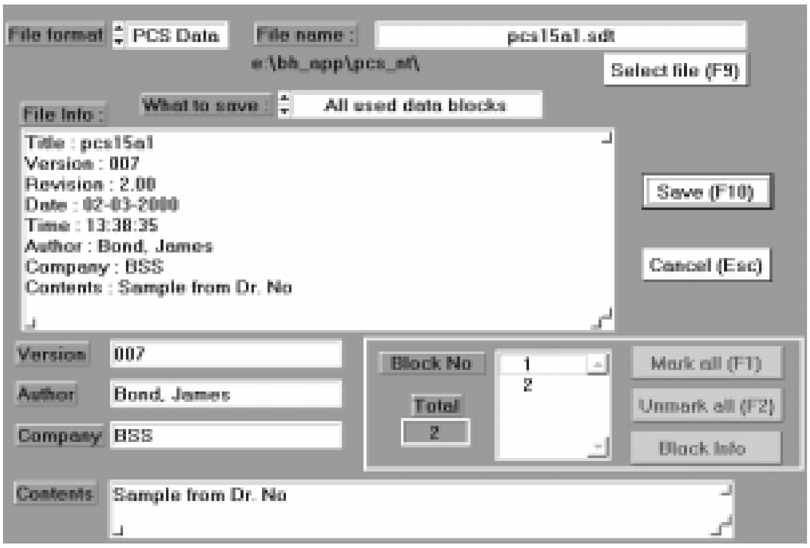
Loading of the selected file is started by 'Load' or F10. 'Cancel' rejects the loading and closes the 'Load' menu.

Loading selected curves

To load selected curves out of a large .sdt file you can select curve numbers from a list that shows the numbers of curves available in the file. The function is used to compare the results of different measurements. Note that no parameter values are loaded in this case.

Save (Windows Software)

The 'Save' menu is shown in the figure below.



In the 'Save' menu the following options are available:

File Format

You can chose between 'PCS Data' and 'PCS Setup'. The selection refers to different file types. With 'PCS Data' files are created which contain measurement data and system parameters as well. Thus the complete state is restored when the file is loaded. If you chose

'PCS Setup' files are created that contain the system parameters only. When loading such files the actual measurement data is not influenced.

Files created by 'PCS Data' have the extension '.sdt', files created by 'PCS Setup' have the extension '.set'.

File Name

The name of the data file to which the data will be saved can be either typed into the 'File Name' field or selected from a list. To select the file from the list, 'Select File' opens a dialog box that displays the available files. These are '.sdt' files or '.set' files depending on the selected file format. Furthermore, in the 'Select File' box you can change to different directories or drives.

File Info

After selecting the file an information text can be typed into the 'File info window'. If you have selected an existing file you may edit the existing file information. When you load the file later on, this text is displayed. This will help to identify the correct file before loading.

Save / Cancel

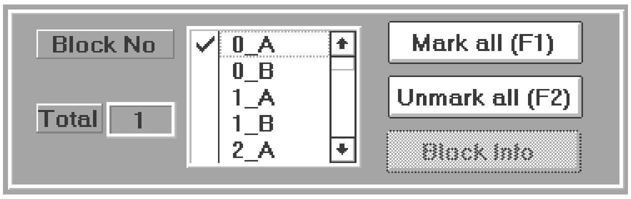
Saving of the selected file is started by 'Save' or F10. 'Cancel' rejects the saving and closes the 'Save' menu.

Saving selected curves

Under 'What to Save' the options 'All used data blocks', 'Only measured data blocks' or 'Selected data blocks' are available. The default setting is 'All used data blocks', which loads all data in the memory. This can be measured data, calculated data or data loaded from another file.

'Only measured data blocks' saves data blocks only which contain data which was measured since the start of the software.

With 'Selected data blocks without setup' a number of selected curves is saved. If this option is used the lower part of the 'Load' menu changes as shown in the figure below.



The list 'Block No' shows the curves which are available in the memory. The desired curves are selected (or deselected) from this list by a mouse click. 'Mark all' selects all curves, 'Unmark all' deselects all curves. 'Block info' displays information about a selected curve.

‘Block Info’ opens a new window which gives information about the data in a selected data block. An example for the block information window is given in the ‘Trace Parameters’ section.

Save (DOS Software)

In the 'Save' menu the following functions are available:

File Format

You can chose between 'PCS Data' and 'PCS Setup'. The selection refers to different file types. With 'PCS Data' files are created that contain measurement data and system parameters as well. Thus the complete state is restored when the file is loaded. If you chose 'PCS Setup' files are created that contain the system parameters only. When loading such files the actual measurement data is not influenced. Files created by 'PCS Data' have the extension '.sdt', files created by 'PCS Setup' have the extension '.set'.

File Name

Selecting of 'File Name' opens a menu that displays the available files. These are '.sdt' files or '.set' files depending on the selected file format. You can select a desired file from a list of existing files or type in a new file name. Furthermore, you can change to different directories or drives.

File Info

After selecting the file an information text may be typed into the 'File info window'. If you have selected an existing file you may edit the existing file information. When you load the file later on this text is displayed. This will help to identify the correct file before loading.

Save (F10), Cancel (ESC)

Saving of the selected file is started by 'Load' or F10. 'Cancel' rejects the saving and closes the 'Load' menu.

Saving selected curves

When saving measurement data in the way described above all 64 curves will be saved in the file. In most cases, however, only a few curves will actually contain data. To save disk space, you can select the curves you want to save from a list. During selection, the number of selected curves is displayed.

Convert (Windows Software)

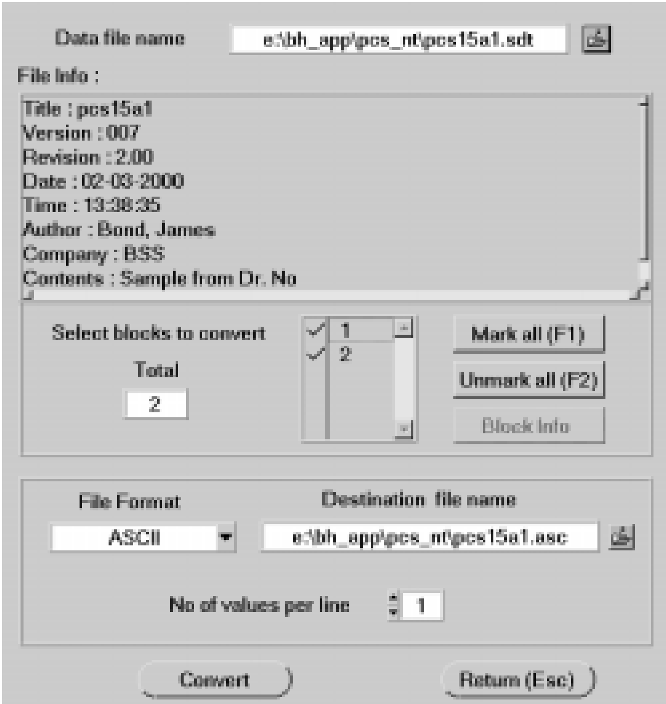
The ‘Convert’ functions are used to convert PCS data files into ASCII data files or into the file format of the Edinburgh Instruments data analysis software. The ‘Convert’ menu is shown in the figure below.

After selecting the source file, the file information is displayed which was typed in when the file was saved by the ‘Save’ function.

By ‘Select blocks to convert’ special blocks (curves) from the source file can be selected for conversion. At the beginning all curves of the source file are marked. Thus, no selection is required if all blocks of the source file are to be converted.

The output file format can be ‘ASCII’, ‘ASCII with Setup’ or ‘EAI-GEM’. ‘ASCII’ converts the measurement data only. ‘ASCII with Setup’ converts the SPC system parameters and the measurement data. For the measurement data part the number of data values per line can be specified. ‘EAI-GEM’ converts into the format of the Edinburgh Instruments data analysis software.

The entering of the destination file name is optional. If no destination file name is entered the source file name is used with the extension .ASC.



Data Conversion to ASCII (DOS Software)

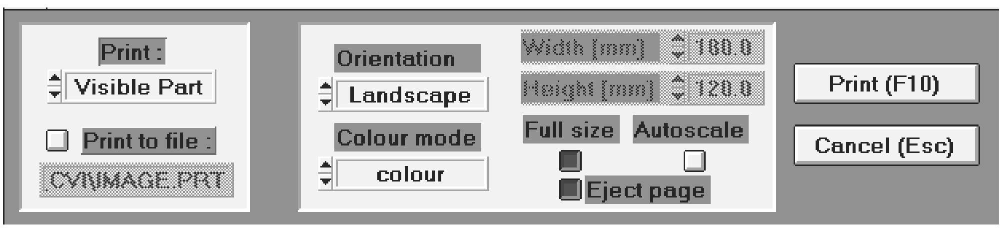
Under DOS SDT data files can be converted to ASCII files by the program SDT2ASC.EXE. This program is executed as follows:

SDT2ASC source file destination file [options]
options: f (from data block) 1...128, default is 1
t (to data block) 1...128, default is 128
c (number of values in each line) 1...16, default is 1

The entering of the destination file name is optional. If no destination file name is entered the source file name is used with the extension .ASC.

Print (Windows Software)

The 'Print' function prints the actual screen pattern on the printer. You can print either the whole panel or the visible part only. 'Portrait' or 'Landscape' selects the orientation on the sheet. The dimensions are set by 'Autoscale', 'Full Size' or 'Size X' and 'Size Y'.



If you want to create a file of a screen pattern you can use the 'Print to File' option. However, another (often more) convenient possibility to save a screen pattern is the 'print screen' key. When this key is pressed, Windows stores the screen pattern to the memory from where it (usually) can be loaded into any other program.

Print (DOS Software)

The 'Print' function prints the actual screen pattern on the printer. You can print either the curve window only ('Graph'), the panel elements only ('Panel') or both ('Screen').

'Portrait' or 'Landscape' selects the orientation on the sheet. The dimensions are set by 'Autoscale', 'Full Size' or 'Size X' and 'Size Y'.

Furthermore, the screen pattern can be stored as a .bmp file or as a HPGL file. BMP files may be used under WINDOWS, HPGL files are used to control a plotter.

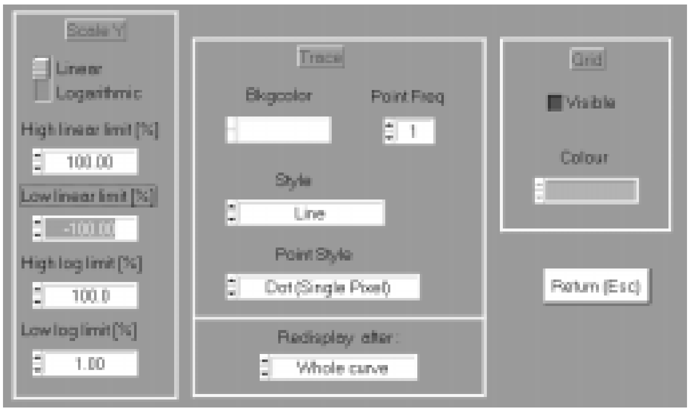
Note: Printing can also be performed by the key 'Shift Print Screen' on the keyboard. To do this, the DOS driver GRAPHICS.COM with the specification of the printer must be loaded (refer to your DOS manual). 'Shift Print Screen' works in all menus.

Parameters

Under 'Parameters' the Display Parameter, Trace Parameter and Adjust Parameter menus are accessible. The display parameters are used for adjusting the curve window and selecting the scales, the trace parameters contain the arithmetic definitions of the displayed curves, and the adjust parameters are used to adjust the module hardware.

Display Parameters

The layout of the curve display is controlled by the display parameters. The display parameter menu is shown in the figure below.



Scale Y

Under 'Scale Y' you can switch between linear or logarithmic display of the curves. Furthermore, the curve window can be set to a fraction of the available input voltage range.

Linear / Logarithmic: Linear or logarithmic Y-scale
High linear limit: Upper limit of the display range at linear scale
Low linear limit: Lower limit of the display range at linear scale
High log limit: Upper limit of the display range at logarithmic scale
Low log limit: Lower limit of the display range at logarithmic scale

All limit values are given in % of the full input voltage range. The range is from -100% to +100% for linear scale and 0.1% to +100% for logarithmic scale.

Redisplay after

Each Curve: No display of intermediate results. The curve appears after the measurement cycle has been completed. 'Each curve' is used for sampling oscilloscope applications.
Each Step: In the sampling mode the current result of the averaging is displayed after the sample point has reached the last point of the curve. You can see how the signal to noise ratio of the recorded curve increases successively. In the boxcar mode the result is displayed when the averaging of the current curve point is complete. So you can see how the waveform of the input signal is written slowly with the final SNR. 'Each Step' is used for the measurement of noisy signals with high values of 'Samples Averaged'.
Each Sample: The averaged result is displayed after each sample. The last value is overwritten. 'Each Sample' is recommended at very low repetition rate only, because the useful sample rate is reduced considerably.

Trace

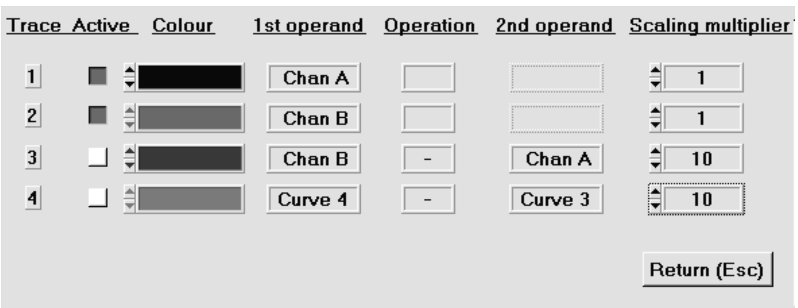
Bkgcolor: Background colour of the curve window.
Style: Display style of the curves. The styles 'Line', 'Points Only' and 'Connected Points' are available.
Point Freq: At values >1 each n-th point is displayed only. 'Point Freq' has no influence if 'Line' is selected.

Grid

Visible: Toggles the grid on and off.
Color: Grid colour.

Trace Parameters

Up to four different curves can be displayed in the curve window. These curves can be the measured waveforms, data from the memory or arithmetic expressions of measured waveforms or stored data. The curves at the screen are referred to as 'traces'. In the trace parameter menu you can define which information the traces should contain and in which colour the are displayed.



With 'active' a particular trace can be switched on or off. To increase the speed of the display we recommend to switch off traces which are not needed.

'Color' sets the colour of the trace.

Under 'Trace Definition' you can define which information should be displayed by the trace. You can display the waveforms that are just measured, curves from the memory or arithmetic combinations of both.

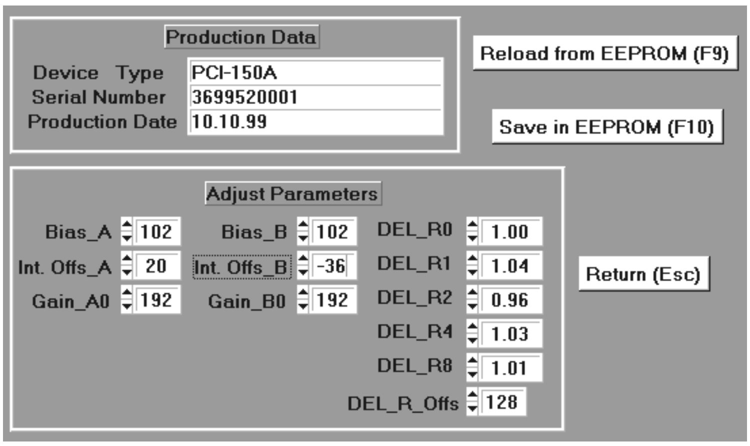
To define a trace you can chose two operands and one operation. The operands can be the measured waveforms, their inversions or curves from the memory (A, -A, B, -B, curve). As operation +, -, *, /, or 'none' is available. (In the latter case there is no second operand.) If you chose a curve from the memory as an operand it is required to define a curve number. The curves are related to the 64 memory blocks as follows:

	Signal A	Signal B
Block 1	Curve 1	Curve 2
Block 2	Curve 3	Curve 4
Block 3	Curve 5	Curve 6
.		. .
Block 64	Curve 127	Curve 128

Please note that the trace definitions act on the display only, not on the data stored in the memory.

Adjust Parameters

Most of the required hardware adjustments in the PCS-150 and PCI-200 are done by the software. The adjust values are accessible via the adjust parameters menu. The adjust values are not stored in a file, but in an EEPROM on the PCS-150 or PCI-200 module. To change the adjust parameters a certain knowledge about the PCS-150 / PCI-200 hardware is required. Wrong inputs may seriously deadjust the module. Therefore you can change the adjust parameters, but not save them into the EEPROM. The changed adjust values are used by the device, but they will be replaced by the original values after restarting the PCS / PCI software.



Production Parameters

This area contains essential information about the particular module. They are used by the software to recognise different module versions. Please do not change these parameters.

Adjust Values

Bias A, Bias B: PCS-150: Bias of the sampling diodes in the gates of the two channels. Increasing the value decreases the gate width, gain factor and linearity. Decreasing the values increases the gate width and improves the linearity. If the bias is too low the gate diodes are opened by higher signal amplitudes causing drastic distortion of the recorded waveforms. PCI-200: Quiescent current in the gate circuit. Increasing improves the linearity but also the noise.

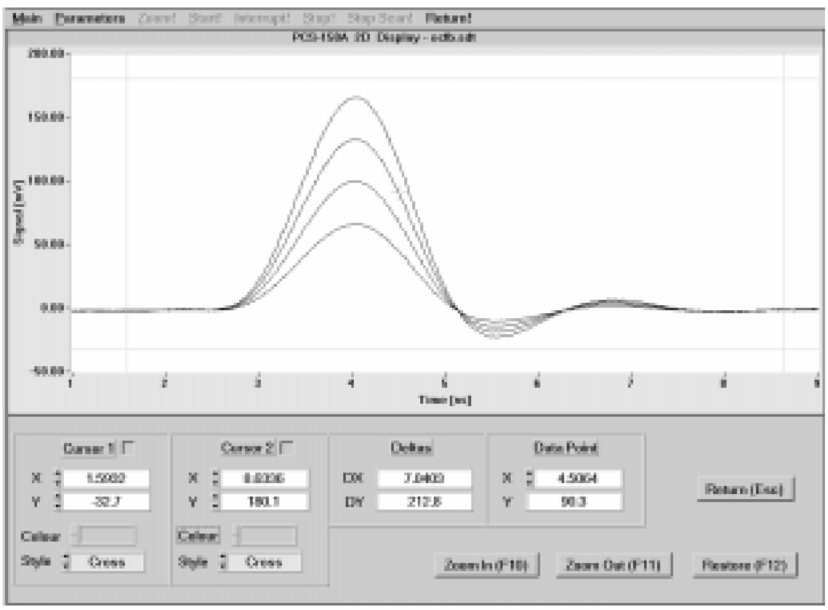
Gain A, Gain B: Gain factor of the sampling channels. Gain is adjusted to achieve approximately the same signal amplitude in the feedback and in the non feedback mode.

Int. Offset A, B: Used for compensating the internal offset of the sampling channels.

Range 0..4: Correction factor for the delay setting in the different ranges of the delay unit:
Range0: for delay from 10ns to <40ns
Range1: for delay from 40ns to <160ns
Range2: for delay from 160ns to <640ns
Range3: for delay from 640ns to <2560ns
Range4: delay >2560ns

Zoom: Evaluation of Curves

'Zoom' incorporates functions for inspection and evaluation of the measured data. Under 'Zoom' the traces defined in the 'Trace Parameters' are displayed. Two cursor lines are available to select curve points and to display the data values numerically. The scale can be changed in both axis by zooming the area inside the cursor lines. The display style (linear/logarithmic, window limits, curve style, background and grid colours) is set in the display parameters. From 'Zoom' the 'Display Parameters', the 'Trace Parameters' and the print function can be accessed directly. The 'zoom' window is shown in the figure below.



Cursors

The two cursors are used to select and measure curve points and to set the range for zooming the displayed data.

With 'Style' you can select whether a cursor is a horizontal line, a vertical line or a cross of a vertical and a horizontal line. For each cursor the X-Position (vertical cursor), the Y-Position (horizontal cursor) or both (crossed line cursor) are displayed. Under 'Deltas' the differences between the cursor values are displayed. The colours of the cursors are set by 'Colors'.

The cursors can be moved with the mouse or with the keyboard. If the keyboard is used, the cursor is selected with 'page up' and 'page down' and shifted with the cursor keys. By pressing the cursor keys together with the 'shift' key a fine stepping is achieved.

Data Point

In addition to the cursors, the 'Data Point' can be used to measure data values. The data point is a small cross which can be shifted across the screen by the mouse. When the mouse key is released, the data point drops to the next true data value of the next trace. At the same time X and Y values are displayed.

Zoom Function

'Zoom in' magnifies the area inside the two cursors to the whole curve window width. If the cursors are vertical lines the magnification occurs in X-direction. If the cursors are horizontal the scale is magnified in Y-direction. For crossed line cursors zooming is done in both directions thus stretching the rectangle between the cursor to the full curve window.

'Zoom Out' restores the state before the last zoom in action. This includes not only the zoom state but also the other display parameters as 'linear' or 'logarithmic'.

'Restore' restores the state as it had been when entering the 'Zoom' function.

Start, Interrupt, Stop, StopScan

'Start' starts the measurement in the selected operation mode. 'Interrupt' will interrupt a running measurement. This can be used to make adjustments in the experimental setup. After selecting 'Start' the measurement will proceed starting from the interrupted state.

'Stop' aborts a running measurement. After stopping the results are displayed as they where present in the moment of stopping. If you want to stop a measurement that runs in the 'repeat' mode and save the data at the end of the current cycle we recommend to switch off 'repeat' rather than using 'stop'.

'StopScan' stops the delay scanning. The function can be used at low repetition rates to hold the sample point at a desired point of the waveform to adjust the external measurement setup.

Exit

The PCS-150 / PCI-200 software is left by 'Exit'. When the program is left, the system parameters are saved in the file 'auto.set'. This file is automatically loaded at the next program start. Therefore the system comes up in the same state as it was left before. If you do not want to save the last settings you can reject saving by switching off the 'save data on exit' knob.

Technical Support

We are pleased to support you in all problems concerning the measurement of fast electrical or optical signals. This includes the installation of the PCS-150 / PCI-200 module, its application to your measurement problem, the technical environment and physical problems related to short time measurement techniques. Simply call us. You will help not only yourself. Also for us the contact to our customers is essential to improve our products.

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