



Przedsiębiorstwo Badawczo-Produkcyjne

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Description of OPCARD – 01/100

Single Channel PCI-bus Ultrasonic PR Card Ultrasonic card with integrated pulser and receiver

OPCARD -01/100 is a complete ultrasonic testing device, suitable for all ultrasonic measurements, and due to many additional inputs and outputs and internal processor, it can be used as a controller for more complicated devices.

The card can work together with following devices:

- 32 channel multiplexer – the card can control it directly;
- Scanner – it has input for incremental encoders;

The card has an implemented one channel pulser & receiver and can be used with one transducer or with two (one is sending and the second receiving).

OPCARD -01/100 is a short PCI card and can be installed in a standard PC.



Technical data

1- software controlled

A/D converter:

- Resolution: 8 bits
- Sampling frequency: 12.5,25,50 or 100MHz¹

Analog parameters:

- Input amplifier gain: -20dB - 76dB¹
- Input attenuator: off or -20dB¹
- Sensitivity: 0.1 mV- 1Vpp / Div
- Bandwidth: 0.5 MHz - 25 MHz (-3dB)
- Input impedance: 50 Ohm, 10pF
- Filter switchable: .5 - 6MHz¹, .5 - 10MHz¹, .5 - 15MHz¹, .5 - 25MHz¹,
1 - 6MHz¹, 1 - 10MHz¹, 1 - 15MHz¹, 1 - 25MHz¹,
2 - 6MHz¹, 2 - 10MHz¹, 2 - 15MHz¹, 2 - 25MHz¹,
4 - 6MHz¹, 4 - 10MHz¹, 4 - 15MHz¹, 4 - 25MHz¹

Pulser:

- Pulse Voltage: from off (0V) to 360V
(positive pulse, short circuit step pulser)
- Fall Time: <= 20 ns
- Pulse Duration: short circuit, bandwidth up to about 50MHz
- Output impedance: < 1 Ohm

Delay time:

Post trigger 256us, measurement accuracy better than 1ns

Data buffer:

256, 512, 1k, 2k,4k,8k,16k,32k, 64k, 128k samples¹

DAC (TGC) with arbitrary waveform generator¹:

- Resolution of time step: 20 ns
- Resolution: 8 bit
- Max. Gain changing: 48dB pro step

Counters / Input for incremental encoder:

- 2 channel, 16-bit

Trigger

- Internal trigger rate: Software
- External trigger rate: TTL Signal
- Multiplexer control: Software
- Trigger output signal: TTL Signal

Additional inputs:

- 2 x digital line: TTL Signal

Output:

- 5 x digital line: TTL Signal

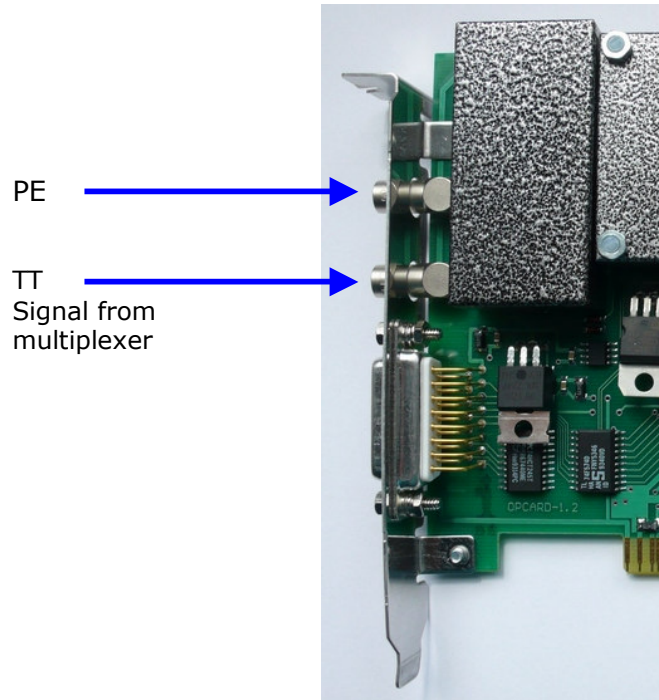
Data bus:

PCI (short card)

Transfer:

Bus Mastering DMA data transfer

Signals on the external connectors



LEMO:

- PE - Measured input signal (sending/ receiving);
- TT - Measured input signal (receiving);

DB15:

- Pin1, 9 - TTL encoder input signals
- Pin2, 10 - TTL general input signals
- Pin4 - TTL trigger out signal
- Pin5, 6, 7, 12, 13 - multiplexer channels control lines
- Pin8 - +12V
- Pin15 - -12V
- Pin14 - GND

Caution:

Upper Lemo connector is connected with the pulser. The maximum voltage of the pulse on this connector can reach about 360 Volts. Due to the short duration it is not dangerous to the human, but can destroy electronic circuits or transducers if not used carefully.

Signal from Multiplexer must be connect to the TT connector.

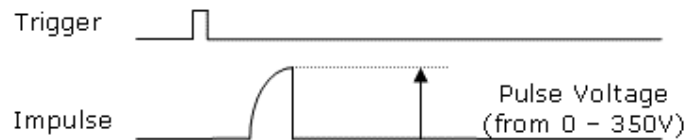
Characteristic of the card:

One of the most important features of the card is a precise synchronization between the transmitter trigger signal postTrigger and the moment when the sampling of the input signal starts.

This time (postTrigger) is software programmable in the range of 0 – 255us with a resolution of 1us and has stability within the range of 1ns. It is particularly important in

the case of scanning devices, since it allows to achieve a very small time skew between different positions (channels). 1ns would correspond to a clock frequency of 1GHz which is much higher than the actual frequency used.

Characteristic of the pulser on board:



Pulser circuit waveforms: The rising edge of the Trigger signal (described as Trigger) initiates the transducer charging process which takes about 3 μ s. After this time a transistor switch which discharges the transducer is turned on (discharge time is about 20ns, but it can be longer, if the capacitance of the transducer is too large; the limit is reached, if the transducer is made from the standard ceramics, is 0.1 mm thick and has 8 mm diameter).

Because of the very low output impedance of the device (<1 Ohm) and short discharge time the pulse generated with this device could be concerned as a real pulse answer for the most transducers. Transducers with a parallel matching inductance should not be used, since they do not allow the transducer to be pre-charged (the inductance causes a short-circuit).

Multiplexer OPCOM-01 (32,16,8 or 4 channels)

OPCOM-01/100 is particularly well suited for ultrasonic measurements as well as other kinds of measurements which need many channels. Together with the card OPCARD and ultrasonic probes it could be used as complete ultrasonic testing device. Each channel has separate pulser & receiver.



Picture 1. OPCOM-01/8 channels

Additional caution:

For OPCOM-01/4 channels: channel 1 has address 8 and 16
channel 2 has address 9 and 17
channel 3 has address 10 and 18
channel 4 has address 11 and 19

For OPCOM-01/8 channels: channel 1 has address 8 and 16
channel 2 has address 9 and 17
channel 3 has address 10 and 18
channel 4 has address 11 and 19
channel 5 has address 12 and 20
channel 6 has address 13 and 21
channel 7 has address 14 and 22
channel 8 has address 15 and 23

Technical data

Channels: 32, 16, 8, or 4
Pulse amplitude range: 50-360V¹
Max cable length between computer and the box: 30m

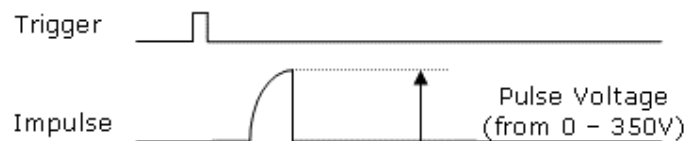
Connectors**BNC:**

Transducers Trigger input
Signal output

DB15:

Control signals/Power supply

1 - software selected

Features and Specifications

Pulser circuit waveforms: The rising edge of the Trig In signal initiates the transducer charging process which takes about 3 μ s. After this time a transistor switch which discharges the transducer is turned on (discharge time is about 20ns, but it can be longer, if the capacitance of the transducer is too large; the limit is reached, if the transducer is made from the standard ceramics, is 0.1 mm thick and has 8 mm diameter). Because of the very low output impedance of the device (<1 Ohm) and short discharge time the pulse generated with this device could be concerned as a real pulse answer for the most transducers

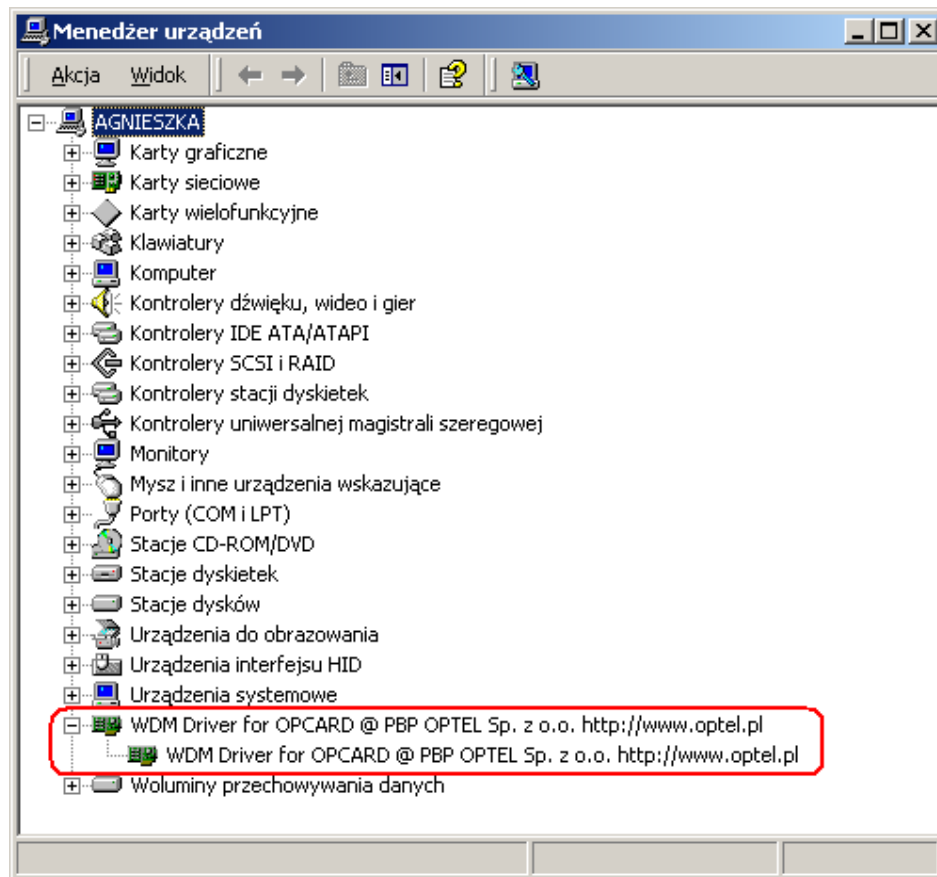
Software Package

The software (for Windows 95,98/NT 4.0/2000/XP) includes all necessary functions for ultrasonic measurements.

Software Package – how to install and use the software, delivered with the OPCARD

1. Please put the card into appropriate PCI slot.
2. BIOS of the PC should watch the card with following data: Vendor ID 88BB, Device ID 0000 and Class "docking station".
3. The card is Plug-and-Play, Windows should be able to detect OPCARD as "docking station", and the Add New Hardware Wizard should open automatically as soon as you start the system. Follow the onscreen instructions for the wizard. When you are prompted to select a driver for this device, browse to the DRIVER folder and select the INF file **siwdm.inf**
4. After restart of system you are to install software in directory "<drive>:\OPCARD" running "setup.exe" from CDROM\INSTALL directory.

OPCARD Card is plug-and-play compatible with Windows 98 and beyond (our recommend Windows 2000 or XP)



Control Panel -> Hardware Manager.

Standard packed software includes:

Driver:

siwdm.inf
siwdm.sys

Libraries:

samplib.h
samplib.dll
samplib.lib

Description of control function OPCARD

List of functions includes on **samplib.dll**

Sample_ReleaseBaddr
 Sample_SetTimeout
 Sample_GetAddr
 Sample_InitMeas
 Sample_GetData
 Sample_SendTGCArray
 Sample_InitTGC
 Sample_Set20dB
 Sample_SetDepth
 Sample_SetDelay
 Sample_SetFreqTGC
 Sample_SetFreq
 Sample_SetPulser
 Sample_SetSource
 Sample_SetFiltr
 Sample_SetChannel
 Sample_SetCounterA
 Sample_SetCounterB
 Sample_SetCounterAActive
 Sample_SetCounterBActive
 Sample_SetTrigger
 Sample_SetSampleTGC
 Sample_SetSingleGain

Basic control functions

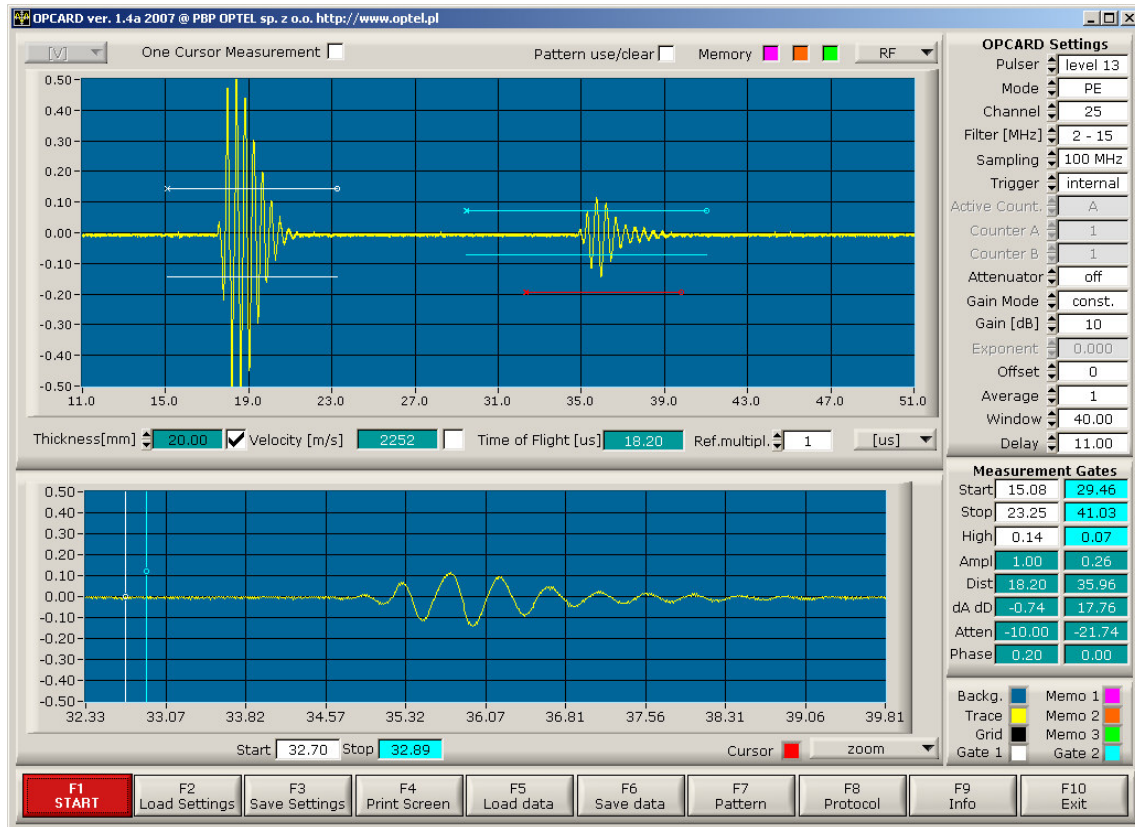
Function	Description
Sample_ReleaseBaddr	Get virtual address for OPCARD
Sample_SetTimeout	Set Timeout for DMA channel
Sample_GetAddr	Get physical address for DMA channel
Sample_InitMeas	Initialize measurement
Sample_GetData	Get Sample
Sample_SendTGCArray	Send TCG Curve
Sample_InitTGC	Initialize TCG curve length
Sample_Set20dB	Set attenuator feature
Sample_SetDepth	Set length of buffer
Sample_SetDelay	Set post trigger
Sample_SetFreqTGC	Set TCG curve frequency sampling
Sample_SetFreq	Set sampling frequency
Sample_SetPulser	Set amplitude of pulser
Sample_SetSource	Choose TT or PE mode
Sample_SetFiltr	Set Filter feature
Sample_SetChannel	Set Multiplexer Channel
Sample_SetCounterA	Set divider for external trigger channel A
Sample_SetCounterB	Set divider for external trigger channel B
Sample_SetCounterAActive	Set active external trigger channel A
Sample_SetCounterBActive	Set active external trigger channel B
Sample_SetTrigger	Set Trigger Mode
Sample_SetSampleTGC	Set TCG curve length of buffer
Sample_SetSingleGain	Set constant gain

DLL Command	Parameter
Long Sample_ReleaseBaddr(long board);	Parameter: <ul style="list-style-type: none"> board - slot number of the opcard board slot (0) Return: 0 if success
long WINAPI Sample_SetTimeout(long board, unsigned long time)	Parameter: <ul style="list-style-type: none"> board - slot number of the opcard board slot (0) time – timeout from 1 to 10000; for 0 timeout disable Return: 0 if success
long WINAPI Sample_GetAddr(long board, unsigned long *dirAddr[])	Parameter: <ul style="list-style-type: none"> board - slot number of the opcard board slot (0) pointer for address array Return: 0 if success
long WINAPI Sample_InitMeas (long board)	Parameter: <ul style="list-style-type: none"> board - slot number of the opcard board slot (0) Return: 0 if success
long WINAPI Sample_GetData (long board, unsigned long count, unsigned long *data)	Parameter: <ul style="list-style-type: none"> board - slot number of the opcard board slot (0) count – buffer counter pointer to array of sample Return: 0 if success
long WINAPI Sample_SendTGCArray (long board, unsigned long count, unsigned long filtr, unsigned long *data)	Parameter: <ul style="list-style-type: none"> board - slot number of the opcard board slot (0) count – buffer counter pointer to array of sample Return: 0 if success
long WINAPI Sample_InitTGC (long board)	Parameter: <ul style="list-style-type: none"> board - slot number of the opcard board slot (0) Return: 0 if success
long WINAPI Sample_Set20dB (long board, unsigned long setpreamp)	Parameter: <ul style="list-style-type: none"> board - slot number of the opcard board slot (0) setpreamp – 0 for OFF 1 for –20dB Return: 0 if success
long WINAPI Sample_SetDepth(long board, unsigned long depth)	Parameter: <ul style="list-style-type: none"> board - slot number of the opcard board slot (0) depth – 0 for 256 1 for 512 2 for 1k 3 for 2k 4 for 4k

	<p>5 for 8k 6 for 16k 7 for 32k 8 for 64k 9 for 128k</p> <p>Return: 0 if success</p>
long WINAPI Sample_SetDelay(long board, unsigned long hdelay)	<p>Parameter:</p> <ul style="list-style-type: none"> board - slot number of the opcard board slot (0) hdelay - 0 to 255 (us) <p>Return: 0 if success</p>
long WINAPI Sample_SetFreqTGC(long board, unsigned long freqtgc)	<p>Parameter:</p> <ul style="list-style-type: none"> board - slot number of the opcard board slot (0) freqtgc - 0 for 50MHz 1 for 25MHz 2 for 12.5MHz 3 for 6.25MHz <p>Return: 0 if success</p>
long WINAPI Sample_SetFreq(long board, unsigned long freq)	<p>Parameter:</p> <ul style="list-style-type: none"> board - slot number of the opcard board slot (0) freq - 0 for 100MHz 1 for 50MHz 2 for 25MHz 3 for 12.5MHz <p>Return: 0 if success</p>
long WINAPI Sample_SetPulser(long board, unsigned long vpulser)	<p>Parameter:</p> <ul style="list-style-type: none"> board - slot number of the opcard board slot (0) vpulser - 0 to 15 <p>Return: 0 if success</p>
long WINAPI Sample_SetSource(long board, unsigned long source)	<p>Parameter:</p> <ul style="list-style-type: none"> board - slot number of the opcard board slot (0) source - 1 - PE mode 2 - TT mode <p>Return: 0 if success</p>
long WINAPI Sample_SetFiltr(long board, unsigned long filtr)	<p>Parameter:</p> <ul style="list-style-type: none"> board - slot number of the opcard board slot (0) filtr - 0 to 15 <p>Return: 0 if success</p>
long WINAPI Sample_SetChannel(long board, unsigned long channel)	<p>Parameter:</p> <ul style="list-style-type: none"> board - slot number of the opcard board slot (0) channel - 1 to 32 <p>Return: 0 if success</p>
long WINAPI Sample_SetCounterA(long board, unsigned long counterA)	<p>Parameter:</p> <ul style="list-style-type: none"> board - slot number of the opcard

	<ul style="list-style-type: none"> board slot (0) counterA - 0 to 255 <p>Return: 0 if success</p>
long WINAPI Sample_SetCounterB(long board, unsigned long counterB)	<p>Parameter:</p> <ul style="list-style-type: none"> board - slot number of the opcard board slot (0) counterB - 0 to 255 <p>Return: 0 if success</p>
long WINAPI Sample_SetCounterAActive(long board)	<p>Parameter:</p> <ul style="list-style-type: none"> board - slot number of the opcard board slot (0) <p>Return: 0 if success</p>
long WINAPI Sample_SetCounterBActive(long board)	<p>Parameter:</p> <ul style="list-style-type: none"> board - slot number of the opcard board slot (0) <p>Return: 0 if success</p>
long WINAPI Sample_SetTrigger(long board, unsigned long trigger)	<p>Parameter:</p> <ul style="list-style-type: none"> board - slot number of the opcard board slot (0) trigger - 0- internal 1 - external <p>Return: 0 if success</p>
long WINAPI Sample_SetSampleTGC(long board, unsigned long divtgc)	<p>Parameter:</p> <ul style="list-style-type: none"> board - slot number of the opcard board slot (0) divtgc - 0 for 128 1 for 256 2 for 512k 3 for 1k 4 for 2k 5 for 4k 6 for 8k 7 for 16k 8 for 32k 9 for 64k <p>Return: 0 if success</p>
long WINAPI Sample_SetSingleGain(long board, unsigned long filtr, unsigned long singleg);	<p>Parameter:</p> <ul style="list-style-type: none"> board - slot number of the opcard board slot (0) filtr - 0 to 15 singleg form -20 to 76 <p>Return: 0 if success</p>

Standard software



Main panel

Overview of Hotkey Selection:

Hotkey	Function
F1 STOP/START	enables / disables selected acquisition mode – start /stop measurement
F2 Load Settings	Load the configuration/settings file
F3 Save Settings	Saving the configuration/settings file
F4 Print Screen	This option will create a hardcopy of the screen into graphics mode compatible printers. The printout will include everything currently on the screen.
F5 Load data	Load in a previously saved data/measurement file and restore the capture settings as they were when the data was saved
F6 Save data	Saving the current measurement/data and current configuration/settings to the file
F7 Pattern	
F8 Protocol	
F9 Info	Short information about the OPTEL Sp. z o.o
F10 Exit	Exit

Settings on the main panel

OPCARD Settings	
Pulser	level 13
Mode	PE
Channel	25
Filter [MHz]	2 - 15
Sampling	100 MHz
Trigger	internal
Active Count.	A
Counter A	1
Counter B	1
Attenuator	off
Gain Mode	const.
Gain [dB]	10
Exponent	0.000
Offset	0
Average	1
Window	40.00
Delay	11.00

Function

Pulser Ampl - Set impulse voltage from off to 360V range in 13 levels

Mode - PE – Measured input signal (sending/receiving); TT – Measured input signal (receiving)

Channel - This function allows choosing the channel, if multiplexer is used.

Filtr [MHz] – Set bandwidth pass filter: 0.5 - 6MHz, 0.5 - 10MHz, 0.5 - 15MHz, 0.5 - 25MHz, 1 - 6MHz, 1 - 10MHz, 1 - 15MHz, 1 - 25MHz, 2 - 6MHz, 2 - 10MHz, 2 - 15MHz, 2 - 25MHz, 4 - 6MHz, 4 - 10MHz, 4 - 15MHz, 4 - 25MHz;

Sampling – Set sampling frequency: 100MHz, 50MHz, 25MHz or 12.5MHz

Trigger – Set Trigger Mode – internal/ext. Internal – software trigger

Active Count.

A - Counter for Inc. Encoder Channel 1

B - Counter for Inc. Encoder Channel 2

Counter A - Set divider for counter for incremental encoder – for encoder channel 1

Counter B - Set divider for counter for incremental encoder – for encoder channel 2

Attenuator – Set attenuator; off / -20dB

GainMode - Set gain mode (switching between DAC and constant gain and freehand DAC)

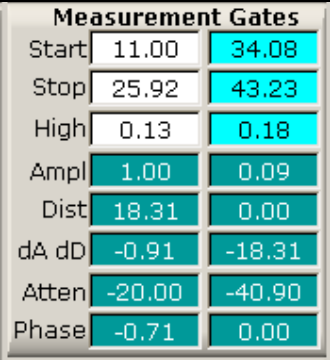
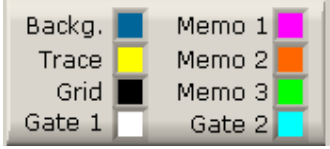
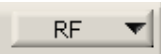

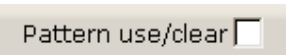

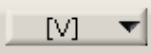
Gain [dB] – Set constant gain / amplification from -29 to +67[dB]

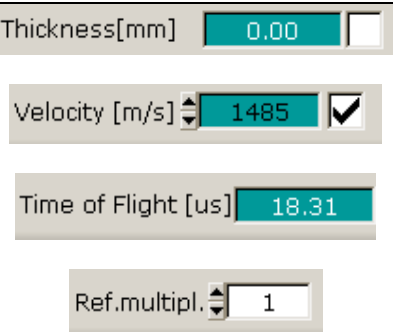
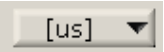
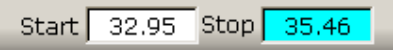

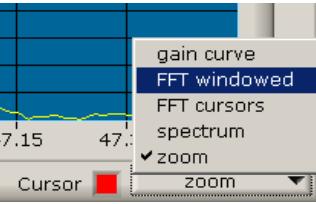
Exponent – Set DAC curve using exponential function

Offset - Allows to set the voltage offset

Average - This function allows to average the signal (using the mean worth of many measurements). Averaging of 2, 4, 8, 16 and 32 signals is possible.

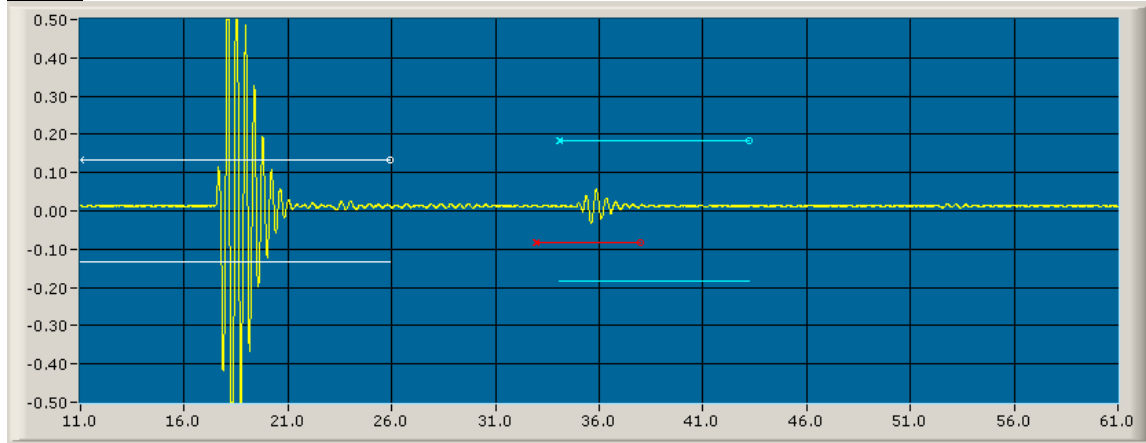
Window – Set the length of the

	<p>measurement window/memory</p> <p>Delay - The time distance between the pulse (trigger) and the beginning of the window, that is visible on the screen can be set</p>																											
 <table border="1" data-bbox="350 359 678 716"> <thead> <tr> <th colspan="3">Measurement Gates</th> </tr> </thead> <tbody> <tr> <td>Start</td> <td>11.00</td> <td>34.08</td> </tr> <tr> <td>Stop</td> <td>25.92</td> <td>43.23</td> </tr> <tr> <td>High</td> <td>0.13</td> <td>0.18</td> </tr> <tr> <td>Ampl</td> <td>1.00</td> <td>0.09</td> </tr> <tr> <td>Dist</td> <td>18.31</td> <td>0.00</td> </tr> <tr> <td>dA dD</td> <td>-0.91</td> <td>-18.31</td> </tr> <tr> <td>Atten</td> <td>-20.00</td> <td>-40.90</td> </tr> <tr> <td>Phase</td> <td>-0.71</td> <td>0.00</td> </tr> </tbody> </table>	Measurement Gates			Start	11.00	34.08	Stop	25.92	43.23	High	0.13	0.18	Ampl	1.00	0.09	Dist	18.31	0.00	dA dD	-0.91	-18.31	Atten	-20.00	-40.90	Phase	-0.71	0.00	<p>Measurement Gates</p> <p>Using cursors it is possible to set two measurement gates in which different functions can be performed.</p> <p>In the part of the main screen, visible here the positions of this gates and the maximum amplitude, attenuation, phase of signal is shown.</p> <p>Control change the background color depending of color of the measurement gate.</p>
Measurement Gates																												
Start	11.00	34.08																										
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Backg.		Memo 1																										
Trace		Memo 2																										
Grid		Memo 3																										
Gate 1		Gate 2																										
On the top of main panel																												
	<p>Choose between RF Signal and Detector (absolute, Positive and Negative) display in upper window.</p>																											
	<p>The software allows storing a signal and showing it (for reference purposes) on the display. Three such memories are available. Click on the square in the upper right area of the window causes, that the signal actually shown is shown on the main window in a frozen form in the color of the memory square</p>																											
	<p>Special function for measuring thickness, sound velocity i.e. when transducer is with delay lines. Please see below Sample 1.</p>																											
	<p>If the square is selected, then only default-white measurement gate are working and the velocity measurement is calculate from the trigger to the signal between the gate limits.</p>																											
	<p>Choose units axis Y between [dB], [%], [V]</p>																											

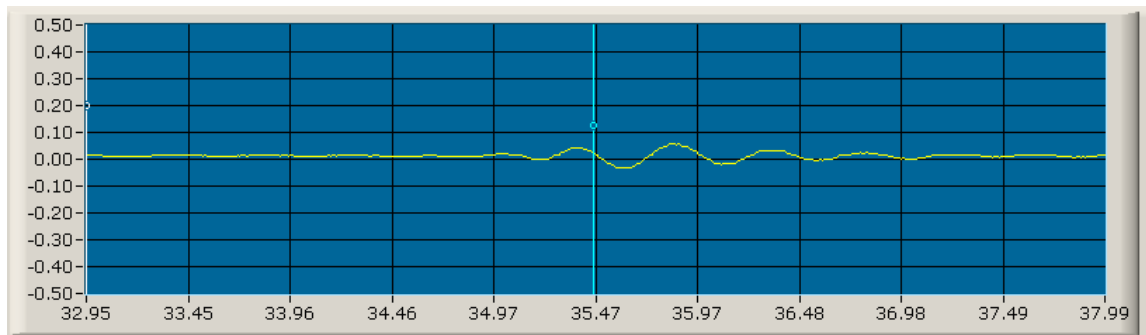
In the middle of main panel	
	<p>Measuring thickness, sound velocity and time of flight</p> <p>This function works on following basis: the user chooses, which signals should be used for thickness and/or velocity measurement (for example the reflection from first and second wall of a sample with parallel walls) This allows to use this software with almost any kind of samples, containments etc. For people using this software it is necessary to have some knowledge about such kind of measurements and physics of ultrasounds.</p> <p>The next step is to choose (toggle button "V"), if thickness or sound velocity should be measured. Than it is necessary to mark, which value should be used as constant. The remaining value will be calculated.</p> <p>The information from the window Ref. Multipl. (Reflection multiplication) is used for this calculation – it informs the software between how many reflections the gates are set.</p> <p>Time of flight shows the time of the signal in the first gate.</p> <p>If the square <input type="checkbox"/> One Cursor Measurement is selected, then only default- white measurement gate are working and the velocity measurement is calculate from the trigger to the signal between the gate limits.</p>
On the bottom of main panel	
	<p>Choose units axis X between [us], [sample], [mm]</p>
	<p>On the bottom window are two measurement (depending on setting units axis X cursors showing: frequency / time / distance)</p>
	<p>Cursor - Using the control it is possible to set personal color of the third cursor on the upper window.</p> <p>Bottom window can be used to show many different results. Its modes can be selected by click on the beam, placed on it right bottom side.</p> 

Bottom window features

zoom



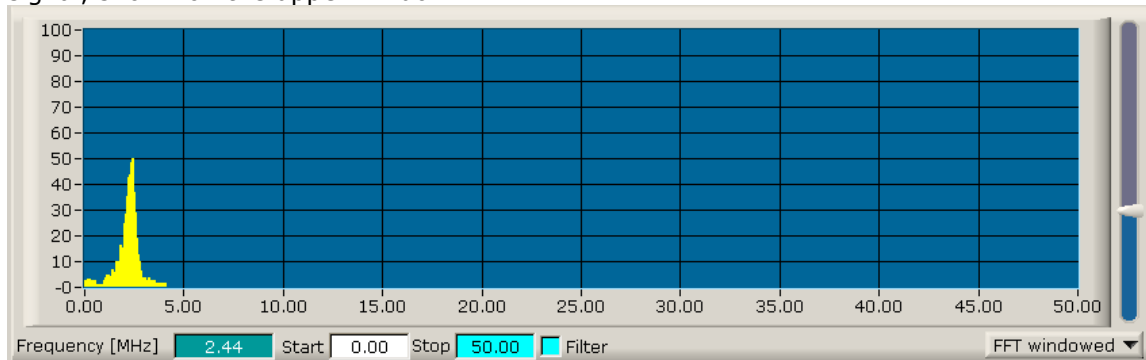
Upper window – yellow trace of the measurement signal – with two measurement gates (white and blue) and the third red cursor for the zoom with is displayed on the bottom window.



Bottom window – with zoom of the measurement signal choosing by red cursor on the upper window

FFT windowed

This function shows the real part of the FFT (with Hamming window applied) of the whole signal, shown on the upper window:



Additional features are available:

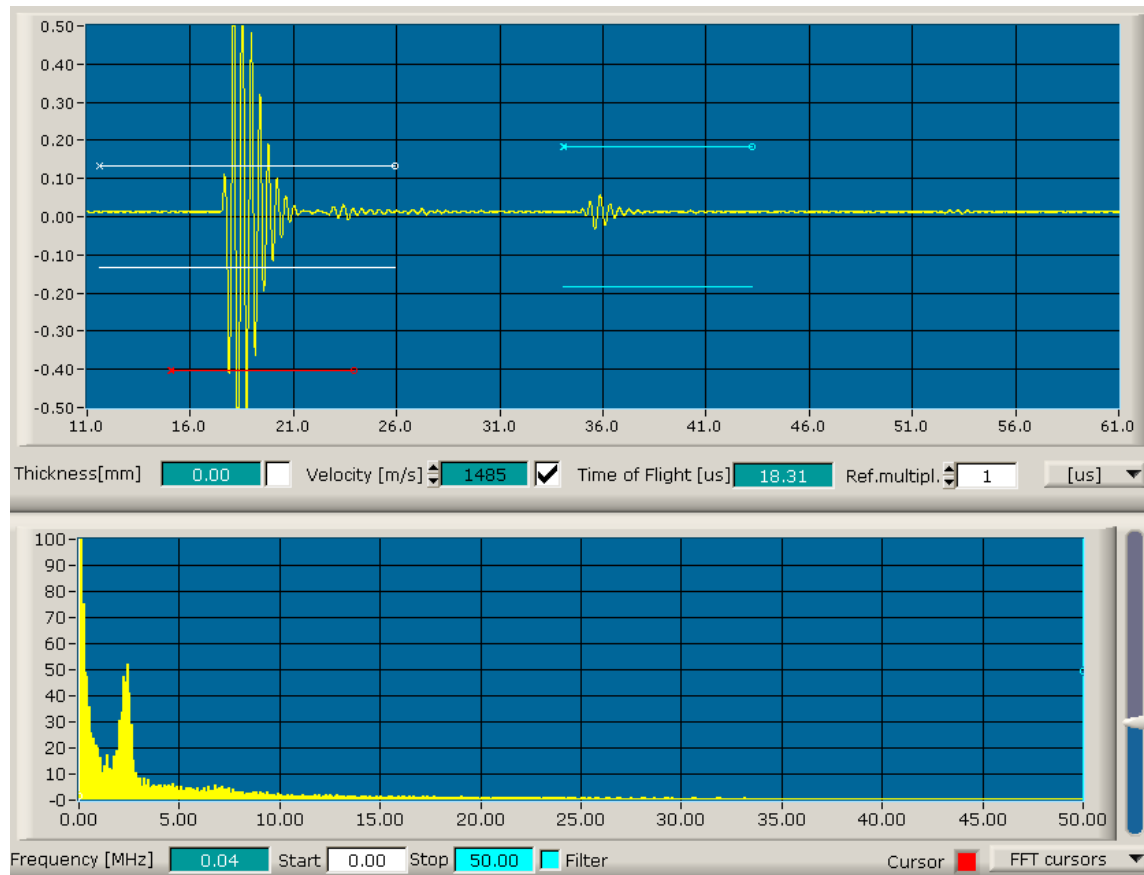
Frequency [MHz] 2.44 - Domain frequency is shown.

Filter – Software/digital bandwidth filter can be used. Bandwidth is set by cursors. Default - white cursor is for low frequency limit and default – the blue cursor is for high frequency limit. If the square “filter” is selected, a digital bandwidth pass filter is applied to the measured signal.

Ring slide – for adjustment the axis Y ratio.

FFT cursors

This function shows the real part of the FFT (with Hamming window applied) of the signal, shown on the upper window in the region, embraced by the gate, that appears on the upper window in this mode (red on the above picture).



Additional features are available:

Frequency [MHz] - Domain frequency is shown.

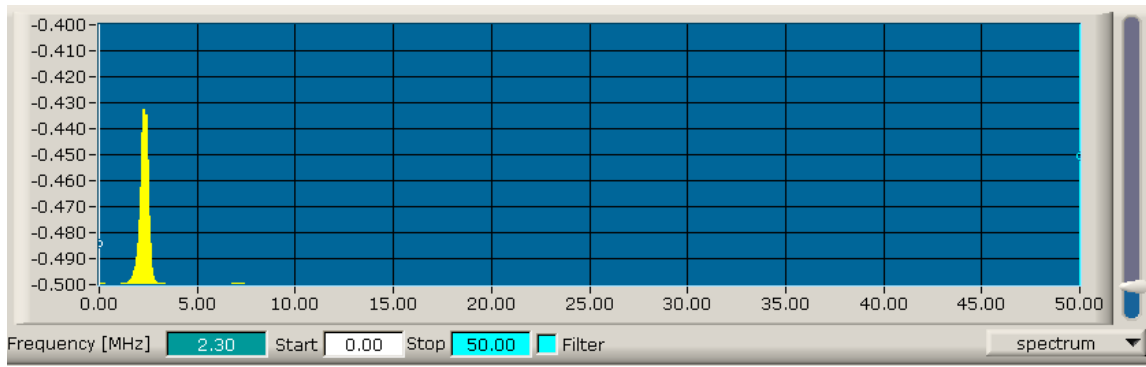
Filter – Software/digital bandwidth filter can be used. Bandwidth is set by cursors. Default - white cursor is for low frequency limit and default – the blue cursor is for high frequency limit. If the square “filter” is selected, a digital bandwidth pass filter is applied to the measured signal.

Ring slide – for adjustment the axis Y ratio.

FFT power spectrum

It shows power spectrum of FFT of the signal from upper window, calculated with following formula:

$$\text{Power Spectrum} = [\text{FFT}\{X\}]^{**2}/n^{**2}$$



Additional features are available:

Frequency [MHz] - Domain frequency is shown.

Filter – Software/digital bandwidth pass filter can be use. Bandwidth is set by cursors. Default - white cursor is for low frequency limit and default – the blue cursor is for high frequency limit. If the square “filter” is selected, a digital bandwidth pass filter is applied to the measured signal.

Ring slide – for adjustment the axis Y ratio.

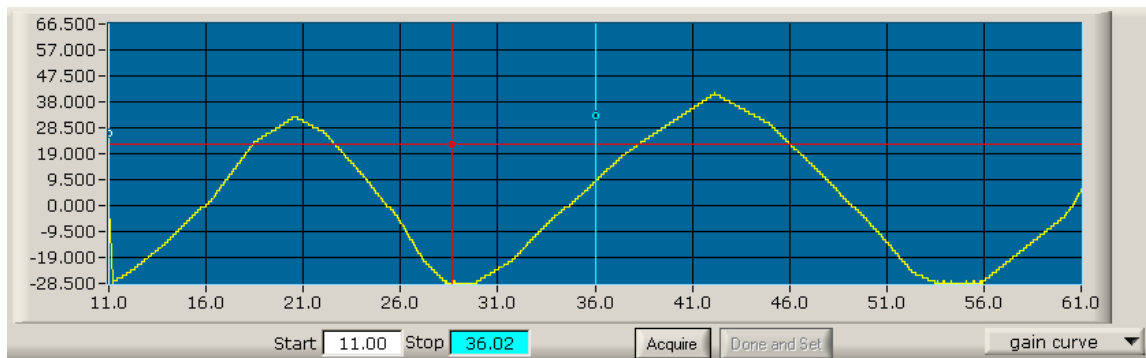
Amplification of the received signal and gain curve (TGC function)

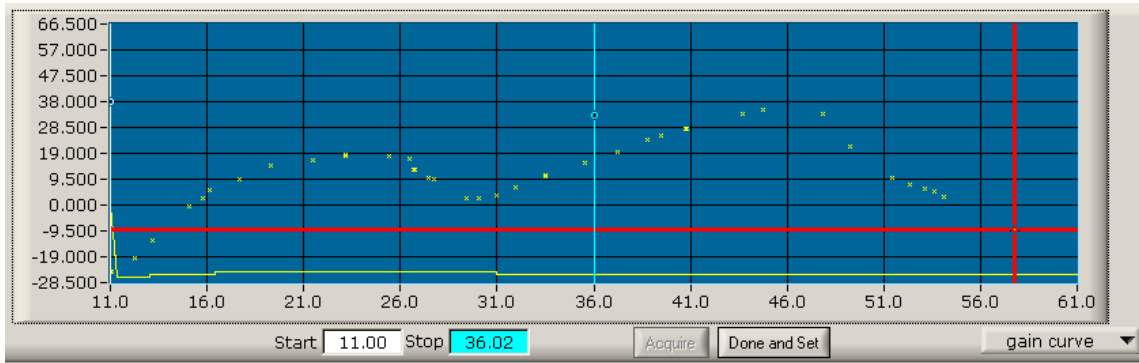
The OPCARD has not only a simple amplifier, but a special function, allowing amplifying the signal depending on the time, passed from the start (trigger). This function is called *time-gain compensation* (TGC).

OPCARD allows setting the curve, which controls the amplifier during measurement using arbitrary waveform generator. Upper window allows controlling it, if it is used in gain curve mode. Additionally it is necessary to set (upper right part of the screen) the gain mode. It is possible to select following modes:

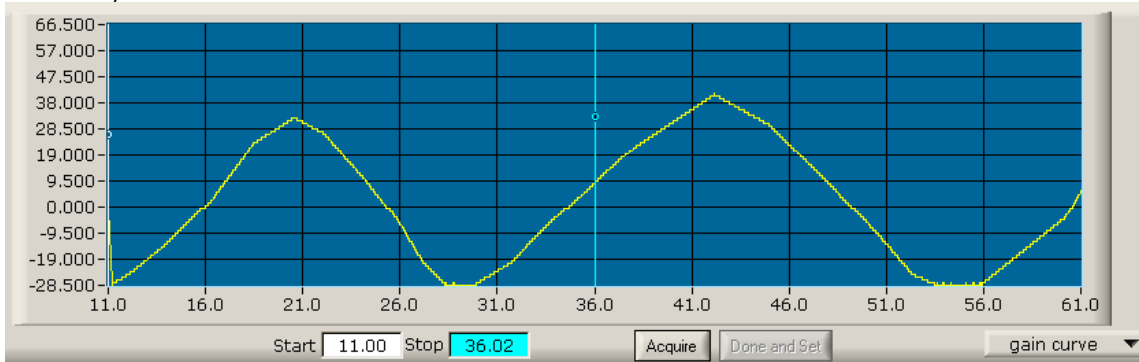
1. **Constant:** Gain is not changed during the time.
2. **Curve:** gain is changing exponentially. It will compensate for exponential signal decay (typical for sound signals) by amplifying the signal by an exponential factor that depends on elapsed time. Exponent is defined by the exponent setting.
3. **Free hand:** Amplification depends on the curve, that can be freely drawn using the upper window:

Red cursor cross in the upper window allows drawing the curve in the way that is wished by the user – after click on button: Acquire





To draw the curve, the user must click on **Acquire**, after the curve is ready on **Done and Set**, and the transfer of the curve to the card is fulfilled with set.



Protocol

F8 Protocol

No.	Channel	ToFl	Velocity	Thickness	Time1	Vmax1	Time2	Vmax2	Att1	Phase1	Att2	Phase2
1	1	18.31	1485.0	0.0	18.31	1.0	11.0	0.086275	-20.0	-0.721728	-41.28235	0.0
2	1	18.31	1485.0	0.0	18.31	1.0	11.0	0.090196	-20.0	-0.724317	-40.896247	0.0
3	1	18.31	1485.0	0.0	18.31	1.0	11.0	0.086275	-20.0	-0.721728	-41.28235	0.0
4	1	18.31	1485.0	0.0	18.31	1.0	11.0	0.090196	-20.0	-0.724317	-40.896247	0.0
5	1	18.31	1485.0	0.0	18.31	1.0	11.0	0.090196	-20.0	-0.724317	-40.896247	0.0
6	1	18.31	1485.0	0.0	18.31	1.0	11.0	0.090196	-20.0	-0.724317	-40.896247	0.0

Pattern: 0 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00

Header {4 lines of text - new line [CTRL+ENTER]}

Measurement Protocol

To file:

- wave
- measured results
- FFT/Spectrum

[F1]- Periodical Measurement ● ● Remaining Time: 0:00:13

Interval: 1 seconds Remaining Meas: 13

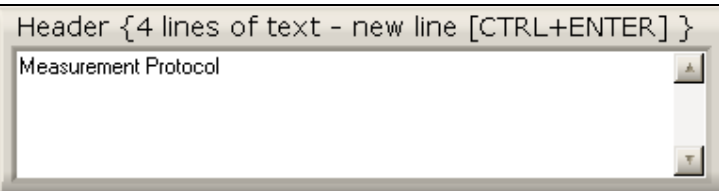
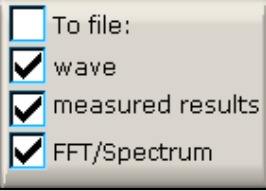

Cycle length: 13 seconds No. of Meas.: 13

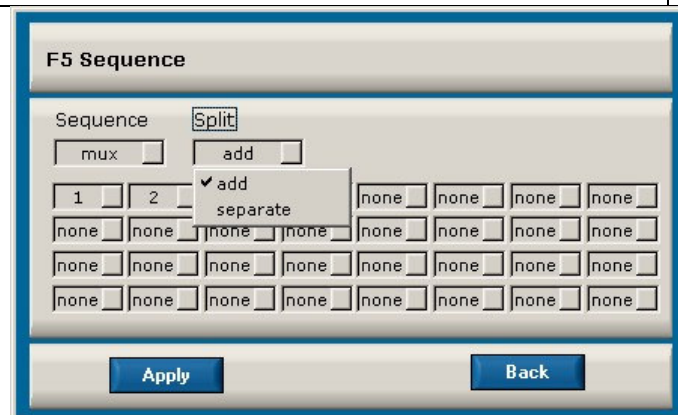
F1 Run Periodical F2 Run F3 F4 F5 Sequence F6 Save *.csv F7 F8 Reset F9 F10 Back

Protocol Panel – under F8 Protocol on Main Panel

Overview of Hotkey Selection:

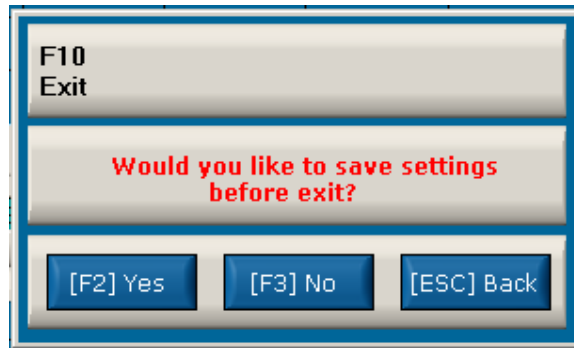
Hotkey	Function
F1 Run Periodical	Periodical Measurement with adjusted interval and cycle length
F2 Run	Standard measurement with speed what fast computer can
F5 Sequence	It is also possible to decide, if the information from different channels should be added (to produce for example one spectrum information from many channels) or treated as a sequence (each channel is separated).
F6 Save *.csv	Save as csv - Saving all results to the file cvs
F8 Reset	Clear all measurement results
F10 Back	Back to the main panel

Settings on the protocol panel	Function
<p>It is possible to store the results as the whole measurements (the whole wave information - raw data) or as measurement results (thickness, wave velocity) or as FFT</p>	
	Additional comments can be added to the csv file.
	Choose what kind of result must be saved to the files.
	Settings for Periodical measurement. Interval between measuring. Length of the measurement cycle.



F5 Sequence panel

Exit from the OPCARD software:



When the OPCARD software is to be closed last panel is displayed. If the settings should be saved then OPCARD software will start with this settings.

EXAMPLE OF MEASUREMENTS WITH THE OPCARD

For better understanding we have prepared an example, showing the use of OPCARD. Especially with the goal to explain such functions as: One cursor measurement, pattern use.

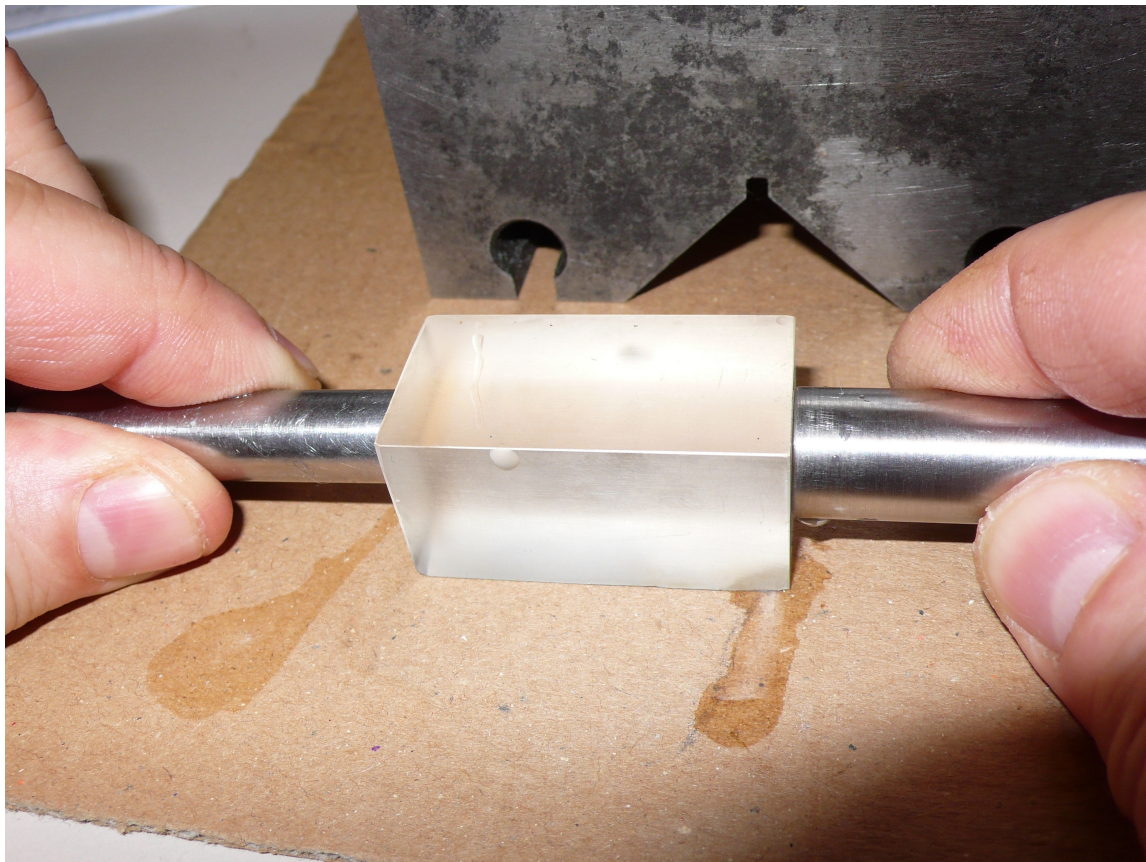


Fig.1 Measurement of a piece of polystyrol, ca. 39 mm length.

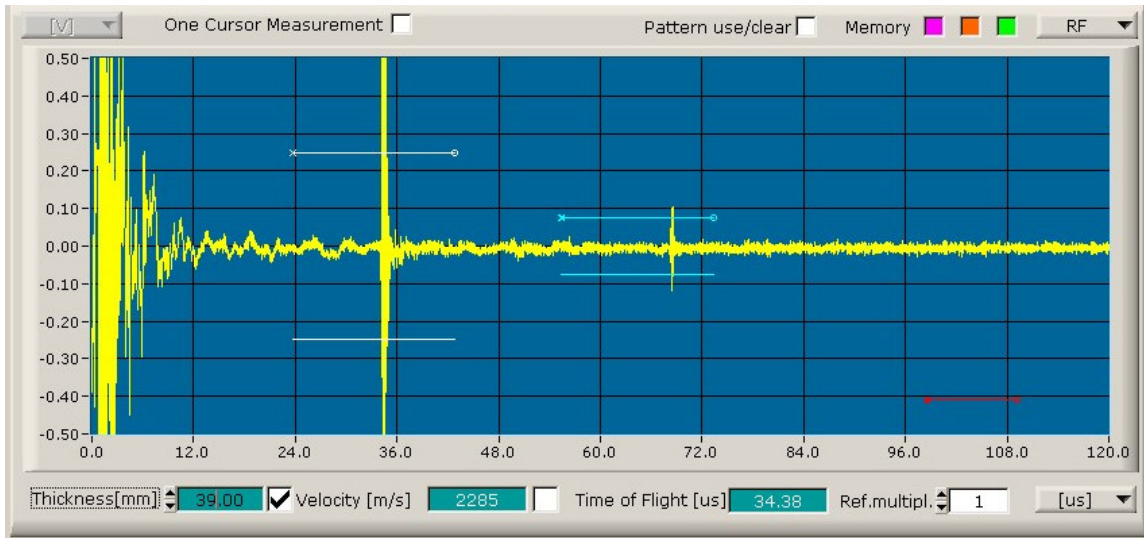


Fig.2 Measurement of parameters: time of flight, sound speed, distance, using pulse echo (PE) method.

First such parameters as window, delay, gain – depending on the measured object must be set and naturally the mode (PE). Now we must set the gates so, that the signal reflected from the wall is inside (first and the second reflection) – as shown on the picture 2. In the field “thickness” the correct thickness must be given. The sound speed in the measured material is shown in the field “Velocity”.

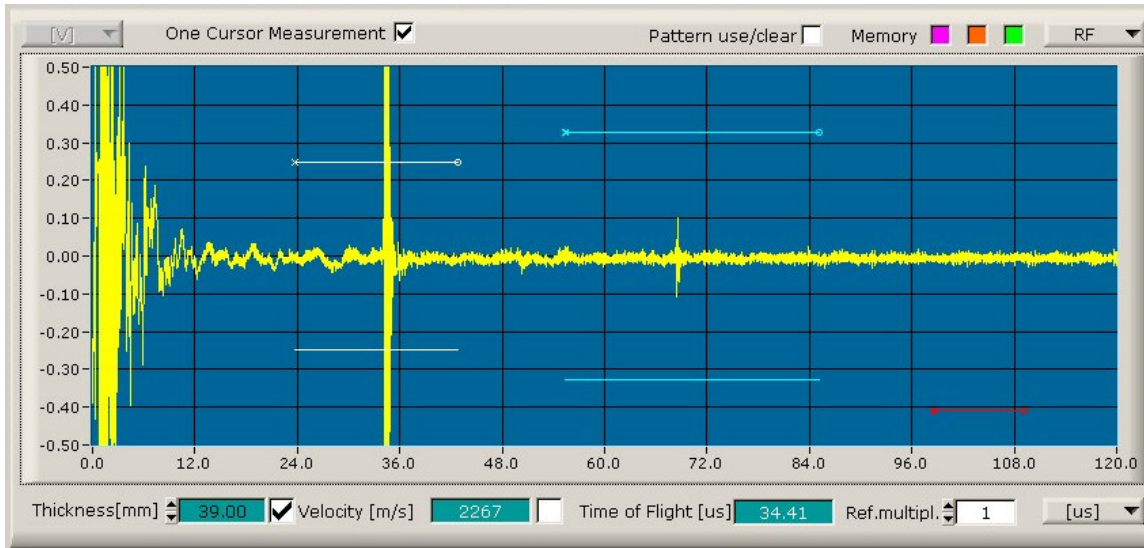


Fig.3 Measurement of parameters: time of flight, sound speed, distance, using PE method and one cursor

First such parameters as window, delay, gain – depending on the measured object must be set and naturally the mode (PE) and the function One Cursor Measurement. Now we must set the white gate(as on the Fig. 3 (Gate1 – white) on the signal reflected from the sample wall. Thickness must be set correctly. The result of the sound speed measurement is visible in the field Velocity. The measurement with one cursor is not so exact as with two, because it includes hardware delay (in electronics and transducer used).

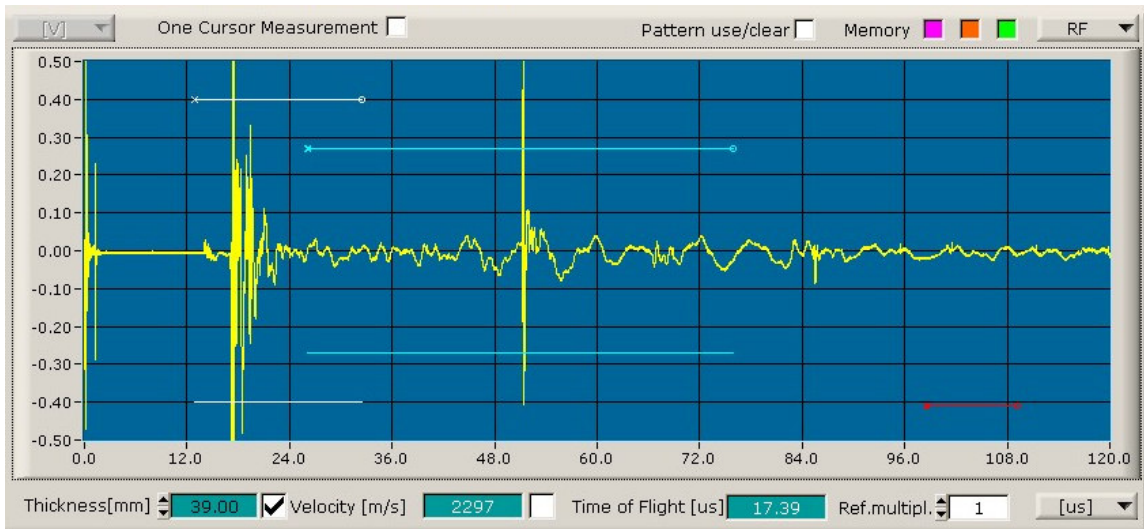


Fig.4 Measurement of parameters: time of flight, sound speed, distance, using TT method

First such parameters as window, delay, gain – depending on the measured object must be set and naturally the mode (TT). Now we must set the gates so, that the signal transmitted and reflected from the wall is inside (first and the second reflection) – as shown on the picture 4. In the field “thickness” the correct thickness must be given. The sound speed in the measured material is shown in the field “Velocity”.

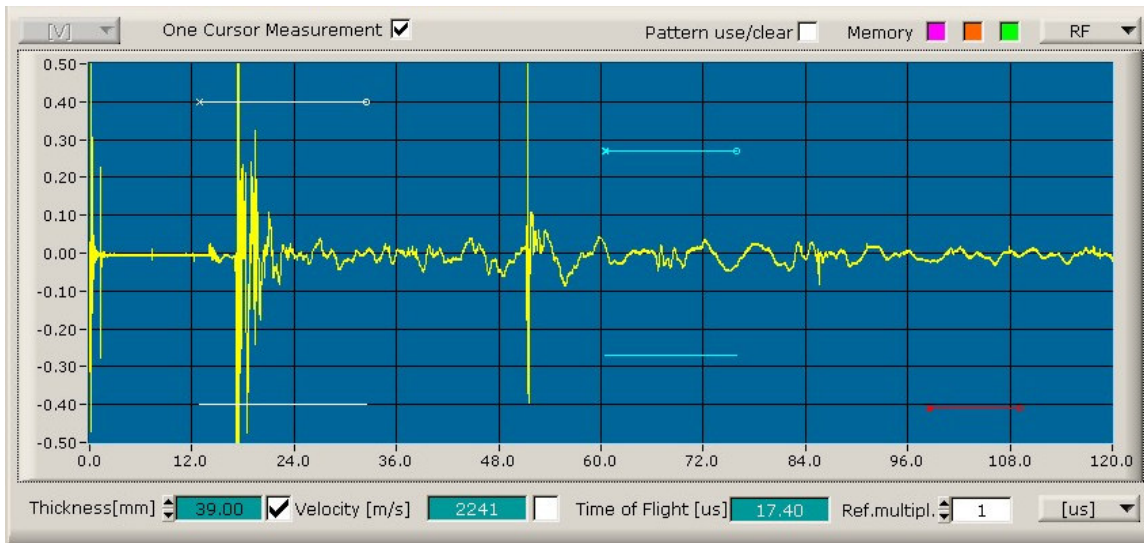


Fig.5 Measurement of parameters: time of flight, sound speed, distance, using TT method and one cursor.

First such parameters as window, delay, gain – depending on the measured object must be set and naturally the mode (TT). Now (as on the fig. 5) we must set the white gate so, that the signal transmitted through the object is inside. In the field “thickness” the correct thickness must be given. The sound speed in the measured material is shown in the field “Velocity”.

The measurement with one cursor is not so exact as with two, because it includes hardware delay (in electronics and transducer used).

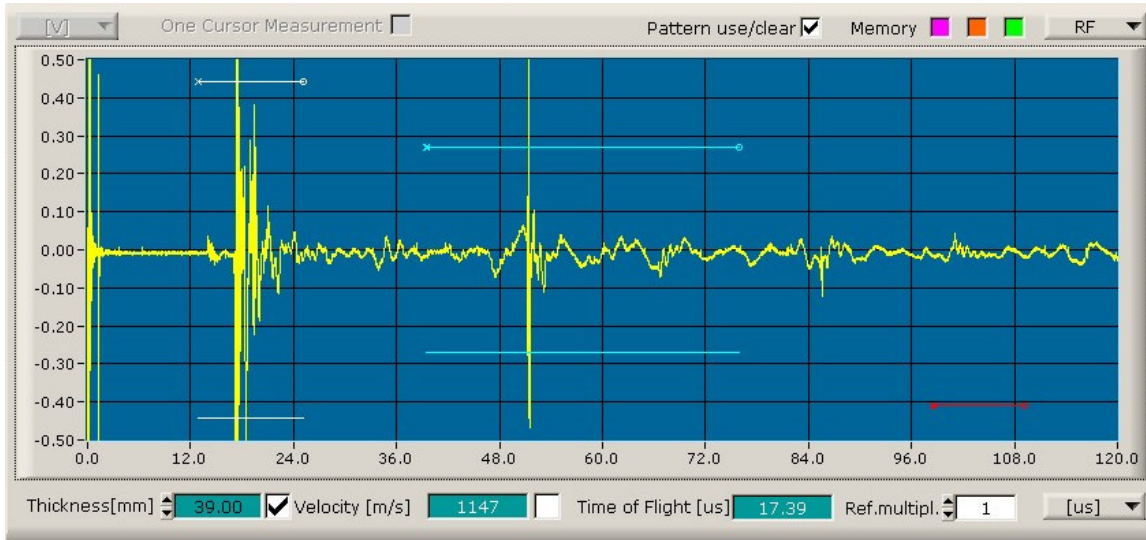


Fig. 6 Measurement with delay lines.

This is possible with the function "pattern". It allows to exclude automatically the transmission time through the delay line from the calculations. For this purpose it is first necessary to measure time of flight through the delay line. Then the measured signal should be stored as pattern. This is done with pressing F7. Now the gate should be set so, that the signal from the measured object is inside. This function can be used both in TT and PE mode.

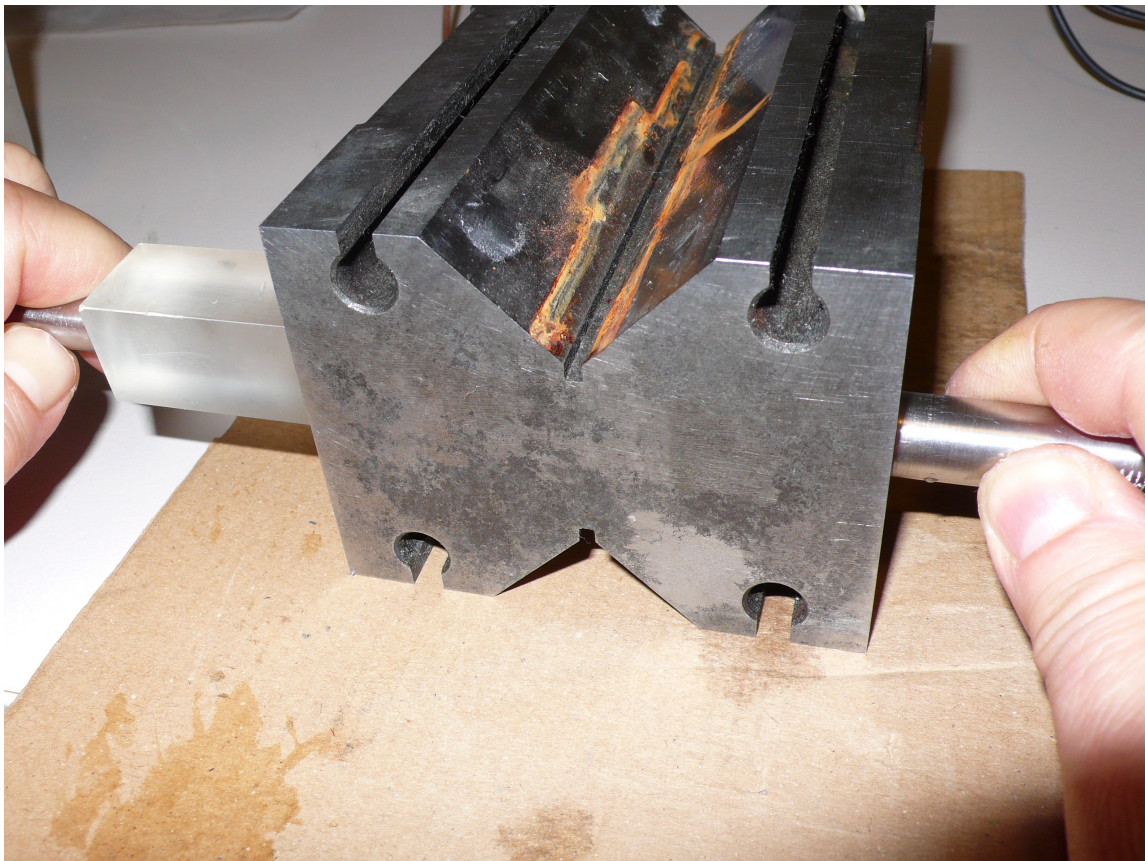


Fig. 7. Measurement of an object with delay line.

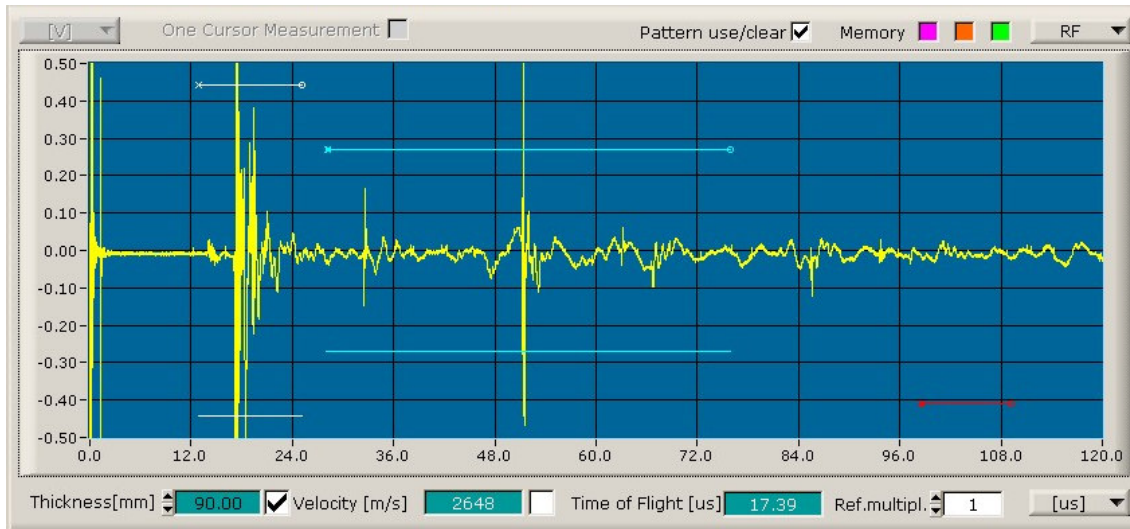


Fig. 8 Signal measured for the object as shown on the Fig. 7. Please note, that the signal coming from the object is between the signals coming from the delay line (transmission and first reflection). Gates shown here are not giving correct results. It is necessary to set the gate as on the fig. 9.

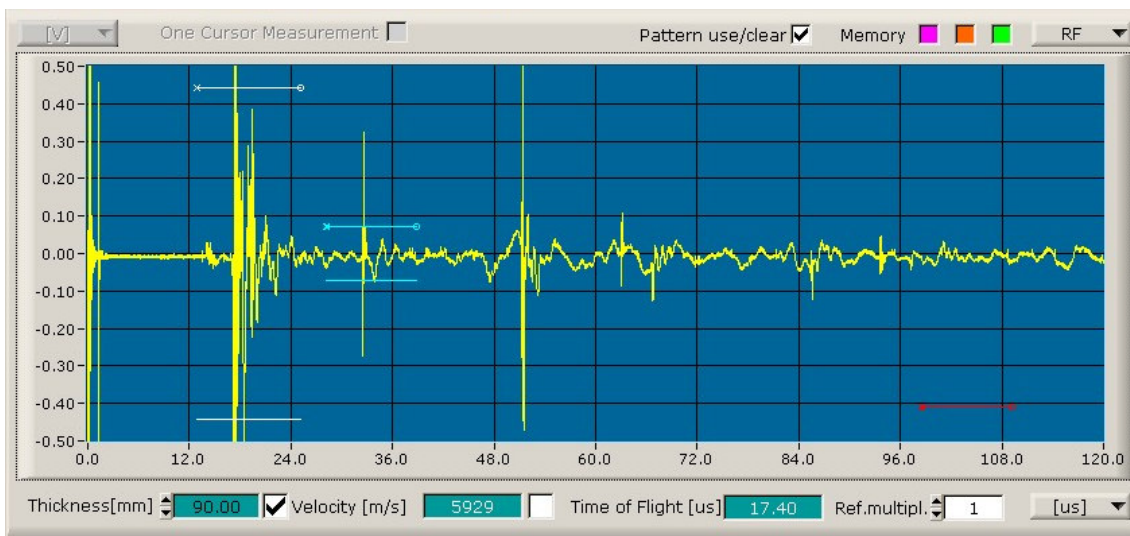


Fig. 9 Measurement of parameters: time of flight, sound speed, distance, using TT method and with delay line. White gate is set on the stored pattern, and blue on the signal going through the object and delay line.

Some additional remarks.

All modes (PE, TT, with one or two cursors) are working perfectly and are giving real results only in the case, when gates are set correctly on proper signals. This requires some experience, especially in the case of complicated objects.

If you have any question, please do not hesitate to contact us.

PBP Optel Spółka z o.o.zarejestrowana w Rejestrze Przedsiębiorców przez Sąd Rejonowy dlaWrocławia Fabrycznej VI Wydział Gospodarczy Krajowego Rejestru Sądowego pod nr KRS 0000124439. NIP: PL8981047033 REGON: 008375538. Wysokość kapitału zakładowego 364.500 PLN (trzysta sześćdziesiąt czterytysiące pięćset złotych).