Instruction Manual

Data Evaluation and Reference Manual Transient Recorder Type 2519A...

Software
TR Control

2519A_002-607e-10.12

KISTLER

measure. analyze. innovate.

Instruction Manual

Data Evaluation and Reference Manual Transient Recorder Type 2519A...

Software
TR Control

2519A_002-607e-10.12

Foreword

Thank you for choosing a Kistler quality product characterized by technical innovation, precision and long life.

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1. Introduction

Please take the time to thoroughly read this instruction manual. It will help you with the installation, maintenance, and use of this product.

To the extent permitted by law Kistler does not accept any liability if this instruction manual is not followed or products other than those listed under *Accessories* are used.

Kistler offers a wide range of products for use in measuring technology:

- Piezoelectric sensors for measuring force, torque, strain, pressure, acceleration, shock, vibration and acoustic-emission
- Strain gage sensor systems for measuring force and torque
- Piezoresistive pressure sensors and transmitters
- Signal conditioners, indicators and calibrators
- Electronic control and monitoring systems as well as software for specific measurement applications
- Data transmission modules (telemetry)

Kistler also develops and produces measuring solutions for the application fields of engines, vehicles, manufacturing, plastics and biomechanics sectors.

Our product and application brochures will provide you with an overview of our product range. Detailed data sheets are available for almost all products.

If you need additional help beyond what can be found either on-line or in this manual, please contact Kistler's extensive support organization.

1.1 Disposal Instructions for Electrical and Electronic Equipment

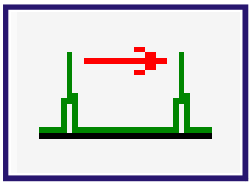
Do not discard old electronic instruments in municipal trash. For disposal at end of life, please return this product to an authorized local electronic waste disposal service or contact the nearest Kistler Instrument sales office for return instructions.

1.2 Software Upgrades and Updates

Kistler may from time to time supply upgrades or updates for embedded software. Such upgrades or updates must always be installed.

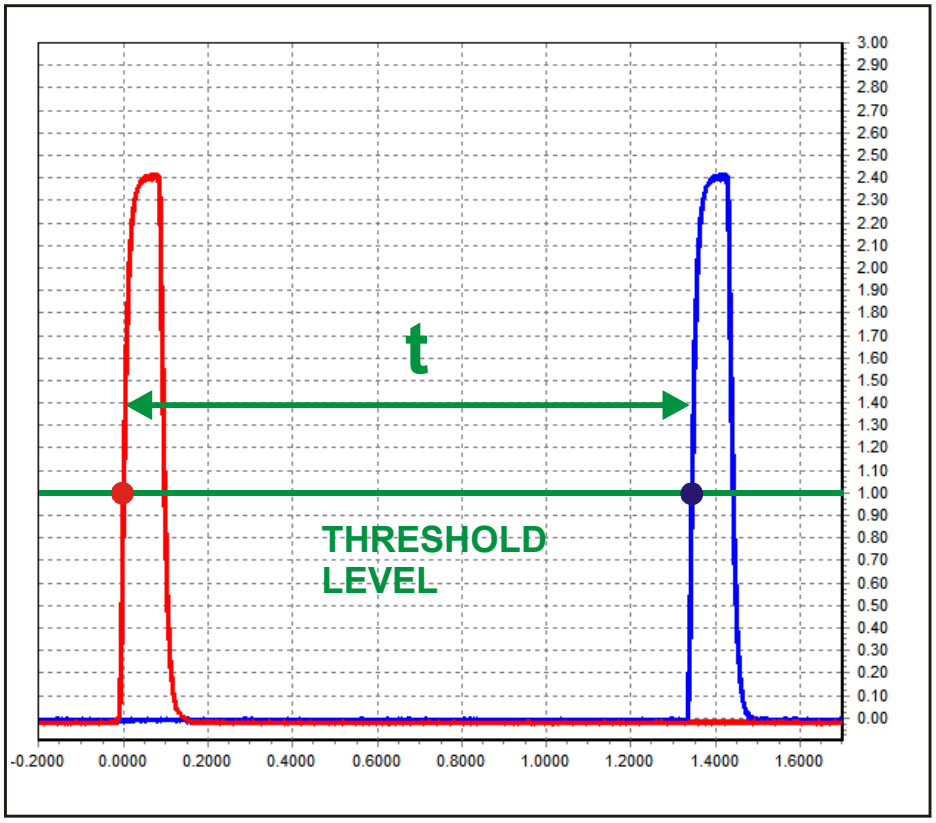
Kistler declines any liability whatsoever for any direct or consequential damage caused by products running on embedded software which has not been upgraded or updated with the latest software supplied.

2. Data Evaluation



Time Interval & Velocity

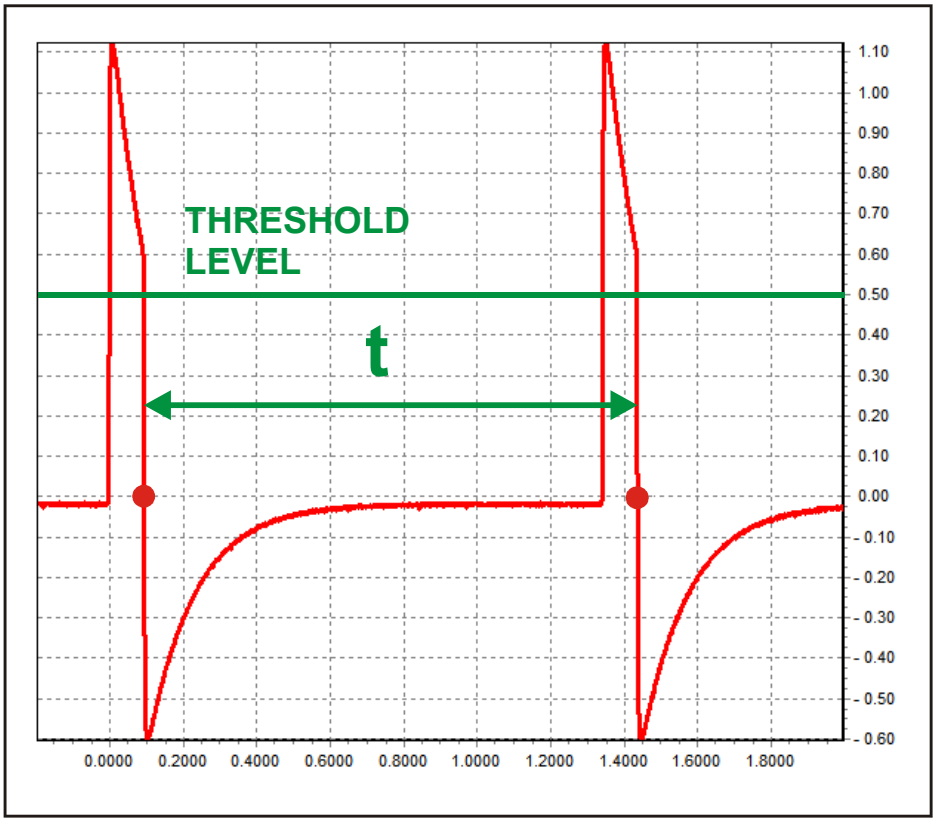
(between two edges)



- measurement of time intervals (between each curves)
- measurement of velocity (by use of known base)
- independent selection of rising or falling edges
- independent setting of threshold levels
- time filter for elimination of shockwaves

Time Interval & Velocity

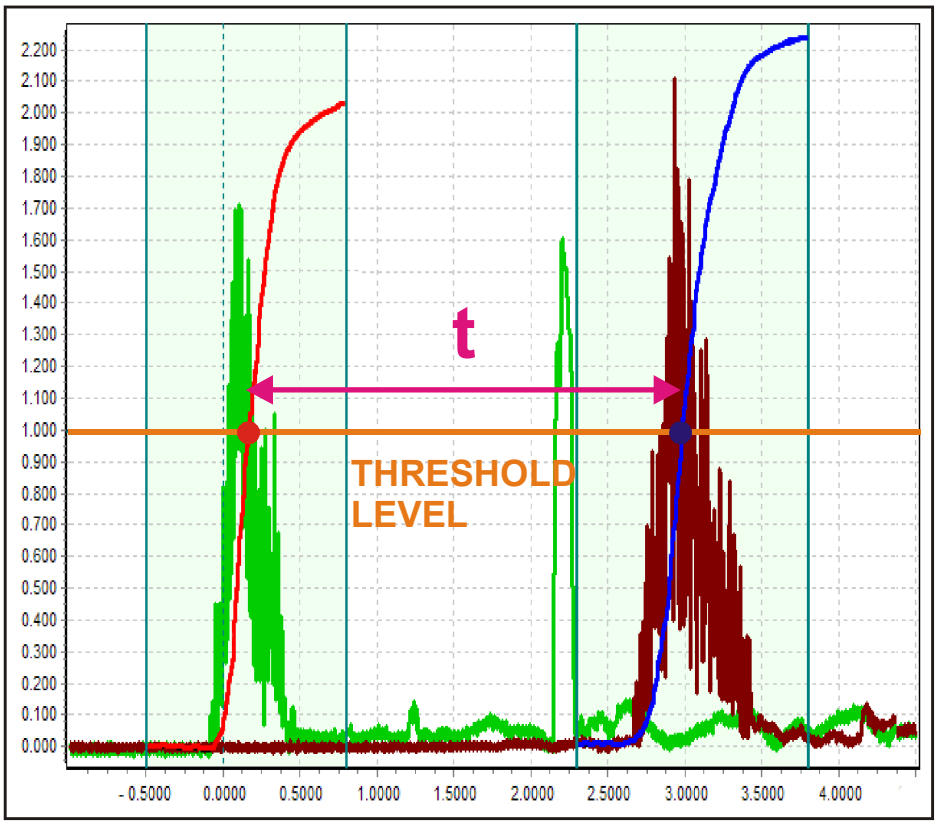
(between two zero-crossings)



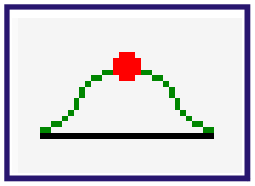
- measurement of time intervals (between each curves)
- measurement of velocity (by use of known base)
- independent selection of first zero-crossing after crossing of the threshold level from left to right or from right to left direction
- time filter for elimination of shockwaves

Time Interval & Velocity

(by use of integral)

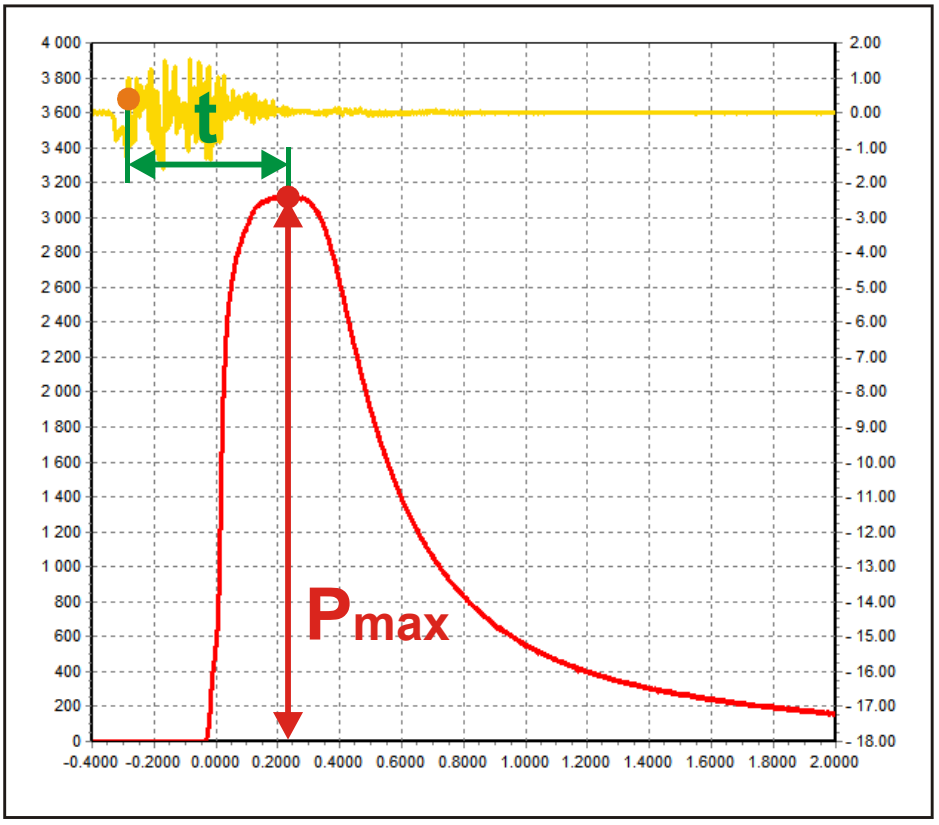


- measurement of time intervals (between each curves)
- measurement of velocity (by use of known base)
- program determines time interval between rising edges of start integral curve and stop integral curve
- especially designed for measurement of velocity by use of centre of gravity (pellets etc.)

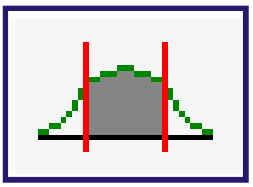


Maximum Value of Curve

(and time position of maximum)

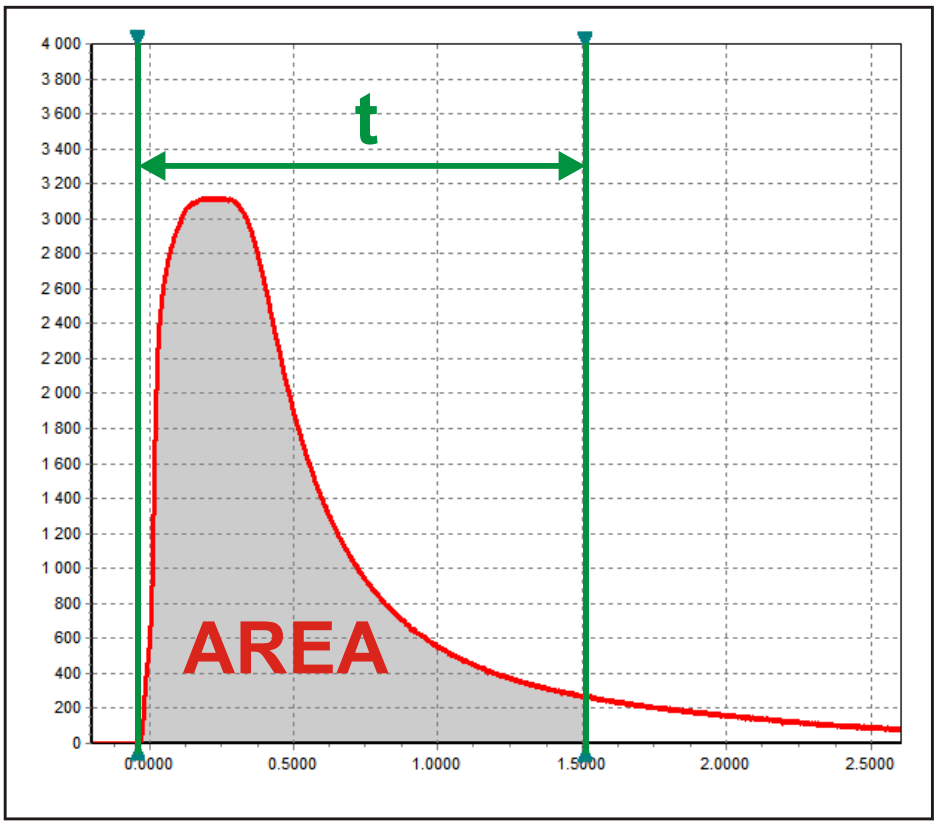


- measurement of curve maximum (Pmax etc.)
- measurement of time position of maximum
  (time interval between accelerometer and Pmax)
- filter for noise supression

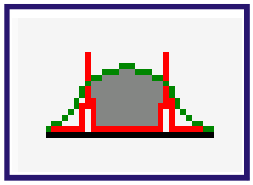


Integral of Curve

(between two cursors)

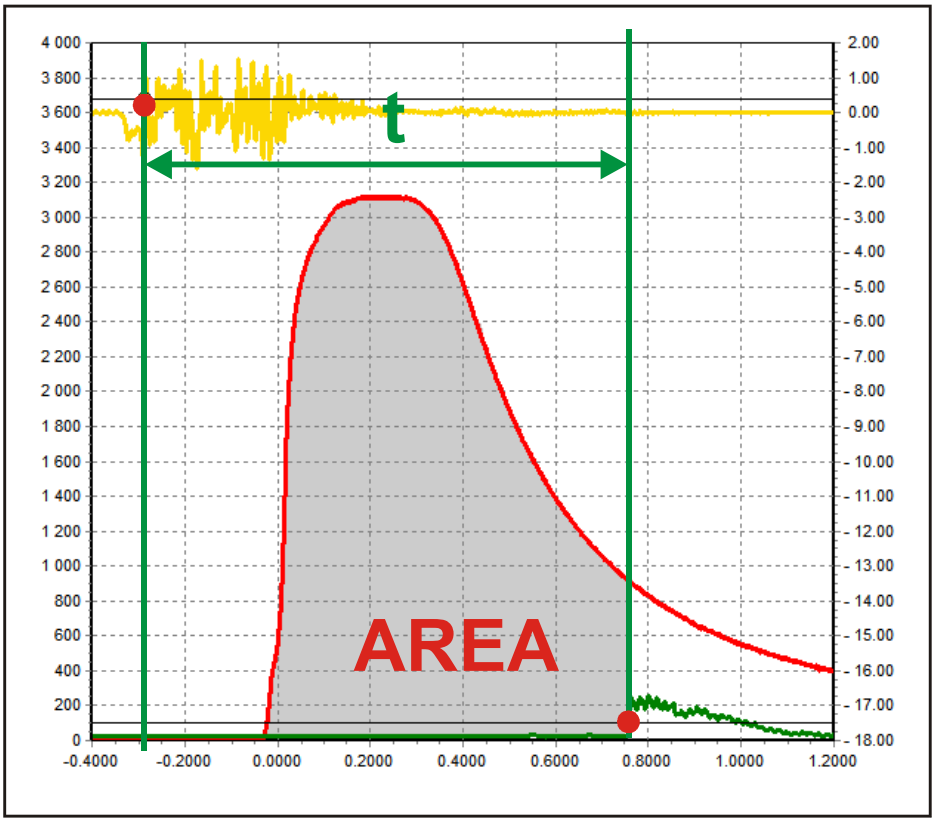


- measurement of integral (area) of curve between two cursors

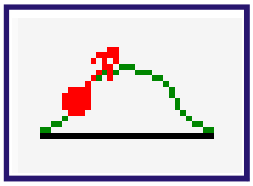


Integral of Curve

(between two events)

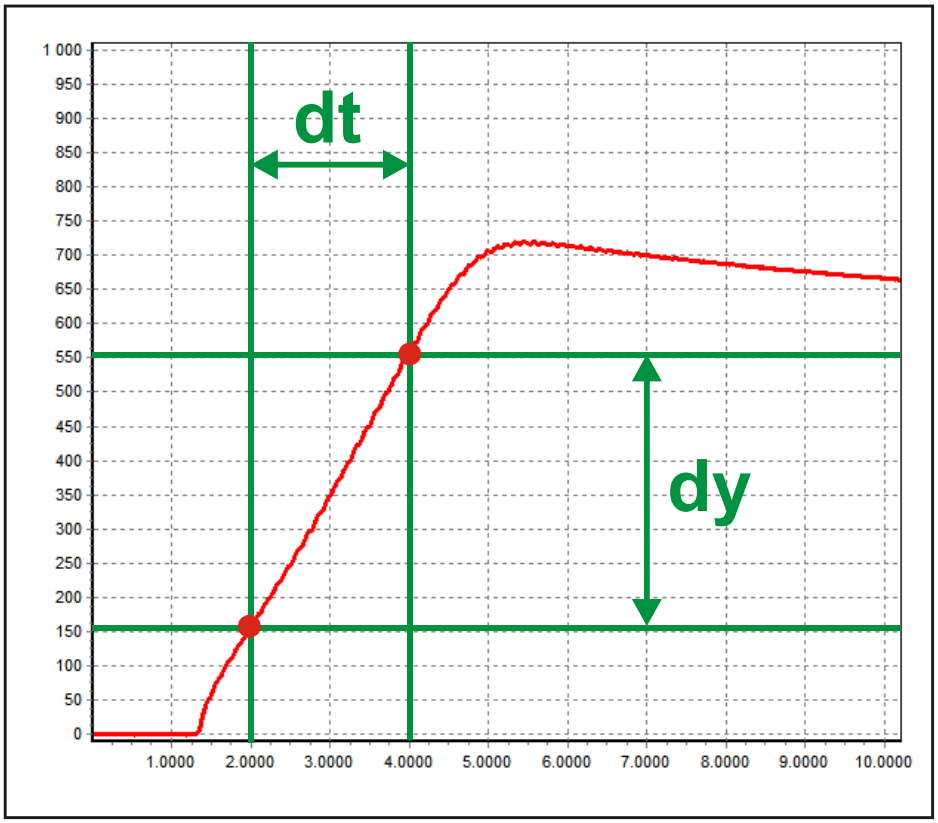


- measurement of integral (area) of curve between two events (see picture) : start of integration is derived from accelerometer signal (yellow curve), stop is derived from muzzle sensor (green curve)
- independent selection of rising or falling edges
- time filter for noise supression

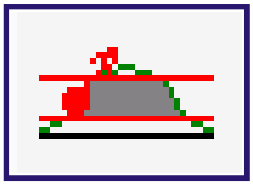


Derivation of Curve

(between two cursors)

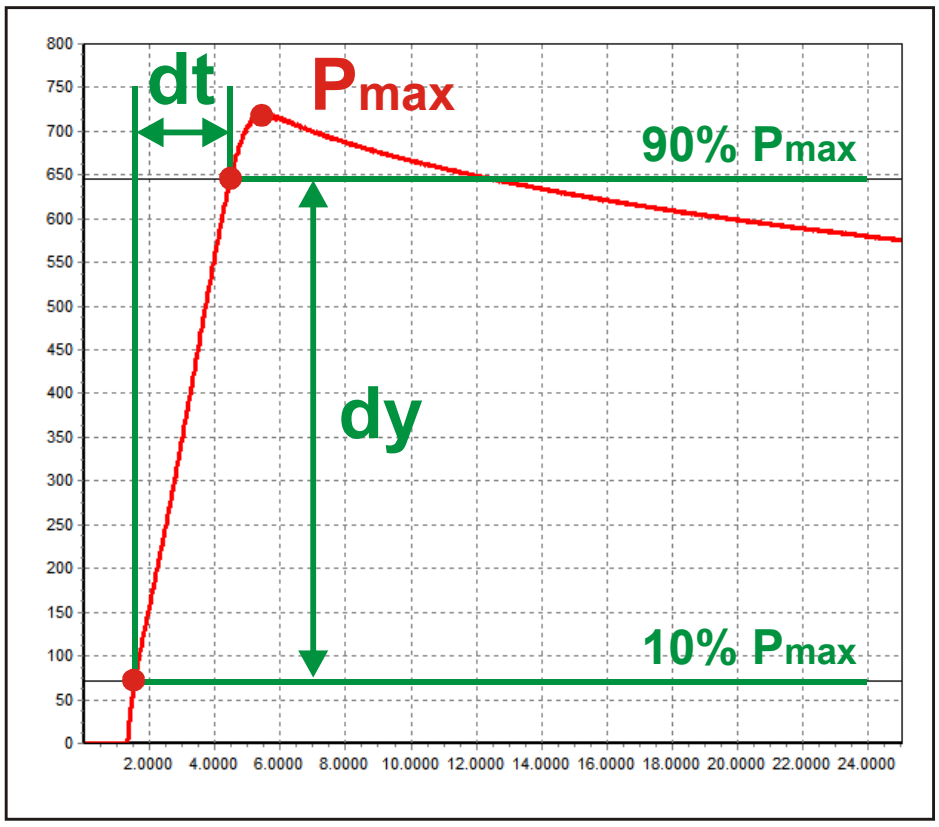


- measurement of derivation (slope, dy/dt) of curve between two cursors

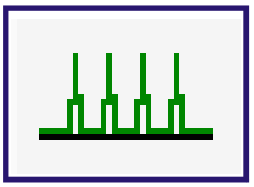


Derivation of Curve

(between two levels)

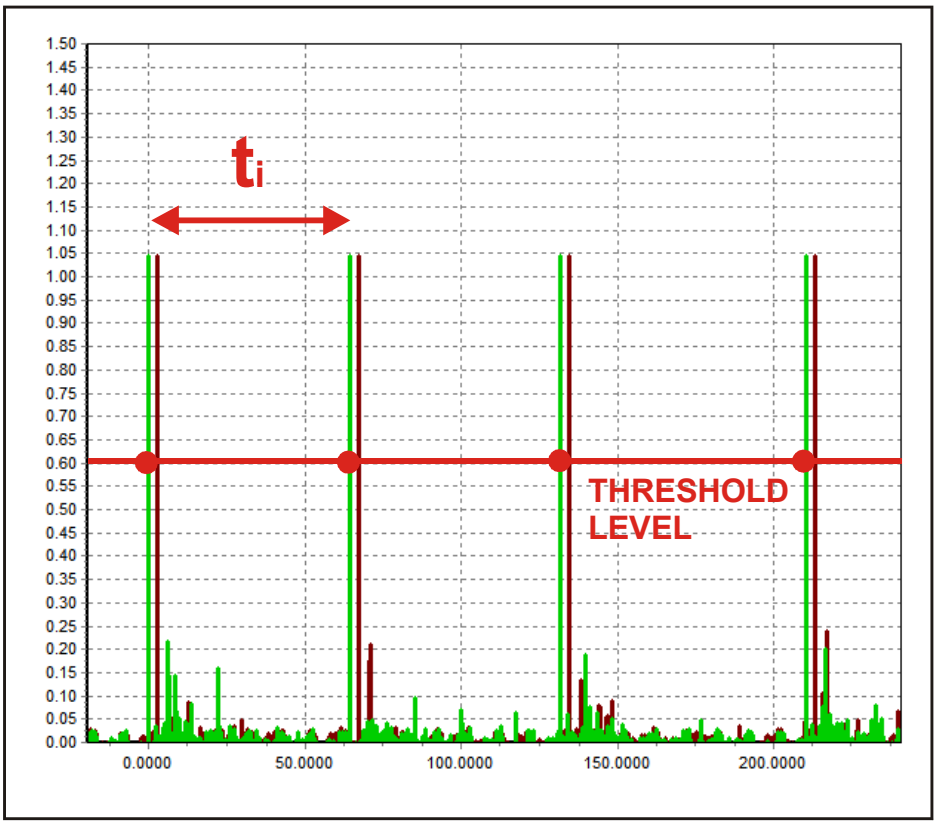


- measurement of derivation (slope, dy/dt) of curve between two levels (in % of curve maximum)
- each level is adjustable in range 0-100%
- designed for easy measurement of curve slew rate

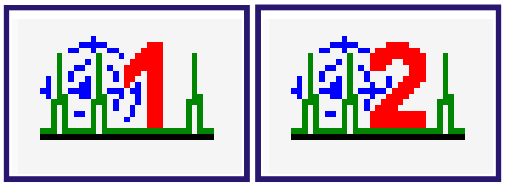


Rate Of Fire

(between two consecutive shots)

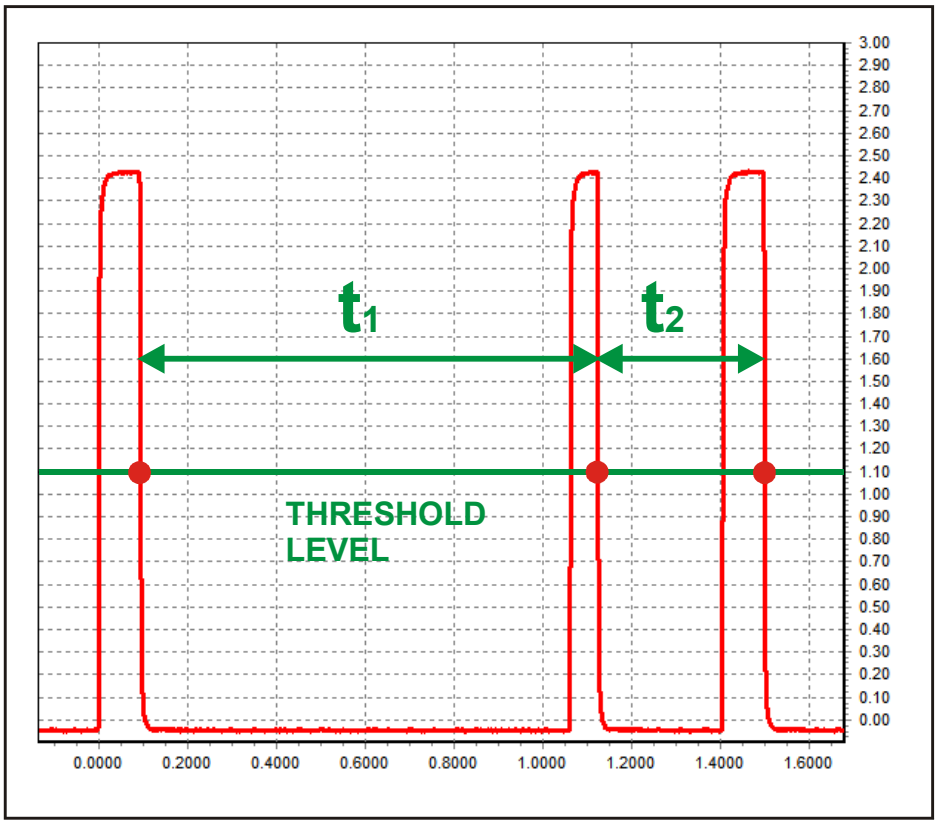


- measurement of Rate Of Fire between all consecutive shots
- measurement of velocity (by use of known base) for all shots
- independent selection of rising or falling edges
- independent setting of threshold levels
- time filter for elimination of shockwaves

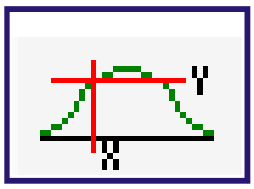


Target System

(2x DTS01/02)

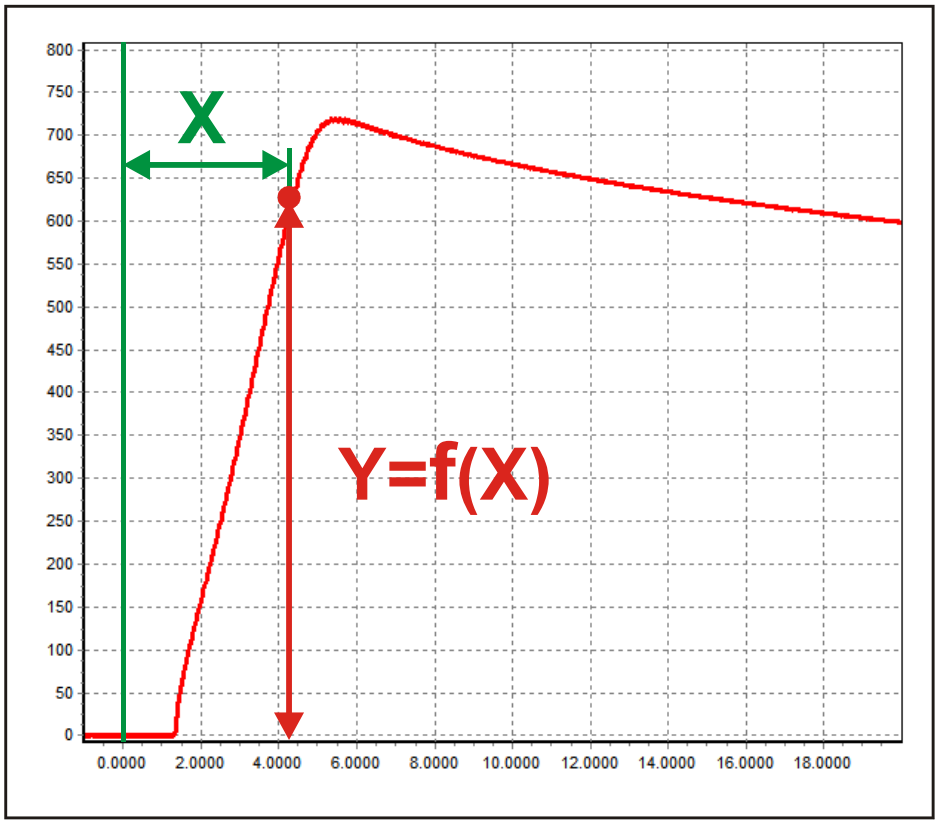


- measurement of hit position and target velocity by use of electronic target system DTS01/02
- ratio of intervals t1 and t2 determines X (or Y) coordinate of hit
- independent selection of rising or falling edges, threshold levels and shockwave filters for X and for Y coordinate

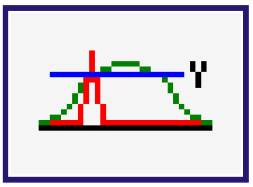


Function Value of Curve

(Y = f(X) for fixed value of X)

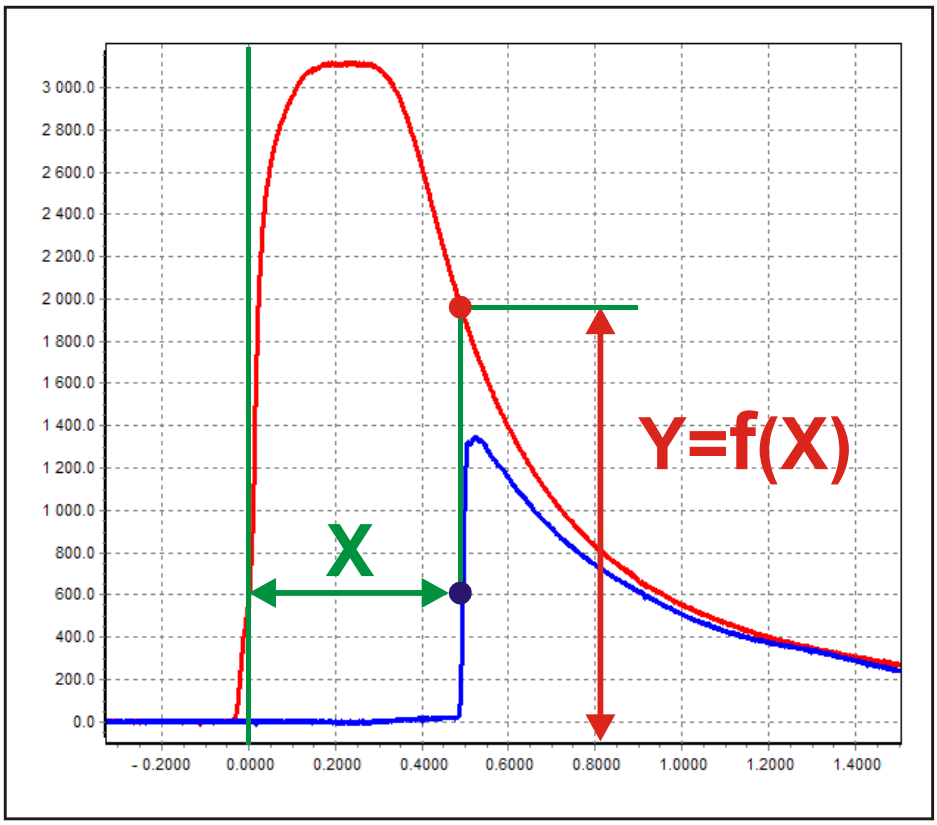


- measurement of function value of curve Y=f(X)
  for entered fixed value of X

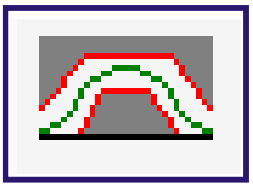


Function Value of Curve

(Y = f(X) at event)

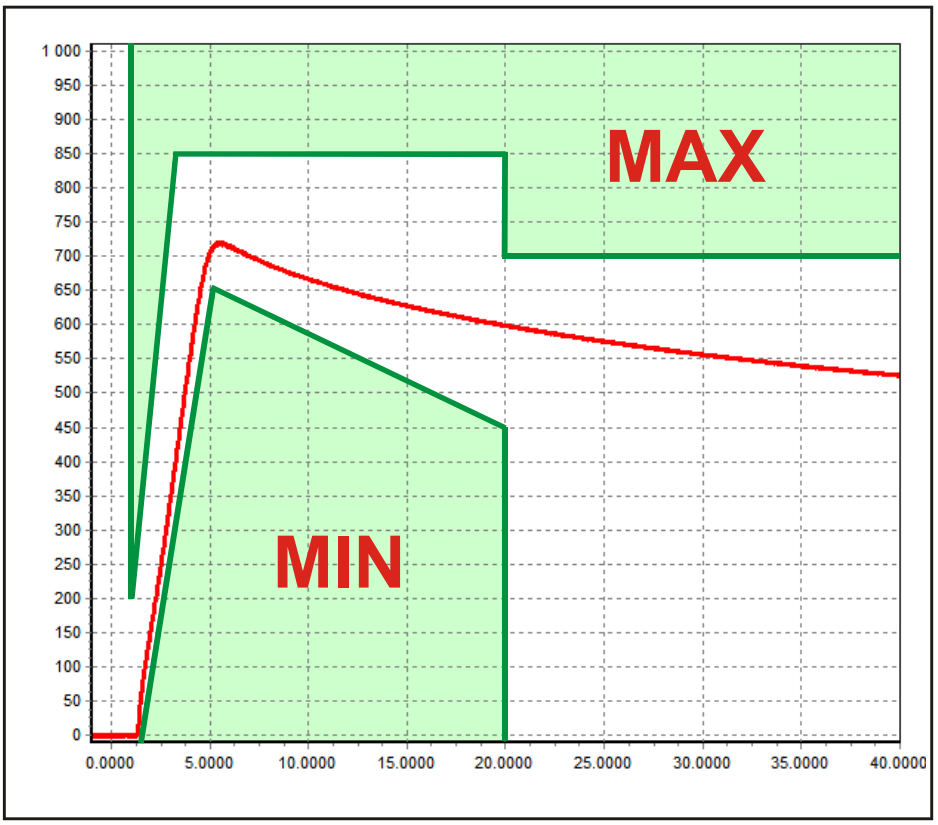


- measurement of function value of curve Y=f(X) at event X (rising or falling edge of impulse)

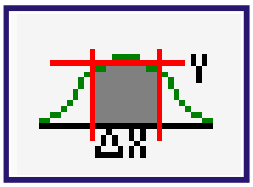


Limit Mask

(PASS / FAIL testing)

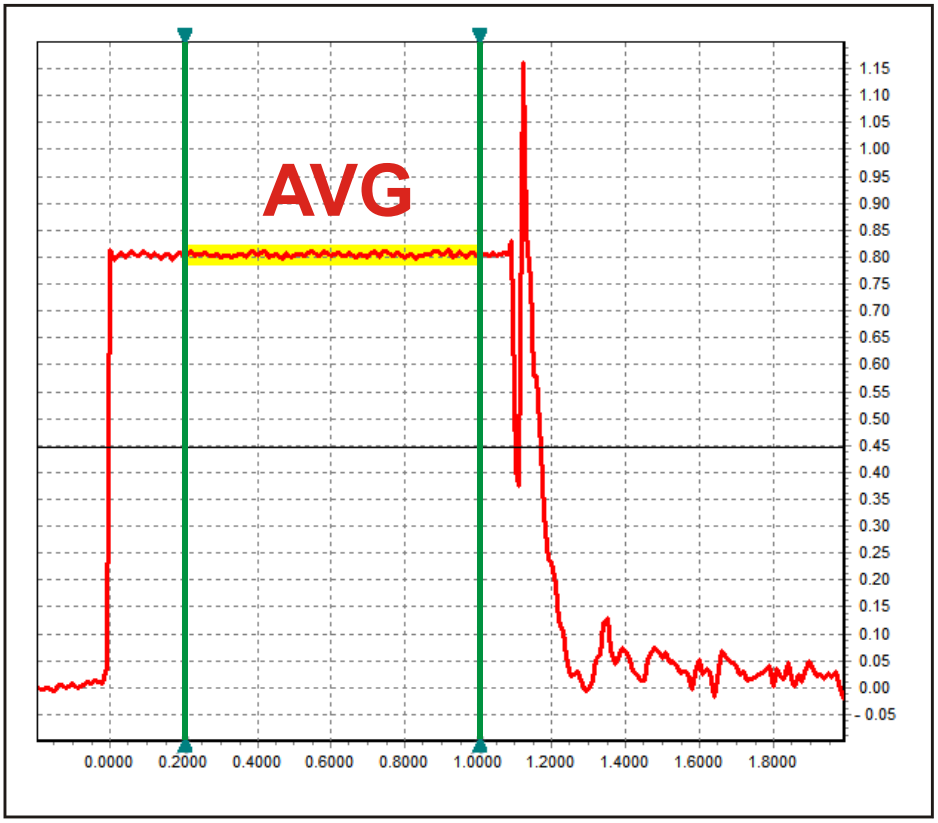


- testing of shape of curve (Pass / Fail)
- unlimited number of masks with save/load option

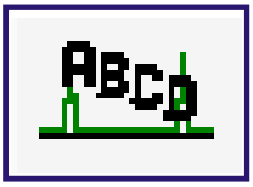


Average Value of Curve

(between two cursors)

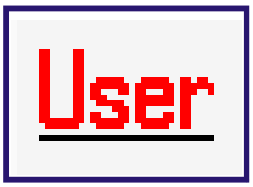


- measurement of average value of curve between two cursors



Counter

(only BA04SE - four start-stop counters for measuring of time intervals up to 429s with 100ns resolution)



User Value

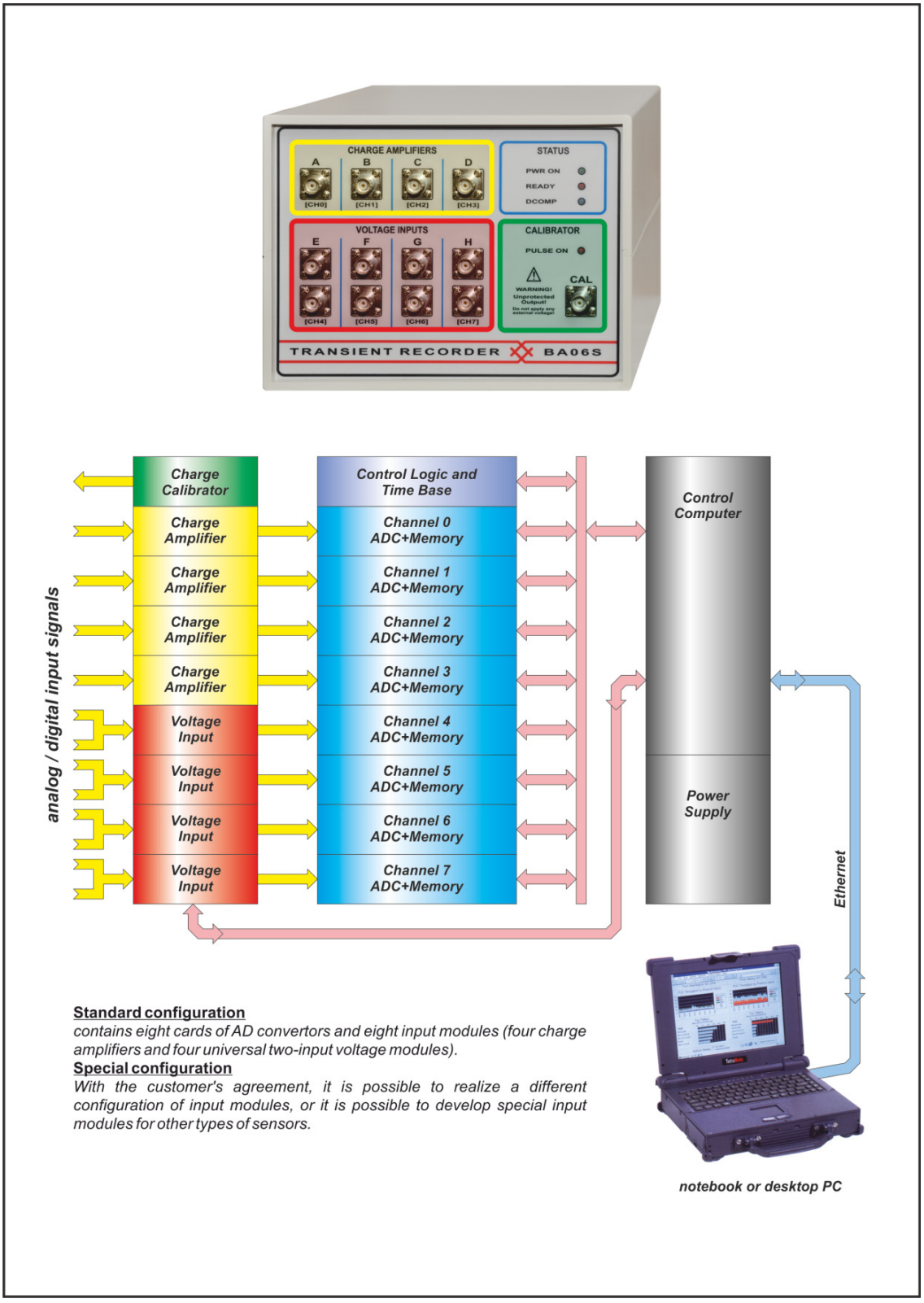
(input of numeric value which will be processed with data)

Conversion Table (PSI approx.)

1	bar	=	0.1	MPa	=	14.5	PSI
10	bar	=	1	MPa	=	145	PSI
0.0690	bar	=	0.00690	MPa	=	1	PSI
1	bar/V	=	0.1	MPa/V	=	14.5	PSI/V
10	bar/V	=	1	MPa/V	=	145	PSI/V
0.0690	bar/V	=	0.00690	MPa/V	=	1	PSI/V
1	pC/bar	=	10	pC/MPa	=	0.0690	pC/PSI
0.1	pC/bar	=	1	pC/MPa	=	0.00690	pC/PSI
14.5	pC/bar	=	145	pC/MPa	=	1	pC/PSI

3. Reference Instructions

3.1 TR 2519: Block Diagram



Standard configuration
contains eight cards of AD convertors and eight input modules (four charge amplifiers and four universal two-input voltage modules).
Special configuration
With the customer's agreement, it is possible to realize a different configuration of input modules, or it is possible to develop special input modules for other types of sensors.

3.2 TR 2519: Technical Specifications

CHARGE AMPLIFIERS

Type :	IM06-0-CHGA (For High-Speed and Quasistatic Measurements)		
Input Ranges (FSR) :	Range [pC]	dQ/dt @ AZON max. [pC/s]	dQ/dt @ AZOFF max. [pC/s]
	2 600	80	2
	5 200	80	2
	10 600	80	2
	20 200	80	2
Bandwidth (-3dB), min. [kHz] : (Bessel 2nd order Low-Pass Filter)	Filter [kHz]	Bandwidth [kHz]	Rise/Fall Edge max. [µs]
	10	10	50
	20	20	25
	40	40	12
	OFF	>100	4
Nonlinearity, max. [%] of FS	0.1		
Total Error, max. [%] of FS @ Tcal	0.5	(AZOn)	
TK, max. [%/°C]	0.005		
Noise (Peak Value, Unfiltered)	< 0.1% FSR		
Capacity of Cable & Sensor :	unlimited	(guaranteed stability only)	
Automatic Drift Compensation :	yes		
High-Speed Discharge :	yes		
High-Speed Overload Recovery :	yes		
High-Speed Overload Recovery Time, max. [s] :	1		
Max. Input Voltage (DC or AC <1kHz) [V] :	50		

CHARGE CALIBRATOR

Type :	BA06PCAL
Output Voltage [V]:	±2.4000
Output Voltage Step [V]:	0.0001
Output Voltage Error, max. [% of FS]:	±0.050
Output Voltage Temperature Drift, max. [% of FS / °C]:	±0.002
Output Voltage Time Drift, typ. [% of FS / 1000 hours]:	±0.005
Output Voltage Noise, 0.1-10Hz, typ. [µVpp]:	5
Output Impedance, typ. [Ohm]:	100

BA06PCAL is precision voltage-step source, which is converted by means of precision reference capacitor to charge.

Recommended calibration capacitor :
KISTLER 5371A10000 (10nF nom. ±0.1%)

VOLTAGE INPUTS

Type :	IM07-0-D2SA (Differential, Two Channels)		IM07-1-D2HG (Single Ended, Two Channels, High-Gain)		
Input Ranges :	Range [V] G=1		Range [V] G=1	Range [V] G=10	Range [V] G=100
	1		1	0.1	0.01
	2		2	0.2	0.02
	5		5	0.5	0.05
	10		10	1.0	0.10
Input Impedance [kOhm] :	10		10	10	10
Slew Rate, min. [V/us] :	10		10	10	10
Bandwidth, min [kHz] :	400		400	400	100
Nonlinearity, max. [%] of FS	0.1		0.1	0.1	0.2
Total Error, max. [%] of FS @ Tcal	1.0		1.0	1.0	2.0
Max. Input Voltage (DC or AC <1kHz) [V] :	50		50	50	50

BA06 VELOCITY MEAS. ACCURACY (with WLS03 or WTS03)

Total Error, max. @ Tcal, [%] :	0.05 + 200 / (Time × SR)

SR = Sample Rate (20 kHz = 20 000, 5 MHz = 5 000 000, etc.)
Time = measured value of time (START - STOP)
Temperature coefficient < 0.005%/°C

BA06 TIME MEAS. ACCURACY

Total Error, max. @ Tcal, [s] :	(0.01% of Time) + (2/SR)

SR = Sample Rate (20 kHz = 20 000, 5 MHz = 5 000 000, etc.)
Time = measured value of time (START - STOP)
Temperature coefficient < 0.001%/°C

BA06S COMMON PARAMETERS

Input Channels :	Max. 8 Independent Channels (ADC+RAM), Full Synchronised					
Analog to Digital Converter (ADC) :	14 bit (±13 bit), ±5V Input Range					
Memory (RAM)	512k x 16 bit SRAM					
	Max. 400 000 Points Accessible					
	Max. -100 000 Points (Pretrigger), +300 000 Points (Posttrigger)					
Sample Rate & Record Length :	Sample Rate :	Pretrigger [Points] :	Pretrigger [ms] :	Posttrigger [Points] :	Posttrigger [ms] :	BREAK Function :
	10.0 MHz (MSa/s)	- 100 000	- 10	+ 300 000	+ 30	No
	5.0 MHz (MSa/s)	- 100 000	- 20	+ 300 000	+ 60	No
	2.0 MHz (MSa/s)	- 100 000	- 50	+ 300 000	+ 150	No
	1.0 MHz (MSa/s)	- 100 000	- 100	+ 300 000	+ 300	No
	0.5 MHz (MSa/s)	- 100 000	- 200	+ 300 000	+ 600	No
	0.2 MHz (MSa/s)	- 100 000	- 500	+ 300 000	+ 1 500	No
	0.1 MHz (MSa/s)	- 100 000	- 1 000	+ 300 000	+ 3 000	No
	50.0 kHz (kSa/s)	- 100 000	- 2 000	+ 300 000	+ 6 000	Yes
	20.0 kHz (kSa/s)	- 100 000	- 5 000	+ 300 000	+ 15 000	Yes
	10.0 kHz (kSa/s)	- 100 000	- 10 000	+ 300 000	+ 30 000	Yes
	5.0 kHz (kSa/s)	- 50 000	- 10 000	+ 300 000	+ 60 000	Yes
	2.0 kHz (kSa/s)	- 20 000	- 10 000	+ 300 000	+ 150 000	Yes
	1.0 kHz (kSa/s)	- 10 000	- 10 000	+ 300 000	+ 300 000	Yes
	0.5 kHz (kSa/s)	- 5 000	- 10 000	+ 300 000	+ 600 000	Yes
	0.2 kHz (kSa/s)	- 2 000	- 10 000	+ 300 000	+ 1 500 000	Yes
	0.1 kHz (kSa/s)	- 1 000	- 10 000	+ 300 000	+ 3 000 000	Yes
Time Base Parameters :	X-tal Controlled, Error < ±100 ppm, Ageing < ±5 ppm/year, Shock Resistance < ±20 ppm, Temperature Coefficient < ±1 ppm/°C					
Time Measurement Error :	±((0.0001 * Time) + 2 / (Sample Rate)) Time = Measured Value of Time in [s] (between START and STOP Cursor), Sample Rate in [Hz] Temperature Coefficient < ±10 ppm/°C					
Trigger :	Trigger Source :	Channel A (CH0) to Channel H (CH7)				
	Trigger Level :	0 to ±87.5 % of Full Scale in 12.5 % Increments				
	Trigger Edge :	Rising or Falling				
Power Supply :	Voltage :	nom. 12V DC (11 - 26V DC) - External 100 - 240V AC Power Adapter included				
	Consumption :	nom. 25W (max. 40W)				
Operating Conditions :	Temperature Range :	-20°C to +40°C				
	Relative Humidity :	Less than 90% (no condensation)				
	Sealing :	IP51				

Pay Attention to maximum input voltage of all input modules. Exceeding of maximum values could destroy this instrument!

Maximum input voltage of channels (DC and AC up to 1 kHz):
Charge amplifier IM06-x-CHGA (Channel A-D)
± 50V/0.01A
(enter pin of BNC connector against its metal body)

Voltage Input (Differential) IM07-0-D2SA (Channel E-H)
± 50V/0.01A
(center pin of BNC connector against its metal body)

Voltage Input (Single Ended) IM07-1-D2HG (Channel E-H)
± 50V/0.01A
(center pin of BNC connector against its metal body)

Maximum voltage between channels (DC and AC up to 1 kHz):
Charge amplifier IM06-x-CHGA (Channel A-D)
± 0.5V/0.1A

- between any two Charge Amplifiers (metal body of BNC connectors)
- between any Charge Amplifier (metal body of BNC connector) and output connector (Ethernet, Signal Box) or GND

Voltage Input (Differential) IM07-0-D2SA (Channel E-H)
± 50V/0.01A

- between any two Voltage Inputs (metal body of BNC connectors)
- between any Voltage Input (metal body of BNC connector) and output connector (Ethernet, Signal Box) or GND

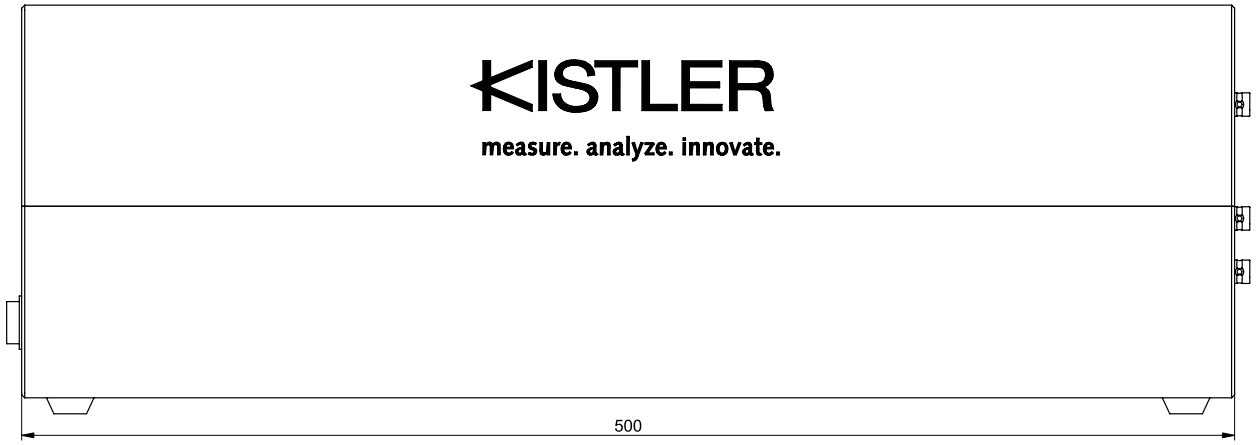
Voltage Input (Single Ended) IM07-1-D2HG (Channel E-H)
± 0.5V/0.1A

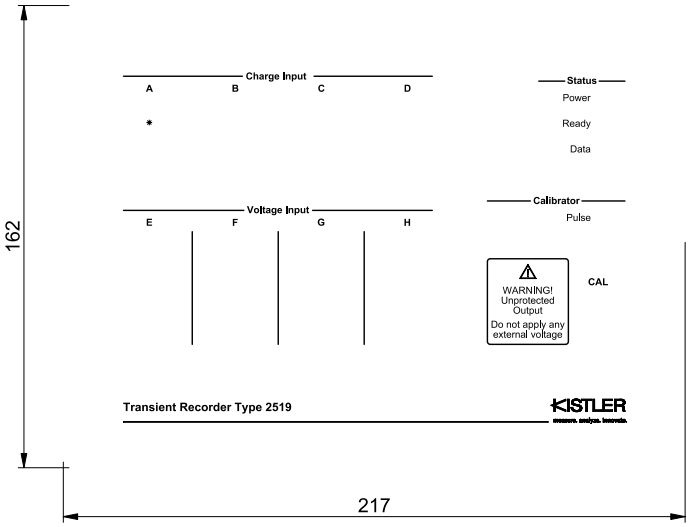
- between any two Voltage Inputs (metal body of BNC connectors)
- between any Voltage Input (metal body of BNC connector) and output connector (Ethernet, Signal Box) or GND

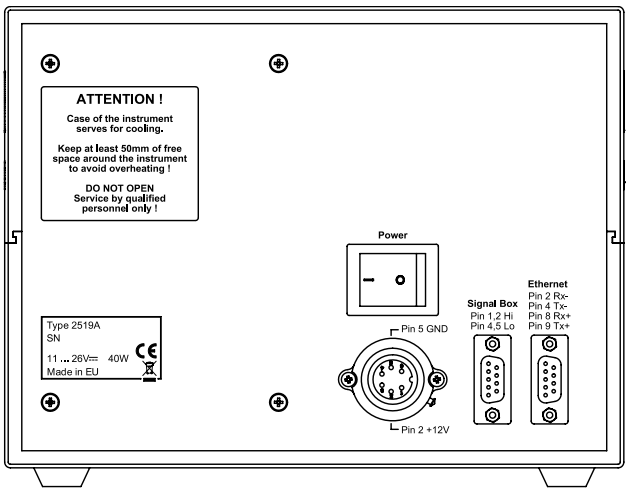
In standard configuration all input modules are NOT galvanically isolated!

Warm-up time of TR 2519 for guaranteed accuracy:
approximately 5 minutes after switch-on

Dimensions (approx.)

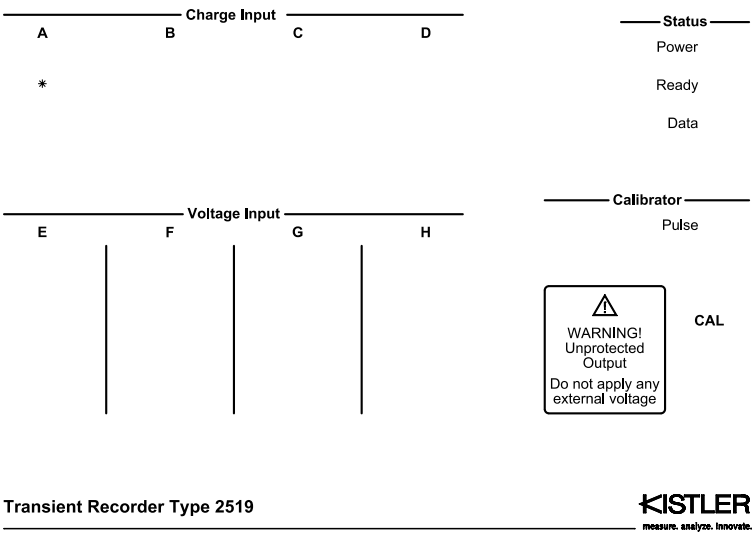






3.3 TR 2519: Description of Front and Rear Panel

3.3.1 Front Panel



BNC Connectors A,B,C,D
- inputs of Charge Amplifiers for connection of piezo-sensors

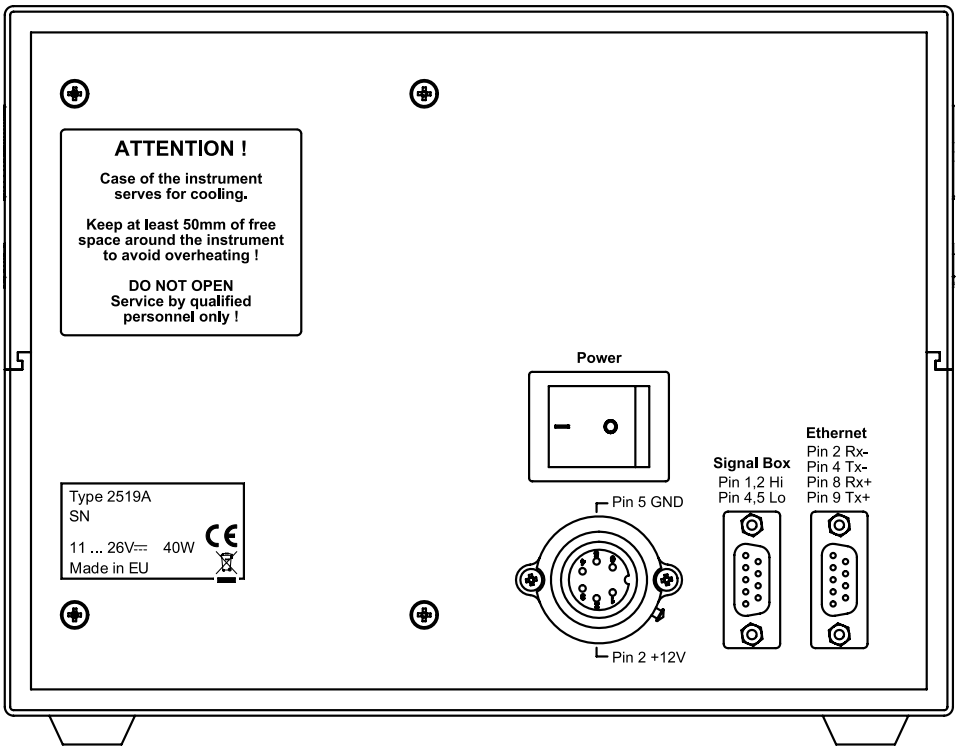
BNC Connectors E,F,G,H
- inputs of Voltage Amplifiers for connection of sensors with voltage output
- both signals in the same group are added together

BNC Connector CAL
- output of precision charge calibrator
- unprotected output - DO NOT APPLY ANY EXTERNAL VOLTAGE !!!

STATUS LED indicators
- POWER signalizes turning-on of equipment
- READY indicates waiting for trigger event
- DATA indicates recalculation and data transport to computer

CALIBRATOR LED indicator
- PULSE signalizes active calibrator output

3.3.2 Rear Panel



POWER INPUT circular connector

- 11 … 26 VDC power input (pin 2 positive, pin 5 negative, protected)

POWER ON/OFF switch

- turning-on of equipment

ETHERNET connector (Cannon 9 pin female)

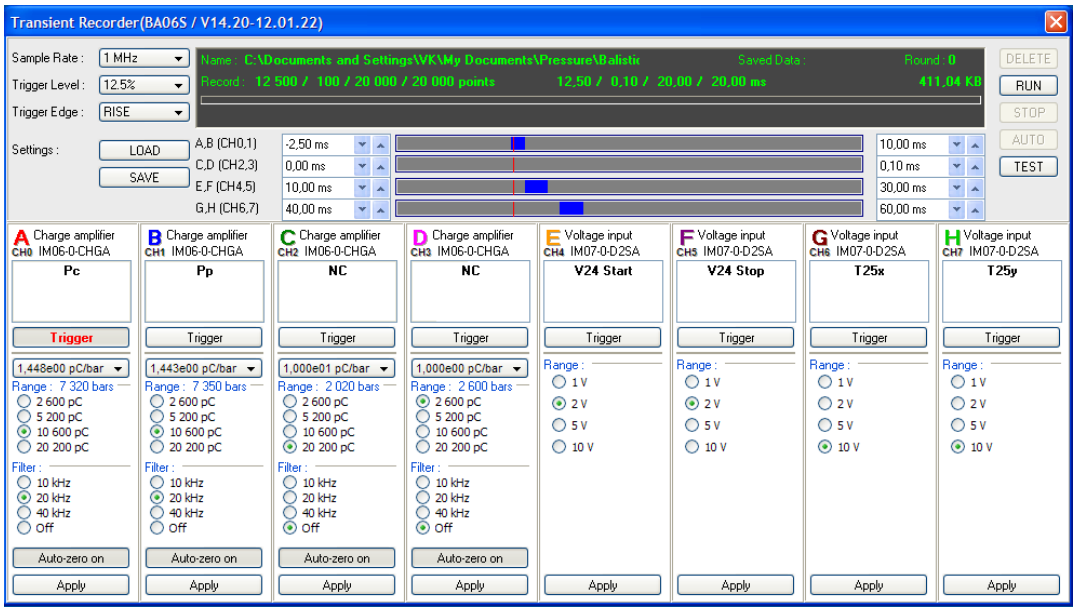
- data communication with computer
- Ethernet 10/100Mb (pin 2 = RX neg., pin 4 = TX neg, pin 8 = RX pos., pin 9 = TX pos.)

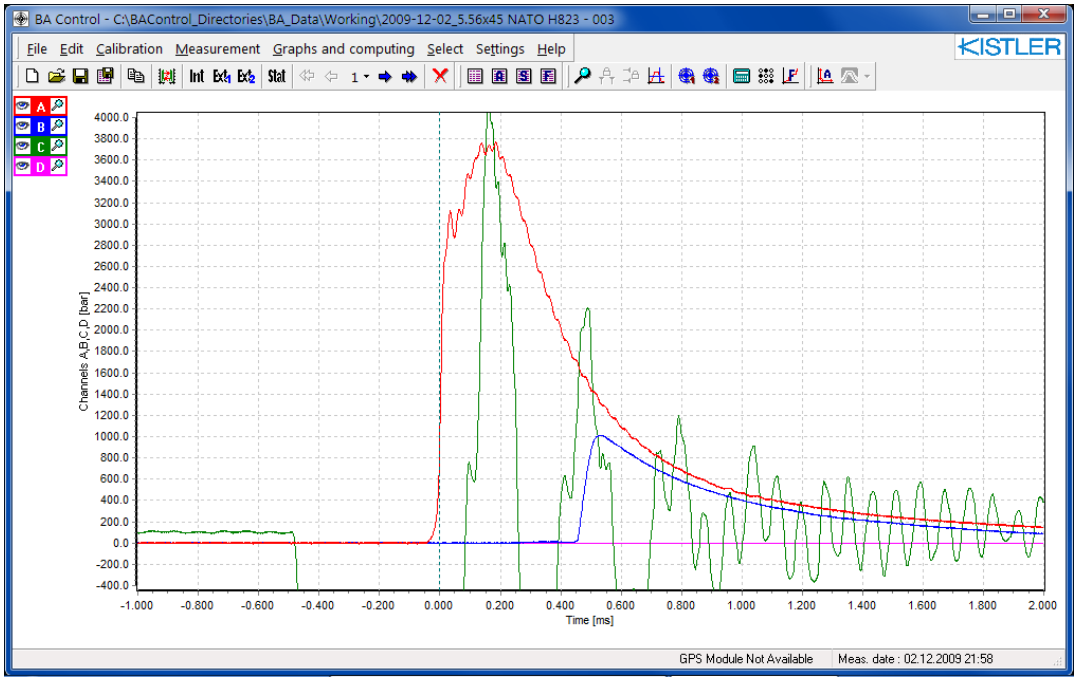
SIGNAL BOX connector (Cannon 9 pin male)

- indication "Ready for Shot"
- current loop, length max. 100m (cable resistance less than 100 Ohm)
- galvanically isolated from TR 2519
- approx. 12 VDC/440 Ohm loop (pin 1,2 = pos., pin 4,5 = neg.)

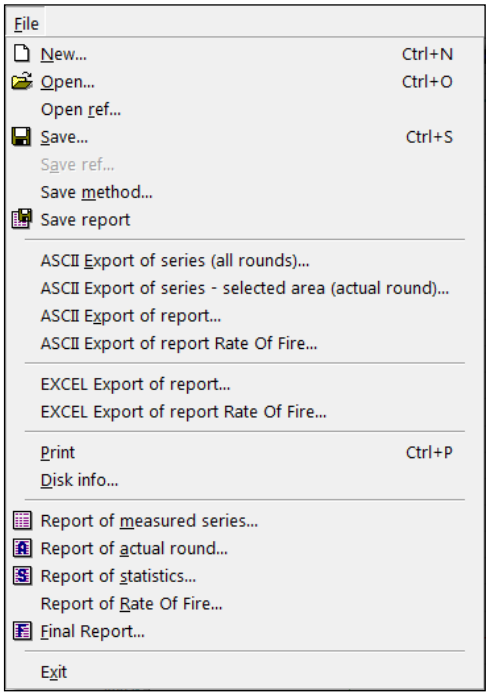
3.4 Detailed Description of All Functions of Control Program

3.4.1 Main TR 2519 Control Window





3.4.1.1 **Menu File**



File > New… Ctrl+N
Creates a new directory on the disc and starts a new series. The name of this directory is corresponding with the name of new rounds series.
Minimum length of the name is four characters !!!
MAXIMUM NUMBER OF SHOTS IS LIMITED TO 250 for one round series.

File > Open… Ctrl+O
Loading of measured data from the disc for their evaluation or for shooting another rounds into this loaded series.

File > Open ref…
Loading of the reference curve from disc for comparison with measured data.

File > Save… Ctrl+S
Saving of the measured data. Data are stored automatically after measurement, but if evaluation was changed or some round was deleted you have to save data again.

File > Save ref...
Saving of the reference curve on the disc for future comparison with measured data (it is accessible only in graph of statistic and in case of selection of only single group of data).

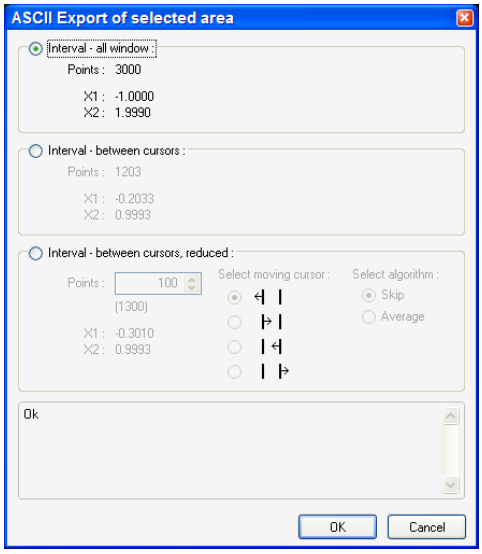
File > Save method...
Saving of the measuring method (setting of TR 2519 + data evaluation), which is extracted from the actual data.

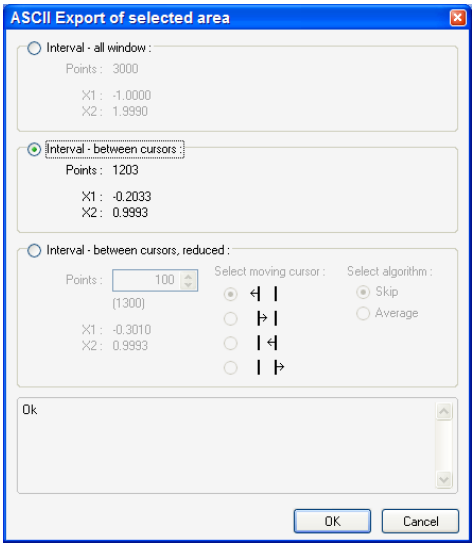
File > Save report
Saving of the reports into folder BA_Results (according to actual settings of graphs and data evaluation). It has no influence to reports saved common with data.

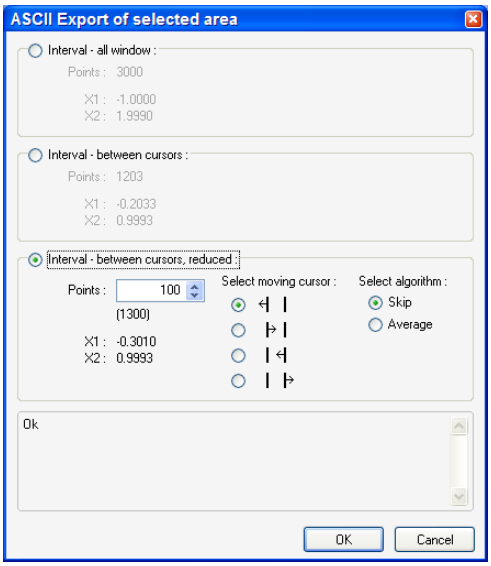
File > ASCII Export of series (all rounds)...
Saving the measured data in ASCII format on the disk (for transport to mathematic or other programs). The user has the option to select a standard or user defined data separator. Data format is not described in this manual. In case of your interest please contact your dealer or developer.

File > ASCII Export of series – selected area (actual round)...
This special function serves for ASCII export of one round. Main feature is possibility of reduction of exported data points to easy reading by other software (MS Excel etc.).
First it is necessary to activate the function Zoom (by means of button etc.). Then show or hide relevant curves by means of buttons with symbol of eye and select required interval by means of vertical cursors. Next select from menu File this ASCII export (ASCII Export of selected area (actual round)) and then appears the window for reduction of points:

Interval – all window - ASCII Export of all window (whole measured curve).
Interval – between cursors - ASCII Export of data between vertical cursors (all measured points between cursors).
Interval - between cursors, reduced - ASCII Export of data between vertical cursors reduced to selected number of points:
Points: number of required points after reduction
Select moving cursor: determines moving cursor and direction of its moving by correction of interval (which is necessary for successful reduction algorithm)
Select algorithm: determines algorithm for reduction number of points (only skip the points or substitute points by its average value).







After OK appears standard dialog window for ASCII export, which allow to enter the name of data export. Default name is derived from filename and number of shot: NAME_XXX_YYY.txt, where XXX is shot number and YYY is number of export.
For example: 2005-07-28 - 5.56x45 NATO EPVAT+ DTS 003_005_001.txt
Data separator is TAB, extension is .txt (text file).
Program automatically increments number of export YYY (for data protection).
Header of export is filled with information about hardware setting of TR 2519 channels (description of the terms is in chapter C 4.4.4 Calibration of sensor and measuring chain).
First column is time in [ms], next contains data of relevant channels.
CAUTION – ASCII export always uses software internal units ([ms], [bar], [V], [user defined]). Actual setting of units in software have no influence to ASCII export.

Example of ASCII exports (imported into MS Excel)

Time	Channel number :	0		Channel number :	1		Channel number :	2	
	Channel name :	Charge amplifier		Channel name :	Charge amplifier		Channel name :	Charge amplifier	
		IM01-1-CHGA			IM01-1-CHGA			IM01-0-CHGA	
	User text :	Pressure		User text :	Port		User text :	Accelerometer	
	Constant :	pC/bar	1.45E+00	Constant :	pC/bar	2.26E+00	Constant :	pC/bar	-1.00E+01
	Range : 4 280 bars	pC	6.20E+03	Range : 2 740 bars	pC	6.20E+03	Range : - 20 000 bars	pC	2.00E+05
	Filter :	kHz	40	Filter :	kHz	40	Filter :	kHz	40
		Auto-zero on			Auto-zero on			Auto-zero on	
ms	bar			bar			bar		
-1.00E+00	1.34E+00			7.48E-01			-2.31E+01		
-9.95E-01	1.03E+00			6.12E-01			-2.11E+01		
-9.90E-01	4.13E-01			4.08E-01			-1.66E+01		
-9.85E-01	1.34E+00			6.80E-01			-2.26E+01		
-9.80E-01	8.25E-01			1.02E+00			-2.21E+01		
-9.75E-01	1.65E+00			1.09E+00			-2.06E+01		
-9.70E-01	2.06E-01			6.80E-01			-1.86E+01		
-9.65E-01	1.03E+00			4.76E-01			-2.11E+01		
-9.60E-01	8.25E-01			2.72E-01			-2.16E+01		
-9.55E-01	1.03E+00			2.04E-01			-1.81E+01		
-9.50E-01	2.06E-01			4.08E-01			-2.11E+01		
-9.45E-01	1.44E+00			8.16E-01			-1.86E+01		
-9.40E-01	5.16E-01			6.80E-01			-1.56E+01		
-9.35E-01	6.19E-01			6.80E-01			-1.61E+01		
-9.30E-01	6.19E-01			4.76E-01			-1.25E+01		
-9.25E-01	3.09E-01			4.76E-01			-1.46E+01		
-9.20E-01	1.13E+00			7.48E-01			-1.00E+01		
-9.15E-01	8.25E-01			6.12E-01			-6.52E+00		
-9.10E-01	4.13E-01			1.36E-01			3.01E+00		
-9.05E-01	1.13E+00			9.52E-01			-2.51E+00		
-9.00E-01	4.13E-01			6.80E-01			-2.51E+00		
-8.95E-01	8.25E-01			8.16E-01			-9.53E+00		
-8.90E-01	-3.09E-01			2.38E-08			-7.53E+00		
-8.85E-01	7.22E-01			6.80E-01			-1.05E+01		
-8.80E-01	7.22E-01			6.80E-01			-1.40E+01		
-8.75E-01	1.55E+00			6.80E-01			-1.10E+01		

Time	Channel number :	0		Channel number :	1		Channel number :	3	
	Channel name :	Bridge Amplifier		Channel name :	Voltage Amplifier		Channel name :	Bridge Amplifier	
		IM04-0-MFM			IM04-0-MFM			IM04-0-MFM	
	User text :	TLAK		User text :			User text :	TAH	
		Recalc. const.						Calibrated	
	Type :	Bridge Amplifier		Type :	Voltage Amplifier		Type :	Bridge Amplifier	
	Constant :	MPa	3.99E+03	Constant :		1.00E+00	Constant :	MPa	1.12E+04
	FSR:	bar	2.49E+02	FSR:	V	1.25E+01	FSR:	bar	7.02E+02
	Range (FSR) :	V	6.25E-03	Range (FSR) :	V	1.25E+01	Range (FSR) :	V	6.25E-03
	Filter :	kHz	5	Filter :	kHz	500	Filter :	kHz	1
	DC Shift :	V	-1.28E-01	DC Shift :	V	-3.00E-02	DC Shift :	V	-2.00E-03
	OCS :	uA	5.74E+00	OCS :	uA	0.00E+00	OCS :	uA	-3.67E+00
	Excitation Type :	Voltage		Excitation Type :	Off		Excitation Type :	Voltage	
	Excitation :	V	6.00E+00	Excitation :	V	1.00E+01	Excitation :	V	1.00E+01
	Sensitivity	mV/V	1.67E+00	Value		1.00E+00	Sensitivity	mV/V	1.78E+00
	Sensor range	bar/V	4.00E+01				Sensor range	bar/V	2.00E+02
	Sensor resistance	Ohm	5.00E+02				Sensor resistance	Ohm	4.00E+02
ms	bar			V			bar		
5.00E+00	1.51E+00			-6.69E-03			1.59E-01		
2.60E+01	5.88E+01			-4.43E-03			1.47E+02		
4.70E+01	1.13E+02			-2.91E-03			2.68E+02		
6.80E+01	1.15E+02			-6.90E-03			2.78E+02		
8.90E+01	1.07E+02			-6.39E-03			2.60E+02		
1.10E+02	9.93E+01			-5.45E-03			2.47E+02		
1.31E+02	9.58E+01			-8.07E-03			2.41E+02		
1.52E+02	9.35E+01			-5.09E-03			2.36E+02		
1.73E+02	9.20E+01			-4.65E-03			2.32E+02		
1.94E+02	8.94E+01			-5.16E-03			2.28E+02		
2.15E+02	8.93E+01			-6.47E-03			2.25E+02		
2.36E+02	8.53E+01			-7.41E-03			2.22E+02		
2.57E+02	8.47E+01			-5.52E-03			2.19E+02		

File > ASCII Export of report...
Saving the results in ASCII format on the disk (for transport to mathematic or other programs). The user has the option to select a standard or user defined data separator The user has the option to select a standard or user defined data separator. Data format is not described in this manual. In case of your interest please contact your dealer or developer.

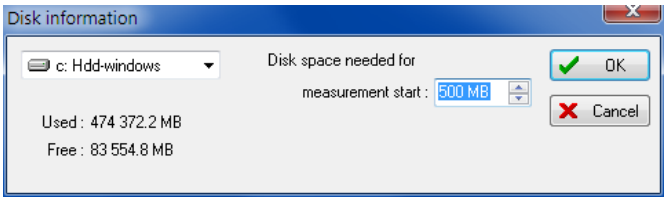
File > ASCII Export of report Rate Of Fire...
Saving the results of Rate Of Fire in ASCII format on the disk (for transport to mathematic or other programs). The user has the option to select a standard or user defined data separator. Data format is not described in this manual. In case of your interest please contact your dealer or developer.

File > Excel Export of report...
Saving the results in MS Excel format on the disk. You can directly open this file in MS Excel as a multi-sheet document for next mathematical processing. Checkbox Export Report Form serves to exporting of Form as a first sheet of this document.

File > Excel Export of report Rate Of Fire...
Saving the results of Rate Of Fire in MS Excel format on the disk. You can directly open this file in MS Excel for next mathematical processing.

File > Print Ctrl+P
Simple printing of actual graph according to printer setting. For high-quality printing use clipboard for graph transfer to suitable text processor program.

File > Disk info...
Information about disk drives in the computer (Used, Free) and adjusting the minimal free disc space for enable the measuring. (Disk space needed for measurement start).



File > Report of measured series...
This button opens the window with round series report.

Report

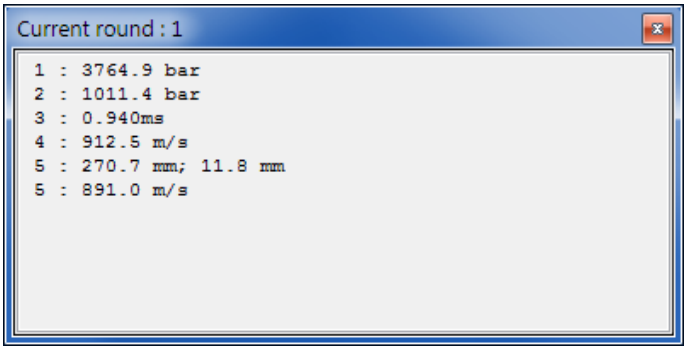
```
DATA REPORT : 2009-12-02_5.56x45 NATO H823 - 003
================================================


       | 1 (Pc)        | 2 (Pp)        | 3 (Action time)| 4 (V10)       | 5 (T25)
 Round |    Max [bar] |    Max [bar] |    Time [ms]   |Velocity [m/s] |       X [mm]        Y [mm] Velocity [m/s]
=============================================================================================================
     1 |      3764.9  |      1011.4  |       0.940    |       912.5   |       270.7          11.8          891.0
     2 |      3781.1  |      1004.2  |       0.864    |       916.8   |       381.4         -35.4          896.4
     3 |      3969.4  |      1004.7  |       0.818    |       924.0   |       378.4        -100.8          903.9
     4 |      3811.2  |      1011.7  |       0.874    |       914.0   |       397.5        -161.3          892.8
     5 |      3806.1  |      1004.5  |       0.839    |       912.0   |       390.8         -62.3          891.5
     6 |      3773.3  |      1008.5  |       0.849    |       913.2   |       450.6         -63.5          892.1
     7 |      3876.2  |      1004.7  |       0.895    |       914.9   |       512.1         -69.6          893.0
     8 |      3851.8  |      1011.4  |       0.868    |       916.6   |       363.8         -68.1          895.0
     9 |      3786.0  |      1000.2  |       0.851    |       916.8   |       355.5         -64.9          896.6
    10 |      3723.1  |      1001.5  |       0.913    |       910.6   |       318.4         -59.1          889.6
-------------------------------------------------------------------------------------------------------------
Avg    |      3814.3  |      1006.3  |       0.871    |       915.1   |       381.9         -67.3          894.2
SD     |        69.69 |         4.19 |       0.0365   |         3.76  |        66.18         43.90           4.11
Max    |      3969.4  |      1011.7  |       0.940    |       924.0   |       512.1          11.8          903.9
Min    |      3723.1  |      1000.2  |       0.818    |       910.6   |       270.7        -161.3          889.6
Delta  |       246.3  |        11.5  |       0.123    |        13.3   |       241.4         173.1           14.3

Target statistics
Method :                  Statistical
Impact Mean Point Xm :     381.9 mm
Impact Mean Point Ym :     -67.3 mm
Radius Rm :                 61.5 mm
Radius R100 :              136.5 mm
Radius R50 :                48.8 mm
Radius Rdisp :             127.5 mm
Diameter 2R100 :           273.1 mm
Group Rect. Width (W) :    241.4 mm
Group Rect. Height (H) :   173.1 mm
Group Rect. Sum W+H :      414.5 mm
Largest Distance :         254.8 mm
```

This report contains these parts:

- the legend with the name of column and with the units (top)
- the column with the round number (left)
- single column of results, where each one is corresponding to line in the window Computing
- statistic list: average value, standard deviation, maximum a minimum value and dispersion (bottom)
- if velocity is calculated in the column, the average kinetic energy is assigned at the bottom (the weight of bullet must be inserted in the C.I.P. form window)

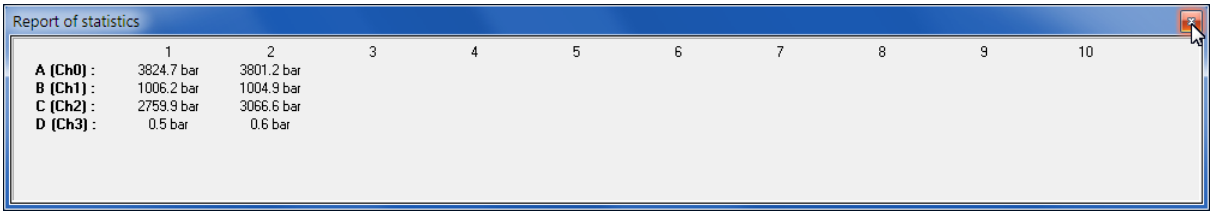
The part of report, which is related to electronic target and overall statistic, is described in the chapter, which describes measurement with the target.

File > Report of actual round...
This button opens the window with listing of basic numerical values of current round.



The title contains current round number and listing of most important results in the window. Each line is corresponding to single line in the window Computing.

File > Report of statistics...
This button opens the window with listing of basic numerical values for statistic graph.

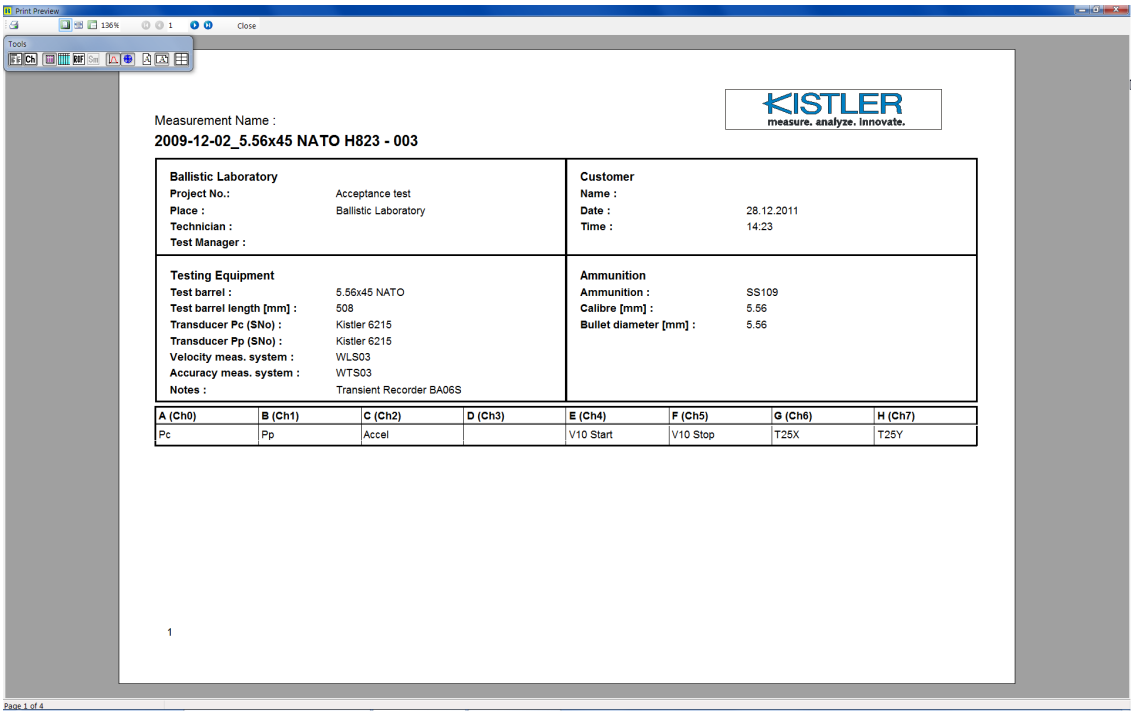


The listing contains only maximum of displayed average pressure curves. These values are different from middle pressure values, assigned in the report of measured series by reason of different calculations.

File > Report of Rate Of Fire...
This button opens the window with listing of report Rate Of Fire.

File > Final Report...

This button opens the Final Report window with round series report. This report includes customer's logo and is given specially for printing of results.



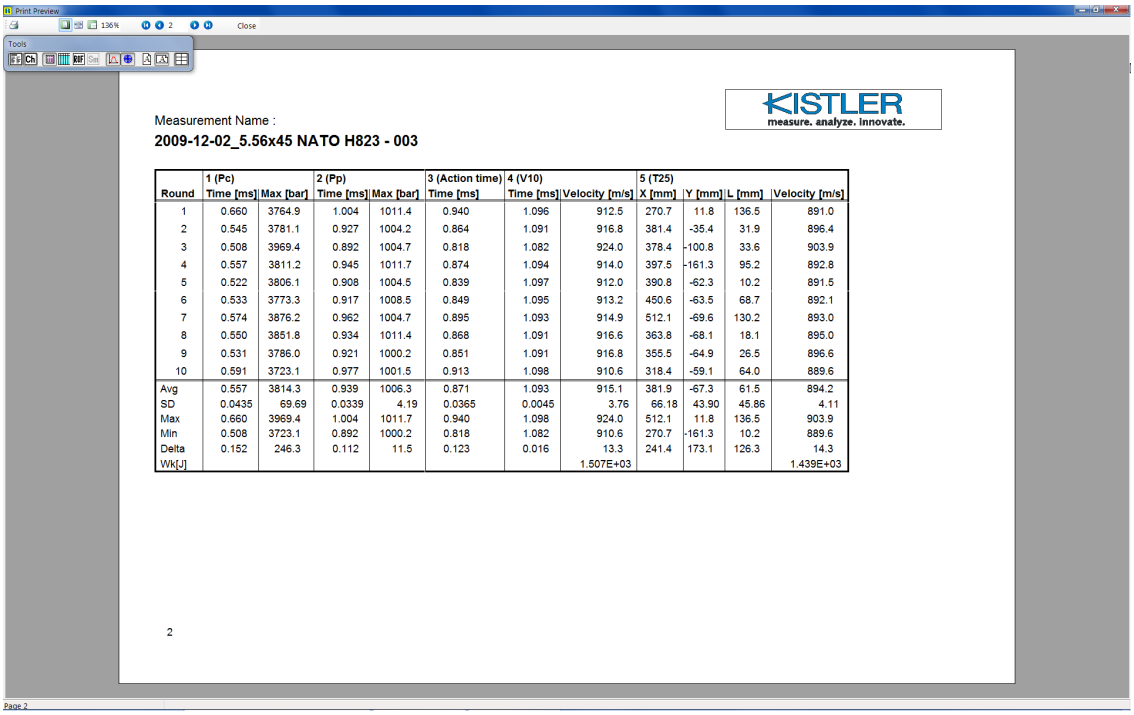
Measurement Name :

2009-12-02_5.56x45 NATO H823 - 003

Ballistic Laboratory		**Customer**	
Project No.:	Acceptance test	**Name :**	
Place :	Ballistic Laboratory	**Date :**	28.12.2011
Technician :		**Time :**	14:23
Test Manager :			
Testing Equipment		**Ammunition**	
Test barrel :	5.56x45 NATO	**Ammunition :**	SS109
Test barrel length [mm] :	508	**Calibre [mm] :**	5.56
Transducer Pc (SNo) :	Kistler 6215	**Bullet diameter [mm] :**	5.56
Transducer Pp (SNo) :	Kistler 6215		
Velocity meas. system :	WLS03		
Accuracy meas. system :	WTS03		
Notes :	Transient Recorder BA06S		

A (Ch0)	B (Ch1)	C (Ch2)	D (Ch3)	E (Ch4)	F (Ch5)	G (Ch6)	H (Ch7)
Pc	Pp	Accel		V10 Start	V10 Stop	T25X	T25Y

1

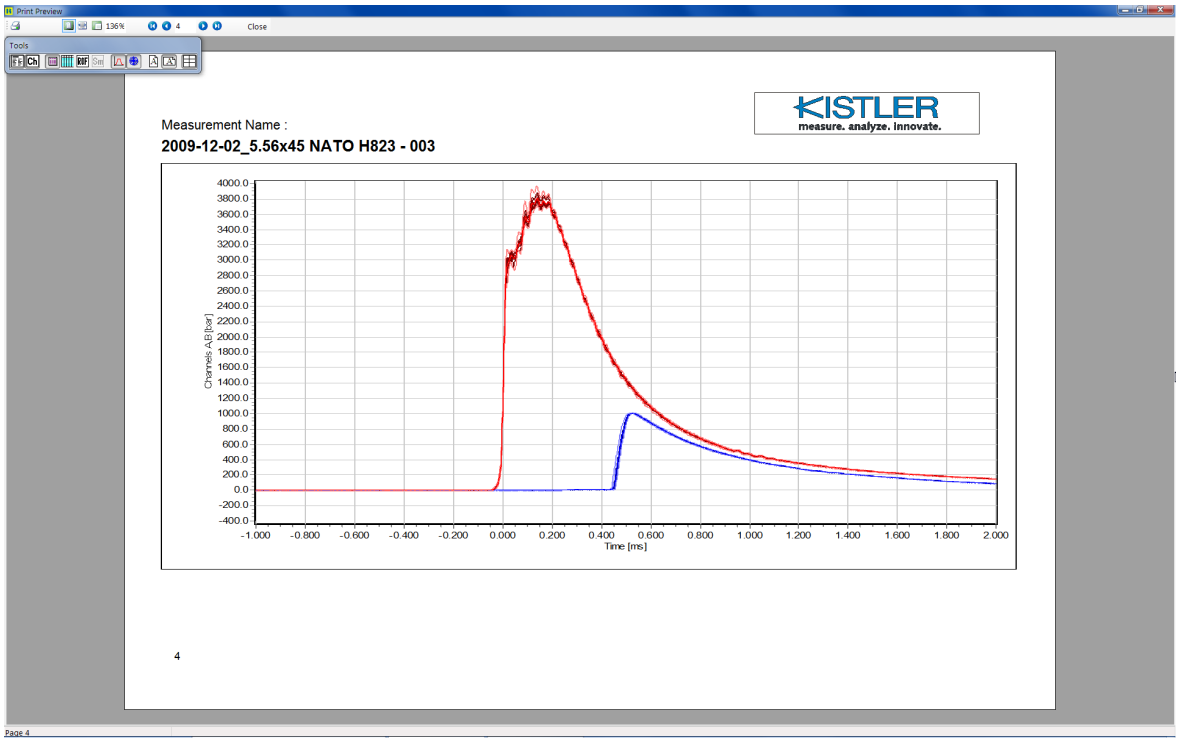


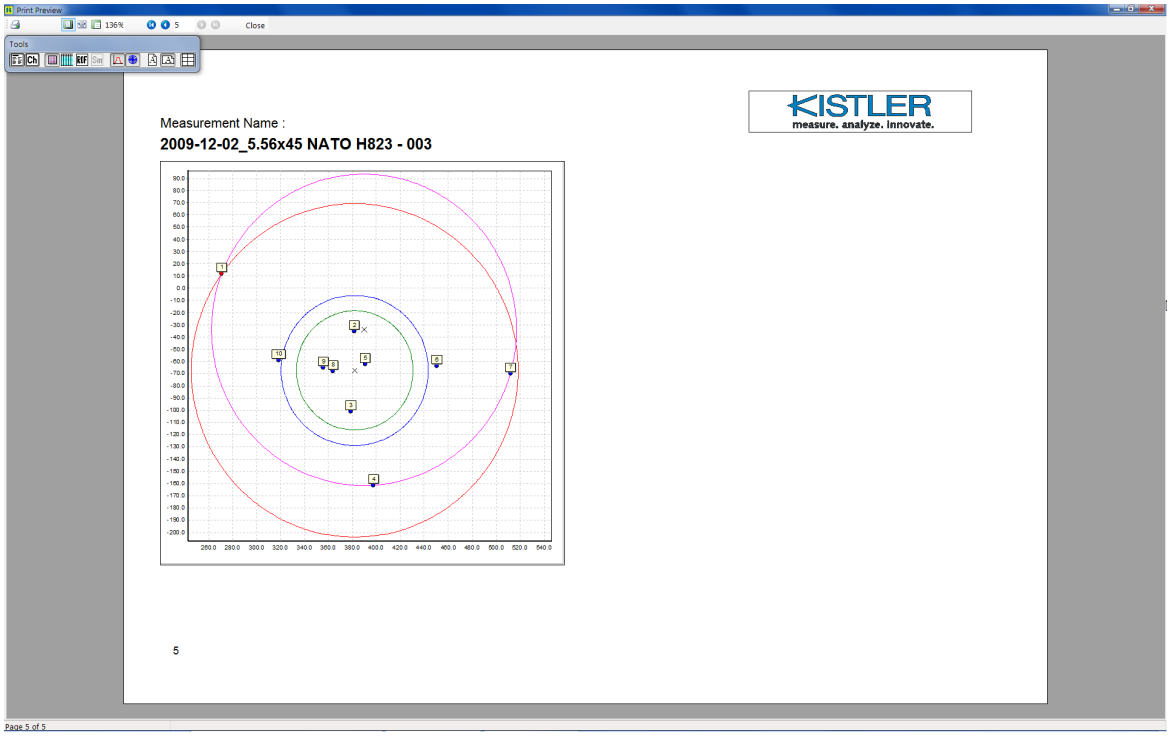
Measurement Name :

2009-12-02_5.56x45 NATO H823 - 003

	1 (Pc)		2 (Pp)		3 (Action time)	4 (V10)		5 (T25)			
Round	Time [ms]	Max [bar]	Time [ms]	Max [bar]	Time [ms]	Time [ms]	Velocity [m/s]	X [mm]	Y [mm]	L [mm]	Velocity [m/s]
1	0.660	3764.9	1.004	1011.4	0.940	1.096	912.5	270.7	11.8	136.5	891.0
2	0.545	3781.1	0.927	1004.2	0.864	1.091	916.8	381.4	-35.4	31.9	896.4
3	0.508	3969.4	0.892	1004.7	0.818	1.082	924.0	378.4	-100.8	33.6	903.9
4	0.557	3811.2	0.945	1011.7	0.874	1.094	914.0	397.5	-161.3	95.2	892.8
5	0.522	3806.1	0.908	1004.5	0.839	1.097	912.0	390.8	-62.3	10.2	891.5
6	0.533	3773.3	0.917	1008.5	0.849	1.095	913.2	450.6	-63.5	68.7	892.1
7	0.574	3876.2	0.962	1004.7	0.895	1.093	914.9	512.1	-69.6	130.2	893.0
8	0.550	3851.8	0.934	1011.4	0.868	1.091	916.6	363.8	-68.1	18.1	895.0
9	0.531	3786.0	0.921	1000.2	0.851	1.091	916.8	355.5	-64.9	26.5	896.6
10	0.591	3723.1	0.977	1001.5	0.913	1.098	910.6	318.4	-59.1	64.0	889.6
Avg	0.557	3814.3	0.939	1006.3	0.871	1.093	915.1	381.9	-67.3	61.5	894.2
SD	0.0435	69.69	0.0339	4.19	0.0365	0.0045	3.76	66.18	43.90	45.86	4.11
Max	0.660	3969.4	1.004	1011.7	0.940	1.098	924.0	512.1	11.8	136.5	903.9
Min	0.508	3723.1	0.892	1000.2	0.818	1.082	910.6	270.7	-161.3	10.2	889.6
Delta	0.152	246.3	0.112	11.5	0.123	0.016	13.3	241.4	173.1	126.3	14.3
Wk[J]							1.507E+03				1.439E+03

2





Buttons in Menu Bar serves for:

- Printing of report
- Zooming
- Listing of Pages (First, Previous, Next, Last)
- Closing of report window

Buttons in Tools panel serves for:

Show/Hide Measurement Form

Show/Hide Channel Description

Show/Hide Tables

Standard Report Table (only main results) or Wide Report Table (all results)

Show/Hide Rate Of Fire Table

Show/Hide Overall Statistics

Show/Hide Graphs

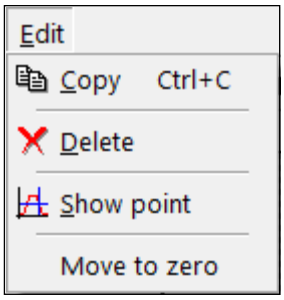
Show/Hide Target

Portrait or Landscape page

Show/Hide Form Grid

File > Exit
This will finish the work with TR 2519 control program.

3.4.1.2 Menu Edit



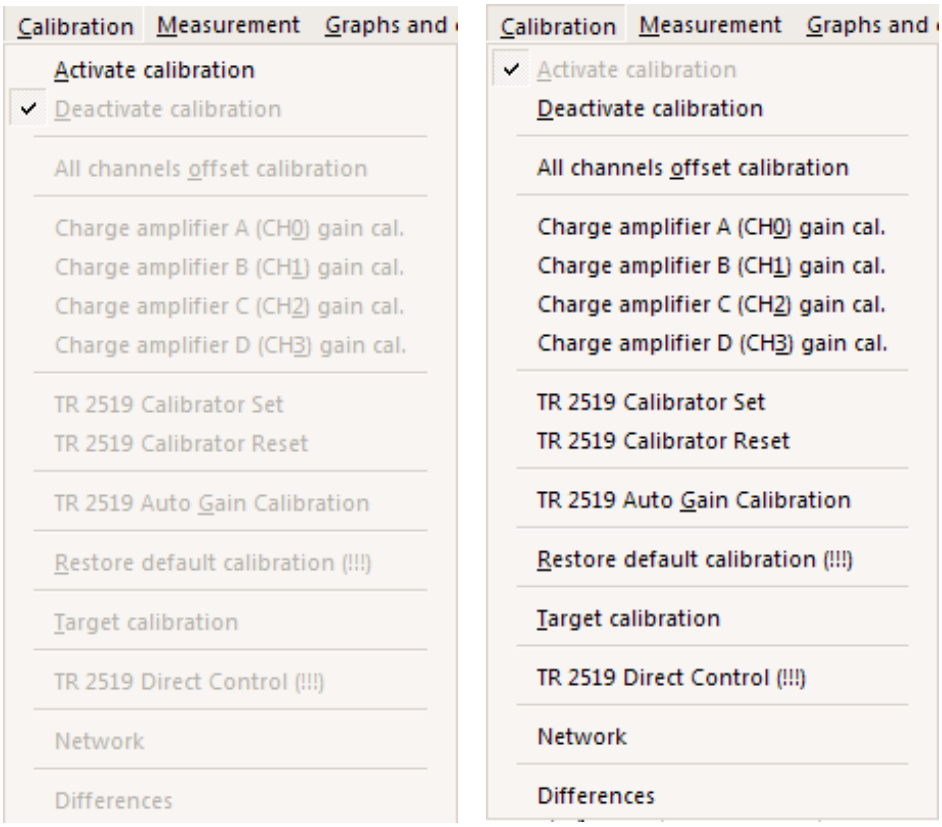
Edit > Copy Ctrl + C
This will make a copy of current graph to the clipboard.

Edit > Delete
This will delete current round. For permanent delete you have to save the data on the disc (the program works only with copy of data by reason protection of original data).

Edit > Show point
It will open the window of zoom and after that it is possible to read the coordinates of selected point (they are written at the bottom part of Zoom window, moving with the cursor is possible by means of the mouse or cursor keys). The function is terminated by switching off the zoom.

Edit > Move to zero
This function serves for offset zeroing of measured curves.
For first round (round No. 1) activate this function and select relevant curve by use of magnifying glass .
By use of cursors select properly area of curve for computing of average value (this value is equal to offset).
After *Apply to all*, the curve is shifted to zero (removing of offset). This action is automatically applied to all shots of series.
If this function is applied on round No. 2 or next, then only relevant curve of this active round is shifted.
For permanent change of data you have to save the data on the disc (the program works only with copy of data by reason protection of original data).

3.4.1.3 Menu Calibration



Calibration > Activate calibration
The calibrations are enabled after inserting of password. This will open window with calibration protocol listing (current calibration constants). There is the new file for calibration protocols saving in the directory on the disc. This file is labeled with a date and time of calibration accessing and is appended step by step with the new data of successfully finished calibrations.

Calibration > Deactivate calibration
The password is deactivated and calibrations are disabled. The window with calibration protocol listing is closed and the protocol about the calibration, which is on the disc in the directory for calibration protocols saving, is closed too. The same effect is going after finishing the program, if the calibrations were still enabled.

Calibration > All channels offset calibration
Automatic offset calibration of all channels. Disconnect all BNC connectors from the TR 2519 front panel before starting calibration. The calibration takes approx. 20 … 30 minutes and after successful finishing is added the new listing of calibration constants.

Calibration > Charge amplifier A gain calibration
Calibration > Charge amplifier B gain calibration

Calibration > Charge amplifier E gain calibration
Calibration > Charge amplifier F gain calibration
Manual gain calibration (calibration constant for charge to voltage recalculation) of single charge amplifiers. Before starting it is necessary to make offset calibration and the comparative measuring series with the reference instrument or calibrator for each charge amplifier range. Determined values are inserted into the table and the program calculates correction coefficients for calibration constant and they are sent to TR 2519. The new list of calibration constants are added to calibration protocol.

Calibration > TR 2519 Calibrator Set
Setting of TR 2519 Calibrator output voltage (DC or pulsed).
For detailed information see chapter TR 2519 Calibration.

Calibration > TR 2519 Calibrator Reset
Reset of TR 2519 Calibrator.
For detailed information see chapter TR 2519 Calibration.

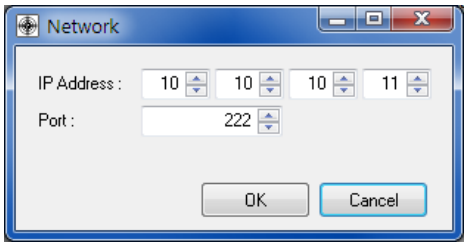
Calibration > TR 2519 Auto Gain Calibration
Auto-calibration of TR 2519.
For detailed information see chapter TR 2519 Calibration.

Calibration > Restore default Calibration (!!!)
Only for service use !!! Restoring calibration from developer. It serves only for TR 2519 function restoration if working calibration constants are corrupted. Next you have to recalibrate all instrument !!!

Calibration > Target Calibration
Manual target calibration (setting of the X and Y axis gain and offset for both target systems). This calibration is default for each new measurement.
For detailed information see User's Guide for Target System 2523.

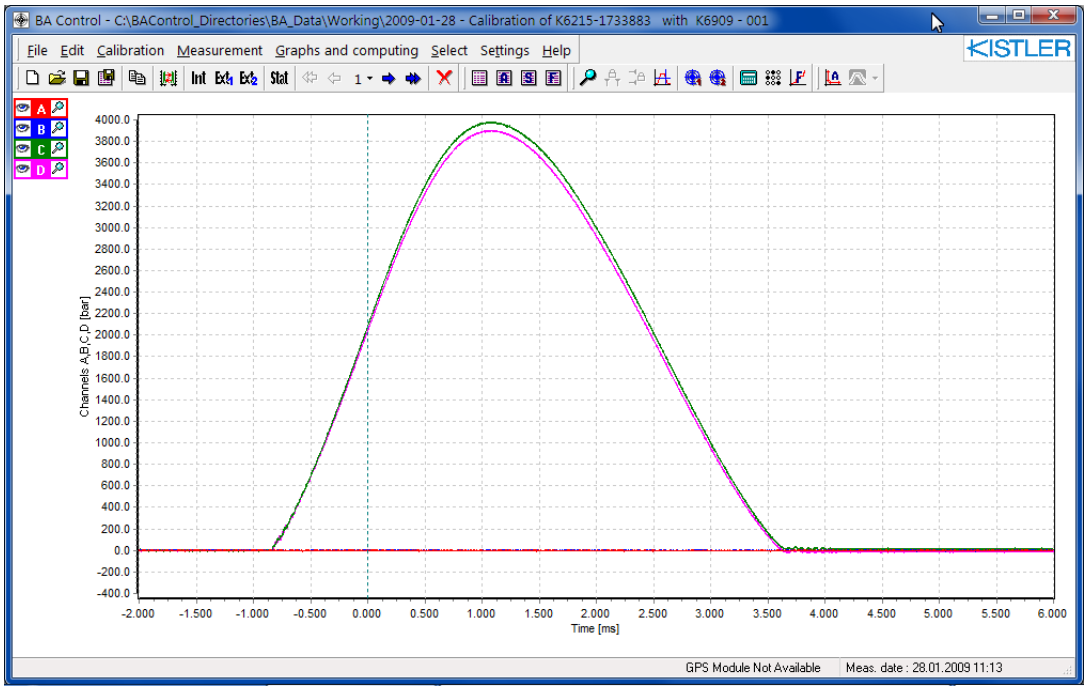
Calibration > TR 2519 Direct Control (!!!)
Manual control of TR 2519 – only for service use !!!

Calibration > Network

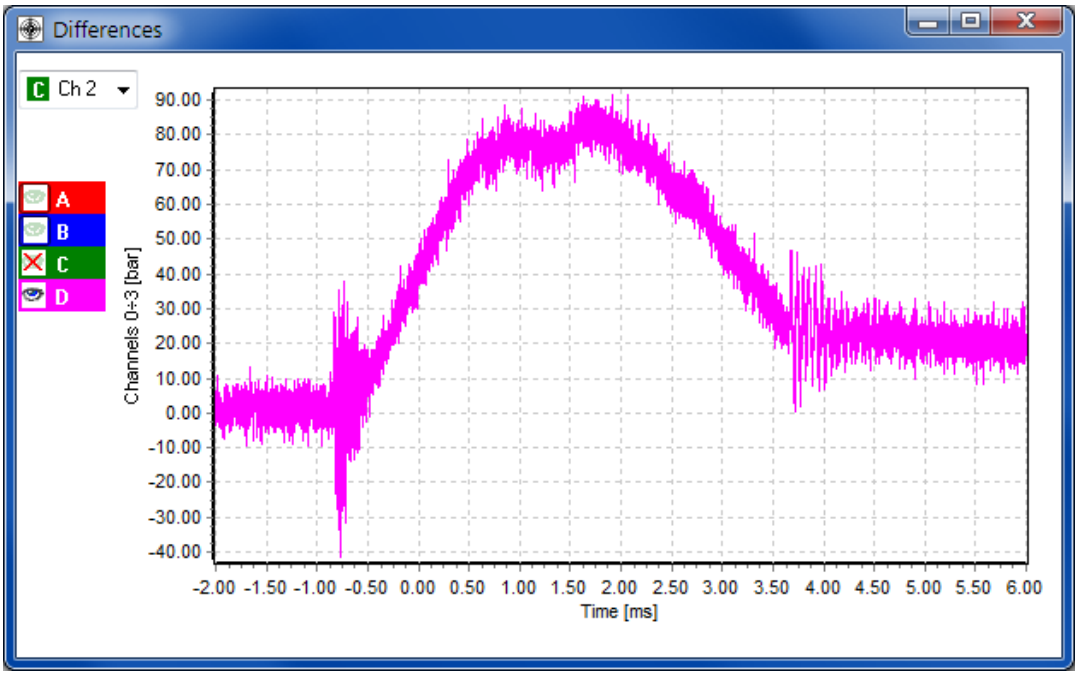


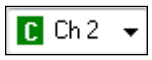
Setting of network address – it is necessary to set values according to the next picture

Calibration >Differences
Special function for visual comparison of pressure curves.
This function is normally un-accessible – use function Activate calibration to make this function accessible. Read data file.
For comparing you can use PRESSURE CURVES ONLY and they must be located in the graph of Internal Ballistics.



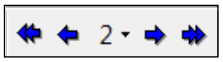
Use function Calibration > Differences for displaying of window Differences:



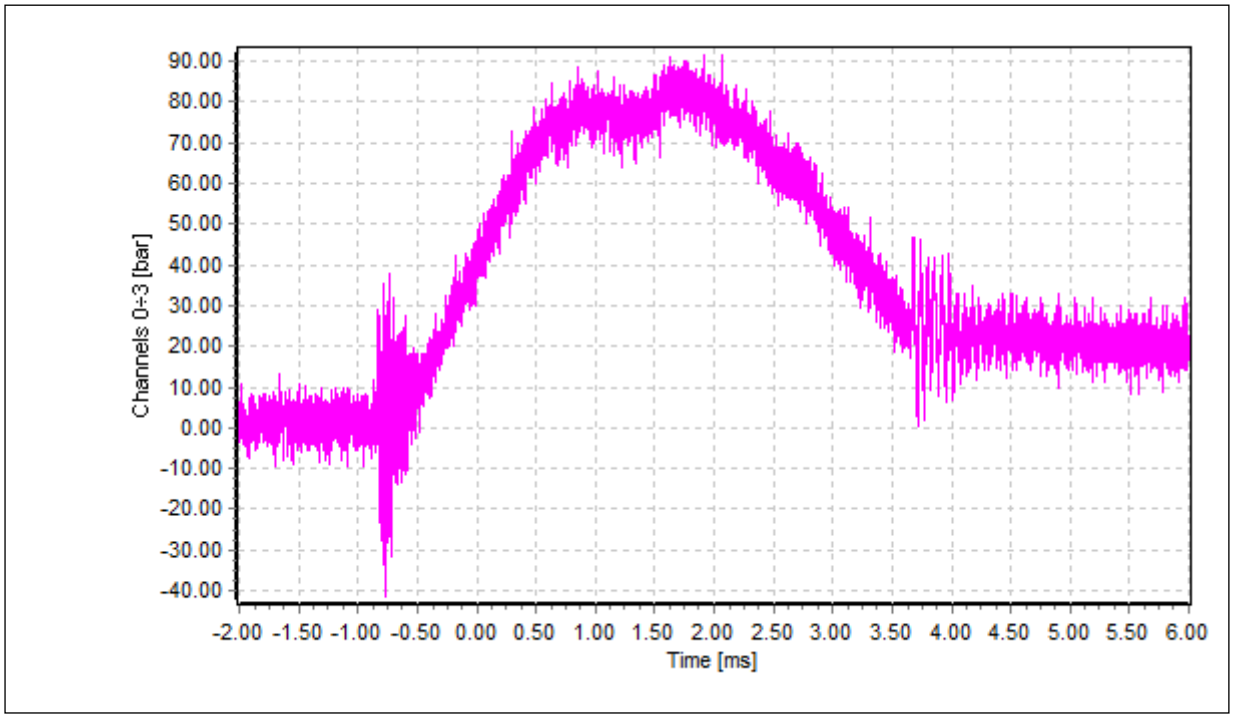


Control buttons:

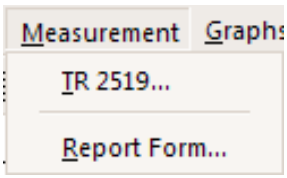
- select Reference Curve - here channel C (Ch2)
- select Differential Curve : C-A hidden
  C-B hidden
  C-C un-accessible
  (C is reference)
  C-D displayed

Use standard buttons 

for displaying of Differential Curves of another shots. It is possible to use clipboard (Ctrl+C) function for easy transport of actual graph to next applications:



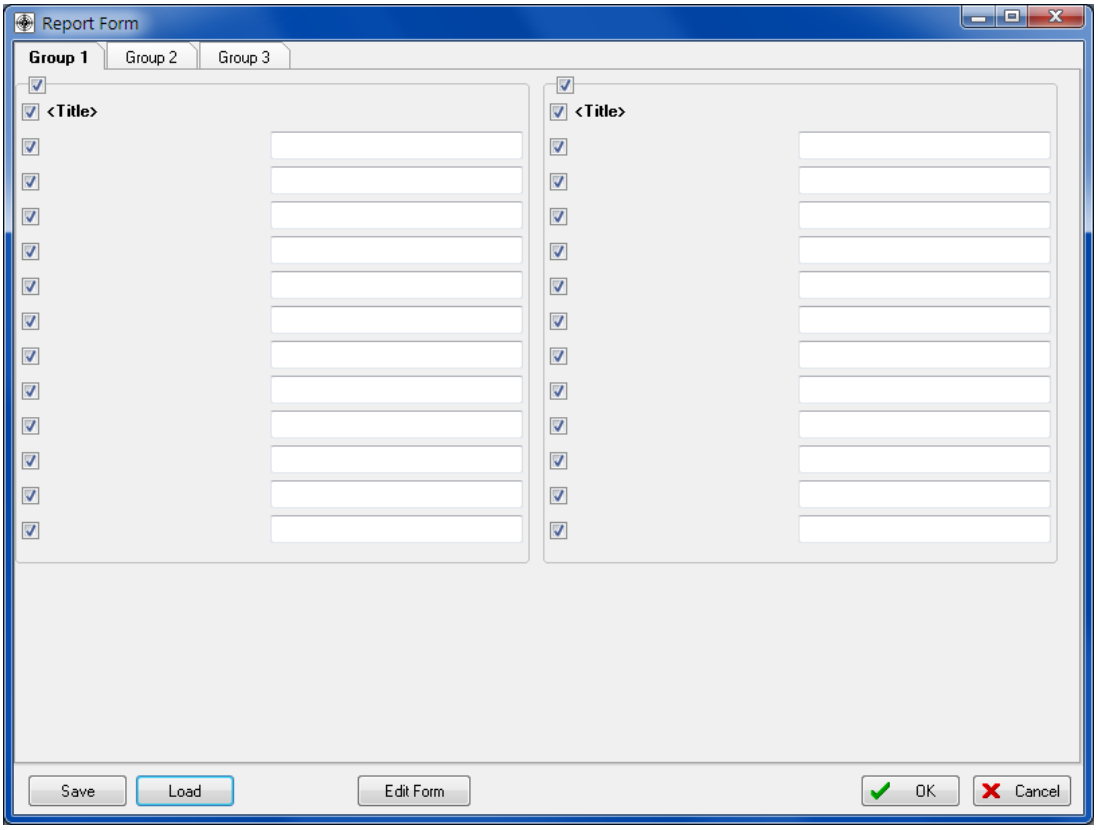
3.4.1.4 Menu Measurement



Measurement > TR 2519 ...
The activation of TR 2519 virtual panel for addition of another rounds to loaded data of previous measurement, from which it is taken complete TR 2519 setting.

Measurement > Report form...
Edit of report form.

Item for creating, saving and loading of form, which is displayed in reports.

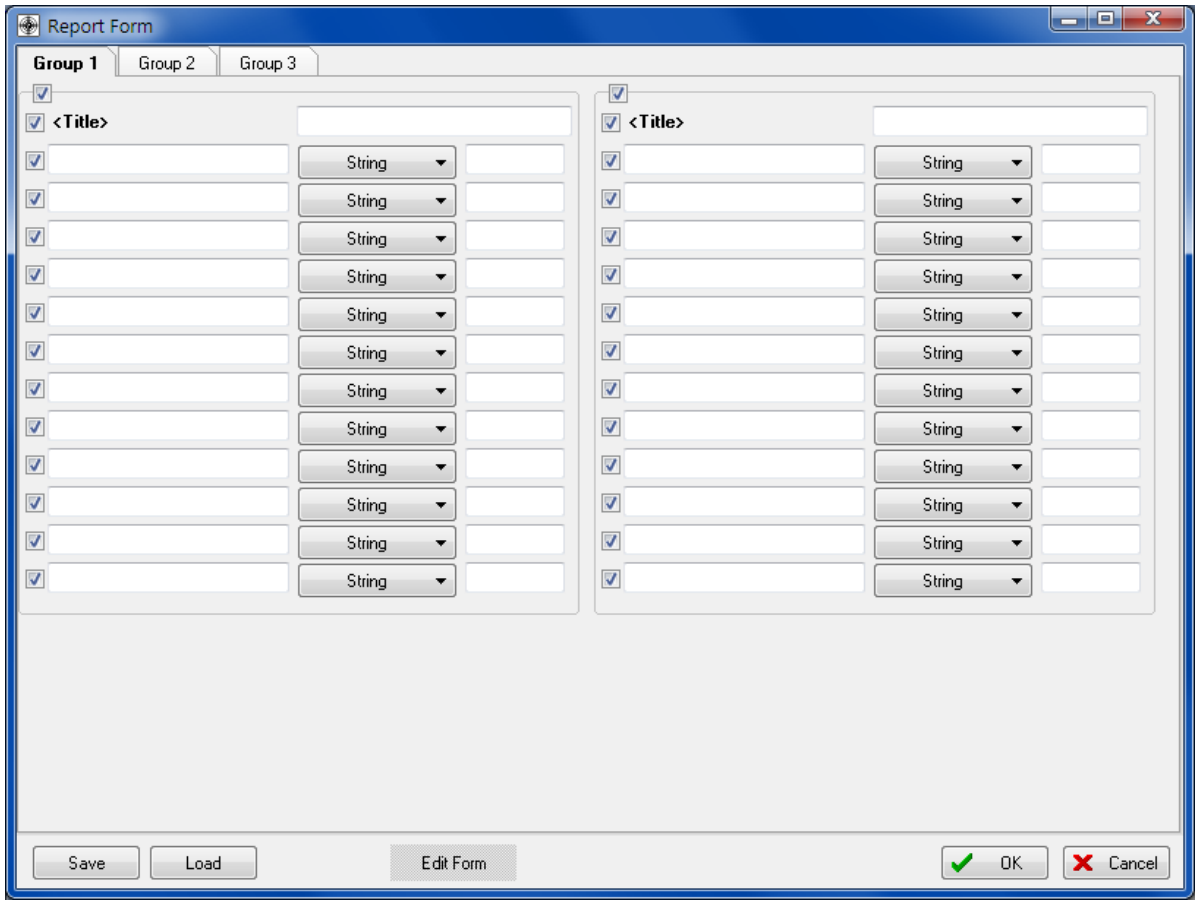


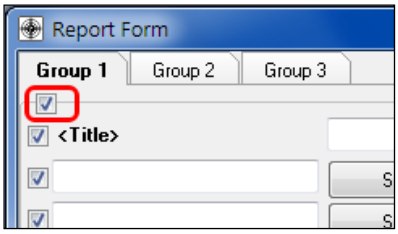
In the next picture there is default blank form:

Form consists of three pages (Group 1,2,3). Each page consists of two tables.
Each table consists of title (<Title>) and twelve rows of data description and data.

To run form edit mode press button Edit Form

.
Now it is necessary to enter password Kiwag and then form in edit mode is accessible:

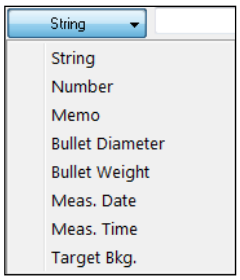




Description of Report Form window in edit mode:
Group 1, 2, 3 – pages of form, each contains two tables.

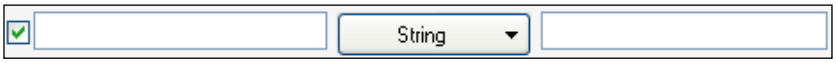
Marked checkbox determines displaying of table in reports.

<Title> - name of table (text string). Checkbox determines displaying of name in reports.

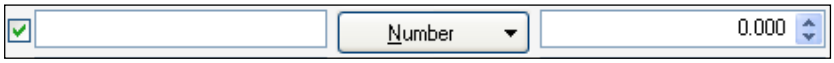


Each row of table contains offer of possible data types. Click on button for displaying of all data types.

Summary of all data types:

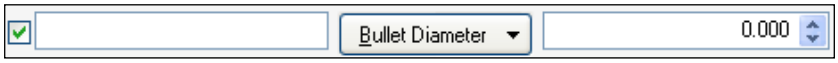


String – one row of text (checkbox determines displaying in reports)

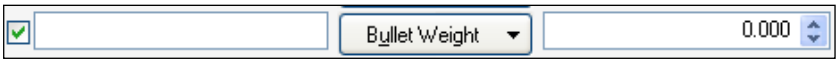


Number general number (checkbox determines displaying in reports)

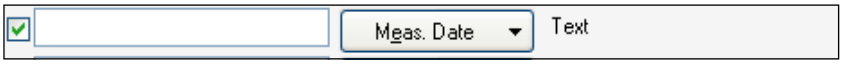
Memo – multiline text (checkbox determines displaying in reports)



Bullet Diameter – bullet diameter (number is used in calculations and can be put only once, checkbox determines displaying in reports)

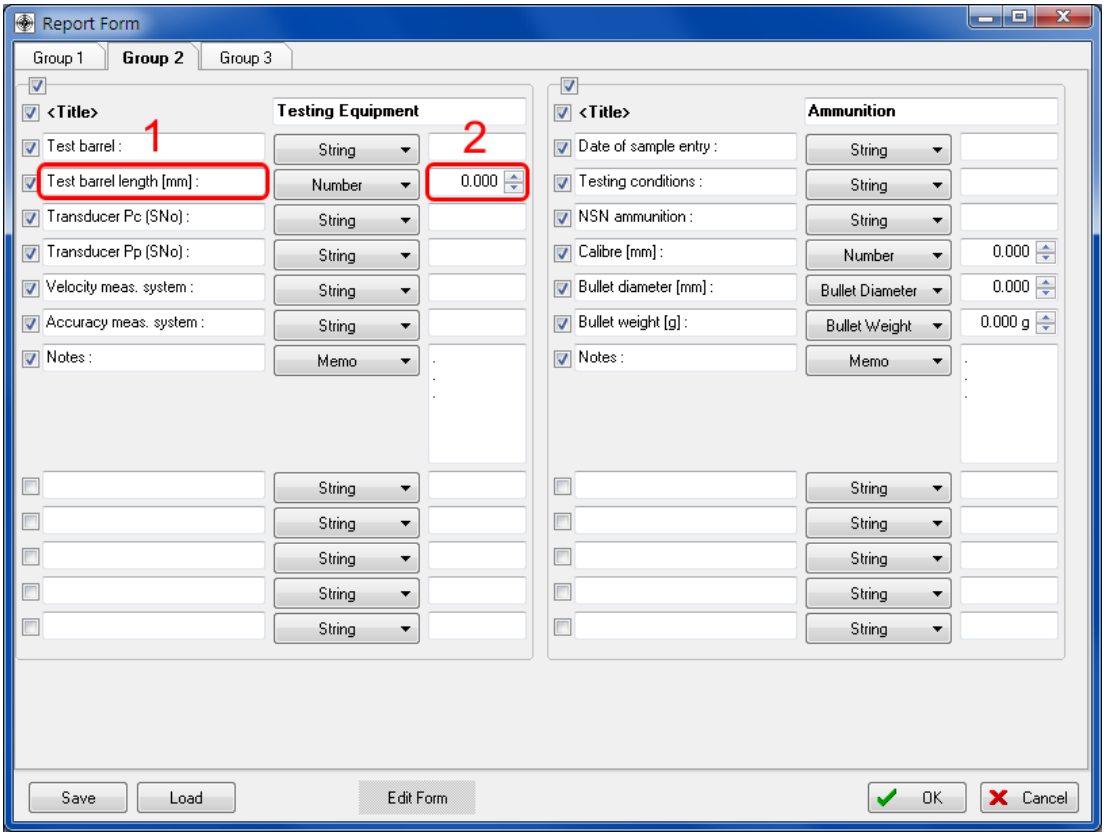


Bullet Weight – bullet weight (number is used in calculations and can be put only once, checkbox determines displaying in reports)



Meas. Date – date of measurement (filled automatically at start of measurement, can be put only once, checkbox determines displaying in reports)

Meas. Time – time of measurement (filled automatically at start of measurement, can be put only once, checkbox determines displaying in reports)



Each row of table contains two parts:

- name of row (in normal mode inaccessible, here is description of data)
- data (in normal mode accessible for filling with data)

Fill step by step all form. Then you can continue to:

Save – saves form to disc.

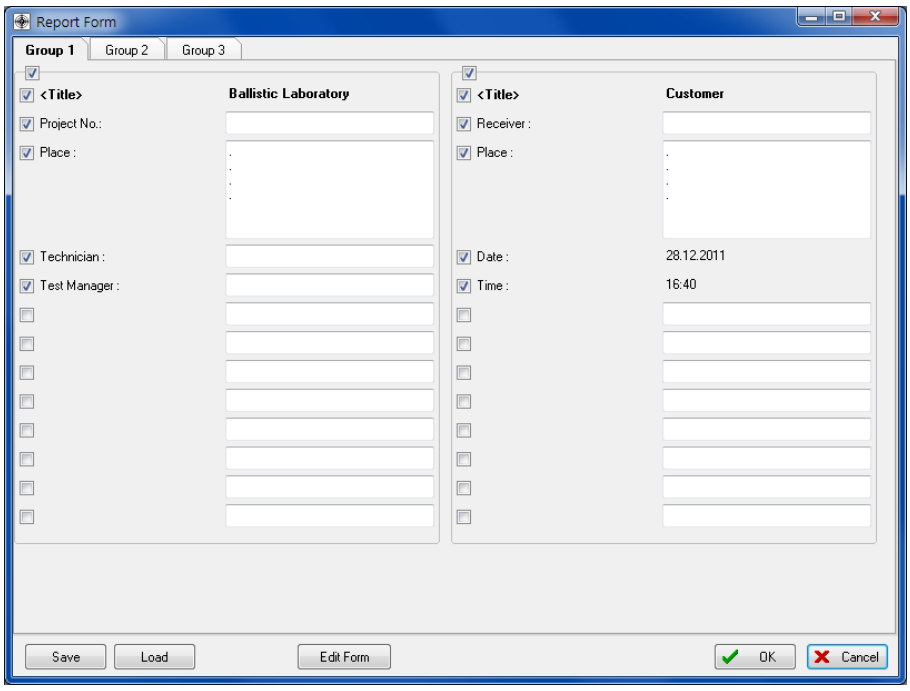
Load – load form from disc.

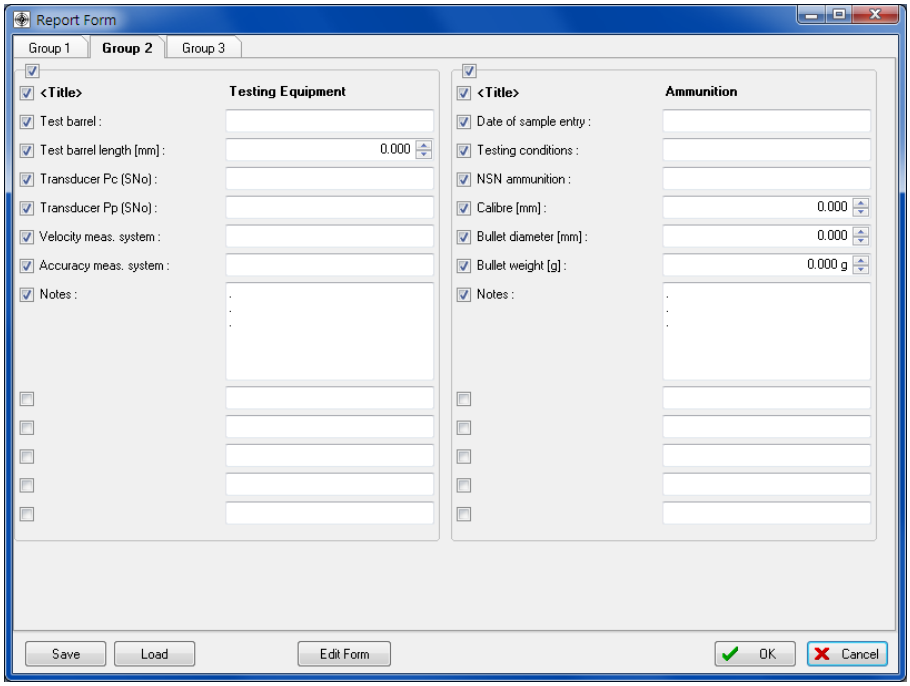
– accepts all changes without saving form to disc and close the form window.

– cancels all changes without saving form to disc and closes the form window.

By means of those functions it is possible to create set of standard forms. In the future you can easy load required form from the disk – it will save a lot of time.

On the next page there is example of completed form:





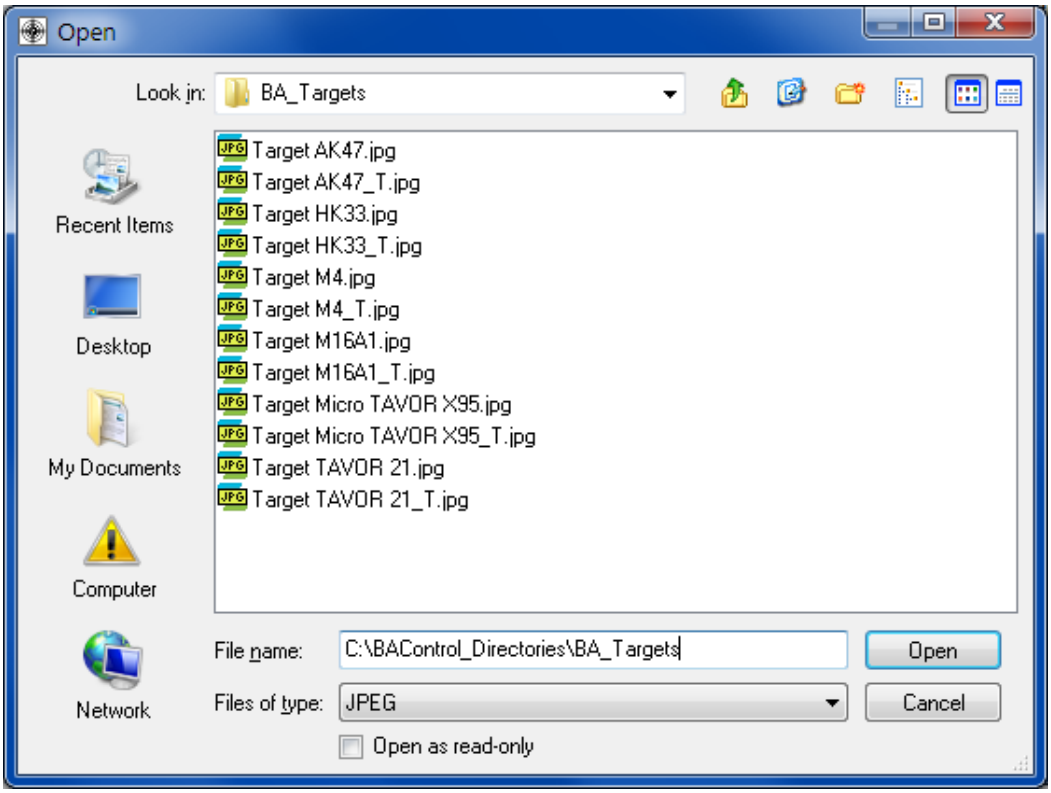
Next functions (connected to Target System):

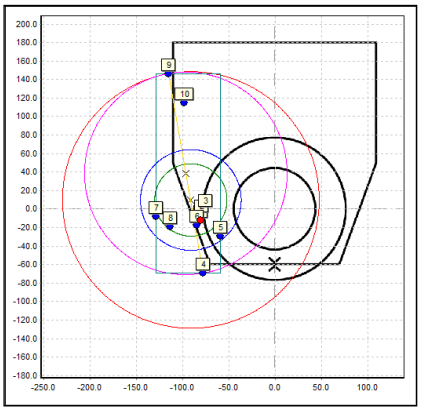
3.4.1.4.1 Target Background

In Edit Mode of Report Form add this row to your Report Form

and save this new Report Form by means of Save button.

Start new measurement. Load your Report Form which contains Target Background row and by means of button search for Target Background picture (.jpg type):





The target picture will contain selected background:

Note 1
No Target Background after moving of data to another computer.

Target Background is not saved with data. If you move your data to another computer which does not contain the same Target Background picture in appropriate folder, target background is clear. To solve this problem use the same folder structure and the same Target Background files for all your computers.

Note 2
Creating your own Target Background.

Target Background is simply bitmap picture, which fulfills next parameters:

- general requirements of JPEG bitmap picture (.jpg)
- size 2 000x2 000 points (it represents 1 000x1 000 mm target - resolution is 2 pixels/mm)
- save file as .jpg file with low compression ratio (quality factor >90 %)

For creating of Target Background you can use:

- vector drawing software (AutoCad, Corel Draw etc.)
  Use square sheet 1 000x1 000 mm, draw your target in 1:1 scale and export picture as JPEG bitmap (.jpg) picture with resolution 2 000x2 000 points

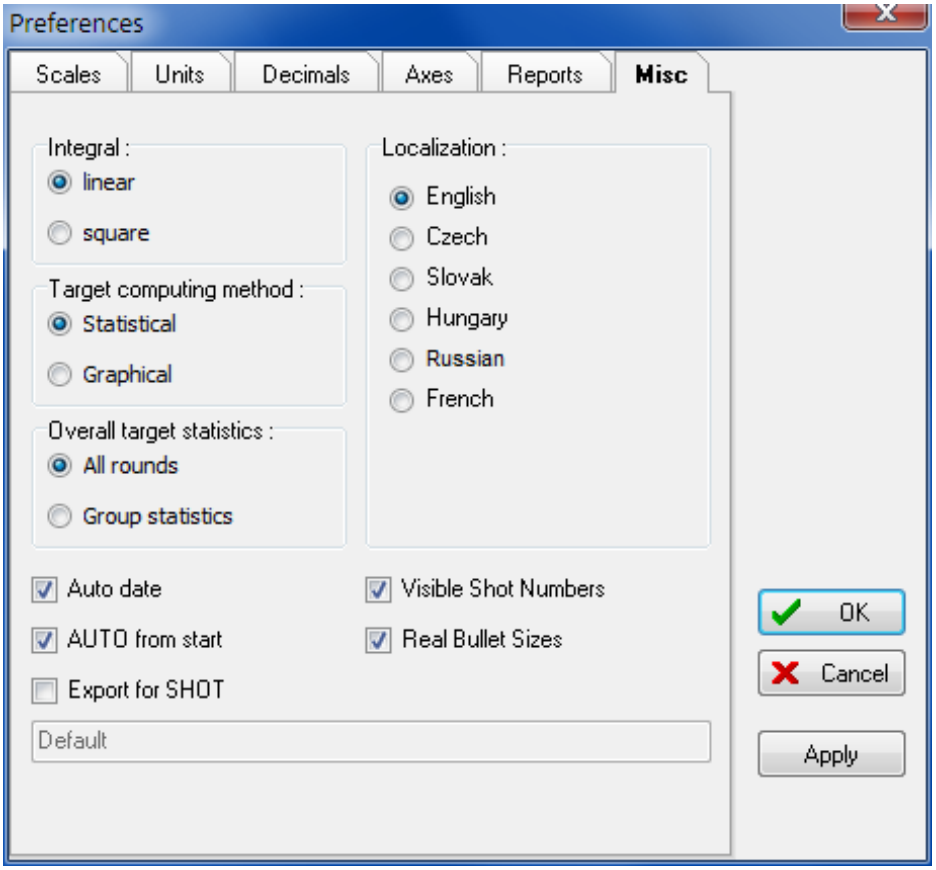
- bitmap drawing software (Corel PhotoPaint, Adobe PhotoShop etc.)
  Use square sheet 2 000x2 000 points, draw your target and save picture as JPEG bitmap (.jpg) picture with resolution 2 000x2 000 points. Instead of drawing you can use scanned original paper target too (but be careful to keep relevant scale and resolution 2 pixels/mm)

3.4.1.5 Real Diameter of Hits and Shot Numbers in Target Picture

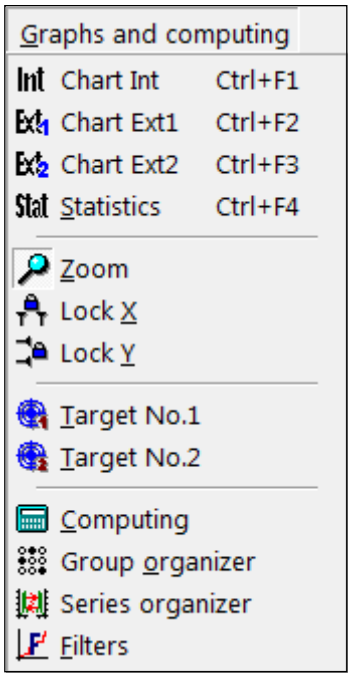
Enter real diameter of bullet in this row of Report Form.

Then in menu C 7.1.7 Menu Settings select Preferences > Misc use checkboxes:

- Visible Shot Numbers (to show or hide of shot numbers in target picture)
- Real Bullet Sizes (diameter of hit in target picture corresponds to real bullet diameter)



3.4.1.6 Menu Graphs and Computing



Graphs and computing > Chart Int Ctrl+F1

Graphs and computing > Chart Ext 1 Ctrl+F2

Graphs and computing > Chart Ext 2 Ctrl+F3

Graphs and computing > Statistics Ctrl+F4
Selection of graphs.

Graphs and computing > Zoom
Activation and finishing of zoom function. Selection of displayed curve is possible by means of small icons of magnifying glass at the number of displayed curves in the left part of main program window (

).

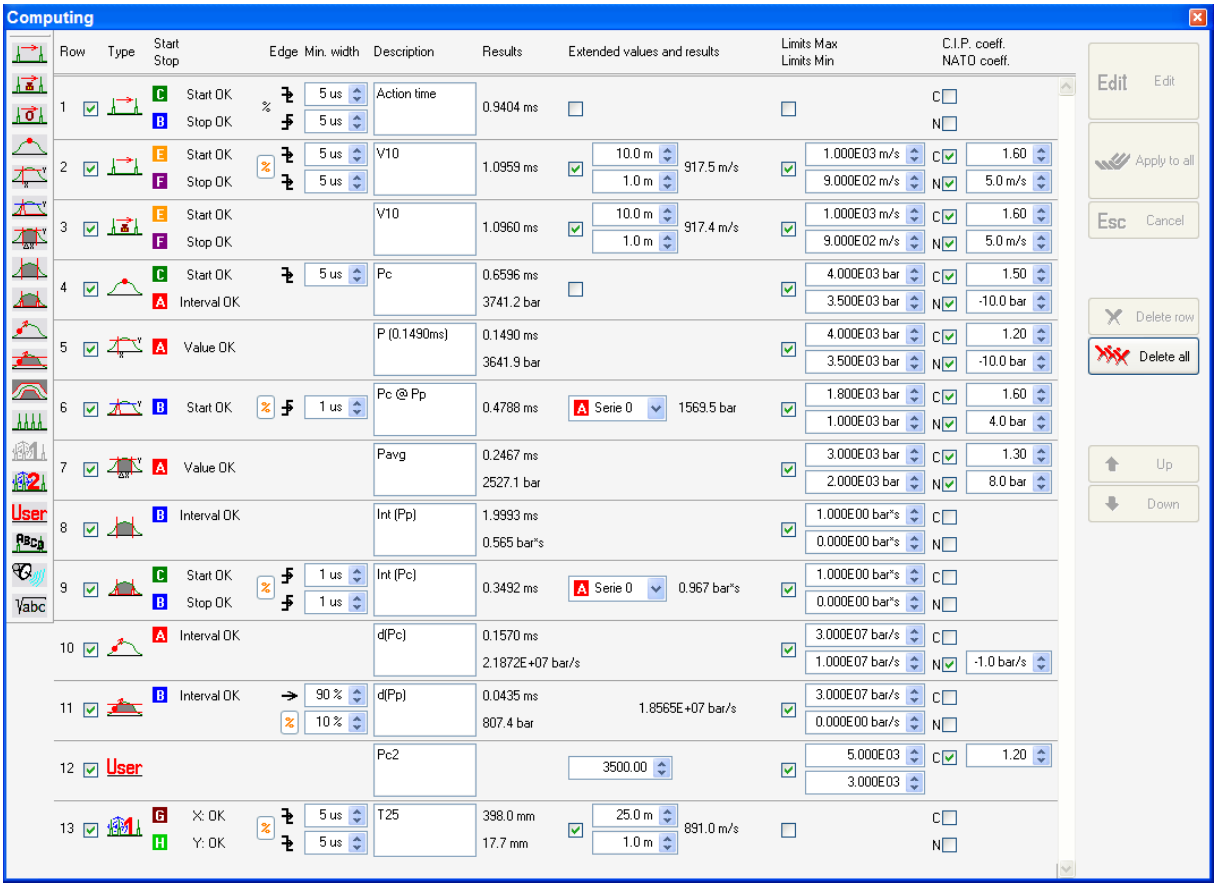
Graphs and computing > Lock X

Graphs and computing > Lock Y

Activation and deactivation of zoom lock for X and Y cursors. (right and left, resp. top and bottom cursors are moved at the same time).

Graphs and computing > Target No. 1, 2
Activation of target window 1 and 2.

Graphs and computing > Computing
Activation and deactivation of computing window



C.I.P. and NATO Correction of results
C.I.P. correction is used for computing of corrected statistic results.
Each single measured value in table is untouched.
Report contains at the end these results :

CIP K: value of C.I.P. coefficient
Avg +: corrected value
[Avg +] = [Avg] + [CIP K] x [SD]
Avg -: corrected value
[Avg-] = [Avg] – [CIP K] x [SD]

where SD means Standard Deviation.

NATO Correction is used for correction of each measured value in table:

Value in table = Measured value + NATO Correction

This menu serves for building the method for evaluation of measured data, i.e. for numerical calculations of time, velocity, gradient and integral of any curve. By contrast to other analyzers it is not prearranged, what the instrument measures, but the user can adjust TR 2519 according to its requirements for concrete application.

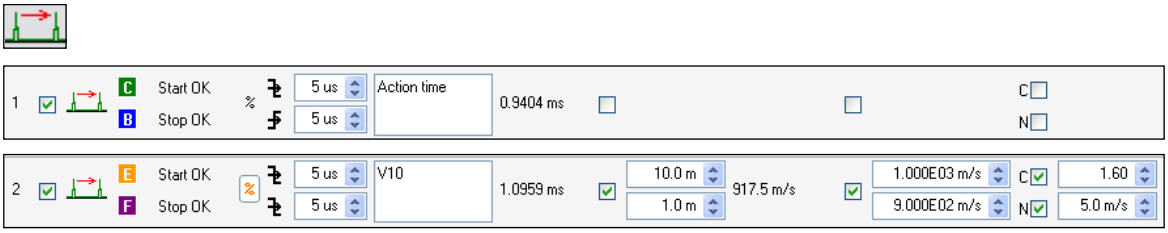
Common instructions for working in this window are:

- the line is selected by means of button with colored number of curve.
- go to edit mode by means of button

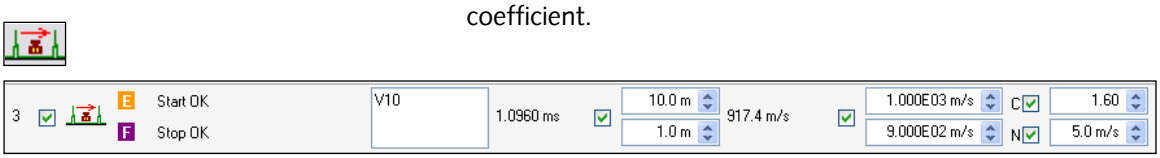
Edit , for finishing press button

Apply to all or

Escape .
- use the key ENTER for numerical value or text inserting or move cursor to another field for number/text inserting or the new value will not be accepted
- all editing of data are accessible only for first round series and the change is applied always for all the others after pressing Apply to all or will be canceled after pressing Escape
- for second and another rounds it is possible to edit only vertical cursors setting (they determine the interval for evaluation) and horizontal cursor (threshold setting)
- detailed description of cursor setting and the practice are assigned on the measurement example, see chapter B 4.4 Creating of method for data evaluation

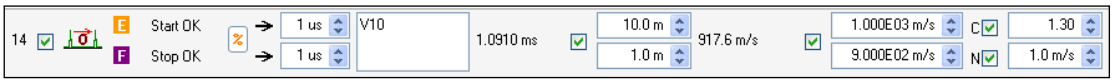


Add Time/Velocity – calculation of time and velocity
The single elements are (from the left): the line number, the checkbox for show/hide row in all reports, the icon for marking of function, the button for start a time admeasurement (up), the button for stop of time admeasurement (down), setting of horizontal cursor unit ([%] of maximum value or Y-axis unit [V, bar,…]), the button for selection of rise/fall edge from left/right for start (up) and stop (down), entering of minimum acceptable width of start (up) and stop (down) impulse, the text field for any line marking, the result of time admeasurement (start – stop), the checkbox for selection of velocity calculation, setting of the distance of first gate of pair from the muzzle (up), setting the size of base (distance between pair of gates, down), the final value of velocity, the checkbox for selection of calculation with limits, entering of maximum (up) and minimum (down) limit value, the checkbox for selection of calculation with C.I.P./NATO coefficients and the field for setting of C.I.P./NATO coefficient.



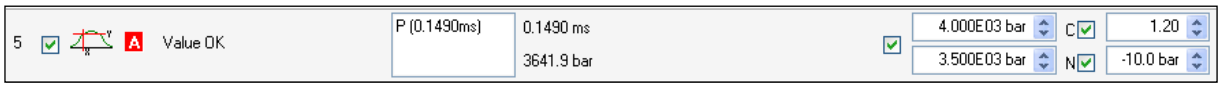
Add t/v integral – calculation of time and velocity by means of integral
The setting is in Settings > Preferences > Misc > Integral. This using requires special analog optical gates, which allow this TR 2519 calculating with the center of flying object (setting basic calculates integral of shadow, i.e. projection of the bullet, square calculates integral of shadow square, i.e. through-flying mass). In selected interval it is always pictured the integral curve and it is calculated its intersection with horizontal cursor. It is pictured position of horizontal cursor in percent from the maximum of integral.
The single elements are (from the left) : the line number, the checkbox for show/hide row in all reports, the icon for marking of function, the button for start a time admeasurement (up), the button for stop of time admeasurement (down), the text field for any line marking, the result of time admeasurement (start – stop), the checkbox for selection of velocity calculation, setting of the distance of first gate of pair from the muzzle (up), setting the size of base (distance between pair of gates, down), the final value of velocity, the checkbox for selection of calculation with limits, entering of maximum (up) and

minimum (down) limit value, the checkbox for selection of calculation with C.I.P./NATO coefficients and the field for setting of C.I.P./NATO coefficient.



Add t/v zero – calculation of velocity from zero crossing
The single elements are (from the left) : the line number, the checkbox for show/hide row in all reports, the icon for marking of function, the button for start a time admeasurement (up), the button for stop of time admeasurement (down), setting of horizontal cursor unit ([%] of maximum value or Y-axis unit [V, bar,…]), the button for acceptance of first crossing by zero after exceeding threshold level from the left or from right for start (up) and stop (down), entering of minimum acceptable width of start (up) and stop (down) impulse, the text field for any line marking, the result of time admeasurement (start – stop), the checkbox for selection of velocity calculation, setting of the distance of first gate of pair from the muzzle (up), setting the size of base (distance between pair of gates, down), the final value of velocity, the checkbox for selection of calculation with limits, entering of maximum (up) and minimum (down) limit value, the checkbox for selection of calculation with C.I.P./NATO coefficients and the field for setting of C.I.P./NATO coefficient.

Add pressure - calculation of the maximum pressure
The single elements are (from the left) : the line number, the checkbox for show/hide row in all reports, the icon for marking of function, the button for start a time to maximum admeasurement (up), the button for setting of interval for maximum pressure calculation (down), setting of horizontal cursor unit ([%] of maximum value or Y-axis unit [V, bar,…]), the button for selection of rise/fall edge from left/right for start (up), entering of minimum acceptable width of start impulse (up), setting of length of noise filter for calculation of maximum value (down), the text field for any line marking, the result of time admeasurement (up) and maximum pressure (down), the checkbox for selection of time up to adjusted pressure level, setting the pressure level in percent of maximum pressure, the final time up to specified pressure level, the checkbox for selection of calculation with limits, entering of maximum (up) and minimum (down) limit value, the checkbox for selection of calculation with C.I.P./NATO coefficients and the field for setting of C.I.P./NATO coefficient.

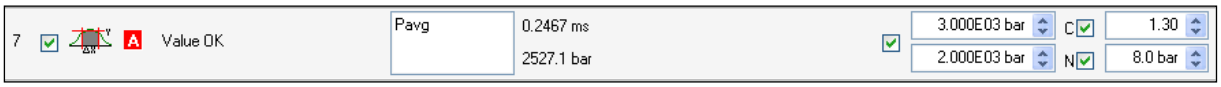


Add Y = f (X) – computing of function value for preset value of X(time)

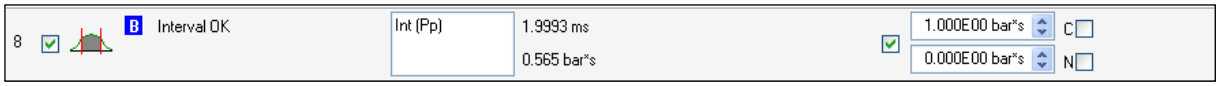
The single elements are (from the left) : the line number, the checkbox for show/hide row in all reports, the icon for marking of function, the button for selection of the curve, the text field for any line marking, value of preset X coordinate (time, up) and computed relevant value Y, the checkbox for selection of calculation with limits, entering of maximum (up) and minimum (down) limit value, the checkbox for selection of calculation with C.I.P./NATO coefficients and the field for setting of C.I.P./NATO coefficient.

Add adv. Y = f (X) – computing of function value at start impulse

The single elements are (from the left) : the line number, the checkbox for show/hide row in all reports, the icon for marking of function, the button for selection of start impulse, setting of horizontal cursor unit ([%] of maximum value or Y-axis unit [V, bar,…]), the button for selection of rise/fall edge from left/right, entering of minimum acceptable width of impulse, the text field for any line marking, value of relevant X coordinate (time), selection of curve for computing of Y coordinate, computed relevant Y-value, the checkbox for selection of calculation with limits, entering of maximum (up) and minimum (down) limit value, the checkbox for selection of calculation with C.I.P./NATO coefficients and the field for setting of C.I.P./NATO coefficient.

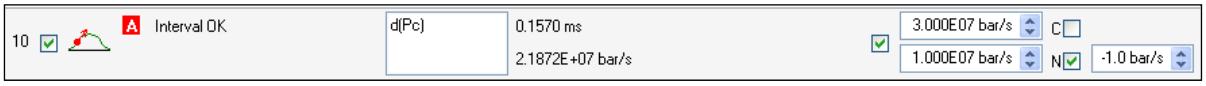


Add Y = AVG (X) – computing of average value of function in interval X
The single elements are (from the left) : the line number, the checkbox for show/hide row in all reports, the icon for marking of function, the button for selection of the curve, the text field for any line marking, value of preset X interval (time, up) and computed relevant value Y=AVG(X), the checkbox for selection of calculation with limits, entering of maximum (up) and minimum (down) limit value, the checkbox for selection of calculation with C.I.P./NATO coefficients and the field for setting of C.I.P./NATO coefficient.

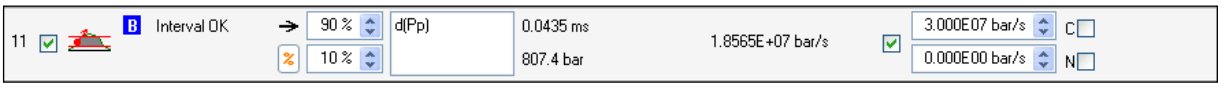


Add integral – calculation of integral (between cursors)
The single elements are (from the left): the line number, the checkbox for show/hide row in all reports, the icon for marking of function, the button for setting the limits of integration, the text field for any line marking, the result of integration time admeasurement (up) and the final value of integral (down), the checkbox for selection of calculation with limits, entering of maximum (up) and minimum (down) limit value, the checkbox for selection of calculation with C.I.P./NATO coefficients and the field for setting of C.I.P./NATO coefficient.

Add adv. integral – calculation of integral (between start/stop impulse)
The single elements are (from the left) : the line number, the checkbox for show/hide row in all reports, the icon for marking of function, the button for selection of start impulse (up), the button for selection of stop impulse (down), setting of horizontal cursor unit ([%] of maximum value or Y-axis unit [V, bar,…]), the button for selection of rise/fall edge from left/right for start (up) and stop (down), entering of minimum acceptable width of start (up) and stop (down) impulse, the text field for any line marking, the result of integration time admeasurement (start – stop), the selection of curve for integration, the final value of integral, the checkbox for selection of calculation with limits, entering of maximum (up) and minimum (down) limit value, the checkbox for selection of calculation with C.I.P./NATO coefficients and the field for setting of C.I.P./NATO coefficient.



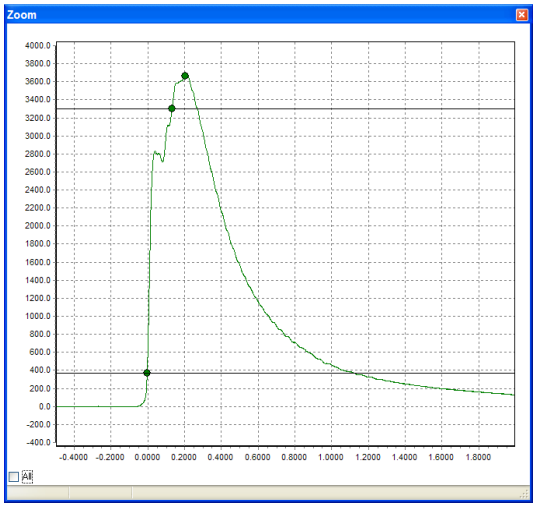
Add gradient – calculation of rate of rise (rate of fall) of the curve
The single elements are (from the left) : the line number, the checkbox for show/hide row in all reports, the icon for marking of function, the button for setting the calculation limits, the text field for any line marking, the result of derivation time admeasurement (up) and the final value of rate of rise (rate of fall, down), the checkbox for selection of calculation with limits, entering of maximum (up) and minimum (down) limit value, the checkbox for selection of calculation with C.I.P./NATO coefficients and the field for setting of C.I.P./NATO coefficient.

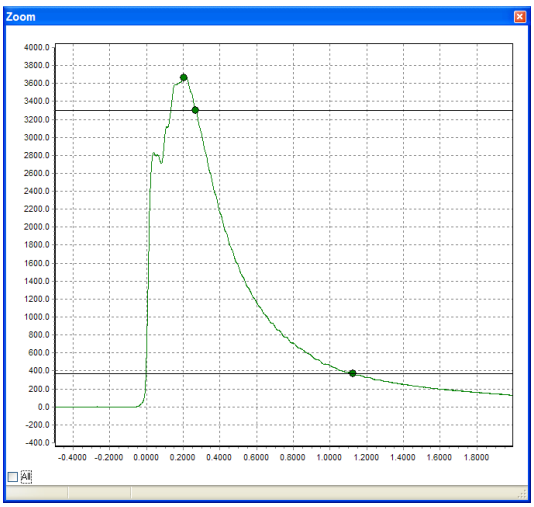


Add Rise/Fall – computing of parameters of impulse edge (rate of rise, rate of fall)

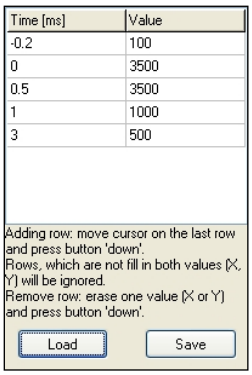
The single elements are (from the left) : the line number, the checkbox for show/hide row in all reports, the icon for marking of function, the button for selection of the curve, the button for setting the calculation limits, the button for selection of rise or fall edge, setting of horizontal cursor unit ([%] of maximum value or Y-axis unit [V, bar,…]), switch for selection of limits (% of maximum value, direct value), entering of the limit values for searching of start point (down) and stop point (up) of linear approximation of impulse edge, the text field for any line marking, computed value of dX (up) and dY (down), the final value of linear approximation of rate of rise (rate of fall) dY/dX, the checkbox for selection of calculation with C.I.P./NATO coefficients and the field for setting of C.I.P./NATO coefficient.

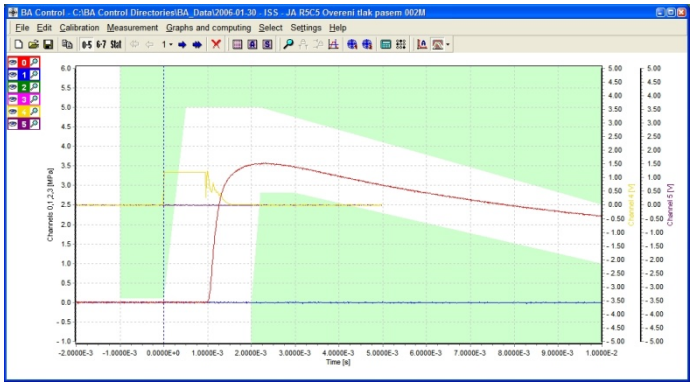
This function serves for determinate of impulse rate of rise (rate of fall) by means of linear approximation between two points, which are computed as a percent of percent of value of maximum in selected interval.

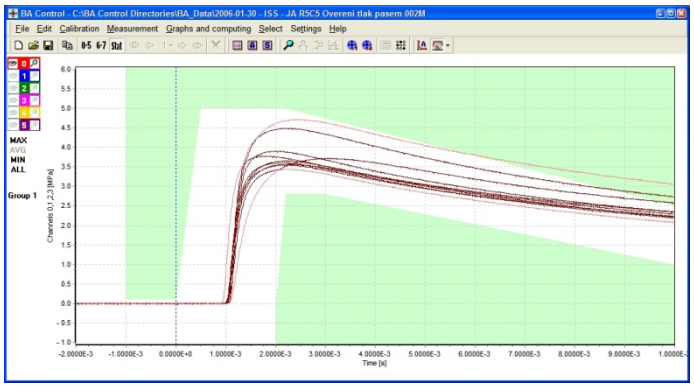




Add Mask – mask for checking of shape of curve
The single elements are (from the left) : the line number, the checkbox for show/hide row in all reports, the icon for marking of function, the button for selection of the curve, the text field for any line marking and the buttons for setting of high and low limit mask. After pressing of button appears the table for entering of mask, where first column means time coordinate (X axe) and second column means value of measured signal (relevant axe Y). Handling of the table is described in help (at the bottom of table). After activation of this row in Computing window the relevant mask is highlighted. Buttons *Load* and *Save* serve for loading and saving of created mask. Relevant tables are written in reports.

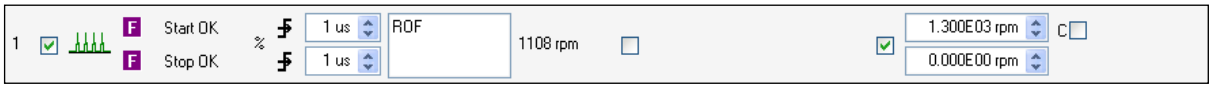




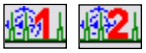


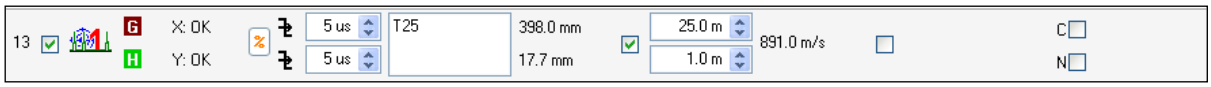
Button

in main program window toolbar serves for displaying (hiding) of selected mask in main program window or statistic window. Number of mask corresponds with relevant number of row in computing .



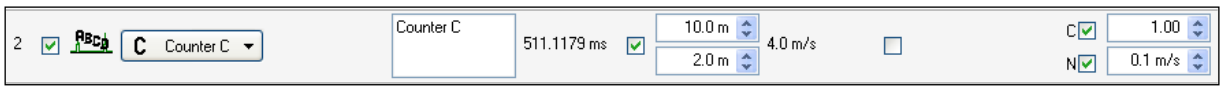
Add Rate Of Fire – calculation of Rate Of Fire
The single elements are (from the left) : the line number, the checkbox for show/hide row in all reports, the icon for marking of function, the button for searching of start impulses (up), the button for searching of stop impulses (down), setting of horizontal cursor unit ([%] of maximum value or Y-axis unit [V, bar,…]), the button for selection of rise/fall edge from left/right for start (up) and stop (down), entering of minimum acceptable width of start (up) and stop (down) impulse, the text field for any line marking, the result value of Rate Of Fire (average value), the checkbox for selection of velocity calculation, setting of the distance of first gate of pair from the muzzle (up), setting the size of base (distance between pair of gates, down), the final value of velocity (average value), the checkbox for selection of calculation with limits, entering of maximum (up) and minimum (down) limit value, the checkbox for selection of calculation with C.I.P. coefficients and the field for setting of C.I.P. coefficient.



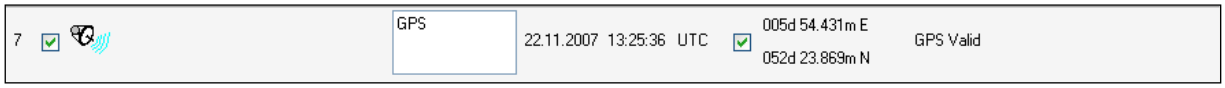


Add target – calculation of target
The single elements are (from the left) : the line number, the checkbox for show/hide row in all reports, the icon for marking of function, the button for searching of X impulses (up), the button for searching of Y impulses (down), setting of horizontal cursor unit ([%] of maximum value or Y-axis unit [V, bar,…]), the button for selection of rise/fall edge from left/right for X (up) and Y (down), entering of minimum acceptable width of X (up) and Y (down) impulse, the text field for any line marking, the result of coordinate X (up) and Y (down), the checkbox for selection of target velocity calculation, setting of the distance of first gate of pair from the muzzle (up), setting the size of base (distance between pair of gates, down), the final value of velocity, the checkbox for selection of calculation with limits, entering of maximum (up) and minimum (down) limit value, the checkbox for selection of calculation with C.I.P./NATO coefficients and the field for setting of C.I.P./NATO coefficient.

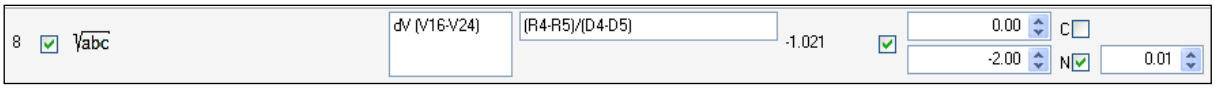
Add user – input of any numeric value
This value will be processed with data.
The single elements are (from the left) : the line number, the checkbox for show/hide row in all reports, the icon for marking of function, the text field for any line marking, the field for setting the numerical value, the checkbox for selection of calculation with C.I.P. coefficients and the field for setting of C.I.P. coefficient.



Add Start-Stop Counter – computing of time/velocity by means of counters (BA04SE only)
The single elements are (from the left) : the line number, the checkbox for show/hide row in all reports, the icon for marking of function, the button for selection of counter channel, the text field for any line marking, the result of time admeasurement, the checkbox for selection of velocity calculation, setting of the distance of first gate of pair from the muzzle (up), setting the size of base (distance between pair of gates, down), the final value of velocity, the checkbox for selection of calculation with limits, entering of maximum (up) and minimum (down) limit value, the checkbox for selection of calculation with C.I.P./NATO coefficients and the field for setting of C.I.P./NATO coefficient.



Add GPS – UTC Time and Coordinates
The single elements are (from the left) : the line number, the checkbox for show/hide row in all reports, the icon for marking of function, the text field for any line marking, UTC Date and Time, checkbox for adding of GPS Coordinates, GPS Coordinates (upper Longitude, lower Latitude) and GPS Status for checking of function.
If GPS module is not present, this function adds date and time stamp from Windows and coordinates are empty.

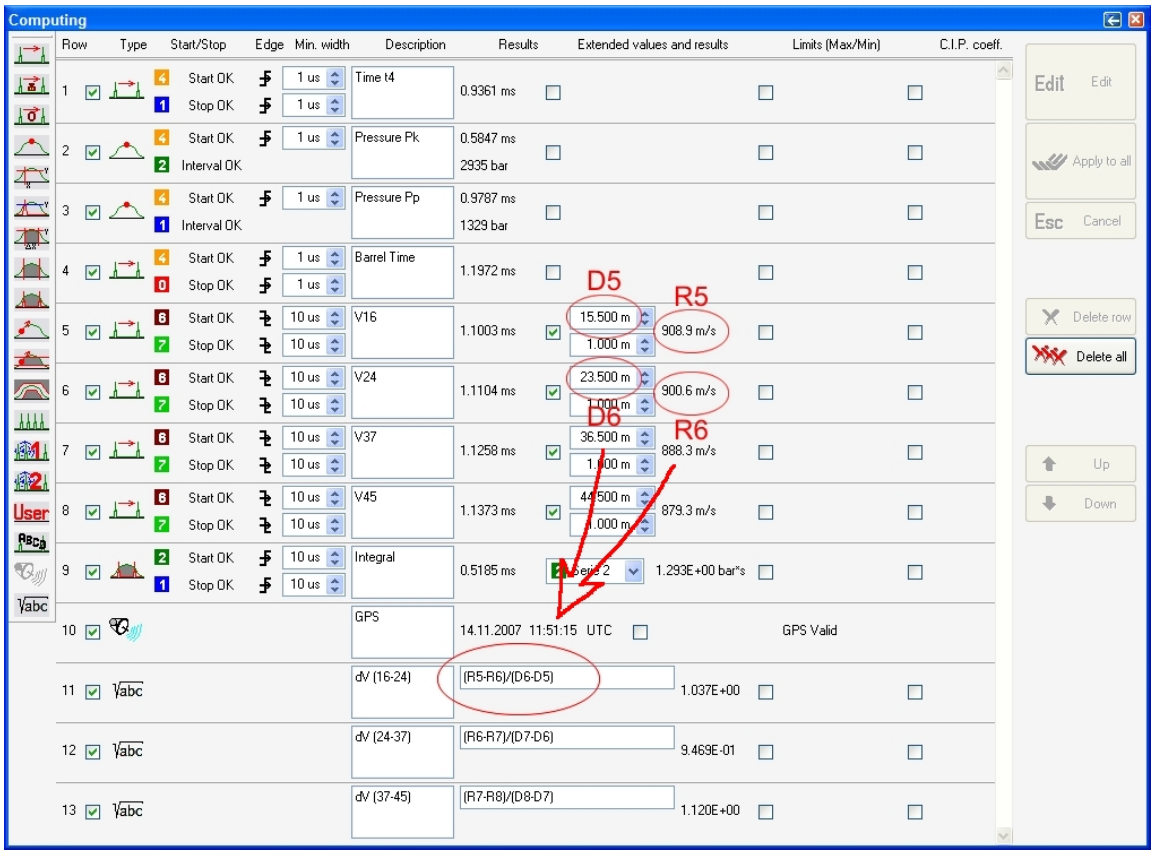


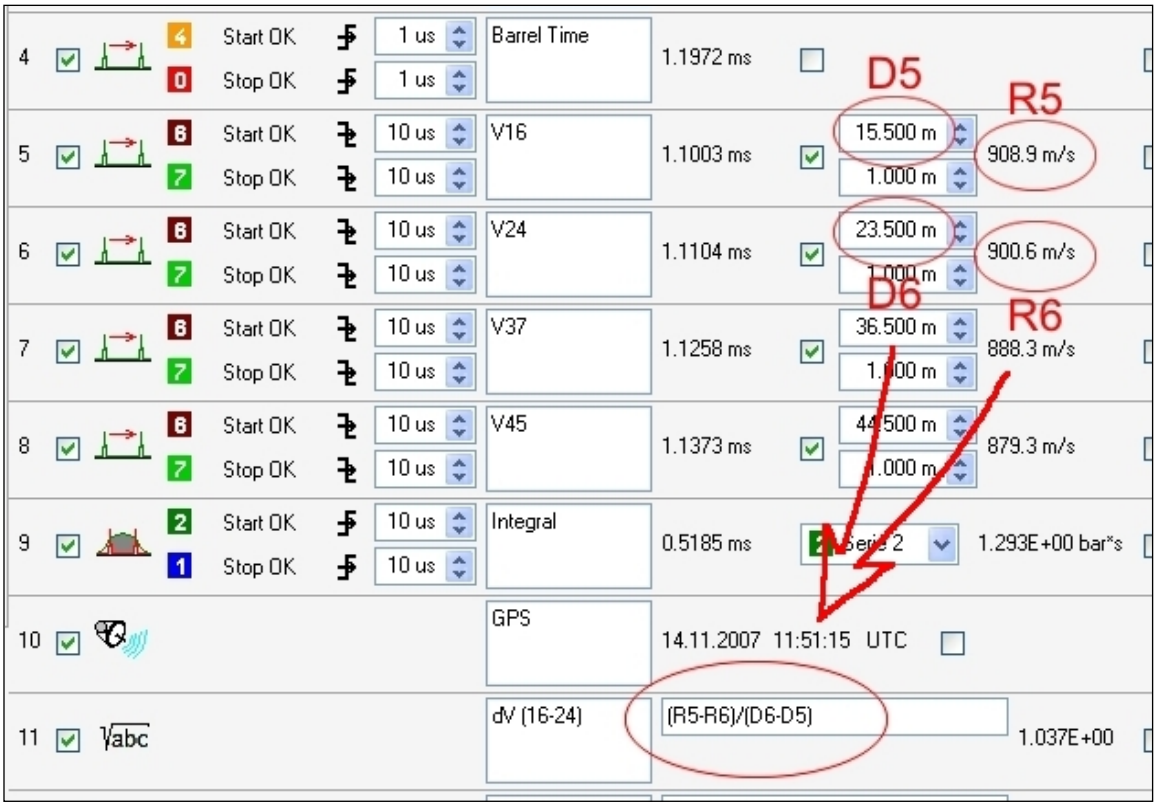
Add Calculation – calculation by use of results of previous rows

The single elements are (from the left) : the line number, the checkbox for show/hide row in all reports, the icon for marking of function, the text field for any line marking, the field for entering of formula, the result of computing, the checkbox for selection of calculation with limits, entering of maximum (up) and minimum (down) limit value, the checkbox for selection of calculation with C.I.P./NATO coefficients and the field for setting of C.I.P./NATO coefficient.

Valid formula elements :

Rn	= result of row number n (R2 etc.)
Dn	= row number n, distance of first velocity gate (D5 etc.)
Bn	= row number n, base for measuring of velocity (B4 etc.)
Abs(x)	= absolute value of a number x
Sqr(x)	= square of a number x
Sqrt(x)	= positive square root of a number x
Round(x)	= rounded value of a number x
Int(x)	= integer part of a number x
Sin(x)	= sine of an angle x
Cos(x)	= cosine of an angle x
Tan(x)	= tangent of an angle x
Arctan(x)	= arctangent of a number x
Ln(x)	= natural logarithm of a number x
Log(x)	= base-10 logarithm of a number x
Log2(x)	= base-2 logarithm of a number x
Exp(x)	= e raised to the power of a given number x
Pi	= value of Pi
+	= addition
-	= subtraction
*	= multiplication
/	= division


Computing
Row
Type
Start/Stop
Edge
Min. width
Description
Results
Extended values and results
Limits (Max/Min)
C.I.P. coeff.
Edit
Apply to all
Esc Cancel
Delete row
Delete all
Up
Down
D5
R5
D6
R6
Time t4
Pressure Pk
Pressure Pp
Barrel Time
V16
V24
V37
V45
Integral
GPS
dV (16-24)
dV (24-37)
dV (37-45)
(R5-R6)/(D6-D5)
(R6-R7)/(D7-D6)
(R7-R8)/(D8-D7)
14.11.2007 11:51:15 UTC
GPS Valid


D5
R5
D6
R6
Barrel Time
V16
V24
V37
V45
Integral
GPS
dV (16-24)
(R5-R6)/(D6-D5)
14.11.2007 11:51:15 UTC

– **Delete row** – delete selected row

– **Delete all** – delete all rows

– **Edit** – switching of selected row to edit mode

– **Apply to all** – exit from edit mode and saving changes (for all round of series)

– **Apply** – exit from edit mode and saving changes for current round

– **Escape** – exit without saving

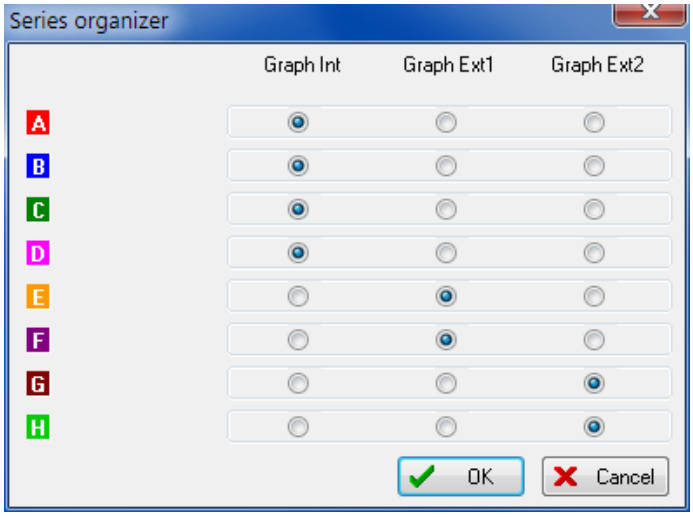
– **Up, Down** – selected line feed up/down

Graphs and computing > Group Organizer

The function for allocation of rounds to the groups.

Graphs and computing > Series Organizer

The function for assigning of channels to relevant graphs - see next picture:



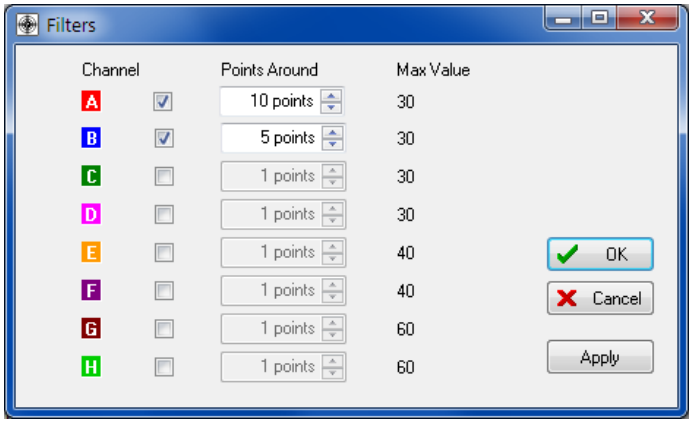
Graphs and computing > Filter

These filters serve to suppression of noise. It is possible to use this filter immediately during measurement or late after measurement. Original data is always retained and data is automatically restored after switch-off filter.

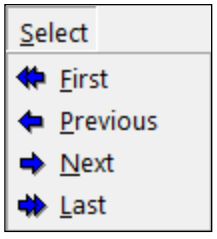
Filter is activated by use of button or in menu Graphs and computing > Filters. It appears the window (Pic 36), which contains setting of running average filter for each channel:

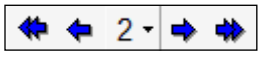
- checkbox of filter activation
- setting of filter parameters (number of points for computing of average value - higher number increases efficacy of filtering, but increases distortion of curve). Maximum number of points for computing of average value is limited to 1 % of all measured points of relevant curve

Channels filtered during measurement are color marked.



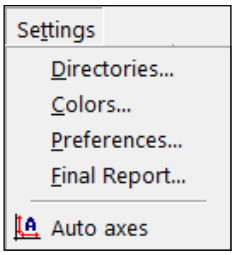
3.4.1.7 Menu Select



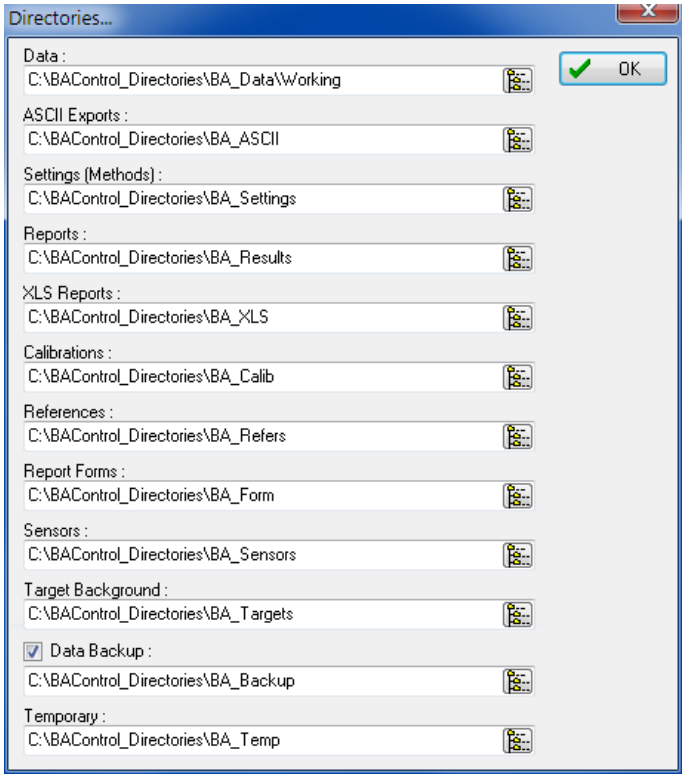


This menu copies the function of buttons and it serves for round selection within the series. Select > First, Previous, Next, Last.
Their function is (from the top / left): first round, previous round, direct selection, next round and last round.

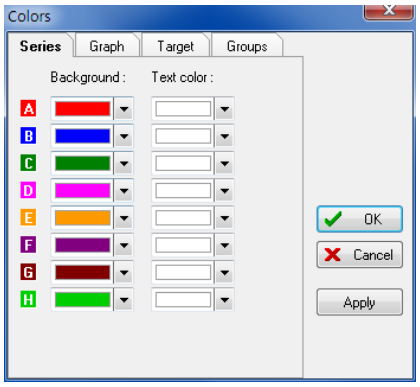
3.4.1.8 **Menu Settings**



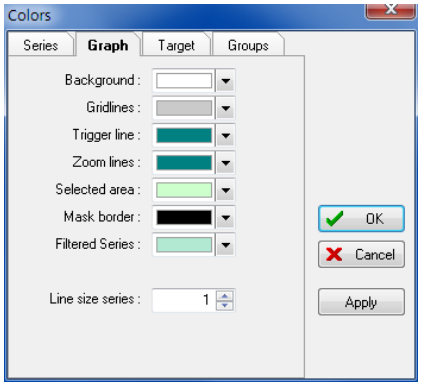
The menu contains basic program setting – directories and preferences.



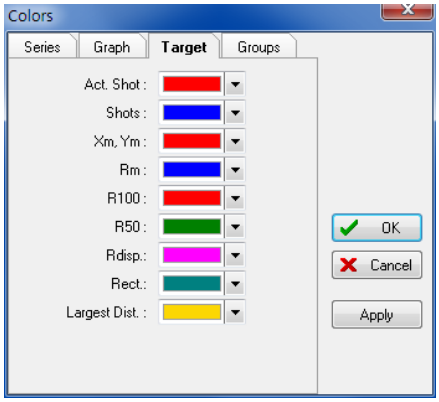
- Data - measured data
- ASCII export - data output in ASCII form
- Settings (Methods) - TR 2519 setting (methods)
- Reports - measured results in the protocol forms
- XLS Reports - measured results in the XLS protocol forms
- Calibrations - calibration protocols
- References - reference curves
- Report Forms - C.I.P. forms
- Sensors - sensors for TR 2519
- Target Background - target backgrounds (jpg files)
- Data Backup - directory for data backup
- Temporary - temporary files



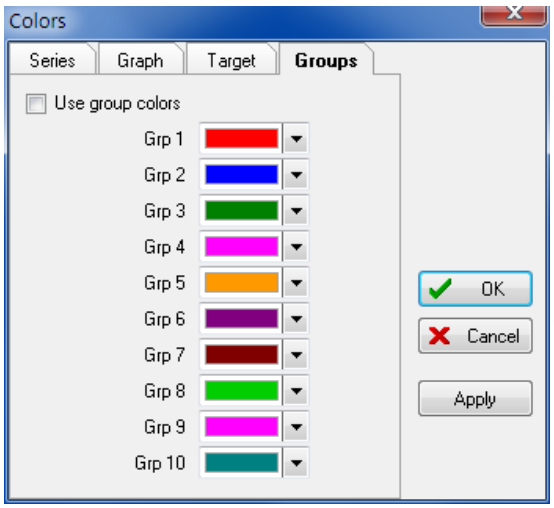
Series contains setting of the colors of curves and their numbering.



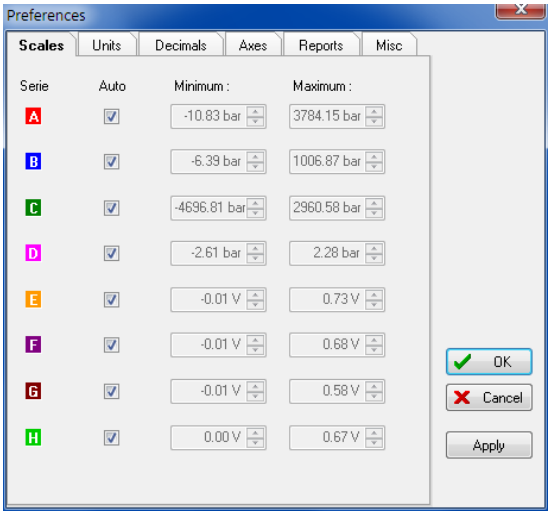
Graph colors contains setting of the colors of graph elements: graph background (Background), gridlines (Gridlines), the marks of triggering time (Trigger line), cursor lines for zoom limitation (Zoom lines), highlighting of selected area (Selected area), border of mask (Mask border) and marking of filtered channels (Filtered series).
Line size series is setting of graph lines width.

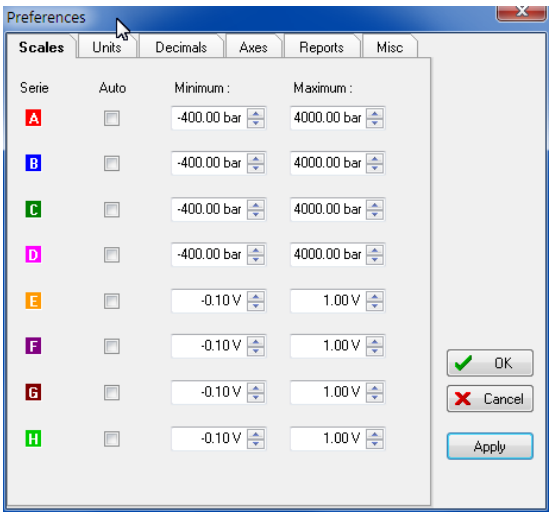


Target contains setting of the colors of target elements.

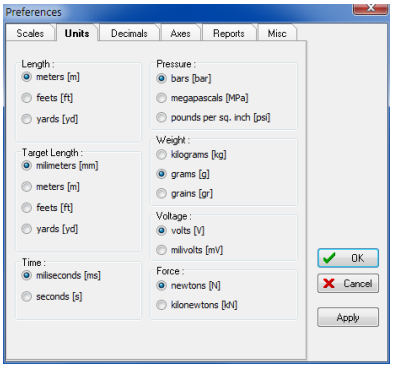


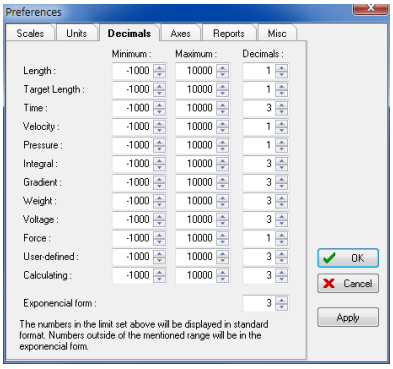
Groups contain setting of the colors of groups.
If checkbox Use group colors is checked then in graph Statistics Stat are used these colors for each group instead of different color for each channel. This function is determined for visual comparison of different groups of ammunitions etc.



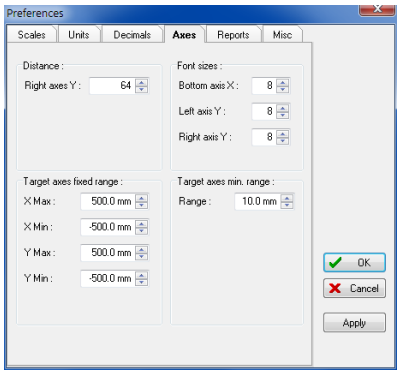


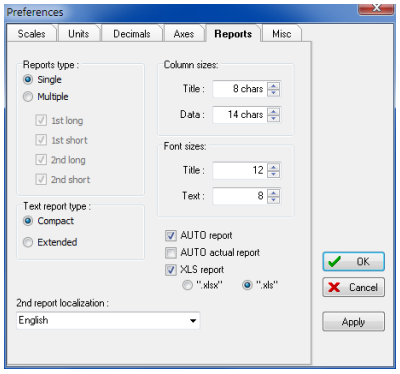
Scales – contains setting of Y-axes scales. The selection Auto makes axis dimensioning according to relevant founded curves maximum and minimum. To set of fixed scale, uncheck the selection Auto and fill minimum and maximum axe value. The option of automatic axes setting can be temporary activated by means of the button .





Units contain settings of length, pressure and weight units.
Decimals contains settings of numeric format (decimals). If value is out of range (Minimum/Maximum), then it will be displayed in exponential form.





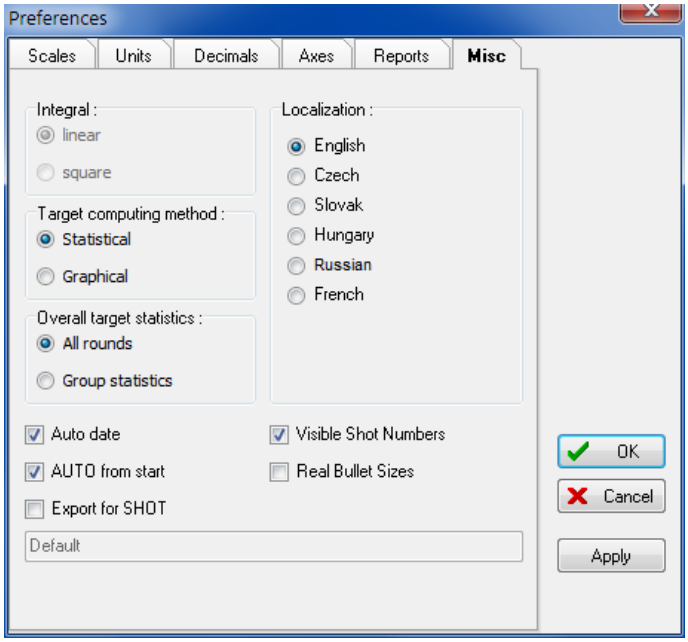
Axes contains settings of distance between right axes and font size.

- Target axes fixed range sets scale of target after using of button Fixed.

Report is reserved for settings of reports.
Report type decides, what type of reports will be generated to preset directory Reports directory:

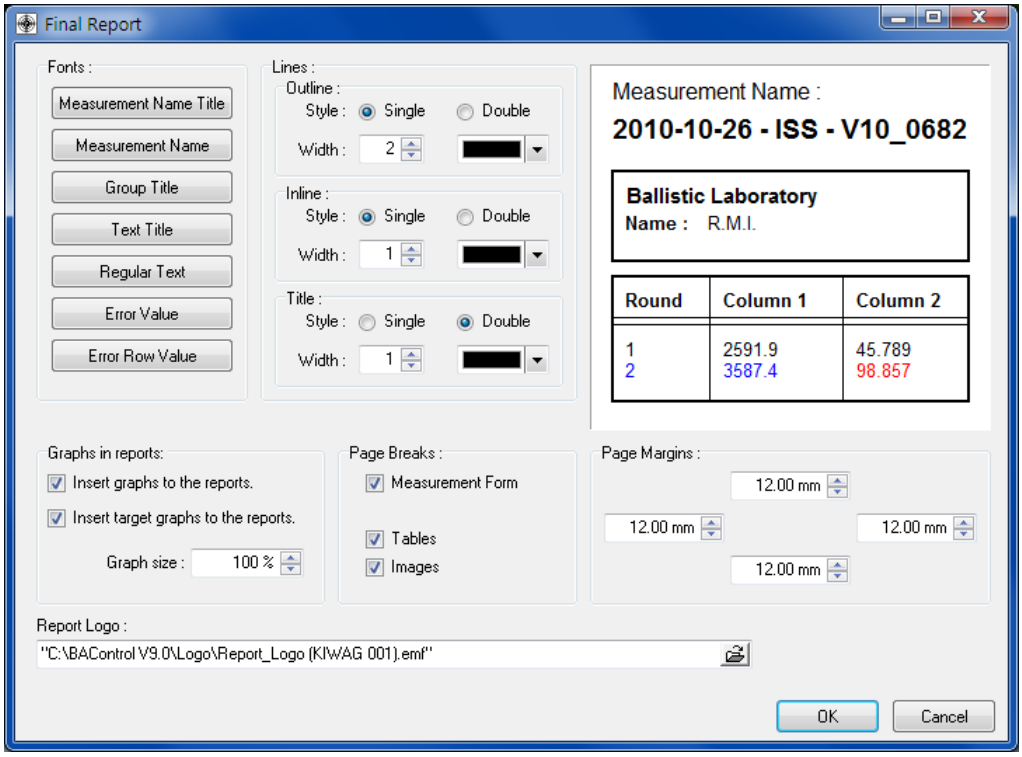
- Single: only short report in primary language localization
- Multiple:
  - 1st long + 1st short (long and short report in primary language localization)
  - 2nd long + 2nd short (long and short report in secondary language localization)

Text report type – selection of displayed report.
2nd report localization – selection of secondary language localization (for writing of secondary reports in different language – restart of program required).
Column sizes, Font sizes – selection width of report columns and fonts (titles, data).
AUTO report, AUTO actual report sets automatic opening of reports at measurement.
XLS report determines automatic generating of report in XLS form and file extension.



Misc is reserved for special program functions:
Integral is the special option for calculating with the center of flying object (setting basic calculates integral of shadow, i.e. projection of the bullet, square calculates integral of shadow square, i.e. through-flying mass). This function has influence only for calculations in Computing >.
Target computing method is selection of electronic target data evaluation method (default choice is Statistical, for special use is determined Graphical – see relevant chapter about measurement of accuracy by means of Target System WTS03).
Overall target statistics determines calculation of Overall target statistics (default choice All rounds calculates it from all rounds regardless of division to groups, Group statistics calculates overall target statistics from all partial group statistics (for special use only)).
Localization – selection of primary language localization (restart of program required).
Auto date serves for automatic inserting of date (in form YYYY-MM-DD) before name of measurement – data on disc are easy sorted by date of measurement.
Auto from start enables access to button AUTO at start of measurement (unchecked make this accessible after first round).
Visible Shot Numbers enables numeration of hits in target.
Real Bullet Sizes enables real hit diameter in target according to bullet diameter.

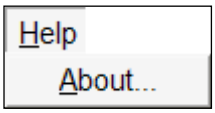
Export for SHOT is custom option for special program mode and must be always inactive!



Final Report contains set of tools for customizing of Final Report.

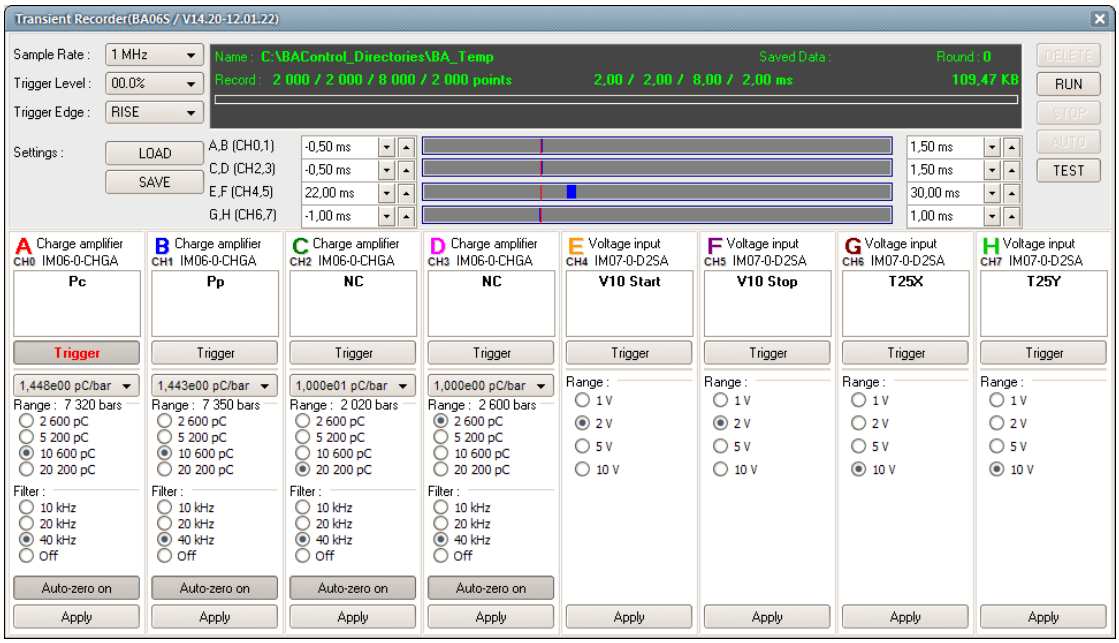
- Report Logo sets path to user's logo.

3.4.1.9 Menu Help

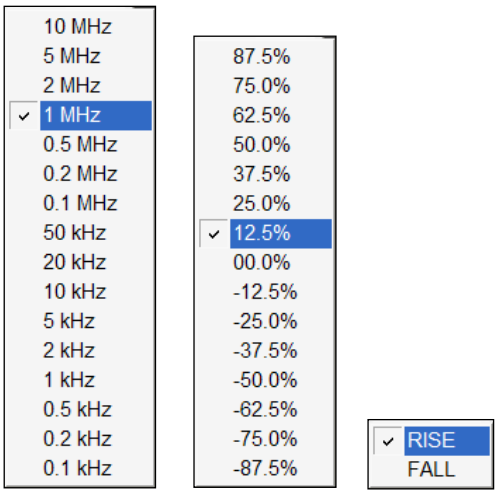


About contains information about the program version.

3.4.2 TR 2519: Panel of Virtual TR 2519



This panel controls all functions during measurement. It is built from the common upper part and from the panels of input modules in the lower part.

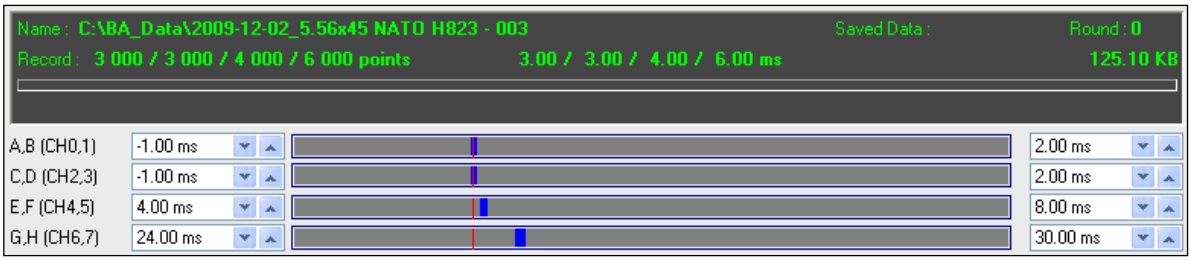


Sampling rate (Sample Rate) determines the number of points of input signal (pressure etc.), which are recorded for every second. Its setting has effect for density of points on the final graph. Too high density made data processing slower and the large files are created on the disk. According to C.I.P. specifies the minimal sampling rare 1MHz, which is a standard method in practice for pressure measuring of powder gases.

Trigger level (Trigger Level) is the specific value. After exceeding this value the TR 2519 data recording is initiated. This value is pictured in percent of given range. For negative values has blue color, for positive values has red color and for zero value has green color. Set optimal trigger value for secure triggering without possibility of false triggering caused by noise and interference (and that is why the level 0.00% is not used during pressure triggering). Recommended value for typical measuring is 12,5 %.

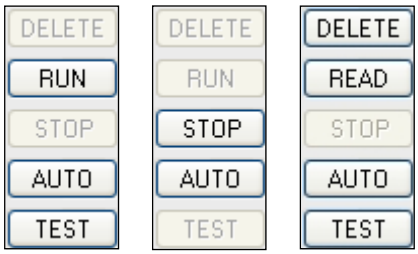
Trigger edge (Trigger Edge) determines, while data recording initialization will be followed after trigger level exceeding (Trigger Level) during signal increasing (RISE) or during signal decreasing (FALL).

These buttons serve for Transient Recorder setting (Settings) and make loading possible (LOAD) and saving (SAVE) on the control computer disk. Detailed description – see relevant text.

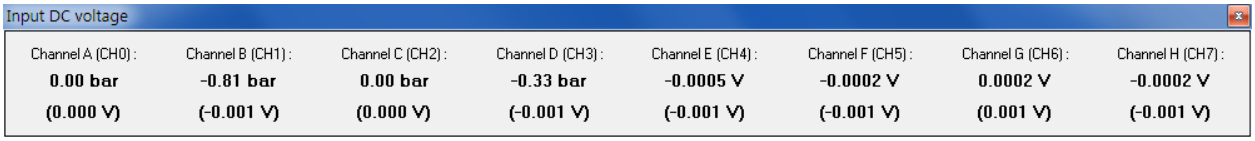


Virtual TR 2519 display provides important information about the setting and TR 2519 measuring procedure. There is the name of directory on the left topside in the first row (Name, Series), where this data will be stored, and the volume of total saved data in this series (Saved Data). There is the round counter on the right topside (Round), the number 0 means, that neither round was recorded so far.

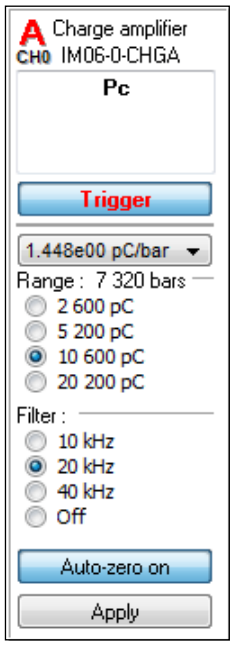
For understanding of function of other settings it is necessary explaining TR 2519 operation with the memory of AD converters. This memory is always filled with data in the range –100 000 to +300 000 points. The negative numbers are the so-called pretrigger, i.e. the data which are recorded before recording initiation, zero is the time of triggering and positive numbers are data after recording initiation. For typical work are 400 000 points too many and that is why only required part of data are transferred to control computer. This part is set-up separately for every pair of channels A(CH0)+B(CH1), C(CH2)+D(CH3), E(CH4)+F(CH5) and G(CH6)+H(CH7) (see chapter B 3.3 Recommendations for choosing and using single channels (inputs)) The beginning of memory reading is located on the left part of display, the end is on the right. The adjusted data are displayed for checking by bar graph form. The vertical red line indicates time of triggering (Trigger point).
In the second line of display are written calculations of transported points and lengths of time intervals for every pair of channels (Record) and total volume of data for the one round.
Free horizontal line in the center of display is used for bar graph displaying with data transport process from TR 2519 to control computer.

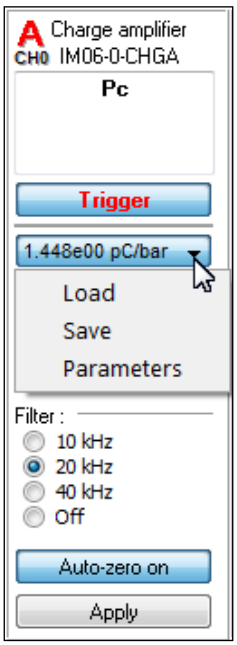


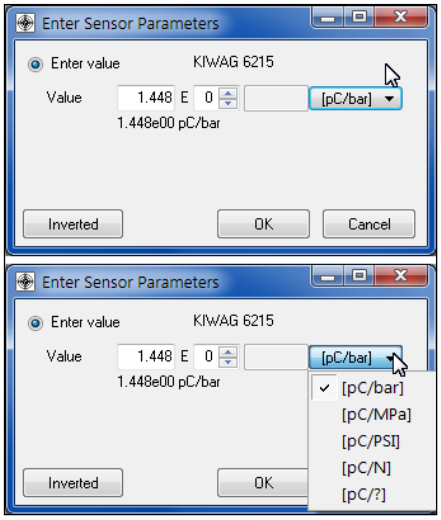
There are **the buttons for TR 2519 measuring control** in the right part of virtual TR 2519 panel. Their functions are: delete last round (DELETE), run measuring (RUN), stop measuring (STOP), automatic measuring of the whole series (AUTO) and testing of inputs (TEST). The button RUN has second function READ (for reread of TR 2519 data after modification of time intervals at first round of series) and the button STOP has second function BREAK (interrupt of long measurement by using low sample rate). The function of those buttons will be described later during measuring.



Window TEST – reading of signal at all channels of TR 2519 in actual units (first row) and voltages at inputs of ADC (max. ±5 V, second row).

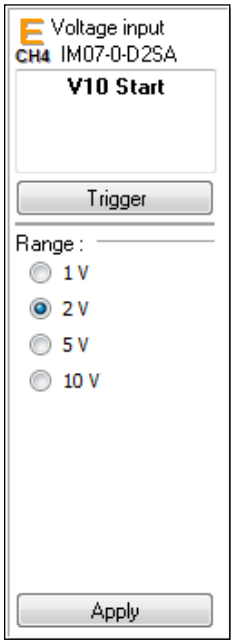






The panel of input module – charge amplifier.
A CH0 – the marking of channel, color is the same as color of curve in graph.
Charge amplifier IM06-0-CHGA – the name of module.
Four lines of free text – text filled for placing description of relevant channel for better orientation of user (sensor type, it's using, location on the weapon i.e.).
Trigger – the switch for the trigger channel selection. Selected channel is highlighted with the red color. We recommend to choose the pressure channel as the triggering source, because by contrast to accelerometer it provides clear course with defined and almost constant shape and it is very resistive against the false triggering.
Setting of calibration constant of sensor – button for setting of the pressure sensor calibration coefficient. For entering of sensor coefficient press this button and select item from menu:

- Load is for loading of saved sensor parameters
- Save is for saving of actual sensor parameters
- Parameters serves for direct entering of sensor parameters in exponential form (button Inverted inverts the sensor polarity - for sensors with negative calibration coefficient let this button inactive). [pC/?] means user defined unit (different from previously defined)
- Range 2 600 pC, 5 200 pC, 10 600 pC, 20 200 pC – the selection of measuring range. Beside the title Range is displayed calculated value of measuring range in bar units (depends on the selection of measuring range and on the sensor calibration coefficient
- provides information about true maximum pressure)



Filter 10 kHz, 20 kHz, 40 kHz, Off – the filter selection.
Auto-zero on, Auto-zero off – the switch of automatically compensation of the offset and the cable leakage. Normally use only Auto-zero on, do not set this switch to Auto-zero off. This provides maximum measuring accuracy by changing of temperature and other ambient conditions. Only for measuring of pressure process which are longer than 100 ms it is necessary to disable this function (Auto-zero off), because compensation causes distortion of measurement.
Apply – serves to send of actual settings into TR 2519.

The panel of input module – universal voltage input.
E CH4 – the marking of channel, color is the same as color of curve in graph.
Voltage input IM07-0-D2SA – the name of module.
Four lines of free text – text filled for placing description of relevant channel for better orientation of user (sensor type, it's using, location on the weapon i.e.).
Trigger – the switch for the trigger channel selection. Selected channel is highlighted with the red color.
Range 1 V, 2 V, 5 V, 10 V – the selection of measuring range. Because this module has three summing inputs, the range means sum of three input voltages.
Apply – serves to send of actual settings into TR 2519.