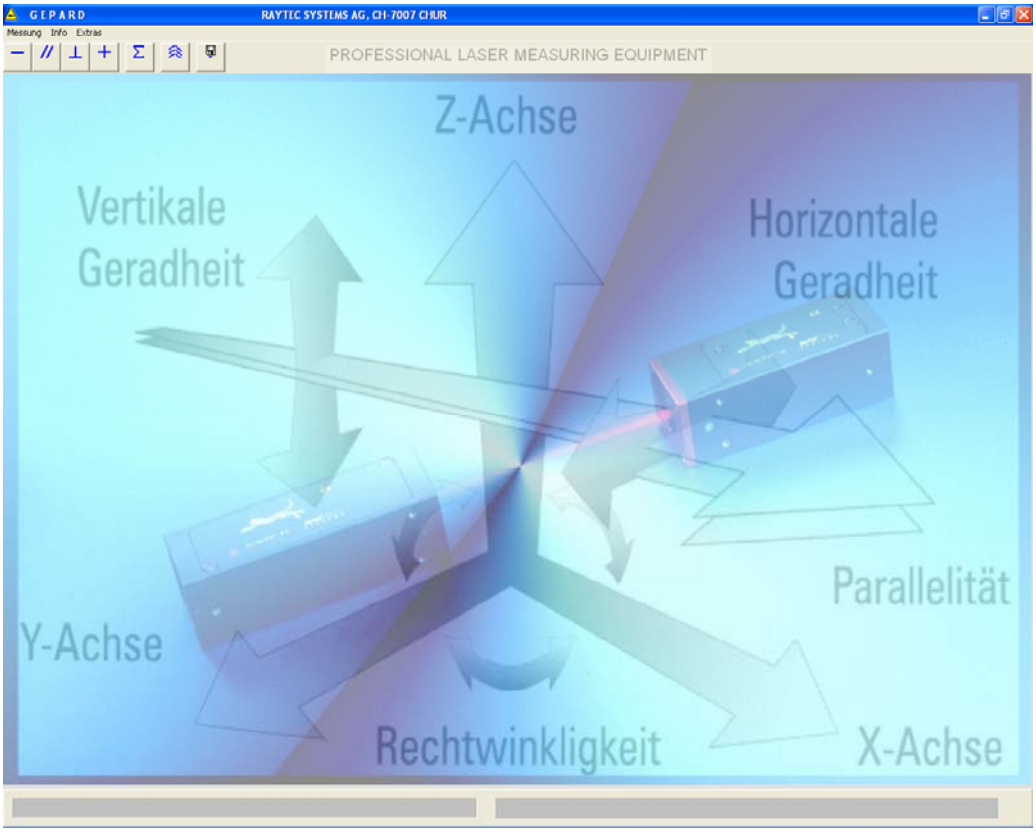
RAYTEC SYSTEMS

GEPARD™

Laser Geometrical Measuring and Alignment System



WIN-GEPARD Software Manual

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WIN-GEPARD SOFTWARE

INTRODUCTION

The processing and interpretation software for measuring data from the ***RAY**TEC GEPARD*$_{bt}$ ™ laser geometrical measuring and alignment system is a program designed to be compatible with any MICROSOFT WINDOWS programme.
The WIN-GEPARD function modules allow the user to carry out quick and qualified measurement of:

- ***straightness***
- ***parallelism***
- ***perpendicularity***
- ***angles***
- ***positioning / alignment***

Positioning of the laser transmitter is not very critical, the WIN-GEPARD software recognizes inaccurate alignment of the laser beam along the measuring line in an elegant way and compensates for it mathematically.

During data collection, measuring values are shown graphically and numerically on the screen of the PC. The numerical X and Y values (in mm) can be displayed in extra large sizes, to be read from a distance. The IR-remote control unit allows measuring to be carried out by one person from any required position.

If a measuring series has been completed, additional functions can be activated. In this way, standardization with any chosen reference point (plumb line method) can be carried out, or the measured values can be presented according to a regression line as per ISO 1101.

Results of a wide range of statistics can be displayed by clicking an icon.

The separate module “statistical analysis for straightness measurements” allows an extended analysis of measurements over several measuring series.

As standard, series of measurements can be printed together with the setting parameters as a measuring report, or saved to memory for further reference at a later date. Archived measuring data can be used with conventional spreadsheets and databank programs (ASCII format).

PREREQUISITES

User knowledge

Users of this system should be acquainted with the user interfaces and philosophy of Microsoft WINDOWS. Basic knowledge of Microsoft WINDOWS is necessary to understand the following explanations regarding WIN-GEPARD.

System requirements

In order for WIN-GEPARD to function quickly and without problems, it is recommended that a powerful PC (notebook or desktop) with a PENTIUM processor of at least 1 GHz and 512 MByte main memory (RAM) is used. At least 100 MB of memory should be available for the WIN-GEPARD program and data files on the hard disc so that additional measuring data can be saved.

Recommendation: for a troublefree operation of WIN-GEPARD Software and the USB-interface-modules run WINDOWS-XP operating system!

INSTALLING THE BLUETOOTH-ADAPTER SOFTWARE DRIVER

Before the WIN-GEPARD software can be used, a functional interface from the PC to the ***RAY****TEC GEPARD*$_{bt}$ ™ receiver must be created. With GEPARD versions 5.02 and above, this data interface is a wireless link which is enabled using a Bluetooth implementation. Detailed information about Bluetooth (BT) can be found on the internet.
A BT wireless module is required on both the ***RAY****TEC GEPARD*$_{bt}$ ™ receiver and the PC. This is already installed in the ***RAY****TEC GEPARD*$_{bt}$ ™ receiver and is included as USB stick for the PC in the scope of delivery from RAYTEC. Alternatively, a notebook PC with state-of-the-art technology can be used where the Bluetooth implementation is also a standard fitting.
When using a notebook PC with an installed Bluetooth interface, no installation of the BT software driver is necessary as this is already included in the basic configuration. The BT interface must then only be configured as a serial port - this procedure is described in detail in the chapter "*Bluetooth-Manager*".

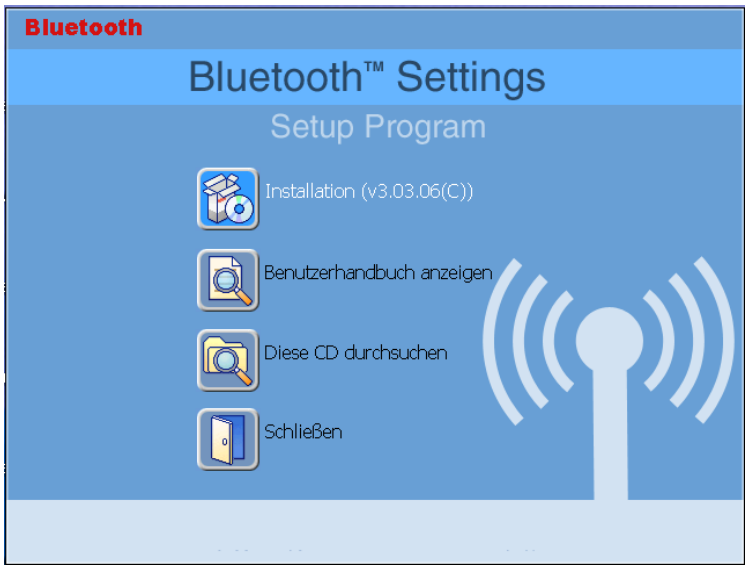
The following instructions describe how to install the Bluetooth adapter and the necessary driver for a PC without a pre-installed BT interface.

Generally:: Proceed according to the installation instructions delivered together with the BT adapter!

1. Install the software for the USB Bluetooth adapter.
2. Connect the Bluetooth adapter to your computer.
3. Proceed installation procedure.

INSTALLATION PROCEDURE FOR THE BT ADAPTER AND THE BT SOFTWARE

Place the CD provided, "Bluetooth 2.0 USB Adapter" in the CD drive.
The installation selection menu should appear automatically.
If this is not the case, select the CD drive in Windows Explorer, search for the Bluetooth Setup Programme (e.g.: d:\utility\setup.exe) and start the programme manually. The following menu selection will be shown:

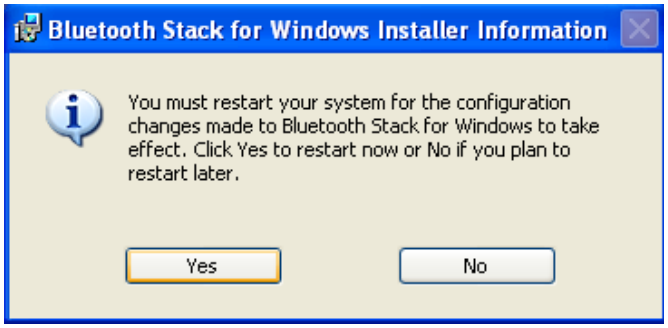


Start "*Installation*" and follow the instructions given.

During installation you will be requested to connect the Bluetooth adapter (see below).

Plug the BT adapter into the corresponding USB port and confirm this by clicking on "*OK*".

Following completion of the driver installation the PC must be restarted. Remove the installation CD from the drive and confirm restarting (see below).



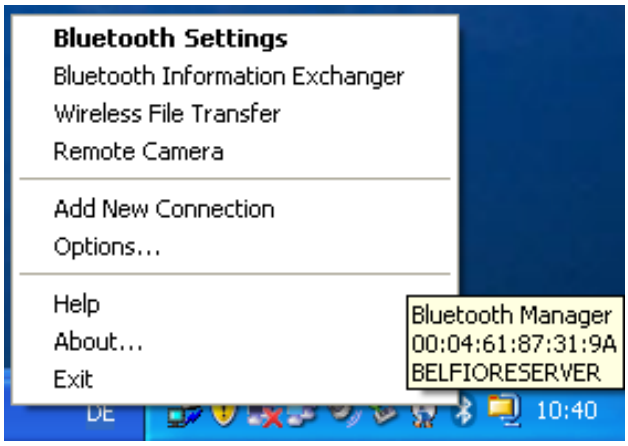
In the following installation step the allocation of the BT module to a PC COM port must be made.
All steps are documented on the following pages. Please follow all instructions step for step in order to ensure that the definition of the interface is successful.

Bluetooth Manager

First switch on the RAYTEC GEPARD$_{bt}$™ receiver - this is necessary for the following installation steps!

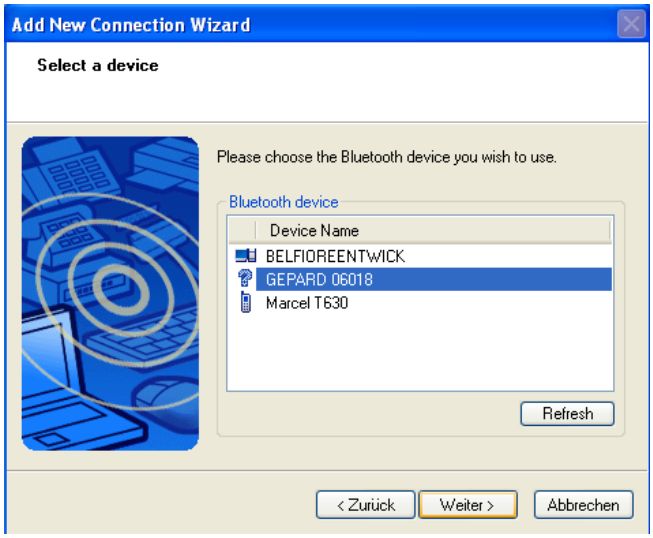
After the PC has been restarted you will see the new symbol for the Bluetooth Manager on the status bar in lower right-hand corner .

Click with the right-hand mouse button on the Bluetooth Manager symbol in the status bar. The Bluetooth Manager will then be opened:

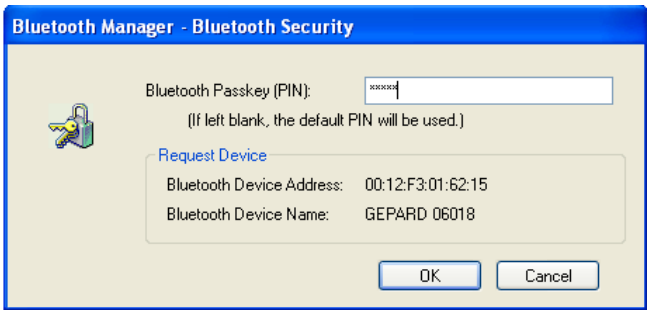


Click on the menu point "*Bluetooth-Settings",* a new window is then opened.

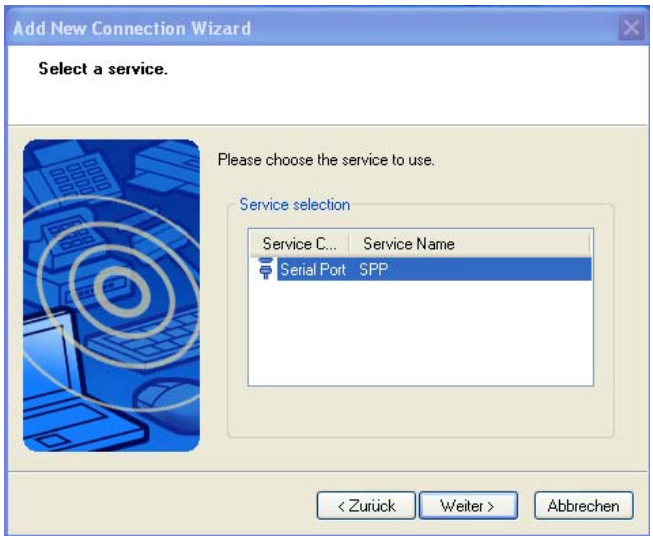
Select the "*User-defined mode*" and click on "*Next"*. The assistant for installing new hardware is now started and at the same time, starts searching for equipment equipped with a Bluetooth interface. When the ***RAY****TEC GEPARD*$_{bt}$™ receiver is located this is shown with its description in the lower window with the list of Bluetooth tools.



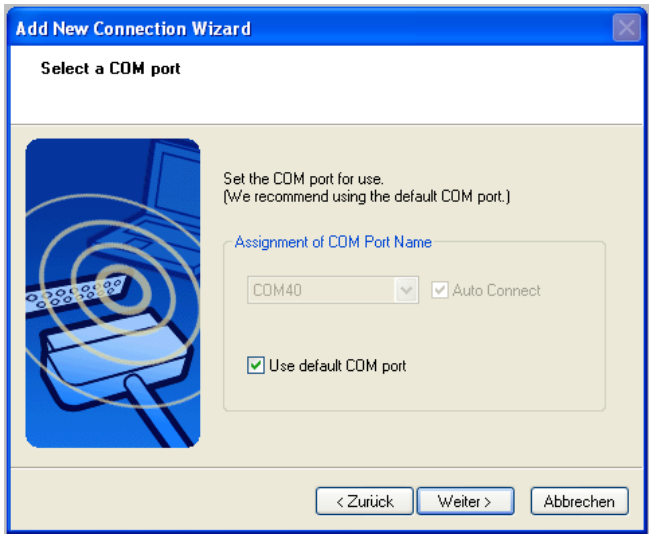
Activate the selection "*GEPARD nnnnn*" simply by clicking on it and continue with "*Next*".



Allocation of a key for your Bluetooth equipment is necessary for undisturbed wireless communication to the ***RAY**TEC GEPARD*$_{bt}$ ™ receiver.
Enter the serial number of your ***RAY**TEC GEPARD*$_{bt}$ ™ receiver as Bluetooth key exactly as it is given on the delivery note (e.g. *06018*).
Confirm this setting with "*OK*".

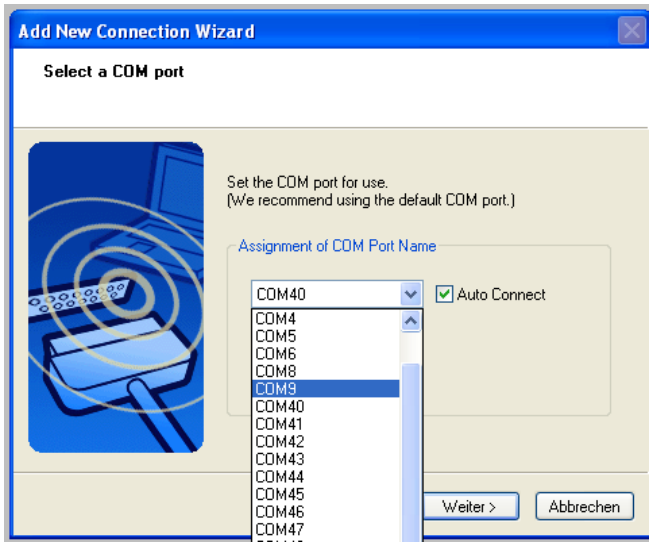


In the choice of services activate "Serial connection" and confirm this setting by clicking on "*Next*".



Deactivate the setting "Use *standard COM port*" by clicking on the box provided!

Confirm your choice by clicking on "OK".

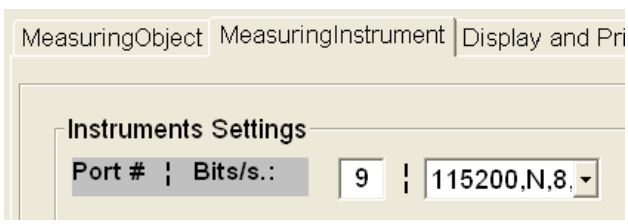


Select a free COM port which can be used for data transmission with ***RAY**TEC GEPARD*$_{bt}$ ™ receiver (e.g. here *COM9*) from the list given.

☞ ***Important: the COM port number must be between COM1 und COM16, otherwise the WIN-GEPARD software cannot manage the interface and data transfer cannot take place!***

Confirm your selection with "*Next*".
The configuration of the Bluetooth USB interface is complete.

COM PORT SETTINGS IN WIN-GEPARD



In the last step, the COM port in the WIN-GEPARD software must be set to the identical COM port number (e.g. *COM9*)!

The data transfer rate for *RAYTEC GEPARD*$_{bt}$ must be set to 115’200 Bps.**

Further information can be found in this manual under the headings: 'Ba*sic settings', 'Option Tab "MeasuringObject"', and 'COM port'*.

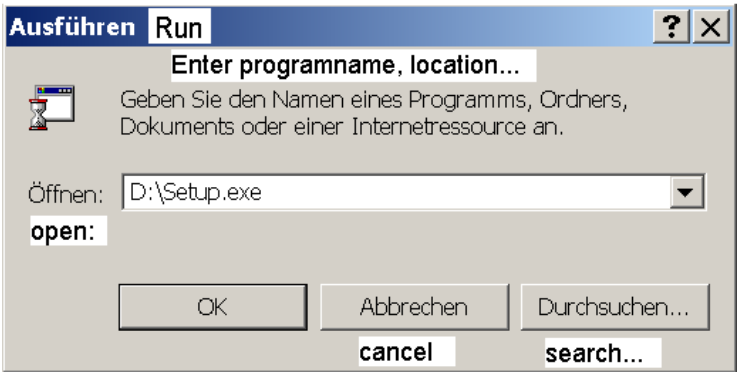
INSTALLATION OF THE WIN-GEPARD PROCESSING SOFTWARE

With every ***RAYTEC GEPARD$_{bt}$***™ system comes a CD-Rom, containing the WIN-GEPARD program, its setup, and the manual.

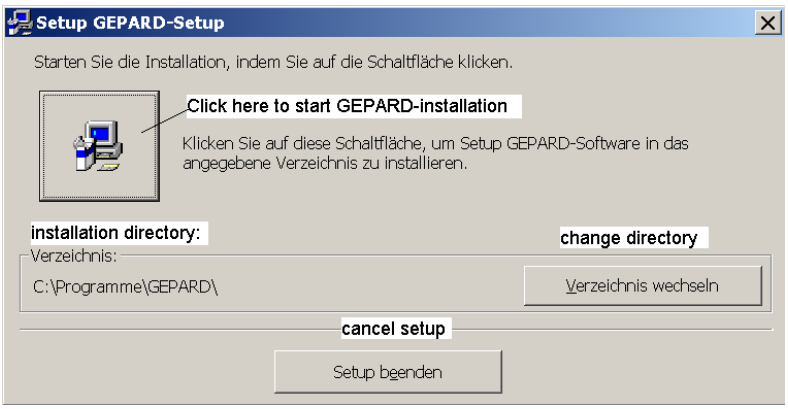
INSTALLING WIN-GEPARD SOFTWARE

- Installation usually starts automatically (auto-run), if not:
- place the WIN-GEPARD CD-Rom in the appropriate drive on your PC.
- click on "*Start*"
- click on "*Run*" :
- write ***D:\Setup.exe*** (e.g. D: for the CD-ROM drive) and confirm with "*OK*".

Installation from CD-ROM:



The set-up program will now start. You will be asked (*unfortunately still in German*) in which sub-directory you would like to install the WIN-GEPARD files. Confirm the default directory given or write the name of your preferred subdirectory.



Start installing the WIN-GEPARD application software by clicking the set-up button. Automatic installation of the software will then begin and the corresponding entries into the WINDOWS system will be made.

Following a successful installation, the GEPARD files will have been copied to the subdirectory C:\PROGRAM\GEPARD\.

Click “OK” to leave the setup procedure.

The GEPARD-icon will have been added to the start menu in the list of programs and can be started from there.

When starting the WIN-GEPARD program for the first time you should enter the name of your company - as it is stated on the delivery note under 'License text', and the “license number” in the appropriate fields. To do so, the following window appears:

If you do not have a **valid license number,** you may click on "Demo". In this way, you have the possibility of using and testing WIN-GEPARD for a limited period of time as an UNREGISTERED DEMO-VERSION.

This window does not appear once the valid company name and the license number have been entered. When using a demo-version, this field must be checked every time.

At wrong entries the following error message appears:

By clicking “Info” this entry-window appears again and you can enter the correct data.
If this is valid, the program proceeds and you may start measuring or you can continue to test the demo-version.

SETTING UP THE MEASURING SYSTEM

The measuring system must now be prepared to start measuring:

The measuring reference, the ***RAY**TEC GEPARD$_{bt}$ ™* transmitter, must be positioned in such a way, that its position, right through a series of measurements, cannot be moved by excessive vibration or jolts from people or vehicles.

The laser beam should be set so that all the measuring points (MP) along a measuring line must lie within the measuring range of the receiver.

An easy way to check this, is to place the ***RAY**TEC GEPARD$_{bt}$ ™* receiver once at the beginning of the measuring line and once at the end. Check the readings at both positions. They should be around ±0.5mm.

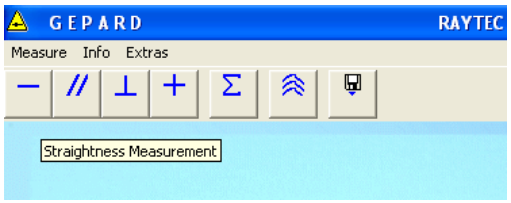
☞ *A more accurate setting of the laser beam is usually not necessary, as WIN-GEPARD recognizes setting inaccuracies and compensates them mathematically. Detailed information about setting up the laser measuring unit can be found in the **RAY**TEC GEPARD$_{bt}$ ™ hardware operating instructions.*

BASIC INFORMATION FOR USE AND HANDLING

WIN-GEPARD works in all modules with the same symbolism, i.e. the menu bars and button functions are identical in all modules. Where necessary the menu bars contain additional functions.

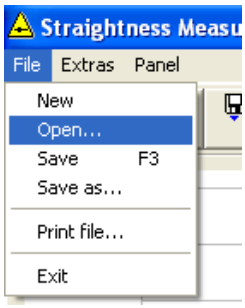
The basic functions are described in detail in the module "measurement of straightness". In the other WIN-GEPARD modules, only functions, which differ from “measurement of straightness”, are explained, and any additional functions are described. Else, reference is made to the corresponding section for “measurement of straightness”.

All important user functions in WIN-GEPARD are controlled by buttons (switches), which, with the help of the TOOL-TIP standard function for WINDOWS, are clearly marked for the user; i.e. when the cursor is positioned on a button, its function is given. (see example below with “Straightness Measurement”.)



The functions most frequently used, are always controlled by buttons on the top end of the screen (see following example: menu bar for "Straightness"):

The drop-down menus at the top of the screen also include additional user commands which are required for special functions within a function module (straightness, parallelism etc.), and which do not necessarily have to be shown directly on the user interface.



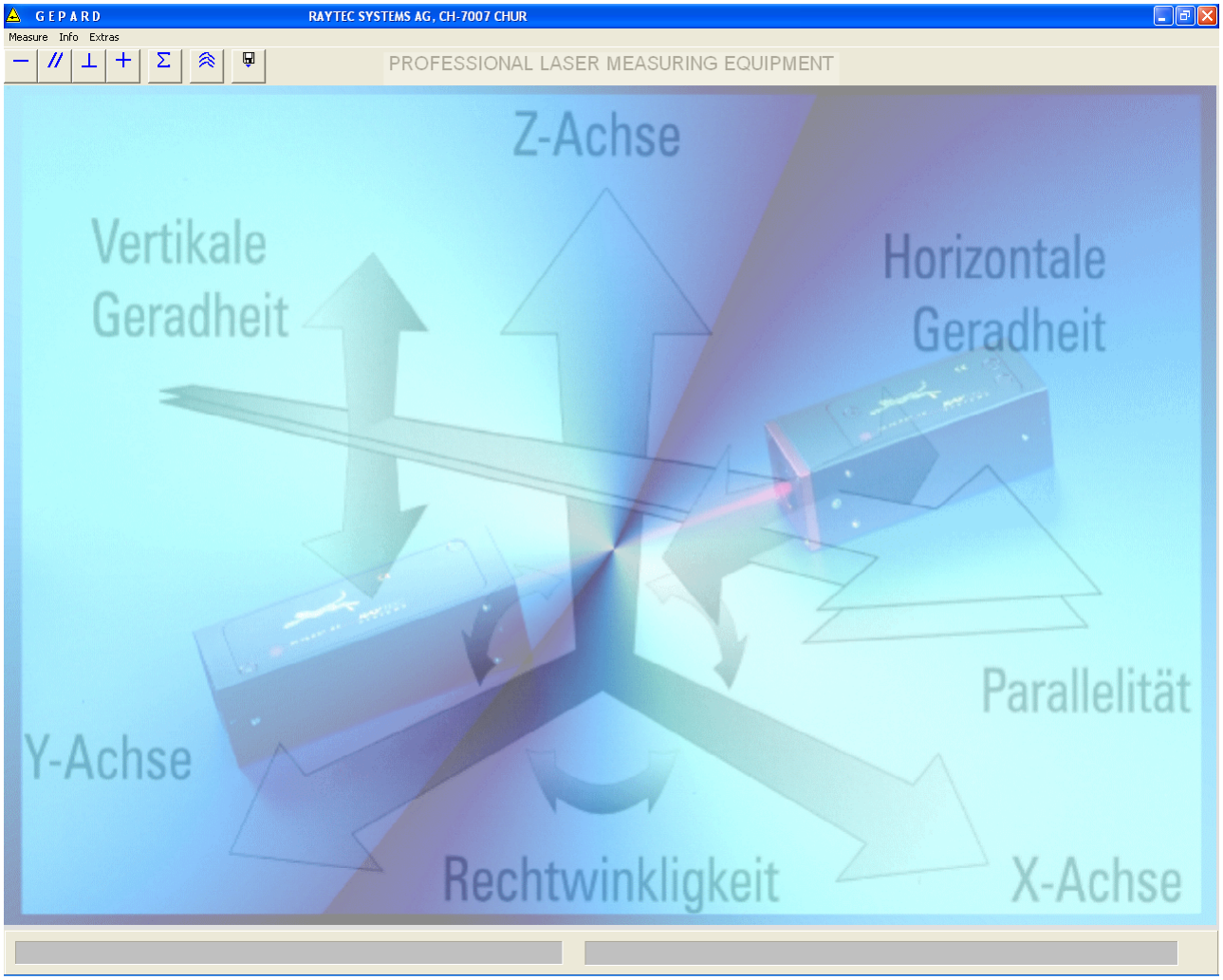
These are important functions such as:

- ***Saving*** measuring data
- ***Print report*** of the series of measured values
- ***Exit*** the current program
- and further special information, queries etc.

START OF THE WIN-GEPARD PROGRAM

Start WIN-GEPARD by selecting “All Programs” in the WINDOWS ‘Start’ menu, click on ***RAYTEC Laser Align Software*** and then ***WIN-GEPARD***.

After starting WIN-GEPARD, the following graphic appears:

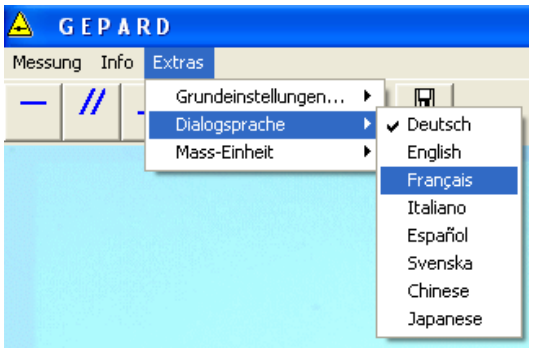


This is the starting point for all further activities with the WIN-GEPARD program.

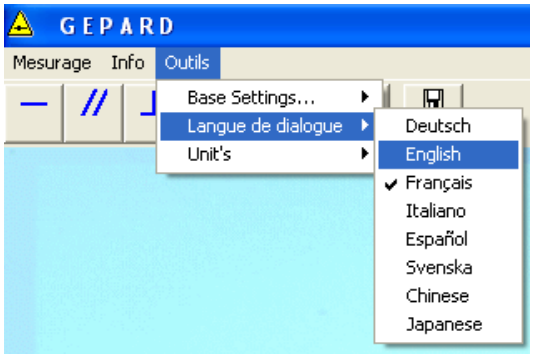
PRE SETTINGS

Language

WIN-GEPARD is configured for use with a choice of several languages (German, English, French, Italian etc.).
Language selection is done in: menu “Option” (*Extras)*:



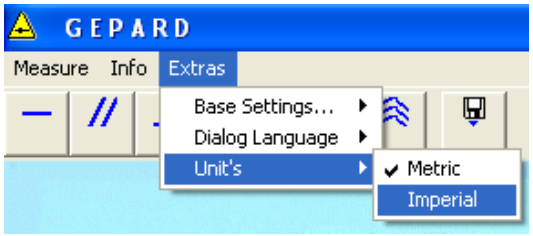
1. Click once on ***Extras***
2. Click once on **Dialog Language**
3. Click on the language required.



All labels and menu items in WIN-GEPARD are changed immediately.

Measuring units

WIN-GEPARD can use both metric (e.g. mm) and imperial (e.g. inch) units. All measured values, lengths, tolerances etc. will be expressed both on screen and in the printed protocol, in the units selected here. WIN-GEPARD always works with metric units within the program itself - these are then recalculated to be expressed in *mil* or *in*.



1. Click once on ***Extras***
2. Click once on **Unit’s**
3. Click on the unit’s required.

Basic Settings

Before actual measuring and data collection can be carried out, some basic considerations should be made for pre-defined settings, so future measurements will be made significantly easier.

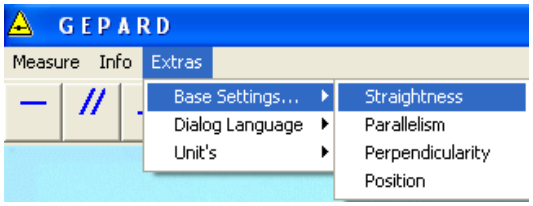
For the definition of a new measuring series as well as for screen presentation and protocolling, WIN-GEPARD always accesses the so-called INI_File. There, the most important parameters can be pre-defined by the user, so that repeated measuring jobs do not need to be defined each time.

☞ ***Every GEPARD measuring program has its own basic settings.***

Basic Settings for "Measurement of Straightness"

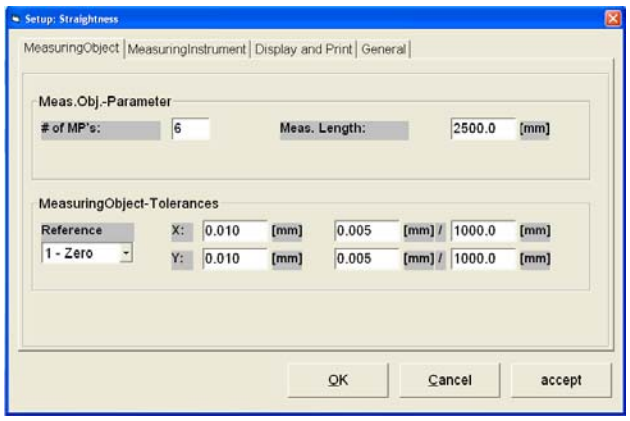
Following, the basic principle is explained, using examples of an INI_File for "measurement of straightness", (these functions also apply for the other modules):

Open *"Base Settings"*:



1. Click on ***Extras***
2. Click on ***Base Settings***
3. Click on ***Straightness***

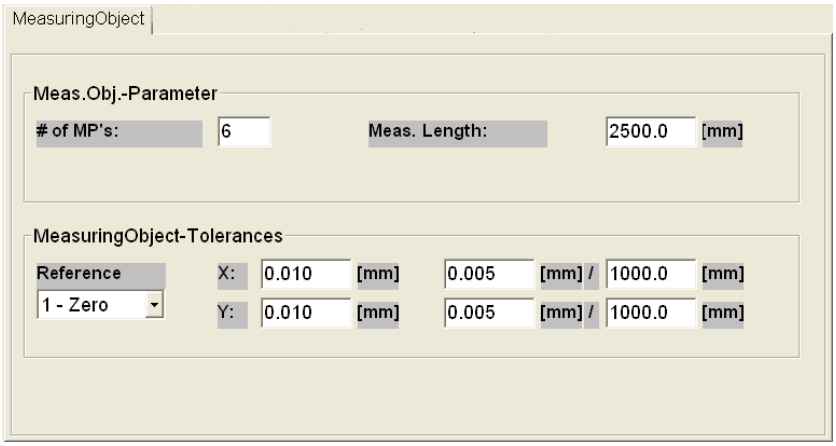
You will see the following screen: *"Setup Straightness".* The basic settings for straightness consist of four "Option-Tabs", namely:



- MeasuringObject:
  information about the object to be measured is entered here.
- MeasuringInstrument:
  all parameters concerning the ***RAY****TEC GEPARD*$_{bt}$ ™ receiver are controlled here.
- Display and Print:
  pre-settings for screen-display and print-out details are done here.
- General:
  Details about company, operator etc. are entered here.

Below, each of the four input boxes is described separately. Which affect the various inputs or activations in the individual boxes produce, can be clearly seen in the form of a printed report (see chapter 6.11: “printing measuring data”).

Option Tab "MeasuringObject"



# of MP's: Number of measuring points on the line to be measured.

Meas. Length: Total length of the measuring object is used by WIN-GEPARD to calculate the equidistance between the measuring points, as well as the tangential angle for the correction of the laser-beam pointing error. The length must be stated precisely by the operator, else positioning errors occur, causing inaccurate measuring results.

Reference: Reference point for defining "field of tolerance".
0-Min: Tolerance band is positioned to the smallest measuring value.
1-Null: Tolerance band is set as ±tolerance around the zero line.
2-Max: Tolerance band is positioned to the largest measuring value.

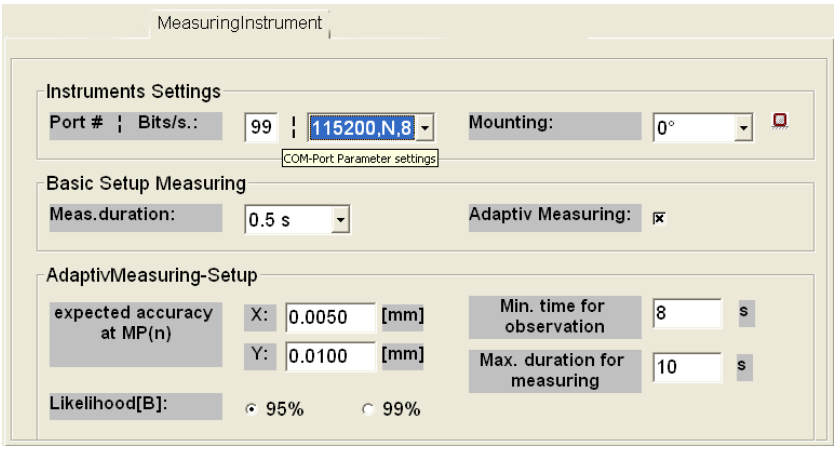
X Nominal tolerance of straightness in X-direction for all measuring points (total distance).

Additional box for the nominal tolerance of straightness in X-direction with regard to a defined length (mm/mm):

- Serves for the toleration of longer measuring objects in order to tolerate more accurately within a determined length. During measuring, all lengths at any one position on the object must be within this tolerance. Length values may not be less than the increment of the equidistance.

Y See definition of X-tolerance (above).

Option Tab "MeasuringInstrument"



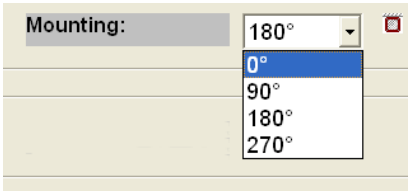
COM port number: This is the number of the serial interface of the PC used for communication with the ***RAY**TEC GEPARD$_{bt}$ ™* receiver. Use the same settings as for the installation of the Bluetooth adapters. The COM port number must be identical with that of the BT adapter in order to enable exchange of the WIN-GEPARD data with the ***RAY**TEC GEPARD$_{bt}$ ™* receiver.

☞ ***The COM port number MUST be defined between 1 and 16, otherwise WIN-GEPARD cannot address the COM interface!***

Bits/s: Speed of transfer of the serial interface.
For equipment with Bluetooth data transfer and fiber optic waveguides to an USB adapter, this setting must be 115'200Bps (all equipment from SNR 06010).
For systems with SMART wireless modules and fiber optic waveguides, PC data module to RS232c interfaces, this setting must be 19'200Bps (all equipment up to SNR 06009).

Mounting: The receiver can be mounted in four axial positions. The setting here will define the X/Y coordinate. E.g. if the receiver is mounted overhead, the setting 180° will convert the X/Y values to standard.

☞ *The X/Y direction is marked with a corresponding coordinate cross on the back of the cylindrical* GEPARD$_{AF}$ *casing.*



☞ *The definition or description of the X/Y axis/coordinates, and the corresponding interpretation can be looked-up in the **RAY**TEC GEPARD$_{bt}$ ™ Manual.*

Measuring duration: Extensive averaging of measuring values can practically eliminate environmental influences on the measuring system.
Vibrations from machinery or heavy traffic, as well as air turbulence in some cases, may have a significant effect on the measured values and thus increase the inaccuracy of the measurements. With a measuring time adapted to suit the current

environment, these effects can be controlled to a great extent. In a rough environment, the measuring time should be increased. The greater time allows the receiver to sample more measuring values, the larger number produces a better averaging result, which in turn suppresses single disturbances better. Default measuring time: 2.0 s.

Adaptiv measuring: Check-Box to toggle “adaptiv measuring” facility on/off. Activation of this box opens the window “AdaptivMeasuring-Setup” with input-parameters for “adaptiv measuring”. Detailed information is given in the separate ***RAY****TEC GEPARD*$_{bt}$ ™ manual.

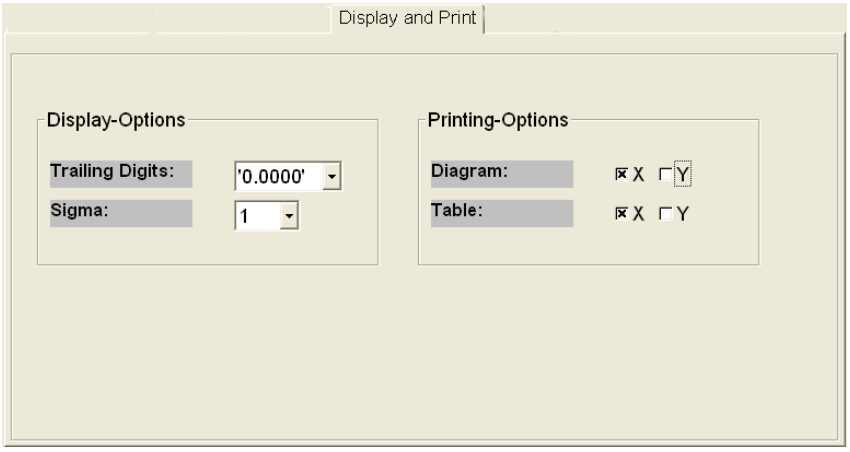
Expected measuring uncertainty per MP: Enter here the values for the X- and Y direction for the required measuring uncertainty which with this method should be reached.

Minimal observation time: This states the shortest possible time in seconds, which „adaptiv measuring“ needs to gather data for a measuring point, so that a statistically safe declaration can be made. The default value is 5 seconds, it can be increased optionally, must in any case be smaller than the maximum time of a measurement. The minimum observation time will be always effective in „adaptiv measuring“ as the lower time limit.

Maximum duration of a measurement: The time the user sets as upper limit for a measurement, to achieve the requested measuring certainty. Is this is reached and the set observation time has lapsed, the measurement is stopped. Can the required measurement certainty not be reached, offers the system an increased measuring time. (see ***RAY****TEC GEPARD*$_{bt}$ ™ manual).

Significance level: States the probability, that the resulting measurement lies within 95% or 99% of the requested accuracy – or vice-versa, that the remaining uncertainty is 5% or 1%. Utilizing 99% is a stronger restriction and requires more time to reach this measuring performance.

Option Tab “Display and Print”:



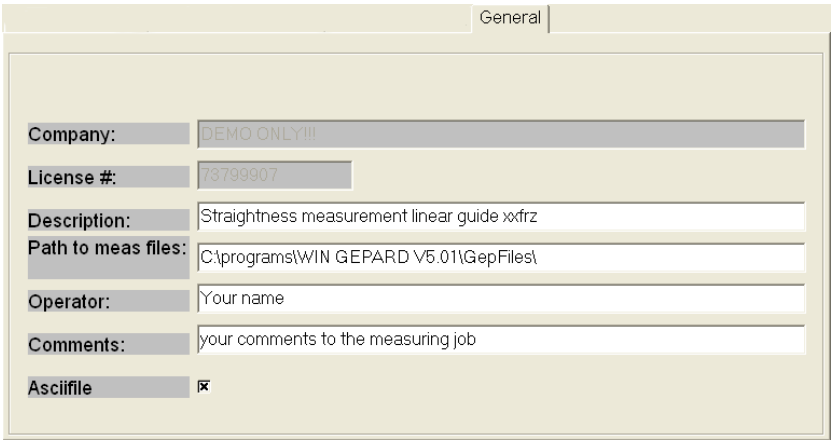
Trailing digits: Number of positions shown after the decimal point in the measuring result (is rounded correspondingly). This has an effect on the screen display and the printed report.

Sigma: Factor for calculation of the standard deviation (1..3Σ)

Diagram: Pre-defined printout of the X and Y diagram (graphic)

Tables: Pre-defined printout of the X and Y tables (values).

Option Tab "General"



Company: The name of your company - must already be defined when ordering WIN-GEPARD.

License no.: Your personal license number, which must correlate to your company name (only available from ***RAY**TEC SYSTEMS AG*).

Description: Preferred text regarding the type of measuring or the object being measured (e.g. measurement of straightness of a linear guide etc.)

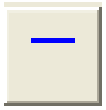
Path for measuring data: Default path for saving measuring data.

Operator: Operator's name.

Comments: Any text referring to the measurements; is printed as part of the report.

ASCII file: Measuring values are saved additionally as an ASCII file and can be further processed at a later date using databank or spreadsheet programs.

☞ *After making the basic settings, these parameters are saved to the GEPARD user registry by clicking on **OK or accept,** for further use in the program "measurement of straightness".*



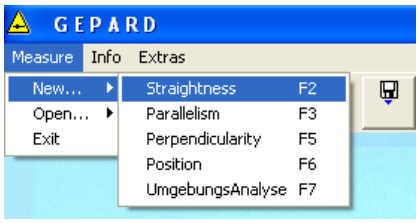
MEASUREMENT OF STRAIGHTNESS 

☞ *General comments:*
Starting the module "measurement of straightness" is done the same way as other measuring programs, the same applies to the activation of functions in WIN-GEPARD. Take note of the underlined letters in the drop-down menus.

STARTING THE PROGRAM

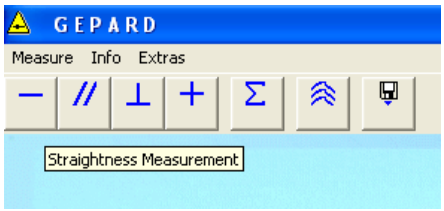
WIN-GEPARD offers different possibilities for starting the 'measurement of straightness' program:

Via the drop-down menus



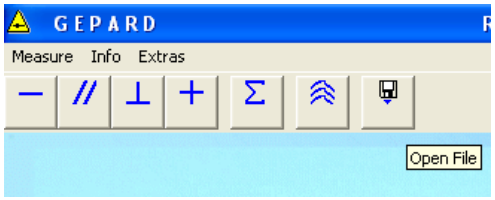
1. Click on ***Measure***
2. Click on ***New***
3. Click on ***Straightness***

Via the icon (button) "Straightness Measurement" in the task bar



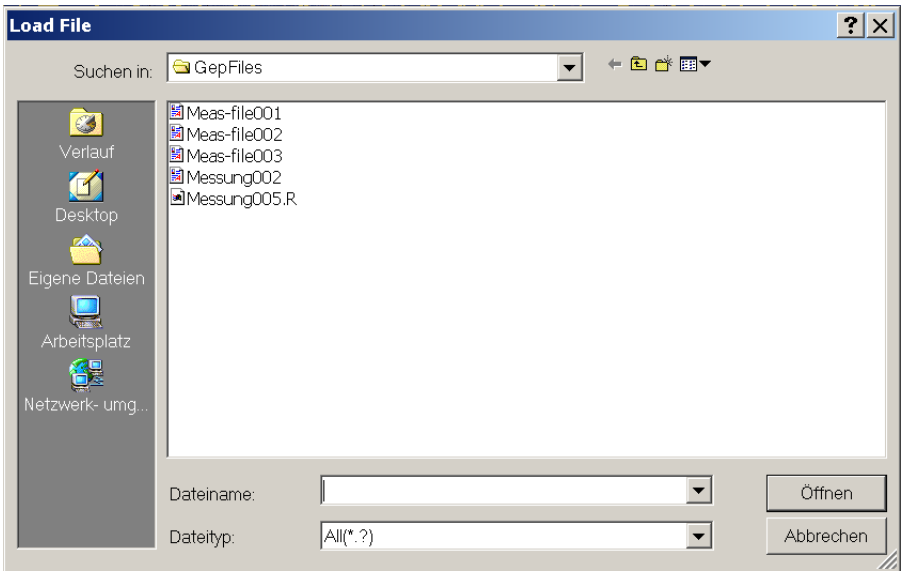
 1. Click on the symbol for "***Straightness***"

Via the button "Open File"



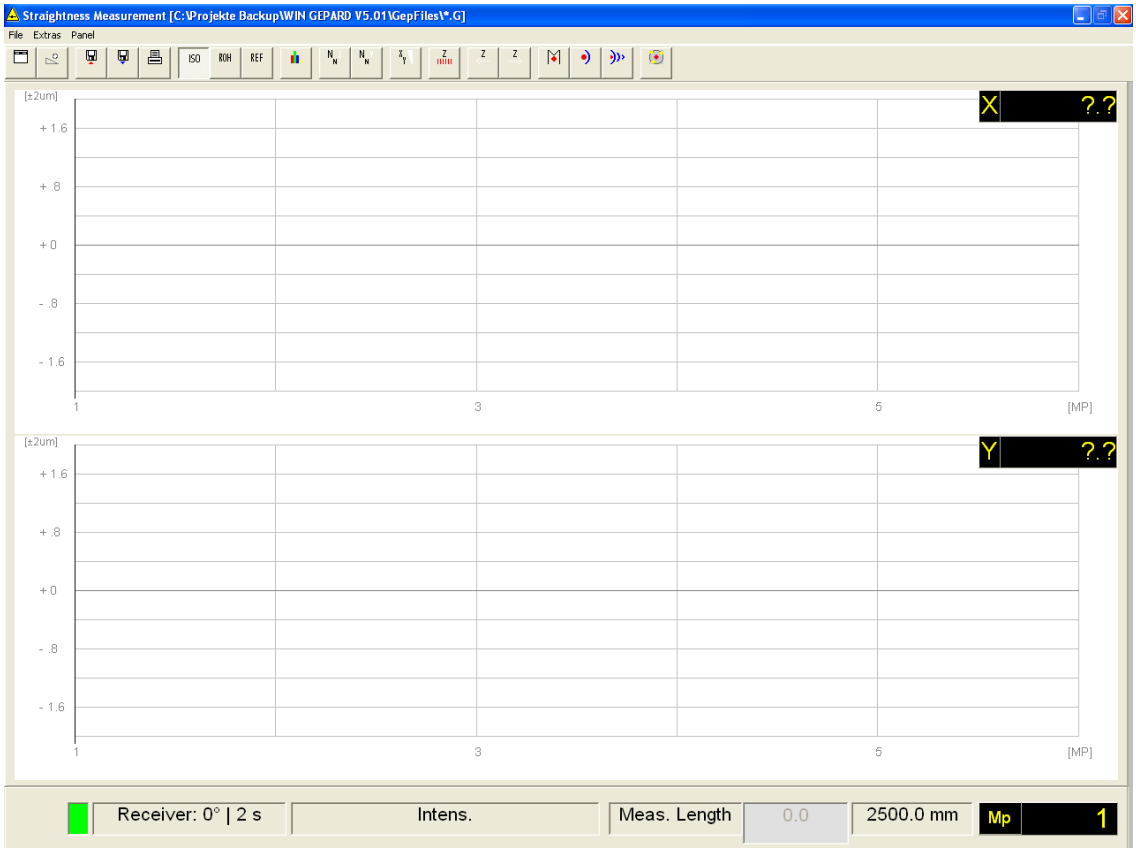
 1. Click on the button "***Open File***"

The screen mask ***Load file*** opens: in order for the measuring data from an already existing measuring series to be used, the type of file *.G (straightness) must be chosen. Following this, any existing WIN-GEPARD file can be selected in the list of files, and opened using the button "***OK"***.



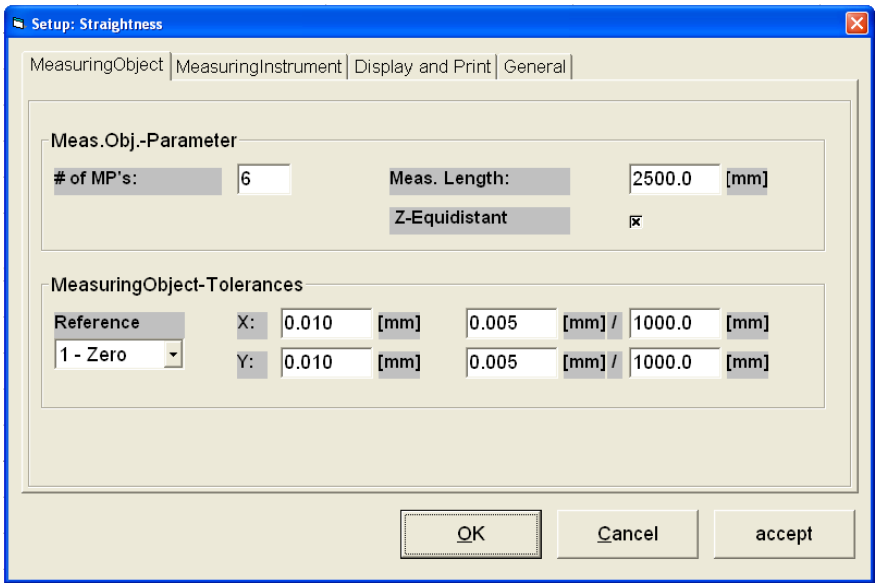
☞ *Measuring data files opened in this way appear on screen exactly as they were when they were saved by the operator. All setting parameters were saved together with the file contents.*
This characteristic can be used, among other things, to pre-define any number of different measuring configurations. These settings can then be recalled when required and the operator can begin straight away with measuring - definition of the measuring parameters is not necessary.

☞ *All these ways to start, mentioned above, lead directly to the measurement of straightness.*



SETTING INFORMATION

Before going further, check the settings of the measuring parameters, which you have configured in the INI-File. To do this, click on the icon shown at the left, or use the drop-down menu *Extras*:



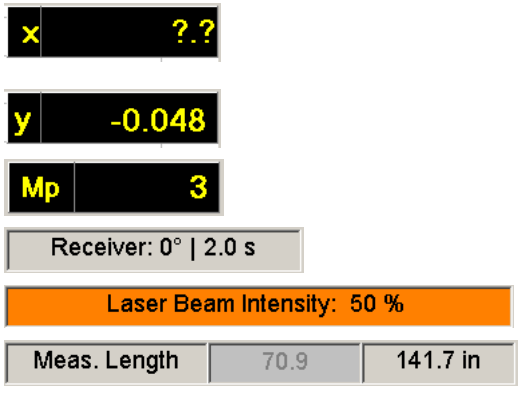
"*Setup: Straightness*" shows the current settings. These can be accepted for the measurements to be made or can be changed with new measuring parameters.

FUNCTIONS AND OPERATING ELEMENTS

The switch-buttons and functions for "measuring straightness" are explained below:

Displays

The following boxes appear on the right side of the screen and below the graphic display:



X value of the current measuring point (?.? : no value available)

Y value of the current measuring point

MP current measuring point

Position of the receiver, measuring time being used

Intensity of laser beam

Distance of the current measuring point to the starting point of the measurement and total length.

COLLECTION OF MEASURING DATA

Single measurement

By clicking on the button shown here, the current X/Y measuring values of the selected measuring point (MPn) are added to the measuring series.
WIN-GEPARD then updates the graphic, and steps automatically to the next measuring point in the series (MPn+1).
This function can be started by the operator either at the PC or directly at the ***RAY**TEC GEPARD$_{bt}$*™ receiver using the IR remote control.

☞ *This allows simple and quick measurement of straightness(X) and flatness(Y) for a preliminary test, to perform final adjustments later on, or for the final quality control, complete with printed report.*

Multiple measurement („Precision-Adjustment Method“)

After clicking on the button shown here, data-transfer from the ***RAY**TEC GEPARD$_{bt}$*™ receiver is set to “continuous measuring”. The transfer-rate is depending on the set measuring time. The current X/Y measuring values for the selected measuring point (e.g. MP2) are continuously updated (graphically and numerically).
*Special to this measuring mode is that the **RAY**TEC GEPARD$_{bt}$™ receiver utilizes a low-pass filter with a **large** time-constant – in this way fast/large changes (disturbances etc) will be strongly suppressed. This results in a considerable improvement of the stability of the measuring values at static measuring. Changes of the position of the receiver however will be actualized relatively slowly (dragging of the measuring value).*

Multiple measurement („Quick-Adjustment Method“)

After clicking on the button shown here, data-transfer from the ***RAY**TEC GEPARD$_{bt}$*™ receiver is set to “continuous measuring”. The transfer-rate is depending on the set measuring time. The current X/Y measuring values for the selected measuring point (e.g. MP5) are continuously updated (graphically and numerically).
After clicking on the button shown here, the transfer of measured data from the GEPARD receiver is set to “continual measuring”. The measured values are transferred to the PC according to the pre-selected measuring time. The current X/Y measuring values for the selected measuring points (e.g. MP5) are saved in the measuring series and WIN-GEPARD calculates the graph for each new value.
*With this mode, the system (GEPARD receiver) utilizes a low-pass filter with a **small** time constant – as a result the receiver reacts very sensitively and quickly to positional changes – disturbances will be noticed this way correspondingly.*

Stopping multiple measurements (J- and Q-Method)

In order to end the measuring, the same button **must** be clicked on again.

☞ *Stopping ongoing measuring can be done by the operator either at the PC or directly at the **RAY**TEC GEPARD$_{bt}$ ™ receiver using the IR remote control.*
Restriction: with the IR remote-control only single- or precision-measurement can be activated/ended – but not „quick adjustment“.

☞ *This allows simple and quick on-line setting or adjustment of straightness(X) and flatness(Y) at any chosen MP in the series. It must be noted that before starting the measurements, the **RAY**TEC GEPARD$_{bt}$ ™ receiver should be set at the correct MP position. (measuring position and measuring point must correspond!)*

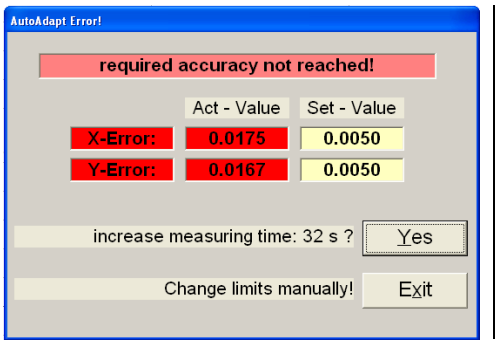
Adaptiv Measuring (Adaptiv-mode)

As a pre-condition for measuring with the adaptiv measuring mode, the checkbox has to be enabled, and the necessary parameters for this mode have to be set. (see basic settings further up, some more details about the adaptiv measuring mode are explained further down at „environmental analysis“).

Clicking on the shown icon, the actual X/Y measurement values at the set measuring point (MPn) will be added to the active measuring line.
The graphic will be refreshed and the MP will be stepped to the next measuring point (MPn+1).
This function can be started by the operator either at the PC or directly at the ***RAY**TEC GEPARD$_{bt}$ ™* receiver using the IR remote control.

If adaptiv measuring is active, a dynamic status-bar is displayed in the upper left corner of the screen and shows the progress of the ongoing measurement.

„Adaptive measuring“ differs in the way measurement-values from the receiver are being treated. WIN-GEPARD collects data from the receiver continuously until the limits, set by the user, have been reached. Averaging of the measuring values together with statistical error-analysis is used to check the calculated against the requested values. If the calculated measuring values are within those set limits, the averaged measuring values (arithmetic average) are added as the actual MP and the graphic is refreshed. WIN-GEPARD then moves on to the next MP (see “single measurement further up). If these limits can not be reached, the operator will be asked to increase the allowed measuring time or to set the limits higher. (see screen below)



Reason: either accuracy was set too restrictive, or the allowed measuring time was too short!

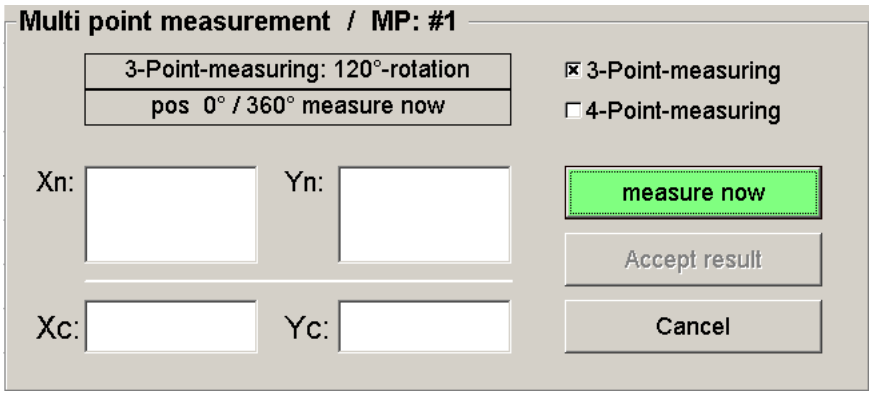
Multi-Point Measuring (MPM)

Multi-point measuring is used to calculate the centre point (circular centre point) out of three or four X/Y measured values for the one selected measuring point (MP).

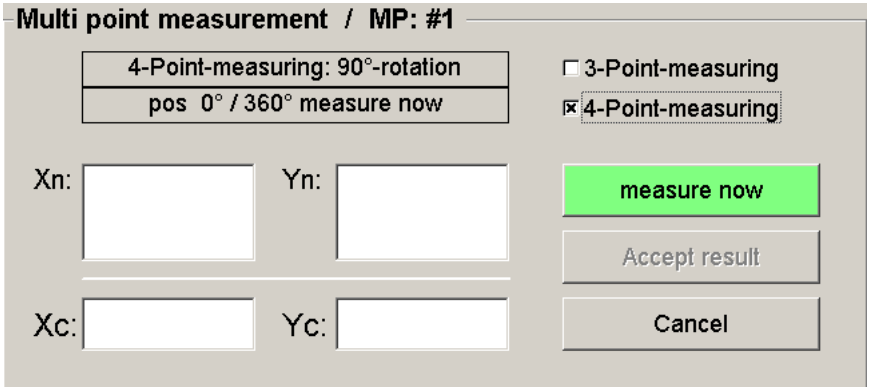
This method of measuring can be used, for example, to test the straightness of spindles on turning- or milling-machines. To do so, the spindle is positioned at a chosen (longitudinal) position, where the multi-point measuring is carried out. There the spindle is turned mechanically in steps of 90° (120°). At each step, an X/Y set of measuring values is taken. When all points have been measured, the (circular) centre point is calculated automatically. This calculated X/Y measuring value can now be added to the graphic and the file for straightness (or parallelism/perpendicularity) by pressing the “accept-button”.
The pre-selected measuring parameters are used for these measurements. Also here „adaptiv measuring“ can be utilized – provided it has been activated beforehand. (see basic settings further up).

If the individual X/Y measuring values are such, that calculation of their centre points does not provide a plausible result, the measurement is discarded as invalid. If the single values lie very close to each other (<0.005mm), the arithmetic centre point is calculated and shown as result.

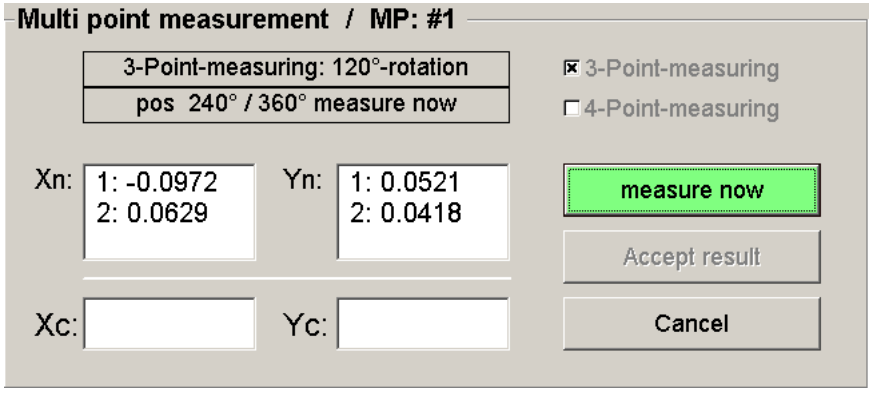
The following window is opened by clicking by clicking the multi-point measurement button:



When using the MPM method for the first time, users can select a 3-point or 4-point measurement. After processing the first measuring value, this selecting option is disabled, only available again when a completely new measuring task is begun.

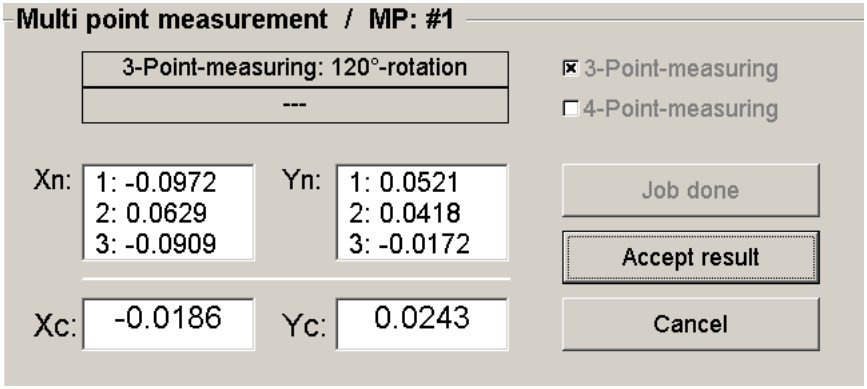


Clicking on “measure now“ collects the set of X/Y values from the ***RAY**TEC GEPARD*$_{bt}$ ™ receiver.



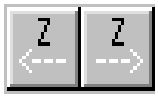
A status display shows the user which measurement has to be taken at this stage. Before the next measuring is done, the object being measured must be turned to the stated position (angle-step 90°/120°).

After all measurements have been taken, the result is displayed and the user must decide whether he will incorporate this result into the graph or discard it.



By clicking on “Accept result”, the values Xc and Yc are incorporated into the graph at the corresponding measuring point (e.g. MP1 in this case).

Choice of a Measuring Point (MP)



By clicking on the Z+ or Z- buttons, any chosen measuring point (MP) within the series can be selected. This function is needed to read a measuring value - or to select an MP for adjustment.
The operator, either at the PC or directly at the ***RAY**TEC GEPARD*$_{bt}$ ™ receiver using the IR remote control; can start this function.

PRESENTATION OF MEASURING DATA (MODE)

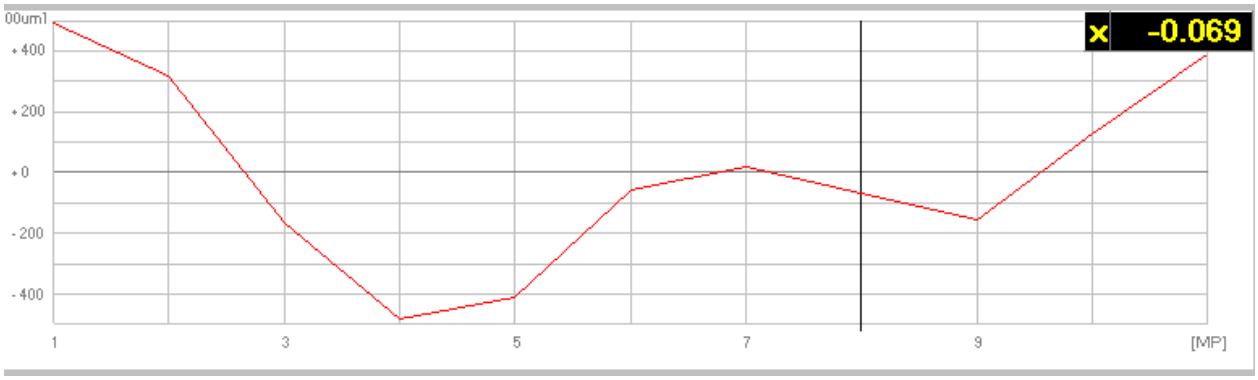
A detailed description and the mathematical basis for the different presentation methods are given in the technical documentation of the laser geometrical measuring and aligning system.

In the following, the presentation methods are described briefly and their effect on the graphical visualization of the measuring values is illustrated.

ISO Method

ISO visualization method: this is the WIN-GEPARD standard method, activated each time the program starts. The measuring points collected are arranged mathematically around a regression line, which, as a weighted mean value, has a value of exactly zero. Measuring values shown in adjustment mode represent the direct deviation from the ideal straight line or the zero-line (in X and Y direction). Using this information, a measuring object can directly be evaluated and, if necessary, be re-aligned.

Example: ISO straight line

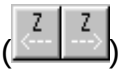
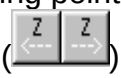


Reference point method (plumb-line method)

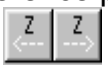
The **Ref** or plumb-line method is used when the straightness needs to be determined from two chose able measuring points (reference points). The straight line between the two reference points is shown on the abscissa. The measuring values collected are arranged mathematically around this reference line. Measuring values shown in adjustment mode represent the direct deviation from the reference line (in X and Y direction). Using this information, a measuring object can directly be evaluated and, if necessary, be re-aligned.

☞ *WIN-GEPARD always selects the first (Ref1) and last (Ref2) measuring points as reference points. However, the operator can define other reference points at any time (see also below).*

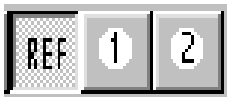
Setting a 'plumb-line' with the laser:

1. Start of a new straightness measurement
2. Select measuring point for Ref.1 ()
3. Register data for chosen measuring point 1
4. Select measuring point for Ref.2 ()
5. Register data for chosen measuring point 2

WIN-GEPARD now draws a (yellow) line between these two reference points.

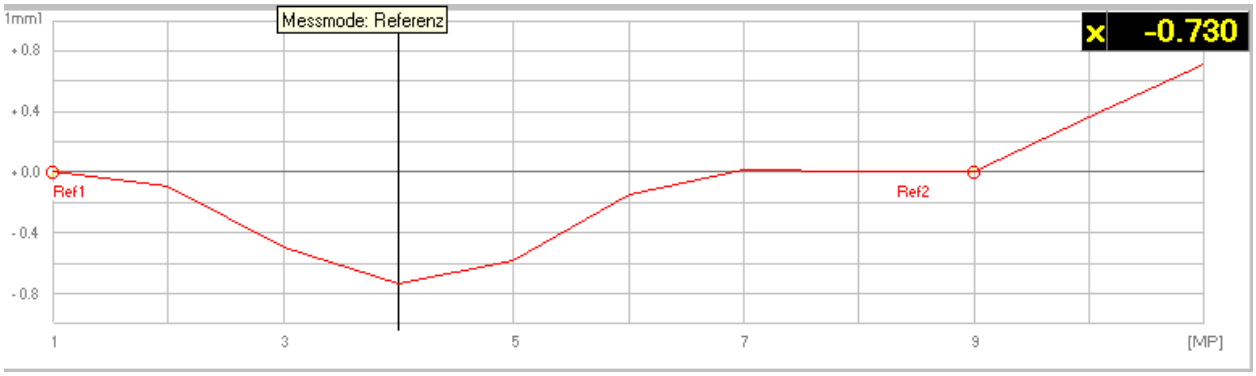
The points in between can now manually be selected with  and registered, in chosen sequence. The actual measuring values represent the direct deviation from the 'plumb-line'.

Selecting reference points



After pushing the button REF, two additional buttons, "1" and "2" become visible so that the reference points 1 and 2 can be selected using the following method:
The measuring point (MP) to be used as reference point can be selected by repeatedly clicking Z+ or Z-. (e.g. MP9), button "2" is then clicked on. WIN-GEPARD moves the mark "Ref2" to MP9 and the calculated reference straight line is now through the points 1 and 9.

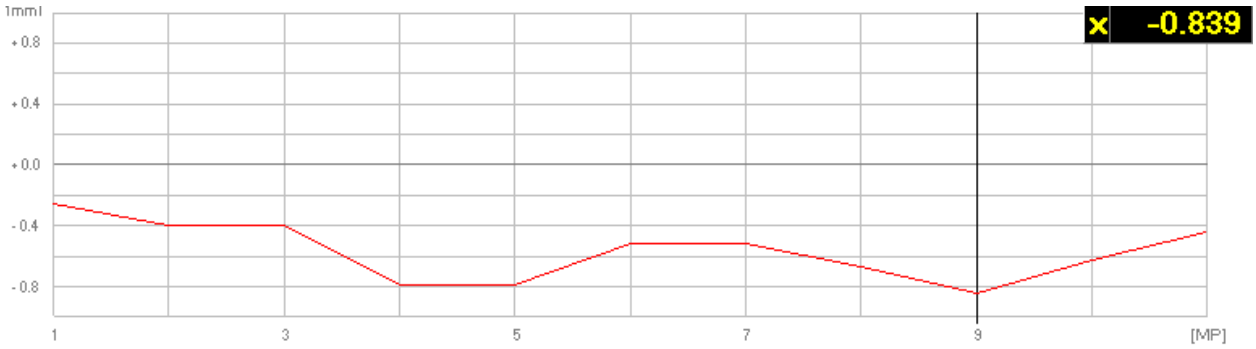
Example: REF - straight line



'Raw' method

Presentation method **Raw**: raw data is subject to setting inaccuracy and, therefore, without validity with regard to the object being measured. However, all results can be derived directly from the raw data. In this case, WIN-GEPARD saves only the raw data in the measuring files together with the parameters of the measurement.

Example: Raw Method - Line



DISPLAY OF STATISTICS

Statistical functions is activated by clicking on the icon (shown at left). WIN-GEPARD determines statistics during collection of the measuring data, and shows these both numerically and graphically in the X/Y diagrams (see example below).

arithmetical mean value of all measuring values.

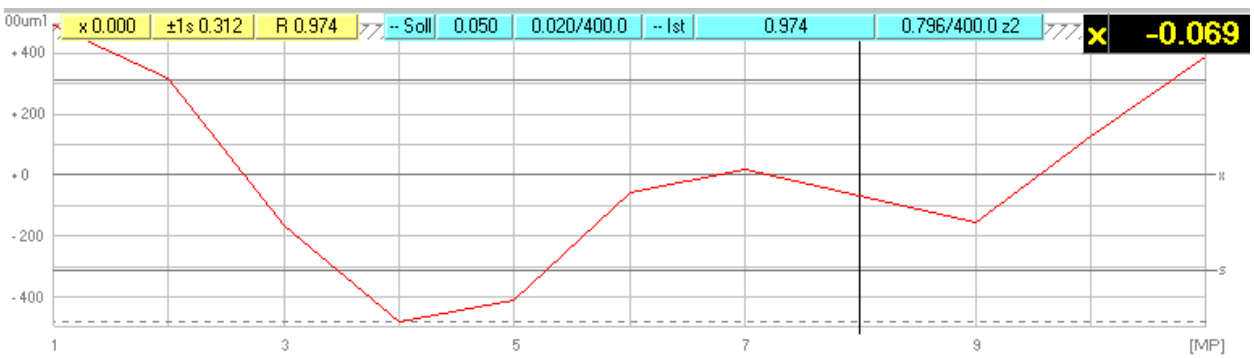
range of measuring values (max_value - min_value).

standard deviation, whereby a factor between 1 - 3 can be selected (Gaussian bell-shaped normal distribution).

displays a “range of tolerance band” with nominal and actual tolerance values.

Example: Display of statistical values

The following example, intended to show the effect of the different statistical functions, shows a graph from the WIN-GEPARD standard method (***ISO***) showing all the statistical functions:



SCALING OF MEASURING VALUES

WIN-GEPARD uses auto-scale as standard configuration. Auto-scaling allows an optimal display of the curve on the screen. WIN-GEPARD chooses the scale values so that the graph fills the screen optimally whenever possible.

By clicking on this button, a set of buttons appear on screen like follows:

Scaling switches

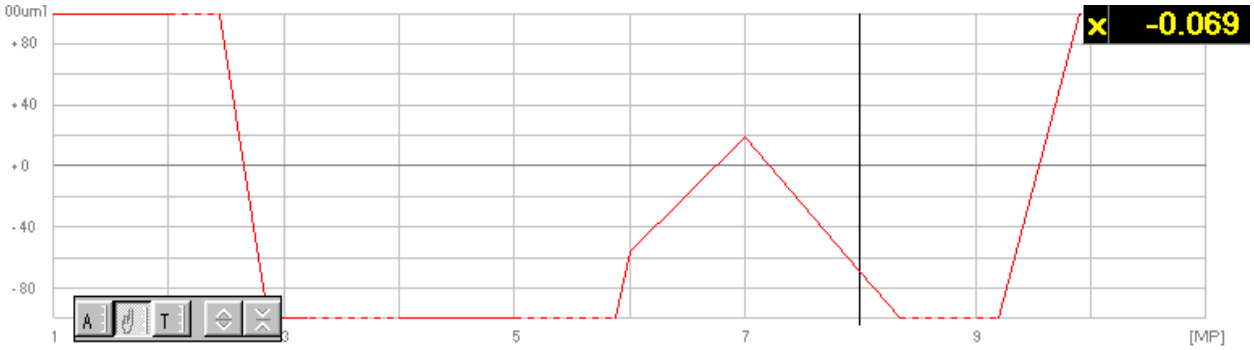
Auto-scale: description of this function as given above.

Manual scale: this allows the operator to choose scaling as required.

These buttons, active at “manual scale”, increase or decrease the scale values.

Auto-scale based on the pre-set tolerances. This scaling method uses the tolerance values (see basic settings) for scaling the X and Y graphics so that the tolerance range band is ALWAYS within the presentation frame.

Example: Manually determined scale with the scale too small



The manually selected scales can be used, for example, to make very small values visible (zoom-in) or also to show the X and Y axes on the same scale for printing the report.

ADJUSTMENT OF GRIDLINES IN Z-DIRECTION

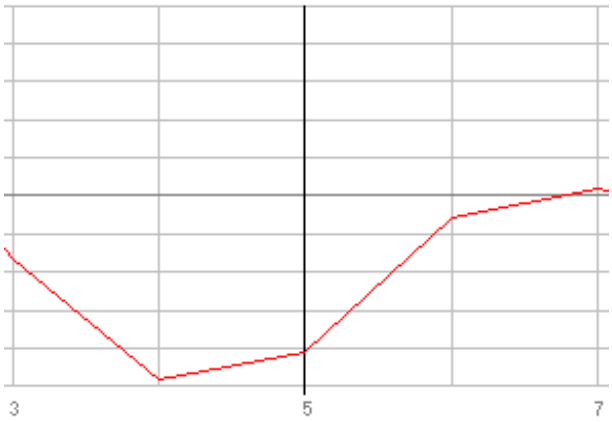
Grid adjustment serves to adjust individual Z-distances, something that may be necessary depending on the object being measured.
As standard, the Z-distances are always equidistant (equal distance from measuring point to measuring point).

To change the setting for a chosen Z-distance, left-click the appropriate vertical bar, hold the mouse-button and drag the bar to the required position, drop it there by letting the mouse-button go. Fine adjustment can be made with the ←→ keys (holding the left mouse button down while pressing the desired key).
Alternatively, the Z-value of a selected MP can be entered numerically in the distance field at the bottom of the screen on the right.
→ Click on the field with the cursor, enter the value and confirm with "**enter**".

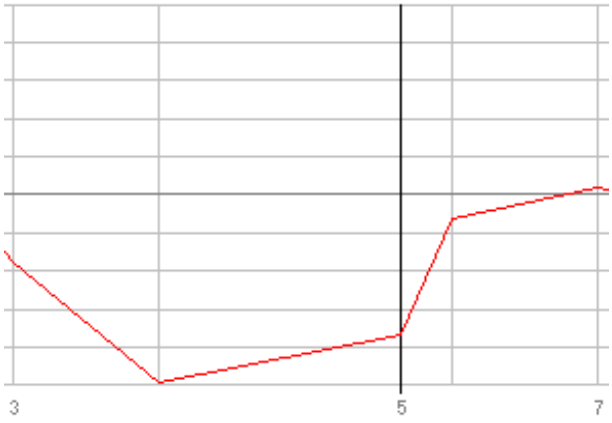
☞ *The distance value may not be more or less than the distance to the next MP. The minimum distance from one MP to the next is 10 mm.*

Example of grid adjustment

Before:



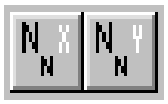
After:



Actual display in the distance field:

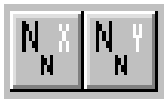
☞ *The adjustment to the grid can be reversed at any time by clicking on the box Z-equidistant in the pull-down menu **Extras**, **Setting info.** WIN-GEPARD then sets the distance(s) from MP to MP back to the equidistant value, originally calculated from the distance and the number of MPs.*

LARGE NUMERICAL DISPLAY



The function N(x) or N(y) switches the large numerical display for the X and Y values on and off (toggle switch).
By clicking on **N(x)** {or, alternatively on *N(y)*}, the actual **X**{*Y*} values for the MP will be shown in maximum size in the **top** {*bottom*} half of the screen and the **X**{*Y*} graph in the **bottom** {*top*} half of the screen. The Y{X} values are not visible at this point!

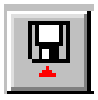
Example for N(x)



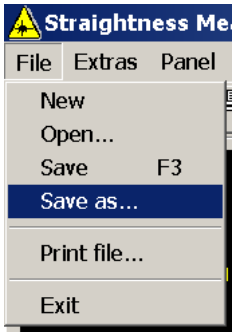
If both N(x) and N(y) buttons are activated, only the actual X and Y values are shown in large numerals (together with the MP) on the screen.

Example for N(x) and N(y)

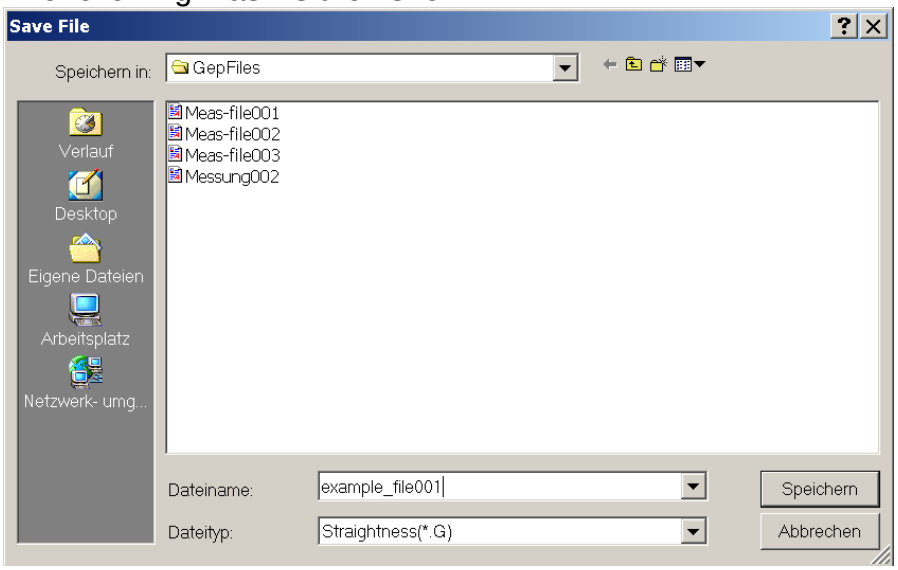
SAVING MEASURING DATA



By clicking on this icon or by using the drop-down menu File and Save, the current measuring data with the corresponding parameters are saved to the file in use.
If there is no existing file, a new one must be created either automatically or using the command: *Save as*.
Saving measuring data is carried out in WIN-GEPARD as in all other WINDOWS programs:

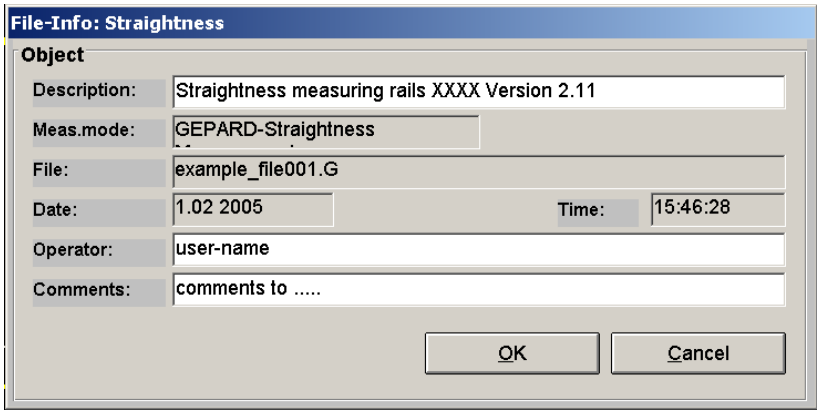


The following mask is then shown:



Enter the name of the file and confirm with ***Save***. The type of file is selected automatically by WIN-GEPARD (in this case, G: format for measurement of straightness).

The pre-selected parameters of the basic settings are shown again as file info and can be changed in some cases.



The following entries can be changed:

- Description
- Operator
- Comments

All other parameters are a fixed part of the measurement, and cannot be changed therefore.

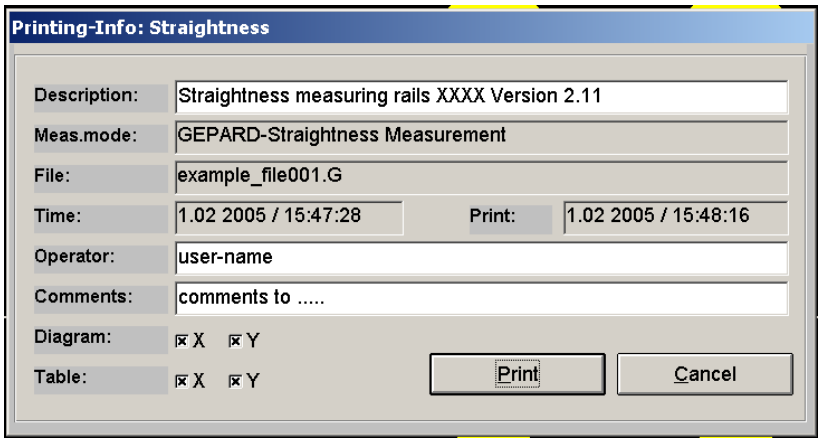
☞ *By confirming these entries with the **OK** button, all raw measuring values, measuring parameters and settings will be saved (in this case in the file **example_file001.G**).*

PRINTING MEASURING DATA

By clicking on this icon or by using the drop-down menu *File* and *Print-file*, the current measuring data and the corresponding parameters are sent to the system printer.

The parameters defined in the base settings will be shown again before printing starts as 'Printing Info' and can be changed in some cases if necessary.

This activates the following mask:



The following report entries may be changed at this point:

- Description
- Operator
- Comments

A choice may be made between the types of report: X/Y graph and/or X/Y tables.
All other parameters are a fixed part of the measurement and cannot be changed therefore.

By clicking on ***Print***, the report will start to be printed.

☞ *NOTE: The current screen setting, i.e. ISO, REF or RAW will also be printed.*

Notes on printing reports

A report can be printed separately for every screen setting, i.e. ISO, REF or RAW, as graph or table.
WIN-GEPARD adds other important information about the date and time of saving as well as date and time of printing. This makes it possible to identify immediately when the measurements were made and/or the report printed.

Example: Description of object

In the header of the report containing graph (and table), details of the object measured are described again. All relevant data from ***basic settings*** or from ***printing info*** are included:

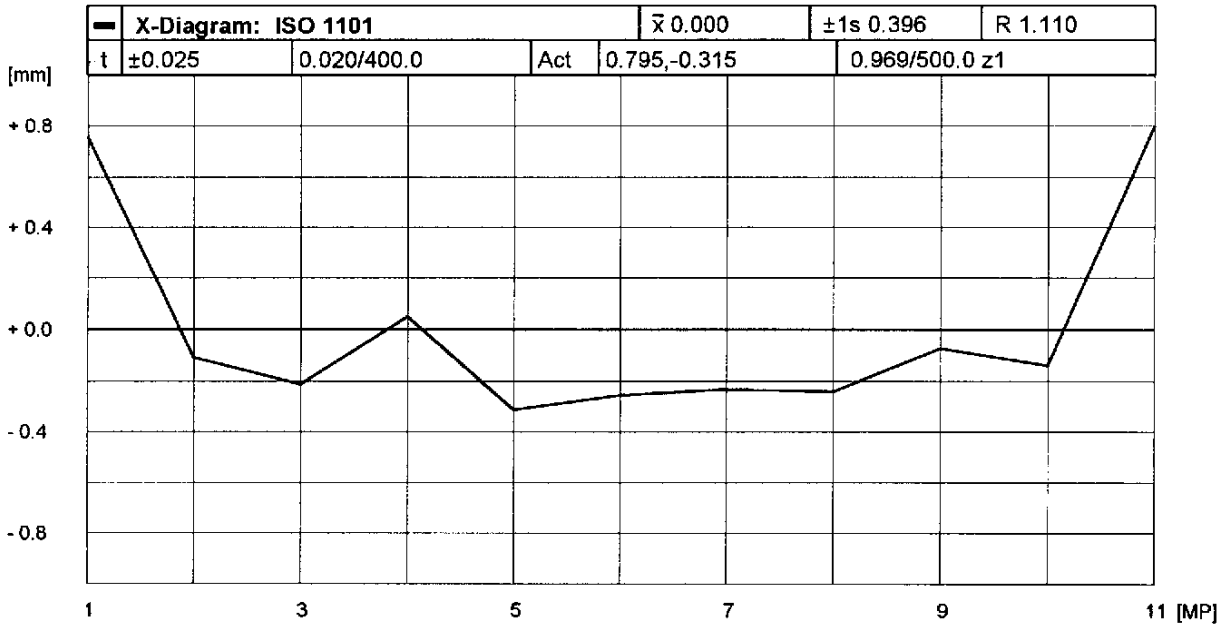
GEPARD-Meas.protocol: Proxy Inc.

Object

Description:	Straightness		
Meas.mode:	GEPARD-Straightness Measurement		
Path:	C:\Programme\GEPARD\GepFiles\example_4.G		
Operator:	Operators-Name		
File:	11.07 2000 / 16:55:19	Print:	11.07 2000 / 17:41:00
# of MP's:	11	Distance:	2500.0 mm
Camera°:	180°	Filter:	Medium
Comments:	Your comments		

Example: X diagram ISO straight line

To illustrate the possibilities available with the report function, an X diagram and the corresponding table of an ISO measurement of straightness are shown and explained below:



The symbols given in the header above the graph provide the following information:

t ±0.025 0.020/400.0	Nominal tolerance of straightness.
Act 0.795,-0.315 0.969/500.0 z1	Actual tolerance of straightness.
x̄ 0.000	Arithmetical mean value.
±1s 0.312	Standard deviation.
R 0.974	Range.
X-Diagram: ISO 1101	ISO measurement of straightness.
[mm]	Measuring range of the X-axis

Example: X/Y table ISO straight line

The report header is identical to the previous one and is therefore not shown here again.

Tabelle: ISO 1101	PosNr	Z[mm]	X[mm]	Y[mm]
	1	0.0	0.493	- 0.359 *2
	2	200.0	0.315 *2	- 0.807 *2
	3	400.0	- 0.165 *2	0.203 *2
	4	600.0	- 0.481 *2	0.691 *2
	5	800.0	- 0.413 *2	0.330 *2
	6	1000.0	- 0.056 *2	- 0.161 *2
	7	1200.0	0.019 *2	0.769
	8	1400.0	- 0.069 *2	0.143 *2
	9	1600.0	- 0.158 *2	- 0.195 *2
	10	1800.0	0.128 *2	0.096 *2
	11	2000.0	0.387 *2	- 0.711 *2

Key: ?.?=Undef. value, * = Out of tolerance (Reference: 0= Min; 1= Zero; 2= Max)

MEASUREMENT OF PARALLELISM

Measurement of parallelism of one or more straight lines referring to a reference line.
This reference line can, for example, originally be recorded as a measurement of straightness and, while being imported to the current measurement, be defined as reference line (Menu: *File* / *Import reference line)* – or the reference line is recorded directly within the module.
The module 'measurement of parallelism' allows measuring points to be recorded, processed and presented in the form of straightness and parallelism.

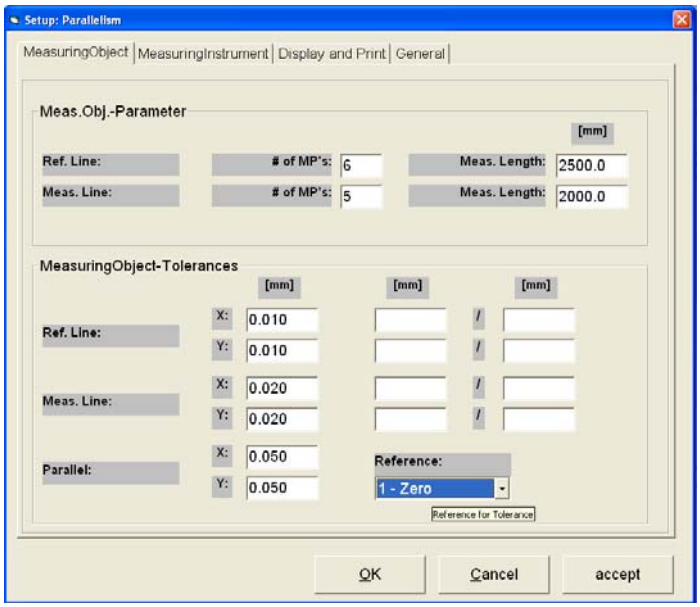
☞ *General notes:*
In the following, only those commands and possibilities for measurement of parallelism which differ greatly from the measurement of straightness as given above, or which are specific to measurements of parallelism, are shown.
The user is explicitly recommended to study operation of the WIN-GEPARD software using the measurement for straightness.

STARTING THE PROGRAM

The program 'measurement of parallelism' is started in the same way as the program start for “measurement of straightness” and is described in the corresponding chapter.

BASIC SETTINGS

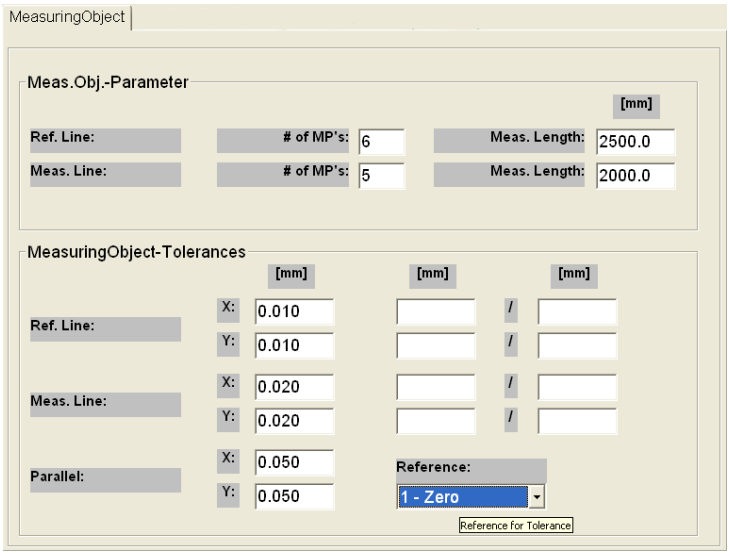
There are some minor differences between the basic settings for “measurement of parallelism” and those for the “measurement of straightness” mentioned above.



Basic Settings for measurement of parallelism

The fields for entering data, which differ from those for “measurement of straightness”, are explained individually - the effect of entering data or activating single fields can be seen most easily by referring to the printed report (see also the chapter on “printing measuring data2).

Option Tab “measuring object”



Reference/meas. line: To determine the parallelism of two lines, WIN-GEPARD requires a reference line – refer also to the ***RAY**TEC GEPARD*$_{bt}$ ™ technical documentation - as well as the measuring line(s). The necessary parameters for the measuring lines are defined here.

 # MP's: Number of measuring points on the reference line and measuring line(s). Note: The numbers of MP’s of the reference line and the line(s) to be measured do **not** need to be identical.

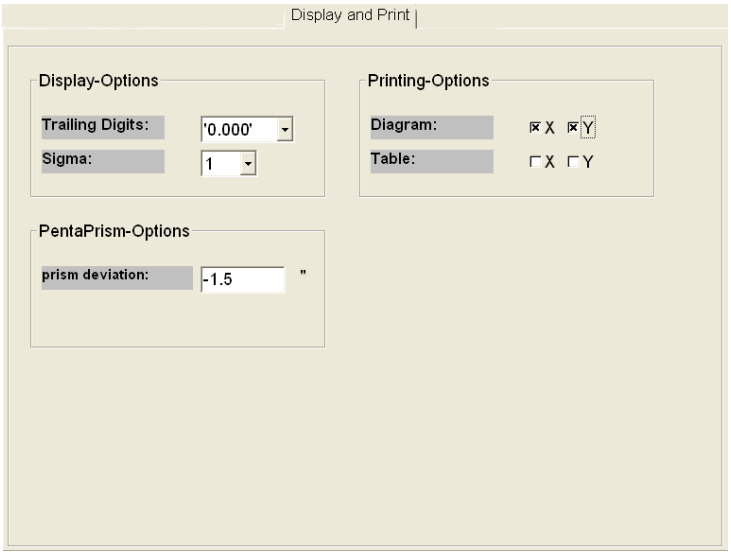
Measuring length: Total measuring length (this is used by WIN-GEPARD to calculate the equidistance between the measuring points, as well as the tangential angle for correction of the laser-beam pointing angle. It must be entered accurately by the operator, else measuring errors, due faulty initial settings do occur. Note: the length of the reference line and the line(s) to be measured do **not** need to be identical.

X/Y Nominal tolerance of the straightness in X/Y direction for the reference line and the line(s) to be measured.
In addition, the tolerance of parallelism can also be defined.

Option Tab "MeasuringInstrument"

All settings are identical with those in the module „straightness". (see above)

Option Tab "Display and Print"



Prism Deviation

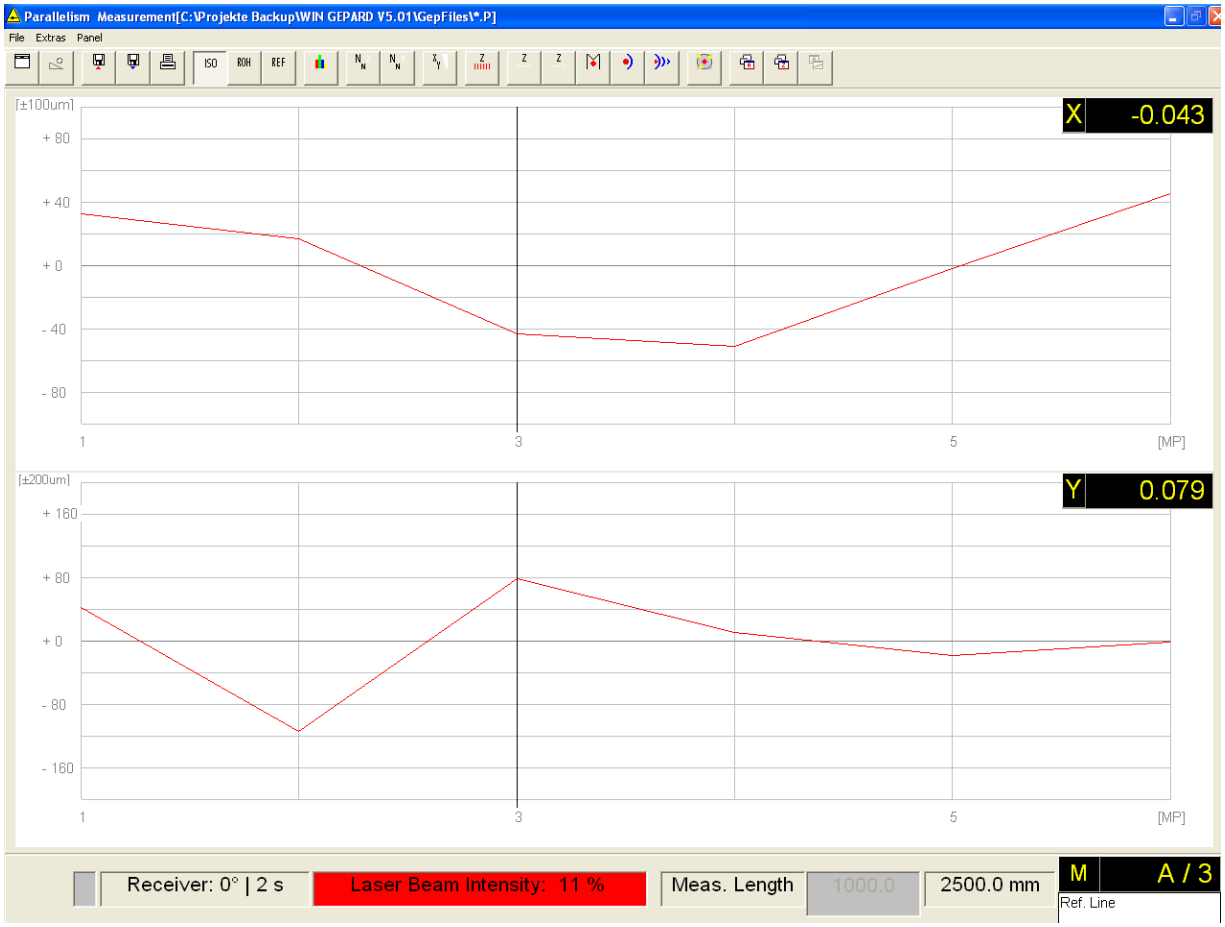
If the optical fault angle of the PentaPrism is known, it can be entered here (with a prefix!). WIN-GEPARD will then compensate for it fault mathematically
The rest of the settings are identical to those in the module "straightness". (see above).

Option Tab "General"

All settings are identical with those in the module „straightness". (see above)

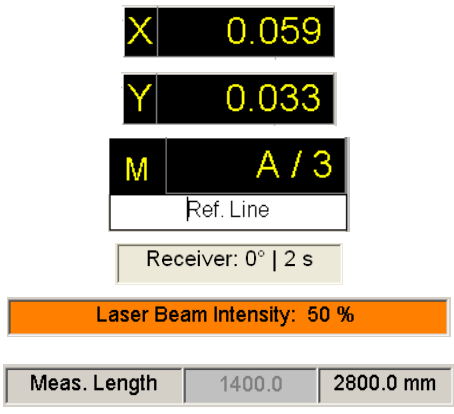
FUNCTIONS AND OPERATING ELEMENTS

Buttons and functions for measuring parallelism are explained below:



Displays

The following boxes appear on the right side of the screen and below the graphic display:



X-value of the current measuring point

Y-value of the current measuring point

M ***A :*** Reference line
3 : current measuring point of the reference line

Position of the camera, measuring duration being used

Intensity of laser beam

Distance of the current measuring point to the starting point of the measurement and total length.

☞ *The reference line is **always** marked with the letter **A**. Based on this reference, parallelism of all further measuring lines (marked with B - Z) is calculated and shown.*

COLLECTION OF MEASURING DATA

Collection, presentation and processing of measuring data are carried out the same way as for “measurement of straightness”.

The additional buttons necessary for recording the parallel measuring lines are explained here:

By clicking on this button, the next measuring line (successor) is selected (B, C, D ...).
Which measuring line the graph shows at any one time is indicated at the bottom right in the display window.

Examples:

☞ *Collection of measuring line data is carried out in the same way as for “measurement of straightness”.*

By clicking on this button the previous measuring line is be selected (Z .., C, B, A).
Which measuring line the graph shows at any one time is indicated at the bottom right in the display window.

Examples:

PRESENTATION OF MEASURING DATA (MODE)

A detailed description and the mathematical basis for the different presentation methods are given in the technical documentation of the laser geometrical measuring and alignment system.

The presentation methods are the same as those used when carrying out the measurement of straightness, i.e. ISO, Ref. and Raw, and are explained in detail in the corresponding chapter.

DISPLAY OF STATISTICS

Statistical functions is activated by clicking on the icon (shown at left). WIN-GEPARD determines statistics during collection of the measuring data, and shows these both numerically and graphically in the X/Y diagrams (see example below).

arithmetical mean value of all measuring values.

range of measuring values (max_value - min_value).

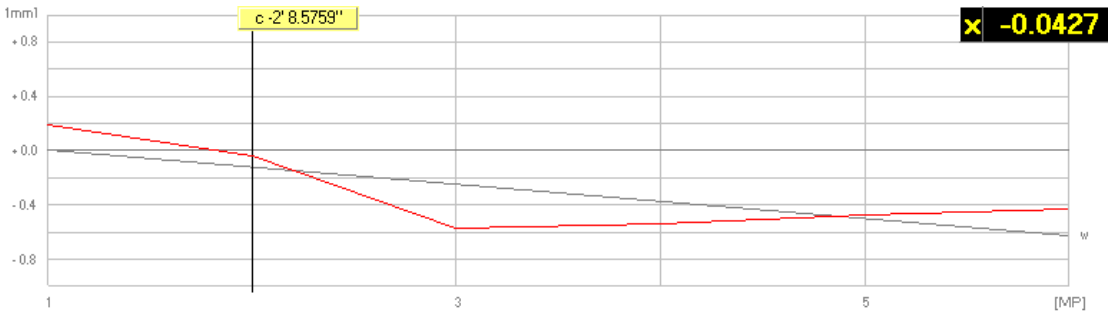
standard deviation, whereby a factor between 1 - 3 can be selected (Gaussian bell-shaped normal distribution).

displays a “range of tolerance band” with nominal and actual tolerance values.

parallelism between the reference line and the measured line in degrees (marked in the diagram with the letter c; basis 0°±Δ∠).

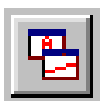
☞ *If instead of parallelism straightness of the measured line is shown, the angle **w** represents the deviation of the laser beam from the ISO straight line. This is also true for the display of the angle of the reference line. This angle is then marked in the graph with the letter **a**.*

*Example: Graph of the angle of parallelism (**w**):*



The value c 2‘8.5759“ represents the error in parallelism (in degrees) between the ISO straight line of the reference line (always A) and the ISO straight line of any one of the lines being measured (B - Z).

SWITCHING BETWEEN STRAIGHTNESS / PARALELLISM



With this button, the screen will change from showing “parallelism” to show the already familiar “straightness” presentation. Pressing the button again will switch back to “parallelism”. This applies to **all** measuring lines B-Z.

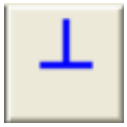
☞ *In this way, both the parallelism and straightness of an object can be recorded and presented.*

PRINTING MEASURING DATA

As for a “measurement of straightness”, the report is always printed according to the current screen display, i.e.:

- ISO, Ref., Raw for a presentation of straightness or the corresponding presentation of parallelism.

The parallelism report is created in the same way as for straightness.



MEASUREMENT OF PERPENDICULARITY 

The measurement of perpendicularity of one or more straight lines based on a reference line.
This reference line can, for example, originally be recorded as a measurement of straightness and, while being imported to the current measurement, be defined as reference line (Menu: *File / Import reference line)* – or the reference line is recorded directly within the module.
The module 'measurements of perpendicularity' allows measuring points to be recorded, processed and presented in the form of straightness and perpendicularity.

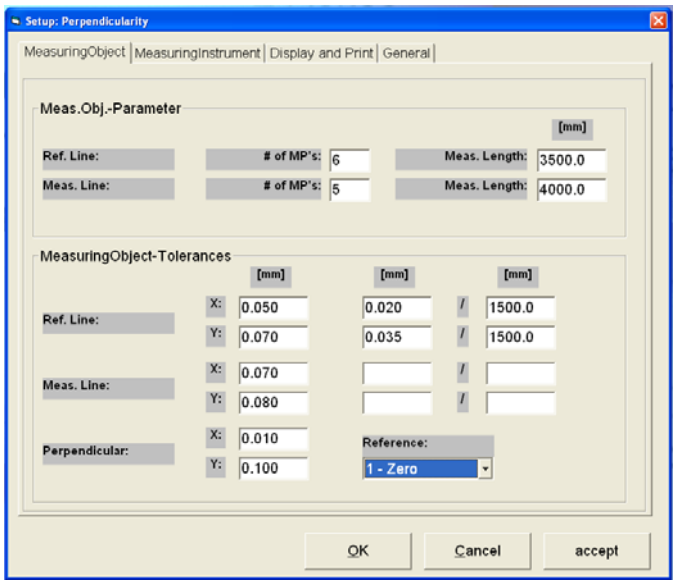
☞ *General notes:*
Following, only those commands and possibilities of "measurement of perpendicularity", which differ greatly from "measurement of straightness" (see above), or which are specific to "measurements of perpendicularity", are shown.
The user is explicitly recommended to study operation of the WIN-GEPARD software using "measurement of straightness".

STARTING THE PROGRAM

The program 'measurement of perpendicularity' is started the same way as "measurement of straightness" and is described in the corresponding chapter.

BASIC SETTINGS

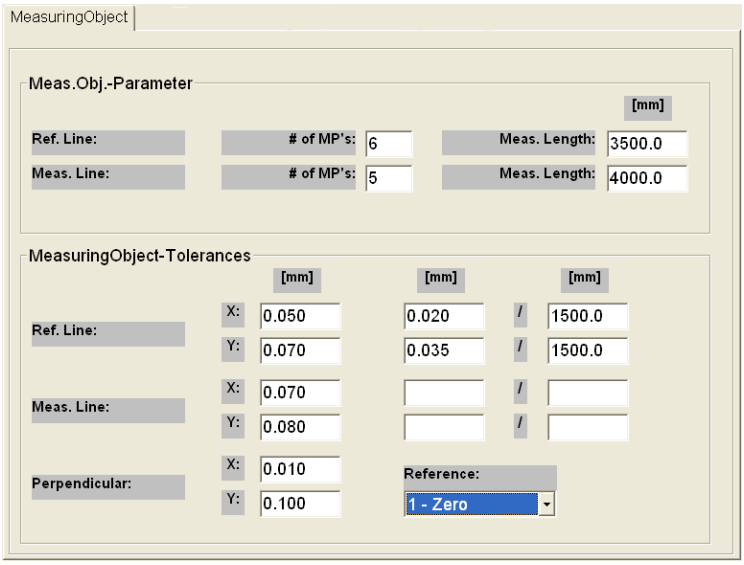
There are some minor differences between the basic settings for "measurement of perpendicularity" and those for "measurement of straightness", explained above.



Basic Settings for measurement of perpendicularity

The fields for entering data, which differ from those for “measurement of straightness”, are explained individually - the effect of entering data or activating single fields can be seen most easily by referring to the printed report (see also the chapter “printing measuring data”).

Option Tab “MeasuringObject”



Important definitions for “measurement of perpendicularity”

Reference/meas. line: To determine the perpendicularity of two lines, WIN-GEPARD requires a reference line – refer also to the ***RAY**TEC GEPARD*$_{bt}$ ™ technical documentation - as well as the measuring line(s). The necessary parameters for the measuring lines are defined here.

 # MP's: Number of measuring points on the 'straight lines' to be measured. Note: The numbers of MP's of the reference line and the line(s) to be measured do **not** need to be identical.

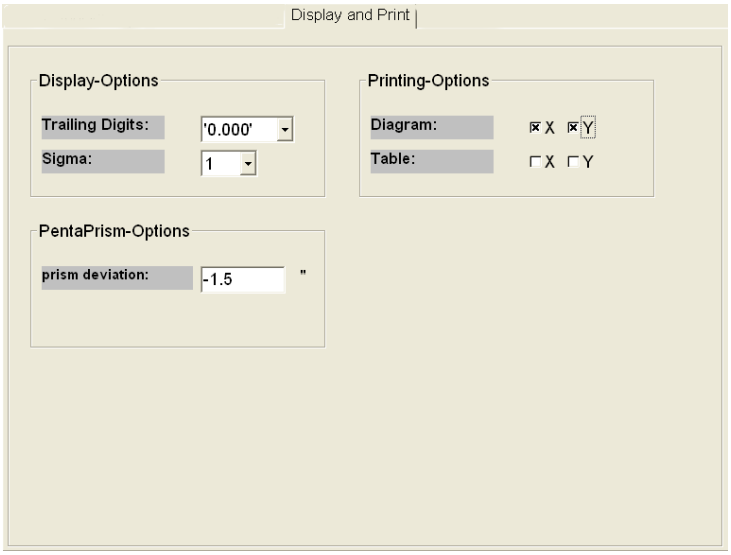
Measuring length: Total measuring length (this is used by WIN-GEPARD to calculate the equidistance between the measuring points as well as the tangential angle for correction of the laser-beam pointing angle. It must be entered accurately by the operator, else measuring errors, due faulty initial settings do occur. Note: the length of the reference line and the line(s) to be measured do **not** need to be identical.

X/Y Nominal tolerance of the straightness in X/Y direction of the reference line and the line to be measured.
In addition, the tolerance of perpendicularity can also be defined.

Option Tab "MeasuringInstrument"

The setup is identical with that of the module „straightness". (see further up).

Option Tab "Display and Print"



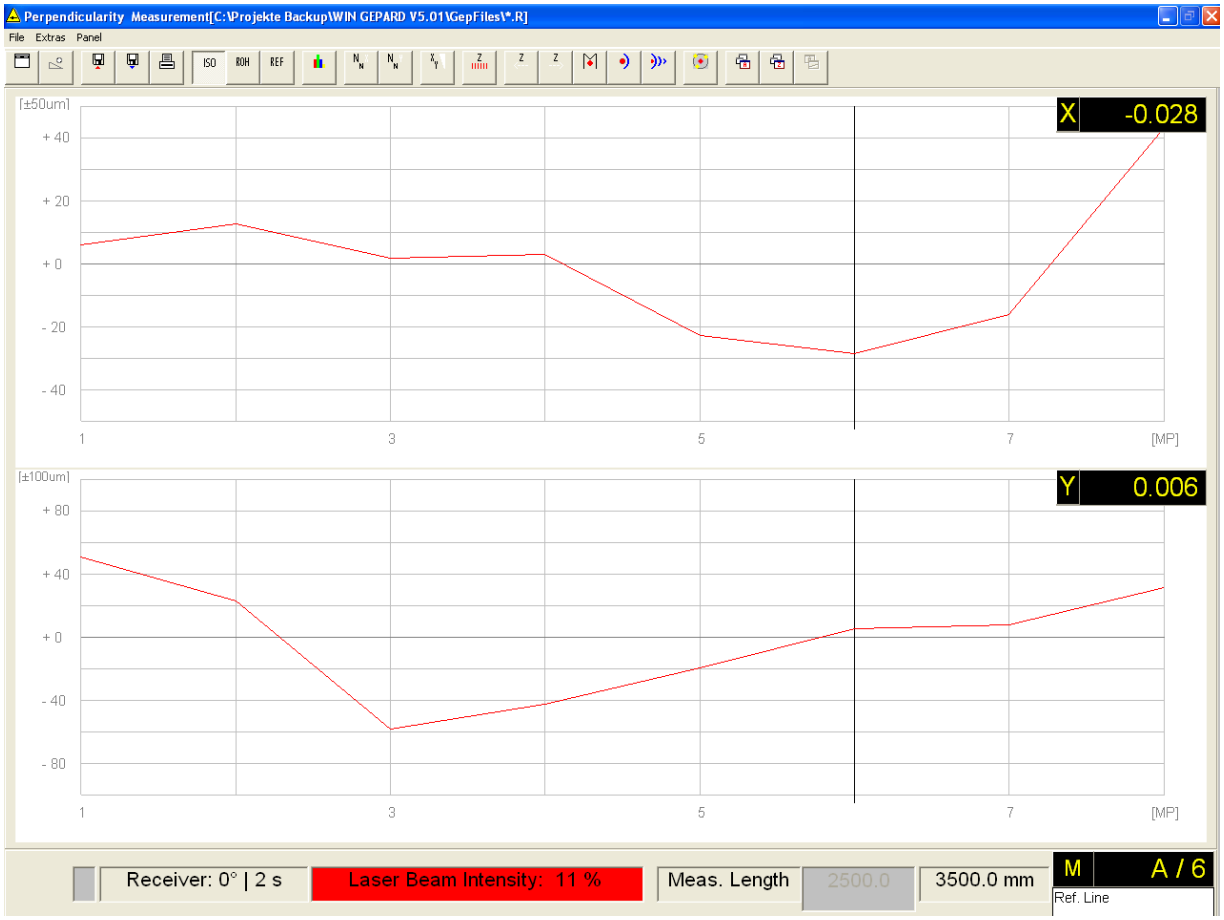
Prism deviation If the optical fault angle of the PentaPrisma is known, it can be entered here (with a prefix!). WIN-GEPARD can then compensate for this fault mathematically.

Option Tab "General"

The remaining part of the set-up is identical to that of the module "straightness". (see above).

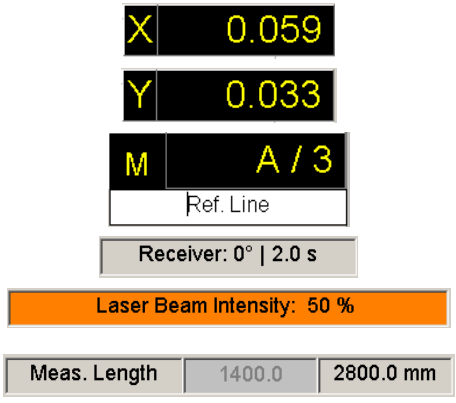
FUNCTIONS AND OPERATING ELEMENTS

Buttons and functions for measuring perpendicularity are explained below:



Displays

The following boxes appear on the right side of the screen and below the graphic display:



X-value of the current measuring point.

Y-value of the current measuring point.

M ***A:*** Reference line
3: current measuring point of the reference line.

Position of the camera, measuring duration being used.

Intensity of laserbeam.

Distance of the current measuring point to the starting point of the measurement and total length.

☞ *The reference line is **always** marked with the letter **A**. Based on this reference, perpendicularity of all further measuring lines (marked with B - Z) is calculated and shown.*

COLLECTION OF MEASURING DATA

Collection, presentation and processing of measuring data are carried out in the same way as for “measurement of straightness”.

The additional buttons necessary for recording perpendicular measuring lines are explained here:

By clicking on this button, the next measuring line (successor) is selected (B, C, D ...).
Which measuring line the graph shows at any one time is indicated at the bottom right in the display window.

Examples:

☞ *Collection of measuring line data is carried out in the same way as for measurement of straightness.*

By clicking on this button, the previous measuring line (predecessor) is selected (Z … D, C, A).
Which measuring line the graph shows at any one time is indicated at the bottom right in the display window.

Examples:

PRESENTATION OF MEASURING DATA (MODE)

A detailed description and the mathematical basis for the different presentation methods are given in the technical documentation of the laser geometrical measuring and alignment system.
The presentation methods are the same as those used when carrying out the measurement of straightness, i.e. ISO, Ref. and Raw, and are explained in detail in the corresponding chapter.

DISPLAY OF STATISTICS

Statistical functions is activated by clicking on the icon (shown at left). WIN-GEPARD determines statistics during collection of the measuring data, and shows these both numerically and graphically in the X/Y diagrams (see example below).

arithmetical mean value of all measuring values.

range of measuring values (max_value - min_value).

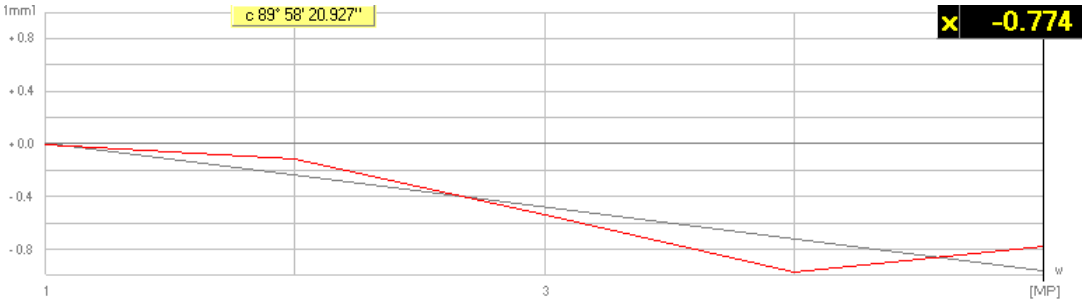
standard deviation, whereby a factor between 1 - 3 can be selected (Gaussian bell-shaped normal distribution).

displays a “range of tolerance band” with nominal and actual tolerance values.

perpendicularity between the reference line and the measured line in degrees (marked in the diagram with the letter c; Basis 90°±Δ∠).

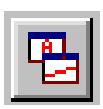
☞ *If instead of perpendicularity straightness of the measured line is shown, the angle **w** represents the deviation of the laser beam from the ISO straight line. This is also true for the display of the angle of the reference line. This angle is then marked in the graph with the letter **a**.*

*Example: Graph of perpendicularity (**w**) :*



The value c 89°58’20.927“ represents the error in angle (in degrees) between the ISO straight line of the reference line (always A) and the ISO straight line of any one of the lines being measured (B - Z). Deviations of the individual measuring points on the measuring line(s) always refer to the ISO line of the reference line.

SWITCHING BETWEEN STRAIGHTNESS / PERPENDICULARITY



With this button, the screen will change from showing “perpendicularity” to show the already familiar “straightness” presentation. Pressing the button again will switch back to “parallelism”. This applies to **all** measuring lines B-Z.

☞ *In this way, both perpendicularity and straightness of an object can be recorded and presented.*

PRINTING MEASURING DATA

As for a measurement of straightness, the report is always printed according to the current screen display, i.e.:

- ISO, Ref., Raw for a presentation of straightness or the corresponding presentation of perpendicularity.

The perpendicularity report is created in the same way as for straightness.

MEASURING OF POSITION / ALIGNMENT

"Position measuring" depicts precisely the laser beam on the ***RAY**TEC GEPARD*$_{bt}$ ™ receiver - shown on the screen as X/Y raw values using the Cartesian system of co-ordinates.
This WIN-GEPARD module is particularly suited to align a system to the middle of the measuring range as accurately as possible.
Use of the timer function enables a (long-term) control of, for example, thermal effects or the effects of vibration on the object being measured.

☞ *General notes:*
Only those commands and possibilities of "measurement of position", which differ greatly from "measurement of straightness" (as shown above), or which a specific to this module, are here explained.
The user is explicitly recommended to study operation of the WIN-GEPARD software using "measurement of straightness".

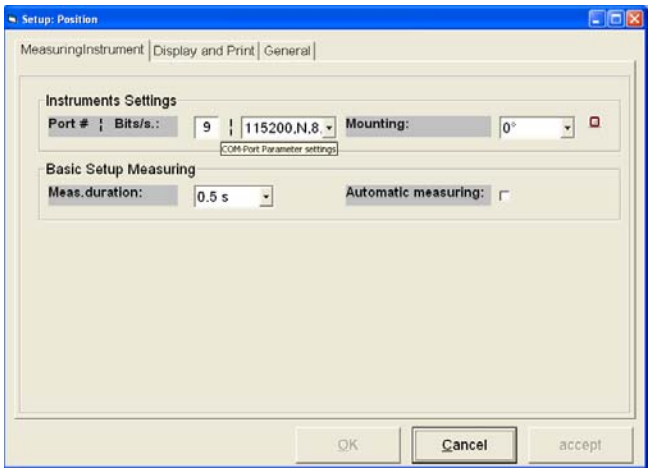
STARTING THE PROGRAM

The program 'measurement of position' is started in the same way as the program "measurement of straightness" (see the relevant section).

BASIC SETTINGS

There are some differences between the basic settings for "measurement of position" and those for "measurement of straightness".

Basic Settings for „ measuring position "



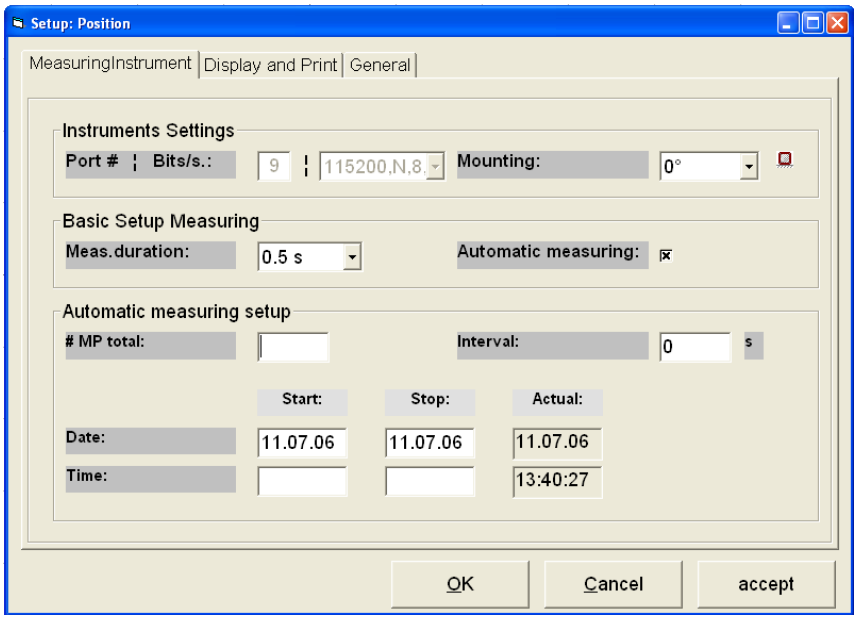
The fields for entering data which differ from those for "measurement of straightness" etc. are explained individually - the effect of entering data or activating single fields can be seen most easily by referring to the printed report (refer also to chapter "'printing measuring data").
Various parameters used in the basic settings in the previously described modules are dropped in this module.

SETTING INFORMATION

The settings for “measuring of position”, contain various pre-settings, which suit specific measuring tasks.
Before proceeding, check the measuring parameter settings which you have made in the basic settings, and take a good look at the additional possibilities.

To do so the select “setting information” in the pull-down menu *Extras*:

Option Tab “MeasuringInstrument”



Explanation of the entry fields:

Autom. Measuring: Only after ticking this box, the window expands and presents extra entry fields for “automatic measuring”.

#MP total: Field to enter (if desired) the number of MP’s which will be gathered with the command “s*ingle measurement”,* and then displayed on the screen.
No entry here activates “continuous measuring”.

☞ *Start and Stop this measuring sequence with the buttons “adjust”, “precision-J” or “quick-J”.*

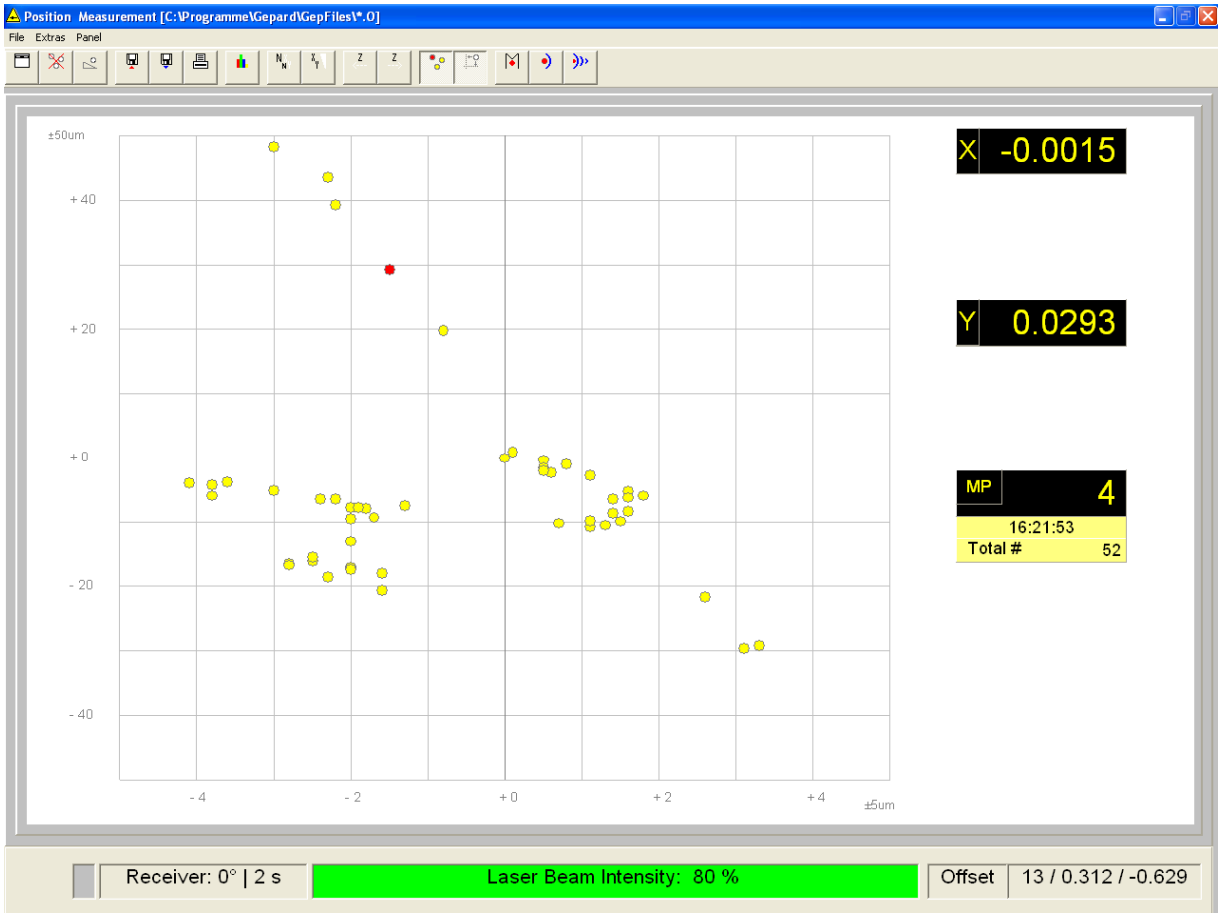
Interval: Field to enter (if desired) the measuring-time-interval in (x) seconds. Every (x) seconds measuring is activated and a MP recorded.
No entry here activates “continuous measuring”.
In combination with # **MP total**, the pre-selected number of measuring points are recorded at the pre-selected interval.

☞ *Start and Stop this measuring sequence with the buttons “adjust”, “precision-J” or “quick-J”.*

Start/Stop Selection of start time and date as well as stop time and date for fully automatic recording of measuring data.

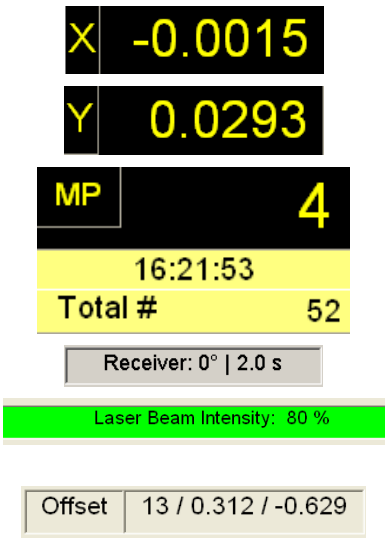
FUNCTIONS AND OPERATING ELEMENTS

The buttons and functions for measuring position/alignment are explained below:



Displays

The following boxes appear on the right side of the screen and below the graphic display:



X-value of the current measuring point

Y-value of the current measuring point

M*p :* measuring point

time of recording
total numbers of measuring points taken

Position of the camera, measuring duration being used

Intensity of laserbeam

Describes the selected offset-point: the X/X values of the first measurement are set to zero, and the corresponding off-set values are displayed.

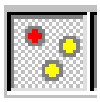
☞ *The activate (current) **MP** is shown red in the graph.*

COLLECTION OF MEASURING DATA

Collection of measuring data is carried out the same way as for “measurement of straightness”. Each MP however is presented as a dot in the quadrant-field.

Additional buttons necessary for specific presentation and recording of “position measurements” are explained here:

Displays all MP’s as dots on the screen.



Shows only the actual (current) MP.

Off-set mode: the current MP is set to zero (X=0; Y=0). All other recorded measuring values are shown in relation to the off-set; i.e. the off-set value is subtracted from the current measuring point (MPx-Ox; Mpy-Oy). So corrected, all consecutive MP’s are shown in the graph.

The off-set is de-activated again and the MP’s are shown as raw values.

All MP are deleted - a new measuring series can be started.

PRINTING MEASURING DATA

As for a measurement of straightness, the report is always printed according to the current screen display, i.e.:

- Presentation of single or all measuring values as a group of dots - with or without off-set calculations.
- Printing of the measuring values in table form with additional measuring times.

ENVIRONMENTAL ANALYSIS 

The module “environmental analysis” is a special form of “position measurement”.
After starting it, continuous measurement over an internally pre-selected time (approx 30s) takes places. By doing so a large number of measuring values is gathered and, by means of a statistical error-calculation, evaluated. The result of this analysis is a statement about the measurement uncertainty for the actual configuration and the current environmental condition. To achieve a valid analysis, ***RAY**TEC GEPARD*$_{bt}$ ™ transmitter and ***RAY**TEC GEPARD*$_{bt}$ ™ receiver should be placed (mounted) on the object to be measured in such a way as the possible measurements later on will take place. Thereby the maximal measuring distance between transmitter and receiver should be selected, as only so all possible external influences on the measurement can be incorporated.

After successful environmental analysis the cross-relation between measuring time and measuring uncertainty can be made clearly visible with the aid of a sliding ruler. With it the virtual measuring time can be altered, at the same time the corresponding measuring uncertainty for X- and Y- direction will be displayed.

Generally: higher precision demands a longer measuring time, this connection is directly visualized with this tool.

As a practical help for “measurement of straightness” (and “parallel-/perpendicular measurement”), the desired parameters (measuring time/accuracy to expect), can be directly – with a simple mouse-click – exported for “adaptiv measuring” to the basic settings

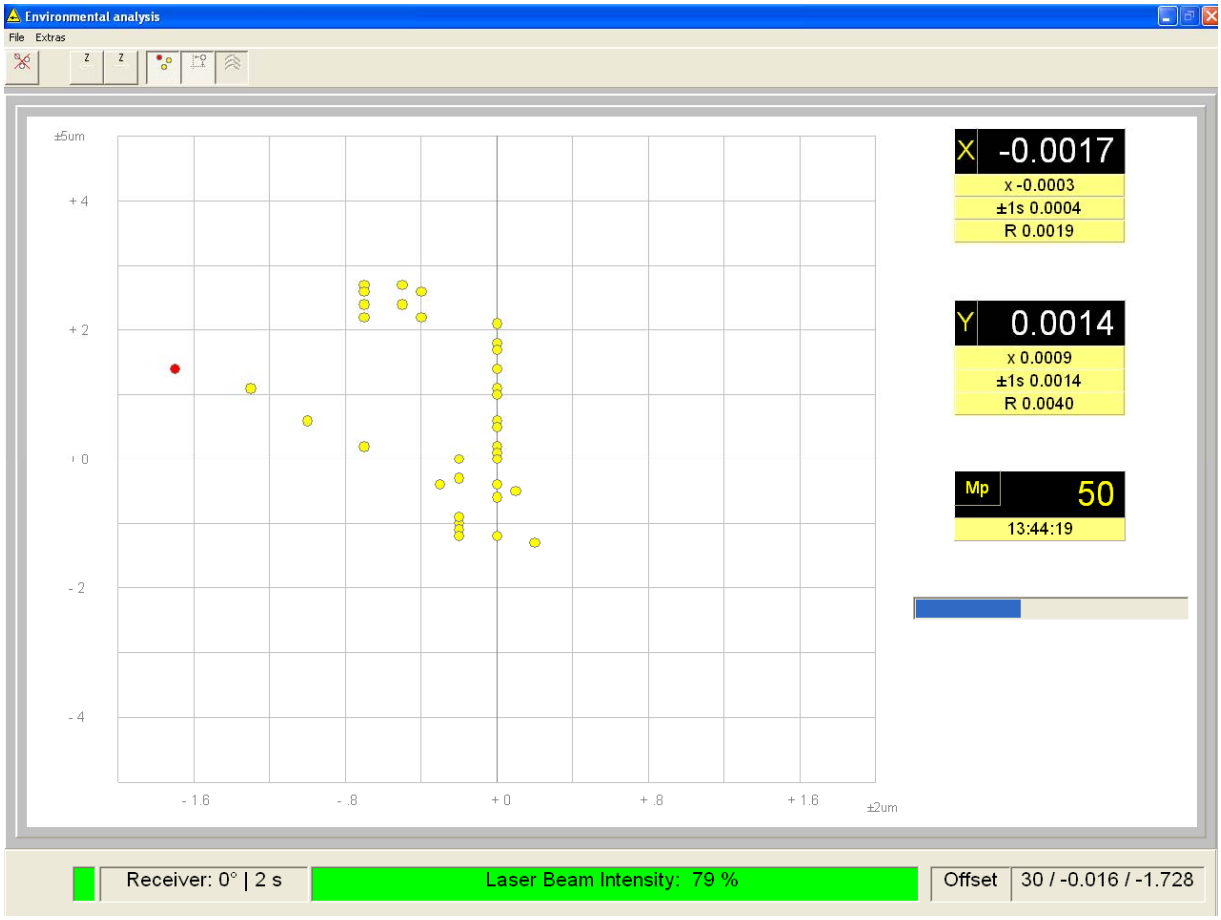
☞ *General note:*
following are only commands and possibilities of “environmental analysis”, which differ greatly from the “straightness / position” modules, or which are specific for this module
The user is explicitly recommended to study operation of the WIN-GEPARD software using “measurement of straightness”.

STARTING THE PROGRAM

The program “environmental analysis” is started in the same way as the program “measurement of straightness” (see the relevant section).

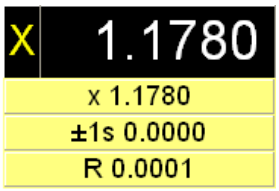
FUNCTIONS AND OPERATING ELEMENTS

The buttons and functions for environmental analysis are explained below:

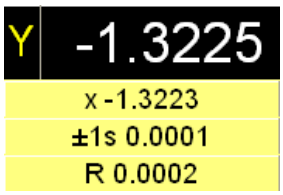


Displays

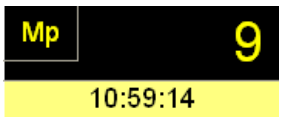
The following boxes appear on the right side of the screen and below the graphic display:



X-value (s) of the current MP – inclusive the calculated statistical values of all the gathered MP (mean-value, standard deviation, span).

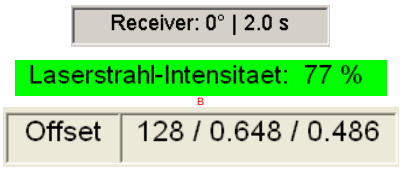


Y-value (s) of the current MP – inclusive the calculated statistical values of all the gathered MP (mean-value, standard deviation, span).



Mp*:* measuring point
time when recorded
total of recorded MP.

Status-bar for the environmental analysis. This will pop-up at the start of the measurement and continuously updated.



Position of receiver / chosen measuring time.

Intensity of laserbeam.

Describes the selected offset-point: the X/X values of the first measurement are set to zero, and the corresponding off-set values are displayed.

☞ *The activate (current) **MP** is shown red in the graph.*

COLLECTION OF MEASURING DATA

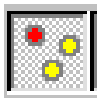
Collection of measuring data is carried out the same way as for “measurement of straightness”. Each MP however is presented as a dot in the quadrant-field.

Additional buttons necessary for specific presentation and recording of “position measurements” are explained here:

Clicking this button activates the gathering of measuring data. On the right hand side of the screen a status bar appears (see picture above), which shows the progress of data-acquisition.
Individual MP’s are shown as dots in the quadrant-field. The pre-set, fixed measuring time (approx. 30sec) can not be altered by the operator. This pre-set time is necessary as WIN-GEPARD needs a minimal time respectively minimum number of MP’s for the calculation of the measuring uncertainty in relation to the allocated time.

Here follows a short description of the other buttons, which are necessary for the specific presentation and evaluation for the “environmental analysis”:

Displays all MP’s as dots on the screen.



Shows only the actual (current) MP.

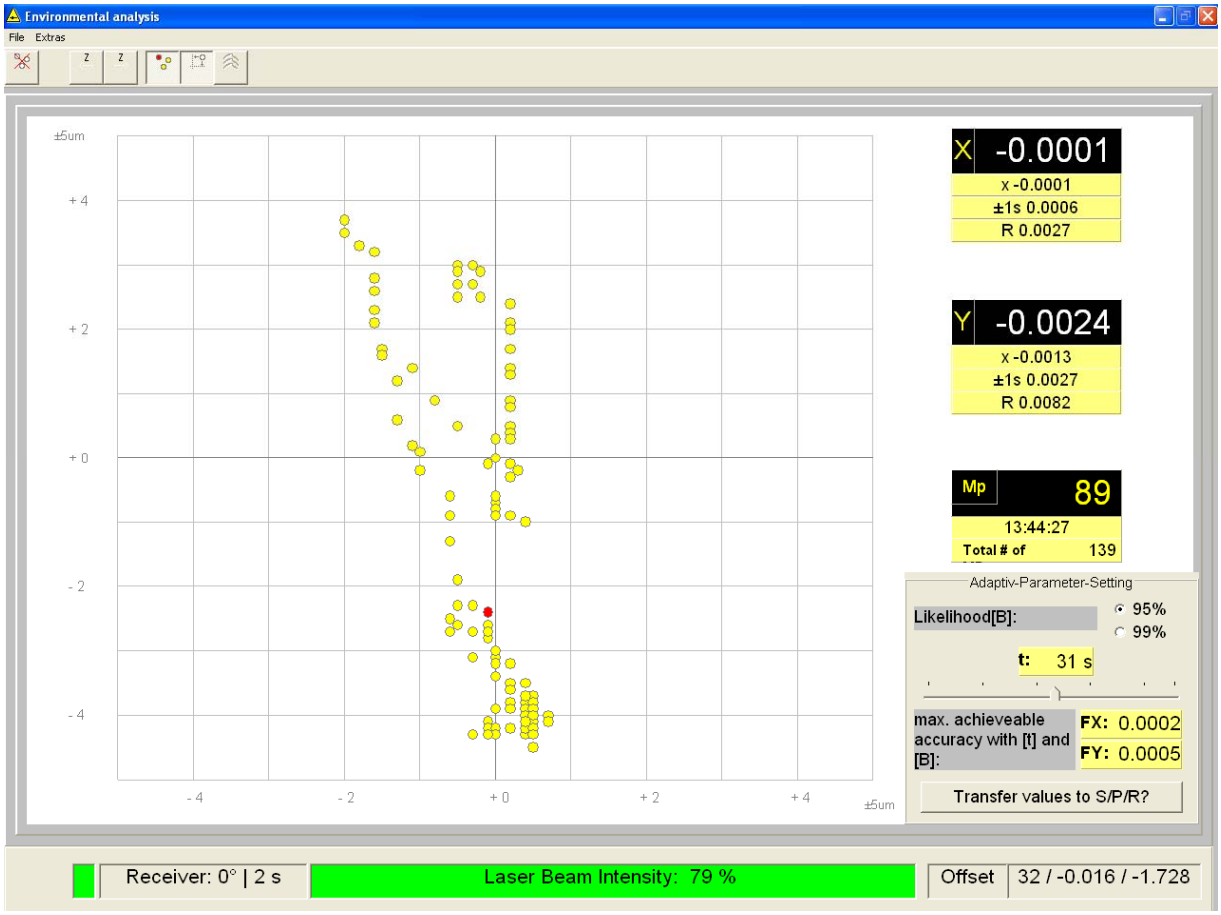
Off-set mode: the current MP is set to zero (X=0; Y=0). All other recorded measuring values are shown in relation to the off-set; i.e. the off-set value is subtracted from the current measuring point (MPx-Ox; Mpy-Oy). So corrected, all consecutive MP’s are shown in the graph.

The off-set is de-activated again and the MP’s are shown as raw values.

After a completed measuring sequence: all MP’s and the calculated adaptiv-measuring-mode-parameters are deleted - a new measuring series can be started.
During data-acquisition: the on-going measuring is stopped and the measurement values already gathered are deleted.

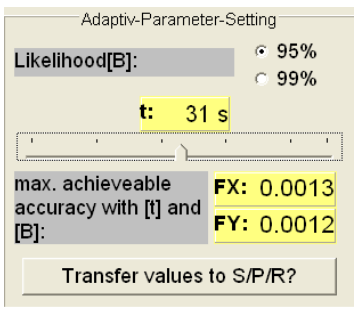
PRESENTATION OF THE MEASURING RESULTS

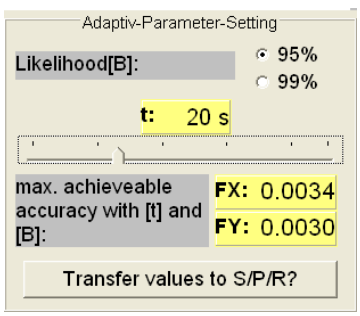
After the completed acquisition of all the individual measuring values (X and Y), the statistical error-calculation takes place automatically. The results are then being displayed in the window “adaptiv-parameter-selection”. in the lower right hand corner of the screen.

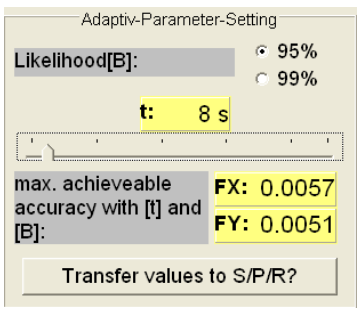


SELECTION OF THE PARAMETERS FOR THE ADAPTIV MEASURING METHOD

After completing the “environmental-analysis” the window “adaptiv-parameter-selection” appears, as shown below. Clicking on the slide-activator (and pulling or scrolling) allows the setting of the desired measuring time respectively the requested measuring accuracy in X-/Y direction – see the sequence of pictures below.







Clicking on the button „*Transfer values to S/P/R?*“ the parameters (Fx, Fy, [B], [t]) are being stored for the later use with the “adaptiv-measuring-mode” and exported to the basic settings for the modules “***S***traightness/***P***arallelism/***P***erpendicularity”.

STATISTICAL EVALUATION OF MEASUREMENT OF STRAIGHTNESS

Statistical evaluation of a range of straightness measurements for the same object.
This ***RAY**TEC GEPARD*$_{bt}$ ™ module allows a comprehensive statistical evaluation of measurement of straightness. At least two straightness measurement values for the same measured object with identically set measuring parameters (length, measuring points, measuring time) are required. The average value, standard deviation, minimum / maximum values and the overall range over all measuring graphs are displayed - in addition, the same information can also be called up at each measuring point (MP statistic). The data can also be printed as a report.

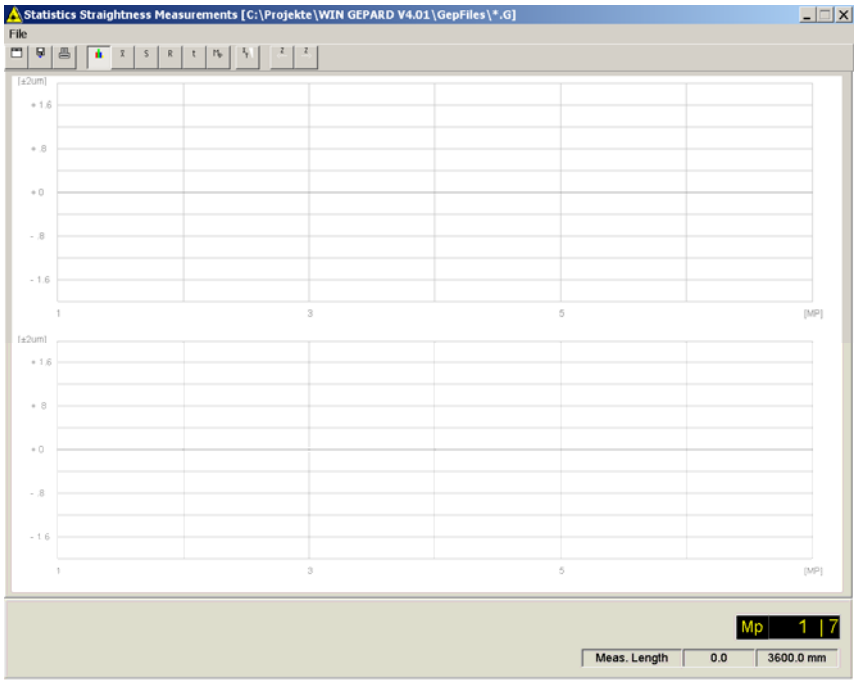
☞ *Note:*
This program serves for additional evaluations. Unlike the programs mentioned above, it does not contain the possibility of measuring objects. For this reason, the data-acquisition for this statistical evaluation must take place beforehand in the module "measurement of straightness".

STARTING THE PROGRAM

The program 'statistical evaluation' is started in a similar way to the program "measurement of straightness" which is explained in the corresponding chapter.

FUNCTIONS AND OPERATION

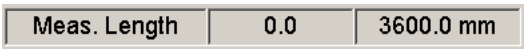
The buttons and functions of the statistical evaluation are explained in the following:



Displays

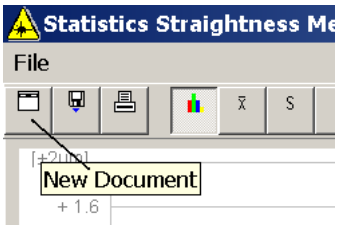
The following are shown below the graphic display:

Current measuring point, number of measuring points

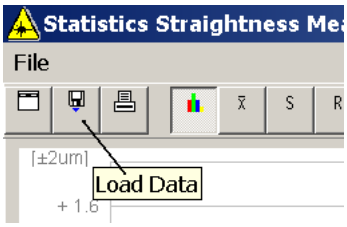


Displays the position of the current MP as well as the total length of the object being measured.

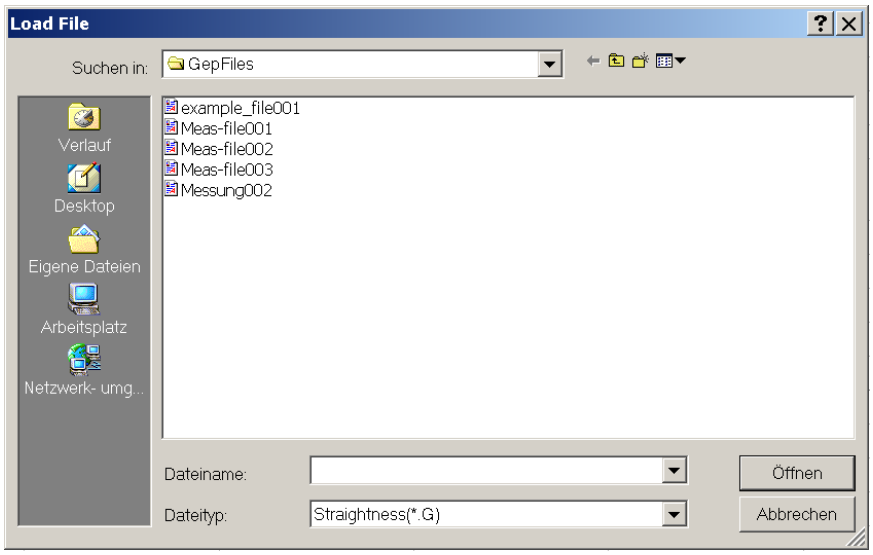
Functions



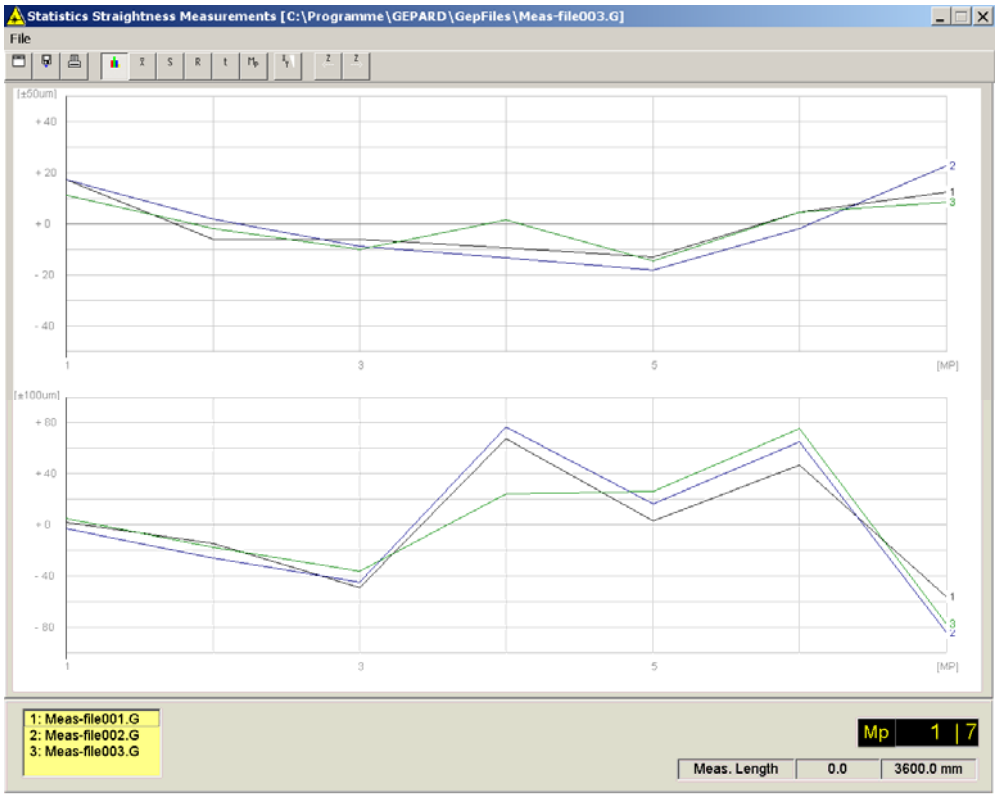
Opens a new document - all existing data and displays will be deleted.



By clicking this button, the window “Load File” is opened.



“Measurements of straightness” files (maximum 20), which were done on the same object, can be opened. The graphs are numbered in the sequence, in which the files were opened, entered and their file names are shown at the bottom-left in the window. This informs the user with which files he is working.



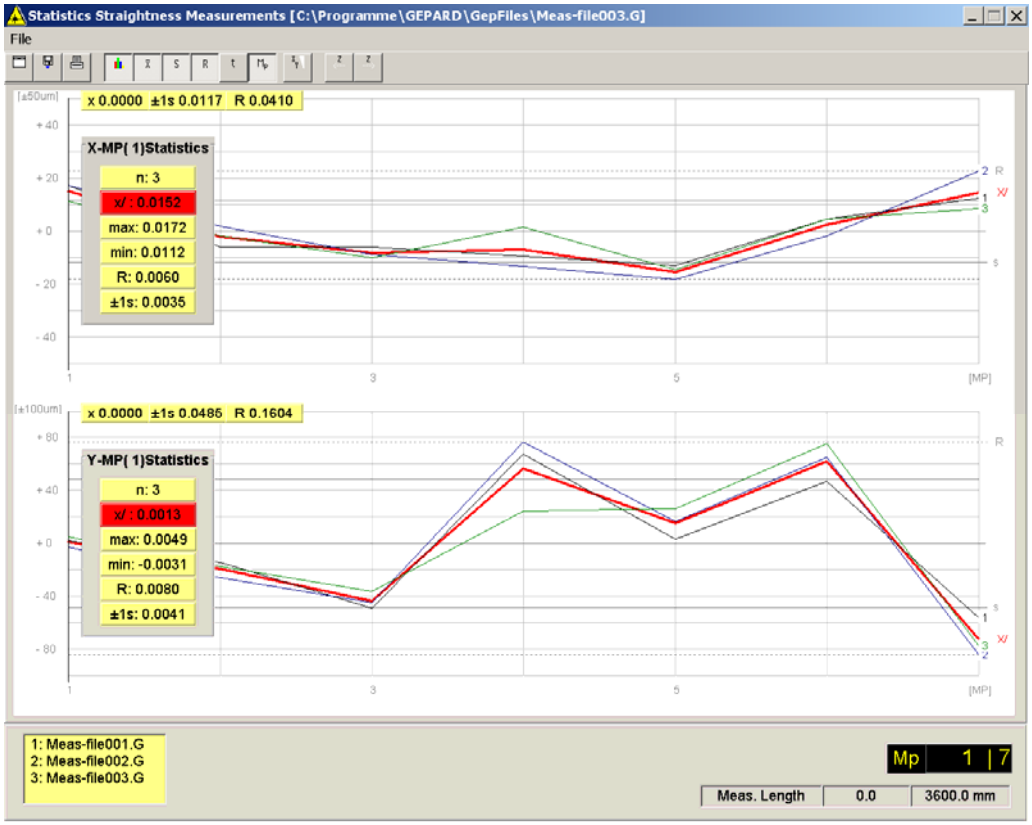
Presentation of statistical values

By clicking on x, s, R, t, the statistical values “average, standard deviation, range and set tolerances” are calculated or imposed on the measured lines for each graph.

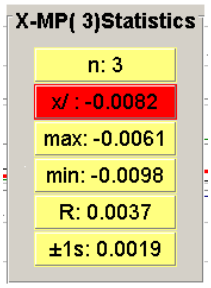
The "MP" function

Clicking on "MP" activates the "single measuring point statistics". The different measurements (here three measuring lines) are depicted for one particular location (measuring point).

The following graph is then displayed:



The bold red line is the average value line through all measuring points, i.e. it is the graph resulting from several measurements and allows the conclusion to be drawn, that with a very high probability (better than 0.98) the measuring accuracy lies below ±2µm for example.



The field "MP" shows the following values for each single measuring point:

- n: number of measuring lines
- x/: average value at the MP(n)
- max: maximum value
- min: minimum value
- R: range or total span
- +/-1s: standard deviation

The Up/Down cursor keys allow navigation through the MP statistics in that either the next higher or next lower measuring point can be selected.

Analogue to a "measurement of straightness", reports are always printed according to the current display on the screen.

ISO representation of all selected graphs including the statistical data.

ERROR MESSAGES

WIN-GEPARD differentiates between notes for the operator - during entry of measuring parameters or on reaching limiting values - and system errors, which may occur within the ***RAY**TEC GEPARD*$_{bt}$ ™ measuring system, or in the processing unit.

ERROR MESSAGES IN CONNECTION WITH THE GEPARD RECEIVER

Error messages which are connected with the transfer of data from the ***RAY**TEC GEPARD*$_{bt}$ ™ receiver and its ready status are shown at the bottom, left hand side of the screen as “ICONS”. These symbols are visible as long as the error exists. The following error messages are possible.

Interruption of data transfer

Data transfer between the ***RAY**TEC GEPARD*$_{bt}$ ™ receiver and the evaluating unit (PC) is interrupted. Reasons: the wireless connection does not work at all or may be interrupted by external high-frequency influences disturbances which influence the exactly defined transmitter/receiver protocol. This symbol is shown if no or wrong character sequences are detected. If this is only visible for a short time, the ***RAY**TEC GEPARD*$_{bt}$ ™ transmitter and the evaluating unit (PC) will have re-established contact and the data transfer is functioning normally again. If a major disturbance occurs and the communication cannot be re-established, the symbol remains permanently visible. If this is the case, it should be determined whether or not the connection to the serial interface and the aerial are connected correctly. If the fault cannot be corrected, it must be assumed that the cause is an external disturbance. In this case, the only solution is to attach the fiber optic waveguide.
Following an interruption in data communication it may take up to one minute for the connection between the two units to be re-established (dependent on WINDOWS / Bluetooth und WIN-GEPARD. More Information s. below “*Restart Bluetooth Datatransmission*”).

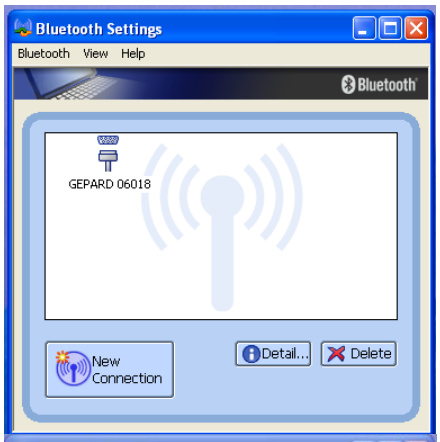
☞ *If this problem occurs during a new installation of WIN-GEPARD, the definition of the COM port in the basic settings must be checked. It is possible that the settings of the port do not correspond to the port actually being used.*

Communication errors

A command, triggered by the ***RAY**TEC GEPARD*$_{bt}$ ™ receiver, cannot be interpreted. It is possible that the COM port address is not correct (see above).

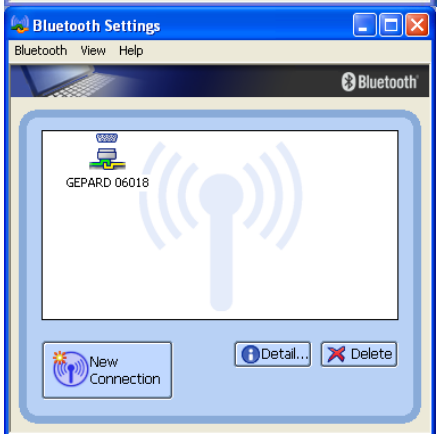
Restart Bluetooth Interface

Ein Restart der BT-Datenübertragung kann notwendig werden, wenn die Verbindung unterbrochen wurde (Störung, zu grosse Distanz, ***RAY****TEC GEPARD*$_{bt}$ ™ Empfänger ausgeschaltet etc.) - s. auch oben unter „ Datenübertragung gestört“



Nach einer Unterbrechung der BT-Datenübertragung kann die BT-Schnittstelle manuell wieder wie folgt aktiviert werden:
Starten Sie den BT-Manager durch Doppelklick auf das Symbol des Bluetooth-Managers in der Statuszeile rechts unten .

Aktivieren Sie jetzt durch Doppelklick die Datenübertragung von neuem.

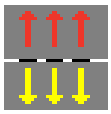


Nach erfolgreicher Aktivierung der Schnittstelle erscheint das entsprechende ICON „BT-Aktiv“ (s. Bild nebenan).

Supply voltage too low

The energy level of the battery of the receiver is getting low. Change the battery for a new, fully charged one.

Intensity of the laser too low / too high



The intensity of the laser is too low (less than 10%) or too high (higher than 97%) to obtain a valid measuring value. Causes can be: laser is covered or displaced and no longer makes contact with the receiver, laser is switched off or the battery of the laser transmitter is empty or you are using a wrong laser source.
Note: in order to obtain a valid measurement a laser intensity of between 10% and 97% is necessary.

GEPARD simulation

If no ***RAY****TEC GEPARD*$_{bt}$ ™ receiver hardware is available it is also possible to simulate a display by generating random measuring data. In this way the WIN-GEPARD software can be completely evaluated for test reasons without the corresponding hardware being necessary. In “simulation mode” the symbol, shown left; is displayed.

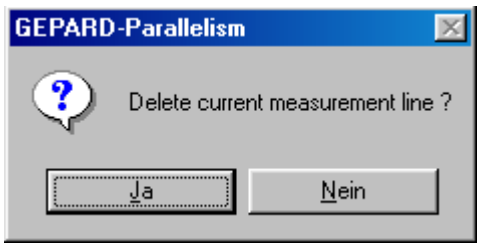
WARNING WHEN THE DEFINED MEASURING RANGE IS EXCEEDED

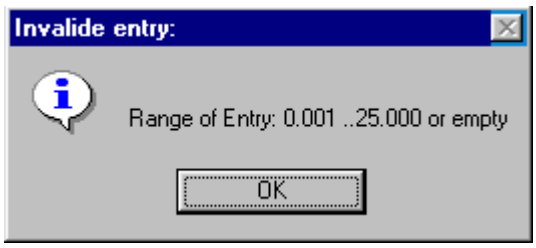
If the numerical display of the X/Y values on the screen change to red, the measuring value (raw value) lies outside the measuring range specified by the manufacturer. This shows the user that he is about to make a measurement with a higher level of measuring uncertainty.

ERROR AND STATUS MESSAGES AT THE PROCESSING UNIT

Error messages in the processing unit (PC) are shown in WINDOWS standard form:

Examples of error/status messages in text form:





Around 20 of these error messages or operator user notes are implemented in WIN-GEPARD. The error messages and notes can be easily understood.
This kind of error message or notes is caused directly by an action of the user, who is then immediately informed of incorrect operation, or steps to undertake, and can react accordingly.

There is no complete list of the error messages as they are self-explanatory.