User guide

SYLVAC REFLEX SCAN+

Sylvac-SCAN F60 / S145

V.4.X

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1. PREAMBLE

1.1 Introduction to the new software

SYLVAC-REFLEX Scan is a powerful software specially designed for operating your SYLVAC-SCAN REFLEX-Click measuring machines. Using this software, you will be able to easily check, summarize and store any data relating to the measurements you have taken.

2. GETTING STARTED

2.1 Login page

At program startup, you have to log in either as a supervisor or as an operator. Default password is “123”. Then press Login button. Later on, you’ll be able to change the password and add some new accounts, for example for operators.

A supervisor is able to create and change measurement programs (Composer mode), whereas an operator is very limited and could only execute them (Replay or Reflex-Click modes). The operator could be provided with more rights via the Settings/Users management/ User rights section.
By default there also a "Diagnostics" user in the list. This account is reserved for Sylvac agents only, in order to do some check tasks.

2.2 Calibration

The machine needs be to calibrated whenever the whole system (machine + software) is started.

This operation ensures reliable measurements while taking into account any environmental changes (e.g. temperature variations).

Please press the calibration button in the toolbar.

If the process could be successfully executed, your screen shows the message «Calibration succeeded» on the top right corner.

3. USER'S INTERFACE

3.1 Work windows

Upon successful calibration, you get the User's interface that will let you inspect your part, edit all setting parameters and access the measurement results. The main commands appear on top of this window. The remaining part (work windows) allows for image viewing and result analysis.

Let us start with the home display button.

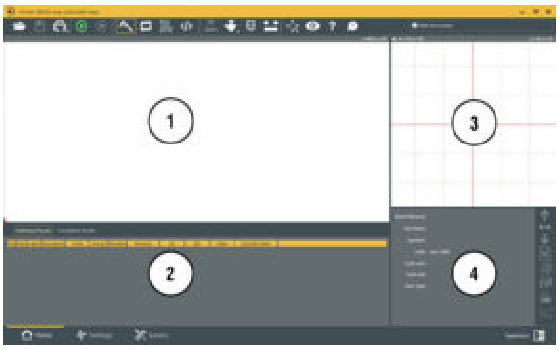
In home display, four work windows are available, i.e.:

1) Main window

2) Edit and results

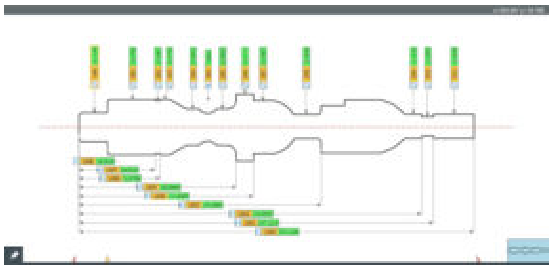
3) Measurement analysis

4) Results management



3.1.1 Main window

This window lets you view the part profile previously scanned. Note that displayed image is approximate. Therefore, only the results shown in the labels or on the other windows should be considered.



At the lower right corner, the whole part is visible, helping you locate its position with high magnification.

At the lower left corner, the pen button allows you to add new features measurements to your part without saving them later (on the fly).

Help or error messages are displayed on the top grey bar. Both X/Y - coordinates can be viewed at the right end of this bar.

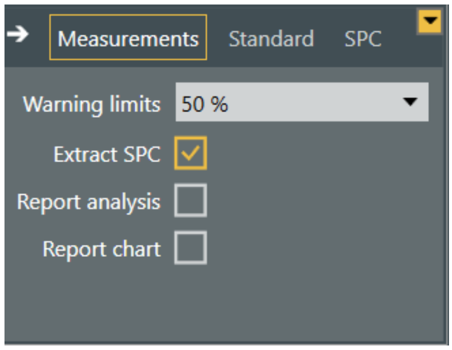
When pressing the mouse right button, you will access a contextual menu ([schematics view menu](#)) to manage the drawing and the measurement program.

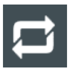
3.1.2 Edit and results window

In Composer mode , this window enables editing parameters such as nominal values or tolerances.

The 2 tabs on the right (Measurements and Standards) allow you to set warning tolerance limits, Extract SPC, or enhance the Report display with the detail of the analysis view or the

statistics.
You can also apply a standard to set up your measurement tolerances.



In Replay  or Reflex-Click Mode , two tabs are available. The first one is called Individual Results and shows the values obtained from the first measurement, whilst the second named Cumulated Results takes all the measurements carried out on a given part into consideration for statistical analysis (e.g. range, sigma, cp, cpk).

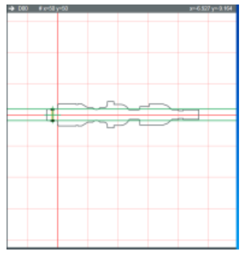
A right mouse click on the title bar at the top of each column lets you choose the parameters you want to visualize.

The Class parameter allows for a colour coded value classification in Good/Out-of-tolerances with green for good, yellow for warning tolerance limits, red for out-of-tolerances or blue for no classification. Any invalid result can thus be easily detected.

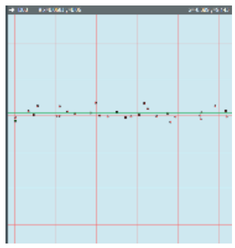
3.1.3 Measurement analysis window

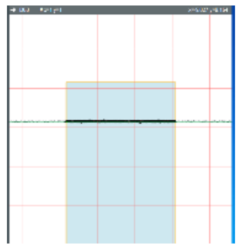
This window displays a graphical analysis of the active measurement. The selected measurement zone in the main window can be analysed, especially all the points which are taken into account for the relevant measurement.

The grid scale and the point-related coordinates are visible on top of this window.



Using the mouse scroll wheel, you may zoom in and out to analyse all details of the part surface.

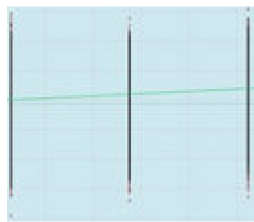


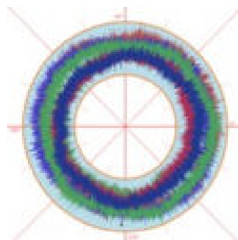


The default zoom is symmetric (homothety of both XY-coordinates is preserved) for static measurements, but asymmetric for dynamic measurements. Clicking with the right mouse button in this window lets you disable the option and get asymmetric zooms that make the results analysis easier. The right mouse button also allows you to select/unselect different options depending on the feature you are using. They are listed as below.

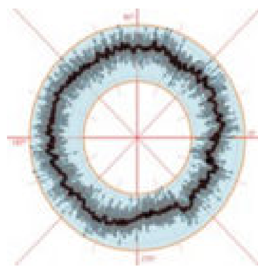
- **View Mode**

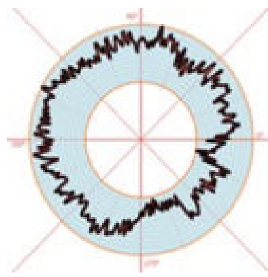
select the right mode to draw the data points: coordinates system and zoom mode:
  - **XY** cartesian coordinates: X is the axis along the part length and Y is the "depth" of the part. This mode is generally relevant for static features
  - **YZ** polar coordinates Y is the "depth" of the part and Z is the rotation angle. This mode is generally relevant for dynamic features, which need the part to be rotated. Both part surfaces points are dispayed (upper and lower surface)
  - **YZ Upper** : Same as YZ, except showing only the points from 1 surface of the part (upper surface)
  - **YZ Lower** : Same as YZ, except showing only the points from 1 surface of the part (lower surface)
  - **Symmetric Zoom:** If enabled, the zoom is symmetric (proportional in all directions). If disabled, the zoom will emphasize the amplitude of the points position differences and follow the exact size of the rectangle that you can draw with the mouse





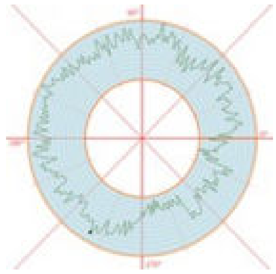
- **Draw**
  - **Draw Points**
    Show/hide the data points which were scanned for that measurement
  - **Draw Lines**
    Show/hide the lines that connect the data points. In case of several hits for dynamic features, the set of points of





each rotational position is displayed with a specific color

- ○ **Draw Unfiltered Points**
  Show/hide the initial raw data points (grey color) in case a filter was configured to compute the measurement
- ○ **Draw tolerance band** (only for "Form deviation/ tolerance band" features)
  Shows the tolerance band around the data points



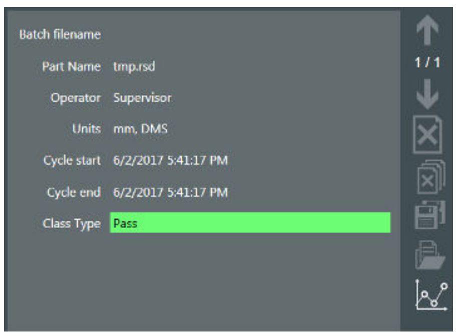
- **Measures**
  - ○ **Set/Reset Cursor 1**
    Display or hide the coordinates of a blue cursor that can be moved on any data point.
  - ○ **Set/Reset Cursor 2**
    When setting the second red cursor, you will display the differences between the 2 cursors positions

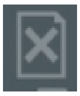
- **Zones**
  Allow to define several small zones instead of a big one, for a non-continuous measurement (e.g. exclude a flat zone when measuring a runout)
  (this menu is enabled when the mouse is over a measurement zone)
  - ○ **Select Zone**
    Allows you to select a zone to be resized or deleted (you can also use the mouse double-click to select the zone)
  - ○ **Split Zone**
    Split the initial zone in 2 sub-zones and allow to resize them in order to include only the relevant data you want
  - ○ **Delete Zone**
    Delete the selected zone

3.1.4 Results management window

This window serves to collect some information such as used unit system, start/end of a measurement cycle within a same part program, result file name. The latter is automatically generated through a mouse click on this button 

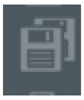
Actual results/ Sum results





Delete active results

Delete all results



Download results previously saved

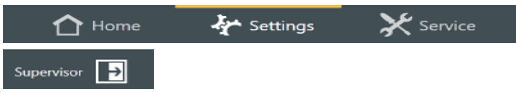
Save results

Manage stats

3.2 Main toolbars

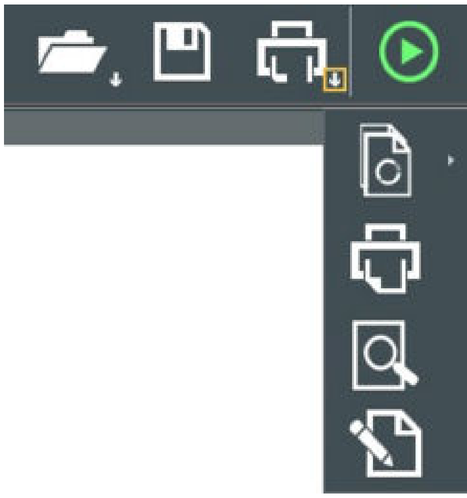
The top part of the main screen is split into 4 groups of control buttons.

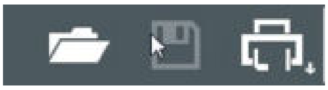
At the bottom of your screen, the status bar shows 4 display buttons : Home (for the main operations), Settings (preferences, units, etc.), Service (logs, maintenance, hardware, etc.) and login (to change user login).



3.2.1 File

The file group includes the buttons listed below.





1. Open (Replay an existing program)
2. Save as (Save a part program)
3. Print inspection resport: The measurement results can be printed out, previewed or edited.

For quick print out of your results, just press in the middle of the print icon () in the upper main toolbar.
When pressing the bottom right small arrow of the print icon, you will have a sub-menu to manage your inspection report. see Inspection report printing

3.2.2 Operation modes

The Start button on the left which is a dynamic command is similar to the white round button located on the front face of the machine. It lets a scan process be started up or any measurement be taken.

The Stop button that comes next is left inactive unless a measurement is being taken. This button is used to stop the current part program.

The three following buttons allow you to change the **operation mode**. You need to press the 'Start button' to execute a scan in the selected mode.

The first button  of this group enables the **REFLEX-Click mode** in order to perform the following operations :

- Execute a static measurement of the main part features, such as lengths and diameters (by default, without preprogramming). You can also measure angles and radii (see User's interface/Menus/Settings/Reflex-Click).

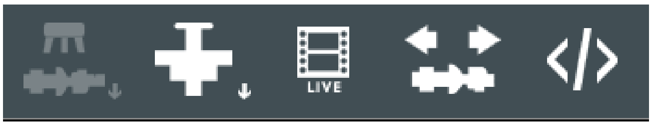
- Start an existing part program through the automatic part recognition (needs 'Guess Program' parameter to be active in Settings/Reflex-Click).

The second button  activates the Replay mode, letting an existing programme be executed.

The third button  enables Composer that will be run to create or edit a part program (available for a Supervisor user only).

3.2.3 Moving axes

The «Move axes» menu includes five buttons named Scan, Calibration, live view and reposition.



The **first button**, which can only be used in Composer mode, allows for scanning the contour of a part. Once completed, you will then be able to start creating your part program by drag/dropping features from the toolbar to the contour of your part.

You can represent different sides or aspects of the part on the same schematics view, e.g. showing the part when rotation axis is at 0° but also when it is at 90°, to allow measuring a hole or a specific form only visible on this side. You can also mix machine scanned contours and DXF imported contours. Those contours are called **layers**.

The **second button** is used when any change has occurred in the ambient conditions (temperature,...). When pressed, the machine compensates it with a calibration.

The **third button** activates the Live View, to allow moving all the machine axes and having a live view of the line camera pixels.

The **fourth button** helps repositioning a part program whenever the initial zone position has changed from the original scan (e.g. in case one changes the fixture of the part).

Finally, the **fifth button** loads the features script editor, to write your own features ("PRO" option package).

3.2.4 Display screen

The group of buttons shown opposite enables you to monitor the screen displaying the measured part in the main window besides the analysis of the measured values.

For centring the image, click on this button 

Activating this button  show/hides the construction features available from your part programs to appear or disappear (axes, edges, and points).

 tells you the current software version as well as your

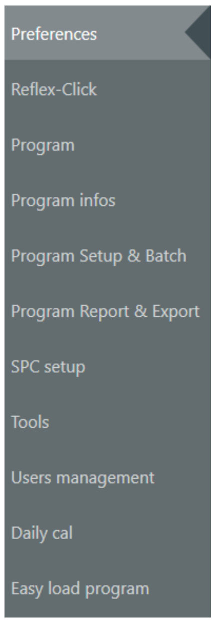
license status.
By pressing on the small arrow at the bottom of the icon, you'll display the on-line help (PDF file)
Three ways to activate your license are available in the lower part of the window :
Update Dongle used to upgrade ReflexScan+ options (e.g. CAD or PRO).
Active Online The user asks for an Activation Key that he will received by mail. This is more dedicated to ReflexScan+ offline license and demo license.
Active Offline The user sends his Registration ID to Sylvac. After a check, the user will receive a License Key by mail. This is more dedicated to ReflexScan+ offline licence and demo license.

The Instruction manual is available in the sub menu (little arrow).

 is the online help. You can drag/drop it on the user interface where you need help (for example on the icons of the features list in Composer mode).

3.2.5 Settings

You can access this menu by pressing the Settings display button in the bottom status bar:



You will then have 11 tabs available :

The 5 followings tabs are specific settings to the current program in use :

- Program
- Program Infos
- Program Setup & Batch
- Program Report & Export
- SPC setup

1. Preferences

Access this sub-menu to change **Settings**, **Default folders** or **Schematic view**.

Settings

In the Settings section, you can change the current language as well as the "warning" options. You can also choose to Export your settings or Import existing ones.

- **Save warning** : if enabled, a "Save your work" message will be displayed and blink in the tittle bar every 15 minutes by default (you can change this parameter with the 'Minutes before warning' field).
- **Export Settings** : allows to save all the ReflexScan+ settings in the selected directory. Can be useful in case you want to duplicate all the settings on another computer/machine.
- **Import Settings** : Import all the ReflexScan+ settings previously saved by 'Export Settings'.

Default folders

Use this tab to access those directories where you want to store your **Part** programs along with the related database available from the international **Standards** being applicable to the measured part features, **Scripts** for advanced features, output files for statistical processing of the measurement results (**SPC**) and output files for **diagnostics** and debugging (when the 'Start with diagnostics' is enabled). The **Master.Dim** folder stands for the list of masters needed for certification (for Service only).
You can also change the Report **Templates** folder for Inspection reports and the **Users** list and rights folder for login.

Schematic view

- **Do not display results on labels** : if enabled, the labels will display only the name of the features, and not the result (shorter labels).
- **Show statistics as a tooltip** : if enabled, allow to see the statistics of previous measurements of a feature when the mouse remains on a feature displayed on the Main window.
- **Frames on labels** : if enabled, boxes surround the different features in the Main window.
- **Enable machine status leds** : if enabled, little lights (green, red or blue) shows on the upper part of the machine to inform you about the progress of the process. Green means all calculated measurements are inside tolerances, red means at least one

measurement is out of tolerances and blue means at least one measurement didn't work.

- **Expert mode** : if enabled, advanced options will be available, especially the 'Start with diagnostics' option (located below the 'Start button'(little arrow)) that is used to send diagnostic data to a Sylvac agent in order to be able to reproduce the program behaviour offline.

- **Tooltip on lines** : if enabled, name of the measurements will be shown when remaining on the measurement line. Useful when there is a lot of measurement in a little zone.

- **Auto Reset Rotation Datum** : if enabled, the "0°" will be reset to a new relative angular position value each time the program is launched. If not enabled, the absolute "0°" will remain the reference angular position and the rotary headstock will come back to its "0°" position before each program execution.

- **Automatic end of part detection** : if enabled, an algorithm will detect the end of the part automatically in order to stop the scanning process. This is useful in case the part is held only by one extremity.

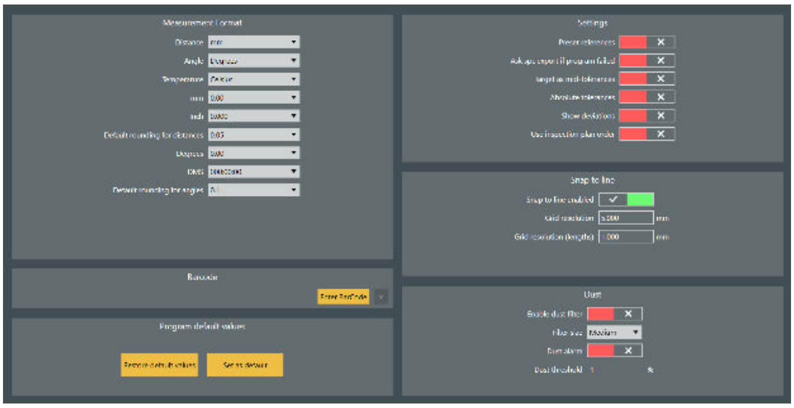
- **Unselect feature after creation** : if enabled, each time a measurement is created, the feature type is unselected automatically. Otherwise, the feature type will remain active until it is explicitly changed to another one or unselected manually.

2. Reflex-Click

Use this tab for the selection of any geometric part feature to be measured in the active REFLEX-Click mode (lengths and diameters are the only defaulted part features). If you need to measure other features automatically, just enable the second column check boxes.
In addition, the Reflex-Click tab enables you to set the option for automatic part recognition (With Guess Program button) in your existing programs when operating in REFLEX-Click mode (see Operations /REFLEX-Click mode).
Modify factory settings button : Allows to change the detection thresholds to detect the selected features. Should be modified by an advanced user only.
Reset default factory settings button : Reset initial parameters.
Report editor template : Specific template used to report printing when in REFLEX-click mode (Guess feature process). In particular, this template doesn't show any classification, nominal, LSL and USL columns.

3. Program

Access this sub-menu to change the different measurement settings.



Measurement Format

The unit system (mm/inch for distances or DMS/Degree for angles) along with the format of the measured value (number of displayed digits) can be changed accordingly under this tab. You can also change the default rounding for nominal distances and angles (used just after creating a feature).

Barcode

Enable Barcode for the current program from a barcode reader connected to the PC. Later this Barcode will be detected to open the related program in ReflexScan.

Program default values

- **Set as default** : Backup all the current program settings (Program, Program infos, Program Setup & Batch, Program Report & Export, SPC setup) and set them as the new default values that will be used when creating a new program.
- **Restore default values** : Restore the values that were set as default for the current program in use.

Settings

- **Preset references** : This setting allows you to automatically set edge/point references to define precisely the zones of the features independent from the position of the part on its fixture. When enabled, the different measurements will be referenced to the nearest edge/point and the nearest centreline as much as possible.
  When creating a new feature, the system will try to find the nearest edge/point, but if possible, one that is already referencing a centreline.

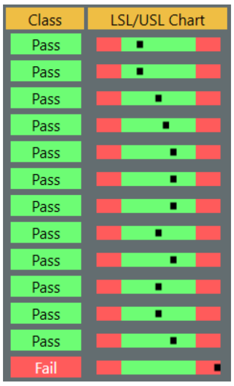
- **Ask spc export if program failed** : If enabled, when an SPC export is defined (In Settings/Program Report & Export/Export SPC data), the user will be asked at the end of a program if he wants to export the data in case the program has failed.

- **Target as mid-tolerances** : If enabled, the centre of the LSL/USL Chart is the mid-value between LSL and USL rather than the Nominal value. This could be useful in case the LSL and USL are not symmetrical or when the Nominal value is not used for classification (e.g. some threads standards have LSL and USL outside of the Nominal value).

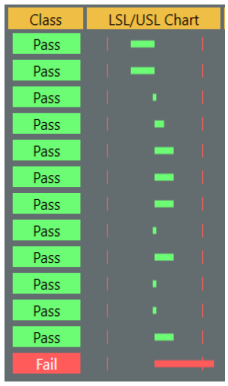
- **Absolute tolerances** : If enabled, the USL and LSL tolerances will display absolute values instead of relative ones to the nominal.

- **Show deviations** : if enabled, all the ideal values of the features are represented at the centre of the LSL/USL Charts, and the red or green bars show the deviation relative to those ideal values.

Not enabled



Enabled



- **Use inspection plan order** : in the inspection plan, you can reorder the features displays. If this setting is enabled, then this order will be used for the measurements view, the print report and the SPC export data (instead of the program initial order). This setting is the same as in the Inspection plan user interface.

Snap to line

Management of the labels' position around the part contour in the schematics view.

- **Snap to line enabled** : Set an invisible grid in the schematics view drawing, to snap (attract) the labels to predetermined position when moving them with the mouse.
- **Grid resolution** : General grid resolution for most labels (all but lengths). It consists of vertical and horizontal equispaced lines.
- **Grid resolution (lengths)** : Specific vertical grid resolution for lengths. This parameter should be lower than the general 'Grid resolution' in order to keep the length labels close to the part contour.

Dust

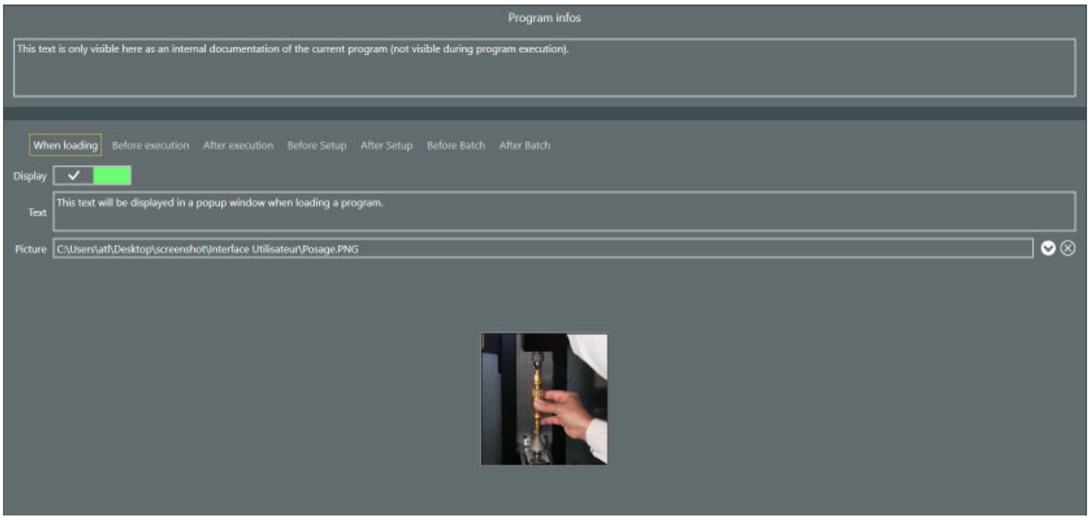
- **Enable dust filter** : Get rid of the points of the part contour that are detected as dust.
- **Filter size** : Selected strength of the filter (Low, Medium, High).
- **Dust alarm** : Add an alarm to pop up when executing a program if the quantity of dust on the work piece is more than a defined threshold. (percentage)
- **Dust threshold** : Percentage of the points that are considered as dust by the algorithm (related to the total scanned points of the part).

4. Program infos

This menu allows you to display messages at different moments of the program life and optionally, write some internal documentation for the current program ('Program infos' box).

- **When loading** : The message and/or picture will pop up when loading a program.

- **Before execution** : The message and/or picture will pop up before the execution of a program.
- **After execution** : The message and/or picture will pop up after the execution of a program.
- **Before Setup** : The message and/or picture will pop up before the execution of a program in "Setup mode".
- **After Setup** : The message and/or picture will pop up after the execution of a program in "Setup mode".
- **Before Batch** : The message and/or picture will pop up before the execution of a program in "Batch mode".
- **After Batch** : The message and/or picture will pop up after the execution of a program in "Batch mode".

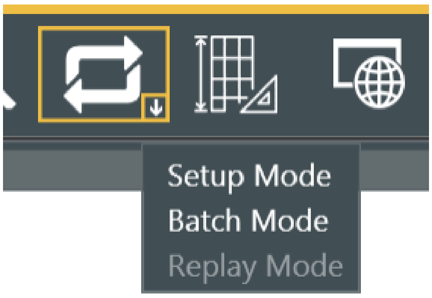


5. Program Setup & Batch

Setup Mode It is a specific way for executing a program, by using several reference parts to be measured sequentially in order to set up the target nominal values for the next batches of parts.
If enabled, a new menu below the small arrow of the Replay button will be available (Setup Mode). Press it to enter this mode, and then, press the Start button to actually start Setup Measurements. It will display a popup with Setup Infos about the number of runs. After pressing OK, the program will measure normally, and at the end of the number of (non-failed) runs, will display a popup to apply the new nominals.
e.g. measure 3 reference parts in 'Setup Mode'. At the end, the system will average the measurement values and use them as the nominal target values for the next parts measurements using the 'Batch Mode' at the Production line level.

Batch Mode Used in Production line to measure parts batches, i.e. by defining the number of parts in each batch, sending instruction messages before or after Batch execution and entering specific data for SPC export.
If enabled, a new menu below the small arrow of the Replay button will be available (Batch Mode). Press it to enter this mode, and then, press the Start button to actually start Batch Measurements. It will display a popup with Batch Infos about the number of runs. After pressing OK, the program will measure normally.
If the 'Allow to switch to standard Measurement Mode' box is disabled, then the operator will not be able to come back to usual Replay Mode. He will only be able to measure parts in Batch Mode.

Use case example when enabling Setup and/or Batch modes, you will end up with a sub-menu below the Replay button :

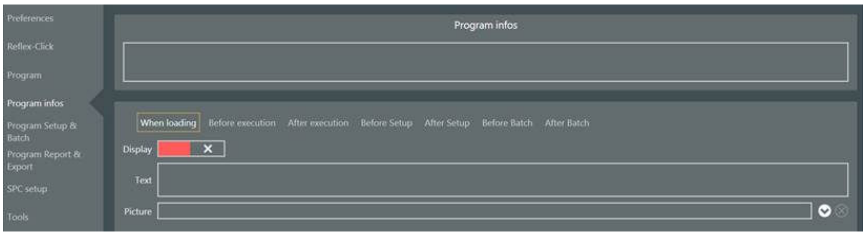


Just select the right mode, and the next program execution () will be done in this mode, following the settings (run numbers, allow to change them, allow to suppress, warn if it fails, …) :

Setup mode : 

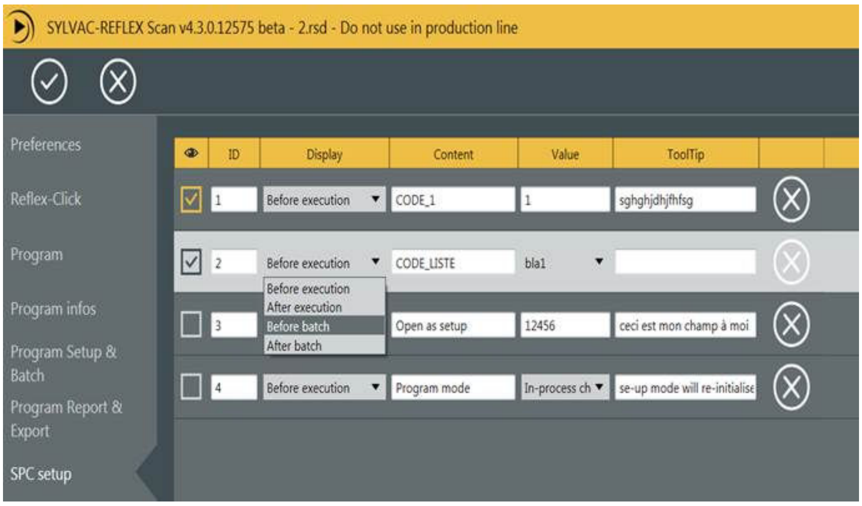
Batch mode : 

Program Infos tab: Before/After Setup/Batch :



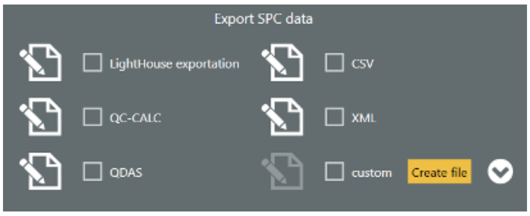
Program Report & Export: Print after each batch :

SPC Setup: Before/After batch trace field :



6. Program Report & Export

Access this sub-menu to change the **report Settings**, and **SPC export** format.



Report Use this tab to choose your different report and print settings.

- **Print language** : Allows you to change the printed language.
- **Report editor template** : selected template that you can customize via the report editor
- **Print after each measurement** : Choose if you want a "Print after each measurement" or not. If yes, in the toolbar menu, the 4 «Page» icons allow you to edit 4 different templates, depending on which results you want to display: «Individual results» (1 part measurements), «Cumulative results» (statistics for several parts), «Batch results» (details for several parts) and «Part results» (overview drawing of the part displayed in the page body).
- **Print after each batch** : Same as "Print after each measurement" but with a "Print after each batch".
- **PDF Filename** : in case you selected a PDF printer in the Print Setup, you can choose
  - "Part_DateTime" : a specific PDF file will be generated after a part measurement (filename = name of your "Part" followed by Date and Time and ".PDF" extension)
  - "Part" : the same PDF file will be overwritten after a part measurement (filename = name of your "Part" followed by ".PDF" extension)

Export SPC data Use this tab to choose the output format of the measurement results for SPC data processing, especially :

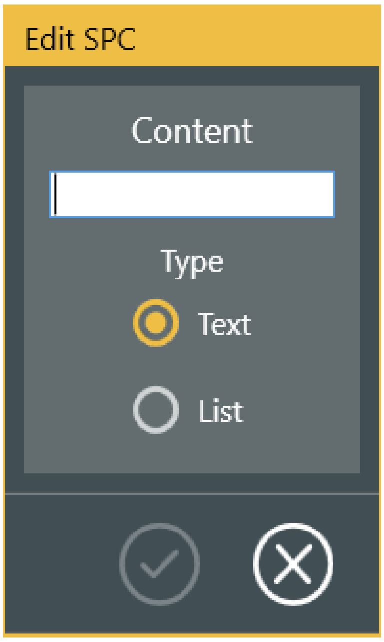
- LightHouse exportation
- QC-CALC
- QDAS
- CSV
- XML
- Custom

For a further information with regard to this, see section 7 – Exporting results.

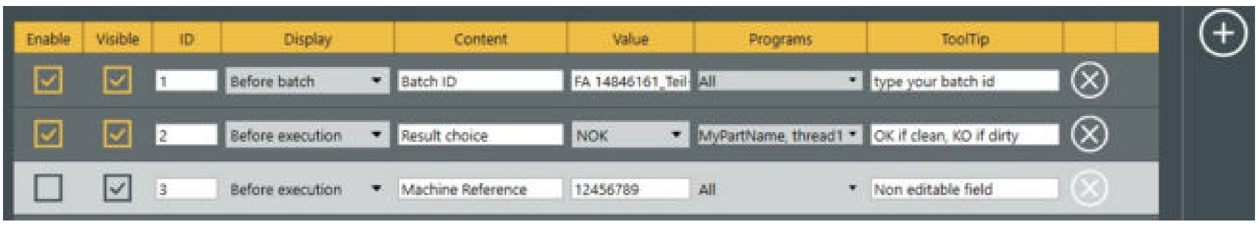
7. SPC Setup

Use this tab to display SPC (Statistical Process Control) traceability fields for the operator to fill before or after every part program execution or Batch of parts execution. The text of those fields will then be available to print in the inspection report via the report editor (see Inspection report/Report editor chapter), or to export via the Program Report & Export/ Export SPC data menu.

First, use the  button to add each traceability field. Then, choose either a text or a list box and enter its "Content" (label that will be displayed near the field).

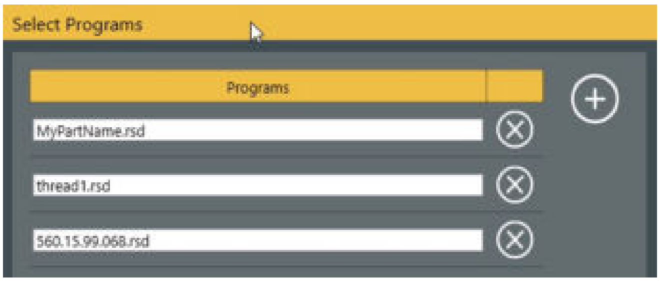


Do it for each field, then if needed fill in ID, Display, Value and ToolTip boxes. Make sure that your items are actually enabled and visible with the 2 check boxes in the left.

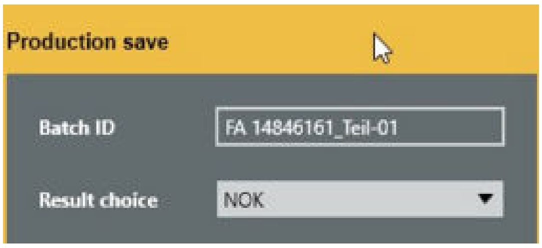


"**Enable**" : if unchecked, the related field will be hidden at program execution, and unavailable for exporting.
"**Visible**" : if unchecked, the related field will be hidden at program execution, but still available for exporting. It could be useful when you want to export the same text ("value") at each execution, and don't need the operator to change it (e. g. MachineID).

"**ID**" : useful for QDAS export only. This ID will be used as the Kfield number (e.g. K0051 if ID=51)
"**Display**" : select the situation when the traceability field will be displayed: before/after the measurement program execution, before/after a batch of programs execution (see Program Setup & Batch)
"**Content**" : label of the field
"**Value**" : default value of the field, that the operator will be able to overwrite if needed
"**Tooltip**" : help text that will show up to the operator when the mouse cursor is standing over the field text for more than 1 second
"**Programs**" : list of programs where the field will be used. Select either "All" if the field needs to be available in all your programs, or select a list of programs by pressing on the "edit" sub-menu, then on the "+" sign to select and add the programs one by one.

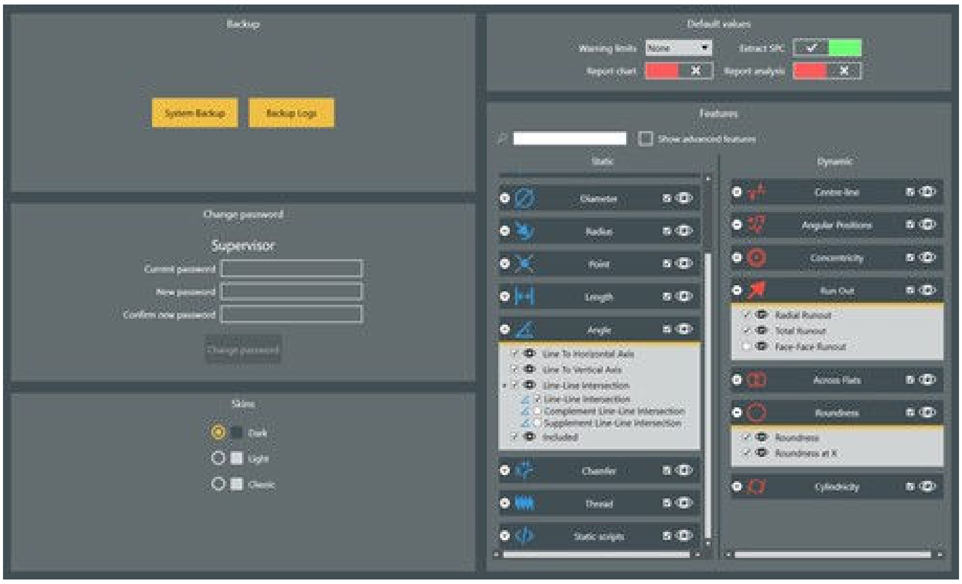


Once done, you will need to open an existing program and choose the "Replay" mode  before starting the program with the "Start button" . The fields will appear in their "Display" order in a popup where you can enter a text (for "text boxes") or select an item in a list (for "list boxes").



8. Tools

Access this sub-menu to change Tools settings.



Backup

System Backup: Copy all the machine settings and programs to a zip file, for your own archive. Caution: Depending on the number of your programs, the archive could be very big.
Backup Logs: Copy the history logs and the machine configuration to a zip file. Could be useful to send to Sylvac for analysing a problem.

Change password

Change the default password "123" for the supervisor user.

Skins

Switch between 3 user interfaces look (mainly background and foreground colours) : Dark, Light or Classic.

Default value

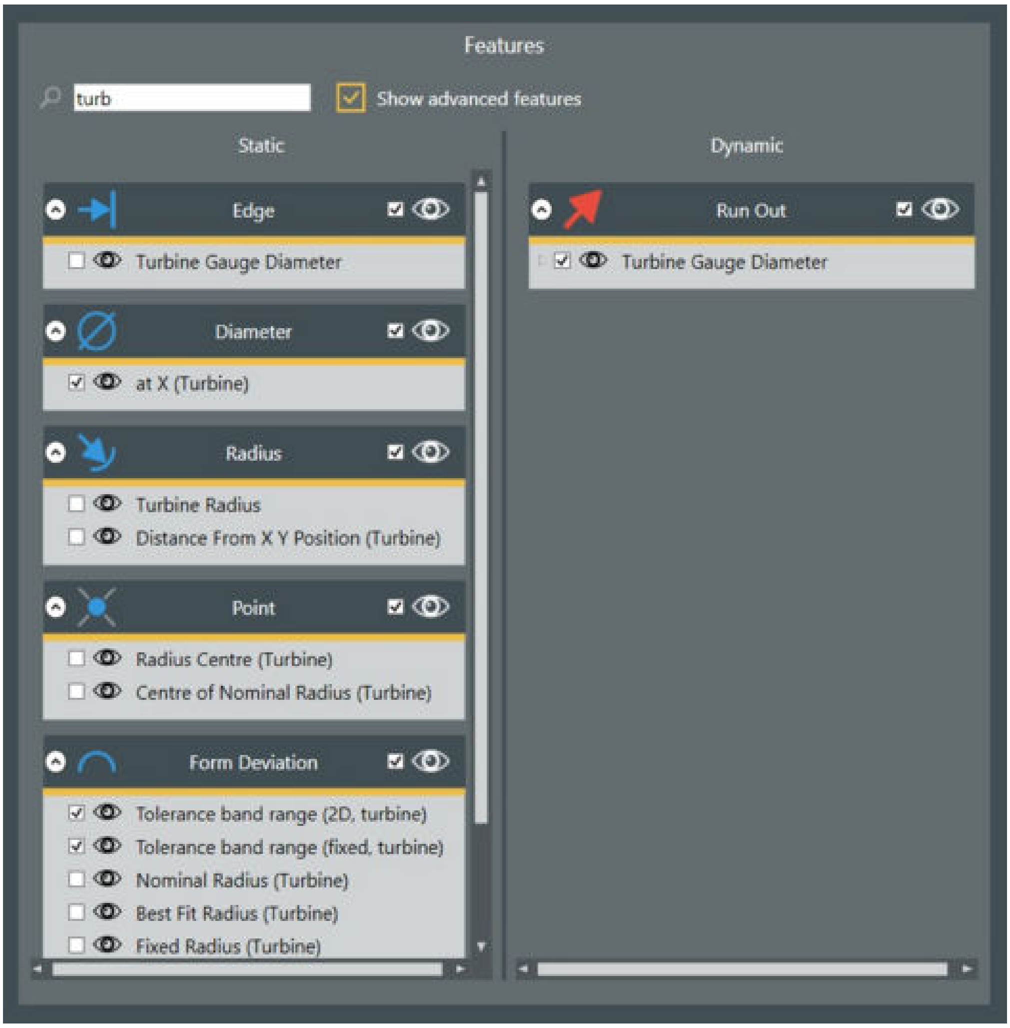
Set some default values. The related parameters will be enabled or disabled by default the next time a new program is created.

Features

Use this tab to display/hide features ( ) or groups of features ( ) that will be visible when creating a program in Composer mode. Some features contain sub-features (the ones with the little) that can also be completely or partially hidden. When adding a new measurement from a feature including sub-features, all the selected sub-features will be created automatically.

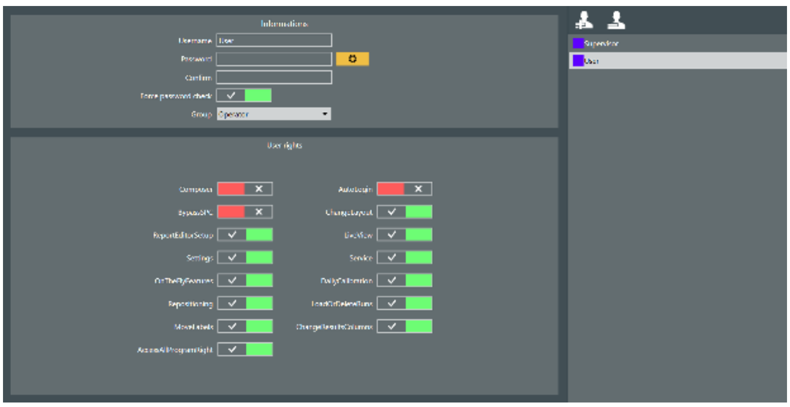
Since there are a lot of features available, only the most commonly used ones are displayed by default. Just enable the "**Show advanced features**" check box if you need to display them all (e.g. turbines, specific threads, external measurements, formula...).

When looking for features, you can use the **search toolbar ( )** : it will display only the related features, containing the search text. e.g. by typing "turb", you will be displayed the turbine features only (in that case, "Show advanced features" must be enabled too)



9. Users management

Use this tab to add or modify the users accounts, including the passwords. You can also define their user rights.



Informations Use this tab to change the different users information, including the Password and the Group type.

User rights Use this tab to define the User rights.

- **Composer** : Access to Composer mode to edit and modify the programs (Composer mode button in the Home page toolbar).

- **BypassSPC** : Show a message window at a program loading when an SPC export is configured ("an SPC file is defined. do you want to extract SPC ?" YES/NO). This right allows the operator to cancel the export by responding "NO".

- **ReportEditorSetup** : Access to report editor to modify the template for the inspection report.

- **Settings** : Access to all the Settings Menus (bottom toolbar).

- **OnTheFlyFeatures** : Access to "Pen" button in the Schematics view (Main window). It allows to add temporary measurement to the program in Replay mode. Those measurements will be measured in the next run, but there will not be part of an optional export, and will be erased when exiting the program.

- **Repositioning** : Access to "Repositioning" button in the Home page toolbar. It allows to move the new scan contour to realign to the original program contour (e.g. when the part has not exactly the same size or when changing the fixtures).

- **MoveLabel** : Allows to change the labels positions of the program.

- **AccessAllProgramRight** : Access to the windows explorer window to open any program on the disc. If disabled, the "Open" button (in the Home page toolbar) will let open only a couple of programs that were configured in the Settings/Easy load program menu.

- **AutoLogin** : Open ReflexScan application without a login window and password.

- **ChangeLayout** : Access to 'Scan' button sub menus (in the Home page toolbar) to manage the program layers ('Rescan Layer', 'Add Layer',...)

- **LiveView** : Access to 'Live View' button (in the Home page toolbar) to display the live view of the pixels of the camera, or to move the motors or to park an axis.

- **Service** : Access to the 'Service' menus (bottom toolbar). Reserved for service people only.

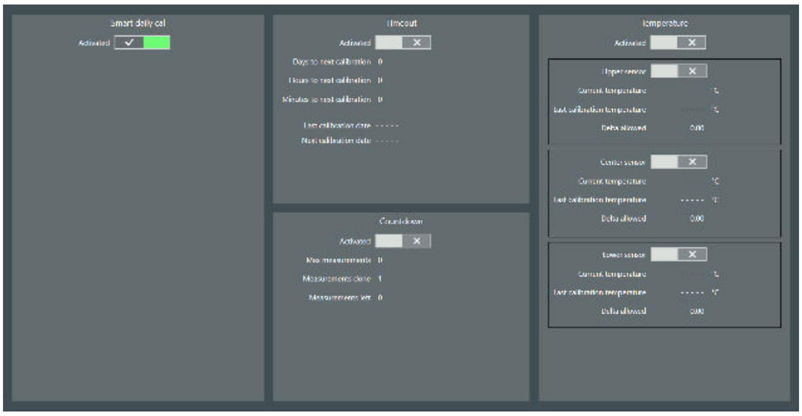
- **DailyCalibration** : Access to Settings/Daily cal menu to manage Daily cal configuration (Timeout, Temperature,...).

- **LoadOrDeleteRuns** : Access to the "Results management window", to allow deleting or loading measurement results.

- **ChangeResultsColumns** : Allow to change the order or remove the columns in the "Edit and result window" (e.g. 'Description', 'Units',...).

Users Use this to add a new user.

10. Daily cal



Smart daily cal — If enabled, automatic running of the Daily cal process, computed by ReflexScan algorithm when it estimates that it is needed, related to a combination of time and temperature sensors.
If disabled, it allows setting a custom Timeout or Countdown or Temperature management of the Daily cal.

Timeout — If enabled, you can set a number of days/hours/minutes before asking for the next Daily cal run process.

Countdown — If enabled, you can set the number of measurements before asking for the next Daily cal run process.

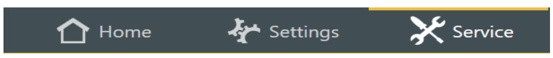
Temperature — If enabled, you can set a temperature deviation (related to the last calibration temperature) to exceed before asking for the next Daily cal run process. This can be set for any of the three machine mounted sensors.

11. Easy load program

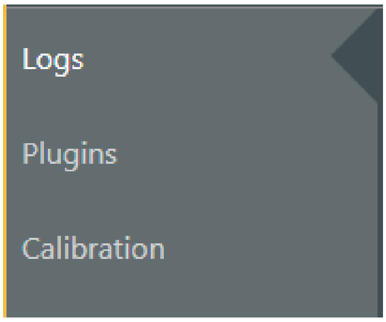
Use this tab to add ( button) or delete ( button) the different programs that an operator with restricted rights can execute (when AccessAllProgramRight is disabled).
If the "Display last used programs" check box is enabled, the operator will be able to execute the last programs used by the Supervisor.

3.2.6 Service display

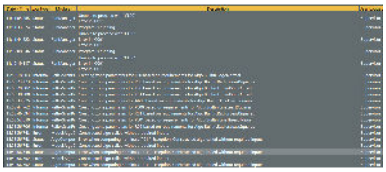
You can access this menu by pressing the Service display button in the bottom status bar ('Plugins' and 'Calibration' tabs are reserved to the service people only) :



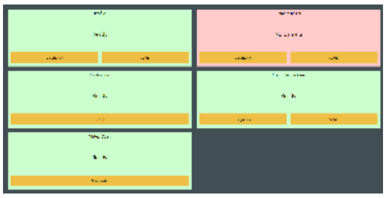
You will then have 3 tabs available :



The **Logs** tab displays the history of the machine, with several levels that you can filter: information, warning, error, alarm, debug.



The **Plugins** tab is dedicated to Service engineers to check and manage the machine hardware.

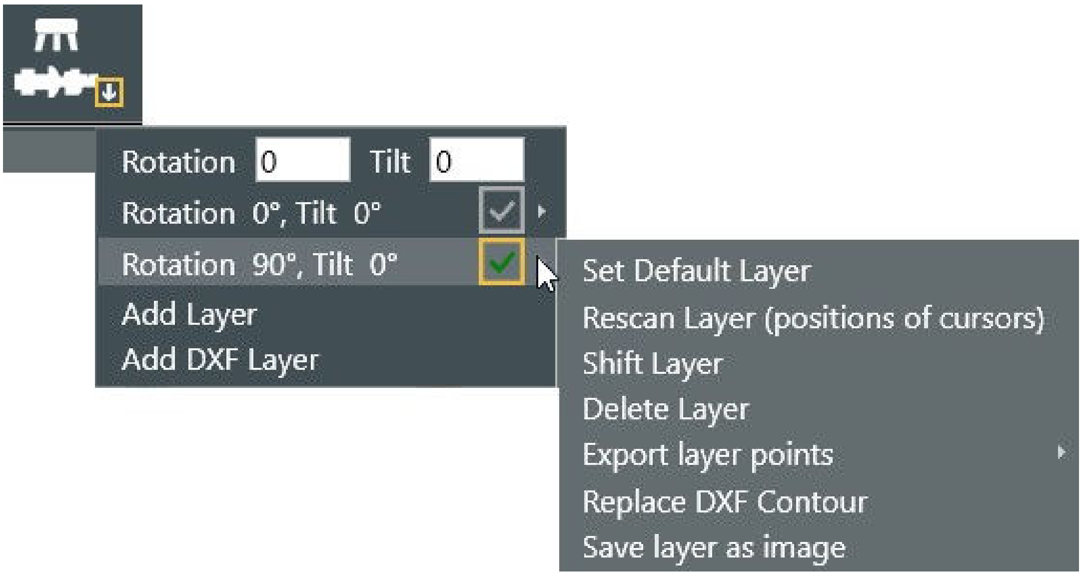


The **Calibration** tab is dedicated to Service engineers to calibrate the machine from scratch.

3.2.7 Manage Layers

The **Scan button**, which can only be used in Composer mode, allows for scanning the contour of a part.

But you can also represent different sides or aspects of the part on the same schematics view, e.g. showing the part when rotation axis is at 0° but also when it is at 90°, to allow measuring a hole or a specific form only visible on this side. You can also mix machine scanned contours and DXF imported contours. Those contours are called **layers**.
Managing multiple layers: When pressing the little arrow at the bottom of the icon, a sub-menu allows to manage several layers of schematics :



A layer is a scan of a part contour or a DXF drawing imported contour, at a specific rotation and tilt axes positions.
The **default layer** is considered being at rotation=0° and Tilt=0°.
Before adding a new layer, **change the Rotation or Tilt value**, then press on "**Add Layer**" to scan a new contour or "**Add DXF Layer**" to import a new DXF file: the new contour will then be displayed in a different color (green color for the 2nd layer).
When selecting a layer menu, you'll have access to several commands :
Set Default Layer: replace the current default layer to the selected one. It will be useful for creating the zones of the features on the right contour by one click of the mouse
Rescan Layer: rescan the selected Layer between the positions of the red triangle cursors in the schematics view
Shift Layer: move the current contour drawing in X,Y or rotation, to make it fit correctly on the other layers
Delete Layer: suppress the current contour
Export Layer points: export all the points of the current contour to a CSV or DXF file, e.g. for an external analysis with another tool
Replace DXF Contour: allows to import a new DXF file to replace the current one, with the advantage of keeping all the measurements and zones that were already programmed. Useful after having updated a DXF drawing.
Save Layer as image: in Demo mode only (needs a specific license), to export the current contour as a part image for the machine simulator.

3.3 Schematics view menu

This Menu bar is accessible with a **right click** on the Main window. The different options available are listed as below.
*: **available in Expert mode only** (Settings/Preferences/Expert mode)

Select All	Select all the features that are currently on the Main window.

Select all of type	Select all the features of a defined type (e.g. Diameter, Edge,...) that are currently on the Main window. It also selects the hidden features of this type.
Hide/Show selected features	Hide or show the features that are selected on the Main window. If some features are hidden, it shows them all.
Feature Type	Allows you to change the selected feature with another feature of the same Type.
Add compatible feature	Allows you to add compatible features in the same zone(s) as the selected feature.
Select last used feature (F6)	Select the last feature type that you used to create new features
Reset fixed positions	Reset the position of all the labels to auto-computed positions. This menu item is available only in Composer mode when the "locker" button (bottom left of Main window) is not active. This could be useful when the positions that were manually fixed are not in a sensible position.
Measure selected features (F3)	Measure the features that are selected on the Main window.
*** Measure selected features with diagnostics**	Measure the features that are selected on the Main window in diagnostics mode (to generate diagnostics files to send to a Sylvac engineer).
Measure all missing features	Measure all the features that have not already been measured during the last scan.
Measure faulty features	Measure all the features that were measured as out of tolerance during the last scan.
*** Export points of selected features**	Export all the points coordinates of the selected features to a CSV file.
*** Export points of all features**	Export all the points coordinates of all the program features to a CSV file.
*** Export SPC data**	Export SPC data.
Delete (Del)	Delete the selected features on the Main window.
Copy (CTRL+C)	Copy selected features.
Paste (CTRL+V)	Paste previously copied features. You will be asked to validate the offset which is the distance from the initial features, where the new features will be pasted (e.g. Paste offset = 10, to copy the features 10 millimetres far from the initial ones).
Symmetrical paste	Paste previously copied features by mirroring them at the other hand of the part. You will be asked to validate the offset which is the distance from the initial features, where the new features will be pasted (e.g. Paste offset = 10, to copy the features 10 millimetres far from the initial ones).
Show statistics window	Show the statistics of all the features that are on the Main window.
Pin chart	Permanently show the statistics window on the labels.
Show/Hide statistics as tooltips	Allows you to either Show or Hide statistics of a measurement when letting the mouse on a label.

Order 'Bring to front' or 'Send to back' the labels displays between them.

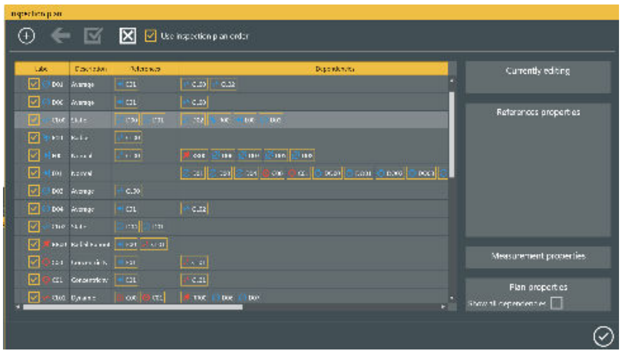
Crop scan to slider positions Crop current scan to the sliders positions (vertical and horizontal sliders).

Flip part Flip the part of a 180° angle around its perpendicular axis.

Toggle inch/mm (CTRL+U) Change quickly all the measurements units from inch to mm and conversely

Inspection plan

- Management of the features for grouping/editing, changing the order of display and report, changing several features properties at once quickly (by features grouping or multi selection).
- Allow changing the basic elements of constructed features (e.g. Edges of a length).
- Allow to change the order of the features by moving them with the mouse.
- Allow to show all the dependencies between all the features.
- Allow to disabled some features in order not to be measured during the program execution (enable/disable check box on the left).



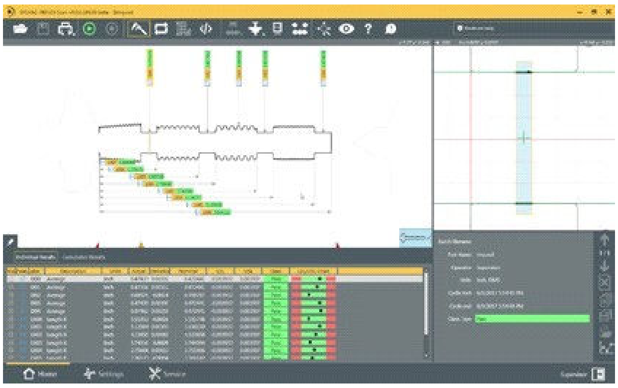
Sort by inspection plan Sort the features display, report and export with the order selected in the Inspection plan.

*** Undo / Redo stack** Show all the last Done and Undone actions in order to select a specific step to switch to.

4.1 REFLEX-Click mode

Clicking on the button lets you access this mode to measure the main features on your parts statically. No preprogramming is needed.

Insert your part into the machine, and then press the REFLEX-Click button on the machine front face, or click on



To change the selection of default part features that you want to measure, report to Settings/Reflex-Click.

Enabling the 'With guess program' function shown under the options (SETTINGS/ REFLEX-Click tab) causes your part to be scanned prior to the analysis of the part programs stored in the memory.

Whenever a program is identified, a message tells you that this program is being loaded. Cancelling this action should occur within five seconds. The measurement process will be started up as soon as this time is over.

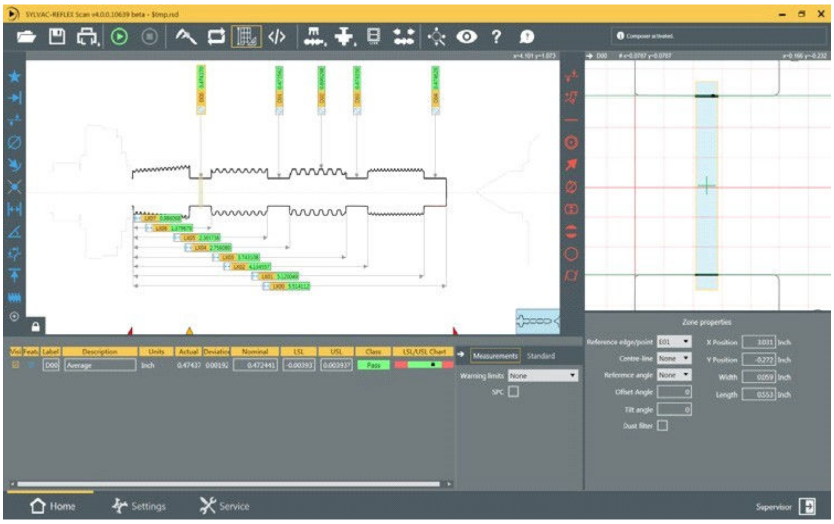
In case of a cancellation, the system will guess and measure each main part feature .

If two or more part programs are recognized, you will be prompted either to select one of them before starting measuring or cancel this action.

Important notice :
Should your parts be measured without preprogramming, no part alignment will occur. Consequently, the machine related specifications might not be met in this operation mode.

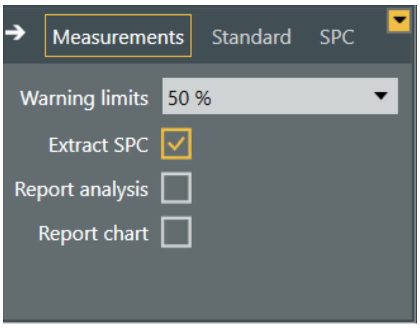
4.2 Edit a part program (Composer)

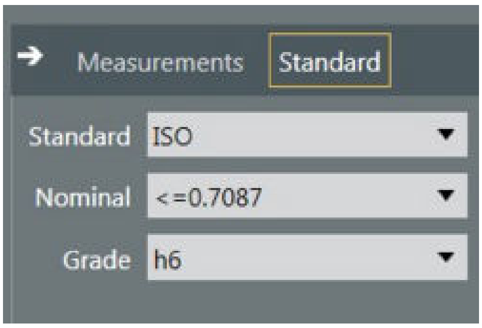
To access this mode, click on Composer  to get all available features on both the left side (for static measurements) and the right side (for dynamic measurements) on the main window. Select one of them and click on the part where you want this feature to be measured. To set the size of the measurement zone, click on the enclosing edges. You may also define a such zone by dragging it using the left mouse button. All information related to the selected feature (description, nominal value, tolerances and the like) will appear in the edit and results window.



The Measurements tab allows you to set the warning tolerance limits beyond which the measured values will appear as yellow, but also to export the selected measurement(s) as SPC data to process externally, or to include the analysis view or statistics chart into the final report.

The Standard tab lets you choose the appropriate database from the international standards applicable to each displayed geometric feature.

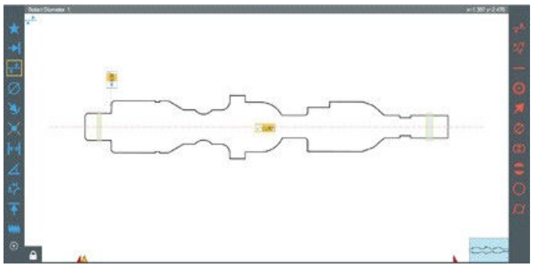




To achieve optimum accuracy, the part must be properly aligned. Choose a static axis (previously defined) from the centre line drop-down list in the 'Zone properties', or a dynamic one, in order to compensate for the alignment error of the part for a given feature (e.g. radius). An edge or a point (previously defined) may also be selected and defined as reference edge/ point to ensure the zone of measurement is at the right place related to the edge position. The last reference feature being of angular type, the part to be measured can be precisely positioned within 0 up to 360°. The 'Tilt angle' can be set manually as well as the 'Number of Hits / 360'. You can also apply a dust filter if needed (this filter configuration is in Settings/Program/Dust), or change the measurement zone coordinates (X,Y positions and width, height values).

4.3 Creating a part program

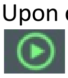
To create a new part program, first click on this button  to scan the part. As instructed earlier, you should have accessed the Composer Edit Mode.



It is recommended to define the first edge of your part as reference edge, enabling a relative zero to be set. Please note that the absolute zero is the position of the head stock plate of the machine. A correction of the axis, which will compensate for any part alignment error, is also advisable (see section 4.2 – Editing a part program (Composer Mode)). In case the preset references was configured in the preferences of the settings menu when creating a centre-line axis, a message will prompt you to confirm the automatic tracking of the measurement zones related to the defined axis.

Once this is done, you will be able to add any feature by selecting it from the bar appearing on the left (static) or the right (dynamic) of your screen, before clicking on the measurement zone.

If a feature is no longer needed, click on the feature icon that is visible at the upper left corner of the main window to make it inactive.

Upon completion of your part program, click on  to run it, or press the button available on the front face of your machine to start measuring.
The results are displayed in the labels, but also in the edit and result window (colour codes green = within tolerances, yellow = at tolerance limits, red = out-of-tolerances).

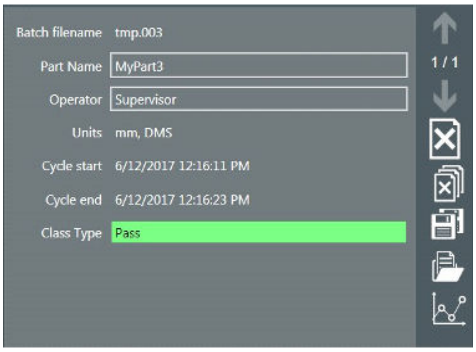
4.4 Individual results

The Individual Results tab details all data related to a single measurement included in your part program - i.e. measured value, deviation from nominal value, tolerances and value classification (good or out-of-tolerances), position of the result on the tolerance chart.

4.5 Cumulated results

The Cumulated Results tab shows the sum of all individual results obtained when inspecting a part series when running the same part program. This sum will then be used for statistical analysis based on the lowest, mean and highest values of the measured feature in addition to Cp or Cpk parameters.

At the bottom right position, the Results Management window gives you the possibility to scroll through the individual results by using the arrow buttons, or to delete or save the runs of results.

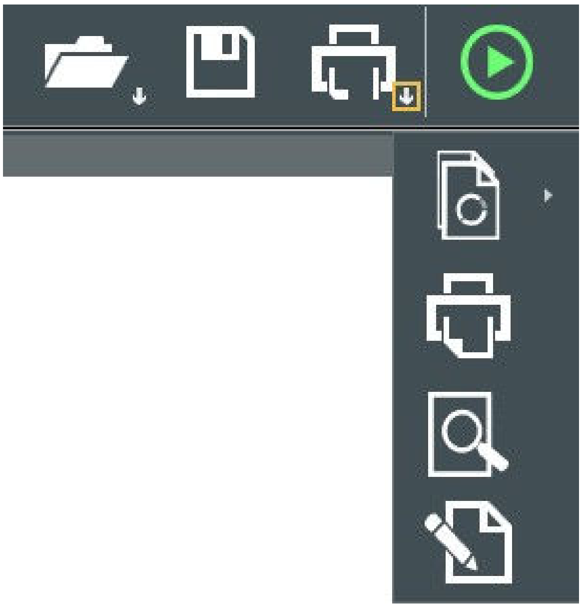


5. INSPECTION REPORTS PRINTING

The measurement results can be printed out, previewed or edited.

For quick print out of your results, just press in the middle of the print icon ( ) in the upper main toolbar.

When pressing the bottom right small arrow of the print icon( ), you will be able to manage your inspection report.



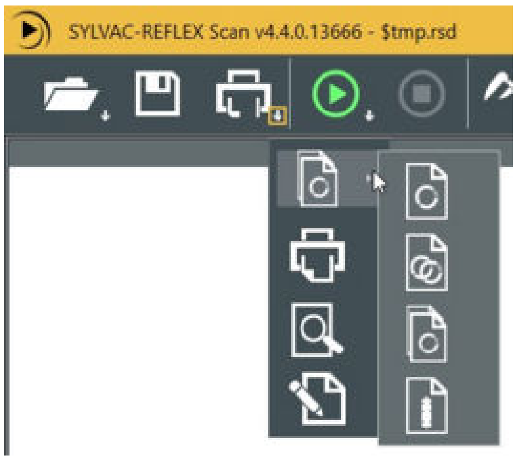
- Select report template
- Print out
- Print preview
- Report editor (display settings)

5.1 Select Report template

When pressing the other small arrow at the right of the "Page" icon, you will be able to select the report template that will be used when printing out or displaying a print preview of your results.

The **4 «Page» icons** allow you to select 1 out of 4 templates, depending on which results you want to display:

- «Individual results» (1 part measurements),
- «Cumulative results» (statistics for several parts),
- «Batch results» (details for several parts),
- «Part results» (overview drawing of the part displayed in the page body).

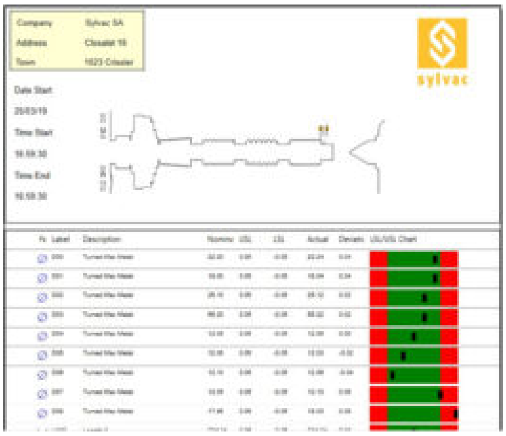


5.2

Before starting printing out your reports, you can

Print preview

click on this button  to view the final layout.



5.3 Print out

For quick print out of your results, just press in the middle of the print icon ()

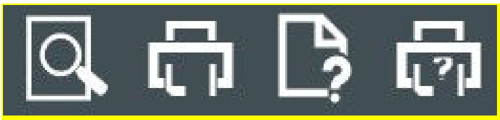
5.4 Report editor

An inspection report can be customized by clicking on the "Report Editor" (or "Display settings") button of the main toolbar ()

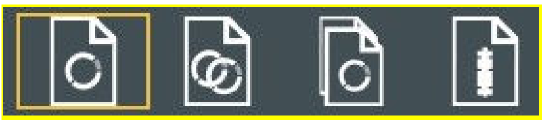
The File menu includes the following buttons :

 :

New template, Open an existing template, Save the active template, Exit

 :

Print preview, Print out, Page setup, Printer setup

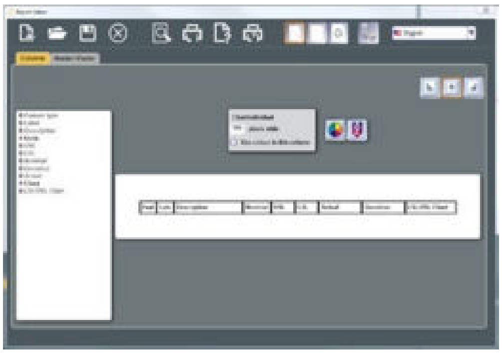


The **4 «Page» icons** allow you to edit 4 different templates, depending on which results you want to display: «Individual results» (1 part measurements), «Cumulative results» (statistics for several parts), «Batch results» (details for several parts) and «Part results» (overview drawing of the part displayed in the page body).

The content of "Columns" and "Header/Footer" windows will change when selecting another active template.

By pressingthe "Duplicatetemplate" button (), the activetemplate format willbe appliedto the 3 other templates(e.g. if the activetemplate isthe "Individual"one, as in the screenshotbeside, when pressingthe "Duplicate"button, it willcopy the current header, footer and enabled columnsto the 3 other templateswhen applicable)

The languageslistat the right end of the toolbar ( ). allowsyou to select a print languagethat is different from the user interface language

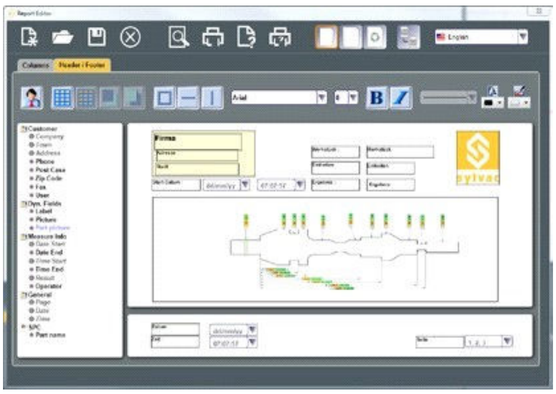


To select the information of your measurement results that you need to display, click on the **«Columns» tab**.
Youwill then be able to add, delete or move each available field .
To add a new measurement result column, you just have to drag/drop it with you mouse from the left vertical window to the horizontal window. You can also resize the columns with your mouse.

Adding a field
Move desired information to the main window with a left mouse click in the list appearing on the left of your screen and leave it where you want.

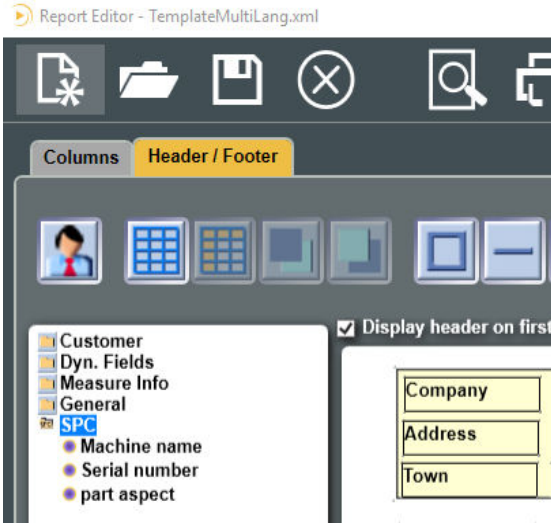
Deleting a field
Select desired field, and then click on Delete with the left mouse button.

Moving a field
Select desired field with a left mouse click and move it to chosen position.

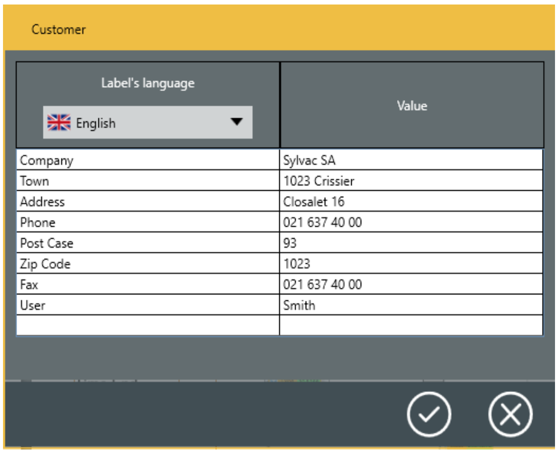


The **Header/Footer tab** makes it possible to add a logo, company name and address or some text in addition to the measurement-oriented information (beginning/end of a cycle, accuracy grade, unit system, operator and part name). For this purpose, unroll the drop-down menus on the left of your screen to add/delete all information depending on yourneeds.
You can also print the SPC trace fields that you have defined in Settings/SPC setup by clicking on the SPC item and drag/dropping the selected trace field onto the header or footer display.

A number of tools such as grids, frameworks and so on are available to enable you customizing your page layout.



If you wish to insert an image of your part in the header of your inspection report. Open the «Dyn. Fields» folder on the left tree and drag/drop the «Part picture» into your header.
You can customize the «Customer» information (Company name, address, user name, ...) by pressing the «smart man» icon on the left of the toolbar. You will then be able to change the value and the label translation of each «Customer» field.



Note : Make sure that desired template is selected in the preferences available from the Settings menu.

6. IMPORTING FILES

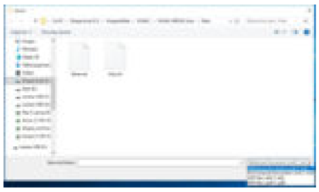
There are 4 different files formats that can be imported in ReflexScan+ software :

- Importing RSD files (ReflexScan+ default format)
- Importing SCH files
- Importing PDF files
- Importing DXF files

6.1 Importing RSD files

Open a file and select « RSD files » in the filter list in bottom right.

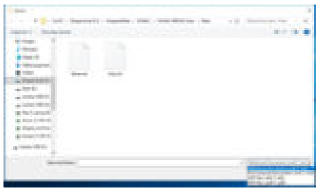
These files could be either the regular ReflexScan+ files or come from ReflexScan old software (e.g. Scan 52 machine).



6.2 Importing SCH files

Open a file and select « SCH files » in the filter list in bottom right.

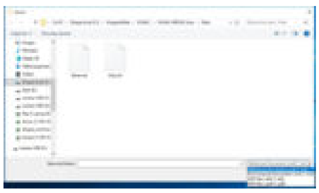
These files come from ProMeasure/ProComposer software. It is possible to import the contour of the part and most of the features in the new ReflexScan+ format.
The usual SPC export ProCal macros (CSV, QDAS,...) will be imported in the new format, but in case of specific ProCal headers or footers, a warning message will be displayed.
Those specific headers will need to be translated manually to C# scripts.



6.3 Importing PDF files

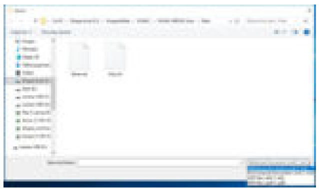
Open a file and select « PDF files » in the filter list in bottom right.

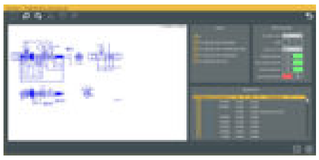
As a PDF document stores all the data as images, we cannot import the nominals and tolerances in ReflexScan+. However, it is possible to collect the contour of a part.



6.4 Importing DXF files

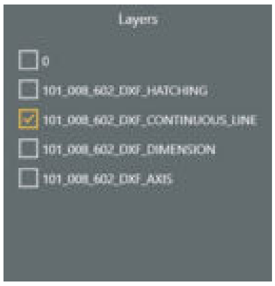
1. **Open a file and select « DXF files » in the filter list in bottom right.**





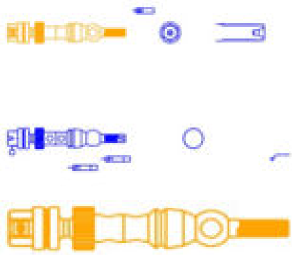
2. Select the DXF file and press 'OK'.

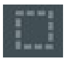
3.  : “rotate the drawing 90°” to the left or to the right if needed.



4. Select the layer(s) that contain the contours of the part.

5. Select the zones to keep or to delete in the overview, and use the tools :



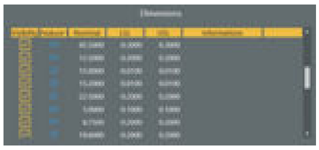
-  **Keep selection** button :
  With the mouse, drag a rectangular zone around the **useful** part of your drawing, then press the “Keep selection” button. It will keep the selected zone only.

-  **Delete selection** button :
  With the mouse, drag a rectangular zone around the **useless** part of your drawing (e.g. inside the contour), then press the 'Delete selection' button. It will delete the selected zone(s).**NB :** with the mouse wheel, you can zoom/unzoom precisely on the drawing to select the zones to delete.

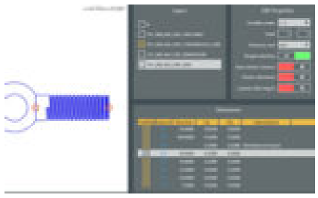
- 

  Auto-extract contour check box :
  Enable it to try to extract the inside of the contour automatically. It is recommended to do it in order to avoid ambiguities once the DXF file has been imported in ReflexScan.
  NB : you have to "erase" the useless lines around the contour with the 'Keep selection' button and the 'Delete selection' button before using this feature.

6. Select the nominal/tolerance values that you want to keep in the 'Dimensions' window.

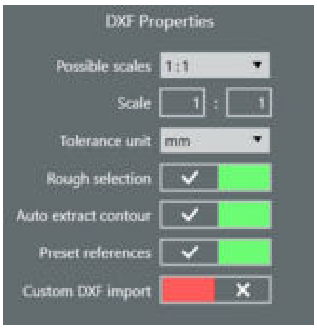


We may be able to import some of them, but because of the several ways they could be mixed in a DXF drawing, this is a very unpredictable process. If it is not reliable enough, we may not include this facility in ReflexScan.
In the lower part of the 'DXF Import' tools window, you can read the list of nominal and tolerance values that ReflexScan was able to discover.
When hovering with the mouse over the features, their measurement zones will be highlighted with red circles.



You can select/unselect the features you want to keep, via the check box on the left. Some of them may not be displayed in the final contour anyway in case the zones are not recognized by ReflexScan algorithms.

7. Set the different parameters in the 'DXF Properties' window.



- **Possible scales** check box

Allows you to choose between the scales detected in your drawing.

- **Scale** parameter

If your drawing has a specific scale that was not detected in the 'Possible scales' list, you can set it with the **'Scale'** parameter.

- **Tolerance unit** check box

With the **'Tolerance unit'** parameter you can choose if you want either millimetre units or micrometre units.

- **Rough selection** check box

This option is useful in case you want to select and erase "polylines" in your drawing. If enabled, you will be able to select only entire polylines. If disabled, you will be able to select specific segments of a polyline.

- **Auto extract contour** check box

Enable it to try to extract the inside of the contour automatically.
NB : you have to "erase" the useless lines around the contour with the 'Keep selection' button and the 'Delete selection' button before using this feature.

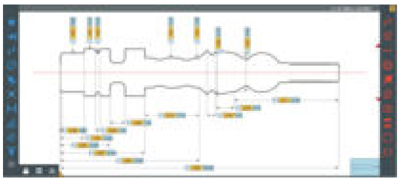
- **Preset references** check box

This setting allows you to automatically set edge/point references to the features. When enabled, the different measurements will be referenced to the nearest edge/point as much as possible. For details, see section User's interface/Menus/Settings/Program /Preset references.

- **Custom DXF import** check box

In the case of a bad import with the usual method, the user can enable this feature to try another method of import.

8. Press the 'OK' button on bottom right to finish the DXF import.



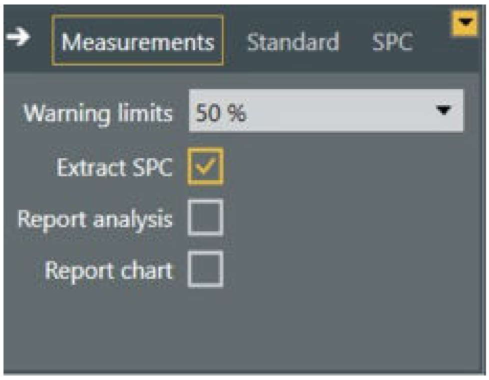
7. EXPORTING RESULTS

Although SYLVAC-REFLEX Scan provides Users with a first-rate tool for statistical analysis through cumulated results (see section 4.5 – Cumulated results), many of them wish to export their measurement results to a dedicated software for further SPC data processing.

This is the reason why your machine offers many exporting possibilities for your measurement results.

Here is the procedure for exporting results in «CSV», «QC-CALC», «Lighthouse exportation», «QDAS», «XML» or even a custom formats (C# script) :

1. Enable SPC parameters from the measurement results window for each geometric feature (holding the Ctrl key allows for a multiple features selection).

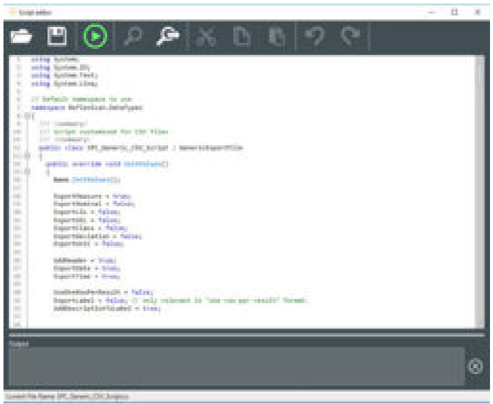


2. Access the options available from Settings/Program Report & Export, and choose the option CSV or other.

3. Make sure that the path is the one you want ("Preferences" tab dealing with default folders).

4. A text file is created upon completion of the measurement cycle, with the right format (CSV, XML,...).

The details of the format are editable when pressing the "Edition button"  at the left of the format check box.
You can customize the format by changing the C# script and compiling it  to make sure that the code doesn't have a syntax error.



8. SCANNING PROCESSES

SYLVAC’s SCAN machines use two scanning processes depending on the measure :

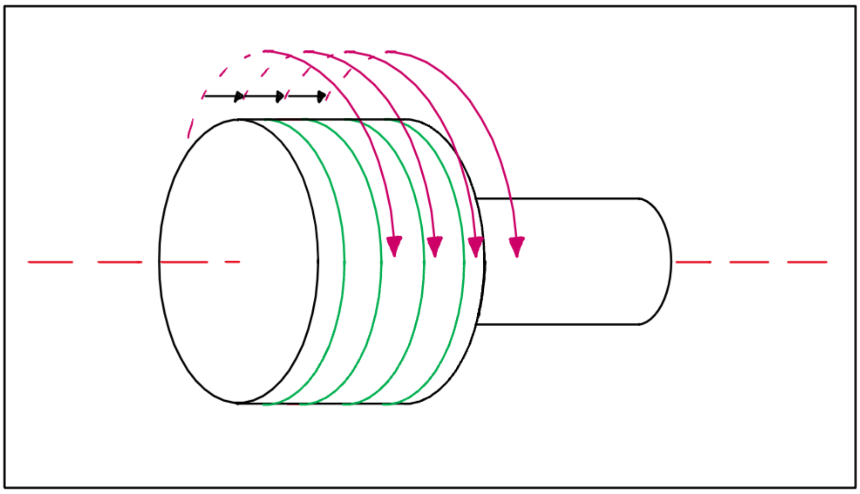
- Axial Scanning
- Radial Scanning

Both use the same 1D camera but the movement of the part is not the same ; one is moving linearly during the scan (Axial Scanning) while the other is rotating during the scan (Radial Scanning). The main difference between them is the output information data which is a profile of the part for the Axial Scanning and a slice of the part for the Radial Scanning. Both have advantages and cons : The Axial Scanning process can have all points of a profile but cannot have the profile of each degree (only a 'Number of Hits / 360'), while the Radial Scanning process can have all points of a slice (10 per degree) but cannot have the entire data points of a profile (only a 'Number of Axial Hits').

Radial Scanning

This process outputs the data points of several slices of the part. The part rotates around its axis while the camera collects the data. The 'Number of Axial Hits' is given by the user in the first place ('Zone properties' window).
The Radial Scanning is used, for example, for the calculation of the average diameter of a cylinder with the feature 'Rotation Diameter Average'.

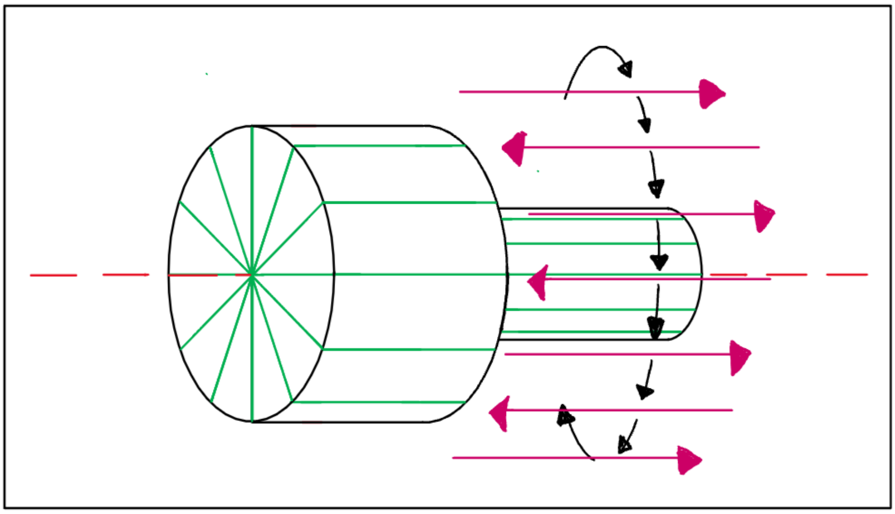
The component is fully rotated during a scan and this process is repeated a 'Number of Axial Hits' times (4 hits for the drawing below).



Axial Scanning

This process outputs the data points of several profiles of the part at different angular positions. A scan is taken along the axis, the component is then rotated to the next radial position and scanned again. This is repeated until all the radial positions have been completed. The scan direction alternates for each radial position.. The number of profiles is the 'Number of Hits / 360' that is given by the user in the first place ('Zone properties' window).
This feature is used for example, for the 'Face-Face Runout' ; the data are collected by stripes around

the face with a specified number of angular positions. Then, each Maxima will be analysed by the ReflexScan+ process and it will give the Runout value. This could not be done with a Radial Scanning because of the impossibility of being exactly in front of the measured face.



9. MEASUREMENT FEATURES REFERENCE

This section describes the measurement features available in ReflexScan+. Those measurement features are grouped inside several categories (e.g. Diameter, Radius,...), which are themselves split in 2 big families : either Static or Dynamic.
For most of them, the basic **static features** don't need the part to be rotated (dimensional measurement), except for some specific ones (Threads, Turbine,...).
The **dynamic features** need the part to be rotated (geometric measurements).

The "last used features" icon (upper left corner of the Main page) allows you to have a quick access to the last features you created.

Edge

This option selects the EDGE feature

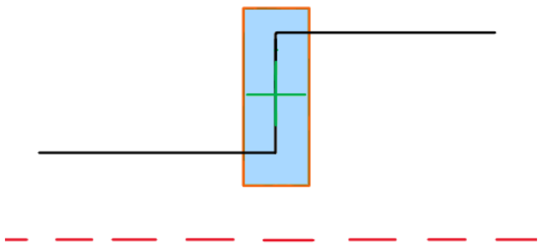
The edge features available are as follows :

- Normal
- Incremental
- Gauge Diameter
- Max Form Diameter
- Min Form Diameter
- Spherical End
- Symmetrical
- Rotational
- Offset
- Midpoint Edge
- Turbine Gauge diameter
- Rotational Incremental
- Incremental from line
- Rotational Incremental from line

Normal

Position of a vertical face.
The algorithm first analyses the data within the zone to locate the positions of the min and max Y data. Then, it used the interpolation method to locate the edge.

Interpolation method :
The data found at the centre of the min and max positions (in Y) is used to calculate the X position of the edge, by interpolation.



Incremental

Position of an edge defined by the increase or decrease from the maximum or minimum height point in the zone.
Where a good vertical edge or intersection cannot be defined, due to the shape of the part, we can specify an incremental edge. When defining an incremental edge, the user specifies a threshold value (Edge Increment = distance in Y) that the data must exceed, for an X location to be determined. This is ideal for locations with very small changes in diameter, and for use as a reference for features such as small angles or radii which may not be in exactly the same X location from part to part. If a **negative** threshold value is used, the algorithm will locate the data point with the largest Y-value and then work its way along the data until data with a Y-value equal to the threshold value has been located. If

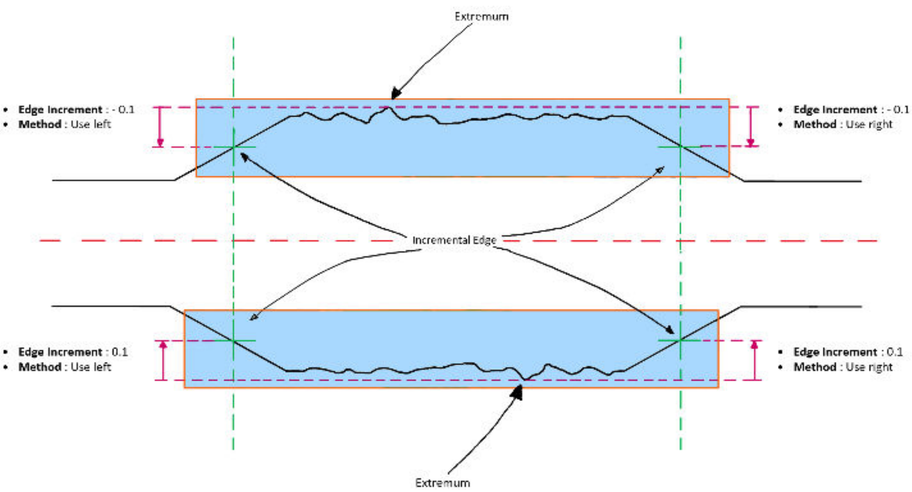
a **positive** threshold value is used, the algorithm will locate the data point with the smallest Y-value and then work its way along the data until data with a Y-value equal to the threshold value has been located.
In case there are several data points equal to the threshold value, you can specify the direction of searching with the 'Method' parameter (from right or from left).
See drawing below.

Rotational Incremental

Position of an edge defined by the increase or decrease from the maximum or minimum height point in the zone when rotating the part.
Where a good vertical edge or intersection cannot be defined, due to the shape of the part, we can specify a rotational incremental edge. When defining a rotational incremental edge, the user specifies a threshold value (‘Edge Increment’ = distance in Y) that the data must exceed, for an X location to be determined. This is ideal for locations with very small changes in diameter, and for use as a reference for features such as small angles or radii which may not be in exactly the same X location from part to part. If a negative threshold value is used, the algorithm will locate the data point with the largest Y-value and then work its way along the data until data with a Y-value equal to the threshold value has been located. If a positive threshold value is used, the algorithm will locate the data point with the smallest Y-value and then work its way along the data until data with a Y-value equal to the threshold value has been located.
In case there are several data points equal to the threshold value, you can specify the direction for selecting the right one with the 'Multiple edges' parameter (from right or from left).

Then the machine will rotate the part and find another intermediate edge value. This process will be reproduced several times (‘Number of Hits / 360’) and the final edge result will be computed using the selected method on the intermediate edges (‘Combination method’ = Average / Max / Min).

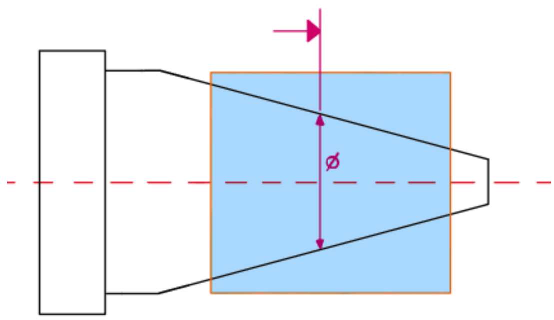
Note : if the ‘Require all rotation positions’ is enabled, then a failure on at least one rotational position will result in an error. If disabled, the failed ones will be ignored by the algorithm in case at least one measurement was successful.
See drawing below.



Gauge Diameter

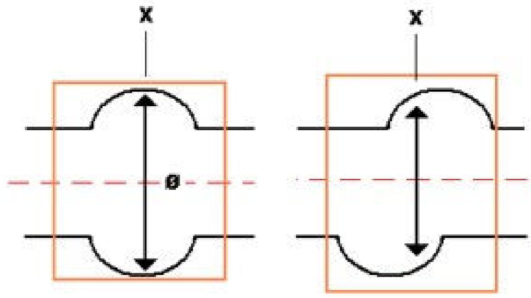
Position of a specified diameter. A measurement zone should be defined on a tapered section of the part. During the measurement, the algorithm will look at the data on both sides of the part, by internally flipping the measurement zone around the Y=0 axis (centreline). Depending on the 'Surface type' parameter ('Measurements' window), best fit 'Line'/'Curve'/'Radius' are applied to the upper and lower surface data to determine the X position of the user specified diameter.

Note: The diameter is calculated perpendicular to the part axis.



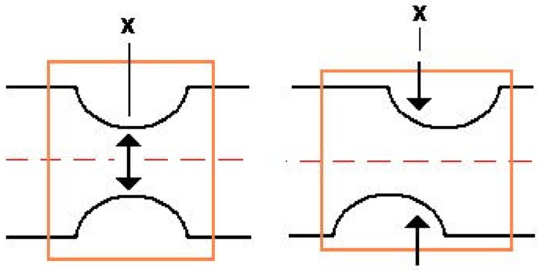
Max Form Diameter

Position of the Max Form diameter. Similar to the diameter measurement with the same name, the software locates the maximum diameter it can see as the measurement zone is scanned. The X position of the max form diameter is used as the edge position.



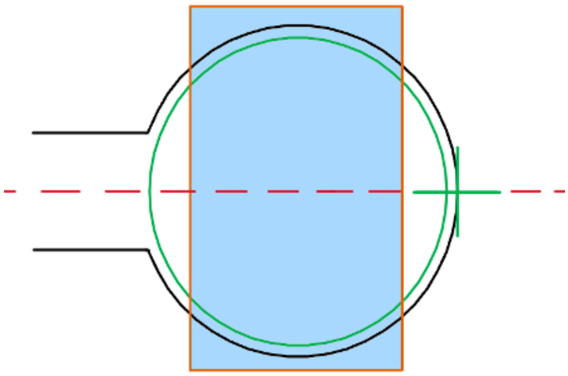
Min Form Diameter

Position of the Min Form diameter. Similar to the diameter measurement with the same name, the software locates the minimum diameter it can see as the measurement zone is scanned.
The X position of the min form diameter is used as the edge position.



Spherical End

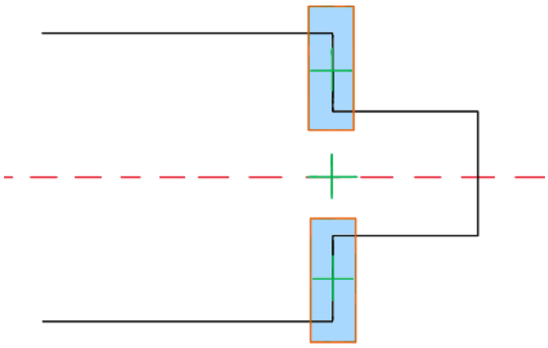
Position at the end of a spherical form. A zone should be placed across the shape of the sphere. A best fit circle is applied to the data in the zone to determine the location of the end of the sphere.



Symmetrical

You can either click near the zone of interest (then two symmetrical zones will be created) or select a crossing zone including points of the upper and lower side of the piece. The position of each virtual edge is found with the interpolation method by analyzing the data points of the upper and the lover side of the part. Then, the algorithm does an average of the X positions to find the Symmetrical Edge.

Interpolation method :
The data found at the centre of the min and max positions (in Y) is used to calculate the X position of the edge, by interpolation.



Rotational

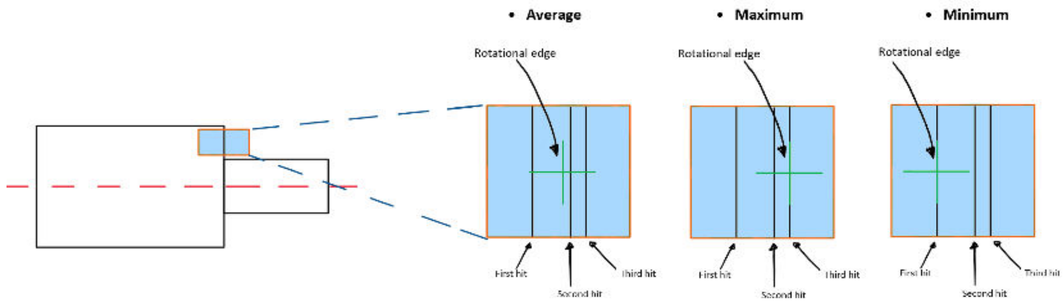
Dynamic edge, calculated on N rotational positions (Number of Hits/360°).
2 options are available :

- Measurement Type: Max, Min, Average

- Zone Spot :
* Zone centre : use points which are located around the zone centre only

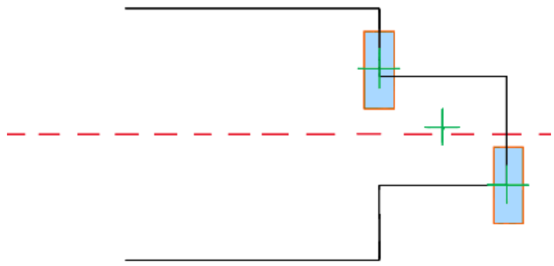
* All Zone : use the points which are located within the whole zone
* Around Y-Position : use points which are located around the Y position only (radius)

See drawing below.



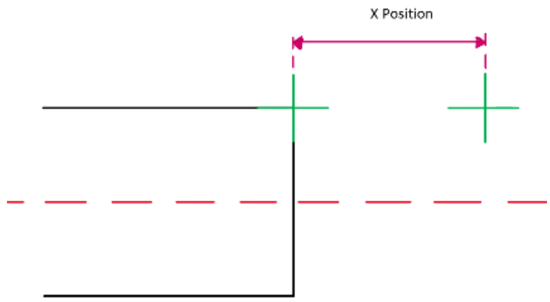
Midpoint edge

Resulting edge half way between two selected edge measurements. The midpoint edge option allows the user to create a theoretical edge position based on the midpoint between two previously defined Edge positions. A good example would be where a length has been defined to the centre of a square groove. We could define two Normal edges on the vertical faces of the square groove, and then select the Edge Midpoint option. We then select the two edge labels we wish to use, to determine the midpoint, to create a new edge at the theoretical midpoint position.



Offset

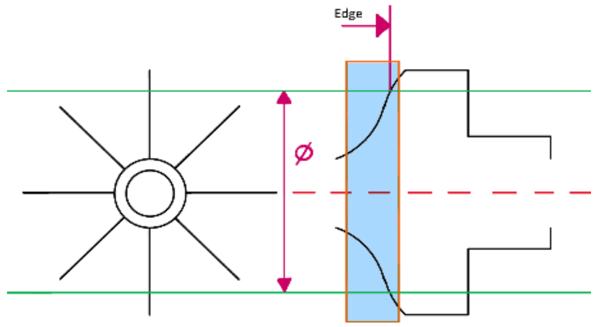
This option is used to create a theoretical start position from a selected edge/point. The related value can be positive or negative.



Turbine Gauge diameter

Position of a specified diameter. A measurement zone should be defined across a turbine gauge section of the part. During the measurement, the algorithm will look at the data of each blade of the turbine (set with the 'Number of Interruptions' parameter in the 'Measurements' window), by internally rotating the measurement zone around the Y=0 axis (centreline). The user needs to specify two 'Surface type' parameters in the 'Measurement' window to help the algorithm fitting a best 'Line'/'Curve'/'Radius' in the proper zone and to let it know if the interruptions are of type 'Constant (All Points)', 'Constant (Average Points)' or 'Pointed'. If you select a 'Constant' type, you need to set the '% of Surface' parameter too. This parameter gives the percentage of the zone you want to look at (e.g. if each blade is constant on a range of 18° and the turbine is made of 5 blades, the '% of Surface' needs to be set to 25% (5*18*100 / 360)). Then, the algorithm will look at each blade surface data to determine the X position of the user specified diameter.

Constant refers to a constant diameter section between the



actual surface interruptions. The algorithm detects the interruptions on the surface and ignores them, using just the constant diameter sections. The difference between 'Constant (All Points)' and 'Constant (Average Points)' is that one calculates an average for each blade as the other keeps every single point.
Pointed refers to a part profile similar to that of a machine cutter which has raised sections of data. The algorithm uses only the raised sections of data.

Note: The diameter is calculated perpendicular to the part axis.

Incremental from line

Position of an edge defined by the increase or decrease from the best fitted line in the zone (the points that fit the line must represent at least 50% of the total zone).
Where a good vertical edge or intersection cannot be defined, due to the shape of the part, we can specify an incremental from line edge. When defining an incremental from line edge, the user specifies a threshold value (Edge Increment = perpendicular distance to the best fitted line) that the data must exceed, for an X location to be determined. This is ideal for locations with very small changes in diameter, and for use as a reference for features such as small angles or radii which may not be in exactly the same X location from part to part. The 'Edge Increment' value must be specified as an absolute value. The algorithm will then determine by itself if the first data point that exceed this value is below or above the best fitted line.
You must specify the zone of the best fitted line with the 'Side of zone' parameter ('right' or 'left').

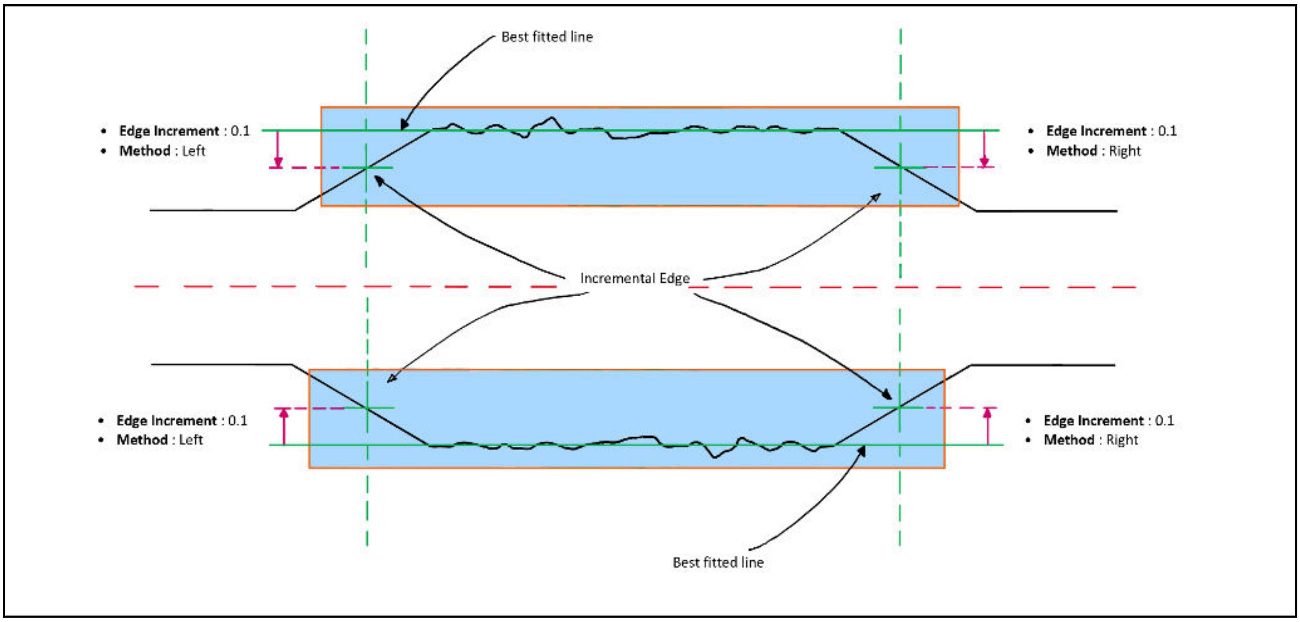
Note : if a point that should fit the line exceeds the 'Edge Increment' distance to the line, an error will occur.
See drawing below.

Rotational Incremental from line

Position of an edge defined by the increase or decrease from the best fitted line in the zone (the points that fit the line must represent at least 50% of the total zone).
Where a good vertical edge or intersection cannot be defined, due to the shape of the part, we can specify a rotational incremental from line edge. When defining a rotational incremental from line edge, the user specifies a threshold value (Edge Increment = perpendicular distance to the best fitted line) that the data must exceed, for an X location to be determined. This is ideal for locations with very small changes in diameter, and for use as a reference for features such as small angles or radii which may not be in exactly the same X location from part to part. The 'Edge Increment' value must be specified as an absolute value. The algorithm will then determine by itself if the first data point that exceed this value is below or above the best fitted line.
You must specify the zone of the best fitted line with the 'Side of zone' parameter ('right' or 'left').

Then the machine will rotate the part and find another intermediate edge value. This process will be reproduced several times ('Number of Hits / 360') and the final edge result will be computed using the selected method on the intermediate edges ('Combination method' = Average / Max / Min).

Note : if a point that should fit the line exceeds the 'Edge Increment' distance to the line, an error will occur.
See drawing below.



Related Topics

Centre-Line 

This option selects the CENTRE-LINE feature

The Centre-Line features are used to make an axis correction of the current part by constructing diameters (for Static features) or concentricities (for Dynamic features). Centre-lines don't have an output result but are used as references for the other features of the program.

For example, for a dynamic centre-line, the line constructed from two concentricity centres gives an axial line relative to both concentricity zones, this line will be the centre-line of the part. It allows the user to correct the machine or part built-on axis with reference zones of a part.

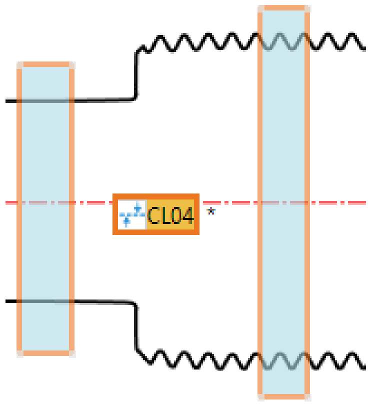
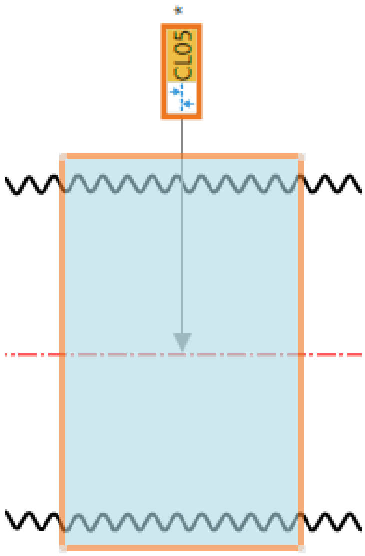
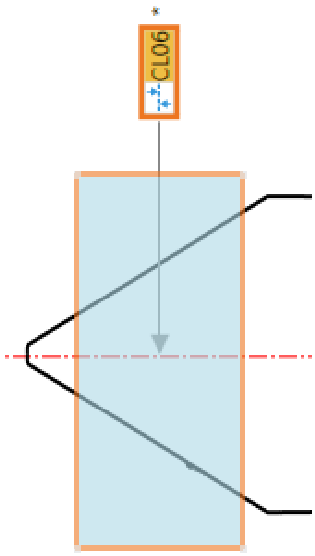
As a centre-line is built from two concentricities, it is possible to construct any type of centre-line based on existing concentricities. To do that, select either the 'Dynamic (Average-Average)' or the 'Dynamic (Turned-Turned)' Centre-Line feature, then select one by one, two existing concentricities. However, to avoid ambiguities, we recommend to use the same scanning method for both concentricity and centre-line features. For example, if you have selected the 'Dynamic (Turned-Turned)' Centre-Line, you should favour 'Turned' Concentricities (both use an axial scanning method).

Another example would be to construct a centre-line on a gauge. To do that, select the 'Dynamic (Average-Average)' Centre-Line, then select two 'Gauge Diameter' Concentricities (The zones should be as far as possible in order to give the best axis correction). Both are calculated with a radial scanning method therefore there will be no ambiguities.

The centre-line features available are as follows :

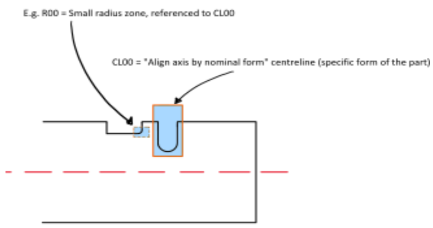
- Static (Diameter-Diameter)
- Static (Thread-Thread)
- Static (Diameter-Thread)
- Static (Single Thread)
- Static (Single Cone)
- Align axis by nominal form
- Dynamic (Average-Average)
- Dynamic (Turned-Turned)
- Dynamic (Thread-Thread)
- Dynamic (Diameter-Face)
- Dynamic (Single Thread)
- Dynamic (Single Cylinder LSC)

Static (Diameter-Diameter)	
Two measurement zones should be defined over plain diameter sections of the part. Ideally these zones should be as far apart as possible, to give the best axis correction. The midpoint of the diameter data seen in each measurement zone is calculated, and then all part data is transformed to force the two midpoints to have the same Y value (Y=0). Under no circumstances should centreline measurement zones overlap each other.	
Static (Thread-Thread)	
Two measurement zones should be defined over threaded diameter sections of the part. Ideally these zones should be as far apart as possible, to give the best axis correction. Each measurement zone should be wide enough that at least 3 pitches of the thread can be seen, else "Insufficient Data Points" will be	

reported by the system. The midpoint of each threaded section (based on Pitch Diameter) is calculated, and then all part data is transformed to force the two midpoints to have the same Y value (Y=0). Under no circumstances should centreline measurement zones overlap each other	
Static (Diameter-Thread)	
Two measurement zones should be defined, one over a plain diameter section and one over a thread section of the part. It is recommended that the thread's zone includes a minimum of 2.5 threads. Ideally these zones should be as far apart as possible, to give the best axis correction. The midpoint of the diameter data seen in each measurement zone is calculated, and then all part data is transformed to force the two midpoints to have the same Y value (Y=0). Under no circumstance should centreline measurement zones overlap each other.	
Static (Single Thread)	
One measurement zone should be defined over a thread diameter section of the part. it is recommended that the zone includes a minimum of 2.5 threads in order to have enough data to give the best axis correction.	
Static (Single Cone)	
One measurement zone should be defined over a cone section of the part. The measurement zone should cover both upper and lower surface of the part section to be measured. The zone should be as large as possible in order to have enough data to give the best axis correction.	

Align axis by nominal form

A single measurement zone should be defined on a portion of the part (not necessary across it). It will then serve as a centreline reference for axis correction of other features. . This feature is useful when a part is not symmetrical or has some complexities (not a simple cylinder) because the centreline is defined with each single point of the zone.
In the 'Measurement' window, you can choose to select the 'Use "Outliers" filter'. The current technique of "filter outliers" could be described as a form of "robust regression" using an "iteratively reweighted least squares technique" (IRLS) .
In summary, this uses a custom weighting function, where points within 3 standard deviations (as determined in the previous iteration) are weighted at 100%, and points outside this are considered with linearly reduced weight, and points outside 5 standard deviations (as determined in the previous iteration) are ignored completely.
Note : this feature could be used a local centreline for small zone measurements.

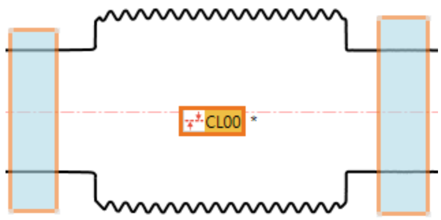


Dynamic (Average-Average)

Two measurement zones should be defined over plain diameter sections of the part. Ideally these zones should be as far apart as possible, to give the best axis correction. The machine will rotate the part in each zone position using the radial scanning method. The midpoints of the diameter data in each zone are calculated for each angular position (similar to concentricity). The algorithm then calculates the 3D correction required to transform the data so that the midpoints of each zone have the same Y value (Y=0).
This type of dynamic centreline should be used on parts with good surface finish.

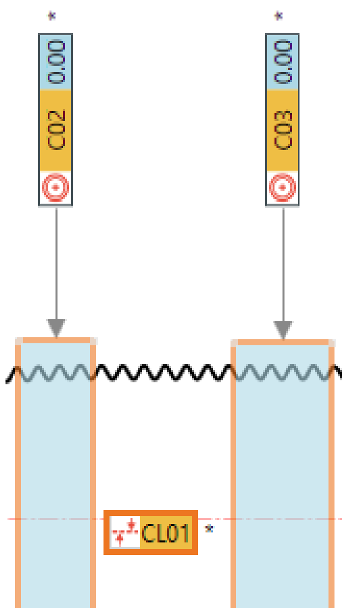
Dynamic (Turned-Turned)

Two measurement zones should be defined over plain diameter sections of the part. Ideally these zones should be as far apart as possible, to give the best axis correction. The machine will take data using the axial scanning method and rotate the part to the next angular position. The number of angular position can be set in the 'Zone properties' window with the 'Number of Hits / 360). The midpoints of the diameter data in each zone are calculated for each angular position (similar to concentricity). The algorithm then calculates the 3D correction required to transform the data so that the midpoints of each zone have the same Y value (Y=0).
This type of dynamic centreline should be used on parts with rough surface finish.



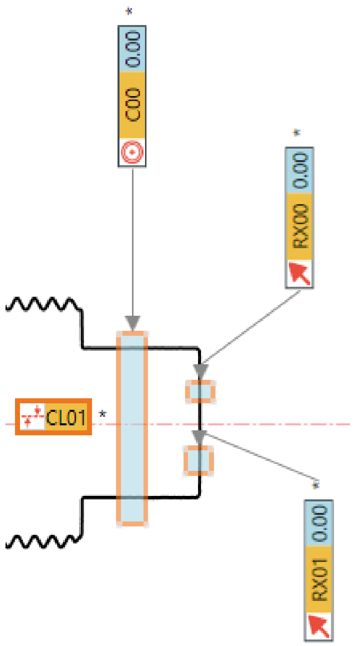
Dynamic (Thread-Thread)

Two measurement zones should be defined over threaded diameter sections of the part. Ideally these zones should be as far apart as possible, to give the best axis correction. The machine will take data using the axial scanning method and rotate the part to the next angular position. The number of angular position can be set in the 'Zone properties' window with the 'Number of Hits / 360). Each measurement zone should be wide enough that at least 3 pitches of the thread can be seen. The midpoint of each threaded section (based on Pitch Diameter) is calculated..The algorithm then calculates the 3D correction required to transform the data so that the midpoints of each zone have the same Y value (Y=0).
This type of dynamic centreline should be used on parts with rough surface finish.



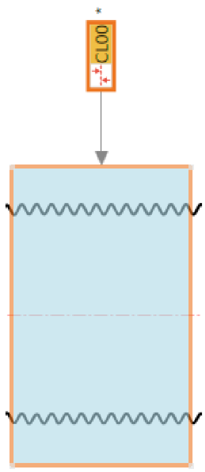
Dynamic (Diameter-Face)

The first measurement zone should be defined over a plain diameter section (measure of a concentricity), the second and third measurement zones should be positioned over a vertical face, one above the centre of the face and one below (Note : Only vertical face data should be seen within the zone). Then, the machine will use the axial scanning method for a specified 'Number of Hits / 360' in order to create each time two points on the vertical face. The line connecting the two points is then calculated. The midpoint of the diameter zone is calculated too and is used to create a theoretical line with the perpendicular of the vertical face line. The algorithm does this operation for the different angular positions, to create a 3D correction.
This type of dynamic centreline should be used on parts with rough surface finish.



Dynamic (Single Thread)

One measurement zone should be defined over a thread diameter section of the part. it is recommended that the zone includes a minimum of 2.5 threads in order to have enough data to give the best axis correction. The machine will memorize data using the axial scanning method. The different midpoints are calculated for a mentioned number of angular position (Number of Hits / 360). The algorithm then calculates the 3D correction required to transform the data so that the midpoints have the same Y value (Y=0).
This type of dynamic centreline should be used on parts with good surface finish.



Dynamic (Single Cylinder LSC)

One measurement zone should be defined over a cylinder section of the part. The machine will rotate the part in each zone position using the radial scanning method. The midpoints of the diameter data are calculated for each angular position (similar to concentricity) then this process is repeated for a 'Number of Axial Hits'. The algorithm then calculates the 3D correction required to transform the data so that the midpoints have the same Y value (Y=0).
This type of dynamic centreline should be used on parts with good surface finish.

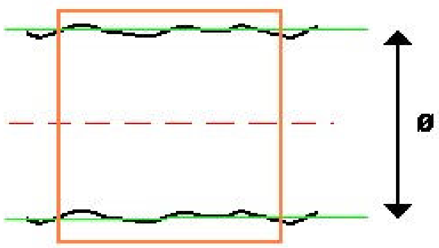
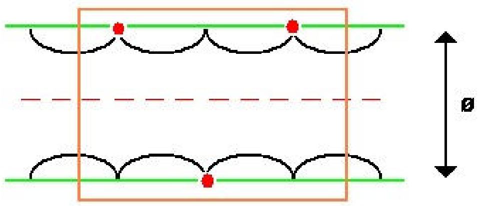
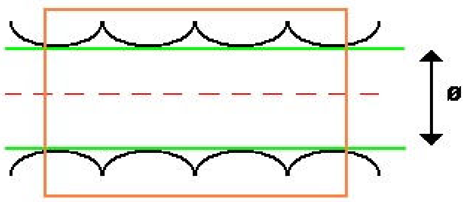
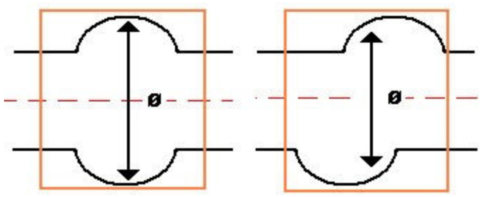
Related Topics

Diameter

This option selects the DIAMETER measurement feature

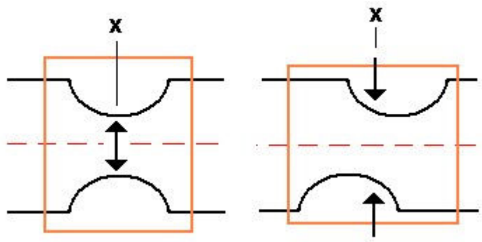
The diameter features available are as follows :

- Average
- Turned Max Metal
- Turned Min Metal
- Max Form
- Min Form
- at X
- at X (Turbine)
- Line - Line Intersection
- Line - Edge Intersection
- Sphere
- Over Wire (4 x Lines)
- Wire Centre (4 x Lines)
- Diameter (Point-Axis)
- At X (2 x Lines)

Average The average diameter is calculated by determining the distance between the averaged data from the upper surface and the averaged data from the lower surface.	
Turned Max Metal Both the upper and lower surfaces are analysed to determine the location of the peaks of the turnings. Statistical analysis of the locations of the peaks is made to remove 'false' peaks that are a result of dirt or damage on the part. Once the invalid peaks are removed, the algorithm calculates the fit of a virtual micrometre' to the upper and lower surface to calculate the true Turned Diameter.	
Turned Min Metal Comparable with the Turned Diameter, the min metal algorithm determines the position of the troughs of the turnings, on upper and lower surfaces. The largest diameter that can be seen, which does not exceed the trough positions (stock material) is output as the result.	
Max Form Each data point from the upper surface is compared with the equivalent data point from the lower surface. The max form diameter is given as the largest distance between these corresponding pairs of data points.	

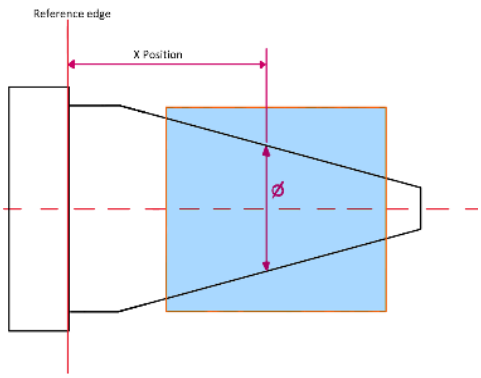
Min Form

Each data point from the upper surface is compared with the equivalent data point from the lower surface. The min form diameter is given as the smallest distance between these corresponding pairs of data points.



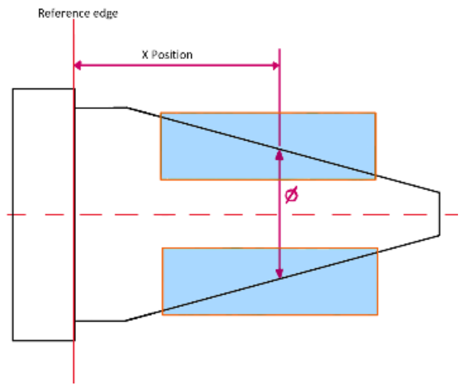
at X

A diameter that is measured at a specified distance from a reference position (normally a reference edge.) The distance can be specified positive or negative. A negative distance will measure the diameter at a position to the left of the reference edge. A positive distance will measure the diameter at a position to the right of the reference edge. This feature will commonly be seen on drawings of parts with tapered sections.



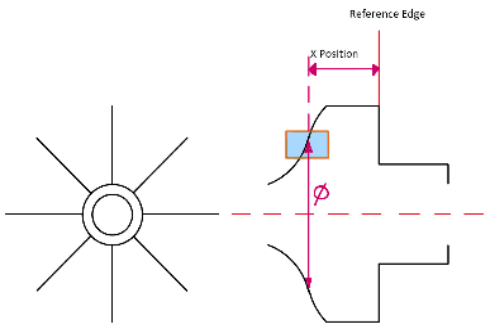
At X (2 x Lines)

A diameter that is measured between two lines at a specified X distance from a reference position (e.g. reference edge). The X distance can be positive or negative.



at X (Turbine)

A diameter that is measured at a specified distance from a datum position (normally a reference edge.) A measurement zone should be defined across a turbine section of the part. To determine the diameter of this specified 'X position', the algorithm will look at the data of each blade of the turbine (set with the 'Number of Interruptions' parameter in the 'Measurements' window), by rotating the measurement zone around the Y=0 axis (centreline). The user needs to specify two 'Surface type' parameters in the 'Measurement' window to help the algorithm fitting a best 'Line'/'Curve'/'Radius' in the proper zone and to let it know if the interruptions are of type 'Constant (All Points)', 'Constant (Average Points)' or 'Pointed'. If you select a 'Constant' type, you need to set the '% of Surface' parameter too. This parameter gives the percentage of the zone you want to look at (e.g. if each blade is constant on a range of 18° and the turbine is made of 5 blades, the '% of Surface' needs to be set to 25% (5*18*100 / 360)). Then, the algorithm will look

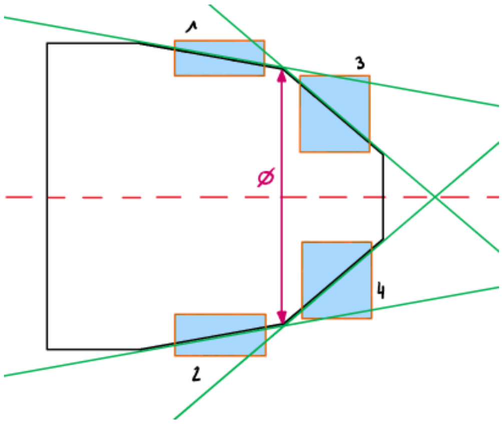


at each blade surface data to determine the diameter of the user specified X position.
Constant refers to a constant diameter section between the actual surface interruptions. The algorithm detects the interruptions on the surface and ignores them, using just the constant diameter sections. The difference between 'Constant (All Points)' and 'Constant (Average Points)' is that one calculates an average for each blade as the other keeps every single point.
Pointed refers to a part profile similar to that of a machine cutter which has raised sections of data. The algorithm uses only the raised sections of data.

Line - Line Intersection

Two zones should be defined on both upper and lower surface of the part in the correct order (as it is shown on the drawing). Each zone will have a best fit line applied to the data seen within. The radial height (Y position) of the intersection points are calculated. The intersection diameter is given as the distance between the Y position of the upper intersection and the Y position of the lower intersection.

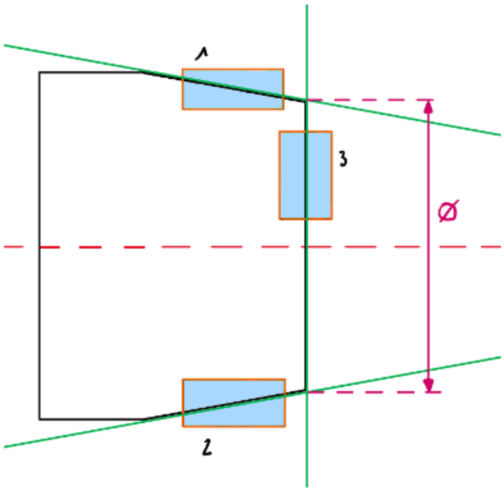
Note : This feature is intended for import of a Procomposer feature. An equivalent measurement can be constructed using "Point" and "Length Y" features.



Line - Edge Intersection

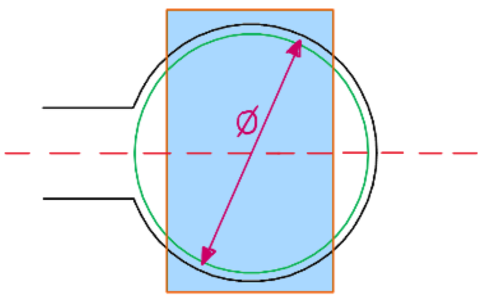
Three zones should be defined on the part in the correct order (as it is shown on the drawing). The first zone should be defined over a plane line section of the part, the second zone should be defined over a plane line section on the other side and the third zone over an edge/face. A best fit line is applied to the first and second zone, and their intersections with the X position of the edge/face are calculated. The 'Line - Edge intersection' diameter is given as the distance between the Y position of the upper intersection and the Y position of the lower intersection.

Note : This feature is intended for import of a Procomposer feature. An equivalent measurement can be constructed using "Point" and "Length Y" features.



Sphere

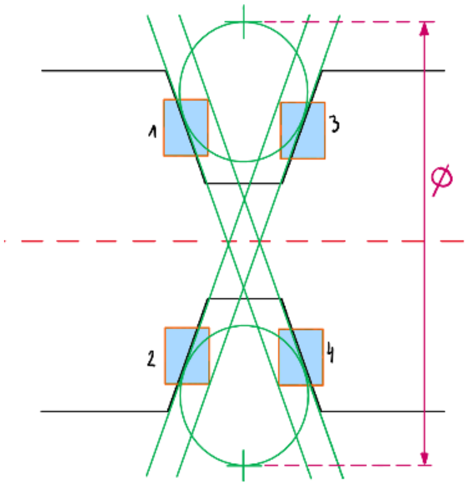
A zone is placed over the shape of the sphere. A best fit circle is then applied to the data within the zone. The sphere diameter is given as the diameter of the best fit circle.



Over Wire (4 x Lines)

Two zones should be defined on both upper and lower surface of the part in the correct order (as it is shown on the drawing). Each zone has a best fit line applied to the data seen within. Next, a best fit circle (or wire) of a user specified diameter is positioned tangentially against the two corresponding best fit lines and the Y co-ordinate of the top of the wire is saved. The same thing is done for the other side of the part. The over wire diameter is calculated as the distance between the upper and lower Y positions.

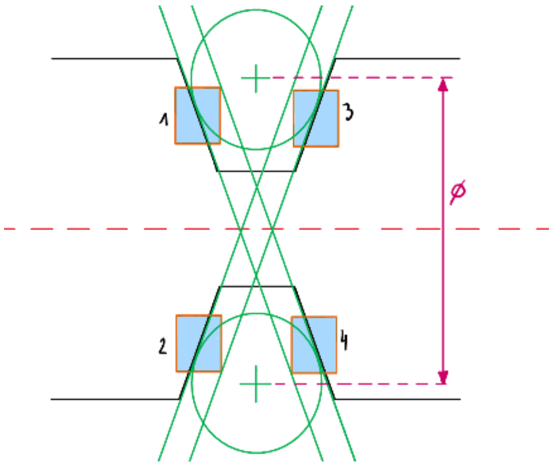
Note : This feature is intended for import of a Procomposer feature. An equivalent measurement can be constructed using "Point" and "Length Y" features.



Wire Centre (4 x Lines)

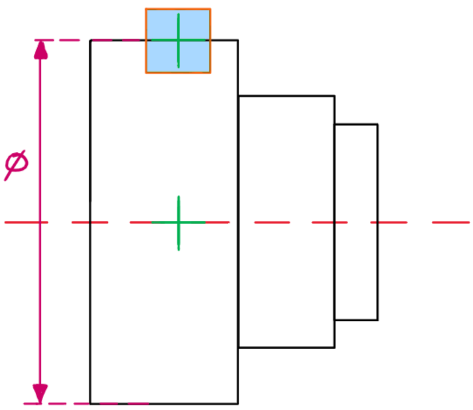
Two zones should be defined on both upper and lower surface of the part in the correct order (as it is shown on the drawing). Each zone has a best fit line applied to the data seen within. Next, a best fit circle (or wire) of a user specified diameter is positioned tangentially against the two corresponding best fit lines and the Y co-ordinate of the centre of the wire is saved..The same thing is done for the other side of the part. The wire centre diameter is calculated as the distance between the upper and lower Y positions.

Note : This feature is intended for import of a Procomposer feature. An equivalent measurement can be constructed using "Point" and "Length Y" features.



Diameter (Point-Axis)

This diameter value is calculated by doubling the height measurement of any point label. To define a diameter of this type, simply select 'Diameter (Point-Axis)' from the Diameter menu and click on any point label.



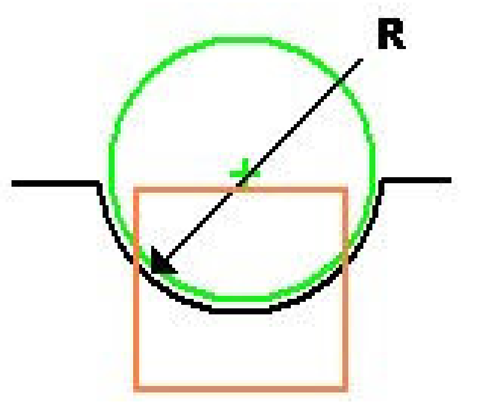
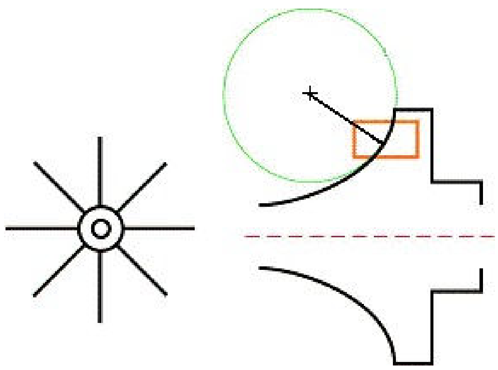
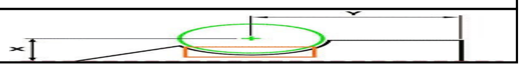
Related Topics

Radius

This option selects the RADIUS measurement feature

The radius features available are as follows :

- Radius
- Turbine Radius
- Distance From X Y Position
- Distance From X Y Position (Turbine)

Radius	
The radius measurement is calculated by applying a best-fit circle to the data in the measurement zone. The measurement zone should contain as much radius data as possible to achieve a good repeatable reading. However, do not make the zone so wide that other data not connected with the radius is seen. Data within the measurement zone that is not a part of the radius will affect the measurement result.	
Turbine Radius	
The radius is calculated from the best-fit circle to the data seen within the measurement zone of each blade. Since this function is a dynamic one, the 'Number of Axial Hits' should be indicated. To determine this radius, the algorithm will look at the data of each blade of the turbine (set 'Number of Interruptions' parameter in 'Measurements' window), by rotating the measurement zone around the Y=0 axis (centreline). The user needs to specify a 'Surface type' parameter in the 'Measurement' window to let the algorithm know if the interruptions are of type 'Constant (All Points)', 'Constant (Average Points)' or 'Pointed'. If you select a 'Constant' type, you need to set the '% of Surface' parameter too. This parameter gives the percentage of the zone you want to look at (e.g. if each blade is constant on a range of 18° and the turbine is made of 5 blades, the '% of Surface' needs to be set to 25% (5*18*100 / 360)). Then, the algorithm will look at each blade surface data to determine the Turbine Radius. **Constant** refers to a constant diameter section between the actual surface interruptions. The algorithm detects the interruptions on the surface and ignores them, using just the constant diameter sections. The difference between 'Constant (All Points)' and 'Constant (Average Points)' is that one calculates an average for each blade as the other keeps every single point. **Pointed** refers to a part profile similar to that of a machine cutter which has raised sections of data. The algorithm uses only the raised sections of data.	
Distance From X Y Position	

The radius matches the one measured from the best-fit circle to the data seen within the measurement zone. This function is used to calculate the value of a radius from both X and Y input values.

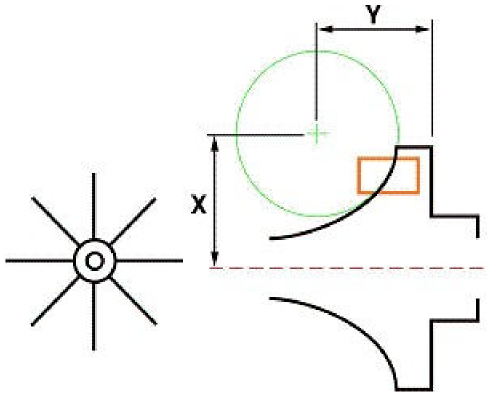
Distance From X Y Position (Turbine)

The radius is calculated from the best-fit circle applied at a specified centre position ('X Position' and 'Y Position' in the 'Measurements' window) to the data seen within the measurement zone of each blade. Since this function is a dynamic one, the 'Number of Axial Hits' should be indicated.

To determine this radius, the algorithm will look at the data of each blade of the turbine (set 'Number of Interruptions' parameter in 'Measurements' window), by rotating the measurement zone around the Y=0 axis (centreline). The user needs to specify a 'Surface type' parameter in the 'Measurement' window to let the algorithm know if the interruptions are of type 'Constant (All Points)', 'Constant (Average Points)' or 'Pointed'. If you select a 'Constant' type, you need to set the '% of Surface' parameter too. This parameter gives the percentage of the zone you want to look at (e.g. if each blade is constant on a range of 18° and the turbine is made of 5 blades, the '% of Surface' needs to be set to 25% (5*18*100 / 360)). Then, the algorithm will look at each blade surface data to determine the Turbine Radius.

Constant refers to a constant diameter section between the actual surface interruptions. The algorithm detects the interruptions on the surface and ignores them, using just the constant diameter sections. The difference between 'Constant (All Points)' and 'Constant (Average Points)' is that one calculates an average for each blade as the other keeps every single point.

Pointed refers to a part profile similar to that of a machine cutter which has raised sections of data. The algorithm uses only the raised sections of data.



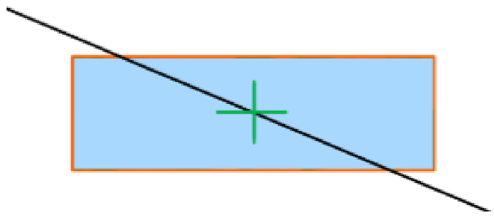
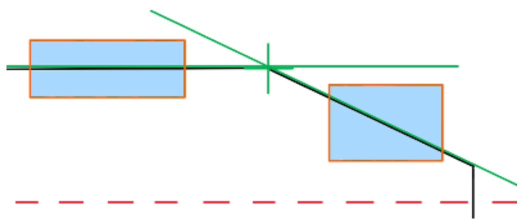
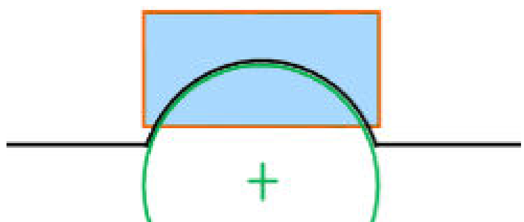
Related Topics

Point 

The point can either be used for a construction (e.g. length or height), or be regarded as reference point.

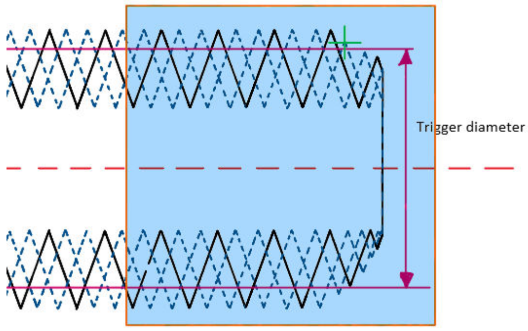
The points features available are as follows :
(1) : available only if the machine is provided with a Tilt system option

- Average Point
- Line-Line Intersection
- (1) Thread End Point (RH Parallel, Major drops to trigger)
- (1) Thread End Point (LH Parallel, Major drops to trigger)
- (1) Thread End Point (RH Parallel, Minor raises to trigger)
- (1) Thread End Point (LH Parallel, Minor raises to trigger)
- Thread Line Intersection
- Thread Radius Intersection
- Wire Centre (2 x Lines)
- Wire Centre (2 x Radii)
- Line-Radius Intersection
- Radius-Radius Intersection
- Radius Centre
- Max Height
- Min Height
- Rotational Max Height
- Rotational Min Height
- At X
- Radius Centre (Turbine)
- Midpoint
- Offset
- Line-Radius Intersection (far point)
- Radius-Radius Intersection (far point)
- Over Wire (2 x Lines)
- Over Wire (2 x Radii)
- Centre of Nominal Radius
- Centre of Nominal Radius (Turbine)
- Gauge Diameter (cone)
- Cone tip
- Fixed Height

Average Point An algorithm is used to analyse the relevant data stated within the measurement zone for the purpose of finding the position of each highest and lowest X/Y-coordinate. The one appearing in-between, in the X/Y-coordinate direction, will be taken into account for the computation of the X/Y-position of the point.	
Line-Line Intersection The intersection point is calculated based on two measurement zones previously defined on the part surface. Each zone includes a best fit line to the reported data. The computed position of the point matches its true X/Y-position. Should the best fit lines not intersect, the error message Measurement zone(s) not suitable for Feature Type is then displayed before the measurement zones are erased on the graph.	
Radius Centre A measurement zone is defined in a such way that only the radius-related data will be displayed. The best-fit circle is then computed for calculating the position of its centre.	

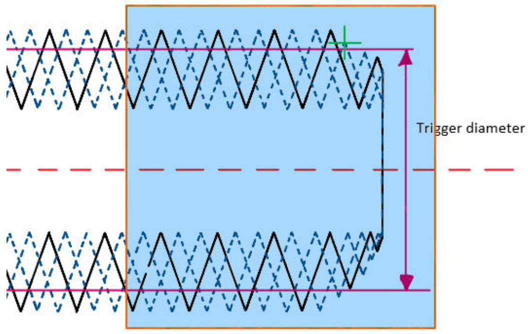
(1) **Thread End Point (RH Parallel, Major drops to trigger)**

Find the position of the last relevant crest point before dropping below the trigger diameter on the selected side of the zone (right/left) for a right hand parallel thread. The selected zone must contain upper and lower zones until the end of the thread ! It is possible to increase the precision by augmenting the 'Number of Hits / 360' (2-24) in the 'Zone properties'. The number of scans will be less than or equal to the required number of pitches through 360 degrees.



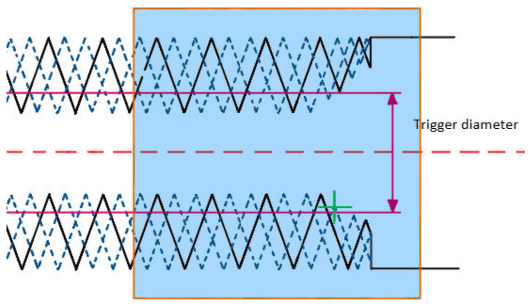
(1) **Thread End Point (LH Parallel, Major drops to trigger)**

Find the position of the last relevant crest point before dropping below the trigger diameter on the selected side of the zone (right/left) for a left hand parallel thread. The selected zone must contain upper and lower zones until the end of the thread ! It is possible to increase the precision by augmenting the 'Number of Hits / 360' (2-24) in the 'Zone properties'. The number of scans will be less than or equal to the required number of pitches through 360 degrees.



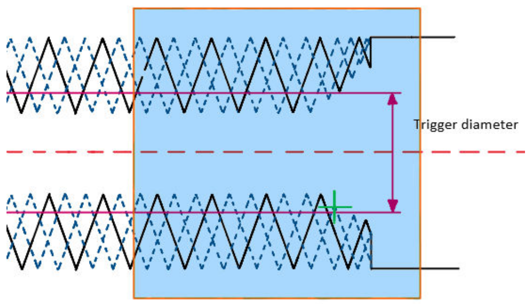
(1) **Thread End Point (RH Parallel, Minor raises to trigger)**

Find the position of the last relevant crest point before raising above the trigger diameter on the selected side of the zone (right/left) for a right hand parallel thread. The selected zone must contain upper and lower zones until the end of the thread ! It is possible to increase the precision by augmenting the 'Number of Hits / 360' (2-24) in the 'Zone properties'. The number of scans will be less than or equal to the required number of pitches through 360 degrees.



(1) **Thread End Point (LH Parallel, Minor raises to trigger)**

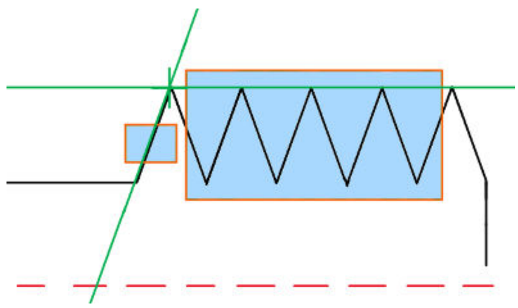
Find the position of the last relevant crest point before raising above the trigger diameter on the selected side of the zone (right/left) for a left hand parallel thread. The selected zone must contain upper and lower zones until the end of the thread ! It is possible to increase the precision by augmenting the 'Number of Hits / 360' (2-24) in the 'Zone properties'. The number of scans will be less than or equal to the required number of pitches through 360 degrees.

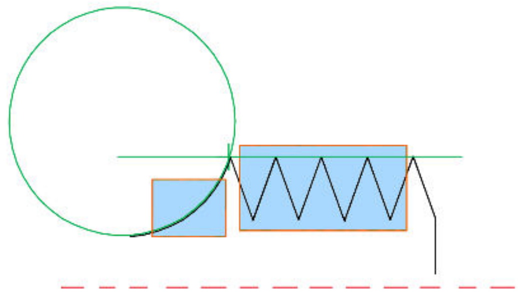
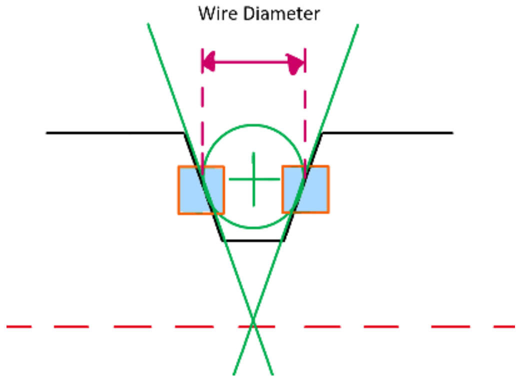
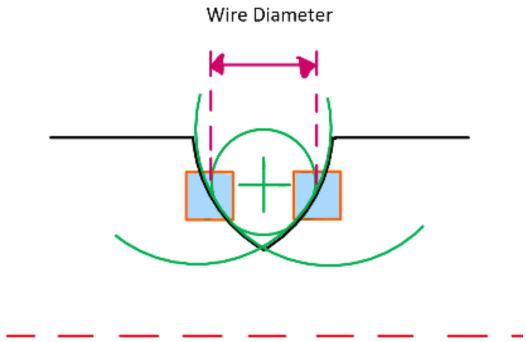
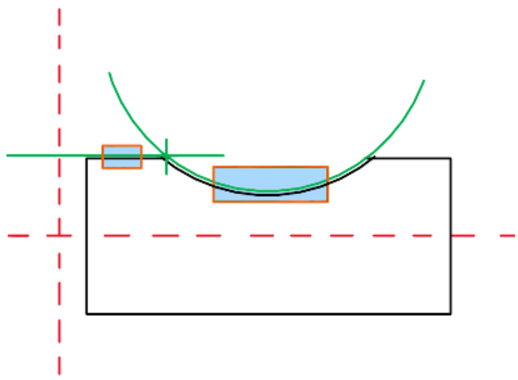


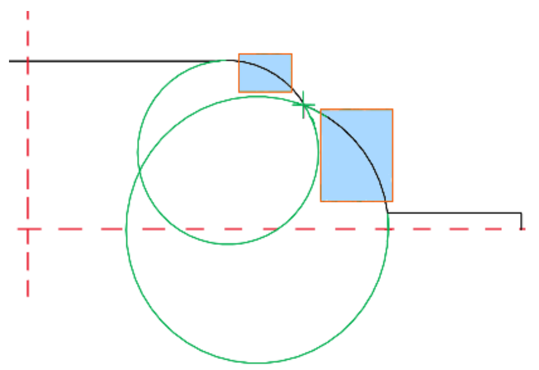
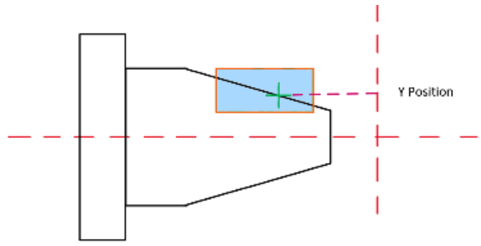
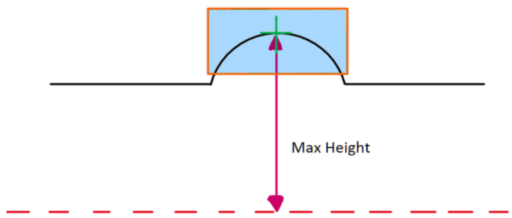
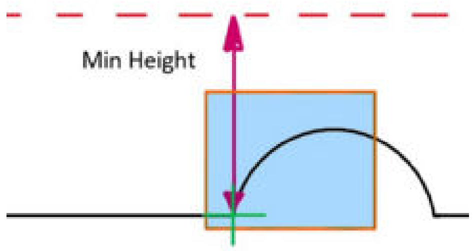
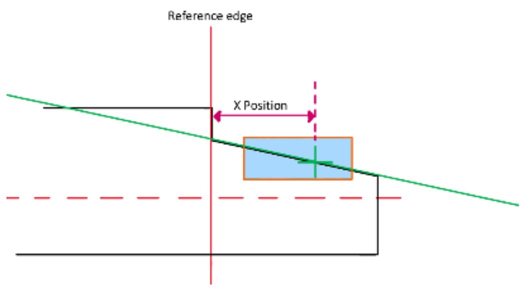
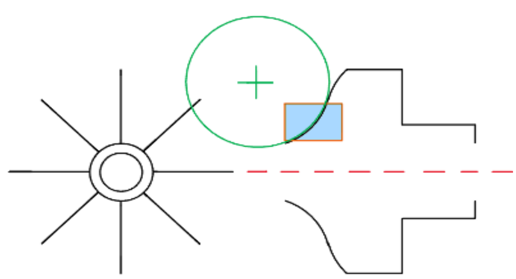
Thread Line Intersection

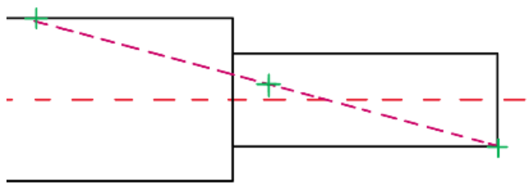
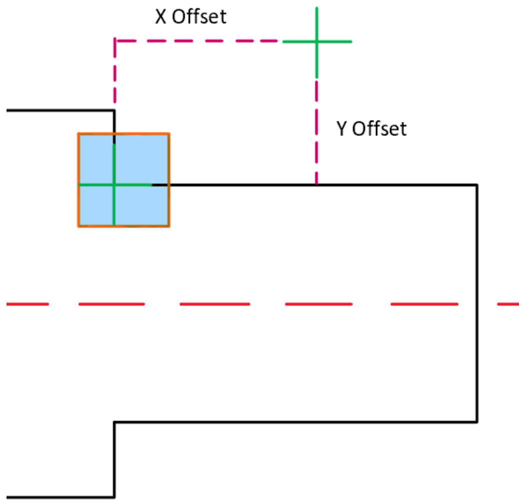
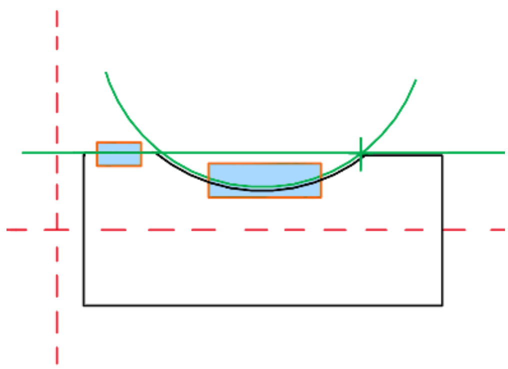
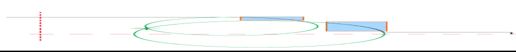
Position of an intersection of a line and a thread. Two zones must be defined on the upper surface of the part. The first zone will calculate a best fit line through the peaks of the thread form, while the second zone will apply a best fit line through the line form data. The point location is calculated as the X and Y coordinates of the intersection.

Note : It is important that the zones are defined in the correct order.



Thread Radius Intersection	
Position of an intersection of a radius and a thread. Two zones must be defined on the upper surface of the part. The first zone will calculate a best fit line through the peaks of the thread form, while the second zone will apply a best fit circle to the data. The point location is calculated as the X and Y coordinates of the intersection. **Note :** It is important that the zones are defined in the correct order.	
Wire Centre (2 x Lines)	
Point location of a best fit theoretical wire to straight flanks. Two zones must be defined on the upper surface of the part. Each zone has a best fit line applied to the data. Finally a best fit circle representing the user specified wire diameter is fit between the two best fit lines. The X and Y coordinates of the centre of the best fit wire is used as the point position. In cases where the best fit lines do not intersect, or, a best fit circle of the size specified cannot be fit, the error message "Measurement Zone(s) not suitable for Feature Type" will be displayed, and the zones removed from the schematic.	
Wire Centre (2 x Radii)	
Point location of a best fit theoretical wire to curved flanks. Two zones must be defined on the upper surface of the part. Each zone has a best fit circle applied to the data. Finally, a best fit circle representing the user specified wire diameter is fit between the two best fit circles. The X and Y coordinates of the centre of the best fit wire is used as the point position. In cases where the best fit radii do not intersect, or, the best fit wire cannot be fit, the error message "Measurement Zone(s) not suitable for Feature Type" will be displayed, and the zones removed from the schematic.	
Line-Radius Intersection	
Position of an intersection of a line and a non-blending radius. To calculate an intersection point, two zones must be defined on the part surface. The first zone will have a best fit line applied to the data seen within, while the second zone will have a best fit circle applied to the data. It is important to define the zones in the correct order. The X and Y coordinates of the first intersection point is calculated and used as the point position. **Note:** A line will intersect the best fit circle in two locations. We always report the intersect point that appears closest to the centre of the two defined measurement zones. If the best fit circle and best fit line do not intersect, the error message "No intersection found between line and circle" will be displayed.	
Radius - Radius Intersection	
Position of the intersection point of 2 radii. To calculate the intersection point, two measurement zones must be located	

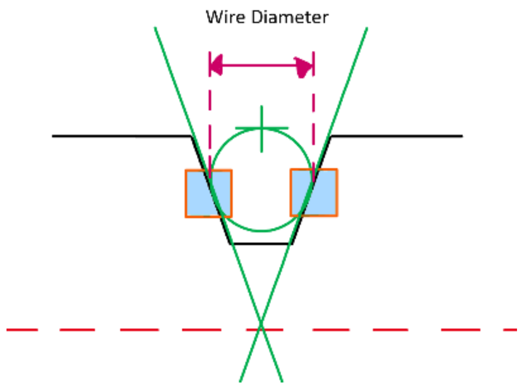
within the two defined circles. The calculated X and Y coordinates of the closest intersection point will match that of the point.	
Fixed Height	
Fixed Height To define any edge of this type, a value based on the axis of the part (Y Position) should be entered by the operator. The point is defined through the intersection of the virtual line at the given distance with the Line/Curve/Radius seen within the part section to be measured. The user should indicate the surface type ('Line'/'Curve'/'Radius') in the 'Measurement' window.	
Max Height and Rotational Max Height	
Max Height: Position of a maximum height. A zone is defined across the upper surface of the part section to be measured. The software then detects the highest point as the measurement zone is scanned. **Rotational Max Height:** use same calculation as Max Height on several rotational positions ("Number of Axial Hits" parameter)	
Min Height	
Min Height: Position of a minimum height. A zone is defined across the lower surface of the part section to be measured. The software then detects the lowest point as the measurement zone is scanned. **Rotational Min Height:** use same calculation as Min Height on several rotational positions ("Number of Axial Hits" parameter)	
At X	
Calculates the position of a tapered part section, relative to the current part axis, at a specified distance from the machine datum position or reference edge. **Note :** When an edge is used as the reference, a negative value for X will look to the left of the reference edge position, a positive X value will look to the right of the reference edge position.	
Radius Centre (Turbine)	
A zone is defined on the profile of the radius. The best fit circle is used to calculate the X and Y coordinates of the centre of this circle. The 'Number of Axial Hits' should be indicated in the measurement properties. To determine the best fit circle, the algorithm will look at the data of each blade of the turbine (set 'Number of Interruptions'	

parameter in 'Measurements' window), by rotating the measurement zone around the Y=0 axis (centreline). The user needs to specify a 'Surface type' parameter in the 'Measurement' window to let the algorithm know if the interruptions are of type 'Constant (All Points)', 'Constant (Average Points)' or 'Pointed'. If you select a 'Constant' type, you need to set the '% of Surface' parameter too. This parameter gives the percentage of the zone you want to look at (e.g. if each blade is constant on a range of 18° and the turbine is made of 5 blades, the '% of Surface' needs to be set to 25% (5*18*100 / 360)). Then, the algorithm will look at each blade surface data to determine the turbine best fit circle and find its centre. **Constant** refers to a constant diameter section between the actual surface interruptions. The algorithm detects the interruptions on the surface and ignores them, using just the constant diameter sections. The difference between 'Constant (All Points)' and 'Constant (Average Points)' is that one calculates an average for each blade as the other keeps every single point. **Pointed** refers to a part profile similar to that of a machine cutter which has raised sections of data. The algorithm uses only the raised sections of data.	
Midpoint	
The midpoint value between two selected position measurements. Similar to the 'Midpoint' edge option, it is possible to generate a position at the centre of two previously defined point measurements. Simply select the 'Midpoint' option from the Point menu and click on the two point labels you wish to use to determine the midpoint position.	
Offset	
This option is used to create a theoretical position from a defined point. Related value can either be positive or negative.	
Line-Radius Intersection (far point)	
Position of an intersection of a line and a non-blending radius. To calculate an intersection point, two zones must be defined on the part surface. The first zone will have a best fit line applied to the data seen within, while the second zone will have a best fit circle applied to the data. It is important to define the zones in the correct order. The X and Y coordinates of the second intersection point is calculated and used as the point position. **Note** : If the best fit circle and best fit line do not intersect, the error message "No intersection found between line and circle" will be displayed.	
Radius-Radius Intersection (far point)	

Position of the intersection point of 2 radii. To calculate the intersection point, two measurement zones must be located within the two defined circles. The calculated X and Y coordinates of the furthest intersection point will match that of the point.

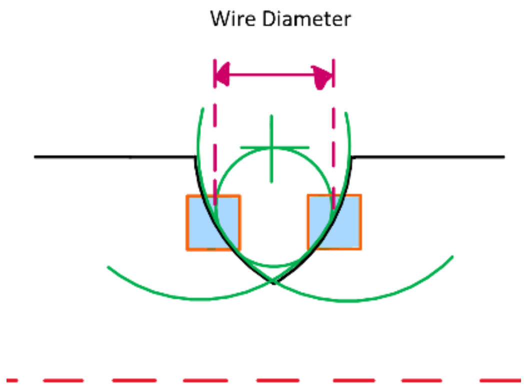
Over Wire (2 x Lines)

Point location of a best fit theoretical wire within straight flanks. Two zones must be defined on the upper surface of the part. Each zone has a best fit line applied to the data points.
Finally, a best fit circle representing the user specified wire diameter is fit between the two best fit lines. The X and Y coordinates of the upper point of the best fit wire is used as the point position. In cases the best fit lines do not intersect, or, a best fit circle of the size specified cannot be fit, the error message "Measurement Zone(s) not suitable for Feature Type" will be displayed.



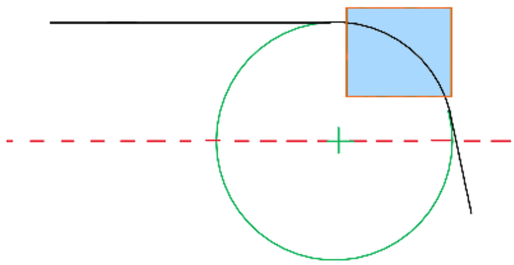
Over Wire (2 x Radii)

Point location of a best fit theoretical wire to curved flanks. Two zones must be defined on the upper surface of the part. Each zone has a best fit circle applied to the data. Finally, a best fit circle representing the user specified wire diameter is fit between the two best fit circles. The X and Y coordinates of the upper point of the best fit wire is used as the point position. In cases where the best fit radii do not intersect, or, the best fit wire cannot be fit, the error message "Measurement Zone(s) not suitable for Feature Type" will be displayed.



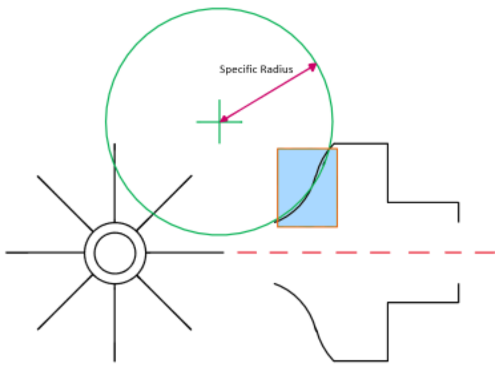
Centre of Nominal Radius

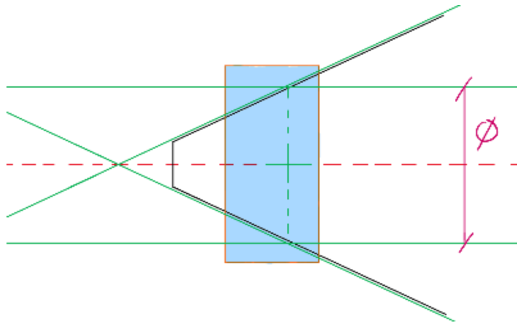
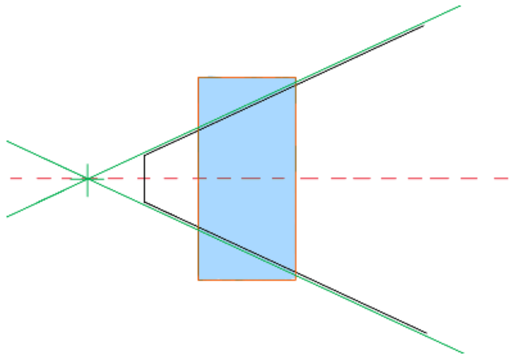
Position of the centre of a best fit circle with a specific radius applied to the data. The Nominal 'Radius' parameter must be specified by the user in the 'Measurements' window.



Centre of Nominal Radius (Turbine)

A zone is defined on the profile of the radius. A best fit circle with a specific radius applied to the data is used to calculate the X and Y coordinates of the centre of this circle. The 'Number of Axial Hits' should be indicated in the 'Zone properties' along with the Nominal 'Radius' ('Measurements' window).
To determine the best fit circle, the algorithm will look at the data of each blade of the turbine (set 'Number of Interruptions' parameter in 'Measurements' window), by rotating the measurement zone around the Y=0 axis (centreline). The user needs to specify a 'Surface type' parameter in the 'Measurement' window to let the algorithm know if the interruptions are of type 'Constant (All Points)', 'Constant (Average Points)' or 'Pointed'. If you select a 'Constant' type, you need to set the '% of Surface' parameter too. This parameter gives the percentage of the zone you want to look at (e.g. if each blade is constant on a range of 18° and the turbine is made of 5 blades, the '% of Surface' needs to be set to 25% (5*18*100 / 360)). Then, the algorithm will look at each blade surface data to determine the turbine best fit circle



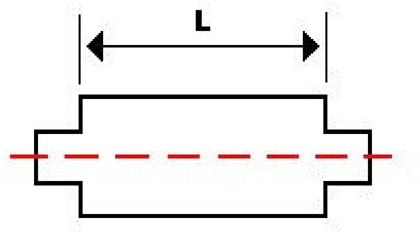
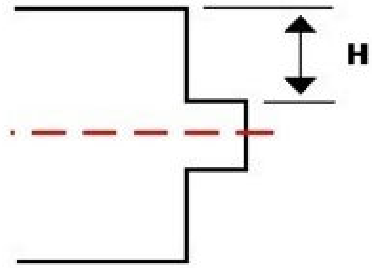
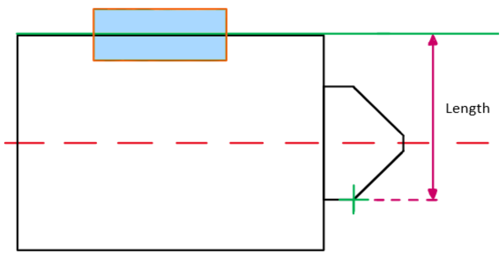
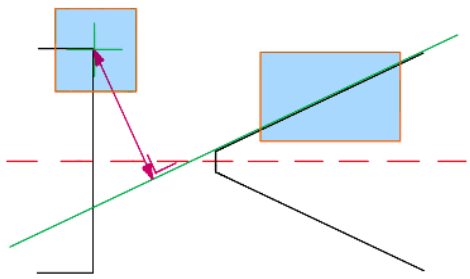
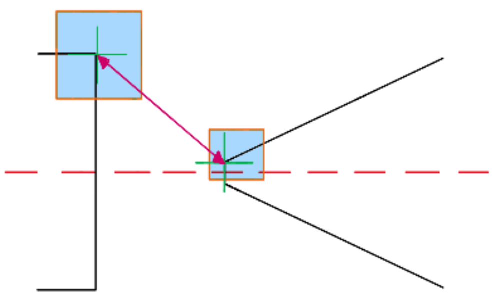
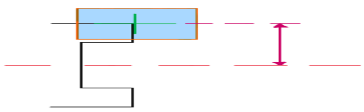
and find its centre. **Constant** refers to a constant diameter section between the actual surface interruptions. The algorithm detects the interruptions on the surface and ignores them, using just the constant diameter sections. The difference between 'Constant (All Points)' and 'Constant (Average Points)' is that one calculates an average for each blade as the other keeps every single point. **Pointed** refers to a part profile similar to that of a machine cutter which has raised sections of data. The algorithm uses only the raised sections of data.	
Gauge Diameter (cone)	
Position of the median point at a specified diameter of a gauge. The 'Diameter' parameter must be defined in the 'Measurements' window.	
Cone tip	
Position of a cone tip. A zone including the upper and lower side of a cone needs to be selected. **Note :** to increase the precision of the measure, the zone has to be as large as possible.	

Length 

This option selects the LENGTH measurement feature

The length features available are as follows :

- Length X
- Length Y
- Distance (Line-Point)
- Nearest on line
- Distance (Point-Point)
- Distance (Point-Axis)

Length X Lengths are defined between any two [edges](). The distance (in X) between the two edge locations is calculated.	
Length Y Lengths are defined between any two [heights](). The distance (in Y) between the two height locations is calculated.	
Distance (Line-Point) This length is defined at an angle of 90 degrees to the data point and the line.	
Nearest on line Find the perpendicular projection of a selected point on a line. **Note :** this Point sub feature is created at the same time as the Length : Distance (Line-Point) feature.	
Distance (Point-Point) This length is defined as the absolute distance between two selected points.	
Distance (Point-Axis) Find the distance between the point and its perpendicular projection	

to the part axis. You just need to select one point, the part axis being taken by default. It is possible to change this axis in the 'Zone properties' window ('Centre-line' box).	

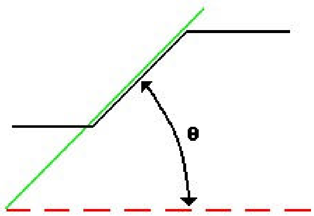
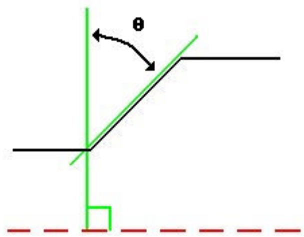
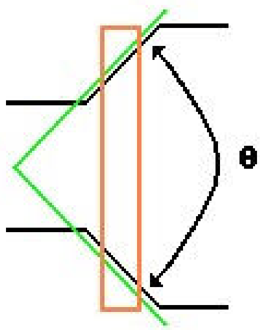
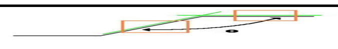
Related Topics

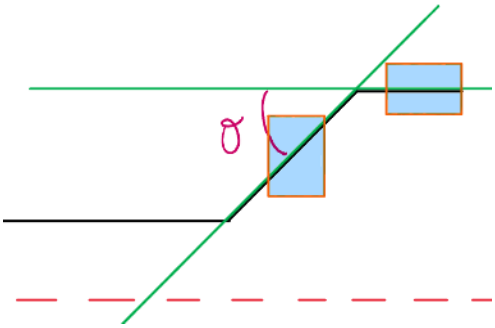
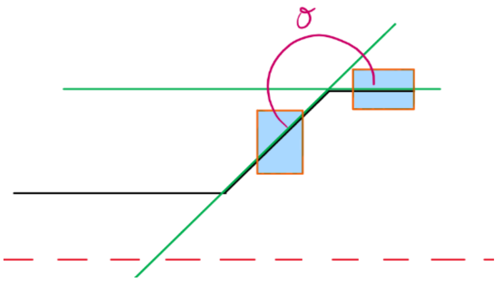
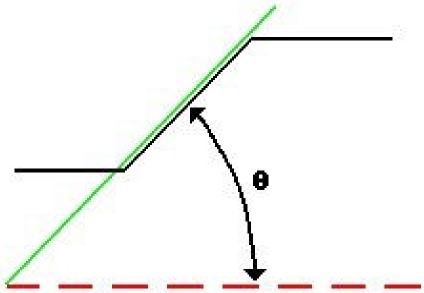
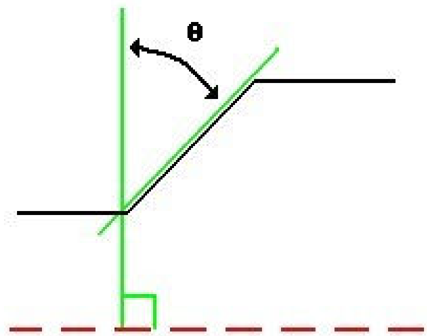
Angle 

This option selects the ANGLE measurement feature

The angle features available are as follows :

- Line To HorizontalAxis
- Line To VerticalAxis
- Line - Line Intersection
  - Line-Line Intersection
  - Complement Line-Line Intersection
  - Supplement Line-Line Intersection
- Included
- Average Line To Axis (legacy)
  - Line-Axis Horizontal
  - Line-Axis Vertical

Line To Horizontal Axis Angle of any line to the part axis (Centre-Line). You can either draw a zone on the surface of the part to select its average line, or select an already existing line measurement in your drawing (e.g. Tangent line or Point-Point line,..)	
Line To Vertical Axis Angle of any line relative to a theoretical plane perpendicular to the part axis. You can either draw a zone on the surface of the part to select its average line, or select an already existing line measurement in your drawing (e.g. Tangent line or Point-Point line,..)	
Included Included angle of two surfaces of the component. The measurement zone should cover both upper and lower surface of the part section to be measured.	
Line-Line Intersection	

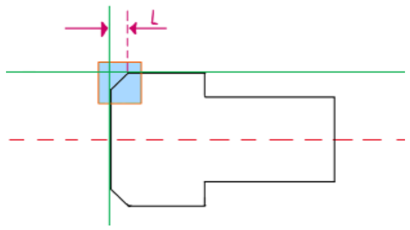
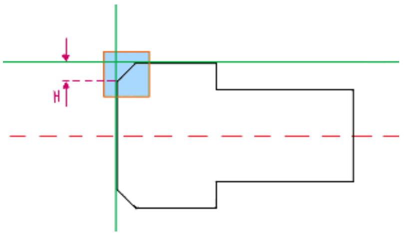
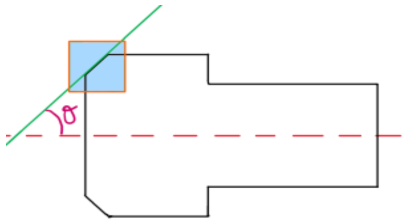
Two zones must be defined on the part surface. Best Fit lines are applied to each zone, and the angle between the two best-fit lines is calculated.	
Complement Line-Line Intersection Complement angle of two surfaces of the component. A best fitted line is created for both selected zones to calculate the angle.	
Supplement Line-Line Intersection Supplement angle of two surfaces of the component. A best fitted line is created for both selected zones to calculate the angle.	
Line-Axis Horizontal (legacy) Angle of a surface of the component to the part axis (Centre-Line).	
Line-Axis Vertical (legacy) Angle of a surface of the component relative to a theoretical plane perpendicular to the part axis.	

Chamfer

The function automatically defines the lines and points of intersection, which determine the axial and radial length as well as the angle of the chamfer.

The chamfer features available are as follows :

- Chamfer Length
- Chamfer Depth
- Chamfer Angle Horizontal Origin

<table>
<tr><td>Chamfer Length</td><td rowspan="2">
</td></tr>
<tr><td>The length of a chamfer is defined relative to the machine axis, parallel to this axis.</td></tr>
<tr><td>Chamfer Depth</td><td rowspan="2">
</td></tr>
<tr><td>The depth of a chamfer is defined relative to the machine axis, at right angle to this axis.</td></tr>
<tr><td>Chamfer Angle Horizontal Origin</td><td rowspan="2"></td></tr>
<tr><td>The angle horizontal origin of a chamfer is defined relative to the machine axis. It is the angle between the best fit line of the chamfer and the machine axis.</td></tr>
</table>

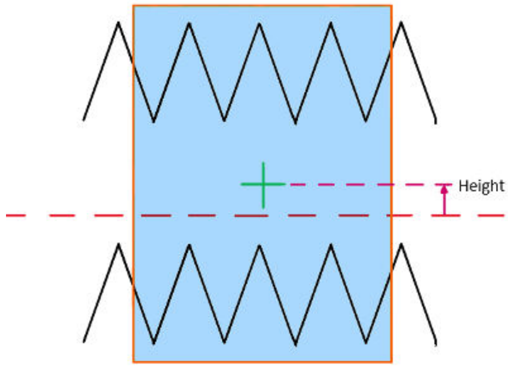
Height 

This option selects the HEIGHT measurement feature

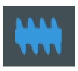
The height measurement features have a dual purpose. They can be used simply as 'markers' to allow for the definition of a depth measurement (similar to edges and lengths), or they can be used to output the distance of the part surface to the current part axis.

The height features available are as follows :

- Thread Centre

Thread Centre	
This option is used to create the theoretical height of the centre of a thread.	

Related Topics

Thread 

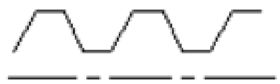
This option selects the THREAD Measurement feature

The thread features available will vary depending upon the gauge hardware.
For gauges with the tilt mechanism fitted, the features available will be as follows :

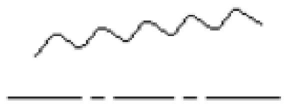
Parallel :

RH Parallel	Measurement of a right hand parallel thread statically.	
LH Parallel	Measurement of a left hand parallel thread statically.	
RH Parallel (Dynamic)	Measurement of a right hand parallel thread dynamically.	
LH Parallel (Dynamic)	Measurement of a left hand parallel thread dynamically.	

Worm :

RH Worm	Measurement of a right hand worm thread statically.	
LH Worm	Measurement of a left hand worm thread statically.	
RH Worm (Dynamic)	Measurement of a right hand worm thread dynamically.	
LH Worm (Dynamic)	Measurement of a left hand worm thread dynamically.	

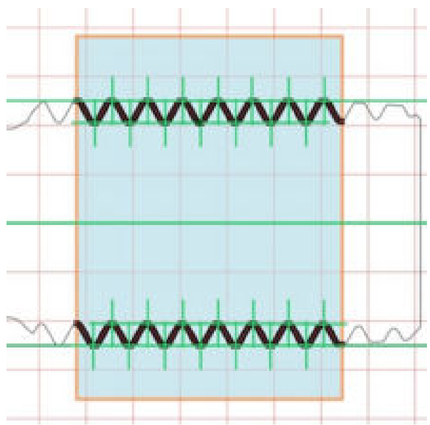
Taper :

RH Taper	Measurement of a right hand taper thread.	
LH Taper	Measurement of a left hand taper thread.	

Cylindricity :

RH Cylindricity	Measurement of the cylindricity of the pitch diameter of a right hand parallel form thread (e.g. V form, Worm thread, ...). **Note** : It is recommended to set the 'Number of Hits / 360' parameter ('Zone properties') to a value higher than 2 (e.g. 12).
LH Cylindricity	Measurement of the cylindricity of the pitch diameter of a left hand parallel form thread (e.g. V form, Worm thread, ...).. **Note** : It is recommended to set the 'Number of Hits / 360' parameter ('Zone properties') to a value higher than 2 (e.g. 12).

Crest and Root diameters :

Minimum Root	Minimum minor diameter, based on the minimum value measured at each pitch root of the thread	
Maximum Root	Maximum minor diameter, based on the maximum value measured at each pitch root of the thread	
Minimum Crest	Minimum major diameter, based on the minimum value measured at each pitch crest of the thread	
Maximum Crest	Maximum major diameter, based on the maximum value measured at each pitch crest of the thread	

For gauges without the tilt mechanism fitted, the features available will be as follows :

Parallel	Measurement of a Parallel thread (either RH or LH) using software compensation.
Taper	Measurement of a Taper thread (either RH or LH) using software compensation.

Parallel Threads

Parallel vee form threads can be measured with flank angles between 50 and 70 degrees.

For machines fitted with a tilt mechanism, the thread will be scanned, tilted at its helix angle, enabling the system to see the true thread form.

For machines without a tilt mechanism the thread feature dimensions will be calculated using software compensation.

Defining Thread Measurement Zones :

It is recommended that the zone width for a thread feature must contain at least 2.5 thread pitches for the algorithm to successfully calculate thread features. It is recommended that as many pitches are included as possible (within reason) to give the best results.

Machines fitted with a tilt mechanism

Available Static features :

- RH Parallel
- LH Parallel

The following thread sub-features can be measured :

Pitch Diameter	Diameter of a theoretical cylinder that passes through the threads in such a position that the widths of the thread ridges and grooves are equal in dimension.
Diameter Over Wire	Define the over wire diameter nearest to the theoretical value against their respective surfaces. This function can only be enabled on machines fitted with the tilt mechanism.
Pitch	Separation between the two intercepts of the nominal pitch diameter on like flanks.
Major Diameter	Maximum diameter of the thread profile.
Minor Diameter	Minimum diameter of the thread profile. This function can only be enabled on machines fitted with the tilt mechanism.
Left Flank Angle	The average value of the left flank angle perpendicular to the thread axis.
Right Flank Angle	The average value of the right flank angle perpendicular to the thread axis.
Root Radius	The Radius at the root of the thread profile. This function can only be enabled on machines fitted with the tilt mechanism.
Crest Radius	The radius at the crest of the thread profile. This function can only be enabled on machines fitted with the tilt mechanism.
Taper Error	The difference in pitch diameter over the length of engagement. This function can only be enabled on machines fitted with the tilt mechanism.
Lead Error	The calculated deviation between the distance X1 X2 and the nominal size. X1 X2 are two points where the pitch diameter line intersects the first full thread flanks, one at each end of the measurement zone at the same thread helix.

	This function can only be enabled on machines fitted with the tilt mechanism.
Flank Form Deviation	Calculates and displays the form error of a thread resulting from a shock or dust on one or several thread flanks.

Available Dynamic features :

- RH Parallel (Dynamic)
- LH Parallel (Dynamic)
- RH Parallel (Thread End, Major below trigger)
- LH Parallel (Thread End, Major below trigger)
- RH Parallel (Thread End, Minor above trigger)
- LH Parallel (Thread End, Minor above trigger)

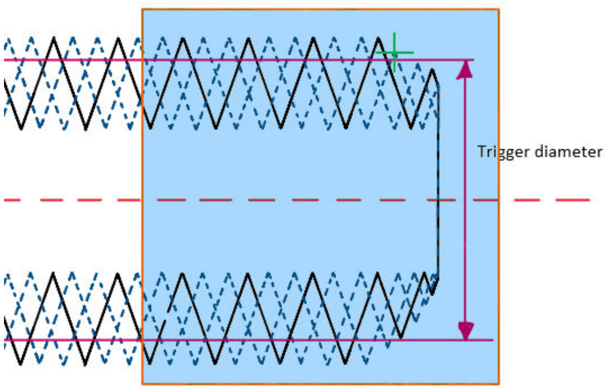
The following thread sub-features can be measured :

In the 'RH Parallel (Dynamic)' or 'LH Parallel (Dynamic)' Menu :

Average Pitch Diameter	Diameter of a theoretical cylinder that passes through the threads in such a position that the widths of the thread ridges and grooves are equal in dimension.
Average Diameter Over Wire	Define the over wire diameter nearest to the theoretical value against their respective surfaces. This function can only be enabled on machines fitted with the tilt mechanism.
Average Pitch	Separation between the two intercepts of the nominal pitch diameter on like flanks.
Average Major Diameter	Maximum diameter of the thread profile.
Average Minor Diameter	Minimum diameter of the thread profile. This function can only be enabled on machines fitted with the tilt mechanism.
Average Left Flank Angle	The average value of the left flank angle perpendicular to the thread axis.
Average Right Flank Angle	The average value of the right flank angle perpendicular to the thread axis.
Average Root Radius	The Radius at the root of the thread profile. This function can only be enabled on machines fitted with the tilt mechanism.
Average Crest Radius	The radius at the crest of the thread profile. This function can only be enabled on machines fitted with the tilt mechanism.
Average Taper Error	The difference in pitch diameter over the length of engagement. This function can only be enabled on machines fitted with the tilt mechanism.
Average Lead Error	The calculated deviation between the distance X1 X2 and the nominal size. X1 X2 are two points where the pitch diameter line intersects the first full thread flanks, one at each end of the measurement zone at the same thread helix. This function can only be enabled on machines fitted with the tilt mechanism.

<table>
<tr><td>Runout (PItch Diameter)</td><td>Run out is based on the current centre-line, and is calculated from variations in Pitch Diameter.
Note : It is recommended to set the 'Number of Hits / 360' parameter ('Zone properties') to a value higher than 2 (e.g. 12).</td></tr>
<tr><td>Circularity</td><td>The calculated ovality of the Pitch Diameter.
This function can only be enabled on machines fitted with the tilt mechanism.
Note : It is recommended to set the 'Number of Hits / 360' parameter ('Zone properties') to a value higher than 2 (e.g. 12).</td></tr>
<tr><td>Functional Diameter</td><td>The calculated effective diameter of the thread compensating for pitch and/or flank angle errors.
This function can only be enabled on machines fitted with the tilt mechanism.
Note : It is recommended to set the 'Number of Hits / 360' parameter ('Zone properties') to a value higher than 2 (e.g. 12).</td></tr>
<tr><td>Average Flank Form Deviation</td><td>Calculates and displays the form error of a thread resulting from a shock or dust on one or several thread flanks.</td></tr>
</table>

In the'RH/LH Parallel (Thread End, Major/Minor drops/raises to trigger)' Menu :

<table>
<tr><td>Thread End Point</td><td>Find the position of the last relevant crest point before raising/dropping above/below the trigger diameter on the selected side of the zone (right/left). The selected zone must contain upper and lower zones until the end of the thread ! It is possible to increase the precision by augmenting the 'Number of Hits / 360' (2-24) in the 'Zone properties'. The number of scans will be less than or equal to the required number of pitches through 360 degrees.</td><td rowspan="2">
</td></tr>
<tr><td>Thread End Angle</td><td>Find the angular position of the last relevant crest point before raising/dropping above/below the trigger diameter on the selected side of the zone (right/left). The selected zone must contain upper and lower zones until the end of the thread ! It is possible to increase the precision by augmenting the 'Number of Hits / 360' (2-24) in the 'Zone properties'. The number of scans will be less than or equal to the required number of pitches through 360 degrees.</td></tr>
</table>

Machines fitted without a tilt mechanism

Available features :

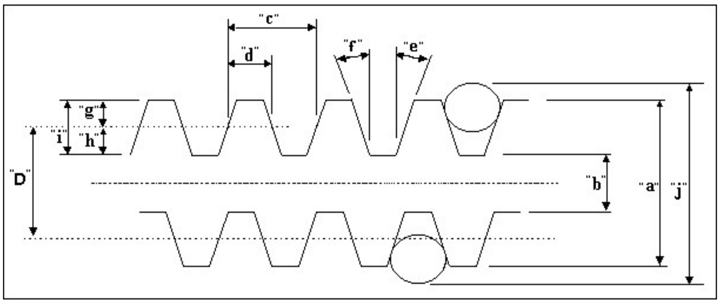
- Parallel

The following thread sub-features can be measured :

Pitch Diameter	Diameter of a theoretical cylinder that passes through the threads in such a position that the widths of the thread ridges and grooves are equal in dimension.
Pitch	Separation between the two intercepts of the nominal pitch diameter on like flanks.
Major Diameter	Maximum diameter of the thread profile.
Left Flank Angle	The average value of the left flank angle perpendicular to the thread axis.
Right Flank Angle	The average value of the right flank angle perpendicular to the thread axis.
Flank Form Deviation	Calculates and displays the form error of a thread resulting from a shock or dust on one or several thread flanks.

Worm Threads

The Profile machine is capable of measuring worm threads on gauges with 'tilt' hardware. The following features can be determined :



Defining Thread Measurement Zones :

It is recommended that the zone width for a thread feature must contain at least 2.5 thread pitches for the algorithm to successfully calculate thread features. It is recommended that as many pitches are included as possible (within reason) to give the best results.

Available features :

- RH Worm
- LH Worm
- RH Worm (Dynamic)
- LH Worm (Dynamic)

The following thread sub-features can be measured Statically (RH Worm and LH Worm) :

"a"	**Major Diameter**	Maximum diameter of the thread profile.
"b"	**Minor Diameter**	Minimum diameter of the thread profile.
"c"	**Axial Pitch**	Separation between the 2 intercepts of the nominal pitch diameter on like flanks.
"d"	**Tooth Thickness**	Separation between the 2 intercepts of the nominal pitch diameter on the opposite flanks on a single tooth.
"e"	**Left Pressure Angles**	Left tooth angle measured relative to a plane perpendicular to the thread axis.
"f"	**Right Pressure Angles**	Right tooth angle measured relative to a plane perpendicular to the thread axis.
"g"	**Addendum**	Radial depth between nominal pitch diameter and thread crest.
"h"	**Dedendum**	Radial depth between nominal pitch diameter and thread root.
"i"	**Thread Depth**	Radial depth of thread.
"j"	**Diameter Over Wires**	This simulates inserting wires of stated diameter such that they rest against the flanks.

	Lead Error	The calculated deviation between the distance X1 X2 and the nominal size. X1 X2 are two points where the pitch diameter line intersects the first full thread flanks, one at each end of the measurement zone at the same thread helix. This function can only be enabled on machines fitted with the tilt mechanism.

The following thread sub-features can be measured Dynamically (RH Worm (Dynamic) and LH Worm (Dynamic)) :

"a"	**Average Major Diameter**	Maximum diameter of the thread profile.
"b"	**Average Minor Diameter**	Minimum diameter of the thread profile.
"c"	**Average Axial Pitch**	Separation between the 2 intercepts of the nominal pitch diameter on similar flanks.
"d"	**Average Tooth Thickness**	Separation between the 2 intercepts of the nominal pitch diameter on the opposite flanks on a single tooth.
"e"	**Average Left Pressure Angles**	Left tooth angle measured relative to a plane perpendicular to the thread axis.
"f"	**Average Right Pressure Angles**	Right tooth angle measured relative to a plane perpendicular to the thread axis.
"g"	**Average Addendum**	Radial depth between nominal pitch diameter and thread crest.
"h"	**Average Dedendum**	Radial depth between nominal pitch diameter and thread root.
"i"	**Average Thread Depth**	Radial depth of thread.
"j"	**Average Diameter Over Wires**	This simulates inserting wires of stated diameter such that they rest against the flanks.
	Average Lead Error	The calculated deviation between the distance X1 X2 and the nominal size. X1 X2 are two points where the pitch diameter line intersects the first full thread flanks, one at each end of the measurement zone at the same thread helix. This function can only be enabled on machines fitted with the tilt mechanism.
	Runout (Major Diameter)	Run out is based on the current centre-line, and is calculated from variations in Major Diameter. **Note** : It is recommended to set the 'Number of Hits / 360' parameter ('Zone properties') to a value higher than 2 (e.g. 12).
	Runout (Pitch Diameter)	Run out is based on the current centre-line, and is calculated from variations in Pitch Diameter. **Note** : It is recommended to set the 'Number of Hits / 360' parameter ('Zone properties') to a value higher than 2 (e.g. 12).
	Runout (Minor Diameter)	Run out is based on the current centre-line, and is calculated from variations in Minor Diameter. **Note** : It is recommended to set the 'Number of Hits / 360' parameter ('Zone properties') to a value higher than 2 (e.g. 12).

Special Notes about Parameter fields for worm threads.

The following parameter fields are specific to worm threads :

Nominal Pitch Diameter defines the reference diameter used for specific worm thread dimensions i.e. tooth thickness. When the measurement parameter window is displayed the cursor defaults to this parameter field, which displays a value of 0.000. The user must then type in the specified size.

Number of Starts defines the number of thread starts, which is important for the calculation of the pitch. The value can be toggled between 1 and 4.

Helix defines the angle to which the machine slide will align in order to view at right angles to the worm profile, when the worm thread is scanned during measurement. The default value is calculated from the scanned profile. This can be modified by typing in a different value.

Note :

The helix angle is calculated as follows :

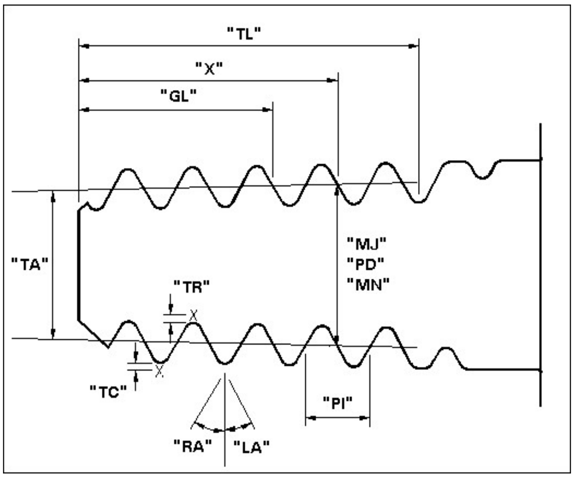
$$\text{ATAN}\,\theta = \frac{\text{Pitch}}{\pi \times \text{Pitch Diameter}}$$

Taper Threads

Taper vee form threads can be measured with flank angles between 50 and 70 degrees.

For machines fitted with a tilt mechanism, the thread will be scanned, tilted at its helix angle, enabling the system to see the true thread form.

For machines without a tilt mechanism the thread feature dimensions will be calculated using software compensation.



Machines fitted with a tilt mechanism

Available features :

- RH Taper
- LH Taper

The following taper thread sub-features can be measured when a tilt mechanism is fitted :

"TA"	**Included Taper Angle**	The included angle of the thread as projected by the pitch diameter.
"GL"	**Gauge length position**	The length at which the pitch diameter has a specified value as defined by the appropriate thread standard.
"TL"	**Last usable root**	The last root point at which the thread profile is still fully formed. An axial scanning process will determine the location of the last full thread form within the measurement zone and output its root point.
"PI"	**Pitch**	The average value of pitch over the complete measuring zone.
"LA"	**Left Flank Angle**	The average value of the left flank angle perpendicular to the thread axis.
"RA"	**Right Flank Angle**	The average value of the right flank angle perpendicular to the thread axis.
"TC"	**Crest Truncation**	The amount by which the actual crest of the thread profile is reduced below the

		theoretical crest height as calculated from the intersection of both flanks.
"TR"	**Root Truncation**	The amount by which the actual root of the thread profile is increased above the theoretical root depth as determined by the intersection of both flanks.
"MJ"	**Major Diameter at "X"**	The maximum diameter of the thread profile at a specified reference plane "X". The reference plane "X" is relative to the reference edge used by the thread feature.
"PD"	**Pitch Diameter at "X"**	The diameter of a theoretical cylinder that passes through the threads in such a position that the widths of the thread ridges and grooves are equal in dimension at a specified reference plane "X". The reference plane "X" is relative to the reference edge used by the thread feature.
"MN"	**Minor Diameter at "X"**	The minimum diameter of the thread profile at a specified reference plane "X". The reference plane "X" is relative to the reference edge used by the thread feature.
	Flank Form Deviation	Calculates and displays the form error of a thread resulting from a shock or dust on one or several thread flanks.

Machines fitted without a tilt mechanism

Available features :

- Taper

The following taper thread sub-features can be measured when a tilt mechanism is not fitted :

"TA"	**Included Taper Angle**	The included angle of the thread as projected by the pitch diameter.
"GL"	**Gauge length position**	The length at which the pitch diameter has a specified value as defined by the appropriate thread standard.
"TL"	**Last usable root**	The last root point at which the thread profile is still fully formed. An axial scanning process will determine the location of the last full thread form within the measurement zone and output its root point.
"PI"	**Pitch**	The average value of pitch over the complete measuring zone.
"LA"	**Left Flank Angle**	The average value of the left flank angle perpendicular to the thread axis.
"RA"	**Right Flank Angle**	The average value of the right flank angle perpendicular to the thread axis.
"TC"	**Crest Truncation**	The amount by which the actual crest of the thread profile is reduced below the theoretical crest height as calculated from the intersection of both flanks.
"MJ"	**Major Diameter at "X"**	The maximum diameter of the thread profile at a specified reference plane "X". The reference plane "X" is relative to the reference edge used by the thread feature.

"PD"	**Pitch Diameter at "X"**	The diameter of a theoretical cylinder that passes through the threads in such a position that the widths of the thread ridges and grooves are equal in dimension at a specified reference plane "X". The reference plane "X" is relative to the reference edge used by the thread feature.
	Flank Form Deviation	Calculates and displays the form error of a thread resulting from a shock or dust on one or several thread flanks

Special Notes on Taper Thread Features :

Special note for Gauge length position :

The Measurement Properties Dialog box for Gauge length position requires additional parameters. Gauge length position determines the axial location of a fixed Pitch Diameter along the taper of the thread. The value of this fixed Diameter that is obtainable from the appropriate thread Standard must be entered in the Diameter parameter field. The other parameter is Measure from which allows the Gauge length position to be measured relative to any edge on the part. Normally, it will be measured relative to the start of the thread and should be set to that edge number. This requires, of course, that this edge is measured before the thread. To ensure that the measuring cycle is performed in this sequence, it is a good idea to set this edge up as a reference edge and to use it as the reference edge for the thread measurement function.

Special note for Usable Thread Length :

Useable Thread Length requires that the part is rotated and checked in different planes to find out where the thread profile changes from a complete form to a reducing form produced by withdrawal of the cutting tool. The operator can choose at which resolution and hence accuracy this is achieved by setting the number of Axial Hits. The default value is 8 hits which provides a resolution of one eighth of the thread pitch. This is adequate for most circumstances where the tolerance on Useable Thread Length is typically 2 x Pitch. However, if needed the resolution can be improved by setting a higher number of Angular Hits. This action will of course increase the measurement time.

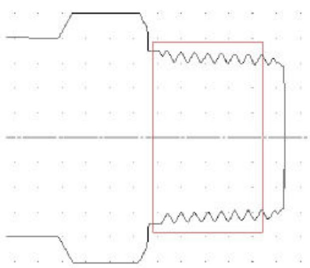
Note : If Useable Thread Length is switched "Off", or if the Number of Axial Hits is set to "0", no rotation of the part will take place.

Special note for Reference Plane 'X' :

The Taper Thread function allows for the measurement of Major, Pitch and Minor diameters at any location along the thread length. This location is defined by entering the distance in the field Reference Plane 'X'. The value entered here is relative to the reference edge number appearing in the main edit window. A negative value will be needed, if the reference plane is between the machine datum and the reference edge.

Special note for Defining Taper Thread Measurement Zones :

For Taper Threads, the chosen measurement zone must conform to certain criteria.



The Measurement Zone should not include chamfers or incomplete thread forms at the start of the thread (smallest diameter). If the Usable Thread length is to be measured, then some of the incomplete thread forms at the larger end of the thread should be included in the zone. If the thread terminates in a flange, as shown in the above illustration, the flange must not be included in the zone.

Correct positioning of the zone may be difficult on a schematic produced from an imported DXF file as the thread profile will not be fully represented. For this reason it is recommended that only schematics obtained by scanning the component are used for programming taper threads.

Form Deviation

This option selects the FORM DEVIATION measurement feature. A profile is the outline of an object in a given plane. The tolerance zone established by the profile of a line is two dimensional extending along the considered feature. Each element of the profile at any cross section must lie between 2 boundaries in relation to a datum plane.

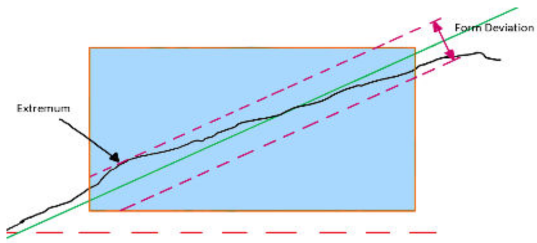
The following deviation types are calculated by locating the data point furthest from the best-fit, or nominated feature. The distance between this data point and the best fit, or nominated feature is doubled to give the 'total' deviation of the surface.

The form deviation features available are as follows :

- Nominal Line
- Best Fit Line
- Nominal Radius
- Best Fit Radius
- Fixed Radius
- Fixed Radius (Turbine)
- Tolerance band range (2D)
- Tolerance band range (fixed)
- Tolerance band range (2D, turbine)
- Tolerance band range (fixed, turbine)
- Nominal Radius (Turbine)
- Best Fit Radius (Turbine)
- Best fit static cone

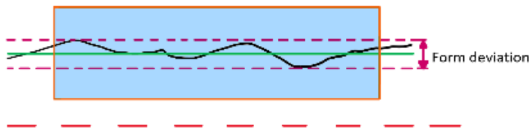
Nominal Line

The operator specifies the angle of a best fit line (relative to the part axis) which is fit to the data seen in the measurement zone. The deviation is calculated relative to this best fit line.



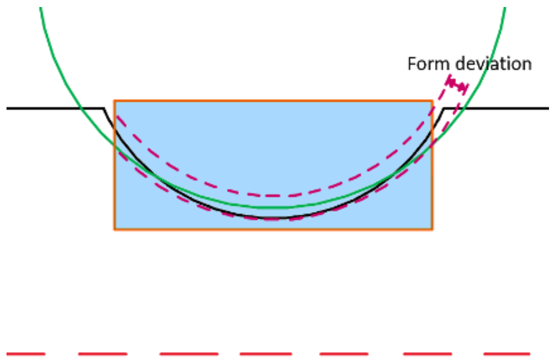
Best Fit Line

A best fit line is applied to the data seen in the measurement zone. The deviation is calculated relative to this best fit line.



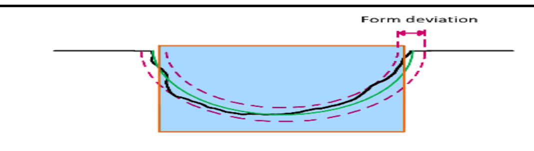
Nominal Radius

The operator specifies the nominal size of the radius in the measurement zone. The deviation is calculated relative to this radius value.



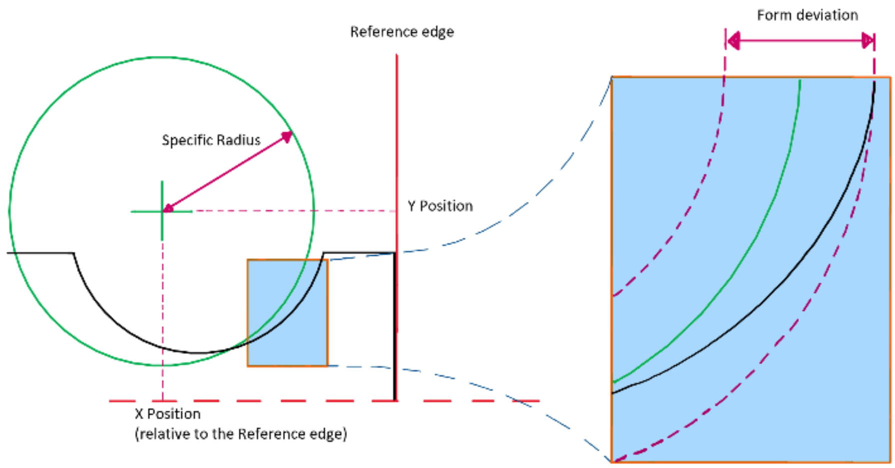
Best Fit Radius

A best fit radius is applied to the data seen in the measurement zone. The deviation is calculated relative to this best fit radius.



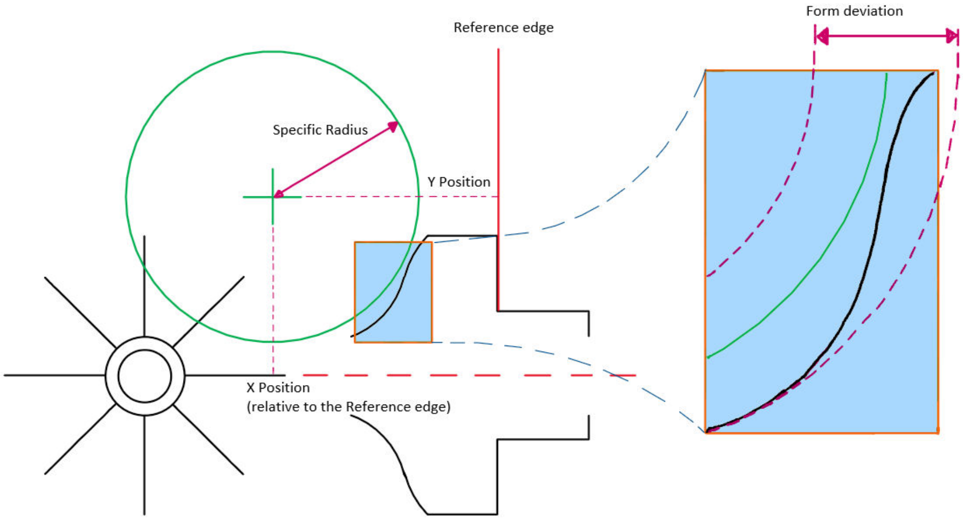
Fixed Radius

The operator specifies the data related to the centre of the radius by entering both X and Y values.
The value of the radius must also be entered.
The deviation of the measured radius relative to the theoretical one is calculated within the chosen measurement zone.
See drawing below.



Fixed Radius (Turbine)

The operator specifies the data related to the centre of the radius by entering both X and Y values. The value of the radius must also be entered as well as the 'Number of Axial Hits'.
The deviation of the measured radius relative to the theoretical one is calculated within the chosen measurement zone.
To determine the deviation, the algorithm will look at the data of each blade of the turbine (set 'Number of Interruptions' parameter in 'Measurements' window), by rotating the measurement zone around the Y=0 axis (centreline). The user needs to specify a 'Surface type' parameter in the 'Measurement' window to let the algorithm know if the interruptions are of type 'Constant (All Points)', 'Constant (Average Points)' or 'Pointed'. If you select a 'Constant' type, you need to set the '% of Surface' parameter too. This parameter gives the percentage of the zone you want to look at (e.g. if each blade is constant on a range of 18° and the turbine is made of 5 blades, the '% of Surface' needs to be set to 25% (5*18*100 / 360)). Then, the algorithm will look at each blade surface data and will calculate the maximum distance to the defined circle. The maximum distance * 2 is equal to the form deviation.
Constant refers to a constant diameter section between the actual surface interruptions. The algorithm detects the interruptions on the surface and ignores them, using just the constant diameter sections. The difference between 'Constant (All Points)' and 'Constant (Average Points)' is that one calculates an average for each blade as the other keeps every single point.
Pointed refers to a part profile similar to that of a machine cutter which has raised sections of data. The algorithm uses only the raised sections of data.
See drawing below.

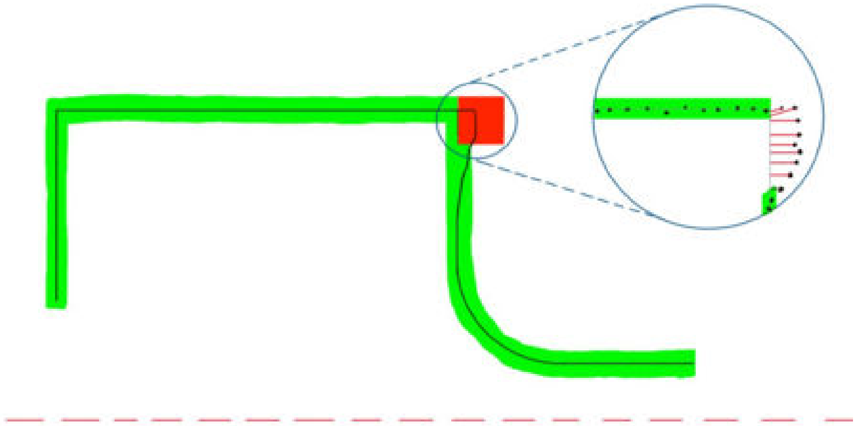


Tolerance band range (2D)

This feature is used to compare the shape of a measured part versus a ‘’perfect’’ part when you don't have any usable references on your drawing. The "perfect" part could be either an imported dxf drawing or a measured part.
The zone of the shape is located **automatically** by the software and a theoretical tolerance envelope is drawn around the measured points. The size of the envelope can be adjusted by the upper tolerance value (USL).The lower tolerance (LSL) is not used. The tolerance band limits will be -USL/2 and +USL/2.
In the 'Measurement' window, you can choose to select the 'Use "Outliers" filter'. The current technique of "filter outliers" could be described as a form of "robust regression" using an "iteratively reweighted least squares technique" (IRLS) .
In summary, this uses a custom weighting function, where points within 3 standard deviations (as determined in the previous iteration) are weighted at 100%, and points outside this are considered with linearly reduced weight, and points outside 5 standard deviations (as determined in the previous iteration) are ignored completely.
The visual output that appears on the Measurement analysis window shows the deviation of each single point that have been measured. The ones that exceed the LSL or USL limit appear in red and the ones that are in the tolerance band appear in green. The 'Visual Expansion' can be adjusted in the upper window with a scroll parameter.
Note : .the auto-alignment on profile process used on this feature takes longer to compute than the 'Tolerance band range (fixed)' process. Therefore, it is recommended to choose the 'Tolerance band range (fixed) when it is possible.
See drawing below.

Tolerance band range (fixed)

This feature is used to compare the shape of a measured part versus a ‘’perfect’’ part. The reference part could be either an imported dxf drawing or a measured part.
The zone of the shape is located thanks to a **reference edge and/or a centreline** (if no references, the zone will always be located at the same absolute position). A theoretical tolerance envelope is drawn around the measured points. The size of the envelope can be adjusted by the upper tolerance value (USL). The lower tolerance (LSL) is not used. The tolerance band limits will be -USL/2 and +USL/2.
In the 'Measurement' window, you can choose to select the 'Use "Outliers" filter'. The current technique of "filter outliers" could be described as a form of "robust regression" using an "iteratively reweighted least squares technique" (IRLS) .
In summary, this uses a custom weighting function, where points within 3 standard deviations (as determined in the previous iteration) are weighted at 100%, and points outside this are considered with linearly reduced weight, and points outside 5 standard deviations (as determined in the previous iteration) are ignored completely.
The visual output that appears on the Measurement analysis window shows the deviation of each single point that have been measured. The ones that exceed the LSL or USL limit appear in red and the ones that are in the tolerance band appear in green. The 'Visual Expansion' can be adjusted in the upper window with a scroll parameter.
See drawing below.



Tolerance band range (2D, turbine)

This feature is used to compare the shape of a measured turbine portion versus a ''perfect'' turbine portion when you don't have any usable references on your drawing. The "perfect" turbine portion could be either an imported dxf drawing or a measured part.
The zone of the shape is located **automatically** by the software and a theoretical tolerance envelope is drawn around the measured points. The size of the envelope can be adjusted by the upper tolerance value (USL). The lower tolerance (LSL) is not used. The tolerance band limits will be -USL/2 and +USL/2.
To determine the deviations, the algorithm will look at the data of each blade of the turbine (set 'Number of Interruptions' parameter in 'Measurements' window), by rotating the measurement zone around the Y=0 axis (centreline). The user needs to specify a 'Surface type' parameter in the 'Measurement' window to let the algorithm know if the interruptions are of type 'Constant (All Points)', 'Constant (Average Points)' or 'Pointed'. If you select a 'Constant' type, you need to set the '% of Surface' parameter too. This parameter gives the percentage of the zone you want to look at (e.g. if each blade is constant on a range of 18° and the turbine is made of 5 blades, the '% of Surface' needs to be set to 25% (5*18*100 / 360)).
Constant refers to a constant diameter section between the actual surface interruptions. The algorithm detects the interruptions on the surface and ignores them, using just the constant diameter sections. The difference between 'Constant (All Points)' and 'Constant (Average Points)' is that one calculates an average for each blade as the other keeps every single point.
Pointed refers to a part profile similar to that of a machine cutter which has raised sections of data. The algorithm uses only the raised sections of data.
In the 'Measurement' window, you can choose to select the 'Use "Outliers" filter'. The current technique of "filter outliers" could be described as a form of "robust regression" using an "iteratively reweighted least squares technique" (IRLS) .
In summary, this uses a custom weighting function, where points within 3 standard deviations (as determined in the previous iteration) are weighted at 100%, and points outside this are considered with linearly reduced weight, and points outside 5 standard deviations (as determined in the previous iteration) are ignored completely.
The visual output that appears on the Measurement analysis window shows the deviation of each single point that have been measured. The ones that exceed the LSL or USL limit appear in red and the ones that are in the tolerance band appear in green. The 'Visual Expansion' can be adjusted in the upper window with a scroll parameter.
Note : .the auto-alignment on profile process used on this feature takes longer to compute than the 'Tolerance band range (fixed, turbine)' process. Therefore, it is recommended to choose the 'Tolerance band range (fixed, turbine) when it is possible.
See drawing below.

Tolerance band range (fixed, turbine)

This feature is used to compare the shape of a measured turbine portion versus a ''perfect'' turbine portion. The reference turbine portion could be either an imported dxf drawing or a measured part.
The zone of the shape is located thanks to a reference edge and/or a centreline (if no references, the zone will always be located at the same absolute position). A theoretical tolerance envelope is drawn around the measured points. The size of the envelope can be adjusted by the upper tolerance value (USL).The lower tolerance (LSL) is not used. The tolerance band limits will be -USL/2 and +USL/2.
To determine the deviations, the algorithm will look at the data of each blade of the turbine (set 'Number of Interruptions' parameter in 'Measurements' window), by rotating the measurement zone around the Y=0 axis (

centreline). The user needs to specify a 'Surface type' parameter in the 'Measurement' window to let the algorithm know if the interruptions are of type 'Constant (All Points)', 'Constant (Average Points)' or 'Pointed'. If you select a 'Constant' type, you need to set the '% of Surface' parameter too. This parameter gives the percentage of the zone you want to look at (e.g. if each blade is constant on a range of 18° and the turbine is made of 5 blades, the '% of Surface' needs to be set to 25% (5*18*100 / 360)).

Constant refers to a constant diameter section between the actual surface interruptions. The algorithm detects the interruptions on the surface and ignores them, using just the constant diameter sections. The difference between 'Constant (All Points)' and 'Constant (Average Points)' is that one calculates an average for each blade as the other keeps every single point.

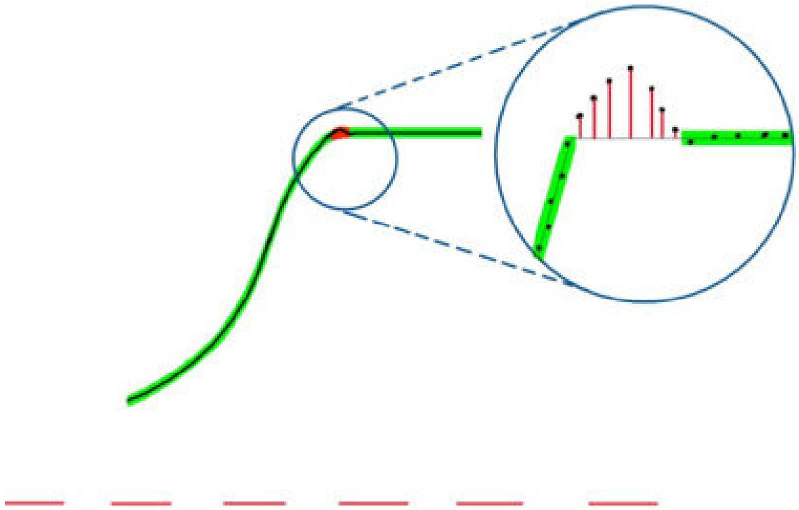
Pointed refers to a part profile similar to that of a machine cutter which has raised sections of data. The algorithm uses only the raised sections of data.

In the 'Measurement' window, you can choose to select the 'Use "Outliers" filter'. The current technique of "filter outliers" could be described as a form of "robust regression" using an "iteratively reweighted least squares technique" (IRLS) .

In summary, this uses a custom weighting function, where points within 3 standard deviations (as determined in the previous iteration) are weighted at 100%, and points outside this are considered with linearly reduced weight, and points outside 5 standard deviations (as determined in the previous iteration) are ignored completely.

The visual output that appears on the Measurement analysis window shows the deviation of each single point that have been measured. The ones that exceed the LSL or USL limit appear in red and the ones that are in the tolerance band appear in green. The 'Visual Expansion' can be adjusted in the upper window with a scroll parameter.

See drawing below.



Nominal Radius (Turbine)

The operator specifies the nominal size of the radius in the measurement zone. The deviation of the measured radius relative to the theoretical one is calculated within the chosen measurement zone for each blade.

The 'Number of Axial Hits' should be indicated in the 'Zone properties'.

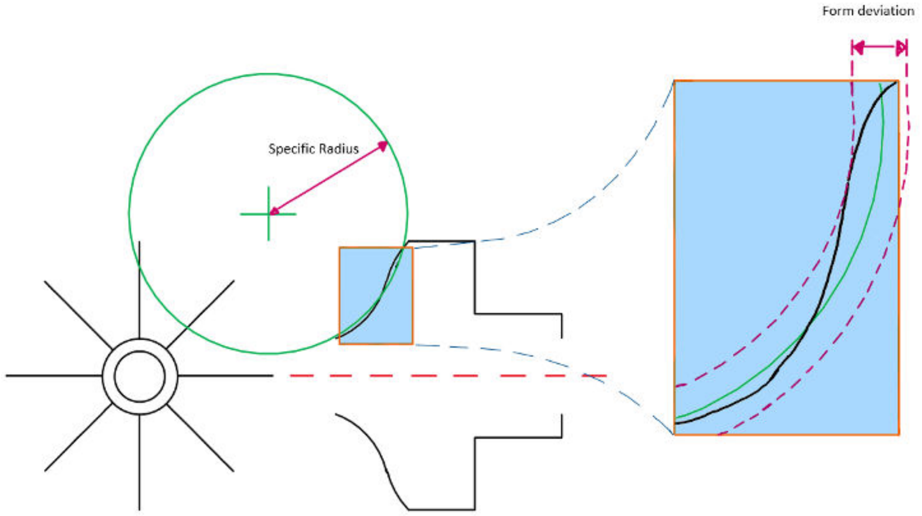
The deviation of the measured radius relative to the theoretical one is calculated within the chosen measurement zone.

To determine the deviation, the algorithm will look at the data of each blade of the turbine (set 'Number of Interruptions' parameter in 'Measurements' window), by rotating the measurement zone around the Y=0 axis (centreline). The user needs to specify a 'Surface type' parameter in the 'Measurement' window to let the algorithm know if the interruptions are of type 'Constant (All Points)', 'Constant (Average Points)' or 'Pointed'. If you select a 'Constant' type, you need to set the '% of Surface' parameter too. This parameter gives the percentage of the zone you want to look at (e.g. if each blade is constant on a range of 18° and the turbine is made of 5 blades, the '% of Surface' needs to be set to 25% (5*18*100 / 360)). Then, the algorithm will look at each blade surface data and will calculate the maximum distance to the defined circle. The maximum distance * 2 is equal to the form deviation.

Constant refers to a constant diameter section between the actual surface interruptions. The algorithm detects the interruptions on the surface and ignores them, using just the constant diameter sections. The difference between 'Constant (All Points)' and 'Constant (Average Points)' is that one calculates an average for each blade as the other keeps every single point.

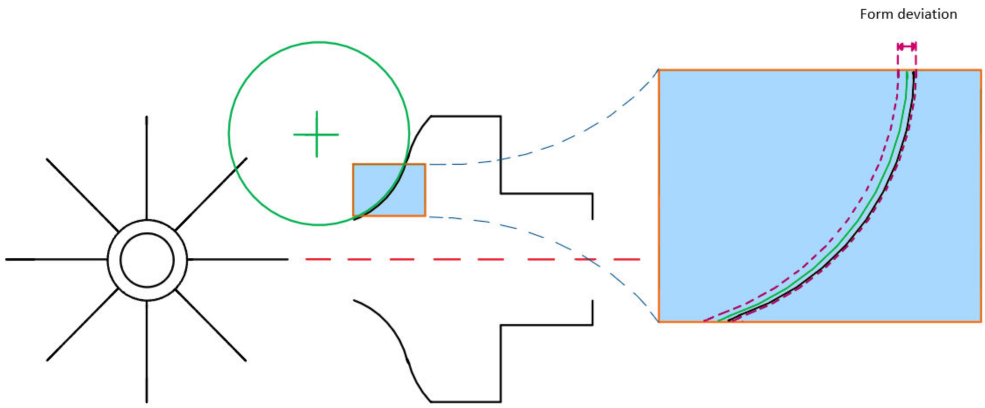
Pointed refers to a part profile similar to that of a machine cutter which has raised sections of data. The algorithm uses

only the raised sections of data.
See drawing below.

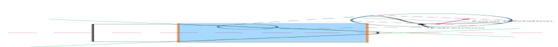


Best Fit Radius (Turbine)

A best fit radius is applied to the data seen in the measurement zone. The deviation of the measured radius relative to the theoretical one is calculated within the chosen measurement zone for each blade.
The 'Number of Axial Hits' should be indicated in the 'Zone properties'.
The deviation of the measured radius relative to the theoretical one is calculated within the chosen measurement zone.
To determine the deviation, the algorithm will look at the data of each blade of the turbine (set 'Number of Interruptions' parameter in 'Measurements' window), by rotating the measurement zone around the Y=0 axis (centreline). The user needs to specify a 'Surface type' parameter in the 'Measurement' window to let the algorithm know if the interruptions are of type 'Constant (All Points)', 'Constant (Average Points)' or 'Pointed'. If you select a 'Constant' type, you need to set the '% of Surface' parameter too. This parameter gives the percentage of the zone you want to look at (e.g. if each blade is constant on a range of 18° and the turbine is made of 5 blades, the '% of Surface' needs to be set to 25% (5*18*100 / 360)). Then, the algorithm will look at each blade surface data and will calculate the maximum distance to the defined circle. The maximum distance * 2 is equal to the form deviation.
Constant refers to a constant diameter section between the actual surface interruptions. The algorithm detects the interruptions on the surface and ignores them, using just the constant diameter sections. The difference between 'Constant (All Points)' and 'Constant (Average Points)' is that one calculates an average for each blade as the other keeps every single point.
Pointed refers to a part profile similar to that of a machine cutter which has raised sections of data. The algorithm uses only the raised sections of data.
See drawing below.



Best fit static cone



A best fit static cone is applied to the data seen in the measurement zone. The deviation is calculated relative to this best fit static cone. The measurement zone should cover both upper and lower surface of the part section to be measured.	

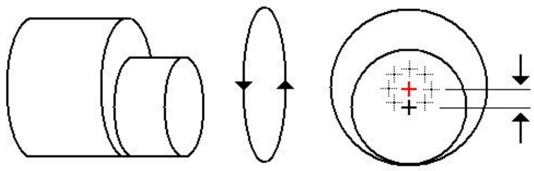
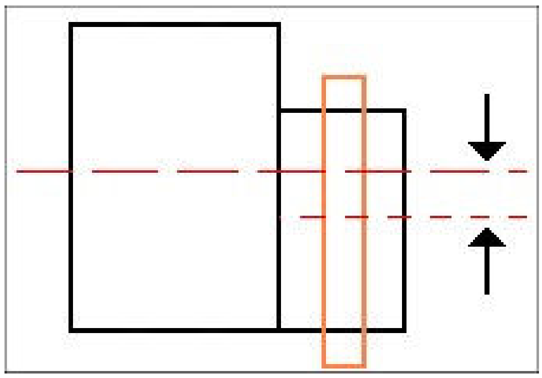
Related Topics

Offset Diameter 

This option selects the OFFSET DIAMETER measurement feature

The features available are as follows :

- Eccentricity
- Symmetry

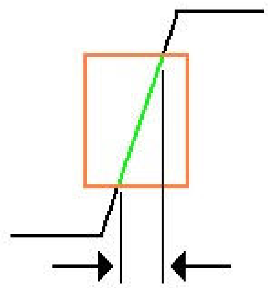
Eccentricity	
The part is rotated 360 degrees within the measurement zone and the midpoints of the upper and lower surfaces of the offset diameter are calculated at each angular position. The largest radial distance between the midpoints and the part centreline is returned as the value for Eccentricity. Eccentricity = Concentricity / 2.	
Symmetry	
The part is scanned axially (in X) along the measurement zone. The midpoint of the upper and lower surfaces is calculated. The value of symmetry is given as the radial distance between the midpoint and the current part centreline. For meaningful values of symmetry to be calculated, we need to make sure that the part is in the correct angular position when it is scanned. See Angular_Positions for information on setting part orientation.	

Related Topics

Perpendicularity 

This option selects the PERPENDICULARITY measurement feature

Perpendicularity is the condition of a surface or axis at a right angle to a datum plane or axis. Perpendicularity tolerance specifies a zone defined by 2 parallel planes perpendicular to a datum plane or axis.

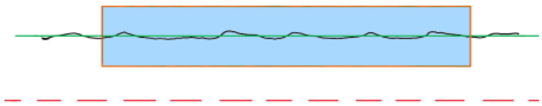
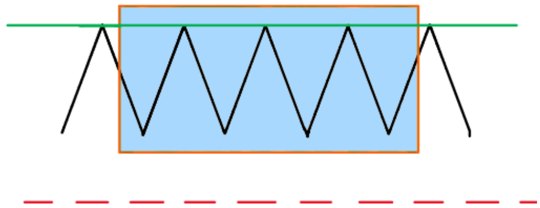
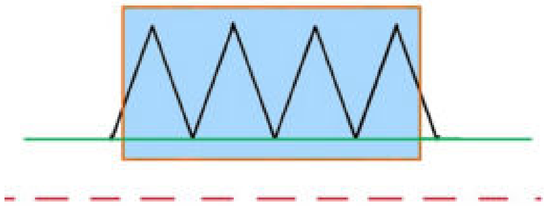
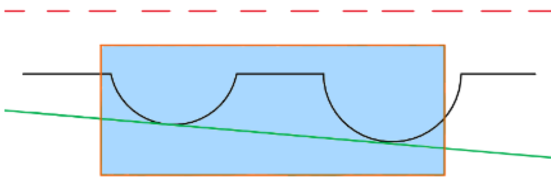
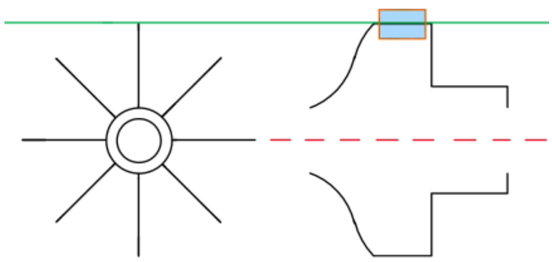
Perpendicularity	
The measurement zone must ONLY be positioned over face data, as we use a best-fit line to fit to the data in the zone. The algorithm measures the deviation in X of the best fit line through the data for a particular vertical extent, which can be specified by the operator. (The initial value for this vertical extent defaults to the height of the initial zone). If the user enters the exact height of the face over which the perpendicularity is to be measured, the algorithm extrapolates the best fit line created from the data in the measurement zone, and computes the perpendicularity over the entered vertical extent.	

Related Topics

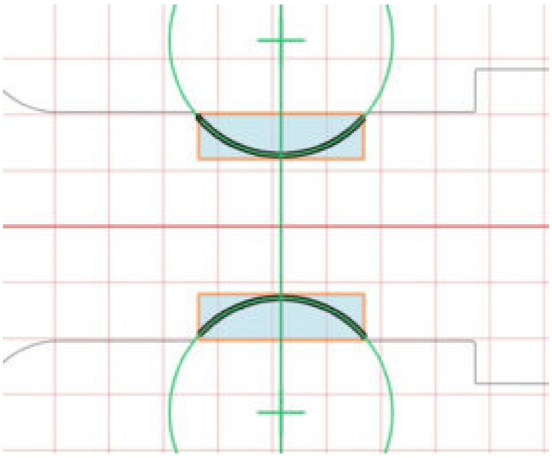
Line

The Line features available are as follows :

- Average Line
- Thread Major Line
- Thread Minor Line
- Tangent Line
- Line (Turbine)
- Line (Point-Point)

Average Line The best fit line from all the data points of the selected zone. This feature doesn't output a result value but can be used to construct another feature (e.g Line-Line Intersection Point).	
Thread Major Line The best fit line of the **external** diameter of a selected thread. The user needs to select either the upper or the lower part of a thread.	
Thread Minor Line The best fit line of the **internal** diameter of a selected thread. The user needs to select either the upper or the lower part of a thread.	
Tangent Line The tangent of the data points in the selected zone. Could be in four different positions : above data, below data, left of data, right of data. The user can specify one of them by choosing the 'Line position' parameter in the 'Measurements' window.	
Line (Turbine) Since this function is a dynamic one, the 'Number of Axial Hits' should be indicated. To determine the best fit line, the algorithm will look at the data of each blade of the turbine (set 'Number of Interruptions' parameter in 'Measurements' window), by rotating the measurement zone around the Y=0 axis (centreline). The user needs to specify a 'Surface type' parameter in the 'Measurement' window to let the algorithm know if the interruptions are of type 'Constant (All Points)', 'Constant (Average Points)' or 'Pointed'. If you select a 'Constant' type,	

you need to set the '% of Surface' parameter too. This parameter gives the percentage of the zone you want to look at (e.g. if each blade is constant on a range of 18° and the turbine is made of 5 blades, the '% of Surface' needs to be set to 25% (5*18*100 / 360)). Then, the algorithm will look at each blade surface data to determine the best fit line. **Constant** refers to a constant diameter section between the actual surface interruptions. The algorithm detects the interruptions on the surface and ignores them, using just the constant diameter sections. The difference between 'Constant (All Points)' and 'Constant (Average Points)' is that one calculates an average for each blade as the other keeps every single point. **Pointed** refers to a part profile similar to that of a machine cutter which has raised sections of data. The algorithm uses only the raised sections of data. **Note :** This feature doesn't output a result value but can be used to construct another feature (e.g. Line-Line Intersection Point).	

Line (Point-Point)	
Build a line between 2 existing point features (e.g. line between the centre points of 2 radius forms)	

External Measure 

This option selects the EXTERNAL MEASURE measurement feature. Those features allow the user to make external measurement with or without Sylvac devices by making them appear in the same place as the built-in ReflexScan measurements. For example, a blind hole cannot be measured with the ReflexScan machine so one possibility is to make the measurement with an external sensor and then include the value with the 'Ext. Manual Distance' feature. The tolerance values can also be set in the LSL and USL input field as well as the Nominal value. The 'External' parameter allows you to choose if you want to enter the external measurement value before ('Header') or after ('Footer') the program execution. You can choose the name of your measurement in the description box. It will be the name that will be display in the 'Enter value' input box.

The "Vmux" features are intended to be used with the Vmux software. Vmux is a Sylvac software that allows to connect most of Sylvac's devices (Bluetooth, USB,...). When using "Vmux" features, you need to specify three other parameters : 'Vmux channel', 'Vmux port', 'Vmux trig'.

Vmux channel to choose the right channel configured in Vmux for your instrument.

Vmux port to choose the virtual port configured in Vmux for your instrument.

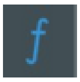
Vmux trig to choose if you want a 'Manual' or an 'Automatic' measurement. With the 'Manual' option, you will be asked to press manually the "send data" button of your device (generally, the middle button of the device). Conversely, with the 'Automatic' option, ReflexScan sends a request to the device to take the measurement automatically via Vmux (no user actions).

The External Measure features available are as follows :

- Ext. Vmux Distance
- Ext. Vmux Angle
- Ext. Vmux Temperature
- Ext. Vmux Value
- Sensor Temperature
- Ext. Manual Distance
- Ext. Manual Angle
- Ext. Manual Temperature
- Ext. Manual Value

Ext. Vmux Distance
A specific distance in mm (by default). You need to select a zone that contains the distance measured by your Sylvac device.
Ext. Vmux Angle
A specific angle in degree (by default). You need to select a zone that contains the angle measured by your Sylvac device.
Ext. Vmux Temperature
A specific temperature in Celcius (by default). You need to select the zone where your Sylvac device will measure the temperature.
Ext. Vmux Value
A specific value without any unit. You need to select the zone where your Sylvac device will take the measurement.
Sensor Temperature
Ext. Manual Distance
A specific distance in mm (by default). You need to select a zone that contains the distance measured by your device.
Ext. Manual Angle
A specific angle in degree (by default). You need to select a zone that contains the angle measured by your device.
Ext. Manual Temperature
A specific temperature in Celcius (by default). You need to select the zone where your device will measure the temperature.
Ext. Manual Value
A specific value without any unit. You need to select the zone where your device will take the measurement.

Related Topics

Formula 

The Formula measurement features can be used to output calculations from one or several existing features results.

A wizard is also provided for guidance, allowing users to make simple or complex calculations from existing measurements, such as, average, max, min, addition, subtraction, multiply, trigonometry, giving added flexibility to the software ("..." button on the right of the formula text box)

The formula features available are as follows :

- Formula Numerical
- Formula DIstance
- Formula Angle

<table>
<tr>
<td>

Formula Numerical
Unit independent calculation : no notion of mm/inch/degree, thus no conversion when changing units display
Formula DIstance
Distance calculation : could be mm or inch ; automatic conversion will occur when changing units display
Formula Angle
Angle calculation : could be decimal degrees or DMS (Degree,Minute,Second) ; automatic conversion will occur when changing units display

</td>
<td rowspan="2">


</td>
</tr>
<tr>
<td>
Select "Formula" in the Composer features list, draw a rectangular zone anywhere on the part drawing and fill in the "Formula" text box in the "Measurements" properties window.
If you need a guidance, just press the "..." button on the left of the text box, and you'll be displayed a wizard to help selecting the existing measurements labels and a scientific calculator.

Syntax rule of the formula: labels must be enclosed within curly brackets { } delimiters. e.g. {D00} - {D01}

In case your formula has a wrong syntax, the text box contour will turn to red and a tooltip will give you some hints to find the error. Otherwise, the contour will be green.

Once the formula is written, you will see its result after measuring the formula explicitly (e.g. start a normal part measurement or "Measure selected feature")
</td>
</tr>
</table>

Static scripts

Contains all the specific customer static features that can be written using a c# script (needs "PRO" option). Those features are stored as *.cs files in the \ScriptUser by default but can be modified in Settings/Preferences/Default folders menu.

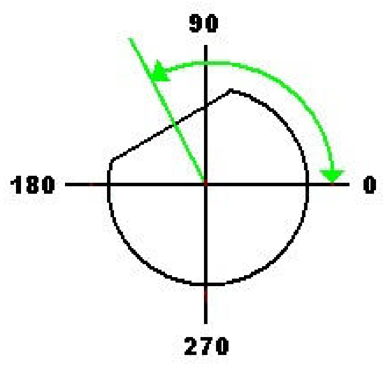
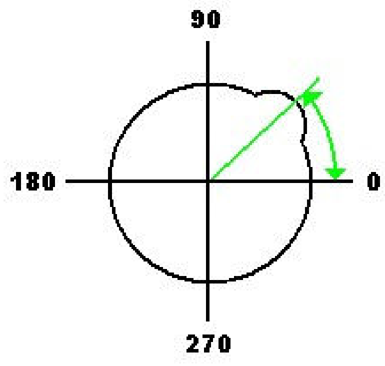
Related Topics

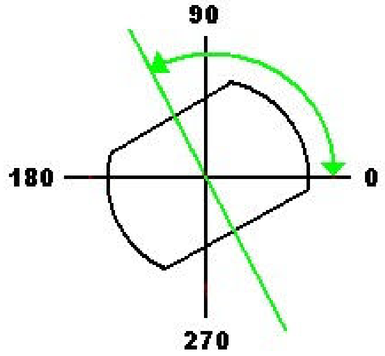
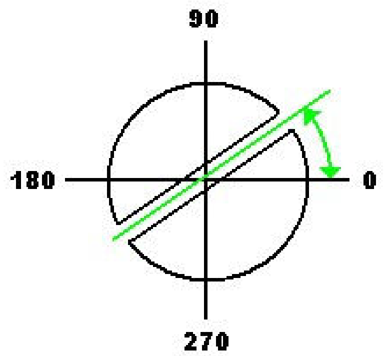
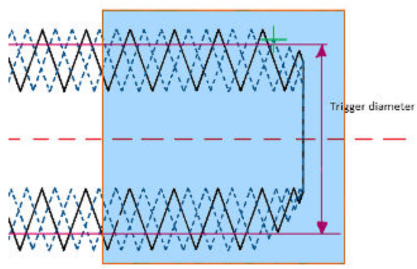
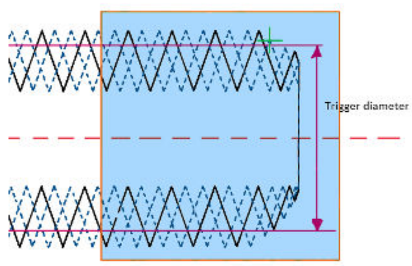
Angular Position

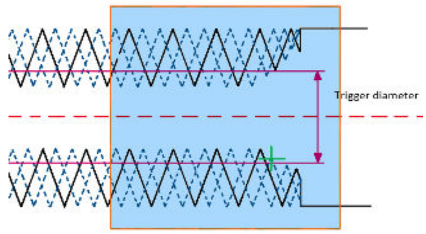
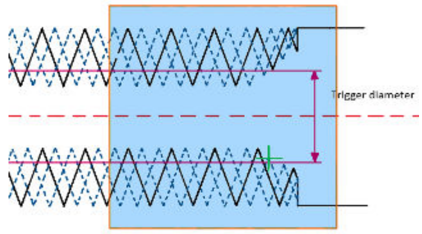
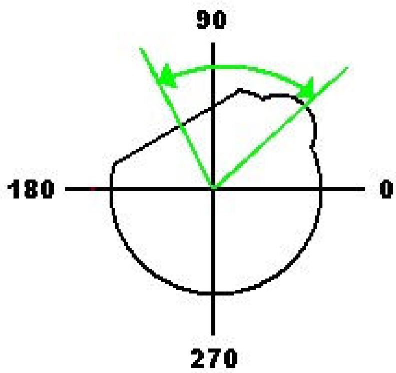
This option selects the ANGULAR POSITION measurement feature, which allows us to set angular reference positions upon a part.

The angular position features available are as follows :

- Angular Positions Min Angle
- Angular Positions Max Angle
- Across Flats Angle
- Slot Angle
- Angle AB
- Angular Positions Min (Single Flat)
- Thread End Angle (RH Parallel, Major drops to trigger)
- Thread End Angle (LH Parallel, Major drops to trigger)
- Thread End Angle (RH Parallel, Minor raises to trigger)
- Thread End Angle (LH Parallel, Minor raises to trigger)

<table>
<tr><td>Angular Positions Min Angle</td><td rowspan="2">
</td></tr>
<tr><td>Angular position of minimum radial co-ordinate, relative to the current rotational datum.
The part will be rotated 360 degrees using the radial scanning method. The algorithm detects the smallest radial distance between the part surface and the current part axis, and records the angular position at which this minimum occurs.
Although by default the part will rotate 360 degrees, it is possible to restrict the length of scan by modifying the Start Angle and End Angle parameters, found in the reference section of the Measurement properties window.
Note: the measurement zone must be defined on the upper surface only.</td></tr>
<tr><td>Angular Positions Max Angle</td><td rowspan="2">
</td></tr>
<tr><td>Angular position of maximum radial co-ordinate, relative to the current rotational datum.
The part will be rotated 360 degrees using the radial scanning method. The algorithm detects the largest radial distance between the part surface and the current part axis, and records the angular position at which this maximum occurs.
Although by default the part will rotate 360 degrees, it is possible to restrict the length of scan by modifying the Start Angle and End Angle parameters, found in the reference section of the Measurement properties window.</td></tr>
</table>

Note: the measurement zone must be defined on the upper surface only.	
Across Flats Angle	
Angular position of an 'across flats' feature, relative to the current rotational datum. The part will be rotated 360 degrees using the radial scanning method. The algorithm detects the smallest diameter as the part is rotated, and records the angular position at which this diameter occurred. Although by default the part will rotate 360 degrees, it is possible to restrict the length of scan by modifying the Start Angle and End Angle parameters, found in the reference section of the Measurement properties window. **Note:** the measurement zone must cover both upper and lower surfaces.	
Slot Angle	
Determines the angular position of a slot, relative to the current rotational datum. The part will be rotated 360 degrees using the radial scanning method. The algorithm detects the position of the slot as the part is rotated, and records its angular position. Although by default the part will rotate 360 degrees, it is possible to restrict the length of scan by modifying the Start Angle and End Angle parameters, found in the reference section of the Measurement properties window. **Note:** the measurement zone must cover both upper and lower surfaces, and be wide enough that the angled measurement arrays will see the slot within the measurement zone.	
Thread End Angle (RH Parallel, Major drops to trigger)	
Find the angular position of the last relevant crest point before dropping below the trigger diameter on the selected side of the zone (right/left) for a right hand parallel thread. The selected zone must contain upper and lower zones until the end of the thread ! It is possible to increase the precision by augmenting the 'Number of Hits / 360' (2-24) in the 'Zone properties'. The number of scans will be less than or equal to the required number of pitches through 360 degrees. Although the part will rotate 360 degrees, it is possible to restrict the length of the scan by modifying the Start Angle and End Angle parameters, found in the 'Zone properties' window.	
Thread End Angle (LH Parallel, Major drops to trigger)	
Find the angular position of the last relevant crest point before dropping below the trigger diameter on the selected side of the zone (right/left) for a left hand parallel thread. The selected zone must contain upper and lower zones until the end of the thread ! It is possible to increase the precision by augmenting the 'Number of Hits / 360' (2-24) in the 'Zone properties'. The number of scans will be less than or equal to the required number of pitches through 360 degrees. Although the part will rotate 360 degrees, it is possible to restrict the length of the scan by modifying the Start Angle and End Angle parameters, found in the 'Zone properties' window.	
Thread End Angle (RH Parallel, Minor raises to trigger)	

Find the angular position of the last relevant crest point before raising above the trigger diameter on the selected side of the zone (right/left) for a right hand parallel thread. The selected zone must contain upper and lower zones until the end of the thread ! It is possible to increase the precision by augmenting the 'Number of Hits / 360' (2-24) in the 'Zone properties'. The number of scans will be less than or equal to the required number of pitches through 360 degrees. Although the part will rotate 360 degrees, it is possible to restrict the length of the scan by modifying the Start Angle and End Angle parameters, found in the 'Zone properties' window.	
Thread End Angle (LH Parallel, Minor raises to trigger)	
Find the angular position of the last relevant crest point before raising above the trigger diameter on the selected side of the zone (right/left) for a left hand parallel thread. The selected zone must contain upper and lower zones until the end of the thread ! It is possible to increase the precision by augmenting the 'Number of Hits / 360' (2-24) in the 'Zone properties'. The number of scans will be less than or equal to the required number of pitches through 360 degrees. Although the part will rotate 360 degrees, it is possible to restrict the length of the scan by modifying the Start Angle and End Angle parameters, found in the 'Zone properties' window.	
Angle A-B	
Angular difference between two angular positions. This feature is similar to a length measurement in that it can output a distance between two features. In this case we can select any two previously defined angular positions, and output the distance (in degrees) between the two features. **Note:** the angular distance between two positions will always be <180° as we report the shortest distance.	

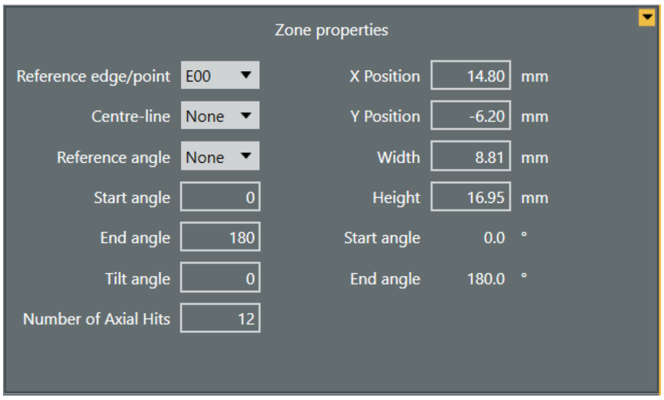
Start Angle & End Angle Parameters

There are many cases where it is appropriate, or even necessary, to restrict the angular distance through which we look for a particular feature. An example could be a part which has two flats milled 180° apart onto its surface. To find the location of the flats, we might choose the 'Across Flats Angle' feature.

If we use the default settings the part will rotate 360 degrees, however, this is not the optimum way to locate the flat position as the machine will see the across flats location in two positions 180° apart. This could induce variation in results if the software alternates between each of the two positions when calculating which should be used as the reference. Ideally, we want to remove the possibility of such variations.

We can do this by setting the Start and End Angle parameters in the 'Zone properties' page. In our example we may decide to set the Start Angle to 0° and the End Angle to 180° to ensure we only see the across flats in one orientation.

This idea can be expanded to cope with parts with any number of max or min angular features. (Consider a hexagon bolt head !)



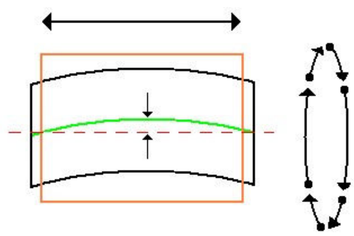
Related Topics

Straightness

This option selects the STRAIGHTNESS measurement feature

Straightness is the condition where all the points on a surface or axis are in a straight line. A straightness tolerance specifies a zone within which the surface or axis must lie.

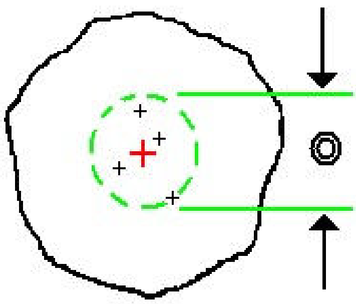
Straightness

Straightness	
The straightness algorithm scans the measurement zone axially (in X) in 6 different angular locations, 60 degrees apart. Each axial scan is broken down into a number of sections, allowing the algorithm to determine the midpoints of each section. The midpoints are then used to reconstruct the actual part axis within the measured zone. The straightness result is calculated as the largest deviation of the part section axis to that of a true centreline passing through the ends of the measurement zone.	

Related Topics

Concentricity

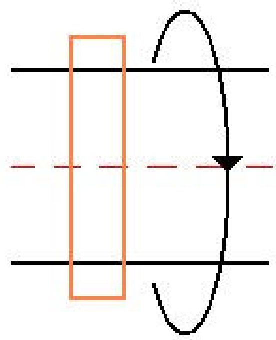
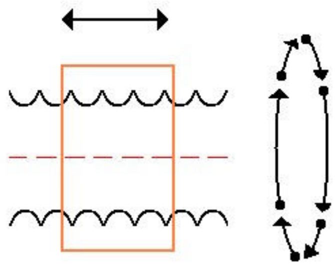
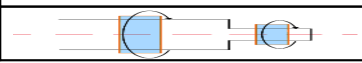
This option selects the CONCENTRICITY measurement feature



Concentricity is the condition where the axes of all cross sectional elements of a surface of revolution are common to the axis of a datum feature. Concentricity tolerance specifies a cylindrical tolerance zone whose axis coincides with the datum axis.

The concentricity features available are as follows :

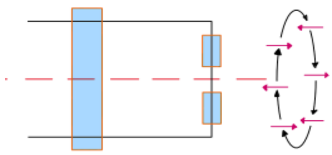
- Concentricity
- Turned
- 2 Diameters
- Face Centre
- Interrupted Diameter
- Flats
- Gauge Diameter
- Thread Diameter
- Maximum Inscribed Circle
- Minimum Circumscribed Circle

Concentricity	
This type of concentricity measurement should be used for parts with a good surface finish. The part is rotated through 360 degrees within the measurement zone using the [radial scanning]() method. Each pair of opposing points is used to determine a single midpoint. The distance between the single midpoint and the current reference axis is used to determine the diameter of a cylinder centred on the reference axis, that encloses the midpoint. The concentricity value is given as the diameter of the cylinder. The part can be rotated in multiple axial positions within the measurement zone (the 'Number of Axial Hits' parameter can be set in the 'Zone properties' window). The concentricity values of each position will be averaged to give a single result. In the 'Measurement' window, you can choose to select the 'Use "Outliers" filter'. The current technique of "filter outliers" could be described as a form of "robust regression" using an "iteratively reweighted least squares technique" (IRLS) . In summary, this uses a custom weighting function, where points within 3 standard deviations (as determined in the previous iteration) are weighted at 100%, and points outside this are considered with linearly reduced weight, and points outside 5 standard deviations (as determined in the previous iteration) are ignored completely.	
Turned	
This type of concentricity measurement should be used for parts with a rough surface finish. The part is scanned axially in 6 different rotational positions using the [axial scanning]() method. The axial data is averaged and then midpoints are calculated from the opposing sets of data to generate a single midpoint. The distance between the midpoint and the current reference axis is used to determine the value of a cylinder centred on the reference axis, that encloses the midpoint. The concentricity result is given as the diameter of the cylinder. The part can be scanned in multiple angular positions within the measurement zone (the 'Number of Hits / 360' parameter can be set in the 'Zone properties' window). The concentricity values of each position will be averaged to give a single result. In the 'Measurement' window, you can choose to select the 'Use "Outliers" filter'. The current technique of "filter outliers" could be described as a form of "robust regression" using an "iteratively reweighted least squares technique" (IRLS) . In summary, this uses a custom weighting function, where points within 3 standard deviations (as determined in the previous iteration) are weighted at 100%, and points outside this are considered with linearly reduced weight, and points outside 5 standard deviations (as determined in the previous iteration) are ignored completely.	
2 Diameters	

Concentricity of 2 diameters gives the relative concentricity between two diameters, i.e. a measure of how far offset they are from each other, rather than from the current part axis (although the correction of a centre-line if present will be taken into account).
This algorithm can also be used for 2 diameters close to one another in X where no part of the component is suitable for placing a dynamic centre-line.
Two measurement zones are defined, one over each diameter section to be compared. By default, each zone is scanned using the radial_scanning method. The data is analysed in each zone to determine midpoints. The midpoint of the first zone is used as a reference for the midpoint data in the second zone. The midpoint of the second zone is used to determine the concentricity relative to the first zone.
For this feature, you can also select existing concentricities but for more accurate results, we recommend to use concentricities with the same scanning method.

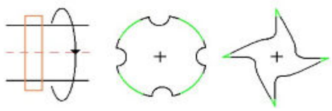
Face Centre

Concentricity of a diameter projected on a face. It gives the relative concentricity between the diameter and the face. Three measurement zones are defined : one on the upper side of the face, one on the lower side of the face and a diameter. Each zone is scanned using the axial scanning method. Then, the algorithm will calculate the perpendicular projection of the concentricity on the face.



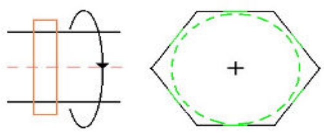
Interrupted Diameter

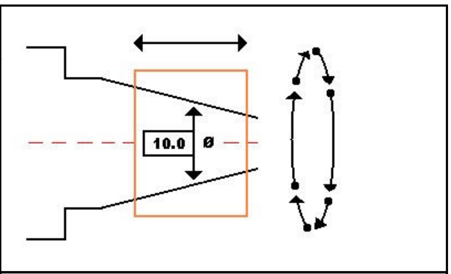
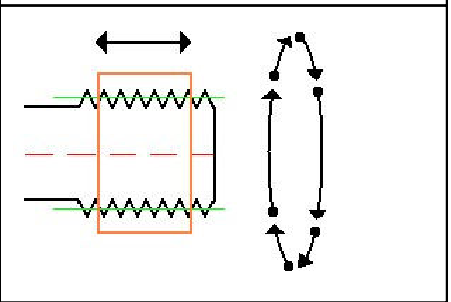
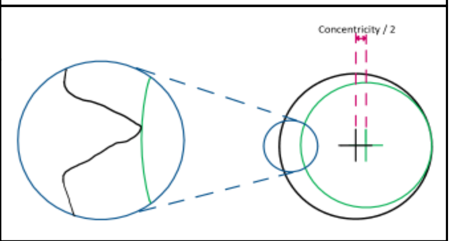
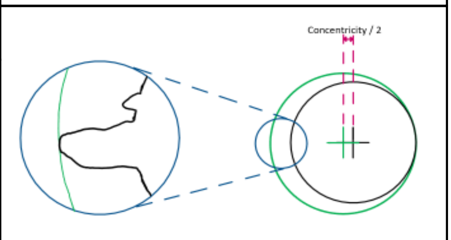
The part is rotated through 360 degrees within the measurement zone using the radial_scanning method. The user specifies the number of interruptions that occur around the circumference of the part, and whether the interruptions are of type 'Constant (All Points)', 'Constant (Average Points)' or 'Pointed' ('Measurements' window). If you select a 'Constant' type, you need to set the '% of Surface' parameter too. This parameter gives the percentage of the zone you want to look at (e.g. if each blade is constant on a range of 18° and the turbine is made of 5 blades, the '% of Surface' needs to be set to 25% (5*18*100 / 360)). Then, the algorithm will look at each blade surface data to determine the Interrupted Diameter Concentricity.
Constant refers to a constant diameter section between the actual surface interruptions. The algorithm detects the interruptions on the surface and ignores them, using just the constant diameter sections. The difference between 'Constant (All Points)' and 'Constant (Average Points)' is that one calculates an average for each blade as the other keeps every single point.
Pointed refers to a part profile similar to that of a machine cutter which has raised sections of data. The algorithm uses only the raised sections of data.



Flats

The part is rotated through 360 degrees within the measurement zone using the radial_scanning method. The minimum points detected as the part is rotated (i.e. the flat positions) are used to determine a best fit circle, from which the concentricity (relative to the current part axis) is calculated.
The user must specify the number of flats that occur around the circumference of the part, a minimum of three must be specified for the algorithm to function. As with all features that use radial scanning, up to 4 positions within the zone can be scanned. All scans will be averaged together.



<table>
<tr><td>Gauge Diameter
The part is scanned using the axial scanning method. Each axial scan is used to determine the location of a user specified diameter within the measurement zone. The midpoints of this diameter are used to determine the concentricity relative to the current part axis.</td><td>
</td></tr>
<tr><td>Thread Diameter
The part is scanned using the axial scanning method. Each axial scan is analysed to determine the pitch diameter within the measurement zone. The midpoints of the pitch diameter in each angular position are calculated to determine the concentricity relative to the current part axis.</td><td></td></tr>
<tr><td>Maximum Inscribed Circle
The part is rotated through 360 degrees within the measurement zone using the radial scanning method. The algorithm finds the extrema points to create the maximum inscribed circle. The difference between the centre of the part and the centre of the maximum inscribed circle x 2 gives the Maximum Inscribed Circle Concentricity.</td><td>
</td></tr>
<tr><td>Minimum Circumscribed Circle
The part is rotated through 360 degrees within the measurement zone using the radial scanning method. The algorithm find the extrema points to create the minimum circumscribed circle. The difference between the centre of the part and the centre of the minimum circumscribed circle x 2 gives the Minimum Circumscribed Circle Concentricity.</td><td>
</td></tr>
</table>

Related Topics

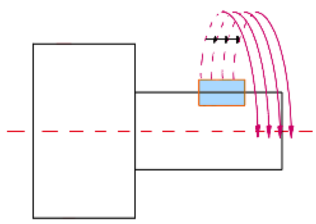
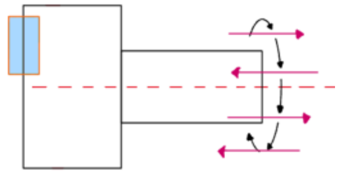
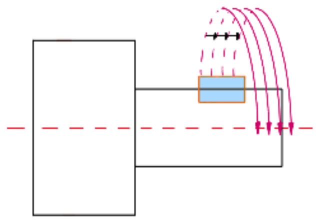
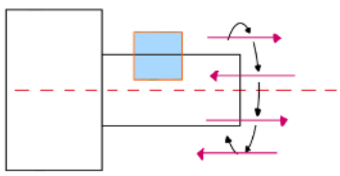
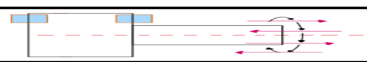
Run Out

This option selects the RUN OUT measurement feature

Circular (or radial) runout is the distance between two concentric circles, within which all circular elements of the part surface must lie in relationship to the datum axis. Face runout is the distance between two planes at right angles to the datum axis within which each circular element of the face surface must lie.

The runout features available are as follows :

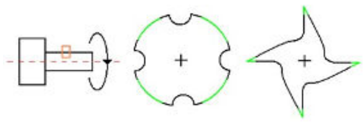
- Radial Runout
- Face Runout (Axial scan)
- Radial Runout (With data)
- Radial Runout (Axial scan)
- Face - Face Runout
- Interrupted Radial
- Gauge Diameter Axial Runout
- Gauge Diameter Radial Runout
- Gauge Diameter Perpendicular Runout
- Flats
- Turbine Gauge Diameter Axial Runout
- Turbine Gauge Diameter Radial Runout
- Turbine Gauge Diameter Perpendicular Runout
- Total Runout

Radial Runout The zone must be placed in the positive Y axis of the part (upper surface). The part is rotated through 360 degrees to trace the rise and fall of the part surface as it rotates. The runout value is calculated as the largest Y data point seen minus the smallest data point seen, relative to the current part axis.	
Face Runout (Axial scan) The zone must be placed in the positive Y axis of the part (upper surface). The zone should contain ONLY face data. The machine will then use the axial scanning method on a specified 'Number of Hits / 360' ('Zone properties' window). The runout value is given as the distance between the minimum recorded X position and the maximum recorded X position.	
Radial Runout (With data) The zone must be placed in the positive Y axis of the part (upper surface). The part is rotated through 360 degrees to trace the rise and fall of the part surface as it rotates. The runout value is calculated as the largest Y data point minus the smallest data point, relative to the current part axis. This feature is the same as Radial Runout, but in addition, it shows the data of the average Y values per degree.	
Radial Runout (Axial scan) The zone must be placed in the positive Y axis of the part (upper surface). The machine will then use the axial scanning method (the 'Number of Hits / 360' can be defined in the 'Zone properties') to create the different data points. The runout value is calculated as the largest Y data point seen minus the smallest data point seen, relative to the current part axis.	
Face-Face Runout	

Two zones are placed in the positive Y axis of the part (upper surface). The machin will then use the [axial scanning](#) method on a specified 'Number of Hits / 360' ('Zone properties' window) to collect the different X coordinates of the data points. The runout value is given as the difference between the smallest X distance between the faces and the largest distance between the faces.

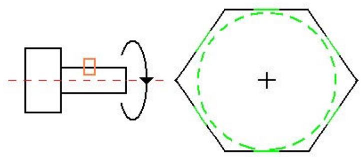
Interrupted Radial

The part is rotated through 360 degrees within the measurement zone using the [radial scanning](#) method. The user specifies the number of interruptions that occur around the circumference of the part, and whether the interruptions are of type 'Constant (All Points)', 'Constant (Average Points)' or 'Pointed' ('Measurements' window). If you select a 'Constant' type, you need to set the '% of Surface' parameter too. This parameter gives the percentage of the zone you want to look at (e.g. if each blade is constant on a range of 18° and the turbine is made of 5 blades, the '% of Surface' needs to be set to 25% (5*18*100 / 360)). Then, the algorithm will look at each blade surface data to determine the Interrupted Diameter.
Constant refers to a constant diameter section between the actual surface interruptions. The algorithm detects the interruptions on the surface and ignores them, using just the constant diameter sections to calculate the runout.
The difference between 'Constant (All Points)' and 'Constant (Average Points)' is that one calculates an average for each blade and the other keeps every single point before calculating the runout. Thus, the runout calculated with 'Constant (Average Points)' could end up smaller than with the 'Constant (All Points).
Pointed refers to a part profile similar to that of a machine cutter which has raised sections of data. The algorithm uses the raised sections of data to determine the runout.



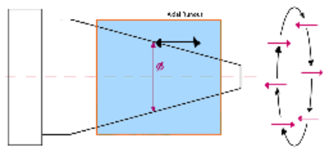
Flats

The part is rotated through 360 degrees within the measurement zone. The user must specify the number of flats that occur around the circumference of the part in the measurement properties dialog box. The 'flats' around the part are detected as it is rotated. The data from these flat positions is used to determine the runout relative to the part axis.
Note : Flat measurements require a part to have a minimum of three flats in order to be valid (as for interrupted measurement features).



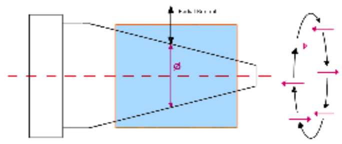
Gauge Diameter Axial Runout

The part is scanned axially (in X) in up to 12 rotational planes (minimum of 4) ('Number of Hits / 360'). Each axial scan is analysed to determine the location of the specified diameter within the measurement zone. The **axial** runout is then calculated as the distance between the minimum and maximum **X Positions.**

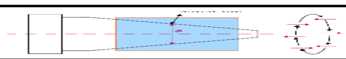


Gauge Diameter Radial Runout

The part is scanned axially (in X) in up to 12 rotational planes (minimum of 4) ('Number of Hits / 360'). Each axial scan is analysed to determine the location of the specified diameter within the measurement zone. The **radial** runout is then calculated as the distance between the minimum and maximum **Y Positions.**



Gauge Diameter Perpendicular Runout

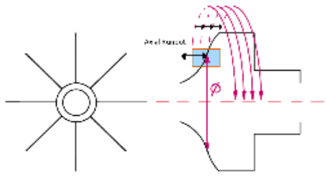


The part is scanned axially (in X) in up to 12 rotational planes (minimum of 4) ('Number of Hits / 360'). Each axial scan is analysed to determine the location of the specified diameter within the measurement zone. The **perpendicular** runout is then calculated as the distance between the minimum and maximum **(X,Y) projected points onto a perpendicular line to the surface of the gauge part.**.

Turbine Gauge diameter Axial Runout

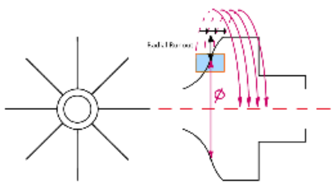
The part is scanned radially and the result is analysed to determine the location of the specified Diameter ('Measurements' window) within the measurement zone. The 'Number of Axial Hits' has to be set in the 'Measurement properties' along with the 'Number of Interruptions'
The algorithm will look at the data of the turbine by rotating the measurement zone around the Y=0 axis (centreline) to determine an **X Position** of the specified diameter for each blade. The user needs to specify a 'Surface type' parameter in the 'Measurement' window to let the algorithm know if the interruptions are of type 'Constant (All Points)', 'Constant (Average Points)' or 'Pointed'. If you select a 'Constant' type, you need to set the '% of Surface' parameter too. This parameter gives the percentage of the zone you want to look at (e.g. if each blade is constant on a range of 18° and the turbine is made of 5 blades, the '% of Surface' needs to be set to 25% (5*18*100 / 360)). The **axial** runout is then calculated as the distance between the minimum and maximum **X Positions.**
Constant refers to a constant diameter section between the actual surface interruptions. The algorithm detects the interruptions on the surface and ignores them, using just the constant diameter sections. The difference between 'Constant (All Points)' and 'Constant (Average Points)' is that one calculates an average for each blade as the other keeps every single point.
Pointed refers to a part profile similar to that of a machine cutter which has raised sections of data. The algorithm uses only the raised sections of data.

Note : A 'Number of Axial Hits' contained within 8 and 12 is enough for a correct measurement result in terms of accuracy and duration of the measurement.



Turbine Gauge diameter Radial Runout

The part is scanned radially and the result is analysed to determine the location of the specified Diameter ('Measurements' window) within the measurement zone. The 'Number of Axial Hits' has to be set in the 'Measurement properties' along with the 'Number of Interruptions'
The algorithm will look at the data of the turbine by rotating the measurement zone around the Y=0 axis (centreline) to determine an **Y Position** of the specified diameter for each blade. The user needs to specify a 'Surface type' parameter in the 'Measurement' window to let the algorithm know if the interruptions are of type 'Constant (All Points)', 'Constant (Average Points)' or 'Pointed'. If you select a 'Constant' type, you need to set the '% of Surface' parameter too. This parameter gives the percentage of the zone you want to look at (e.g. if each blade is constant on a range of 18° and the turbine is made of 5 blades, the '% of Surface' needs to be set to 25% (5*18*100 / 360)). The **radial** runout is then calculated as the distance between the minimum and maximum **Y Positions.**
Constant refers to a constant diameter section between the actual surface interruptions. The algorithm detects the interruptions on the surface and ignores them, using just the constant diameter sections. The difference between 'Constant (All Points)' and 'Constant (Average Points)' is that one calculates an average for each blade as the other keeps every single point.
Pointed refers to a part profile similar to that of a machine cutter which has raised sections of data. The algorithm uses only the raised sections of data.

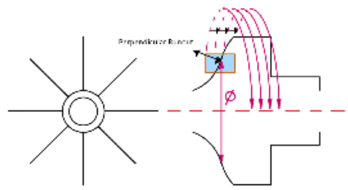


Note : A 'Number of Axial Hits' contained within 8 and 12 is enough for a correct measurement result in terms of accuracy and duration of the measurement.

Turbine Gauge diameter Perpendicular Runout

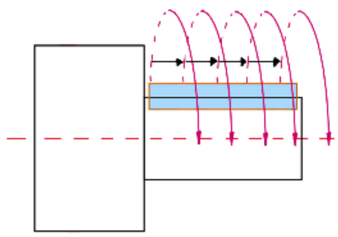
The part is scanned radially and the result is analysed to determine the location of the specified Diameter ('Measurements' window) within the measurement zone. The 'Number of Axial Hits' has to be set in the 'Measurement properties' along with the 'Number of Interruptions'
The algorithm will look at the data of the turbine by rotating the measurement zone around the Y=0 axis (centreline) to determine an **(X,Y) Position** of the specified diameter for each blade. The user needs to specify a 'Surface type' parameter in the 'Measurement' window to let the algorithm know if the interruptions are of type 'Constant (All Points)', 'Constant (Average Points)' or 'Pointed'. If you select a 'Constant' type, you need to set the '% of Surface' parameter too. This parameter gives the percentage of the zone you want to look at (e.g. if each blade is constant on a range of 18° and the turbine is made of 5 blades, the '% of Surface' needs to be set to 25% (5*18*100 / 360)). The **perpendicular** runout is then calculated as the distance between the minimum and maximum **(X,Y) projected points onto a perpendicular line to the surface of the gauge part.**
Constant refers to a constant diameter section between the actual surface interruptions. The algorithm detects the interruptions on the surface and ignores them, using just the constant diameter sections. The difference between 'Constant (All Points)' and 'Constant (Average Points)' is that one calculates an average for each blade as the other keeps every single point.
Pointed refers to a part profile similar to that of a machine cutter which has raised sections of data. The algorithm uses only the raised sections of data.

Note : A 'Number of Axial Hits' contained within 8 and 12 is enough for a correct measurement result in terms of accuracy and duration of the measurement.



Total Runout

The zone must be placed in the positive Y axis of the part (upper surface). The part is rotated through 360 degrees to trace the rise and fall of the part surface similar to the Radial Runout option. However, the Total runout allows the user to specify between 2 and 99 locations within the measurement zone to make this measurement. The runout value is determined as the largest radial distance measured, minus, the smallest radial distance measured, relative to the part axis. The min and max radial values can come from any scan made within the measurement zone.



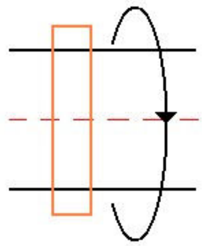
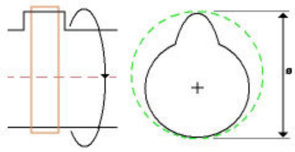
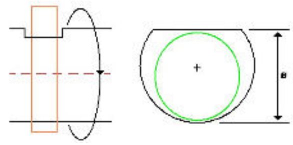
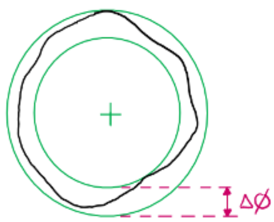
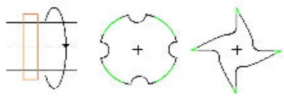
Related Topics

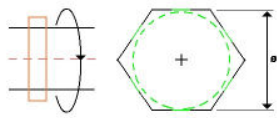
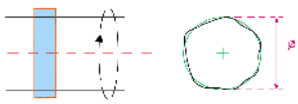
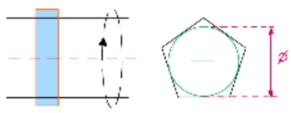
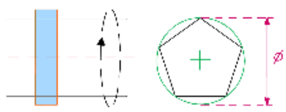
Rotation Diameter

This option selects the ROTATION DIAMETER measurement feature

The rotation diameter features available are as follows :

- Rotational Diameter Average
- Rotational Diameter Max Form
- Rotational Diameter Min Form
- Rotational Diameter Ovality
- Interrupted
- Flats
- Cylinder Diameter Average
- Maximum Inscribed Circle
- Minimum Circumscribed Circle

Rotational Diameter Average The part is rotated through 360 degrees, with opposing data points on the diameter being recorded at each angular position. The outputted result is based on the average of the diameters seen at all angular positions.	
Rotational Diameter Max Form The part is rotated through 360 degrees, with opposing data points on the diameter being recorded at each angular position. The outputted result is based on the largest of the diameters seen as the part was rotated.	
Rotational Diameter Min Form The part is rotated through 360 degrees, with opposing data points on the diameter being recorded at each angular position. The outputted result is based on the smallest of the diameters seen as the part was rotated.	
Rotational Diameter Ovality The part is rotated through 360 degrees, with opposing data points on the diameter being recorded at each angular position. The algorithm then calculates both the minimum and maximum diameter seen as the part was rotated. These figures are then applied to the formula below to calculate a value for Ovality: **Ovality = (Max Diameter - Min Diameter) / 2**	
Interrupted The part is rotated through 360 degrees within the measurement zone using the radial scanning method. The user specifies the number of interruptions that occur around the circumference of the part, and whether the interruptions are of type 'Constant (All Points)', 'Constant (Average Points)' or 'Pointed' ('Measurements' window). If you select a 'Constant' type, you need to set the '% of Surface' parameter too. This parameter gives the percentage of the zone you want to look at (e.g. if each blade is constant on a range of 18° and the turbine is made of 5 blades, the '% of Surface' needs to be set to 25% (5*18*100 / 360)). Then, the	

algorithm will look at each blade surface data to determine the Interrupted Diameter. **Constant** refers to a constant diameter section between the actual surface interruptions. The algorithm detects the interruptions on the surface and ignores them, using just the constant diameter sections to create a best fit circle. The diameter of the circle is output as the result. The difference between 'Constant (All Points)' and 'Constant (Average Points)' is that one calculates an average for each blade as the other keeps every single point. **Pointed** refers to a part profile similar to that of a machine cutter which has raised sections of data. The algorithm uses only the raised sections of data to create a best fit circle. The diameter of the circle is output as the result.	
Flats The part is rotated through 360 degrees. The user specifies the number of flats that occur around the circumference of the part (minimum of 3). As the part rotates, the machine detects the flat positions, and uses the data at these points to create a best fit circle. The diameter of this best fit circle is output as the diameter result.	
Cylinder Diameter Average The part is rotated through 360 degrees, with opposing data points on the cylinder diameter being recorded at each angular position. The outputted result is based on the average of the cylinder diameters seen at all angular positions.	
Maximum Inscribed Circle The machine uses the radial scanning method to find the extrema points of the selected zone. The maximum inscribed circle (internal circle) is found by the algorithm by using all the extrema points. **Note :** careful not to confuse the maximum inscribed circle with the min form diameter !	
Minimum Circumscribed Circle The machine uses the radial scanning method to find the extrema points of the selected zone. The minimum circumscribed circle (external circle) is found by the algorithm by using all the extrema points. **Note :** careful not to confuse the minimum circumscribed circle with the max form diameter !	

All of these feature types use the radial scanning method.

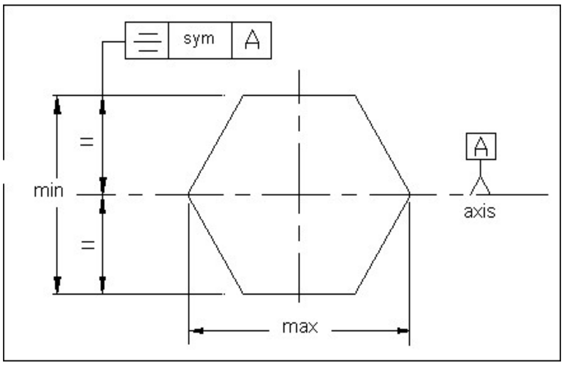
Related Topics

Across Flat

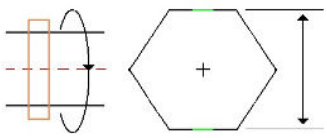
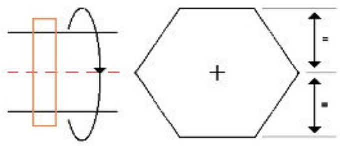
This option selects the ACROSS FLATS measurement feature

The Across Flats features available are as follows :

- Dimension
- Symmetry



The axial scanning method is used for all of these measurement features.

Dimension	
The algorithm detects the smallest diameter seen by the machine as the part is rotated, and returns this as the Across Flats dimension. It is possible to specify the rotational distance that is to be scanned by entering a 'Start Angle' and 'End Angle' position in the Measurement Properties reference page. This allows us to report the dimensions of multiple sets of flats individually. For example, a Hex bolt has 6 flats around its circumference. If the part is scanned through 360 degrees, the smallest of the 3 across flats dimensions will be reported. By setting an appropriate arc to be scanned (e.g. 0° - 60°), we can force the algorithm to work off one particular pair of flats at a time.	
Symmetry	
The algorithm detects the smallest diameter seen by the machine as the part is rotated. The midpoint of this smallest diameter is calculated and compared to the current part axis. The radial distance between these two points is returned as the symmetry. It is possible to specify the rotational distance that is to be scanned by entering a 'Start Angle' and 'End Angle' position in the Measurement Properties reference page. This allows us to report the dimensions of multiple sets of flats individually. For example, a Hex bolt has 6 flats around its circumference. If the part is scanned through 360 degrees, the smallest of the 3 across flats dimensions will be reported. By setting an appropriate arc to be scanned (e.g. 0° - 60°), we can force the algorithm to work off one particular pair of flats at a time.	

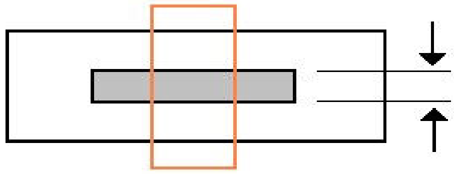
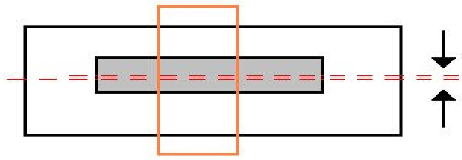
Related Topics

Slot 

This option selects the SLOTS measurement feature

The slot features available are as follows :

- Dimension
- Symmetry

Dimension	
The part is rotated 360 degrees within the zone. The algorithm detects the slot seen by the machine as the part is rotated, and records its position relative to the scan start position. The machine then moves the part back to that position and makes a short fine scan, to determine the dimension of the slot.	
Symmetry	
The part is rotated 360 degrees within the zone. The algorithm detects the slot seen by the machine as the part is rotated, and records its position relative to the scan start position. The machine then moves the part back to that position and makes a short fine scan. The positions of the upper and lower surface of the slot are used to determine a midpoint. The radial distance between the midpoint and the current centreline is output as the Symmetry	

NOTE:
The measurement zone should be defined over the Outside Diameter of the part. The zone must be wide enough that the angled arrays cross the actual slot within the zone limits, otherwise an 'insufficient data points' error will be displayed.

Related Topics

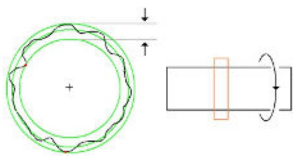
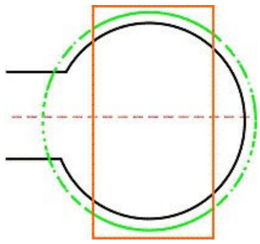
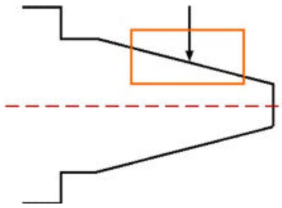
Roundness 

This option selects the ROUNDNESS measurement feature:
Roundness or Circularity, is the condition where all the points on a surface are in a circle. Roundness tolerance specifies a zone bounded by 2 concentric circles, within which the measured surface must lie. A filter can be applied to the data. Pro-Measure software incorporates a selection of the four most commonly used filters:

15upr
50upr
150upr - (most commonly used)
500upr

The roundness features available are as follows :

- Roundness
- LSC Sphericity
- Roundness at X

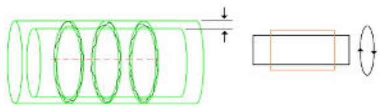
Roundness	
The part is rotated through 360 degrees within the measurement zone using the radial scanning method, collecting 3600 data points. A best fit circle, calculated using the Least Squares method, is applied to the data. Two other circles, concentric to the best-fit circle are then applied to the data, one which touches the data point with the greatest positive deviation from the best fit circle, and the other which touches the data point with the greatest negative deviation from the best fit circle. The radial distance between these two concentric circles is output as the Roundness value.	
LSC Sphericity	
The part is rotated through 360 degrees within the measurement zone of each axial pitch (3 to 99) using the radial scanning method, collecting 3600 data points. A mean sphere is calculated from these data points using the Least Squares method. The difference between the farthest and the nearest data points is output as the result.	
Roundness at X	
The roundness of a cone-shaped part section defines the shape of a surface where all data points are laying within a circle.	

Related Topics

Cylindricity

This option selects the CYLINDRICITY measurement feature
Cylindricity is the condition where all points of a surface of revolution are equidistant from a common axis. Cylindricity tolerance specifies a zone bounded by 2 concentric cylinders within which the measured surface must lie. A filter can be applied to the data. Pro-Measure software incorporates a selection of the four most commonly used filters:

15upr
50upr
150upr - (most commonly used)
500upr

Cylindricity	
The part is rotated 360 degrees within the zone, in up to 99 positions (minimum of 2). Two concentric cylinders are fit to the data. One cylinder bounds the data point with the greatest deviation from the centreline axis (from any scan), while the other cylinder bounds the data point with the smallest deviation from the centreline axis (from any rotational scan). The radial distance between the two cylinders is output as the value for cylindricity.	

Related Topics

Dynamic scripts

Contains all the specific customer dynamic features that can be written using a c# script (needs "PRO" option). Those features are stored as *.cs files in the \ScriptUser by default but can be modified in Settings/Preferences/Default folders menu.

Related Topics

10. NOTES

Changes without prior notice
Sous réserve de toute modification
Anderungen vorbehalten

Edition : 2019.04 /