

MCOSMOS

Data Processing System for Manual/CNC CMM

COORDINATE
MEASURING MACHINES



MiCAT

Mitutoyo Intelligent Computer Aided Technology

the standard in world
metrology software

cmm

Further Evolution Based on Linkage to the Latest MCOSMOS Addresses All Customer Issues, from

• Simple Operation

MCOSMOS is a family of new processing programs for coordinate measuring machines that runs under Windows. Since the user can proceed with measurements by selecting the desired functions using icons and pull-down menus in the familiar Windows operation method, there is no need to memorize control codes.

• Supporting Manual and CNC Measurement

MCOSMOS is available in two versions: one for a manual type CMM and one for a CNC type CMM. Both use a consistent mode of operation to handle manual or CNC measurement tasks.

• Linkage to CAD Data

The software package features for linking to CAD data include CAT1000P (online/offline teaching program for creating measurement routines) and CAT1000S (3D free-form evaluation module for checking free-form surfaces against design values (CAD data)) without actually operating a coordinate measuring machine.

• Comprehensive Software Line-up

A wide variety of optional software packages that meet customer needs is available, including SCANPAK for evaluating 2D profile data, GEARPAK for evaluating gear measurements, and MAFIS Express for evaluating the shape of an airfoil.

• Full Hardware Support

MCOSMOS supports a wide range of probes, such as touch probes, scanning probes, vision probes, SURFTEST probes, rotary head, and auto-probe changers, enabling automatic measurement of all types of workpiece.



CAD Data

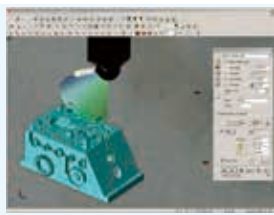
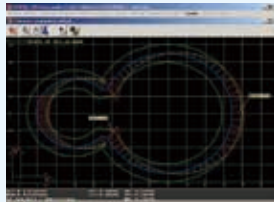
Coordinate Measurement to Linkage to CAD Data.



System performance from every viewpoint

Performance features of standard software packages

The optimum program for your particular application can be selected from the software packages listed below.

software packages	MCOSMOS 1			MCOSMOS 2			MCOSMOS 3		
	Manual								
	CNC								
PART MANAGER (P5) The control center from which the software package is initialized, and individual part programs are managed.									
GEOPAK (P6~15) For (online/offline) part program creation, using the measurement of geometric elements. Extensive tolerance comparisons and output functions are included.									
CAT1000P (P16・17) For (online/offline) part program creation, using the measurement of geometric elements directly from the CAD model, with automatic collision avoidance.									
CAT1000S (P18・19) CAD model-based generation of surface measurement points, and comparison of actual/nominal data, with graphical output.									
SCANPAK (P20・21) For the scanning and evaluation of workpiece contours, and 3D digitizing of surfaces.									

Other Optional Software Packages (starting on p. 22)

A wide variety of optional software packages that meet customer needs is available, including MAFIS Express for evaluating the shape of an airfoil, GEARPAK for evaluating gear measurements, NC-Auto Measure for generating CAD models from NC data, RepeatPak2700 for executing older data-processing programs, and the MeasurLink statistical processing program.

PART MANAGER

PART MANAGER

Registers and manages the part programs to be used on a CNC type CMM and the measurement procedures for a manual CMM.



● Login

An operator logs on to the system by entering their User Name and password. This makes it possible to set User Rights for each operator.

Example of Priority

	Class	User Rights
Operator A	Admin	All system operations including the changing and registration of User Rights
Operator B	User	All measurement operations including the creation of part programs
Operator C	User	Running part programs

● Program Start Toolbar

Starts GEOPAK, part editor, CAT1000PS, etc.

● Part Process Toolbar

Provides such functions as new part creation, part name change, copy, deletion, search, registration/output of graphics (.BMP file) and voice (.WAV file), and head data input.

● Parts List

- Displays the list of parts that have already been created. In the columns to the right of the part names, a data type symbol (GEOPAK part program, CAT1000S CAD data, statistical data, memo data, graphics/voice file, or head data) is displayed to show the data available for each part, giving you an at-a-glance configuration of data. Double-click on a data-type icon, and the associated program will start if data exists.
- If graphics have been registered to parts, the parts list can be displayed with the graphics. This allows you to check the form of a workpiece to be measured next to a picture or photo. (Double-clicking this picture starts the program.)

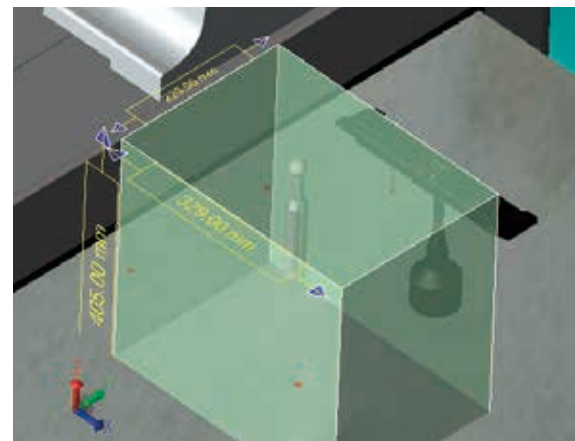
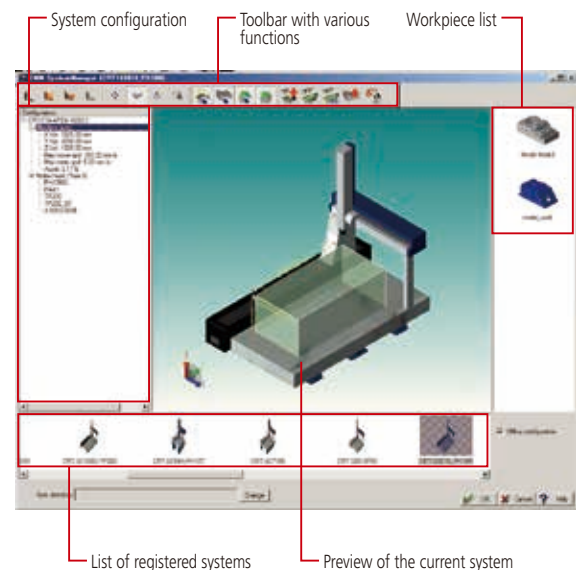


Remote Manager

Remotely starts GEOPAK. It can be used in an inline system, etc., that must be operated from an external system.

CMM System Manager

This program is used for registering and managing system configuration, such as the main unit of the coordinate measuring machine to be used, as well as its measurement range, probe system, and auto-change rack.



- You can create an auto-calibration program for the probes registered on the system.
- You can display a measurement range that takes the dead zone of a rotating probe into account.
- You can import and register the CAD data for a workpiece, and by displaying it in the system preview window, can check the measurement range.
- You can register multiple different system configurations, and easily add to or edit them.

GEOPAK (Universal Geometric Measurement Program)

- Software program for universal geometric measurement of a workpiece.
- This program allows measurement operation with the same operational feeling as Windows.
- The program has achieved extraordinary ease of operation by a new method using toolbar/icon menus and

Basic Screen Configuration

Distance/Angle Calculation Toolbar

- You can specify two measured elements to calculate distance or angle.

Elements Toolbar

- A group of icons for measurement of point, line, plane, circle, etc. the icon of an element to be measured to display a sub-window formula, invoke an element from memory, combine multiple elements

Measurement End Instruction Icon

Tolerance Zone Measurement Toolbar

- Performs tolerancing on a measured or calculated value from the design value and tolerance.

Probe Setting Icon

- Provides optional functions such as probe replacement and stylus replacement in addition to basic functions including probe information key-in, correction and deletion, and file storage and invocation.

Emergency Stop Icon

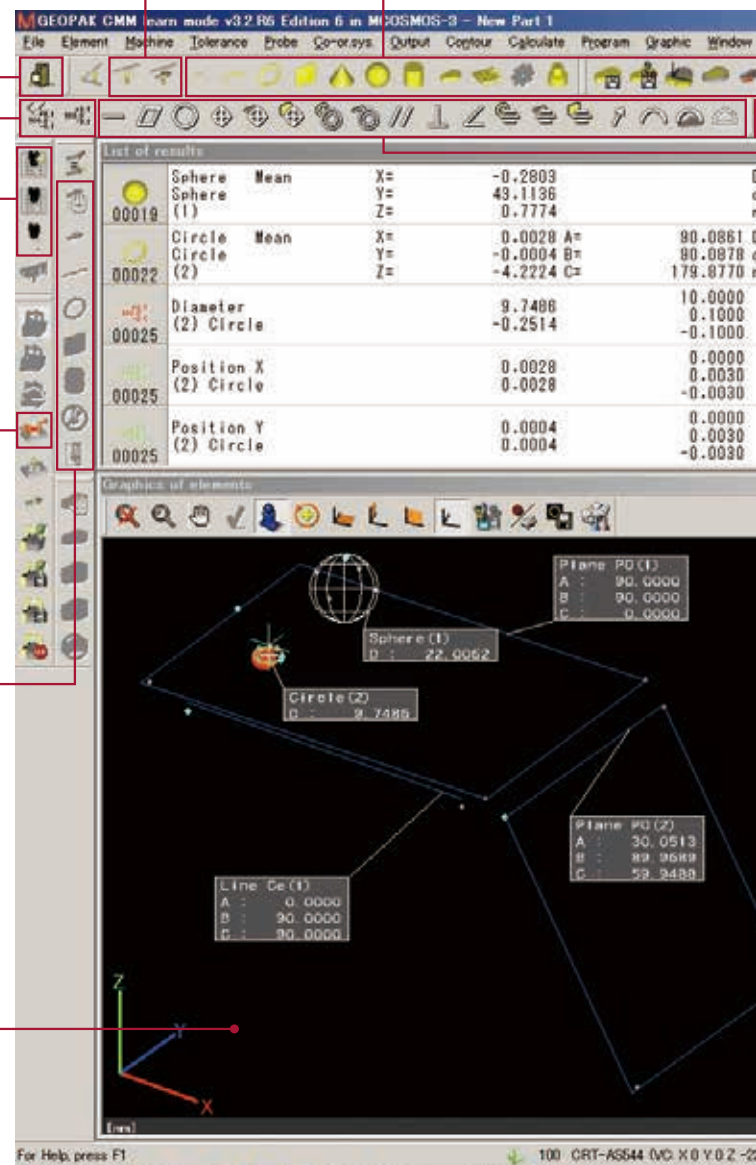
- Used for stopping CNC measurement during an emergency

Auto Element Toolbar (CNC)

- Provides the function of auto-measuring a point, line, plane, circle, cylinder or curve by giving design values, the number of input points, etc.

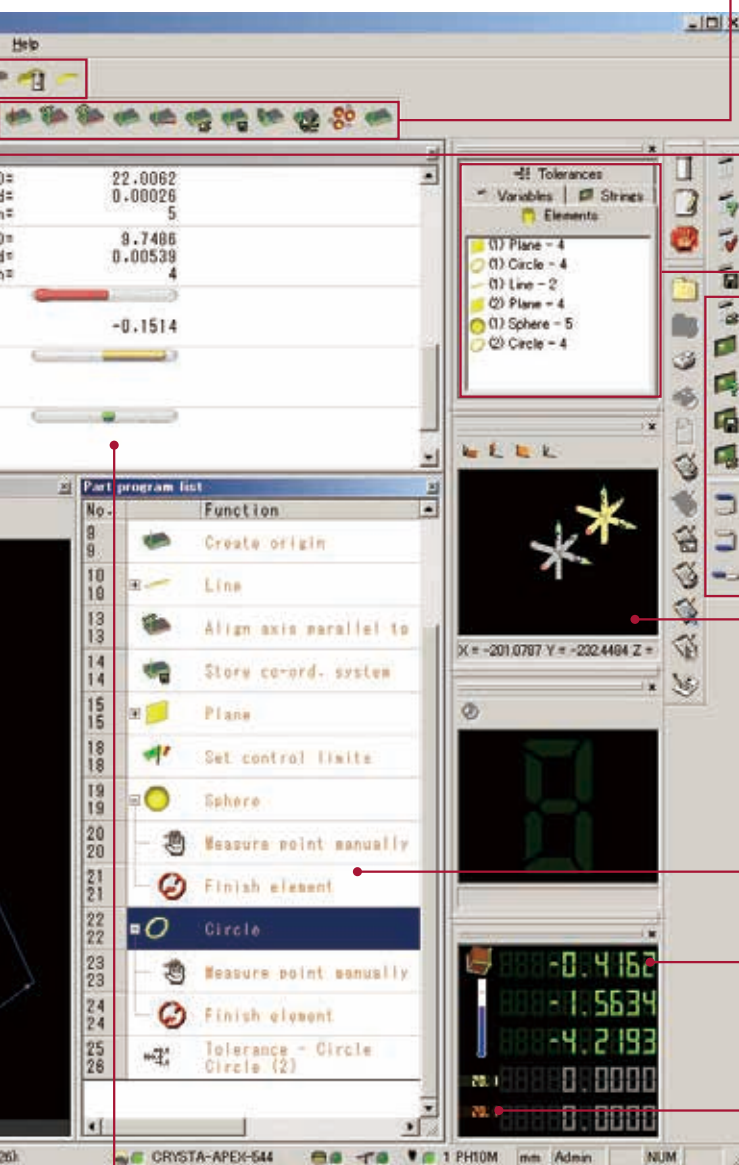
Element Drawing (Measurement Result Graphic Display) Window

- Graphically displays measurement results in real-time (Auto-magnification).
- Recalls an element from memory by clicking its graph with the mouse.



totally without using any code or code number.

ellipse, cone, sphere, cylinder, curve, curved surface, and gear elements. Click on the button which allows you to change the number of input points, select a calculation method, calculate the point(s) of intersection of two elements, and so on.



Coordinate System Setting Toolbar

- Sets up a coordinate system by setting a reference plane, reference origin, or reference axis, or axis rotation, etc. It can also store reference coordinates that have been set or recall them from memory.

Form/Orientation Deviation Calculation Toolbar

- Performs tolerancing for straightness, flatness, roundness, position, concentricity, coaxiality, parallelism, squareness, angularity, symmetry, runout, or profile. (Profile tolerancing is optional.)

Element List Window

- Displays elements that have been measured/calculated in a list.

Program Control Toolbar

- Inserts various control statements in a part program to perform logical operations, such as looping the program over a certain section and branching according to defined conditions.

Coordinate System Display Window

- Graphically displays the correlation between the machine coordinate system and part coordinate system. When measurement is performed while the coordinates are displaced frequently for feature measurement, this window allows easy confirmation of the current part coordinate position. It can also change the viewpoint of the coordinate system.

Part Program List Window

- Lists the commands of the part program being created

Counter Display Window

- Displays the current position readout from the X, Y and Z scales.

Current Temperature Display

- Displays the current reading from each temperature sensor. (Only for a CMM equipped with the temperature compensation function.)

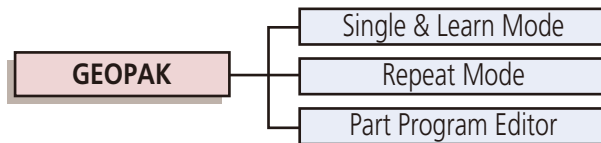
Measurement Result Display Window

- Displays measurement results and tolerancing results for each design value.

GEOPAK

Three Measurement Modes

GEOPAK has three modes of operation.



● Single & Learn Mode

Performs usual single-workpiece measurement. At this time the measurement procedures are stored as parts and available in the Repeat mode.

● Repeat Mode

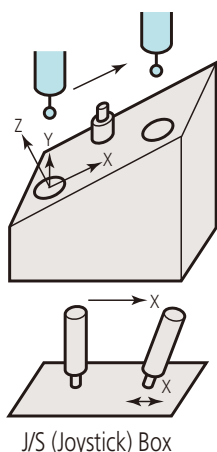
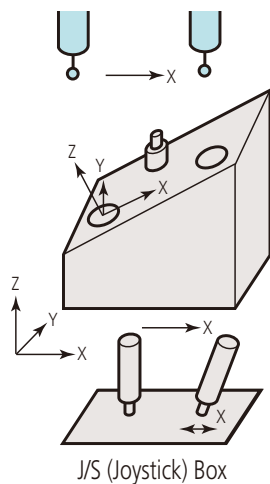
Performs measurement according to the part program or procedure. A CNC type CMM performs automatic measurement.

● Part Program Editor

Allow a part program or procedure to be edited.

Probe Movement by Joystick (CNC)

The CMM probe can be moved parallel with an axis of a part coordinate system (PCS) by tilting the joystick. (Only applies to a CMM with this function.)



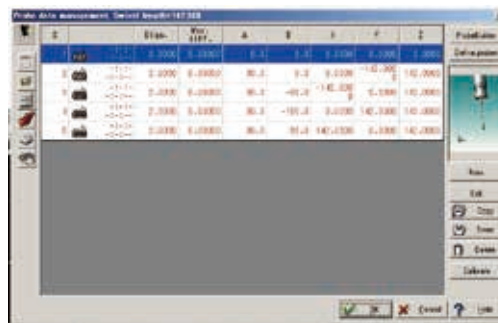
(Movement parallel to an axis)

Useful Probe Setting Functions

● Probe Data Manager

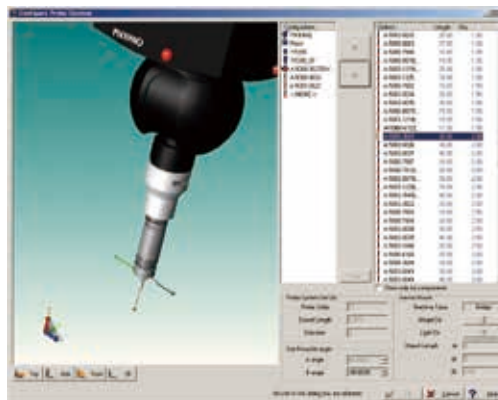
Performs creation, edit (change), copy, delete, or storage of probe data and calibration (compensation of stylus ball center position by probing the master ball).

A set of probe data that has been registered can easily be selected by highlighting that data set with the mouse. (See figure below.)

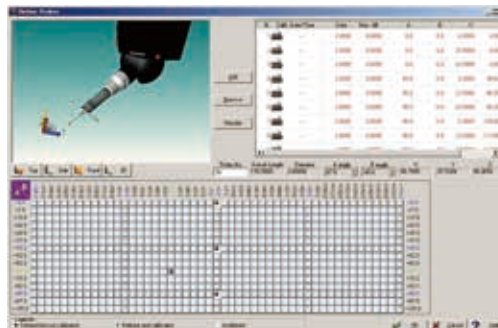


● Probe Builder

Builds the probe configuration to be used by selecting a probe and stylus from the screen. Auto-calibration can start with the built probe configuration.



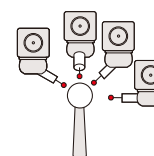
For rotating probe, probe registration can be easily performed in one operation by just selecting angle of axis A and axis B from the table.



● Auto Calibrate Probe (CNC)

Automatically performs probe calibration just from one probed point on top of the master ball, made using the joystick.

This function has drastically reduced the number of man-hours compared with the conventional method of step-by-step instruction.

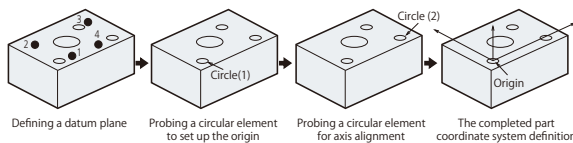
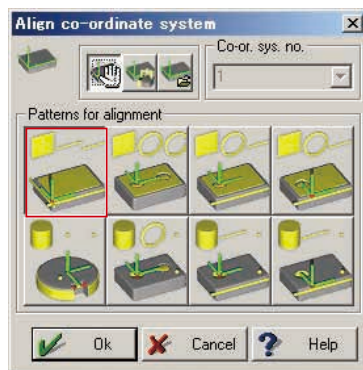


User-friendly Coordinate System Setting

Sets up the coordinate system for a workpiece placed anywhere within the measuring volume.

● Coordinate System Definition Using a Predefined Element Sequence

- Probing sequences using eight predefined combinations of typical workpiece elements are available to define the part coordinate system. The most appropriate sequence for any particular workpiece is invoked by selecting the corresponding menu icon.
- In contrast to conventional coordinate setting, you can change an element within a sequence and the number of points that define its orientation.



● Coordinate System Definition Using the Separate Element Functions

A part coordinate system can also be defined by combining coordinate system setting functions and element measurement functions.

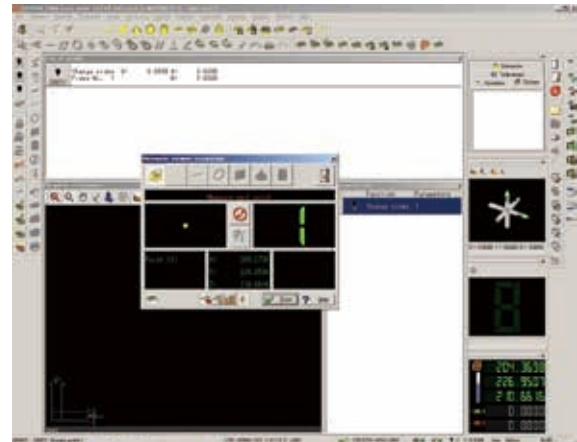
Coordinate Setting Toolbar



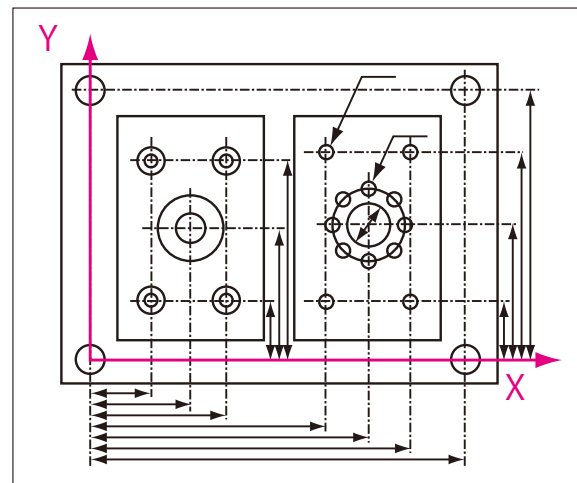
- Plane alignment (part inclination alignment, height origin setting)
- Axis alignment parallel to an axis (axis alignment with a line, cylinder axis, etc.)
- Axis alignment with reference to a point (axis alignment with a point, circle center point, etc.)
- Offset axis alignment (axis alignment with a point off the axis)
- Origin setting
- Translation and rotation of the coordinate system (translation/rotation by key-in)
- Coordinate system call
- Coordinate system storage
- RPS correction (coordinate system setting with a measurement point and design value)
- Coordinate system best-fitting

Automatic element measurement (AI function)

The AI function automatically determines what elements were measured and performs the necessary calculations, even if the user does not specify commands such as "Measure surface" or "Measure circle" in advance.



The need for a key operation to indicate measurement completion is also eliminated. Therefore, in the measurement example in the figure below, the user can complete the measurement without operating any keys.



Voice Recognition Function (For manual type CMM)

This function allows voice instruction of operations conventionally performed with the mouse. This eliminates the necessity of taking hands off the CMM each time it is operated, thus drastically increasing operating efficiency.

Voice recognition example

Instruction	Voice instruction
Point measurement	Point measurement
Line measurement	Line measurement
Plane measurement	Plane measurement
Circle measurement	Circle measurement
Coordinate system pattern 1	Coordinate system pattern
Delete the last instruction	Return to the previous instruction
Move one point back	Delete the one point



GEOPAK

A Rich Choice of Elements and Calculation Methods

Single and multiple element measurement options and calculation methods are available.

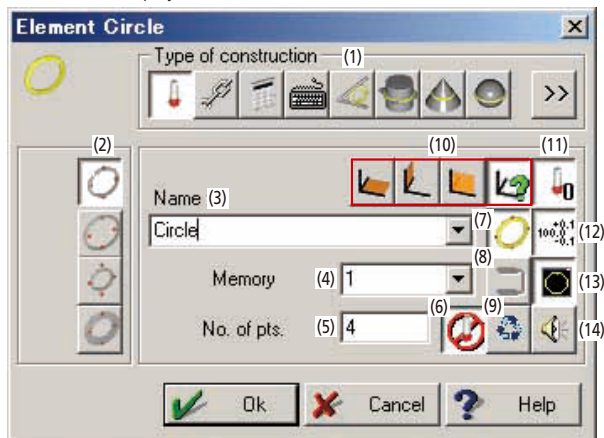


Calculation can be performed by the combination of base elements (point, line, circle, ellipse, plane, cone, sphere, cylinder, stepped cylinder, etc.) with point intersection, line intersection, distance, and angle, etc. Sophisticated measurements such as contour, free-form surface, and gear measurement are also possible (option).

Sub Window

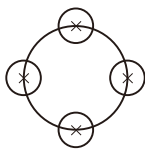
When an element measurement is selected, a sub window will appear. This window allows setting a calculation method, changing the number of input points, and other settings.

Sub Window (displayed after Circle Icon is selected)



(1) Element measurement method selection

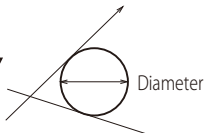
This toolbar allows selection of real input, combination, call from memory/recalculation, creation of theoretical circle by key-in, intersection of circle between a plane and a cylinder/cone/sphere or height up to the specified intersection circle radius, two-axis tangent circle, etc.



Combination
Calculates a new element created in combination with other elements.



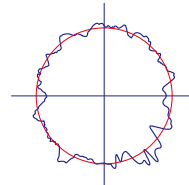
Intersection circle
By specifying a circle created by intersecting two elements or the circle diameter, it is possible to calculate the height to an apex.



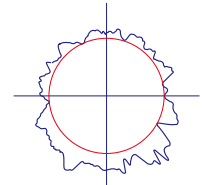
Intersection circle
Calculates the position of a circle that touches two line elements. (A diameter is given.)

(2) Calculation formula selection

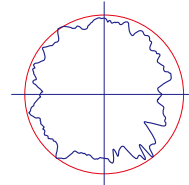
This toolbar selects a calculation method for circle measurement from among the least squares, inscribed circle, circumscribed circle or minimum zone methods.



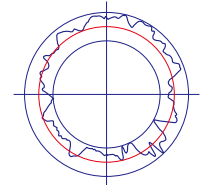
Least squares method
Determines the circle that makes the sum of the squares of the deviation between that circle and the measurement data a minimum.



Inscribed circle method
Determines the largest diameter circle that inscribes the measurement data.



Circumscribed circle method
Determines the smallest diameter circle that circumscribes the measurement data.



Minimum zone method
Determines the circle that is equidistant between two concentric circles that enclose the measurement data so as to produce the minimum separation.

(3) Element name

An arbitrary name can be given to an element to be measured.

(4) Memory number

Specifies the memory location number for an element.

(5) Number of input points

The number of measurement input points is specified here. No limit is placed on the number of points. (The upper limit is dependent on computer performance.)

(6) Unspecified number of input points

If the number of measurement input points is unknown, this icon is turned ON. Measurement can be interrupted at any given number of points during measurement.

(7) Auto-measurement ON/OFF (only for CNC CMM)

Auto-measurement can be performed just by specifying a design value.

(8) Memory location increment

To automatically increment an element memory number during looping, this icon is turned ON. (Usually, if the command is specified in the loop, the icon is automatically turned ON.)

(9) Repeat measurement

This icon specifies whether or not to repeat the same measurement.

(10) Datum plane

This toolbar specifies the datum plane for circle calculation manually or by auto-selection.

(11) Datum plane projection ON/OFF

Specifies whether or not to perform projection onto the datum plane. A circle is calculated as that projected on the datum plane if this icon is turned ON and as that located at the mean height of input points if it is turned OFF.

(12) Tolerance zone measurement ON/OFF

Specifies whether or not to perform tolerance zone measurement. If this icon is turned ON, the Tolerance Zone Measurement Setup window (see page 11) is automatically opened after the end of element measurement.

(13) Graphics ON/OFF

Specifies whether or not to display an element graphic on the input point number counter.

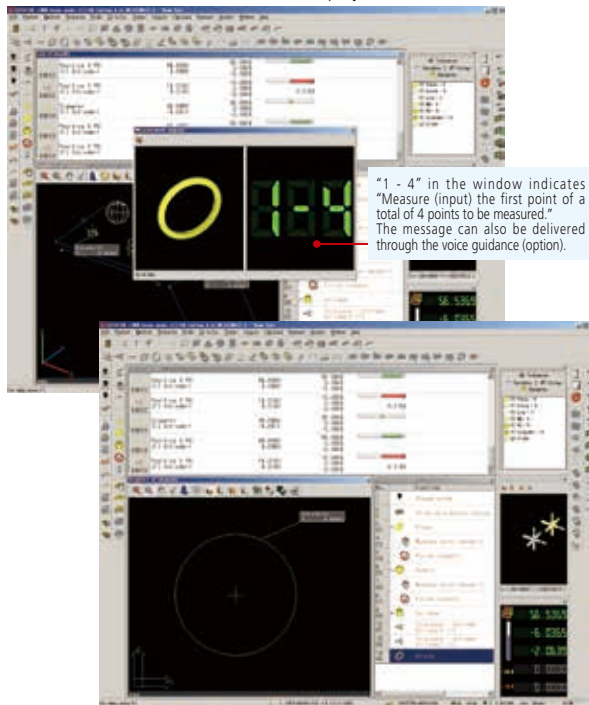
(14) Voice ON/OFF

Specifies whether or not to inform you of the count of input points by voice.

● Measurement/Measurement Result Display

When a measurement element is selected, the Measurement Display (Measurement Point Number Display) window appears. Now, you can start by measuring the position of a point.

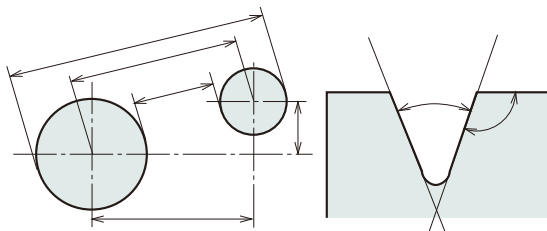
Measurement / Measurement Result Display



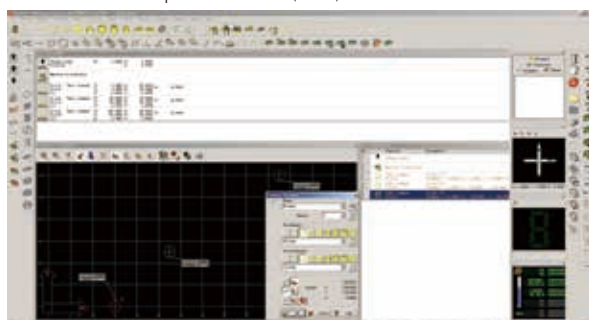
▲ When measurement (input) has been completed, actual measurement values are displayed in the Result Display field (window) and the graphics of measured elements are displayed in the Element Drawing window. (Auto-magnification and zooming are possible in drawing.)

● Distance/Angle Calculation

Performs calculation of a distance or angle by specifying two elements.



Measurement Example of Distance (Pitch) between Two Circle Centers



▲ In this example, after circle data has been collected (circle 1 to circle 3), the distance between the centers of circles 1 and 3 is measured. At this time circle 1 and circle 3 can also be selected from the pull-down list shown in (1). However, these circles can be selected more easily by directly clicking on their graphics displayed in the Element Drawing window. (Selected graphics are marked with red numerals.)

Tolerancing (Tolerance Zone Comparison)

Compares element data from measurement or calculation against the design value for a specified tolerance.

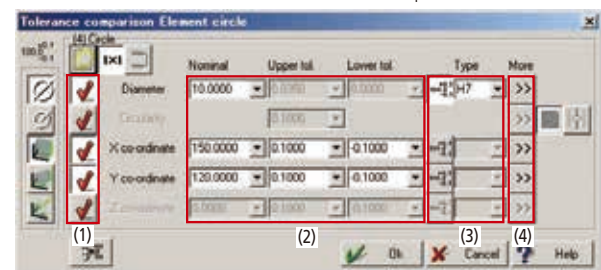
● Element/Form Tolerance Zone Measurement

The measurement result for an element is analyzed by specifying the element that has been measured or calculated and giving the design value and tolerance to be applied.

Items That Can Be Toleranced for Each Element

Elements	Items to be specified
Point	Coordinate
Line	Coordinate, angle, straightness
Plane	Coordinate, angle, distance, flatness
Circle	Coordinate, radius/diameter, roundness
Ellipse	Coordinate, minor axis, major axis, ellipticity
Cone	Coordinate, angle, full apex angle/half apex angle, conicity
Sphere	Coordinate, radius, diameter, roundness, sphericity
Cylinder	Coordinate, radius, diameter, cylindricity
Distance	Distance and its individual X, Y, Z component outputs
Angle	Spatial angle, XY-, YZ-, and ZX-projected angles

Circle Element Tolerance Zone Measurement Setup Window



(1) Tolerance zone measurement ON/OFF

Click on the icon of an item to be tolerated.

(2) Design value/tolerance input

Enter the design value and upper/lower tolerance limit for each item.

(3) Fitting symbol specification

Tolerancing can also be performed by giving a design value and type of fit symbol.

(4) Extended tolerancing specification

Select any of these icons to output tolerancing data to MeasurLink (Statistical Processing Program).

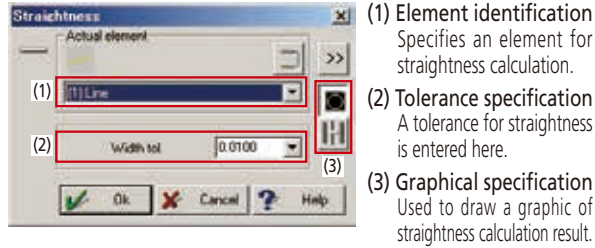
Tolerancing Result Compared with Design Value

▲ When the design data has been entered, tolerancing results are displayed. In the Result Display field, tolerance status is displayed in bar graph form in addition to actual measured values, design values, tolerance limits, and errors for specified items, giving you an at-a-glance status of measured data. (A result within tolerance is displayed green or yellow, and that out of tolerance is displayed red.)

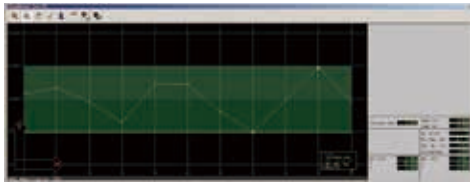
GEOPAK

Tolerancing (Tolerance Zone Comparison)

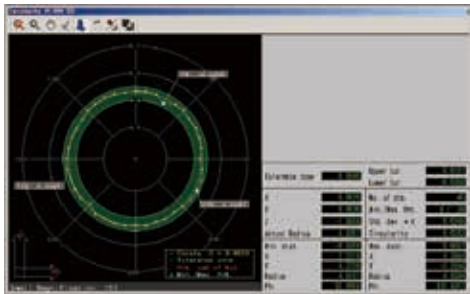
Straightness Tolerance Zone Measurement Setup Window



Straightness Evaluation Graphic



Roundness Evaluation Graphic

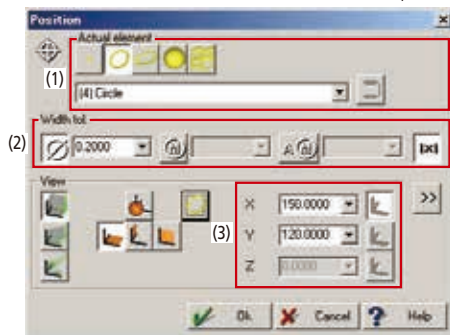


Note: The window can also draw graphics for flatness and runout.

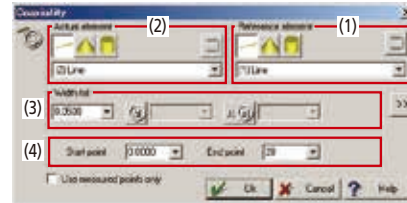
● Positional Deviation Tolerance Zone Measurement

Performs calculation of positional deviation, concentricity, coaxiality, and symmetry by specifying two elements that have been measured or calculated.

Positional Deviation Tolerance Zone Measurement Setup Window



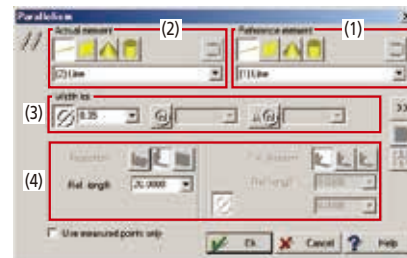
Coaxiality Tolerance Zone Measurement Setup Window



● Orientation tolerance zone measurement

Performs tolerancing of parallelism and squareness by specifying two elements.

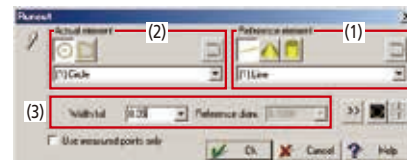
Parallelism Tolerance Zone Measurement Setup Window



● Runout Tolerance Zone Measurement

This function performs tolerancing of runout.

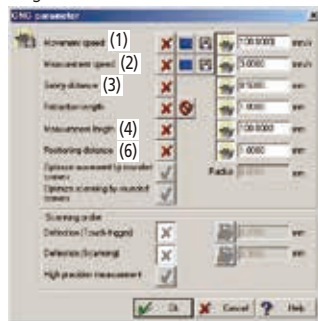
Runout Tolerance Zone Measurement Window



CNC Parameter Setting (CNC)

This function allows setting of traverse speed, approach distance, positioning accuracy and other factors for a CNC type CMM.

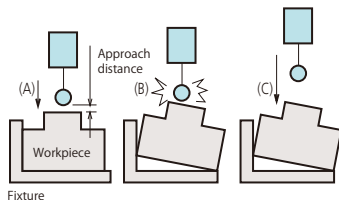
CNC Parameter Setting Window



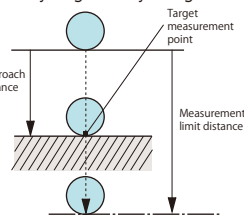
(1) **Traverse speed**
Sets the maximum traverse speed for the CMM.

(2) **Measuring speed**
Sets a measuring speed for the CMM.

(3) **Approach distance**
Sets the distance at which a CMM probe stylus decelerates from traverse speed to measuring speed when approaching the target measurement point. If the mounting position of a workpiece is only approximate, or if its dimensional variation is large, there is a risk the stylus could bump the workpiece (B) at traverse speed if the approach distance is specified as the ideal minimum (A). If this is the case, this field can be used to guarantee safe operation (C) by making sure the approach distance includes a sufficiently large safety margin.



(4) **Measurement limit distance**
Specifies the distance at which the probe is allowed to move at measuring speed if no workpiece is encountered.

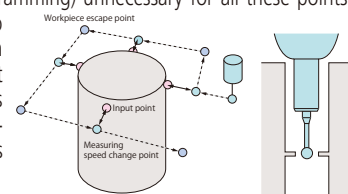


(5) **Positioning distance during traverse**
Positioning accuracy at a corner is specified by a distance during traverse. This function is intended to reduce the traverse time and does not affect the accuracy of measurement positions.

Auto Element Measurement (CNC)

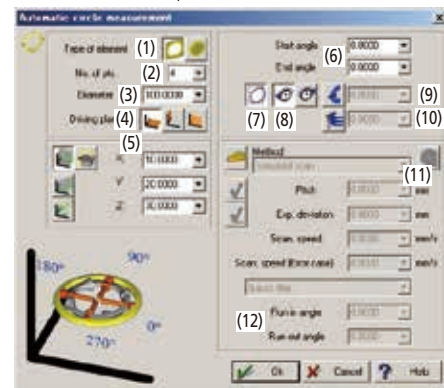
This function performs auto measurement by simple numerical input.

Usually, to perform auto measurement, an auto measurement part program is created by means of teaching, etc., through the remote control. If circle measurement (as shown below) is performed at this time, for example, the workpiece escape point and speed change point must be specified as well as measurement input points. The use of the auto element measurement function makes teaching (programming) unnecessary for all these points. Also, it makes it possible to perform measurements such as accurate positioning at theoretical measurement points (as shown at right) and equally-divided point input which is difficult with teaching.



The auto element measurement function is also available for measurement of a point, line, plane, and cylinder in addition to a circle.

Auto Circle Measurement Setup Window



(1) **Inside/outside diameter**
Specifies the inside or outside diameter of a circle to be automatically measured.

(2) **Number of points for auto circle measurement**
Specifies the number of points with which a circle is automatically measured.

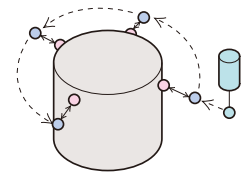
(3) **Circle diameter**
Specifies the diameter of a circle to be automatically measured.

(4) **Drive plane switch**
Identifies the plane on which a circle is positioned.

(5) **Circle center coordinates**
Specifies the center coordinates of a circle to be automatically measured. Cartesian, cylindrical or spherical coordinates can be used.

(6) **Partial circle auto-measurement**
Enables auto-measurement of a partial circle by specifying the start angle and end angle.

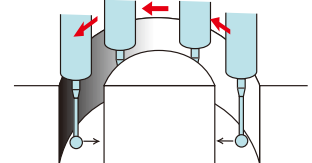
(7) **Circular travel**
Allows circular traverse of the probe between input points to perform circle measurement at higher speed. (See figure below.)



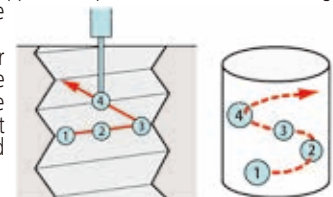
(Figure 1) Auto Circle Measurement by the Circular Travel Function

(8) **Measuring direction**
Specifies whether auto-measurement of a circle is performed clockwise or counterclockwise.

(9) **Circular groove auto-measurement**
Enables auto-measurement of the inside or outside diameter of a circular groove so that the probe contact point does not touch the opposite-side wall.



(10) **Direct measurement of a tapped hole**
If the position of a tapped hole is measured as if it were a plain hole then a large measurement error will usually occur. The conventional way of accurately measuring tapped hole position is to screw a tooling ball into the hole so that the ball can be probed instead. This function offers the faster alternative of probing the thread directly by driving the contact point in a spiral that matches the diameter and pitch. (Registered patent)



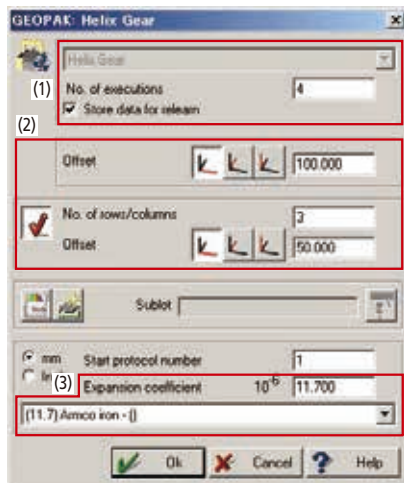
(11) **Contour measurement by design value scanning (scanning probe function)**
Performs design value scanning at a specified scanning speed. The function enables filter processing at the same time.

(12) **Start-up/post-travel angle specification**
Specifies a start-up angle and post-travel angle for contour measurement by design value scanning.

GEOPAK

Repeat Mode

This mode implements measuring procedures based on existing part programs.

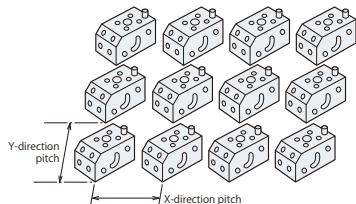


(1) Part specification

This field specifies the part program and the number of times this program is to run.

(2) Offset values

Used when a number of workpieces are to be measured with one instruction. The workpieces are arranged in a regular 2-D rectangular grid pattern in the XY, YZ or XZ planes at a specified pitch in each direction.

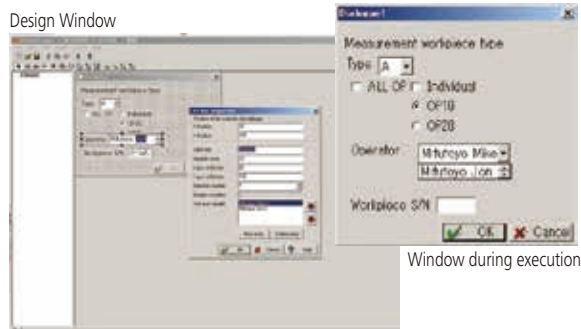


(3) Thermal expansion coefficient (effective only for a CMM equipped with the temperature compensation function)

The thermal expansion coefficient of a workpiece is specified in this field so that the CMM can convert a measurement result obtained at a temperature other than 20°C to that at 20°C.

Dialog Designer

Dialog displays during part program execution can be designed freely. By using this function, an operator can select several part programs and set the execution condition easily. Serial number of workpieces and an operator's name can be selected as well. Finally, such information can be written in the certificate, etc.



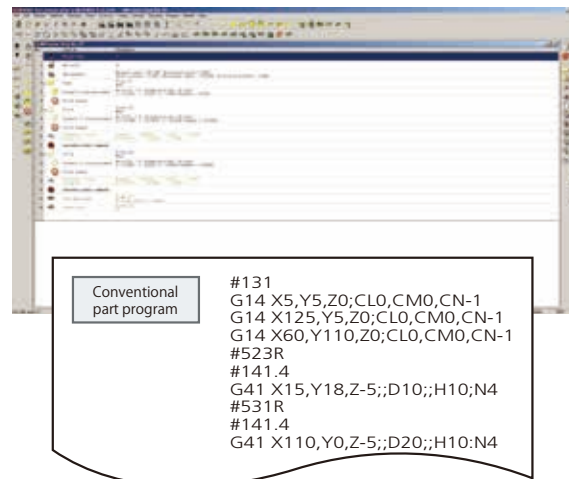
Window during execution

Part Program Editor

This function allows editing of a part program.

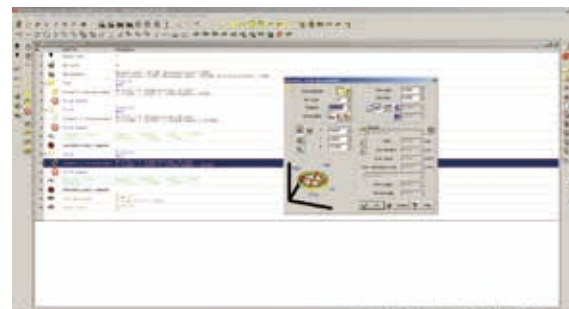
MCOSMOS part programs have a more easily understandable configuration compared with the conventional program since they are given the same icon and element name as the measurement and detailed information can also be included.

Part Program List



To edit a part program, highlight the line to be corrected (or inserted) and then execute the correction command. The following sub window identical to measurement will appear. Now a correction can be made to a numeric value, etc.

Part Program Correction Example



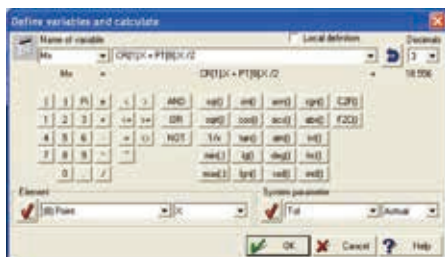
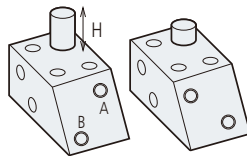
Program Control

It is possible to create a part program that can be changed according to the measurement situation by inserting various control statements.

Control statement	Control information
Loop	Repeats a specified series of instructions for a fixed number of times. Related icons: Loop initiation, Loop termination
Branch	Departs from the normal sequence of executing instruction according to the given condition. Related icons: Branch If, Branch initiation, Branch termination, Else
Goto	Transfers execution from the normal sequence control to a predefined label. Related icons: Goto, Label definition
Sub-program	Returns to the original program after executing a specified subprogram. Related icons: Subprogram initiation, Subprogram termination
Variable/calculation	Defines a variable or a calculation formula. Related icons: Variable definition and calculation, others

● For example, the following operations can be executed with these control statements.

- If the measurement result of a certain feature is decided as NG, the part is measured three times.
(Otherwise, the program is stopped.)
- As shown in the right figure, the workpieces, which are different only in position between holes A and B depending on pin height H on the top, are to be measured with one part program.
- A measurement result is to be substituted in a particular computing equation.



Graphic Display/Voice Output/Comment Display

This function allows display of graphics (.bmp/.jpg file) that have been created beforehand in the following window. The use of this window (as shown below) will be an operating procedure guide for beginners who are unfamiliar with the operating instructions. This window also allows comment display or voice output (.WAV file).



Output

Result data is output to a printer or a file.

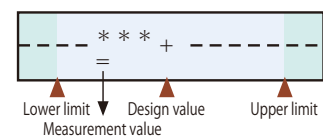
● Output to Printer

The program provides highly-flexible printouts by specifying data items such as header, footer, comment (text), all data, out-of-tolerance data only, control limit data only, etc.

Printout Example: Tolerance Zone Measurement

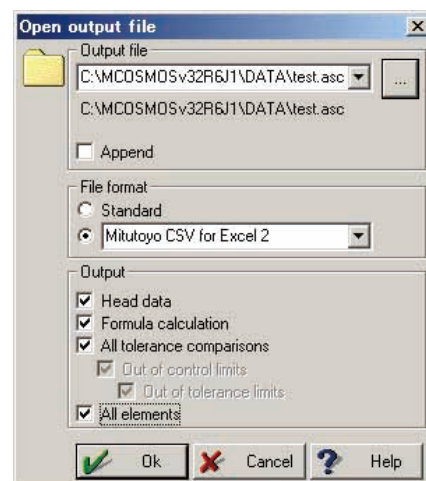
Admin		01/05/25 15:21	
Diameter	AP= 20.035 Mm	20.000	-----
Circle	DP= 0.038 UT	0.050	-----
(1)	LT= 0.000		
Diameter	AP= 50.052 Mm	50.000	-----
Circle	DP= 0.052 UT	0.100	-----
(2)	LT= 0.000		
Position X	AP= 80.076 Mm	80.000	-----
Circle	DP= 0.076 UT	0.100	-----
(2)	LT= -0.100		
Position Y	AP= 40.056 Mm	40.000	-----
Circle	DP= 0.056 UT	0.100	-----
(2)	LT= -0.100		
Diameter	AP= 50.063 Mm	50.000	-----
Circle	DP= 0.063 UT	0.100	-----
(3)	LT= 0.000		
Position X	AP= -76.919 Mm	-80.000	-----
Circle	DP= 0.084 UT	0.100	-----
(2)	LT= -0.100		
Position Y	AP= 40.056 Mm	40.000	-----
Circle	DP= 0.056 UT	0.100	-----
(3)	LT= -0.100		
Distance X	AP= 30.882 Mm	40.000	-----
Distance	DP= -0.138 UT	0.180	-----
(1)	LT= -0.180		

At the time of tolerance zone measurement a result marking is appended to each measurement value so that any trend may be seen easily.



● Output to File

- The information to be displayed in the Result Display field can be stored in a specified file.
- Data items to be stored can be selected in the same manner as printouts.



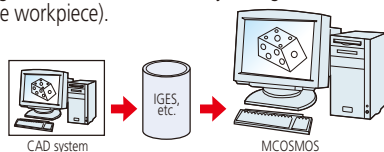
CAT1000P (Online/Offline Teaching Program)

CAT1000P is a simplified online/offline teaching program for creating a GEOPAK part program from model data output from a 3D-CAD system.

Loading CAD Data

This program reads model data (e.g. IGES) and displays it through MCOSMOS.

CAT1000P allows mirror inversion of a model and thick-plate setup (correcting an error by giving an offset if it is caused by a height difference between model data and the workpiece).



Supported CAD Data Formats

Format	Extension	Supported version*2
SAT	.sat	up to 23
STEP	.stp / .step	AP203/AP214 (geometry only)
IGES*1	.igs/.ige/.iges	V4.0, V5.2, V5.3
VDAFS*1	.vda / .vdafs	V1.0, V2.0
UG/NX*1	.prt	11 to 18, NX1 - NX8.0 (With PMI), NX8.5 (Without PMI)
SolidWorks*1	.sldprt/.prt	98 - 2013
Pro/E*1	.prt.1/.prt	16 - Wildfire 5 (With PMI), Creo 1.0 (With PMI)
CATIA V4*1	.exp	V4.1.9 - V4.2.4
CATIA V5*1	.CATPart/.CATProduct	R6 - R22 (With PMI)
Parasolid*1	.x_t/.xmt/.x_b	10.0 - 25.0
Autodesk Inventor*1	.ipt	R6 - R11, 2008 - 2013

*1 Option

*2 Supported version as of April 2014.

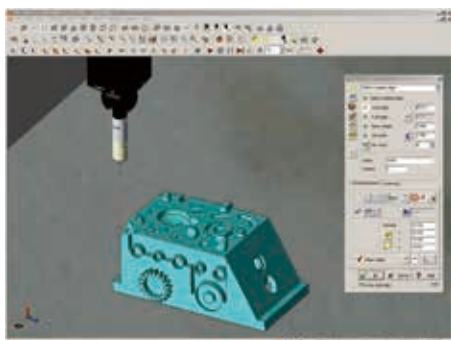
● Creating a part program from a CAD model

Instead of conventionally teaching (creating a part program) while operating the joystick, the program allows this work to be performed on a CAD model.

● Operation manner compatible with GEOPAK

The CAT1000P screen configuration is compatible with GEOPAK and allows the operator to work with almost the same operating image as seen in GEOPAK when actually measuring with a CMM.

Measurement path generation



● Automatic element measurement using the mouse

With CAT1000P, you can click the mouse to generate various commands such as those for automatically measuring or moving elements, and for rotating the probe. There is no need to manually enter data (data for specifying the position of an element, such as the center coordinates of a circle).

● Machine builder

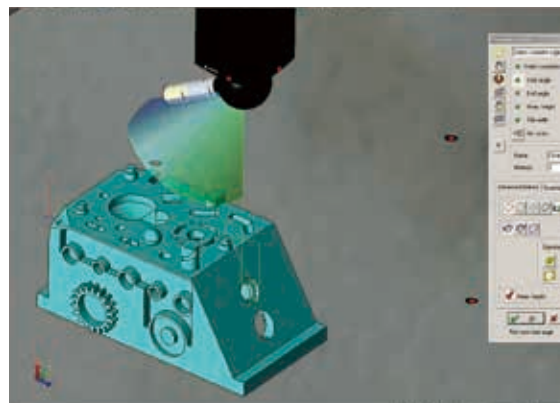
This builder can easily configure a CMM by selecting the CMM model, the type of a master ball, probe changer, etc., and setting the corresponding locations on the table. It is possible to perform operation simulation and interference check of probe and workpiece for the entire system configuration that has been created.

● Interference check function

Automatically determines whether or not a programmed probe motion would cause an interference situation (collision) with a workpiece. This helps create safe part programs.

● Automatic Probe Change

When the rotating probe head is used, the probing angle suitable to the location to be measured is automatically generated. The user can therefore create a measurement path without being concerned about the probe orientation.



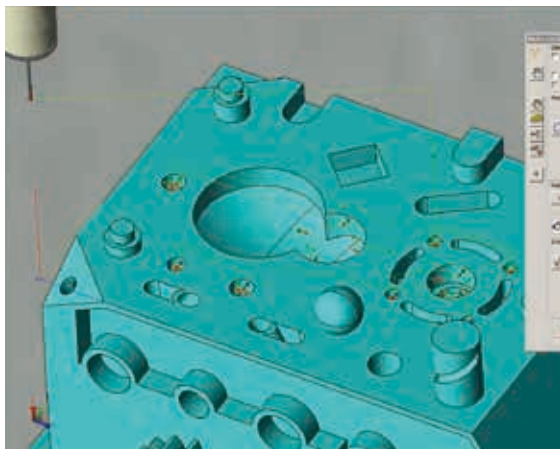
● **A rich choice of measuring elements**



Point/Line/Circle/Plane/Cone/Sphere/Cylinder/Inclined circle/Rectangular hole/Slotted hole

● **Measurement of multiple circles**

When the workpiece contains multiple circles, you can generate a path for measuring all of them. You can also specify whether a circle is to be measured based on its size, and optimize the measurement path.



● **Simulation function**

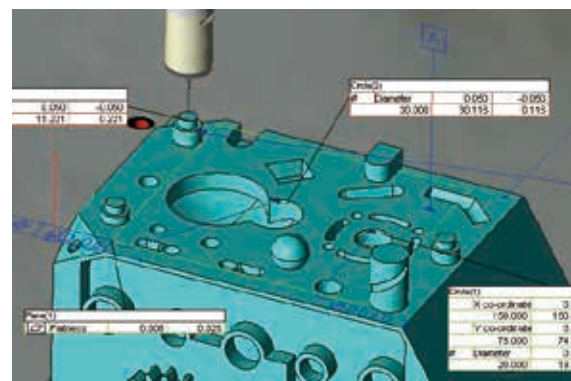
Once a program has been created, you can run a simulation on CAT1000P before using the program for actual measurement.

You can also check the operation of an existing part program by loading its CAD data. Furthermore, should interference occur during a simulation, the program stops at the interference location, allowing you to edit the program as necessary.

● **Element annotation**

You can display the measurement results of points and circular elements as well as the comparison results of various types of tolerances on a CAD model on CAT1000P.

You can also create and save the template to be displayed.

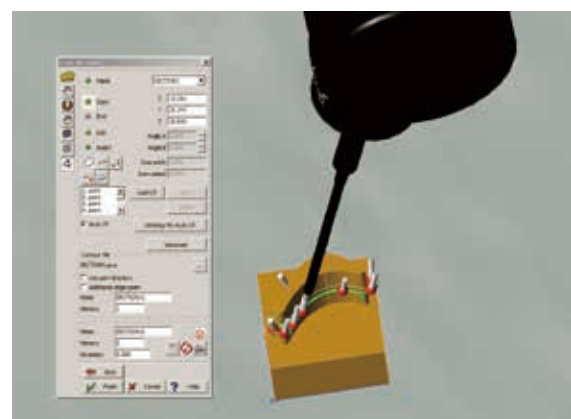


● **REVO Probe Compatibility**

MCOSMOS is compatible with the REVO five-axis measuring head and probe system.

Even for complicated movements, CAT1000P allows you to create a program quickly using mouse clicks only.

Because MCOSMOS is compatible with the sweep-scan unique to the REVO Probe, combining it with CAT1000S allows you to evaluate even a free-form surface.



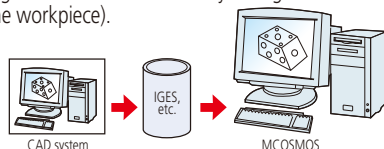
CAT1000S (Free-form Surface Evaluation Program)

CAD data is loaded on MCOSMOS to perform tolerancing with measurement data.

Loading CAD Data

CAT1000S reads model data (e.g. IGES) and displays it on MCOSMOS.

The program allows mirror inversion of a model and thick-plate setup (correcting an error by giving an offset if it is caused by a height difference between model data and the workpiece).



Supported CAD Data Formats

Format	Extension	Supported version*2
SAT	.sat	up to 23
STEP	.stp / .step	AP203/AP214 (geometry only)
IGES*1	.igs/.ige/.iges	V4.0, V5.2, V5.3
VDAFS*1	.vda / .vdafs	V1.0, V2.0
UG/NX*1	.prt	11 to 18, NX1 - NX8.0 (With PMI), NX8.5 (Without PMI)
SolidWorks*1	.sldprt/.prt	98 - 2013
Pro/E*1	.prt.1/.prt	16 - Wildfire 5 (With PMI), Creo 1.0 (With PMI)
CATIS V4*1	.exp	V4.1.9 - V4.2.4
CATIA V5*1	.CATPart/.CATProduct	R6 - R22 (With PMI)
Parasolid*1	.x_t/.xmt/.x_b	10.0 - 25.0
Autodesk Inventor*1	.ipt	R6 - R11, 2008 - 2013

*1 Option

*2 Supported version as of April 2014.

Measurement

The program performs one-point measurement of a workpiece and tolerancing comparison with CAD data.

● Online Measurement (Manual/CNC)

CAT1000S performs tolerancing of an arbitrary position (one point) measured with the Surface Measurement icon of GEOPAK with CAD data real-time.

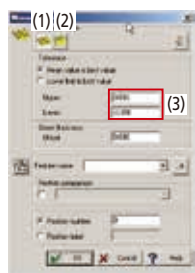
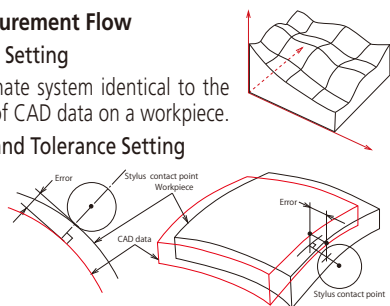
CAT1000S Online Measurement Flow

■ Reference Coordinate Setting

Set a reference coordinate system identical to the dimensional reference of CAD data on a workpiece.

■ Measurement Mode and Tolerance Setting

Switches the mode between surface measurement and border measurement, and sets tolerances.



- (1) Surface measurement
Measurement of point position on a curved surface
- (2) Border measurement
Measurement of edge position
- (3) Tolerance setting
Tolerances used for evaluation by CAT1000S

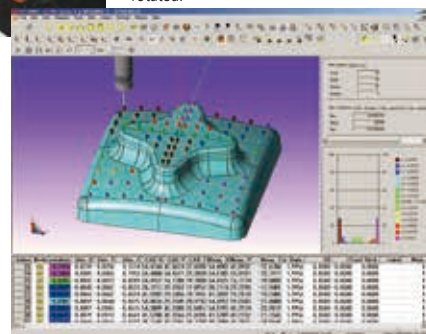
■ Measurement/tolerancing result display

A measured point appears in real-time on the CAD graphics in MCOSMOS.



◀ A 3D free-form surface or edge can be evaluated just by probing one point at an arbitrary position, irrespective of input direction.

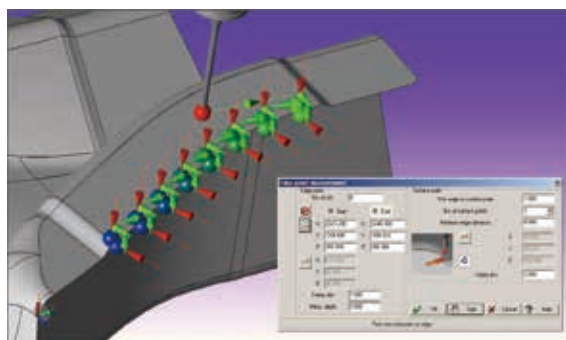
▼ Error bands are established and marked by color coding for easy visualization. An error line or numeric value can also be appended to each band. A graph can be zoomed and rotated.



It is also possible to specify a measurement position from the CAT1000S side at the time of CNC surface measurement.

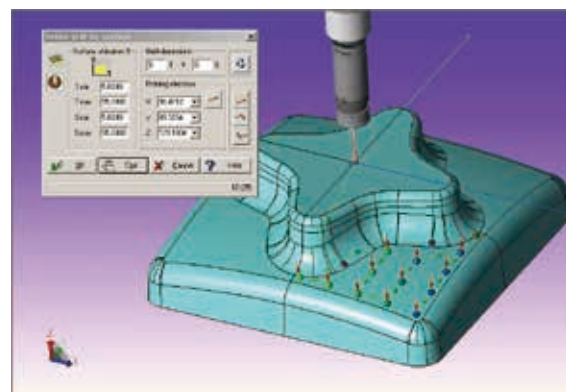
● Surface Search

Select an arbitrary position on a model and specify one point to be measured.



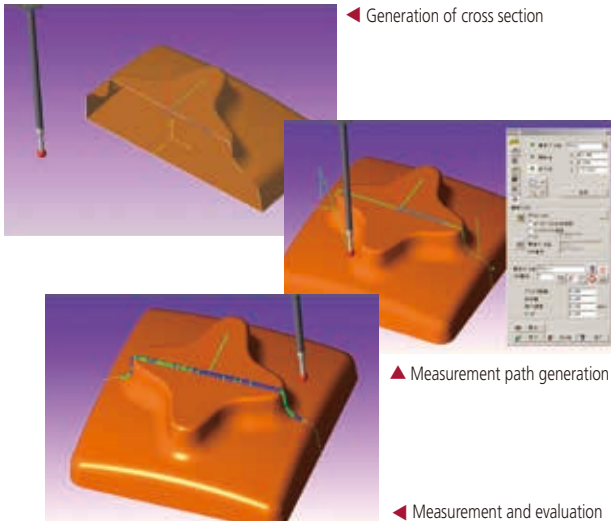
● Surface Grid

Select an arbitrary patch and specify the number of points arranged vertically/horizontally and the area usage rate to be set automatically in a reticular pattern.



● Sheet model section definition

This icon creates point sequence data between two points specified arbitrarily and performs auto-measurement of relevant points. (SCANPAK is required for this processing.)



These procedures can be stored as a part program and thereby any CNC type CMM can perform auto-measurement.

● Output

Measurement results can be output to a text file, DMIS file, and measurement data file.

Example of Output to a Text File

Point	X	Y	Z	Distance	Angle	Radius	Area	Volume
1	10.000000	10.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
2	10.000000	10.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
3	10.000000	10.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
4	10.000000	10.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
5	10.000000	10.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
6	10.000000	10.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
7	10.000000	10.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
8	10.000000	10.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
9	10.000000	10.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
10	10.000000	10.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000

● Offline Measurement

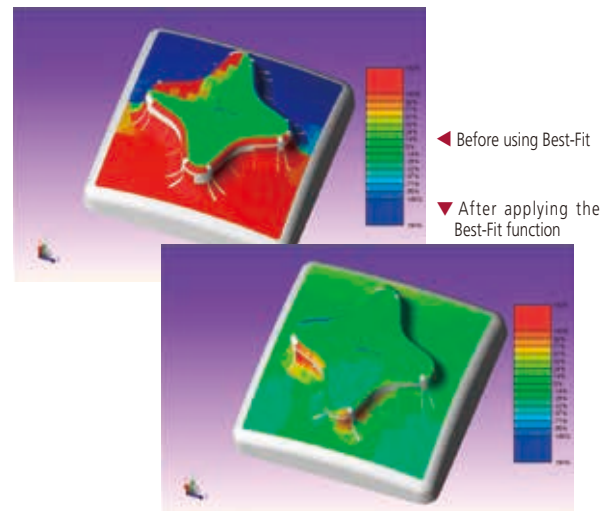
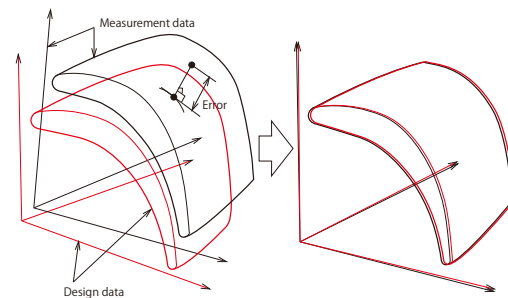
CAT1000S can perform evaluation (calculation only) of a free-form surface using measurement data already stored, ASCII data from an external system, or coordinates entered from the keyboard.

Measurement Data

```
PR;1.999403;
EB;SF;1;Surface;
MM;SF;0.050000;-0.050000
MP;10.003000;10.005000;2.044703;0.000000;0.000000;-1.000000;
MP;30.002200;10.000000;2.018003;0.000000;0.000000;-1.000000;
MP;30.000000;30.000000;1.976403;0.000000;0.000000;-1.000000;
EF;
EB;SF2;Surface;
MP;50.002000;50.050000;2.016403;0.000000;0.000000;-1.000000;
MP;60.000000;50.000000;2.058403;0.000000;0.000000;-1.000000;
MP;60.003000;70.030000;2.002403;0.000000;0.000000;-1.000000;
EF;
```

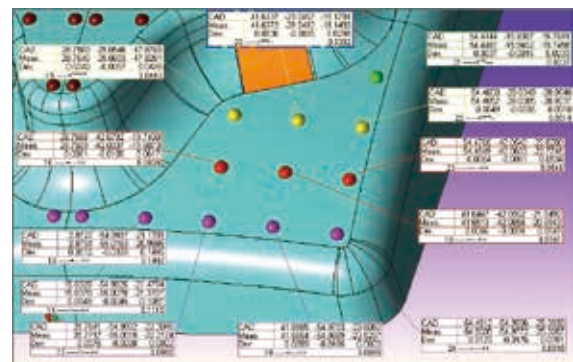
The Best-Fit function

This function automatically positions the workpiece coordinate system so as to minimize differences (errors) between the measured and design forms. It is effective where a reference coordinate system is not well defined.



Graphic Protocol Edition

Allows a graphic of a model to be displayed and printed with numeric data attached. The layout can also be stored (learned).



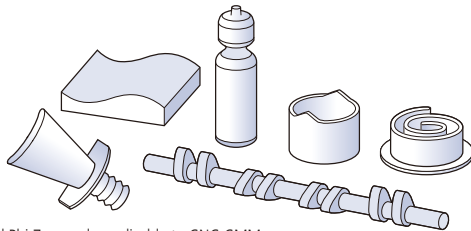
SCANPAK (Contour Measurement Program)

SCANPAK is a program for evaluating profile data obtained by GEOPAK.

Measuring Workpiece Contours

SCANPAK can evaluate 2.5D contours (3D mode), rotational body contours (R-Z mode) and cylindrical cam contours (Phi-Z mode)*1.

Examples of Workpieces Assessable with SCANPAK

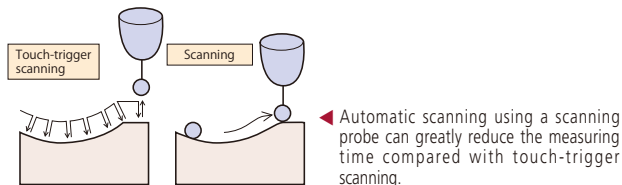
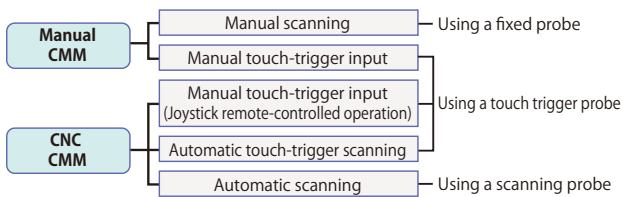


*1 R-Z and Phi-Z are only applicable to CNC CMM.
CAT1000S is required for measurement/evaluation of 3D free-form surface.

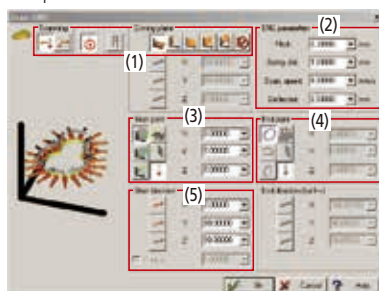
Measuring Method

Data is acquired through the GEOPAK Contour Measurement icon

Contour Measuring Method



Measurement Setup Window

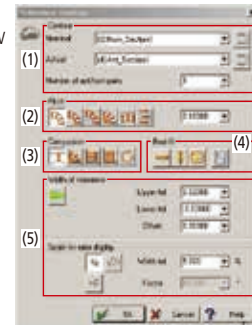


- (1) Scanning direction/cross-section
These tool icons are used to specify a scanning direction and a cross section.
- (2) Data loading
Specifies the measurement input pitch, safe distance (approach distance), scanning speed, etc.
- (3)(4) Start point/end point
These fields specify the start point and end point of measurement by setting each coordinate value.
- (5) Direction
This field specifies the direction the probe approaches the measurement start point.

Contour Tolerance Zone Measurement

This function performs tolerancing by comparing measured values with the corresponding design values.

Contour Tolerance Zone Measurement Setup Window

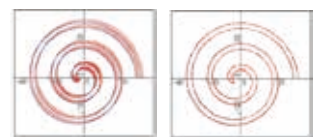


- (1) Contour data specification
Specifies design data and measurement data.
Design data can be provided with point sequence (X, Y, Z) data on a contour.

84.95687	0.01006	-6.99845
84.95563	0.36494	-6.99960
84.77160	3.28886	-6.99966
84.30990	6.17095	-6.99932
83.57109	8.99483	-6.99938
82.56004	11.73262	-6.99962
81.29150	14.36238	-6.99945
79.77063	16.85551	-6.99925
78.01538	19.18613	-6.99964
76.04346	21.33798	-6.99961
73.86841	23.28751	-6.99916
71.51881	25.01633	-6.99991
69.01574	26.50986	-6.99986
66.37367	27.74854	-6.99921
63.62563	28.73844	-6.99959

- (2) Tolerancing pitch
This field specifies a tolerancing point pitch and direction.

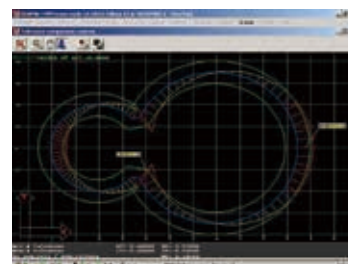
- (3) Tolerancing direction
This toolbar specifies whether to perform tolerancing in the axial or the normal direction.



- (4) Best-fit
This toolbar optimizes the correlation between the reference coordinates of measurement data and design data to minimize the amount of error.

- (5) Tolerance limit
Sets the upper and lower limit tolerances of a feature and specifies the width of the magnified error zone.

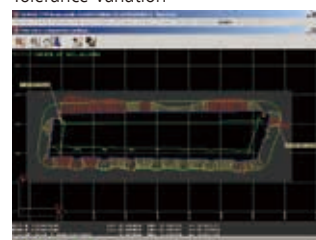
Tolerance Zone Measurement Result Display



A tolerancing result is displayed with graphics and "profile tolerance". If more detailed data (such as coordinates of each point) is necessary, analyze measurement data with FORMPAK-CMM (see page 24).

Tolerance Zone Measurement with Profile Data Specified as Tolerance Limits

Tolerance Zone Measurement with Tolerance Variation



● SCANPAK can perform non-uniform tolerancing by specifying profiles to represent the tolerance limits.

• Specifying tolerance limits with two different profiles

• Specifying tolerance limits with symmetric profiles

• Specifying tolerance limits with one profile and a limit value

▲ Tolerancing example (turbine blade fir-tree root)

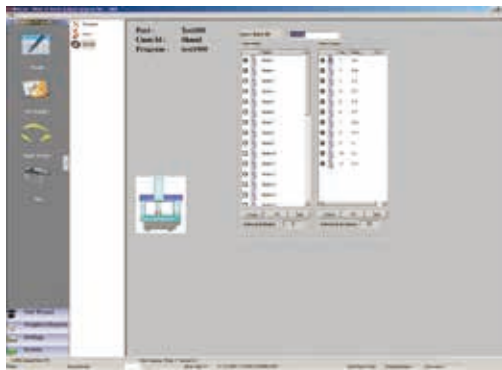
MAFIS Express (Optional Software)

This software enables measurement program creation, measurement instruction and analysis for blades/blisks.

MAFIS (Mitutoyo AirFoil Inspection System) Express is a software package for evaluating the precise shape of airfoil blades, individually and in the form of blisks, by enabling highly efficient part family based part-program generation and high-speed execution on a CNC type CMM. Part programs are easily generated by just selecting the parameters associated with the blade type to be measured. The package supports a wide range of touch-trigger and scanning probes (such as the SP25M and REVO), and measurement results are detailed in a report incorporating 2D graphic displays that highlight deviation from nominal data at each blade section. Database storage allows previous measurement results to be recalled and recalculated at will.

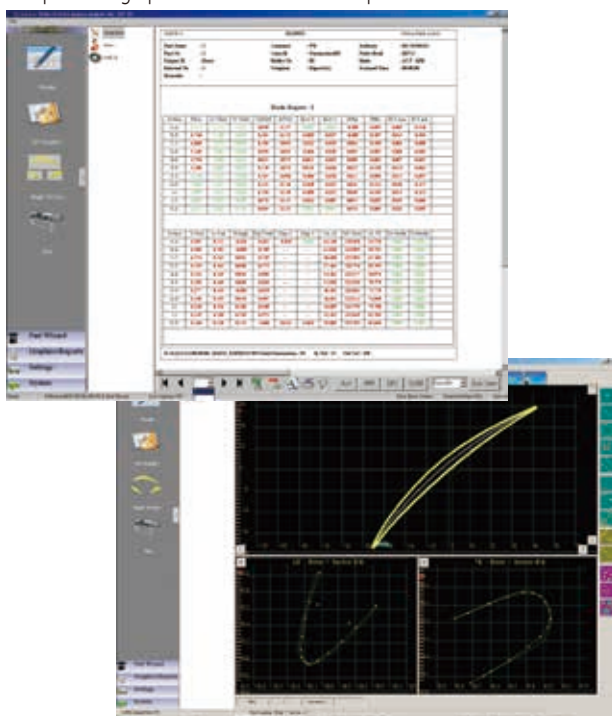
● Flexible measurement instruction

A blade (or cross section) to be evaluated is measured by selecting it at measurement-start time.



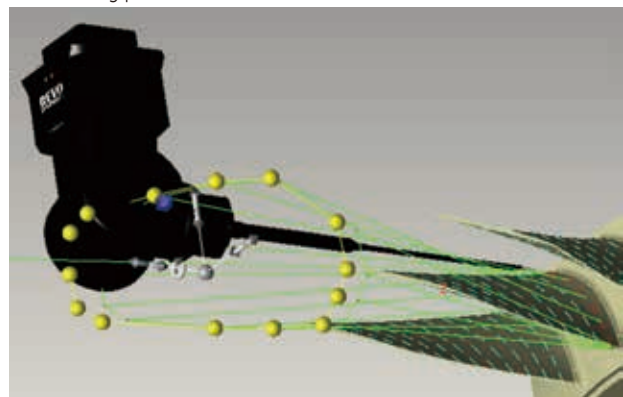
● Measurement result display

A measurement result can be checked with the numeric values on the report and graphic view of cross-section profile data.



● REVO 5-axis scanning path generation

The use of CAD data and CAT1000 allows easy generation of 5-axis measuring paths.



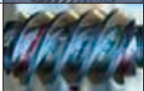
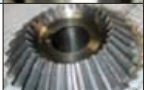
Optional Software

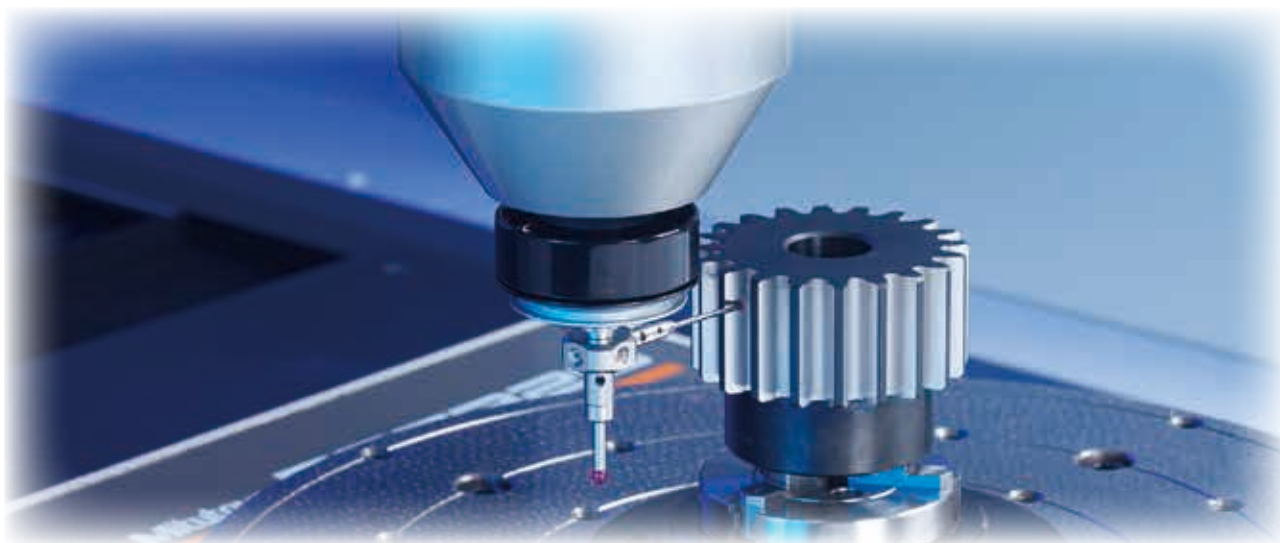
A wide variety of optional software packages that meet customer needs is available.

GEARPAK Series

Software is available for using a CNC coordinate measuring machine to measure various types of gears. When gear data is input, the various types of software packages generate simple part programs, enabling you to evaluate tooth surface shape, pitch, etc.

Gear types supported

Gear type		Touch trigger measurement	Scanning measurement	Required software package/Remarks
Cylindrical spur gear		●	●	GEARPAK Cylindrical
Cylindrical helical gear		●	● ^{*1}	GEARPAK Cylindrical ^{*1} : Does not support a cross-stylus
Worm gear (cylindrical)		●	● ^{*2}	GEARPAK Worm ^{*2} : MRT and MPP310 (Q) are required.
Worm gear (hourglass shape)		×	×	
Worm wheel (cylindrical)		●	●	GEARPAK Cylindrical Cylindrical gears only
Worm wheel (hourglass shape)		×	×	
Bevel gear		●	×	GEARPAK Bevel Supports Gleason gears. Note: Some gears are not supported.
Hypoid gear		●	×	GEARPAK Hypoid Supports Gleason gears. Note: Some gears are not supported.



Optional Software

GEARPAK-Cylindrical

GEARPAK-Cylindrical is for evaluating a tooth-form profile, tooth-alignment profile, etc., from the measurement data of an involute spur gear or helical gear obtained with a CNC CMM.

- **Creates a simplified part program from gear specification data**

A CNC part program can be created automatically on GEARPAK-Cylindrical just by entering the gear specification data and a measuring method. There is no need to teach the system so measurements are easily performed.

- **Automatic tolerance setting compatible with various standards**

GEARPAK-Cylindrical supports various gear standards and can set tolerance just by entering the specification data and the kind and level of standard. This software supports ISO1328, JIS B 1702*, DIN 3961 ff, AGMA 2000-A88, and R01-33-001F. Moreover, the software allows geometrical evaluation of gears with an arbitrary tolerance since a tolerance can be keyed in and edited.

*The new JIS standard is supported. If evaluation is performed with the old JIS, specify a tolerance through key-in. In addition to GEARPAK-Cylindrical, Internet Explorer (r 5.x or later) is required for evaluation.

Optional Software

GEARPAK-Worm

GEARPAK-Worm is for evaluating tooth-form profile, tooth-alignment profile, etc., from the measurement data of a worm gear obtained with a CNC CMM.

- **Creates a simplified part program from gear specification data**

A CNC part program can be created automatically on GEARPAK-Worm just by entering the gear specification data and a measuring method. There is no need to teach the system so measurements are easily performed.

- **Automatic tolerance setting compatible with various standards**

GEARPAK-Worm supports various gear standards and can set tolerance just by entering the specification data and the kind and level of standard. GEARPAK-Worm supports DIN 3974-1 and AGMA 2111-A98. Moreover, the software allows geometrical evaluation of gears with an arbitrary tolerance since a tolerance can be keyed in and edited.

Evaluation Item

Gear tooth form	Evaluation item	Total tooth form error
		Tooth-form profile error
		Tooth-form gradient error
Gear tooth alignment	Evaluation item	Total tooth alignment error
		Tooth-alignment profile error
		Tooth-alignment gradient error

Optional Software

GEARPAK-Bevel/Hypoid

GEARPAK-Bevel/Hypoid is for evaluating tooth-plane profile, pitch error, etc., from the measurement data of a bevel gear or hypoid gear obtained with a CNC CMM.

- **Creates a simplified part program from gear specification data**

A CNC part program can be created automatically on GEARPAK-Bevel/Hypoid just by entering the gear specification data and a measuring method. There is no need to teach the system so measurements are easily performed.

- **Determines specification data for corrected gear cutting by a unique algorithm**

GEARPAK-Bevel/Hypoid determines the specification data (estimated value) that indicates good tooth contact from gear data measured with GEOPAK and gear cutting specification data (initial value) used for a gear-cutting machine.

- **Supporting gears manufactured on a Gleason Corporation's gear-cutting machine**

GEARPAK-Bevel/Hypoid supports ring gears and pinion gears manufactured by the Formate or Helixform methods.

Note: In addition to GEARPAK-Bevel/Hypoid, Internet Explorer (r 5.x or later) is required for evaluation.



Result Drawing

Optional Software

Optional Software

FORMPAK-CMM

FORMPAK-CMM analyzes 2-dimensional cross-section profiles.

● Profile Analysis

- FORMPAK-CMM performs calculations by specifying an arbitrary range with the mouse.
- It can print a drawing, measurement conditions, measurement results, comments, etc., as a report after they are laid out in a freely-definable format.

Note: This software requires SCANPAK.



Optional Software

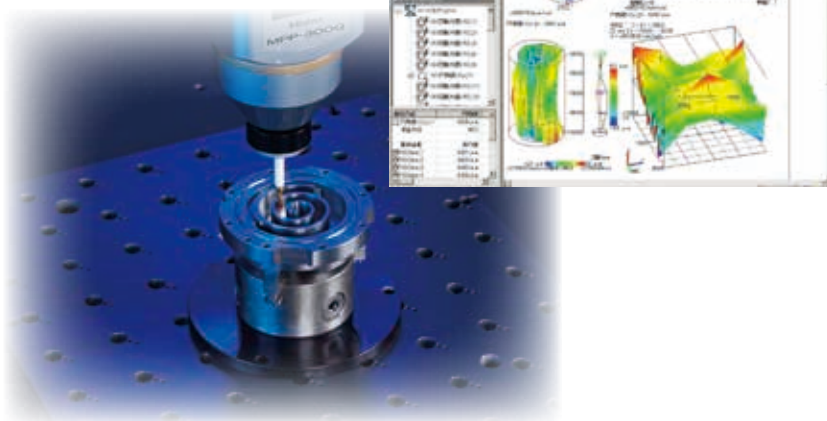
ROUNDPAK-CMM

This software can analyze not only cylindricity and roundness in detail, but also create excellent visual results.

● Elements that can be output from GEOPAK to ROUNDPAK-CMM

Lines, circles, cylinders, and surfaces

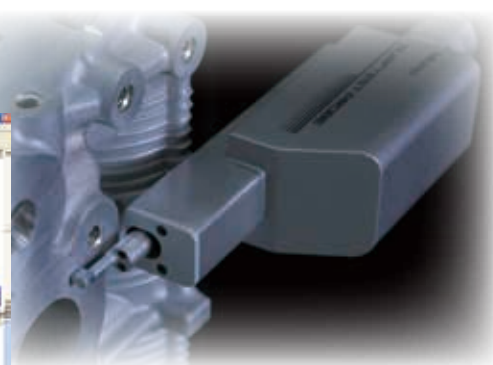
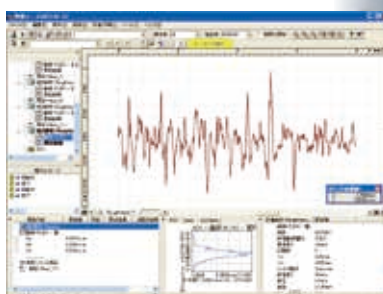
Note: This software requires a scanning probe.



Optional Software

SURFPAK-SP

- SURFPAK-SP is a specialized software package for analyzing surface roughness in conjunction with the SURFTEST PROBE, which is a surface roughness measuring probe for use on CNC CMMs.
- SURFPAK-SP analyzes surface roughness in conformance with ISO, JIS, ANSI and VDA standards. In combination with MCOSMOS, it enables fully automatic dimensional and surface roughness measurements.



Optional Software

SurfaceDeveloper

This software generates free-form surface models from multi-sectional contour data.

This is specialized software that generates CAD models from multi-sectional contour measurement data obtained using a CNC coordinate measuring machine.

SurfaceDeveloper can automatically generate high-quality, high-precision triangular mesh models (STL data) from multi-sectional probe center cloud data. Furthermore, it can generate free-form surface data (IGES data) from triangular mesh data.

Using the created CAD model as the master data, SurfaceDeveloper can be used in combination with CAT1000S.

Note: This software requires a scanning probe and SCANPAK.



Probe center cloud data



Real triangular mesh model



CAD data

Optional Software

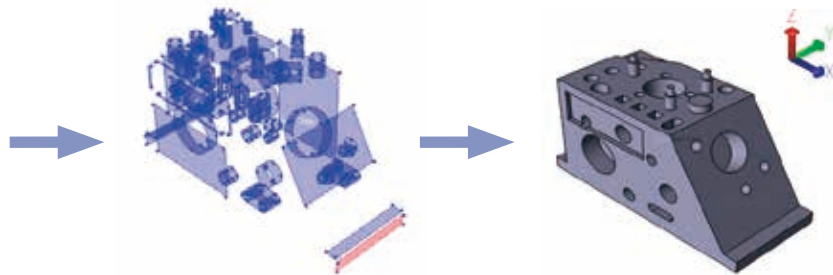
SolidModelDeveloper

This software generates a solid model from coordinate measurement data.

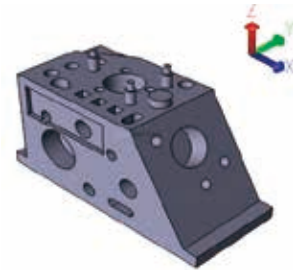
Designed to help with the design task by automatically generating a solid model from measurement results obtained by GEOPAK. When a result file is specified, a solid model is automatically generated. Auto-generation functions that support various shapes (angular, round, and shaft) are also included. Editing functions, such as element editing, solid model editing, and model geometry verification, are also included. The solid model data is created in the form of a SAT file.



Coordinate measurement



Loading of geometric elements



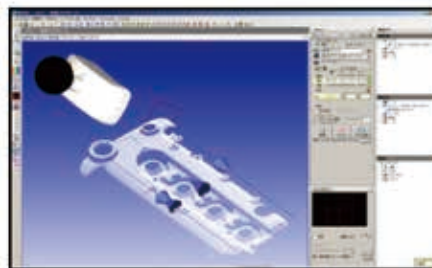
Solid model generation



Optional Software

MSURF

Point-cloud data processing software that can perform all steps from measurement to analysis.

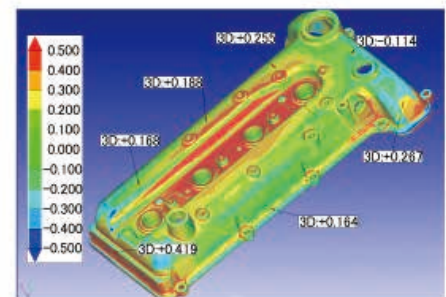


MSURF-I

This software extracts geometric elements from, and evaluates free-form surfaces and cross sections in, high-density, point cloud data obtained from the surface of a part, and then checks the results against master data. Point cloud data obtained using a non-contact probe as well as point cloud data obtained using a contact probe can be analyzed.

● MSURF-S/G

This is the dedicated software for the non-contact probe SurfaceMeasure. MSURF-S is the software for connecting to a CNC coordinate measuring machine online, while MSURF-G is offline software. Icon-based operations provide a user-friendly interface. MSURF-S/G can be linked with MCOSMOS and can continuously perform contact and non-contact measurements.



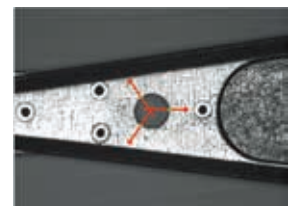
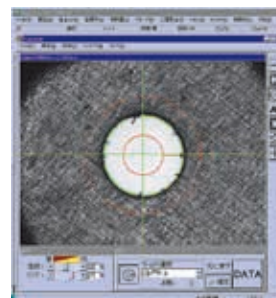
Optional Software

VISIONPAK

This software is specifically designed for the QVP Probe, which adds vision measuring functions to CNC coordinate measuring machines.

This software is specifically designed for the vision probe QVP, which provides CNC coordinate measuring machines with vision measuring functions.

A powerful image-processing function (tool) can perform various types of automatic edge detection on images captured by the QVP at high speed. Furthermore, this function can recognize edges that may be created by burrs or dust as abnormal points and avoid them.



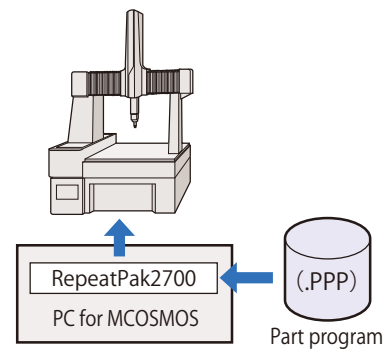
Optional Software

Optional Software

RepeatPak2700

This software is used for executing, within the Windows environment, part programs (.PPP files) created by an older data- processing system(GEOPAK2700, etc.)

*Probe calibration and creation of coordinate system by the part program execution are required.

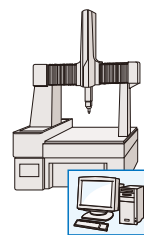


Optional Software

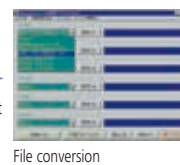
MeasureReport (Inspection Table Generation Software)

MeasureReport generates an inspection table in free format using data measured or acquired by GEOPAK.

- **MeasureReport can perform tolerance judgment on workpiece data and calculate mean, minimum, maximum, and range for measurement results.**
- **An inspection table is generated in combination with discrete measurement results.**
A maximum of 6 files can be combined.
Up to 200 inspection items or up to 10,000 workpieces can be combined.
- **A graphic (part drawing) and text (work instruction) can be added to a table.**
A maximum of 10 graphics and texts can be appended.
The software supports BMP-format files.
- **MeasureReport allows macro (operation) setting of inspection table generation.**
Preliminary macro settings such as auto-print, auto-termination, format specification, and calculation specification can greatly reduce inspection table generating operations.



Measurement result file

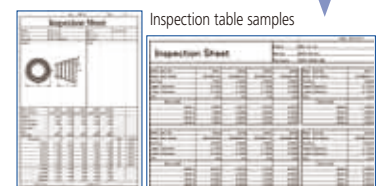


File conversion



Generation of inspection table

Note: In addition to this software, Microsoft-Excel is necessary.

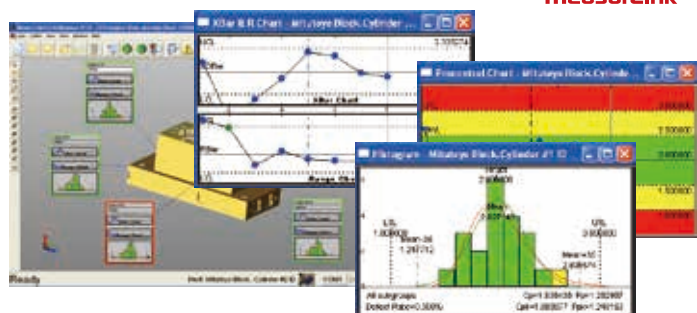


Inspection table samples

Optional Software

MeasurLink STATMeasure PLUS (Statistical Processing/Process Control Software)

MeasurLink STATMeasure PLUS allows statistical processing of measurement data. Also, real-time display of control charts can promptly recognize fault conditions caused by cutting tool abrasion or damage. This allows you to implement effective countermeasures (such as change of cutting tool or machining conditions). Moreover, with this software as a terminal, it is possible to build a central control system by connecting to a higher-level network environment.

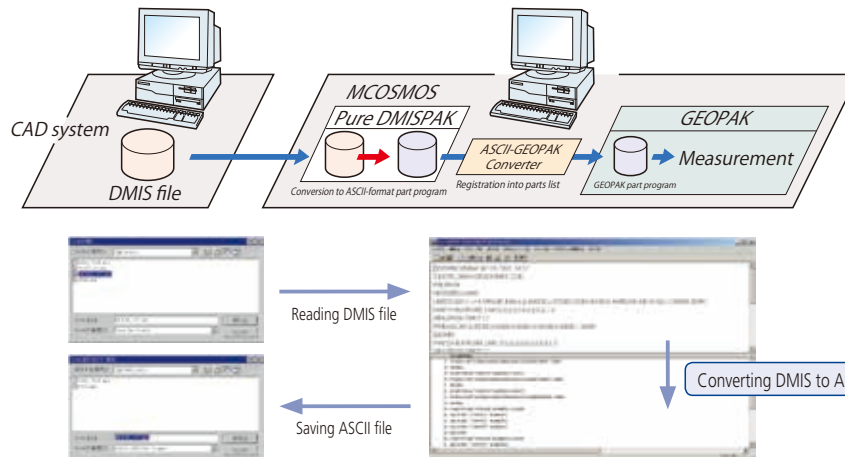


MiCAT
Mitutoyo Intelligent Computer Aided Technology
the standard in world metrology software
MeasurLink

Optional Software

Pure DMISPAK

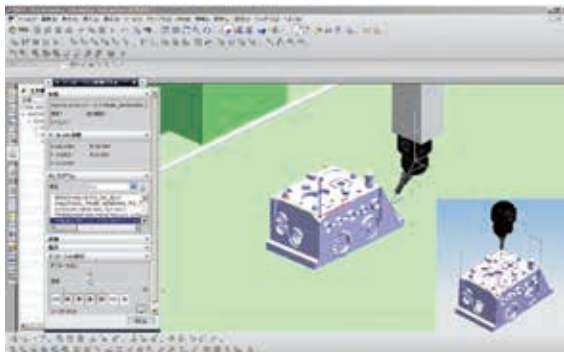
Pure DMISPAK converts a DMIS file created by an external system to an ASCII-format part program for GEOPAK.



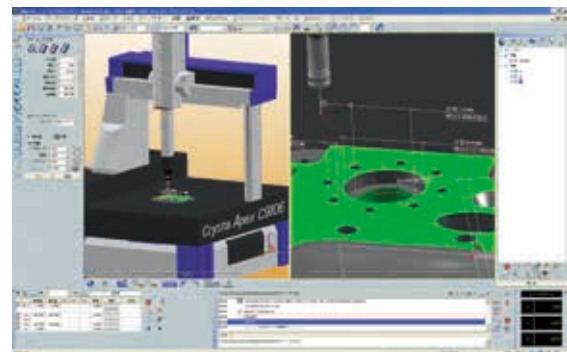
Example of Creating DMIS Files

Pure DMISPAK performs simulation, optimization, evaluation and verification of labor-saving machinery associated with robots, NC machine tools, coordinate measuring machines, physical distribution/transfer systems, etc.

NX CMM Inspection Programming of Siemens PLM Software Inc.



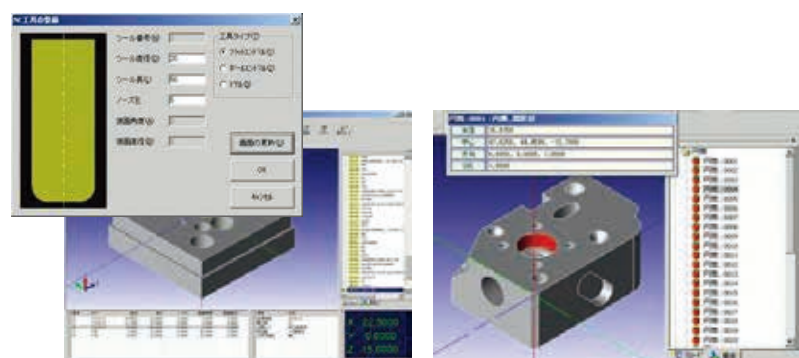
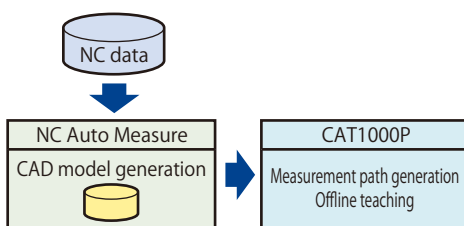
Silma XG of Mitsui Zosen Systems Research Inc.



Optional Software

NC Auto measure

This software generates CAD models from NC data. Since a CAD model can be generated for each processing step, NC-Auto Measure supports the creation of a part program for each step. No expensive commercially available CAD software is required.





**Whatever your challenges are,
Mitutoyo supports you from start to finish.**

Mitutoyo is not only a manufacturer of top quality measuring products but one that also offers qualified support for the lifetime of the equipment, backed up by comprehensive services that ensure your staff can make the very best use of the investment.

Apart from the basics of calibration and repair, Mitutoyo offers product and metrology training, as well as IT support for the sophisticated software used in modern measuring technology. We can also design, build, test and deliver bespoke measuring solutions and even, if deemed cost-effective, take your critical measurement challenges in-house on a sub-contract basis.

Note: Product illustrations are without obligation. Product descriptions, in particular any and all technical specifications, are only binding when explicitly agreed upon.

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