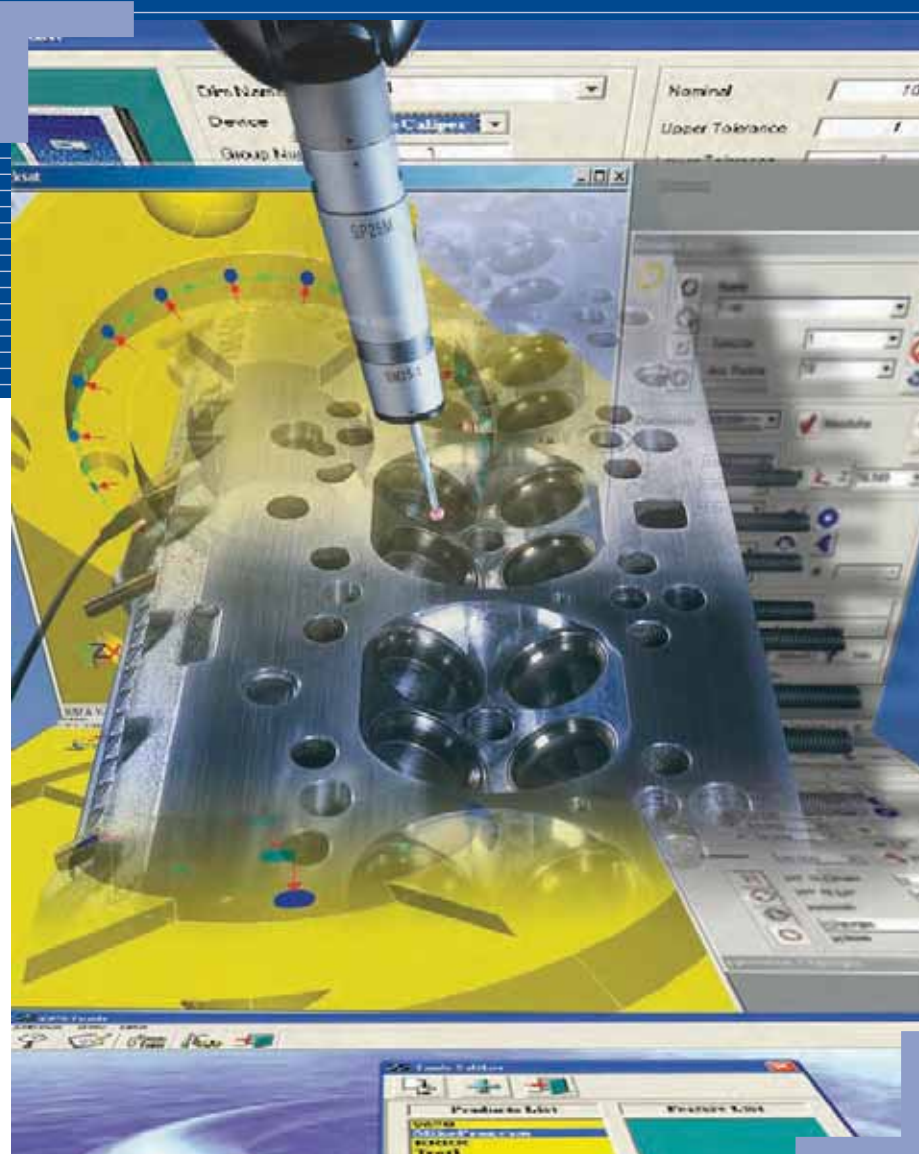


# mcosmos SOFTWARE

Bulletin No. 1921



Coordinate Measuring Machine software for the  
beginner to the expert.

# mcosmos—CMMs leveraged with the power of Mitutoyo MiCAT

CMM SOFTWARE

## MCOSMOS®—Developed on the MiCAT® metrology software platform

MiCAT® metrology software from Mitutoyo comprises the platform on which the comprehensive suite of Mitutoyo metrology software solutions are built—facilitating enterprise-wide integration of software products like MeasurLink®, ScanPAK, VisionPAK and MCOSMOS®.

With MiCAT, your metrology equipment and systems become powerhouses of design, production and quality control. Measurement is streamlined with intuitive user interfaces that provide a familiar look and feel across all products—so multiple devices work together seamlessly to put reliable metrology at your fingertips - for application throughout the entire production process.

## MCOSMOS: The 3D Coordinate Measuring Machine Software from Mitutoyo—For a new dimension in metrology management

MCOSMOS helps you accomplish all your measuring requirements quickly and easily. Developed on Mitutoyo's MiCAT platform, MCOSMOS handles large amounts of data with ease, making it available across all networked areas of the production environment.

With its dedicated expansion modules, MCOSMOS can focus in on your company's very specific measurement requirements. With Mitutoyo software, you are best prepared for every imaginable 3D coordinate measurement challenge, both now and in the future, with maximum flexibility.

Mitutoyo: Precision is our Profession

# Experience

MCOSMOS, from Mitutoyo—Nearby, wherever you are.  
Precision measurement with global dimensions.

Mitutoyo is the world's largest provider of measurement-and-inspection solutions, with the most complete, most capable, line of machines, systems, sensors and software. With a presence in more than 100 countries, Mitutoyo is the international leader in providing precision measurement technology from a single source.

So when it comes to CMM software, MiCAT-platformed MCOSMOS is based on expertise acquired from around the globe—providing the assurance that you are employing best practices for managing your CMM operations.

With computer technology laboratories in the United States, Europe and Asia, Mitutoyo employs highly qualified specialists who devote their expertise to the development of 3D coordinate measurement technology.



# mcosmos Professional

## Software packages and expansion modules to meet your metrology production requirements

The modular system developed by Mitutoyo allows you the capability of tailoring your measuring software with only the specific modules needed to meet your requirements. The measurement results may be displayed, printed, and archived with numerous built-in and user definable formats.



### Software package features

#### PartManager

Is the command center that manages all the software modules. Includes: ProtocolDesigner, ProbeBuilder, DialogDesigner, user Management, manager program (unattended shift).

#### GEOPAK (Geometry online/offline modules)

Includes: support for high-speed nominal scanning (known path) with scanning probes (optional), rotary table as a fourth axis, user-definable dialogs, parametric programming with the use of variable substitution, and user-definable reporting.

#### CAT1000P\* (Online/offline programming module)

For the creation of measurement and evaluation routines of Prismatic features (lines, planes, circles, cylinder, etc.), from a CAD model for nominal to actual comparison. Includes: MachineBuilder, automatic path generation (animated), collision checking and flexible reporting formats.

#### CAT1000S\* (3D freeform evaluation module)

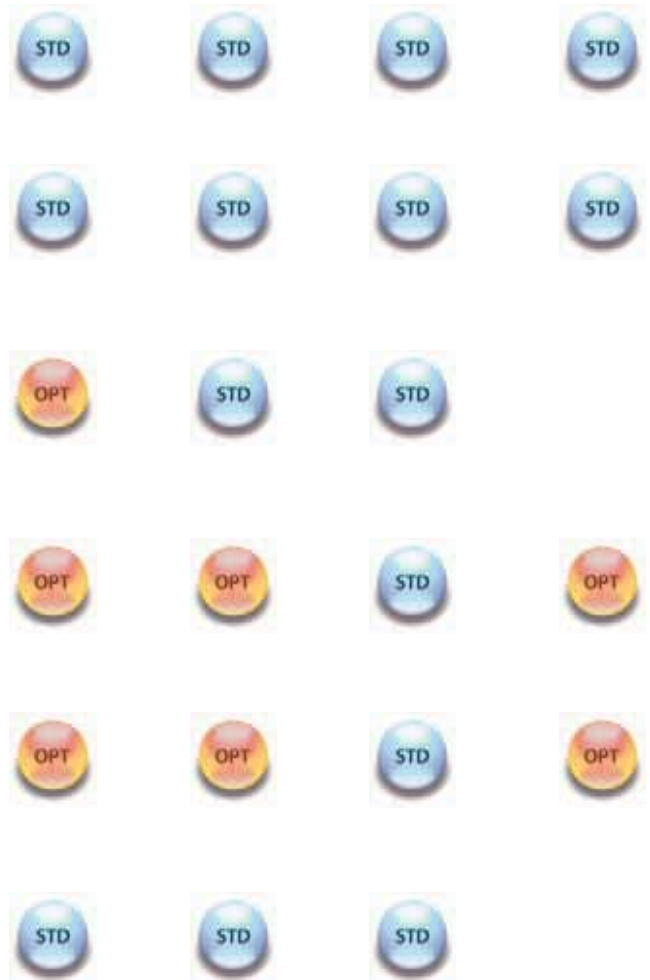
For the creation of measurement and evaluation routines of surfaces from a CAD model for nominal to actual comparison. Includes: automatic path generation (animated), collision checking and flexible reporting formats.

#### SCANPAK (2D profile evaluation module)

For the scanning and evaluation of workpiece profiles (2D). Includes: support for single-point/measuring probes, rotary table as a fourth axis, variable contour tolerances, best fit, patch scan (Digitizing), flexible reporting.

#### MachineBuilder

MachineBuilder works with ProbeBuilder to build a graphical representation of your CMM. Once you have built and configured your CMM you will have a 3D graphical model of this configuration to use for part program animation and collision detection. This allows you to perform part program proofing.



\* Standard CAD import interfaces: ACIS (\*.sat), IGES, VDA-FS  
Optional CAD import interfaces: CATIA V4, CATIA V5, Pro/E, STEP, Parasolid, Unigraphics and SolidWorks



### Optional modules

	<b>MeasurLink®</b> Statistical evaluation module. Real-time data collection, network-capable SPC analysis.
	<b>SCANPAK</b> For the scanning and evaluation of workpiece profiles (2D). Includes: support for single-point/measuring probes, rotary table as a fourth axis, variable contour tolerances, best fit, patch scan (digitizing), flexible reporting.
	<b>CAT1000S</b> For the creation of desired/setpoint comparisons of freeform surfaces from the CAD model and measuring points. Includes: automatic traverse path generation (animated), collision control and flexible reporting
	<b>CAT1000P</b> For the creation of measurement and evaluation routines of Prismatic features (lines, planes, circles, cylinders, etc.), from a CAD model for nominal to actual comparison. Includes: MachineBuilder, automatic path generation (animated), collision checking, and flexible reporting formats.
	<b>SurfaceDeveloper</b> 3D surface generation with 2D profiles. Generates free-formed surface models and triangular mesh models from multi-sectional scanning data.
	<b>MAFIS</b> Airfoil evaluation module. For the analysis of selected characteristics of airfoil surface profiles, supports flexible reporting
	<b>GEARPAK</b> Measuring module for gear profiles. For the measurement of all types of involute gear profiles (cylindrical, worm, hypoid/bevel) and subsequent comparison with international and user-defined standards.
	<b>Pure DMISPAK</b> Interface to convert DMIS (Dimensional Measuring Interface Standard), measurement routines for use by GEOPAK.

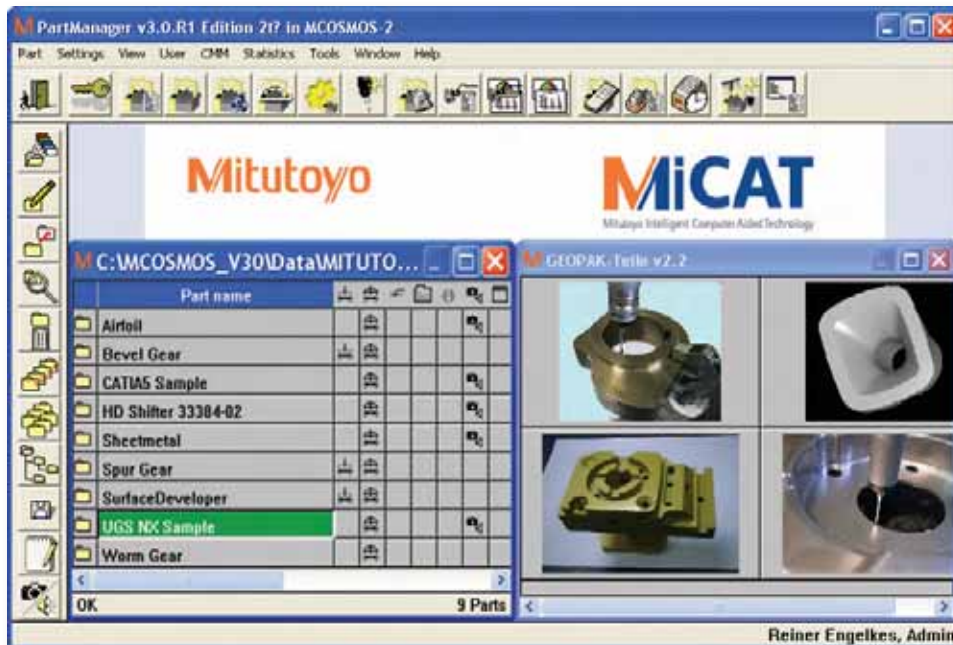
### Optional modules

	<b>MeasurLink®</b> Statistical evaluation module. Real-time data collection, network-capable SPC analysis.
	<b>SCANPAK</b> For the scanning and evaluation of workpiece contours (2D). Includes: support for variable contour tolerances, best fit, digitisation and flexible reporting.
	<b>CAT1000S*</b> For the creation of desired/setpoint comparisons of freeform surfaces from the CAD model and measuring points. Includes: flexible reporting
	<b>MAFIS</b> Airfoil evaluation module. For the analysis of selected characteristics of airfoil surface profiles, supports flexible reporting
	<b>Pure DMISPAK</b> Interface to convert DMIS (Dimensional Measuring Interface Standard), measurement routines for use by GEOPAK.

MCOSMOS is the modular software system for professional control, measurement and evaluation in coordinate measuring technology.

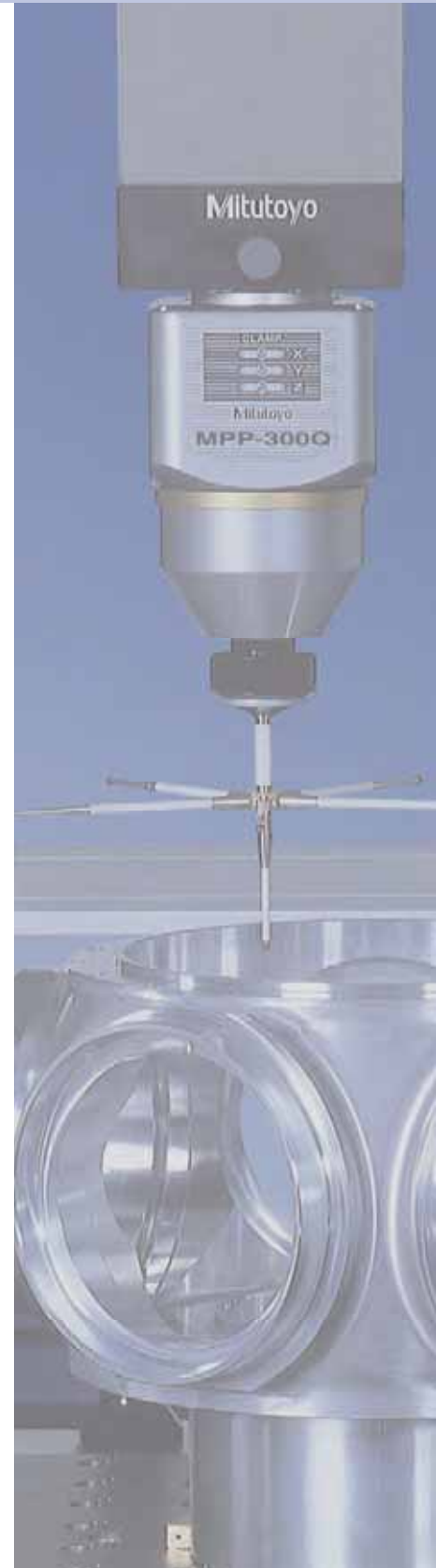
# PartManager. Control and command center.

PartManager is a flexible management center within the MCOSMOS software that controls all measurement tasks. PartManager executes and administers modules such as GEOPAK, GEARPAK, CAT1000P/S etc.; configuration programs such MachineBuilder, DialogDesigner, ProtocolDesigner; and user management (individual definable user rights). PartManager also manages the detailed data reports generated from each module using simple and convenient methods that include archiving.



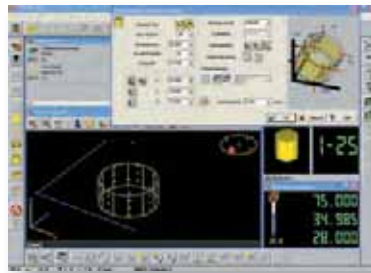
Use PartManager to organize all your notes, reports, data and images for any measurement process; clearly listed and assigned to each workpiece. A symbol in a given data column identifies at first glance specific attributes about each part program. Click on the symbol and you can view the documents and start the programs you need. PartManager contains a user management system with a detailed system of user rights and revision management for measurement programs including change history. In compliance with USFDA 21CFR Part 11.

**Mitutoyo**



# GEOPAK, the geometry module. Performance in the third dimension.

With the universal geometry measurement program for multidimensional measurement, you can control your workpiece from design to completion. Multiple functions make GEOPAK one of the most powerful programs available, meeting the most stringent requirements, while still being user friendly. For example, the steps required for aligning the workpiece can be graphically displayed to the CMM operator. In addition to many flexible reporting options, output to other systems (e.g., QS-Stat, Word, Excel) is also possible. In pallet mode, several workpieces of the same type can also be measured in unattended operation. Solutions to specific measuring tasks can be found in highly sophisticated hardware components such as various probe systems, probe change systems, rotary tables and clamping and loading systems.



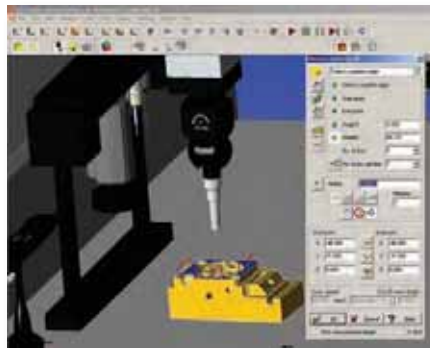
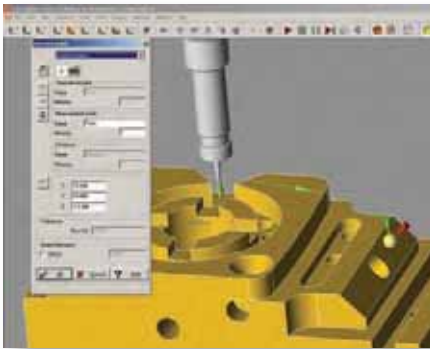
User-defined reports

## GEOPAK features:

- Clear user guidance with menus and graphics
- Online/offline programming (in tutorial mode, virtual or editor mode)
- Known-path high-speed scanning with the use of a scanning probe (optional)
- Flexible programming by the use of user-definable dialogues and variables
- Support of rotary tables as 4th axis
- Use of various interchangeable probe systems (single point, measuring and laser probe systems, as well as sensors for image processing, including their associated change systems)
- Macros for automatic measurement
- Automatic element recognition
- Quick and easy program modification (in editor mode or in repeat mode)
- Integration of text, images and sound
- Flexible customer-specific reporting
- Physikalisch Technischen Bundesanstalt (PTB) certified algorithms
- Certified QS-Stat interface

# CAT1000P, the online/offline programming module. Easy programming from the CAD model.

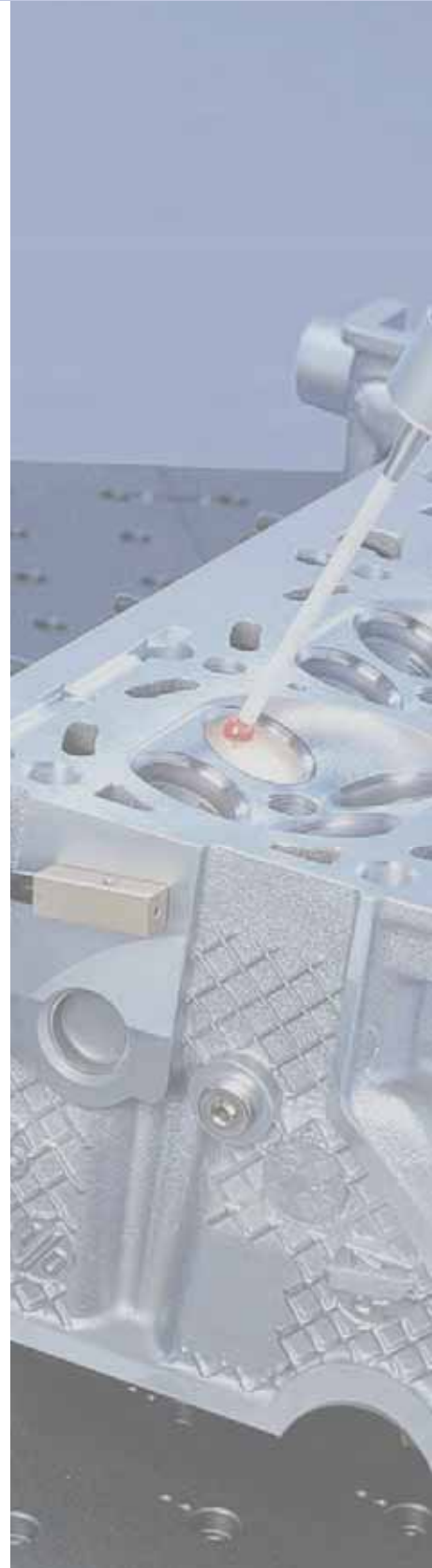
CAT1000P eliminates the time consuming task of data input from paper prints allowing your CMM to work in a paperless environment. CAT1000P significantly facilitates the programming of measurement tasks during the GEOPAK learn mode. All data for measuring parts and tolerance evaluations are taken accurately from the CAD model via pointing device (mouse, trackball, etc.) selection. The same principles apply for programming probe paths (clearance and measurement), while at the same time, using the nominals of the CAD model for tolerance comparison to the measured actuals. Probe paths are displayed graphically in a 3D view and may be changed as needed with the single click of a button. Any possible collisions or obstructions are calculated in advance and automatically avoided. With Automatic Probe Selection enabled, the optimal probe stylus orientation is selected for maximum clearance. MachineBuilder® is a complete workspace from which to operate displaying user-specific CMM, probe/changer system, calibration sphere, and part/fixture in 3D. This allows a realistic simulation before any measurements are taken. This may be performed with a CMM (online), or without (offline-optional module).



## CAT1000P features:

- Simple measurement program generation from the CAD model (only for Prismatic elements)
- Probe indexing optimization
- Automatic probe path generation and collision avoidance
- Measured points are represented on the CAD model graphically in 3D
- 3D simulation of complete measurement routines or between two user-defined steps
- Offline program creation using a precisely configured model of the particular Mitutoyo CMM
- Standard CAD interfaces (IGES, VDA-FS, ACIS)
- Optional CAD interfaces (CATIA V4, CATIA V5, Parasolid, PRO/E, STEP, UGS NX, SolidWorks)
- Supports the following sheet metal elements: circle, rectangle, square, triangle, trapezoid, hexagon, slot & drop

**Mitutoyo**



# CAT1000S, the 3D freeform surface evaluation module. Accurate tolerance comparison of freeform surfaces.

The strength of CAT1000S is in the precise comparison of the actual measured surface with the corresponding CAD nominal data. Points can be measured across single or multiple surfaces. The measured results are represented as easy-to-interpret graphics, in which non-conformances are quickly and easily recognizable by user definable color graduations. The trim edges of sheet metal parts can be precisely measured using CAT1000S. The animation of the virtual CMM simplifies and assists the scanning process.



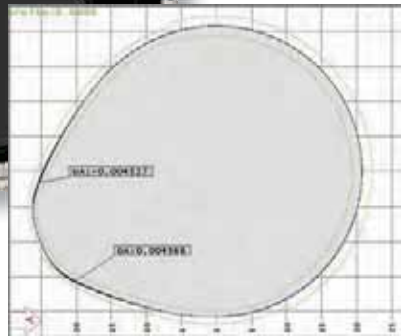
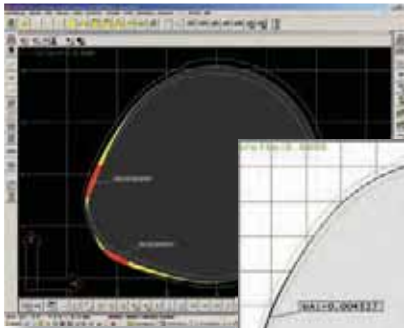
User-defined reports

## CAT1000S features:

- Effortless operation with built in flexibility
- Rapid nominal/actual comparison between CAD data and measurement
- 3D CAD style display functions (zoom, rotate, pan, etc.)
- Representation of non-conformances with user definable color graduations
- Best-fit analysis of measured points on the CAD model
- User definable customer-specific reporting
- Standard CAD interface support (IGES, VDAFS, SAT)
- Optional Direct CAD interface support (CATIA V4, CATIA V5, Parasolid, PRO/E, STEP, NX, SolidWorks)
- All CAD interfaces for CAT1000S can also be used with CAT1000P

# SCANPAK, the 2D contour evaluation module. Nominal to actual evaluation of Profiles.

SCANPAK evaluates and reports the non-conformances between the actual measured profile and nominal profile. The best-fit analysis reports deviations from the nominal workpiece profile to determine any necessary adjustments.



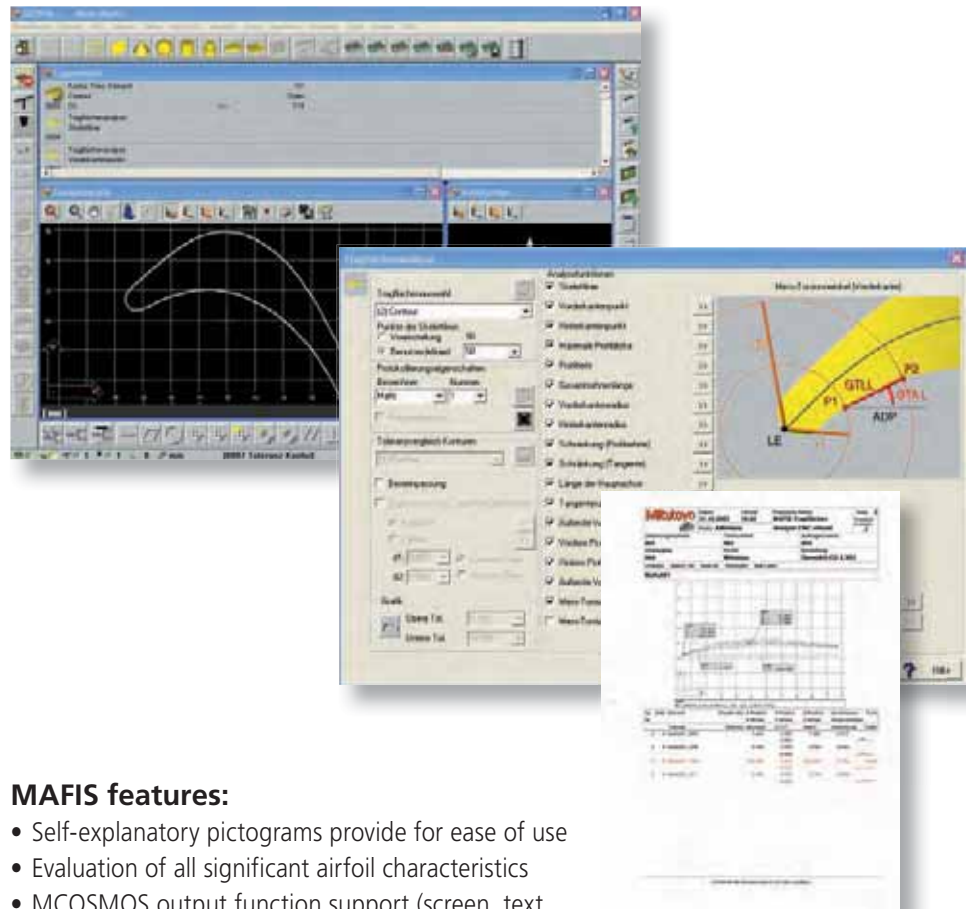
## SCANPAK features:

- Effortless functions for processing and evaluating profiles
- Successful integration of profiles into the inspection routine
- Simple and accurate data collection
- Import/Export of machine tool languages (FANUC, MAZAK, OKUMA and many more) and CAD format (IGES, DXF), of scanned profiles
- Graphical representation of nominal/actual comparison
- User definable flexible reporting (ProtocolDesigner)
- Supports dynamic rotary table scanning (option for MRT320 only)
- Supports touch trigger, scanning , and image processing probe systems (QVP)
- PatchScan Generator for digitizing unknown 3D surfaces from a measured or user defined perimeter profile
- Supports variable profile tolerancing
- Scanning to known and unknown profiles
- Best-fit analysis of profiles



# MAFIS, the airfoil evaluation module.

MAFIS (Mitutoyo Airfoil Inspection Software), enables the calculation of all significant airfoil surface parameters, e.g., of turbine blades on aircraft engines or pump blades. It works with the MCOSMOS module SCANPAK, for the automatic scanning of workpiece forms. With SCANPAK, the profile is measured, after which the airfoil surface analysis can be selected for the evaluation of desired parameters. Using simple pictograms, all the necessary inputs can be quickly carried out. Outputting measured values is possible in both text and graphics. MAFIS output is supported in ProtocolDesigner for generating user definable reports with ease.



## MAFIS features:

- Self-explanatory pictograms provide for ease of use
- Evaluation of all significant airfoil characteristics
- MCOSMOS output function support (screen, text, ProtocolDesigner, MeasurLink)
- Airfoil profile measured using SCANPAK module (required)

# GEARPAK, the measurement module for involute gear profiles.

## Quick and precise, inside and out.

Gear measurement and analysis is made possible with a Mitutoyo CNC Coordinate Measuring Machine with three optional modules within the GEARPAK suite of applications:

**Cylindrical** – measures external, internal, spur, and helical gears. Spur and helical gears can be measured with a touch trigger or scanning probe (scanning probe for helical requires the optional MRT320 rotary table). Cylindrical gears can be measured as a complete gear or only a segment of the complete gear (simple segment specified by the number of the teeth of the segment). Cylindrical gears with modifications can also be specified.



Cylindrical Gear Spur



Cylindrical Gear Helical

**Worm** – measures cylindrical worm gears. The supported worm types are ZI, ZK, ZA, ZN. Cylindrical worm gears can be measured with a touch trigger or scanning probe (scanning probe requires the optional MRT320 rotary table).



Worm Cylindrical Gear

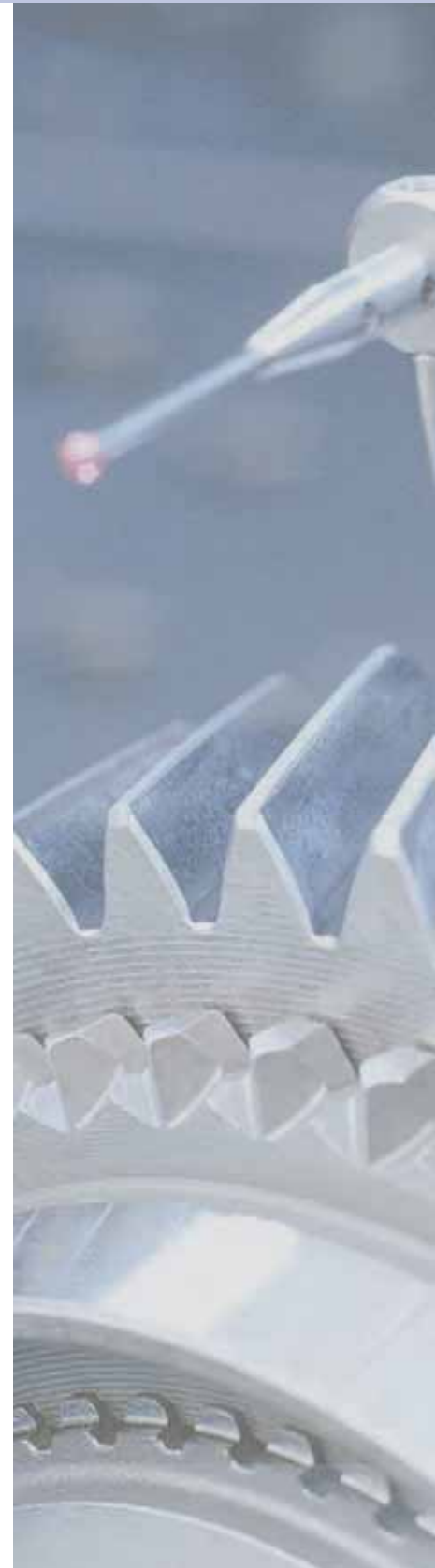
**Bevel/Hypoid** – measures straight and spiral bevel gears manufactured by the Gleason Works Company (Ring Gear / Pinion). Measures hypoid gears generated by the Gleason Works Company (Ring Gear [Formate, Helixform] / Pinion).



Bevel Gear



Hypoid



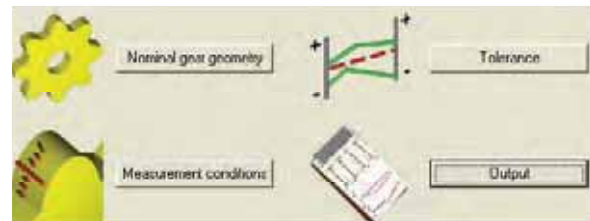
## GEARPAK features:

- Nominal gear geometry entry is made easy with the Input Assistant dialogs that display only required inputs for the option and parameters selected
- Specific tasks of creating the measurement programs, evaluation, and creating the analysis protocol are done with the specific GEARPAK module, all actual measurement is with GEOPAK
- With the combination of the GEARPAK modules and a Mitutoyo CMM, eliminates the need for expensive dedicated measurement devices



## Cylindrical features:

- Supports tolerance classes ISO 1328, DIN 3961 ff, AGMA 2000-A88, JIS B 1702, R01-33-0001F, and user defined
- Tolerancemodifications with ANSI and K charts
- Pitch, tooth thickness, and rolling test evaluation settings
- User defineable graphical/numerical combinations that are saved to HTML format
- PTB validated (permissible deviation of GEARPAK measurement results from PTB data is 0.0001mm or less)
- Supports Import/Export of Gear Data Exchange (GDE) specification (VDI/VDE 2610)

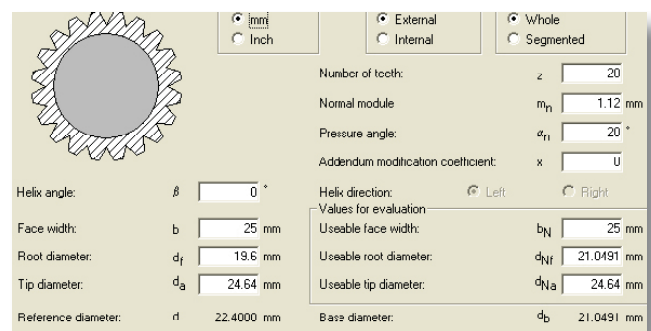


## Worm features:

- Supports tolerance classes DIN 3974-1, AGMA 2111-A98 for metric, AGMA 20110A94 for inch
- Filter for scanning probe measurement to smooth measurement peaks that may occur from vibrations

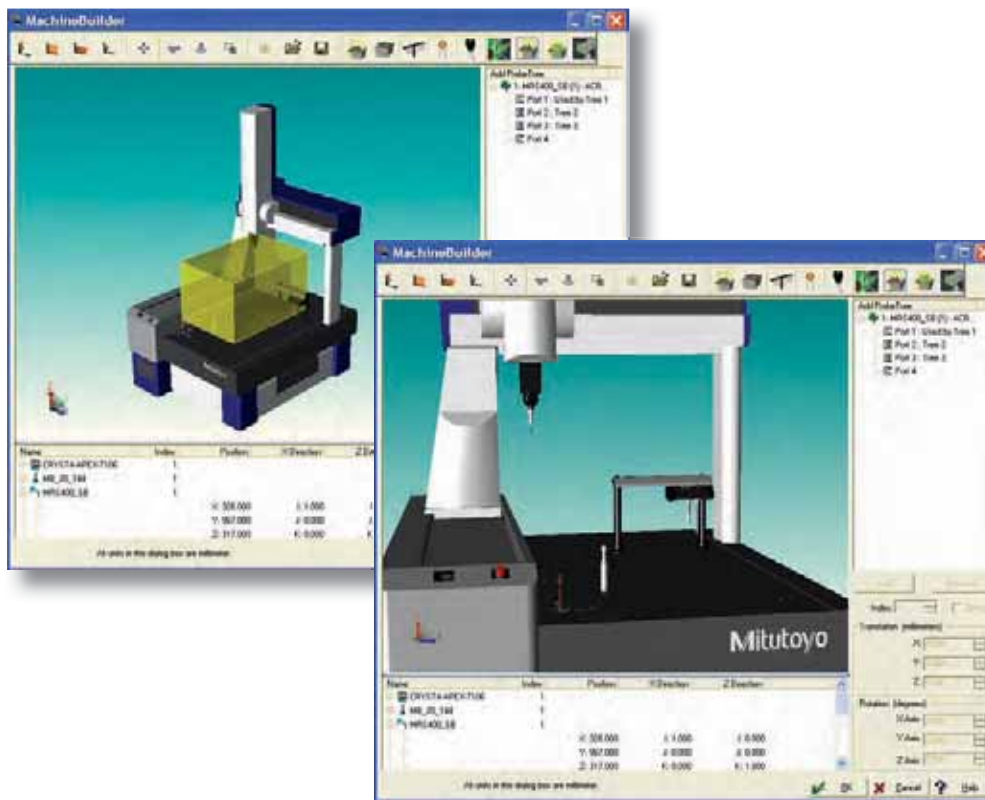
## Bevel/Hypoid features:

- HTML output
- Evaluated results for flank/pitch are automatically saved as "CSV" format which can be used in Word processor or Spreadsheet programs
- Supports Left/Right helical for Hypoid
- Specify cutting parameters of concave/convex of Hypoid gear



# MachineBuilder, workspace control. The ideal visualization tool.

MachineBuilder creates a graphical representation of your model CMM with accessories (qualification sphere, and probe systems including changers). Once you have built and configured your CMM workspace, you have a 3D graphical model of this configuration to use for part program animation and collision detection. This allows you to perform precise part program proofing.



## MachineBuilder features:

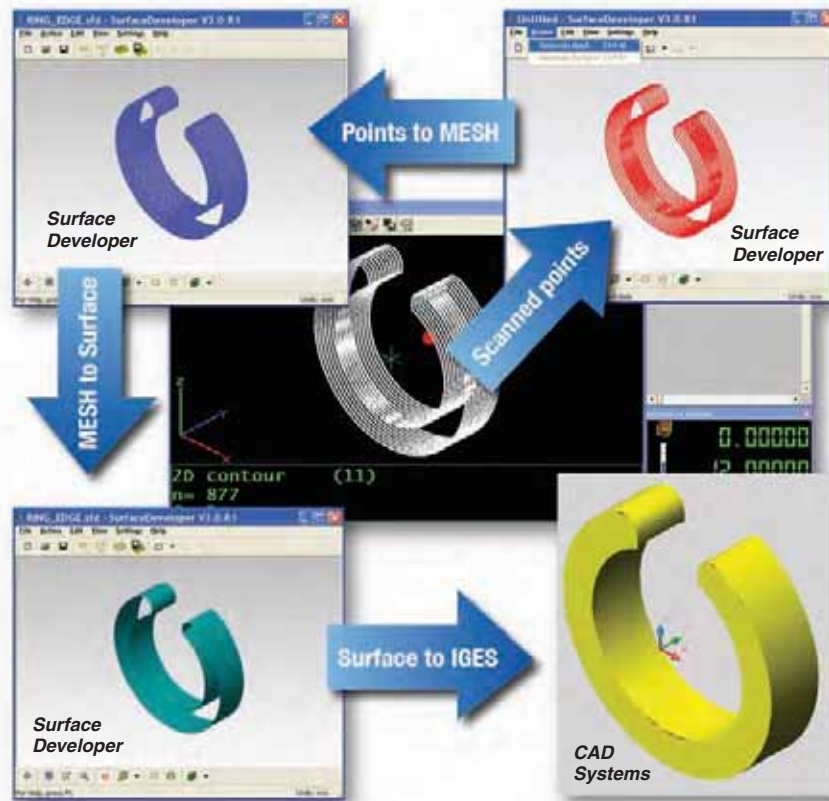
- Easy graphical user interface (GUI)
- Supports all current Mitutoyo CNC models
- Library of probe systems and changers
- Provides virtual models for simulation in CAT1000
- Easily determine workspace requirements for a specific workpiece with or without a fixture
- On-line/Off-line capable
- Save/Recall different machine configurations
- Optimize CMM measurement volume and probe accessibility

**Mitutoyo**



# SurfaceDeveloper, 3D surface generation with 2D profiles. Easy to create, high-accuracy surface design.

The SurfaceDeveloper module generates a high-quality, free-formed surface model or triangular mesh model from multi-sectional scanning data obtained with a Mitutoyo CMM. SurfaceDeveloper creates the probe center triangular mesh model from the measurement coordinates, and compensates for probe radius. A completed actual triangular mesh model can be exported to an STL type file. A free-formed surface model can be generated from the actual triangular mesh model that can be exported as an IGES or STL file for use in a CAD system.



## SurfaceDeveloper features:

- Highly accurate probe radius compensation
- Create an actual triangular mesh model from a measurement
- Create a free-formed surface model from an actual triangular mesh model
- Supports 3 scanning measurement modes:
  - 1) Parallel Open
  - 2) Parallel Closed
  - 3) Radial
- Profiles measured using SCANPAK module (required)

# Pure DMISPAK, the interface module. Import, convert and export with ease.

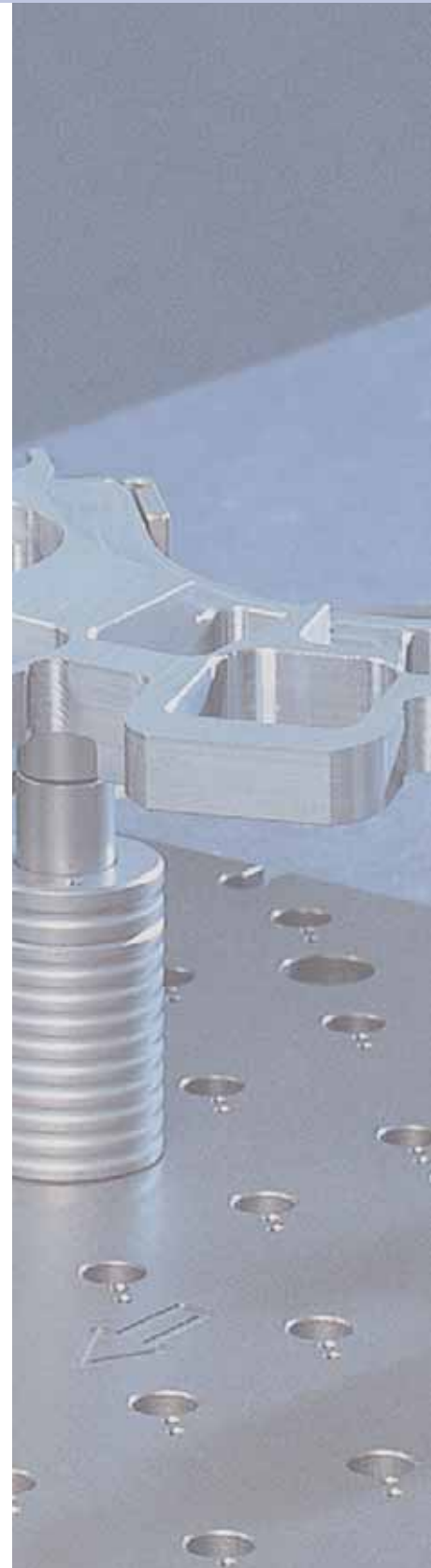
The Pure DMISPAK module is a powerful bidirectional conversion tool supporting DMIS (**D**imensional **M**easuring **I**nterface **S**tandard) programs in MCOSMOS.



```
Pure DMISPAK V3.007 (Oct. 20, 2005) B1 [Test.dmi]
File Edit Parameter View Conversion Jump Edit ASCII File Help
SS-----
$$ Translated by DMISOut v3.0.0, Build Date: 10/25/05
$$ From MCOSMOS v3.0 Mitutoyo Corporation
$$
$$ Translated Date/Time : 11/22/05 11:02
$$ GEOPAK Input File : D:\Mitutoyo\MCOSMOS\DATA\PSN7XS\PP00DIMP.001
$$ GEOPAK Program Name : SingleTests
$$ GEOPAK Part Name : SingleTests
SS-----
DMISMN\SingleTests',04.0
FILNAM\SingleTests',04.0
PRCOMPYON
MODE/MAN
DECL/GLOBAL_CHAR,64,Label_Var[20]
DECL/GLOBAL_REAL,Geopak_Var[20]
UNITS/MM,ANGDEC
DECL/FILL_3
RECALL/SA[S1]
SNSLCT/SA[S1]
RECALL/DA[1]
GEOMLG/CIRCLE,LSTSQR
F[Cir_1]=FEAT/CIRCLE INNER,CART,0.000,0.000,0.000,0.0,1,10.000
MEAS/CIRCLE,F[Cir_1],4
DTMPFAS\AHT 5,000 0 000 0 000 -1 000 0 000 0 000
-----
ASCII translation finished
1  $$----- GEOPAK ASCII Part Program -----
2  FILNAM\AK_0017909_B_1"
3  UNITS/MM
4  ANGUNITS/ANGDECMD
5  VEUNITS/ANGCOS
6  FDP/F
7  CNCON(MESVEL=DEFAULT,POSVEL=DEFAULT,APPROCH=1.5
8  DATSET/MCS
9  RECALL/DA,1
10 $$-----
11 $$ TRANSLATED BY DMISOUT V3.0.0, BUILD DATE: 10/25/05
12 $$ FROM MCOSMOS V3.0 MITUTOYO CORPORATION
13 $$
14 $$ TRANSLATED DATE/TIME : 11/22/05 11:02
15 $$ GEOPAK INPUT FILE : D:\MITUTOYO\MCOSMOS\DATA\PSN7XS\PP00DIMP.001
16 $$ GEOPAK PROGRAM NAME : SINGLETESTS
17 $$ GEOPAK PART NAME : SINGLETESTS
18 $$-----
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21 TEXT/OUTFIL,"PRCOMPYON"
22 CNCOFF
23 FDP/F
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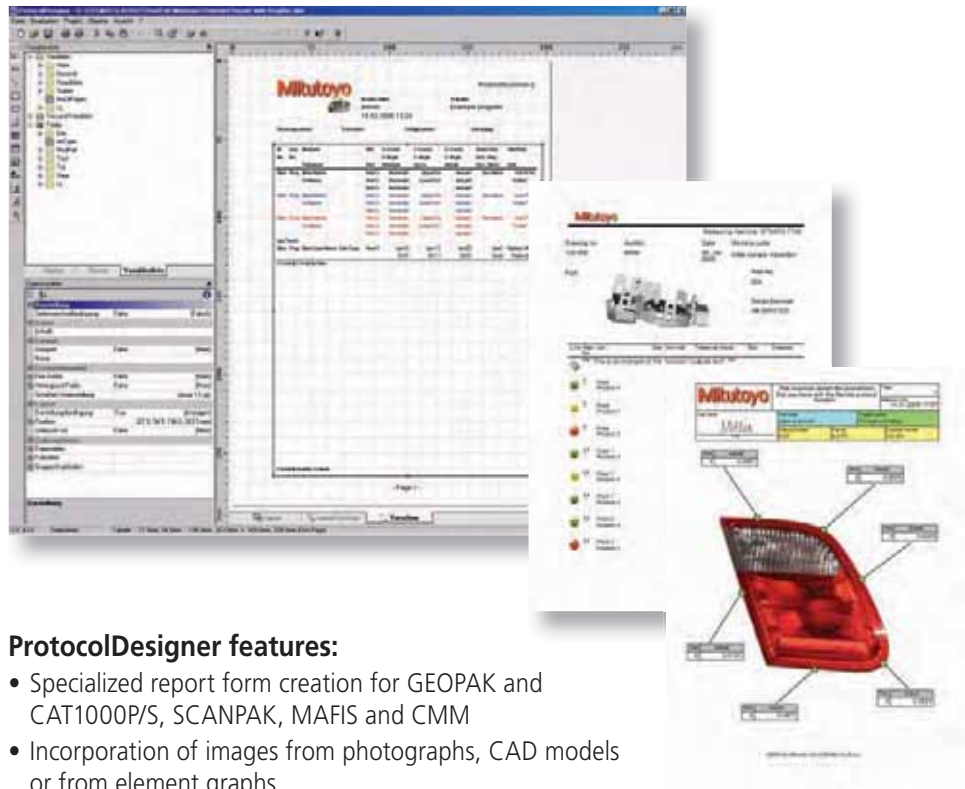
## Pure DMISPAK features:

- Import and conversion of DMIS measurement programs and their execution under MCOSMOS
- Conversion and export of MCOSMOS measurement programs in DMIS format



# ProtocolDesigner, the report form creation tool. Individual reporting, informative documenting.

With the ProtocolDesigner – a standard tool within MCOSMOS – you can effortlessly create new, personalized forms for the GEOPAK, CAT1000P/S, MAFIS and SCANPAK CMM modules, or adapt existing forms to your personal requirements. The standard report becomes a flexible report and you can create the perfect models for basic pages, first and subsequent pages. For the graphic implementation of your own ideas, there is a wide range of variables, fields, tables and graphs available. You will be provided with detailed on-line help and documentation. Create with ProtocolDesigner, for example, headings with your company logo and nominal/actual value comparisons in colorful images, or define new levels and enhance your reports with call-out boxes.

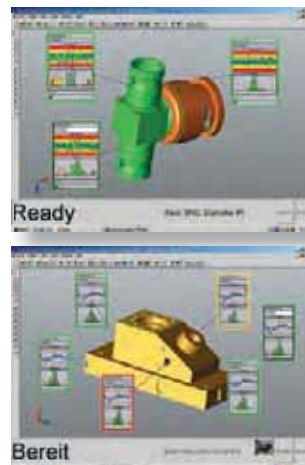


## ProtocolDesigner features:

- Specialized report form creation for GEOPAK and CAT1000P/S, SCANPAK, MAFIS and CMM
- Incorporation of images from photographs, CAD models or from element graphs
- Easy Excel exports (even where Excel is not installed on your own system)
- Text exports into a CSV file (text-based table format)
- TIFF and multi-TIFF export
- PDF export (128 bit coding)
- ANSI or ASCII export
- HTML/MHTML export
- JPG, BMP and EMF export

# MeasurLink®, the statistical evaluation module. Evaluation, visualization, process control.

The MeasurLink module provides data analysis capabilities and a means of centralizing all of your quality data. This high-end statistical platform delivers real-time data analysis with automated trend detection, instant message capabilities and comprehensive quality reporting. MeasurLink provides customizable part inspection visualizations that are second to none, ensuring a clear view of your inspection process and your measurement results. With the most versatile tool and instrument interface options available, MeasurLink can be used to analyze data from a wide range of digital tools and instruments beyond your Coordinate Measuring Machine. Implemented in a client/server network, MeasurLink can provide plant wide quality data access. Whether used as an enterprise wide quality data solution or as a stand-alone quality data station, MeasurLink® provides the complete situational awareness that you need to successfully manage your process improvement and defect prevention efforts.



## MeasurLink features:

- Multi-variate charting
- Capability reporting with ISIR/PPAP reporting capability
- Multi-media aids (video, sound, 2D and 3D images, file attachments)
- Automatic email of inspection results
- Dynamic update of part tolerance changes
- GD&T labeling capability
- On screen traceability filters
- FDA 21CFR Part 11 support with enhanced logon security, profiles and audit trails
- Live remote inspection monitoring from multiple work stations (Process Manager module)
- Real-time multi-feature Gage R&R study creation (analysis with Gage R&R module)
- Non-normal data transformations and analysis (Process Analyzer module)

Request the separate MeasurLink brochure with more detailed information.

**Mitutoyo**



# Something else your partners will need to measure up to: Competent advice and service.

Companies performing precision manufacturing need a partner who is dedicated to them. This dedication does not end with the development and delivery of precision measuring instruments and systems, but also must take place before the selection process begins with knowledgeable advice and afterwards with dependable services. As a manufacturer of the broadest range of measuring instruments and machines and over 70 years of experience, Mitutoyo provides a range of services that leads to complete customer satisfaction from the procurement process through the service life of your instrument.



## Service

With A2LA accredited calibration laboratories, field service, preventative maintenance programs, service parts availability, product repair centers, metrology training at the Mitutoyo Institute of Metrology, and comprehensive online knowledge bases, you can be sure that you have chosen the right partner with Mitutoyo. Mitutoyo understands the importance of supporting you after the installation and is dedicated to providing you with the lowest cost of ownership. Our commitment is to be able to completely satisfy your needs now and well into the future.

## Advice

Mitutoyo's application engineers and product specialists work closely with you to assure that the machine or instrument you select meets and exceeds your specific measuring tasks. Through the M<sup>3</sup> Solutions concept, you work directly with experienced product specialists to define the machine or system –either standard or custom-integrated– best fit to your operation's needs based on your requirements. This assures that the solution you select is the best suited technically and economically to make your operation more productive and efficient.

When you purchase Coordinate Measuring Machines from Mitutoyo, you are drawing on the outstanding experience and expertise of the world's leading specialist in production measurement technology.

You will also be drawing on decades of knowledge for the tasks of tomorrow. Setting the highest standards for quality, performance and progressive technology.

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- Coordinate Measuring Machines
- Vision Measuring Systems
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