MiCAT Planner

Changing the relationship between people and precision measurement with one click
Three Letter Acronyms (TLAs)

- MBD is Model Based Definition
- MBM is Model Based Manufacturing
- MBI is Model Based Inspection
- PMI is Product & Manufacturing Information
- DME is Dimensional Measurement Equipment
Defining MBDs

- MBDs include PMI, which are visible dimensions, tolerances, notes, text, or symbols
- MBDs are created by Design Engineering but used by Manufacturing & Inspection
- MBD standards include ASME Y14.41-2012 *Digital Product Definition Data Practices* and Mil-Std-31000A *Technical Data Package*
MBDs & two kinds of PMI

• Presentation PMI
  • Visualizes PMI for the person
  • Essentially creates a 3D drawing
  • It may be organized by views in the CAD software

• Representation PMI
  • Complements Presentation PMI
  • Also known as ‘Semantic’ PMI
  • Enables Model Based Inspection

Joshua Lubell at NIST notes: “Unambiguous representation and presentation of PMI are critical for digital product definition”

The MBD Journey

• Drawing Based workflow, where the 2D Drawing is the Master

• Model Centric workflow, where the 2D Drawing is the Master and the 3D Model provides part geometry

• Model Based Definition Workflow, where the 3D Model with PMI is the Master

To assess your company’s model based capability:
MBDs & Supplemental Geometry

• Supplemental geometry communicates design requirements but is not intended to represent a real part feature

• Some examples of supplemental geometry are
  - Center Lines
  - Center Planes
  - Datum Targets
  - Bolt Circles
Questions before we proceed?
What’s Required for MBI?

• A 3D BRep Solid Model that includes semantic PMI
• A virtual DME and its actual counterpart
• A Measurement Plan that contains Rules and Settings
• The MiCAT Planner, of course
Dimensional Measuring Equipment

- Model Based Inspection is used often with CNC DMEs
- The most common CNC DME is the Coordinate Measurement Machine (aka CMM)
- Most current and new Mitutoyo CNC CMMs support MBI when used with the MiCAT Planner
Sensors for MBI

CONTACT SCANNING

TOUCH TRIGGER

SP80
CMMs for MBI

BRIDGE

Shop Hardened GANTRY
CMMs and Components for MBI

Shop Hardened
HORIZONTAL ARM

Change Racks, Modules & Stylii
Questions before we proceed?

Virtual Legex CMM

Actual Legex CMM
What is MiCAT Planner?

It is a measurement program software from Mitutoyo that enables one-click automated generation of CNC CMM programs.

MiCAT Planner makes model based inspection a practical and worthwhile reality.
Upstream of MiCAT Planner

- Activities upstream of the MiCAT Planner MBI solution include
  - 3D Modeling
  - 3D Model Annotation
  - Model Based Procedures
  - MBD Validation
  - Best Practice MBI Rules
The MiCAT Planner MBI Work Flow

MiCAT Planner
- Measurement Plan
  - Plane – A
  - Align Plane – A
  - Circle – B
  - Origin Circle – B
  - Circle – C
  - Axis Circle – B
  - …

Geopak Part Program

Inspection Program Generation

MCOSMOS Part Manager (On-line/Off-line)

Configured virtual CMM (DME)

MBD

User Defined Rules

User Parameter Settings

Defaults & Intelligence

Mitutoyo
Defaults & Intelligence
Defaults & Intelligence
Defaults & Intelligence
Program Generation Options
Program Generation Options

User Parameter Settings

Mitutoyo
Program Generation Options

User Parameter Settings
User Defined Rules
## Rules Editor

The Rules Editor is a tool that allows users to define and manage rules for various features and characteristics in MiCAT. It includes features for adding, copying, deleting, and running selected rules. The editor is designed to facilitate the creation and manipulation of rules to ensure accurate and efficient measurement processes.

### Rules

<table>
<thead>
<tr>
<th>Rules</th>
<th>Criteria</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Feature Measurement</td>
<td></td>
<td></td>
</tr>
<tr>
<td>All Characteristics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cylinder Measurement (in touch trigger mode)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Core Measurement (in touch trigger mode)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sphere Measurement (in touch trigger mode)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plane Measurement (in touch trigger mode)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### User-Defined Rules

- **Feature**: Circle
- **Radius**: 0.999
- **Material direction**: Inner

### Actions

<table>
<thead>
<tr>
<th>Measure</th>
<th>Add</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fitting method</td>
<td>Minimum circumscribed</td>
</tr>
<tr>
<td>Automatic tool selection</td>
<td>True</td>
</tr>
<tr>
<td>Sampling method</td>
<td>Contact scanning</td>
</tr>
<tr>
<td>Sampling pattern</td>
<td>Circle</td>
</tr>
<tr>
<td>Points per circle</td>
<td>5</td>
</tr>
<tr>
<td>Edge offset</td>
<td>1.000</td>
</tr>
<tr>
<td>Rotation</td>
<td>Clockwise</td>
</tr>
<tr>
<td>Circular movement</td>
<td>None</td>
</tr>
<tr>
<td>Start angle</td>
<td>0.000000</td>
</tr>
<tr>
<td>End angle</td>
<td>0.000000</td>
</tr>
<tr>
<td>Sampling interval</td>
<td>By pitch</td>
</tr>
<tr>
<td>Scan pitch</td>
<td>0.500</td>
</tr>
<tr>
<td>Filter type</td>
<td>Gaussian</td>
</tr>
<tr>
<td>Scan points per circle</td>
<td>200</td>
</tr>
<tr>
<td>High speed scan</td>
<td>True</td>
</tr>
<tr>
<td>Scan speed high</td>
<td>10.00</td>
</tr>
<tr>
<td>Scan speed standard</td>
<td>3.00</td>
</tr>
<tr>
<td>Scan run in angle</td>
<td>0.000000</td>
</tr>
<tr>
<td>Scan run-out angle</td>
<td>0.000000</td>
</tr>
</tbody>
</table>
User Defined Rules

Criteria: For an inner Circle measurement with a Radius of less than or equal to 9.999
Actions - define all the parameters to be used for measuring all Circles in the Design Model that meet the Criteria.
Adding a Rule

To view this video, click on the link or copy into your WEB browser:
http://www.mitutoyo.com/wishlist-member/?reg=1422306802
MiCAT Planner Work Flow under 6 Minutes

MiCAT Planner
- **Measurement Plan**
  - Plane – A – Align Plane – A – Circle – B – Origin Circle – B – Circle – C – Axis Circle – B – …..

- **Defaults & Intelligence**
- **User Parameter Settings**
- **User Defined Rules**

**Geopak Part Program**

**PartManager** (On-line/Off-line)

**DME Configuration**

**CAD Model with PMI**
MiCAT Planner Work Flow under 6 Minutes

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Part Program Tasks Automatically Completed by MiCAT Planner

- Part Setup Information
- Operator Warnings (Optional On/Off)
- All Positional Moves
- All Measurement Commands
- All Sensor Changes
- All GD&T Applied
- Inspection Results Report Generated
Managing Projects

To view this video, click on the link or copy into your WEB browser: http://www.mitutoyo.com/wishlist-member/?reg=1422306802

- **Flexibility** – a program can automatically be generated for most part features or for just a selected few, and each program can be saved as part of a complete project

- **Customization** – generate a project for First Article Inspection or in-process production or final inspection from the same MBD
• **Associativity** – locate and view the relationships of features and characteristics quickly and easily

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http://www.mitutoyo.com/wishlist-member/?reg=1422306802
Adding GD&T

To view this video, click on the link or copy into your WEB browser: http://www.mitutoyo.com/wishlist-member/?reg=1422306802

- **GD&T Wizard** – Easily add PMI to a ‘geometry only’ CAD model
Models (ex. Prototypes) without PMI?

- Just select the features to be measured...
Selective animation – preview selected part program paths for verification, review, and measurement coverage

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http://www.mitutoyo.com/wishlist-member/?reg=1422306802
Overall MiCAT Planner Benefits

- Streamlined processes
- Improved productivity
- Reduced manufacturing costs
- Enhanced traceability
- Up to a 95-percent savings in time compared to drawing-based methods
- Suppliers receive a single CAD file to inspect a part
Overall MiCAT Planner Benefits

- Features and characteristics are transferred directly into the inspection software, reducing the risk of misinterpretation
- CMM configurations can be changed at any point
- Enhanced workflow automation
- Part measurement consistency
Additional Information

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Product Demo Request
http://www.mitutoyo.com/about/contacting-mac/product-demo-request/

Thank you...