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Preventive Measures against Product Scrapping

All data from measuring tools and instruments connected to the network is collected in real time, allowing process failure prediction by implementing statistical process control.

*C1: including third-party equipment with RS-232C or CSV data output

Causal Analyses Enabled with Accumulated Data

Immediate database access to measurement results enables statistical analysis to be applied for rapid identification of process issues.

Data collection/Analysis module MeasurLink Real-Time
(Refer to P4 and P5 for details.)

This SPC software allows data collection from each tool and instrument and still allows real-time display of statistical processing data such as control charts, histograms and process capability indexes.
In-line Coordinate Measuring Machines

Third-party equipment with RS-232C or CSV data output

This administrative software allows confirmation of measurement results and various statistical analyses by access to the database where the measurement data collected with MeasurLink Real-Time is stored.

This is evaluation and analysis software compliant with the MSA required in ISO/TS 16949.

Gage Management Software
MeasurLink Gage Management
(Refer to P10 for details.)

This software plans and implements a complete calibration schedule and incorporates a powerful retrieval function in addition to recording and managing the operational state of gages.
MeasurLink Real-Time is the Statistical Process Control (SPC) MeasurLink module that collects data from Mitutoyo and third-party measuring devices and systems to provide analysis functionality in real-time by displaying control charts, histograms, or process capability indexes. Three versions are offered so that a customer can choose the version that best suits the requirements, from a standard version providing basic functionality through to the full-spec version offering data handling using Hoops 3D graphics. (Refer to Table 1 on page 5.)

**Real-Time Standard:** Acquisition and analysis of measurement data in real-time.

**Real-Time Professional:** Higher functionality with native Mitutoyo integration (DDE) connectivity.

**Real-Time Professional 3D:** The full-spec version, able to display analysis results in 3D.

### The Use of MeasurLink Real-Time
- Allows prevention of product scrapping by implementing measurement data collection and statistical process control (SPC).

### MeasurLink Real-Time common functions
- **Various data views**
The measurement results are displayed in various views, including statistical analysis results, data lists, and work process imaging. The display can be switched instantly according to the needs of the operator.

  - **A wide choice of statistical analysis functions**
    - **[Chart]** Measurement value: Xbar-R, Xbar-S, X-Rs, EWMA control charts, Histograms, Run chart, Pre-control chart, Tear chart, Box plot chart, Meter chart, Indicator bar, multivariate data control chart, etc. Countable number of value: p, np, c, u control charts, Pareto chart, and pie chart.
    - **[Statistics]** Maximum value, Minimum value, Standard deviation, Average $\pm 3\sigma$, $4\sigma/6\sigma$, Process capability indexes (Cp, Cpk, Pp, Ppk), Defect ratio.

  - **Alarm function**
The operator is notified when an “Out of Tolerance” or “Out of Control Limit” situation occurs. The method of notification can be selected from a pop-up window, e-mail (Fig. 1), or log file recording.

  - **Report print out function**
Measurement values, analysis calculation results and various charts can be arranged to output according to requirements.

  - **Adding traceability information**
Traceability information for each workpiece can be added, for example, serial no., lot no., inspector name, machine no., or cause of problems and remedies. This information can be used as search criteria when extracting data using the filtering function (RT Pro / RT Pro 3D) when a problem occurs.

  - **Exporting data to an Excel file**
Measurement data can be exported to an Excel file. This function is useful if the data needs to be used in a department that does not have MeasurLink. (Fig. 2)

  - **Security function**
Once the access authorization is set, it requires “User name” and “Password” input before the program will start. Data editing actions such as reference, entry and changes require authorization according to the user’s role in order to preserve data reliability.
MeasurLink Real-Time Professional / Real-Time Professional 3D common functions

- **Automatic linking with part programs**
  Linking with software created in CMM or Vision Measuring Systems, data such as part name; measurement item; target value; tolerance and more can be downloaded from a part program. MeasurLink parts information and inspection procedure are automatically created on the database.

- **Filtering function**
  Required data can be easily extracted based on the date and time of the measurement, added comments, or alarms.

- **Import function**
  Measurement data saved in default format files (text files with the dedicated format for MeasurLink, Q-DAS files, etc.) can be loaded. Also, a feature to customize a template for loading according to the format is provided.

MeasurLink Real-Time Professional 3D functions

- **Real-time Professional 3D is a full-spec package**
  The feature to be measured can be displayed in detail using 3D CAD data.

![3D View]

3D graphics library HOOPS displays real view of the workpiece using an hsf file created from 3D CAD data. The displayed workpiece image can be freely turned, translated, or scaled so that you can easily get a view of the feature to be measured. The word balloons and lead lines that display the measurement result and measured feature will move following the CAD data.

| Table 1  Data collection/analysis software Real-Time functional comparison |
|---------------------------------|-----------------|-----------------|-----------------|
| **Functions**                   | **Data collection software** |
| Collected data display          | Real-Time Standard | Real-Time Professional | Real-Time Professional 3D |
| Classic view                    | x                | x                | x                |
| Data sheet                      | x                | x                | x                |
| 2D view                         | x                | x                | x                |
| 3D view (HOOPS)                 |                  |                  | x                |
| Data extract                    | Filter           |                  | x                |
| Input from tools and devices    | Measuring tools (RS-232C, USB) | x | x | x |
| Text input                      | Import           |                  |                  |

Automatic Report Generation Program

**MeasurLink Report Scheduler**

Automatically generates a report created by the Real-Time (Standard, Professional or Professional 3D) or Process Analyzer (Lite or Professional) modules, each of which is connected to the network according to a specified schedule.

**The Use of MeasurLink Report Scheduler**

- **Examples of use**
  - Automatic generation of a weekly report specified from among last week’s data
  - Automatic report generation by extracting only data with tag information about “tool replacement” (due to wear, breakage, etc.)
  - Automatic generation of a daily report for each shift by filtering inspection record data on the basis of a shift

**MeasurLink Report Scheduler common functions**

- **Report output destinations**
  - Printer, file, E-mail (as an attached document)
MeasurLink Process Manager enables centralized monitoring of real-time measurement information from all MeasurLink data collection terminals networked together on the shop floor.

The Use of MeasurLink Process Manager
- Allows prevention of product scrapping by real-time capture of production status on the shop floor.

Functions of MeasurLink Process Manager
- Capability of real time monitoring of measurement results
  This allows monitoring of current measurement results collected from all tools and instruments networked together. Measurement results can be checked without visiting the shop floor.
- Capability of early detection of an abnormal trend
  This allows early detection of a trend toward process abnormality using tools such as control charts, histograms and process capability indexes as well as simple GO / NG judgments.

Administrator
The administrator can immediately see the current measurement data from all measuring instruments networked together using the multiple views MeasurLink provides.

Global Measured Value View
Displays process capability indexes.

Manager View
Displays run charts, histograms, etc.

Plant View
Displays a process capability index for each measuring instrument on the plant layout drawing.

Log View
Displays events (such as measurement start, termination and occurrence of an abnormal condition) for each measuring instrument.

DB

Shop Floor Measurement
MeasurLink Real-Time collects all data from coordinate measuring machines and other measuring tools and stores it in the database in real time.
Detailed Functions of MeasurLink Process Manager

- **Manager view**
  Displays various types of charts as an at-a-glance guide. The administrator can narrow down all items of data currently being measured into a specific monitoring range of those of critical importance or sort those data (in ascending or descending order) on the basis of process capability index.

- **Global measurement value view**
  Displays bar graphs that can determine good or bad process capability indexes at a glance. This allows the administrator to sort all current measurement data (in ascending or descending order) on the basis of process capability index, measurement date and time, part name, etc.

- **Log view**
  Displays various types of events that occur during measurement. This allows the administrator to grasp the state of measurement operation (measurement start/termination, etc.) and the occurrence of an abnormal event (out-of-tolerance or an abnormal trend) for all current measurement data.

- **Plant view**
  Displays a process capability index for each measuring instrument on the plant layout drawing. This allows the administrator to quickly identify the location where an abnormality has occurred.
MeasurLink Process Analyzer is a software package provided for administrators who are authorized to access the database storing measurement data collected by MeasurLink Real-time for the purpose of checking and analyzing measurement results. Two types of packages are made available: Process Analyzer Lite, the basic version; and the full-spec Process Analyzer Professional version. (see Table 1)

MeasurLink Process Analyzer Lite: A cost-effective package for viewing the measurement data database.

MeasurLink Process Analyzer Professional: A full-spec package that provides additional data check and analysis capability.

The Use of MeasurLink Process Analyzer
- Confirmation of measurement results and various statistical analyses by accessing the database is a powerful aid to verification of abnormal process operation.

MeasurLink Process Analyzer common functions
- Measurement data viewer function
  Data stored in the MeasurLink database can be checked from a selected list.

- Display and output functions
  The functions equivalent to MeasurLink Real-Time Standard are available, such as measurement result, statistical analysis result (charts and statistics), reporting, data export, and more.
  Target data can be selected from the list of the Windows Explorer type tree format and the measurement result and the statistical analysis result (charts and statistics) can be displayed.

MeasurLink Process Analyzer Professional functions
- Filtering function that allows data extraction and grouping
  Data can be extracted or grouped by selecting the date and time and other traceability information as keywords.

  Example) Filtering data by an operator name .... Displays statistical analysis result in charts (Xbar-R, for example).

  Filtering item selection menu

  Result of filtering the chart

  Example) Grouping by Machine No. ..... Cp, Cpk comparison

  Item selection for grouping

  Cpk value and bar graph per machine

Table 1  Process Analyzer functional comparison (an option available for administrators)

<table>
<thead>
<tr>
<th>Function</th>
<th>Process analysis software</th>
<th>Process Analyzer Lite</th>
<th>Process Analyzer Professional</th>
</tr>
</thead>
<tbody>
<tr>
<td>Result display</td>
<td>Classic SPC view</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td></td>
<td>Data sheet</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td></td>
<td>2D view</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Data extract</td>
<td>Filter</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Data processing</td>
<td>Data file merging, Copying, Editing</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Masking</td>
<td>Archive data</td>
<td>x</td>
<td></td>
</tr>
</tbody>
</table>
This is evaluation and analysis software conforming to Measurement System Analysis (MSA) required in ISO/TS 16949. ISO/TS 16949 requires that a proper measurement system be achieved by analyzing the accuracy of each instrument and variations in operator effects on repeatability using statistical methods.

The Use of MeasurLink Gage R&R

- Allows evaluation/analysis of a measurement system conforming to the MSA analysis method, thus implementing MSA evaluation easily and quickly.

Functions of MeasurLink Gage R&R

- Automatic calculation of MSA evaluation results.
This allows the operator to simply input an evaluation method/evaluation condition and measurement data with the Wizard function. The operator can implement MSA evaluation simply by selecting an "investigation type option", "gage option", "data input source option", "parameter option", etc. Measurement results, charts, and statistical calculation results are presented with the look and feel of Windows Explorer.

- Evaluation method compliant with MSA (fourth edition)
The software can implement evaluation using the following methods compliant with MSA (Measurement System Analysis).
1. Measurement value tolerance gage R&R variance analysis method
2. Measurement value tolerance gage R&R range&average method
3. Measurement value branching gage R&R variance analysis method
4. Measurement value branching gage R&R average&range method
5. Measurement value range method
6. Measurement value simplified method
7. Measurement value MSA4
8. Deviation
9. Linearity
10. Stability

- Analysis chart view
Various charts such as the control chart are effective for analysis/judgment on variations due to operator, the adequacy of gage accuracy, etc., and remedies for problems.

- Output of results as a report
Evaluated results and chart can be printed as a report.

- Registration of gage-specific information
1. Registration of information on gages within the system
This allows registration of gage information on the following items and association with evaluated results.
Registration items: Gage name, maker, model, resolution, unit, measuring range, etc.
2. Information link between MeasurLink Gage Management and this software
This software can use gage information that has been registered in Gage Management directly as options. Additionally, since R&R evaluation results are also linked with gage information, the schedule of gage R&R expiry dates can be managed by Gage Management.
This software can plan and implement a reliable calibration schedule with a powerful retrieval function in addition to recording and controlling the usage state of gages.

The Use of MeasurLink Gage Management

- Allows simple recording of gage usage state (operation, storage, calibration, gage R&R, repair, out-of-service) to speedily grasp the current location and state of all gages.
- Allows all common gage information to be viewed from all networked terminals in which this network-compatible software has been installed.
- Allows sharing of gage information between each software package in linkage with MeasurLink Gage R&R.

Functions of MeasurLink Gage Management

- Creation of a list of calibration-targeted gages from the gage administration table
  The target gages are retrieved from a variety of search items such as gage ID, gage type, model, maker, distributor, calibration date, current usage state and location to create the list.

- Confirmation of detailed gage information
  Allows confirmation of detailed information on individual gages. The software allows you to display a list of gages depending on "Calibration Overdue", "Next Month Due", etc. by setting a calibration date and confirm detailed information on calibration history of gages.

MeasurLink common specifications

- Operating environments
  (Recommended OS and DB)
  [Operating System]
  - Windows7 (32bit/64bit)
  - Windows8.1 (32bit/64bit)
    (Microsoft Windows 8.1 RT edition is not supported)
  - Windows10 (32bit/64bit)
    (Microsoft Windows 10 Mobile and IoT edition are not supported)
  [Data base]
  - Microsoft SQL Server 2016 Standard Edition
  - Microsoft SQL Server 2016 Business Intelligence Edition
  - Microsoft SQL Server 2016 Enterprise Edition
  - Microsoft SQL Server 2014 Standard Edition
  - Microsoft SQL Server 2014 Business Intelligence Edition
  - Microsoft SQL Server 2014 Enterprise Edition
  - Microsoft SQL Server 2012 Standard Edition
  - Microsoft SQL Server 2012 Business Intelligence Edition
  - Microsoft SQL Server 2012 Enterprise Edition

- Operating environments
  (Recommended OS and DB)
  [Operating System]
  - Windows7 (32bit/64bit)
  - Windows8.1 (32bit/64bit)
    (Microsoft Windows 8.1 RT edition is not supported)
  - Windows10 (32bit/64bit)
    (Microsoft Windows 10 Mobile and IoT edition are not supported)
  [Data base]
  - Microsoft SQL Server 2016 Standard Edition
  - Microsoft SQL Server 2016 Business Intelligence Edition
  - Microsoft SQL Server 2016 Enterprise Edition
  - Microsoft SQL Server 2014 Standard Edition
  - Microsoft SQL Server 2014 Business Intelligence Edition
  - Microsoft SQL Server 2014 Enterprise Edition
  - Microsoft SQL Server 2012 Standard Edition
  - Microsoft SQL Server 2012 Business Intelligence Edition
  - Microsoft SQL Server 2012 Enterprise Edition

- MeasurLink Real-Time common specifications
  [Supported data processing software]
  - CMM: MCOSMOS V3.2 or later
  - Vision System: QVPAK V10.0 or later / QSPAK V10.2 or later / QSPAK MSE V3.1 or later / QIPAK V4.1 or later
  - Surface Roughness / Contour instruments: FORMTRACEPAK V5.3 or later
  - Roundness instruments: ROUNDPAK V5.6 or later
  - Hardness Testing Machines: AVPAK V2.0 or later

MeasurLink Real-Time Professional/Real-Time Professional 3D common functions

- Connectable software systems
  - Mitutoyo Measurement Data Management System (equipped with PC data processing unit)

MeasurLink Real-Time Professional/Real-Time Professional 3D common functions

- Connectable measuring instruments
  - Measuring tools equipped with Digimatic output
  [Supported interfaces]
  - Wireless (USB) U-WAVE (VCP)
  - Wired (USB) USB-ITN (VCP or HD), IT-012U (HDI), IT-016U
  - Wired (D-sub 9 pin) IT-007R, MUX-10F, DP-1VA LOGGER, and others
  - Various RS-232C devices (partially restricted)

* The documentation supplied with this product is the Installation Manual. Refer to Online Help for information about how to operate the software.
Example of a Stand-alone System

**Company A: Inspection department**

<table>
<thead>
<tr>
<th>Workpiece</th>
<th>In-vehicle electronic product (molded cylindrical part)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring instrument</td>
<td>Digimatic Thickness Gage to measure outside diameter at 2 points</td>
</tr>
</tbody>
</table>
| Purpose                    | • To check the condition of the mold (when the mold is worn, the diameter becomes enlarged).  
                              • To calculate the control limits for the initial run (calculates per 30 pieces). |
| Background                 | SPC is requested when the production of parts is started. |

Data collection / Analysis software
MeasurLink Real-Time Standard

Example of a Networked System

**Company B: Quality control department**

<table>
<thead>
<tr>
<th>Workpiece</th>
<th>Aluminum die-cast products; cylinder block or transmission casing for vehicle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring instrument</td>
<td>CNC CMM, 4 units</td>
</tr>
</tbody>
</table>
| Purpose                    | • To analyze error trends and feedback to the process.  
                              • To report the process capability index to the client when there is a change of facility or materials. |
| Operation and effectiveness| • A database server consolidates all the part programs and measurement data.  
                              • Same measurement can be performed with any machines in the system, and all the data management can be unified.  
                              • Since there are multiple machines in the system, the operator can start measurement with any of the available machines. |

Data collection / Analysis software
MeasurLink Real-Time Professional

Software for Administrator
MeasurLink Process Analyzer Professional
MeasurLink Process Manager

* For networked applications a Microsoft SQL Server 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.

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