

Geomet Gage R&R

Users Guide

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Geomet Gage R&R

Repeatability and Reproducibility CMM Software

Introduction

Welcome to the Geomet Gage R&R User Guide. This guide is designed to step you through the operations of Gage R&R and how it interacts with Geomet CMM Software.

Repeatability is defined as the variability of measurements taken by a single operator on the same artifact repeatedly. This is also known as the inherent precision of a given piece of measuring equipment. Reproducibility is the variability of the measurement system caused by the differences in operator behavior.

With these definitions in place, a gage R&R study will help identify the overall precision and accuracy of measurements between cycle runs and operators. Returning the Percent of Tolerance for a given feature based on a expected tolerance limit. For example a 10% limit on a tolerance band of .002" results in control limits at .0002".

Summary on how Geomet Gage R&R works

Geomet Gage R&R Software will produce reports and maintain history of studies captured through Geomet CMM Software. To start a study, create a part inspection program on a known work piece. Select various features that will be saved to an ASCII file.

When running the study, Geomet will prompt the correct sequence for operator and part. At the end of a single run, a data file is updated with the results of the run.

Upon completion of all necessary runs, Geomet Gage R&R imports the measurements into the Gage R&R database, and will maintain the history of all studies for archival purposes. Once the data has been imported, various characteristics such as descriptive headers and tolerance values are added. Gage R&R can the print one or all reports for review.

Prepare a Gage R&R Study

The first step to preparing a study is to write an inspection part program in Geomet. Select a well-defined artifact to be use in the study. The part should have well defined features and represent the average size you expect in normal inspections.

Build the part program as in a normal inspection. Use Geomet's Feature Tagging to identify which features to save for Gage R&R. The example below shows you a Feature Tagging dialog.

In this example, we tagged the X and Z components of the selected feature. Once all features have been identified and tagged, perform a "Save As" under the file drop-down menu to save your part program.



The next step is to establish the operating criteria for a Gage R&R study. Open the part inspection, if it is not already open. Then from the Analysis drop-down menu, choose "Setup Gage R&R".



The setup dialog will appear from which you establish the characteristics for the study. A study can have 2-3 operators, 2-3 trials and up to 10 parts. There are validations built that verify that the number of operators multiplied by the number of parts exceeds 14. This is the minimum required for the statistical formulas used to calculate Gage R&R. Once this setup data has been entered, you are now ready to start the study.



If you require to change, or restart a study in progress, press the "Start Over" button.

Running the Study

Once you load the part program and begin the first run, Geomet will prompt for the operator, trial number and part number. Do not edit this header information as it is used to identify throughout the part inspection.

In this example, operator Joe is running trial 1 on part 1. Upon completion of the run, Geomet will export the tagged measurements to a data file called *my prog.SPC*. This name is derived from the original part inspection; *my prog.GMT* and should *never be renamed or moved during the course of the study.*

When the program is completed the Geomet Restart dialog will appear. At the bottom, a button is available which starts the next run, but also identifies the next operator, trial and part. In the event you must stop the study, you can escape from here. Geomet maintains the current position completed and will restart from that point when you resume. To resume a study, simply re-load the program associated with the study and run it.

Upon completion of the necessary runs, Geomet Gage R&R will be used to view and print the results.

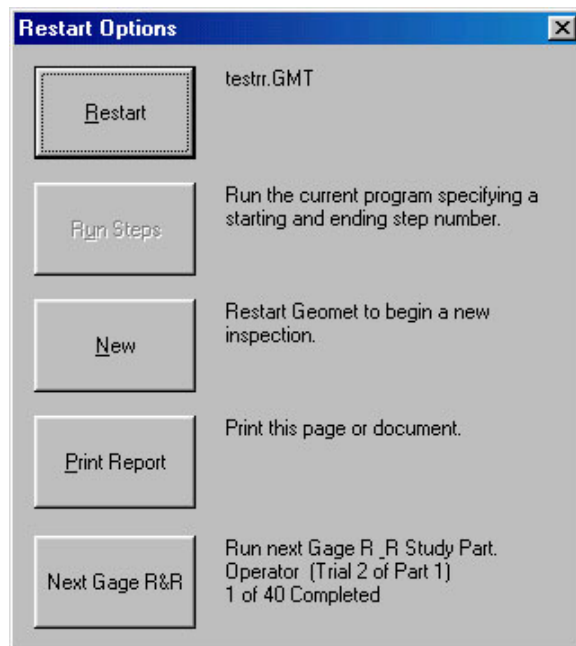


Inspection Report Header - Geomet v.4.00.018.001

Drawing #:	123-456789
Part Name:	
Serial #:	1
Operator:	Joe
Date:	
Notes:	Trial 1 of Part 1

Continue

Complete the required information and press < Enter > to proceed.



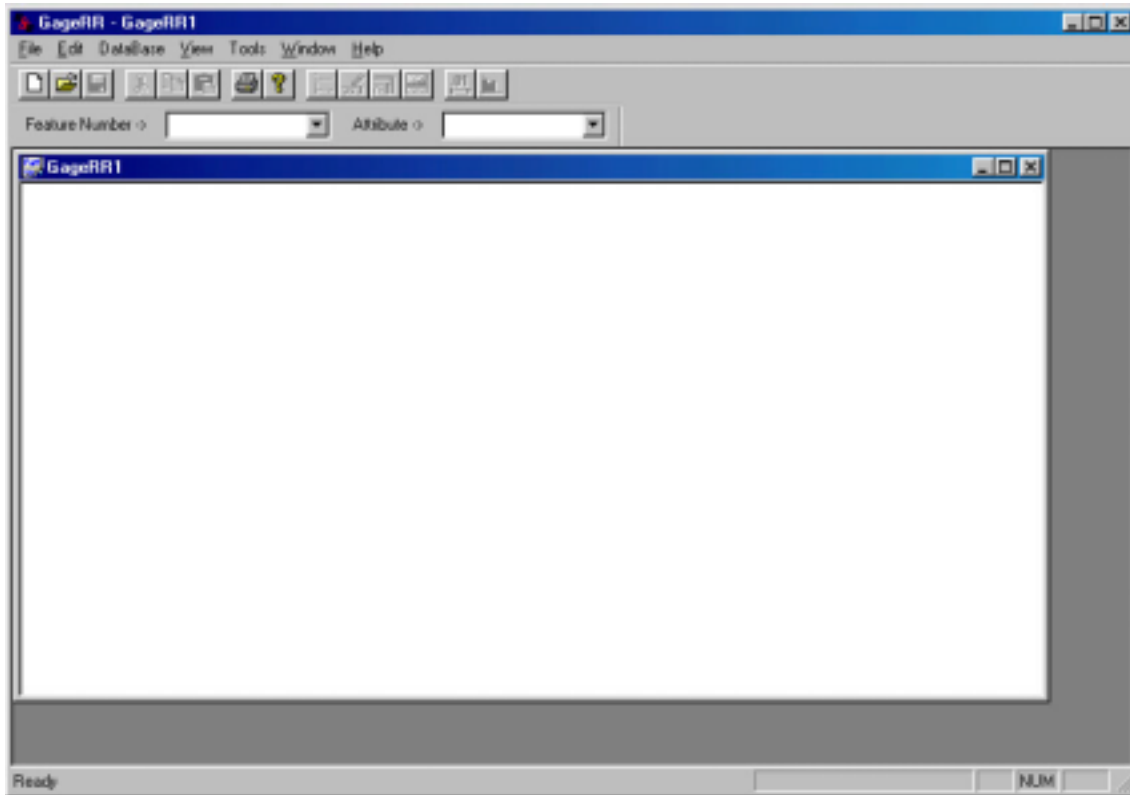
Restart Options

Restart	testrr.GMT
Run Steps	Run the current program specifying a starting and ending step number.
New	Restart Geomet to begin a new inspection.
Print Report	Print this page or document.
Next Gage R&R	Run next Gage R_R Study Part. Operator (Trial 2 of Part 1) 1 of 40 Completed

NOTE: If an existing part program with the same file name is utilizing SPC tags during a part program run, it should be copied to a backup file. When Gage R&R stores the first run, it will over write the existing file! The default naming convention is *my_prog.GMT* stores all SPC ASCII data in *my_prog.SPC*.

Geomet Gage R&R

To start reviewing the measured results gathered from your Geomet study, activate the Geomet Gage R&R program. The example below shows a blank Gage R&R document.



The following steps are used to complete the results and print the Gage R&R reports.

- Import Data
- Edit Record Headers
- Apply Tolerance
- Edit Feature Headers
- Review Reports
- Gage R&R Database Operations
- Print Reports

Importing data takes the saved measurements from the Geomet created ASCII file and enters that data into the gage R&R database.

When the data has been imported, a summary will show listing the statistics of the imported data. At this time, Save or Save-As the database. NOTE: Gage R&R will remind you to save your database when closing or making major changes.

The Gage R&R database can retain several gage R&R studies on file. This can be helpful when tracking historical performance of one study to a previous one. To import another study into an existing database, start by opening the database through the File->Open, select the existing database and left-click "Open". At this point, follow the same steps listed above to import new data into the database.



The Gage R&R Database

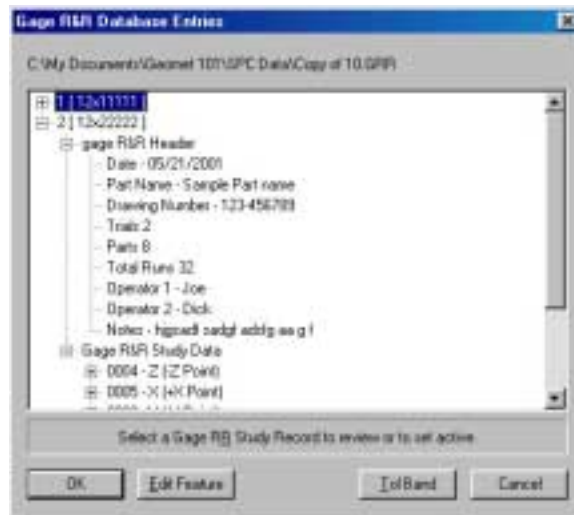
Access to the Gage R&R database is provided through an expandable tree structure as shown in the example to the right. To view this dialog, activate it through the drop down menu found under "Database" and the select "Select Gage R&R Study" or by choosing the tool bar button:



In this example, two studies are shown:

12x11111

12x22222



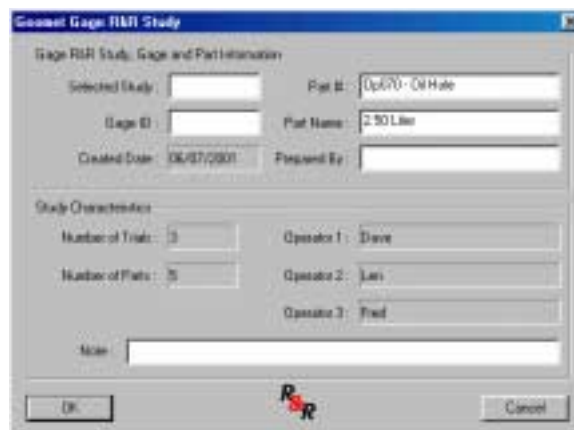
To view the specifics on the study, left-click on the + located to the left of the name. This will expand to the study and show two entries; gage R&R Header and gage R&R Study Data. You can further expand the data attached to each by left clicking on the + next to the name. To select a study for review, double left-click on the study name.

Editing the Study Header

Once data has been imported, it has limited data on the description of the study. You can edit the header record for the study by selecting from the drop down menu "Database" and choose "Display Gage R&R Header" or by selecting from the toolbar:



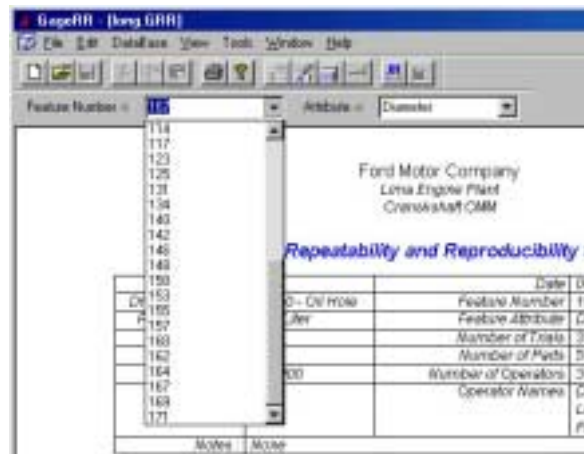
The header dialog will appear allowing access to update the names and notes associated with this study.




Navigating the Database Features

To choose a specific feature to review, select the feature number from the list of available numbers in "Feature Number ->" as shown here. This list maintains all the feature numbers associated with the active study.

Once the feature has been selected, choose the attribute to review from the drop down list "Attribute ->". The available attributes for the current feature number updates automatically when a new feature number has been selected. The Gage R&R report displays the current data for your selection.



Editing the Report Header

To edit the record of an individual attribute, select from the drop down menu, "Database", 'Edit Current Feature Header'. Or from the toolbar: 

The dialog will appear providing you with access to the feature name, Nominal value, Tolerance Band and Limit Test variable, in addition a check box is provided to identify this record for batch printing.



NOTE: For meaningful results to be displayed, every record must have the Tolerance Band and Limit Test values entered. *The Nominal is shown, however with v.1.0 it is not required for calculating Gage R&R Studies. In the next release, the nominal will be used to calculate accuracy.*

Updating Data Headers on all Features

Data that has been imported lacks any tolerance band information. To globally enter a tolerance band, select from the "Database" drop down menu "Add Tolerance Band" or from the toolbar:



A dialog will appear where you can enter a global tolerance band, which will be applied, to all records that currently does not have a value assigned.

Geomet Gage R&R offers a test for individual measurements which highlights any value which exceeds the range that measurement belongs too. For example, in the report located here, we have result highlighted 0.00450 under part #5. This is an early warning that the range of the trial exceeds the Upper Control Limit for that group of ranges.

Operator Dave						
Part No.	R1	R2	R3	R4	R5	
Trial #1	70.01719	80.00808	70.01680	70.01180	70.01930	
Trial #2	70.01719	80.00808	70.01680	70.01180	70.01930	
Trial #3	70.01719	80.00808	70.01680	70.01180	70.01930	
Average	70.01713	80.00807	70.01680	70.01180	70.01930	
Range	0.00170	0.00000	0.00000	0.00000	0.00000	0.00450

The two options available include "Highlight Fails" and "Outline Fails". Depending on the type of printer available you would select the most appropriate. Highlight Fails works well with color printers. The example report shows both options selected.

Not all features will have the same tolerance band. The method described above will update *all* records that currently do not have a tolerance band attached. You will need to edit those records that have a different tolerance band.

Editing Measurement Values

NOTE: This feature currently is not available in Gage R&R v.1.0.

In cases where individual measurements require editing, choose from the "Database" drop down menu "View / Edit". A dialog will appear providing you access to the individual measurements for the current record. You can edit and update the values on a one-by-one basis.



Geomet Gage R&R Reports

There are two reports provided by Gage R&R. To change the view from one report to another, use the drop down menu "View" then "Report Type" and left-click on the desired report.



Feature Report

An example of the feature report is shown to the right. It provides full detail on the selected feature attribute.

This report contains all measurement data, operator and the final results of the Gage R&R Study.

Under Results, conditional errors and warnings are provided to assist when evaluating the report.

Gage Repeatability and Reproducibility Study - Vendor Site R&R

Study ID	Operator	Attribute	Measurement
1000000000	Dave	70.03770	
1000000000	Lan	70.03620	
1000000000	Fred	70.03630	

Operator	Trial	1	2	3	4	5	Average	Range	Standard Deviation
Dave	1	70.03770	69.90500	70.01500	70.01260	70.01620	70.01620	0.01620	0.00300
Lan	1	70.03620	69.90650	70.01680	70.01250	70.01500	70.01500	0.01680	0.00300
Fred	1	70.03630	69.90670	70.01620	70.01290	70.01650	70.01620	0.01650	0.00300

Operator	Trial	1	2	3	4	5	Average	Range	Standard Deviation
Dave	1	70.03770	69.90500	70.01500	70.01260	70.01620	70.01620	0.01620	0.00300
Lan	1	70.03620	69.90650	70.01680	70.01250	70.01500	70.01500	0.01680	0.00300
Fred	1	70.03630	69.90670	70.01620	70.01290	70.01650	70.01620	0.01650	0.00300

Operator	Trial	1	2	3	4	5	Average	Range	Standard Deviation
Dave	1	70.03770	69.90500	70.01500	70.01260	70.01620	70.01620	0.01620	0.00300
Lan	1	70.03620	69.90650	70.01680	70.01250	70.01500	70.01500	0.01680	0.00300
Fred	1	70.03630	69.90670	70.01620	70.01290	70.01650	70.01620	0.01650	0.00300

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Fred	1	70.03630	69.90670	70.01620	70.01290	70.01650	70.01620	0.01650	0.00300

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Fred	1	70.03630	69.90670	70.01620	70.01290	70.01650	70.01620	0.01650	0.00300

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Fred	1	70.03630	69.90670	70.01620	70.01290	70.01650	70.01620	0.01650	0.00300

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Fred	1	70.03630	69.90670	70.01620	70.01290	70.01650	70.01620	0.01650	0.00300

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Lan	1	70.03620	69.90650	70.01680	70.01250	70.01500	70.01500	0.01680	0.00300
Fred	1	70.03630	69.90670	70.01620	70.01290	70.01650	70.01620	0.01650	0.00300

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Lan	1	70.03620	69.90650	70.01680	70.01250	70.01500	70.01500	0.01680	0.00300
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Lan	1	70.03620	69.90650	70.01680	70.01250	70.01500	70.01500	0.01680	0.00300
Fred	1	70.03630	69.90670	70.01620	70.01290	70.01650	70.01620	0.01650	0.00300

Operator	Trial	1	2	3	4	5	Average	Range	Standard Deviation
Dave	1	70.03770	69.90500	70.01500	70.01260	70.01620	70.01620	0.01620	0.00300
Lan	1								

The summary report highlights only the Tolerance, Gage R&R, Limit test and Percent of Tolerance results listing all features in one report.

[illegible]

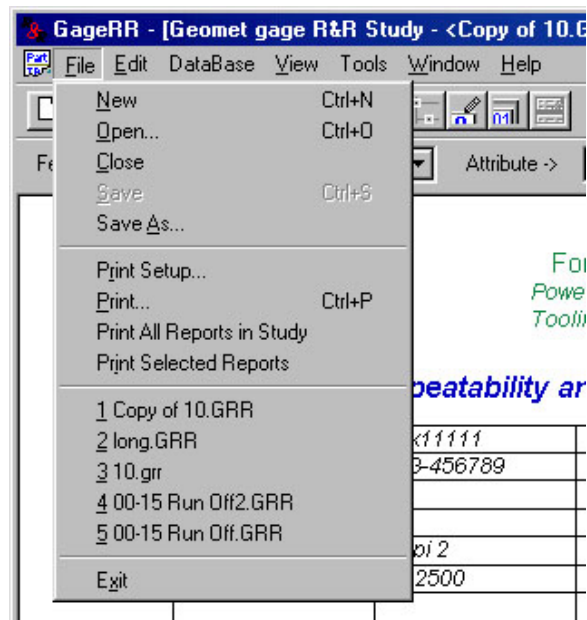
Printing of the reports is accomplished through the File drop-down menu. There are three options available:

- Print***

Print all Reports in Study

Print Selected Reports

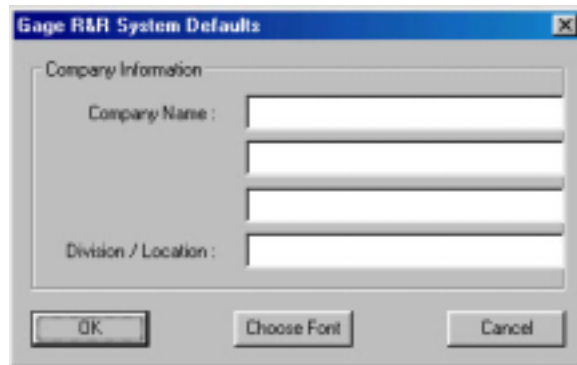
This option will print only the reports that have been tagged as included in batch printing, *see Editing the Report Header*.



Program Preferences

Under the Tools drop-down menu selection, you can set the report preferences. This includes the report header information that will be included on every report.

The "Choose Font" provides a dialog selection box where you can choose the font and color to be applied to the company name line on your report.



The image shows a Windows-style dialog box titled "Gage R&R System Defaults". It contains a section labeled "Company Information" with two text input fields. The first field is labeled "Company Name :" and has three horizontal lines below it, suggesting a multi-line or scrollable text area. The second field is labeled "Division / Location :". At the bottom of the dialog, there are three buttons: "OK", "Choose Font", and "Cancel".

*	
*.SPC.....	7

E

Editing Measurement Values.....	11
Editing the Report Header.....	9
Editing the Study Header.....	8

F

Feature Report	11
Feature Tagging.....	4

G

Gage R&R Database.....	8
Geomet Gage R&R.....	6
Geomet Gage R&R Reports	11

I

Import Data.....	7
Introduction	3

N

Navigating the Database Features	9
--	---

O

Open	7
------------	---

P

Prepare a Gage R&R Study	4
Print	12
Print all Reports in Study.....	12
Print Selected Reports	12
Printing Reports.....	12
Program Preferences.....	13

R

Running the Study	5
-------------------------	---

S

Summary Report.....	12
---------------------	----

T

Tests, Limits	10
---------------------	----

U

Updating Data Headers on all Features	10
Upper Control Limit	10