GAGEtrak®

Calibration Management Software Version 4

User Guide

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Chapter 1: Introduction

Overview

We're proud to welcome you to GAGEtrak Version 4 - 2007 for Windows, a database software program that automates your calibration information, saving you time and giving you precise control over the tools you use to do your job. The program was designed for quality control professionals who need a convenient, easy-to-use, and powerful method for documenting, tracking, and retrieving calibration information. Once you've mastered its essentials, GAGEtrak will become a vital tool for managing your calibration records.

The *Quick Start Guide* will help you install and run GAGEtrak quickly so that you can evaluate its major features. The *User's Manual* gives you detailed information about working with records and reports. The *System Administrator's Guide* provides comprehensive installation instructions (including client/server installations) and directions for setting up and maintaining the program and database.

The first section of this guide briefly discusses the development of formal measurement testing and calibration. Next, we'll look at a hypothetical example of how you could use GAGEtrak on a typical day. This example will familiarize you with the program's major functions and features while giving you a look at some optional accessories.

In the second part of this guide, you'll learn how to quickly install and use GAGEtrak's three major functions—Gage Entry, Calibration Entry, and Gage Issue and Return.

Measurement and Calibration

Throughout history, measurement has been a tricky process. Before our modern measurement systems were developed, people didn't have standard measurements to use in their daily lives. For example, if you told the local woodcutter that you needed a "foot" of wood, you would get just that—but a foot by *his* definition, not *your* definition. If his feet were longer than yours, you benefited; if not, you were left short.

Gradually, people began to realize that this method of measurement simply would not do. They developed standards of measurement–ultimately, national standards. However, with the advent of the global marketplace, it became apparent that we needed global standards to ensure part interchangeability between countries. In developing these standards, we were trying to ensure *accuracy* and *precision* in our measurements. *Accuracy* is how close a measurement instrument comes to an established standard; *precision* is how consistent that instrument is when measuring the same item several times. Therefore, we calibrate our instruments to adjust them to the proper standard.

This is where GAGEtrak comes in. Every day, you have to test and calibrate gages to ensure their accuracy and precision. In order to ensure quality and provide for a ready analysis of a single gage's performance over time, you have to document each calibration that you perform on that gage. Now, you could do this on paper, but then you have stacks of paperwork to keep organized. This paperwork is easily lost, and you often don't have backup copies for it. We developed GAGEtrak for this reason. By giving you a paperless, easy-to-use tracking system, GAGEtrak makes the job of managing your gages and test equipment easier and ensures that your calibration records are accurate and up-to-date.

Chapter 2: How Does GAGEtrak Work?

To answer this question, let's look at how your calibration lab might use GAGEtrak on a typical day. Please note that this story is merely hypothetical; it's not meant to be prescriptive. You'll notice that all of the program's **features** and **reports** are in **bold** print, and all of the *optional accessories* are in *italic* print.

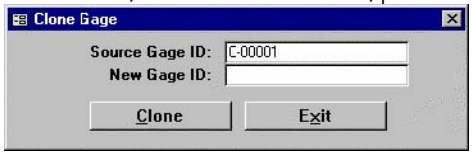
A Typical Day in the Calibration Laboratory

It's Monday morning, and it's time to plan the day. The QC manager asks you for the weekly **Calibration Schedule**. You anticipated this request, and you've already printed it, so your first task of the day is finished almost effortlessly.

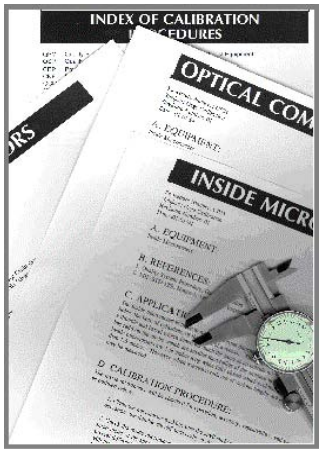
Next, you pour your coffee, turn on your computer, and start up GAGEtrak to help you plan the rest of your day. Your **Automatic Calibration Due Listing** report pops up on the screen, showing all of the calibrations that are due today. You print it out to use as a handy reference so that you can be sure that all of the required work is finished today.

Now it's time to organize the work for your calibration crew. First, you assemble the reports that you printed last Friday. Because you have several calibration technicians, and you have some gages that you must send off-site for calibration, you printed a separate **Calibration** report for each of these people or sites.
Along with each of these lists, you include the **Calibration Work Order** for each gage that needs to be calibrated. The **Calibration Work Order** includes a list of all of the **Calibration Standards** used, along with the minimum, nominal, and maximum measurements for each standard. You've also been thorough enough to include the **Calibration Procedures** needed for each **Work Order**.

Later in the morning, you finally receive the new gages that you ordered last week. Since you already have a gage of the same type as one of these new gages, you use the **Clone Gage** feature to copy the common information about this gage into a new gage record. When you clone the gage, GAGEtrak copies all of the calibration standards, parts, and procedures to the clone. All you have to do is enter the gage's unique information, like its serial number, purchase date, and next calibration date.

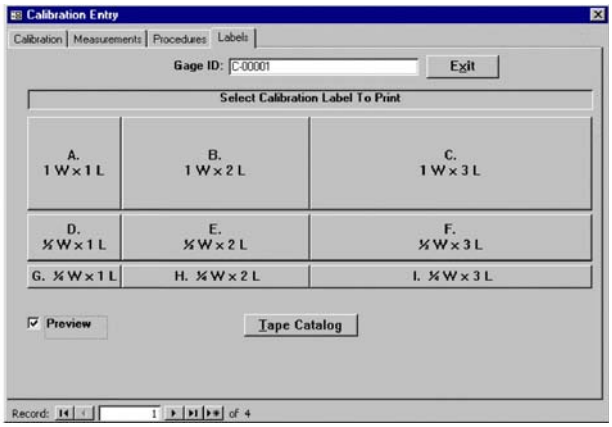


After you clone the first gage, it's time to enter a record for a completely different type of gage. You enter all of the specifications for the gage, and you're ready to enter its calibration standards. Because you will electronically check this gage at incremental intervals during calibration, you use GAGEtrak's **Calibration Standards Prefill** feature to automatically create the eight calibration checkpoints required. You'll need a new procedure for calibrating, too. You use *CalPro*, a database of step-by-step calibration procedures that covers everything from gage blocks to micrometers and calipers. Thanks to *CalPro*, you don't have to waste time researching or creating calibration procedures. You can simply import the procedures directly into GAGEtrak. Using *CalPro* also helps your company comply with ISO 9001 and QS 9000 quality standards.

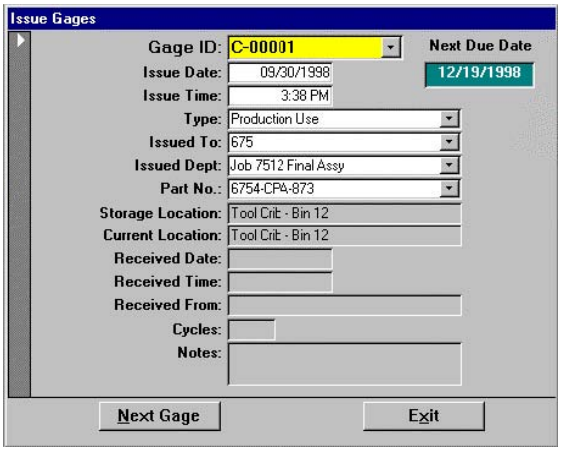


After lunch, you spend the afternoon calibrating some gages yourself. One of the gages you calibrate is the new electronic gage you received this morning. The output from this gage is transmitted through one of the serial ports on your PC. You're using the *Software Wedge* program to capture this real-time data and automatically insert the gage's measurements into GAGEtrak's **Calibration Measurements** screen.

Once you've finished, you use the *GAGEtrak Calibration Label Kit* to print out a calibration label for each gage. These laminated, durable labels are oil- and water-resistant, and they're easy to print and apply to your gages.



Now one of your lab technicians tells you that another department needs to borrow a gage. "May I just give it to them?" he asks. Your reply? "No, we need to provide traceability each time someone uses our gages." You ask him for the gage ID, and use **Gage Issue and Return** to loan out the gage so that you have an accurate location for it. You might have never found this gage again if it had gone off to the other department unchecked. You've also ensured that you'll have traceability for this gage.



Later in the afternoon, you check on the tool crib. Some gages used for manufacturing today are being returned. An employee with a *Barcode Reader* is quickly scanning the bar-coded labels on each gage. A second scan across bar-coded department identification completes the gage return information.

Because you expect your auditor to arrive tomorrow, you print the **Calibration History with Measurements** report for the last three months, for all of your gages. You also print the **Standards Traceability** report, which shows all of the reference standards associated with your calibration standards for every calibration. Now you have documented proof as to exactly which instrument or standard you used to calibrate each gage. If your auditor asks for more information about your reference standards, you can quickly generate reports showing each one's NIST number, uncertainty, calibration schedule, calibration history, calibration certificate numbers, and even the exact calibration measurements, since you've entered this much detail into your GAGEtrak records.

It's time to go home now, and you're ready to go. As you leave, you try to remember what your workday was like before you had GAGEtrak. How did you ever manage?

Benefits

As you can see, using GAGEtrak and its accessories saved you a lot of time, effort, and stress.

Let's list these benefits by what feature of the program they used:

1. You easily and quickly generated an accurate **Calibration Schedule**.
2. You also easily generated an **Automatic Calibration Due Listing** report that told you what you had to do for the day. Plus, you were able to give each of your technicians the **Calibration Work Orders** and **Calibration Procedures** that they needed for their assigned calibrations.
3. The *PDA* gave the technician who was going off-site a faster, less-cumbersome way of recording his calibration information, and later, you will easily be able to upload this information into your database.
4. The **Clone Gage** feature also saved you time. Without it, entering the new gage's information would have taken much longer, not to mention that it would have been a redundant task. This feature also provided for more accurate data entry, since you didn't have to worry about as many potential errors.
5. The *Software Wedge* program instantly inserted your calibration measurements into GAGEtrak—you didn't have to enter anything.
6. *CalPro* gave you proven calibration procedures that were already researched and documented.
7. The *Calibration Label Kit* helped you speedily print durable, easy-to-read calibration labels for each gage that you calibrated.
8. Using **Issue Tracking Entry**, you were able to quickly issue a gage out to another department and avoid the problem of not knowing where the gage is located. Most importantly, you now have an easy way to provide traceable gage usage history for each of your gages.
9. The *Barcode Reader* provided for fast, easy, and accurate entry of issued and returned gages, and even updated their current information—all directly into

GAGEtrak.

10 Thanks to GAGEtrak's large variety of detailed reports, you can rest assured that you'll be able to quickly and accurately retrieve any calibration information that your auditor asks to see.

11 Finally, GAGEtrak's features and optional accessories helped you with one extremely important task—ensuring your company's compliance with ISO 9001 and QS 9000.

Chapter 3: Installing and Running GAGEtrak

Now that you've seen how GAGEtrak works, it's time to install your software. The following instructions will tell you how to install and run the software quickly, allowing you to evaluate its major functions. For more detailed information, please consult your *System Administrator's Guide* and *User's Manual*, which are located elsewhere in this publication.

System Requirements

GAGEtrak 4 (2007) for Windows requires the following:

- Microsoft Windows 2000 or Windows XP
- Hard disk with 700 MB of free space for program files, plus 5-20 MB for a typical Access database
- 512 MB (or more) of random-access memory

Installing GAGEtrak

The *System Administrator's Guide* contains detailed information about different ways to install GAGEtrak and set it up on a network, including how to set it up in a client/server environment. However, if you'll just be using the program on one PC and installing it from the CD-ROM, follow these instructions:

1. Click the Windows *Start* button and select the Run . . . command.
2. Place the GAGEtrak 4 (2007)CD into your CD-ROM drive [D] and enter D:\SETUP.EXE in the *Open* field in the Run box.
3. Follow the installation instructions on your screen.

Running GAGEtrak

To run your program for the first time, click the *Start* button, select Programs, and then select the GAGEtrak 4 (2007) program group. Choose GAGEtrak 4 (2007) from this program group to start using GAGEtrak.

When you open GAGEtrak, a logon window will appear, if you have set up security. The window will ask you to enter your PIN (Personal Identification Number). Enter your PIN and click *OK* (see the *System Administrator's Guide* for more information about setting up security).

Next, GAGEtrak will give you this message: "Please enter your Serial No. in the About box!". Click the *OK* button, and the *About* window will appear. Enter the serial number for your copy of GAGEtrak (you can find this serial number in your manual package, on your registration card, and on the packing list that came with your order). Please call Technical Support at (480) 922-7300 if you can't find your serial number.

Trial Period

Each copy of GAGEtrak is set to give you a 45-day, single-user license trial period. If you purchased a multi-user license of GAGEtrak, please follow step 1 after you install your software.

Seven days before your trial period is over, GAGEtrak will begin giving you messages that your trial period is nearing its end. For your convenience, the trial period will not expire on a Saturday or Sunday. To enable your copy of the software to continue past the 45-day period, you can do one of two things:

1. Go to the Tools and Utilities menu and select Modify License. GAGEtrak will generate a screen that gives you a *Code Entry* number and a *Computer ID* number. Leave this screen open and call Technical Support immediately. The support representative will then give you two additional code numbers that you will enter on your Modify License screen. Once the modification is complete, GAGEtrak will give you a message titled "Modification Successful".
2. You can also wait until the date on which your trial period expires. At that time, you'll receive an Application Violation message when you open GAGEtrak. Click the *OK* button, and the Modify License screen will appear. Again, leave this screen *open* and call Technical Support immediately for the necessary code numbers. You will receive a Modification Successful message once you have entered the code numbers that your support representative gives you.

To check on your expiration date and number of assigned user licenses, click the *About* button (on the main menu), and look under *License and System Information*.

Main Menu

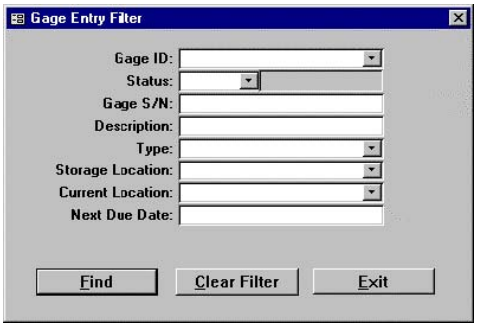
GAGEtrak's main menu looks like this:

Note that in the lower left-hand corner, you see the name of the currently logged-in user. In the lower right corner, you'll see the full path to the GTDATA40-2007.MDB file (default database) or the ODBC database specified (currently open, as seen above). To add, change, or delete records, select the menu button that looks like a yellow folder. To view or print reports, select the button that looks like a printer. To configure GAGEtrak; set up users; back up your data; edit your data tables; archive or un-archive records; export records; or run a utility, select the menu button that looks like a pocket of tools. To exit the program, click the *"X"* in the upper right.

Chapter 4: Entering Gage Records

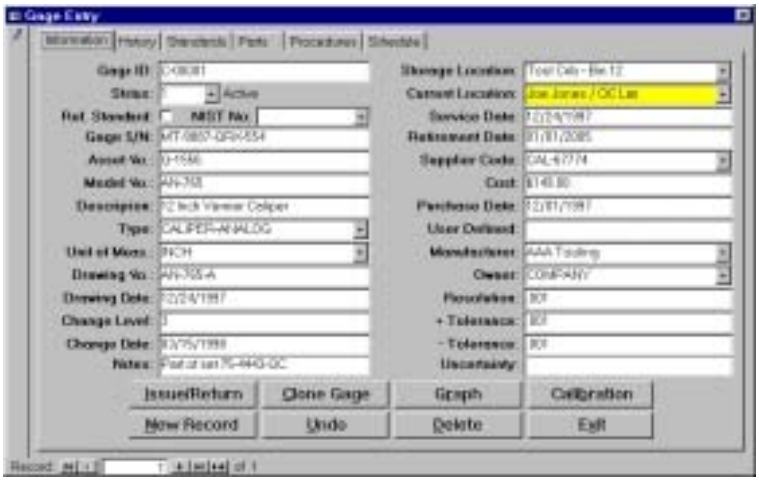
Gage Entry

To begin entering your gage records, select Gage Entry from the Enter/View Records menu. A filter window will appear, as shown below:



Since you don't have any gage records entered yet, leave the filter fields blank. After you enter your gage records, you can use these fields to narrow your record searches. Click the *Find* button to go to the gage record window.

Gage Information



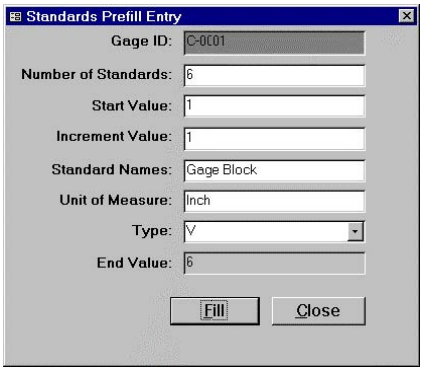
To enter a new gage record, click the *New Record* button at the bottom of the screen, then fill in the gage record with your data. Below are brief descriptions of the major fields in this screen:

Field/Button Name	Description
Gage ID	Enter a *unique* alphanumeric gage identification code; you must enter this ID in order to store the record. If you don't have a gage ID numbering system, you can take this opportunity to create one. Tip: Avoid using the characters #, *, and ? in your gage IDs or other fields, as these are considered wildcard characters in GAGEtrak. For more information about wildcards, please see the *Program Conventions* section of the *User's Manual*.
Status	Use the list box to pick from available choices (such as *Active* or *In-Active*). This field is also required. Tip: If the *Status* field is not set to Active, the Calibration Due reports will skip over the gage.
Ref. Standard	Check this box to indicate that this record is for a calibration reference standard, not a gage (use it to identify gage blocks or reference weights).
NIST No.	If this record is for a reference standard, enter its NIST number here.

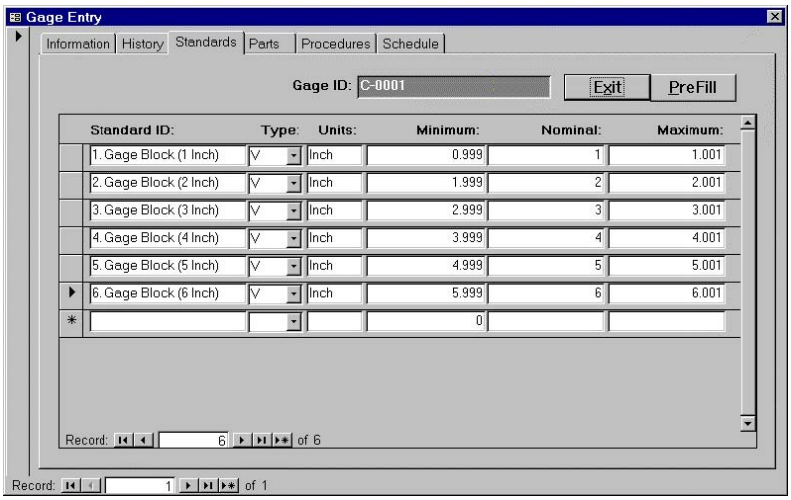
Calibration Standards Entry

Select the Standards tab to define the set of standards that you'll measure when you calibrate the gage. Later, GAGEtrak automatically copies these standards to the calibration record. Enter as many calibration standards as you need.

If you have two or more similar standards, use the Standards Prefill feature to save data entry time and avoid mistakes. Click the *PreFill* button in the Standards screen, and this screen appears:



Enter the information for this particular standard, then click *Fill*. GAGEtrak automatically enters the information into the Standards screen.



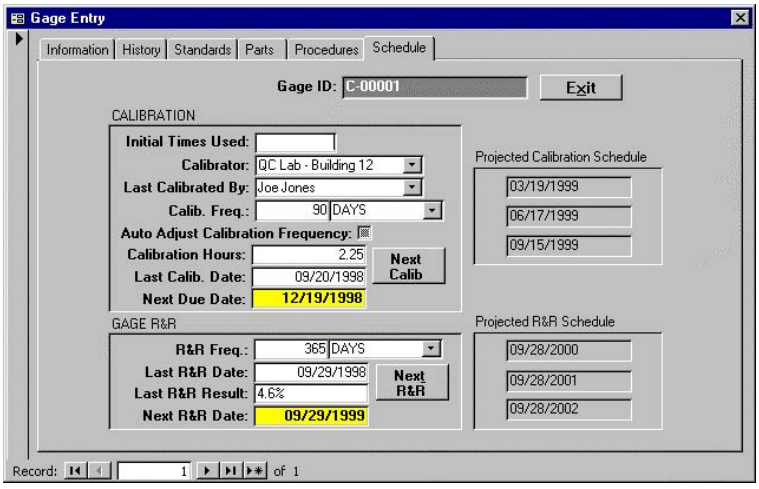
In this example, the minimum and maximum measurements are automatically calculated, based on the + and – tolerances entered in the Gage Entry–Information screen (.001).

The Calibration Standards table contains the following fields:

Field/Button Name	Description
Standard ID	Enter the name or identification of the calibration standard or checkpoint (for example, "Gage Block"). Each standard ID that you enter for the gage must be unique. If you need to use the same name for more than one ID, number or letter each ID. For example, if you need to use the name "CMM Check" for more than one standard ID, you could number the name each time. The names would then look like this: "1. CMM Check", "2. CMM Check", "3. CMM Check".
Type	Select either **V** for Variable or **A** for Attribute.
Unit of Meas.	Enter the units measured, such as MM, inches, lbs., or degrees.
Minimum	This field contains the minimum acceptable value for the gage or instrument for when you measure this standard (for example, 0.999). When you enter the nominal measurement, GAGEtrak automatically calculates the minimum measurement, based on the gage's –tolerance.
Nominal	Enter the nominal value for the gage or instrument for when this standard is measured (for example, 1.000).
Maximum	This field contains the maximum acceptable value for the gage or instrument for when this standard is measured (such as 1.001). When you enter the nominal measurement, GAGEtrak automatically calculates the maximum measurement, based on the gage's +tolerance.

Gage Entry—Schedule

Use the Schedule tab to set up the calibration schedule for each gage.



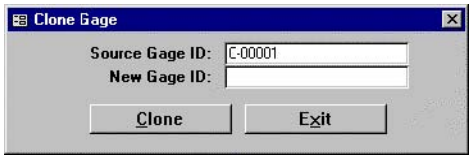
Gage Calibration Schedule

Field/Button Name	Description
Initial Times Used	To track gage usage, go to this field and enter the gage's current number of uses as a starting point. As you issue the gage out and enter usage information, GAGEtrak automatically counts the number of uses and displays it in the Issue Tracking Entry screen.
Calibrator	This field is a list box from which you choose the code of the calibration service supplier; see the *Supplier Entry* section in the *User's Manual* for more information. If you calibrate the gage within your own facility, you could enter "In-House", a specific department, or a technician's name. You can later use your *Calibrator* field entries to print a group of gages due for calibration by a particular calibrator.
Last Calibrated By	The name of the user who last calibrated the gage appears in this field
Calib. Freq. and *Calib. Freq. Units*	Enter the frequency of calibration, using the unlabeled list box field on the right for the frequency units (for example, "45 DAYS"). When the software calculates the next calibration due date, it uses this value. Your choices for the *Units* field are explained below: **Days**—schedule is based on elapsed calendar days **Weeks**—each week equals seven days; schedule is based on elapsed calendar weeks **Months**—schedule is based on elapsed calendar months **EOM**—rounds the next due date to the end of the month in which it occurs. For example, "6 EOM" means *every 6 months*, but the program extends the due date to the end of the sixth month (or the last working day of the month if you're using skip days – see the *System Administrator's Guide* for more information) **Years**—each year equals 365 days; schedule is based on elapsed calendar years **Usage**—when using this schedule, the program won't create a next due date for calibration until you issue (use) the gage, even if you enter a calibration record for the gage. When you issue the gage, GAGEtrak calculates a predicted next due date based on the remaining number of usage days. You must use the Issue Tracking records for this to work. **Cycles**—similar in principle to the usage days method, but it tells the program to schedule calibration only when the total number of cycles equals the calibration frequency value. You must use the Issue Tracking records for this schedule to work. **Each Use**—select this option if you calibrate the gage *before or after each use*;

	you must manually enter your due dates **Bef. Use**—select this option if you calibrate the gage *before every use*; you must manually enter your due dates Aft. Use—select this option if you calibrate the gage *after every use*; you must manually enter your due dates
Calibration Hours	In this field, enter the actual or estimated time it takes to calibrate the gage.
Last Calib. Date	Enter the last calibration date for the gage. GAGEtrak automatically updates this field whenever you add a new calibration record for the gage.
Next Due Date	The next calibration due date is automatically updated when you add a new calibration record for the gage (*Next Due Date = Calibration Date + Freq*). You can also manually enter a date into this field. If today's date is past the *Next Due Date*, you'll see the message "Past Due" on the right of this date. Tip: Click *Next Calib.* to calculate this field immediately (only if you entered a calibration frequency and last calibration date). This button is useful if you want the program to calculate the next due date, but don't want to enter a calibration record for the gage.
Projected Calibration Schedule	To the right of the calibration scheduling, you can see the next three anticipated calibration dates. To calculate these three dates, click *Next Calib.* GAGEtrak automatically updates them, based on the current calibration frequency, whenever you add a new calibration record for the gage.

Cloning Gage Records

If you want to copy a gage record, including its set of calibration standards, procedures, and parts, click the *Clone Gage* button in the Gage Entry – Information screen. This window will appear:



Enter the ID of the new gage into the *New Gage ID* field, then click *Clone*. To clone more gage records, keep entering new gage IDs and clicking the *Clone* button. Click the *Exit* button when you're finished.

Other Gage Entry Options

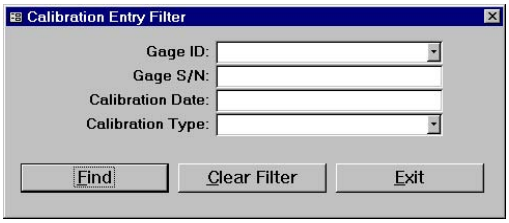
We'll discuss each of these options in more detail in the *User's Manual*.

Tab/Button Name	Description
Gage R&R Schedule	In this part of the Schedule screen, you can set up the R&R ("repeatability & reproducibility") study schedule for each gage.
History	This tab shows all calibration history for the gage. It sorts the calibration history by date in descending order.
Parts	Use these records to define the parts and operations for which you will use the gage. Associating this information facilitates traceability to manufacturing. Before you can associate parts with a gage, enter the part records in Part Entry.
Procedures	The Procedures tab lets you link a procedure to each gage. You must enter the procedure in Procedure Entry before you can access it in this screen.
Graph	To view an accuracy chart, click on this button.
Undo	Click this button to remove any changes to the current record.
Delete	Use the *Delete* button to delete the gage record and all associated records.
Calibration	This button takes you directly to Calibration Entry for the current gage ID. In this window, Calibration Entry from Gage Entry, you can perform all actions that you would normally do in Calibration Entry, except delete whole records. To return to Gage Entry, click *Return* or *Exit*.

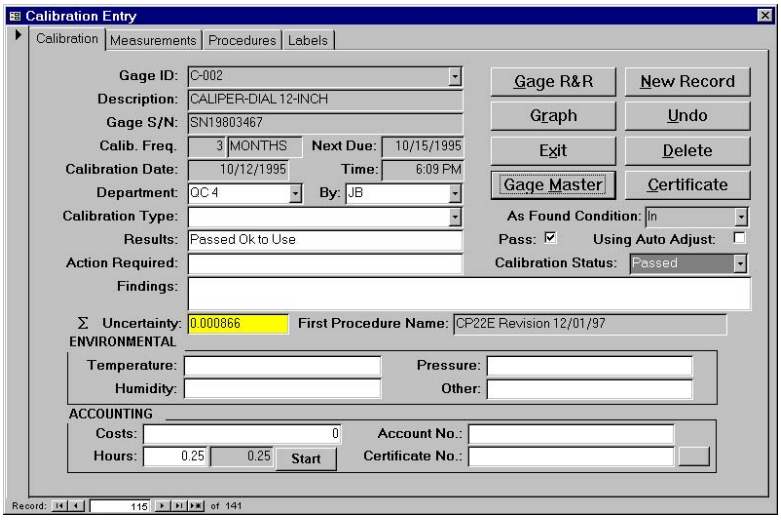
Chapter 5: Entering Calibration Records

Calibration Entry

To enter calibration records, select Calibration Entry from the Enter/View Records menu; a filter window will appear. By now, you should have at least one gage record entered; use the *Gage ID* list box field to select that gage so that you can create a calibration record for it.



After you select a gage, click the *Find* button, and the Calibration Entry window will appear. To enter a new calibration record, click *New Record*. After you save the record by entering information into this screen (such as your department), GAGEtrak automatically retrieves any standards you set up for the gage.



The major fields in the calibration record window are described below:

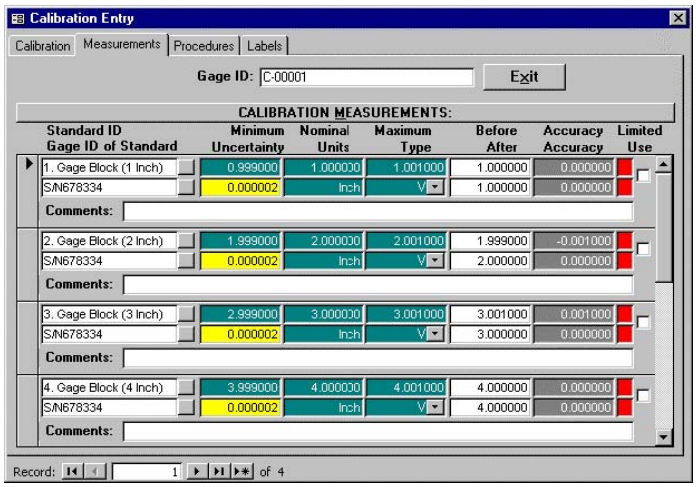
Field/Button Name	Description
Gage ID	The gage ID that you filtered for automatically appears. If you left the filter window blank, use the drop down list box to select a gage ID. Tip: Once you select a gage, DO NOT change this field. If you want to enter another record, click *New Record*.
Next Due Date	This field stores the next due date for calibration, based on the calibration frequency. You must check the *Pass* checkbox field in order for GAGEtrak to show the next due date.
Department	Enter the name of the department that used the gage before calibration.
Action Required	In this field, enter any required action, such as "send out for repair".
Findings	Use this memo field to describe any other pertinent information, such as visual inspection notes. Note: What you enter here appears on the calibration certificate.
As Found Condition	Choose the condition of the gage before calibration or adjustment. Select Infor in-tolerance, Outfor out-of-tolerance, or Newfor a gage that hasn't been calibrated before. Before calibration, *all* test points of the gage must be within tolerance to have the as found condition set to In.
Σ *Uncertainty*	This field displays the total calculated uncertainty value, using the root sum of squares method. You can't edit it.
Calibration Status	Select from the following options: Passed, Failed, Repaired, or Limited.
Environmental	Enter the *Temperature*, *Humidity*, *Pressure*, and *Other* factors that may affect the calibration.

Accounting Section

Field/Button Name	Description
Cost	Enter any costs related to the calibration, such as those for internal or external service or supplies.
Hours	In this field, enter the actual time (in hours) that the calibration required. In the gray box next to this field, GAGEtrak shows the estimated default time from Gage Entry. Use the *Start* timer button next to the *Hours* field to time your calibration (it works like a stopwatch). When you're ready to calibrate, click *Start*. Its name will change to *Stop*. When you're finished with the calibration, click *Stop*, and GAGEtrak will automatically calculate the time and enter it in the *Hours* field. The time is expressed in decimal hours (example: 0.25 hours = 0.25 x 60 minutes = 15 minutes)
Acct. No.	Enter any tracking number associated with the calibration cost, such as a job, purchase order, invoice, customer, or department number.
Certificate No.	You can enter a certificate number or push the button next to this field to generate a sequential certificate number (first, you must manually enter a starting certificate number, such as 1001).

Calibration Measurements

Use this screen to view the standards (test parameters or checkpoints) that you use to calibrate the gage. GAGEtrak copies this list from the Calibration Standards table that you defined in Gage Entry.



You'll use the following fields in the Measurements table:

Field/Button Name	Description
Standard ID, Minimum, Nominal, and Maximum	GAGEtrak copies the calibration standards and their nominal, minimum, and *Minimum, Nominal,* maximum values from Gage Entry. and *Maximum*
Type and Unit of Measure	The program automatically pulls this information from Gage Entry. If you enter this information here, it becomes part of this calibration record, but not the gage record.
Before	Enter the actual measurement before you calibrate the gage.
After	Next, enter the actual measurement after you calibrate or adjust the gage.
Acc. Bfr.	This field shows the accuracy based on the before measurement (*Before - Nominal*).
Acc. Aft.	In this field, GAGEtrak shows the accuracy based on the after measurement (*After - Nominal*).
Accuracy Flag	If the before and after measurements are greater than the maximum or smaller than the minimum, GAGEtrak alerts you by placing an X in the red square on the right of the accuracy calculation.
Limited Use	If a gage is out of tolerance, you can still "pass" it, depending on its before and after measurements compared to its calibration standards. Check this box to indicate limited use for it for specific operating ranges. GAGEtrak doesn't automatically update this field.
Gage ID of Standard	This field stores the gage ID of the reference standard, which is important for traceability back to a specific standard. You can manually enter the standard's gage ID or select from a list of available standards by clicking the small button on the right of this field. The list shows only those gage records that have "X's" in their Gage Entry *Ref. Standard* checkboxes.
Uncertainty	If you select the reference standard from the list, the uncertainty value will automatically display. If you manually enter the standard, then enter its uncertainty value here. You can obtain this value from the manufacturer; it's expressed in units, such as percentage (0.5%), proportion (0.005), or measurement (0.0001 inch). You must enter units of the same value—otherwise, the calculated ∑ *Uncertainty* will be wrong.

Other Calibration Entry Options

Like the Gage Entry options, we'll talk about each of these Calibration Entry options in the *User's Manual*.

Tab/Button Name	Description
Calibration Procedures	Use this screen to view the procedures that you use to calibrate the gage. The program copies these procedures from Gage Entry—Procedures.
Labels	From this screen, you can print a calibration label for the current record (only if you have the optional *GAGEtrak Calibration Label Kit*).
Gage R&R	To enter a gage R&R study, click this button to access Gage R&R Entry.
Graph	If you want to see an accuracy chart for the current record, click this button.
Delete	Click this button to delete the current calibration record.

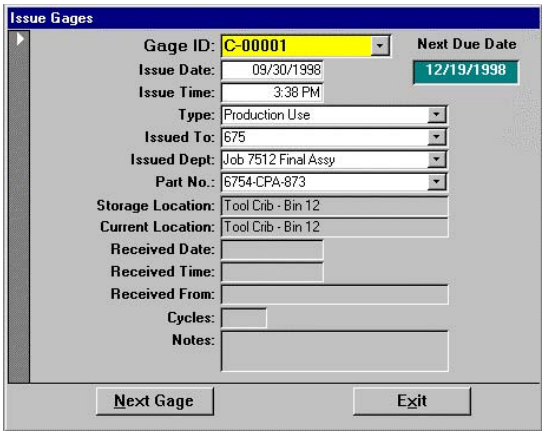
Chapter 6: Issuing and Returning Gages

Gage Issue and Return

In Gage Issue and Return, you can track each time you loan out a gage, including return information. This is particularly useful in a gage crib, where gages and inspection equipment are checked out and then returned for storage. By tracking this information, you'll identify which gages your company uses the most and who uses those gages. You'll also be able to locate any gage. Another purpose of these records is to track gage usage times and cycles if you base the gage's calibration schedule on days used or cycles. If you consistently use the *Part No.* field, you can create manufacturing traceability. For example, if you find that a gage is out of tolerance, you can immediately generate a part recall report listing all parts that you might have measured incorrectly.

> Note: You can also issue or return gages one-at-a-time via Gage Entry's */ssue/Return* button; however, Gage Issue and Return is designed for consecutive gage issues/returns and to facilitate bar-coded data entry. Both screens operate in the same way.

To issue or return gages, go to the Enter/View Records menu and select Gage Issue and Return. Click *Issue Gages*, and this screen appears:



Gage Issue

The Gage Issue fields are as follows:

Field/Button Name	Description
Issue Date and *Issue Time*	These fields track the date and time on which you checked out the gage. They're prefilled with the current date and time.
Type	Select the type of issue; this field creates its own list from your entries.
Issued To	Enter the name of the person to whom you issued the gage.
Issued Dept.	Use this field to track the department or job number that will use the gage.
Part No.	Enter the number of the part the gage will measure.

Gage Return

The Gage Return fields are as follows:

Field/Button Name	Description
Received Date and *Received Time*	These fields track the date and time when you received the gage. Click the small button next to *Received Date* to fill in the current date and time.
Received From	In this field, enter the name of the person that returned the gage.
Cycles	Enter the number of use cycles performed by the gage (usually 1). For gages that you calibrate according to cycles, GAGEtrak adds this number of cycles to any previous cycles that the gage performed, then it uses that number to calculate the next calibration due date.
Notes	Record any important comments, such as damages or malfunctions.

GAGEtrak uses the following rules for managing Issue Tracking records:

1. When you issue a gage, the program automatically inserts the current date and time. It also changes the gage record's *Current Location* field to a description that consists of the *Issued To* field plus the *Issued Dept.* field, separated by a slash (for example, "675/Job 7512 Final Assy").
2. The program assumes you want to return a gage (complete the Issue Tracking record) if the gage has an incomplete current record. After you save the Issue Tracking record, GAGEtrak marks the gage record's current location as its storage location.

Chapter 7: Conclusion

We hope that you're more familiar with GAGEtrak 4 (2007) now and that this guide has helped you understand more about how GAGEtrak can help you organize and document your gage and calibration records. Please consult your *User's Manual* and *System Administrator's Guide*, located elsewhere in this publication, for detailed instructions on other entry screens, reports, program setup options, and other features.

If you have any questions please contact CyberMetrics at **(480) 922-7300**, and choose option three for Technical Support.

GAGEtrak®

Calibration Management Software

User's Manual

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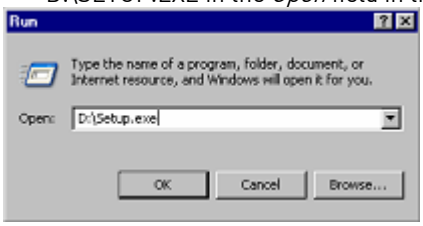
Chapter 1: Starting GAGEtrak

Installing GAGEtrak

The *System Administrator's Guide* contains detailed information about different ways to install GAGEtrak and set it up on a network, including how to set it up for a client/server environment. However, if you're planning to use the program on one PC and install it from the CD-ROM, follow these instructions:

1 Click the Windows *Start* button, then select the Run . . . command.

2 Place the GAGEtrak Version 4 - 2007 - 2007 CD into your CD-ROM drive [D] and enter D:\SETUP.EXE in the *Open* field in the Run box.

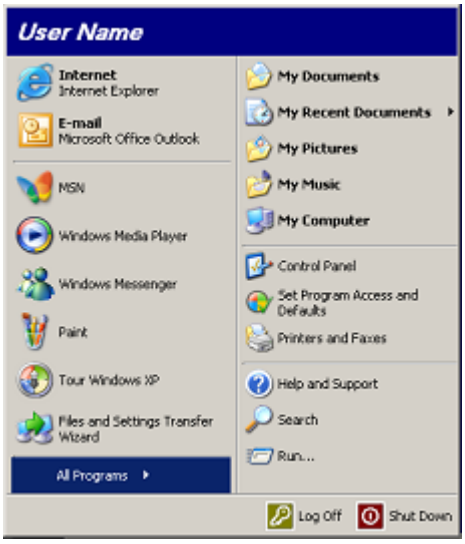


3 Follow the installation instructions on your screen.

Running GAGEtrak

1 Click the *Start* button.

2 Select Programs.



3 Select the GAGEtrak 4 (2007) program group, then choose the GAGEtrak 4 (2007) program, and the main menu will appear.

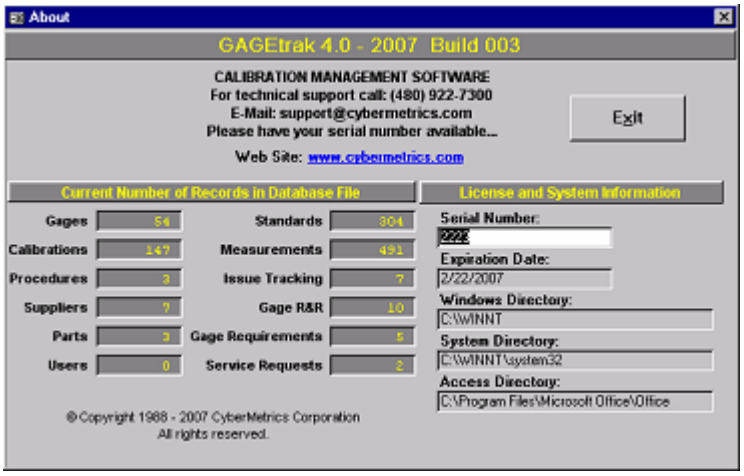
GAGEtrak Logon

When you run GAGEtrak, a logon window will appear, if you have set up security. Enter your PIN (Personal Identification Number) and click the *OK* button. For more information about setting up user security, please see the *System Administrator's Guide*.

GAGEtrak Serial Number

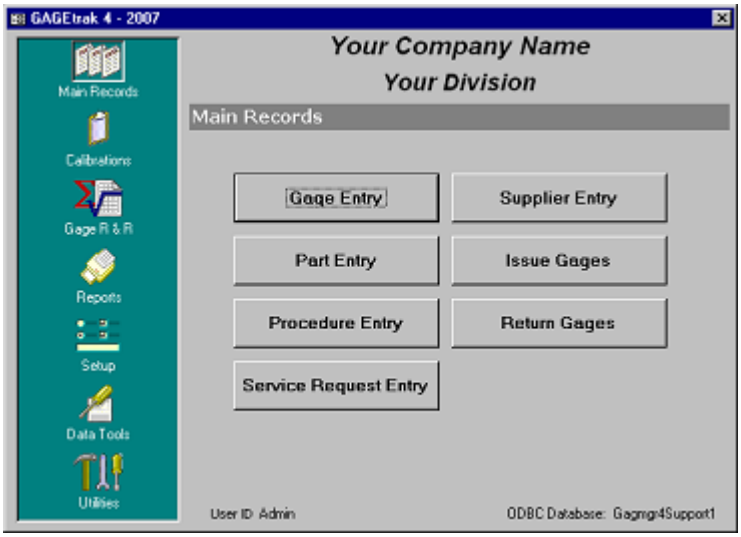
If you haven't entered your program serial number into the About box, the following message will appear to remind you to enter it.

Click the *OK* button, and the About window will appear. Enter the serial number for your copy of GAGEtrak (the serial number is located in your manual package, on your registration card, and on the packing list that came with your package). If you can't locate your serial number, please contact CyberMetrics Technical Support at **480-922-7300.**

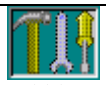


Main Menu

The main menu shows the name of the currently logged-in user in the lower left corner and shows the full path to the current data file in the lower right corner.



The main menu contains the following buttons:

Button	Description
 Main Records	Click this button to access the Main Records menu, where you can add, change, or delete records for your gages, parts, suppliers, and other elements of your calibration management system.
 Calibrations	Click this button to access the Calibrations Menu where you can add, change, or delete calibration records.
 Gage R & R	Click this button to access your GAGEtrak Gage R & R studies.
 Reports	Click this button to access the GAGEtrak Reports menu.
 Setup	Click this button to set up your GAGEtrak program; or enter user information.
 Data Tools	Click this button to back up your GAGEtrak data; import or export data (Access database); or archive or un-archive records.
 Utilities	Click this button to edit your GAGEtrak data tables directly; or run utilities.

Organization of GAGEtrak's Menus

Enter/View Records Menu

- Gage Entry
  - Information
  - History
  - Standards
  - Parts
  - Procedures
  - Schedule
- Supplier Entry
- Procedure Entry
- Service Request Entry
- Part Entry
- Gage Issue and Return

Calibrations Menu

- Calibration Entry
  - Calibration
  - Measurements
  - Procedures
  - Labels

Gage R&R Menu

- Gage R&R Entry (and Reports/Charts)
  - Average and Range
  - Linearity
  - Stability
  - Attribute
  - ANOVA

Reports Menu

- Gage Listing
  - With Calibration Standards
  - With Calibration Procedures
- Gage Detail Report
- Gage Status Report
- Calibration Due Listing
  - With Calibration Standards
  - With Details
  - Grouped by Calibrator
- Calibration Schedule
  - Summarized by Day, Week, Month, Quarter, or Year
  - Detailed by Day
- Calibration Work Order
  - With Calibration Procedures
- Certificate of Calibration
- Calibration Costs & Labor
- Calibration Labels
- Calibration History
  - With Calibration Measurements
- Standards Traceability Report
- R&R Due Listing
- Gage Issue History Listing
- Supplier Listing
- Procedure Listing
  - Summary by Gage ID
  - Summary by Calibration Procedure
- Corrective Action/Request Part Listing
  - Summary by Gage ID
  - Summary by Part No.
  - Gage Requirements by Part
- Customizable Gage Report
- Customizable Calibration Report

Setup Menu

- Settings
- Report Control ID Entry
- Setup Users
- Setup CA/Service Request
- Status ID Entry

Data Tools Menu

- Archive/Un-Archive
- Backup/Restore
- Compact/Repair Data
- Export/Import
- Modify License

Utilities Menu

- Edit All Tables
- Calculate All Due Dates
- Remove Spaces from Gage IDs
- Set Status of Gages
- Reset Gage Issue Status
- Reset Adjusted Frequencies
- Fill Calibration History

Chapter 2: Gage Records

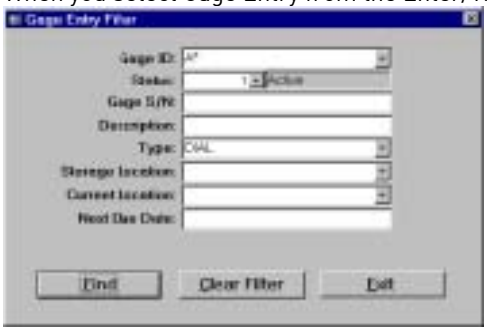
Before you begin entering information into your GAGEtrak program, we recommend that you look over the *Program Conventions* section of this manual (beginning on page 125). This will help you learn the most efficient ways to use your program's basic commands and functions.

Entering Gage Records

Gage Entry Filter

Use Gage Entry to enter gage information, issue/return gages, set up calibration standards, and link calibration procedures to gages.

When you select Gage Entry from the Enter/View Records menu, this filter window will appear:

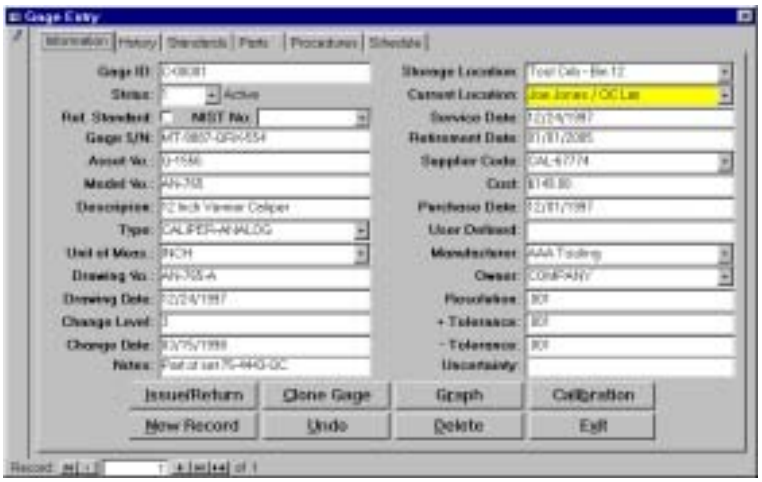


If you want to search for a particular gage and don't know its ID, then select the *list box* button (it has a downward pointing arrow) next to the *Gage ID* field. A list of all available gages, showing both gage ID and description, will appear. Similarly, for the other fields, you can select from the list box if one is available, or type in information that applies only to the particular gage(s) you want to find.

In any of the list box fields, after you type in one or two characters, the first option that begins with those characters will appear in the field. To save time, if this is the selection you want, you can instantly go to the next field instead of entering the rest of the characters.

In the sample screen, the user is searching for active dial gages with IDs that start with the letter A (the asterisk—*—is a wildcard character that is an effective search tool; see page 126 for more information).
If you don't enter any filter information, GAGEtrak will present *all* of your gage records. At first, you'll probably use this method more than the search options. To remove any existing filter values, click the *Clear Filter* button. Click the *Find* button to go to the main entry screen.

Gage Entry—Information



To enter a new gage record, click the *New Record* button (it looks like a blank sheet of paper) on the floating toolbar or click the *New Record* button at the bottom of the screen.

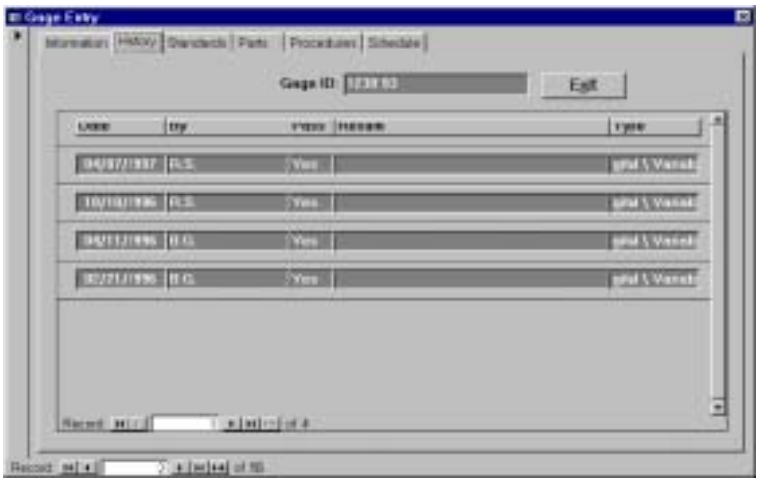
Use your mouse cursor (or TAB key) to move between the available fields in the gage record window. Press the F2 key to edit existing field information.

Gage Entry–Information records contain the following fields:

Field/Button Name	Description
Gage ID	In this field, enter a *unique* alphanumeric identification code for each gage. In order to save the gage record, you must enter an ID. For consistency and efficiency, you'll need to develop your own gage ID numbering system. Tip: Avoid using the characters #, *, or ? in your gage IDs or other fields, as these are considered wildcard characters in GAGEtrak. If you must use these characters, such as in "Gage #1", then you must place brackets around the wildcard character whenever you want to search or filter your records; for example, you would enter Gage [#]1.
Status	Use the list box to pick from your available choices (for example, 1–Active). This field is required. To add more choices to the *Status* field, go to the Tools and Utilities menu and select Status ID Entry (see the *System Administrator's Guide* for more information). Tip: If the *Status* field is *not* set to Active, the Calibration Due and Calibration Schedule reports will skip over the gage.
Ref. Standard	Check this box to indicate that the record is for a calibration reference standard (such as a gage block or reference weight), not a gage.
NIST No.	For reference standards only, enter the number that NIST provides for traceability purposes. If it's not marked on the reference standard, ask your supplier for the number.
Gage S/N	Enter the actual gage manufacturer's serial number (found on most gages).
Asset No.	In this field, enter the gage's asset number (usually issued by your accounting department).
Model No.	Use this field to store the model number of this gage.
Gage Description	Enter a brief, but informative, description of the gage.
Type	This field is a list box field from which you can choose or enter a classification of the type of gage (such as "Variable", "Attribute", "Dial", "Vernier", "Hard", "Digital", or "SPC").
Unit of Meas.	Enter the actual units that the gage measures in (such as "In", "mm", "N", "LBf", "LBm", "Ohms", or "mA"). This field is a list box in which more choices will be available as you add them for other gage records.
Drawing No. **and**	If applicable, enter the gage drawing number and date of the original drawing

Drawing Date	(usually for custom-designed gages, fixtures, or templates). Otherwise, use this field to store other information.
Change Level and *Change Date*	Enter the current change level ID of the current gage drawing and the date of the most recent drawing change level.
Notes	Use this field to store any comments about the gage.
Storage Location	Enter the gage's storage or usual location (for example, "Tool Crib–Bin 12").
Current Location	This field contains the gage's current location (such as "Assembly Dept.").
Service Date	Enter the date on which you first started using the gage.
Retirement Date	In this field, enter the expected or actual date on which you stop using the gage. Usually this date is at the end of the gage's useful service life (typically 5-10 years) or at the expected date of major overhaul or maintenance.
Supplier Code	This field contains the supplier code or name of the gage supplier. If you plan to use GAGEtrak's supplier records, enter the supplier ID code in this field— not the supplier *name*. The drop-down list box for this field contains information that you entered in Supplier Entry (for more information, see page 107).
Cost	Enter the actual purchase price or build cost of the gage.
Purchase Date	In this field, enter the date on which you purchased or first used the gage.
User Defined	This field stores any other data you need to track.
Manufacturer	Select or enter the manufacturer of the gage (this field creates its own list as you enter different manufacturers, so you can later just select from the list).
Owner	This field also creates its own list as you enter different gage owners.
Resolution	Use this field to store the resolution of the gage. This is the smallest (or least count) unit of motion that the gage is capable of measuring and displaying. For example, 0.001 is the resolution on a typical dial caliper.
+ Tolerance	Use this field to store the *upper* tolerance for the gage, as published by the manufacturer. GAGEtrak later uses this information to calculate the maximum value for calibration standards. To enter this value as a percentage of the nominal, enter the value followed by the percentage sign (for example, enter 1%). Tip: Check the placement of decimal points—for example, 1% equals one percent; .1% equals one-tenth of a percent.
- Tolerance	Enter the *lower* tolerance for this gage, as published by the manufacturer (use a positive value). GAGEtrak later uses this information to calculate the minimum value for calibration standards. To enter this value as a percentage of the nominal, enter the value followed by the percentage sign (for example, enter 1%). Tip: Check the placement of decimal points—for example, 1% equals one percent; .1% equals one-tenth of a percent.
Calibration	To go to Calibration Entry for this gage, click this button (see page 54).
New Record	When you need to create a new record, click this button.
Undo	If you want to remove a change you've just made, click *Undo*.
Delete	To delete this gage record, click this button.
Exit	When you're finished with this record, click *Exit* to return to the main menu.

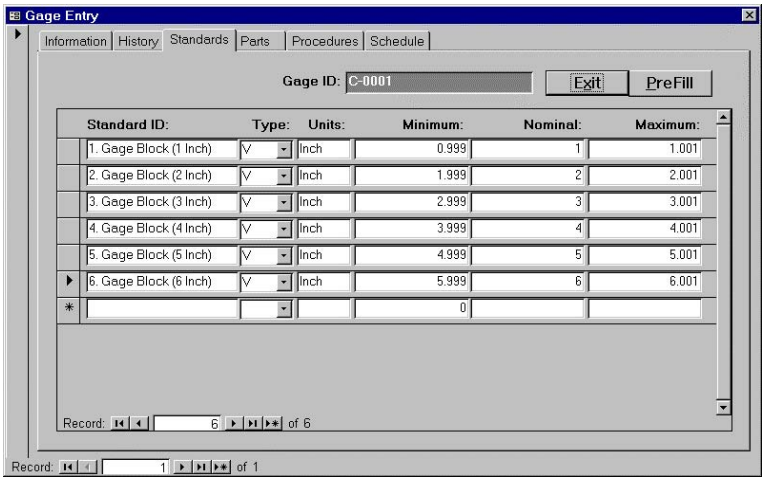
Gage Entry—History



The History tab displays all calibration history for the selected gage ID. These records are sorted by date in *descending* order—this means that the most recent calibrations are at the top of the list. GAGEtrak pulls this information from the data you record in Calibration Entry.

Field/Button Name	Description
Gage ID	The ID code for the current record appears in this field.
Date	This field shows the date for each calibration record.
By	In this field, you'll see the name of the user who performed the calibration.
Pass	This field tells you whether each calibration was successful.
Results	Any additional results recorded about the calibration will appear in this field.
Type	A description of the type of calibration performed will appear in this field.

Gage Entry—Standards



Calibration Standard Records

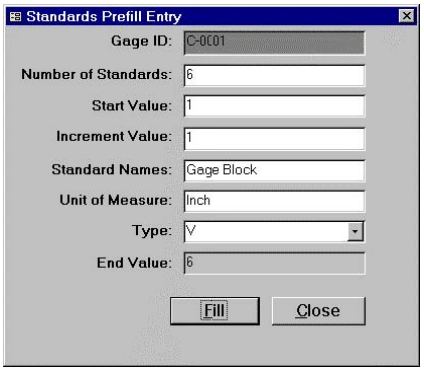
Use these records to define the list of standards or test parameters that you measure when you calibrate the gage. Later, when you enter a calibration record for the gage, GAGEtrak automatically copies this list to the calibration record. It sorts and displays your calibration standards in ascending order, based on the standard IDs. You can enter as many calibration standards as you need.

The Calibration Standards table contains these fields:

Field/Button Name	Description
Standard ID	Enter the name or ID of the calibration standard or checkpoint (for example, "Gage Block"). Each standard ID that you enter for the gage must be unique. If you need to use the same name for multiple standards, number or letter each name. For example, if you're using "CMM Check" in more than one standard ID, number the name for each standard. Your IDs would look like this: "01. CMM Check", "02. CMM Check", "03. CMM Check". This numbering also lets you control the list's sort order (the program automatically keeps the list in alphabetical order by the *Standard ID* value).
Type	Two types are available: Variable or Attribute. Select Variable for those standards that have a value that you actually measure (such as 0.502 inches). Select Attribute for pass/fail or visual types of checks.
Units	Indicate the units being measured, such as inches, mm, or degrees.
Minimum	When you enter the nominal measurement, GAGEtrak automatically calculates the minimum measurement, based on the gage's –tolerance. This value is the minimum acceptable value for the gage when you measure this standard (for example, 0.999).
Nominal	Enter the nominal value for the gage when you measure this standard (for example, 1.000).
Maximum	When you enter the nominal measurement, GAGEtrak automatically calculates the maximum measurement, based on the gage's +tolerance. This value is the maximum acceptable value for the gage when you measure this standard (such as 1.001).

Standards Prefill Entry

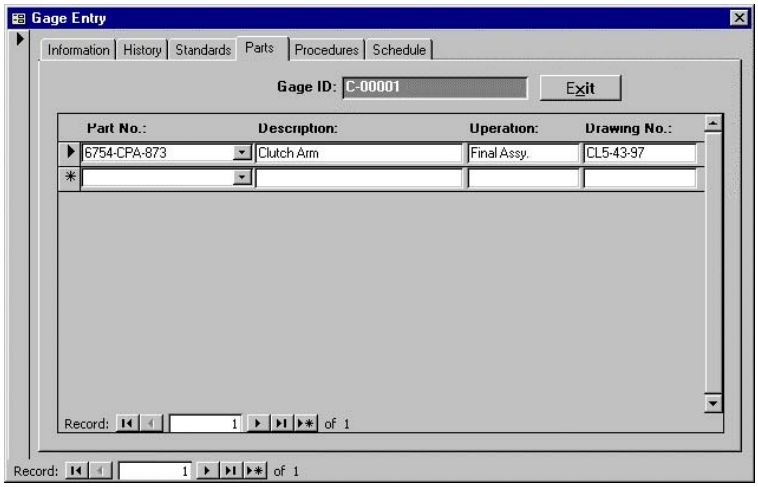
Use Standards Prefill Entry to save time when you have multiple calibration standards and their nominal values are evenly spaced (for example, if you have a group of standards with the values 1, 2, 3, 4, 5, and 6).



Field/Button Name	Description
Number of Standards	In this field, enter the amount of standards.
Start Value	Enter the smallest nominal value for the similar standards.
Increment Value	You can enter the difference between the sizes of the nominal values of the standards, such as .5 or .005, in this field.
Standard Names	Enter the part of the names that's the same for all of them. For example, let's say that you've entered 6 as your *Number of Standards*, and 1 as the Start *Value*. Also, you've chosen an *Increment Value* of 1, with Inches your *Unit of Measure*. If you enter Gage Block in this field, the resulting names for your standards will be "1. Gage Block (1 Inch)" and "2. Gage Block (2 Inch)". Tip: If your number of standards is between one and nine, your standard ID names will be numbered like this: "1.Name", "2.Name". If you have from ten to 99 standards, their names will look like this: "01.Name", "02.Name".
Unit of Measure	In this field, enter the unit of measure that the standards share.
Type	Select the type of standard: Variable or Attribute.
End Value	GAGEtrak calculates the end value for you, depending on the *Number of Standards*, the *Start Value*, and the *Increment Value*.
Fill	After you've entered the information, click the *Fill* button, and GAGEtrak will fill in the information. The *Minimum* and *Maximum* values will be calculated from the *– Tolerance* and *+ Tolerance* values.

Gage Entry—Parts

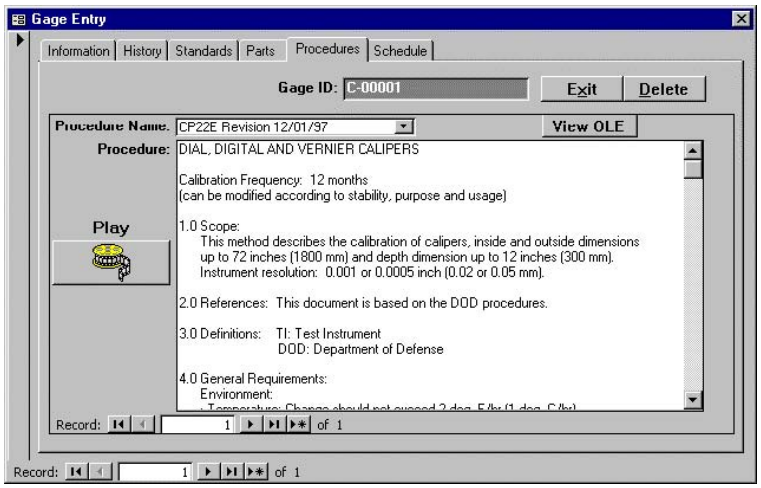
Use these records to define the parts and operations for which you'll use the gage. By linking this information to each gage, you're facilitating manufacturing traceability. Before you can link a part to a gage, you must enter the part's record in Part Entry (see page 115).



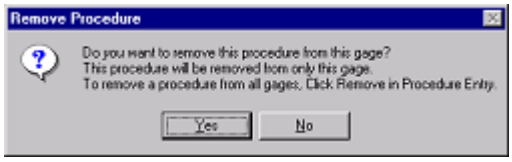
Field/Button Name	Description
Part No.	Select the part's ID number. After you select the part number, GAGEtrak will fill in the other fields with the information that you entered in Part Entry.
Description	The name of the part will appear in this field.
Operation	This field stores the production operation or work center description (such as "Stamping" or "Machine 13").
Drawing No.	The blueprint drawing number of the part appears in this field.

Gage Entry—Procedures

In the Gage Entry—Procedures screen, you can link calibration procedures to each gage.



Field/Button Name	Description
Gage ID	The ID of the selected gage will appear in this field.
Procedure Name	To link a calibration procedure to the current gage, select the procedure name from this list box.
Procedure	In this section, you'll see either the procedure text or any attached pictures.
Play	To view or listen to an attached media file, click the *Play* button.
View/Hide OLE	You can view the procedure text, or you can click the *OLE* (Object Linking and Embedding) button to view its associated picture. The *OLE* button's name will be either "*View*" or "*Hide*"; only one of these options is visible at a time. *View OLE* appears when you're viewing the text, and *Hide OLE* appears when you're viewing the picture.
Exit Delete	To exit Gage Entry, click this button. Click this button to remove the procedure from this gage. When you click this button, a dialog window will appear to tell you that, in Gage Entry, you can only remove the procedure from the current gage record. To remove the procedure, click *Yes*. If you want to delete or remove a procedure from all gages, you must do so in Procedure Entry (see page 109).

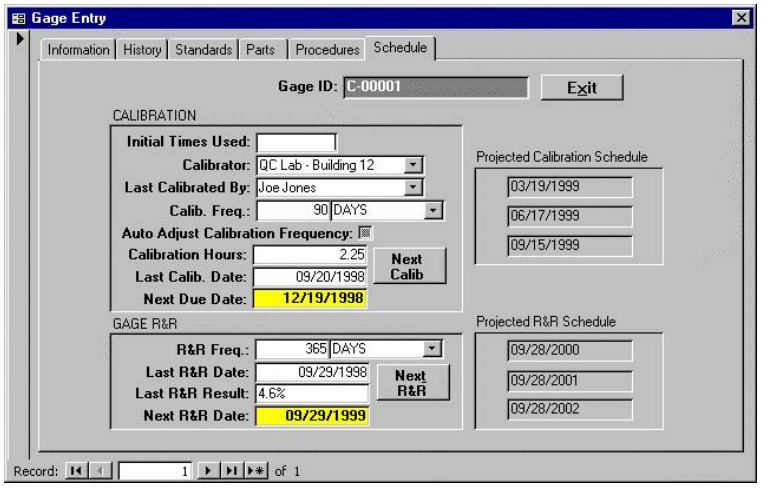


Adding Procedures

To link another calibration procedure to this gage, use the navigation buttons at the bottom of the Procedures window to add a new procedure record. Again, select the name of the procedure from the list box. You can choose only procedures that you've entered in Procedure Entry (see page 109).

Gage Entry—Schedule

In this screen, you'll set up the calibration and gage R&R schedules for each gage.



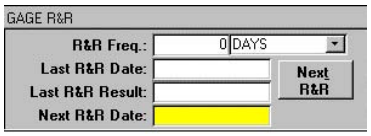
Gage Calibration Schedule

Field/Button Name	Description
Initial Times Used	GAGEtrak counts how many Issue Tracking records the gage has and adds it to this field. The total is displayed as *Cumulative Times Used* at the top of the Issue Tracking Entry screen.
Calibrator	This field is a list box field from which you can enter or select the code for the supplier that normally calibrates the gage (the calibration service supplier). You can also set this field to "In-House" or a department or technician's name, if calibrated within your own facility (simply type the information into this field). Later, you can use this information to select a group of gages due for calibration by that calibrator. Note: If you have the GAGEtrak PDA, you must enter a calibrator, since the PDA downloads calibrations by this field.
Last Calibrated By	The name of the user who last calibrated the gage appears in this field.
Calib. Freq. and ***Calib. Freq. Units***	Enter how often the gage should be calibrated (such as "45 DAYS"). When GAGEtrak calculates the next calibration due date, it uses this value. The field located just to the right of the *Calibration Frequency* field is the *Frequency Units* field (it's not labeled). Use the list box button to choose the calibration schedule type. You can choose from these types: **Days**—the most common units; schedule is based on elapsed calendar days **Weeks**—each week equals seven days; schedule is based on elapsed calendar weeks **Months**—this option bases the schedule on months **EOM**—always rounds the calculated *Next Due Date* to the end of the month in which it occurs. For example, "6 EOM" means every 6 months, but the program extends the *Next Due Date* to the end of the sixth month. If you're using skip dates (see the *System Administrator's Guide*), GAGEtrak schedules the *Next Due Date* on the last working day of the month. **Years**—each year equals 365 days; schedule is based on elapsed calendar years **Usage**—when using this type of schedule, the program won't create a next due date for calibration until you issue (use) the gage, even if you enter a calibration record for the gage. When you issue the gage, GAGEtrak calculates a predicted next due date based on the remaining number of usage days. You must use the Issue Tracking records for this to work. **Cycles**—similar in principle to the usage days method, but schedules

	calibration only when the total number of *cycles* equals or exceeds the *Frequency* value ("cycles" means either the number of *parts measured* or number of *cycles operated*). You must use Issue Tracking records in order for this schedule type to work. **Each Use**—use this option if you must calibrate the gage *before* or *after* each use. GAGEtrak *will not* automatically calculate calibration due dates for this frequency; you must manually enter your due dates. **Bef. Use**—select this option when you must calibrate the gage *before* every use. GAGEtrak *will not* automatically calculate calibration due dates for this frequency; you must manually enter your due dates. **Aft. Use**—select this option when you must calibrate the gage *after* each use. GAGEtrak *will not* automatically calculate calibration due dates for this frequency—you must manually enter the due dates.
Auto Adjust Calibration Frequency	If you want GAGEtrak to change this gage's calibration frequency according to its as found condition before calibration, select this option. If you check this box, GAGEtrak will automatically adjust calibration frequencies whenever you enter a new calibration record, according to the rules you defined in the *Frequency Adjustment Factors* table. Please see the *System Administrator's Guide* for more information. Tip: Do not check this box unless you fully understand this feature and decide that you want GAGEtrak to automatically adjust your calibration frequencies.
Calibration Hours	Enter the actual (or estimated) time it takes to calibrate the gage.
Last Calib. Date	When you first enter the gage record, enter the gage's last calibration date. Later, the program will automatically update this field whenever you add a new calibration record for the gage.
Next Due Date	This field shows the next calibration due date. It's automatically updated whenever you add a new calibration record for the gage (*Next Due Date* = *Calibration Date* + *Freq*). You can also manually enter any date into this field. If the current date is past the next due date, you'll see the message "Past Due" on the right of this date. Tip: To calculate this date immediately, click the *Next Calib.* button (only if you've entered a calibration frequency and last calibration date). Using this button, you can calculate the next due date even if you don't enter a calibration record for the gage.
Next Calib.* and *Future Calibration Dates	To the right of the calibration schedule, you'll see the next three anticipated calibration dates, which GAGEtrak calculates when you click *Next Calib.* When you add a new calibration record for the gage, GAGEtrak automatically updates these dates, based on the current frequency. Note: If you're using the Auto Adjustment of Calibration Frequency feature, be aware that these dates do not take into account future adjustments of the calibration frequency (since GAGEtrak can't predict if future calibrations will pass or fail).

Gage R&R Schedule

The *Gage R&R* ("R&R" stands for "Repeatability and Reproducibility") section is located at the bottom of the Schedule screen.



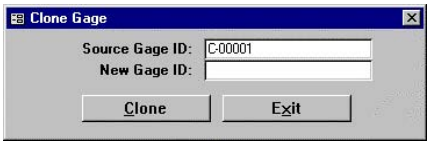
The table below describes the fields in this area:

Field/Button Name	Description
R&R Freq. and *R&R Freq. Units*	Enter the frequency of gage R&R studies (such as "6 MONTHS"). When the software calculates the next gage R&R study date, it uses this value. Use the field located on the right of the *R&R Frequency* field to select the *Frequency Units* (schedule type). Choose from these options: **Days**—the most common units; schedule is based on elapsed calendar days **Weeks**—each week equals seven days; schedule is based on elapsed calendar weeks **Months**—the schedule is based on months **Years**—each year equals 365 days; the schedule is based on elapsed calendar years When you first enter the gage record, enter the gage's last R&R study date. As you add new R&R records for the gage, as long as you use an *R&R Frequency* value other than zero, GAGEtrak automatically updates this field.
Last R&R Date	
Last R&R Result	This field shows the last gage R&R study results (usually this is the gage error GRR expressed as either a percentage of TV or a percentage of tolerance). Later, it will be automatically updated as you add new R&R records for the gage, as long as you enter an *R&R Frequency* value other than zero.
Next R&R Date	This field tracks the next gage R&R due date. GAGEtrak automatically updates it whenever you add a new R&R record for the gage or you can manually enter a date into this field. If the today's date is past the next due date, you'll see a "Past Due" message. Tip: To calculate this date immediately, click the *Next R&R* button (only if you've entered an R&R frequency and a last R&R date).
Future R&R Dates	To the right of the *Gage R&R* fields, you can see the next three future R&R dates. GAGEtrak calculates these dates when you click the *Next R&R* button, then updates them when you add a new R&R record for the gage.
Next R&R	Click this button to calculate the *Next R&R Date* and three future R&R dates. You can use this button to calculate the *Next R&R Date* even if you don't enter an R&R study record for the gage.

Using Gage Records

Cloning Gage Records

If you want to copy a particular gage record, *including* its set of calibration standards, procedures, and parts, click the *Clone Gage* button (located at the bottom of the Gage Entry window). This window will appear:



Enter the gage ID of the new record into the *New Gage ID* field, then click the *Clone* button. If you want to clone more gages, keep entering new gage IDs and clicking the *Clone* button. Click the *Exit* button when you're finished. If you filtered for just one gage, when you're done cloning, GAGEtrak will show you the original gage record from which you created the clones. If you want to edit your cloned records, you'll have to re-filter and find them (to re-filter, click the toolbar button that looks like a funnel with a pencil).

A better way to clone gages is to re-filter and find **all** of your gages *before* you clone any of them (again, to re-filter, click the toolbar button that looks like a funnel with a pencil). You can then use the *Find* (binoculars) button on the toolbar to find the gage(s) that you want to clone. If you use this method, when you're done cloning, GAGEtrak will show you the last cloned record that you created, and you can enter each clone's unique information.

Issue/Return Tracking Records

When you need to check a gage out to a different location or department, you can record the issue in GAGEtrak. This feature is particularly useful in a gage crib situation, where gages and inspection equipment are loaned out and then returned for storage and safe-keeping. By tracking this information, you'll know which gages your company uses most often and which employees or departments use them. To check out or return a gage, click the *Issue/Return* button at the bottom of the Gage Entry—Information screen. The Issue Tracking Entry screen will appear.

> Tip: You can also issue and return gages by selecting Gage Issue and Return from the Enter/View Records menu. However, Gage Issue and Return is designed for consecutive gage issues or returns (for large batches of gages) and to facilitate bar-coded data entry. Issue Tracking is designed for issuing or returning a single gage. Please see page 117 for information on Gage Issue and Return.

You must use Issue Tracking records for any gage whose calibration schedule is based on usage or cycles instead of elapsed calendar days. These records track usage days and operating cycles; they also update the next due dates of gages with usage frequencies.

If you consistently use the *Part No.* field, you'll create manufacturing traceability. For example, if you find that a gage is out of tolerance, you can immediately generate a part recall report that lists all parts that you might have measured incorrectly.

The table below explains the fields and buttons in the Issue Tracking Entry screen.

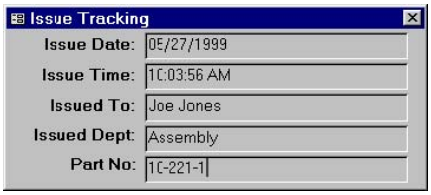
Field/Button Name	Description
Issue Date and *Issue Time*	These fields track the date and time at which you issue the gage—they're prefilled with the current date and time.
Issued To	Enter the person to whom you issue the gage or use this field to track the customer number.
Type	Select the reason for issue; this field creates its own list from your entries.
Issued Dept	Enter the department (or job number) that will use the gage.
Part No.	Use this field to track the part or group of parts that the gage will measure.
PO No.	You can enter a PO number if you're sending the gage out to a supplier for repair or calibration or are manufacturing parts for a customer.
Promised Date	Enter the date on which you expect the gage to be returned to you.
Received Date and *Received Time*	These fields track the date and time at which the gage was returned. Click the small button next to *Received Date* to insert the current date and time.
Received From	In this field, enter the name of the person who returned the gage.
Cycles	Enter the number of cycles performed by the gage (usually 1). GAGEtrak adds this number to any previous cycles for the gage. It uses that number to calculate the *Next Due Date* for gages that calibrated according to cycles.
Notes	Use this field for important comments, such as damages or malfunctions.
New	To create a new issue record for this gage, click the *New* button.
Undo	If you need to undo an entry you've made, click this button.
Exit	Click *Exit* to return to the Gage Entry—Information screen.

GAGEtrak uses the following rules to manage Issue Tracking records:

1. When you issue a gage, GAGEtrak inserts the current date and time as the issue date and time. It also changes the gage's *Current Location* field to a description that consists of *Issued To* plus *Issued Dept.* (for example, "Joe Jones/Assembly").
2. GAGEtrak assumes you want to return a gage if its current record is incomplete. After you enter the *Received Date* and *Time* and save the record, GAGEtrak changes the gage's *Current Location* field to its storage location.

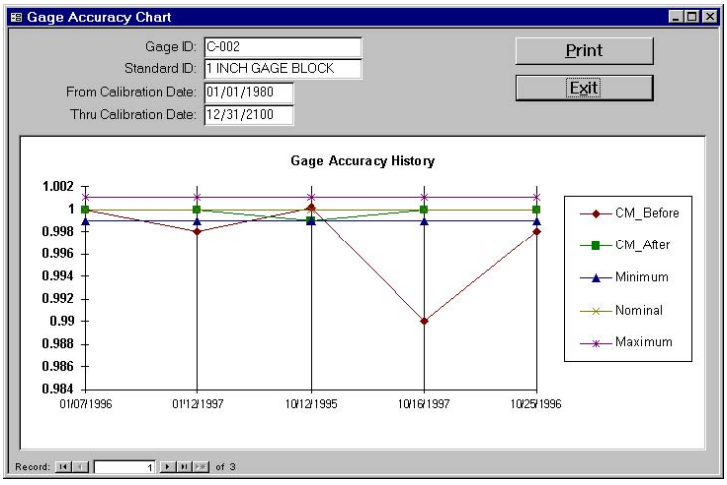
Pop-Up Issue Information

In the Gage Entry—Information tab, the *Current Location* field turns yellow to show that the gage is currently issued out. Double-click on this field to open a pop-up window that shows you the date, time, person, department, and part information from Issue Tracking. Double-click anywhere in the pop-up window to close it.



Gage Entry—Graph Button

To generate an accuracy chart for the current gage record, click the *Graph* button in the Gage Entry—Information screen. By default, the program charts the entire calibration history for the first calibration standard. You can specify a time frame by entering beginning and ending dates in the *From Calibration Date* and *Thru Calibration Date* fields.



To view different standards, use the navigation arrow buttons (or press the PAGE DOWN/PAGE UP keys). Remember, you can generate this chart only after you've entered some calibration and measurement records (see the next chapter for more information on calibration records). As you can see in the sample screen, the chart plots before and after values, as well as the nominal, minimum, and maximum allowable limits. Click the *Print* button to print the graph or go to the File menu and select Print (the latter method lets you print multiple charts per page).

Modifying Accuracy Graphs

To edit accuracy graph properties (such as scaling or fonts), double-click on the chart. You can modify charts only if you have a compatible version of a Microsoft Windows program, such as Word or Excel, that includes a complete version of MS Graph. Due to the licensing arrangement with Microsoft, GAGEtrak comes with only a non-modifiable, run-time version of MS Graph.

If you do own a complete version of MS Graph, and you want to save your modified chart settings, follow these

steps:

1. Make your chart changes in MS Graph and return to GAGEtrak. Your screen should reflect the changes that you made.
2. Select File | Print Preview.
3. Select File | Print Setup..., then adjust one of the margin values. You can type the same value, but you must type something so that the program can detect a change.
4. Close the Gage Accuracy Chart screen (the program will ask if you want to save your changes).

You can print modified charts by first viewing the chart, then selecting File | Print from the top menu bar.

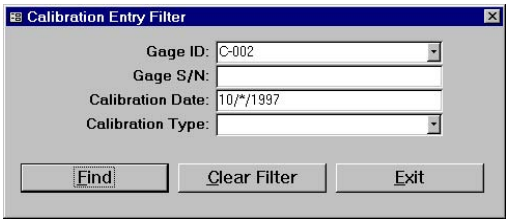
Gage Entry—Calibration Button

This button will take you directly to the Calibration Entry screen for the current gage ID. When you go to Calibration Entry from Gage Entry, you can see only the calibration records for the gage that you selected in Gage Entry. In this window, you can enter everything that you would normally enter in Calibration Entry, but you can't delete whole records. To return to Gage Entry from Calibration Entry, click *Return* or *Exit*. Please read the following section of this manual for complete instructions for Calibration Entry. When you go to Calibration Entry from the main menu, you can choose from calibration records for all of your gages.

Chapter 3: Calibration Records

Calibration Entry

Calibration Entry Filter To enter calibration records, select Calibration Entry from the Enter/View Records menu. This filter window will appear:



As with the Gage Entry filter, you can search for a particular gage by selecting its ID from the *Gage ID* drop-down list. In the sample screen, you can see that the user is looking for calibration records for gage C-002 from October of 1997.

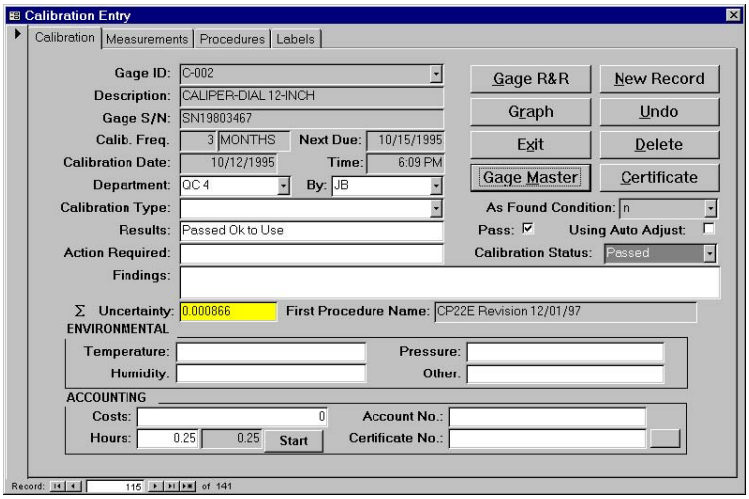
To see all of your calibration records, leave the filter fields blank.

If you try to calibrate a gage that you haven't already set up in Gage Entry, you'll get the following warning message:

Click *OK*, then enter the gage in Gage Entry. Once you're finished, you can enter calibration records for the gage.

Calibration Entry—Calibration

After you click the *Find* button in the filter, the Calibration Entry screen will appear. When you first open this screen, GAGEtrak displays the most recent calibration record. If you filtered for a group of gages, the most recent record for the first gage in the group will appear. To enter a new calibration record, click the *New Record* button.



Each calibration record contains the following fields:

Field/Button Name	Description
Gage ID	Use the drop-down list box to select from a list of available gage IDs. Tip: Once you've selected a gage to calibrate, do not change this field. After you save the calibration record, you can't edit this field. If you want to enter another calibration record for this gage or for another gage, click the *New Record* button first.
Description	GAGEtrak looks up the gage's description from its Gage Entry record and displays it here (you can't edit it in this screen).
Gage S/N	This field displays the gage's serial number; you can't change it here.
Freq.	After you mark the gage as having passed calibration, GAGEtrak displays the calibration frequency that you entered in Gage Entry. If you need to edit this value, do so in Gage Entry. Calibration frequencies are stored with the calibration record. This allows you to maintain a complete history of calibration frequencies and how they might change over time. Note: If you checked the *Auto Adjust Cal Frequency* box for this gage, whenever you enter a new calibration record, GAGEtrak will automatically adjust the *Calibration Frequency*, according to the rules you defined in the *Frequency Adjustment Factors* table. Please see the *System Administrator's Guide* for details.
Next Due Date	This field stores the next due date for calibration, based on the calibration frequency. You must check the *Pass* box in order for GAGEtrak to show the next due date.
Date	Use this field to store the date of the calibration—it's automatically set to the current date, but you can change it until you save the calibration record.
Time	Like the *Date* field, this field automatically displays the current time. If you change the time, enter it in this format: HH:MM. This field is required.
Department	In this field, select or enter the name of the department that used the gage before calibration.
By	Select or enter the name of the person who calibrated the gage. This field automatically displays the name of the current user, but you can change it.
Results	Enter any results or comments (typically used for attribute-type gaging or dimensional layouts). Enter calibration measurements into the *Measurements* table (see below).
As Found Condition	Choose the condition of the gage before calibration or adjustment. Select In for in-tolerance, Out for out-of-tolerance, or New for a new instrument that has not been calibrated before. Prior to calibration, *all* test points of the instrument must be within tolerance to have the *As Found Condition* field set to In. You need this information only if you've chosen Auto Adjust

	Calibration Frequency for this gage (see the *System Administrator's Guide* for details).
Action Required Pass	Enter any action that may be required, such as "send out for repair".
Findings	You must check this box in order for the program to automatically calculate the next calibration due date (*Calibration Frequency* + *Calibration Date*). Use this memo field to describe any other pertinent information, such as visual inspection notes. You can scroll through this field if you need more room for text. Note: Your certificates of calibration will include this field.
Σ *Uncertainty*	This field will display the total calculated uncertainty value using the root sum of squares method. You can't edit it. $\text{Uncertainty} = \sqrt{(\text{Uncertainty } 1^2 + \text{Uncertainty } 2^2 + \text{Uncertainty } N^2)}$ *where "Uncertainty N" is the last reference standard's Uncertainty value* Calibration Status Select the final calibration status: Passed, Failed, Repaired, or Limited.
Environmental Conditions	Enter the relevant environmental conditions for the calibration: *Humidity*, *Temperature*, *Pressure*, or any other factor that may affect results.
Type	In this field, enter the type of work being performed, such as "calibration", "repair", or "rebuild".
Cost	To track your costs, enter any expenses related to this calibration (such as internal labor/material costs or outside calibration service costs).
Acct. No.	Enter an account number or other tracking number associated with the cost (examples include a job, purchase order, invoice, or customer number).
Hours	There are two fields for hours. The gray *Hours* field will display the estimated hours that you entered for this gage in Gage Entry. The white *Hours* field applies to this particular calibration. Enter the actual amount of time the calibration required, or click the *Start* button to use the built-in calibration timer (see below).
Certificate No.	Record the certificate number issued by the outside calibration provider or your company. You can use this field in one of two ways. If you want to use a format made up of numbers, use the automatic numbering feature. To do so, first enter a numeric certificate value. On your next calibration record, click the small button next to *Certificate No.*, and GAGEtrak will automatically insert the next number in the sequence you started. The first number you enter in this field "sets" the counter; any other number you enter "resets" it. Each subsequent automatic number will be incremented by one. For example, if you enter 156 in this field, then go to the next record and click the numbering button, the next certificate number will be 157. Then, if you go to a third calibration record and enter the number 256, it will reset the number format. This means that if you go to a fourth record and click the automatic numbering button, the certificate number will be 257 (not 158). If you want to use a number format that contains *both numbers and letters*, you can't use the automatic numbering feature; instead, you must enter a new certificate number for each calibration record.
Gage R&R	To enter a gage R&R study for the current gage, click the *Gage R&R* button (gage R&R studies are explained in the following chapter).
Graph	To view an accuracy chart, click the *Graph* button. Please see page 53 for more information.
Gage Master	Use this button to switch to the Gage Entry record for the current gage.
Undo	This button allows you to remove any changes you've made to the record.
Delete	If you need to delete this calibration record, click this button. It won't delete any other calibration records for the gage.
Certificate	This button is visible only if you've checked the *Pass* box for the current record. Use this button to print a calibration certificate for the current record. See page 123 for more information on this report.
Exit	Click this button to return to the main menu.

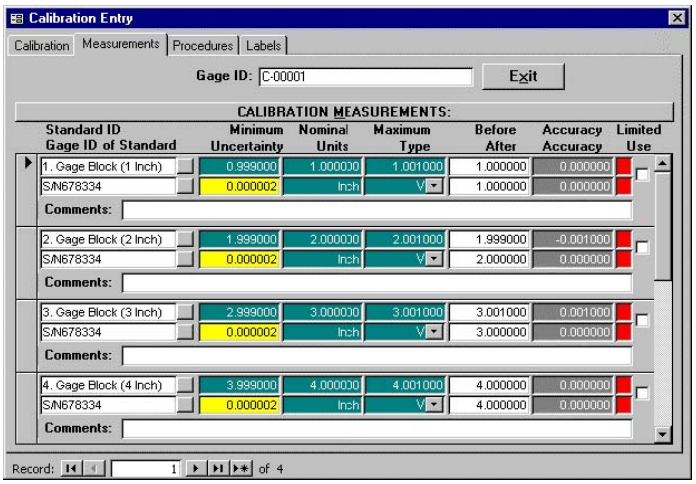
Calibration Timer Button

Use the *Start* button next to the *Hours* field to time your calibration—it works like a stopwatch. When you're ready to calibrate, just click the *Start* button. Its name will change to "*Stop*". When you're finished, click *Stop*, and GAGEtrak will automatically calculate the hours for you. The timer is *cumulative*. This allows you to temporarily stop the timer and do something else. Just click the *Stop* button to stop the timer, then, when you're ready to resume, click the *Start* button again. The time is expressed in decimal hours (the smallest unit of time is 0.01 hours, which equals 36 seconds):

Example 1: 0.25 hours = 0.25 x 60 minutes = 15 minutes

Example 2: 0.01 hours = 0.01 x 60 minutes = 0.6 minutes

Calibration Entry—Measurements



You can use this screen to compare the actual before and after measurements of the gage with the standards that you use to calibrate the gage.

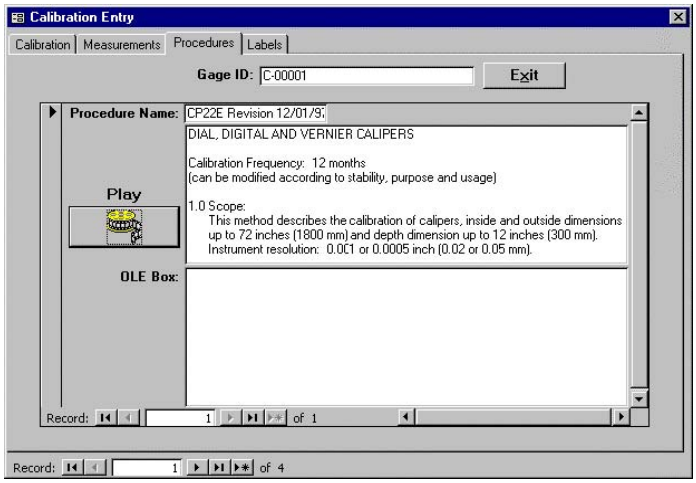
You will use these fields in the Measurements screen:

Field/Button Name	Description
Standard ID	GAGEtrak copies the *Standard IDs* from the Calibration Standards table that you defined in Gage Entry (see page 43).
Minimum, Nominal, and Maximum	GAGEtrak copies the gage's *Minimum*, *Nominal*, and *Maximum* values from and *Maximum* Gage Entry.
Units	The type of calibration standard will be either *Variable* or *Attribute*. GAGEtrak copies it from Gage Entry, if entered, or you can select it here.
Type	The type of calibration standard will be either *Variable* or *Attribute*. GAGEtrak copies it from Gage Entry, if entered, or you can select it here.
Before	Enter the actual measurement observed before you adjust the gage.
After	Next, enter the actual measurement observed after you adjust the gage.
Acc. Bfr.	This field shows the accuracy value based on the before measurement (*Before* minus *Nominal*).
Acc. Aft.	In this field, you'll see the accuracy value based on the after measurement (*After* minus *Nominal*).
Limited Use	Based on the gage's accuracy compared to its calibration standard, use this box to restrict the gage to limited use, meaning that it shouldn't be used for measurement of this particular range.
Gage ID of Standard	This field stores the gage ID of the reference standard, which is important for traceability back to a specific standard. You can manually enter the standard's gage ID or select from a list of available standards (shown below) by clicking the

	small button on the right of this field. The list shows only those gage records that have "X's" in their Gage Entry *Ref. Standard* checkboxes.
Uncertainty	If you select the reference standard from the list, the uncertainty value will automatically display. If you manually enter the standard, then enter its uncertainty value here. You can obtain this value from the manufacturer; it's expressed in units, such as percentage (0.5%), proportion (0.005), or measurement (0.0001 inch). You must enter units of the same value—otherwise, the calculated ∑*Uncertainty* will be wrong.

Calibration Entry—Procedures

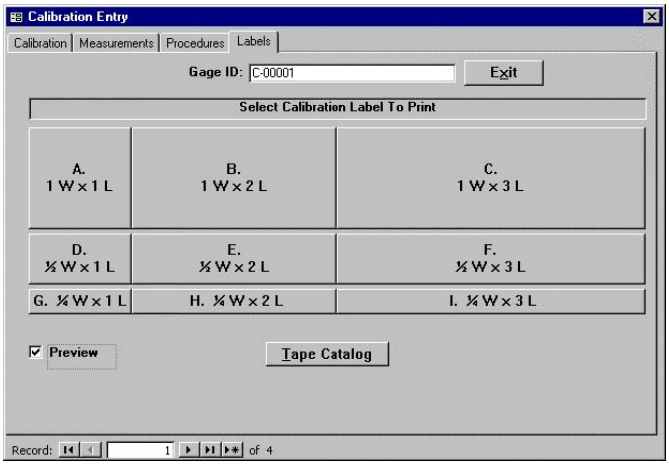
In this screen, you can see any calibration procedures that are attached to the gage.



The first procedure appears automatically; to view additional procedures for this gage, click the record navigation button at the bottom left corner of the inner window. If a media file is attached to the procedure, click *Play* to watch or listen to it.

Tip: You can't edit procedures here—you can only view them. To edit procedures, go to Procedure Entry.

Calibration Entry—Labels



In the Labels tab, you can print a calibration label for the current record. You can use this feature only if you've installed the optional GAGEtrak Calibration Label Kit printer and software (shown below).

The Calibration Label Kit prints durable, laminated, cut-to-length calibration labels. It includes a printer that attaches to your PC's serial port so it won't interfere with your default printer. It also includes label design software, fonts, clipart, and barcodes—features that let you use it for many other quality control and production labeling applications. For more information about the kit, please contact CyberMetrics Corporation or your distributor. If you purchased the Calibration Label Kit, see the appropriate section of this manual for installation and setup instructions.

Chapter 4: Gage R&R Entry

Overview

With Gage R&R Entry, you can assess your measurement systems using the statistical test procedures of *repeatability*, *reproducibility*, *bias*, *stability*, and *linearity* (collectively referred to as "gage R&R" studies). This feature saves time and prevents the mistakes that you can make when you manually assess your measurement systems. You'll soon find that it's an essential tool for analyzing and managing your gage R&R studies.

This feature was designed for calibration technicians, metrologists, inspectors, and other quality control professionals who need a convenient, easy-to-use method for documenting, tracking, and performing measurement systems analysis. The software is based primarily on the techniques described in the AIAG MSA guide and other industry publications (see the reference list in this manual).

Before starting SPC, capability studies, or any type of repetitive measuring, use Gage R&R Entry to make sure that your measurement system can give you reliable measurements. Instructions for performing studies on your measurement system are given throughout this chapter.

About the Manual, Software, and Technical Support

The purpose of this guide is to help you learn how to *operate the software*. It's not meant to be an authoritative guide on conducting, analyzing, and interpreting your gage R&R studies. Although this manual describes gage R&R study procedures, they are simply the views as documented by various industry publications.

The software is simply a tool used to store data, calculate results, and generate printed reports and charts in compliance with the Measurement Systems Analysis 2nd Edition pulished by the AIAG. It does not determine whether a measurement system is *good* or *bad*. As the user, this determination is your sole responsibility.

> Important: The technical support available for this software is limited strictly to the *operation of the software*. We cannot provide advice or support on interpreting results or charts. If you have interpretation questions, please consult your customer, a statistician, or other qualified professional.

Validating the Software

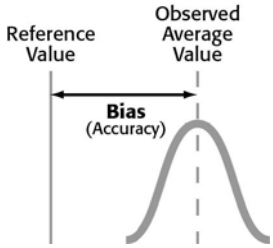
This software has been tested, validated, and deemed suitable for release. Calculation validations were conducted using test data with known results. However, you should still conduct your own validation tests using data with known results – those that you calculate by hand or proven published values. When comparing the software results to your manually calculated results, remember that you may find differences due to *rounding errors*. The software uses up to 15 significant digits of precision in all intermediate calculations, rounding only the final results.

Terms and Definitions

Before using Gage R&R Entry, you may want to familiarize yourself with these terms.

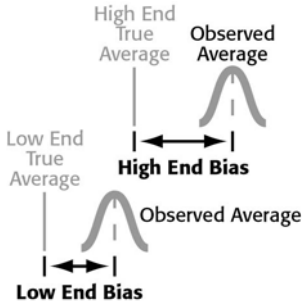
Bias (Accuracy)

The difference between the observed average of measurements and the reference value is known as *bias* (often called "accuracy"). The reference value (accepted reference value or master value) functions as an agreed-upon reference for the measured values. You can determine a reference value by using a higher level of measuring equipment (such as metrology lab or layout equipment) to average several measurements.



Linearity

Linearity is the difference in the bias (accuracy) values through the gage's estimated operating range.



Precision

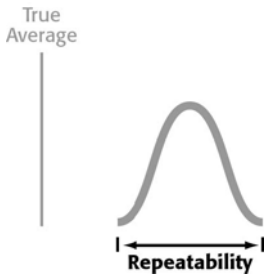
Below, we'll use a bull's eye target to describe three examples of *precision*.

Accurate but not precise. Notice that the average of all the readings would be in the center of the target (no bias). A measuring instrument like this would have a significant amount of error.

Precise but not accurate. You can see that the readings are all close to each other, but are biased in the upper right region of the target. Statistically, this amounts to a histogram with a small spread with the average of the measurements differing from the true value. **Precise and accurate.** In this, the best condition, the readings are all close to each other and centered.

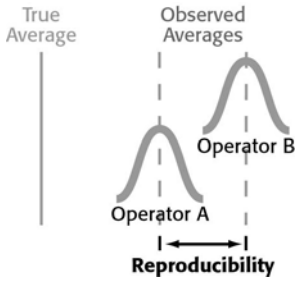
Repeatability (Equipment Variation)

Gage *repeatability* is the measurement variation that occurs when one appraiser uses the same gage to measure identical characteristics of the same parts.



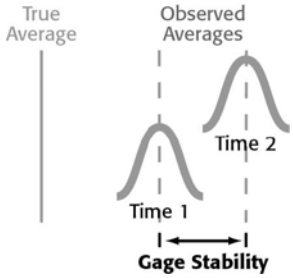
Reproducibility (Appraiser Variation)

When different appraisers use the same gage to measure identical characteristics on the same parts, the variation in the average of these measurements is known as gage *reproducibility*.



Stability

When using a measurement system to evaluate the same characteristic on a master or part over an extended period of time, the total variation in the measurements is known as *stability* (or drift).



Variation Components

Equipment Variation (EV): The equipment variation is the component of the total GR&R study error that the measurement device causes. A worn-out gage or a non-rigid fixture on the gage might contribute to a large EV.

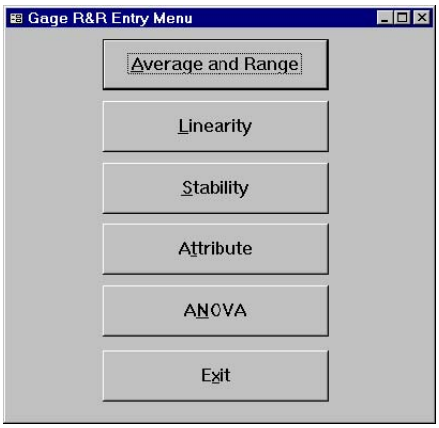
Appraiser Variation (AV): The appraiser variation is the part of the total GR&R study error that is caused by the appraiser's measurement method. If the appraiser uses a poor measurement technique or doesn't know how to read the measurement instrument, it can cause a large AV.

Part Variation (PV): The part variation is the part of the total GR&R study error that is due to the parts being measured.

Total Variation (TV): The total variation is the sum of the equipment variation, appraiser variation, and the part variation. In general, the TV should be less than 10% of the total tolerance. If the TV is between 20% to 30%, try to decrease it by using cost-effective methods, such as training, to decrease the error. Beyond 30% TV, you should work to correct the measurement error. A TV larger than 30% causes problems because it might cause you to judge good parts unacceptable and mistakenly accept bad parts.

Gage R&R Entry Menu

Select Gage R&R Entry from the Enter/View Records menu to access the Gage R&R Entry menu:



Click the menu button that corresponds to the study you want; click *Exit* to return to the main menu. We'll discuss each type of study next.

> Tip: You can also run GAGEstat by clicking the *Gage R&R* button in the Calibration Entry screen. Running GAGEstat this way restricts you to entering gage R&R studies for only the gage shown in the Calibration Entry screen.

Range Method (Short Method)

The Range method (also called the "Short" method) offers a *quick estimate* of measurement variability. This method provides an overall picture of the measurement system, but it doesn't break down the variability into repeatability and reproducibility.

The Range method typically uses two appraisers and five parts (although you can use more parts). Both appraisers measure each part just once. The range for each part is the absolute difference between the measurement obtained by Appraiser A and the measurement obtained by Appraiser B. Next, find the sum of the ranges, then calculate the average range ($\bar{R}$). To find the total measurement variability, multiply the average range by $5.15/ d_2$. You should also calculate what percentage of the process variation (or tolerance) the measurement variation consumes. To convert the R&R to a percentage, multiply by 100 and divide by the process variation (or tolerance).

> Note: The formula for d_2 is based on the number of appraisers and parts used in the study.

Range Method (Short Method) Interpretation

To interpret a Range Method study, look at the percentage of the part tolerance that measurement system error consumes or at the percentage of total variation due to measurement system error.

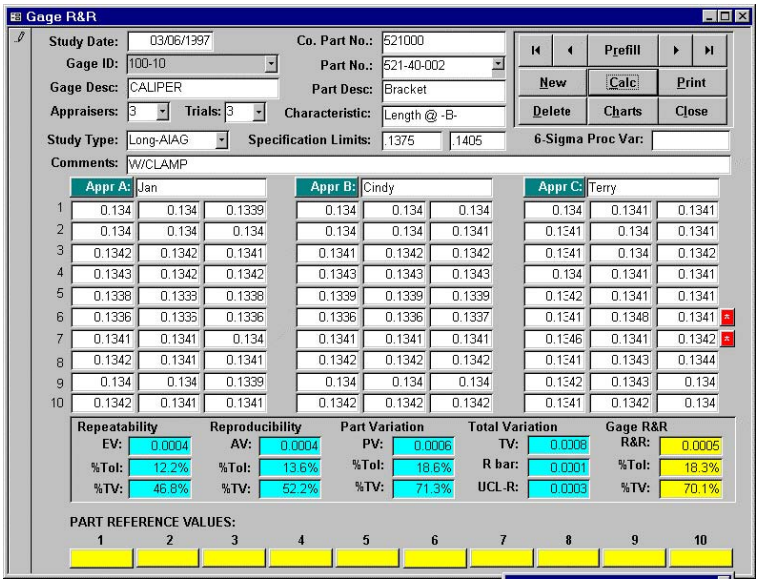
No strict rules exist for determining if a percentage amount is acceptable or unacceptable; each industry will have its own criteria. Manufacturing industries generally follow the guidelines below.

> If the R&R as a percentage of the tolerance is:

- under 10%–the system is acceptable
- between 10% and 30%–you might need to further analyze the system to find the cause of the error; use the Average and Range method (the Long method) to learn more about the problem
- over 30%–you should perform further analysis on the system to find the cause of the error; you might learn more about the problem by using the Long method

Average and Range Method

The Average and Range method helps you pinpoint the reasons for measurement system error. In contrast to the Range method, with this method, you can break down the measurement system into repeatability and reproducibility.



Average and Range Study Screen

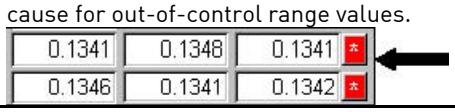
The table below explains each of the fields in the Average and Range study screen:

Field/Button Name	Description
Study Date	This field shows the date of the study (defaults to the current date).
Gage ID	Using the drop-down list box, select the ID of the gage.
Gage Desc.	This field shows the name of the gage or measurement device.
Appraisers	In this field, enter the number of appraisers used in the study.
Trials	Enter the number of measurement tests that each appraiser performed (either two or three).
Study Type	Select the type of study (Long or Short) and the method used to calculate results (such as AIAG, GM, Ford, or Chrysler).
Comments	Enter any comments you wish to note.
Co. Part No.	You can enter your internal company part or job number in this field.
Part No.	Select a related part number, such as the customer or supplier part number.
Part Desc.	The description or name of the part appears in this field.
Characteristic	Enter the characteristic that you're evaluating in the study.
Specification Limits	Be sure to enter the minimum and maximum *Specification Limit* values; otherwise, the software can't calculate the %tolerance values for your study.
6-Sigma Proc. Var.	If you know the 6-Sigma Process Variation of the characteristic that you're measuring, enter it here. This causes the program to use this value instead of

	estimating part variation from your sample of study parts. If you know the standard deviation of the characteristic (from SPC or Capability studies), multiply it by six and enter the result here.
Appr. A, Appr. B, and *Appr. C*	Enter the names of Appraisers A, B, and C.
Part Reference	If known, enter the reference values for parts 1 through 10 (used for *Values* generating Error and X-Y Plot charts). If you don't enter any values, then *(1–10)* GAGEstat will use the *part averages* in place of the reference values.
New	To enter a new study, click the *New* button to open a blank data entry form.
Prefill	If most of your measurements begin with the same numbers (such as 1.1651, 1.1650, and 1.1658), you can save time by prefilling the measurements with those digits. In this case, click the *Prefill* button, then enter a prefill value of 1.165. Now you need to enter only the last digit of each measurement. Before using *Prefill*, enter the number of trials and appraisers for the study.

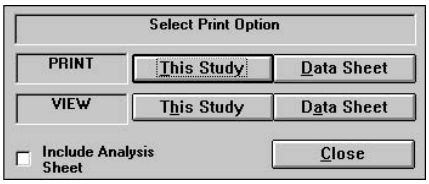
Tip: Since all measurements must be eight digits or less, you might need to code the data to fit it into the measurement fields. For example, suppose the actual measurements consist of 2223.11221, 2223.12373, and 2223.10312, with a drawing specification of 2223.10 +/- .05. The measurements exceed the eight-digit limit, so you must code them. To code the data, use only the last eight digits of the measurements. For 2223.11221, the coded measurement would be 23.11221. Coding the specifications results in 23.10 +/- .05 (USL = 23.15 and LSL= 23.05). The resulting percentage values calculated for the study (%R&R, %EV, and %AV) will still be correct.

The program calculates these fields when you click the *Calc* button:

Field Name	Description
EV	*Equipment variation (Repeatability)*
% Tol	Percent of tolerance consumed by EV
% TV	Percent of total variation that EV contributes
AV	Appraiser variation (Reproducibility)
% Tol	Percent of tolerance consumed by AV
% TV	Percent of total variation that AV contributes
PV	Part Variation—the portion of variation contributed by the parts
% Tol	Percent of tolerance consumed by PV
%TV	Percent of total variation that PV contributes
TV	Total variation resulting from both gage variation and part variation
R-bar (R)	The overall average range value
UCL-R	The upper control limit for ranges Any trials that have a range value that exceeds the Upper Control Limit for Ranges (UCL-R) will be marked with a red flag, as shown below. You should review these values to see if there has been a typing error—a common cause for out-of-control range values. 
R&R	Overall gage R&R variation
% Tol	Percent of tolerance consumed by R&R
% TV	Percent of total variation that R&R contributes

Printing the Study

To print the study, click the *Print* button, and a Print menu will appear, as shown here:



To print the study report, click the *This Study* button that's in the *Print* section. To preview the study report on-screen, click the *This Study* button that's in the *View* section. Use the *Data Sheet* buttons to print or preview a blank data collection sheet you can use to record measurements during the study.

If you want the two-page report (the second page is an analysis report that includes more detail), place a check in the *Include Analysis Sheet* checkbox.

Average and Range Method Interpretation

To interpret an Average and Range Method study, look at the percentage of the part tolerance that measurement system error consumes or the percentage of total variation that's due to measurement system error.

As with the Range method studies, no strict rules exist for determining what percentage amount you should consider acceptable or unacceptable. Generally, manufacturers accept the guidelines below (percentages expressed as a *percent of the total variation* or *as a percent of part tolerance*).

If the R&R percentage is:

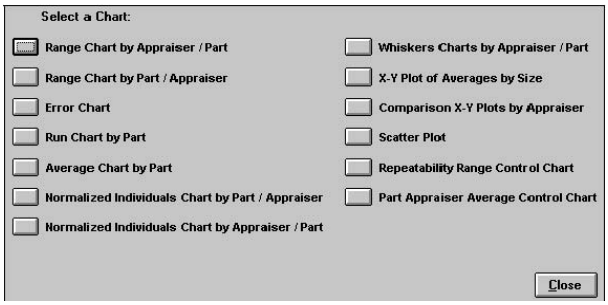
- under 10%–the measurement system is acceptable
- between 10% and 30%–depending on costs, criticality of use, and other factors, you might need to perform further analysis to find the source of the measurement system error.
- over 30%–the measurement system needs improvement; you should perform additional studies to find the source of the error.

  If the error component of the reproducibility is large (perhaps twice as much as the repeatability), you might reduce error by training the appraisers on using and reading the gage and ensuring the gage face or readout is legible to the appraisers.

If the error component of repeatability is large (perhaps twice as much as the reproducibility), you might reduce gaging error by cleaning and repairing the gage (such as sticking parts) and/or redesigning the gage and fixture to be more rigid.

Generating Charts

Gage R&R Entry offers an extensive variety of charts to help you determine the causes of measurement error. To generate a chart from your Average and Range study, click the *Charts* button, and the Gage R&R Charts menu will appear:



Printing Charts

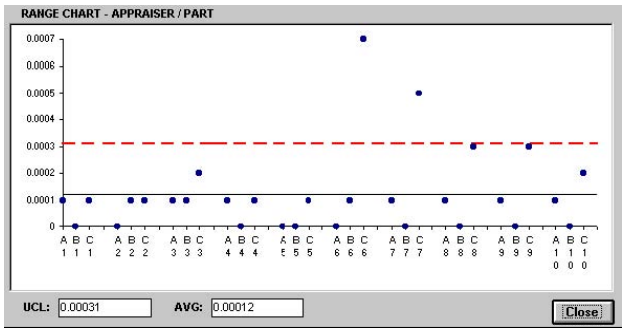
To print a chart, first click the small button next to the chart type to generate it on-screen. Then choose File | Print from the top menu bar.

We'll discuss each type of chart next.

Range Chart by Appraiser/Part (and by Part/Appraiser)

Using a standard range chart, this chart plots the ranges of each appraiser's readings, including the average range and control limits. You can choose to plot the data grouped by part or grouped by appraiser.

Example Range Chart—Appraiser/Part



Range Chart Interpretation

The Range chart can help you determine both statistical control in regard to repeatability and consistency of the measurement process among appraisers for each part. You won't see lines connecting the range data points because this data is not *ordered*. Neither chart should show patterns in the data relative to the appraisers or parts. You can determine stability by a point or points outside the control limit, within appraiser or within part patterns.

Error Chart

The Error chart shows the individual deviations from the accepted reference values. GAGEtrak calculates the individual deviation or error for each part according to the following formula:

Error = Observed Value – Reference Value

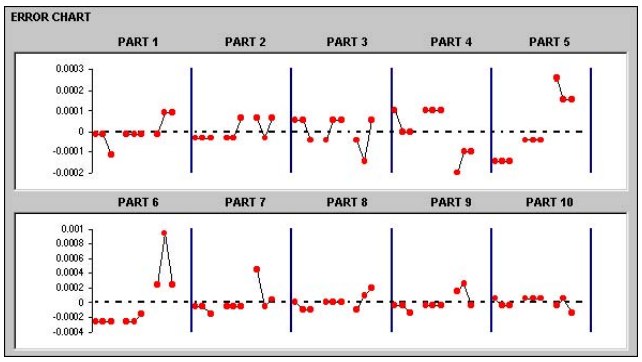
or

Error = Observed Value – Average Measurement of the Part *(if you didn't enter a reference value, GAGEstat uses this method)*

Before you do any other statistical analysis, you should thoroughly screen the deviations for clear causes of variations that you can ascribe to specific factors.

Look for any uniform patterns in your Error chart, including the following: one appraiser's second (or third) set of readings is consistently higher than his first; one appraiser's average is higher than the other appraisers' averages; and/or one part standing out as more difficult to measure consistently.

Example Error Chart

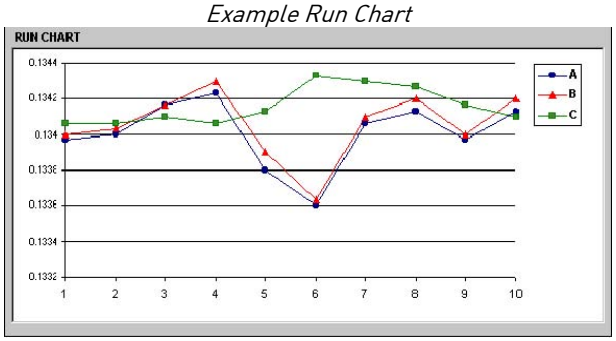


Run Chart and Average Chart

Run Chart

This chart plots the averages of each appraiser's various readings, using part number as an index. The Run chart can help you determine the consistency among appraisers.

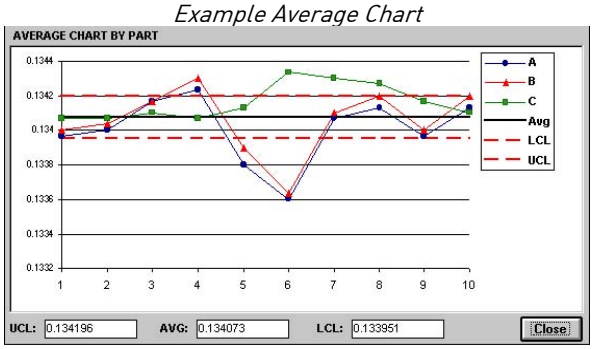
Example Run Chart



Average Chart

The Average chart is much like the Run chart, except that it also calculates the overall average and control limits. From this chart, you can determine the measurement system's acceptability.

Example Average Chart

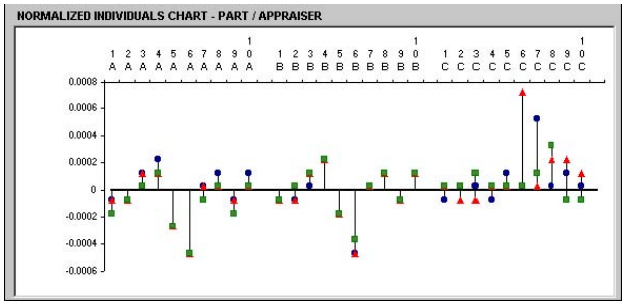


The measurement discrimination, or noise, is represented by the area within the control limits. If the group of parts used in the study represents the process variation, about half or more of the averages should be outside the control limits. If the chart shows this pattern, then the measurement system should be able to reveal part-to-part variation; it can also provide useful information for analyzing and controlling the process. If less than half the averages are outside the control limits, it might be because the measurement system isn't able to thoroughly distinguish differences or because the part sample doesn't represent the expected process variation.

Normalized Individuals Chart (by Part/Appraiser and by Appraiser/Part)

In this chart, the plotted data consists of the individual readings minus the overall average of the readings. The normalized data is plotted grouped by appraiser or part number. This chart can help you determine reproducibility; consistency among appraisers; occurrences of abnormal readings; and the interaction between the parts and appraisers.

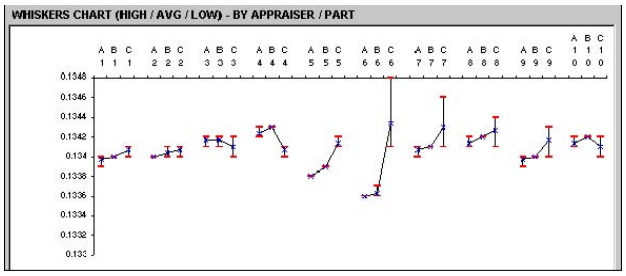
Example Normalized Individuals Chart



Whiskers Chart

The Whiskers chart plots and connects the high and low data values and the average by part by appraiser. This chart helps you see consistency among appraisers; occurrences of abnormal readings; and the interaction between the parts and the appraisers.

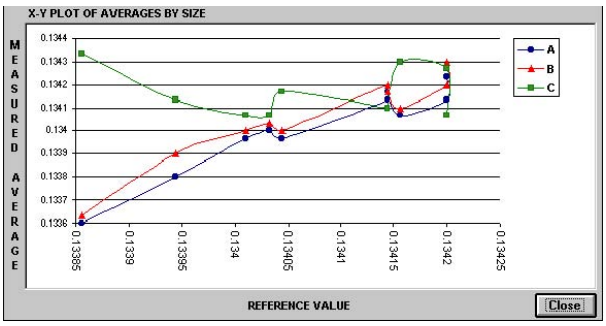
Example Whiskers Chart



X–Y Plot of Averages by Size

This chart plots the averages of each appraiser's various readings for each part, using the reference value (or overall part average, if you don't enter a reference value) as the index. This plot can help you determine linearity (if you use the reference value) and consistency in linearity among appraisers.

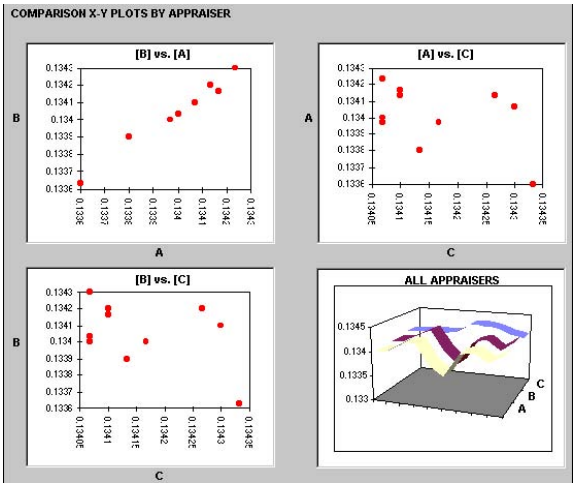
Example X–Y Plot—Averages by Size



Comparison X–Y Plots

In a Comparison X–Y Plot, the averages of each appraiser's readings on each part are plotted against each other, using appraiser as an index. This plot compares one appraiser's readings to those of another appraiser. If the appraisers' readings matched perfectly, the plotted points would form a straight line 45 degrees to the axis.

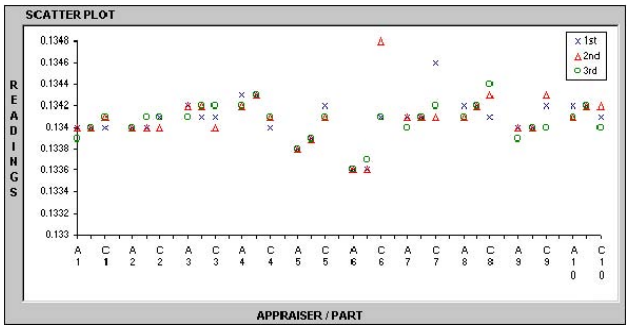
Example Appraiser Comparison X–Y Plots



Scatter Plot

The Scatter Plot charts individual readings by part by appraiser to help you determine consistency among appraisers; occurrences of abnormal readings; and the interaction between the parts and appraisers.

Example Scatter Plot



Repeatability Range Control Chart

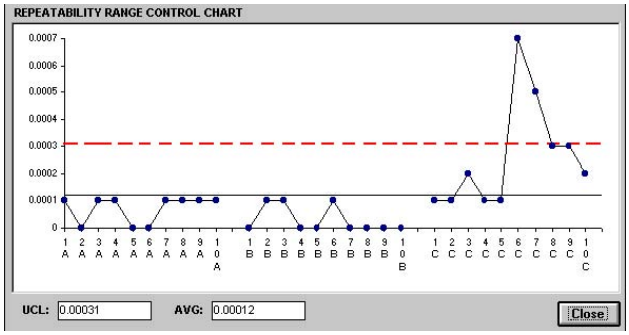
Using a standard range chart, this chart plots the ranges of the readings by each appraiser, for each part, including the average range and control limits. The data is grouped by appraiser, and lines connect the points for each appraiser.

Repeatability Range Chart Interpretation

The Range Control chart shouldn't show data patterns relative to the appraisers or have any out-of-control points. An *in-control* Range Control chart is a sign that the appraisers are consistent and use the gage in the same way.

With the Range Control chart, you can determine consistency of the measurement process among appraisers for each part and statistical control in regard to repeatability.

Example Repeatability Range Control Chart

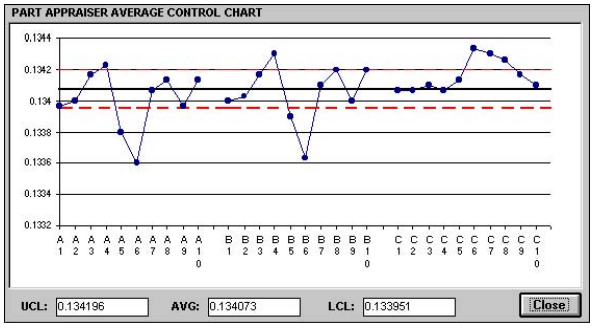


Part Appraiser Average Control Chart

Using a standard average chart, the averages of each appraiser's readings for each part are plotted, including the overall average and control limits. The data is grouped by appraiser with lines connecting each appraiser's points.

If half or more of the points are outside of the control limits, then the measurement system should be able to detect *part-to-part* variation. If less than half are outside the control limits, it might be because the measurement system isn't able to thoroughly distinguish differences or because the part sample doesn't represent the expected process variation.

Example Part Appraiser Average Control Chart



Average and Range Formulas

Range (Short Form) Method

Values of d_2

Parts	1	2	3	4	5	6	7	8	9	10
2 Appr's	1.41	1.28	1.23	1.21	1.19	1.18	1.17	1.17	1.16	1.16
3 Appr's	1.91	1.81	1.77	1.75	1.74	1.73	1.73	1.72	1.72	1.72

EV = Not calculated
AV = Not calculated *

R&R = 5.15÷d2 ×R
% R&R = (100×R&R)÷TOL

Or

%R&R = (100×R&R)÷PV
where PV is the Process Variation

Note: When calculating R&R, the Short Form Ford method uses 6.00 instead of 5.15: 6.00 ÷d2 ×R.

AIAG Average and Range Method (Long Form)

Equipment Variation (EV)—Repeatability

Trials	2	3
K_1	4.56	3.05

EV =R ×K1
%EV =100 ×(EV ÷TV)

or, *if comparing to tolerance:*
%EV =100 ×(EV ÷Tolerance)

Appraiser Variation (AV)—Reproducibility

Appr's	2	3
K_2	3.65	2.70

$$\sqrt{\left|(\bar{X}_{diff} \times K_2)^2 - (EV^2 \div n \times r)\right|}_{22}$$

AV =[(X ×K) -(EV ÷n ×r)]

diff 2 where n = # of parts, r = # of trials

Note: If a negative value results under the square root, the AV is reported as "0".%AV =100 ×(AV ÷TV)

Or, if comparing to tolerance:

%AV =100 ×(AV ÷Tolerance)

Repeatability & Reproducibility (R&R)

R&R =$\sqrt{(EV^2 + AV^2)}$ (EV^2 +AV^2)

%R & R =100 ×(R &R ÷TV) *or*, *if comparing to tolerance*:%R & R =100 ×(R &R ÷Tolerance)

Part Variation (PV)

Parts	2	3	4	5	6	7	8	9	10
K3	3.65	2.70	2.30	2.08	1.93	1.82	1.74	1.67	1.62

PV =Rp ×K3

R =Max X -MinX p

Xp values are the averages of each measured part

Note: If you know the 6-Sigma Process Variation (from SPC or Capability studies), enter it into the *Proc. Var.* field. If entered into the Gage R&R Study form, the software will calculate TV as: TV =5.15(6 -SigmaProc. Var. ÷6)

and calculate PV as:

$$PV = \sqrt{(TV^2 - R\&R^2)}$$

Total Variation (TV)

$$TV = \sqrt{R\&R^2 + PV^2}$$

General Motors and Chrysler Long Form Method

Equipment Variation (EV)—Repeatability

Trials	2	3
K_1	4.56	3.05

EV =$\bar{R}$ ×K1 %EV =EV ÷TOL

Appraiser Variation (AV)—Reproducibility

Appr's	2	3
K_2	3.65	2.70

$$AV = \sqrt{(\bar{X}_{DIFF} \times K_2)^2 - (EV^2/nr)}$$

where n = # of parts, r = # of trials

Note: If a negative value results under the square root, the AV is reported as "0".%AV =(100 ×AV)

÷TOLRepeatability & Reproducibility (R&R)

R&R =$\sqrt{(EV^2 + AV^2)}$ (EV^2 +AV^2)

%R &R =(100 ×R&R) ÷TOL

Ford Long Form Method

Equipment Variation (EV)—Repeatability

Appr's	2	3
K1	4.56	3.05

$$EV = \bar{R} \times K_1$$

%EV =100 ×EV^2 ÷R&R ×TOL

Appraiser Variation (AV)—Reproducibility

Appr's	2	3
K_2	3.65	2.70

$$AV = \sqrt{(\bar{X}_{DIFF} \times K_2)^2 - (EV^2/nr)}$$

$$\%AV = 100 \times AV^2 \div R\&R \times TOL$$

Repeatability & Reproducibility (R&R)

R&R =$\sqrt{(EV^2 + AV^2)}$ (EV^2 +AV^2)

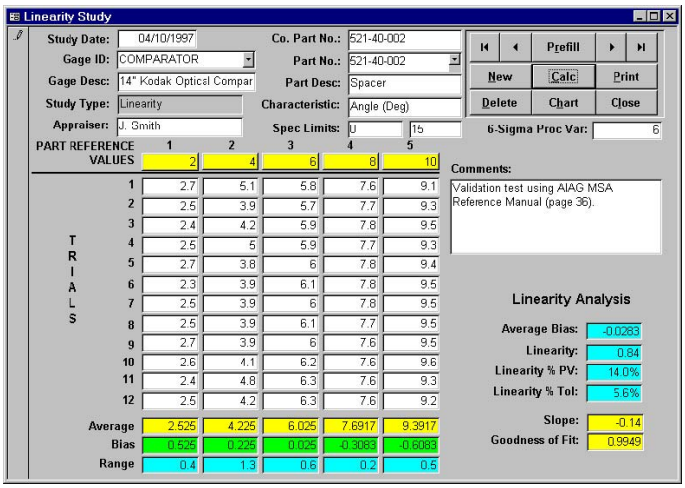
%R&R =%EV +%AV

Linearity Study

To determine linearity, choose parts throughout the gage's operating range. To find the bias of each part, calculate the difference between the reference value and the observed average measurement. The slope of the regression line that best fits the bias average versus reference values, multiplied by the process variation (or the tolerance) of the parts, is an index that can represent the linearity of the gage. To convert gage linearity to a percentage of process variation (or tolerance), multiply by 100 and divide by the process variation (or the tolerance). As with stability, the recommended analysis technique is graphical–a scatter diagram with a best-fit line.

You can use tool room or layout inspection equipment to determine the reference values of the parts. The appraisers measure the parts, then the program calculates each part's observed average. The difference between the reference value and the observed average is the *bias*; the software calculates it for each part. The linearity graph plots biases and reference values throughout the operating range. If the graph shows that a straight line could represent the plotted points, then a best-fit linear regression line between biases and reference values represents the linearity between those two parameters.

Linearity Study Screen



The Linearity Study screen contains these fields:

Field/Button Name	Description
Study Date	Enter the date of the study; this field defaults to the current date.
Gage ID	Select the gage ID from the drop-down list box.
Gage Desc.	The name of the gage or measurement device appears in this field.
Study Type	GAGEstat automatically sets this field to "Linearity"; you can't change it.
Appraiser	Enter the name of the person conducting the study.
Comments	Use this field to enter any comments about this study.
Co. Part No.	Enter your internal company part or job number.
Part No.	Select a related part number, such as the customer or supplier part number.
Part Desc.	This field displays the description or name of the part.
Characteristic	In this field, enter the name of the characteristic that you're evaluating.
Specification Limits	These fields show the minimum and maximum specification limits of the characteristic that you're measuring.
6-Sigma Proc. Var.	In order to calculate linearity, you must know the 6-Sigma Process Variation (required) of the characteristic. Enter it here, and GAGEstat will use it in the Linearity and Linearity % PV calculations.
Part Reference	Enter all five part reference values (required). *Values 1–5* (required)
Trials 1–12 (required)	In these fields, enter all 12 trials of measurements for each part reference (required).
New	To enter a new Linearity study, click *New* to open a blank data entry form.

Linearity Analysis Fields

Field/Button Name	Description
Average Bias	Average bias based on the individual part bias values
Linearity	Linearity value for the study (absolute value of the slope multiplied by process variation)
Linearity % PV	Linearity expressed as a percentage of the process variation
Linearity % Tol	Linearity expressed as a percentage of the tolerance (shown only if you entered both the upper and lower specification limits)
Slope	Slope value of the regression line for the plotted data (a slope of zero is best when plotting bias versus reference values)
Goodness of Fit (R^2)	The value that represents how well the regression line fits the data points (the closer this value is to 1, the better the fit is)

Part Bias, Average and Range Fields

Note: You must click the *Calc* button in order to see the following fields:

Field/Button Name	Description
Average	Average measured value of the reference part
Bias	Part average minus the part reference value
Range	Linearity expressed as a percentage of the process variation
Linearity % Tol	Difference between the largest and smallest part measurement

Printing the Linearity Study

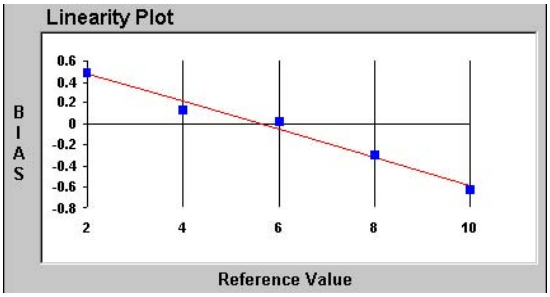
If you want to print the Linearity study data and analysis values (but not a chart), first click the *Calc* button to display the results. Then choose File | Print from the top menu bar.

> Tip: If you want to print just the data for a single study, then first preview the report on-screen and make a note of which page numbers pertain to the study. Then, when you select the Print command, enter the range of page numbers you want to print. Otherwise, the program will print all of your studies.

Linearity Chart

To generate a Linearity chart, click on the *Chart* button. You'll see a plot chart of the Bias versus Reference Value for each point, as well as a best-fit linear regression line (which should have a downward—negative—slope).

Example Linearity Chart



Printing the Linearity Chart

To print the Linearity chart, first generate it on-screen, then select File | Print. Click the *Print* button to see a preview of the report before printing it.

Linearity Study Interpretation

The *Goodness of Fit* value (R^2) of the linear regression line determines whether the biases and reference values have a good linear relationship. This value will be a number between 0 and 1; the closer it is to 1, the better the linear relationship is.

Using the slope of the regression line and the process variation (or tolerance) of the parts, the program calculates linearity and percent linearity of the system. If the regression line has a good linear fit, then you can evaluate the magnitude of the linearity and percent linearity to determine if the linearity is acceptable. If the regression line does not have a good linear fit, then the bias average and reference values might have a *nonlinear* relationship. You then must perform additional analysis to determine if the measurement system's linearity is acceptable.

If a measurement system has non-linearity, look for these possible causes:

1 gage not calibrated properly at lower and upper ends of the operating range
2 error in the minimum or maximum master
3 worn instrument
4 internal instrument design characteristics

Linearity Formulas

y = b + ax

x = reference value

y = bias

a = slope

$$a = \frac{\Sigma xy - \left(\Sigma x \frac{\Sigma y}{n}\right)}{\Sigma x^2 - \frac{(\Sigma x)^2}{n}}$$

$$b = \Sigma\frac{y}{n} - a \times \left(\Sigma\frac{x}{n}\right)$$

$$R^2 = \frac{\left[\Sigma xy - \Sigma x\frac{\Sigma y}{n}\right]^2}{\left[\Sigma x^2 - \left(\frac{(\Sigma x)^2}{n}\right)\right] \times \left[\Sigma y^2 - \left(\frac{(\Sigma y)^2}{n}\right)\right]}$$

Bias = b + ax

R = Goodness of fit

If using the Process Variation (6-Sigma Process Variation):

Linearity =Slope ×Process Variation

%Linearity =100 ×(Linearity / ProcessVariation)

Or, if using the tolerance:

Linearity =Slope ×Tolerance

%Linearity=100 ×(Linearity / Tolerance)

where Tolerance = Upper Spec Limit - Lower Spec Limit

Stability Study

When thinking about measurement system stability, you must distinguish between *measurement system stability* (the amount of total variation in the bias of the system over time on a particular part or master part) and *statistical stability.* Statistical stability is the more common term that is used to describe stability, repeatability, bias, and processes.

Two different measurement systems could measure the same master part, and both could show statistical stability, yet one system might have much higher variation in its bias over time than the other. From a statistical point of view, they're equally stable. However, from a traditional gage stability point of view, the system with the lower bias variation over time is more stable than the one with higher bias variation. You can quantify these total bias variations, but not until you can demonstrate that both systems are statistically stable.

Control Charts

You can use control charts to determine statistical stability. Control charts help you differentiate common cause variation (variation due to causes affecting all measurement results) from special cause variation (variation that is the result of specific conditions).

When using control charts, you should look for both points that fall beyond the control limits and for other special cause indicators, such as trends and centerline hugging. The existence of these factors indicates out-of-control or unstable conditions. You can find control charting methods and interpretation guidelines in texts on quality and statistical process control (SPC).

The method presented here for studying measurement system stability is to plot the average and range of repeated master or master part readings on a *regular basis*. For example, you might conclude from this analysis that an out-of-control signal is a sign that you need to calibrate your measurement system. Calibration of the system without any out-of-control signals is likely to increase the variation of your readings. If the master or master part is dirty, you might see an out-of-control signal. Your knowledge of the process is the basis for your interpretation of the control signals.

To determine the sample size and the frequency for a measurement system control chart, you should have an in-depth knowledge of the system and focus on the conditions to which the system is exposed during its use. If, for example, you are certain that the system's users allow for sufficient warm-up time before using it, don't take samples before the warm-up period.

Also, when you're designing a measurement system control chart, make sure that the time at which you take the samples of master or reference value isn't introducing bias into the results. For example, samples taken only after morning calibration might not represent the usual conditions to which the measurement system is exposed. As with any control chart, out-ofcontrol signals might exist because of problems in the sample size and frequency, so it's important to carefully design your control-charting techniques. As mentioned before, to find more information on control chart design, look in SPC publications.

You don't need to calculate a measurement system stability number. You can use indices to measure progress, but you can use a control chart to view the system's progress. The elimination of special causes from a process might improve it, making it more stable. You can see more improvement in the reduction in the width of control limits, which indicates that you've lowered the system's common cause variation. Training and education on statistical process control theory and practice will help you better understand control chart patterns.

Stability Study Screen

Each of the fields in the Stability Study screen is explained in the table below.

Field/Button Name	Description
Study Date	Enter the date of the study; this field defaults to the current date.
Gage ID	Select the gage ID of the measurement device.
Gage Desc.	In this field, you'll see the name of the gage or measurement device.
Study Type	GAGEstat automatically sets this field to "Stability".
Appraiser	Enter the name of the person conducting the study.
Comments	Use this field to enter any comments.
Co. Part No.	Enter your internal company part or job number.
Part No.	Select a related part number, such as the customer or supplier part number.
Part Desc.	This field shows the description or name of the part.
Characteristic	In this field, you'll see the characteristic that you're evaluating.
Specification Limits	If needed, you can enter the upper and lower part *Specification Limits* (optional; used only for reference purposes).
6-Sigma Proc. Var.	If you know the 6-Sigma Process Variation of the characteristic that you're measuring, enter it here. Use this field only for tracking purposes—the program doesn't use it for stability calculations.
New	To enter a new Stability study, click *New* to open a blank data entry form.

Adding Stability Sub Groups

To add stability sub group measurements, click on the first row in the *Sub Group* table. Each sub group row represents the values of the repeated master (or master part) measurements that you make. You must use the same number of readings for each sub group of measurements; for example, you shouldn't use a sample size of five repeated readings on your first sub group and then use only three repeated readings on your second sub group. Add additional sub groups to the rows following the first sub group row.

The sub group record fields are explained below (use the table's horizontal scroll bar to view the fields on the rightmost side of the table).

Field Name	Description
Sub #	Use this number to identify the subgroup—usually you will start with 1, then go to 2, then 3, and keep using consecutive numbering. However, you can also use letters, such as "M-100", "M-200", then "M-300".
Date	In this field, enter the date on which you measured the repeated readings.
1 through 10	Enter the actual measurements taken on the master (or master part). For example, if you're taking a sample size of five repeated readings, enter the first reading in field 1, the second in field 2, the third in field 3, continuing up to field 5. In this example, fields 6 through 10 remain blank.
R	In this field, you'll see the range for the sub group (the largest reading minus the smallest reading). This value is calculated; you cannot change it.
S	GAGEtrak calculates the standard deviation for the sub group (only when the sub group size is five or more). You can't change this value.
Xbar (X)	In this field, you'll see the average (arithmetic mean) for the sub group. This value is calculated; you can't change it.
Notes	Record any comments in this field.

Printing the Stability Study

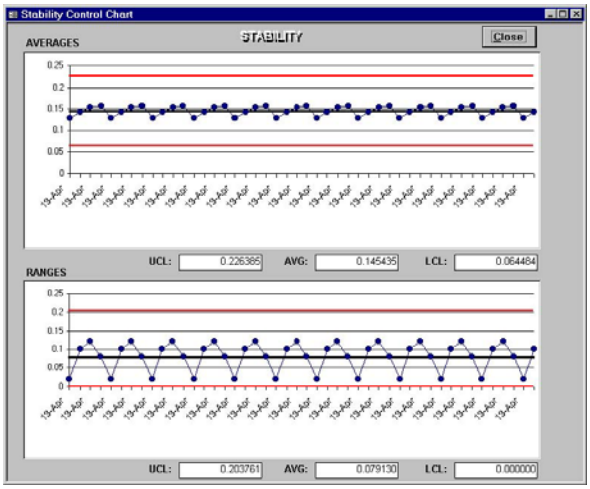
If you want to print the Stability study data, select File | Print from the top menu bar.

> Tip: If you want to print just the data for a single study, first preview the report on-screen and make a note of which page numbers pertain to the study. Then, when you select the Print command, enter the range of page numbers. Otherwise, all of the studies will print.

Generating Stability Control Charts

To generate a Stability Control chart, click the *Chart* button. You'll see two control charts. The top contains a control chart of averages, and the bottom contains a control chart of ranges. For easier interpretation, the program draws control limits and average lines on each chart.

Example Stability Control Chart



Calculated Average Control Chart Fields

Field Name	Description
UCL	From your measurement data, GAGEtrak calculates the upper control limit for the averages and displays it in this field.
AVG	This field shows the overall grand average value.
LCL	GAGEtrak calculates the value for the lower control limit for the averages from the measurement data that you entered.

Calculated Range Control Chart Fields

Field Name	Description
UCL	From the measurement data that you entered, GAGEtrak calculates the upper control limit for the ranges and displays it in this field.
AVG	This field shows the average range value.
LCL	GAGEtrak calculates the lower control limit for the ranges based on the measurement data that you entered.

Printing the Stability Control Chart

To print the Stability Control chart, first generate the chart on-screen, then select File | Print. Click the *Print* button to see a preview of the report before printing it.

Stability Formulas

n = sample size (number of observations in sub group)
X = individual sample measurement
R = Range
$\bar{X}$ = Sub group average
A_2, D_3, D_4 = control chart constants based on value of *n*, as shown in the table below:

n	A_2	D_3	D_4
2	1.880	0	3.267
3	1.023	0	2.575
4	0.729	0	2.282
5	0.577	0	2.115
6	0.483	0	2.004
7	0.419	0.076	1.924
8	0.373	0.136	1.864
9	0.337	0.184	1.816
10	0.308	0.223	1.777
11	0.285	0.256	1.744
12	0.266	0.284	1.716
13	0.249	0.308	1.692
14	0.235	0.329	1.671
15	0.223	0.348	1.652

$$\bar{X} = \Sigma X / n$$

$$R = \text{Max X - Min X}$$

$$\bar{R} = \Sigma R / \text{no. of subgroups}$$

$$UCL_R = \bar{R} \times D_4$$

$$LCL_R = \bar{R} \times D_3$$

$$\bar{\bar{X}} = \Sigma \bar{X} / \text{no. of subgroups}$$

$$UCL_{\bar{X}} = \bar{\bar{X}} + (A_2 \times \bar{R})$$

$$LCL_{\bar{X}} = \bar{\bar{X}} - (A_2 \times \bar{R})$$

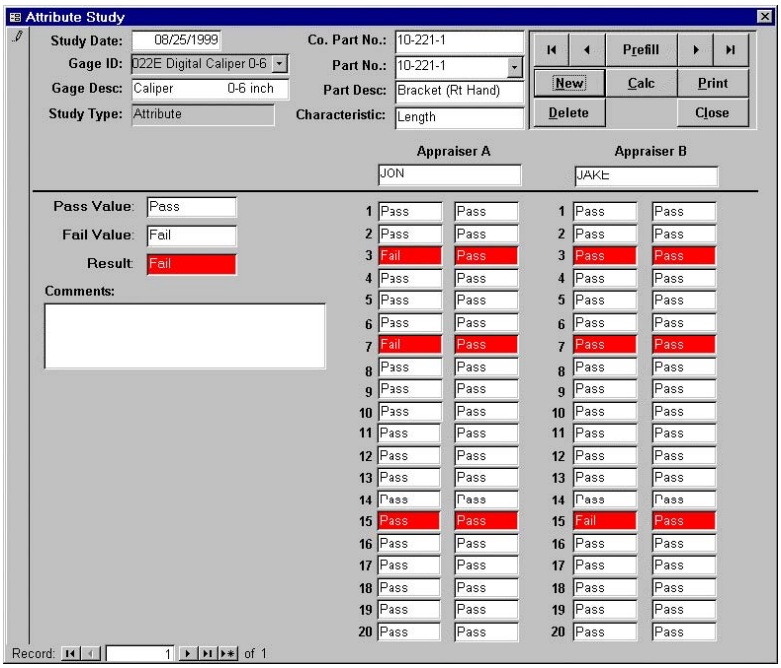
Attribute Study—Short Method

Attribute (or go/no-go) gages evaluate parts according to whether or not those parts meet a particular standard; any part that doesn't meet this standard fails the test. These gages don't measure the degree of a part's success or failure; they judge only whether the part met the established limits.

GAGEtrak uses the short method for attribute studies. For this type of study, select twenty parts and two appraisers. Each appraiser should measure each part; be sure that they perform the measurements randomly. To prevent appraiser knowledge bias, you should conceal these numbers from the appraisers. The group of parts that you select should range from somewhat below to somewhat above the standard in question.

The gage passes the study *only if all of the measurements agree*. This means that each appraiser's measurement must match those of the other appraiser for each part; for example, if Appraiser A finds that part number 8 failed, then Appraiser B should also find that part number 8 failed. If the appraisers' measurements are different for even one part, you should take steps to improve the gage's performance and then re-evaluate it. If the gage continues to fail this type of study, or if you cannot improve it, you should discard and replace the gage.

Attribute Study Screen



GAGEtrak highlights the non-matching measurements in red, as you can see in the screen above. For this study, when you click the *Calc* button, the program will display the *Result* as *Fail*.

The Attribute Study screen contains these fields and buttons:

Field/Button Name	Description
Study Date	This field defaults to the current date, but you can change it.
Gage ID	Select the ID code for the gage you're using in the study.
Gage Desc.	Once you select a gage ID, the gage's description will appear in this field.
Trials	In this field, select how many trials you're going to perform (two or three).
Study Type	This field automatically displays *Attribute*; you can't change it.
Co. Part No.	In this field, enter your company's part number for the part(s) used in the study.
Part No.	Select the number of the part used in the study. don't meet the established limits – such as "no go", "fail", or "no".
Part Desc.	After you select the part number, its description appears in this field.
Characteristic	Enter a brief description of the aspect you're studying with this gage for this part.
Pass Value	In this field, enter a description of how the appraisers should describe a part that meets the standard – such as "go", "pass", or "yes".
Fail Value	You can enter a brief description of how appraisers should note parts that don't meet the established limits – such as "no go", "fail", or "no".
Result	After you click *Calc*, this field will confirm whether the gage passed or failed this study. If it failed, GAGEtrak will highlight this field in red.
Comments	Enter any notes relevant to the study.
Appraiser A and *Appraiser B*	In these fields, enter the name of each appraiser.
1-20	Enter the appraiser's measurement results in these fields. Any measurements that don't match for both appraisers will appear red.
Prefill	If all measurements will begin with similar digits, you can use the Prefill feature to save data entry time.
New	Click this button to create a blank Attribute record.
Calc	After you enter all of the measurements, click this button to see the results of

	your study.
Print	If you want to print the study, click this button.
Delete	Click this button to delete the current record.
Close	When you're finished, click *Close* to return to the main menu.

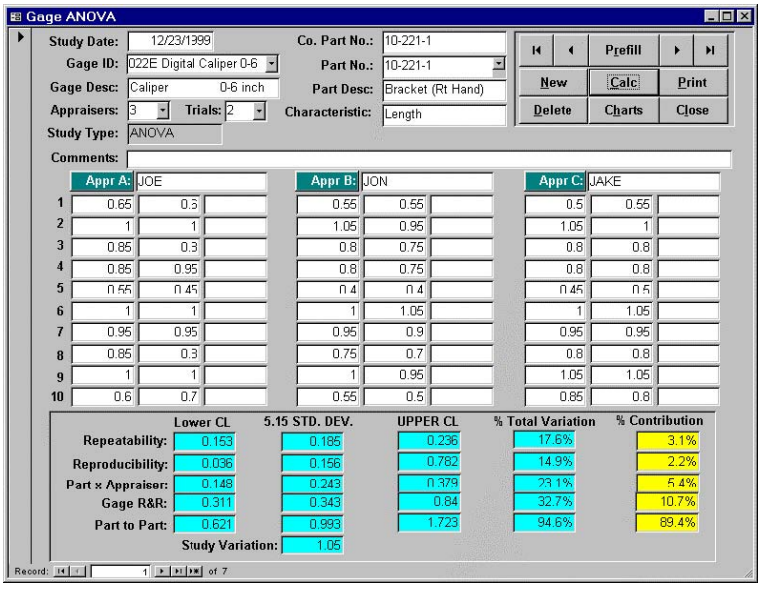
ANOVA

Analysis of variance (ANOVA) is a type of study that you can use to look at the factors (particularly measurement error) that contribute to variability in measurement system analysis. Using this method, you can break variance down into four groups: parts, appraisers, part-appraiser interaction, and gage repeatability.

ANOVA offers you several advantages, including the fact that you can use it in almost any type of testing arrangement. Its estimate of variation is more precise than that of other methods and it allows you to pull more information from your study (such as part-appraiser interaction). GAGEtrak's Gage R&R feature automatically performs ANOVA's complex calculations, eliminating worry about manually calculating the results of your study. However, ANOVA is a difficult technique that requires you to have a thorough understanding of how to explain your findings.

When gathering data for an ANOVA study, you must be careful to use random measurements in order to prevent bias values. To do this, you can use a random number table or a simpler technique, such as pulling appraiser/part measurement assignments out of a hat or bowl. No matter what method you use, you must carefully plan, then execute your study.

ANOVA Study Screen



GAGEtrak's ANOVA study screen contains the following fields and buttons:

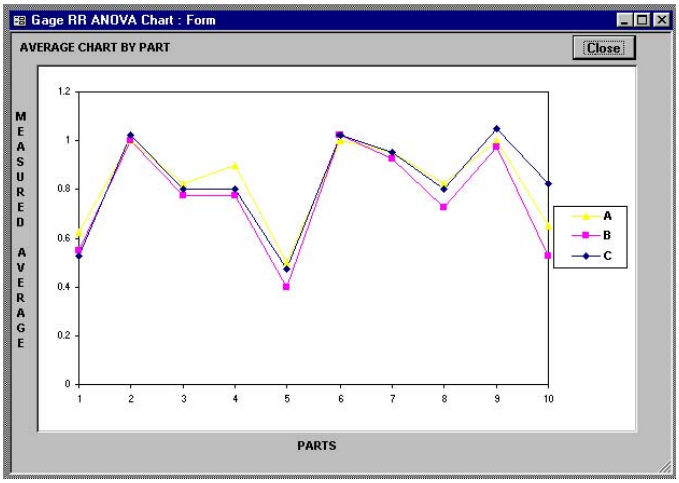
Field/Button Name	Description
Study Date	This field defaults to the current date, but you can change it.
Gage ID	Select the ID code for the gage you're using in the study.
Gage Desc.	Once you select a gage ID, the gage's description will appear in this field.
Appraisers	Select the number of appraisers you're using in the study.
Trials	In this field, select how many trials you're going to perform (two or three).
Study Type	This field automatically displays *ANOVA*; you can't change it.
Comments	Enter any notes relevant to the study.
Co. Part No.	In this field, enter the part number for the part(s) used in the study.

Part No.	Select the number of the part used in the study.
Part Desc.	After you select the part number, its description appears in this field.
Characteristic	Enter a brief description of the aspect you're studying with this gage.
Appr. A, B, and *C*	In these fields, enter the name of each appraiser.
1-10	Enter the appraiser's measurement results in these fields.
Prefill	If all measurements will begin with similar digits, use the Prefill feature to save data entry time (see the description under the Average and Range section on page 70).
New	Click this button to create a blank ANOVA record.
Calc	After you enter the measurements, click *Calc* to see the results of your study.
Print	If you want to print the study, click this button.
Delete	Click this button to delete the current record.
Chart	To see a chart for your study, click this button.
Close	When you're finished, click *Close* to return to the main menu.

Click the *Calc* button, and GAGEtrak automatically calculates these fields:

Lower CL	lower control limit
5.15 Std. Dev.	standard deviation x 5.15; provides measure of variation or spread
Upper CL	upper control limit
% Total Variation	percentage of total variation
% Contribution	percentage of contribution
Repeatability	equipment variation
Reproducibility	appraiser variation
Gage R&R	overall gage R&R variation
Part to Part	variation caused by the difference in parts
Study Variation	overall variation for the study

ANOVA Chart



This chart plots the average measurement per appraiser for each part, then connects the plotted points for each appraiser. The more parallel the appraiser lines, the less significant the interaction. You should carefully study any points where the lines are nonparallel, especially if they appear to have a large angle of intersection.

ANOVA Formulas

Estimate of Variance Components

	Variance Estimate
Gage	$\tau^2 = MS_e$
Interaction	$\gamma^2 = \frac{(MS_{op} - MS_e)}{r}$
Appraiser	$\omega^2 = \frac{(MS_o - MS_{op})}{nr}$
Part	$\sigma^2 = \frac{(MS_p - MS_{op})}{kr}$

ANOVA Calculation

ANOVA Calculation

Source	DF	SS	MS	F	EMS
Appraiser	2	0.04800	0.02400		$\tau^2 + 2\gamma^2 + 20\omega^2$
Parts	9	2.05871	0.22875		$\tau^2 + 2\gamma^2 + 6\sigma^2$
Appraiser x Part	18	0.10367	0.00575	4.45*	$\tau^2 + 2\gamma^2$
Gage (Error)	30	0.03875	0.00129		τ^2
Total	*59*	*2.2491*		** Significant at $\alpha = 0.25$ level*	

Estimate of Variance	Std. Dev. (σ)	90% Conf. Limit for Std. Dev.	5.15 (σ)	%Study Variation	%Contribution
$\tau^2 = 0.00129$ (Repeatability)	0.0359	(0.030, 0.046)	EV = 0.19	17.6	3.1
$\omega^2 = 0.00091$ (Operator)	0.0302	(0.007, 0.152)	AV = 0.16	14.8	2.2
$\gamma^2 = 0.00223$ (Interaction)	0.0472	(0.029, 0.074)	INT = 0.24	23.2	5.4
R&R = 0.00443 ($\tau^2 + \gamma^2 + \omega^2$)	0.0666	(0.060, 0.163)	R&R = 0.34	32.7	10.7
$\sigma^2 = 0.0371641$ (Part)	0.1928	(0.121, 0.334)	PV = 0.99	94.5	89.3

Study (or total) Variation, $TV = \sqrt{R\&R^2 + PV^2} = \sqrt{(0.34)^2 + (0.99)^2} = 1.05$

$$\%\text{ (study) Variation} = 100\left[\frac{5.15\sigma(\text{components})}{5.15\sigma(\text{study variation})}\right]$$

$$\%\text{Contribution} = \left(\frac{5.15\,\sigma(\text{components})}{5.15\,\sigma\,(\text{study variation})}\right)^2 \times 100$$

Gage R&R ANOVA Method

GA File: GASKET
GAGE R&R
ANOVA METHOD
STUDY #: 1
STUDY DATE: MM-DD-YY
GAGE #: X-2034
DESC: Thickness Gage
TYPE: 0-10.0 MM
CHAR #: 1
NAME: One
3 APR, 10 PARTS, 2 TRIALS
Comment: Special Study

	LOWER CL	5.15 STD. DEV.	UPPER CL	%TOTAL VARIATION	PERCENT CONTRIBUTION
Repeatability	0.15	0.19	0.24	17.6	3.1
Reproducibility	0.04	0.16	0.78	14.8	2.2
Part x Appraiser	0.15	0.24	0.38	23.2	5.4
GAGE R&R	0.31	0.34	0.84	32.7	10.7
Part-to-Part	0.62	0.99	1.72	94.5	89.3

BASED ON DATA CATEGORIES, GAGE OK

Note:
Tolerance = N.A.
Study Variation = 1.05
Number of distinct data categories = 4
Conf. level (CL) = 90.00%

Source: AIAG Measurement Systems Analysis Guide

Readings

Appraiser A

Part Trial 1 Square Trial 2 Square Sum Sum Square

1	0.65	0.42	0.60	0.36	1.25	0.78
2	1.00	1.00	1.00	1.00	2.00	2.00
3	0.85	0.72	0.80	0.64	1.65	1.36
4	0.85	0.72	0.95	0.90	1.80	1.62
5	0.55	0.30	0.45	0.20	1.00	0.50
6	1.00	1.000	1.00	1.00	2.00	2.00
7	0.95	0.90	0.95	0.90	1.90	1.80
8	0.85	0.72	0.80	0.64	1.65	1.44
9	1.00	1.00	1.00	1.00	2.00	2.00
10	0.60	0.36	0.70	0.49	1.30	0.85
		7.14		7.13		
Total = 16.55						
SS Total = 14.27						

Appraiser B

Part Trial 1 Square Trial 2 Square Sum Sum Square

1	0.55	0.30	0.55	0.30	1.10	0.60
2	1.05	1.10	0.95	0.90	2.00	2.00
3	0.80	0.64	0.75	0.56	1.55	1.20
4	0.80	0.64	0.75	0.56	1.55	1.20
5	0.40	0.16	0.40	0.16	0.80	0.32
6	1.00	1.00	1.05	1.10	2.05	2.10
7	0.95	0.90	0.90	0.81	1.85	1.71
8	0.75	0.56	0.70	0.49	1.45	1.05
9	1.00	1.00	0.95	0.90	1.95	1.90
10	0.55	0.30	0.50	0.25	1.05	0.55
6.60				6.03		
Total = 15.35						
Sum Square Total = 12.63						

Appraiser C

Part Trial 1 Square Trial 2 Square Sum Sum Square

1	0.50	0.25	0.55	0.30	1.05	0.55
2	1.05	1.10	1.00	1.00	2.05	2.10
3	0.80	0.64	0.80	0.64	1.60	1.28
4	0.80	0.64	0.80	0.64	1.60	1.28
5	0.45	0.20	0.50	0.25	0.95	0.45
6	1.00	1.00	1.05	1.10	2.05	2.10
7	0.95	0.90	0.95	0.90	1.90	1.80
8	0.80	0.64	0.80	0.64	1.60	1.28
9	1.05	1.10	1.05	1.10	2.10	2.20
10	0.85	0.72	0.80	0.64	1.65	1.36
7.19				7.21		
Total = 16.55						
Sum Square Total = 14.40						

Legend

AV = appraiser variation	k = number of appraisers
AV_{LCL} = appraiser variation lower control limit	LCL = lower control limit
AV_{ss} = appraiser variation sum square	MS_{ap} = appraiser x parts mean square
AV_{UCL} = appraiser variation upper control limit	MS_{err} = gage error mean square
CF = correction factor	MS_{p} = parts mean square
DF = degrees of freedom	n = number of parts
CHI = CHI probability distribution	PC = percent contribution
CHI_{INV} = inverse of CHI probability distribution	PV = part variation
DF = degrees of freedom	PV_{LCL} = part variation lower control limit
DF_{ap} = appraiser x parts degrees of freedom	PV_{SS} = part variation sum square
DF_{app} = appraiser degrees of freedom	PV_{UCL} = part variation upper control limit
DF_{err} = gage error degrees of freedom	r = number of trials
DF_{p} = parts degrees of freedom	R&R = repeatability & reproducibility
EV = equipment variation	RR_{LCL} = R&R lower control limit
EV_{i} = inverse of equipment variation	RR_{SS} = R&R sum square
EV_{LCL} = equipment variation lower control limit	RR_{UCL} = R&R upper control limit
EV_{SS} = equipment variation sum square	S^2 = sum square
EV_{UCL} = equipment variation upper control limit	SS_{ap} = appraiser x parts sum square
F_{INV} = inverse of F probability distribution	SS_{app} = appraiser sum square
F = F probability distribution	SS_{err} = gage error sum square
I = interaction	SS_{p} = parts sum square
I_{LCL} = interaction lower control limit	TV = total variation
I_{SS} = interaction sum square	TV_{SS} = total variation sum square
I_{UCL} = interaction upper control limit	UCL = upper control limit

Study Values

k = 3

n = 10

r = 2

$$\text{Appraiser DF} = k - 1 = 3 - 1 = 2$$

$$\text{Parts DF} = n - 1 = 10 - 1 = 9$$

$$\text{App.} \times \text{Parts} = \text{App.DF} \times \text{Parts DF} = 2 \times 9 = 18$$

$$\text{Total DF} = (n \times k \times r) - 1 = (3 \times 10 \times 2) - 1 = 60 - 1 = 59$$

$$\text{Gage (Error)} = Tot_{DF} - A_{DF} - P_{DF} - AP_{DF} = 59 - 2 - 9 - 18 = 30$$

Sum All Readings

16.55 + 15.35 + 16.55 = 48.45

Sum Square All Readings

273.90 + 235.62 + 273.90 = 783.42

Parts	Sum	Square
1	3.40	11.56
2	6.05	36.60
3	4.80	23.04
4	4.95	24.50
5	2.75	7.56
6	6.10	37.21
7	5.65	31.92
8	4.70	22.09
9	6.05	36.60
10	4.00	16.00
Totals	48.45	247.08

Correction Factor for ANOVA

CF =(SumReadings)^2 ÷n ÷k ÷r

=48.45^2 ÷10 ÷3 ÷2

=39.123

Appraiser Sum Square

SS_{app} =(SSReading÷n ÷r)-CF

=(783.42÷10 ÷2)-39.123

=0.048

Appraiser Mean Square

=SS_{app} ÷DF_{app}
=0.048 ÷2
=0.024

Parts Sum Square

SS_p=(PartsSumSquare÷k ÷r)-CF

=(247.08÷3 ÷2)-39.123

=2.057

Parts Mean Square

MS_p =SS_p ÷DF_p

=2.124÷9

=0.2286

App. × Parts Sum Square

SS_{ap} =(SumSquare TotalReadings÷r)-CF -SS_p -SS_{app}

=(82.668÷2)-39.123-2.057-0.048

=0.106

App. × Parts Mean Square

MS_{ap} =SS_{ap} ÷DF_{ap}

=0.106 ÷18

=0.0059

Gage Error Sum Square

SS_{err} =(SumSquare All-CF)-SS_{ap} -SS_p –Ss_{app}

=(41.373-39.123)-0.106-2.057-0.048

=0.039

Gage Error Mean Square

MS_{err} =SS_{err} ÷DF_{err}

=0.039÷30

=0.0013

F Value=MS_{ap} ÷MS_{err}

=0.0059÷0.0013

=4.5385

F0.25 =(fromF Table)

=1.310

ANOVA Table

Source	DF	SS	MS	F	F0.25
Appraiser	2	0.048	0.024		
Parts	9	2.057	0.2286		
App. × Parts	18	0.106	0.0059	4.5385	1.310
Gage Error	30	0.039	0.0013		
Total	59	2.249			

Components of Variance

Most of these values are calculated using values from an F-distribution table. You can find F-tables in most statistics manuals.

Lower Control Limits

$$AV = [MS_{ap} \div (nr)] \times [1/F_{INV}(0.05, DF_{app}, DF_{ap})(MS_{app} \div MS_{ap} - 1)]$$

$$PV = [MS_{ap} \div (kr)] \times [1/F_{INV}(0.05, DF_{p}, DF_{ap})(MS_{ap} \div MS_{app} - 1)]$$

$$I = (MS_{err} \div r) \times [1/F_{INV}(0.05, DF_{ap}, DF_{err})(MS_{ap} \div MS_{err} - 1)]$$

$$EV = MS_{grr} \div (CHI_{INV}(0.05, DF_{err}) \div DF_{err})$$

$$R\&R = [1 \div (nr)] \times [MS_{app} \div (CHI_{INV}(0.05, DF_{app}) \div DF_{app})] + n(r-1) \times MS_{err} + (n-1) \times MS_{ap}$$

Sum Squares

$$AV = (MS_{app} - MS_{ap}) \div (nr) \qquad EV = MS_{err}$$

$$PV = (MS_{p} - MS_{ap}) \div (kr) \qquad R\&R = AV_{ss} + I_{ss} + EV_{i}$$

$$I = (MS_{ap} - MS_{grr}) \div r \qquad TV = RR_{ss} + PV_{ss}$$

Upper Control Limit

Upper control limit formulas are the same as LCL formulas. Just substitute 0.95 in the F_{INV} and CHI_{INV} factors where 0.05 exists.

Table	LCL	S^2	UCL
AV	0.0	0.00091	0.023
PI	0.0146	0.03716	0.1119
I	0.0008	0.00223	0.0054
EV	0.0009	0.00129	0.0021
RR	0.0036	0.00444	0.0266
TV		0.04160	

Study Variation

$$TV = 5.15 \times \sqrt{TV_{ss}}$$
$$= 5.15 \times \sqrt{0.0416}$$
$$= 1.05$$

Repeatability

$$LCL = 5.15 \times \sqrt{EV_{LCL}}$$
$$= 5.15 \times \sqrt{0.0009}$$
$$= 0.15$$
$$5.15_{sp} = 5.15 \times \sqrt{EV_{ss}}$$
$$= 5.15 \times \sqrt{0.00129}$$
$$= 0.19$$
$$UCL = 5.15 \times \sqrt{EV_{UCL}}$$
$$= 5.15 \times \sqrt{0.0021}$$
$$= 0.24$$
$$\%TV = (\text{Rep. Std. Dev.} \div \text{Study Variation}) \times 100$$
$$= (0.19 \div 1.05) \times 100$$
$$= 17.6\%$$
$$PC = \%TV^2$$
$$= 3.1\%$$

Reproducibility

$$LCL = 5.15 \times \sqrt{AV_{LCL}}$$
$$= 5.15 \times \sqrt{0.00005}$$
$$= 0.04$$
$$5.15_{sp} = 5.15 \times \sqrt{AV_{ss}}$$
$$= 5.15 \times \sqrt{0.00091}$$
$$= 0.16$$
$$UCL = 5.15 \times \sqrt{AV_{UCL}}$$
$$= 5.15 \times \sqrt{0.0230}$$
$$= 0.78$$
$$\%TV = \text{Std. Dev.} \div TV$$
$$= 0.16 \div 1.05$$
$$= 14.8\%$$
$$PC = \%TV^2$$
$$= 2.2\%$$

Part × Appraiser

$$LCL = 5.15 \times \sqrt{I_{LCL}}$$
$$= 5.15 \times \sqrt{0.0008}$$
$$= 0.15$$
$$5.15_{sp} = 5.15 \times \sqrt{I_{ss}}$$
$$= 5.15 \times \sqrt{0.00223}$$
$$= 0.24$$
$$UCL = 5.15 \times \sqrt{I_{UCL}}$$
$$= 5.15 \times \sqrt{0.0054}$$
$$= 0.38$$
$$\%TV = \text{Std.Dev.} \div TV$$
$$= 0.24 \div 1.05$$
$$= 23.2\%$$
$$PC = \%TV^2$$
$$= 5.4\%$$

Gage R&R

$$LCL = 5.15 \times \sqrt{RR_{LCL}}$$
$$= 5.15 \times \sqrt{0.0036}$$
$$= 0.31$$
$$5.15_{sp} = 5.15 \times \sqrt{RR_{ss}}$$
$$= 5.15 \times \sqrt{0.00444}$$
$$= 0.34$$
$$UCL = 5.15 \times \sqrt{RR_{UCL}}$$
$$= 5.15 \times \sqrt{0.0266}$$
$$= 0.84$$
$$\%TV = \text{Std.Dev.} \div TV$$
$$= 0.34 \div 1.05$$
$$= 32.7\%$$
$$PC = \%TV^2$$
$$= 10.7\%$$

Part to Part

$$LCL = 5.15 \times \sqrt{PV_{LCL}}$$
$$= 5.15 \times \sqrt{0.0146}$$
$$= 0.62$$
$$5.15_{sp} = 5.15 \times \sqrt{PV_{ss}}$$
$$= 5.15 \times \sqrt{0.03716}$$
$$= 0.99$$
$$UCL = 5.15 \times \sqrt{PV_{UCL}}$$
$$= 5.15 \times \sqrt{0.1119}$$
$$= 1.72$$
$$\%TV = \text{Std. Dev.} \div TV$$
$$= 0.99 \div 1.05$$
$$= 94.5\%$$
$$PC = \%TV^2$$
$$= 89.3\%$$

Measurement System Evaluation Procedures

To perform a measurement system evaluation, gather ten parts and discreetly number them (put the numbers on the back of the parts so they aren't obvious). Use parts that represent the variability normally seen in production.

Next, randomly mix the parts. Appraiser A measures the ten parts while Appraiser B records the measurements and corresponding part numbers. Next, Appraiser B measures and Appraiser A records. Appraiser C (if you use three appraisers) then measures the ten parts. Make sure that you randomly mix the parts before each appraiser measures them. Each appraiser should measure the parts at least two or three times (trials).

> Tip: In Long Form and Short Form gage R&R methods, maintain part number traceability when you record the measurements. For example, record Appraiser A's part #8 measurement next to Appraiser B's part #8 measurement.

In order to use the software correctly, you should gather data for at least two appraisers performing one trial of 2–10 measurements each. If you use one trial of measurements, then the program uses the Short Form method for calculating gage R&R results. This method will **not** divide the R&R results into their AV and EV components.

If the part size is quite large or parts aren't readily available, then use this alternate part measuring sequence:

1. Randomly select the first part to be measured.
2. Let Appraiser A measure and record.
3. Next, Appraiser B and Appraiser C measure the same part.
4. Finally, randomly select another part and repeat this sequence until the appraisers have measured all ten parts.

If the appraisers that you're using work on different shifts, you can use this sequence:

1. Appraiser A measures the parts randomly and someone records the results.
2. Appraiser A re-measures the parts in a different order and records the results.
3. Finally, Appraiser B and Appraiser C measure the parts on their own shifts.

> Tip: If you're using three trials, the appraisers must measure the parts three times.

Analysis

Next, enter the recorded measurements into GAGEtrak for automatic calculation (press the *Calc* button). You can then judge whether your measurement system is adequate. The program marks out-of-control ranges with an asterisk (*). You should re-measure those readings or remove the data and reprint the report.

R&R: %Tol

R&R: %Tol is the percentage tolerance measure of a gage's **repeatability** and **reproducibility**.
In general, the gage acceptability criteria for %R&R is as follows:

- under 10%—acceptable
- 10% to 30%—might be acceptable based on the importance of application, gage cost, repair cost, or other factors
- over 30%—not acceptable; you must identify and correct the problem(s)

AV Tol% and EV Tol%:
AV Tol% is the percentage tolerance measure of appraiser variation (gage reproducibility), and EV Tol% is the percentage tolerance measure of equipment variation (gage repeatability). Viewing these values as components

helps you pinpoint the sources of measurement system error.

If the AV Tol% is large compared to the EV Tol%, it might signify that:

1 the measurement method needs standardization (such as gage or part position)
2 the appraisers need training in method
3 the gage dial or display is not clear

If the EV Tol% is large compared to the AV Tol%, it might signify that:

1 the gage needs maintenance
2 the gage needs more rigidity
3 the location of part to gage should be improved

Total Measurement Variation

You can classify total measurement variation into five categories, which we'll discuss next, including definitions and examples.

1. *Accuracy*—the difference between the average observed measurement and the average true measurement of the same characteristic, on the same part.

   Example: The calipers are off by .001" on all the measurements.
   Gage Accuracy = True Measurement – Observed Avg. Measurement

2. *Linearity*—difference between accuracy values throughout the range of the gage.

   Example: The calipers are off by .001" when closed, but are off by .002" when fully opened.
   Avg. Gage Linearity = Largest Accuracy – Smallest Accuracy

3. *Stability*—the difference in the average of the gage's measurements over time.

   Example: Calipers are subject to wear, deterioration, and environmental changes over time.

If you use the gage infrequently and calibrate it before each use, then you can calculate the stability at the same time as the R&R study. To do this, you must calibrate the gage before and after each trial.

Record the calibration change for each trial (for example, the gage was off by .002" before trial and off by .005" after trial), then calculate the difference between the largest calibration change and smallest calibration change for that trial (.005"- .002" = .003"). The result is the stability for this trial only. Perform this for each of the trials during the study and calculate the gage stability as follows:

$$\text{Gage Stability} = \frac{\text{sum of calibration differences for all trials}}{\text{number of trials}}$$

If you use the gage often and it doesn't need to be calibrated with each use, you can determine gage stability by performing two gage R&R studies. Perform one study after a normally scheduled calibration and a second study just before the next scheduled calibration. Calculate the gage stability as follows:

GageStability =largest grand average of the 2 studies –smallest grand average of the 2 studies

Convert gage accuracy, linearity, and stability each to a percentage of tolerance (multiply by 100 and divide by the total tolerance). Compare the percentages with these guidelines:

- 5% or under—acceptable gaging
- 5% to 10%—may be acceptable, based on application, importance, or repair cost
- over 10%—not acceptable—identify and correct problem

Gage accuracy over 10% might be caused by an error in the master; worn gage parts/components; or measuring the wrong characteristic.

Gage linearity over 10% might be due to the gage not being calibrated throughout operating range; a worn gage; error in masters; or the internal gage design.

Gage stability over 10% could result from infrequent gage calibration; the gage auxiliary equipment needing controls; or a warm-up period being necessary.

Although gage accuracy, linearity, and stability variations are not as dominant as gage repeatability and reproducibility, you can—and should—identify and reduce them.

4. *Repeatability*—the variation in the measurements obtained with a gage when one appraiser uses it several times to measure the same characteristic on the same part.

   Example: The calipers are off randomly due to internal friction, electrical noise, or some other factor (also called precision).

   You can also express this as "Equipment Variation" (EV).

5. *Reproducibility*—variation in the measurement average when several appraisers use the gage to measure the same characteristic on the same part. You can also express this as "Appraiser Variation" (AV).

   Example: Each of the three inspectors gets a different measurement, although each one is measuring the same part.

Other Techniques/References

Other measurement system error evaluation techniques are available, such as Confidence Interval Determination, Control Charting, and Performance Curve Plotting. However, these excellent (but somewhat technical) statistical tools are beyond the intended scope of this manual.

We used the following publications as references in developing Gage R&R Entry; we recommend them to expand your understanding of measurement system evaluations:

AIAG, MSA Measurement Systems Analysis Reference Manual, Automotive Industry Action Group, Southfield, Michigan, 1995 (*highly recommended*—to order a copy, call AIAG at 810-358-3003 and ask for document number "MSA").

DUNCAN, A.J., *Quality Control and Industrial Statistics*, Fourth Ed., Richard D. Irwin, Inc., Homewood, Illinois, 1974.

GRUBBS, F. E., "Errors of Measurement, Precision, Accuracy and the Statistical Comparison of Measuring Instruments", *Technometrics*, Vol. 15, February, 1973.

HICKS, C. R., *Fundamental Concepts in the Design of Experiments*, Holt, Rinehart and Winston, New York, 1973.

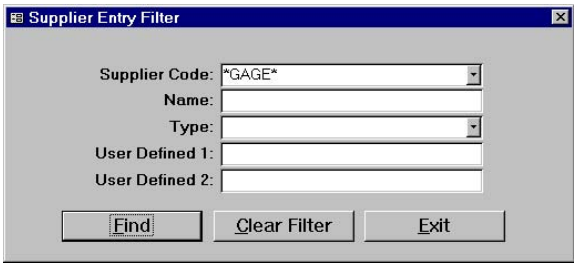
LAZUR, John G., "Measurement Systems Analysis", General Motors publication, March, 1985.

WESTERN ELECTRIC, "Statistical Quality Control Handbook", Select Code 700444, Indianapolis, Indiana.

Chapter 5: Supplier Records

Supplier Entry Filter

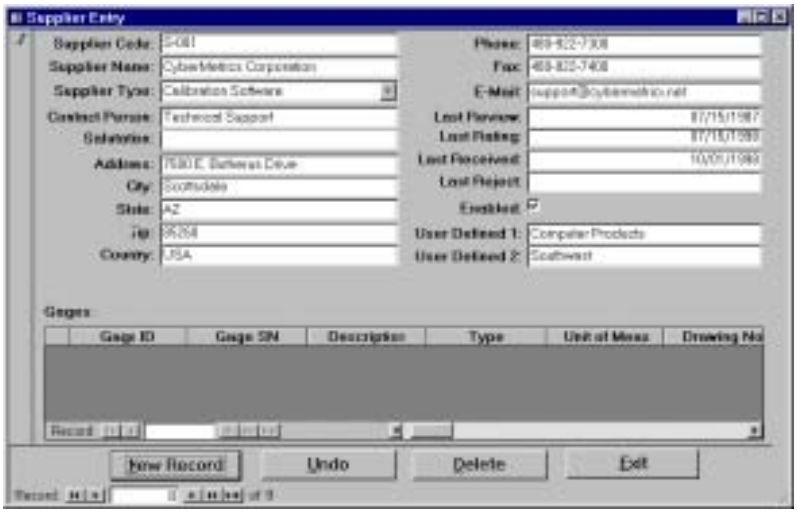
To enter supplier records, select Supplier Entry from the Enter/View Records menu. A filter window will appear; enter any search criteria if you want to open only a certain group of supplier records. Otherwise, leave the filter fields blank, click *Find*, and all supplier records will appear.



In the sample screen, note that the user is looking for all suppliers whose supplier IDs contain the word “gage”.

Supplier Entry

After you click *Find*, the Supplier Entry window will appear. It looks like the one shown below:



Each supplier record contains the following fields:

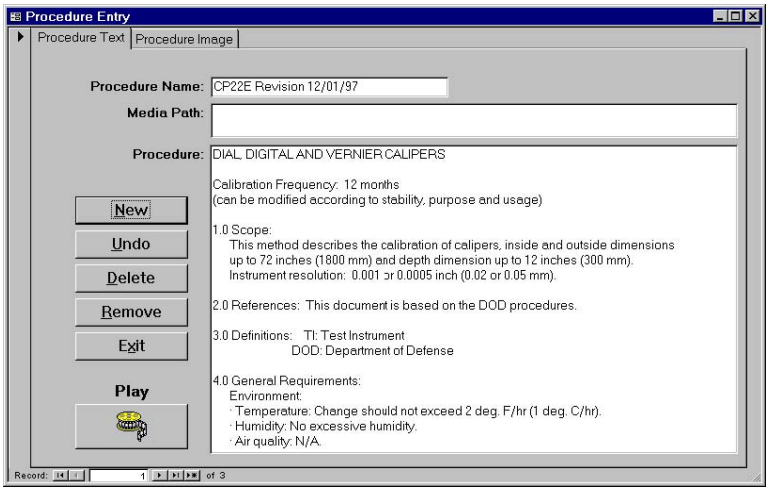
Field/Button Name	Description
Supplier Code	Create a unique supplier ID or code for each supplier, then enter it here.
Supplier Name	In this field, enter the company name of the supplier.
Supplier Type	Use this field to categorize your suppliers by the type(s) of goods they sell.
Contact Person	In this field, enter the name of the contact person at the supplier company.
Salutation	Enter the salutation to use for written correspondence to this supplier (such as Mr., Ms., or Mrs.). Leave this field blank if you don't want to use a salutation (i.e., Joe Smith vs. Mr. Joe Smith).
Address, City, State, Zip, Country, Phone, and *Fax*	In these fields, fill in the complete address of the supplier, including phone and fax numbers.
E-Mail	Use this field to store the contact person's e-mail address.
Last Review and *Last Rating*	In these fields, enter the date of the last quality review and last quality rating for this supplier.
Last Received and *Last Rejected*	Enter the date on which you last received a shipment from the supplier and the date on which you last rejected a shipment from the supplier.
Enabled	Check this box to indicate that the supplier is currently active and approved.
User Defined 1 and *2*	Enter any other information that you wish to track on the supplier. Be sure to use these fields consistently throughout your supplier records.
Gages	This table displays a list of all gages that you purchased from the supplier. It's for viewing only; GAGEtrak automatically updates it when you enter the code in a gage record's *Supplier Code* field.

Chapter 6: Calibration Procedures

When you select **Procedure Entry** from the **Enter/View Records** menu, the **Procedure Entry** window appears. It contains two different tabs: **Procedure Text** and **Procedure Image**.

Procedure Entry–Procedure Text

In this screen, you can copy or enter the text of each procedure.



This screen contains the following fields:

Field/Button Name	Description
Procedure Name	Enter a unique title for each procedure. If you try to create two procedures with the same name, GAGEtrak tells you that you can't have duplicate index values. If this happens, enter a unique procedure name or click *Undo*.
Media Path	To attach a media file (such as a movie or an audio clip) to the procedure, enter the media player path and the media file path into this field (example: C:\WINDOWS\MPLAYER.EXE C:\MOVIES\CALIPER.AVI). *Procedure* In this field, enter the text of the procedure.
New	Click this button to create a new procedure.
Undo	Use this button to remove any changes you've made to the procedure.
Delete	To remove the procedure from all associated gage records and from your database, click *Delete*.
Remove	If you want to keep the procedure in your database, but remove it from your gages,

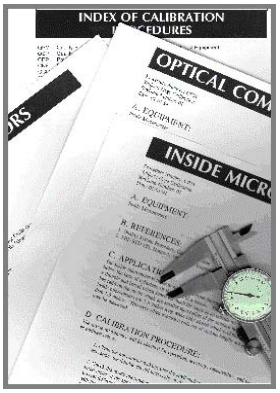
	click *Remove*. This action removes the procedure from all attached gages, but keeps it in Procedure Entry for your reference. If you want to remove a procedure only from a particular gage, go to Gage Entry.
Exit	Click this button to return to the main menu.
Play	To view or listen to any media file that you've attached to this procedure, click the *Play* button.

Copying Procedures from Another Windows Application

You can use Windows Clipboard to copy procedures from other programs. If you want to paste a procedure from the Clipboard:

1. Open the program that contains the procedure you want to copy.
2. Highlight the text, then press CTRL-C to copy it to Windows Clipboard.
3. In GAGEtrak's Procedure screen, first enter a procedure name.
4. Next, click within the *Procedure* body field.
5. Press CTRL-V to paste the procedure. The pasted procedure text will word wrap to fit the region—you might need to adjust it as necessary. GAGEtrak won't paste text formatting, such as fonts or bolding; it will paste just the text.

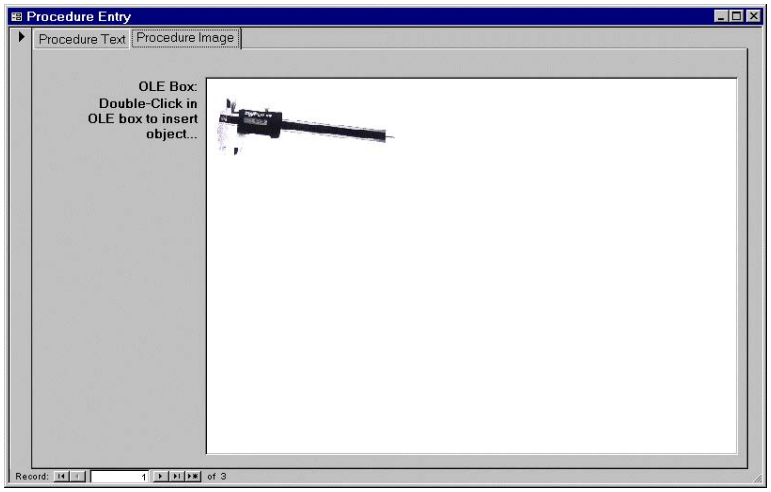
CalPro Calibration Procedures



To help save time when you're entering procedures, CyberMetrics Corporation offers an optional add-on product called CalPro. CalPro is a database of complete step-by-step calibration procedures, covering everything from gage blocks to micrometers and calipers. CalPro procedures are industry-proven, editable procedures that you can automatically import into your GAGEtrak database or use separately as documents. For information about purchasing CalPro, please contact CyberMetrics Corporation or your distributor.

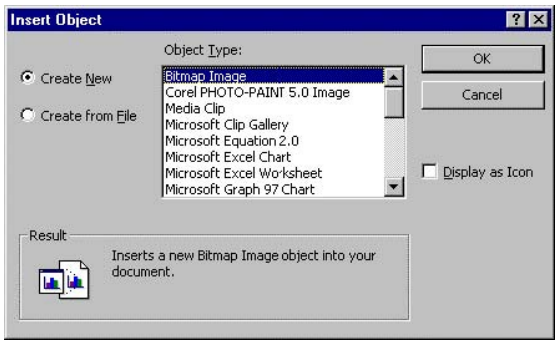
Procedure Entry—Procedure Image

In the Procedure Image screen, you can attach a picture or map to each procedure. To do so, double-click in the *OLE* box.



"OLE" stands for "Object Linking and Embedding". This means that you can link any valid Windows object (such as a graph, picture, or digitized movie) into this field. When you double-click in the *OLE* field, the Insert Object box appears, and you can select the program in which you created (or will create) the object.

Note: The list of object types varies, depending on which programs are on your computer.

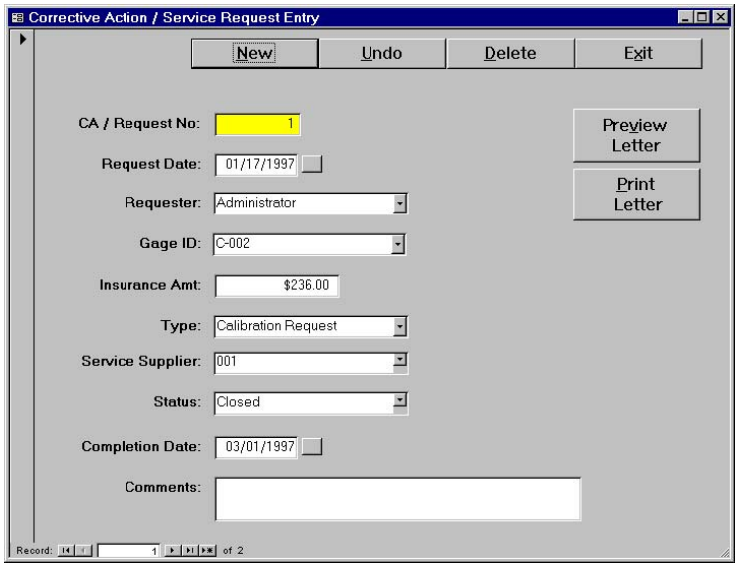


Use the scroll bar to select the type of object that you want to link, then click *OK*. When you select an object type, the program in which you created the object opens so that you can edit the image (if necessary). When you're finished, just click inside the object to insert it and return to Procedure Entry.

Chapter 7: Service Requests

You can use Service Request Entry to track and print service requests for both in-house and outside service providers. More importantly, you can use it to document, track, and report on corrective actions that you've issued for failed or malfunctioning gages.

Select Service Request Entry from the Enter/View Records menu, and the main entry screen will appear.



Field/Button Name	Description
CA/Request No.	This field automatically generates a number to track your requests.
Request Date	Enter the date or click the small button on the right of this field to automatically enter today's date.
Requester	Select or enter the name of person requesting service.
Gage ID	Choose the ID of the gage for which you need service.
Insurance Amount	Enter the amount for which you want to insure the device (use for return freight insurance if you're sending the device out for repair or calibration).
Type	Select the type of the document to use (such as Calibration, Repair, Calibration & Repair, or Corrective Action Notice). For directions on adding new documents and editing service request letters or corrective action request forms, see your *System Administrator's Guide*.
Service Supplier	Select the supplier code of the service provider (this might also be a department within your own company).
Status	Mark the service request as either Open or Closed.
Completion Date	Enter the date on which the service was completed. You can use the small button to the right of this field to automatically enter today's date.

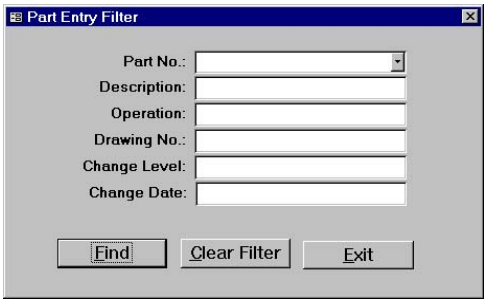
Comments	In this field, enter any notes about this request.
New	Click this button to add a new letter.
Exit	When you're finished, click the *Exit* button to return to the main menu.
Undo	To remove any changes you've made to the current letter, click this button.
Delete	Use this button to delete the service request or corrective action letter.
Preview Letter	To view the letter currently linked to this record, click *Preview Letter*.
Print Letter	Click the *Print Letter* button to print the letter associated with this record.

Chapter 8: Part Records

Use Part Entry to track parts and set up lists of gage requirements (lists of gages that you need to inspect parts as you produce them).

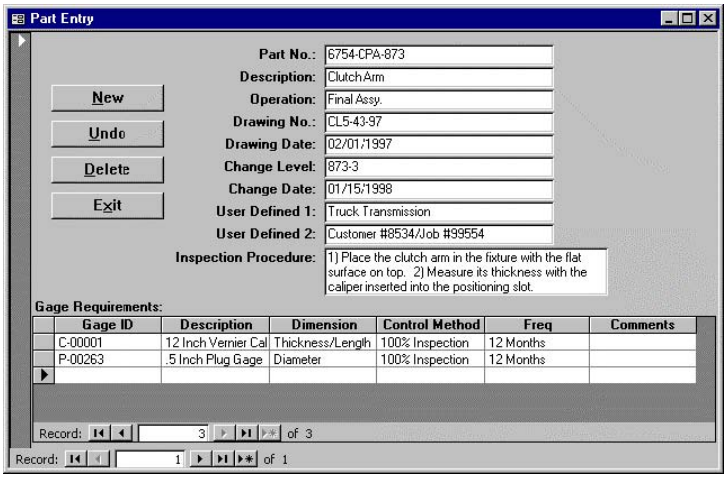
Part Entry Filter

From the Enter/View Records menu, select Part Entry. This filter window will appear:



Use the filter to select a specific record or group of records. If you want to find all of your part records, leave the filter blank. After you've entered any of the optional filters, click the *Find* button. The Part Entry window will appear.

Part Entry



Field/Button Name	Description
Part No.	In this field, enter the number of the part (use either the customer's or your
Description	Enter the name of the part or a description that includes the name.
Operation	Use this field to track the production operation or work center description that uses or installs the part (such as "Stamping" or "Machine 13").
Drawing No. and *Drawing Date*	Use these fields to record the blueprint drawing number and drawing date.
Change Level and *Change Date*	In these fields, enter the blueprint change level (also called engineering change level) and the change date.
User Defined 1 and *2*	Use these fields to track additional information on the part.
Inspection Procedure	Enter instructions for checking the part.

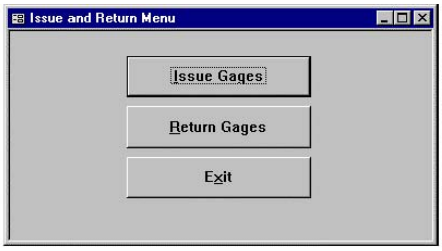
Gage Requirements

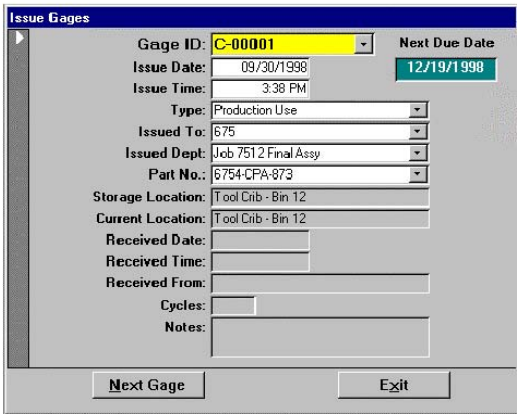
Field/Button Name	Description
Gage ID	Select the gage ID of the gage you will use to inspect the part.
Dimension	In this field, enter the dimension or characteristic that you will check with the gage.
Control Method	Enter the control method, such as "Inspection Sheet" or "Control Chart".
Freq.	Specify how frequently you will inspect the part with this gage (such as "5 per Shift" or "10 per Day").
Comments	Record any notes about the dimension or characteristic that you're checking.

Chapter 9: Gage Issue and Return (Batch Mode)

You can issue and return gages one-at-a-time via Gage Entry (click the *Issue/Return* button to open Issue Tracking Entry). For higher-volume, batch-mode processing of gage issues and returns, use Gage Issue and Return. Intended for use in a gage or tool crib, this feature was designed for bar-coded data entry, but will also work with manual keyboard entry.

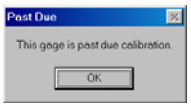
Select Gage Issue and Return from the Enter/View Records menu. Another menu will appear; click either *Issue Gages* or *Return Gages* to open an entry screen.





Gage Issue

The Gage Issue fields are as follows:

Field/Button Name	Description
Gage ID	Select the ID of the gage.
Issue Date and *Issue Time*	These fields track the date and time at which you issued the gage—they're prefilled with the current date and time.
Type	Choose the type of issue; this field creates a self-building list as you enter different descriptions.
Issued To	Enter the name of the person to whom you issued the gage.
Issued Dept.	Select the department or job number that will be using the gage.
Part No. Next Gage Exit	This field tracks the part or group of parts that you'll measure with the gage. If you have other gages to issue, click this button to issue the gage. Click the *Exit* button to save the record and exit the screen.
Next Due Date	Issue Gages will create a predicted *Next Due Date* when you issue out a gage that has a usage frequency. If the gage is due for calibration, this message will appear beneath the date: 

Gage Return

The Gage Return fields are as follows:

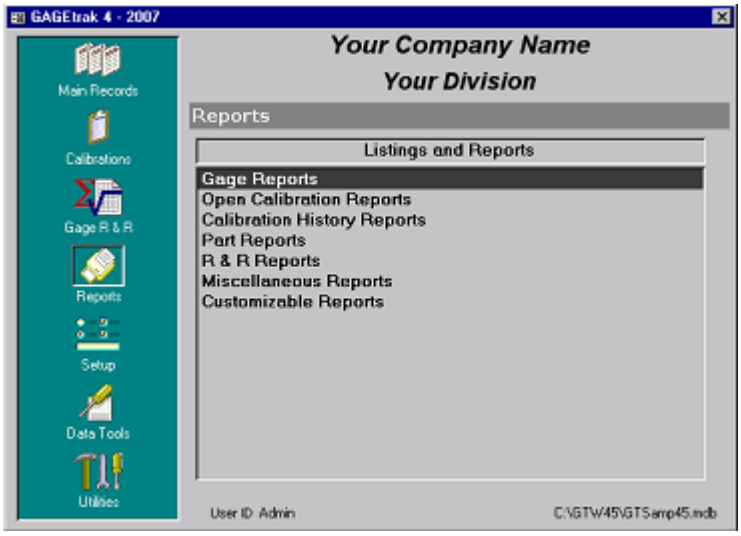
Field/Button Name	Description
Gage ID	Select the ID to return.
Received Date	These fields show the date and time at which you received the gage–they're and *Received Time* prefilled with the current date and time.
Received From	In this field, enter the name of the person that returned the gage.
Cycles	Enter the number of cycles used or parts measured by the gage. GAGEtrak adds this value to any previous cycles for the gage, then uses that value to calculate the *Next Due Date* for gages that you calibrate according to cycles.
Notes	Record any important comments, such as damages or malfunctions.
Next Gage	If you have other gages to return, click *Next Gage* to process the record.
Exit	When you're finished, click the *Exit* button to return to the main menu.

GAGEtrak uses the following rules to manage Issue Tracking records:

1. When you issue a gage, GAGEtrak inserts the current date and time as the issue date and time. It also changes the gage's *Current Location* field to a description that consists of *Issued To* plus *Issued Dept.* (for example, "675/Job 7512 Final Assy").
2. GAGEtrak assumes you want to return a gage if its current record is incomplete. After you enter the *Received Date* and *Time* and save the record, GAGEtrak changes the gage's *Current Location* field to its storage location

Chapter 10: Reports

GAGEtrak includes a large variety of standard reports. To generate reports, go to the main menu and select the Listings and Reports menu.



Like some of the entry screens, each report starts with a filter window that allows you to select a specific group of records for the report. Most reports also let you select the sort order (click the appropriate sort button in the filter). Some reports, such as the Calibration Due Listing report, are time-based; you can specify the date range you need to see. All reports were designed using standard Windows True Type fonts.

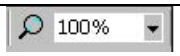
Report Commands and Functions

Viewing Reports

You can preview any report by clicking the *View* button in the filter. After the report appears, you can use the scroll bars to look at different parts of it. Use the navigation buttons to go to other pages of the report. To zoom in or out of the report, click anywhere in the body of the report.

Report Preview Toolbar

GAGEtrak's Report toolbar contains common commands that you can use for reports. Each toolbar button is described below.

Button	Description
 *Print*	Click this button to print the report.
 *Send*	To e-mail the current report, click this button.
 *Zoom*	If you need to see a close-up or an overview of the report, click the magnifying glass to zoom in or out of the report. You can also select a specific percentage value for magnification.
 *Close*	When you're finished, click this button to close the report.

Print Preview Keyboard Shortcuts

Press	To
P	Print the report
S	Open the Setup dialog box
Z	Zoom in (or out) for a magnified view of part of the page
C or ESC	Cancel Print Preview

To view different pages in Print Preview when zoomed-out:

F5	Go to the page number box (enter the page number you want to see and press ENTER)
PAGE DOWN or DOWN ARROW	Move to the next page (when zoomed out)
END	Move to the last page
PAGE UP or UP ARROW	Go to the previous page (when zoomed out)
HOME	Move to the first page

To view different parts of the current page using the zoomed-in feature:

DOWN ARROW	Scroll down in small increments
PAGE DOWN	Scroll down in large increments
CTRL DOWN ARROW	Go to the bottom of the page
UP ARROW	Scroll up in small increments
PAGE UP	Scroll up in large increments
CTRL+UP ARROW	Move to the top of the page
RIGHT ARROW	Scroll to the right in small increments
CTRL RIGHT ARROW or END	Go to the right edge of the page
CTRL+END	Move to the lower-right corner of the page
LEFT ARROW	Scroll to the left in small increments
CTRL+LEFT ARROW or HOME	Move to the left edge of the page
CTRL+HOME	Go to the upper-left corner of the page

Output To

The Output To command from the File menu allows you to transmit reports to a text file, Microsoft .RTF file, .HTML, or Microsoft Excel spreadsheet file. If you save a file in .RTF format and then open that file in a word processing application, such as Microsoft Word, your data will have the appearance and formatting of the GAGEtrak report that you exported. If you output to a text file, all of the data will be present, but the formatting will be lost. Output to an Excel spreadsheet is the best option to select when you wish to export a report created from Datasheet view (see page 131), such as the Customizable Gage Report or Customizable Calibration Report (see the description for these reports under *Report Descriptions*).

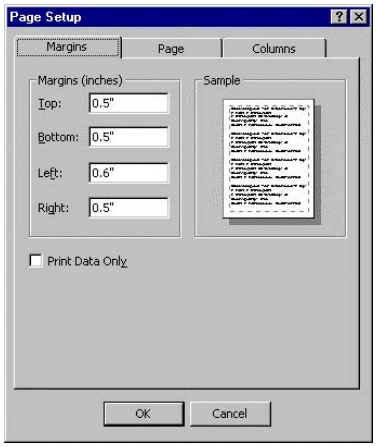
Send

The Send command from the File menu allows you to output reports to Microsoft Mail (or any MAPI compatible mail program). The output includes subforms and subreports. The file format and appearances are the same as those described above for the Output To command.

Print Setup

Select Print Setup from the File menu if you want to change report settings, such as orientation (*Portrait* or *Landscape*) or margins.

Some options are controlled by the type of printer and Windows printer driver that you have, but a typical setup window looks like this:



Tip: To save paper and time, first view the report on-screen and then adjust the print setup values. You'll see any changes on-screen after you click the *OK* button. When you close the report window, the program will save the new settings.

Report Descriptions

This table contains a description of each report, including special filtering options.

Report	Description
Gage Listing	To generate a list of gages, use this report. You can include calibration standards or procedures and sort the list in several different ways.
Gage Detail Report	Use this report to see a comprehensive gage report, including record details.
Gage Status Report	To create a list of your gages sorted by status, choose this report.
Calibration Due Listing	This report lists gages that are due for calibration during the time period you specify. You can sort the list by several different fields, such as *Gage ID*. Check the *Calibration Stds.* box to include the standards table for each gage. To see past due calibrations, check the *Include Past Due* box. Check *Include Details* to include additional calibration information for each gage. Important: The Calibration Due Listing report lists only gages that you assigned as *Active* (status ID 1) in Gage Entry.
Calibration Schedule	If you have a large gage inventory with a variety of calibration frequencies, it's difficult to plan your workload. This powerful report makes this task easier by helping you predict calibrations that are due during a specific time frame. It builds a temporary schedule for each gage and then summarizes the findings, taking your skip days/dates into account. Use this report as a labor and cost-planning tool. After you enter any filter values, click the *Generate* button to generate the schedule. Tip: Don't use too wide of a date range, such as a 10-year span, as it can take a long time to generate. If the schedule takes too long, press CTRL-BREAK to stop it, then try a smaller date range. **Schedule report options include:** *Include days with no activity*—If you want your report to include *complete time frames*, check this box to include days on which calibrations aren't scheduled. For example, suppose you wanted to create a schedule for January through March, and no calibrations were due in February. If you left this box un-checked, your report would show January and March, but not February. If you checked this box, the report would include February. *Default Hours*—GAGEtrak uses this value for gages that don't have an estimated calibration length (i.e., their *Calibration Hours* fields are blank). For example, if you enter 0.5, GAGEtrak assigns a half-hour of time only to those gages. If you entered *Calibration Hours* for your gages, leave this field blank. *Schedule Type*—Use this field to select how to summarize your schedule–by day, week, month, quarter, or year. Select *By Day With Details* for a comprehensive listing. Tip: You can print more than one schedule type without having to re-generate the schedule each time.
Calibration Work Order	Use these forms to gather calibration data and document work assignments *Work Order* for your personnel.
Certificate of Calibration	Calibration certificates prove that you've performed the proper calibrations and that the procedures used meet/exceed certain minimum requirements. GAGEtrak retrieves the certificate information from Calibration Entry. You can update only three fields in the report screen: *Customer Information*, *Statement*, and *Format*. If you need to add or edit other information, go to Calibration Entry. *Customer Information*—Enter what you want to print on the certificate. This might include the customer's company name, contact name, address, telephone number, or other important information. *Statement*—You can edit the calibration statement for each certificate. Any changes you make to the calibration statement apply only to that record. If you want to change all

	future calibration statements, go to Settings— Calibration Options (see the *System Administrator's Guide*). *Format*—Use the drop-down list box to select the format for the standards and measurements that you used to calibrate the gage.
Calibration Costs and Labor Report	Use this report to track your calibration costs for each gage.
Calibration Labels (Batch)	You must have the optional Calibration Label Kit to print labels. You can print a batch of calibration labels based upon the calibration date, gage ID, location, or description for any existing calibration records. Tip: Use this report to print your calibration labels at the end of the day in one batch. This method eliminates the blank waste tape that prints for each label you print from Calibration Entry. You'll still get an initial piece of waste tape, but after that, the printer adjacently ejects and cuts your labels. To preview a label, check the *Preview* box and click the label button. To print a label, clear the *Preview* box, then click the label button. Be sure to install the appropriate label tape in your printer.
Calibration History	To see a list of calibration history, select this report. Enter the dates for the time frame in question along with any other filters. Check the *Calibration Meas.* box to include the table of calibration measurements.
Standards Traceability Report	Use this report to provide traceability for your calibration and reference standards.
R&R Due Listing	This report lists gages that are due for R&R studies.
Gage Issue History Report	For a complete list of gage issue history, use this report.
Supplier Listing	This report lists your suppliers. Check *Enabled* to see only active suppliers. To see both active and inactive suppliers, click *Clear Filter* (the *Enabled* field will become a gray box).
Procedure Listing	To see a list of calibration procedures, choose this report. Check the *Summary Listing By Gage ID* box to include the gages linked to each procedure.
Corrective Action/ Request	Use this report for a list of open corrective action or service requests. For each request, the report lists the date, supplier, requester, and gage ID.
Part Listing	This report lists parts, including descriptions and uses. Check one of the *Summary Listing* options to show parts or gages that you use together. To print gage requirement sheets, check *Gage Requirement Listing By Part*.
Customizable Gage Report and *Customizable Calibration Report*	These reports show you Datasheet views of your gage or calibration records. Use them to change the way your tables look (such as font style or column size) and format lists of records. Please note that you cannot change any of the actual data in these reports—just the formatting.

Chapter 11: Program Conventions

To save time and ensure consistency, GAGEtrak uses a set of program conventions, which are standard commands and design elements that make the different windows and forms operate in the same way. You can use these conventions to navigate through, add, edit, and delete records. Other conventions help you retrieve and print records. Shortcut keys help you save data entry time and avoid mistakes. You should become familiar with these conventions before you begin using GAGEtrak.

Rather than repeating the same information in every section of this manual, we discuss these conventions only in this section. You'll find record-specific information, such as each record's individual purpose, fields, and special buttons in the parts of this manual that discuss specific record types.

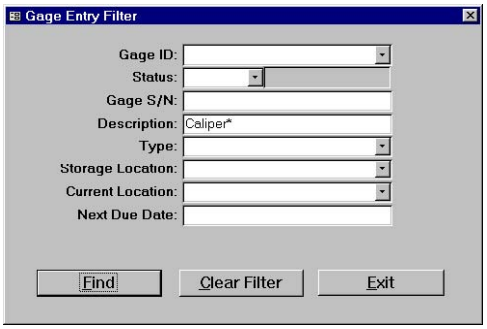
GAGEtrak Help

Go to the Help menu or press the F1 key to open GAGEtrak's on-line Help. Select a topic from the Contents or use the Search function to browse an alphabetical list of topics. Use the *Back* button and *History* listing to return to recent topics. Click *Print* to print any Help topic.

Record Filter Windows

Some entry screens and reports open with filter windows that you can use to select a *subset* of records that match the criteria you enter. This may not seem useful at first, but you will appreciate this feature later when you have hundreds or thousands of records from which to select.

Sample Filter Window



Accessing All Records

If you want to open *all* of your records, leave the filter fields blank and just click the *Find* button.

Accessing Certain Records

To access only certain records, you can use wildcard characters (optional). For example, you might want to edit gage records that have descriptions *exactly equal* to "Caliper". In this case, enter Caliper in the *Description* field in the Gage Entry filter.

In the same way, if you want to find gage records with descriptions that *start with* "Caliper"–such as "Caliper 6-inch" and "Caliper Digital"– then enter Caliper* in the filter (as shown above). The asterisk (*) is a wildcard character that indicates, in this example, that you want all gage records that have a description *starting* with the word "Caliper".

Likewise, if you enter *Caliper, it tells the program that you want all gage records with descriptions *ending* in the word "Caliper" (such as "4-inch Caliper"). Furthermore, if you enter *Caliper*, it tells the program that you want all gage records with descriptions *containing* the word "Caliper" ("4-inch Caliper" *and* "Caliper Digital"). You can specify as many filter fields as you need, depending on how selective you want to be. After you enter any filter values, click the *Find* button to view the filtered recordset. To remove any filter information, click the *Clear Filter* button.

Supported Wildcard Characters in Search Fields

The asterisk (*), question mark (?), number sign (#), exclamation point (!), hyphen (-), and brackets ([ ]) are all wildcard characters. You can use them in record filters and in Find/Replace commands to include all records that begin with specific characters or match a certain pattern.

Wildcard Character	If You Enter	GAGEtrak Finds
*	wh*	*what*, *white*, and *why*; works like MS-DOS commands
*	*at	*cat*, *bat*, and *what*
*	*/*/94	records with any date in 1994
*	11/*/*	records with any date in the month of November
?	b?ll	*ball*, *bell*, and *bill*; this symbol matches any single character
#	1#3	*103*, *113*, *123*; matches any single digit (not for use with date fields—use asterisk (*) instead)
[ ]	b[ae]ll	*ball* and *bell*, but not *bill*; matches any single character within the brackets Tip: Because it allows a literal search on wildcard characters, this character helps you find records that *contain* wildcard characters; for example, to find "Machine #1", you would enter Machine [#]1(*#* is another wildcard character).
!	b[!ae]ll	*bill* and *bull*, but not *bell*; matches any character not in the list between the brackets
-	b[a-c]d	*bad*, *bbd*, and *bcd*; matches any one of a range of characters

Floating Toolbar

In GAGEtrak, you can access common program functions from a floating toolbar that appears in all entry screens. If you don't want the toolbar to appear, you can disable it through GAGEtrak's Settings screen (see the *System Administrator's Guide* for more information).

Shown in Horizontal Mode

Repositioning the Toolbar:
To move the toolbar, click its title bar and drag it to its new location.
Resizing the Toolbar:
Click one of the edges of the toolbar and drag it to the desired size.

Button	Description
Form View	Click this button to display your records in Form view (the default presentation of your records). In Form view, you can see all of the fields for a record, but you can see only one record at a time.
Table View	To display your records in a tabular format, click this button. Table views allow you to view many records at a time (available only in certain record entry screens).
Find	Use this command to search for specific information. Place your cursor in the field containing the category by which you want to search, then click this button. The Find window opens, and you can enter the information that you want to locate.
Find Next	After you've closed the Find window, click the *Find Next* button to locate the next instance of the information for which you're searching.
Replace	Place your cursor in the field containing the information you want to replace. The Replace window will prompt you for *Find What* and *Replace With*. You can replace any or all occurrences of the same information.
Filter Records	Use this button to re-open the filter window for the record window. You can then filter for a group of records that match the criteria you enter.
Sort Ascending	Select this button to sort all of your records in ascending order (numbers show before letters).
Sort Descending	Click this button to sort all of your records in descending order (numbers show after letters).
Undo	If you need to remove any changes to the current record, click this button.
New Record	Use this button to enter a new record.

Pop-Up Calendar for Date Fields

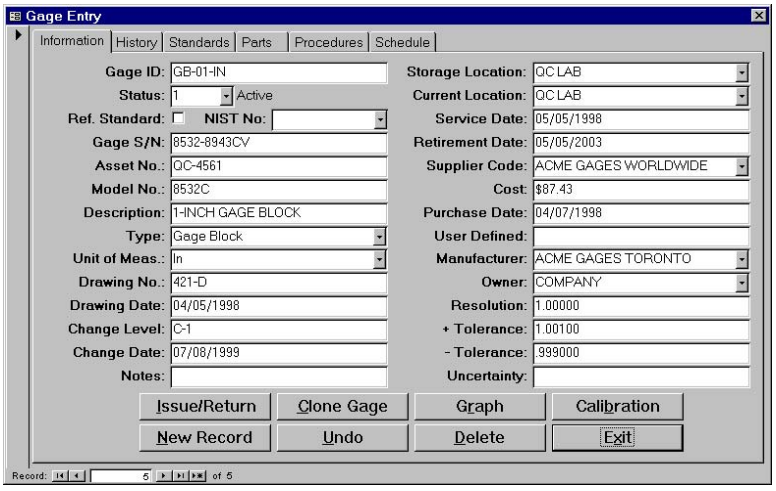
You can enter dates by choosing them from a pop-up calendar instead of manually typing them. Whenever you're entering information in a filter or data entry screen, double-click on any date field to view the calendar (this works only in date fields). When the calendar first appears, it displays the current date. To select another date, click the up or down arrow buttons to scroll to the desired month and year, then click the day of the month. Click the *OK* button to accept the date; click the *Cancel* button to close the calendar without selecting a date.

Form Views of Records

After you click *Find* in a filter window, GAGEtrak looks through your database and opens the first record in the set, displaying it in Form view. Form views of records show you only one record at a time, while Table (or "Datasheet") views display many records at a time (each row represents a record, and many rows (records) are displayed at once).

Form view is the default presentation of your data (use the toolbar or the View menu to switch between Form and Datasheet views).

Sample Form View of a Gage Record



Elements of a Record Form

All record forms have the following elements:

Form Title Bar

Located at the top of each form, the title bar shows the form's name ("Gage Entry" in the above example). Click the title bar to drag the form to a new location.

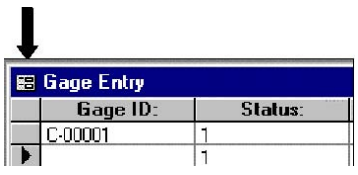
Menu Bar

Located above the title bar, the menu bar usually has menus for File, Edit, View, Records, and Help. Click on a menu title, and a list of commands will appear. Some items may not be available (they appear gray). If commands are unavailable, you can't use them in Form view.

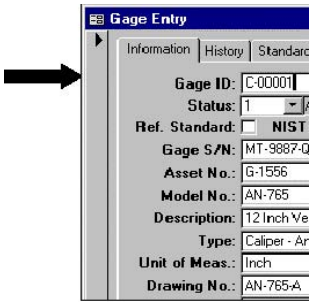
Control Menu Icon

Click on this icon, located to the left of the name on the title bar, to change the window's size and location. Double-click on it to close the window.

Control Menu Icon from Gage Entry Screen



Record Selector Bar



You can use the record selector bar, a tall rectangular bar located on the left side of the form, to select the entire record for copying or deletion. You can also use it to save any changes made to the record–if you change anything, an icon of a pencil appears on the bar; click on the bar to write your changes to the database.

Record Selector Bar Symbols

 Current Record

 New Record

 Record changed but not saved yet

 Record locked and in use by another user

Navigation Buttons

Use the navigation buttons (located at the bottom left corner of the form) to move through your records. Each of the four buttons has an arrow on it that indicates its navigation direction:

 First Record

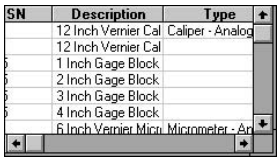
 Next Record

 Previous Record

 Last Record

Record: Allows you to type in the record number that you want to go to. Example: If you have 250 records and you want to go to the sixteenth record, enter 16 in the *Record* box, then press ENTER to go to that record.

Scroll Bars



You might see scroll bars on the right, the bottom, or both sides of a form. Use them to go to portions of the form that you can't see.

Tab Selectors

Each tab selector contains an entry screen that stores a specific category of information. In each tab, you can edit or view information for the current record. The tabs shown above are available in Gage Entry.

Maximize/Minimize/Restore/Close Buttons

 Minimize Button

 Restore Button

 Maximize Button

 Close Button

Use these buttons, located in the upper right corner of the form, to maximize the form's size to the largest size allowed or to minimize the form to an icon. If you maximize the form, then the *Maximize* button changes to the *Restore* button. Click this button to return the window to its original size.

List Box Buttons

List box buttons indicate that a field has a list of items available from which you can choose. When you click the button, it presents the list in a scrollable box. Click on any item in the list to select it.

Example of a list box button:

Datasheet (Table) Views of Records

Datasheet (also called Table) views allow you to see many records at once. Because of this, they can be a more efficient interface for adding or modifying your records. Table views operate like spreadsheet programs. Each row represents a record, and each column represents a field. In Table view, you can add, change, and view records. This format offers more flexibility in that you can resize column widths and row heights; rearrange column positions; and even hide columns. One drawback of Datasheet views, however, is that they cannot display the related records in an *embedded table* (for example, the Table view of gage records contains an embedded table of calibration standards for that gage—you can't see both the gage record and a table of calibration standards at the same time).

Since the program automatically presents records in Form view, you must manually switch to Table view (use the toolbar button or select Datasheet View from the View menu).

Sample Datasheet View of Gage Records

Gage Entry

Gage ID:	Status:	Description:	Type:
022E Digital Caliper 0-6	1	Caliper 0-6 inch	Digital
1230193	1	Digital Indicator	Digital/Variable
3862C-002	1	Temp. Controllar	Digital/Variable
9128M81-40	1	2.344" Height Block Set	Height Block
9128M81-80	1	2.375" Height Block Set	Height Block
A1230196	1	Digital Scale	Digital/Variable
C-002	1	CALIPER-DIAL 12-INCH	DIAL
COMPARATOR	1	14" Kodak Optical Comparator	Comparator
CTG002	1	SUNDSTRAND THREAD GAGE	GO NO GO
DB-S/N 1	1	.0001" NO. 3 Dial Bore	Bore Gage
DI04	1	MITUTOYO .0001" ELEC DROP IND	DROP INDICATOR
DM-00002	1	Digital Micrometers	Digital\Variable
FG09	1	FEELER GAGE (PERSONAL)	FEELER GAGE SET
FG25169	1	0-200 LB'S DICITAL FORCE GAUGE	DIGITAL FORCE GAUGE
FIX143	2	OLIN WING SPAN GAGE .848-.010"	FIXTURE
FM147	1	0.0-1.50 GPM (LIQUID) FLOWMETER	FLOWMETER
FMM-00003	1	Multimeter	Digital/Variable
GNG-00013	1	Go/NoGo Pin Gage	Attribute
GNG124	1	SMW01 GO/NOGO .051/.055	PLUG GAGE
GNG125	1	SMW01 GO/NOGO .052/.055	PLUG GAGE
L44565-20	1	.028" Step Gace	Step Gage
MSGB1	2	GAGE BLOCK SET, 81 PC	GAGE BLOCK(S)
MSM12	1	1-2" OD MIC. .0001 MITUTOYO	MICROMETER
MSM23	1	2-3" OD MIC. .0001 MITUTOYO	MICROMETER
MSM34	1	3-4" OD MIC. .0001 MITUTOYO	MICROMETER
MSM45	1	4-5" OD MIC. .0001 MITUTOYO	MICROMETER

Record: 1 of 52

Elements of a Table View Window

All Table view windows have the following elements:

Title Bar

Located at the top of each table, the title bar contains the table's name ("Gage Entry" in the above example). Click the title bar to drag the table window to a new location.

Menu Bar

The menu bar, located above the title bar, typically has menus for File, Edit, View, and Help. To select a menu, click on the menu title, and a list of menu commands will appear. Some menu items may not be available (they will appear gray).

Control Menu Icon

Click on this icon, located to the left of the title bar, to change the table window's size and location. You can also use it close the window.

Record Selector Buttons

Record selector buttons are small rectangular buttons located on the far left side of each row. Use them to select the entire record for copying or deletion. You can also use them to store any changes made to the record—if you change any fields, an icon of a pencil will appear on the button; click on the button to write your changes to the database.

You can select multiple records by clicking and dragging your mouse pointer over the desired records. To select all records between two records, first click on the first record, then hold the SHIFT key while you click on the last record. This operation selects all records between the first and last records. A selector button that has an asterisk (*) on it indicates that a row is a new record position (it will always be located at the bottom of the table).

Record Selector Bar Symbols


Current Record


New Record

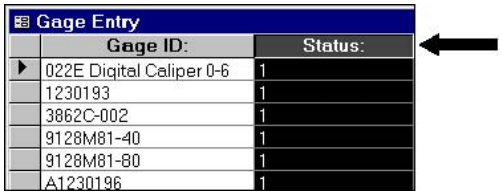

Record changed but not saved yet


Record locked and in use by another user

All Records Selection Button

This small square button is located on the upper left portion of the table, just below the control menu icon. Click it to select *all* records in the table.

Column (Field) Selector Buttons



These small rectangular buttons are located at the *top* of each column. Each button contains the name of the field that it represents ("*Gage ID*" and "*Status*" in the above example). When you click on one of these buttons, you select the entire column (like the *Status* column shown above). You can then work with it as a whole. For example, click the column selector button to select a column that you want to move or hide.

Note: You cannot move the contents of one column to another column.

Navigation Buttons

Use the navigation buttons (located in the bottom left corner of the window) to move through the records in the table. Each of the buttons has an arrow on it that indicates its navigation direction.

 First Record

 Next Record

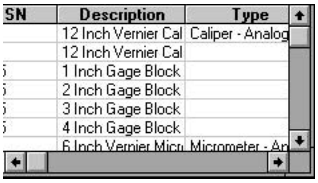
 Previous Record

 Last Record

Record: Allows you to type in the record number that you want to go to.

Example: If you have 250 records and you want to go to the sixteenth record, enter 16 in the *Record* box, then press ENTER to go to that record.

Scroll Bars



You might see scroll bars on the right, the bottom, or both sides of the table. Use the vertical (up/down) scroll bars to scroll to different records. Use the horizontal (left/right) scroll bars to scroll to portions of the table that you can't see.

Maximize/Minimize/Restore/Close Buttons

Use these buttons, located in the upper right corner of the table, to maximize the table's size to the largest size allowed or to minimize it to an icon. If you maximize the table, the *Restore* button is visible. Click the *Restore* button to return the table back to original size.

Saving Table View Changes

While in an entry screen, you can't save any changes you make to table attributes, such as column widths, displayed/hidden columns, column locations, gridlines, and fonts. If you want to save any of these changes in your gage or calibration records, use the Customizable Gage Report or Customizable Calibration Report (both available form the Listings and Reports menu). Each of these reports shows you a Datasheet view of your records; you can follow the instructions given in this section to format your reports. However, you cannot change any record data when using the customizable reports. For more information about these reports, please see "Customizable Gage Report and Customizable Calibration Report" under the *Report Descriptions* section..

Printing Tables of Records

You can print records in both Table and Form views. To do so, select Print from the File menu. You can also select Print Setup and Print Preview from the File menu. These commands, combined with the Filter/Sort command, will be useful when you're designing customized reports.

Hiding and Displaying Columns

You can temporarily hide columns while in Table view. This feature helps you remove nonessential data from the screen and reduce the report's width when you're designing a custom report.

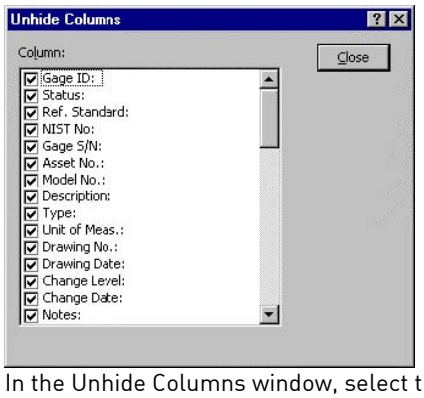
To Hide Columns

1. Go to the column you want to hide and click anywhere in it or click its field selector button (located at the top of the column). To hide multiple columns, drag across the field selectors.

2. From the Format menu, choose Hide Current Column.

To Display Hidden Columns

1. From the Format menu, choose Show/Hide All Columns.



2. In the Unhide Columns window, select the column you want to show.
3. When you've selected all the columns you want, click *Close*.

Hiding and Displaying Gridlines

By default, the program shows gridlines around each cell in Table view. You can hide the gridlines by choosing Gridlines from the Format menu (remove the checkmark, which indicates that gridlines are active).

Changing the Row Height

To adjust the height of all rows in a table, choose Format | Row Height.

Changing the Column Width

Choose Column Width from the Format menu to adjust the width of selected columns in a datasheet.

To Freeze Columns

To prevent columns from moving off the screen, choose Format | Freeze Columns to freeze selected columns on the left side of the window. If you haven't selected any columns when you choose this command, the program freezes the column that your cursor is in. GAGEtrak adds new frozen columns to the right of existing frozen columns. A bold line separates the frozen and unfrozen columns.

To Unfreeze Columns

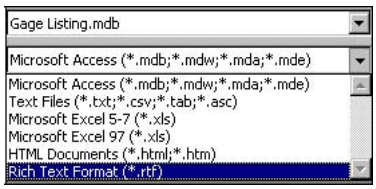
To release frozen columns, choose Format | Unfreeze Columns. When you unfreeze columns, they remain in the same order they were in while frozen. You can't unfreeze specific columns; you can only release all frozen columns at once.

Other Commands and Functions

Output To Command

The Output To command from the File menu allows you to transmit reports to a text file, Microsoft .RTF file, .HTML, or Microsoft Excel spreadsheet file. If you save a file in .RTF format and then open that file in a word processing application, such as Microsoft Word, your data will have the appearance and formatting of the GAGEtrak report that you exported. If you output to a text file, all of the data will be present, but the formatting will be lost. Output to an Excel spreadsheet is the best option to select when you wish to export a report created from Datasheet view, such as the Customizable Gage Report or Customizable Calibration Report (see the description for these reports under *Report Descriptions*.

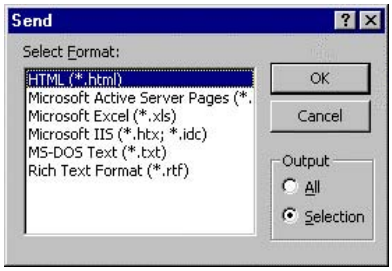
The following is an example of the output options for the Gage Listing report:



Send Command (E-mail Reports)

The Send command from the File menu allows you to output reports to Microsoft Mail (or any MAPI compatible mail program). The output includes subforms and subreports. The file format and appearances are the same as those described above for the Output To command.

You can send GAGEtrak information in the following formats:



Select Record Command

Use the Select Record command from the Edit menu to select (highlight) the current record, which allows you to work with it as a whole. For example, you can select a record you want to copy to the Clipboard.

Select All Records Command

You can use the Select All Records command from the Edit menu to select (highlight) all open records so that you can work with them as a group. For example, you can select all the records in one table and copy them to a spreadsheet or word processing document.

Find Command

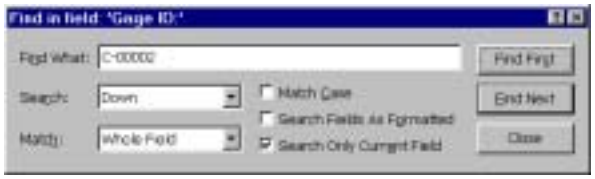
While you're in Form view or Table view, you can use Edit | Find to search through your records for specific information. For example, you could search the database for gages located in a certain department or for gages you purchased last year.

You can search for any text string, including a phrase, a word, or part of a word. You can also use wildcard characters to make the search more general. For faster searches, search for the first few characters within a single field.

The Find box remains open during searches, so you can find as many records as you want without repeatedly selecting the Find command. If necessary, drag the Find box out of the way so that you can see your records.

To Find Data:

1. Display the table or form for the records you want to search.
2. Select the field (column) in which you want to search, unless you want to search in all fields. However, remember that searching a single field is faster than searching in all fields.
3. From the Edit menu, choose Find. The Find window appears.



4 In the *Find What* box, type the text you want to find. Use wildcard characters (such as "*"and "?") to make your search more general.

5 Set other Find dialog box options, if necessary.

6 To find the first occurrence of the text, choose the *Find First* button. To find the next occurrence of the text, click *Find Next*.

7 When you're finished, click the *Close* button.

Replace Command

While you're in either Form or Table view, the Replace command is available via the Edit menu. Within a database table, you can search for and replace all or some occurrences of a specified text string, including a phrase, a word, or part of a word. For example, you might want to change all occurrences of the word "Bolt" to "Washer" in a part description field.

To Replace Data in a Table

1 Display the table or form containing the information you want to replace.

2 Select the field (column) in which you want to replace data, unless you intend to search all fields.

3 From the Edit menu, choose Replace. The Replace dialog box appears.

4 In the *Find What* box, type the text you want to find. Use wildcard characters to make your search more general. If you use wildcard characters, you might want to confirm text replacements to ensure that they're correct (see below).

5 In the *Replace With* box, type the replacement text.

6 Under *Search In*, select *Current Field* or *All Fields*. If you select *Current Field*, the program searches for data in the field in which your cursor is located.

7 Set other Replace dialog box options if necessary.

You can confirm each replacement, or you can replace all occurrences without confirmation:

To Confirm Each Replacement

8 Choose the *Find Next* button to find the first occurrence of the text. The program locates the first occurrence of the text and highlights it.

9 Click the *Replace* button to replace the highlighted text with the text in the *Replace With* box. If you don't want to replace this occurrence of the text, click the *Find Next* button to locate the next occurrence.

To Replace All Occurrences without Confirmation

10 Click the *Replace All* button.

Quick Sort Command

You can use the Quick Sort command from the Records menu to perform a simple sort of your records, based on the currently selected field(s). When you select this command, you'll see a submenu that enables you to sort in ascending or descending order (see below). The sorted records return to their original order when you close the form (or table).

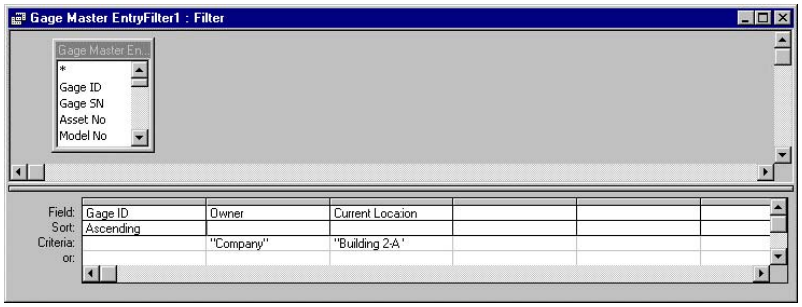
Ascending: A–Z or 0–100
Descending: Z–A or 100–0

Filter/Sort Command

To filter and sort records in either Form or Table view modes, use the Filter/Sort command. You can sort in ascending order or descending order (see "Quick Sort Command" above). The sorted records return to their original order when you close the form (or table).

To Sort Records

1. Choose Edit Filter/Sort from the Records menu. The filter window appears, with a list of available fields.



2. In the *Field* row in the filter window's grid, add the fields for which you want to specify a sort order. You can drag fields from the field list, or you can click a cell in the *Field* row, then click the drop-down arrow and choose a field from the list.
3. For each field whose data you want to sort, click the drop-down arrow in the *Sort* row to select a sort option. If you sort on multiple fields, the program sorts on the fields you specify, in order, from left to right.

   Tip: You can also sort on a hidden field.
4. Minimize the Filter window.
5. Select Apply Filter/Sort in the Records menu (this menu is available while the Filter window is open, but minimized).

To undo a sort, click on the toolbar's *Filter* button and clear the filter values, then click the *Find* button.

Entering Filter Criteria

In addition to sorting, you can enter a criteria expression to find only those records that match your specific conditions. Enter criteria expressions into the *Criteria* cell row and, optionally, into the *Or* cell row. If you're using field names in the criteria expression, choose only those fields displayed in the field list (you must spell the field names exactly as shown).

Criteria Expression Examples

Field	If You Enter	GAGEtrak Will Find
Description	"Caliper"	Gages with the description "Caliper"
Description	"Caliper" Or "Micrometer"	Calipers or micrometers
Next Due_Date	= #3/2/2000#	Gages due on March 2, 2000

Field	If You Enter	GAGEtrak Will Find
Next Due_Date	Between #3/1/2000# And #3/31/2000#	Gages due between the 1st and 31st of March, 2000
Current Location	In ("QC Lab", "Receiving")	Gages located in the QC Lab or in Receiving
Current Location	Not "QC Lab"	Gages that aren't located in the QC Lab
Next Due_Date	↓ Date( )- 30	Gages overdue by more than 30 days; Date( ) represents the current date
Next Due_Date	Year([Order Date]) = 2000	Gages due in 2000
Next Due_Date	DatePart("q", [Next Due Date]) = 4	Gages due in the fourth calendar quarter
Description	Like "C*"	Gages with descriptions that start with the letter C
Description	Like "[A-D]*"	Gages with descriptions that are between A and D
Gage ID	Right([Gage ID],2) = "99"	Gage IDs that have "99" in the last two field positions
Description	Is Null	Gages with null (blank) descriptions
Description	Is Not Null	Gages with descriptions that aren't null (blank)

Adding New Records

Adding Records in Form View

To add new records in Form view, you can:

1. Click the *New* button in the toolbar.

   or

2. Click the *Last Record* navigation button, then click the *Next Record* navigation button.

   or

3. Use the keyboard shortcut: CTRL +.

Enter the information into the record, then repeat any of the above steps to add another new record.

Adding Records in Table View

To add new records in Table view you can:

1. Click on the *Last Record* navigation button, then click on the *Next Record* navigation button.

   or

2. Scroll to the bottom row (the record selector button will have an asterisk on it).

Enter the information into the record; repeat either of these steps to add another new record.

Go To Command

You can use the Go To command from the Records menu to quickly move to different records. After you select this option, a submenu will appear, with the following options to help you navigate through your records:

Command	Description
First	To move the cursor from a field in the current record to the same field in the first record, choose First.
Last	Select this command to move the cursor from a field in the current record to the same field in the last record.
Next	If you want to move the cursor from a field in the current record to the same field in the next record, select Next.
Previous	To move the cursor from a field in the current record to the same field in the previous record, select this command.
New	Select New to move the cursor to a blank record at the end of your form or datasheet, allowing you to enter a new record.

Show All Records Command

To display the most current records in a form or datasheet, select Records | Show All Records. This command removes a filter if you're currently using one (including a sort created with the Quick Sort command), queries the database to display the most current data, and then moves to the first record.

Copying Records

You can easily copy records to save time and reduce mistakes. However, remember that certain records require that certain fields be unique. In these cases, go ahead and copy the record, but make sure that you've entered unique information in those fields before you try to save it. Otherwise, GAGEtrak will give you an error message.

To copy a record, follow these steps:

1. Go to the record you want to copy and click on the record's selector bar (or button).
2. Choose Copy from the Edit menu (or press CTRL-INS on your keyboard).
3. Go to a new record.
4. Click on the new record's selector bar (or button).
5. Finally, choose Edit | Paste or press SHIFT-INS on your keyboard.

Deleting Records

To delete records, do the following:

1. Go to the record you want to delete and click on the record's selector bar (or button).
2. Choose Delete from the Edit menu or press the DELETE key.
3. GAGEtrak will ask you to confirm the deletion (sometimes twice).

In Table view, you can delete multiple records by selecting more than one record. Use the record selector buttons to select all the records that you want to delete, then follow steps 2 and 3.

Undoing Changes to Fields and Records

If you want to undo changes to a field (and you haven't left the field), either press the ESC key or select Undo Current Field from the Edit menu.

If you change more than one field on a record and want to remove those changes, select Edit | Undo Current Record. If you're still in one of the fields that you changed, first go to the Edit menu and select Undo Current

Field, then select Undo Current Record.

Saving Records

GAGEtrak automatically saves records whenever you go to a different record or close the window, but you can manually save records by clicking the record selector bar (or selector button in Table view). You can also use Save Record from the File menu to save your records.

Editing and Shortcut Keys

You can use these keyboard shortcuts to save time when you're entering records.

Note: Where indicated by "CTRL", press the CTRL key while pressing the other key:

Keyboard Shortcuts—General

Press	To
PAGE DOWN	Go to next record in Form view (next page of records in Table view)
PAGE UP	Go to prior record in Form view (prior page of records in Table view)
CTRL PAGE DOWN	Go to next record, but keep cursor in same field
CTRL PAGE UP	Go to prior record, but keep cursor in same field
CTRL '	Copy field data from the *prior* record's field
CTRL ;	Insert the current date
CTRL :	Insert the current time
CTRL +	Add a new record
SHIFT ENTER	Save changes to the current record
CTRL	Delete the current record
CTRL ENTER	Add a new line to a memo field
F2	Switch between field editing and navigation modes
F5	Move to the record number entry box
SHIFT SPACE	Select the current record

Field Editing and Selection Keys

Press	To
SHIFT RGT ARROW	Extend the selection or deselect one character to the right
CTRL SHIFT RGT ARROW	Extend the selection or deselect one word to the right
SHIFT LFT ARROW	Extend the selection or deselect one character to the left
CTRL SHIFT LFT ARROW	Extend the selection or deselect one word to the left
CTRL C or CTRL INSERT	Copy the selection into Windows Clipboard
CTRL V or SHIFT INSERT	Paste text from Windows Clipboard

Datasheet (Table) Keyboard Shortcuts

Press	To
TAB, ENTER, or RGT ARROW	Move to the next field
END	Move to the last field in the current record (Table view)
SHIFT TAB or LFT ARROW	Move to the previous field
HOME	Move to the first field in the current record (Table view)
DN ARROW	Move to the current field in the next record
CTRL DN ARROW	Move to the current field in the last record
CTRL END	Move to the last field in the last record
UP ARROW	Move to the current field in the previous record
CTRL UP ARROW	Move to the current field in the first record
CTRL HOME	Move to the first field in the first record

Menus and Commands

The following is a summary of the various menus available from the menu bar, including explanations of the available commands in each.

File Menu

Command	Description
Close	Use this command to close the current screen and return to the prior screen.
Save Record	To save the current record, choose File | Save Record.
Output To...	Select this command to output the current record(s) to an Excel spreadsheet, word processing .RTF, or ASCII text file.
Print Setup	Choose File | Print Setup to define your printer and settings.
Print Preview	To see the current record as it would look if printed, select this command.
Print	This command prints the current record (performs like a screen dump).
Send	Use File | Send to e-mail the report (if you have MAPI compliant e-mail).
Exit	To quit GAGEtrak, choose File | Exit.

Edit Menu

Command	Description
Undo Typing (CTRL-Z)	Choose this command to remove any typing in the current field (active only if your cursor remains in that field).
Undo Current Field (ESC)	To remove all changes to current field, choose this command (active only if your cursor remains in that field).
Cut (CTRL-X)	Select Edit | Cut to remove the selected text from a field or a selected record (a copy is placed in the Clipboard).
Copy (CTRL-C)	To copy the selected text or record into the Clipboard, choose Edit | Copy. *Paste* (CTRL-V) This command is active only when you cut or copy something—use it to paste the cut or copied text at the location of your cursor.
Delete	Choose Edit | Delete to either delete the selected text from a field or to delete a record (select the record first).
Select Record	Use this command to place the current record in a "selected" state for copying, deleting, or printing
Select All Records	To select *all* records for copying, deleting, or printing, select Edit | Select All Records.
Find	Select this command to search for a record based on the current field.
Replace	To perform a Find and Replace operation from the field in which your cursor is located, choose Edit | Replace.

View Menu

Command	Description
Form	Choose this command to see the record in Form view.
Datasheet	To see records in Datasheet view, select this command.
Show/Hide Toolbar	Use this command to display or close the floating toolbar.

Format Menu

Note: These commands are active only in Datasheet view.

Command	Description
Font	Use this command to change the Table view font (doesn't affect Form view).
Row Height	To change the height of all rows, select Format | Row Height.
Column Width	Select this command to adjust the width of the selected column(s).
Hide Current Column	To hide the selected column, choose this command.
Show/Hide All Columns	Use this command to show or hide all or several columns.
Freeze Columns	You can use this command when you want to freeze the current column so that it is always visible, even when you're scrolling to the right.
Unfreeze Columns	To release any frozen column(s), choose Format | Unfreeze Columns.
Gridlines	Use this command to display or hide the gridlines surrounding each cell.

Record Menu

Command	Description
Go To	Choose this command to go to the first, last, next, or previous record.
Quick Sort	Use this command to quickly sort by the currently selected field(s) by either ascending (A-Z) or descending (Z-A) order.
Edit Filter/Sort	Select this command to set up record filters and sorting via the Query By Example (QBE) grid.
Apply Filter/Sort	Use this command to apply the record filters and sorting set up in the QBE grid.
Show All Records	Choose this command to disable any previous filters and see all records.

Help Menu

Command	Description
Contents	To see the Help file's table of contents, choose Help | Contents.
About	Select this command if you want to see information about the program.

Appendix A: Calibration Label Kit

The following instructions will help you install and set up the optional GAGEtrak Calibration Label Kit. You can use the kit to print durable, oil-resistant, adhesive backed calibration labels for your gages, test equipment, and calibration standards. The kit includes a dedicated Brother P-Touch PC label printer, cables, black-on-white tape cartridge, and software drivers for Windows and Macintosh. If you ordered extra tape cartridges, they are enclosed with your kit.

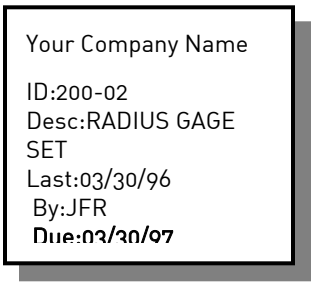
Installing the Label Printer and Windows Software

First, attach the Brother P-Touch PC printer's serial port or USB cables, then put the tape cartridge into the printer. Next, install the *P-Touch PC Editor for Microsoft Windows* software. See the enclosed Brother booklets for more detailed instructions.

Printing Calibration Labels

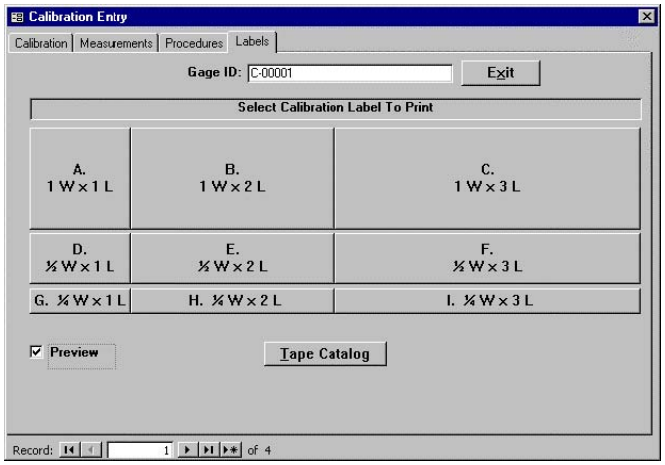
GAGEtrak can print 1-inch, ½-inch, and ¼-inch wide calibration labels in three lengths–1-inch, 2-inch, and 3-inch. A sample label is shown below:

1-inch W x 1-inch L



Printing Labels from Calibration Entry

You can print individual calibration labels directly from the Calibration Entry–Labels tab:



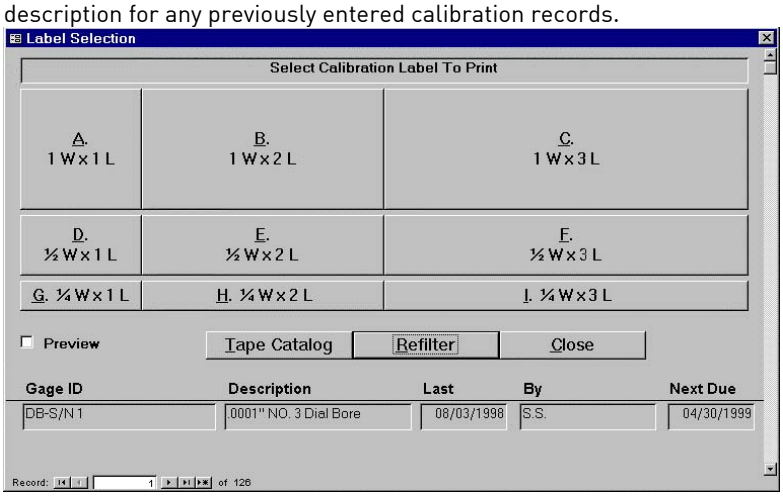
To immediately *print* a label, click on any of the label buttons, such as *1 W x 1 L*; the button size is about the same size as the label. You must choose a button that's the same width as the tape currently installed in your label printer.

> Note: Because the labels are designed to cut off as close to the edges as possible, a piece of blank tape will eject before the actual label prints.
>
> To *preview* a label on-screen, check the *Preview* box and click the label button.

Printing Labels from the Calibration Labels Report

To print a batch of labels, select Calibration Labels from the Listing and Reports menu. You can use this report to print all of your calibration labels in a single batch at the end of the day.

You can filter for a group of calibration labels based upon the calibration date, gage ID, location, or description for any previously entered calibration records.



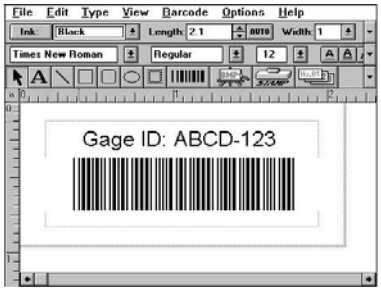
> Tip: This method eliminates the blank waste tape that ejects with each label that you print from Calibration Entry. You'll still get an initial piece of blank waste tape, but after that, the printer adjacently cuts and ejects all of the labels.

Use the scroll bar or navigation buttons to view the selected calibration records. To change the filter criteria, click *Refilter*. To preview labels, check the *Preview* box and click the label button. To print labels, make sure the *Preview* box is *not* checked, then click the label button. Make sure that you have the correct tape cartridge in your label printer.

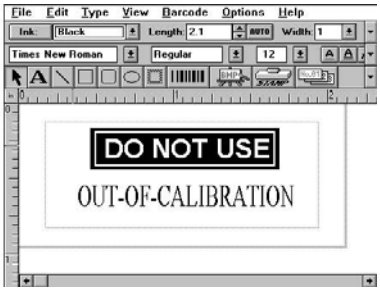
Designing Your Own Labels

Your label kit includes special label designing software. To use this software, double-click the P-Touch PC Editor icon. You can use this software to create barcode and "Do Not Use" labels.

Barcode Label



"Do Not Use" Label



You can also create other types of labels, including:

- Gage R&R Part ID Labels
- Calibration Instructions
- Operating Instructions
- Sample Submissions
- SPC Capability Studies
- Receiving Inspection Tags
- Inspection Hold Tags
- Test Tubes and Apparatus
- Dangerous Materials Notice
- Warning Notices
- Floppy Disks
- Equipment Identification
- Inventory
- Storage Bins
- File Cabinet Labeling
- Folder Labels
- Equipment Maintenance
- Parts Bins
- Asset ID Labels
- Employee Badge Labels
- Computer Cabling

... and more!

Important: You can't use GAGEtrak to print your custom labels; use the P-Touch PC Editor program instead. See the enclosed Brother manuals for instructions.

Appendix B: Gage Calibration and Control

This section discusses the basics of gage calibration and control; it's intended for users with limited experience, but it also serves as a review for more experienced users. A list of references is at the end of this section.

Purpose of Calibration

Gages, test equipment, and measurement standards are all susceptible to deterioration in accuracy during use and storage. To maintain accuracy in your measurements, you need an ongoing calibration system.

Calibration Terminology

Calibration

Unfortunately, the terminology associated with calibration control is not universally standardized. Typically, the term "calibration" means placing a gage, measurement standard, or test instrument into a state of accuracy. Calibration is also called "re-calibration" or "reconditioning".

Purchased Precision Standards

Companies buy these high accuracy measurement standards, such as gage blocks or standard load cells, from outside sources. These standards represent the highest degree of accuracy in a company. Usually, your only form of calibration control on one of these standards is your supplier's certification that the standard is traceable to the U.S. Department of Commerce's National Institute of Standards and Technology (NIST—formerly the National Bureau of Standards). Your supplier, an independent laboratory, or the NIST must perform any subsequent calibrations on these standards.

Purchased Working Standards

These standards aren't as accurate as the precision standards—they usually don't cost as much, either. You use them to check calibration internally before using gages or test equipment. You might calibrate these standards in-house, but more often you send them to an outside source for calibration.

Test Equipment

The term "test equipment" covers a variety of measuring equipment, sometimes including working standards. You use this equipment to check your products and manufacturing processes. Check test equipment for calibration before you use it—even if it's brand new.

Test Materials

This term refers to all consumable standards, such as films or liquids, used in calibrating test equipment. Since variability in these materials can affect your measurements and calibrations, suppliers often give you data on the test material's variation.

Gages (or Gauges)

This term applies to many measurement inspection devices, including fixed-limit (attribute or go/no-go) and variable (actual numeric measurement) gages. Usually, your company calibrates this type of equipment internally, using either working or precision standards. You can calibrate fixed-limit gages by using working standards or dimensional layout. For simplicity throughout this manual, we use the term "gage" to refer to all measurement equipment.

Inventory and Classification

To begin your gage control system, take an inventory of your gages. During this initial inventory (usually the most difficult), determine origins, locations, types, and calibration schedules, then assign identification numbers and collect additional information to classify your gages. In the past, companies manually recorded this information on gage record cards—that's where GAGEtrak comes in. Instead of sifting through hundreds of cards to find gages due for calibration, GAGEtrak automates the task, letting you selectively create a list of these gages.

Calibration Schedules

You usually determine calibration schedules by the gage's classification. You can establish initial calibration schedules by expected usage, engineering judgment, and bargaining. As you gather actual calibration information, you might need to adjust the schedules. The primary intent of a calibration schedule is to detect accuracy deterioration *prior* to intolerable levels of accuracy. Accuracy deterioration usually results from gage usage; less often, it results from the passage of time.

The most common methods for determining calibration schedules are:

- elapsed calendar time—the most popular method, it establishes a fixed calendar time, such as 90 days, as a checking interval
- actual amount of usage (time and cycles)—based on counting the number of days (or operating cycles) for which the gage was used (you can keep this count manually or automatically)
- actual operating time—an excellent method for electrically driven gages (a device used for measuring actual operating time is called a "coulometer")

Calibration Practice

To ensure consistency in your calibration techniques, develop procedure manuals of calibration practices. At minimum, include tolerances for accuracy; standards; temperature and humidity controls (if needed); time cycles; human technique; and other important factors.

After calibration, make the equipment tamper-proof (if possible) with sealed adjusting screws, lead-sealed lock wires, stamps, and other devices.

Record the results of your calibration checks and any required adjustments or repairs. At minimum, record the following information:

- date on which calibration was checked
- person that checked calibration
- any deficiencies seen in the equipment
- accuracy data (if able to measure accuracy)
- causes for out-of-calibration conditions
- repair time and calibration time

Review this information periodically to see if you should reduce checks on stable equipment; increase checks on unstable equipment; or redesign/replace the measurement equipment.

References

The following books and publications discuss gage calibration and control:

JURAN, J.M., *Juran's Quality Control Handbook,* Fourth Ed., 1988.

JURAN, J.M., *Quality Planning and Analysis,* Second Ed., 1980.

FARAGO, Francis T., *Handbook of Dimensional Measurement,* Second Ed., 1982.

National Conference of Standards Laboratories (NCSL), *Establishment and Adjustment of Calibration Intervals (RP-1),* Second Ed., 1989.

U.S. Dept. of Defense, MIL-STD-45662A, Calibration System Requirements, 1988.

Resources for Books, Publications, and Reference Materials

American Society for Quality Control (ASQC)
310 W. Wisconsin Ave., Milwaukee, WI 53203
Phone numbers: (800) 952-6587 or (414) 272-8575

National Conference of Standards Laboratories (NCSL)
1800 30th St., Suite 305B, Boulder, CO 80301
Phone number: (303) 440-3339

National Institute of Standards and Technology (NIST)
Bldg. 411 Rm. A112, Gaithersburg, MD 20899

American National Standards Institute (ANSI) 1430 Broadway, New York, NY 10018

American Society for Testing and Materials (ASTM) 1916 Race St., Philadelphia, PA 1910

The Naval Publications and Forms Center 5801 Tabor Ave., Philadelphia, PA 19120

GAGEtrak®

Calibration Management Software

System Administrator's Guide

CyberMetrics

16100 N. Greenway-Hayden Loop,
Suite 100
Scottsdale, AZ 85260
(480) 922-7300
Fax: (480) 922-7400
www.cybermetrics.com

Chapter 1: Installation

You can use GAGEtrak 4 (2007) on a single workstation, on a network, or in a client/server environment – installation will vary slightly for each of these options. This chapter gives you general installation instructions for all options. Chapters 2 and 3 deal specifically with setting up an Oracle client/server system and an MS SQL client/server system, respectively.

Program Requirements

GAGEtrak 4 (2007) for Windows requires the following:

- Microsoft Windows 98, 2000, XP, or Vista
- Hard disk with 700 MB of free space for program files and 25-50 MB of free space for typical database
- 512 MB RAM or more
- VGA or compatible display monitor
- Mouse or compatible pointing device
- Printer (if you want to print reports; ink jet, bubble jet, or laser printer is best)
- IBM PC or 100% compatible computer
- Pentium 133 MHz or higher CPU

Installation

Files

The setup consists of three files: **SETUP.EXE** contains all the files required to run GAGEtrak; **G_CONECT.INI** is the initialization file used during installation to configure the user's database settings; and **README.TXT** notes special features or changes to the program.

Important Note for Oracle Users

If you're planning to use GAGEtrak on an Oracle client/server system, you must install Oracle Tools **before you install GAGEtrak**. See chapter 2 for more instructions; return to this section when you're finished.

Installation Options

You can use GAGEtrak 4 (2007) as a client/server program, with one centralized, dedicated computer hosting the database and one or more user workstations accessing the database from that server. You can also choose to install and use GAGEtrak on only one PC (a single-user setup).

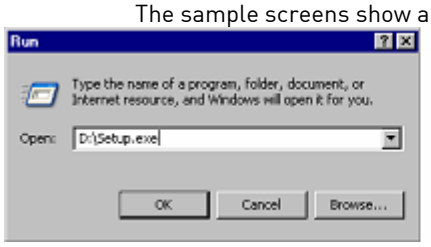
If you have a multi-user license of GAGEtrak, you and your other GAGEtrak users can install the program from the CD or from a network location. If you want your users to install from a network location, copy the

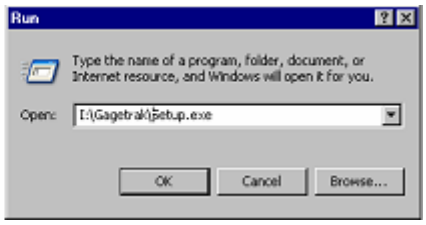
SETUP.EXE and G_CONECT.INI files to the same network location, then instruct users to run SETUP.EXE from that location. You can find the Access, Oracle, or MS SQL G_CONECT.INI file on the CD under the directory of the database name (i.e., the Access G_CONECT.INI file is in the Access directory on the CD).

To install GAGEtrak, follow these instructions:

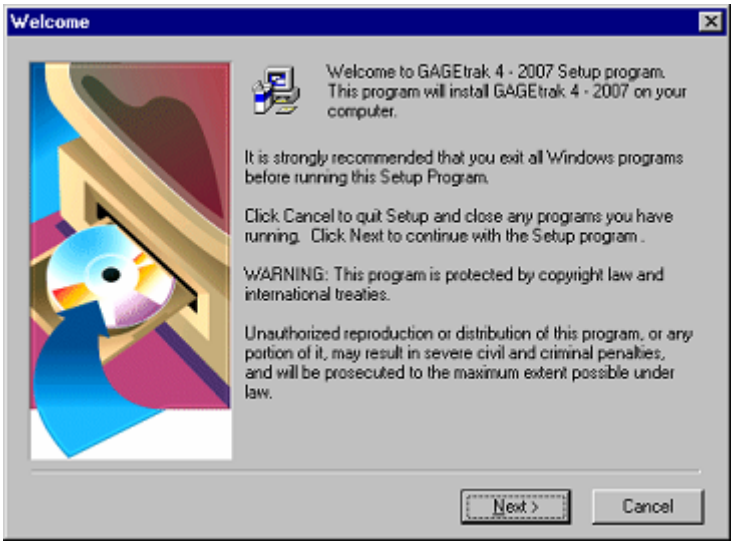
1. To begin installation, click the Windows *Start* button and select the Run . . . command. Click the *Browse* button to navigate to your CD-ROM or network drive, then select SETUP.EXE

The sample screens show a CD and a network installation.



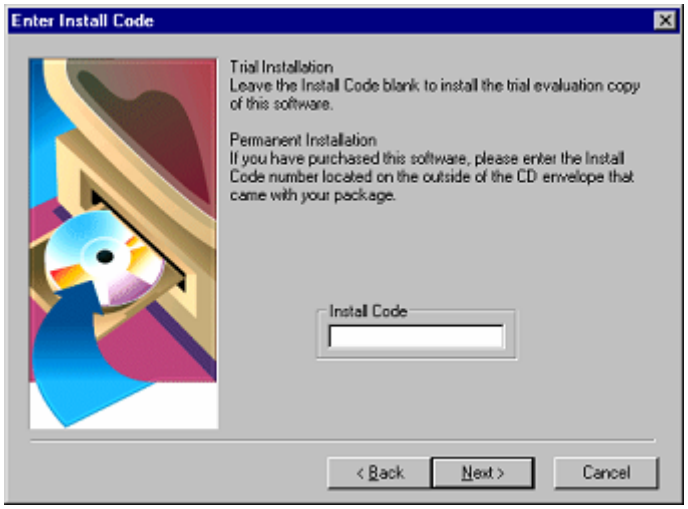


2. Next, you'll see the Welcome screen. Make sure that you've closed all other programs, then click *Next*.



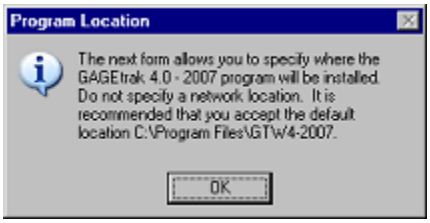
In the next screen, enter the install code for your copy of GAGEtrak. You can find this code on the CD envelope that came with your software package.

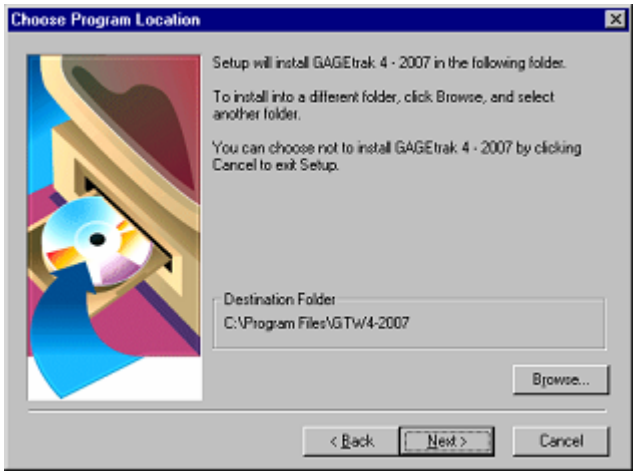
Tip: If you don't have an install code, leave this field blank.



1 Now the installation program will tell you that you will be choosing the location for the program on your hard drive. Since this location is specific to each workstation, do not select a network location. We recommend using the default directory—C:\GTW4.

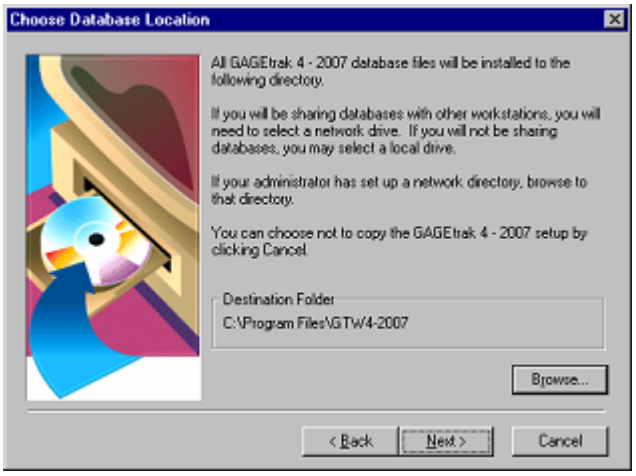
2 Unless you're using the program with an Oracle or MS SQL database, the installation program will now let you select a location for the GAGEtrak database. If you are using GAGEtrak in a client/server environment, skip to step 5.



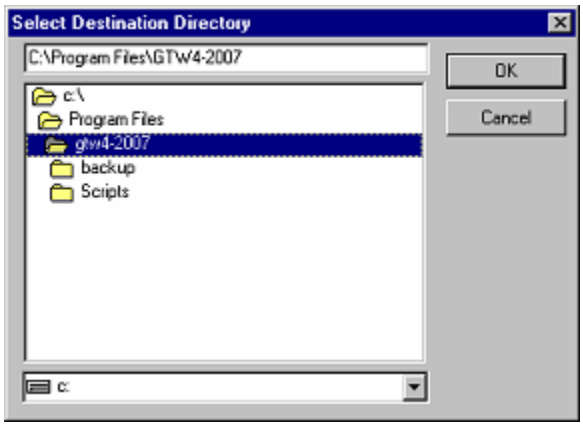


If you are using the program on a single workstation, select the default directory – C:\GTW4. If you have a network license of the program and are using it with an Access database, click the *Browse* button and select the network directory where you will store your database. If you are running the setup from a network drive, the path to the SETUP.EXE file will be the default database location.

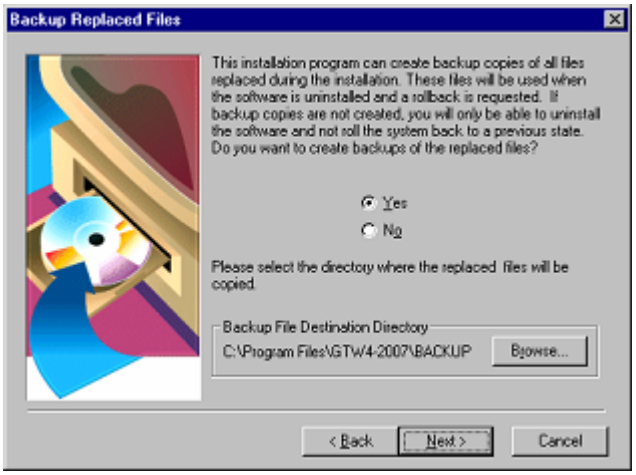
Note: If your Windows Registry or INI file already lists a directory for the GAGEtrak database file, that directory information will appear in this screen. Go to step 5.

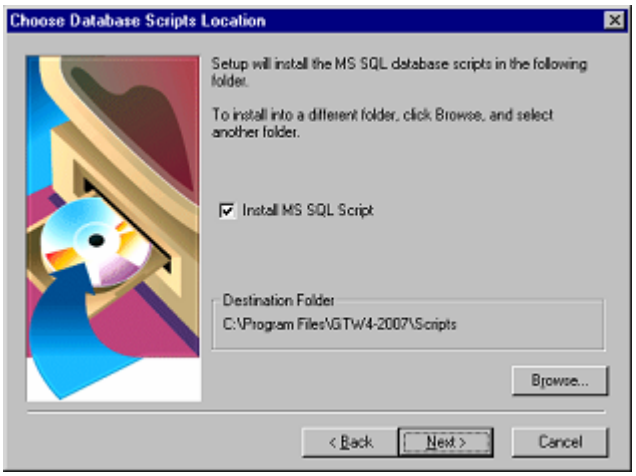


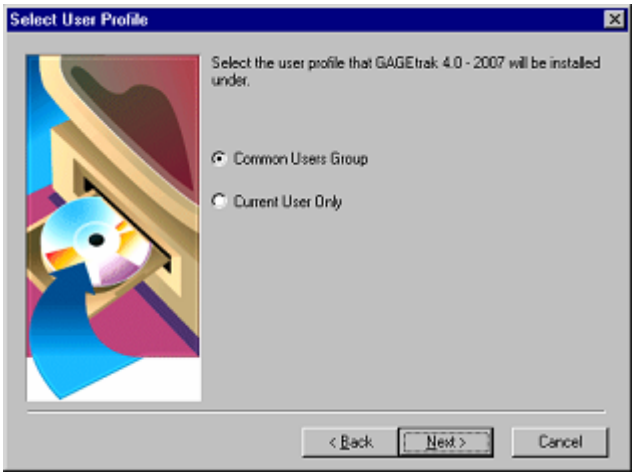
The Browse button will allow you to specify a location on any file server directory where the anticipated range of GAGEtrak users have been given Full Rights. This form is a directory level browse only:

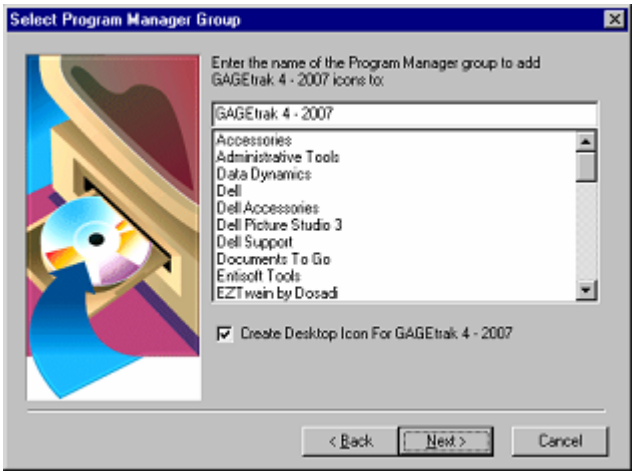


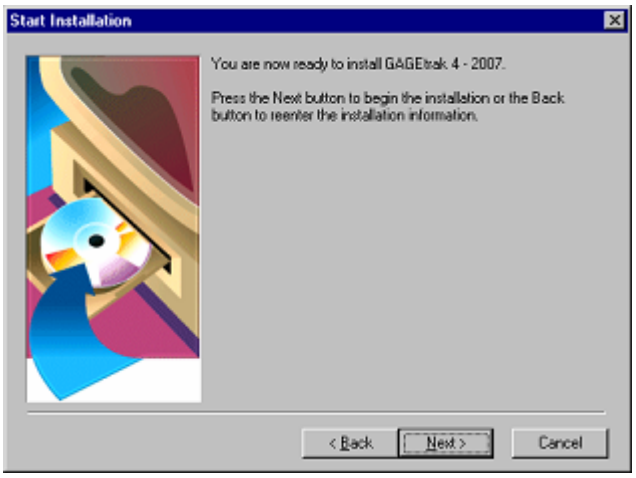
1. Next, GAGEtrak will ask if you want it to create backup copies of all of the files that it overwrites on your system. We recommend that you select *Yes* and use the default location (C:\GTW4\BACKUP).
2. If you're using an Oracle or SQL version of GAGEtrak, the installation program now asks where you want to install the database scripts. Click the *Browse* button to select a location. If you don't want to install the scripts, remove the check from the *Install (Oracle or MS SQL) Scripts* box.
3. Next, GAGEtrak will ask if you want to install under the Common Users Group or the Current User only. It is recommended that you install under the Common User Group.
4. Now the program will ask you to select the Program Manager group to add GAGEtrak's icons to. We recommend that you select the default—GAGEtrak 4 (2007).
5. Click *Next*, and this screen will appear:


Backup Replaced Files
This installation program can create backup copies of all files replaced during the installation. These files will be used when the software is uninstalled and a rollback is requested. If backup copies are not created, you will only be able to uninstall the software and not roll the system back to a previous state. Do you want to create backups of the replaced files?
Yes
No
Please select the directory where the replaced files will be copied.
Backup File Destination Directory
C:\Program Files\GTW4-2007\BACKUP
Browse...
< Back
Next >
Cancel


Choose Database Scripts Location
Setup will install the MS SQL database scripts in the following folder.
To install into a different folder, click Browse, and select another folder.
Install MS SQL Script
Destination Folder
C:\Program Files\GTW4-2007\Scripts
Browse...
< Back
Next >
Cancel


Select User Profile
Select the user profile that GAGEtrak 4.0 - 2007 will be installed under.
Common Users Group
Current User Only
< Back
Next >
Cancel





10. Click *Next* to begin the installation. During Installation you will see the following Windows Installer popup, this will appear when the installer is almost done:

When it's finished, you'll see this screen:

After you've read the information about the database location and license, click *Finish*. If additional files are required for GAGEtrak 4 (2007) to run, they will install now. Follow the instructions on your screen to install any additional files.

> Important Note: During user workstation installations from your network, GAGEtrak will look for the appropriate program settings in the configuration file (G_CONECT.INI) in the network directory. If it doesn't find them there, it will check the workstation's Windows Registry and use the settings there. If the settings aren't in either of these locations, the program will use the default information (MS Access).

Please note that Technical Support is not available for the creation of your client/server database.

After You Install GAGEtrak

If you're upgrading from a previous version of GAGEtrak, you will need to run the Data Transfer Utility before you begin using the program. Please see *Appendix A: Data Transfer Utility*, beginning on page 209, for complete instructions. If you're using GAGEtrak in a client/server environment, first follow these steps to configure it with your Oracle or MS SQL database:

Administrator Installation

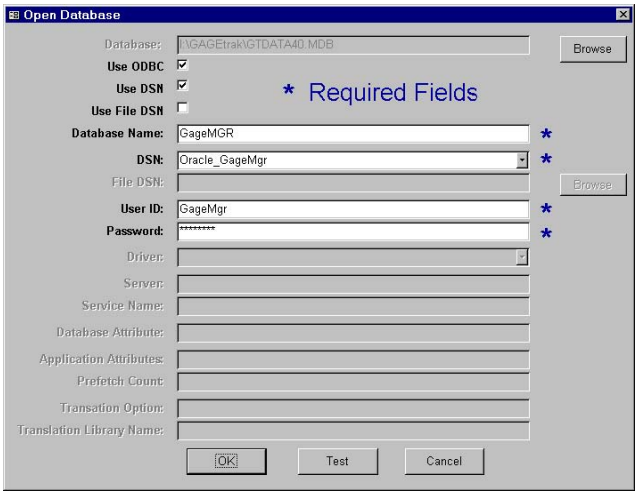
To complete the administrator setup, follow these steps:

> Note: You will need to do this only once for an administrator setup. To set up each workstation, follow steps 3-10.

1. Run the appropriate scripts for your server to create the database and tables. The scripts are located in the GTW4\SCRIPTS directory. The files have prefixes to their names (Step1, Step2...) to indicate the order in which you should run them. You might need to modify the data file in the table space for your system. See the Step 1 script for details.
2. Next, run GAGEtrak's Data Transfer Utility Version 4 to import existing data from a previous version or prefill the database. See page 209 for instructions.
3. Open GAGEtrak 4 (2007) and select Open Database from the File menu.
4. In the Open Database screen, check the *Use ODBC* checkbox.
5. Place a check in the *Use DSN* checkbox.

> Important: If you used a different *Database Name*, *DSN*, *User ID*, and/or *Password* during installation, enter the information you used instead of the values listed below. If you set up the configuration file (G_CONNECT.INI), GAGEtrak will automatically fill in these fields in this screen.

1. The *Database Name* should read GageMgr (or the name that you entered during installation).
2. The *DSN* field should show Oracle_GageMgr or MSSQL_GageMgr (the DSN that you entered during installation; this value may be different).
3. Your user ID should be GageMgr (this field may also vary according to your setup).
4. The *Password* field should contain the password you entered during installation. Note that the password is displayed as asterisks for security purposes.
5. Your screen should look similar the one below (shown set up for an Oracle version). When you're finished, click *OK*.



Configuration File Settings

If you want to reconfigure your G_CONECT.INI file, follow these guidelines:

> Note: The brackets (↓x↑) contain instructions about the information you should enter after the equal sign (=) on each line.

[Database]
dbType=↓0 *for a Microsoft Access Database*, 1 *for a client/server database*↑
UseDSN=↓0 *for No*, 1 *for Yes (used only for client/server)*↑
UseFileDSN=↓0 *for No*, 1 *for Yes (used only for client/server)*↑
File=↓*Name of the database file (used for Microsoft Access Database)*↑
Path=↓*Path (mapped drive or UNC) to the database file (used for Microsoft Access Database)*↑
DSN=↓*Data Source Name for the database (used for DSN)*↑
FileDSN=↓*Name and path (mapped drive or UNC) of the DSN file (used with FileDSN)*↑
Driver=↓*Driver name (only if not using FileDSN or DSN)*↑
Server=↓*Name of the server (used for Microsoft SQL Sever)*↑
Database=↓*Name of the database (used for client/server)*↑
UID=↓*User ID (used only for client/server)*↑
PWD=↓*Password (used only for client/server)*↑
APA=↓*Application Attributes (used only for client/server) (not required)*↑
DBA=↓*Database Attribute (used only for client/server) (not required)*↑
DBQ=↓*Service Name (required for Oracle if not using DSN or FileDSN)*↑
PFC=↓*Prefetch Count (used only for client/server) (not required)*↑
TLL=↓*Translation Library Name (used only for client/server) (not required)*↑
TLO=↓*Translation Option (used only for client/server) (not required)*↑

[Network]
LicensePath=↓*Path (mapped drive or UNC) to the license file.*↑

Sample Configuration

The following sample is for a single-user, Access database version of GAGEtrak 4 (2007).

[Database]
dbType=0
UseDSN=
UseFileDSN=
File=*GTData40-2007.mdb*
Path=*C:|GTW4*
DSN=
FileDSN=
Driver=
Server=
Database=
UID=
PWD=
APA=
DBA=
DBQ=
PFC=
TLL=
TLO=

[Network]
LicensePath=*C:|GTW4*

Chapter 2: Oracle Installation

Setting Up Oracle Tools

If you're planning to use GAGEtrak on an Oracle server, you must set up Oracle and create the data source name (DSN) before you install GAGEtrak. You must also be using Oracle 8. Follow this sequence to install and set up the software:

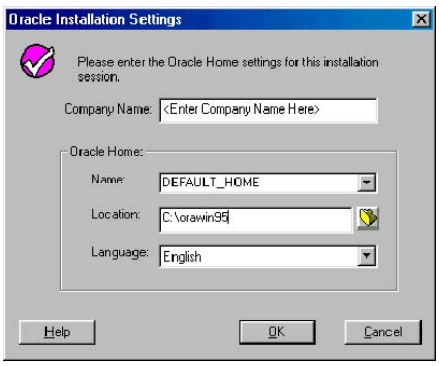
1. Install Oracle Tools.
2. Install updated Oracle ODBC drivers.
3. Configure SQL Net with Oracle Net 8 Assistant.
4. Create data source name (DSN).
5. Install GAGEtrak 4 (2007).

This chapter gives you step-by-step instructions for installing and configuring your database. When you're finished, please return to chapter 1 for instructions on installing and setting up GAGEtrak.

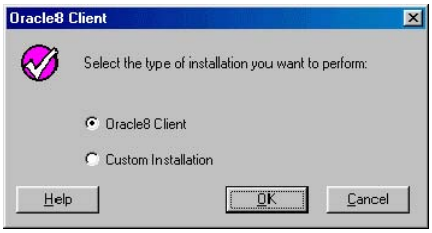
> Note: Remember to modify all references to drives, paths, user ID, password, server names, etc. to fit your system.

Install Oracle Tools

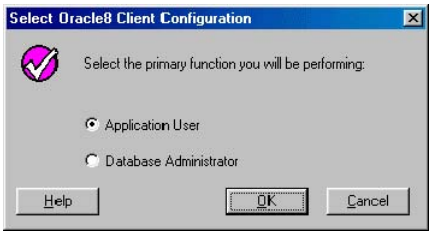
1. First, run SETUP.EXE from your Oracle 8 CD.
2. The Oracle Installation Settings screen will appear. Keep the default settings and click *OK*.



3 In the next screen, select Oracle8 Client and click *OK*.



4 Another screen will appear; select Application User and click *OK*.



5 Complete the installation.

6 After installation, you might need to correct changes to your C:\AUTOEXEC.BAT file. Edit the file using Notepad.

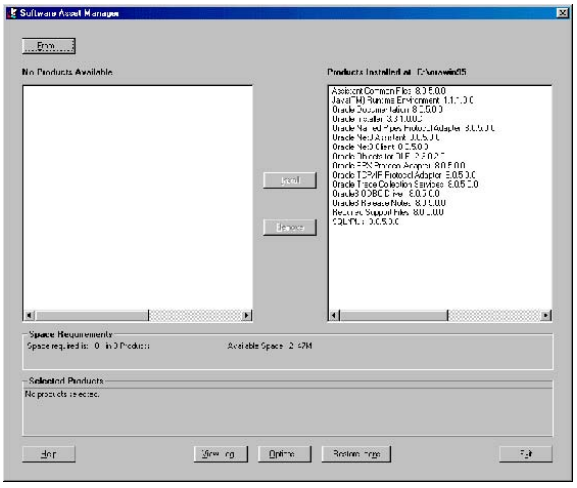
> Tip: If you have a PATH line in this file, make sure it includes the following: C:\WINDOWS; C:\ORAWIN95\BIN (assuming that C:\ORAWIN95\BIN is where you installed Oracle Tools and that C:\WINDOWS is the location of your Windows installation).

7. Reboot your system.

Install Updated Oracle ODBC Drivers

Next, install your new Oracle ODBC drivers.

1. Click *Start* and select Programs | Oracle for Windows 95 | Oracle Installer. You'll see the Software Asset Manager screen.



3 Click the *From* button to browse to the location of the new ODBC drivers (on the CD).

4 Select the file WIN95.PRD and click *Open*.

5 Highlight Oracle ODBC Driver 8.0.5.6.0 under *Available Products.* Click *Install*.

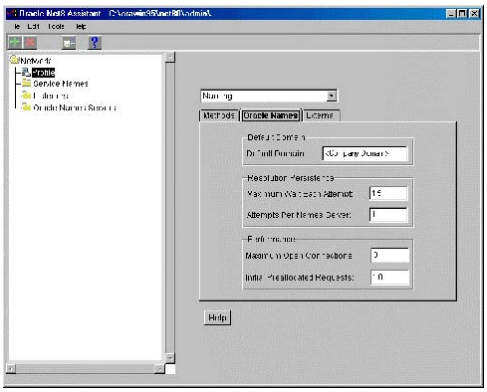
6 When you're finished, click *Exit*.

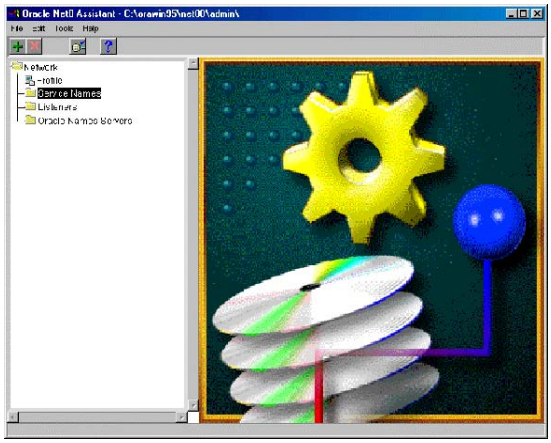
Configure SQLNet with Oracle Net 8 Assistant

Now, set up the configuration for SQL Net with the Oracle Net 8 Assistant.

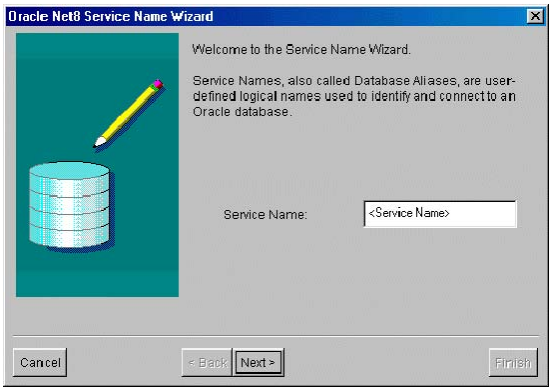
1. Click *Start* and select Programs | Oracle for Windows 95 | Oracle Net8 Assistant. You'll see this warning:

2. Click *Yes* to continue.
3. Another screen will appear. In the left pane, select the Profile folder.
4. In the right pane, click the Oracle Names tab.
5. Set *Default Domain* to your company's domain.

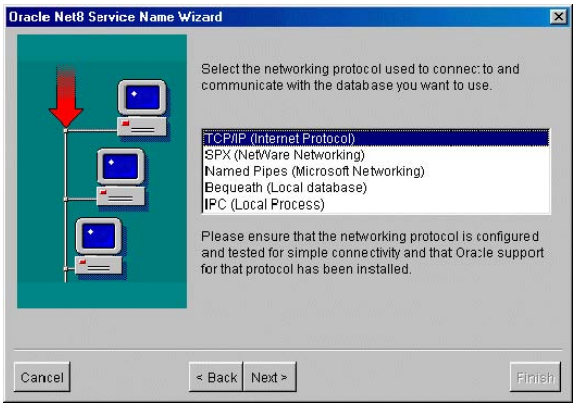


6. Now, go to the left pane and click the Service Names folder.
7. 

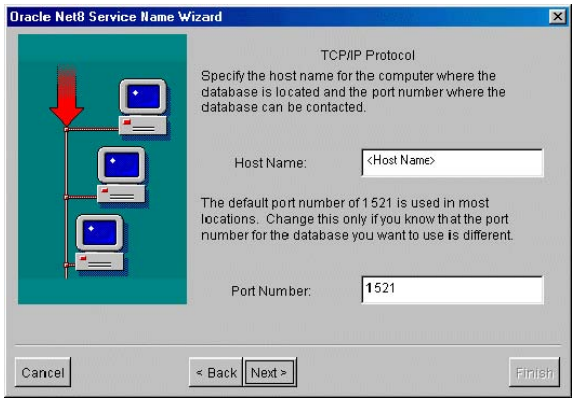
8. Next, click the *Plus (+)* button to create a service name.
9. The Service Name Wizard will appear. Enter your service name and click *Next*.



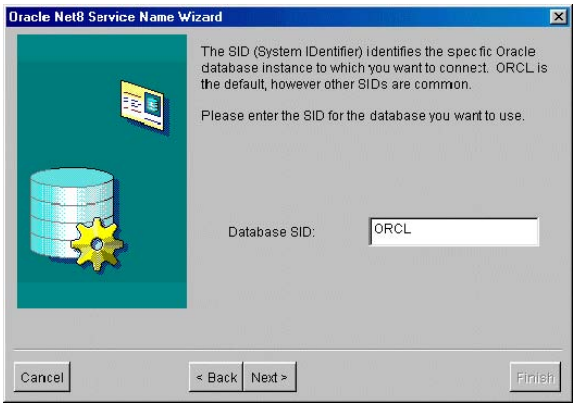
10. In the next screen, select the networking protocol that your company uses and click *Next*.



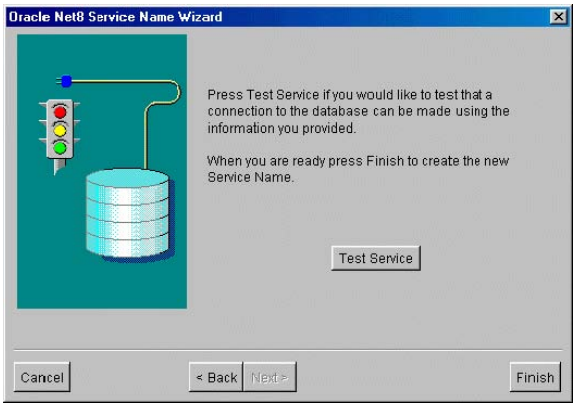
11. Enter your *Host Name* (the name or IP address of your Oracle server) and *Port Number*. Click *Next*.



12. In the next Wizard screen, enter your *Database SID* (usually ORCL) and click *Next*.



12. In the last Wizard screen, click the *Finish* button.



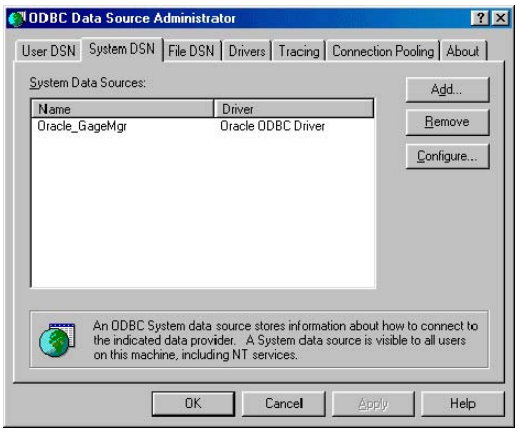
13. From the File menu, select Save Network Configuration.
14. When you're finished, close the program by selecting Exit from the File menu.

Create Data Source Name (DSN) for Oracle

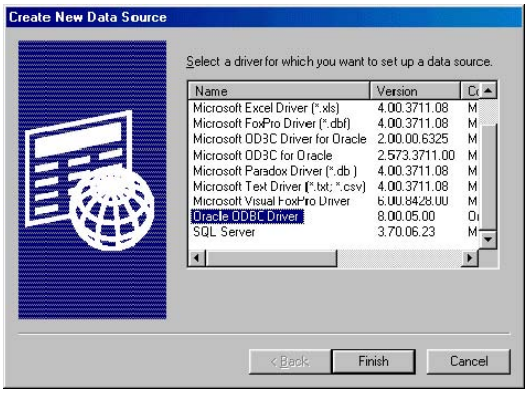
Next, create the data source name (DSN) for your GAGEtrak 4 (2007)/Oracle setup.

1 Click *Start* and select Settings | Control Panel. Double-click the ODBC icon. The ODBC Data Source Administrator window will appear.

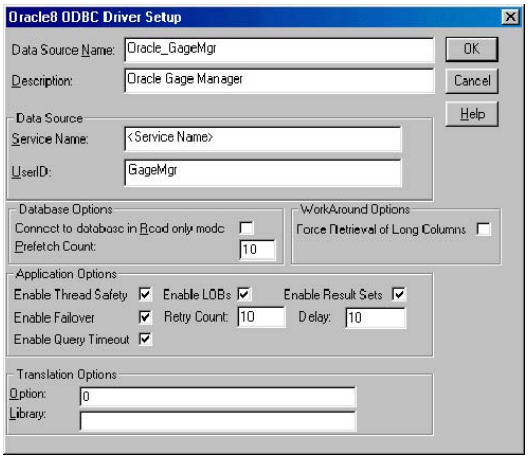
2 Go to the System DSN tab.



3 Click the *Add* button. You'll see a screen similar to this one:



4 Select the Oracle ODBC driver and click *Finish*. This screen will appear:



5 Enter Oracle_GageMgr for the *Data Source Name*.

6 In the *Description* field, enter a brief explanation about the data source.

7 Next, enter your *Service Name* (the name you created with the Service Name Wizard).

8 Go to the *UserID* field and enter GageMgr.

9 Click the *OK* button, then close the ODBC Administrator.

Chapter 3: MS SQL Installation

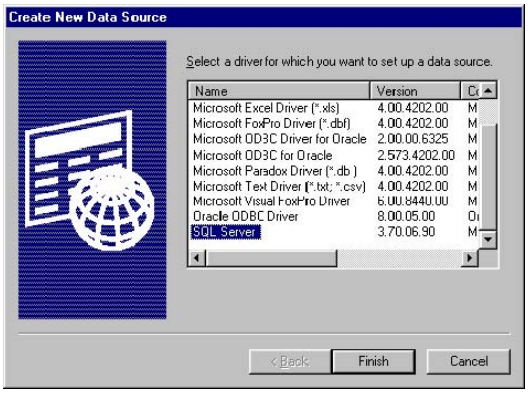
If you're going to use GAGEtrak on a MS SQL client/server system, first install GAGEtrak (see chapter 1 for instructions), then create the data source name (DSN) for your setup, following the instructions in this chapter.

Create Data Source Name (DSN) for MS SQL

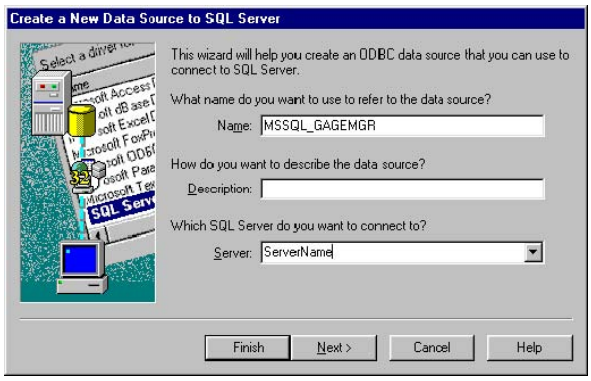
If you're using GAGEtrak with an MS SQL server, follow these steps to create your DSN.

1. Click *Start*, then select Settings | Control Panel. Double-click the ODBC icon, and the ODBC Data Source Administrator window will appear.
2. Go to the System DSN tab.

3. Click the *Add* button. You'll see a screen similar to this one:



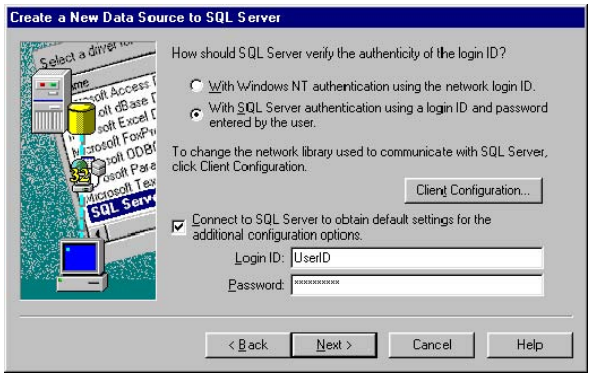
4 Select the SQL Server ODBC driver and click *Finish*. This screen will appear:



5 Enter MSSQL_GAGEMGR for the data source *Name*.

6 In the *Description* field, enter a brief explanation about the data source.

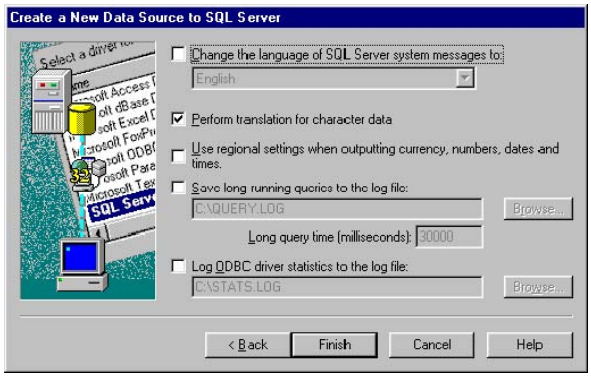
7 After you enter the name of the MS SQL server, click *Next*. This screen will appear:



8 Enter the *Login ID* and *Password* for your SQL server, then click *Next*.

9 You'll see the Configuration screen. If needed, change the default database (check the box next to this field and enter or select a new database).

10 Now, click the *Next* button. You should see a screen similar to this one:



11 Click *Finish*. The SQL Server Setup screen will appear.

12 To check the data source, click *Test Data Source*. If you don't want to test it, click *OK*.

13 When you're finished, close the ODBC Data Source Administrator.

Chapter 4: Running GAGEtrak

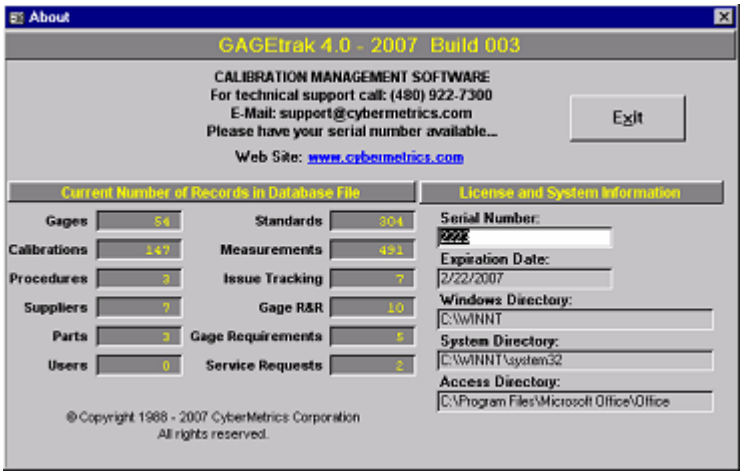
Logon

When you open GAGEtrak, a logon window will appear, if you have set up security. Enter your PIN (Personal Identification Number) and click *OK*. For information about setting up user security, please see page 195.

Serial Number

If you haven't entered your program serial number into the About box, the following message will appear to remind you to enter it.

Click *OK*, and the About window will appear. Enter your GAGEtrak serial number (located on your registration card and on the packing list that came with your package). If you can't find your serial number, contact Technical Support at **480-922-7300.**



License and Trial Period

Each copy of GAGEtrak 4 (2007) is set to give you a 45-day, single-user license trial period. If you purchased a multi-user license, please follow step 1 after you install your software.
Seven days before your trial period is over, GAGEtrak will begin telling you that the expiration date is near. For your convenience, the trial will not expire on a Saturday or Sunday. To enable your license to continue past the 45-day trial, you can do one of two things:

1 Go to the Tools and Utilities menu and select Modify License. GAGEtrak will generate a screen that gives you a *Code Entry* number and a *Computer ID* number. Leave this screen open and call Technical Support immediately. The support representative will then give you two additional code numbers that you will enter on your Modify License screen. Once the modification is complete, GAGEtrak will give you a message titled "Modification Successful".

2 You can also wait until the date on which your trial period expires. At that time, you will receive an Application Violation message when you open GAGEtrak. Click the *OK* button, and the Modify License screen will appear. Again, leave this screen open and call Technical Support immediately for the necessary code numbers. You'll receive a Modification Successful message once you have entered the code numbers that your support representative gives you.

To check on your expiration date and number of assigned user licenses, click the *About* button (on the main menu), and look under *License and System Information*.

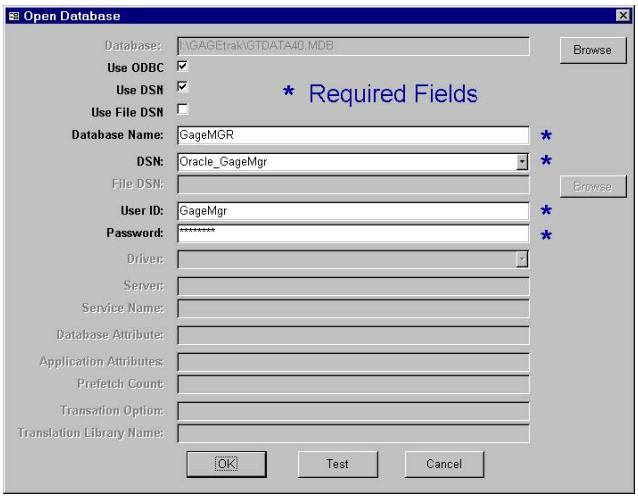
Main Menu

The main menu shows the name of the currently logged-in user in the lower left corner and shows the full path to current database file in the lower right corner.

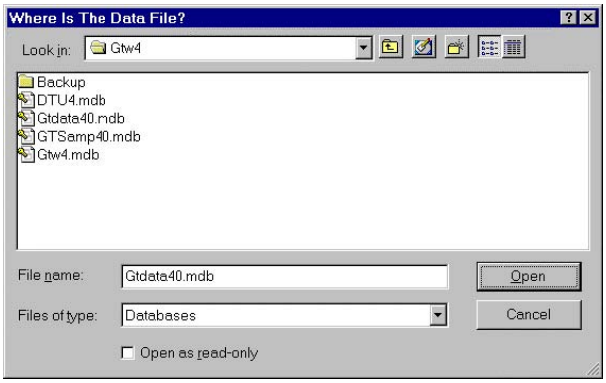
The function of each main menu button is explained in this table.

Button	Description
 Main Records	Click this button to access the Main Records menu, where you can add, change, or delete records for your gages, parts, suppliers, and other elements of your calibration management system.
 Calibrations	Click this button to access the Calibrations Menu where you can add, change, or delete calibration records.
 Gage R & R	Click this button to access your GAGEtrak Gage R & R studies.
 Reports	Click this button to access the GAGEtrak Reports menu.
 Setup	Click this button to set up your GAGEtrak program; or enter user information.
 Data Tools	Click this button to back up your GAGEtrak data; import or export data (Access database); or archive or un-archive records.
 Utilities	Click this button to edit your GAGEtrak data tables directly; or run utilities.

If the program can't find your database file, then the Open Database window will appear. If this happens, you'll need to tell GAGEtrak where to find the database file "GTDATA40-2007.MDB". The Open Database window looks like the one shown here:



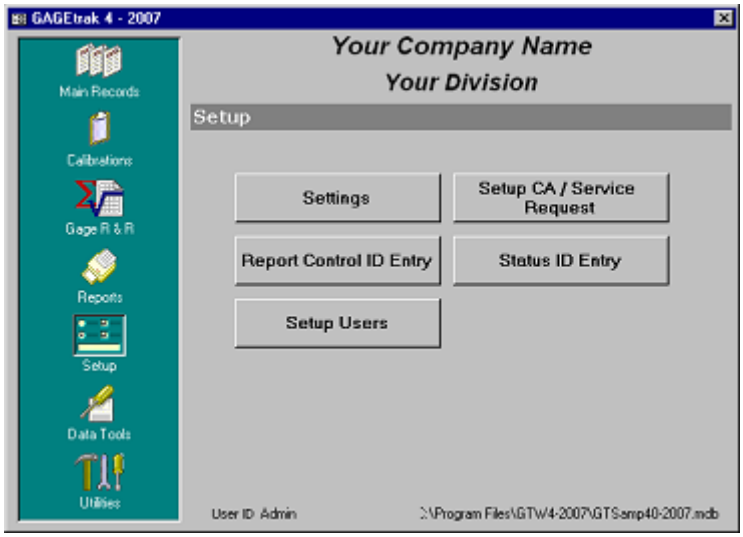
If this window appears, click the *Browse* button and navigate through the available drives and directories until you find the database file. Remember, the file name must be "GTDATA40-2007.MDB".



Note: Users who have their database file located on the network server must log into the network operating system before they can open the database file. If you're using GAGEtrak on a client/server system, you must set up the Open Database screen according to your database configuration. Please see page 170 for more information.

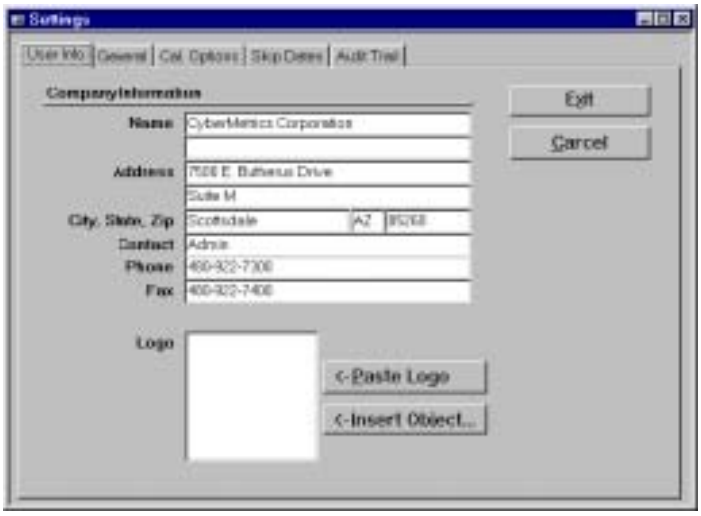
Chapter 5: Setting Up GAGEtrak

Before you begin entering records, we recommend that you configure your GAGEtrak program. To do so, go to the Settings Area of the Main Menu.



GAGEtrak Settings

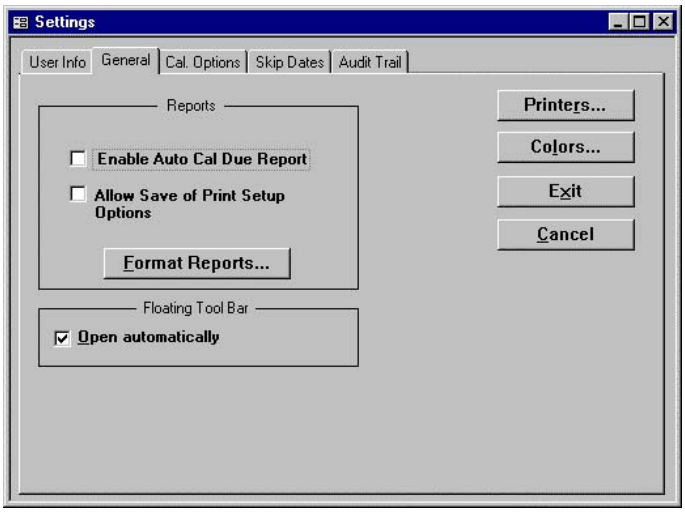
In the first Settings screen, User Info., enter your company information.

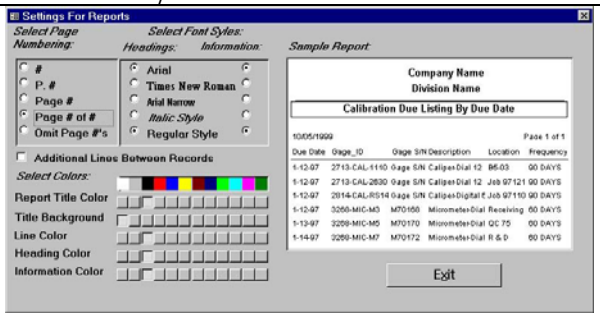


User Information Entry

Field/Button Name	Description
Company Information	Enter your company name, address, phone/fax numbers, and logo (optional). The two lines for your company name and logo will appear at the top of all reports.
Paste Logo and *Insert Object*	To enter your company logo, use the *Insert Object* or *Paste* buttons. Use *Insert Object* if you already have a logo file or want to create the logo in a graphics program and link it to GAGEtrak. Use the *Paste* button if you've copied the logo to Windows Clipboard. Try to insert a logo graphic about the same size as the logo region shown. Otherwise, you might not have enough memory available to print the logo on your reports. Also, to avoid wasting memory, don't use a logo with more colors than your printer can print. You can use a scanner to obtain your logo, but scanners are often set for more resolution or colors than your printer can support. A logo created this way becomes a huge file that uses an excessive amount of memory. To conserve memory, paste your logo into GAGEtrak as a .BMP file, even if you created it in a graphics program. Pasting your logo as a bitmapped object uses less memory. If you can view your logo in the Settings window, but it doesn't appear on your reports, you don't have enough memory for the logo size (in bytes) that you've used.
Exit	To save your changes and return to the main menu, click the *Exit* button.
Cancel	Click *Cancel* to return to the main menu without saving your changes.

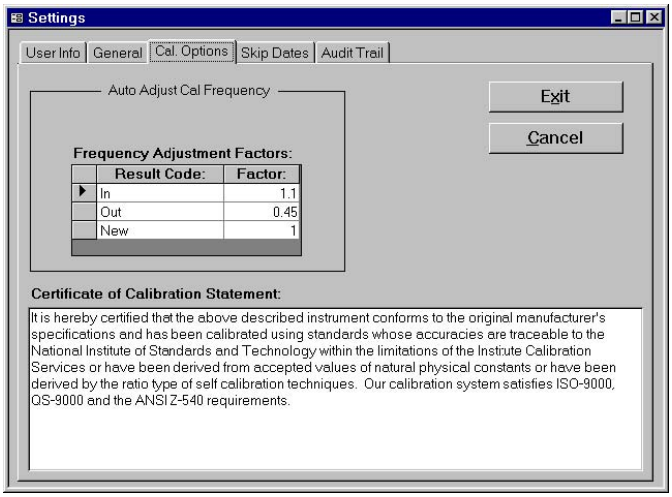
General Preferences Selection



Field/Button Name	Description
Enable Auto Cal Due Report	Check this box if you want the Calibration Due Report to automatically pop up when you open GAGEtrak. This report shows gage IDs that are due or past due. You can print the report or close it to continue into the program. A message will appear if you don't have any gages due for calibration.
Allow Save of Print Setup Options	You must check this box if you want to save changes to print setup options, such as margins. If you've enabled *Allow Save of Print Setup Options*, you can also change and save which printer will be used for a form or report. To do so, go to the Print Preview version of the form or report and designate the printer as the *Specific Printer*.
Format Reports	 Click the *Format Reports* button to access this screen, where you can set your report options. The sample report on the right side of the screen shows your current settings. Selections include: ▪ four different types of page number formats (or omit page numbers altogether) ▪ three types of fonts with two font styles (regular and italic) ▪ different font styles for report headings and information ▪ additional separator lines between records ▪ ten different colors available for title, title background, lines, headings, and information
Floating Toolbar	In the data entry screens, you can click the floating toolbar to resize or move it. If you don't want the toolbar to appear at all, un-check the *Open Automatically* checkbox in this screen. Please see the *Program Conventions* printer or install new printer drivers. You must select a default Windows printer in order to preview any reports. See Windows Help or your Windows manual for more information on the Printers screen.
Colors	To select a new color scheme for your Windows environment, click the *Colors* button to access Windows Control Panel. See Windows Help or your Windows

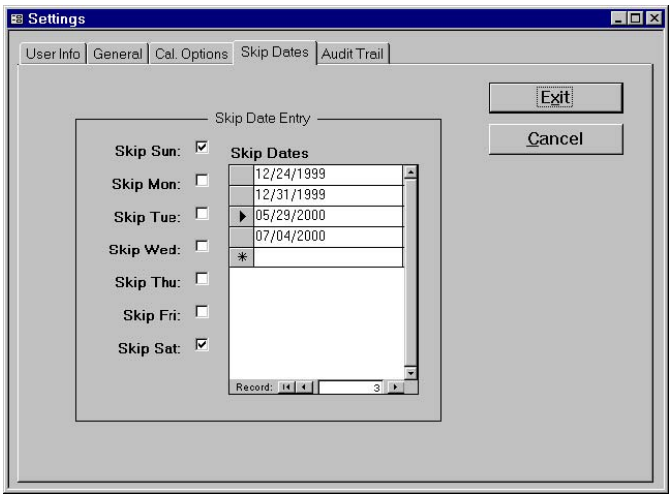
	manual for more information on the Appearance tab.
Cancel	Click the *Cancel* button to discard any changes and exit this window.
Exit	To save your changes and return to the main menu, click the *Exit* button.

Calibration Options Selection



Field/Button Name	Description
Auto Adjust Cal Frequency/ Frequency Adjustment Factors	If you check the *Auto Adjust Cal Frequency* box (in Gage Entry) for any gage, whenever you enter a new calibration record for it, GAGEtrak automatically adjusts its calibration frequency according to the rules you define in the *Frequency Adjustment Factors* table. This table is preset to use the NCSL RP-1 Method A1 (see Appendix C of the *User's Manual* for NCSL's address). This method increases the existing calibration frequency by 10% if the as found condition of the gage is in tolerance (multiplied by 1.1). If the as found condition of the gage is out of tolerance, then it reduces the interval by 55% of the existing frequency (multiplied by .45). If the gage is new and you've never calibrated it, then the interval remains the same (multiplied by 1). Simulation studies show that you achieve measurement reliability target of 95% EOP using this approach. "EOP" stands for "End Of Period"—it refers to the reliability of a gage at the end of its calibration interval. You can change the table to use different factors if you need to use another frequency adjustment method. Example: If the frequency is 30 days, and the as found condition before calibration is *in* tolerance, then the frequency would be set to 33 days (1.1 x 30 = 33 days). If the as found condition was *out* of tolerance, the frequency would be automatically reduced to 13.5 days (.45 x 30 = 13.5 days).
Certificate of Calibration Statement	This statement is included in the Certificate of Calibration document (see *Calibration* the *Reports* section of the *User's Manual*). This field scrolls up and down to allow for longer statements.
Exit	To save your changes and exit this screen, click this button.
Cancel	If you don't want to save your changes, click *Cancel* to exit Settings.

Defining Calibration Skip Dates

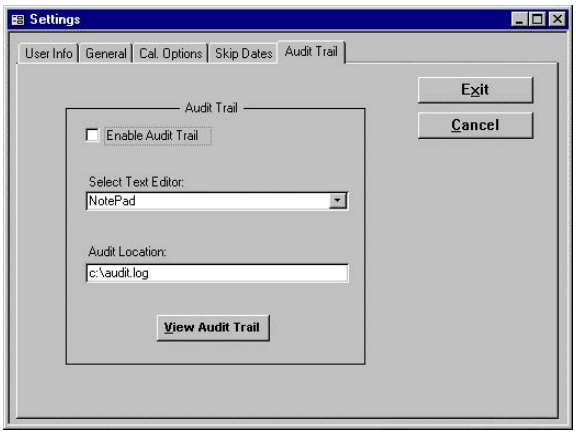


GAGEtrak lets you define dates that you want it to skip when it calculates calibration due dates. These days, called skip dates or skip days, might include holidays, vacation periods, or plant shutdown periods.

Go to the Skip Dates tab and enter as many skip dates as necessary. To delete a skip date, click on the record selector box (on the left of each date) and press DELETE. To skip days of the week (like weekends), check the box next to each day you want to skip. If a *calculated* calibration due date falls on a skip date, GAGEtrak schedules it on the following day. If you *manually* enter a calibration due date, GAGEtrak won't apply your skip dates to it.

Audit Trail

Use GAGEtrak's Audit Trail feature to keep a text file of actions made during use of the program, such as record modifications and deletions. The file also includes the name of the user who performed each action.



Tip: If you are sharing the GAGEtrak database on a network drive, locate your audit log in the same folder.

Field/Button Name	Description
Enable Audit Trail	Click in this box to enable the Audit Trail feature.
View Audit Trail	Click this button to see your audit trail file.
Select Text Editor	Choose a default text editor program, such as NotePad, to use for viewing the audit trail file.
Audit Location	GAGEtrak puts the audit trail file in the directory you designate in this field.
Exit	If you want to save your changes, click *Exit* to return to the main menu.
Cancel	To exit this screen without saving your changes, click the *Cancel* button.

Set Up Users—Security

When you're finished with Settings, select Setup Users from the Tools and Utilities menu to enter your user records. You can assign different rights to the program for each user.

Field/Button Name	Description
PIN	Each user should have a unique PIN (Personal Identification Number), a four-digit number used to log on to GAGEtrak. *Name, Title,* In these fields, enter information about the user, including his or her name, *Location,* and *Phone* job title, location (or department), and phone number.
User Rights	This area lists each program area and user privilege (see the following descriptions).
Access	*Access* indicates that the user can get into this area of the program. If the user has only this box checked, he or she can only view records.
Add	Mark this box to let the user add new records in that area of the program.
Modify	Check this box to let the user edit existing records in this program area.
Delete	If you check this box, you allow the user to delete records in this area. Important: If the user has permission to delete records, then the user automatically has permission to modify records.
Access to Tools and Utilities Menu	This checkbox gives the user access to all program utilities, including the User Entry screen. Tip: You should give this right only to supervisors.
Access to Reports Menu and Printing	To let the user print from the Reports menu and print records from data entry screens (selecting File | Print in a data entry screen), check this box.

Chapter 6: Other Utilities

In addition to setup features, the Tools and Utilities menu also contains functions that help you maintain your program and database. In this chapter, we'll discuss these utilities, including backing up your data; editing data tables; archiving or un-archiving records; and exporting or importing records.

Remove Spaces from Gage IDs

Run this utility once after you've imported data from any other gage management program. This utility removes any unnecessary trailing spaces that your old program used and that were in any databases that you imported into GAGEtrak. It also rounds your calibration measurements to six decimal places, removing any extraneous digits added or transferred during the import process. Depending on how many records you have, this process can take from one to ten minutes.

> Note: This utility is not the same as the GAGEtrak Compact Data utility. The Compact utility doesn't remove *spaces*; it removes old, deleted *records* that you no longer need.

Set Status of Gages

This procedure updates the Gage Entry *Status* field for *all* records to which you haven't assigned a status. It changes these empty *Status* fields to status 1 (Active). This utility won't change the status of any gages in your database that already have a status.

> Note: Use this utility only if you're upgrading from a 1.x version of GAGEtrak or if you imported data from another program or file format. If you're upgrading from a 1.x version of GAGEtrak, run this utility after the Data Transfer Utility (see *Appendix A*).

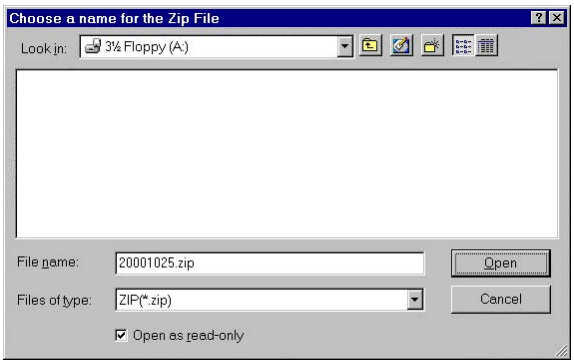
Backup/Restore

You should periodically back up your GTDATA40-2007.MDB database file (we suggest that you do so every day). We recommend that you use GAGEtrak's built-in Backup/Restore function for this task. However, if you have a specialized backup product (such as Colorado Backup, Zip Drive, or another network backup utility), you can use that product instead.

Backing Up Data

First, gather some pre-formatted, blank diskettes (you might need several depending on how many records are in your database). Next, select Backup/Restore from the Tools and Utilities menu. When the Backup/Restore screen appears, click the *Backup* button.

A dialog box called "Choose a name for the Zip File" will appear.

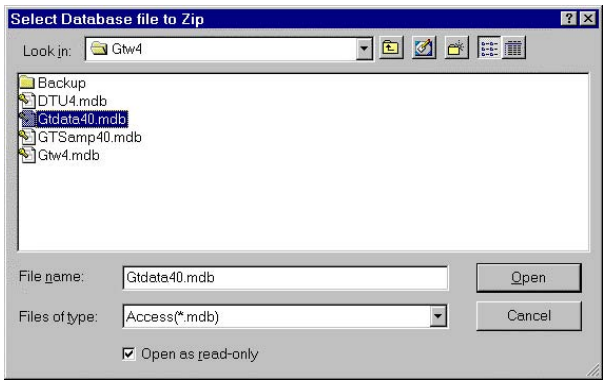


Select the drive and enter a name for the backup ZIP file. If you'll be saving (not reusing) the diskettes, use the current date as your filename, in this format: YYYYMMDD.ZIP. For example, save October 25, 2000's backup as "20001025.ZIP".

> Tip: The drive that you are backing up to must be *removable media* such as floppy disks or zip disks. You cannot back up onto your hard drive using the GAGEtrak Backup utility, but you can copy your database to a network drive that is backed up daily.

Alternate your backup diskettes so that you always have at least your last two backups available. You can also use five or six *sets* of diskettes (one set labeled for each day of the week) and back up your database as GTDATA40.ZIP every day. This way, you'll always have a week's worth of backups. You might also want to archive a permanent set of backups on a regular basis (perhaps once a month).

Next, select the database file to add to your ZIP file. Choose your data file (GTDATA40-2007.MDB) and click the *Open* button.



> Tip: If your database is on your server, you must change the drive letter to your network drive and select the appropriate folders, then highlight GTDATA40-2007.MDB. If you aren't sure where your database is located, check the database location on the lower right corner of the main menu before you back up your database. If you use more than one database with GAGEtrak, back up each one of your databases on a separate set of labeled diskettes.

Place a blank, pre-formatted diskette in the drive and click the *OK* button.

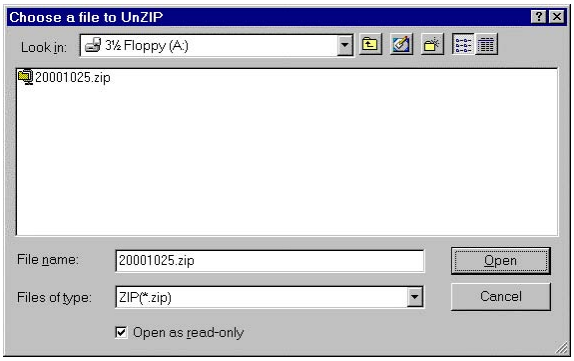
A progress meter will show you the percentage of completion. If the backup requires more than one diskette, the program will ask you to insert another disk. When the backup is finished, you'll see this message:

Your data is now backed up. For future reference, clearly label the backup diskette(s) with the date (or day of the week) and diskette number.

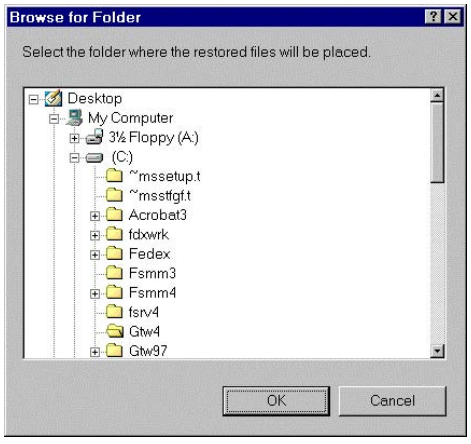
The resulting backup files will be in a highly compressed, industry-standard, "ZIP" format. This means that you can use other utilities, such as PKZIP, PC-Tools, WinZip, or Norton, to restore your backup file.

Restoring Data

If you need to restore your database file, place your backup disk in the drive and click the *Restore* button in the Backup/Restore screen. If your backup used more than one disk, insert the *last* disk of the set.
A dialog box will appear; highlight the file you want to restore (unzip) and click *Open*.



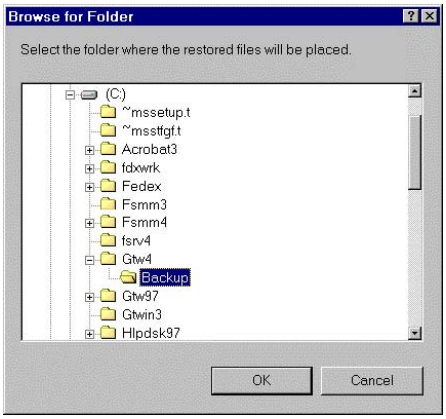
Now choose the drive and directory to which you want to restore the backup ZIP file.



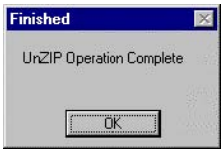
Note: When you restore your database, restore it to a different location than your current database location. The Restore utility contains a safeguard that prevents you from overwriting your current database, even if you try to do so. This safeguard lets you alternately open your restored and current

databases to compare them in case you suspect that you've lost data because of a corrupted database.

Use a folder named "Backup" as the location for your restored database, as shown here:



Click *OK* to begin the Restore operation. When it's finished, you'll see this message:



Tip: If you've replaced your hard drive or are installing the software to another computer, reinstall GAGEtrak first, then restore your backup database file.

Edit All Tables

This utility provides a direct interface for you to make changes to your records (instead of going through GAGEtrak's normal data entry screens). When you open it, the Edit All Tables menu will appear; you can choose from the following data tables:

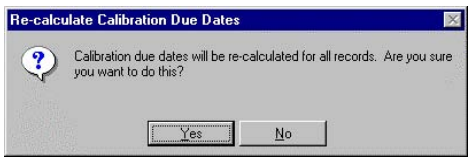
- Gages
- Calibration Headers
- Calibration Measurements
- Calibration Standards
- Issue Tracking
- Gages/Parts Links
- Parts
- Procedures
- Procedure Links
- Suppliers

Warning: When editing data from this utility, you are working directly with the tables in your database—none of the GAGEtrak features that protect against data entry errors or relational integrity corruption are in place. Please be extremely cautious when using this feature.

Calculate All Due Dates

If you need to re-calculate calibration due dates, select this utility. For example, if you change the calibration frequencies on all of your micrometers from 60 Days to 90 Days, and you have 50 micrometer records, it's easier to run this procedure than manually click the *Next Calib.* button on the Gage Entry window for those 50 records.

You'll see the message shown below when you select this utility:

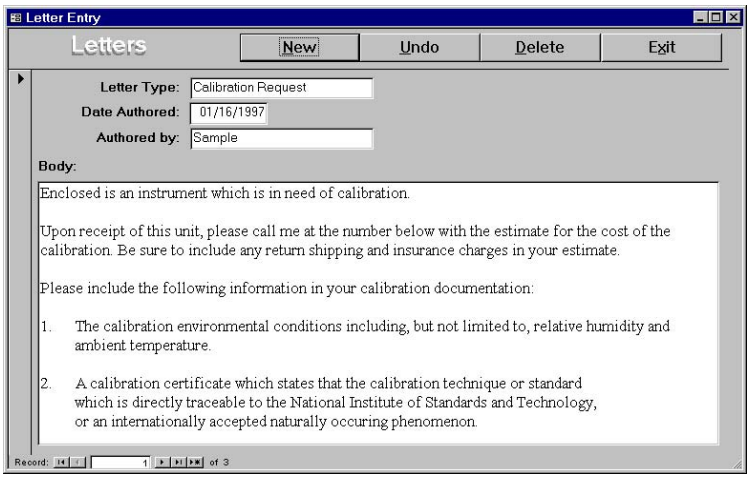


Click *Yes* to have GAGEtrak calculate the *Next Due Date* for every Gage Entry record, based on *Calibration Frequency* and *Last Due Date*. It deletes or overwrites any manually entered dates.

Set Up CA/Service Request

To set up service request letters or corrective action request notices, choose Setup CA/Service Request Letter from the Tools and Utilities menu.

The Letter Entry screen will appear. Here you can enter the letter *Type*, *Date Authored*, *Authored By*, and the *Body* of the letter. Enter as many letters as you need.

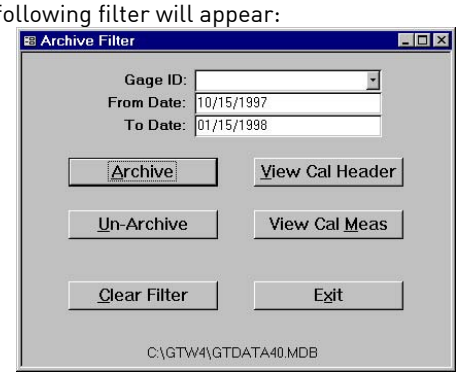


Archive/Un-Archive

Use this utility to archive or un-archive your calibration records. *Archive* moves your records from the current group and puts them in a storage location within the database. This makes your current group of records smaller and your database faster. An archive is not the same as a *backup*.

> Remember: Always make a backup copy of your GTDATA40-2007.MDB file before you archive it!

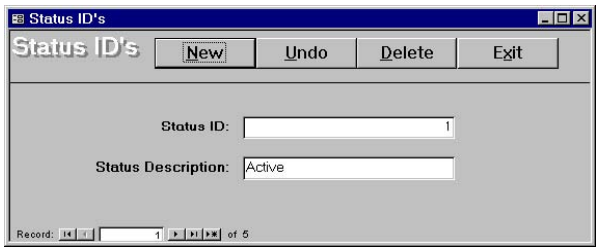
When you select this feature, the following filter will appear:



You can archive your calibration records by *Gage ID* or by *Date*. To archive by *Date*, enter the beginning date in the *From Date* field and the ending date in the *To Date* field. Click the *Archive* button when you're ready. Archived records are stored within the database. After you archive records, you can decrease the size of your data file by running Compact Data from the GAGEtrak 4 (2007) program group. To view the archived records, click the *View Cal. Header* or *View Cal. Meas.* buttons. To put archived records back into the current record group, set up the criteria in this screen and click *Un-Archive*.

Status ID Entry

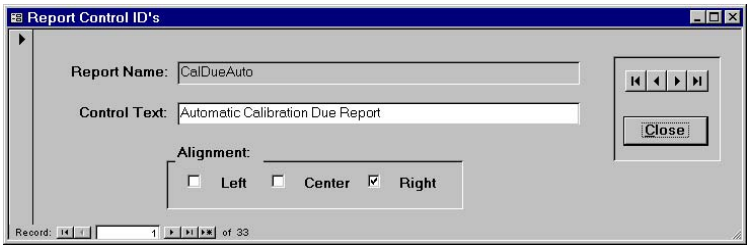
Select this utility to enter the descriptions you want to appear in the *Status* drop-down list in Gage Entry. You **must** use the status ID 1 for current gages because the 1 tells GAGEtrak that the gage is active. On Calibration Due Listings, Calibration Work Orders, and Calibration Schedules, GAGEtrak includes only active gages—those marked with status ID 1. Therefore, **do not delete** status ID 1 (*Active*).



The default *Status Descriptions* that come with GAGEtrak are *Active*, *Inactive*, *Out For Repair*, *Out For Calibration*, and *Lost*. You can change these descriptions (except *Active*) or add as many additional descriptions as might necessary for your company; for example, you may need to add *Status Descriptions* like *Retired*, *Sealed*, or *Loaned Out*.

Report Control ID Entry

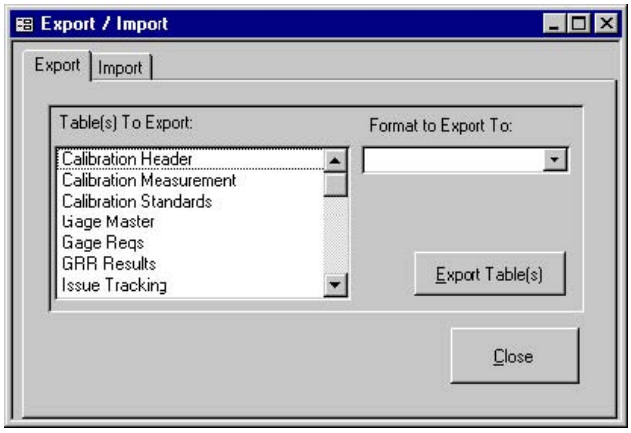
If your company needs to comply with ISO 9000 or QS 9000 Document Identification and Control requirements, you can identify each GAGEtrak report with a unique document control number. To set up this feature, select Report Control ID Entry from the Tools and Utilities menu. Enter the control text for each report, using the navigation arrows at the bottom of the window to go to the next report. The document control ID (the *Control Text* field) will appear at the bottom of reports, using the alignment you have chosen for each individual report (*Left*, *Center*, or *Right*).



Tip: If your company doesn't require a form number on reports, use this area for your company's address and telephone numbers.

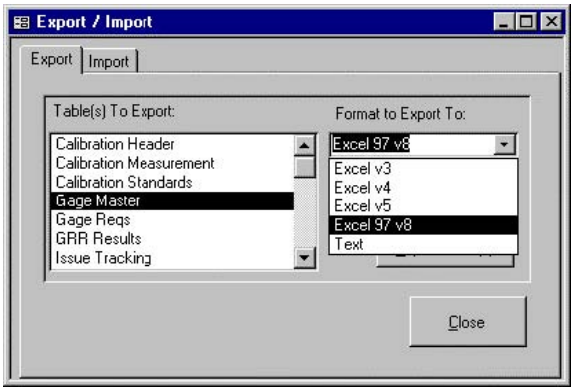
Export/Import

For your convenience, GAGEtrak includes an automated export program. To export or import data, go to the Tools and Utilities menu and select Export/Import. This screen will appear:



Exporting Data

From the left side of the Export screen, highlight the table(s) you want to export. From the right side of the screen, choose the file format you want.



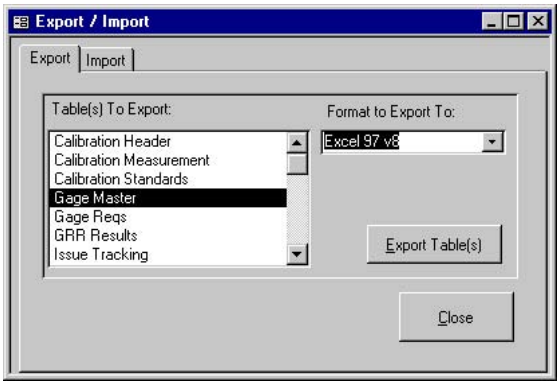
Each table that you can export has a corresponding filename, so you don't need to name your export files. The filenames are based upon the destination/source tables plus the appropriate extension for the file type. For example, a text file from the Parts Master table will be named PARTS.TXT; the same file sent to an Excel file will be named PARTS.XLS.

The Export utility places these files in the same directory as your program file.

Table Name	Export Filename	Helpful Information
Calibration Header	CalHead	Every calibration record will be present in the Calibration Header table.
Calibration Measurement	CalMeas	Not every Calibration Header record requires a corresponding Calibration Measurement record. The Calibration Measurement table contains only calibrations that include actual calibration standards/measurements. One Calibration Header record may have many corresponding calibration records.
Calibration Standards	CalStd	This table links gages to their calibration standards.
Gage Master	GageMast	All Gage Entry information is contained in this table.
Gage Reqs	GageReqs	In this table, gages are linked with parts.
GRR Results	GRR	This table stores all of your gage R&R studies and results.
Issue	IssueTrk	All Gage Issue and Return information is in this table.

Tracking		
Letter	Letter	The form letters you create for repairs, service requests, or calibrations are stored in this table.
MDR	SrvReq	This table contains the service requests that you've entered into GAGEtrak.
Part Master	Parts	In this table, you'll find all of the Part Entry information.
Procedure Link	ProcLink	This table links gages with procedures.
Procedures	Procs	Procedures are stored in this table.
ResultCodes	RsltCode	The Result Codes table stores your *Automatic Frequency Adjustment* factors.
Skip Dates	SkipDate	This table stores all of the dates that the program skips when it calculates *Next Due Dates* for gages.
Status	Status	The Status table contains all of your gage status options.
Supplier Master	Supplier	The Supplier table stores all of your supplier information.

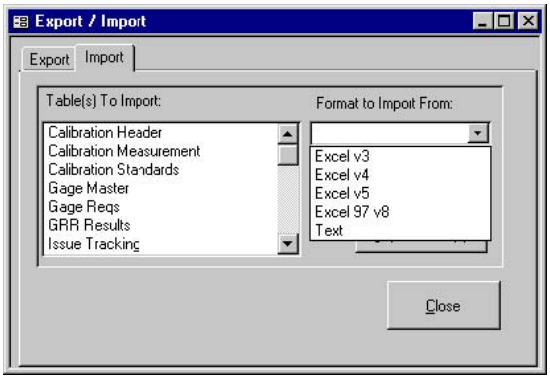
After you've selected one or more tables to export, click the *Export Table(s)* button.



The Export program automatically sends the file(s) to the same directory as your program file. When it's finished, a message tells you that GAGEtrak successfully exported the tables.

Importing Data

You can import data into the same tables from which you can export, using the same filenames and file types as for the Export utility.



The easiest way to import data is to first export data from GAGEtrak's empty database to the file format of your choice. You'll then have the exact import configuration in place for the file. Next, open the file and duplicate its configuration for a file you already have or add the records you want to import to the file created by the export. In order to import files, you must name them as shown, with the appropriate file extension of .TXT or .XLS. Make sure that you put the files you're importing into the same directory as your GAGEtrak program file.

Reset Gage Issue Status

This utility is for users who have imported information to the Gage Master or Issue Tracking tables or upgraded from previous GAGEtrak versions. It modifies the database to accommodate the entry and display of user-defined *Issue Types* while it updates gage records.

Compact/Repair Data

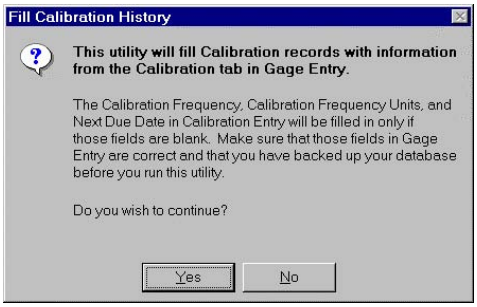
Whenever you delete a record, the program doesn't *actually* delete the record—it only marks it as deleted and then re-uses it whenever you add new records (i.e., your data file size does not decrease). If you delete many records, you should compact your data file so that the program actually removes these records, decreasing the size of the data file. You can do this by running Compact/Repair Data from the Tools and Utilities menu.

Reset Adjusted Frequencies

If you've enabled the Auto Adjust Cal Frequency feature for any gage, and then decide that you would like to change the gage's frequency back to its original value, run this utility. It resets the frequency, as long as you used GAGEtrak Versions 3.5 or 4 to enable the Automatic Adjustment feature. Running this utility won't affect any calibration frequencies automatically adjusted within previous versions of GAGEtrak.

Fill Calibration History

This utility is designed for users who are upgrading from previous versions of GAGEtrak for Windows software. It calculates the *Next Due Date* for the calibration records, using the current calibration frequency from Gage Entry. If you've ever used GAGEtrak Versions 1 or 2, or if you've imported records to the Calibration Header table, run this utility once to update your calibration records with information from your gage records. When you select this utility, the following window will appear:



Appendix A: Data Transfer Utility

Use this utility only once—when you install your new GAGEtrak 4 (2007) and need to transfer your data from GAGEtrak for Windows Version 3.0, 3.1, 3.5, 4.x or 4 - 2007 (if you're using a client/server setup with Version 4).

Version 3	*3* means any GAGEtrak Version 3 or higher (including GAGEtrak 97 and GAGEtrak Version 3). For GAGEtrak 97 (32-bit), the database file is DATA9731.MDB; the archive file can be named either ARCH9731.MDB or ARCH9735.MDB. For GAGEtrak Version 3 (16-bit), the database file is DATA30.MDB; the archive file is ARCHIVE.MDB.
Version 4.0	*4.0* means any GAGEtrak Version 4 Access Database. The database and archive are in one file– GTDATA40.MDB.
Version 4 - 2007	*4 – 2007* means any GAGEtrak Version 4 - 2007 Access Database. The database and archive are in one file–
Version 4 – 2007 New	Transfer to ODBC database. Use 4 – 2007 New to populate newly created ODBC database first.

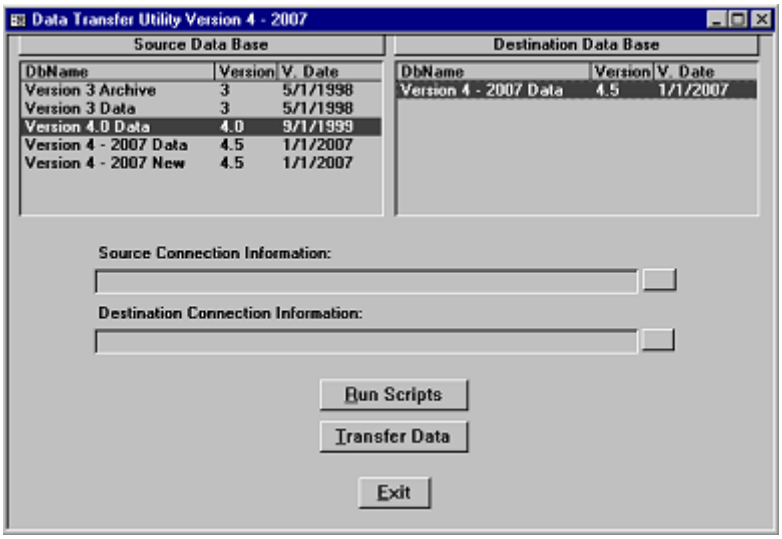
Running the DTU *overwrites* your GAGEtrak 4 (2007) database. You need to run the DTU because new fields and tables have been added to GAGEtrak 4 (2007); new client/server users need to run it in order to transfer the prefilled settings (such as status IDs) to the client/server database. If you're a new user with an Access database, these settings are already in the database, so you do not need to run the DTU.

After you run the DTU, your records will be in both your old and new versions of GAGEtrak. However, don't use your old version of GAGEtrak; enter all new records into GAGEtrak 4 (2007).

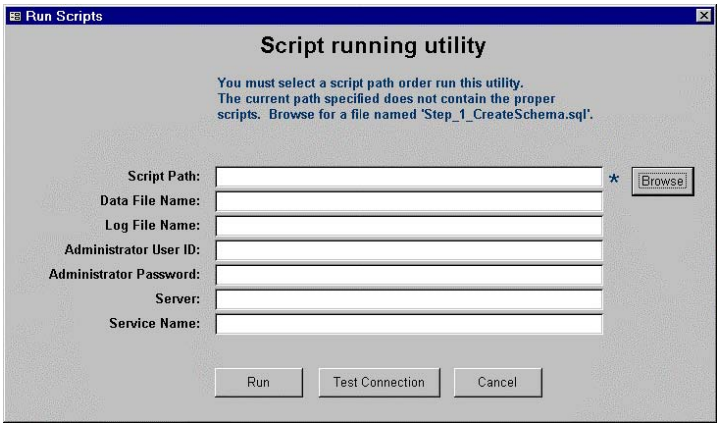
Client/Server Versions—Before You Run the DTU

If you're using a client/server version of GAGEtrak 4.0, You do not need to run the DTU to use version v – 2007 as the ODBC schemas are identical, only the Access backend database has been upgraded to Jet 4.0 (Access 2000).

If you are a new user of GAGEtrak version 4 – 2007 Client/Server, you must run scripts to set up your database and tables before you transfer your data. To do so, click the *Run Scripts* button on the main DTU screen.



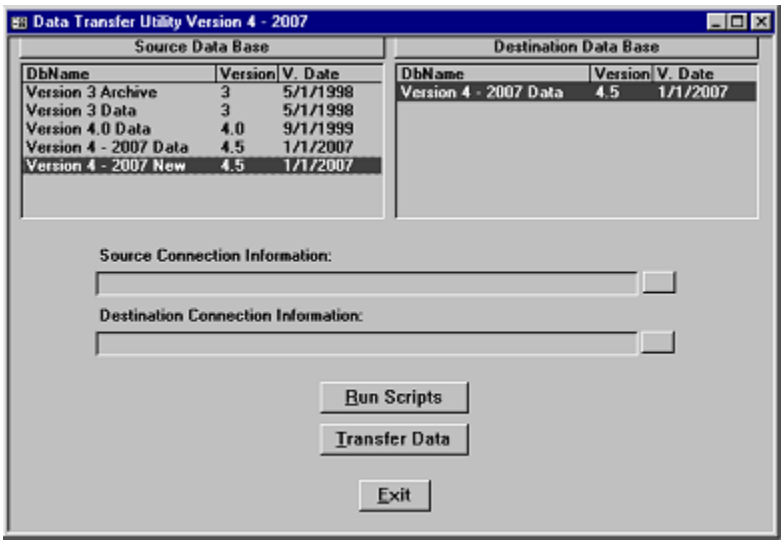
The Run Scripts screen will appear. The table below contains information about the fields and buttons in this screen.



Field/Button Name	Description
Script Path and *Browse*	This field contains the location of the "Scripts" file for the current workstation. It defaults to the same path that the DTU is in for the current workstation. If this path is incorrect, you'll see a message similar to the one shown above. Click *Browse* to find the directory where the "Scripts" file is located.

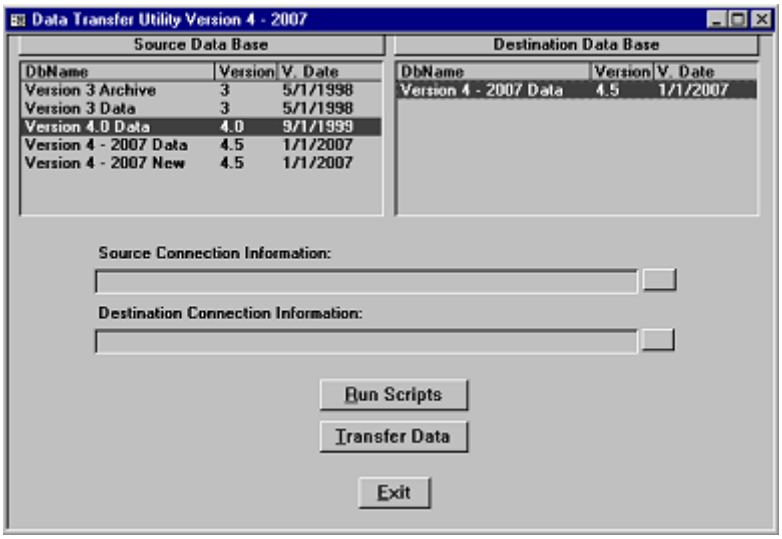
Data File Name	Enter the name and server location of the GAGEtrak 4 (2007) data file. The letter for the drive must be its physical drive letter, not a mapped letter. For example, if your server has a physical drive (D) that's mapped to as a different letter (F), enter D followed by the rest of the path.
Log File Name (MS SQL only)	MS SQL users should enter the name and server location of the log file. We recommend that you use the same path as for the data file (again, using the drive letter of the physical drive).
Administrator User ID and *Password*	Enter the user name and password of your database administrator.
Server (MS SQL only)	MS SQL users must enter the server name in this field. For example, if the server name is "Company_NT", enter that name in this field.
Service Name (Oracle only)	Oracle users must enter the name of the service that the database will be installed on; you create this name when you configure Oracle on the server.
Run	When you've finished entering all of the necessary information, click this button to run the scripts.
Test Connection	Click this button to make sure that you're connected to the correct path before you run the scripts.
Cancel	To exit this screen without running the scripts, click *Cancel* to return to the main DTU screen.

When you're finished running the scripts, you can begin transferring data. Next, you'll see several sets of instructions for running the Data Transfer Utility. Please consult the section that corresponds to your old version number. After You first create your blank ODBC database from the scripts, you must run the DTU from version 4 – 2007 New to fill in the default tables before you can use GAGEtrak version 4 – 2007 especially if you are a new customer and do not have any data from a previous version of GAGEtrak to transfer into the newly created ODBC database.



Data Transfer Instructions–Version 4 (2007) Access Users to Client/Server Version 4 (2007)

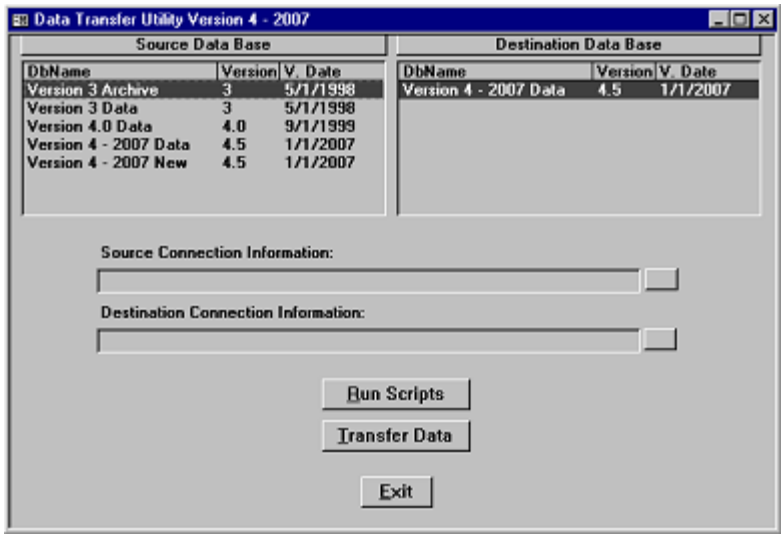
Converting your old version 4.0 database file—GTDATA40.MDB



1. Under *Source Data Base*, select Version 4.0 Data.
2. Click the small button on the right of the *Source Connection Information* field to navigate to your GTDATA40.MDB file.
3. Next, click the small button on the right of the *Destination Connection Information* field to select the new location of your GAGEtrak 4 (2007) database on the network or server (GTDATA40-2007.MDB).
4. Click the *Transfer Data* button.

Data Transfer Instructions for Version 3—Archive File

Converting your archive file—ARCH9731.MDB or ARCH9735.MDB



1. Under *Source Data Base*, select Version 3 Archive.
2. Click the small button on the right of the *Source Connection Information* field to navigate to your

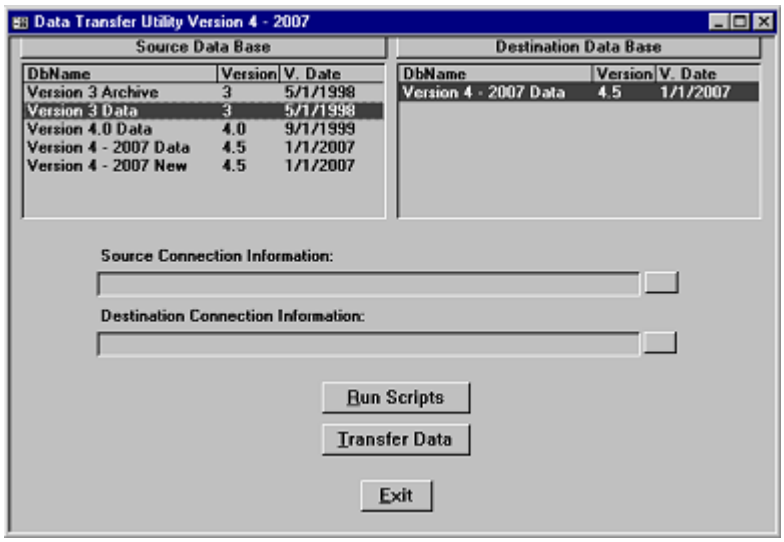
ARCH9731.MDB or ARCH9735.MDB file.

3 Next, click the small button on the right of the *Destination Connection Information* field to navigate to your GAGEtrak 4 (2007) database (GTDATA40-2007.MDB).

4 Click the *Transfer Data* button.

Data Transfer Instructions for Versions 3—Database File

Converting your database file—DATA9731.MDB



1 Under *Source Data Base*, select Version 3 Data.

2 Click the small button on the right of the *Source Connection Information* field to navigate to your DATA9731.MDB file.

3 Next, click the small button on the right of the *Destination Connection Information* field to navigate to your GAGEtrak 4 (2007) database (GTDATA40-2007.MDB).

4 Click the *Transfer Data* button.

All Versions—Verify Data Transfer

After you click *Transfer Data*, GAGEtrak automatically moves your records into the new database. When it's finished, you'll see this message:

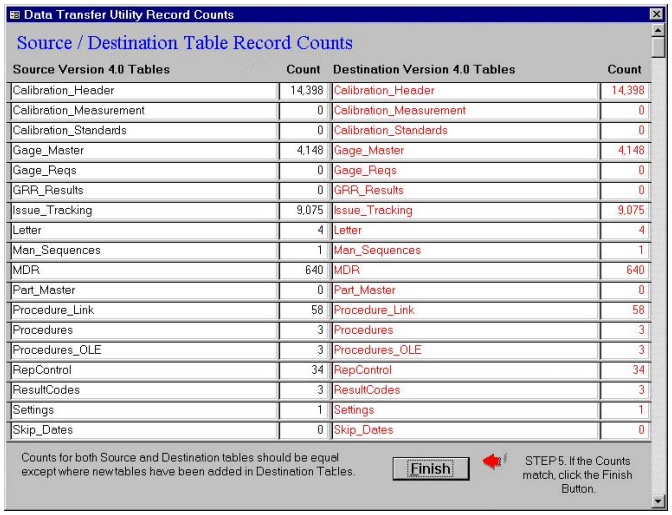
Click *OK*, then GAGEtrak will show you a screen where you can check the transfer and verify that it was successful. This screen is different for each version, but the general instructions are the same.

The *Record Count* values should match in both the *Source* and *Destination* tables for those table names that appear in **both** sections. You can ignore the table names on the *Destination* list that have no corresponding name on the *Source* list; these are GAGEtrak 4 (2007)'s new tables (the report control table will always be higher on the *Destination* side when you are transferring data from Version 3).

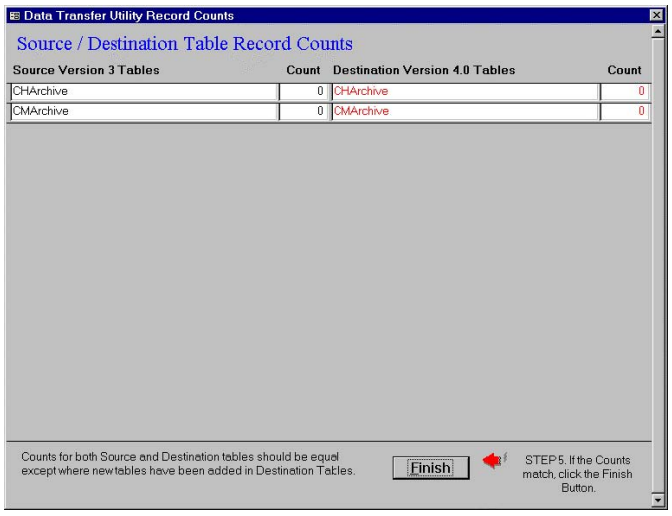
If the counts for the tables that appear in both sections don't match, print the form (select File | Print) and contact Technical Support at 480-922-7300 for assistance.

Click the *Finish* button to return to the main DTU window.

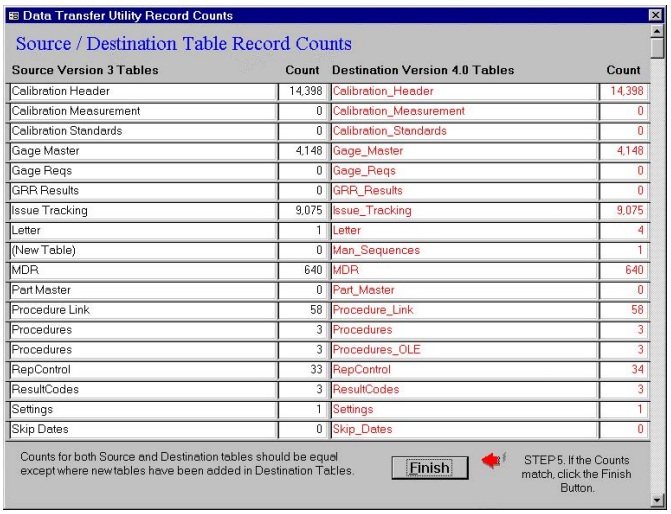
Sample Data Transfer from Version 4.0 Data



Sample Data Transfer from Version 3 Archive



Sample Data Transfer from Version 3 Data



Data Transfer Utility Record Counts

Source / Destination Table Record Counts

Source Version 3 Tables	Count	Destination Version 4.0 Tables	Count
Calibration Header	14,398	Calibration_Header	14,398
Calibration Measurement	0	Calibration_Measurement	0
Calibration Standards	0	Calibration_Standards	0
Gage Master	4,148	Gage_Master	4,148
Gage Reqs	0	Gage_Reqs	0
GRR Results	0	GRR_Results	0
Issue Tracking	9,075	Issue_Tracking	9,075
Letter	1	Letter	4
(New Table)	0	Man_Sequences	1
MDR	640	MDR	640
Part Master	0	Part_Master	0
Procedure Link	58	Procedure_Link	58
Procedures	3	Procedures	3
Procedures	3	Procedures_OLE	3
RepControl	33	RepControl	34
ResultCodes	3	ResultCodes	3
Settings	1	Settings	1
Skip Dates	0	Skip_Dates	0

Counts for both Source and Destination tables should be equal except where new tables have been added in Destination Tables.

Finish

STEP 5. If the Counts match, click the Finish Button.

Appendix B: Record Formats

Key Fields

A key field is a single field or combination of fields that the program uses to uniquely identify each record in a table. In the tables that follow, if the Data Type column contains the word "(Key)", it means that this field or combination of fields is a key field.

Combination Key Fields

This table shows combination key fields (two key fields are identified).

Name	Data Type	Size
Gage_ID	Text_(Key)	50
Standard_ID	Text_(Key)	50

The following data table is *acceptable* (at least one of the key fields is unique):

Gage_ID	Standard_ID
100-10	1-Inch Block
100-10	2-Inch Block

Whereas this data table is *not* be acceptable (none of the key fields is unique):

Gage_ID	Standard_ID
100-10	1-Inch Block
100-10	1-Inch Block

Record Formats

The next few pages contain summaries of the record formats within the database tables. If you need information for other tables, please contact Technical Support at 480-922-7300.

Table Name: Gage_Master

Name	Data Type	Size
Gage_ID	Text (Key)	50
Gage_SN	Text	50
Asset_No	Text	50
Model_No	Text	50
Manufacturer	Text	50

Name	Data Type	Size
GM_Owner	Text	50
Description	Text	50
GM_Type	Text	50
Unit_of_Meas	Text	50
Drawing_No	Text	50
Drawing_Date	Date	8
Change_Level	Text	50
Change_Date	Date	8
Storage_Location	Text	50
Current_Location	Text	50
Service_Date	Date	8
Retirement_Date	Date	8
Calibrator	Text	50
Calibration_Frequency	Double	8
Calibration_Frequency_UOM	Text	50
Resolution Text	Text	50
Operating_Range	Text	50
Plus_Tolerance	Text	50
Minus_Tolerance	Text	50
Supplier_Code	Text	50
GM_Cost	Double	8
Purchase_Date	Date	8
Calibration_Hours	Double	8
Next_Due_Date	Date	8
Last_Calibration_Date	Date	8
Notes	Text	250
Status	Text	50
User_Defined	Text	50
RefStandard	Yes/No	1
GM_Format	Text	50
Calibrated_By	Text	50
GM_Usage	Double	8
AdjPlanCode	Text	50
AdjCalFreq	Double	8
RRFreq	Double	8
RRFreqUnits	Text	50
LastRR	Date	8
NextRR	Date	8
RRResult	Text	50
LabelCode	Text	50
Uncer	Double	8
PriorCalDate	Date	8
Nist_No	Text	50

Table Name: Calibration_Standards

Field Name	Type	Size
Gage_ID (key)	Text (Key)	50
Standard_ID	Text (Key)	50
Minimum	Double	8
Nominal	Double	8
Maximum	Double	8
Units	Text	50
CS_Type	Text	50

Table Name: Issue_Tracking

Field Name	Type	Size
Gage_ID (key)	Text (Key)	50
Issue_Date	Date (Key)	8
Issue_Time	Date (Key)	8
Issued_To	Text	50
Issued_Dept	Text	50
Received_Date	Date	8
Received_Time	Date	8
Received_From	Text	50
Notes	Text	50
Return_Cycles Long 4	Long	4
Part_No	Text	50
Issue_Tracking_Type	Text	50
PO_No	Text	50
ExpReturnDate	Date	8

Table Name: Procedures

Field Name	Type	Size
Procedure_Name	Text (Key)	50
Procedure_txt	Memo	—
MediaPath	Text	255

Table Name: Procedure_Link

Field Name	Type	Size
Gage_ID	Text (Key)	50
Procedure_Name	Text (Key)	50

Table Name: Calibration_Header

Field Name	Type	Size
Gage_ID	Text (Key)	50
Calibration_Date	Date (Key)	8
Calibration_Time	Date (Key)	8
Calibration_Type	Text	50
Calibration_By	Text	50
Department	Text	50
Results	Text	50
Action_Required	Text	50
Approved	Long	4
Findings	Memo	—
Calibration_Cost	Double	8

AcctNo	Text	50
TotalUncert	Double	8
ResultCode Double	Double	8
CalDateUpdated	Long	4
CertNo	Text	50
Time_Required	Double	8
CalFrequency	Double	8
CalFrequency_UOM	Text	50
NextDue	Date	8
Temperature	Text	50
Humidity	Text	50
Pressure	Text	50
Other	Text	50
CalibType	Text	50

Table Name: Calibration_Measurement

Field Name	Type	Size
Gage_ID	Text (Key)	50
Calibration_Date	Date (Key)	8
Gage_Standard_ID	Text (Key)	50
CM_Before	Double	8
CM_After	Double	8
Minimum	Double	8
Nominal	Double	8
Maximum	Double	8
Uncert	Double	8
CM_Calibration_ID	Text	50
LimitUse	Long	4
Units	Text	50
CM_Type	Text	50
Comments	Text	50

Table Name: Supplier_Master

Field Name	Type	Size
Supplier_Code	Text (Key)	50
Supplier_Master_Name	Text	50
Salutation	Text	50
Contact	Text	50
Phone	Text	50
Fax	Text	50
EMail	Text	50
Address	Text	50
City	Text	50
State	Text	50
Zip	Text	50
Country	Text	50
Last_Review	Date	8
Last_Rating	Date	8
Last_Received	Date	8
Last_Reject	Date	8
Enabled	Long	4
User1	Text	50
User2	Text	50

SupType	Text	50

Table Name: Part_Master

Field Name	Type	Size
Part_No	Text (Key)	50
Gage_ID	Text (Key)	50
Description	Text	50
Operation	Text	50
Drawing_No	Text	50
Drawing _Date	Date	8
Change_Level	Text	50
Change_Date	Date	8
Insp_Procedure	Memo	-
User_Defined1	Text	50
User_Defined2	Text	50

Table Name: Gage_Reqs

Field Name	Type	Size
Part_No	Text	50
Gage_ID	Text	50
Step_No	Text	50
Dimension	Text	50
Method	Text	50
Freq	Text	50
Comments	Memo	-

Appendix C: Database Management

Moving or Renaming the GAGEtrak Database

When you first install GAGEtrak, the database location and name are set for each workstation. To change the database location or name, first make sure that all users exit GAGEtrak. Next, select Rename—Move Database from the GAGEtrak 4 (2007) program group. This utility shows you the current name and location for the database. Enter a new name and/or a new location, and the utility will rename and/or move the database. It will then update the program shortcuts with the new database name/location.

Create a New GAGEtrak Database

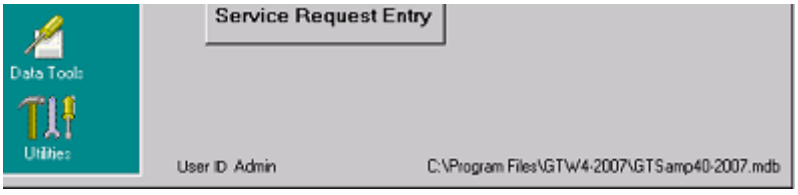
You can use multiple databases with GAGEtrak. For your convenience, the program installs an empty data file in the same location as your database (named GTDATA40-2007.EMP). Copy this empty data file for each additional database that you want to use.

Before you add a new data file, you may want to create a new folder in which to store it. Use Windows Explorer or My Computer to create the new folder. You can name your folder to identify which GTDATA40-2007.MDB file it contains, such as "PLANT5" or "CALIPERS", or by the name of a customer or a supplier. For example, if you had a database for three locations, you might name your folders as follows:

C:\Program Files\GTW4-2007**CHICAGO**\GTDATA40-2007.MDB
C:\Program FilesGTW4-2007**MIAMI**\GTDATA40-2007.MDB
C:\Program Files\GTW4-2007**SEATTLE**\GTDATA40-2007.MDB

After you've created your new database, run GAGEtrak and select File | Open Database while in the main menu. Click the *Browse* button to navigate to the new directory containing the second GTDATA40-2007.MDB file, then click *OK*.

In the lower right corner of the main menu, you'll find the name of the database file that you're currently using, as shown here:



GAGEtrak will remember which database file you last opened even if you quit the program and restart it later. To open and use your original GTDATA40-2007.MDB file, select File | Open Database again, but this time go to your original directory (usually C:\Program Files\GTW4-2007).

> Important: Currently, no easy method exists for transferring records between databases. Although you can use the Copy and Paste approach, it's cumbersome and error-prone; you must be extremely careful and fully understand the data table relationships. Please consider this if you decide to use multiple databases. If you do use multiple database files and later want to merge them, please contact Technical Support for assistance (there may be a small charge for this service).

Creating Icons in Windows

These general steps are the same for creating the different GAGEtrak icons.

1 Click on My Computer.

2 Select Drive C: (or wherever you have GAGEtrak installed).

3 Click on the GTW4-2007 directory.

4 Highlight the TOOLS.ICO icon by clicking on it once. If you can't see it, go to View, Options, and View again, then click on the radio button for *Show All Files*.

5 Without moving the mouse button off of the TOOLS.ICO icon, click the right mouse button and click on Create Shortcut.

6 You'll see the new shortcut icon appear at the bottom of the window, already highlighted in blue.

7 Click the right mouse button on the new shortcut icon.

8. Go to Properties.

9. Click on the Shortcut tab (it's next to the General tab).

Program Icon

To create a program icon for GAGEtrak 4 (2007), follow the steps above, then:

10. Enter this entire line of text in the *Target* field:

> c:\Program Files\Microsoft Office\ART\Office\msaccess.exe /excl /runtime /wrkgrp "c:\Program Files\gtw4-2007\system.mdw" "c:\Program Files\gtw4-2007\gtw4-2007.mdb"

All of the files referenced in the target for the GAGEtrak 4 (2007) program file should be located on the hard drive whether your GAGEtrak 4 (2007) database file is located on your hard drive or on your server.

1 Click *Apply*, then click *OK* or *Close*.

2 Right click on the shortcut icon again and then go to Rename. Name it GAGEtrak 4 (2007) and press ENTER.

3 Double-click the new shortcut to start GAGEtrak 4 (2007).

Compact/Repair Icon

To create a Compact/Repair icon, follow the steps above, then:

10. Enter this entire line of text in the *Target* field:

> "C:\Program Files\Microsoft Office\ART\Office\LaunchAccess.exe" /runtime /profile "GAGEtrak 4 (2007)" /wrkgrp "C:\Program Files\GTW4-2007\system.mdw" /repair "C:\Program Files\GTW4-2007\GTSamp40-2007.mdb"

If you have installed the GAGEtrak database to your local workstation, the default "↓location of database↑" will be "c:\Program Files\gtw4-2007\gtdata40-2007.mdb".

1. Click *Apply*, then click *OK* or *Close*.
2. Right click on the shortcut icon again and then go to Rename. Name it Compact Database and press ENTER.
3. Double-click the new shortcut to repair and compact the GAGEtrak 4 (2007) database.

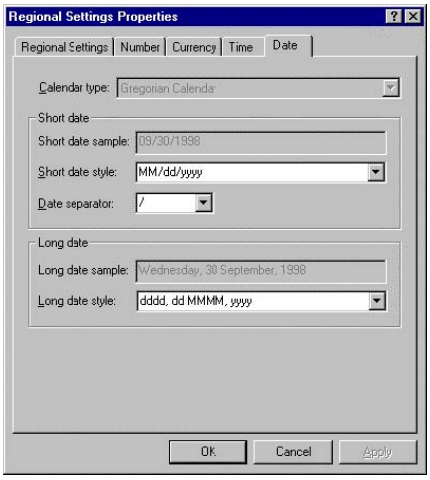
Appendix D: System Maintenance and Troubleshooting

Date Formats

GAGEtrak supports all of the available numeric date formats within Windows. For example, you can represent the date of November 1, 2000 as 11/1/00, 11/01/00, 11/1/2000, 00/11/1, 00/1/11, or 2000/11/1. Because GAGEtrak's reports use only numeric dates, you can select only numeric date formats. Therefore, you can't use dates like "November 1, 2000" or "1 November 2000".

As a precaution, you may want to verify your date settings in Windows Control Panel. Select Start | Settings | Control Panel, then run the Regional Settings icon.

The date formats that you enter into GAGEtrak *must match* the Windows date setting; otherwise, errors will occur while you're running the program. The sample screen shows the most popular format used in the United States:



Maintaining Your Hard Drive

We highly recommend that you run the Windows ScanDisk and Disk Defragmenter utilities to keep your hard disk running smoothly. Run ScanDisk each week to clean up cross-linked files and other problems. Next, run Disk Defragmenter to reorganize your files (this keeps your files from being spread out in pieces all over the hard drive). Your disk accesses will run somewhat faster and your hard drive will be less prone to problems. To

run these utilities, check the *Start* button, select Programs, then choose Accessories. Highlight System Tools, then select the utility and follow the directions on your screen.

Maximizing Your Performance

We recommend that you keep a large amount of empty hard drive space for your operating system's virtual memory management. If you have limited resources and GAGEtrak runs slowly, try closing all other applications to devote all available system resources to GAGEtrak.

Installation Fails

If, for any reason, you can't install your CD or you receive any error messages during installation, try reinstalling the CD. If installation fails again, please write down any error messages and call Technical Support at 480-922-7300 for further instructions.

Repairing Data Files

Although GAGEtrak has been designed to be as trouble-free as possible, error messages may appear because of occurrences like power outages, accidental resetting of your computer, network disconnects, and other mishaps. In these cases, you might need to repair and compact your data file (GTDATA40-2007.MDB). You can do this by selecting the Compact Repair/Data utility from the Tools and Utilities menu. Depending on the size of your file, this may take several minutes to complete. Network users should make sure that no one else is running GAGEtrak when someone is performing this operation. If you cannot open your GAGEtrak database, click the Windows *Start* button, select Programs, choose the GAGEtrak 4 (2007) program group and run Compact Database. If you have copied or created a Compact Database shortcut icon on your desktop (see Appendix C), you can double-click it to repair and compact your GAGEtrak database.
If the error message persists when you're trying to run the program, contact Technical Support immediately at 480-922-7300 for additional instructions.

Duplicate Value—Error Message

An error message may appear if you enter two records with the same key field values.

You'll receive a similar message if you enter:

- two gage records with the same gage ID
- two calibration standards with the same name, for the same gage
- two procedures with the same procedure name, for the same gage
- two calibration standard ID names on the same calibration record
- two supplier records with the same supplier code
- two procedures with the same procedure name
- two parts with the same part number

If an error message appears, click *OK*, then click the *Undo* button or choose Undo from the Edit menu.

Previewing or Printing Reports—Error Message

The error message stating "The sum of the margins and the height of the page footer is greater than the length of the page you are printing on" appears if you install the P-Touch label printer and assign it as the default Windows printer. To eliminate this error, select your report printer as the default Windows printer. GAGEtrak is designed so that calibration labels are printed to the P-Touch printer as a specific printer. For more information about the label printer, please see Appendix A of the *User's Manual*.

P-Touch Printer Does Not Print Labels

If you can preview calibration labels, but cannot print them, you probably do not have a compatible version of the P-Touch printer driver, editor, or spooler files. If you can print labels from the P-Touch Editor program, but you get a message that your P-Touch printer is not installed or recognized, you may also have this problem. Please visit our web site (www.cybermetrics.com) to download the current P-Touch files for your operating system (if you don't have Internet access, please contact Technical Support to obtain these files).

GAGEtrak Won't Open

Message: "The program has expired!"

After you install GAGEtrak 4 (2007), you have 45 days to obtain your trigger code. Once you exceed the 45-day limit, you'll receive this expiration message when you try to open GAGEtrak. To obtain your trigger code, go to the Technical Support section of the CyberMetrics web site (www.cybermetrics.com) or call Technical Support at 480-922-7300. You can contact Technical Support to obtain a trigger code anytime within the 45 days after you install the program, or you can wait until you receive this message.

If you're using the software on just one workstation and you receive this message, it means that your operating system has detected more than one instance of GAGEtrak open on your computer. Close any unidentified open applications or restart Windows to remove the message.

Appendix E: Training

CyberMetrics Corporation offers GAGEtrak for Windows training workshops on a regular basis throughout the year, at various locations. This one day, hands-on training workshop will take you step-by-step through planning, preparation, setup, and successful operation of the GAGEtrak calibration software. You'll learn how to save time, avoid common mistakes, and maximize the use of your software. You'll also learn about advanced topics such as data import/export, data filtering, system maintenance, system security, creating macros, performance tuning, and more.

Anyone involved in the implementation or use of the GAGEtrak for Windows calibration management software is encouraged to attend. We keep our class sizes small in order to provide individualized instruction and assistance. Attendees will receive a complete workbook detailing all of the training topics presented in the workshop.

On-site training classes are also available. For more information about our training program or to make your reservation, please contact CyberMetrics Corporation or your distributor.