Pro Manual

Operator Guide

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Introduction to GageXpress Pro 3.0 file

The GageXpress Pro 3.0 file program is used to configure the GageXpress Pro 3.0 program to interface with your precision inspection systems. The GageXpress Pro 3.0 file program makes creating inspection sequences for virtually any equipment a simple and straight forward process. If you understand a little bit about measurement techniques then you have the qualifications required to program the GageXpress Pro 3.0 system with the GageXpress Pro 3.0 file program.

Typographical Conventions

Before you start using this guide, it is important to understand the terms and typographical conventions used in the documentation.

For more information on specialized terms used in the documentation, see the Glossary at the end of this document.

The following kinds of formatting in the text identify special information.

Formatting convention	Type of Information
Triangular Bullet(Ø)	Step-by-step procedures. You can follow these instructions to complete a specific task.
Special Bold	Items you must select, such as menu options, command buttons, or items in a list.
Emphasis	Use to emphasize the importance of a point or for variable expressions such as parameters.
CAPITALS	Names of keys on the keyboard. for example, SHIFT, CTRL, or ALT.
KEY+KEY	Key combinations for which the user must press and hold down one key and then press another, for example, CTRL+P, or ALT+F4.

System Requirements

Operating System	Version
Windows XP Professional XP Themes MUST be disabled! See below for instructions.	SP2
Windows 2000	SP4
Hardware Component	**Minimum**
Processor	Pentium 800 MHz or equivalent
System RAM	256 MB
Disk Space Available	100 MB
Monitor	15" SVGA (minimum resolution 800 x 600)
Pointing Device	Mouse, PS2 mouse, trackball, light pen or similar device
Parallel or USB Ports	1 (for a printer as desired)
CD/DVD ROM Drive	Required for installation
Internet Explorer	5.0 or later
Adobe Acrobat Reader	5.0 or later (for user documentation)

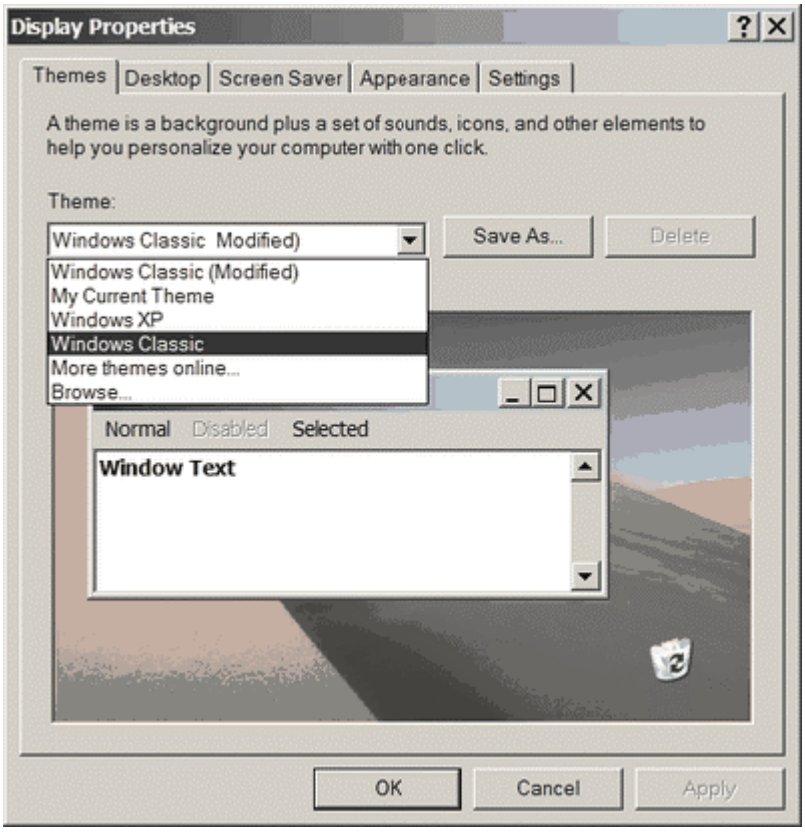
Supported Languages:

English

Turning off XP Themes

If XP Themes is not set to Windows Classic, numerous display issues will be observed in GageXpress Pro 3.0 including but not limited to incorrect color displays and some forms appearing to be blank.

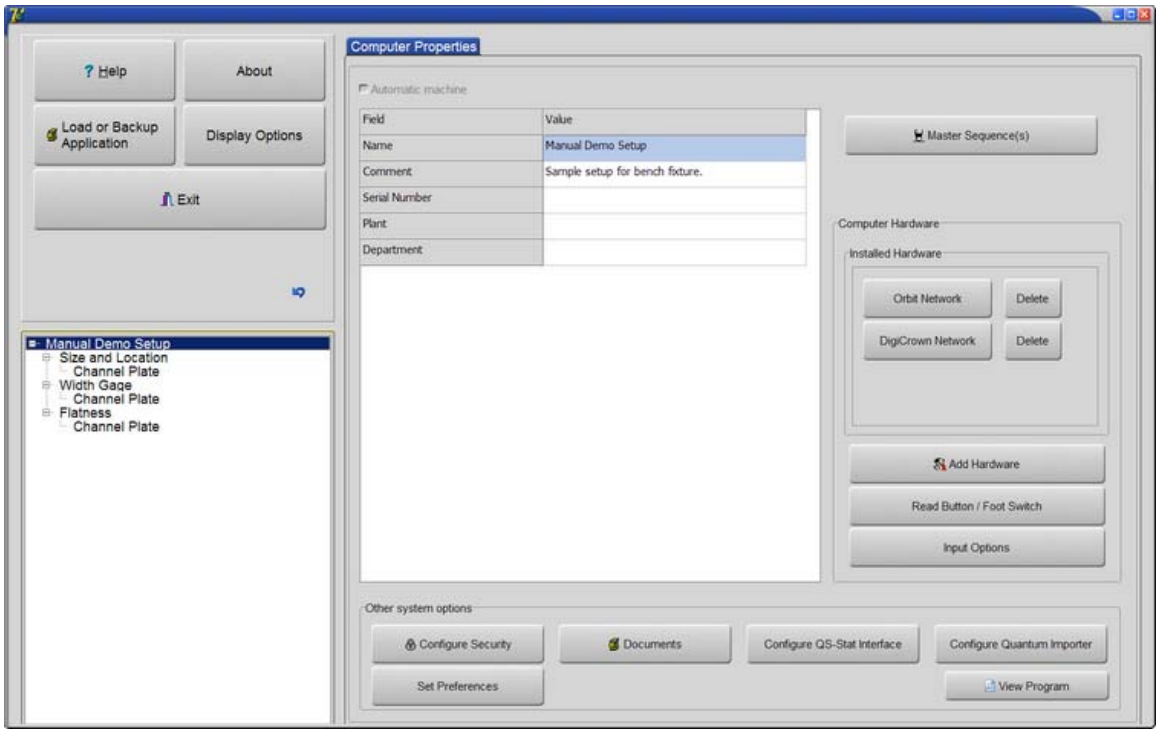
1. Right click the Windows desktop and select Properties on the pop-up menu.
2. Select Windows Classic from the Theme drop down list.



3. Click the OK button.
4. Done!

User Interface

The GageXpress Pro 3.0 file screen is divided into three panes. In the upper left corner, we have system options. In the lower left corner, we have the application objects. And on the right side of the screen, we have selected object's properties.



The objects window displays all objects the GageXpress Pro 3.0 application will work with. Objects are the computer, parts, gages, and machines. Applications for manual gages will display the computer, gages, and parts used in the system. Applications for automatic machines will display the computer, machines and parts used in the system.

The contents of the properties window change whenever a new object is selected in the objects window. The sequence window displays the inspection sequence when a part is selected in the objects window.

The buttons at the upper left of the screen provide access to GageXpress Pro 3.0 file system functions. They are defined as follows:

	System Functions
? Help	The Help button displays the systems online help documentation. You probably clicked that button to view this information. The Help button displays the system online help documentation. You probably clicked that button to view this.
About	Displays about screen.

	Provides access to application maintenance functions including changing your working directory, deleting an application, and backing up your application.
	Displays "Display Options" screen.
	Exits GageXpress Pro 3.0 file program.

Objects are created in the object and sequence windows by right clicking objects and making selections from the displayed pop up menus.

Getting Started

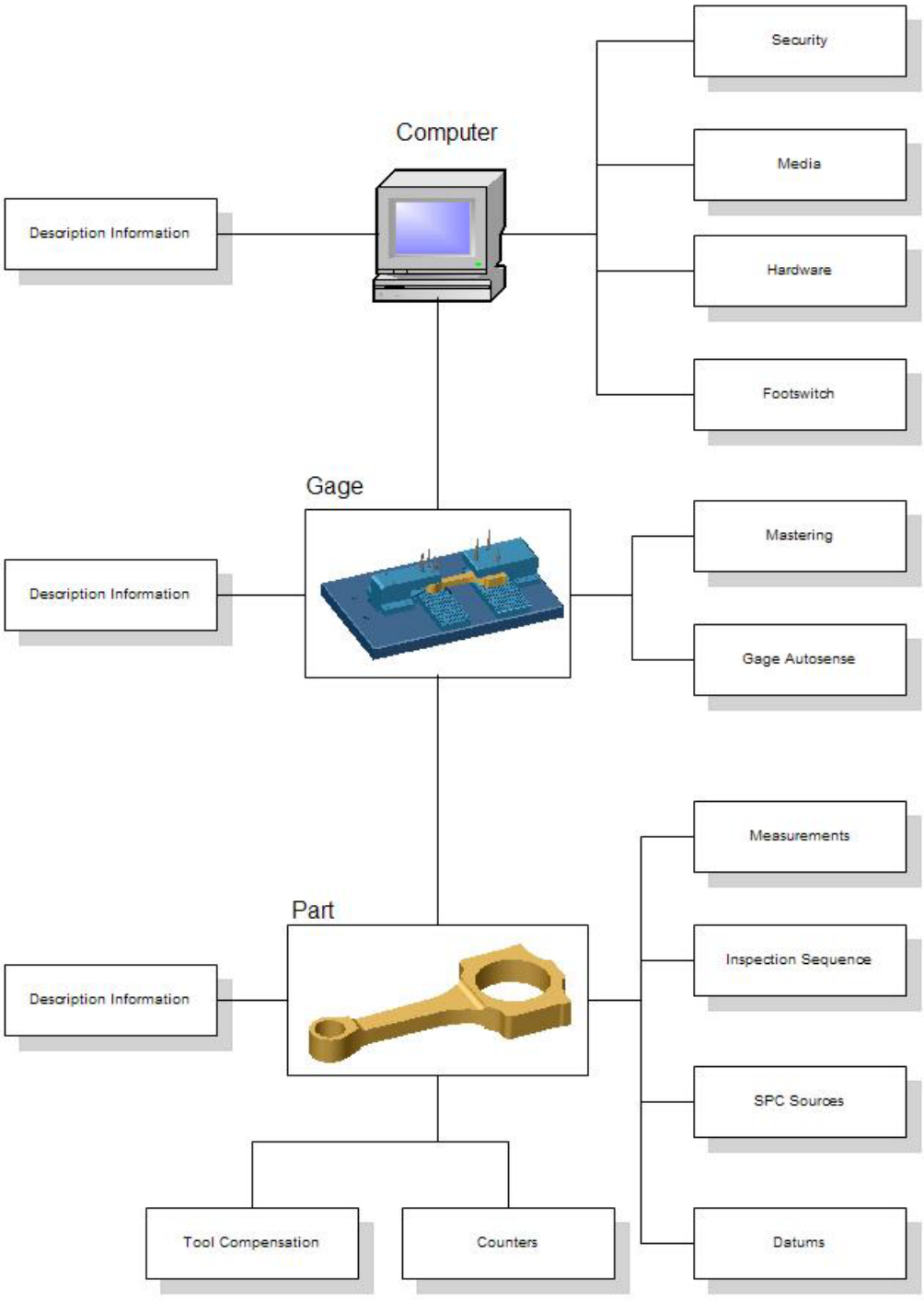
When starting a GageXpress Pro 3.0 setup, the first thing that must be done is to determine if the setup for a manual system or an automatic system. Automatics are defined as systems that run without operator intervention. That is, the operator does not have to press palm buttons or load the part into the fixture. An automatic may be manually loaded or unloaded as long as the loading/unloading consists of nothing more than placing or retrieving parts from some sort of part conveyor system. The operator does not take part in the measurement process. All other systems, including semi-automatics, should be configured as manual GageXpress Pro 3.0 applications.

Please note that once a setup is started as one type or another, it cannot be changed.

Creating a GageXpress Pro 3.0 setup involves creating GageXpress Pro 3.0 objects, setting object properties, and finally creating an inspection sequence using the objects. The GageXpress Pro 3.0 objects are slightly different for manual and automatic configurations.

Anatomy of a GageXpress Pro 3.0 application:

How Created	GageXpress Pro 3.0 Object	What is it?
Automatically created. Configure the computer with the hardware required for your application.	Computer	The computer that gages are connected to and which contains the electronic hardware required to interface transducers.
Create one GageXpress Pro 3.0 gage for each desired gage sequence you require. The gage sequence may use one or more fixtures/gages attached to the GageXpress Pro 3.0 computer.	Gage	One or more physical gages connected to the computer.
Create one part for each part type to be inspected by the gage.	Part	A part is inspected by one or more of the gages connected to the computer.
Create measurements using GageXpress Pro 3.0 templates for each part feature to be inspected.	Measurements	Measurements made on the part. Their values may be stored or just be intermediate measurements made to facilitate the calculation of a more complex measurement.
Calibration Fields are created automatically when a measurement is created using inputs.	Calibration Fields	A combination of one or more inputs that are combined and then scaled to represent actual engineering values.
Create inputs for each transducer connected to the GageXpress Pro 3.0, Inputs are created as part of the hardware configuration.	Inputs	Transducers in gage fixtures that are connected to the workstation's signal conditioning hardware.



Manual Configuration Objects	Automatic Configuration Objects
Computer	Computer
Gage	Machine
Part	Part
Overview of creating a setup for a manual gage.	

1. Add hardware to Computer.
2. Create Gage.
3. Create Part.
4. Add Event(s) to part inspection sequence.
5. Add measurement(s) to event(s).
6. Configure Mastering as required.

Overview of creating a setup for an automatic machine.

1. Add hardware to Computer.
2. Create Machine.
3. Create Part.
4. Assign PLC interface I/O.
5. Add Part to Machine.
6. Add Station to Inspection Sequence.
7. Add Event(s) to Station in Inspection Sequence.
8. Assign Start Gage Input to Event.
9. Add measurement(s) to event(s).
10. Configure Mastering as required.

This manual will discuss, in detail, the process of creating these configurations.

Objects and their Properties

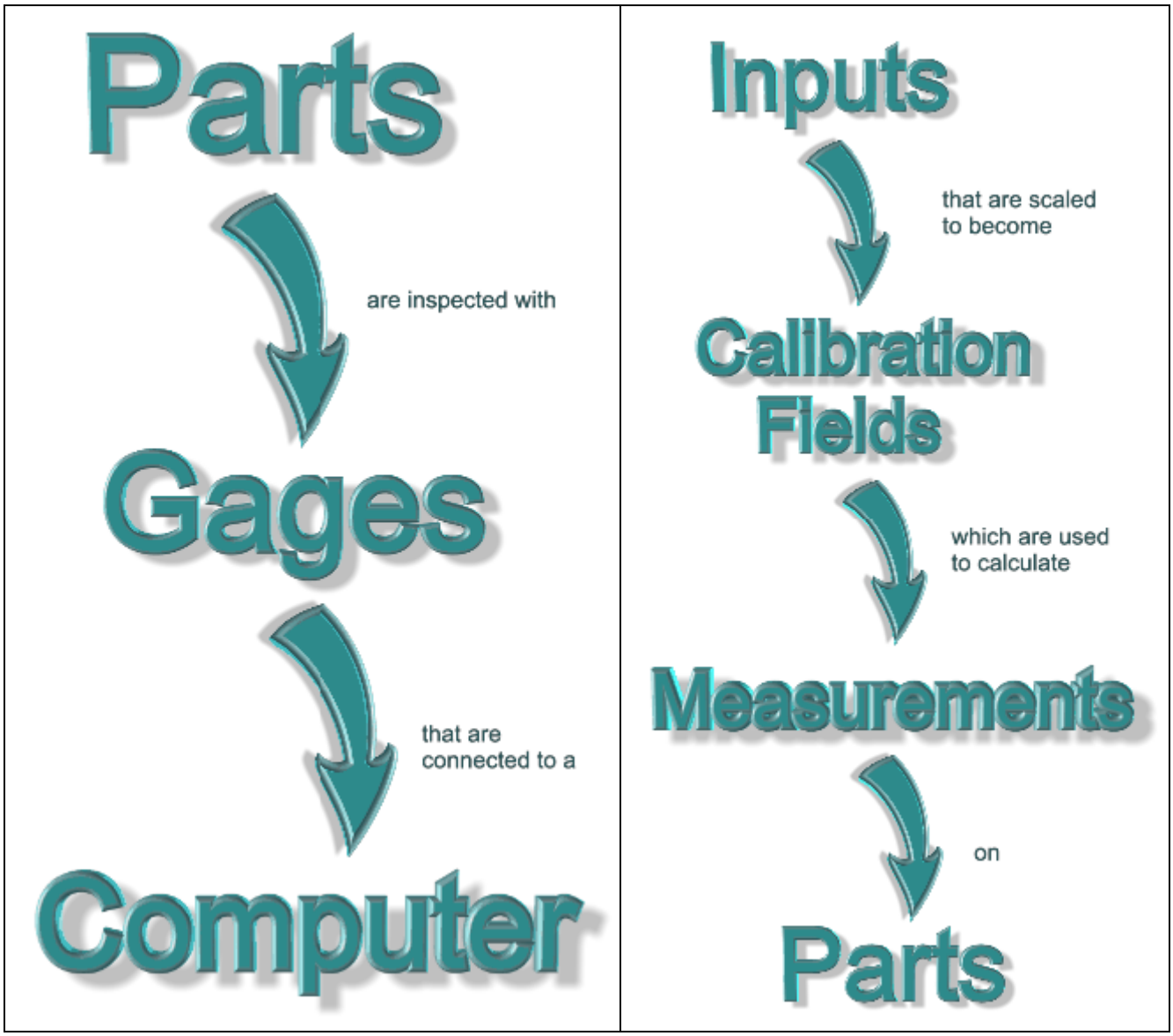
A GageXpress Pro 3.0 setup consists of objects, object properties, and sequences using the objects. This section describes how to create objects in the GageXpress Pro 3.0 objects window and the properties of each object. Some object properties are required for a setup to function properly while others are optional.

The GageXpress Pro 3.0 objects to be defined are:

Manual Configuration Objects	Automatic Configuration Objects
Computer	Computer
Gage	Machine
Part	Part

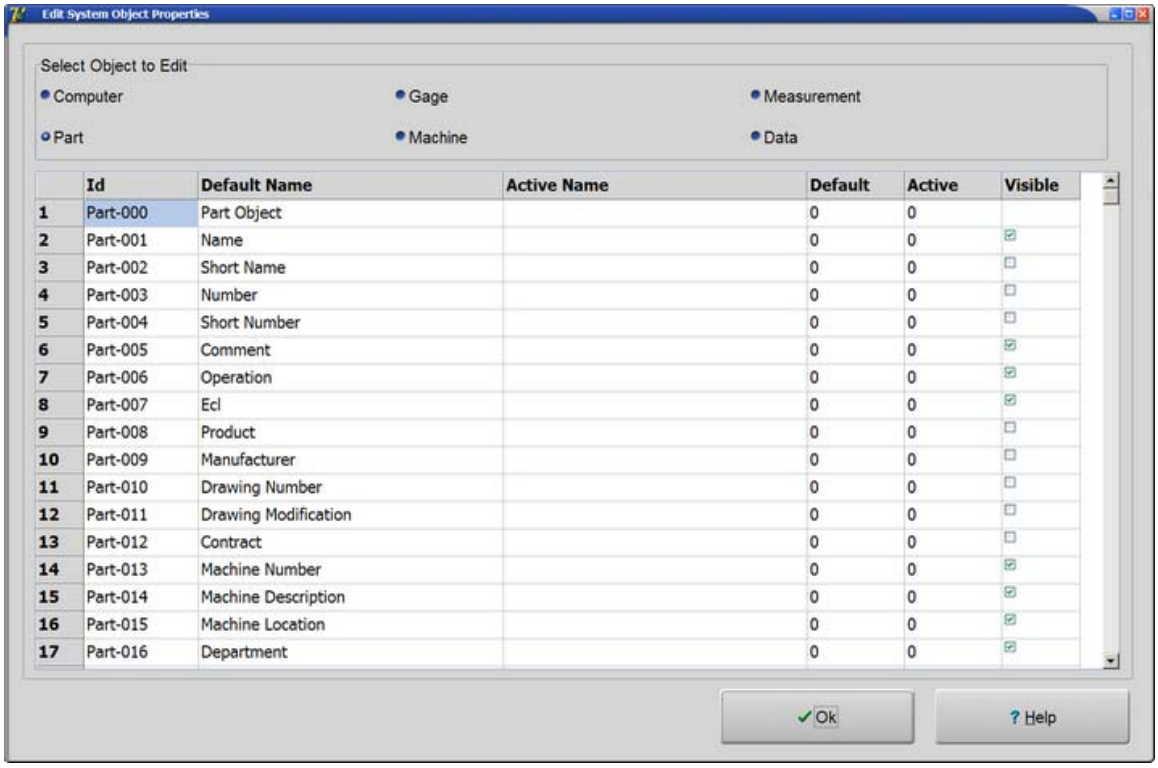
These objects are created in the object window of the properties screen. The Computer object is automatically created each time a new setup is started. Gages can be created by right clicking the computer object and then selecting the "New Gage" item on the pop up menu. A new Gage is displayed under the computer when this is done. A Gage always belongs to a computer .. ie the computer is the gage's parent. If a Gage object is right clicked, the pop up menu allows a "New Part" to be created. The same part can be inspected by multiple gages.

GageXpress Pro 3.0 Objects	GageXpress Pro 3.0 Objects work with



GageXpress Pro 3.0 provides access to many properties for each object. Generally, only a few of these properties are required for any particular setup but you can use as many of them as desired. To view all available properties for GageXpress Pro 3.0 objects, double click the property name area of any object property grid to display the GageXpress Pro 3.0 property editor screen.

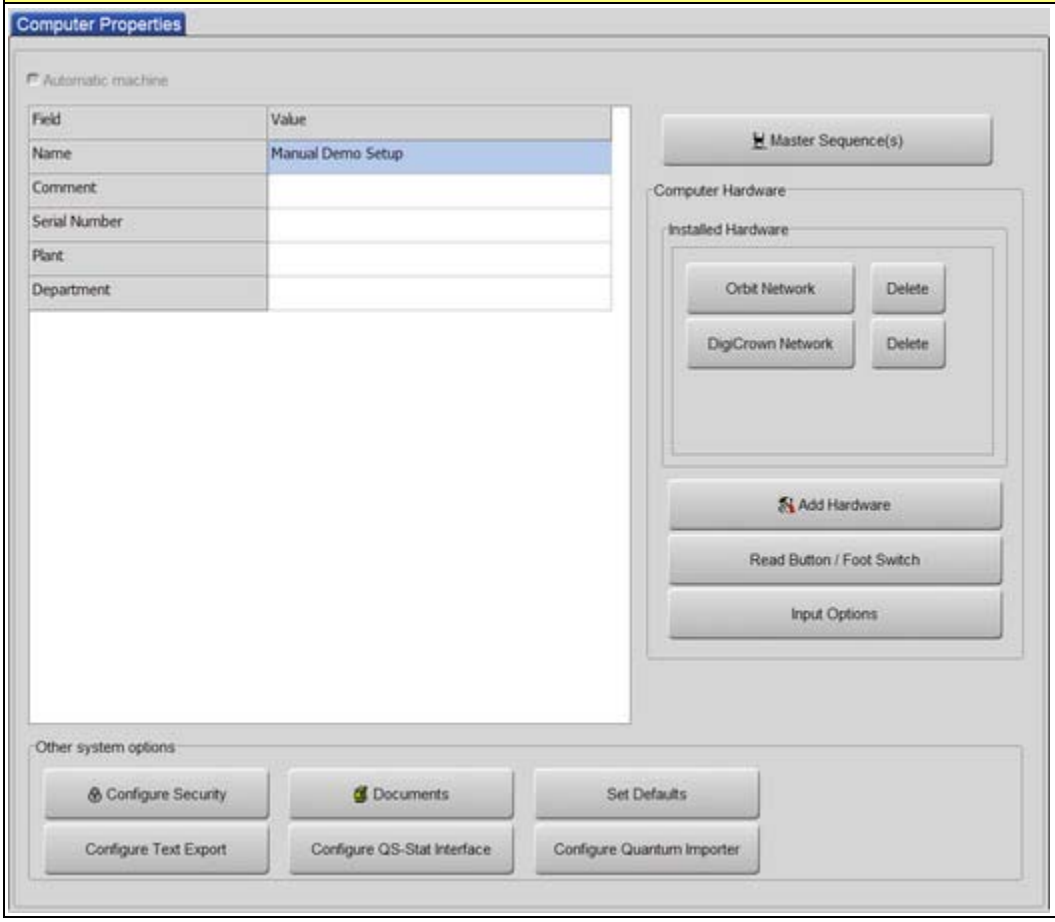
Double Click to display object properties screen

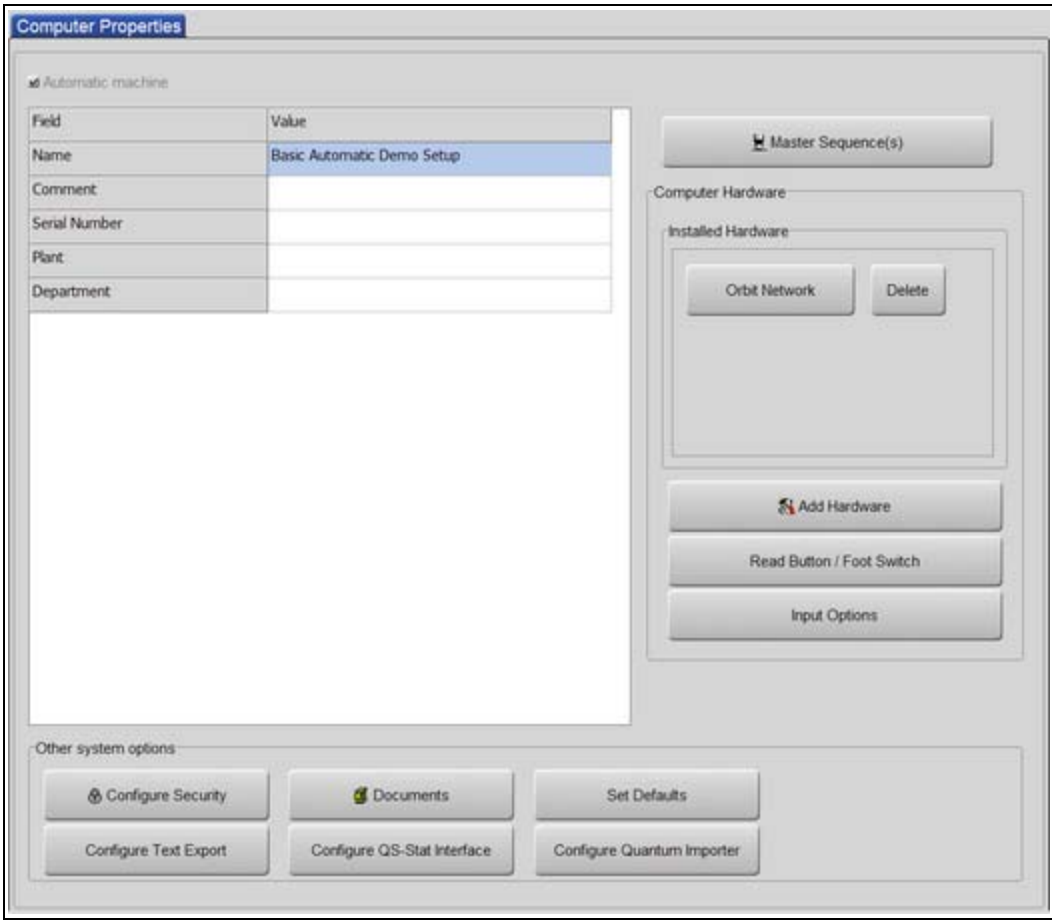


Field	Description
Id	Property identification tag.
Default Name	Name displayed in all captions
Active Name	User defined name to be used for property captions. If blank, the Default Name is used.
Default	Reserved for future use.
Active	Reserved for future use.
Visible	Designates whether property is displayed in property grid.

Computer Properties

The GageXpress Pro 3.0 Computer is the computer which houses the signal conditioning hardware connected to the gage transducers in the gage. It is the highest object in the GageXpress Pro 3.0 hierarchy and is automatically created when the application is started.

Computer Properties screen	Description
	Computer properties for manual application



Computer properties for automatic application

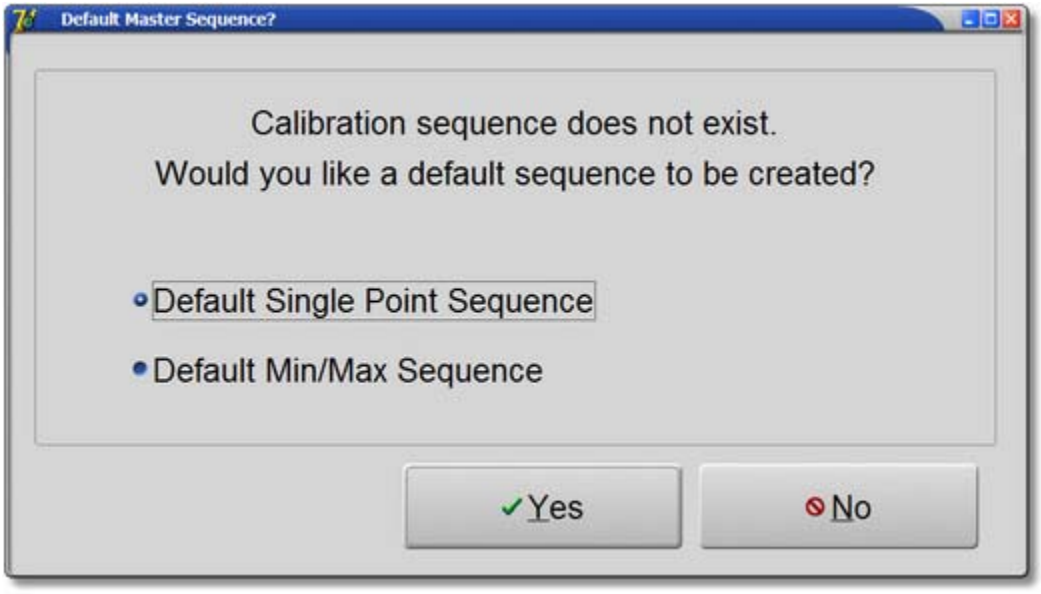
Property	Name	Description
WS-001	Name	Computer name.
WS-002	Short Name	Short Computer name.
WS-003	Number	Number assigned to Computer.
WS-004	Short Number	Short number assigned to Computer.
WS-005	Comment	Comment regarding Computer.
WS-006	Serial Number	Computer serial number.
WS-007	Plant	Plant Computer is located in.
WS-008	Department	Department Computer is located in.
WS-009	Company	Company computer belongs to.
WS-010	Customer Name	Customer Computer is used for.
WS-052	QS-Stat K0012 Index	QS-Stat database identification value.
WS-090	Automatic	Determines if Computer setup is an automatic application.

Mastering

Most every application will require some form of mastering. Even if transducers with absolute scaling are used, the zero value generally has to be set using a nominal master. Exceptions to this are measurements which are relative to one or more inputs. Many times, these types of measurements do not require mastering. Examples of this are a single contact sweep used to inspect true position or a total indicated reading (TIR) measurement.

The Master Sequence Configuration screen is displayed when the Master Sequence button is clicked on Computer properties page. The first time you enter the sequence configuration screen, you are asked if you would like a default sequence created. Default sequences can be created for mean mastering or minimum/maximum mastering sequences. In either case, it is assumed that all calibration fields will be mastered on the created events. These options cover the majority of applications and can save you some time.

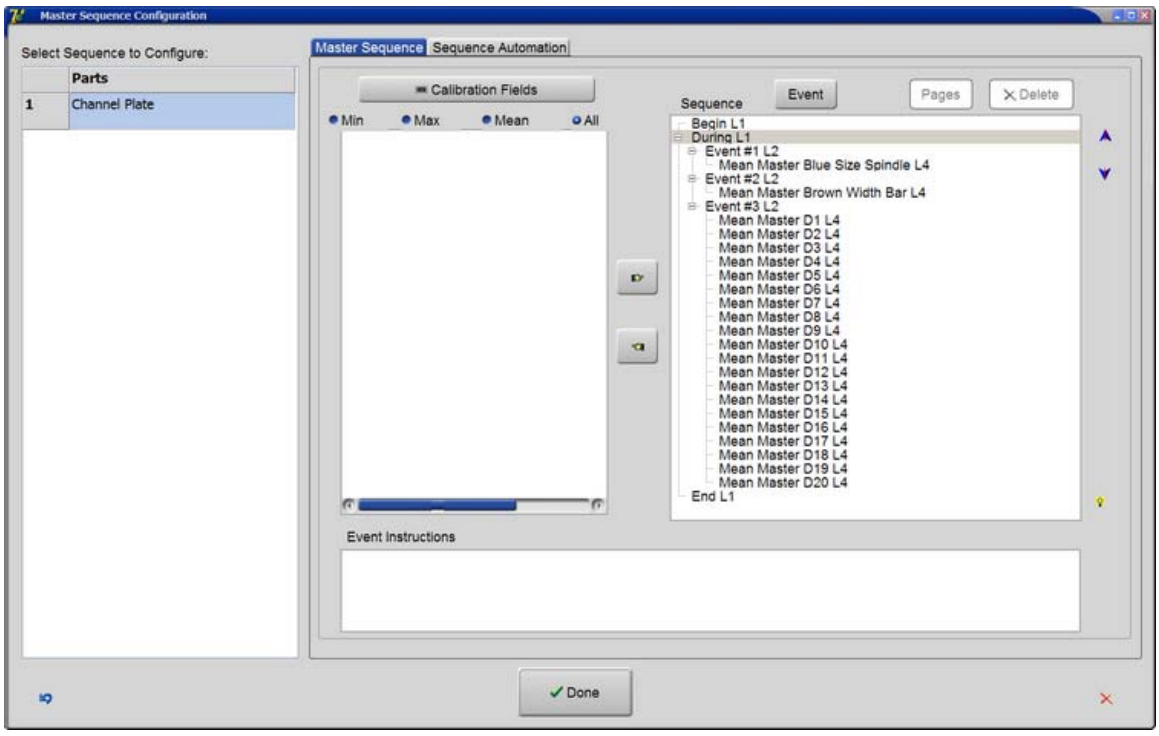
If your mastering sequence is more complex, simply click No and you will be able to create your own sequence events and assign calibration actions as desired.



If you have GageXpress Pro 3.0 file create a default sequence, you can then modify the results at any time.

Master Sequence Configuration

Configuring the master sequence is very similar to configuring an inspection sequence. First you create events and then you add calibration actions to the events. Calibration actions are simply the actions to be performed on a calibration field on a specific event and are either read field minimum master, read field maximum master, or mean master a field. Lastly, pages can be created for calibration events just as they are for gage or machine events. This is of course, optional.

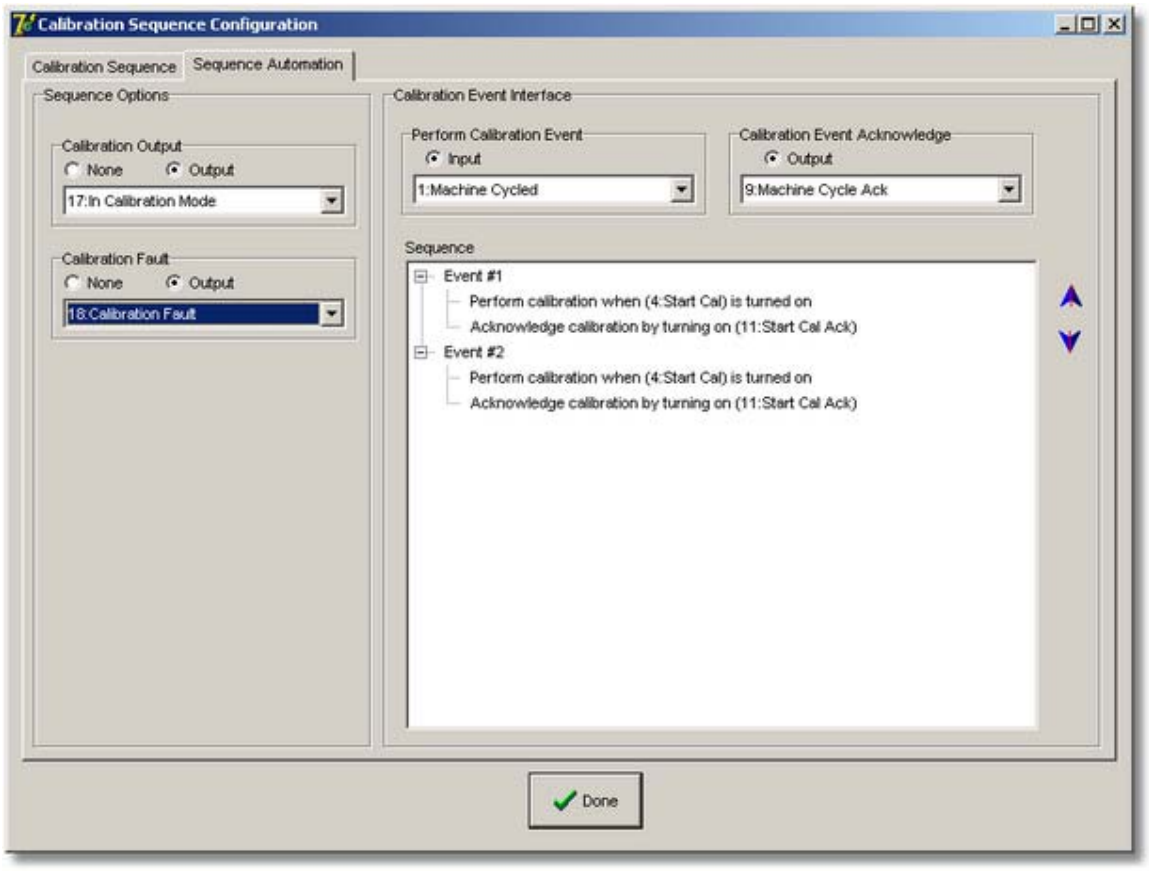


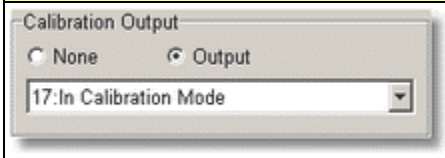
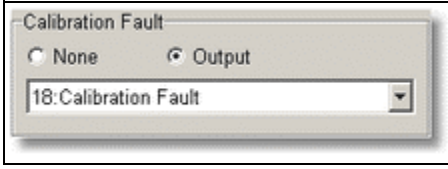
Calibration Sequence Item	Description
Calibration Fields	Displays properties for all sequence calibration fields.
Event	Adds an event to the calibration sequence. The event button will only be active when the During node is selected in the calibration sequence.
Pages	Opens the page editor so that event pages can be created. The Pages button will only be active when an event node is selected in the calibration sequence.
Delete	Deletes the selected item in the calibration sequence.
	Moves the selected calibration action to the currently selected calibration event.
	Moves the selected calibration action from the event it is currently assigned to and puts it back in the list of available actions.
Actions	The actions window shows the calibration field actions available for the selected event. For a given calibration field CFx. valid actions are CFx Min. CFx Max. and CFx Mean.

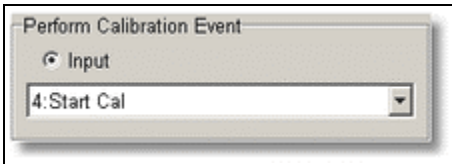
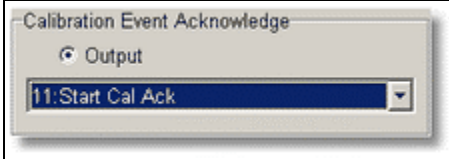
	Only one action can be performed on an event for any given calibration field so once the field is used, it will be removed from the actions window.
Sequence	The master sequence is a series of events that are performed to master all calibration fields used in the system. Each event will have one or more calibration field actions performed on it.
Event Instructions	These are instructions that will be displayed for the operator when performing this master sequence. The instructions are only displayed when viewing the default mastering screens. If you create custom pages for your application, you must include instructions on the page you create.

Calibration Sequence Automation

This screen is used to automate the calibration sequence. This is a common requirement for automatic machines. GageXpress Pro 3.0's calibration sequence automation features allow a PLC to schedule and control all calibration sequences.

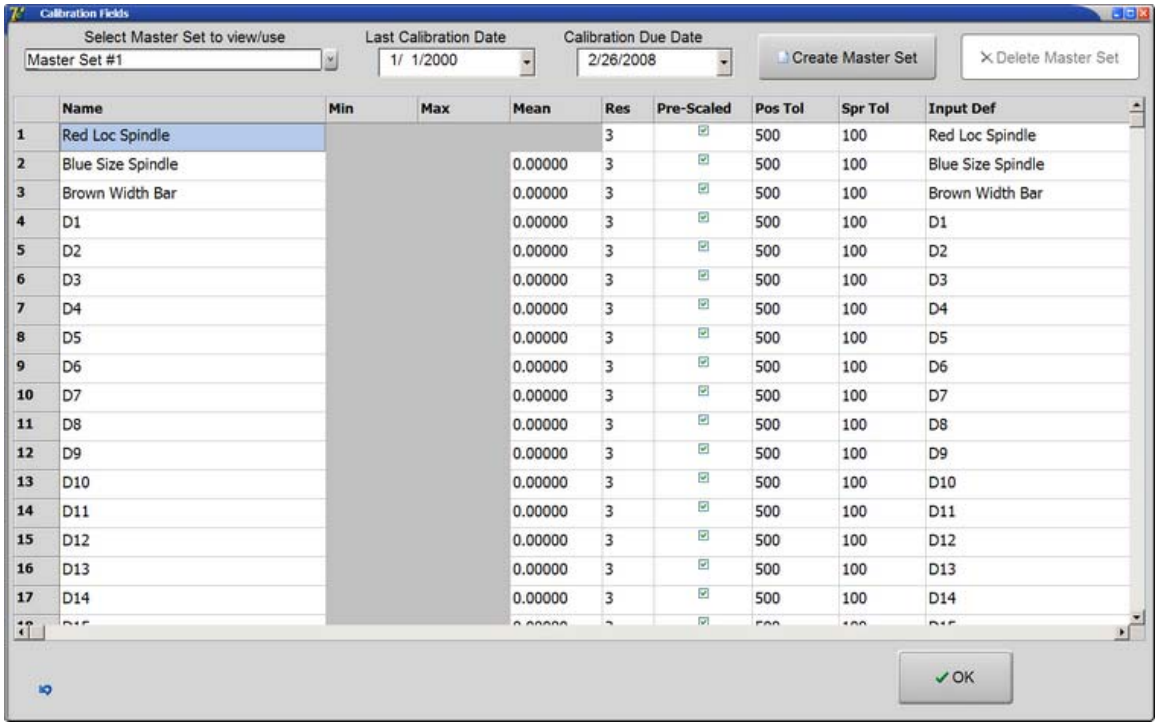


Calibration Automation Property	Description
	This optional output is turned on when GageXpress Pro 3.0 enters calibration mode. It allows a PLC to implement any special sequencing that may be required when in calibration mode.
	This optional output is turned on when a calibration fault occurs.

	This input is the signal from the PLC to GageXpress Pro 3.0 to perform calibration on the designated event. These signals are assigned to calibration events by right clicking the desired event and selecting "Assign Calibration Input" from the pop up menu. The currently selected input in the Perform Calibration Event drop down list will be assigned to the event.
	This output acknowledges receipt of the Perform Calibration Event input and provides a complete handshake for the calibration sequence. These signals are assigned to calibration events by right clicking the desired event and selecting "Assign Calibration Acknowledge from the pop up menu. The currently selected output in the Calibration Event Acknowledge drop down list will be assigned to the event.

Calibration Field Properties

Calibration fields are a combination of one or more inputs that are scaled into engineering units. Inputs have output values in counts or what is called A/D units. Calibration fields are the scaled inputs that are used to take measurements.



Name	Min	Max	Mean	Res	Pre-Scaled	Pos Tol	Spr Tol	Input Def
1 Red Loc Spindle				3	☑	500	100	Red Loc Spindle
2 Blue Size Spindle			0.00000	3	☑	500	100	Blue Size Spindle
3 Brown Width Bar			0.00000	3	☑	500	100	Brown Width Bar
4 D1			0.00000	3	☑	500	100	D1
5 D2			0.00000	3	☑	500	100	D2
6 D3			0.00000	3	☑	500	100	D3
7 D4			0.00000	3	☑	500	100	D4
8 D5			0.00000	3	☑	500	100	D5
9 D6			0.00000	3	☑	500	100	D6
10 D7			0.00000	3	☑	500	100	D7
11 D8			0.00000	3	☑	500	100	D8
12 D9			0.00000	3	☑	500	100	D9
13 D10			0.00000	3	☑	500	100	D10
14 D11			0.00000	3	☑	500	100	D11
15 D12			0.00000	3	☑	500	100	D12
16 D13			0.00000	3	☑	500	100	D13
17 D14			0.00000	3	☑	500	100	D14

Calibration Field Property	Description
Name	Each calibration field can be assigned a meaningful name. The default name is Cx where x is the number of the field.
Min Val	This is the minimum calibration value for the field. The certified master value should be entered here as a deviation from the nominal size. If min/max mastering is not used, this property is ignored. The entered value must be a deviation from the measurement nominal.
Max Val	This is the maximum calibration value for the field. The certified master value should be entered here as a deviation from the nominal size. If min/max mastering is not used, this property is ignored. The entered value must be a deviation from the measurement nominal.
Mean Val	This is the mean calibration value for the field. The certified master value should be entered here as a deviation from the nominal size. If mean mastering is not used, this property is ignored. The entered value must be a deviation from the measurement nominal.
Res	This is the display resolution for the field. It does not affect system accuracy, just how the field values are displayed on screen.
Pre-Scaled	This field should be checked if you want to use the internal scaling for the input. It is only valid if the calibration field is a single input. This is most often used with Solartron digital probes.
Pos Tol	This is the position tolerance used to determine if the calibration field is close enough to the position that was taught to allow it to be calibrated. The value is represented as counts and therefore its sensitivity will be dependent on the resolution of the inputs used by the calibration field. If the position tolerance is 200 counts, the calibration field will not calibrate if it drifts more that 200 counts from the taught position. (+/- 200 count position requirement)
Spr Tol	This is the spread tolerance used to determine if the calibration field spread is close enough to the

	spread that was taught to allow it to be calibrated. This property is only used when min/max mastering is used. The value is represented as counts and therefore its sensitivity will be dependent on the resolution of the inputs used by the calibration field. If the spread tolerance is 50 counts, the calibration field will not calibrate if the spread from min to max changes more than 50 counts from the taught spread. (+/- 50 count spread requirement)
Expr	This property shows how the calibration field inputs are combined. The property is for display only and cannot be changed.
	This drop down list allows selection of the master set to edit and use. GageXpress Pro 3.0 supports multiple sets of masters.
	The date that the current master set was last calibrated can be entered here.
	The date that the current master set is due for calibration can be entered here.
	This creates a new master set for use.
	This deletes the currently selected master set. If only one master set exists, this button will be disabled.

Hardware

The GageXpress Pro 3.0 hardware configuration is the identification of all data acquisition and Input/Output (I/O) boards used in the system. These are physical boards that are inserted into the GageXpress Pro 3.0 Computer. Each board supports one or more types of inputs which are used in the setup. If hardware is not configured, then the system will not be able to make measurements using probe inputs and will only be able to gather data using keyboard entry.

The hardware configuration area is used to select the I/O boards installed in the GageXpress Pro 3.0 computer and then configure the inputs on each of the selected boards.

Click the Add Hardware button to select a board to add to the computer. The board will then be displayed in the Installed Hardware area. Clicking the board button will display the configuration screen for that board. This screen is displayed automatically when the board is first added to the system.

Digital Network

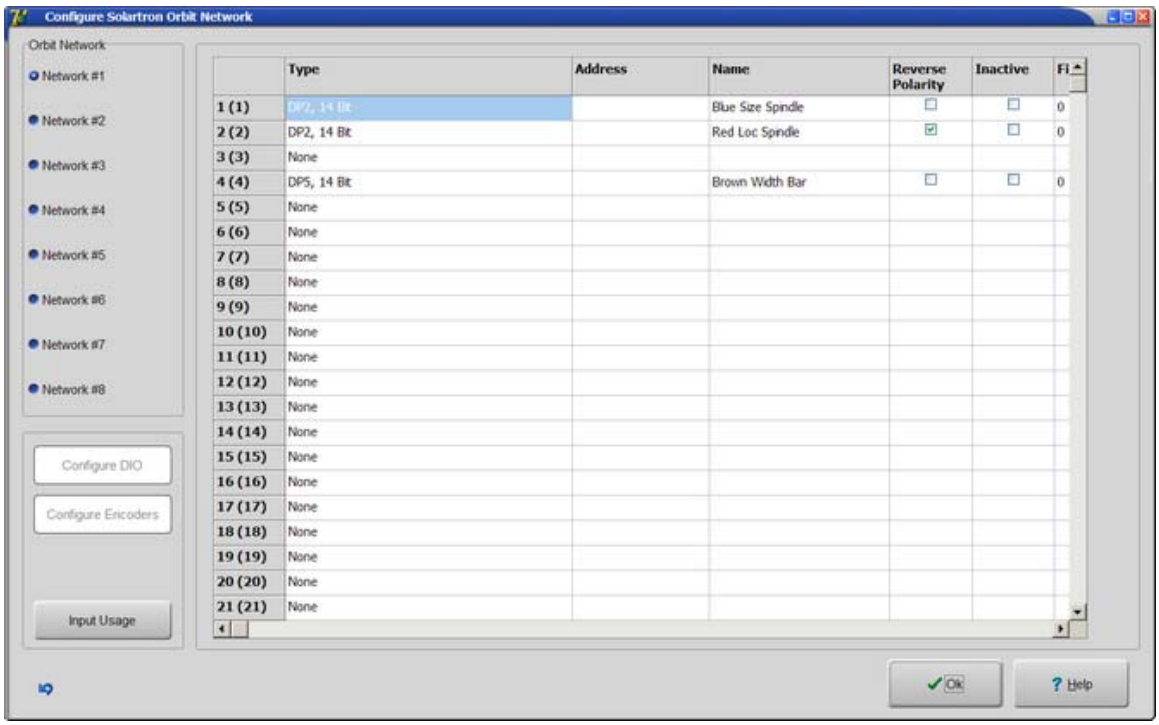
The Sterling ProMeasure System (SPS) I/O network of signal conditioning is very popular for its absolute scaling characteristics. Practice has shown that the SPS Digital Probes are linear over their operating range and can be mastered using mean masters and do not require min/max master sets. This can significantly reduce the overall cost of a gage and also make it easier to maintain and operate. A number of probe types are supported under this system:

- DP00020, (1 mm travel available in normal and pneumatic versions)
- DP00040, (2 mm travel available in normal and pneumatic versions)
- DP00100, (5 mm travel available in normal and pneumatic versions)
- DP00200, (10 mm travel available in normal and pneumatic versions)
- DPIODIM, (Digimatic Interface Module)
- DPIOM08, (Digital TTL module supporting 8 I/O)
- DPIOEIM, (Encoder Interface Module supporting linear and rotary quadrature encoders)
- DPRSUSB, (Digital USB interface module)
- DPPSIM0, (Digital transducer power supply)
- DPTCONN, (Digital transducer “T” connection block)

Current digital probes can operate in 14 bit (16384 counts), 16 bit (65535 counts), or 18 bit (262144 counts) modes. As the range of the probe increases, the measurement resolution decreases. It's important to select the right probe and resolution for the application based on its tolerance.

Probe	14 bit Resolution (mm)	16 bit Resolution (mm)	18 bit Resolution (mm)
DP00020	0.00006104	0.000015259	0.000003814
DP00040	0.00012207	0.000030518	0.000007629
DP00100	0.00030517	0.000076295	0.000019073
DP00200	0.00061035	0.00015259	0.000038146

The SPS Digital system consists of a series of networks each of which contains up to (31) modules. GageXpress Pro supports up to (8) networks making the maximum number of supported modules 248. Networks consist of either PCI network cards that contain (2) networks each or a single network created by an USB module. Adding a SPS digital I/O system to GageXpress Pro only requires that it be told that an Orbit system is being used. The SPS digital I/O software drivers detect and handle all networks. Networks defined by PCI cards are reported first and USB networks are reported last.



Configuration of the SPS digital system hardware requires that a probe type be selected in the "Type" column of the grid shown above. This column can be right clicked to display a menu of the supported module types. Selecting one of the modules indicates that you intend to connect a module of that type in that location. Each module has a unique address assigned to it. The address is displayed on the top of the module and must be used by GageXpress Pro to read the module's data. This address can be entered in the "Address" column of the grid. The address information is usually entered in the system when the gage is being setup. This is done using the notify procedure available on the Transducer Setup/Tools screen of GageXpress Pro. This allows the address to be set automatically by moving the probe tip and doesn't require any typing. The name column is optional and allows a meaningful name to be given to each input.

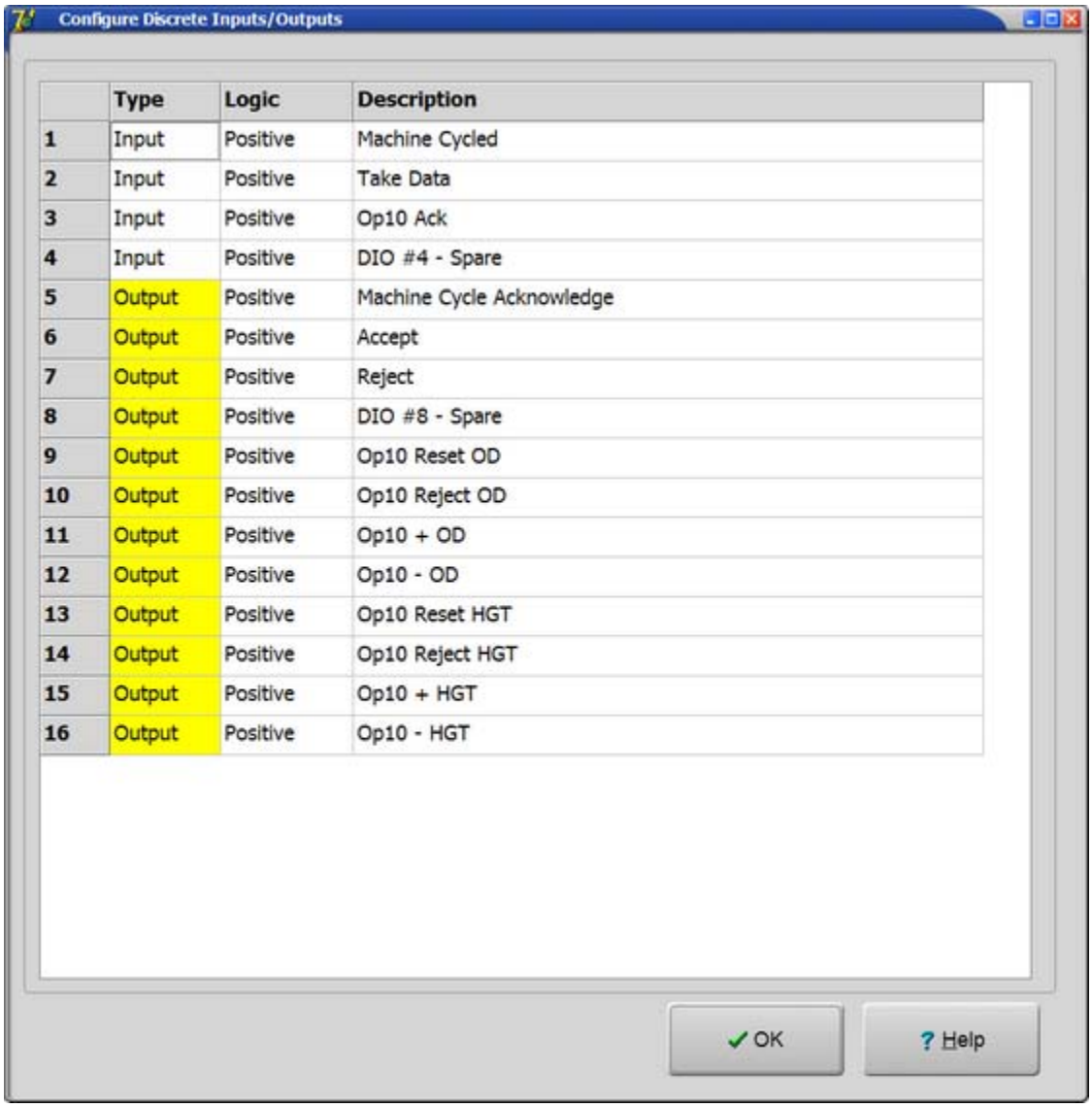
Orbit Input Properties	Description
Type	The Orbit module type is set here. Right click the cell and select the module type from the popup menu.
Address	Unique module address shown on the top of each Orbit module.
Name	Application specific name for the input. Use something that makes sense to the operator.
Reverse Polarity	Reverses input polarity. Generally used when the input will be used in a sweep and only mean mastered.
InActive	Makes the input inactive. All measurements using the input will be disabled.
Filter	Applies a running average filter to the input. Values less than 2 disables filtering. Values greater than 1 apply a running average filter to input values.

Discrete I/O Module (DIOM)

The SPS digital system DIOM module provides (8) TTL level I/O lines that can be used to interface with external equipment including PLC controllers, warning lamps, buttons, and other devices. Each line can be configured as either an Input or an Output. GageXpress Pro allows use of multiple DIOM modules to be used meet specific application requirements. The I/O lines can be accessed using GageXpress Pro's standard handling for specific functions such as the standard PLC controller interface used for automatic functions, or GageXpress Pro's I/O Function Templates can be used to accomplish application specific tasks.

When a DIOM module is added to the Orbit network, the Configure DIO button is enabled.

Click the Configure DIO button on the Configure Solartron Orbit Network screen to configure the DIOM's I/O lines.



This screen illustrates what would be seen if 2 DIOM modules had been added to the Orbit network.

Property	Description
Type	Defines the I/O line as either an Input or an Output. Click the cell to change its type.
Logic	Changes the Logic for the line to between positive true or negative true. Click the cell to change the logic value. Changing the logic may be required to easily interface with some external equipment.
Description	A description used to identify the function of the I/O line. Enter something meaningful to the application.

Encoder Interface Module (EIM)

The SPS digital system DIOM module provides GageXpress Pro with the ability to u rotary and linear encoders. Encoders may be used to perform measurements in place of other transducers or are sometimes used to ignore irregularities in a part.

When an EIM module is added to the Orbit network, the Configure Encoders button is enabled.

Click the Configure Encoders button on the Configure SPS Orbit Network screen to configure the encoder attached to the EIM.

This screen illustrates what would be seen if 1 EIM module had been added to the Orbit network.

Property	Description
Name	Encoder input name. This is set on the Configure Solartron Orbit Network screen and is shown here for reference.
Type	Defines the encoder type. This is a drop down list that allows selection of either Linear or Rotary.
Scaling	Enter the required scaling factor to convert the EIM's count values to scaled engineering values. For example, if a rotary encoder reports 2048 counts per revolution, then the scaling factor would be 360/2048 = 0.17578 to report the encoders output in degrees. Take note that the EIM module supports x1, x2, and x4 quadrature modes. This can allow the EIM to increase the resolution of an encoder with a native 2048 count output to 4096 (x2) or 8192 (x4).

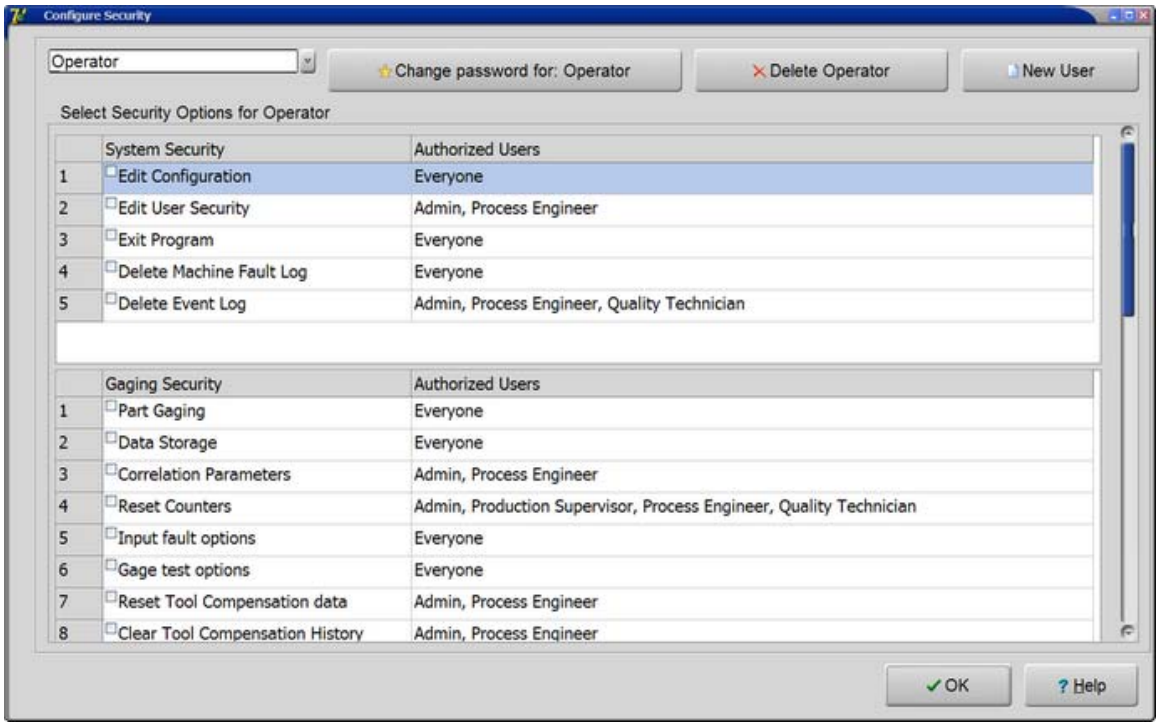
Security

The system security screen provides the means to adjust which areas of GageXpress Pro 3.0 are password protected. GageXpress Pro 3.0 uses a combination of user groups with passwords to implement security. Each user group has a unique password (by default they are set the same) that controls access to selected security items.

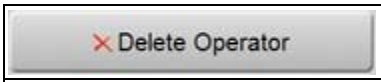
Six user groups are created by default. You can add or delete user groups depending on your needs. The Admin group is an exception and cannot be deleted. The Admin group also ALWAYS has access to everything in the system and the Admin password should be protected if you wish to implement security.

The default ship state also provides the Process Engineer group with access to everything.

Default User	Default Password
Admin	4321
Operator	1234
Production Supervisor	1234
Process Engineer	4321
Quality Technician	1234
Gage Technician	1234



Security Screen	Description
	Select the user group you want to assign access rights to.
	Change current user group's password.

	Delete current user group. The Admin group cannot be deleted.
	Create a new user group.

To set security for an item, select the user group you wish to grant access to and then check each item you want that group to have access to. Once an item has been protected, only people who know that group's password can gain access to the item. Multiple groups can be granted access to the same item. In this case, people knowing the password for any group with access will be allowed access to the item. If an item has not been password protected by any group, then that item will be available to everyone.

The Authorized Users column displays all users that have been granted access to each item. It will say Everyone if the item has not been assigned any password protection. Otherwise, it will list each group that has been designated for the item. The Admin group will always be listed.

Security items are organized into (5) groups organizing the various protection options. Each group has items that can be protected that are specific to the group.

Security Group	Item	Description
System		Protects options that affect the entire system.
	Configuration	Protects entry into GageXpress Pro 3.0 file. Once GageXpress Pro 3.0 file is running, nothing is password protected in it.
	Edit Security	Protects entry into the Security screen. Anyone with access to this screen can override all security options.
	Delete Machine Fault Log	Automatic gage systems log all PLC interface faults. This option determines who can clear the log.
	Delete Event Log	This option determines who can clear the event log.
	Exit Program	Protects program exit.
Gaging		Options to protect on the gaging screens.
	Part Gaging	Protects gage screen entry.
	Data Storage	Protects ability to turn data storage on or off.
	Correlation Items	Protects measurement offset and invert options used for gage correlation.
	Reset counters	Protects ability to reset part counters.
	Input Fault Options	Protects ability to turn on/off the input movement and input linear range fault checking used in gaging and mastering.
	Gage test options	Protects ability to turn on/off options for gage testing including simulation mode, virtual DIO, random data storage, and diagnostic mode.
	Reset Tool Compensation Data	Determines who can clear the current tool compensation running averages.
	Clear Tool Compensation History	Determines who can clear the history of all comp's sent to the machine.
Mastering/Setup		Options to protect on the mastering and setup screens.
	Mastering	Protects master screen entry.
	Master Parameters	Protects ability to edit master certification values
	Master Frequency	Protects ability to edit master frequency requirements
	Teach/Balance	Protects ability to teach a master setup or balance LVDTs.
	Orbit Network Ids	Protects ability to change Orbit Network Ids.
Quality Control		Options protecting data required for quality control.

	Edit Specification Limits	Protects ability to edit part accept/reject limits
	Data Deletion	Protects ability to delete stored data
	SPC Source Parameters	Protects changing of SPC source parameters including subgroup size and store frequency.
	Assign assignable causes	Protects ability to assign assignable causes to stored data.
	Edit assignable causes	Protects ability to edit or add to the list of assignable causes
	Edit Control Limits	Protect ability to edit control chart fixed limits.
	Create Studies	Determines who can create new studies.
	Delete Studies	Determines who can delete studies.
	Save Agile Sequence	Determines who can save inspection sequences.
	Edit Agile Sequence Prompts	Determines who can change prompting for an agile inspection sequence to be performed.
	Edit Agile Sequence Name	Determines who can change the name of an agile sequence.
GR&R		Options to protect on the GR&R screens.
	Regage GR&R parts	Protects ability to re-gage parts in a GR&R
	Delete GR&R's	Protects ability to delete old GR&Rs.

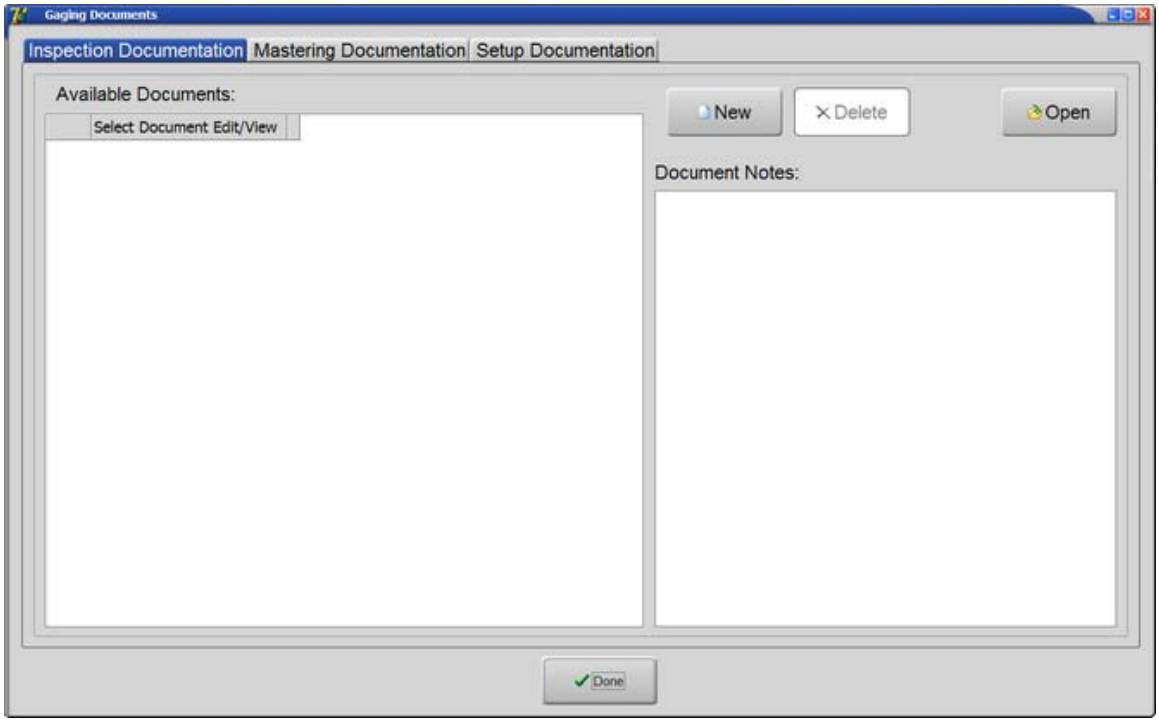
Preferences

This screen allows some system wide preferences to be set. It is primarily used to establish appropriate GageXpress Pro 3.0 QS-Stat mappings so that data is passed properly to the QS-Stat database.

System Preferences	Description
Mode Select Options	By default the GageXpress Pro 3.0 Mode Select screen is only displayed upon request. However, preferences exist to have the screen automatically displayed when GageXpress Pro 3.0 first starts or every time the gage screen is entered.
Standard Defaults	Sets system parameters to GageXpress Pro 3.0 defaults.
GMPT Defaults	Sets system parameters to GM Powertrain defaults. This is primarily setting the visibility of required properties and performing the required QS-Stat mappings.
AQDEF Defaults	Sets system parameters to AQDEF defaults. This is primarily setting the visibility of required properties and performing the required QS-Stat mappings.
View Properties	Displays GageXpress Pro 3.0 object properties screen.
Charting Program	Specifies a program to be run when the GageXpress Pro 3.0 Charts button is clicked if you wish to replace the internal GageXpress Pro 3.0 charts.

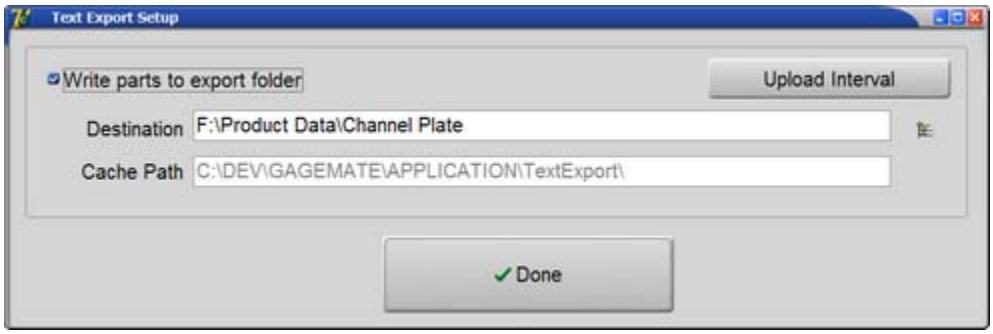
Application Documents

The GageXpress Pro 3.0 Application Documents option provides the operator with access to secondary reference information directly from GageXpress Pro 3.0. This feature can be used to provide operators with access to maintenance instructions, mission statements, design information, quality control plans, or anything else that might be of value. Document types are not limited and include DOC, PDF, DWG, XLS, PPT, TXT, and others. As long as the appropriate file reader is installed on the system, GageXpress Pro 3.0 will open and display the file. That is, if you can double click the file in Windows Explorer to open it, then GageXpress Pro 3.0 can provide access to the file using the Application documents option. Application documents must be entered for use using GageXpress Pro 3.0 file. GageXpress Pro 3.0 only displays the files.

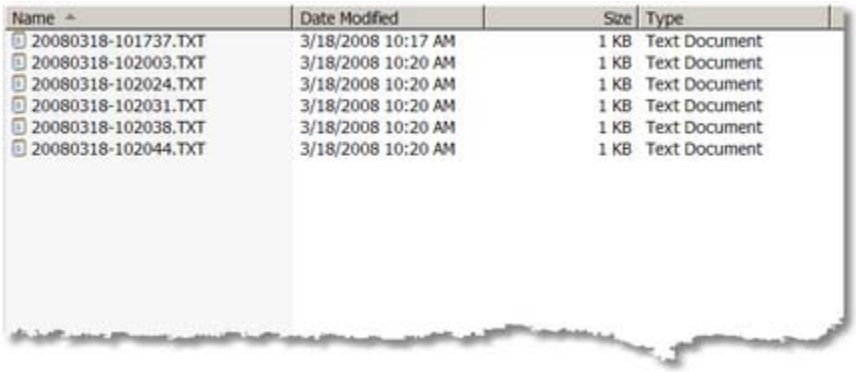


Configure Text Export

GageXpress Pro 3.0 can be configured to write each inspected part to a comma delimited text file. The data is written upon completion of the inspection sequence for the part. All data written to text files is then moved to a folder of your choice, generally a network folder. This allows current part data obtained using GageXpress Pro 3.0 to be transferred on a timely basis to plant wide data collection systems.

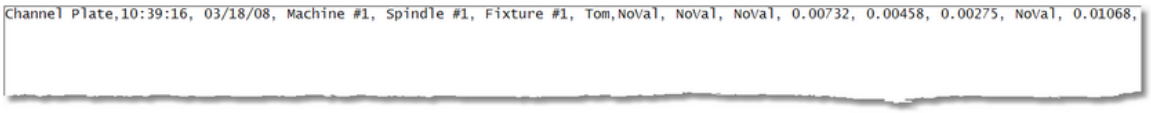


If active (by placing a check in the "Write parts to export folder" check box), GageXpress Pro 3.0 writes the data for each inspected part to a text file in a local cache folder. The cache folder is located in the application directory and cannot be changed. Each part is written to a separate text file that is named using the current time and date. The format is yyyymmdd-hhnnss.txt.



Name	Date Modified	Size	Type
20080318-101737.TXT	3/18/2008 10:17 AM	1 KB	Text Document
20080318-102003.TXT	3/18/2008 10:20 AM	1 KB	Text Document
20080318-102024.TXT	3/18/2008 10:20 AM	1 KB	Text Document
20080318-102031.TXT	3/18/2008 10:20 AM	1 KB	Text Document
20080318-102038.TXT	3/18/2008 10:20 AM	1 KB	Text Document
20080318-102044.TXT	3/18/2008 10:20 AM	1 KB	Text Document

The file format is simple comma delimited (CSV) and is suitable for direct import into MS-Excel and other SPC programs.



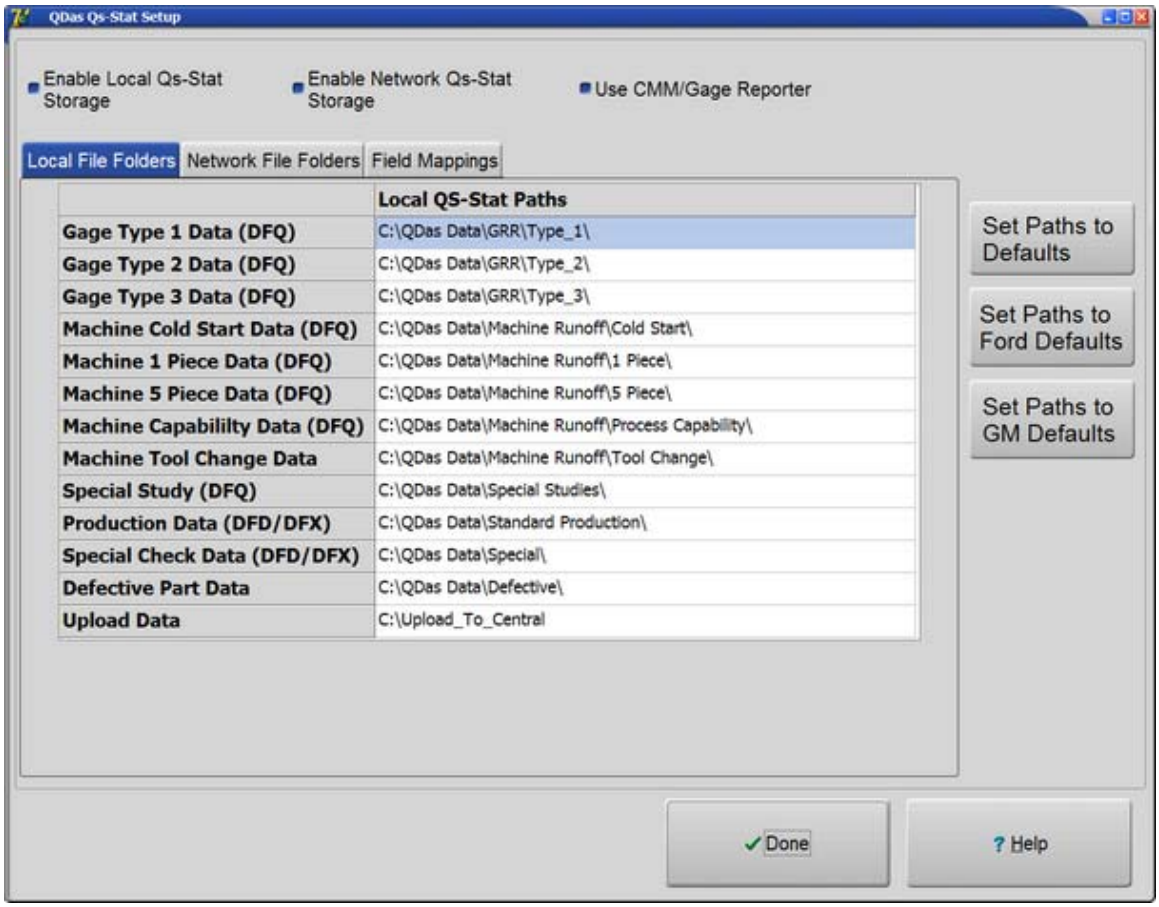
```
Channel Plate,10:39:16, 03/18/08, Machine #1, Spindle #1, Fixture #1, Tom,NoVal, NoVal, NoVal, 0.00732, 0.00458, 0.00275, NoVal, 0.01068,
```

The upload to the destination folder interval can be controlled by setting parameters available after clicking the Upload Interval

button.

Configure QS-Stat Interface

QS-Stat is a powerful SPC package with a central database that many manufacturers have standardized on. GageXpress Pro 3.0 provides considerable support for the QS-Stat product line to facilitate movement of data from the plant floor where GageXpress Pro 3.0 is used to the QS-Stat database.



GM Powertrain Requirements

The following information is provided as a guideline for setting up GageXpress Pro 3.0 to meet GMPT SP-Q-GCR Version 5.0

Information Required from GMPT

The following information will be required from GMPT to complete the GageMate setup:

1. Completed GSPIS form for the project. This defines the required QS-Stat Data Catalog fields.
2. Will project use QS-Stat Gage Reporter program?
3. Will project use QDas QS-Stat library?
4. What is QS-Stat network data path?

Materials Required from GMPT:

The following materials will be required from GMPT (and must be installed) before delivery:

1. GMPT certified anti-virus program.
2. QS-Stat program.

Note:

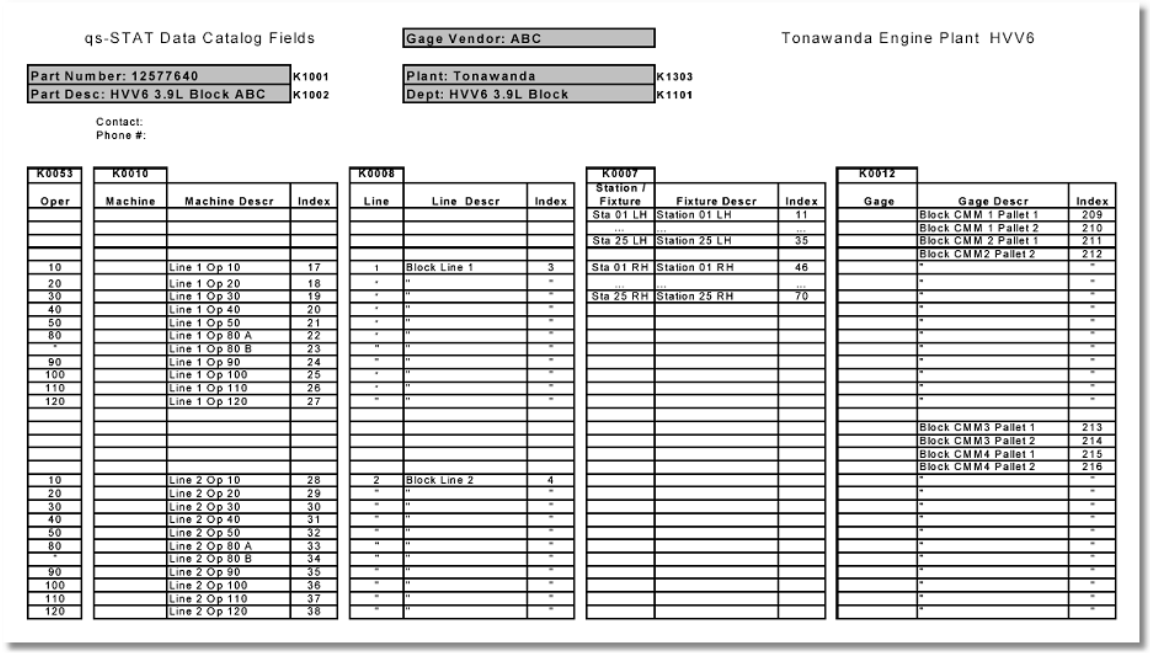
If the project uses either QS-Stat Gage Reporter or QS-Stat library, these programs must also be installed but it is your responsibility to purchase the programs separately. They are not supplied by GMPT.

Creating the GageXpress Pro 3.0 Setup

GageXpress Pro 3.0 file Actions

1. Start setup editor.
2. Click the Set Preferences button located on the Computer Properties screen. The Set Defaults screen will appear.
3. Click the GMPT Defaults button located on the Set Defaults screen. Click yes when asked to confirm setting property values to GMPT defaults.
4. Create your application normally but make sure that ALL displayed property fields that show a corresponding K field for the Computer, Gage, Part, and Measurements have values entered. If any fields are left blank, GMPT requirements will not be satisfied. One exception to this is the part ECL field (Part-007, K1004). This is an optional field that may or may not be used depending on plant requirements.
5. Review the GMPT provided GSPIS form to determine if the project requires part traceability for machines, lines, fixtures, etc.
   If so, do the following for each Part that is programmed in the system:

1. Select the Part by clicking it
2. Click the Part Labels (Traceability) button located on the Part Properties page.
3. Create Labels for each of the required traceability items. Make sure that the appropriate QS-Stat field is selected for each Label. The GMPT defaults are K0010 = Machine, K0008 = Line/Module, K0007 = Station/Fixture.
4. Click the Use property so that the label is used for the current part.
5. Create choice lists for each label. The choice descriptions should be entered as shown on the provided GSPIS form and the QS-Stat Index field MUST match the value in the index column of the GSPIS form.
6. If required/desired, create a cascaded menu for the Labels.



qs-STAT Data Catalog Fields | Gage Vendor: ABC | Tonawanda Engine Plant HVV6

Part Number: 12577640 K1001
Part Desc: HVV6 3.9L Block ABC K1002
Plant: Tonawanda K1303
Dept: HVV6 3.9L Block K1101
Contact:
Phone #:

K0053 Oper	K0010 Machine	Machine Descr	Index
10		Line 1 Op 10	17
20		Line 1 Op 20	18
30		Line 1 Op 30	19
40		Line 1 Op 40	20
50		Line 1 Op 50	21
80		Line 1 Op 80 A	22
"		Line 1 Op 80 B	23
90		Line 1 Op 90	24
100		Line 1 Op 100	25
110		Line 1 Op 110	26
120		Line 1 Op 120	27
10		Line 2 Op 10	28
20		Line 2 Op 20	29
30		Line 2 Op 30	30
40		Line 2 Op 40	31
50		Line 2 Op 50	32
80		Line 2 Op 80 A	33
"		Line 2 Op 80 B	34
90		Line 2 Op 90	35
100		Line 2 Op 100	36
110		Line 2 Op 110	37
120		Line 2 Op 120	38

K0008 Line	Line Descr	Index
1	Block Line 1	3
2	Block Line 2	4

K0007 Station / Fixture	Fixture Descr	Index
Sta 01 LH	Station 01 LH	11
Sta 25 LH	Station 25 LH	35
Sta 01 RH	Station 01 RH	46
Sta 25 RH	Station 25 RH	70

K0012 Gage	Gage Descr	Index
	Block CMM 1 Pallet 1	209
	Block CMM 1 Pallet 2	210
	Block CMM 2 Pallet 1	211
	Block CMM2 Pallet 2	212
	Block CMM3 Pallet 1	213
	Block CMM3 Pallet 2	214
	Block CMM4 Pallet 1	215
	Block CMM4 Pallet 2	216

6. Click each Part and check the "Don't show subgroup 1 of n in gaging" option.

7. Click each Part and check the "Don't show file part # in gaging" option.

8. Click the Configure QS-Stat Interface button located on the Computer properties screen.

9. If project uses QS-Stat Gage Reporter, place a check in the "Use CMM/Gage Reporter" check box.

10. If the project uses QS-Stat Statistical Library, place a check in the "Use QS-Stat Library" check box.

GageXpress Pro 3.0 Actions

These steps must only be done if the application contains Features and GMPT has provided a list of measurements resulting from specific machine tools.

1. Exit GageXpress Pro 3.0 file and start GageXpress Pro 3.0.
2. Click the Seq button located on the Gaging screen.
3. Select Features dependent on a specific machine tool.
4. Click the Save Seq button.
5. Enter a name for the saved sequence that uses the machine tool name.
6. Repeat steps 3 thru 5 for each machine tool.

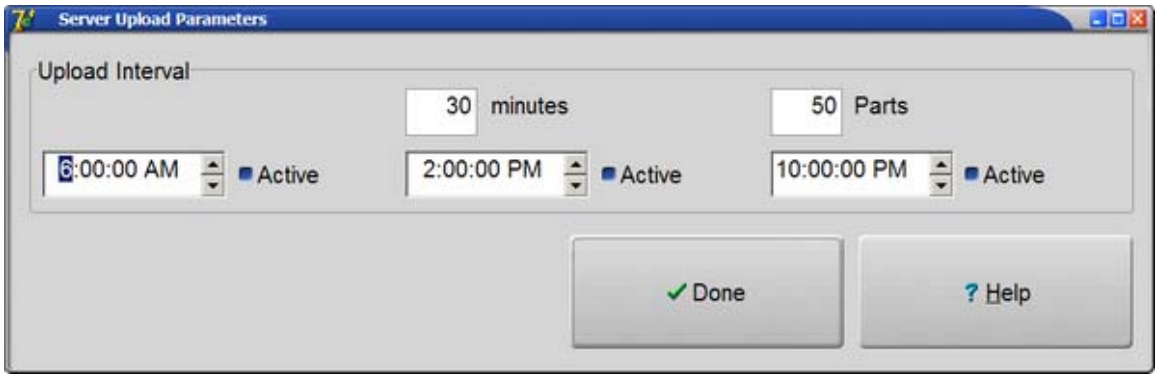
Other recommendations:

Lock up the OS as much as possible … only allow access to GageXpress Pro 3.0 and the QS-Stat programs

1. If the project uses QS-Stat Gage Reporter, set it to run automatically on computer start up.
2. Disable virus checking on data QS-Stat data directories. The anti-virus software "may" prevent QS-Stat from deleting data files after they've been uploaded. This can cause severe damage to the Qs-Stat database and must be avoided.
3. It is preferable to have the QS-Stat data in a separate partition on the local hard drive.

Server Upload Interval

GageXpress Pro 3.0 provides options to control how often exported data is moved from the gage station to a central server. These options apply equally to QDas ASCII files, Importer GAM files, and text export files. Each of the (3) export methods provide local cache support so that data is not lost if the server connection is not available when parts are inspected. All part data is stored locally and then transferred to the server according to the setting below.

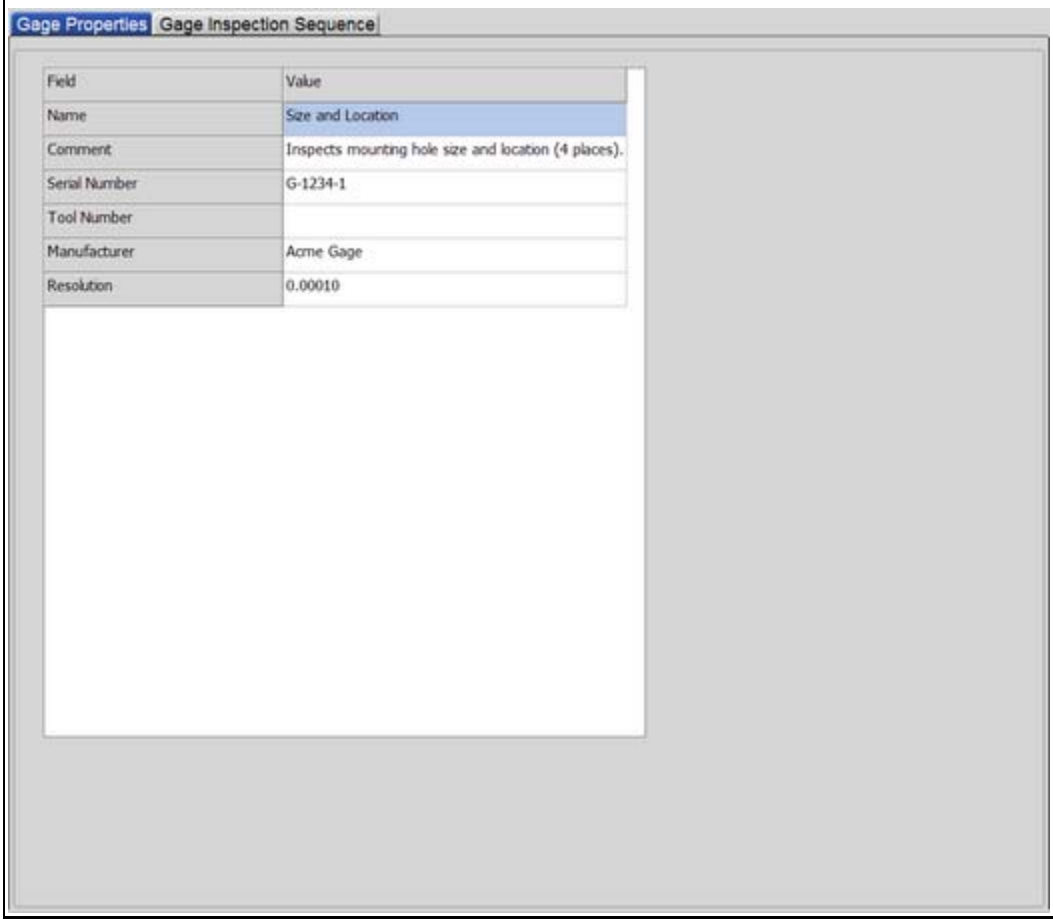


System Preferences	Description
50 Parts	Sets number of parts cached locally before transferring to server.
30 minutes	Sets time limit for transferring parts to server. At the end of this time interval, all part data is transferred to the server whether the number of parts specified above have been inspected or not.
6:00:00 AM Active	Three time settings are available to transfer data at specific times of the day. For instance, it may be desirable to transfer data in the late evening when network traffic is low.

Gage Properties

Gages are used in manual setups to take measurements on a part. They are not used in automatic setups.

Manual Configuration Gage



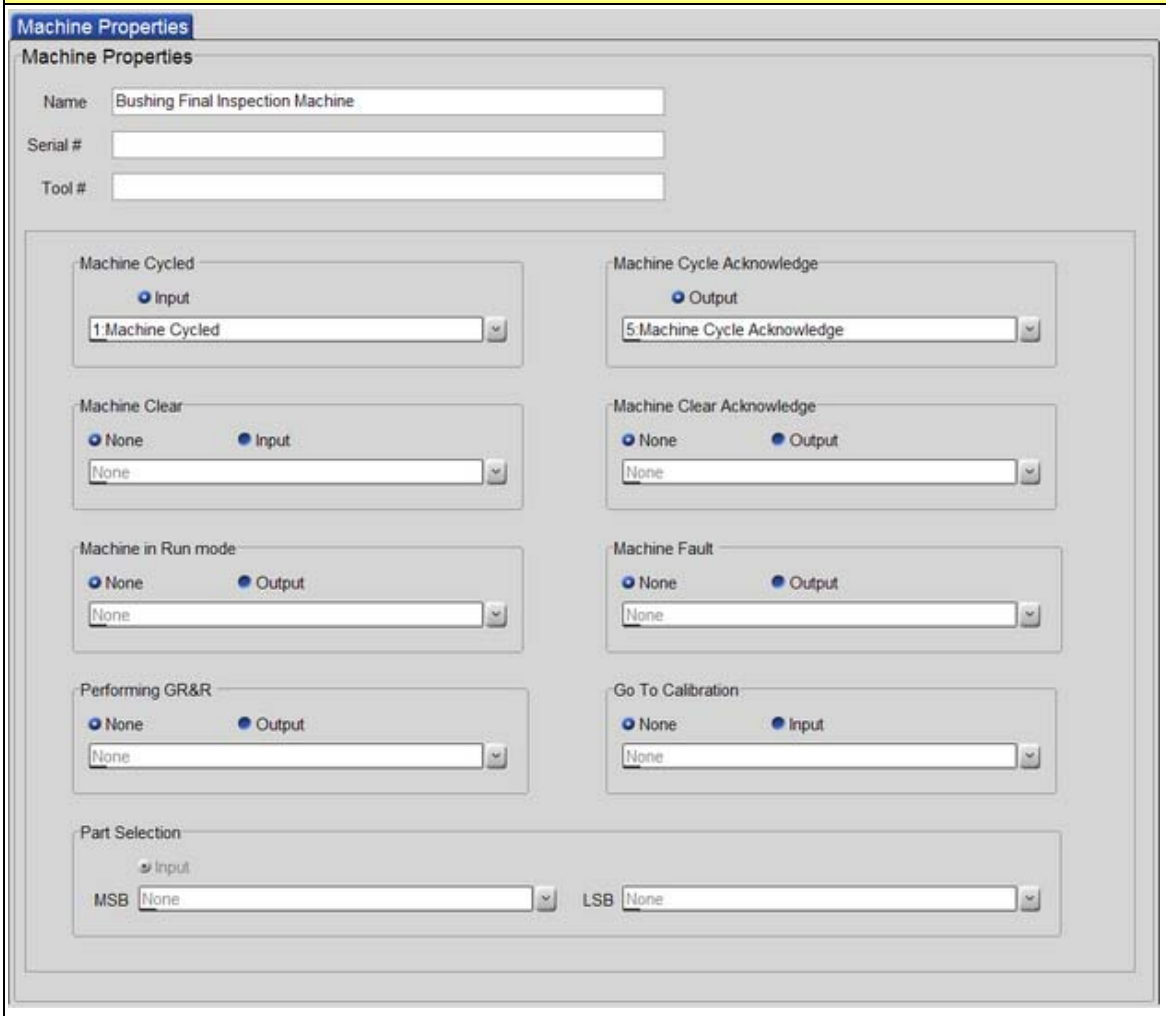
Property	Name	Description
Gage-001	Name	Gage name.
Gage-002	Short Name	Short Name for Gage
Gage-003	Number	Gage Number
Gage-004	Short Number	Short Number for Gage
Gage-005	Comment	Gage specific comment
Gage-006	Serial Number	Gage serial number.
Gage-007	Tool Number	Gage tool number.
Gage-008	Manufacturer	Gage Manufacturer
Gage-009	Resolution	Gage resolution
Gage-010	SPC Device Number	
Gage-011	SPC Device Description	
Gage-012	SPC Device Type	

Gage-201	User Field #1	Generic field for application specific use.
Gage-202	User Field #2	Generic field for application specific use.
Gage-203	User Field #3	Generic field for application specific use.
Gage-204	User Field #4	Generic field for application specific use.
Gage-205	User Field #5	Generic field for application specific use.
Gage-206	User Field #6	Generic field for application specific use.
Gage-207	User Field #7	Generic field for application specific use.
Gage-208	User Field #8	Generic field for application specific use.
Gage-209	User Field #9	Generic field for application specific use.
Gage-210	User Field #10	Generic field for application specific use.

Machine Properties

A GageXpress Pro 3.0 Machine represents a physical machine that the GageXpress Pro 3.0 is connected to for performing inspection tasks. Obviously, Machines are only used on automatic applications.

Automatic Configuration Machine

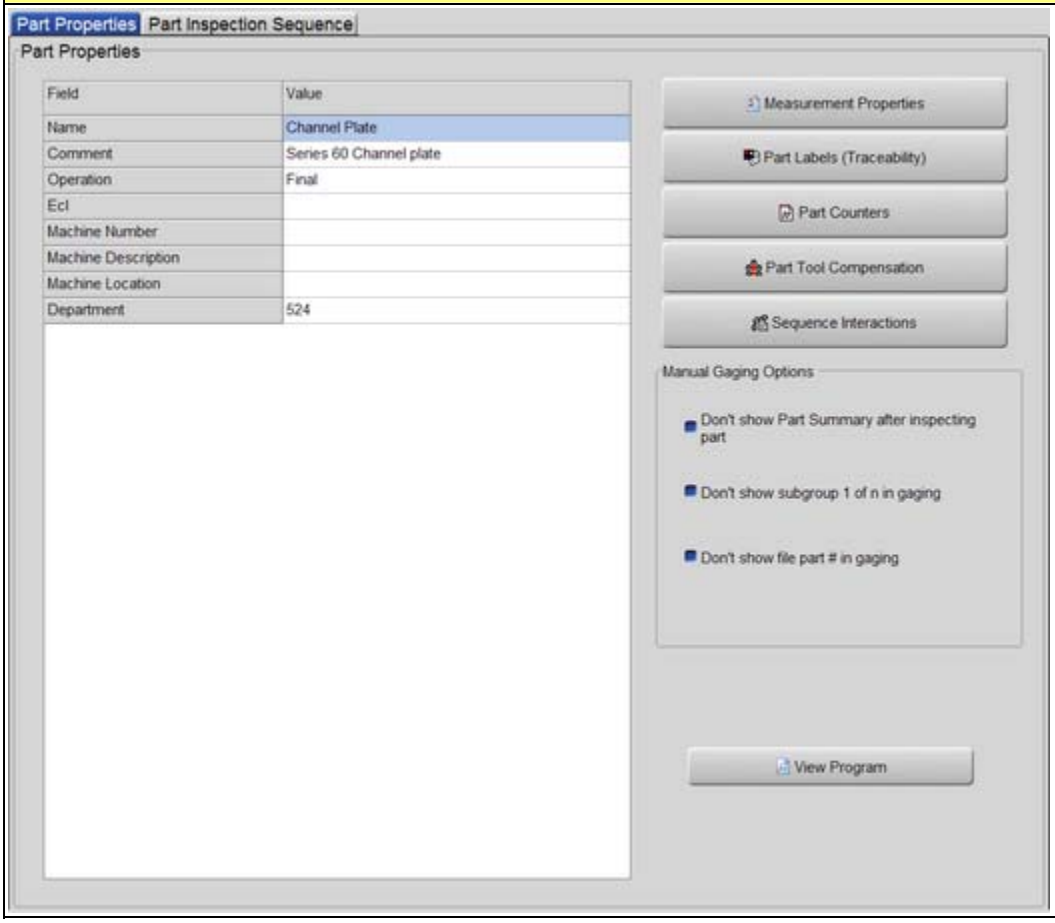


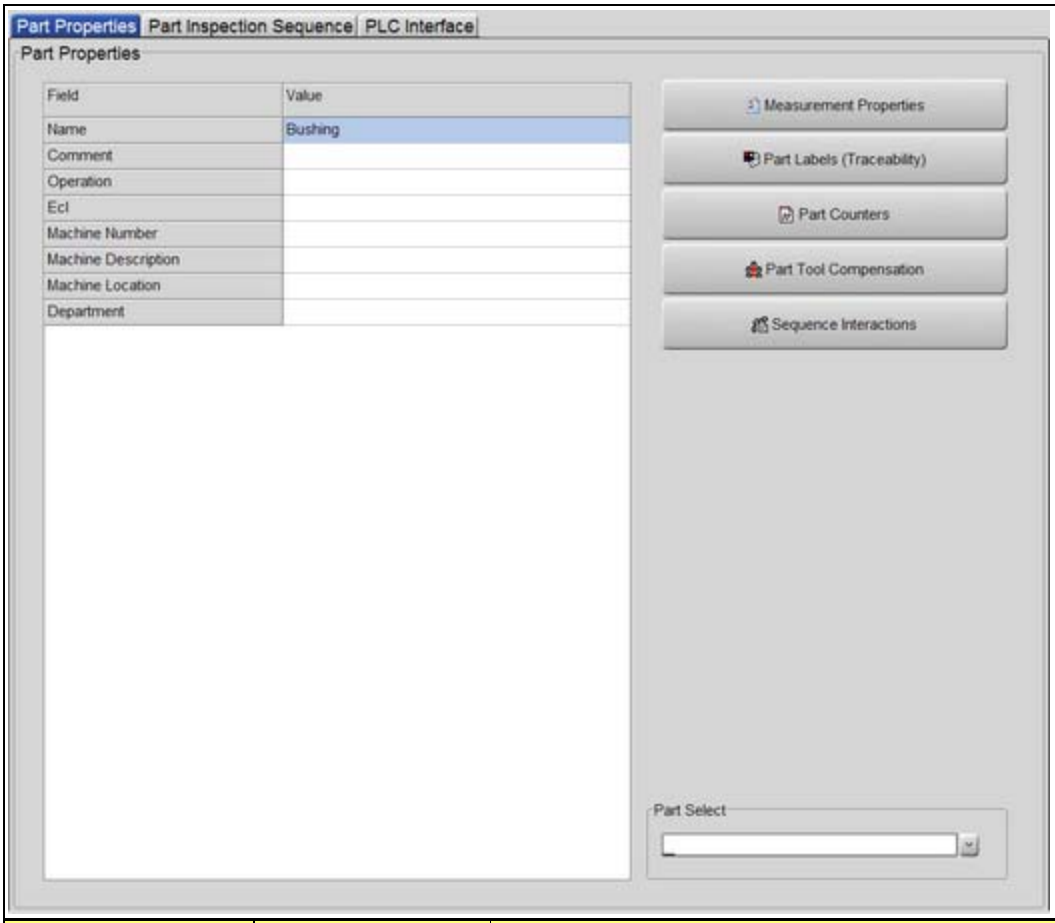
Property	Used on	Required	Description
Name	Automatics	No	Optional machine name.
Serial #	Automatics	No	Optional machine serial number.
Tool #	Automatics	No	Optional machine tool number.
Machine Cycled	Automatics	Yes	Digital input indicating that the machine has cycled.
Machine Cycle Acknowledge	Automatics	Yes	Digital output acknowledging receipt of the Machine Cycled signal.
Machine Clear	Automatics	No	Clears all machine stations and deletes any parts that may be in the machine.
Machine Clear	Automatics	No	Acknowledges receipt of the Machine Clear signal.

Acknowledge			
Machine In Run Mode	Automatics	No	Digital output GageXpress Pro 3.0 turns on when ready to inspect parts. If it is off, GageXpress Pro 3.0 will not inspect parts or respond to the PLC controller. This output is off when: • GageXpress Pro 3.0 is in mastering mode • GageXpress Pro 3.0 is in setup mode • GageXpress Pro 3.0 is in diagnostic mode
Machine Fault	Automatics	No	Digital output GageXpress Pro 3.0 will turn on when it detects a fault condition. The output is turned on whenever a handshake fault occurs with the PLC.
Performing GR&R	Automatics	No	Digital output GageXpress Pro 3.0 will turn on when performing a GR&R.
Go to Calibration	Automatics	No	GageXpress Pro 3.0 enters calibration mode when this signal is received.
Part Selection	Automatics	No	Identifies the part type entering the machine at the first station.

Part Properties

A GageXpress Pro 3.0 Part represents the actual part being inspected. A GageXpress Pro 3.0 Part is created for each part type to be inspected. For manual configurations, Parts are inspected by one or more Gages. For automatic configurations, the each Part is inspected by a single Machine.

Screen	Description
	Part properties for manual applications



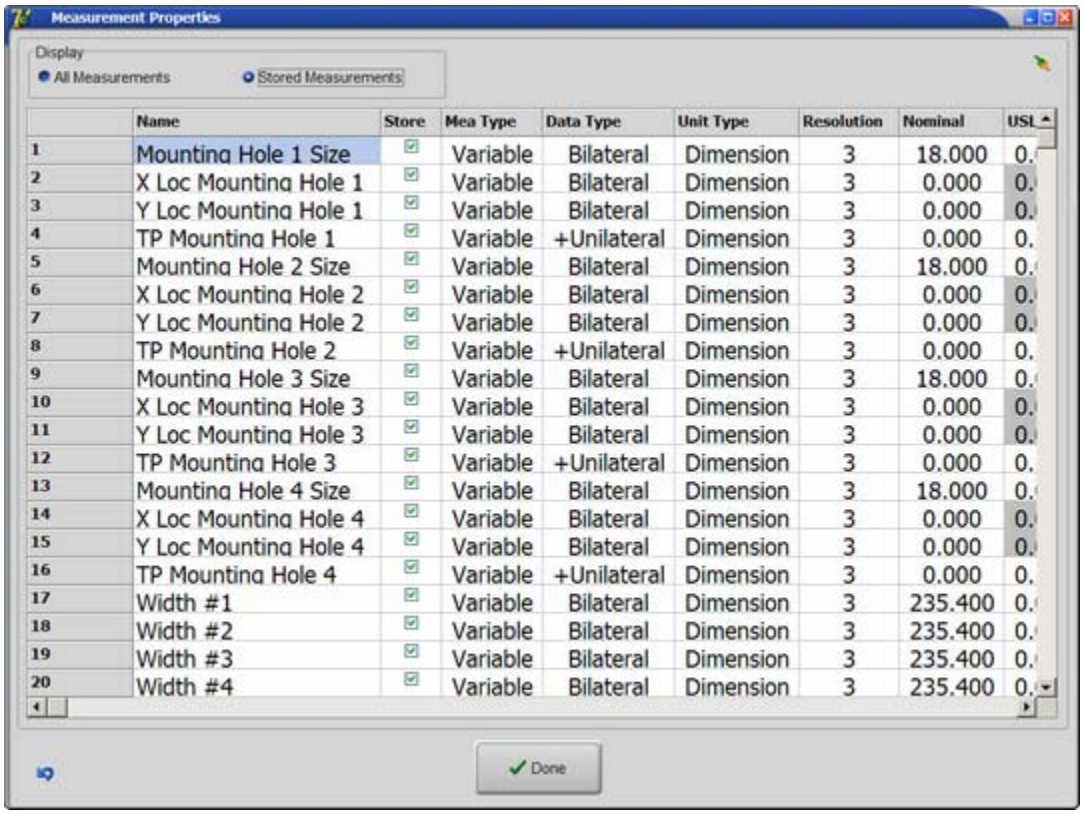
Part properties for automatic applications

Property	Name	Description
Part-001	Name	Part name.
Part-002	Short Name	Short Part name
Part-003	Number	Part number.
Part-004	Short Number	Short Part number.
Part-005	Comment	Part specific comment.
Part-006	Operation	Machining/production Operation for part.
Part-007	Ecl	Engineering Control Level.
Part-008	Product	
Part-009	Manufacturer	Part manufacturer.
Part-010	Drawing Number	Part print drawing number .
Part-011	Drawing Modification	Part print modification number.
Part-012	Contract	Contract or order information.
Part-013	Machine Number	Machine number of machine primarily responsible for part production.
Part-014	Machine Description	Description of machine primarily responsible for part production.
Part-015	Machine Location	Location of machine primarily responsible for part production.
Part-016	Department	Department where part is produced.
Part-017	Measurement Program Number	Customer assigned GageXpress Pro 3.0 setup number.
Part-018	Measurement Program Version	Current version of GageXpress Pro 3.0 setup.
Part-052	Part Selection Value	Used on automatics so that the PLC can select the part to be inspected by setting a

		binary value on a series of discrete inputs. Enter the numeric value that will select this part. Each part must have a unique selection value.
Part-201	User #1	Generic field for application specific use.
Part-202	User #2	Generic field for application specific use.
Part-203	User #3	Generic field for application specific use.
Part-204	User #4	Generic field for application specific use.
Part-205	User #5	Generic field for application specific use.
Part-206	User #6	Generic field for application specific use.
Part-207	User #7	Generic field for application specific use.
Part-208	User #8	Generic field for application specific use.
Part-209	User #9	Generic field for application specific use.
Part-210	User #10	Generic field for application specific use.
Part-211	User #11	Generic field for application specific use.
Part-212	User #12	Generic field for application specific use.
Part-213	User #13	Generic field for application specific use.
Part-214	User #14	Generic field for application specific use.
Part-215	User #15	Generic field for application specific use.

Measurement Properties

Measurements are data representing part characteristics of interest. They are most often arrived at by reading and combining one or more inputs in a manner that gives us a measure of the size, location, or other physical part attribute.



	Name	Store	Mea Type	Data Type	Unit Type	Resolution	Nominal	USL
1	Mounting Hole 1 Size	☑	Variable	Bilateral	Dimension	3	18.000	0.
2	X Loc Mounting Hole 1	☑	Variable	Bilateral	Dimension	3	0.000	0.
3	Y Loc Mounting Hole 1	☑	Variable	Bilateral	Dimension	3	0.000	0.
4	TP Mounting Hole 1	☑	Variable	+Unilateral	Dimension	3	0.000	0.
5	Mounting Hole 2 Size	☑	Variable	Bilateral	Dimension	3	18.000	0.
6	X Loc Mounting Hole 2	☑	Variable	Bilateral	Dimension	3	0.000	0.
7	Y Loc Mounting Hole 2	☑	Variable	Bilateral	Dimension	3	0.000	0.
8	TP Mounting Hole 2	☑	Variable	+Unilateral	Dimension	3	0.000	0.
9	Mounting Hole 3 Size	☑	Variable	Bilateral	Dimension	3	18.000	0.
10	X Loc Mounting Hole 3	☑	Variable	Bilateral	Dimension	3	0.000	0.
11	Y Loc Mounting Hole 3	☑	Variable	Bilateral	Dimension	3	0.000	0.
12	TP Mounting Hole 3	☑	Variable	+Unilateral	Dimension	3	0.000	0.
13	Mounting Hole 4 Size	☑	Variable	Bilateral	Dimension	3	18.000	0.
14	X Loc Mounting Hole 4	☑	Variable	Bilateral	Dimension	3	0.000	0.
15	Y Loc Mounting Hole 4	☑	Variable	Bilateral	Dimension	3	0.000	0.
16	TP Mounting Hole 4	☑	Variable	+Unilateral	Dimension	3	0.000	0.
17	Width #1	☑	Variable	Bilateral	Dimension	3	235.400	0.
18	Width #2	☑	Variable	Bilateral	Dimension	3	235.400	0.
19	Width #3	☑	Variable	Bilateral	Dimension	3	235.400	0.
20	Width #4	☑	Variable	Bilateral	Dimension	3	235.400	0.

Property	Name	Description
Mea-001	Name	Measurement Name
Mea-002	Short Name	Short Measurement Name
Mea-003	Number	Measurement Number
Mea-004	Short Number	Short Measurement Number
Mea-005	Comment	Measurement specific comment
Mea-013	Machine Number	Number of Machine responsible for measurement
Mea-014	Machine Description	Description of Machine responsible for measurement
Mea-015	Machine Location	Location of Machine responsible for measurement
Mea-051	Store	Determines whether data for measurement is stored
Mea-052	Mea Type	Variable/Attribute
Mea-053	Data Type	Bilateral/Unilateral
Mea-054	Unit Type	Designates units for measurement. Used for toggling between metric/english displays
Mea-056	Resolution	# of decimal places displayed for measurement. Does not affect accuracy.
Mea-057	Importance	Designates relative importance of measurement
Mea-058	Meaning Name	Designates geometric meaning of measurement

Mea-060	KPC	Designates a critical path characteristic
Mea-071	Nominal	Measurement Nominal value
Mea-072	USL	Measurement Upper Specification Limit. This should always be entered as a deviation from the measurement nominal value.
Mea-073	LSL	Measurement Lower Specification Limit. This should always be entered as a deviation from the measurement nominal value.
Mea-074	UAL	Measurement Upper Approach Limit. This should always be entered as a deviation from the measurement nominal value.
Mea-075	LAL	Measurement Lower Approach Limit. This should always be entered as a deviation from the measurement nominal value.
Mea-078	URL	Measurement Upper Reasonable Limit. This should always be entered as a deviation from the measurement nominal value.
Mea-079	LRL	Measurement Lower Reasonable Limit. This should always be entered as a deviation from the measurement nominal value.
Mea-080	Material Condition	Determines if specification limits are Regardless of Feature Size (RFS) or if material conditions are taken into account
Mea-081	Material Condition Size Mea	Size measurement used to establish Material Condition specification limit modifier
Mea-082	Classes	Determines if measurement has multiple classes for part classification purposes
Mea-090	Tool Wear Type	Specifies direction of tool wear
Mea-201	User #1	Generic field for application specific use.
Mea-202	User #2	Generic field for application specific use.
Mea-203	User #3	Generic field for application specific use.
Mea-204	User #4	Generic field for application specific use.
Mea-205	User #5	Generic field for application specific use.
Mea-206	User #6	Generic field for application specific use.
Mea-207	User #7	Generic field for application specific use.
Mea-208	User #8	Generic field for application specific use.
Mea-209	User #9	Generic field for application specific use.
Mea-210	User #10	Generic field for application specific use.
Mea-211	User #11	Generic field for application specific use.
Mea-212	User #12	Generic field for application specific use.
Mea-213	User #13	Generic field for application specific use.
Mea-214	User #14	Generic field for application specific use.
Mea-215	User #15	Generic field for application specific use.

Measurement Material Conditions

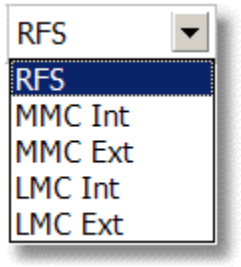
Measurement limits are used convey the status of the measurement. Specification limits and Approach limits are used for this purpose. Specification limits are used to define accept/reject criteria for the measurement and Approach limits are used to define caution warnings for the measurement. Columns and data fields will be displayed red if a specification limit is exceeded and yellow if an approach limit is exceeded. If none of the limits are exceeded, then the columns and data fields will be shown in green.

GageXpress Pro 3.0 treats all limits as Regardless of Feature Size (RFS) by default but also supports specification limit modification using Maximum Material Condition (MMC) and Least Material Condition (LMC) methods.

Material Condition	Definition
Regardless of Feature Size RFS	Geometric tolerance applies at any increment of size of the feature within its size tolerance.
Maximum Material Size MMC	Geometric tolerance applies when the part is at the MMC condition and is allowed to get larger equal to the amount of departure from MMC until LMC is reached.
Least Material Size LMC	Geometric tolerance applies when the part is at the LMC condition and is allowed to get larger equal to the amount of departure from LMC until MMC is reached.

MMC and LMC may be applied to external features, such as a shaft, or internal features, such as a hole.

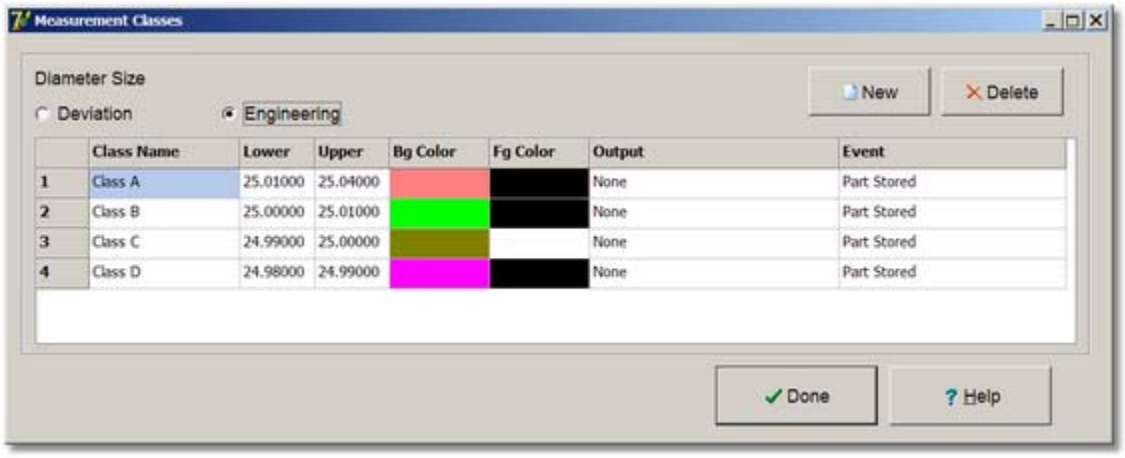
Measurement Property	Description
Measurement	Measurement name.
LSL Lower Specification Limit	Lower Specification Limit (LSL) for measurement. If the measurement value falls below this value, the measurement will be shown in red and considered under size.
USL Upper Specification Limit	Upper Specification Limit (USL) for measurement. If the measurement value rises above this value, the measurement will be shown in red and considered over size.
LAL Lower Approach Limit	Lower Approach Limit (LAL) for measurement. If the measurement value falls below this value, the measurement will be shown in yellow as a warning that its value is approaching the LSL limit.
UAL Upper Approach Limit	Upper Approach Limit (UAL) for measurement. If the measurement value rises above this value, the measurement will be shown in yellow as a warning that its value is approaching the USL limit.
Classes	Click this cell to create or edit measurement classes.
Mat Cond	Material Condition list used to select how a GDT tolerance should be modified based on its corresponding size measurement. RFS - Regardless of Feature Size MMC Int-Maximum Material Condition Internal Feature MMC Ext-Maximum Material Condition External Feature

	LMC Int-Least Material Condition Internal Feature LMC Ext-Least Material Condition External Feature
Mat Cond Size Mea	Measurement list used to select the size measurement used for establishing limit modifications when a GDT measurement is evaluated as a MMC or LMC tolerance.

Measurement Classes

Sometimes it is necessary to sort parts based on the value of specific measurements. This is often done when the part must be matched to a mating part for fit purposes. GageXpress Pro 3.0 has built in classification capabilities to make these applications simple to implement and support.

Classes can be created for a measurement from the Measurement Limits screen by clicking the cell in the Classes column for the measurement requiring classification.

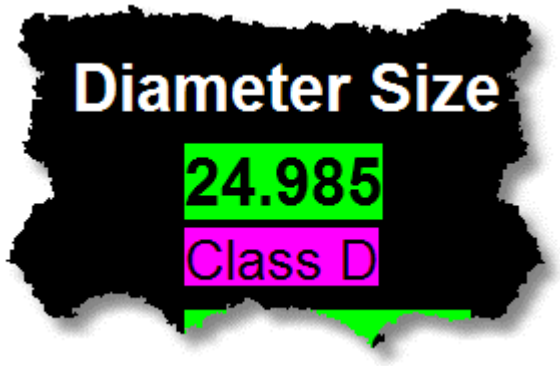
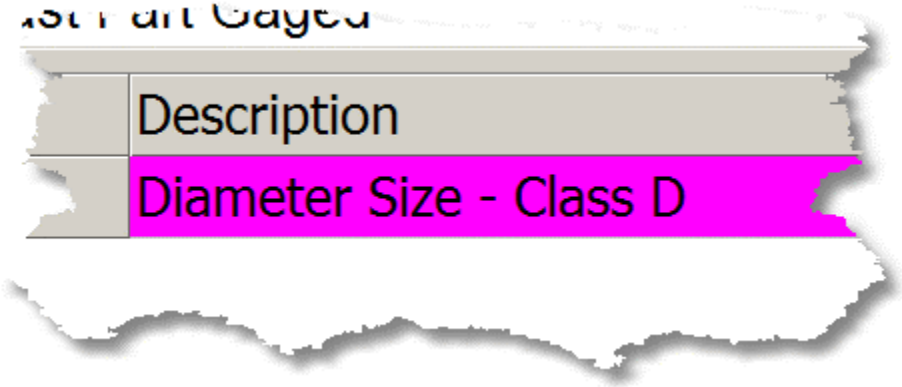


Class Property	Description
Class Name	Measurement name.
Lower Lower Class Limit	Lower Class Limit for measurement class. If the measurement value is greater than or equal to the Lower Class Limit and less than or equal to the Upper Class Limit then the measurement is said to belong to this class.
Upper Upper Class Limit	Upper Class Limit for measurement class. If the measurement value is greater than or equal to the Lower Class Limit and less than or equal to the Upper Class Limit then the measurement is said to belong to this class.
Bg Color Background Color	The class background color used to display this class.
Fg Color Foreground Color	The class foreground color used to display this class.
Output Digital Output	Digital output to be set when the measurement belongs to this class.
Event Gage Event	Gage Event on which to set digital output when measurement belongs to this class. The output will be set at the end of the event. If the selected Event is Part Stored, the output will be set at the end of the last event when the part data is stored.

When determining the class a measurement belongs to, each class is evaluated in order from top to bottom. If the measurement's current value falls within the upper and lower class limits, it is said to belong to that class. (ie, the measurement is in the class if the Lower Class Limit <= measurement value <= Upper Class Limit) Obviously, if limit ranges overlap, the measurement may fall into more that one class range. If this occurs, the class is determined by the last class that the measurement value matched. The evaluation order of the classes can be changed by changing the

actual class order. Class order can be changed using drag/drop on the rows in the measurement class grid. Move rows by dragging the row number of the row to be moved to the new location and then dropping it.

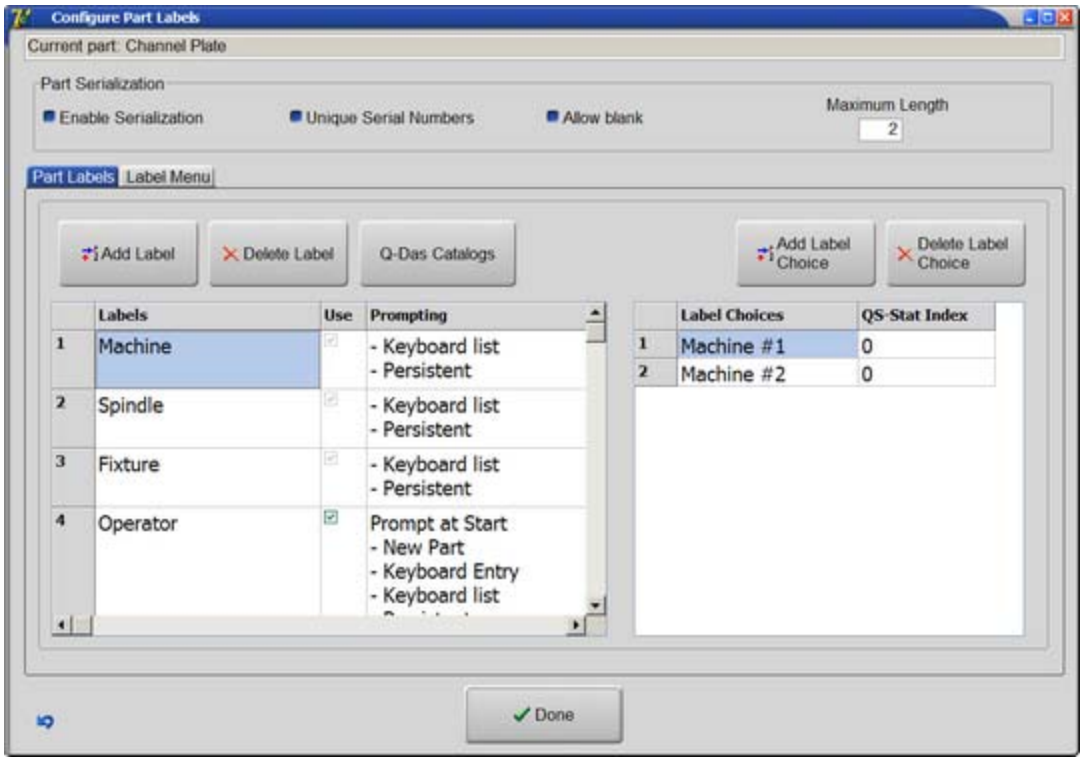
Measurement class status is shown on gage pages with the display of the class beneath the measurements data field. The part data screen attaches the measurement's class to the measurement name and color codes the measurement appropriately.

	Data field display with class shown.
	Measurement display on part data screen with class shown.

Labels

GageXpress Pro 3.0 supports labels to provide part traceability of measured part data. A Label provides information that can be used to sort measured part data. Typical labels include the machine a part was manufactured on, the spindle on the machine that produced the part, the machine fixture, the operator that inspected the part, or any other information that you may want to track.

Numerous options are available for prompting the operator to enter labels. Labels can also be used in a menu that provides the ability to have one label selection control subsequent label options.



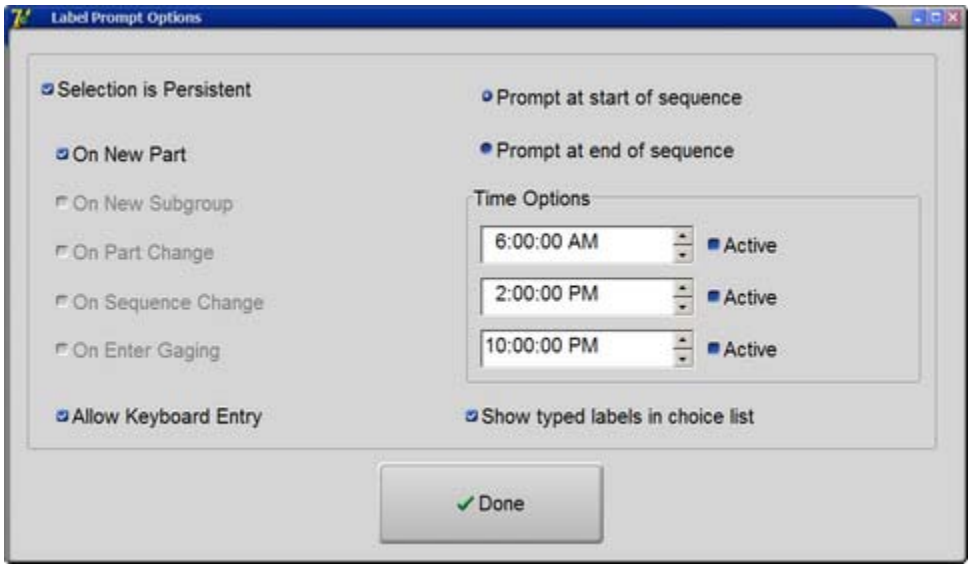
Label Properties	Description
Name	Name of Label
Use	Labels are global within GageXpress Pro 3.0. When viewing the Part Labels screen, you can create labels that will be available for all parts inspected by GageXpress Pro 3.0. To use a particular label with a specific part, place a check in the Use column.
Prompting	Click this area to set label prompt options.
QS-Stat Field	Use this field to identify the QS-Stat K-Field that corresponds to the label. Default GMPT assignments are: K0010 = Machine K0008 = Line/Module K0007 = Station/Fixture.

Each label will have a list of choices that the operator can choose from.

Label Choice Properties	Description
Name	Name of Label Choice
QS-Stat Index	QS-Stat Catalog Index number. This number is specified by the end user and will vary from plant to plant depending on the QS-Stat catalog implementation.

Label Prompting Options

Numerous options are provided to determine if and when operators are prompted to enter labels for inspected parts. By default, the operator is not prompted to enter labels. GageXpress Pro 3.0 will continue to use the last selected label on all inspected parts until the operator makes a new selection. If you wish to prompt the operator, the following options are available.



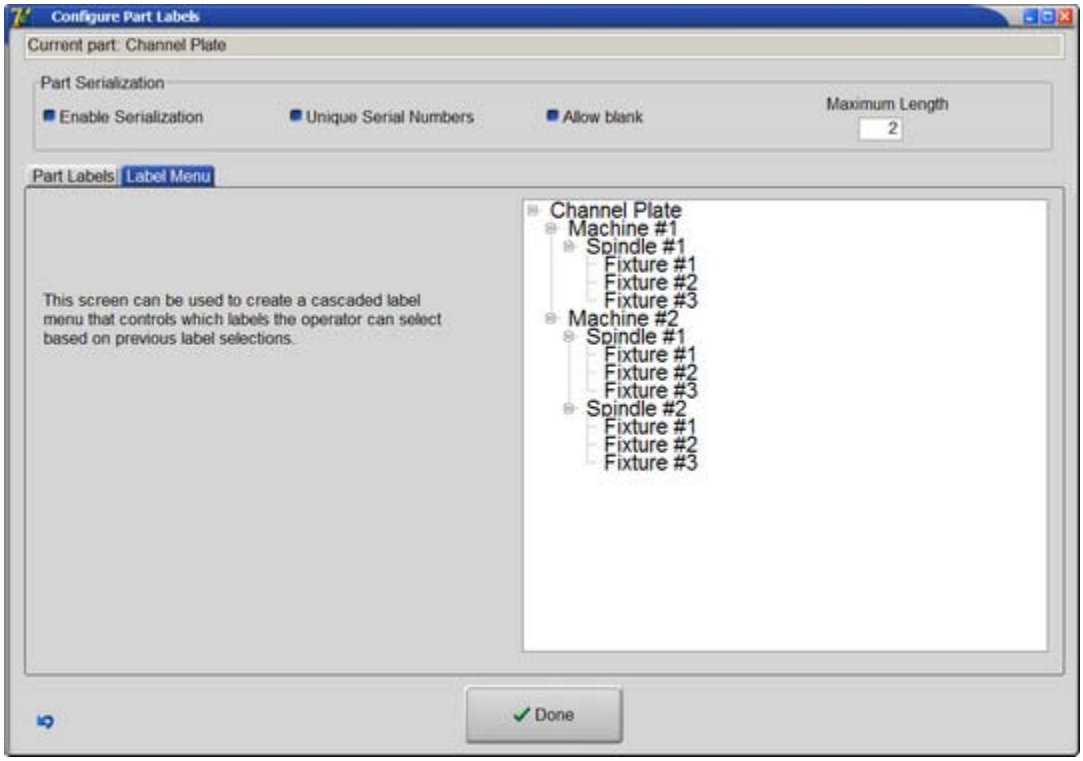
Label Prompt Option	Description
Selection is Persistent	GageXpress Pro 3.0 will retain the last selected label. If the label is prompted, the default selection will be the last selected label.
Prompt at start of sequence	The label prompt will be displayed at the start of the part inspection sequence. This is ignored if the label is not prompted.
Prompt at end of sequence	The label prompt will be displayed at the end of the part inspection sequence. This is ignored if the label is not prompted.
On New Part	The label prompt will be displayed every time the operator inspects a part.
On New Subgroup	The label prompt will be displayed every time the operator inspects the first part of a subgroup.
On Part Change	The label prompt will be displayed every time the operator changes the part type being inspected.
On Sequence Change	The label prompt will be displayed every time the part inspection sequence is changed. This will only occur if the part inspection sequence uses Features or the part is inspected by multiple Gages.
On Enter Gaging	The label prompt will be displayed each time Gaging is selected in GageXpress Pro 3.0. The selected label will then be retained until the operator exits the gaging screen and then re-enters it.
Time Options	The label prompt will be displayed for the first part inspected after the entered time passes. Each of the (3) time options can be triggered once each day.
Allow Keyboard Entry	Allows labels to be typed instead of selected from the choice list.
Show typed labels in choice list	Determines whether typed labels are displayed in the choice list.

Label Menu

The label menu is used to provide an easy to use operator interface for selecting manufacturing traceability labels. In this situation, the production line often contains multiple lines or machines producing the same part. Each machine may or may not have the same configuration. For instance, the example below shows two machines producing a part. The first machine has one spindle that performs machining on a part resting in one of three fixtures. The second machine has two spindles, each of which machine a part that rests in one of three fixtures.

When displayed in GageXpress Pro 3.0, the menu allows the operator to first select the machine that produced the part he is about to inspect. Once the machine selection is made, he selects the spindle. Depending on which machine was selected, he will be able to select only spindle #1 or either spindle #1 or spindle #2. After the spindle selection, the fixture selection is made.

The label menu allows each label selection to determine the available selections at the next level.



Creating a Label Menu:

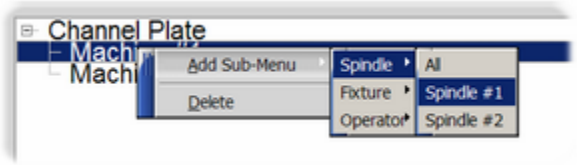
The example shown above will be used to illustrate creating Label Menus.

1. Create the Labels and Label Choices.
2. Select each of the desired Labels for use with the current part.
3. Click the Label Menu tab.

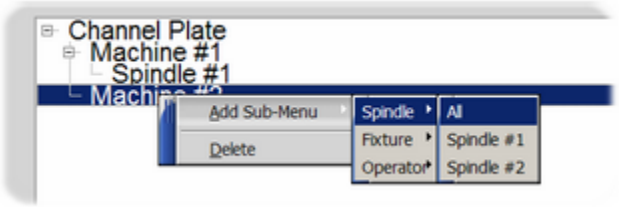
4. Right click the part name (Channel Plate in the above example). The list of label menu options will be displayed.

5. Select All machines. Your display should now look like the following.

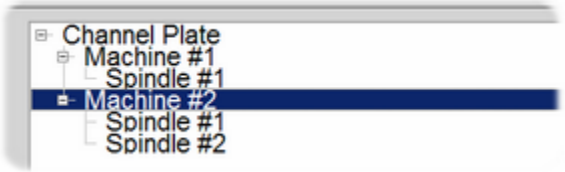
6. Right click Machine #1 and select Spindle #1 on the pop up menu.



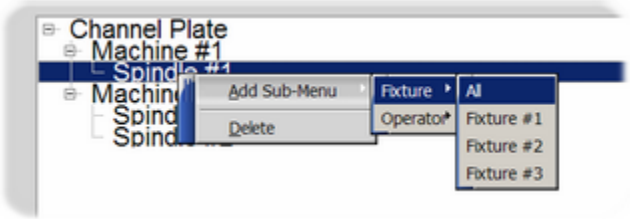
7. Right click Machine #2 and select All spindles on the pop up menu.



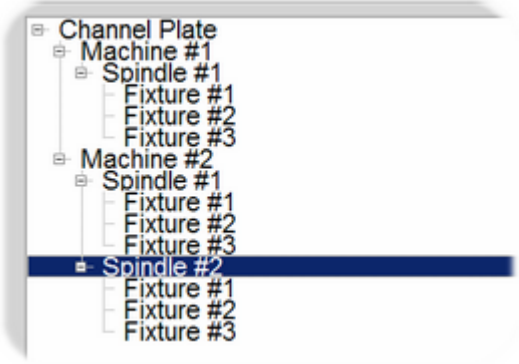
8. Your display should now look like the following.



9. Right click Spindle #1 under Machine #1 and select All fixtures on the pop up menu.



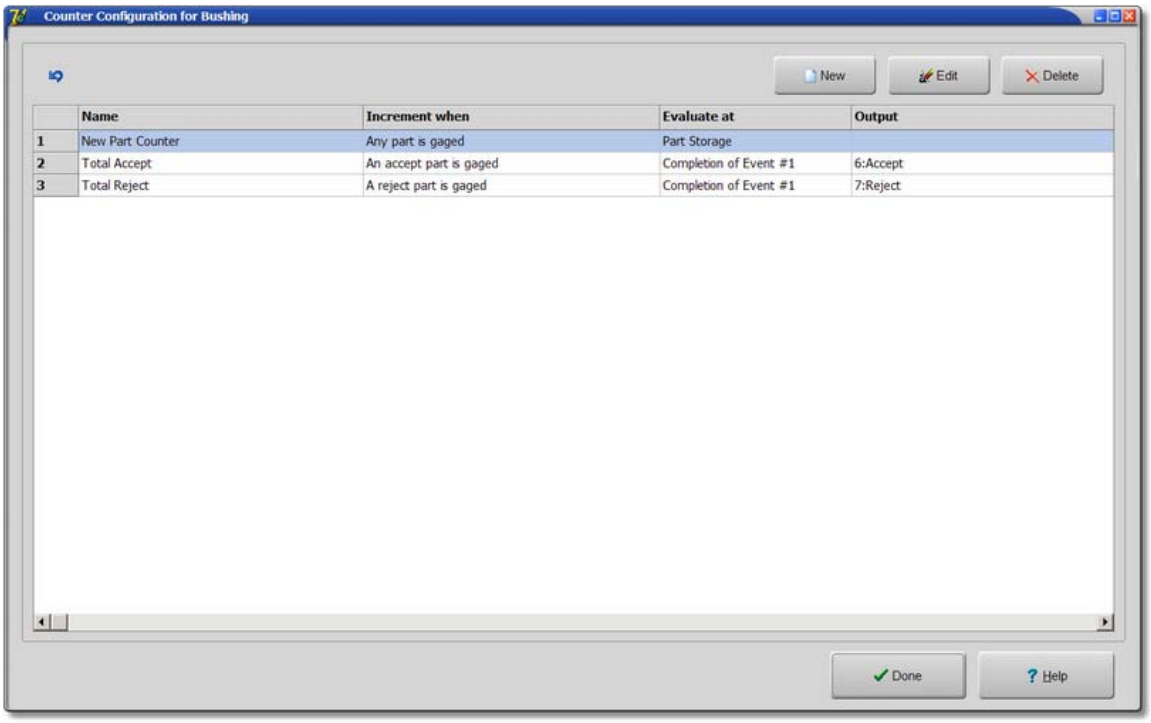
10. Repeat step 9 for Spindle #1 and Spindle #2 of Machine #2.
11. Your display should now look like the following.



12. Done

Counters

Counters are used to count the number of times specified part conditions occur. They also provide a convenient mechanism for turning on outputs based on the part's condition. These outputs are most often used as signals to a PLC identifying the condition of the part just inspected. The PLC can then process the part appropriately as it leaves the machine. Counters are most frequently used on automatic configurations but may also be used on manual configurations if desired.

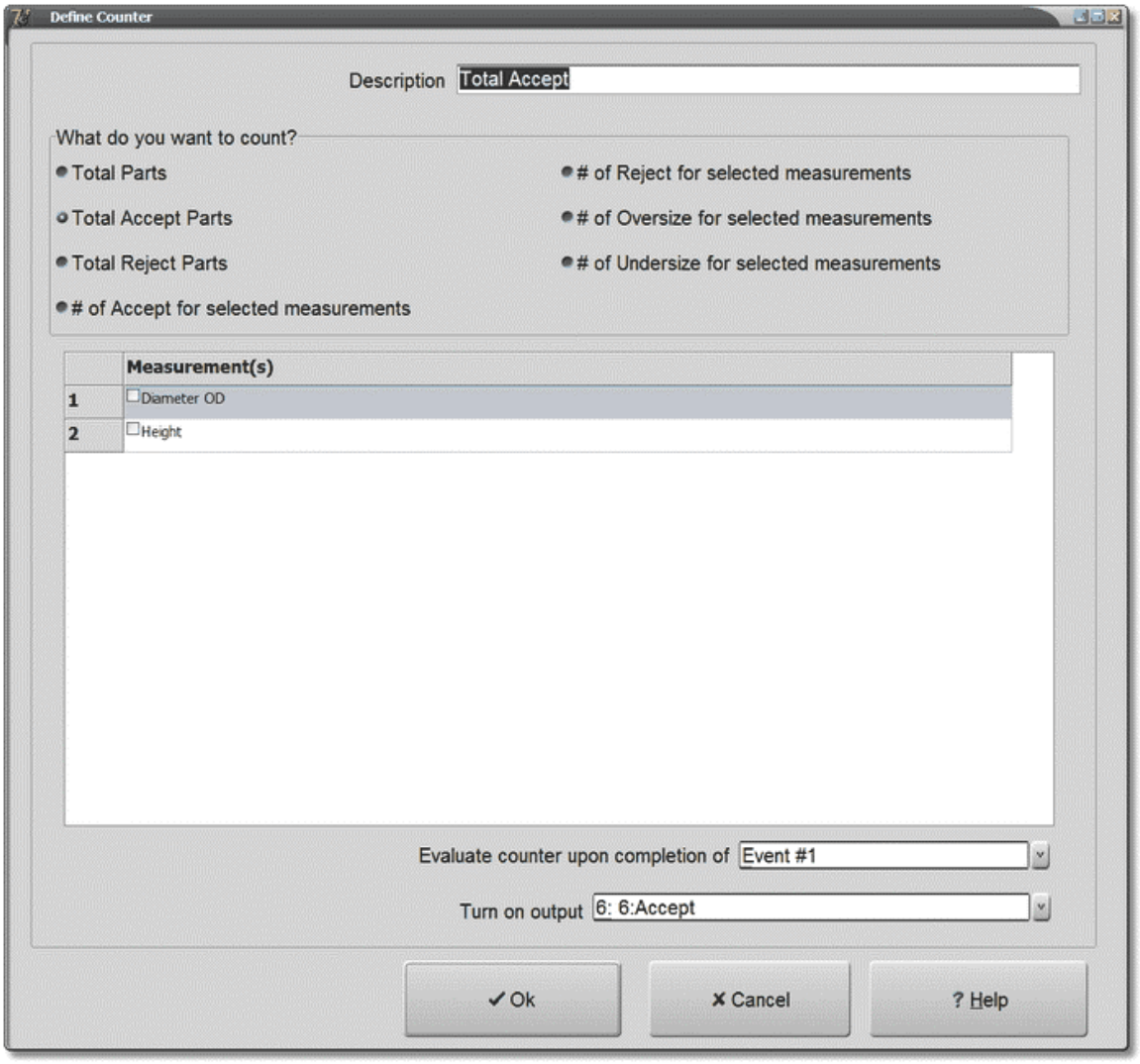


	Description
New	Adds a new counter using the defined selections to the list of counters.
Edit	Edit selected counter.
Delete	Deletes the selected counter.

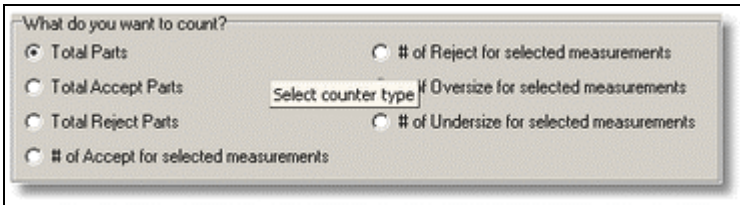
The counters are processed and displayed in the order shown. If the order needs to be changed, drag the counter that needs to be moved by clicking and dragging the far left column to its new location.

Creating or Editing a Counter

GageXpress Pro 3.0 counters are an easy way to keep track of production totals when used with automatic equipment performing 100% inspection. Although they can be used in manual applications, they are most frequently used with automatic machinery. In addition to counting parts, they also provide an easy mechanism for providing part status feedback to the PLC controlling the machine. This is done by associating an output with the counter. Each time the counter is incremented, the associated output is turned on.



Counter Properties	Description
Description 	This is a text description describing what the counter is counting. It will be displayed on the GageXpress Pro 3.0 counters screen along with the counter value.
Counter Type	This identifies what the counter is counting. It can have one of (7) values.

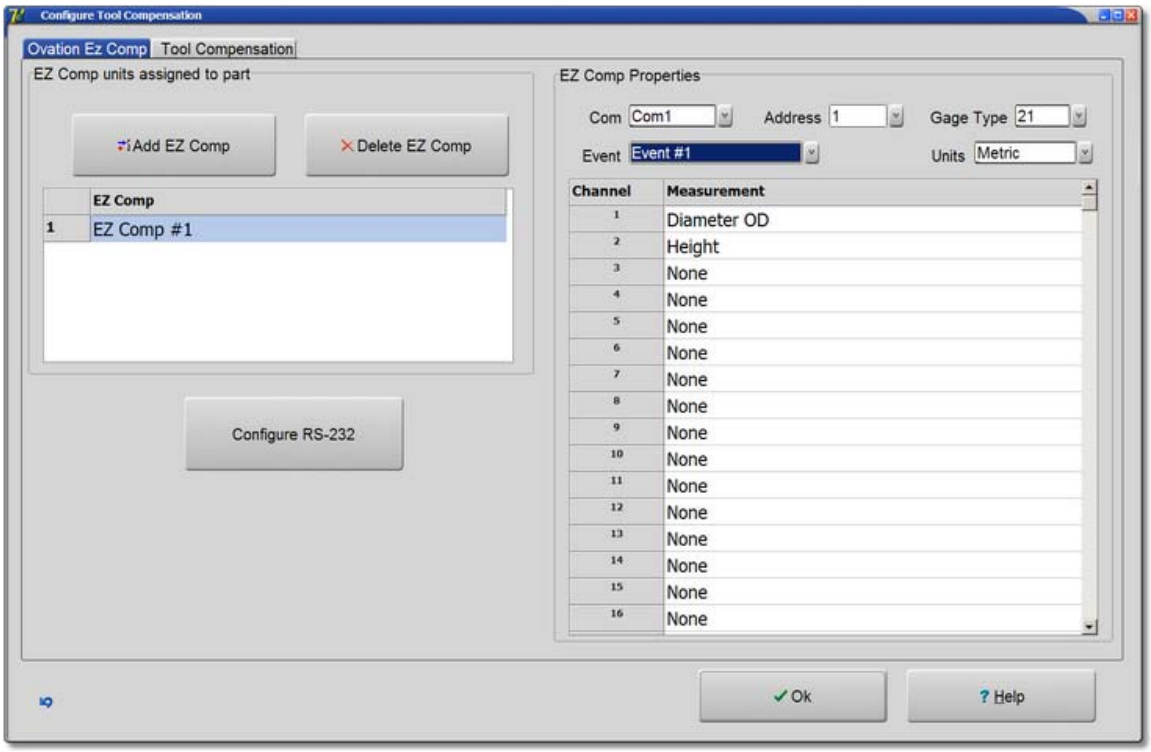
	have one of (7) values. • Total Parts - Increments once for each inspected part • Total Accept Parts - Increments once for each inspected part that is accepted • Total Reject Parts - Increments once for each inspected part that is rejected • # of Accept for selected measurements - Increments once for each part where all of the selected measurements are accepted • # of Reject for selected measurements - Increments once for each part where any of the selected measurements are rejected • # of Oversize for selected measurements - Increments once for each part where any of the selected measurements are oversize • # of Undersize for selected measurements - Increments once for each part where any of the selected measurements are undersize
Counter Event 	The counter event identifies when the counter will be evaluated. Either select the event where all measurements used by the counter have been measured or you can select "part stored". In this case the counter will be evaluated when the part is stored. This will not normally be useful if you are using the counter to also trigger an output.
Counter Output 	The output line to be turned on whenever the counter increments. The output is cleared when machine cycled is received for automatic applications or when a new part is started for manual applications.

Tool Compensation

GageXpress Pro 3.0 supports feedback of measurement data to the machines producing the parts. This capability is most often used in automatic applications and allows continuous production of parts with zero defects. Tool compensation can be implemented using Ovation Engineering's third party specialized tool compensation unit or GageXpress Pro 3.0's integrated capabilities for passing compensation data to machines.

EZ Comp

GageXpress Pro 3.0 supports the EZ-Comp tool compensation system manufactured by Ovation Engineering. GageXpress Pro 3.0 passes measurement results to the EZ-Comp for each part gaged. The EZ-Comp then uses the information to provide compensation values to machines. It is not uncommon to have multiple machines responsible for the measurements being inspected. In this case, multiple EzComp units can be connected to GageXpress Pro 3.0 so that each machine is compensated properly.



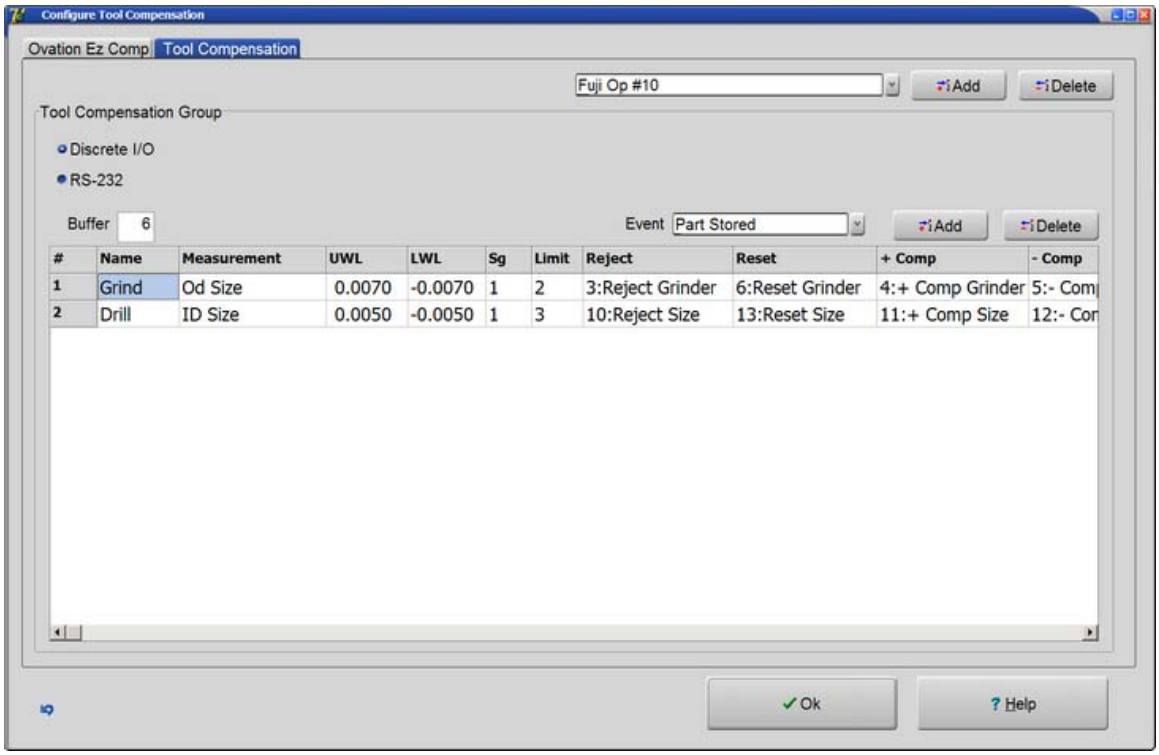
EzComp Properties	Description
Name	Name assigned to EzComp. Used for reference only.
Com	Com port EzComp is connected to. GageXpress Pro 3.0 will default its RS232 communication parameters to the EzComp defaults.
Address	EzComp address. This value must match the address set in the EzComp.
Gage Type	Sets the communication protocol used with the EzComp. This value must match the value set in the EzComp. Refer to the Ovation EzComp documentation for details.
Event	Determines when measurement data is sent to the EzComp. Valid values are when the part data is stored or upon the completion of a selected Event. The default value is when part data is stored.

Units	Units to send data in. Valid options are mm or inches.
Channel/Measurement	Assignment of measurements to internal EzComp channels. Each EzComp can handle up to 20 measurements.

GageXpress Pro 3.0 Tool Compensation

GageXpress Pro 3.0 Tool Compensation is accomplished my maintaining a configurable moving average of one or more measurements that is used to compensate a tool if the average exceeds a specified wear limit. The system takes into account the number of parts residing in the automation between the machine and the fixture has both RS232 and discrete interfaces to the machine.

a configurable output string, and allows the measurement units, resolution, and maximum compensation value to be configured.



Tool Compensation Group Property	Description
Com Port	Com port to be used to communicate with PLC. Com parameters are set using existing com configuration.
CR	Option to append a carriage return character (ASCII 13) to the end of each compensation string.
LF	Option to append a line feed character (ASCII 10) to the end of each compensation string.
Units	This is the unit of measure used for compensation values. All compensation values are sent in the selected unit. The Resolution parameter uses this value also. Valid values are Metric/English. Default is Metric.
Buffer	This is the # of parts between the machine and the gage. After a comp is issued, the buffered parts will be ignored for establishing a subsequent moving average. Therefore, a second comp will not occur until at least "buffer size" + "Avg Count" parts have been gaged. Valid values are 0 to 100. Default value is 1.
Event	Option to select which event compensation values will be sent on.
Tool Compensation Property	Description

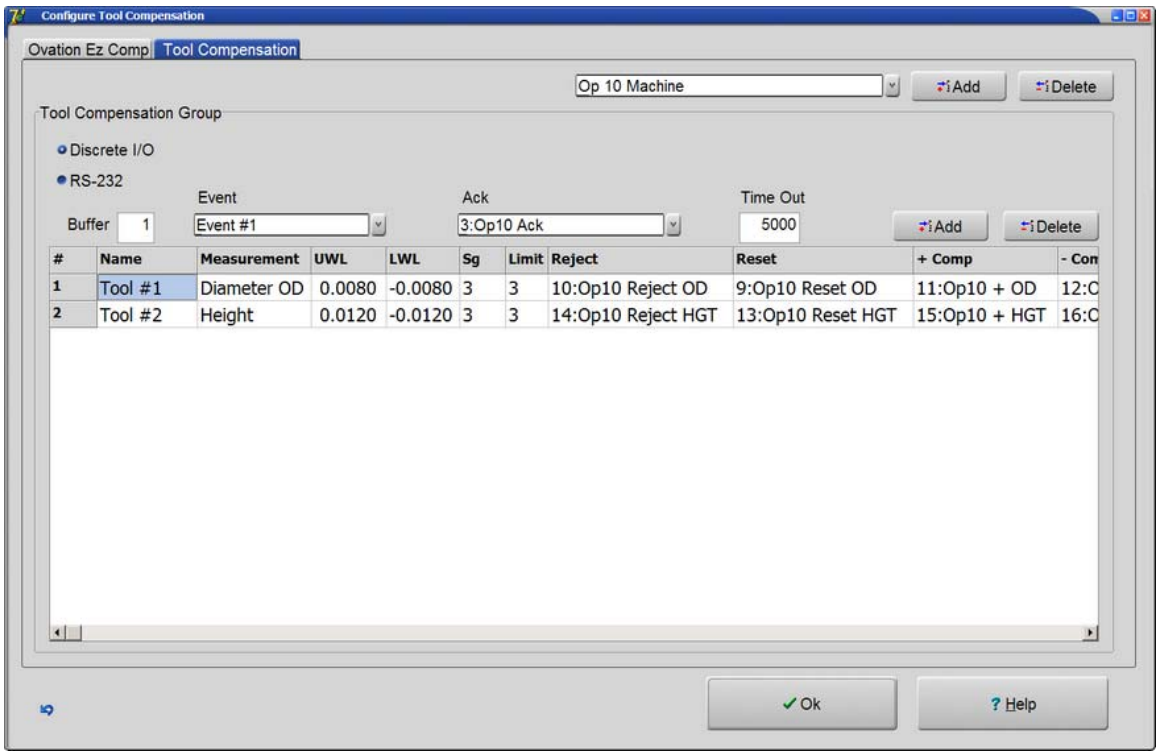
Name	Name used to reference the tool being compensated.
Format	The default compensation format is [compVal]. This string will be replaced with the actual compensation value. If it is required to send additional information to the PLC, the format string can be modified to include it. For example, a format string of '1,[compVal] mm' will send the string '1,0.023 mm' to the PLC when a 0.023 compensation value is required.
Resolution	This is the resolution used for the compensation value when sent to the PLC or displayed on screen
Measurement	This is the measurement that will be monitored to determine the compensation value.
Upper Wear Limit (UWL)	This is the value used to trigger a compensation value being sent to the PLC. Whenever the moving average exceeds this value, a comp will be generated.
Lower Wear Limit (LWL)	This is the value used to trigger a compensation value being sent to the PLC. Whenever the running average falls below this value, a comp will be generated.
Target	This is the target measurement value. Compensation values are calculated by subtracting the running average from this value. Default value is 0.00.
Max Comp	This is the maximum compensation value allowed in either direction. It should be a positive value. A value of 0.0 disables this feature and allows any size compensation value to be sent. Default value is 0.0.
Sg	This is the subgroup size to use to calculate the moving average. Valid values are 1-20. Default value is 3.
Active	This field can be used to turn off compensation for a specific tool. Valid values are true/false. Default is true.

Discrete I/O Interface #1

GageXpress Pro 3.0 can send compensation data to machines using discrete I/O. GageXpress Pro 3.0 maintains a moving average for each measurement used to compensate a tool. The subgroup size (Sg) parameter determines the number of consecutive parts used to calculate the moving average. If the average exceeds one of the wear limits (Uwl or Lwl), a compensation signal is sent to the machine. After sending a compensation to the machine, GageXpress Pro 3.0 resets the moving average and then waits for all parts currently between the machine and the gage to pass before resuming calculation of the moving average. The number of parts between the machine and gage is defined by the Buffer parameter.

Each machine has (1) Reject input that is activated by GageXpress Pro 3.0 whenever a reject part is measured. Each tool feature has (3) inputs that specify required compensation or Reset. Each time a compensation signal is sent to the machine, the machine increments a counter. If it receives two consecutive compensation signals, it performs a compensation and resets its internal counter. If GageXpress Pro 3.0 measures a good part (inside wear limits), it activates the Reset output. The machine then clears its internal counter and waits for the next signal. If GageXpress Pro 3.0 measures a reject part, it activates the Reject output and the Reset output.

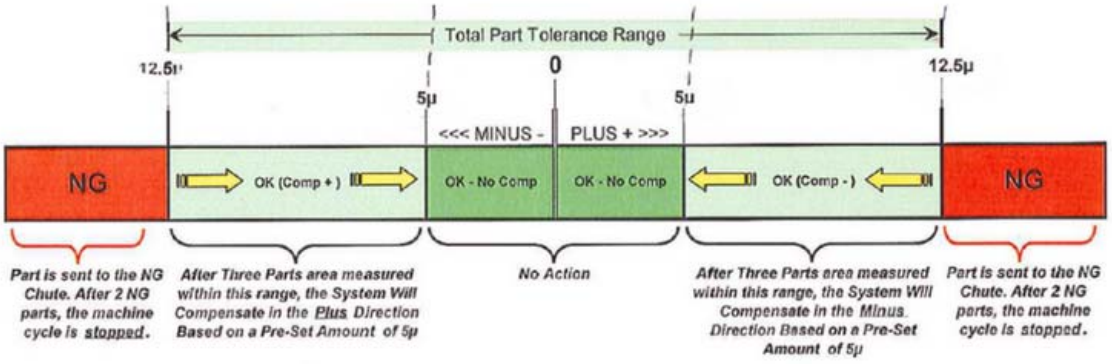
An optional Ack signal may be used from the machine. If the Ack signal is used, GageXpress Pro 3.0 output will be cleared when the Ack is received. If the Ack signal is not used, the signals will be pulsed for a configurable period of time.



Tool Group Property	Signal Type	Description
Buffer	NA	This is the # of parts between the machine and the gage. After a comp is issued, the buffered parts will be ignored for establishing a subsequent moving average. Therefore, a second comp will not occur for at least "buffer size" + "Avg Count" parts have been gaged. Valid values are 0 to 100. Default value is 1.

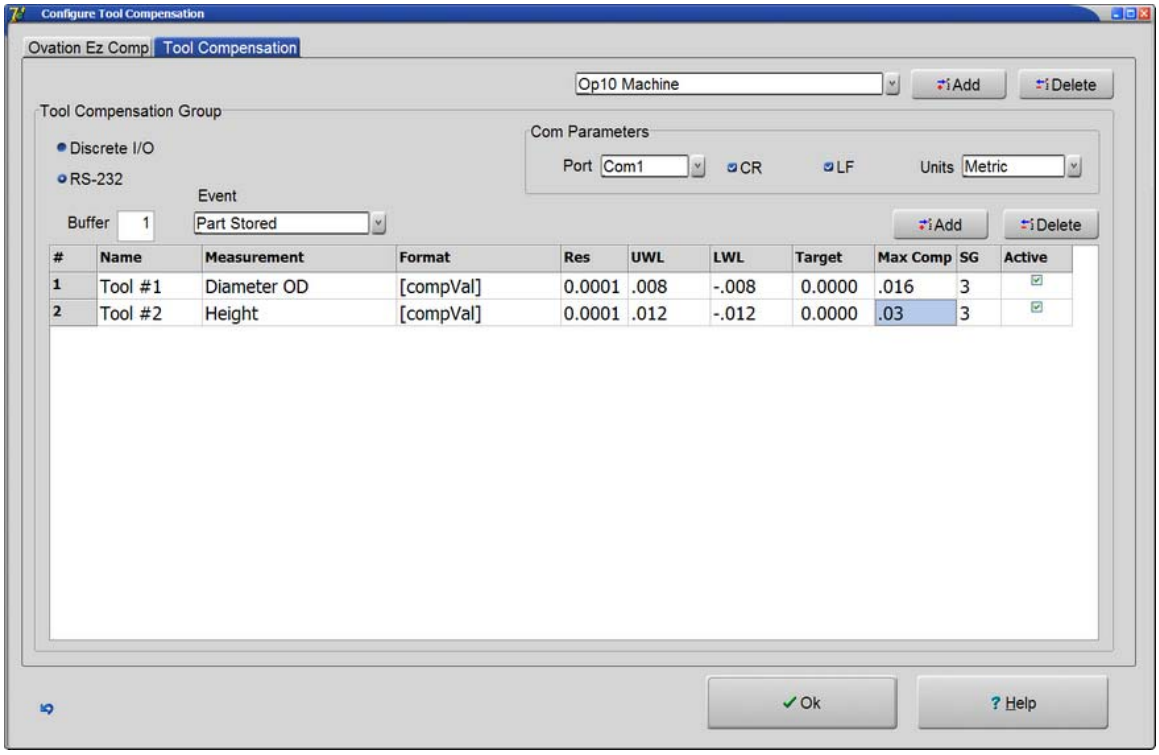
Event	NA	Controls when the compensation data will be sent to the machine. The default is when the part data is stored (receive Machine Cycled) but it can be set to occur at the completion of any event.
Ack	Machine Output/Computer Input	Machine activates in response to any of the above signals. If the Tool Group Acknowledgement is used, the Ack bits for any Tools belonging to the group are ignored. The Tool Group Ack bit takes precedence.
Time Out	NA	Time Out in milliseconds that GageXpress Pro 3.0 waits for the Ack signal from the machine. If the Ack signal is not used, this is the amount of time GageXpress Pro 3.0 waits before clearing the tool comp outputs.
Tool Property	Signal Type	Description
Name	NA	Name of tool being compensated.
Measurement	NA	Measurement used to generate compensation values.
Uwl	NA	Upper Wear Limit This is the value used to trigger a compensation value being sent to the PLC. Whenever the moving average exceeds this value, a comp will be generated.
Lwl	NA	Lower Wear Limit This is the value used to trigger a compensation value being sent to the PLC. Whenever the running average falls below this value, a comp will be generated.
Sg	NA	Subgroup size used to calculate moving average.
Limit	NA	Number of consecutive wear limit violations required for a compensation signal to be generated.
Reject	Machine Input/Computer Output	GageXpress Pro 3.0 activates each time a reject part is measured
+ Comp	Machine Input/Computer Output	GageXpress Pro 3.0 activates each time a + comp is required for the tool feature
- Comp	Machine Input/Computer Output	GageXpress Pro 3.0 activates each time a - comp is required for the tool feature
Reset	Machine Input/Computer Output	GageXpress Pro 3.0 activates each time a part is inside the tool wear limits or is a Reject
Ack	Machine Output/Computer Input	Machine activates in response to any of the above signals
Enable	Machine Output/Computer Input	Signal used to enable/disable tool compensation for this tool by an external device. If used, this input must be on to enable compensation of this tool.
Time Out	NA	Time Out in milliseconds that GageXpress Pro 3.0 waits for the Ack signal from the machine. If the Ack signal is not used, this is the amount of time GageXpress Pro 3.0 waits before clearing the tool comp outputs.
Active	NA	This field can be used to turn off compensation for a specific measurement. Valid values are true/false. Default is true.

GageXpress Pro 3.0 will send a compensation signal if it receives some number (Limit) of consecutive parts exceeding one of the tool wear limits. The diagram below illustrates the actions taken for a Limit value of 3 and wear limits set to +/- 0.005 microns.


Total Part Tolerance Range
12.5µ
0
12.5µ
5µ
5µ
<<< MINUS -
PLUS + >>>
NG
OK (Comp +)
OK - No Comp
OK - No Comp
OK (Comp -)
NG
Part is sent to the NG Chute. After 2 NG parts, the machine cycle is stopped.
After Three Parts area measured within this range, the System Will Compensate in the Plus Direction Based on a Pre-Set Amount of 5µ
No Action
After Three Parts area measured within this range, the System Will Compensate in the Minus Direction Based on a Pre-Set Amount of 5µ
Part is sent to the NG Chute. After 2 NG parts, the machine cycle is stopped.

RS232 Interface

GageXpress Pro 3.0 can send compensation data to machines using RS232. GageXpress Pro 3.0 maintains a moving average for each measurement used to compensate a tool. The subgroup size (Sg) parameter determines the number of consecutive parts used to calculate the moving average. If the average exceeds one of the wear limits (Uwl or Lwl), a compensation value equal to the difference between the average and the target value is sent to the machine. If the magnitude of the required compensation value is larger than the maximum allowed compensation value (Max Comp), then a value equal to Max Comp is sent. After sending a compensation to the machine, GageXpress Pro 3.0 resets the moving average and then waits for all parts currently between the machine and the gage to pass before resuming calculation of the moving average. The number of parts between the machine and gage is defined by the Buffer parameter.



Tool Group Properties	Description
Name	Name of tool group.
Buffer	This is the # of parts between the machine and the gage. After a comp is issued, the buffered parts will be ignored for establishing a subsequent moving average. Therefore, a second comp will not occur for at least "buffer size" + "Avg Count" parts have been gaged. Valid values are 0 to 100. Default value is 1.
Event	Controls when the compensation data will be sent to the machine. The default is when the part data is stored (receive Machine Cycled) but it can be set to occur at the completion of any event.
Port	Com port to be used to communicate with PLC. Com parameters are set using existing com configuration.
CR	Appends a carriage return to the compensation string.
LF	Appends a line feed to the compensation string.
Units	This is the unit of measure used for compensation values. All compensation values are sent in the selected unit. The Resolution parameter uses this value also. Valid values are Metric/English. Default is Metric.
Tool Properties	Description
Name	Name of tool being compensated.

Measurement	Measurement used to generate compensation values.
Format	By default, compensation values sent to the PLC via RS232 are in the format "x.xxxxx crlf". This parameter allows configuration of a compensation string to be used for this tool. Enter the desired string with '[compVal]' inserted in the location where the compensation value should be.
Res	This is the resolution used for the compensation value.
Uwl	Upper Wear Limit This is the value used to trigger a compensation value being sent to the PLC. Whenever the moving average exceeds this value, a comp will be generated.
Lwl	Lower Wear Limit This is the value used to trigger a compensation value being sent to the PLC. Whenever the running average falls below this value, a comp will be generated.
Target	This is the target measurement value. Compensation values are calculated by subtracting the running average from this value. Default value is 0.00.
Max Comp	This is the maximum compensation value allowed in either direction. It should be a positive value. A value of 0.0 disables this feature and allows any size compensation value to be sent. Default value is 0.0.
Sg	Subgroup size used to calculate moving average.
Active	This field can be used to turn off compensation for a specific measurement. Valid values are true/false. Default is true.

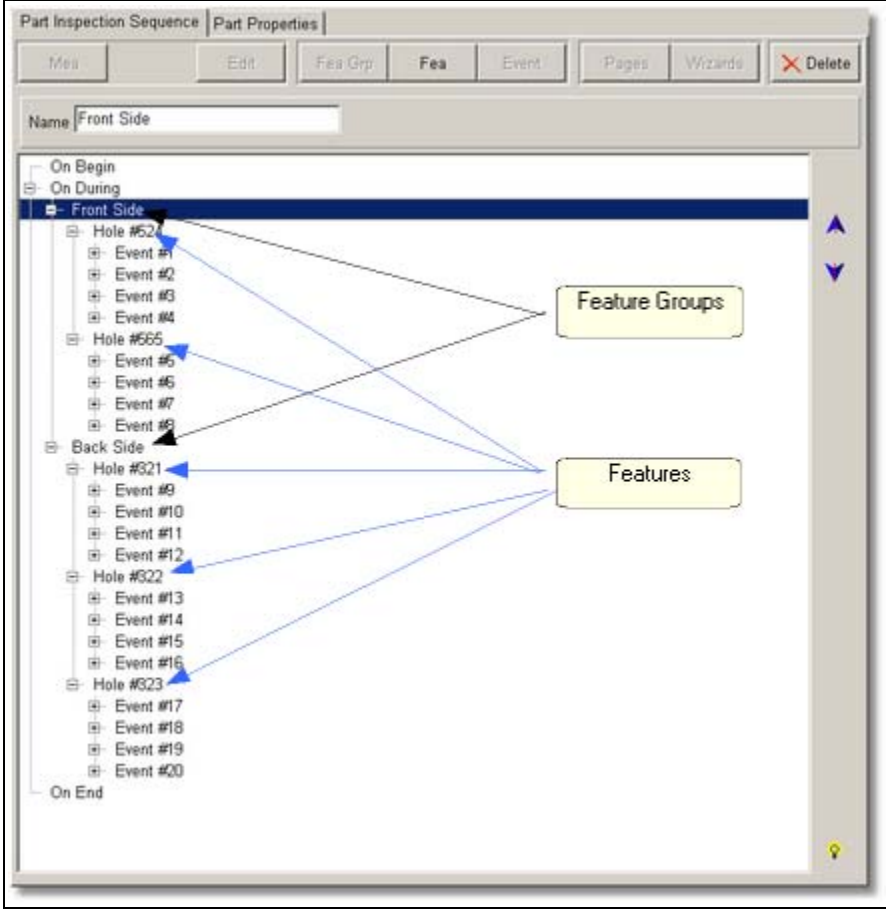
Part Inspection Sequence

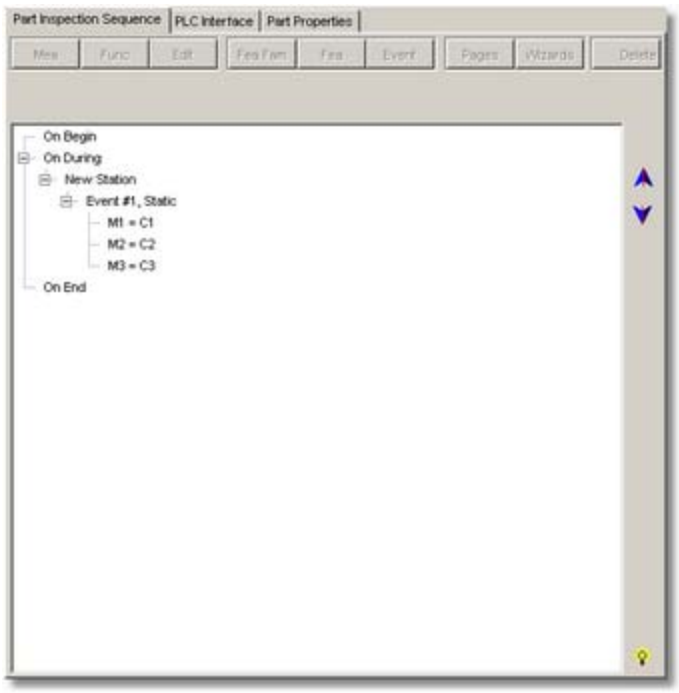
The GageXpress Pro 3.0 inspection sequence is a series of events that must be performed to inspect a part. An event is one press of the foot switch for a manual application or a take data signal from the PLC for automatic applications. Generally, measurement results are recorded when the event is completed. (foot switch pressed)

Most of your time creating a GageXpress Pro 3.0 application will be spent creating the part inspection sequence. The sequence defines all steps that the operator or machine must perform to inspect the part. Measurements are created for each event to define what is inspected on the part for that step. Custom pages (screens) can also be created for each event of the sequence. These screens provide operator instructions and display inspection results.

Manual gage and automatic machine part inspection sequences are very similar but each has options specific to their requirements. Therefore they are covered separately in the following sections.

Events are created by right clicking the On During node and then selecting New Event from the pop up menu or clicking the Event button.

	Description
	Manual Gage Sequence

	Automatic Gage Sequence

How created	Manual Gage Sequence Item	Definition
Right click the On During node or a Feature node and select New Event or click the Event button.	Event	Used to create a set of steps required to inspect a part. Measurements are taken on each event as required. Once a measurement is taken, its value is available for use on future events but it cannot normally be changed.
Right click the On During or Feature Group node and select New Feature or click the Fea button.	Feature	Used to group a number of events together and make the set of events optional in the gage sequence.
Right click the On During node and select New Feature Group or click the Fea Grp button.	Feature Group	Used to group a number of Features together.
How created	Automatic Gage Sequence Item	Definition
Right click the On During node and select New Station	Station	Used to create a GageXpress Pro 3.0 machine imitating the actual gage machine. One nest should exist for each machine station starting with the first station measurements are taken in and continuing thru the last station measurements are taken in.
Right click a Station node and select New Event.	Event	Used to create a set of steps required to inspect a part. Measurements are taken on each event as required. Once a measurement is taken, its value is available for use on future events but it cannot normally be changed.

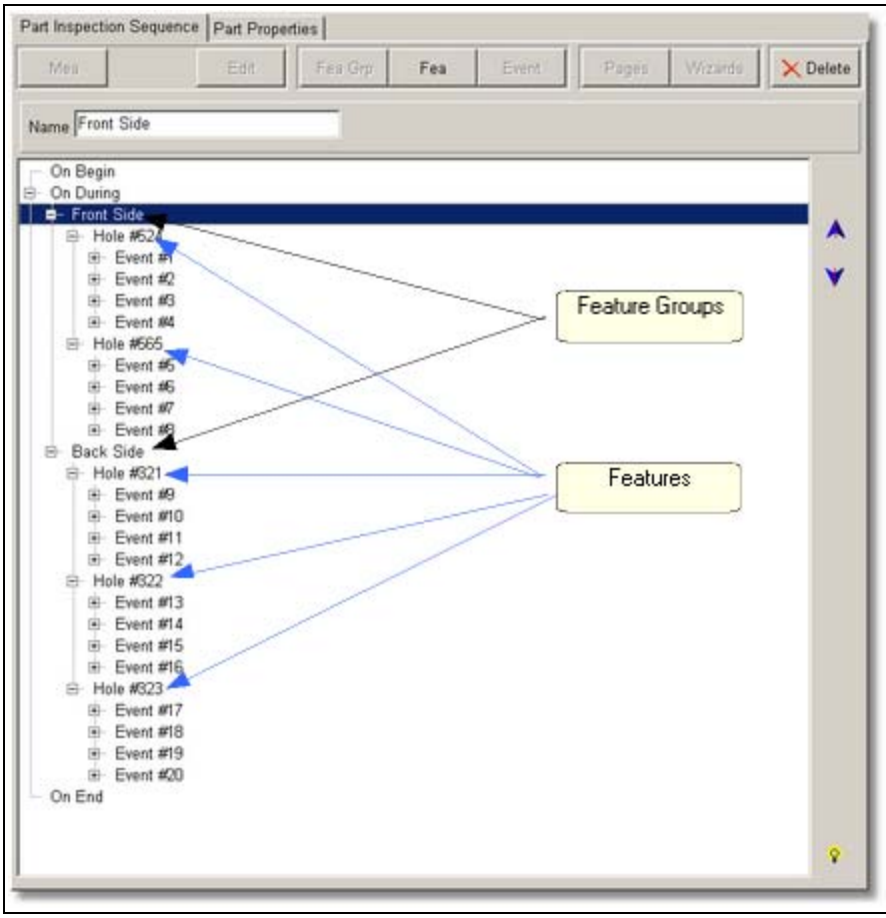
Manual Gage Inspection Sequence

The part inspection sequence for manual applications uses a combination of

- Events
- Features
- Feature Groups
- Measurements

Events and measurements are used in every application. Features and Feature Groups are used to group events and features respectively and may or may not be used. All items in an inspection sequence are created by selecting a node in the inspection sequence tree and then either clicking an available button shown at the top of the sequence or right clicking the node and selecting an option from the pop up menu. The options change depending on the node selected in the inspection sequence.

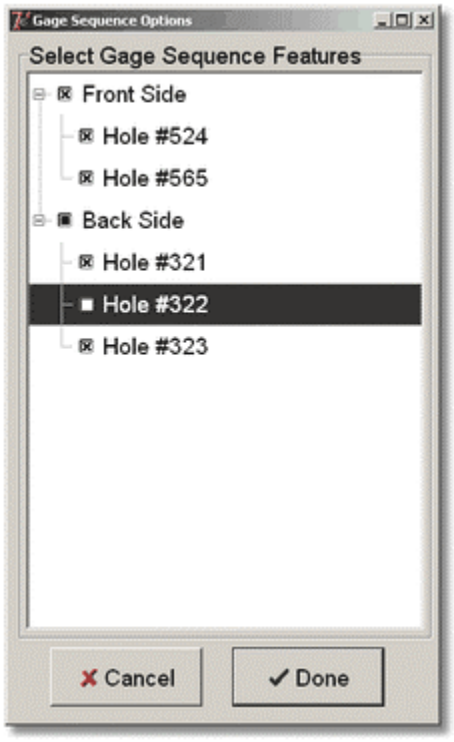
How created	Manual Gage Sequence Item	Definition
Right click the On During node or a Feature node and select New Event or click the Event button.	Event	Used to create a set of steps required to inspect a part. Measurements are taken on each event as required. Once a measurement is taken, its value is available for use on future events but its value cannot be changed.
Right click the On During or Feature Group node and select New Feature or click the Fea button.	Feature	Used to group a number of events together and make the set of events optional in the inspection sequence.
Right click the On During node and select New Feature Group or click the Fea Grp button.	Feature Group	Used to group a number of Features together.
Manual application inspection sequence		



- Events provide a way to sequence a series of one or more steps required to inspect a part
- Measurements are the results of inspecting some area of the part
- Features group events and provide the ability to select which areas of the part you want to inspect
- Feature Groups are a group of features and provide a way to organize your sequence.

If features are used in an inspection sequence, the features can be selected or eliminated from the sequence for any particular part being inspected with GageXpress Pro 3.0. The GageXpress Pro 3.0 part inspection screen provides access to the sequence selection menu which allows you to select which features to include the part inspection process.

GageXpress Pro 3.0 sequence selection screen	



The screen to the left is available to the operator on the GageXpress Pro 3.0 part inspection screen.

Using Features and Feature Groups allows the operator to easily eliminate portions of the inspection sequence when inspecting a part.

Remove the X marks from in front of a feature to remove that portion of the inspection sequence on subsequent part inspections.

Changing a Manual Gage Inspection Sequence

Sometimes creating an inspection sequence is just the beginning of the configuration process. It seems that however much care is taken to create the sequence in a manner that satisfies everyone's needs, changes will be inevitable. With this in mind, GageXpress Pro 3.0 file provides a number of tools for rearranging your sequence to meet new requirements. These tools include the ability to easily move and copy measurements, events, features, and feature groups.

Inspection sequence items can be moved by dragging and dropping them within the inspection sequence tree. Simply click and hold the left mouse button and then drag (move) the mouse to the desired location for the item and then release the left mouse button. If the new location is valid for the selected item, it will be moved. This is a very powerful feature since when an event is moved, all measurements and pages created for the event are moved with it. Similarly, moving a feature automatically moves all of the events on the feature and moving a feature group automatically moves the features belonging to the feature group. These abilities make changes that may require hours or even days of work on other systems trivial with GageXpress Pro 3.0 file.

Moving	to	Result
Measurement	On During	The measurement is moved to the main inspection sequence loop. This will cause the measurement to be evaluated during the entire part inspection sequence without regard to the current event.
Measurement	Event	The measurement is moved to the event and becomes the first measurement evaluated for the event.
Measurement	Measurement	The measurement is inserted immediately before the destination measurement.
Event	On During	The event is moved to the main inspection sequence loop and becomes the first event in the inspection sequence.
Event	Feature Group	The event is moved to the main inspection sequence loop immediately in front of the destination feature group.
Event	Feature	The event is moved to either immediately before the destination feature or is inserted as the first event of the feature. You are prompted to select one or the other. If the feature belongs to a feature group, the event is inserted as the first event of the feature.
Event	Event	The event is inserted immediately before the destination event.
Feature	On During	The feature is moved to the main inspection sequence loop and becomes the first feature in the inspection sequence.
Feature	Feature Group	The feature is moved to become the first feature in the feature group.
Feature	Feature	The feature is inserted immediately before the destination feature.
Feature	Event	The feature is inserted immediately before the destination event. This can only be done if the event does not belong to a feature.
Feature Group	On During	The feature group is moved to the main inspection sequence loop and becomes the first feature group in the inspection sequence.
Feature Group	Feature Group	The feature group is inserted immediately before the destination feature group.
Feature Group	Feature	The feature group is inserted immediately before the destination feature. This is not allowed if the destination feature belongs to a feature group.
Feature Group	Event	The feature is inserted immediately before the destination event. This is not allowed if the event belongs to a feature.

Copying inspection sequence items provides a means of quickly creating long sequences that have a repetitive nature very quickly. This is generally the case with any long inspection sequence and is typified by dog house gages. Using GageXpress Pro 3.0 file, an event, feature, or feature group can be created and then effortlessly duplicated to perform the same task repetitively. This is done by right clicking the item to be copied and selecting Copy on the pop up menu. You then select the place you want to copy the item to and select Paste on the pop up menu.

Copying	to	Result
Measurement	Event	A new measurement is created and added to the event and becomes the last measurement evaluated for the event.
Event	On During	A new event is created and copied to the main inspection sequence loop and becomes the last event in the inspection sequence. All measurements and pages on the event are also copied.
Event	Feature	A new event is created and copied to the destination feature and becomes the last event in the feature. All measurements and pages on the event are also copied.
Feature	On During	A new feature is created and copied to the main inspection sequence loop and becomes the last feature in the inspection sequence. All events on the feature are also copied.
Feature	Feature Group	A new feature is created and copied to the destination feature group and becomes the last feature of the feature group. All events on the feature are also copied.
Feature Group	On During	A new feature group is created and copied to the main inspection sequence loop and becomes the last feature group in the inspection sequence. All features in the feature group are also copied.

Automatic Machine Sequence

GageXpress Pro 3.0 has been designed to handle inspection performed with automatic machines. Since machines are controlled by programmable logic controllers (PLC), an interface between GageXpress Pro 3.0 and a PLC must be created. The most common and reliable interface for these systems is the use of discrete I/O to create a handshaking protocol. GageXpress Pro 3.0 interfaces with the PLC in this manner. Before discussing the GageXpress Pro 3.0 <-> PLC interface, we should clarify the purpose and responsibility of each device.

Device	Purpose & Responsibilities
PLC	The PLC provides all machine control. It is responsible for all machine movement, part handling, and measurement initiation. After the part has been inspected, the PLC provides part handling as required based on the part status received from GageXpress Pro 3.0.
GageXpress Pro 3.0	GageXpress Pro 3.0 performs part inspection when signaled by the PLC and provides part status back to the PLC. It does not perform any machine control functions.

The standard GageXpress Pro 3.0 <->PLC interface is very simple. There are only (3) required signals, although any robust system should contain more. A summary of the supported interface signals is shown below.

Interface Signal/Type	Required	Description
Machine Cycled (MC) Input	Yes	This is a signal from the PLC indicating that the machine has cycled. This is the cornerstone of the GageXpress Pro 3.0 <->PLC interface. The GageXpress Pro 3.0 shifts the part buffer when Machine Cycled is received and stores the part in the last nest at this time. Machine Cycled (MC) also results in the GageXpress Pro 3.0 performing an internal reset of all states back to a fresh start up condition. This value is selected on the machine properties screen.
Machine Cycle Acknowledge (MCA) Output	Yes	The GageXpress Pro 3.0 sets the Machine Cycle Ack (MCA) output after receiving the Machine Cycled signal from the PLC. MCA is set after the GageXpress Pro 3.0 shifts the part buffer and performs storage tasks. This provides a positive handshake to the PLC. The GageXpress Pro 3.0 expects MC to be cleared within the designated time frame and displays a fault on the screen if the PLC fails to do this. The Machine Fault output is set if it exists. This value is selected on the machine properties screen.
Start Gage Input	Yes	This is a signal from the PLC indicating that a part is in position to be inspected. The GageXpress Pro 3.0 inspects the part when Start Gage is received. These values are selected on the PLC interface tab of the part properties screen.
Start Gage Acknowledge Output	No	This is a signal to the PLC indicating that the Start Gage signal has been received. It is turned on after the GageXpress Pro 3.0 completes the inspection process for the Start Gage signal. These values are selected on the PLC interface tab of the part properties screen.
Machine In Run Mode Output	No	This is a signal to the PLC indicating that GageXpress Pro 3.0 is ready to inspect parts. It indicates that GageXpress Pro 3.0 is powered up and capable of inspection. GageXpress Pro 3.0 does not allow gaging if it is in Mastering, Setup, or Diagnostic modes. The Machine in Run Mode output will be off in

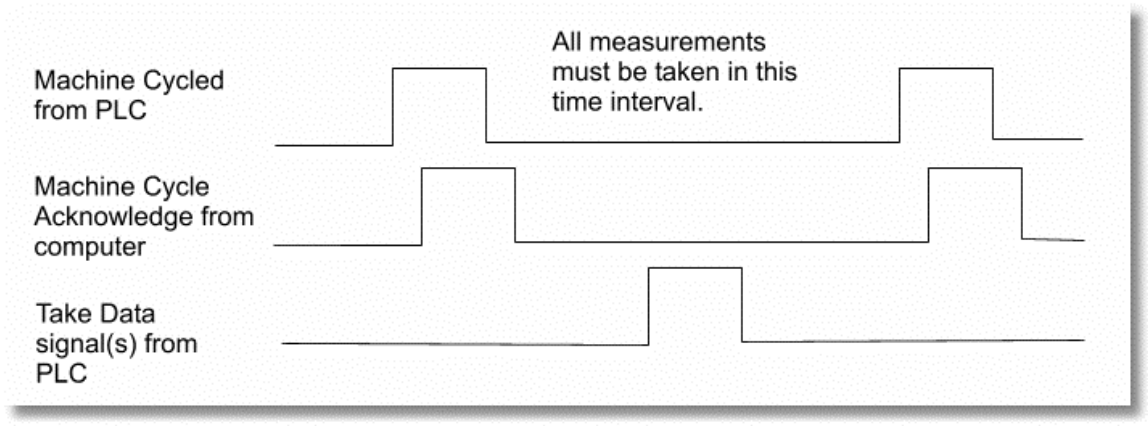
		any of these states. This value is selected on the machine properties screen.
Machine Fault Output	No	This is a fault signal to the PLC turned on whenever GageXpress Pro 3.0 detects a fault. Fault conditions include: • MC/MCA handshake timeout • Start Gage received without a part ID signal (applies to machines supporting multiple part types) This value is selected on the machine properties screen.
Performing GR&R Output	No	This output signals the PLC that a Gage Repeatability & Reproducibility (GR&R) study is being performed. This is often necessary so that the PLC can provide specific part handling during GR&R procedures. This value is selected on the machine properties screen.
GR&R Event Complete Output	No	This output is the output to be turned on as the part status output during a GR&R sequence. These values are selected on the PLC interface tab of the part properties screen.
Go to calibration Input	No	Signal from the PLC telling GageXpress Pro 3.0 to go to the calibration screen. GageXpress Pro 3.0 will drop out of run mode and enter the calibration screen where it will wait for additional signals from the PLC. This is used to implement automatic calibration sequences. Refer to the section discussing calibration for more information. This value is selected on the machine properties screen.
Part Selection Input Range	Maybe	These inputs identify the part type in the gage station and is only required if multiple part types are inspected on the machine. The part type must be identified in the first nest when the start gage signal is turned on. The range of inputs are interpreted as a binary value selecting one part. Each part must be assigned a unique selection value on its properties screen. This value is selected on the machine properties screen.
SPC Source Selection Input Range	Maybe	These inputs identify the SPC source for the part in the first gage station and is only required if multiple SPC sources are available for the parts. The SPC source must be identified in the first station when the start gage signal is turned on. The range of inputs are interpreted as a binary value selecting one SPC source. SPC sources are selected based on their order ... ie the first SPC source is binary value 1, the second is 2 and so on. This value is selected on the machine properties screen.
Machine Reset Input	No	This input resets GageXpress Pro 3.0. When the Machine Reset signal is received, GageXpress Pro 3.0 performs a reset similar to what is done when Machine Cycled is received. The main difference is that no data is stored for parts which may have been gaged. All gage stations are reset to their initial states and any gage results are abandoned. The machine reset can be used to recover from faults and essentially empties the machine. This value is selected on the machine properties screen.
Machine Reset Acknowledge Output	No	An output which is turned on after GageXpress Pro 3.0 receives a Machine Reset and completes its reset operation. This value is selected on the machine properties screen.

Station Reset Input	No	This input resets one GageXpress Pro 3.0 station. When the Station Reset signal is received, GageXpress Pro 3.0 performs a reset on the designated station. All gaging that has taken place is reset and the status of the part in the station is reset to the same state it was in when the part first shifted into the station. This can be used to implement part re-gaging that is entirely PLC controlled allowing reject parts to be re-gaged multiple times before accepting the results. These values are selected on the PLC interface tab of the part properties screen.
Station Reset Acknowledge Output	No	An output that is turned on after GageXpress Pro 3.0 receives a Station Reset and completes its reset operation. These values are selected on the PLC interface tab of the part properties screen.

The minimum GageXpress Pro 3.0 <-> PLC interface, which could only be used for a single nest, single event machine is as follows:

Action	Description
PLC sets Machine Cycled	This signals GageXpress Pro 3.0 that the machine has been cycled. GageXpress Pro 3.0 shifts the part buffer and stores data for the part in the last nest (which is now leaving the machine).
GageXpress Pro 3.0 sets Machine Cycle Acknowledge	This is set after shifting the part buffer and storing data. GageXpress Pro 3.0 then waits for Machine Cycled to clear. A fault is generated if the PLC does not clear Machine Cycled within the designated time (default value is 5 seconds).
PLC clears Machine Cycled	GageXpress Pro 3.0 is now ready to gage a part.
PLC sets Start Gage	GageXpress Pro 3.0 gages part.
PLC clears Start Gage	Gaged part will be stored on next Machine Cycle.

The following timing diagram illustrates the minimum required handshake between the PLC and GageXpress Pro 3.0. All required part inspection takes place between consecutive Machine Cycled signals from the PLC. It is the PLC's responsibility to reset the Take Data signal before the next Machine Cycled signal.

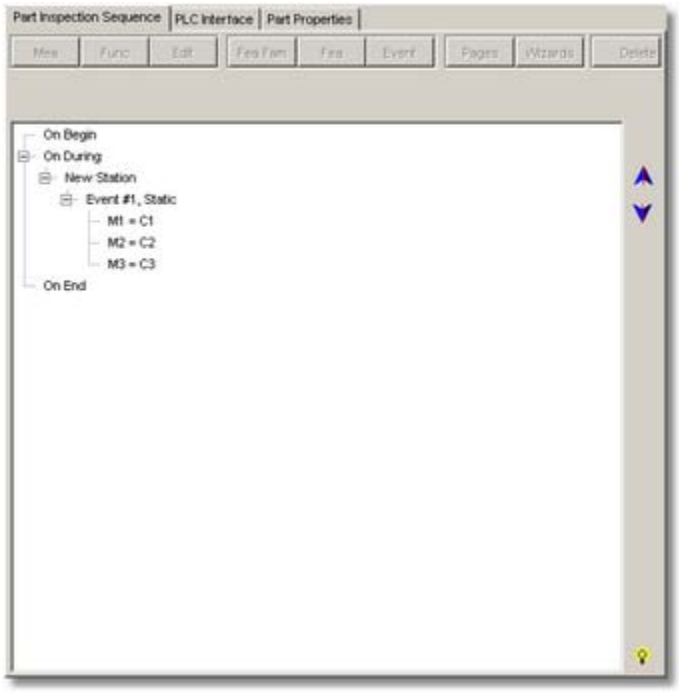


A more typical GageXpress Pro 3.0<->PLC interface would include additional handshaking as follows:

Action	Description
PLC sets Machine Cycled	This signals GageXpress Pro 3.0 that the machine has been cycled.

	GageXpress Pro 3.0 shifts the part buffer and stores data for the part in the last nest (which is now leaving the machine). Start Gage Acknowledge and all part status outputs are also cleared at this time if they are used.
GageXpress Pro 3.0 sets Machine Cycle Acknowledge	This is set after shifting the part buffer and storing data. GageXpress Pro 3.0 then waits for Machine Cycled to clear. A fault is generated if the PLC does not clear Machine Cycled within the designated time (default value is 5 seconds).
PLC clears Machine Cycled	GageXpress Pro 3.0 is now ready to gage a part.
PLC sets Start Gage	GageXpress Pro 3.0 gages part, increments counters, and sets status outputs indicating the accept/reject status of the part. The PLC will use this information to determine the disposition of the part when it is cycled out of the machine.
GageXpress Pro 3.0 sets part status outputs	Part status outputs are set based on the part's counters or from a custom GageXpress Pro 3.0 script.
GageXpress Pro 3.0 sets Start Gage Acknowledge	Positive indication to the PLC that the part has been gaged and GageXpress Pro 3.0 is ready to continue.
PLC clears Start Gage	Gaged part will be stored on next Machine Cycle. Start Gage Acknowledge and all part status outputs are also cleared at that time.

Events are created by right clicking the On During node and then selecting New Event from the pop up menu or clicking the Event button.

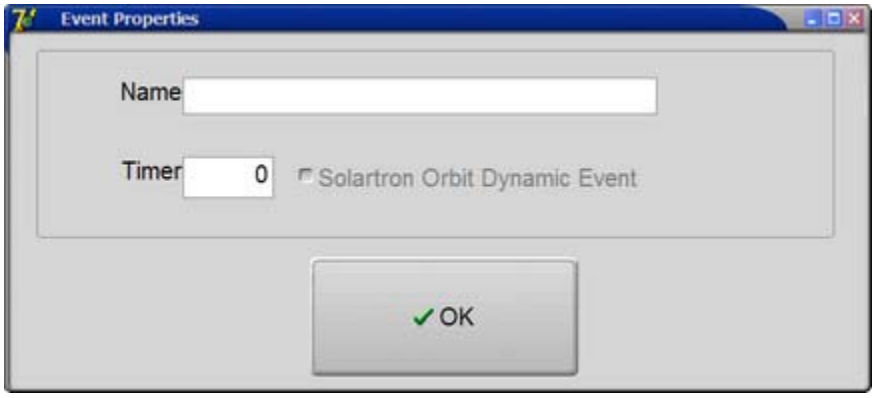
	Description
	Automatic Gage Sequence

How created	Automatic Gage Sequence Item	Definition
Right click the On During node and select New Station	Station	Used to create a GageXpress Pro 3.0 machine imitating the actual gage machine. One nest should exist for each machine station starting with the first station measurements are taken in and continuing thru the last station measurements are taken in.

Right click a Station node and select New Event	Event	Used to create a set of steps required to inspect a part. Measurements are taken on each event as required. Once a measurement is taken, its value is available for use on future events but it cannot normally be changed.

Events

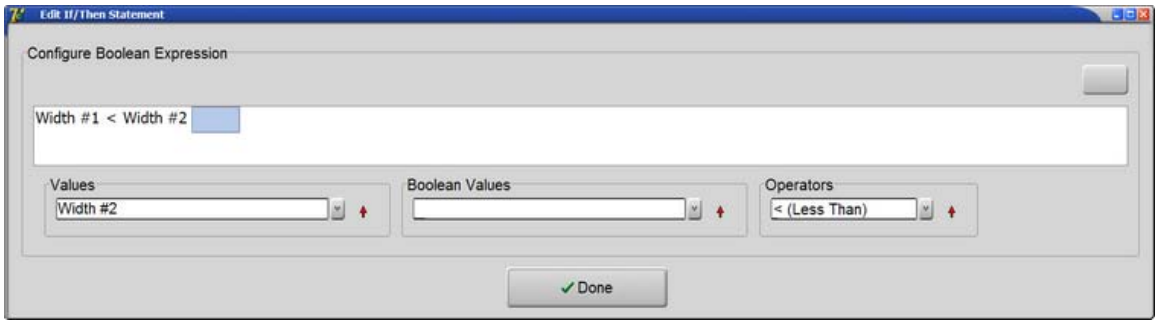
Events are the foundation of all manual and automatic part inspection sequences. Events are used to identify every step required to inspect a part. Manual application Events are performed by the operator pressing the Read button on the gage screen or an attached foot/palm button. GageXpress Pro 3.0 then moves to the next event in the sequence and displays the selected page for that event. Automatic application Events are performed by the PLC sending a Take Data signal to GageXpress Pro 3.0 indicating that all machinery is in the proper position for measurements to be taken on the event. After GageXpress Pro 3.0 completes event processing, it replies to the PLC and moves on to the next event where it once again waits for the PLC signal.



Event Properties	Description
Name	Event name. Defaults to "Event #X" where X is the position of the event in the inspection sequence.
Timer	Allowed time for event to complete. Default value is 0 and means that the event is not timed. It will wait for the Read button indefinitely. The value is entered in seconds and if non-zero, GageXpress Pro 3.0 will automatically move to the next event when the allotted time expires. This is most often used with the Solartron Orbit Dynamic capability discussed next.
Solartron Orbit Dynamic Event	Makes this event a Solartron Orbit Dynamic event. Instead of GageXpress Pro 3.0 processing inputs at its normal scan rate, the Solartron Orbit network is placed in dynamic mode allowing inputs to be read at 1000 samples a second. GageXpress Pro 3.0 processes the buffered data when the event completes and then displays the results. This allows high speed data sampling for critical inspection tasks. The dynamic mode is only available for timed events.

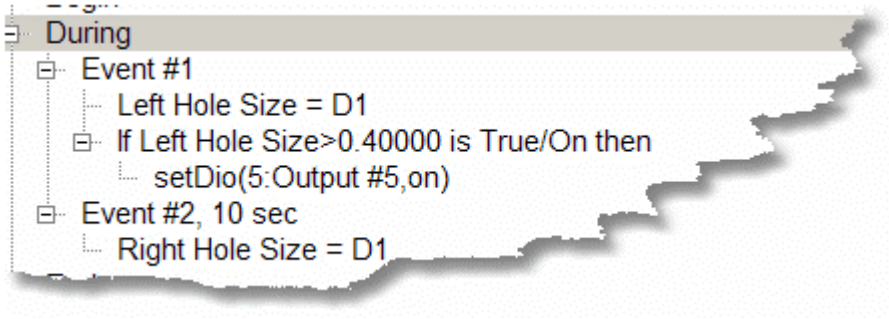
If/Then Decision Statements

Special application specific circumstances often require that a decision be made before specific portions of the inspection sequence are performed. GageXpress Pro 3.0's If/Then statements allow an application to make decisions based on conditions existing while the inspection sequence is being performed.



If/Then Properties	Description
Expression	This is an expression that is evaluated to determine if items beneath the If/Then statement will be evaluated. Expressions
Values	Displays list of available values that can be used in expression. Values can be selected from the current list of measurements, function results, or a constant numeric value can be entered.
Boolean Values	Displays list of boolean values that can be used in expression. Values can be selected from list of existing digital inputs and function results.
Operators	List of operators available for comparing Numeric Values and Boolean Values. Options include: AND (boolean AND operator) OR (boolean OR operator) NOT (boolean NOT operator) < (numeric LESS THAN operator) <= (numeric LESS THAN or EQUAL operator) > (numeric GREATER THAN operator) >= (numeric GREATER THAN or EQUAL operator) = (numeric EQUAL operator) <> (numeric NOT EQUAL operator) ((left paren for grouping items within expression)) (right paren for grouping items within expression)

The part inspection sequence snippet below shows how a output can be turned on if a measurement exceeds a specified value. In this case, output #5 is turned on if the Left Hole Size measurement is greater than 0.4. This example uses a constant value for comparison but the 0.4 could also be replaced by a measurement or a function result. Combining the If/Then statement with the list of available GageXpress Pro 3.0 functions provides considerable flexibility for handling special inspection requirements.



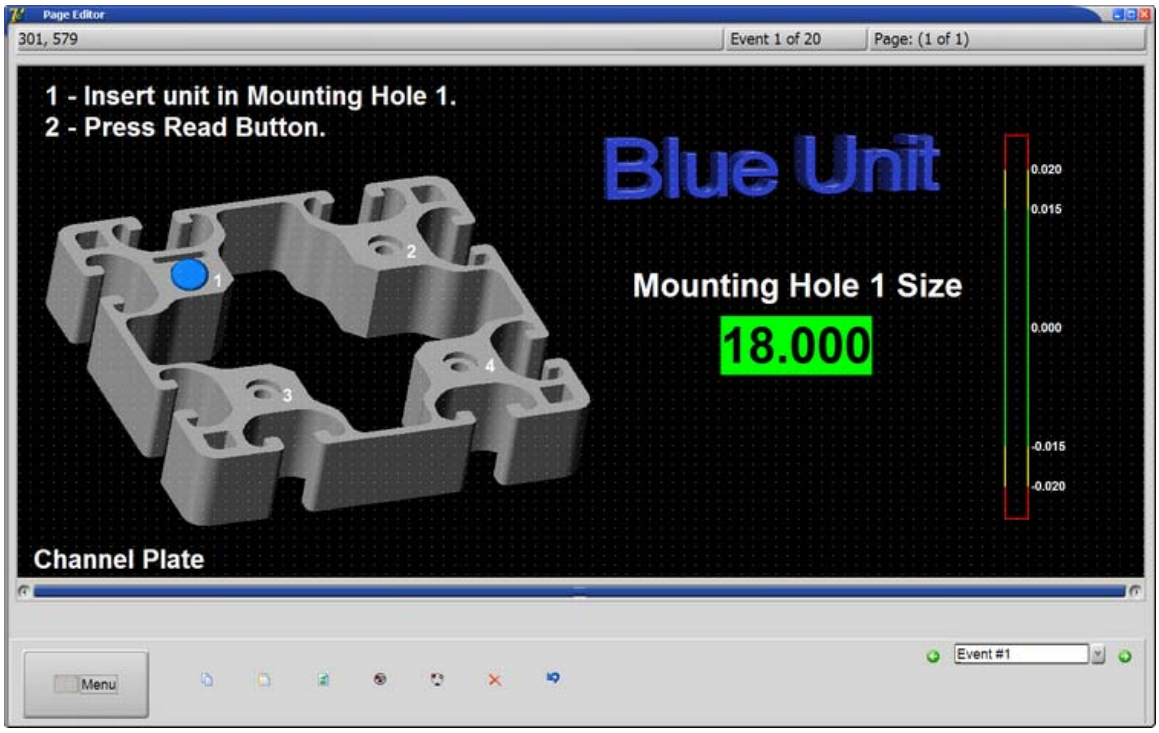
Default Inspection Screens

GageXpress Pro 3.0 automatically generates Inspection screens displaying the measurements being made on each inspection event. You don't have to do anything if the default screens meet your needs. The default screens display a column, data field, and short description for each measurement. Up to 30 measurements can be displayed on the screen at one time without scrolling. If more than 30 measurements are active on a single event, then a scroll bar appears at the bottom of the gage screen allowing the operator to scroll the screen horizontally.

Custom Inspection Screens

GageXpress Pro 3.0 provides easy to use tools for creating custom inspection screens for your operators. The screen shown below is a sample custom inspection screen. It contains the most common elements operators like to see including a picture of the part or gage, instructions, a column field, and a data field.

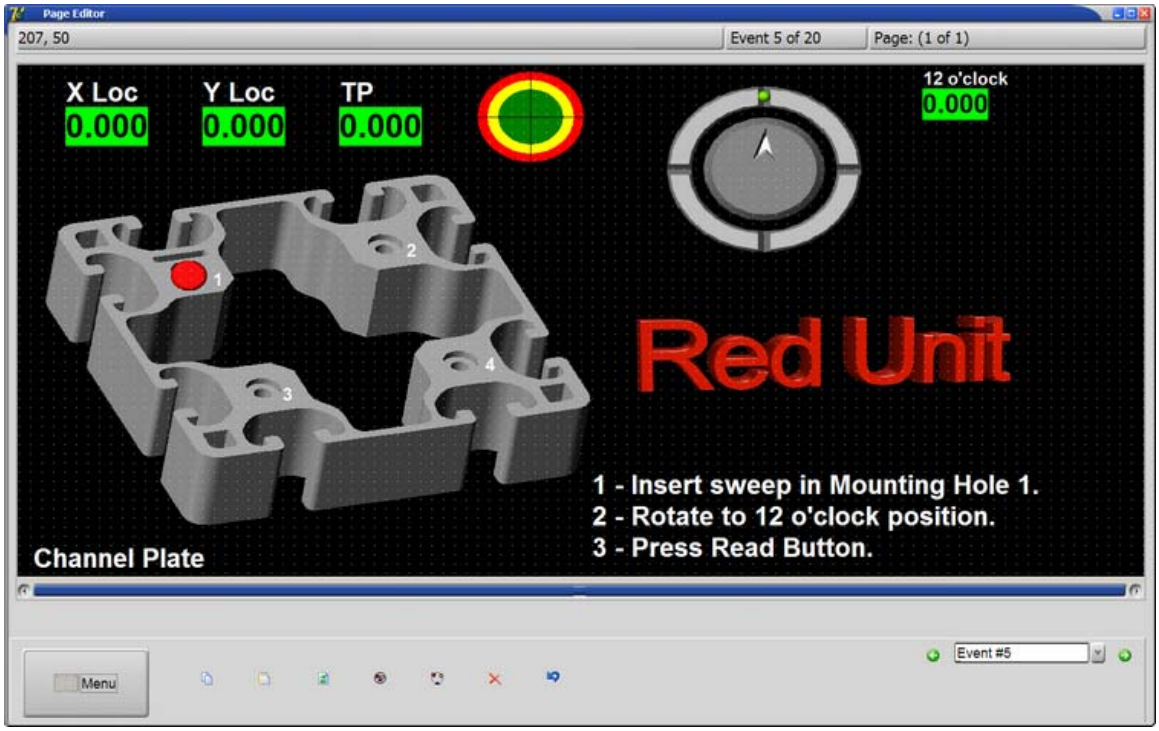
Each Inspection Event can have its own set of custom pages so that screens can be created to lead operators through the inspection sequence on a step by step basis. Creating custom screens adds another step to the configuration process but your operators will appreciate it.



Page Editor

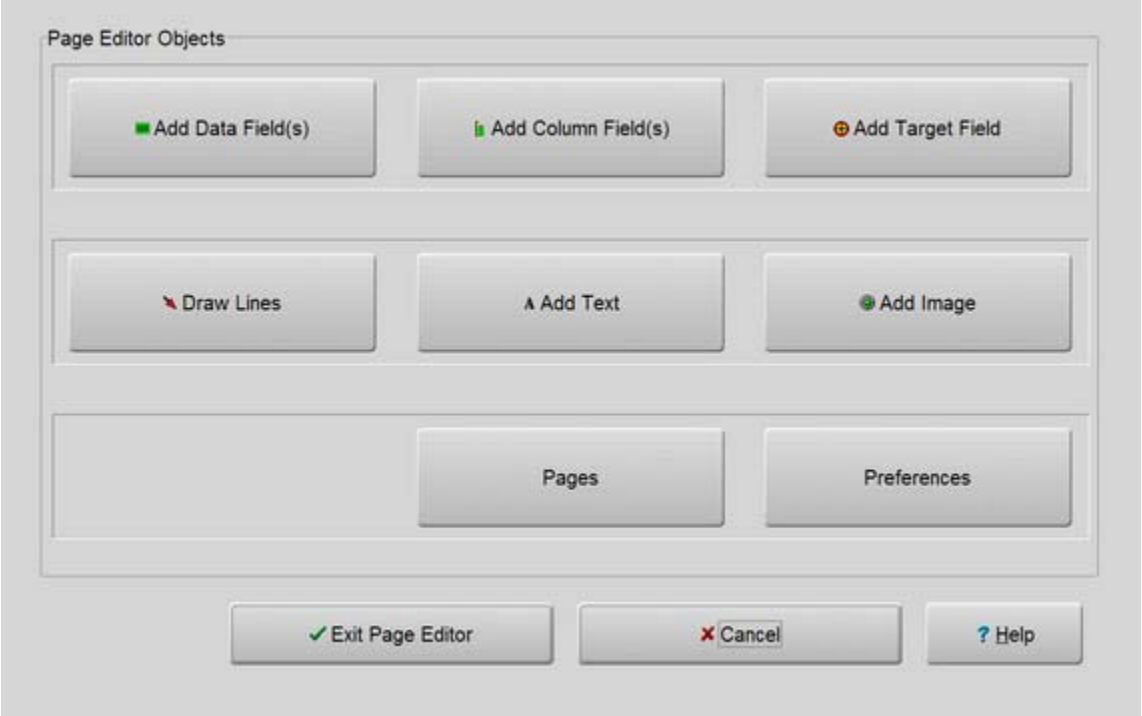
The GageXpress Pro 3.0 file page editor is used to create custom screens for the part inspection sequence. It provides a "what you see is what you get" (wysiwyg) interface for creating custom screens.

The Page Editor is started by selecting an Event in the Inspection Sequence and then clicking the Pages button. The Event can also be right clicked to display a pop up menu containing a Pages selection.

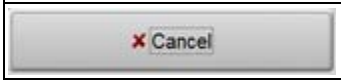


The page editor provides an interactive environment for creating inspection sequence pages for each event. The current event is displayed in the event selection box in the lower right corner of the screen. This box can be used to select an event to create pages for without exiting the page editor.

The Menu button displays the page editor menu used to select items to be added to the screen.

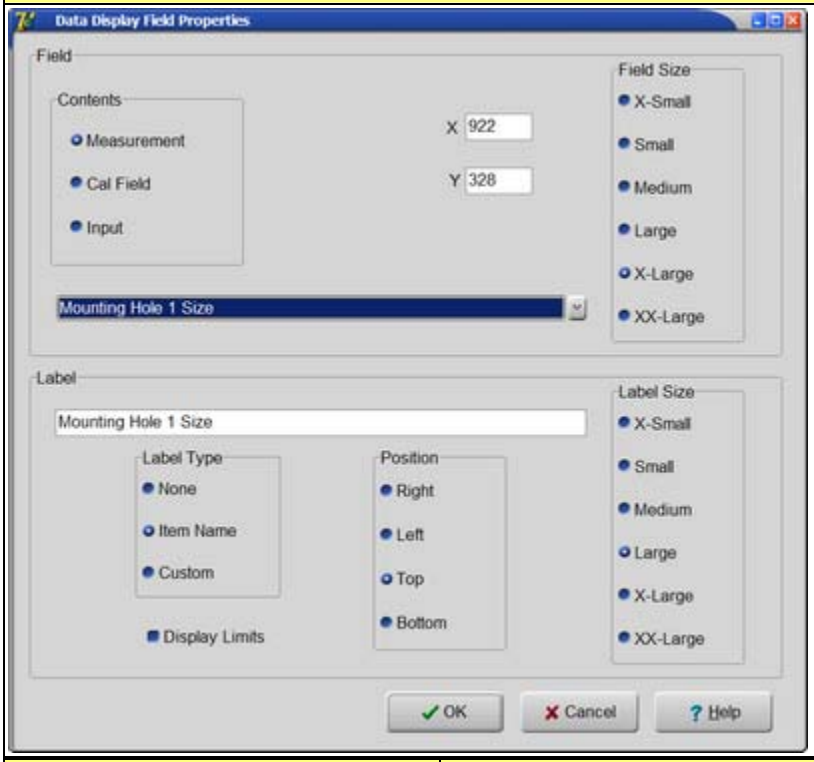


Page Editor Object	Description
Add Data Field(s)	Displays the Data Field edit screen and places the page editor in data field placement mode.
Add Column Field(s)	Displays the Column Field edit screen and places the page editor in column field placement mode.
Add Target Field	Displays the Target Field edit screen and places the page editor in target field placement mode.
Draw Lines	Places the page editor in line drawing mode.
Add Text	Displays the Text Field edit screen and places the page editor in text field placement mode.
Add Image	Displays the Image Field edit screen and places the page editor in image field placement mode.
Pages	Displays page list for current Event. Event Pages can then be added or deleted.
Preferences	Displays page editor preferences. Preferences are global for the system.

	Exits page editor.
	Removes page editor function menu and displays page editor.

Data Fields

Data Fields are used to display the current value of measurements, calibration fields, or inputs. A data field is a numeric field displayed on the screen that updates according to its underlying data type and changes color based on its value and the data types limits.

Data Field Properties	Data Field Display
	

Data Field Properties	Description
Field Type	The field type for data fields can be a measurement, calibration field, or an input. The size of the field can be one of six values from x-small to xx-large. The field type is set by clicking the desired type and then select the desired field from the drop down selection box.
Label	Each data field can have a label. By default, the label is the name assigned to the selected data item (measurement, cal field, input). You can optionally disable the label feature or set it to Custom and enter your own label text. The label position can be set to any one of the four data field sides and the label size can be one of six sizes. (x-small to xx-large)

Placing a Data Field on the screen:

1. Click the **Menu** button.
2. Click **Data Field** button.
3. Set desired options in the Data Field properties screen.
4. Click the **Ok** button.
5. Move the screen cursor to the desired location on the screen where you want the field to be and press the left mouse button. The data field will be placed on the screen.
6. The page editor will assume that additional fields will be placed on the screen. Repeat step #5 until all desired fields have been placed on the screen. All fields will be the same type but the data item will be incremented

for each new field. For example, if the first field was displaying Measurement #1, the second field will display Measurement #2, the third Measurement #3, and so on.

7. Press the right mouse button to stop placing fields on the screen.

Editing a Data Field :

1. Place the screen cursor over the data field you wish to change.
2. Press the right mouse button. The Data Field properties screen will appear.
3. Set desired options in the Data Field properties screen.
4. Click the **Ok** button.

Moving a Data Field:

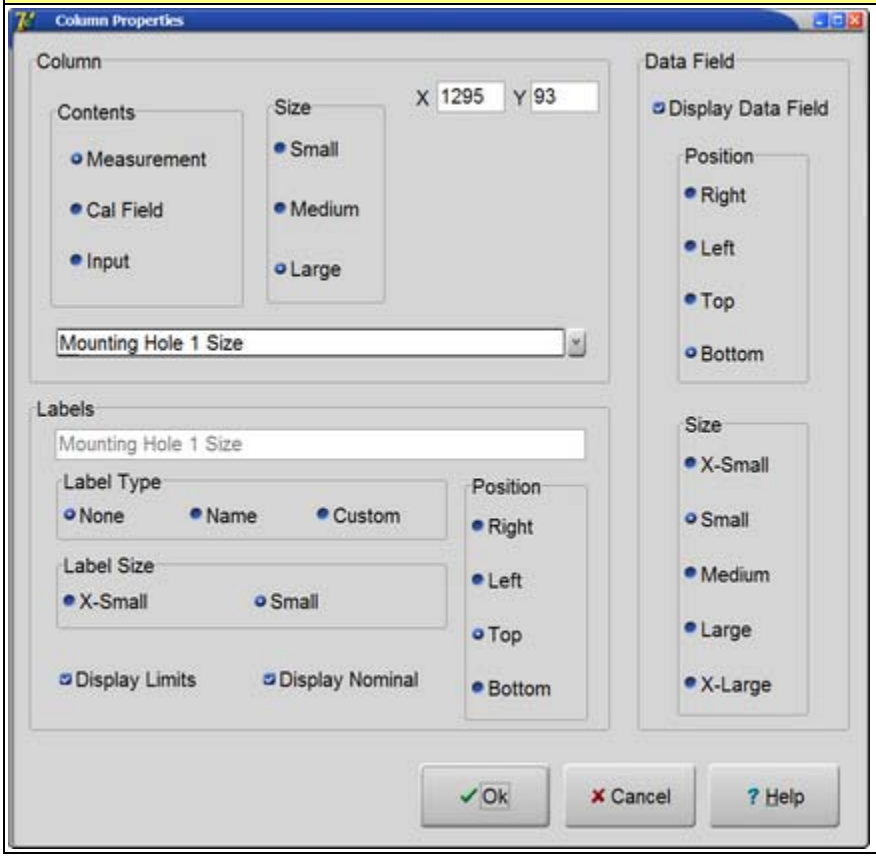
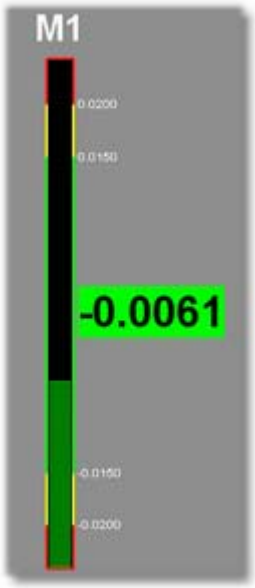
1. Place the screen cursor over the data field you wish to move.
2. Press the left mouse button. Field selection pips (green rectangles) will be shown on the four corners of the data field. Clicking the field again will remove the pips.
3. Once the pips are shown on the field, press and hold the left mouse button down and then move the mouse. The Data Field will move with the mouse. Release the left mouse button to stop moving the field. NOTE THAT ALL SELECTED ITEMS WILL MOVE!
4. Un-select the field by clicking it again to remove the pips.

Deleting a Data Field:

1. Place the screen cursor over the data field you wish to delete.
2. Press the left mouse button. Field selection pips (green rectangles) will be shown on the four corners of the data field. Clicking the field again will remove the pips.
3. Once the pips are shown on the field, click the delete  button. NOTE THAT ALL SELECTED ITEMS WILL BE DELETED!

Column Fields

Column Fields are used to display the current value of measurements, calibration fields, or inputs. A column field is a bar graph displayed on the screen that updates according to its underlying data type and changes color based on its value and the data limits.

Column Properties	Column Display
	

Column Field Properties	Description
Field Type	The field type for column fields can be a measurement, calibration field, or an input. The size of the field can be one of three values from small to large. The field type is set by clicking the desired type and then select the desired field from the drop down selection box.
Label	Each column field can have a label. By default, the label is the name assigned to the selected data item (measurement, cal field, input). You can optionally disable the label feature or set it to Custom and enter your own label text. The label position can be set to any one of the four column field sides and the label size can be one of two sizes. (x-small or small) In addition to the label, the data limits can be displayed on the column if so desired.
Data Field	A column field can have an associated data field displayed next to it to show the numeric data value. The Data Field position can be any one of the four sides of the column and can be one of six sizes.

Placing a Column Field on the screen:

1. Click the **Menu** button.
2. Click **Column Field** button.
3. Set desired options in the Column Field properties screen.
4. Click the **Ok** button.
5. Move the screen cursor to the desired location on the screen where you want the field to be and press the left mouse button. The column field will be placed on the screen.
6. The page editor will assume that additional fields will be placed on the screen. Repeat step #5 until all desired fields have been placed on the screen. All fields will be the same type but the data item will be incremented for each new field. For example, if the first field was displaying Measurement #1, the second field will display Measurement #2, the third Measurement #3, and so on.
7. Press the right mouse button to stop placing fields on the screen.

Editing a Column Field :

1. Place the screen cursor over the column field you wish to change.
2. Press the right mouse button. The Column Field properties screen will appear.
3. Set desired options in the Column Field properties screen.
4. Click the **Ok** button.

Moving a Column Field:

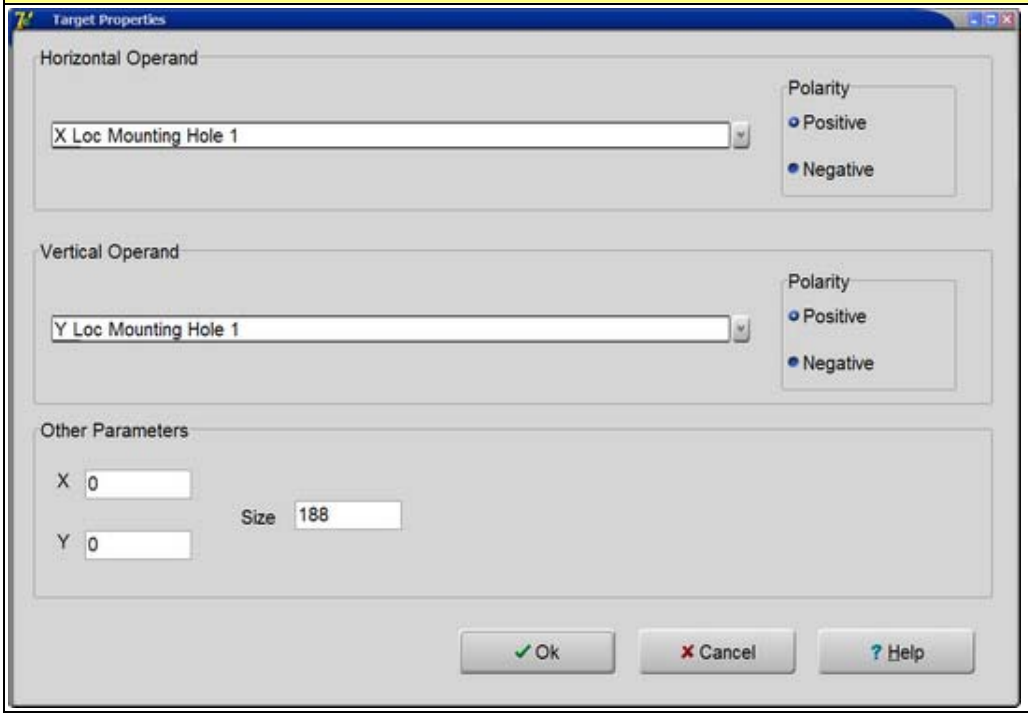
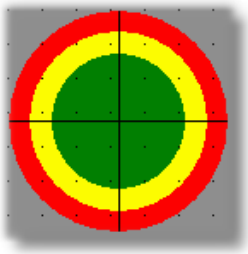
1. Place the screen cursor over the column field you wish to move.
2. Press the left mouse button. Field selection pips (green rectangles) will be shown on the four corners of the column field. Clicking the field again will remove the pips.
3. Once the pips are shown on the field, press and hold the left mouse button down and then move the mouse. The Column Field will move with the mouse. Release the left mouse button to stop moving the field. NOTE THAT ALL SELECTED ITEMS WILL MOVE!
4. Un-select the field by clicking it again to remove the pips.

Deleting a Column Field:

1. Place the screen cursor over the column field you wish to delete.
2. Press the left mouse button. Field selection pips (green rectangles) will be shown on the four corners of the column field. Clicking the field again will remove the pips.
3. Once the pips are shown on the field, click the delete  button. NOTE THAT ALL SELECTED ITEMS WILL BE DELETED!

Target Fields

Target Fields are used to display the current value of measurements, calibration fields, or inputs. A target field is a bulls eye displayed on the screen that updates according to its underlying data. The target field is similar to the bulls eye used for the game of darts and is used to graphically show hole locations.

Target Properties	Target Display
	

Target Field Properties	Description
Horizontal Operand	Measurement representing hole location in the horizontal direction. The polarity value changes the direction of the cross hair for a positive value. Normally positive values are plotted going right and negative values to the left. Changing the polarity reverses this.
Vertical Operand	Measurement representing hole location in the vertical direction. The polarity value changes the direction of the cross hair for a positive value. Normally positive values are plotted going right and negative values to the left. Changing the polarity reverses this.

Placing a Target Field on the screen:

1. Click the **Menu** button.
2. Click **Target Field** button.
3. Set desired options in the Target Field properties screen.
4. Click the **Ok** button.
5. Move the screen cursor to the desired location on the screen where you want the field to be and press the left mouse button. The target field will be placed on the screen.

Editing a Target Field :

1. Place the screen cursor over the target field you wish to change.

2. Press the right mouse button. The Target Field properties screen will appear.
3. Set desired options in the Target Field properties screen.
4. Click the **Ok** button.

Moving a Target Field:

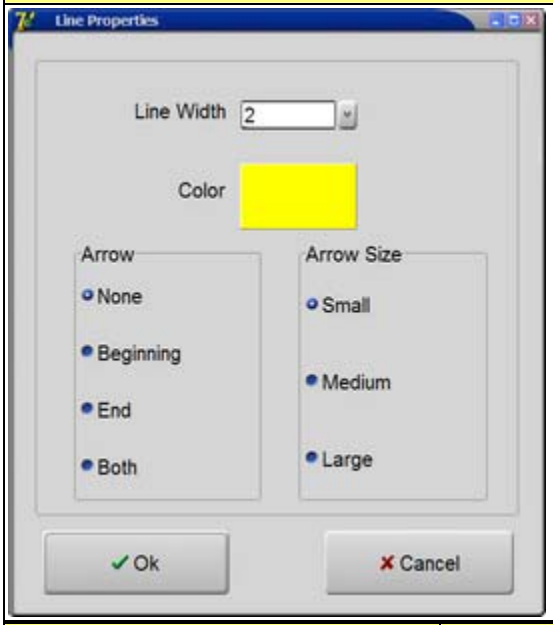
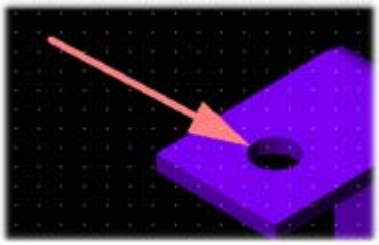
1. Place the screen cursor over the target field you wish to move.
2. Press the left mouse button. Field selection pips (green rectangles) will be shown on the four corners of the target field. Clicking the field again will remove the pips.
3. Once the pips are shown on the field, press and hold the left mouse button down and then move the mouse. The Target Field will move with the mouse. Release the left mouse button to stop moving the field. NOTE THAT ALL SELECTED ITEMS WILL MOVE!
4. Un-select the field by clicking it again to remove the pips.

Deleting a Target Field:

1. Place the screen cursor over the target field you wish to delete.
2. Press the left mouse button. Field selection pips (green rectangles) will be shown on the four corners of the target field. Clicking the field again will remove the pips.
3. Once the pips are shown on the field, click the delete  button. NOTE THAT ALL SELECTED ITEMS WILL BE DELETED!

Lines

Lines are used to draw attention to items on the screen and make the information easily understandable. Lines can be used to draw arrows from data or column fields to areas of an image or they can be used to draw boxes and other shapes to create borders between items on the screen.

Line Properties	Line Display
	

Line Properties	Description
Width	Line widths can be set to have widths of 1 pixel to 8 pixels.
Color	Color of line and arrow.
Arrow	Specifies whether an arrow should be displayed at either or both ends of the line.
Arrow Size	Size of arrow to display if the Arrow property is not set to None.

Drawing Lines

1. Click the **Menu** button.
2. Click **Draw Lines** button.
3. The screen cursor will change from an arrow to a cross hair.
4. Move the screen cursor to the screen location where the line should start.
5. Click the left mouse button. This starts the line.
6. Move the screen cursor to the position on the screen that you want to draw a line to. A moving line will be displayed starting at the first point and ending with the cursor.
7. Click the left mouse button to accept the current line segment.
8. Repeat steps 6 and 7 until you have drawn the line as desired.
9. Press the right mouse button to exit line drawing mode. The screen cursor will change back to an arrow.

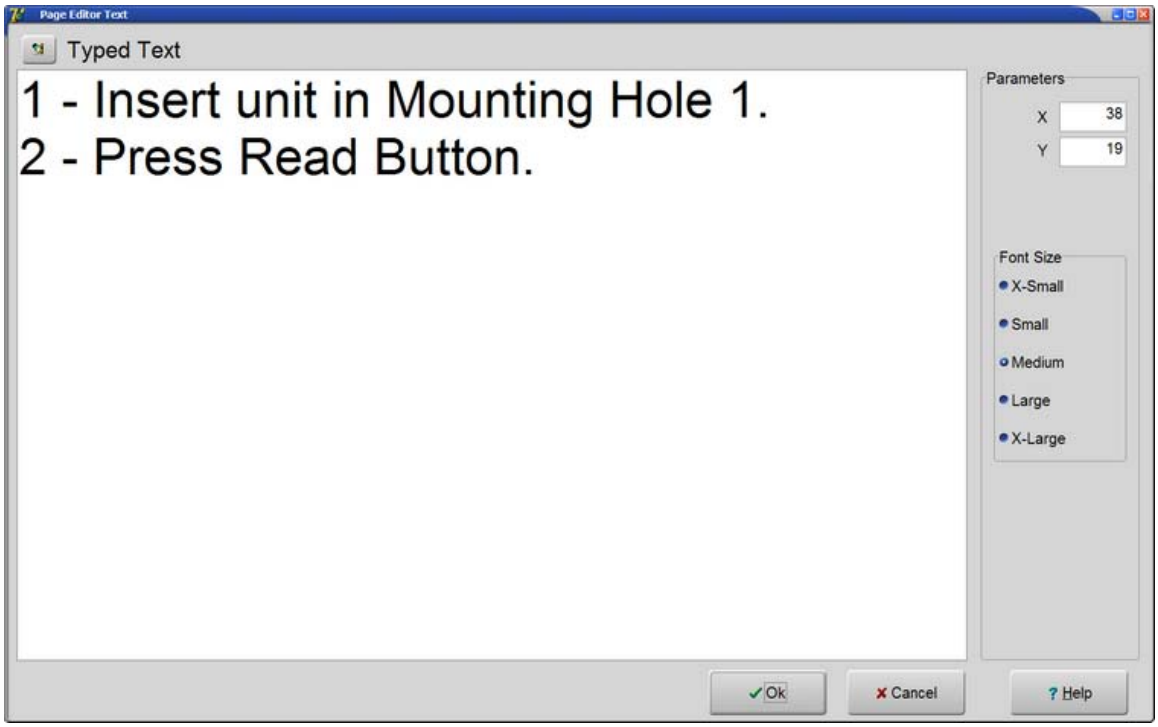
Changing Line Properties

1. Right click the line you wish to edit.
2. The Line Properties screen is displayed.
3. Set properties as desired.

4. Click the Ok button.

Text Fields

Text Fields are used to enter information on gage pages that will be useful to the operator. The information might be gage operation instructions or other information such as currently selected part name, number, or operation.



Text Properties	Description
Text Type 	Defaults to General Text meaning that you can type in whatever you like. If the text type button is clicked, then you have the option of selecting an item property and having that property value displayed on the screen. This provides significant advantage over entering the information as Typed Text in that if the information changes, it can be changed in one place and all screens using the information are automatically updated. Computer, Part, and Gage property fields are all available for use.
Font Size	Select one of 5 text sizes.
Text	If text type is General Text, any text can be entered, otherwise the selected item's property value is displayed.

Placing a Text Field on the screen:

1. Click the **Menu** button.
2. Click **Add Text** button.
3. Set desired options in the Text properties screen.
4. Click the **Ok** button.
5. Move the screen cursor to the desired location on the screen where you want the field to be and press the left mouse button. The text will be placed on the screen.

Changing Text Field on the screen:

1. Place the screen cursor over the text you want to change.
2. Right click the text.
3. Make desired changes in the Text properties screen.
4. Click the **Ok** button.

Image Fields

GageXpress Pro 3.0 provides the ability to place BMP and JPG image files on gage screens to provide visual aids to operators using the equipment. Three image classes are used; Application, Flasher, and Clock Face.

Application images are images that are specific to an application, generally pictures of the fixture or part, that have been obtained using a camera.

Flashers are system images that are used to highlight areas of an Application image by flashing on top of it. GageXpress Pro 3.0 provides a number of circles of varying color for this purpose. Additional Flasher image options can be added by placing image files in the GageXpress Pro 3.0 system Images\Flashers directory. Flashers must be BMP images.

Clock Face images are images used to show the radial position of a spindle when used to inspect hole true positions. The list of default images can be added to by adding image files to the GageXpress Pro 3.0 system Images\Clock directory. Clock Face images can be BMP or JPG images.

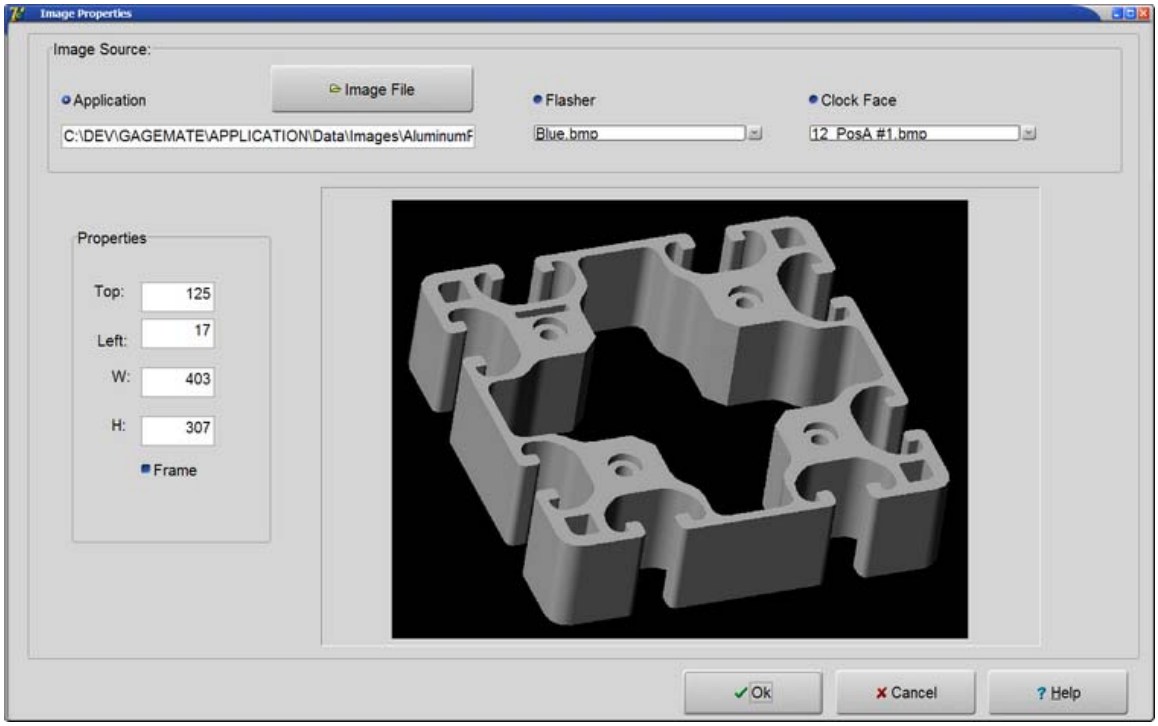


Image Field Properties	Description
Image File	Selected image file for display.
Frame	Draws a line around the image to provide a frame between the image and screen background.

Placing an Image on the screen:

1. Click the **Menu** button.
2. Click **Add Image** button.
3. Set desired options in the Image Field properties screen.

4. Click the **Ok** button.
5. Move the screen cursor to the desired location on the screen where you want the field to be and press the left mouse button. The image field will be placed on the screen.

Changing an Image on the screen:

1. Place the screen cursor over the image you want to change.
2. Right click the image.
3. Make desired changes in the Image properties screen.
4. Click the **Ok** button.

Changing the size of an Image on the screen:

1. Place the screen cursor over the image you want to change.
2. Left click the image. Four green pips will be displayed at the corners of the image.
3. Place the screen cursor over one of the pips.
4. Press and hold the left mouse button.
5. Move the mouse to re-size the image. Release the left mouse button when image is desired size.

Creating Measurements

Measurements are what a gage fixture is all about. The purpose behind gage fixtures and GageXpress Pro 3.0 is to determine the quality of a part by measuring part characteristics. This section provides a complete overview of the measurement process of GageXpress Pro 3.0.

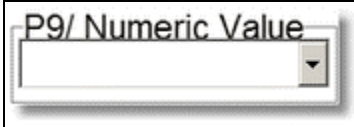
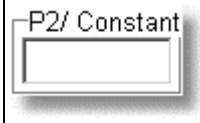
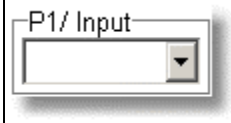
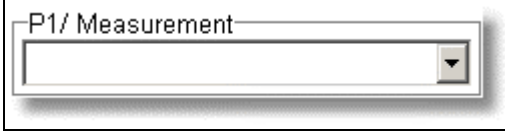
Measurements are created in GageXpress Pro 3.0 using "templates". Templates provide a standard method of creating measurements without requiring substantial mathematical knowledge. A template is selected first by identifying the measurement category it belongs to and then by reviewing the templates within that category to find one that matches the characteristics of the measurement as implemented on the gage. (probe placement and mastering technique)

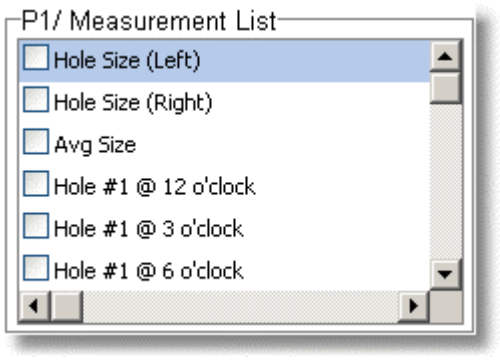
Each template contains one or more parameters that must be specified to satisfy the requirements of the template. The parameters can represent a variety of data types depending on the template's needs. Each template also contains descriptive information describing how each parameter in the template is used.

Before discussing the format of the two template types used in GageXpress Pro 3.0, a discussion of the various field and data types is in order.

Template Parameters

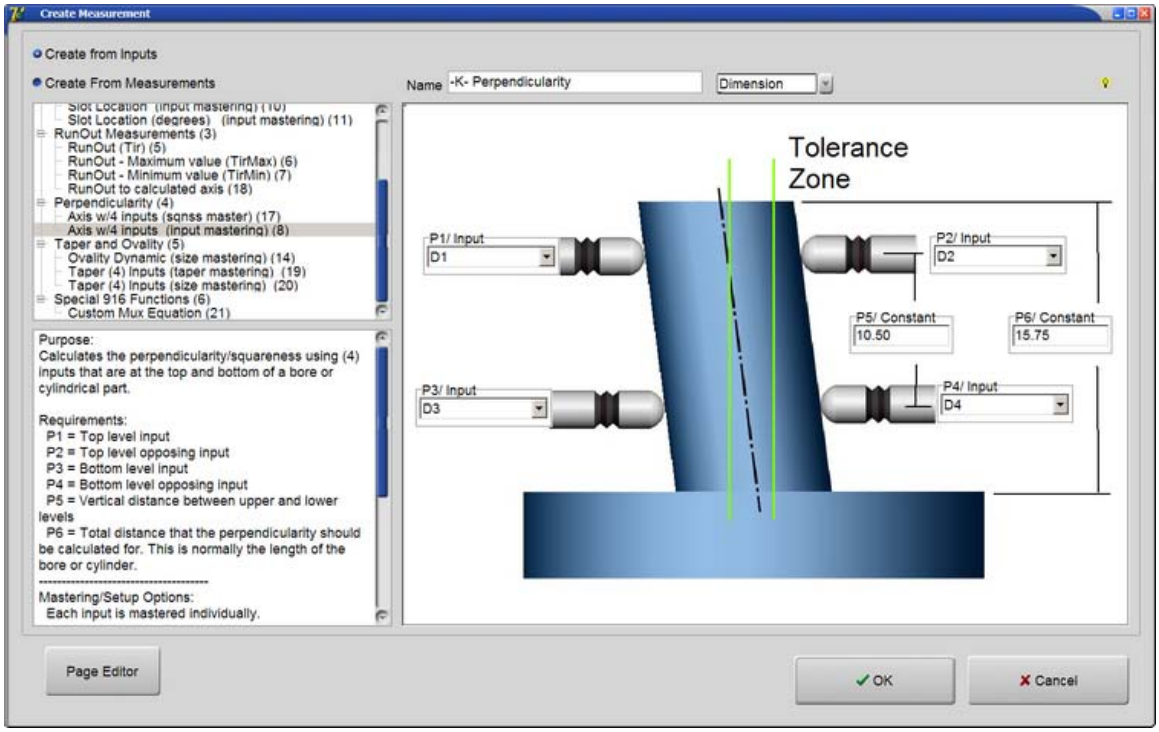
A variety of data types are used in templates to allow the creation of measurements performing both simple and complex part inspection tasks. Fields are always identified in the templates by Px, where x is a numeric value identifying the field within the template. For instance, if a template requires three parameters, there will be three fields identified as P1, P2, and P3. Each field also has a suffix identifying the type of data item the field supplies to the template. A constant value field would be labeled P1/Constant. All parameter types are shown below.

Field Example	Data Type & Description
	Numeric Value This drop list allows selection of any existing measurement or allows you to type in a constant numeric value.
	Constant Numeric value generally used to represent a distance or angle required in the template calculation. The required value is typed in the field edit box.
	Input A drop down list allowing one input to be selected.
	Measurement A drop down list allowing one measurement to be selected.

	Measurement List A list of all existing measurements allowing multiple measurements to be selected by placing a check in the box in front of each desired measurement.
	Plane A drop down list allowing one datum plane to be selected.

Measurements from Inputs (MFI templates)

Input based measurements are calculated by reading inputs directly. Every configuration that performs variable gaging will have at least one input based measurement unless it is a manual data entry application.



The measurement types are organized by category to make it easy to identify the desired measurement type. In most cases, the inputs used for measurements must be mastered. Therefore, input based measurement templates also include the information required to create the appropriate calibration fields to support mastering.

Before creating a GageXpress Pro 3.0 setup for a specific application, a strategy should be developed that fits the requirements of the gage design, master design, probes, and signal conditioning being used. Each of the stated elements can have a critical impact on the measurement templates selected for use. Before starting, make sure you have answers to the following questions.

The following questions should be answered before you start creating your setup!

1. Is mastering required? If all measurements are relative, and absolute probe scaling exists, then mastering may not have to be configured. (typical of TIR or hole true position measurements)
2. When the master is loaded in the fixture, can it move around or does it have a fixed location? For example, min/max rings used to master a size spindle "float" on the spindle (they can move around slightly) while a location spindle mastered in a tube master has a fixed location (a slip fit exists between the spindle body and the tube master bore so that the spindle cannot move).
3. Will the inputs be used in multiple measurements? If so, this is an indication that you "may" want to only use single input Calibration Fields or create simple measurements that are simply probe assignments and then use Measurement From Measurements (MFM) templates to perform all math functions.
4. Do probes of differing types need to be combined for a single measurement result? If so, this is an indication that you "may" want to only use single input Calibration Fields or create simple measurements that are simply probe assignments and then use Measurement From Measurements (MFM) templates to perform all

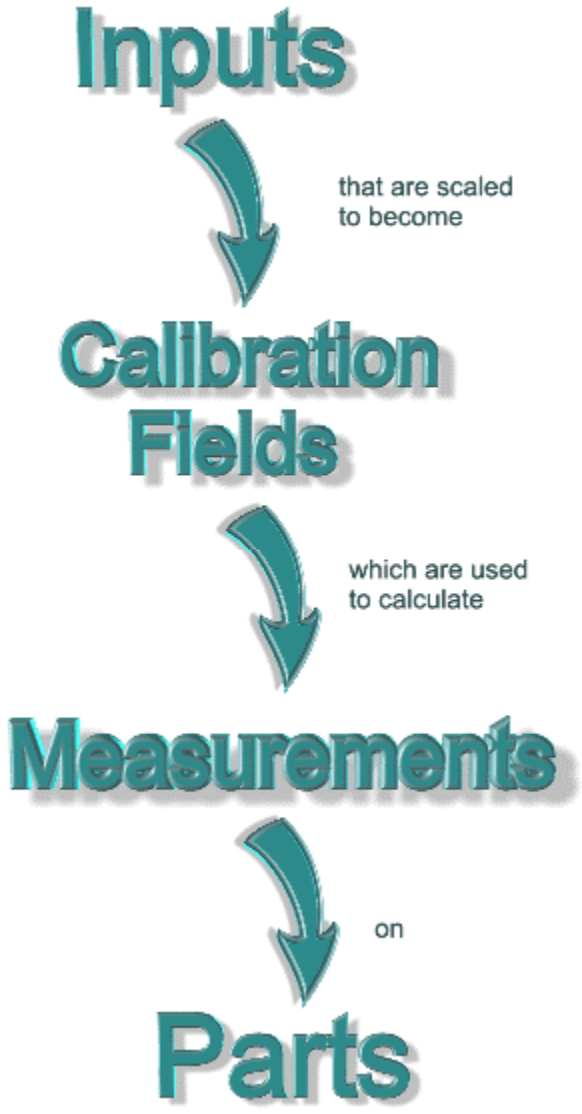
math functions. If differing probe types are used in a multiple input Calibration Field, min/max mastering will be required and probably balancing too.

5. Does the fixture support multiple part types that require different mastering? The answer to this is yes if you have separate masters for each part type or a single master exists but the measurements for the different parts have different nominal values. When MFI templates are used, you must create the proper Calibration Fields to support the mastering sequences you desire later.

Calibration Fields

Calibration Fields are one of the three key components of the measurement process. The first component, inputs, are the actual transducers in the fixture. Inputs provide an A/D count value that when read, gives us an indication of their position. The A/D count value must then be scaled to report the input's position in units that we can understand (millimeters or inches). This is where Calibration Fields come in. Calibration Fields are a combination of one or more inputs that are scaled to provide meaningful position information for the inputs.

The scaled calibration fields can then be combined in a variety of ways to create measurements of various part characteristics.

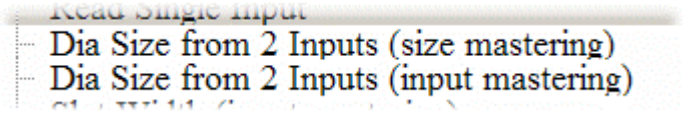
Measurement Hierarchy	
	• Inputs are the transducers in a gage. They report their positions in A/D count values. • Calibration Fields are a combination of one or more inputs and are scaled to provide meaningful position data for the inputs. • Measurements provide dimensional information about characteristics of interest on parts. Measurements are created from Calibration Fields or other measurements.

There are two types of Calibration Field, single input Calibration Fields and multiple input Calibration Fields.

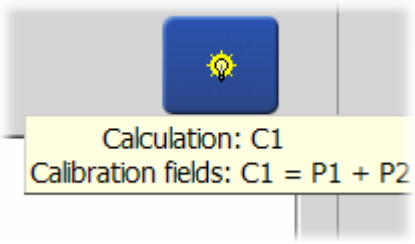
Single Input Calibration Fields only use one input and lend themselves to re-use by other measurements.

Multiple Input Calibration Fields use multiple inputs and many times are only useful for the measurement they were created for. Scaling applies to the Calibration Field and not the inputs used so if the inputs are used by another measurement, they will generally require a new Calibration Field.

To better understand the differences between single input Calibration Fields and multiple input Calibration Fields, lets look at a simple example for the two probe MFI size templates.



First off, if the MFI template description states that "input mastering" is being used, then single input Calibration Fields are being created, otherwise multiple input Calibration Fields are being created. Another way to determine the type of Calibration Field generated by a MFI template is to hover over the light bulb in the upper right corner of the Create Measurements screen. This will show how the parameters on the screen are being used to generate both the Calibration Field(s) and Measurement.



The light bulb in the upper left corner of the Create Measurement screen shows the template definition including how Calibration Fields will be created and used by the measurement.

In this example, two parameters are on the screen (P1 and P2). The two parameters will be used to create one Calibration Field (C1 = P1 + P2) and one measurement (equal to C1)

Measuring Diameter from Two Inputs with Size Masters

The "Dia Size from 2 Inputs (size mastering)" MFI template requires to parameters, P1 and P2, and has the following definition:

Calculation (measurement): C1

Calibration Fields: C1 = P1 + P2

Each parameter for this template is an Input. Therefore, when values are assigned to the parameters, the Calibration Field will be defined as the sum of the two inputs. As stated earlier, the function of Calibration Fields is to take the A/D count values generated by Inputs and scale the values to produce decimal values (metric or english) that make sense to us as users. Lets examine more closely how this occurs for this template.

Assumptions:

Input #1 has current value of 987 counts.

Input #2 has current value of -682 counts.

Count Offset Value = -1100 counts
(this is the count value produced by the Calibration Field during mastering when the minimum or mean master was read)

Gain Value = 0.000122
(this is the scale factor calculated the last time the Calibration Field was mastered)

Calculations:

Calibration Field = Input #1 + Input #2 = 987 + (-682) = 305 counts

Scaling is now applied to the Calibration Field to convert the count value to decimal number.

Calibration Field scaled value output = 0.000122*(305 - (-1100)) = 0.17141mm

Measurement = Calibration Field = 0.17141mm

The important thing to note here is that the scaling did not take place until AFTER the two input count values were added. One scale factor (gain) is used to scale the combination of the input counts. This infers that we would never want to use inputs of different types in this manner as the resulting Calibration Field output would be unstable due to balance issues.

General rules for multiple input Calibration Fields are:

Do not use multiple input Calibration Fields when:
• You have inputs of different types • You want to reuse the scaling of one or more of the Inputs without creating additional Calibration Fields
Use multiple input Calibration Fields when:
• All inputs used in the Calibration Field MUST be of the same type • The master is allowed to move while in the fixture • The tolerance being measured is very tight

Measuring Diameter from Two Inputs with Location Masters

The "Dia Size from 2 Inputs (input mastering)" MFI template requires to parameters, P1 and P2, and has the following definition:

Calculation (measurement): C1 + C2

Calibration Fields: C1 = P1, C2 = P2

Each parameter for this template is an Input. Two single input Calibration Fields are created, one for each input. The measurement calculation is then the sum of the two Calibration Fields. This is a significant distinction from the approach shown above. Lets examine how the final measurement value is arrived at for this case.

Assumptions:

Input #1 has current value of 987 counts.

Input #2 has current value of -682 counts.

Calibration Field #1 Count Offset Value = -540 counts
(this is the count value produced by the Calibration Field during mastering when the minimum or mean master was read)

Calibration Field #1 Gain Value = 0.000122
(this is the scale factor calculated the last time the Calibration Field was mastered)

Calibration Field #2 Count Offset Value = -573 counts
(this is the count value produced by the Calibration Field during mastering when the minimum or mean master was read)

Calibration Field #2 Gain Value = 0.000122
(this is the scale factor calculated the last time the Calibration Field was mastered)

Calculations:

Calibration Field #1 = Input #1 = 987 counts

Calibration Field #2 = Input #2 = -682 counts

Scaling is now applied to the Calibration Fields to convert the count values to decimal numbers.

Calibration Field #1 scaled value output = 0.000122*(987 - (-540)) = 0.186294mm

Calibration Field #2 scaled value output = 0.000122*(-682 - (-573)) = -0.013298mm

Measurement = Calibration Field #1 + Calibration Field #2 = 0.186294mm + (-0.013298mm)= 0.172996mm

The important thing to note here is that since each Calibration Field is a single input, the scaling takes place on an input basis and then the two resulting scaled values (Calibration Fields) are added to arrive at the final result.

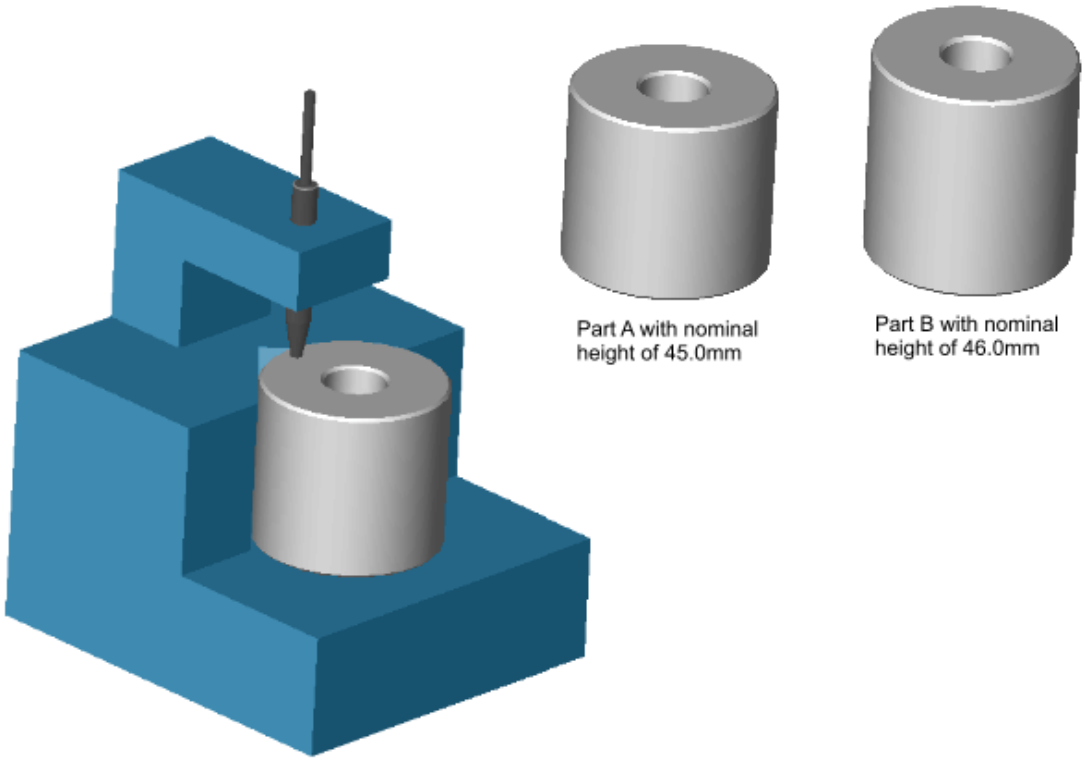
General rules for single input Calibration Fields are:

Do not use single input Calibration Fields when:
• The master is allowed to move while in the fixture and the inputs are not perfectly balanced (generally analog probes or single orifice air) • The tolerance being measured is very tight.
Use single input Calibration Fields when:
• You have inputs of different types • You want to reuse the scaling of one or more of the Inputs without creating additional Calibration Fields

Creating multiple Calibration Fields for the same Input(s)

There are times when inputs need to be scaled in more than one way. For this reason, GageXpress Pro 3.0 allows multiple calibration fields to be created for each input. This allows the input to be scaled differently for different uses.

An example of this would be a simple fixture designed to measure one dimension using a single input that will need to inspect multiple part types.



Height fixure used to inspect part A and part B.

In the displayed example, the same input is used to inspect two parts having different nominal values. There are two ways to handle this situation. The first and most preferable is to create two calibration fields for the input and scale them as required for the two parts.

The second approach is to create one calibration field and use it for both parts. This would require a 1mm offset be added to one of the parts during gaging to attain the proper results. This approach is not preferred for reasons of clarity. Also, if two parts share Calibration Fields, then they must have the same master sequence.

Common indications that duplicate Calibration Fields should be used:
• The same input(s) must be scaled differently for use in two or more measurements • Multiple masters are used to scale the same input. For instance, if two part types are being inspected, and each part type has its own master

Calibration Field Scaling

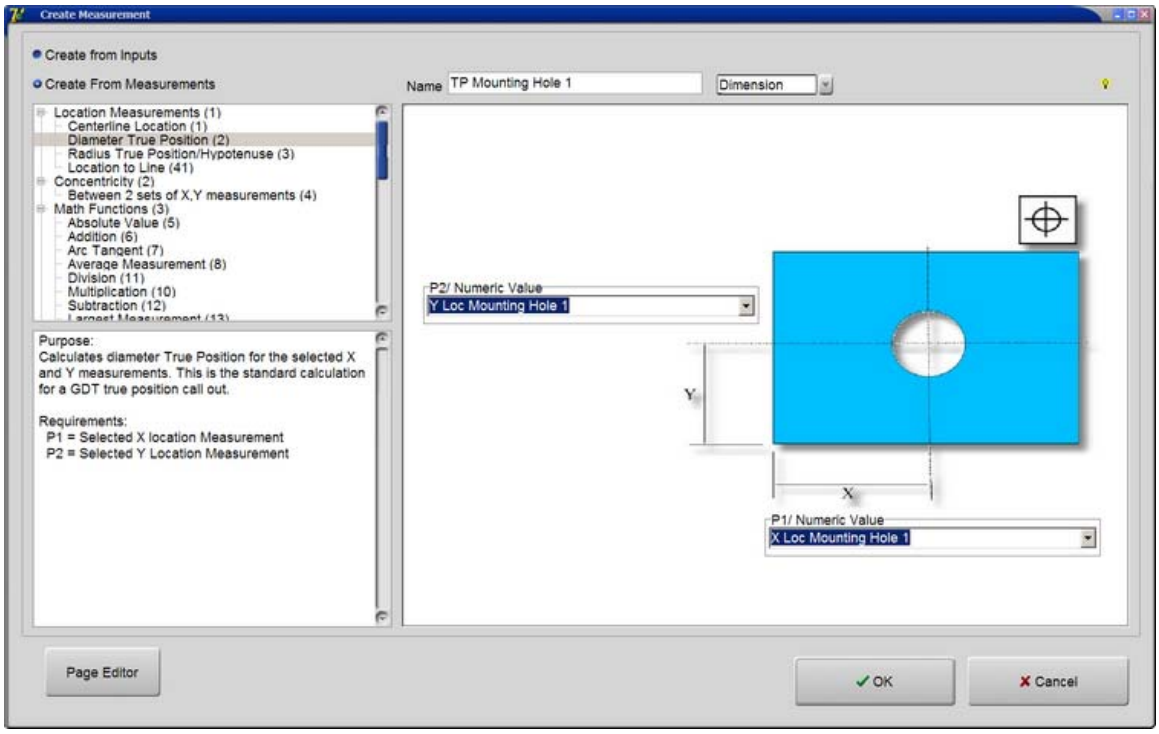
Proper measurement of parts requires that Calibration Fields be scaled correctly. This is often one of the most confusing subjects of computer precision measurement systems. Proper system calibration requires that input types, fixture design, and master designs all be considered when the application is created.

GageXpress Pro 3.0 supports a number of Calibration Field scaling options.

- Default probe scaling. This uses GageXpress Pro 3.0's default scale parameters for the input. It is only useful for pencil probe inputs (LVDT's and Digital Probes).
- Minimum/Maximum master scaling. This method uses masters that have been designed for the application to determine scaling for each Calibration Field.
- Mean mastering. This method uses a single master to set a known position for the calibration field. This method is almost always used when Digital Probes are used and can sometimes be used for LVDT's. GageXpress Pro 3.0 uses its default scale parameters for the Calibration Field gain.

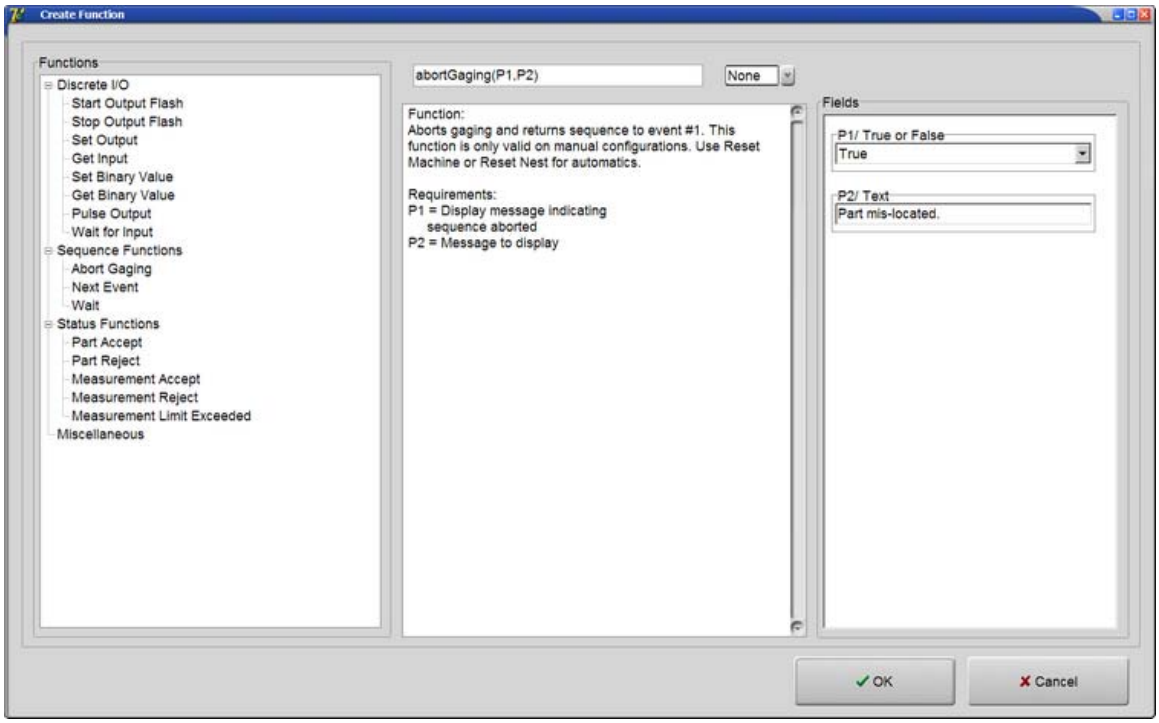
Measurements from measurements (MFM templates)

A measurement created from the combination of one or more other measurements. Measurements from measurements perform all advanced measurement calculations. The calculations range from simple arithmetic and trigonometric calculations to the calculation of flatness from a plane generated from a series of points.



Using Functions

Functions allow special part inspection circumstances to be accommodated. Functions can be inserted in the inspection sequence wherever a measurement can be inserted and provide access to digital I/O, measurement status, and sequence control functions. Combining the use of Functions with the If/Then statement can provide considerable flexibility for satisfying special inspection sequence requirements.



Wizards

One of the most common gage designs for checking large parts is what is called an dog house gage in the industry. These gages use a fixture to locate the part with a series of bushings mounted in the fixture for use with spindles that can inspect hole locations and surface depths. This type of equipment is labor intensive to use and generally difficult to program for due to the large number of inspection events required.

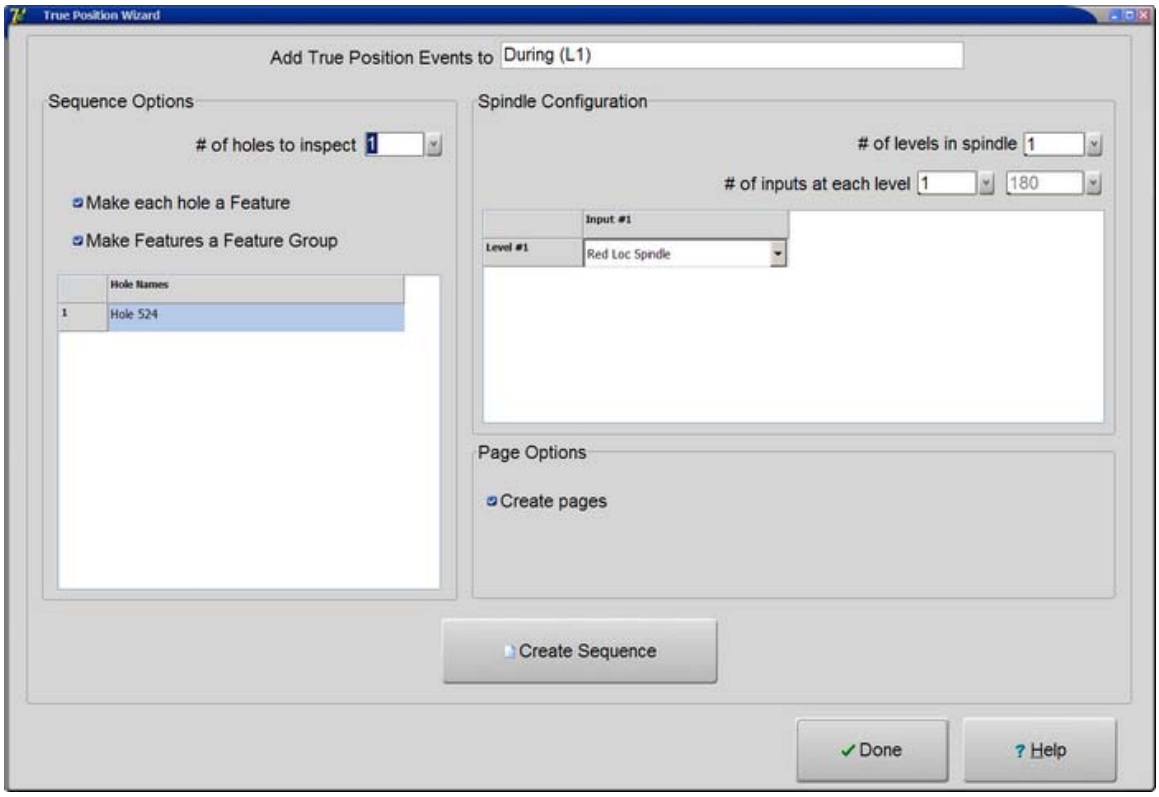
To alleviate this, GageXpress Pro 3.0 provides wizards that quickly create the events and measurements required for these types of systems. Use of wizards can be a tremendous time saver and make programming for dog house gages no more difficult than any other system.

Some wizards create multiple measurements on a single event while others also create events for the measurements they create. Use of wizards can eliminate what otherwise may be a tedious configuration to create. Incorporation of Feature Groups and Features in the wizard creation make the resulting sequence flexible for the operator to use and easy for you to manipulate if the sequence order ever needs to be changed. Try them, they're wonderful!

True Position Wizards

The True Position Wizard is used to create a series of events and measurements for checking true position using sweeps. The wizard supports the use of Feature Groups and Features. This makes it ideal for creating long inspection sequences required for dog house gages. This wizard, in conjunction with the input measurement wizards, makes the creation of inspection sequences for dog house gages a quick and easy process which can be completed in a short amount of time.

The wizard supports multiple contact sweeps including multiple contacts at multiple levels.



Frequently Asked Questions

General

1. How do I backup my GageXpress Pro 3.0 application?
2. How do I install a GageXpress Pro 3.0 application?
3. How do I delete an application?

Gaging

1. How do I change the order of my inspection sequence?
2. How do I make portions of my inspection sequence optional?

Measurements

1. How do I stop storing data for a measurement?
2. How do I change the display order of my measurements?

Graphics

Hardware

1. What hardware does GageXpress Pro 3.0 support?
2. How do I configure hardware for GageXpress Pro 3.0 to use?

Mastering

Application Documents

1. How do I add instructional videos to my application?

Tutorials

Tutorial #1 - Simple Size Gage

This tutorial is the best place to start when learning how to use your new GageXpress Pro 3.0 system. It lists the steps required to configure a simple gage application using a size spindle with min/max masters and a Solartron Orbit network.

Require application for:	
Part	Oil Pump Cover
Required measurements	Hole size in (2) places
Gage	Size Spindle (Air)
Min Master	49.9875mm ring
Max Master	50.0125mm ring
Single Point Master	NA

1. Delete current application and then start GageXpress Pro 3.0 file again.
2. Click the "Add Hardware" button.
3. Add Orbit network.
4. Add one "Air Converter" module.
5. Right click "Computer System" and select "New Gage"
6. Replace the default gage name, "Gage #1" with "Hole Size Gage"
7. Right click the gage and select "New Part"
8. Replace the default part name, "Part #1" with "Oil Pump Cover"
9. Select the "Part Inspection Sequence" tab.
10. Right click the "On During" node and select "Add Event"
11. Right click the new event and select "Add Measurement". The Create Measurements screen will appear.
12. The default measurement template is appropriate for our purposes. Select input "D1" using the drop down list.
13. Enter "Hole #1 Size" in the measurement name edit field.
14. Click "OK"
15. Click the gage object "Hole Size Gage". The gage properties screen will appear.
16. Click the "Master Sequence" button. You will be asked if you wish to create a default master sequence. Click the "Default Min/Max Sequence" option and then click "Yes". The master sequence screen will appear with the required events and master actions already in place.
17. Click the "Calibration Fields" button. The calibration fields screen will appear.
18. Enter 0.0125 for the maximum value and -0.0125 for the minimum value. These are the min/max master values for the input.
19. Click "Done". The master sequence screen will be displayed again.
20. Click "Done" again to return to the main GageXpress Pro 3.0 file screen.
21. Click "Exit" and run GageXpress Pro 3.0 to view your completed application.

Glossary of Terms

Computer

The GageXpress Pro 3.0 Computer is the computer which houses the signal conditioning hardware connected to the gage transducers in the gage.

Measurement based measurement

A measurement created from the combination of one or more other measurements.

Input based measurement

A measurement created from the combination of one or more calibration fields.

Feature

Features are used to segregate groups of gage events that can be selected or left out of gage sequences.

Feature Group

Feature Groups are used to group Features together.

Gage

Gages are used in manual configurations to take measurements on a Part. They are not used in automatic configurations.

Inspection Event

A Inspection Event is one press of the foot switch or click of the Read button on the gage screen. All measurements are made on inspection events. Inspection Events belong to Gages on manual configurations and Stations on automatic configurations.

Input

An Input is a single physical transducer connection to the GageXpress Pro 3.0 . Inputs aren't generally scaled. The most common input types are LVDTs, digital probes, and air/electronic converters.

LAL

Lower Approach Limit: This value provides a warning that a measurement value is approaching the LSL. Measurement values that are smaller than LAL but larger than LSL, are shown on a yellow background on gage screens and in the part summary.

LSL

Lower Specification Limit: This value represents the smallest value a measurement can have and still be considered an acceptable part. If a measurement value is smaller than LSL, its values will be shown on a red background on gage screens and in the part summary.

Machine

A GageXpress Pro 3.0 Machine represents an actual physical machine that the GageXpress Pro 3.0 is connected to for performing inspection tasks. Obviously, Machines are only used on automatic configurations.

Measurement

Measurements are a combination of one or more Calibration Fields that when combined represent an inspection feature on the part.

Station

A station on a machine that holds a part. Gaging on automatic machines always takes place in a Station although not all Stations will perform gaging. One Station must be created for each physical station in the machine.

Part

A GageXpress Pro 3.0 Part represents the actual part being inspected. A GageXpress Pro 3.0 Part is created for each part type to be inspected. For manual configurations, Parts are the first object under the Workstation ... all gages, checks, and other objects belong to the Part. For automatic configurations, the Part belongs to a Machine and the Machine is the first object under the Workstation.

Calibration Field

Calibration Fields are scaled Inputs. A Calibration Field may be a direct Input assignment or a mathematical combination of Inputs. All scaled values in GageXpress Pro 3.0 come from Calibration Fields.

UAL

Upper Approach Limit: This value provides a warning that a measurement value is approaching the USL. Measurement values which are larger than UAL but smaller than USL, are shown on a yellow background on gage screens and in the part summary.

USL

Upper Specification Limit: This value represents the largest value a measurement can have and still be considered an acceptable part. If a measurement value is larger than USL, its values will be shown on a red background on gage screens and in the part summary.

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