Overview of the HGS2000 Gauging Software

Features

HGS2000 gauging software offers many features needed when manufacturing, inspecting and controlling many products. A wide range of features and configuration choices are available for most gauging requirements.

System Features

_ 96 Analog or Transducer Inputs (hardware dependent)
_ 96 Inputs & Outputs (hardware dependent)
_ 40 Gauging Characteristics (80 for enhanced version)
_ Real Time SPC (statistics)
_ Gage Repeatability & Reproducibility Reports (for all characteristics)
_ Data Storage designed to be manually or automatically transferred to any storage location
_ Add additional information to data (machine number, part number, etc.)
_ Create a graphical representation of you part with icon overlays
_ Interface to a PLC (programmable logic controller)
_ Machine Interface (control tool ware in post processing applications)
_ Interface to four (4) Machines
_ Classification of the part
_ Multiple Station Gauging
_ RS-232 Input or Output (hardware dependent)
_ Automatic gauging in manual or standalone applications
_ Multiple Configurations (all selectable)
_ Trend Analysis
_ Counters
_ Simple Operator Interface (four position joystick, enter and escape)
_ Make configuration changes while gauging
_ Visual Displays for all features
_ Create custom menu structures
_ Assign function keys (function are also used to access configuration features)

Calibration Features

_ Group Mastering
_ Individual Characteristics Mastering
_ Individual Transducer Positioning or Calibration (analog)
_ Balancing or Matching of Transducers
_ Transducer Integrity (check for defective transducers)
_ Minimum/Maximum of Offset mastering
_ Mastering Failed (restricts data collection if mastering has failed)
_ Mastering Required (forces calibration on preset times in a 24 hour clock)
_ Automatic Mastering (masters are built into the gage an cycled by machine)
_ Create Custom Mastering Instructions

Machine Interface

_ Interface to Four (4) different machines
_ Use a Trend analysis or averaging of Data for Tool Offsets
_ Part Queuing

_ Status based on average (does not apply to a reject condition)
_ Interface to a PLC or directly to your machining center

Gauging Characteristic

_ Type unique Descriptions
_ Create custom algorithms
_ Static, Dynamic or Calculated Check Type
_ Assign RS-232 Port as input (hardware dependent)
_ Assign up to 12 Transducers
_ Automatic Data Storage (manual of PLC controlled)
_ Mastering Type
_ Master values
_ Mastering Instructions
_ Assign a Station
_ Tolerances (reject, caution, stray, trigger)
_ Assign an Icon (part display use)
_ Copy checks

HMI (Human Machine Interface)

_ Keyboard
_ Mouse
_ Menu Driven
_ Touchscreen
_ Joystick, Pushbutton Control through Digital I/O

o **Most Max** – During a dynamic gauge function, the most maximum value will be stored as a **result** for that check.

o **Most Max - Most Min** – During a dynamic gauge function, the most minimum value and most maximum value is stored until completed. Then the most minimum value is subtracted from the most maximum value with the result stored in the **result** for that check.

o **Ave (Most Max & Most Min)** – During a dynamic gauge function, the most minimum value and most maximum value is stored until completed. Then the most minimum value is added to the most maximum value and divided by two. The result stored in the **result** for that check.

o **Absolute Value** – Returns the absolute value of the check.

o **Ave Most Max & Most Min (Tolerance on Ave. Only)** – During a dynamic gauge function, the most minimum value and most maximum value is stored until completed. Then the most minimum value is added to the most maximum value and divided by two. The result stored in the **result** for that check. The Average result is compared to the tolerance values only. The most min and most max results are ignored.

o **Data Settling Option** – This option allows the data to settle before a value is stored. It is only used in a manual gauging application.

_ **Fixed Algorithms:** – A list of mathematical formulas that are designed in the software that are typical for gauging applications. There are twelve available functions that can be assigned to any input from 1 to 96. The functions are **A,B,C,D,E,F,G,H,I,J,K,L**. The first function, letter **A** takes its value from the first number programmed into the Transducer Assignment window.

The second letter **B** takes its value from the second number. Any number can be programmed into the list. The order in the list corresponds with ordered list of letters. For example; if an algorithm **A+B** is selected and the numeric values programmed into the

Transducer Assignment are **1,4**; the value of input **1** is assigned to **A** and the value of input **4** is assigned to **B**.

_ **Created Algorithms:** – List all algorithms create by the user. This window will be blank when no algorithms are created.

_ **Create Algorithm:** – Any algorithm can be created by following simple mathematical formula rules or syntax. Below is a list of allowable expressions:

- A,B,C,D,E,F,G,H,I,J,K,L – These letters represent an assigned transducer
- + , - , * , / , MIN , MAX , ABS , SQR – Mathematical expressions
- [ ] ( ) – brackets that group expressions
- 0,1,2,3,4,5,6,7,8,9 – any numerical value including decimal point

After completing you algorithm, click on the Save Algorithm button.

_ **Transducer Assignment** – Each check must get its values from an input. Inputs are defined numerically from **1 to 96**. The actual working number or value is determined by the input device hardware. When programming these numbers, make sure their order corresponds to the alphabetical order in the selected algorithm. Each number must also be separated by a comma. (**,**) The number of assignments must match the number of alphabetical letters in the selected algorithm. For example; algorithm **A+B** requires two assignments.

_ **Auto-gauging:** – This function is used for manual gauging applications when data storage is required. There are three options to select from:

- **(None)** – No data is taken and stored.
- **Master** – This selection allows the check to monitor the Trigger values programmed into the Tolerances table. When data falls on or within the +/- Trigger values, the check will take data and store the value after an Auto-gauging delay is meet. If the check type is dynamic, gauging is performed though out a Gauging Duration. When the duration is complete, the check will take data and store the values.
- **Slave** – This option allows the check to be a slave to a check that is configured as a Master. It will follow all Auto-gauging options and settings.

_ **Auto-gauging Delay:** – This function is used with the Auto-gauging Master option. When data falls on or within the +/- Trigger values, the check will take data and store the value after an Auto-gauging delay is meet. Any reasonable numeric value can be programmed. It is recommended that values less than 0.1 seconds and more than 10.0 seconds not be used.

_ **Gauging Duration:** – This function is also used with the Auto-gauging Master option. When data falls on or within the +/- Trigger values, the check will take data after an Auto-gauging delay is meet. This option only works when the check type is configured as dynamic. Once gauging is performed though out a Gauging Duration, the check will take data and store the values. Any reasonable numeric value can be programmed. It is recommended that values less than 0.1 seconds and more than 10.0 seconds not be used.

_ **Enable Filtering:** – This feature is designed to remove spikes caused by machining debris left on the part during the machining process. Other uses for example are oil holes, key ways, and similar manufactured conditions found on the ID or OD characteristics that require gauging.

_ **Enable Classification:** – Allows a programmable range of classifications that available for data storage and digital output. Up to 16 classes can be programmed and labeled with two character identification.

_ **Enable Interface:** – This **INTERFACE** is a communications link to machining centers requiring measurement data from an in-process gauge. This data is transmitted to the machining center after a machined part is gauged. The data is then used to help produce offset recommendations on how much of an adjustment is required for tool wear or other contributing factors. The data that is used to produce offset are based on an average of data taken from the 50 Part Trend. When an offset is made by one of the machining centers, the machining center notifies ***HGS2000*** software clearing **Average** and **Queue** counters. This restarts starts the process thus preventing over or undersized parts contributed from tool wear. The Machine Interface has three option:

- **Resolution** – The Resolution value determines the number of places paste the decimal for display and values transmitted.
- **Average** – The Average value determines how many parts are used to calculate an average that is transmitted to the machining center. If an offset is determined, the average counter is set to one.
- **Queue** – The Queue value is needed when more than one part is between the gauge and machining center. After and offset is determined, zeroes are transmitted until the queue count is meet.
- **Interface Data Multiplier** – This value is used when the machine data requires change. If the data transferred needs to be an inverse, enter a -1. If the compensation amount needs to be smaller, enter 0.5.

_ **Group / Station:** – This option has two functions. The Group allows mastering or calibration of multiple checks at the same time. The Station groups these checks in stations designed into an automatic gauging application and more than one gauge stations are used. Up to 12 stations and or groups are allowed.

_ **Mastering Type:** – This option determines the type mastering and masters used the check requires for calibration. There are four was to calibrate a check:

- **None:** – No calibration or mastering is required for this check.
- **Min / Max:** – This option requires one or two masters with a minimum and maximum calibrated value.
- **Min / Max / Offset:** – This option requires one or three masters with a minimum, maximum and mean calibrated value.
- **Offset:** – This option requires one master with a mean calibrated value.

_ **Mastering Description:** – This option attaches a descriptor to master and its calibrated value.
Options are default or programmable descriptions.

_ **Mastering Values:** – Each check requiring calibration must attached calibrated values for each master used.

_ **Mastering Instructions:** – This option attaches a mastering descriptor to guide the operator through a step by step calibration Single Check Mastering procedure. Options are default or programmable descriptions.

_ **Group Mastering Instructions:** – This option attaches a mastering descriptor to guide the operator through a step by step calibration procedure in the Group/Station Mastering. Options are default or programmable descriptions. (see Mastering Options)

_ **“OK to Continue Mastering” Option Window** – Checking this box will create a message window asking the operator if they wish to continue or abort the action.

_ **Gain Window:** – Limits are required when applying gain corrections during calibration. The value of this window represents a percentage of the range allowed. This is based on the range of the mastering values and gain of 1.0.

_ **Offset Window:** – Limits are required when applying offset corrections during calibration. The value of this window represents a percentage of the range allowed. This is based on the range of the mastering values and gain of 1.0.
_ **Balance / Matching:** – Not used
_ **Balance Master #1:** – Not used
_ **Tolerances:** – Each check is also required to have a minimum of a +Reject and –Reject value. Caution, Trigger and Strays are optional. If these values are not used, the cautions must match the reject values and the strays must be greater than the +reject and less than the –reject. Values can be whole numbers or +/- from nominal. One rule that must be followed is that the master values must follow the tolerance values when using whole numbers and +/- from nominal. The Mean value is calculated from the +reject and –reject values and cannot be manually entered.
_ **Tolerance Auto Scale:** – When this option is checked, the Strays and Caution values are automatically scale based on the Auto Scale percent value of the + and – reject values.
_ **Auto Scale Value %:** – This sets the scale for the Tolerance Auto Scale. Value is displayed as a percent. (%)
_ **Display Resolution:** – Determines the resolution of the data throughout the software displays.
_ **Part Display Icon:** – Identifies the check characteristics based on the American National Standard Engineering Drawings & Related Documentation Practices. The symbols are in icons as part of the Part Display.

STATISTICS

HGS2000 Statistical options are designed to aid the manufacturing process of production trends, data
storage and process control. All statistical results and charts can be viewed in real time. Data storage can be manually or automatically transferred to any storage location (see **Data Transfer**).
There are two charts available to view statistical data and results:
1. Xbar & Range charts
2. Statistical Data

Xbar & Range Chart
Statistical Data

Enabling Statistics

Press the **F2** function key and select the Statistics tab to access the Statistics window. Place the mouse pointer on the **Enable** box and click the left mouse button. The default Groups and Subgroups are set to maximum values. These values can be changed to your requirements.
Based on the Group and Subgroup size, HGS2000 calculates the following:
_ **X-BAR** Average of subgroups
_ **R-BAR** Range of subgroups
_ **UCL** Upper control limits
_ **LCL** Lower control limits
_ **CPK** Process capability index
_ **CR** Inverse of CP
_ **CP** Process capability
_ **SIGMA** Standard deviation
All results are calculated on data the most current data. To determine the number of records, multiply the group and subgroup size.

Number Records = Groups x Subgroups

NOTE: The statistical data is different from the Data Storage. The statistical data is stored in a circular buffer and old data is lost as more recent data is taken.

Data Transfer and Storage

Enabling Statistics will store data two ways:

1. Data array up to 300 records per check.

2. Into a text file saved into the data directory under the configuration directory.