



Plant Applications 8.2

Handling Quality



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doc@ge.com

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Introduction to Quality Management

Quality Management enables conformance assessments by linking product information, specifications, and recipes to actual quality and process summary information. It provides the ability to capture real-time data, manage product specific objectives, quantify results, monitor compliance, and display work instructions on the plant floor.

The calculation engine makes it possible to perform both simple and complex calculations. The module is designed to work with SPC/SQC functionality.

Quality Management supports both automatic data collection from control systems, external interfaces, and manual entry of data. Its plant-floor interface means you get accurate product costing from detailed process data, not best-guess work.

Quality Management also provides real-time quality feedback to your plant operations staff. Managers only have to get involved when exceptions occur.

When you need data collected and presented in a way that makes sense and in a format that's easy to follow, you can view any of Quality Management's standard reports in Microsoft Excel or through the *Plant Applications* Web Client. Quality Management even streamlines customer quality reporting and complaint research.

Implementing Quality Management Overview

Configuration Steps for Quality Management

1. Build Up the Physical Layout of The Plant's Production Lines and Units
2. Determine Which Process Variables to Capture And Summarize On Each Unit
3. Determine Which Manually Entered Variables to Capture
4. Establish Any Calculations Combining or Summarizing Other Variables
5. Build Up Products and Specifications
6. Attach Products to Units
7. Configure A Production Event on Each Unit
8. Configure A Product Change Event on Each Unit
9. [Establish Rules For Disposition / Routing](#)
10. [Establish Rules For Alarming](#)
11. Establish Inspection Plans / Testing Frequencies for Manual Entries
12. [Build Quality Management Displays](#)
13. Configure Security on Variables and Displays. For more information, see Assigning Security Groups.

Quality Management Features

The Quality Management module provides facilities for managing quality information, automating quality control decisions, and analyzing quality and process performance. Quality Management supports both automatic data collection from control systems or external interfaces, and manual entry of quality or test information. Many standard reports are provided that can be viewed in Microsoft Excel or through the Plant Applications Web Client.

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The features of Quality Management include:

- Track Quality and Process Data On Time Basis Or Event Basis
- Automatically Capture Production Events (Batch, Lot, etc)
- Automatically Capture Product Information With Production Events
- Track The Original Product and Applied Product Of A Production Event
- Research Products For Which A Particular Production Event Will Meet Specifications
- Automatically Capture And Filter Process Data From Control Systems
- Set Up Critical Control Points And Automatically Disposition / Route Production Events
- Set Up Inspection Plans To Audit And Control Quality Testing And Disposition Decisions
- Create Customized Displays By User Or Operating Function
- Automate Testing Labs and Lab Equipment
- Communicate Test Information To The Plant Floor In Real-Time
- Attach Documents And Procedures To Products, Variables, and Specifications
- Build Calculations Based On Manually Entered And Process Data
- Manually Enter Quality And Process Data
- Support Numeric, String, Comment, and User Defined Data Types
- Comment Production Events And Individual Data Points
- Create Key Performance Indicator Calculations Based On Quality Information
- Create Key Performance Indicator Calculations Based On Process Information
- Use Genealogy In Calculations And Alarms
- Apply Product Specifications To Process and Quality Information
- Report Exceptions To Quality Specifications
- Alarm Out-Of-Control Conditions And Require Acknowledgement
- Track Cause Reasons and Actions Around Alarm Conditions
- Expose Operating Procedures With Alarms
- Comment Alarm Conditions
- Trend And Analyze Quality Information
- Create Ad-Hoc Reports To Research Quality Issues
- Publish Quality Information To The Web
- Control Security Around Entry And Viewing Of Process and Quality Data
- Maintain An Audit Trail Of Data Changes
- Maintain An Audit Trail Of System Usage
- Maintain An Audit Trail Of System Configuration Changes

Quality Management Displays

Client displays with Quality Management are:

- Autolog Display

- Production Run Analyst Display
- Trend Display
- Relative View Display
- Alarm View Display
- Sequence Of Events Display

Approaches to Test Scheduling, Inspection Plans

The inspection plan or Test Frequency can be defined at the variable level and may be overridden by the product specification.

For time-based variables, the sampling interval (minutes) is used as the base interval for scheduling tests. The test frequency in the product specification is used as a multiplier on the base interval. For example, a variable with 60-minute sampling interval and a product specification test frequency of 3 will be scheduled every $3 \times 60 = 180$ minutes.

For event-based variables the default test frequency is defined at the variable level and is overridden by the test frequency in the product specification. For example, a variable with 5 as the default test frequency and a product specification test frequency of 3 will be scheduled every three events.

In addition to base scheduling there are a few other opportunities to modify the base frequency with exception conditions. The schedule for time-based variables may be reset at product change, or never reset based on the **Reset Test Frequency** attribute of a variable. When reset at product change, a test will be scheduled for the interval immediately following the product change and then follow the prescribed frequency after that point. When the frequency never resets, scheduling is always based on midnight as the reference.

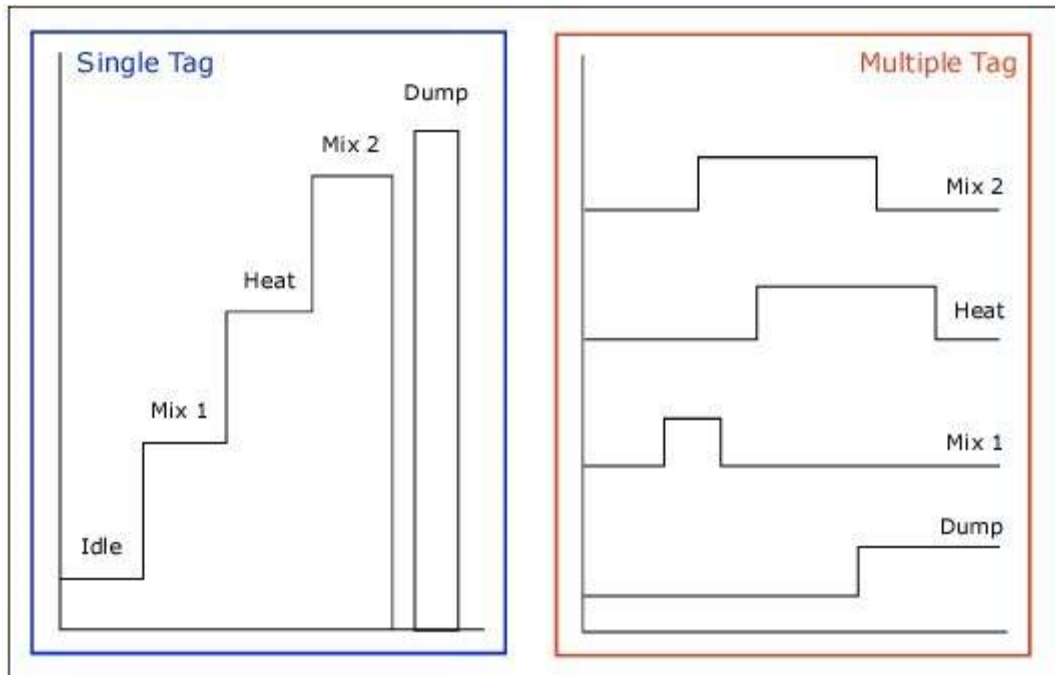
Extra testing may be scheduled for tests that fall outside the Warning or Reject limits. Using the **Force Test Frequency** attribute of a variable, tests may be scheduled immediately after a Warning Test, or a Reject Test, or both. For example, if the test frequency were once every five batches, but a test fell outside the warning limits, a test would be scheduled on subsequent batches until the test fell within the warning limits again.

In determining the testing schedule for event-based variables, the number of good production events into the current production run is used. Any time a production event is rejected, it is essentially ignored in determining the test interval for a given test. If a test were scheduled for a production event that was subsequently rejected, that test would always be scheduled again when the next production event was created.

Events With Quality Management

- Production Event
- Disposition Event
- Alarm Event

Automatic Data Sources for Quality Management



What Can Be Automated?

- Batch and Phase Triggers
- Batch, Lot Identification
- Product Identification
- Disposition And Routing
- Collection Of Process Data From Control Systems
- Collection Of Lab Data From Lab Instruments
- Inspection Plans
- Process and Batch Recipes

Examples:

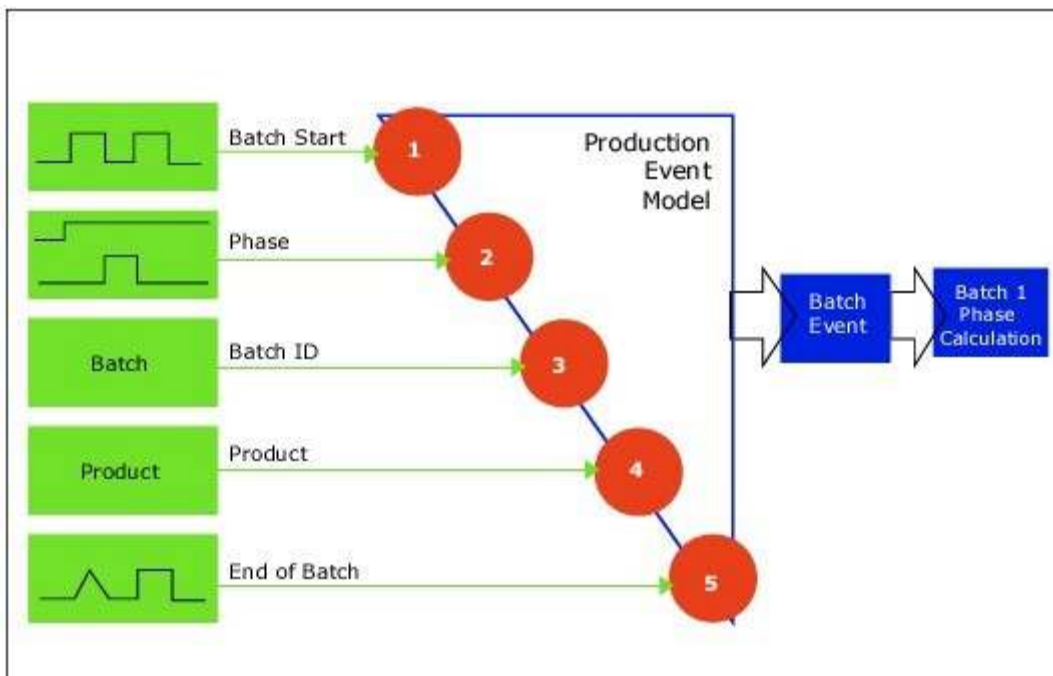
- Recipe Downloaded To Batch Execution System At Batch Start
- Batch Execution System Triggers Phase And Batch End
- Batch Data and Control System Data Summarized By Batch, Phase
- Disposition Automatically Set By Specification Limits

Which Clients Can Manipulate Quality Data?

- AutoLog Display
 - Production Event Disposition
 - Applied Product Of Production Events
 - Original Product Of Production Events
 - Manual Tests
 - Calculation Overrides
 - Comments
- Alarm Display
 - Alarm Reasons

- Alarm Comments
- Sequence Of Events Display
 - Production Events
 - Alarms
- Genealogy Log Display (Production Management Module)
 - Production Event Disposition
 - Applied Product Of Production Events
 - Original Product Of Production Events
 - Manual Tests
 - Calculation Overrides
 - Comments

Data Flow for Events



The four parts to a typical Production Event Model are:

- Collect product identification information and Batch ID information
- Watch one or more tags to signal start of Batch
- Watch one or more tags to signal Phase changes
- Watch one or more tags to signal end of Batch

Some Production Event Models capture the Product Change Event in-line with capturing the batch trigger. Other Downtime Models simply capture a "serial number" of an item and trigger the creation of an event when the "serial number" tag value changes.

Once a Production Event is created, calculations based on the Production Event are fired and manual tests are scheduled according to the test frequency / inspection plan.

Alarm Event

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An Alarm Event occurs when a variable violates a configured alarm rule, such as a reject or warning limit.

Relationships

Unit: The major piece of equipment which produced (or contains) the production event.

Event Number: Batch ID, lot ID, or unique identifier for event.

Start Time: The time the event started production.

End Time: The time the event stopped production.

Event Status: Disposition or routing of event (Hold, Reject, Good, In Process, etc.).

Original Product: The product the event was originally intended for.

Applied Product: The product the event was actually applied to.

Testing Status: Indicates status of testing for event.

Order Line: Customer order line item event was applied to.

Shipment Line: Shipment or load event was applied to.

Dimension X,Y,Z: Dimensions of event such as weight, width, length.

Orientation X,Y,Z: Spatial orientation of event.

Strategies For Alarming

Alarming is typically done by many different systems within the plant. Certain types of alarms are better serviced by certain systems based a few criteria. In general, the question is "Which alarms should be serviced by the control system and which alarms should be in the information system?" To set up an Alarm event, refer to Alarm Event.

Reasons Why Control System Should Alarm

- Need for extremely fast data
- Need for real-time action
- Most convenient operator interface

Reasons Why Information System Should Alarm

- Not all the data is available to control system
- Dependency of alarm on manual entry
- Based on values that can be recalculated non real-time
- Awareness of product and product specification
- Awareness of schedule and order characteristics

Why Alarm in Plant Applications?

- Documents alarm conditions for historical analysis
- Capture alarms reasons, actions
- Expose exception based operating procedures
- Use alarms in quality control and disposition

The general process for configuring Alarms in Plant Applications is as follows:

1. Choose variables that should have alarms.
2. Define Cause Reason and Action Trees.
3. Configure product specifications for each product where alarms are appropriate.
4. Group variables related by process, or by a specific problem.
5. Define documentation for each group and for each variable to be used when alarm condition is detected.
6. Define Alarm Rules under "Alarms" in the Template Library. A Rule should be created for each group of variables.
7. Attach variables to the Rule, define Limits which should trigger alarms, and attach appropriate documentation to the Rule and individual variables.
8. Build Alarm View displays.
9. Configure security and attach to Alarm View displays to control who can acknowledge alarms and change reasons.

Disposition Event

Disposition events are triggered when the production status or testing status of an event has changed.

You must have the license for the Quality Management module to configure disposition events.

Relationships

Unit: The major piece of equipment that produced (or contains) the production event

Event Number: Batch ID, Lot ID, or Unique Identifier for event

Start Time: The time the event started production

End Time: The time the event stopped production

Event Status: Disposition or Routing of Event (Hold, Reject, Good, In Process, etc.)

Original Product: The product the event was originally intended for

Applied Product: The product the event was actually applied to

Testing Status: Indicates status of testing for event

Order Line: Customer order line item event was applied to

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Dimension X,Y,Z: Dimensions of event, such as weight, width, length

Orientation X,Y,Z: Spatial orientation of event

Planning for Control Points and Disposition Decisions

Many processes require that a "disposition" decision be made for each item produced. The disposition decision may involve simply accepting or rejecting a batch or lot, or it may also involve changing the "routing," or path the product will take through the plant.

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In the process disposition, decisions that will be made are known as "control points" and are configured as Production Units within the Plant Model. Control points may represent physical pieces of equipment, or may simply be a logical point in the process where quality decisions must be made.

Do you want manual or automatic disposition?

Manual disposition can be achieved from a variety of clients by simply changing the status of a Product Event. Automatic disposition can be driven by the Disposition Model defined by the Production Event properties on a given Unit. The standard Disposition Model watches for any variables to fall outside of Reject limits and automatically Rejects the Production Event without user intervention.

Which variables can affect disposition?

Any variable whether manually entered or calculated may have specification limits, therefore may affect disposition. The general strategy to associate certain variables with the disposition decision is to make sure those variables have Reject Limits defined as part of the Product specification. Any variables that do not affect disposition should not have Reject Limits defined.

Who needs to be aware of a disposition change?

Whenever a Disposition Event occurs, the status of the Production Event changes and is be automatically updated on any Displays where that Production Event is shown. In addition, the Disposition Event may trigger alarms and calculations. These alarms and calculations may be on the Unit where the Disposition Event occurred or may be on upstream or downstream Units. This provides a variety of ways to highlight an issue with product that may need to be dealt with upstream or downstream in the process.

Changing the disposition may also affect how Production Events can be routed through the process. Each Unit has one or more "Inputs" defined. For each Input, the "legal" statuses available for a move into the Input are defined. Through this configuration, rejected statuses can be prevented from moving further in the process. Likewise, this may be used to prevent the movement of Production Events before a Disposition Event occurs.

What is the upstream and downstream effect of disposition?

As discussed above, changing the status of a Production Event can affect its potential paths through the process. The case that is potentially more important to consider is, what should happen when disposition is changed after a Production Event has already moved forward in the process. Sometimes the output of the next Unit in line needs to be automatically rejected, other times the process may need to be shut down. Both can be achieved through Alarms and Calculations.

Specifically, a type of calculation known as a "Genealogy Calculation" may be employed. Genealogy calculations model genealogy to perform calculations that cross Units. Through a Genealogy calculation, changes in the data or the status of a Production Event can fire calculations upstream and downstream in the process, which can in-turn provide alarming or automatic disposition at that point in the process.

Production Event

A Production Event is a generic term for a lot or batch. It represents the output of a given production line and is generally labeled with some unique identifier. Different parts of an operation may track different types of Production Events. For example, a food processing facility may track batches of raw materials and package lots of product. Within Plant Applications each unique type of production event is created (Batch, Lot), assigned its units of measurement, and then attached to one or more units in the plant.

Relationships

Unit: The major piece of equipment which produced (or contains) the production event.

Event Number: Batch ID, Lot ID, or Unique Identifier for event.

Start Time: The time the event started production.

End Time: The time the event stopped production.

Event Status: Disposition or Routing of Event (Hold, Reject, Good, In Process, etc.).

Original Product: The product the event was originally intended for.

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