Plant Applications 8.2

Handling Efficiency

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Introduction to Efficiency Management

The Efficiency Management module can be licensed as part of Plant Applications. Efficiency features enable you to monitor and control overall equipment efficiency, providing a comprehensive look at factors such as equipment downtime waste production, production quantity, and event sequences.

With release 6.2, displays are offered for display in a browser to track multi-events, add property data, and review and enter comments. OEE analysis displays are also provided.

Efficiency Management has four key areas of focus: downtime tracking, waste tracking, production counting and user-defined event tracking. Together, this comprehensive set of capabilities helps significantly improve operating efficiencies while greatly reducing costs.

Efficiency Management makes it possible to associate each downtime event with a specific cause on a real-time basis. It provides a window into why that downtime is occurring and allows you to calculate and improve your overall equipment effectiveness. In addition, the module calculates KPIs, such as overall equipment effectiveness, and allows you to create ad hoc reports on your performance that can be shared throughout the organization via the Web.

Preparing for Different Products

For those production processes that manufacture multiple products on the same equipment, it is important to the waste, production counting, and calculations of the OEE metric to know what the active product is. Based on knowing the product code, certain conversion factors, such as filled pallets being converted to cases and cases being converted to individual units of product, can be determined. In addition, the Performance Rate metric of OEE requires an Ideal Performance rate by Product. Therefore, a targeted Ideal Rate for every product that runs on the line must be configured, and Plant Applications must know which product is currently running so it can apply the correct targeted rate. Even if a line runs one only product, this product will have to be executed in the Plant Applications database with no end date and have appropriate conversion factors configured for the same reasons as stated above.

The most important item in preparing for running different products is this: "How Do You Know Which Product Is Running?" Usually, this indication is operator driven, as an operator chooses which product order or process order to execute. Sometimes, the control system can detect which product is running by examining certain attributes of the product (such as length, width, weight, and so on). This assumes that these product attributes are set up in Plant Applications and used to detect the product. If there are sufficient signals in the control system to determine the product (operator entry or deduction), it is generally very easy to historize this signal and subsequently drive a Product Change model (see Product Management).

It may be necessary to manually maintain which product is running on a given line at any given time. Several client applications allow users to manually add or alter which product is running at a given time.

In either the manual or automatic case, it is necessary to build a list of all potential products that a particular line runs. It may also be necessary to create product specifications representing conversion factors for each product, which can subsequently be used in waste models and production calculations. See Product Management for more information on building specifications, characteristics, and recipes, and associating products to equipment.

The Excel Import/Export tool is a good and efficient tool to configure a large number of products that can run on each line.

Downtime

Downtime Event

A downtime event occurs either when equipment is not running (downtime) or when equipment is not running at its target rate (rate loss). When tracking downtime, the key measure is downtime minutes. When tracking rate loss, both downtime minutes and the lost opportunity from target production rate are the key measures. A downtime event represents the time a particular unit (or line) was in a faulted condition.

What Can Be Automated in Downtime?

- Downtime Start and End Times

- Production Rate Capture for Rate Loss

- Cause Location for Downtime

- Downtime Fault

- Reasons Based on Fault

Examples of Automatic Events in Downtime

- Line Speed Supplies Downtime Start and End

- Conveyor Faults Determine Cause Location

- Cause Location Determines Overall Fault

- Overall Fault Determines Default Reasons

Relationships

Unit: The major piece of equipment around which downtime is being tracked.

Fault: What the control system thought the reason for downtime was. Can be a "first out," or simply the active interlock that prevents equipment from running.

Detail: An individual downtime event whose duration represents the time of a given fault condition. An overall downtime occurrence may have several faults; therefore, several details.

Summary: An overall downtime event which contains one or more downtime details found. A summary represents the total time of downtime, whereas the detail represents the time in a given fault condition.

Location: The specific piece of equipment (equipment module) along a production line causing the line to go down.

Cause Reasons: The reasons thought to be the cause of a downtime event.

Action Reason: Reasons identifying any corrective action taken.

Configuration for Tracking Downtime

1. [Audit Available Signals For Automating Downtime Detection](#)
2. Establish the Physical Layout of Units On The Production Line
3. Configure Reason Trees for Classifying Downtime Causes
4. Configure Reason Tree for Classifying Corrective Actions
5. Configure the Downtime Event on The Target Unit

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6. Establish Possible Downtime Locations

7. Assign Reason Trees to Each Downtime Location

8. Establish the Fault List and Default Reasons

9. Configure and Activate the Downtime Detection Model

10. Create a Downtime Display

Tracking Downtime

Downtime tracking gives you a window into the exact reasons why your production equipment suffers downtime. It lets you audit the downtime events collected automatically by your Plant Applications Server.

Reasons for downtime can be comprised of as many as five different levels, arranged in a hierarchical structure. A five-level structure provides four possible levels of drill down. It is typical to see a three or four-level tree in many plants. This is an example of a four-level tree structure, by level title:

Level 1: Location Equipment A

    Level 2: Downtime Group Machine Failure

        Level 3: Downtime Category Operator Assist

            Level 4: Downtime Detail In feed belt jammed

In real time, or perhaps later at a time convenient to you, you can edit the reasons and add comments to each recorded downtime event as appropriate. Edits are not required, and doing nothing merely means that you accept the downtime faults provided by the control systems and translated into the reason tree structure by Plant Applications. The likelihood that there will be a necessity to edit downtime records is usually reduced in direct proportion to the quality of fault information that is available from the control systems.

Optionally, you can add actions to the downtime analysis by asking your operators to select the action that they took from a drop-down list of possible actions to correct downtime faults.

Finally, you can configure shortcuts of possible edits so that typing a shortcut will edit a downtime fault and automatically fill in all reason levels for that downtime fault. For example, entering "9" might be a shortcut for:

Equipment 'A' Machine Failure: Operator Assist In feed belt jammed.

Data Flow for Downtime Events
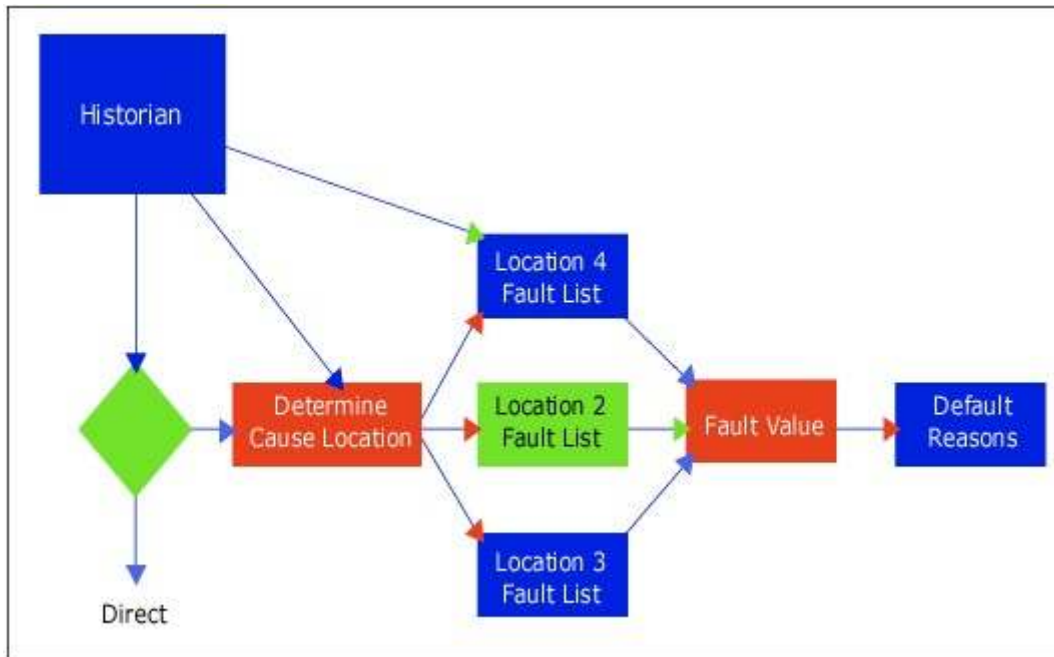
Downtime Model

The three parts to a typical downtime model are:

1. Determine if the unit is running or not

2. Determine the source location for downtime

3. Determine the fault, based on the location

Downtime models can be simple and can look at a single tag to determine all of the above information, or can be complex and look at many tags to determine what the source location of downtime was likely to be and, based on the location, establish the fault condition.

Automated Sources for Downtime

Planning for automatic downtime detection starts with auditing the available signals is the control system that can be used to determine when the line is up or down, and potentially what the root cause for downtime is. The most difficult issue is often the timing or availability of data at the instant a line goes down. While it will not be necessary to accumulate all downtime information in the control system or PLC, it may be necessary to "latch" faults, or capture "first outs" in the PLC when timing is very critical.

How to Prepare the Control System for Automatic Downtime Detection

1. Establish the "rule" that defines whether or not the production line is up or down.

2. Determine what fault information already exists in the control systems.

3. Determine how the available fault information maps to specific locations or equipment.

4. Determine the behavior of the signals making up the fault information. How fast do the fault values change? When do they change relative to the signals that determine the Production Line status? When do they change relative to the Fault information from other pieces of equipment?

5. Establish a way to determine (or infer) the status of individual pieces of equipment along the line.

6. Determine if fault signals "latch" for the duration of a downtime event, or change freely.

7. Where timing is critical, supplement logic in the control system to latch faults or determine the sequencing of events to establish a "first fault".

8. Collect all signals into the historian at the highest resolution possible.

What Can Be Automated?

- Downtime start and end times

- Production rate capture for rate loss

- Cause location for downtime

- Downtime fault

- Reasons based on fault

Examples:

- Line speed supplies downtime start and end

- Conveyor faults determine cause location

- Cause location determines overall fault

- Overall fault determines default reasons
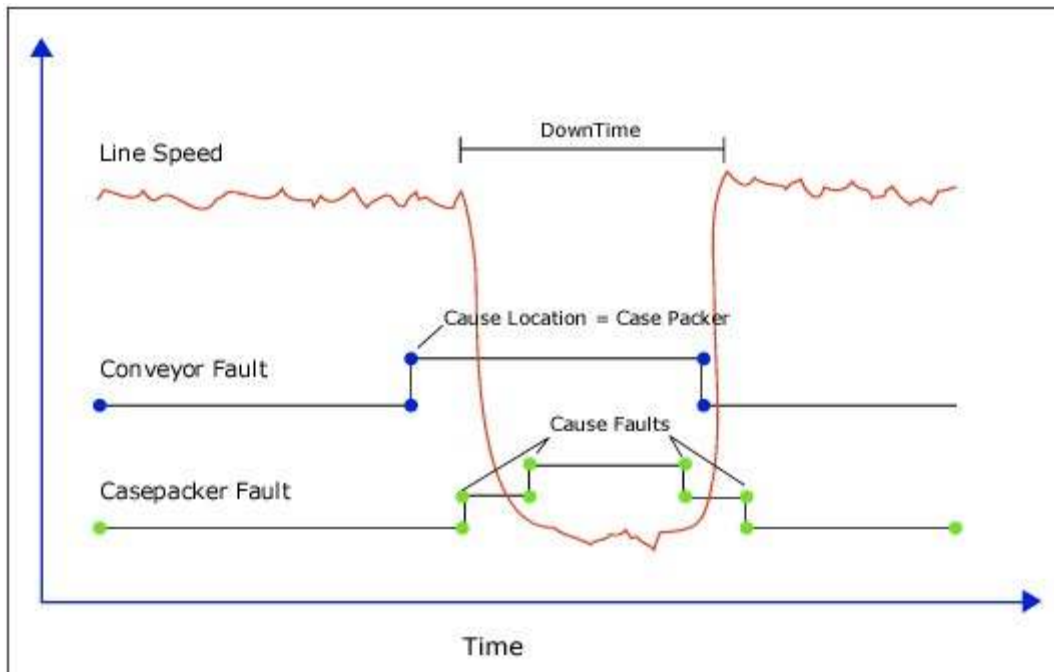
Example Types of Downtime and Waste Signals

Manual Sources for Downtime

Displays that can manipulate Downtime data:

- Downtime Display

- Sequence Of Events Display

Summarizing Process Data Around Downtime Events

1. Create or edit a variable.

2. Make sure the **Data Source**, **Event Type**, **Sampling Interval**, **Sampling Offset**, **Sampling Type**, and **Input Tag** columns are visible in the Variable Sheet.

3. If these columns are not visible, do the following:

   a. click the ⬥Column/Row Visibility icon. The Column/Row Visibility dialog box appears.

   b. Select the appropriate columns in the Hidden list and move them into the Visible list by selecting the ⟩ button.

   c. Close the Column/Row Visibility dialog box to return to the Variable Sheet.

4. Select a Data Source of Historian, an Event Type of Delay, and a Sampling Type of Average.

5. If the input tag that will drive the calculation is known, type the name of the input tag in the Input Tag column. If you need to search for a tag, do the following:

   a. Right-click the Input Tag column and click Tag Search. The Tag Search dialog box appears.

   b. Search for an appropriate tag, select a tag from the search results, and click OK. The selected tag will appear in the Input Tag column.

6. To save the variable, select the 💾Save icon in the Variable Sheet.

Waste

Waste Event

A Waste Event occurs when a product is rejected or lost in a processing stream. It is calculated against a location, which is a specific piece of equipment (equipment module) along a production line causing waste, or around which a material balance was performed to calculate waste. A Production Event can be associated with one or more Waste Events. Each Waste Event has a calculated waste amount using a specific unit of measurement. When stored in the database, waste amounts are normalized to a standard engineering unit based on conversion factors established for each waste measurement. Each Waste Event can have a Cause and an Action Reason applied to it. Cause Reasons are what caused the Waste Event. Action Reasons identify any corrective action taken.

Waste Events and Reasons can be captured automatically using control points and pre-configured Waste Models. Additionally, Waste Events and Reasons can be manually entered. Key Performance Indicator calculations can be created along with ad hoc reports to capture key information regarding Waste Events. This information can also be published to the Web using the Web Report Server.

What Can Be Automated in Waste?

- Waste Times

- Waste Production Event

- Cause Location, Or Location of Material Balance

- Waste Type and Measurement

- Default Reasons Can Be Model Specific

Examples of Automatic Events in Waste

- Photo eye counts two input streams

- Photo eye counts output stream

- Active product determines expected conversion of inputs to output

- Model determines Waste Type, Measurement, and Amount

- Model Defaults Reasons

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Relationships

Unit: The major piece of equipment around which Waste is being tracked.

Type: Normally the type of model which produced the Downtime detail. (i.e., "Manual," "Automatic Balance," "Automatic Rejects," or "Manual Rejects"

Production Event: The batch waste is associated with or was taken from. More than one waste event can be associated with a given Production Event.

Measure: The Unit Of Measurement waste was recorded in. When stored in the database, waste amounts are normalized to a standard engineering unit based on conversion factors established for each waste measurement.

Amount: The amount of waste recorded in a specific engineering unit.

Location: The specific piece of equipment (equipment module) along a production line causing the waste, or around which a material balance was performed to calculate waste.

Cause Reasons: The reasons thought to be the cause of a waste event.

Action Reasons: Reasons identifying any corrective action taken.

Configuration for Tracking Waste

1. [Audit Available Signals For Automating Waste Detection](#)
2. Establish the Physical Layout Of Units On The Production Line
3. Configure Reason Trees for Classifying Waste Causes
4. Configure Reason Trees for Classifying Corrective Actions
5. Configure Possible Products Unit Can Manufacture
6. Configure Conversion Factors for Measurement Conversion
7. Configure Possible Waste Measurements and Associated Conversion Factors
8. Configure Possible Waste Types
9. Configure the Waste Event on The Target Unit
10. Establish Possible Waste Locations
11. Assign Reason Trees to Each Waste Location
12. Configure and Activate the Waste Detection Models (Potentially For Each Waste Type And For Each Waste Location)
13. Create A Waste Display

Tracking Waste

Waste is a large topic, with the Efficiency Management module handling certain aspects of it, and the Quality and Production Management modules handling others — and some aspects are left up to management. "Waste" is an umbrella term for many things. It is defined as "those elements of the system (including elements of the final product) which do not bring value to the customer, where 'value' is defined as that which the customer is willing to pay for.

The Efficiency module can help to reduce Defect and Waiting Waste. Overall Equipment Effectiveness specifically measures "first time right production" in the Quality Rate metric. Drill-down reporting allows you to analyze waste information by amount, production unit, reason, and frequency. Waiting time that affects production can be a downtime reason configured in the reason tree, and waiting times can be captured, analyzed and improved upon.

The Quality module reveals and analyzes those items that don't meet product specifications. What you do with those items determines whether they are:

- Scrap or Waste: The product does not meet specifications and must be thrown away.

- Rework: The product does not meet specifications, but can be reworked to meet specifications. There is waste involved in the rework however in terms of effort and possible materials.

- Sub-spec: The product does not meet specifications, but can still be sold as "B" product, or in a different market.

Following are eight waste factors that can hinder efficiency.

- **Inventory Waste:** Inventory is a measure of total manufacturing effectiveness. Too much or the wrong kind of inventory costs money! It was created by the system. Inventory includes raw material, work-in-process (WIP), obsolete goods, and finished goods. There are many contributing factors to excess inventory.

- **Defects:** The concept of "do it right the first time" is the goal in any process or task because defects increase the cost of production. So, when you decrease the incidence of defects, you will lower your production costs and increase your profits. An additional benefit of reducing defects is increased employee morale.

- **Processing Waste:** Defined as "any effort that adds no value to the product or service from the customer's viewpoint." There are many tasks, operations, and processes that occur on a daily basis in your company. Many are vital for survival. However, based on the definition above, examining this type of waste is to determine how many of these tasks, operations, or processes make a difference to your customer?

- **Transportation Waste:** There is no value in moving material, raw components, partially completed product, or finished goods around the plant. Growth, new equipment, and/or additional capacity present opportunities for more business but can present an opportunity to introduce increased transportation or motion waste. Poor facility layout is a large contributor to transportation waste.

- **Overproduction Waste:** Overproduction increases WIP, thus overall inventory is increased. Inventory is a symptom -- a measure of total manufacturing effectiveness. Many factors contribute to overproduction.

- **Motion Waste:** Motion waste is "any movement of people or machine that does not add value to the product or service." Walking, putting something on a shelf, then going back to retrieve it later is an example of motion waste. Processing waste, transportation waste, and motion waste are interrelated -- looking at one requires looking at the other two.

- **Waiting Waste:** No manager, supervisor, or lead person likes to see an operator standing around or just sitting there...waiting. There are usually very valid reasons why the operator is waiting to perform their task. This is one of the many reasons for increased inventory -- to reduce the waiting time. However, just like inventory, waiting is a symptom. The root cause of the problem is being masked or hidden.

- **People Waste:** Equipment, machinery, and processes are vital components to an organization because they can provide the means to produce product "bigger, faster, better." However, it is the human factor that makes it all happen. "People Waste" can be defined as the waste of not using people's (mental, creative, physical, skill) abilities.

Data Flow for Waste Events

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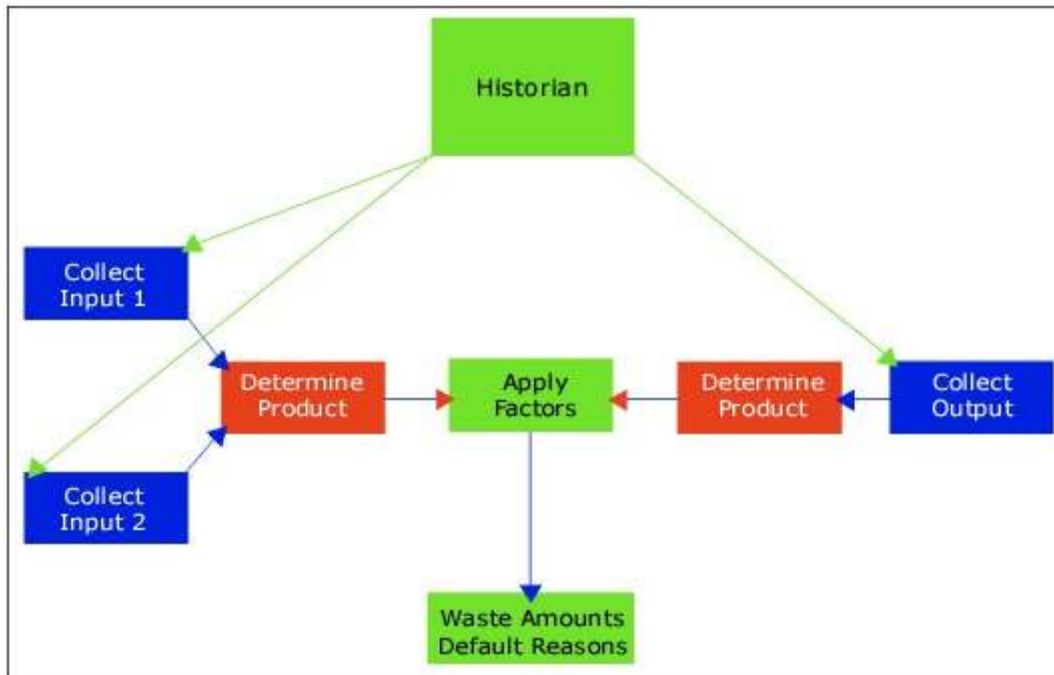
Example Waste Model

The three parts to a typical Waste Model are:

1. Collect signal data to establish expected size, amount of production, etc.

2. Collect signal data to establish actual size, amount of production, etc.

3. Apply a deadband to differences between expected and actual

Waste can be based on time or event. A typical time-based model performs some type of material balance between a set of input and output signals. A typical event-based model watches for specific data to change and associates waste with that event. Examples might include the rejection of a batch, a manual entry on a specific set of variables, or some data changing in the process historian.

Automated Sources for Waste

As with downtime, planning for automatic waste detection starts with auditing the available signals. There are several types of signals we are looking to automatically drive waste calculations.

- Directly measured waste streams with or without reject reasons

- Directly measured raw material inputs

- Inferred raw material inputs (using combined signals and/or conversion factors)

- Directly measured production outputs

- Inferred production outputs

- Signals implying product or configuration

Frequently, knowing the product or configuration of the line is important to correctly interpreting raw material and production signals. For example, the product code may help to infer how much finished product is expected from a given amount of raw materials.

How To Prepare The Control System For Automatic Waste Detection?
1. Locate all signals that measure production

2. Determine what conditions make each signal valid or invalid. This could be based on configuration, product code, or by direct feedback of another signal.

3. For material balance type models, determine the conversions between inputs and outputs expected for each product the line will run.

4. For direct measurements, determine the behavior of the signals. How fast do the values change? When do they change?

5. Where timing is critical, supplement logic in the control system to accumulate or filter values

6. Collect all signals into the historian at the highest resolution possible.

What Can Be Automated?

- Waste Times

- Waste Production Event

- Cause Location, Or Location Of Material Balance

- Waste Type And Measurement

- Default Reasons Can Be Model Specific

Examples:

- Photo eye counts two input streams

- Photo eye counts output stream

- Active product determines expected conversion of inputs to output

- Model determines Waste Type, Measurement, and Amount

- Model Defaults Reasons
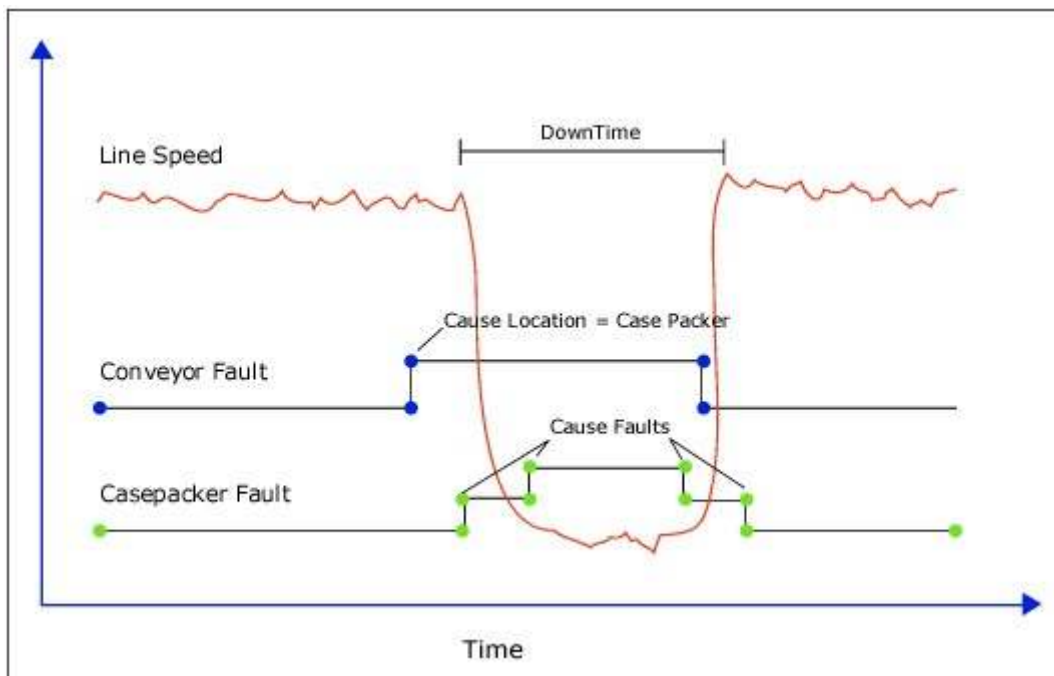
Example Types of Downtime and Waste Signals

Manual Sources for Waste

Displays that can manipulate Waste data:

- Waste Display

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- Sequence Of Events Display
- Autolog
- Genealogy View

Summarizing Process Data Around Waste Events

1. Create or edit a variable.

2. Make sure the **Data Source**, **Event Type**, **Sampling Interval**, **Sampling Offset**, **Sampling Type**, and **Input Tag** columns are visible in the Variable Sheet.

3. If these columns are not visible, do the following:

    a. click the **Column/Row Visibility** icon. The **Column/Row Visibility** dialog box appears.

    b. Select the appropriate columns in the **Hidden** list and move them into the **Visible** list by selecting the ⟩ button.

    c. Close the **Column/Row Visibility** dialog box to return to the Variable Sheet.

4. Select a Data Source of **Historian**, an Event Type of **Waste**, and a Sampling Type of **Average**.

5. If the input tag that will drive the calculation is known, type the name of the input tag in the Input Tag column. If you need to search for a tag, do the following:

    a. Right-click the Input Tag column and click **Tag Search**. The Tag Search dialog box appears.

    b. Search for an appropriate tag, select a tag from the search results, and click **OK**. The selected tag will appear in the Input Tag column.

6. To save the variable, select the **Save** icon in the Variable Sheet.

Production Counting

Production counting is likely to be performed using "Variables" as opposed to "Models." Variables are simply measurements or calculations attached to a given production line that produce values either on an event basis or a time basis.

What Can Be Automated in Production?

- Any raw signal measuring production
- Any conditions that invalidate production counting
- Product specific conversion factors to normalize engineering units

Examples of Automatic Events in Production

- Flow signal measures raw production rate
- Signal from valve indicates whether product is being accepted or rejected
- Variable used to totalize good production and bad production separately using valve status

Configuration for Production Counting

1. Audit Available Signals For Counting Production

2. Audit Factors That Affect The Quality Of Signals For Counting Production

3. Configure Calculations To Assimilate Data Quality

4. [Configure Calculations To Count Production](#)

Data Flow for Production Counting
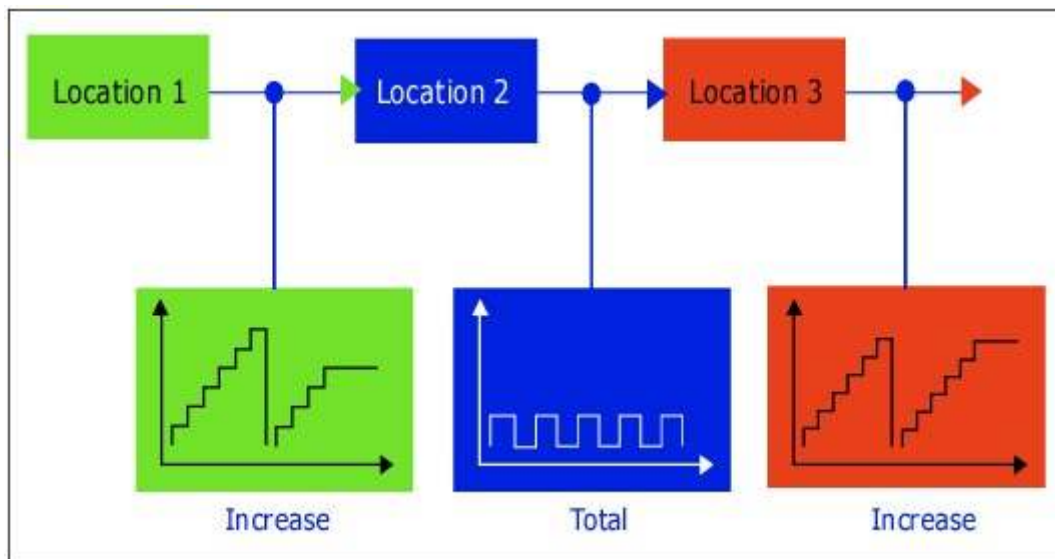
Production counting is usually done using **Variables** rather than **Models**. Variables are simply measurements or calculations attached to a given production line that produce values based either on Event or Time. Examples of the calculations used for a production count variable might be totalizing a flow or weight signal, counting pulses from a photo eye, or comparing the previous level in a tank to the current level in a tank.

The three parts to a typical Production Count calculation:

1. Collect raw signal data.

2. Filter the raw signal using **Data Quality**.

3. Apply a specific **Sampling Type** to the data such as **Average**, **Total**, or **Increase**.

4. The **Data Quality** filtering can be very important to extracting valid production data from raw control system data.

Automated Sources for Production Counting

Many of the same issues apply to production counting as waste detection. Planning starts with auditing the availability and behavior or signals that imply production. Production signals can come in many forms, and can have many issues that affect the quality of the measurement. It will be necessary to model the data quality into the calculation of production so it will be necessary to understand the behavior of those signals as well.

What Can Be Automated?

- Any raw signal measuring production

- Any conditions that invalidate production counting

- Product specific conversion factors to normalize engineering units

Examples:

- Flow signal measures raw production rate

- Signal from valve indicates whether product is being accepted or rejected

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- Variable used to totalize good production and bad production separately using valve status
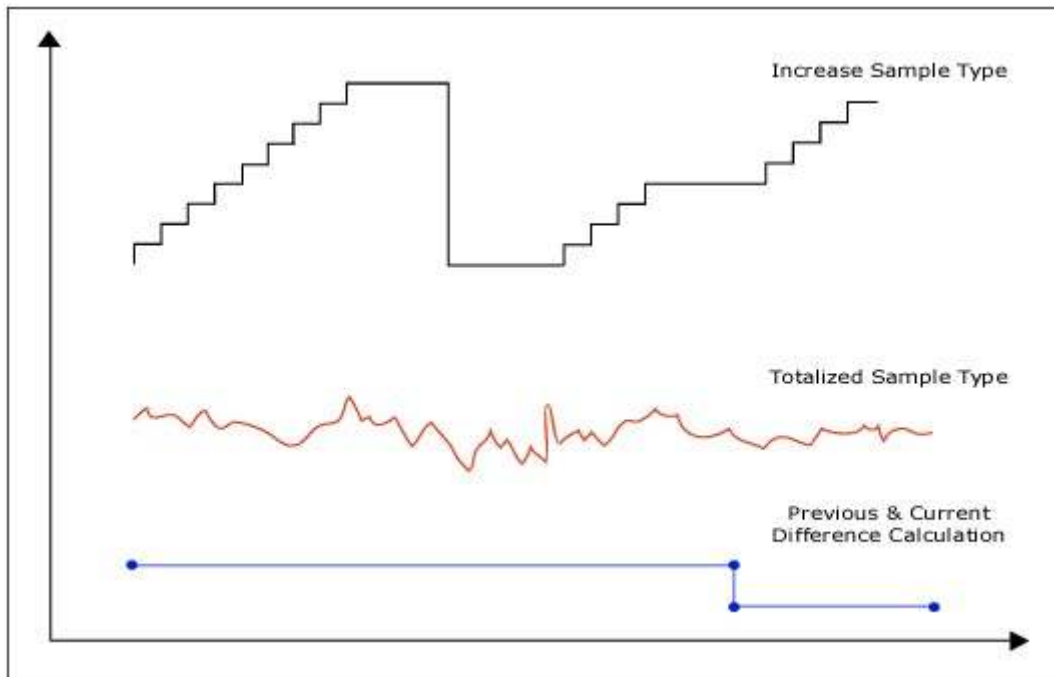
Examples of Production Signal Data

Manual Sources for Production Counting

Displays that can manipulate Production data:

- Sequence Of Events Display
  - Production Event Details
- Autolog
  - Creation Of Batches
  - Variables Driving Production Calculations
  - Adjustments To Production
- Genealogy Log
  - Creation Of Batches
  - Variables Driving Production Calculations
  - Adjustments To Production
- Genealogy View
  - Creation of Batches

Configuring Production Counting Calculations

1. Create or edit a variable.

2. In the **Variable Sheet**, make sure the **Data Source**, **Event Type**, **Sampling Interval**, **Sampling Offset**, **Sampling Type**, and **Input Tag** are visible. Click the ⊙**Column/Row Visibility** icon in the Variable Sheet window toolbar to change column visibility. The **Column/Row Visibility** dialog box appears.

3. Select the appropriate columns in the **Hidden** list and move them into the **Visible** list by clicking the [>] button.

4. Close the **Column/Row Visibility** dialog box to return to the Variable Sheet window.

5. In the Variable Sheet, select a Data Source of **Historian**, an Event Type of **Time**, a Sampling Interval of **0**, a Sampling Offset of **0**, and a Sampling Type of **Raw Count**. This Sampling Type is designed to count event archived in the historian, so would be appropriate for some types of pulse counters.

6. Under the Input Tag column, identify an input tag. You may type the name of a tag if it is known, or you may search for a tag using the Tag Search. To use the Tag Search select the Input Tag column; right-click and click **Tag Search**.

7. Search for an appropriate tag, select a tag from the search results, and click **OK**. The selected tag will appear in the Input Tag column.

8. To save the variable, select the ■**Save** icon in the Variable Sheet window toolbar.

Overall Equipment Effectiveness

Overall Equipment Effectiveness (OEE) is a standard performance metric—a tool that objectively measures your production by the performance of your equipment and your personnel. In Plant Applications, OEE measurement can:

- Help you reduce the gap between actual production and what your operations are capable of producing

- Help you "drill down" into areas where improvements can be made, allowing you to increase production uptime, throughput, and quality

The ultimate goal in efficiency management is to achieve 100% in quality, speed, and uptime in your operation. But how do you measure where you are at now, relative to that goal?

OEE rolls up a number of perspectives into a single figure, and provides an easy way to measure efficiency—you can analyze a machine's or a line's efficiency over time, compare it with like units on the same line or in the same plant, or compare your operation to another. Plant Applications' OEE adds the advantage of letting you drill down into your processes in order to discover where improvements can be made.

A small improvement in OEE can mean tremendous savings over time. For instance, if a pulp mill that produces 2000 tons per day improves its OEE by just 1%, it could realize a savings of $2.8M per year (if pulp is $450/ton).

OEE = Availability X Performance X Quality

At its core, OEE combines three separate metrics that measure equipment *availability*, *performance*, and *quality* ("quality" refers to equipment's ability to produce "first-time-right" product). Once these metrics are derived, they are multiplied to arrive at the OEE result, which is a single number expressed as a percentage.

Availability refers to the uptime of equipment during a period for which it is scheduled to run. An availability rate of 100% indicates that the equipment suffered no unplanned downtime.

Performance measures the speed at which the equipment operates, as compared with the speed at which it was designed by its manufacturer to run, or with the results of an engineering department's efforts to increase design speed through retrofits, etc. A performance rate of 100% indicates that the equipment ran at 100% of design speed. In theory, performance speed can never exceed 100%. If it does, then the design speed specification is too low, and should be adjusted accordingly.

Plant Applications takes this fact into consideration in its Performance Calculation and "caps" performance rates at 100% if they exceed this. If your reports constantly show Performance Rates at 100%, then it may be an indication that your design rate targets are too low, should be analyzed and adjusted upwards.

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Quality measures the percentage of "first-time-right" products produced by the equipment, as compared with the total amount (gross production) of product it produced. A quality rate of 100% indicates that the equipment operated at a 0% defect rate.

Generic OEE Benchmarks

OEE is a relative measure, used to gauge improvement or decline in overall equipment effectiveness over time. For example, if one week OEE on a given unit is 73%, and on the next week it is 75%, then the overall effectiveness of the unit has shown improvement. While you will generally find the best use of OEE in this manner, the following table shows some generic OEE reference points, typical across many industries:

OEE Percent	Interpretation
< 65%	Get help now
65 – 75%	Passable, but only if trends are improving
> 75%	Good
> 80%	World class for batch processes
> 85%	World class for continuous processes

OEE in Plant Applications

The built-in OEE functionality in Plant Applications is a refinement of the simple Availability X Performance X Quality formula. It catetgorizes the data from your process, then performs calculations and compares the results against targets to arrive at a percentage rating. For more information on OEE calculations in Plant Applications, see OEE Base Calculations.

Before configuring OEE, be sure you are familiar with the other topics in Proficy Efficiency Management, so that you have an understanding of downtime, waste, and production counting in Plant Applications.

Plant Applications uses *production metrics* to draw on specification, product, event, and other information in order to arrive at OEE in displays and reports. So, prior to configuring production metrics, you must set up:

- Reason Trees

- Production Units

- Products and Specifications

- Production Events

OEE Time Categorization

The most important factor in tracking OEE is accounting for what equipment is doing 100% of the time that it is scheduled or intended to run. In Plant Applications, you do this by capturing all the time when the equipment is up or down—even the time when it is not scheduled to run. You apply reasons to the downtime, and categorize these reasons according to four main categories:

- Unavailable Time

- Outside Area (External Downtime or Line Restraint)

- Performance Downtime

- Unplanned Downtime

Using these four categories, Plant Applications places all equipment time and events into meaningful groupings that are used to calculate OEE.

Once configured, Plant Applications will:

- Subtract the amount of time that is not relevant to the measurement of equipment's effectiveness while it is scheduled or intended to run (Unavailable Time and Outside Area).

- Monitor production and rate, and for given products compare the actual production rate to the production rate target specifications

- Capture events either manually via operator interface (Proficy Client) or automatically via historian tags, which collect appropriate data from the controls system.

- Translate the output from historian tags into downtime reasons—which you have created in reason tree(s) and which have already been appropriately categorized.

The chart below illustrates the fundamentals of how equipment time is handled in Plant Applications, and the following calculations show how each component of the OEE equation (Availability X Performance X Quality) is derived. For more information, see the OEE Glossary and OEE Calculations topics.

Click on chart sections to quickly link to the legend below.
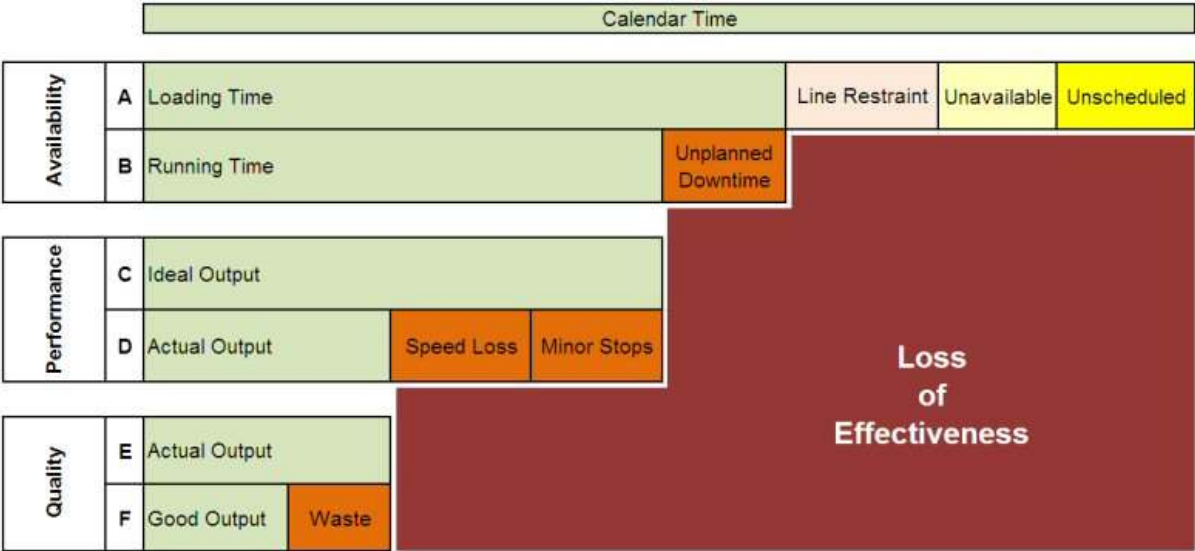
Availability = Gross Running Time (B) / Loading Time (A)
Performance = Actual Output (D) / Ideal Output (C)
Quality = Good Output (F) / Actual Output (E)
OEE is a score assigned to the unit based on the three preceding parameters.
OEE = Availability X Performance X Quality

Calendar Time

Total amount of time being considered.

Unscheduled Time

Proficy does not differentiate this category from Unavailable Time.

Unavailable Time

A built-in category for downtime that represents known periods of time where production is not expected. Such reasons include: weekend, holiday, vacation, plant is closed, unit is down for maintenance.

Line Restraint (Outside Area)

Handling Efficiency

A built-in category for downtime that occurred and was not due to the equipment in question but is attributed to external reasons. Such reasons include: blocking or starving a unit.

Loading Time

The amount of time that a unit is scheduled to run and is ready to run, whether the unit was running or not running.

Unplanned Downtime

A built-in category to represent downtime that does not fall into the following categories (Unscheduled, Line Restraint/Outside Area, or Performance/Speed Loss).

Gross Running Time

The amount of time that a unit was producing product, whether the product was good or not good.

Gross Running Time = Loading Time – Unplanned Downtime

Ideal Rate

The theoretical rate of production for the unit as stated by the equipment manufacturer. If not stated then it is the highest known observed rate.

Ideal Output (Ideal Production)

The theoretical amount of product (good and bad) that could have been produced if the unit had not been "down".

Ideal Output = Ideal Rate X Gross Running Time

Actual Output (Actual Production)

The amount of product (good and bad) that was actually produced by the unit.

Speed Loss

Downtime that was attributed to a slowdown. Speed Loss + Minor Stops = Performance Downtime.

Minor Stops

Downtime that was brief and is not considered downtime. Speed Loss + Minor Stops = Performance Downtime.

Availability Rate

This is a ratio between the amount of time a unit should have been running and how much was it actually running.

Performance Rate

This is a ratio between Ideal and Actual. This is in terms of production amounts or production rates.

Quality Rate

This is a ratio between the amount of Good Production and Total Production

Performance Downtime

A built-in category to represent downtime that was attributed to a slowdown or a minor stoppage.

Downtime Categories

To calculate the components of OEE (Availability, Performance, Quality), Calendar Time is segmented into the Plant Applications downtime categories.

In order to generate meaningful reports, reason trees must be designed effectively to provide further drill-down groupings for each of these categories. For further information, see Reasons and Categories.

OEE Deliverables

The advantage that Plant Applications provides in terms of OEE is the ability not only to derive an OEE percentage that can be used for trend purposes, but also the ability to drill into your operations in order to determine where improvements can be made.

Output is obtained in displays and reports, such as the built-in OEE Summary Report and the OEE by Unit Web Part.

Depending on circumstances, the following are possible Plant Applications deliverables for OEE:

Displays (for manual entry and online reporting)

- Downtime

- Waste

- Product change - includes Production Metric variables (if alarms are configured)

- Alarms (if configured)

Displays are not mandatory, but depend on your needs—though most plants do have some displays. Besides real-time display of data, displays provide an "out-of-the-box" method for manual entry into Plant Applications.

For information on Downtime, Waste, and Alarms, refer to Plant Applications Client Management help guide. For Product change, refer to Plant Applications Product Management help guide.

Reports/Web Applications

- OEE Summary

- Unit Time Accounting

- Event Analysis

- Event History

- Sequence of Events

For more information, refer to Plant Applications Web Reporting help guide.

Web Parts

- OEE by Unit

- Operating Downtime Distribution

- Downtime Top N Charts By Units

- Downtime Distribution Charts By Units

- Waste Top N Charts By Units

- Waste Distribution Charts By Units

- Overview Statistics

For more information, refer to Plant Applications Web Reporting help guide.

Configuring Overall Equipment Effectiveness (OEE)

Handling Efficiency

Plant Applications' OEE functionality is built upon the core *Availability X Performance X Quality* formula. Once configured, Plant Applications captures and categorizes data from your process, then performs calculations to derive availability, performance, and quality rates. When multiplied together, these produce the OEE rate. For detailed information, see OEE Terminology and Calculations.

Requirements for OEE

In order to use Plant Applications' built-in OEE functionality:

- You must have purchased the Proficy Server with the Efficiency module.

- For the OEE by Unit Web Part and OEE Summary report, the Proficy Dashboard and Proficy Web Reports modules are required.

- In cases where you wish to analyze a unit or line that is event based (batch process) and not time based (continuous process), you may require the Quality module. In most cases, however, OEE is calculated for time-based operations such as packaging lines, and this module is not required.

Configuration

Preparing to measure OEE involves the coordination of many areas in Plant Applications, and requires considerable time and planning. Essentially, however, to configure OEE in you will:

- On a unit-by-unit or line-by-line basis—depending on what entity you are measuring—determine your equipment's ideal performance capabilities by product, and set these ideal capabilities as specification targets.

- Configure a variety of historian tags and other data inputs from your process control system to capture downtime, waste, and production events.

- Ensure that Plant Applications is configured to model the production process (i.e., in the Plant Model), and capture and categorize the data in order to facilitate the OEE Production Metric calculation.

- Configure displays for manual editing of Downtime and Waste as required, and for alarming on availability, performance, quality and OEE if alarms are configured.

- Configure reports, such as the built-in OEE Summary Report and the OEE by Unit Web Part, in order to actually view OEE data and drill down into your operations.

Following are the areas involved in configuring OEE in Plant Applications. Each linked topic provides information particular to OEE, and where necessary points you to other sections of Plant Applications Help for further information.

- Data Input

- Reasons

- Specifications

- Production Metrics

- Shifts and Crew Scheduling

- Units, Variables, and Events

Data Inputs for OEE

Historian tags

These are guidelines for configuring historian tags for use in OEE.

For each piece of equipment/line:

- A "product code" tag that indicates the product that is running on that Unit/Line.

For each piece of equipment or line being measured for **availability**:

- A definitive running tag, or a combination of tags to determine whether the equipment/line is definitely running or not running.

- Fault root cause tags, which determine the root cause for the equipment/line not running. "First out" tags are preferred (and are the easiest to configure). Individual fault tags can also be used, but more advanced models must be configured.

For each piece of equipment/line being measured for **performance**:

- A gross production tag for each piece of equipment for "Unit OEE," or a gross production tag that represents the maximum production speed of the line for Line OEE. For example, on a beverage packing line this would come from the Filler, not the Palletizer.

Historian tags that are being used to count production should ideally be counting tags, with a sampling type of "increase" and pre-established reset values that cannot be arbitrarily reset by operators.

For each piece of equipment/line being measured for **quality** (in "time-based" rather than "event-based" situations):

- Defect tags that count defects for the equipment/line (a "defect" represents one unit of product that was not produced "first time right")

    OR

- A gross production tag for each piece of equipment for *Unit* OEE, or a gross production tag that represents the production of the line for *Line* OEE—for example, a Filler.

    And

- A "good product" tag that represents "first-time-right" net production for the equipment or the line—for example, a Palletizer.

    If 400 units are produced by a filler, and 377 units are successfully palletized, then 400 represents gross production, while 377 represents "good product."

Manual Entry

Where information cannot be provided via instrumentation (i.e., historian tags), displays should be configured to provide this necessary input.

OEE: Reasons and Categories

Reasons, Reason Categories and OEE

Ensure that your reason trees are built in a manner that allows you to effectively drill into your process when viewed in reports. Furthermore, ensure that the tree nodes are categorized correctly, as these categories are used to calculate the availability and performance rate metrics which form the basis for the overall OEE calculation. For more information, see Creating Reason Trees and Strategies For Creating Reason Trees. To understand how categories are applied in Plant Applications, see OEE Time Categorization.

All of the time (every second of every day) when equipment is up or down—even the time when it is not scheduled to run—must be captured, given a reason, and categorized. To do this, you develop reason trees that will permit Plant Applications to assign pre-established reasons to all scheduled, unscheduled, or unplanned downtime events. These downtime events will be captured automatically by Plant Applications via its connection to the control system through Proficy Historian. In rare cases downtime events might be entered through manual input. These pre-established reason tree nodes are grouped into four main categories for the OEE calculation (and other Production Metrics), and for reporting purposes. These are:

Handling Efficiency

- Unavailable Time

- Outside Area

- Unplanned Downtime

- Performance Downtime

The Performance Downtime category is considered a production speed issue, and is assigned in the Production tab of Production Metrics.

See the Glossary for definitions of these categories. For information on attaching categories to reason trees, see Creating Reason Trees.

OEE: Specifications

Production Rate

The Production Rate specification contained in the Production tab of the Production Metrics is used by Plant Applications to calculate the Ideal Production Rate used in OEE calculations.

There is a tight correlation between the production rate specification and products. Products are assigned to production units to signify that these are the possible products that can run on those units. Specification variables are attached to production units, and also assigned to a characteristic which represents the product. The end result is a Production Rate specification that indicates the ideal rate that a product should be able to run on that unit or line. The specification is a rate and is therefore written as product units per time of measure, for example, 40 bottles per minute. In Production Metrics, you choose the time units (per day, hour, minute, or second) that actually determines the rate. This specification must be configured in order for Plant Applications to calculate OEE.

For information on configuring specifications for production metrics, see Specifications for Production Metrics Alarming.

To Configure the Production Rate Specification for OEE:

For detailed information on creating specifications, see Building a Plant-level Recipe or Product Specification, found under Product Management in the Plant Applications Help Contents.

As an example, you have a product called "Bottled Product 1," for which you want to calculate OEE. To configure a production rate specification:

1. Under **Product Management** in the Server Manager tree, create a Product Property as a Generic/Quality property and name it something like "Rate Specs."

2. Create the Generic/Quality characteristic "BP1."

"BP1" represents Bottled Product 1. If there was a Bottle Product 2, you would also create a BP2 characteristic, and so on for each product.

3. Create a specification variable for the target.
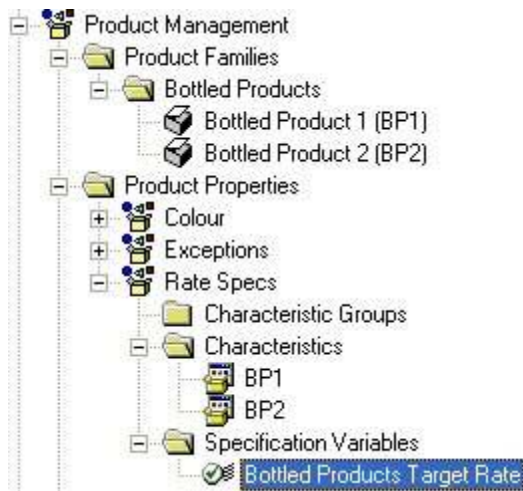
4. Enter the target rate for the property/characteristic. For additional information, see How To Map Products To Units.

5. Right-click the assigned unit in the Plant Model and choose **Edit [Unit Name] Propertie**s. In the **Unit Properties Configuration** dialog box > **Production Metric**s tab > **Production** tab, choose "Bottled Products Target Rate" as the Production Rate Specification. Here, you also specify the time factor, which determines the rate in Production Rate Time Measurement Units. In other words, if the specification is 40 bottles per minute, you would choose "Minute" as the Time Units. If the specification was 2400 (60 X 40) per hour, you would choose "Hour" as the Time Units. For more information, see Production Metrics.

OEE: Plant Model, Variables, & Events

Plant Model

The Plant Model is the basis for all operations in Plant Applications. To configure OEE you must create a department, production line, and at least one production unit with the following related elements:

- A variable group containing appropriate variables
- Event models for product change, downtime, and waste
- Central or local specifications for ideal or design speed by product
- Products assigned to the production unit
- Reason trees configured
- Downtime and waste displays configured for manual edits on that production unit
- Production metrics appropriately configured (for each production unit on which OEE will be calculated)

For details on configuring the Plant Model, see Configuration Process Overview and The Plant Layout and Efficiency Management.

Variables

Variables provide one of the interfaces between incoming data sources and Plant Applications. There are many data sources with which variables can interface including historians, flat files, ODBC sources, OPC servers, other variables, etc. Typically, however, the Proficy Historian is used as the data source.

Use of a Variable for Gross Production to Calculate Performance Rate and Net Production

A typical "time-based" or continuous process efficiency configuration has a variable configured to hold gross production counts with the speed or design rate specification likely attached to that variable (packaging lines, which are ideal candidates for using the OEE metric for analysis, are typically time-based or continuous in nature). Variables can also be used to count gross production for batch or event-based processes. Usually, however, production counts on processes configured for production events are derived from the Dimension X field, which includes the engineering unit (e.g., lbs.) for the product produced, and not from a variable.

Use of Variables for Waste to Calculate Quality Rate

Variables can be used to capture OEE defects (Waste). It is not necessary to put the values into variables unless you are going to use these variables for other display or calculation purposes. These variables can be used as input tags (local historian) to a Waste model that will have to be configured. Alternatively, the input tags can come directly from Proficy Historian. The downside to putting the values in variables that you may have no other purpose for is the use of unnecessary space in the database.

If you choose to use variables there would be two methods to achieve this:

- Configure a variable(s) attached to Historian tag(s) that captures actual defects as detected by the control systems. This could be one or more variables as there could be more than one waste location. If more than one, then a calculation variable would also have to be configured to sum the defect counts of all variables into one total for the unit or line. This usually provides the most accurate result but is not often used as most control systems do not have sufficient field instruments in place provide an accurate count of total waste defects for the unit or line in question. In order to get the data from this single waste or total calculation variable into the correct table (Waste_Event_Details) two methods are possible:
  - The Waste Event Model 5011 can used and configured with the variable being used one of the input tags. Optionally a waste reason can also be configure with this model. A model 301 could also be used in the same fashion.
  - Another calculation can be created using Stored Procedure as the Calc type and the Sample5014_Calc Stored Procedure as the actual Stored Procedure. (search for it when setting up the calc). The waste variable will be used as one of the input tags. Optionally a waste reason can also be configure with this calc. This calc will work with either Time Based or Event Based Waste.
- Configure a variable attached to an Historian tag that captures Net Good Product. This would represent "first-time-right" products that were produced by this unit. Assuming that you have already configured the Gross Production variable mentioned above, you need to configure a calculation variable to calculate defects.

Gross Production – Net Good Product = Waste

Again, a Waste Model 5011, Waste Model 301 or Sample5014_Calc Stored Procedure would have to be used to populate the calculated Waste in the variable to the Waste_Event_Details table.

Event Models

Following are guidelines for configuring event models for use with OEE, and for production metrics in general.

For Availability:

Configure a downtime model, attach reason trees, and populate a fault translation table. Optionally, configure actions and reason shortcuts. Although manually populating the fault translation table is possible, use import/export tools to Excel (available in the Fault Translation tab) to populate larger numbers of faults.

The downtime model you use depends upon the tags collected in the historian, and how much additional logic is required. The simplest downtime model is Model 200 (used for a single "first out fault tag," that provides all running and fault logic in one tag). Model 210 is often used when logic has to be configured via VB script to establish downtime fault logic. Models 211 and 212 can also be used, but are usually used for Master/Slave Plant Model configurations. See Downtime Models 200, 210, 211, 212 for descriptions of these models, and to determine whether they fit your circumstances.

For Quality (Defects):

Defects configured from two input tags:

This presumes that you have two tags, and that when the value of the first tag is subtracted from the value of the second tag, the result is total defects for that timestamp. The input tag usually represents gross production, and the output tag net production. Waste Model 300 can be used to configure these two tags into a Waste Event. The waste would then be added appropriately in the Waste_Events table and the calculation of the OEE metric would use it to derive Quality rate.

Defects configured from one tag:

This presumes that you have one tag to represent defects on the unit. If the control system has good defect information and if it supplies it at more than one location, then the sum of these locations could be combined into one tag, and that tag could then feed this model. The tags could be summed either on the historian side (if the calculation collector is enabled on the historian), or on the Plant Applications side (in a calculation variable). Once in a variable, the appropriate Waste Event Model would attach this variable by using the "local" historian for the tag (variable) search.

Waste Model 301 or 5011 would be used for defects configured from one tag.

Product Change:

Configure Model 100 (Models 100 through 117 are possible depending on your needs). A Model 100 is often used if product change is derived from watching the change of one tag.

For those with some Stored Procedure programming experience, and wanting maximum flexibility or control over Product change logic, a Model 601 is often used. This would require a Stored Procedure to be written to support the model and write the product change to the Production_Starts table.

Configure a product cross reference, if the code delivered from the product change model above does not match the product code configured in Plant Applications. For example, the control system might call a product "123," while Plant Applications uses a product code of "SCool1." In this case, you would cross reference 123 to SCool1.

For Batch Processes:

Configure a production event model if production events are being used (these typically are not used for time-based or continuous lines). The Production Management Module is required in order to use production event models.

Once configured, OEE calculations will get gross production and product produced engineering units from Dimension X of the Events table for that production unit. In this case, a gross production variable would not have to be configured for performance rate purposes.

OEE: Production Metrics

See Production Unit Properties – Production Metrics for details on navigating to Production Metrics, and an overall description of production metrics configuration.

Production metrics are configured for units in the Plant Model. Right-click a unit, choose Edit [Unit] Properties, and then in the Production Unit Properties dialog box click the Production Metrics tab. In this tab, there are four more tabs:

Handling Efficiency

- Downtime

- Efficiency

- Production

- Waste

The calculation of OEE requires the configuration of at least the Downtime, Efficiency and Production tabs. Prior to configuring Production Metrics for OEE, ensure that you have set up:

- [Reason trees](#)

- Products and production rate [specifications](#)

- [Plant Model, variables, and events](#)

You can also configure alarms to fire based on specification limits in any or all of the Production Metrics areas. For further information, see Production Unit Properties: Production Metrics.

Downtime Tab

The OEE downtime categories—Unavailable Time and Outside Area—are attached in the Downtime tab.

1. In Unavailable Downtime Category, choose Unavailable Time.

2. In External Downtime Category, choose Outside Area.

3. In Availability Downtime Percent, choose the variable you configured with a target the downtime specification.

Efficiency Tab

- Ensure that Use Standard Efficiency Calculation is selected. The other option, Use Efficiency Calculation Variable, is used if you derive OEE from a custom calculation stored in a variable. For further information, see Production Unit Properties: Production Metrics.

Production Tab

1. If production events have been configured for this line or unit, select Production is Accumulated From Event Dimensions. If you have configured a variable to collect gross production amount data, select Production is Accumulated from a Variable.

2. If you assigned some reasons to the Performance Downtime category as you set up your reason tree, choose it from the list in Performance Downtime Category.

   Performance Downtime factors into OEE by including speed changes in downtime calculations. This is useful in cases where a line does not actually go down, but rather slows by varying degrees from its target performance. For more information, see [OEE Time Categorization](#).

   Performance Downtime is optional and is used if you have a method for tracking minor stops or other issues involving speed decreases.

3. In Production Rate Specification, choose the specification variable in which you set up the target for ideal production rate by product. For more information, see [Specifications](#).

4. In Production Rate Time Units, select the unit of time corresponding with the Production Rate Specification in the previous step.

OEE: Shifts and Crew Scheduling

If you require OEE reporting by crew or shift, then crews and shifts must be configured. For more information, see Administering Crew Schedules.

If you do not configure crews and shifts, then the following site parameters are used to determine shifts.

- Shift Offset
- Shift Interval
- End of day hour
- End of day minute

For more information, see Plant Applications Site Parameters.

OEE Reference

OEE Calculations Glossary

Plant Applications performs a variety of calculations in order to arrive at OEE. See OEE Calculation Example.

Availability

Categories:	Description:
Unavailable Time	A built-in category to denote downtime reasons that could fit into the following classifications: Planned Downtime + Unscheduled Downtime. All types of downtime that occur when a unit is not intended or scheduled to run.
Outside Area Time	A built-in category in Plant Applications to denote downtime reasons that could fit into the following classifications: Line or unit restraints such as blocked and starved conditions. These downtime reasons occur when a unit is scheduled to run, but the unit or production team should not be held accountable for these downtime issues as they are "outside area" or outside their area of control.
Unplanned Downtime	A built-in category in Plant Applications to denote downtime reasons that could be classified as unplanned (e.g., neither Unavailable Time nor Outside Area nor Performance Downtime). Downtime reasons that fit into the category are those that occur while a unit is scheduled to run, and are downtime stoppages that can be attributed directly to equipment that is running or under the control of—and therefore attributed to—the production team that is operating the equipment. Issues of speed such as minor/micro stops or slowdowns do fall into the Unplanned Downtime category, and are considered performance or "speed" issues.
Performance Downtime	A built-in category in Plant Applications to denote downtime reasons that could be classified as machine speed issues, such as minor or micro stops and slowdowns.
Calculated Times:	**Description:**
Loading Time	Calendar Time - Unavailable Time - Outside Area. The time a unit is scheduled to run less Outside Area downtime.
Gross Running Time	Loading Time - Unplanned Downtime

Run Time	Loading Time - Unplanned Downtime - Performance Downtime. The amount of time a unit is "actually" available after unplanned downtime is removed while it is scheduled to run. Same as Available Time, Uptime.
Calculated Rates:	**Description:**
Availability	Gross Running Time / Loading Time.

Performance

Production Data:	Description:
Total Production for Production Events	Sum (Initial Dimension_X)
Total Production for Timed Events or Continuous Process	Sum (User Specified Production Variable that collects Gross Production)
Calculated Production:	**Description:**
Net Production	Actual Production – Waste
Total Production	Total Production (as defined under **Production Data**), including waste
Performance Rate Specification:	**Description:**
Ideal Speed Rate or Design Speed	Ideal production target rate specification for this product on a production unit, as configured in Product Management. This reflects the ideal speed that this unit can produce this product (e.g, 40 bottles per minute on Machine A for Product Q).
Ideal Production	Ideal Speed Rate (by product) X Gross Running Time (by product)
Calculated Times:	**Description:**
Speed Loss in Time	(Ideal Production – Total Production) / Ideal Rate
Performance Downtime	Sum of all actual fault durations that have reasons with the Performance Downtime category assigned to them during the reporting period.
Runtime	Gross Running Time – Performance Downtime
Calculated Rates:	**Description:**
Performance	Total Production / Ideal Production
Speed:	**Description:**
Actual Speed Rate	Total Production / Gross Running Time. When product changes occur within the reporting period and each has different speeds, the average is prorated by product.
Speed Loss in Time	Actual Speed Rate / Ideal Speed Rate

Quality

Calculated Production	Description:
Net Production	Total Production – Defects
Calculated Rate	**Description:**
Quality Rate	Net Production / Total Production
Category	**Description:**
Waste	Any produced product that is not "first time right" (the number of products produced with defects).

OEE

Calculated Rate:	Description:
OEE	Availability Rate X Performance Rate X Quality Rate

OEE Calculation Example

Plant Applications performs a variety of calculations in order to arrive at OEE rates.

This is a sample calculation, with time shown in minutes. See the Glossary and the Time Categorization topics for explanations of terms:

Configuration Data	
Ideal Rate	10 (units per min)

Actual Production Data	
Total Production	1050 units
Good Production	1043 units
Waste (Defects)	7 units

Time Categorization	Minutes
Calendar Time	125
− **Unavailable Time**	- 0
= **Loading Time**	= 125
− **Unplanned Downtime**	- 5
= **Gross Running Time**	= 120
− **Performance Downtime**	- 25
= **Run Time**	= 95

Handling Efficiency

– Speed Loss (Ideal Production – Total Production) / Ideal Rate)	- 15
= Duration at Design Speed	= 80
Ideal Production (Ideal Rate * Gross Running Time)	1200

Availability Rate = (Gross Running Time / Loading Time) X 100	= 96.00%
Performance Rate = (Total Production / Ideal Production) X 100	= 87.50%
Quality Rate = (Good Production / Total Production) X 100	= 99.33%
OEE = Availability X Performance X Quality **=** .96 X .8750 X .9933	= 83.44%

Setting Up User-Defined Events

You must have an Efficiency Management module license to configure User-Defined Events.

A User-Defined Event (UDE) is a generic, manually recorded event used to document important occurrences related to process operations. UDEs could be major maintenance items, routine maintenance items, process checks, shift notes, or any other event important to later analysis. UDEs are defined as unique subtypes.

A UDE can be set up to report Production status in an Autolog and also to lock data related to a status.

Relationships

Unit: The major piece of equipment to which the event is attached.

Event Subtype: A unique configuration representing the specific type of User-Defined Event, for example, a Pump Change or Shift Notes. Subtypes are created ahead of time for use when configuring a UDE.

Location: The specific piece of equipment (equipment module) along a Production Line with which the UDE is associated.

Cause Reasons: The reasons thought to be the cause of the UDE.

Action Reasons: Reasons identifying any corrective action taken.

Process for Setting Up a UDE

These topics describe how to configure a UDE:

Step 1: Create a UDE.

Step 2: Create a new model for the UDE.

Step 3: Configure the UDE on a Production Unit. (To set up Production Statuses for UDEs, refer to Setting Up Production Statuses for User-Defined Events.)

Step 4: Configure variables to update when the UDE is triggered.

Legacy Reports

The following legacy reports give useful information:

- Efficiency Statistics by Unit
- OEE Summary Web Report
- Unit OEE Web Part