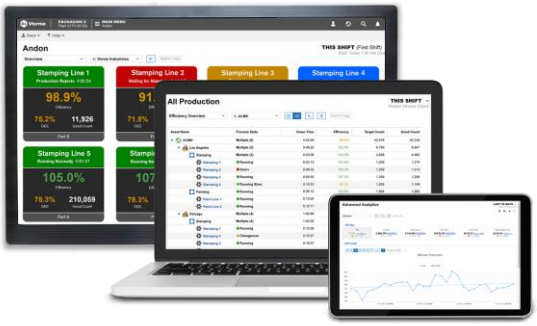

Meet XL

XL Version 2.18

Audience: This guide is for anyone that wants to get a deeper understanding of the XL platform.

Purpose: Introduces you to XL and provides a top-level view of key features.

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How to Contact Us

Need help? Contact us from 8:00 AM to 6:00 PM Monday to Friday CST (UTC-6:00).

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We also have an extensive network of international partners. View them at www.vorne.com/partners.

Important User Information

XL products are not designed or intended for control applications and MUST NOT be used for control applications under any circumstances. There are fundamental differences in the design methodology of a control product such as a Programmable Logic Controller (PLC) and a non-control product such as an XL device. Outputs (e.g., relays) are provided for annunciation only, and MUST NOT be used for control purposes.

This product is designed and intended for use solely in indoor industrial applications and MUST be installed by a qualified electrician. This product is designed and intended for use solely in a secure, private network environment. It is the responsibility of all persons applying this product to a given installation and/or application to carefully review the installation and/or application to evaluate and ensure the suitability of this product for the intended application.

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XL Platform

XL is a productivity improvement platform with over 25,000 XL devices installed across 45 countries.

We pride ourselves on the ease of our platform and a simple, cost-efficient implementation. Start small with a single unit on a 90-day free trial. If XL works for you, expand to a department, then site, then entire enterprise. Your upfront commitment is minimal, and expansion is on your timeframe – not ours.

As you add more XL devices, they communicate with each other using our patented technology to provide you with complete information and integrated reporting. You can also connect XL devices to XL Enterprise cloud services for an even more integrated experience.

Summarized in the sections below, the **XL Platform** consists of three parts:

- XL Productivity Appliance™
- XL Enterprise™
- XL Integration Tools

XL Productivity Appliance

The **XL Productivity Appliance** (XL810, XL610, XL410, or the XL HD) is an IoT device that monitors a single manufacturing process. XL devices are unique because they work equally well as stand-alone devices, networked devices in your internal network, or edge computing devices connected to XL Enterprise. Every XL Productivity Appliance™ includes the following features:

The **production monitor** snaps onto your existing manufacturing process with just one or two sensors. From this simple integration, XL generates 120 metrics (numeric values) and 20 dimensions (descriptive values). More importantly, it delivers a comprehensive view of production and productivity.

The **data warehouse** stores the production data XL collects in a SQL database and makes that information available to you via reports, dashboards, export templates and the XL API. One of the paramount XL design goals is to always make the underlying data easily accessible and immediately available to you and your team.

The **scoreboard** provides instant feedback for your plant floor team so they can "win the shift". The only difference between XL models is the scoreboard. Every XL collects the same in-depth information and provides the same in-depth reporting.

The **reports** engine provides instant access to over 50 built-in reports organized as pages and views. Views can be built-in (shipped with the device), shared (created by a user and shared with others), or local (created for personal use).

The **dashboards** engine enables you to create an unlimited number of custom reports. Combine chart, table, chronogram, KPI, and KPI group widgets in dashboards to create your own reports. Dashboards can also roll up data from multiple XL devices.

The **settings menu** allows you to configure and adapts XL to your application. The nuts and bolts of this console are covered in the **Configure XL** Guide.

XL Enterprise

XL Enterprise, a separate SaaS (Software as a Service) application developed by Vorne that runs on Amazon Web Services, provides optional free and paid cloud-based services that extend the functionality of XL. XL Enterprise currently provides three free services:

Alerts: monitors production in real-time to deliver email and text messages that help your team drive action when it's needed – right away. Create alerts based on metrics (e.g., OEE below 75%), production states (e.g., down more than 15 minutes), and targets (e.g., changeover 5 minutes over target time). Automatically escalate as the severity of the situation increases.

Reports: emails you production reports at the end of each shift. Select from built-in templates with options to customize. Templates can focus on a single work center or aggregate information from multiple work centers.

Updates: makes it easy to take advantage of new features released for the XL Productivity Appliance™. Each time a new software update is available, the XL Productivity Appliance automatically downloads it – ready to be applied at a time of your choosing.

XL Integration Tools

XL Integration Tools make it easy for you to integrate XL with your other systems and applications. The XL platform includes built-in tools, the XL API for programmatic integrations, and third-party tools to help you create specialized integrations and customizations unique to you. Our recommendation is to start simple and add integrations once XL is firmly established and adding value to your day-to-day operations.

When you are ready, there are three types of integrations:

Built-in tools enable XL to use information from your existing systems with minimal investment of time or money. For example, XL can be configured to respond to your existing part and job barcodes, and you can import parts and jobs using simple spreadsheets. Built-in integrations are particularly useful for smaller companies with limited IT resources.

The **XL API** is a REST-based interface that enables you to directly integrate XL with other systems and applications (e.g., ERP applications). The XL API is particularly useful for larger companies with well-staffed IT departments that want total control over integration projects.

Third-party tools are products and services offered by partner companies. Examples include PLC integration, ERP integration, and local SQL databases to integrate to your enterprise reporting platform. This is a great choice for any company that wants to leverage standard products to accelerate progress. Learn more about third-party tools at www.vorne.com/tools.

TIP

XL is continually improving – with new features released every few months. To see the latest features, visit **www.vorne.com/new.**

Our team is here to help. Please contact us with any questions.

How XL Categorizes Time

XL assigns every moment of time to an **impact** value, **production state**, and **reason;** impact directly affects how **metrics** are calculated**.** This provides a consistent way to view information, perform analytics, and generate reports. Time categorization starts with a reason which can be added by users.

Impact	Production States	Reason (Examples)	Metrics
Run	**Running**	Running Normally	Affects OEE, TEEP, Target Count, and Labor metrics via Performance and Quality Loss
	Running Slow	Slow and/or Small Stops	
	Running Poor Quality	Running Poor Quality	
	Running Poorly	Slow with Poor Quality	
Unplanned Stop	**Down**	Missing Reason, Breakdown, Jam, No Material, No Operator	Affects OEE, TEEP, Target Count, and Labor metrics via Availability Loss
Planned Stop	**Changeover**	Changeover, Part Change	Affects OEE, TEEP, and Labor metrics via Availability Loss
	Maintenance	Cleaning, 5S, General Maintenance	
Not Scheduled	**Meal/Break**	Break, Lunch	Affects TEEP metrics via Schedule Loss
	Meeting	Shift Handover	
	No Production	Optional Shift Scheduled, Shift Ended Early	
	Not Monitored	Powered Off, Upgrading	

Impact provides a top-level perspective aligned with how time affects productivity metrics.

Production State provides a standardized and uniform way for XL to describe what is happening at the manufacturing process from a "best practices" perspective. This standardization enables consistent reporting and seamless integration with third-party tools.

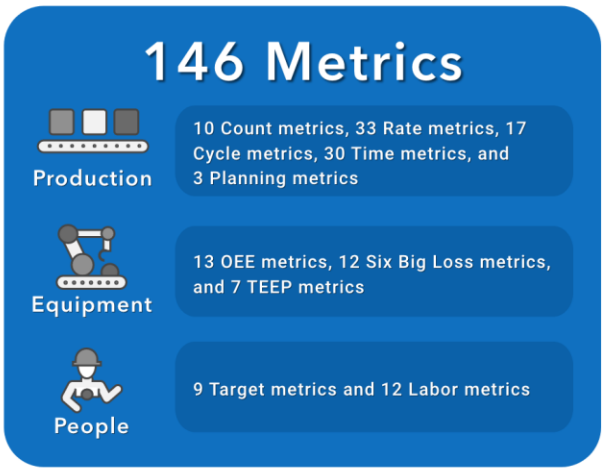
Reason describes time from your perspective – using terms that are familiar to your company. Reasons are particularly valuable for capturing information with a greater level of detail – enough detail to help you address losses and drive improvement. You can define an unlimited number of reasons. Reasons can be provided by XL (e.g., Running Normally), by operators (e.g., No Material), or by integrations (e.g., from a PLC).

Metrics and Dimensions

XL organizes production data as either a metric or dimension.

- **Metrics** are numeric values that measure a quantitative characteristic of production, such as Good Count, OEE, or Labor Efficiency.
- **Dimensions** are descriptive values that refer to a qualitative attribute of production, such as the Shift, Work Center, or Hour.

For a complete list of metrics and dimensions with descriptions refer to Appendix A and Appendix B.



How XL Aligns Time

XL aligns time-based dimensions with your shift schedule to make reports more consistent and easier to understand, especially across work centers.

Weeks are captured as **production weeks**. Production weeks always run from Monday to Sunday to provide consistency when aggregating information across multiple time zones and geographical areas.

Days are captured as **production days**. Production days are based on shift boundaries to ensure that shifts that cross midnight don't get split across two days in reports. You can configure XL to begin your production day with the last shift before midnight or the first shift after midnight. You can visually see this in the time schedule, which shows each shift within its associated production day.

Shifts are captured as **shift** and **ordinal shift**. Both of these reference the exact same periods of time. Shift uses the names you configure for each shift (e.g., Shift 1 or AM Shift). Ordinal shift is automatically assigned by XL and represents the order of shifts within a production day (e.g., 1st Shift of Day). Ordinal shift makes it much easier to align shifts across work centers in reports.

Hours are captured as **shift hours** (e.g., Shift Hour 1, Shift Hour 2). Shift hours are relative to the beginning of the shift. For example, the first hour of each shift is Shift Hour 1. This makes it easy to compare information across shifts (such as that all-important first hour, which often makes or breaks a given shift). It also makes it easier to align data across time zones since even with different start times shifts can be compared hour-by-hour.

Run Detection and Cycles

XL **Automatic Run Detection** continually monitors and analyzes the cycle input to determine if the manufacturing process is running or down and if it is running, how well is it running (i.e., what are the losses from slow cycles and small stops). If this is a poor fit for your application (e.g. your process does not create cycles, or your cycle times span multiple hours), use the **Deploy XL: Manual Run Detection** guide for more information.

There are three configurable thresholds found in **Settings > Plant Floor > Parts and Run States**

Threshold	Default	Description
Ideal Cycle Time	1.0 second	The theoretical fastest possible cycle time. Set for each part. It is extremely important that this value be accurately set as it is used to calculate OEE Performance. Refer to the **Collect Accurate Data** chapter for more information. (Found in **Parts**)
Small Stop	500% of ICT	Differentiates between run cycles and small stops. One value applies to all parts. Set as a percentage of Ideal Cycle Time. (Found in **Run States**)
Down	3 minutes	Differentiates between small stops and down. Set for each part. Note that this threshold, as well as the small stop threshold, does not affect your overall OEE score. Instead they merely change the type of cycle loss and the balance between cycle loss (OEE Performance) and down time loss (OEE Availability). (Found in **Parts**)

XL can also monitor and analyze the cycle input to detect transitions from one production state to another. This can be configured to be as simple as detecting cycles or as complex as having to maintain a configurable speed for a configurable number of cycles.

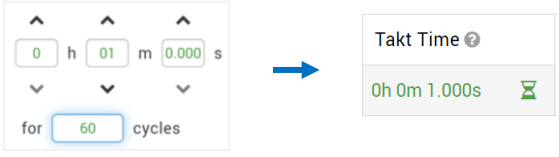
Threshold	Default	Description
Running	After 1 cycle	The Running setting used by XL to automatically detect when the process transitions from down to running. When this threshold is met you should be reasonably confident the process is running.
Definitely Running	When avg. speed is 50% of ICT across 10 cycles	The Definitely Running setting is used for features like automatically exiting changeovers or detecting when a shift has started early. When this threshold is met you should be very confident that the process is running.

Ideal Cycle Time vs. Takt Time

It is important to understand the difference between Ideal Cycle Time and Takt Time. Both represent the duration for one cycle and are set per part, but they have vastly different purposes.

Value	Drives	Description
Ideal Cycle Time	OEE Performance	The theoretical fastest possible time to complete one manufacturing cycle. Includes no "budgeted" losses whatsoever.
Takt Time	Target Count & Efficiency	The expected time to complete one manufacturing cycle. Includes "budgeted" losses for down time, small stops, slow cycles, and rejects. Once Takt Time is correctly set per part, it applies every time that part is run and an Efficiency of 100% or better represents a "Win" for your team.

The easiest way to calculate Takt Time is to think of your expected rate per minute or rate per hour and use the built-in calculators to help convert this to a time per cycle.



Data Warehouse

Each XL device stores the production data it collects in its own embedded database. This means that there is no requirement for you to install a dedicated server or SQL database.

One of the paramount XL design goals is to always make the underlying data easily accessible and immediately available to you and your team. The data warehouse supports this by providing many ways for you to access your data.

Access Method	Description
Reports	XL includes a sophisticated reporting engine, which runs in your browser, and includes over 50 built-in reports organized as pages and views. Many of the reports are configurable on-the-fly with controls for exploring your data.
Dashboards	It is easy to create custom reports using point-and-click tools included in every XL. Use widgets (andon, chart, chronogram, event list, KPI, KPI group, pivot table, table, and top losses) to organize information in whatever way is most helpful to you and your team.
Export Templates	Create any number of Excel® export file templates (another dashboards feature). Each export template includes the metrics and dimensions that you select organized as tabular data – ready to export as an Excel® file.
XL API	Use our REST API to programmatically access information from XL devices. You can access raw "table" data as well as business-ready "channel" data. Please note that the XL API is subject to change as we continue to add to and improve the XL platform.
Backup	You can instantly create a backup of your production data with a single click from the XL browser interface (**Settings > Management > Backup and Restore**).

Scoreboard

The scoreboard always reflects the current state of your manufacturing process. It provides your operators with contextual information that guides their actions towards "winning the shift".

The run screen is displayed when **running** normally. The default screen shows TAED (Target, Actual, Efficiency, Down) so your operators can easily see what they have produced and if they are winning the shift (Efficiency ≥ 100%). If you prefer different metrics, the run screen can be configured (**Settings > Device > Scoreboard**).

If the line goes **down**, your operators are immediately prompted with a message that includes event down time and a reminder to scan a Down Reason. Note: the Reason can be scanned any time before the next down event.

If Run Variants are enabled, when **running slow**, **running poor quality**, or **running poorly** (which is running slow with poor quality), your operators will be prompted in real-time so they can respond immediately.

When a **changeover**, **maintenance**, **meal/break** or **meeting** starts, your operators are prompted with a target and remaining time (if so configured) to help them stay on target.

Reports

XL includes over 50 built-in standard reports organized as pages and views:

- Each **Page** presents information with a different layout and visual design. (see summary below)
- Each **View** captures a different perspective on a page using the controls for that page. For example, the All Production page rolls up metrics across your work center hierarchy and includes 17 built-in views, such as Production Overview, Cycle Time Audit, OEE Factors, and Hidden Factory.

Built-in report pages are featured in Appendix C and summarized below.

Report Page	Description
Advanced Analytics	Dynamically explore data through an interactive set of KPI, chart and table widgets. Includes 17 built-in views.
All Production	View rolled-up real-time and historical production data for every work center, area, and site. Includes 17 built-in views.
Andon	View the real-time status of every process with a colorful page suitable for display on a large format television or monitor. Includes 6 built-in views.
Changeover	Deep dive into changeovers with instant analytics and answers to key questions.
Down Time	Deep dive into down time and its underlying reasons.
OEE	Deep dive into OEE and its underlying factors: availability, performance, and quality.
Performance Loss	Deep dive into performance loss and its underlying constituents: cycle loss and small stop loss.
Quality Loss	Deep dive into quality loss and its underlying constituents: startup rejects and production rejects.
Six Big Losses	Deep dive into the six big losses: down time, planned stops, cycle loss, small stops, startup rejects, and production rejects.
Teams and Labor	Deep dive into teams (an analytical dimension) and labor (metrics).
TEEP (Hidden Factory)	Deep dive into TEEP, which fully exposes your "hidden factory" by extending OEE with utilization and schedule loss.
Timeline	View the state of multiple work centers over time on a synchronized timeline. Includes 6 built-in views.
Top Losses	View every loss that impacts OEE, ranked and prioritized by how much production time was lost, with additional details for each loss.
Total Production Timeline	View the state of the manufacturing process over time, including production state, shift hours, shifts, and part runs.
View Comments	Analyze comments to identify follow up and improvement actions – or simply to verify that your team is following your policies for capturing comments.

Dashboards

In addition to built-in views, XL includes a powerful engine for custom reporting via Dashboards. Each Dashboard starts as a blank page, allowing you to add any widget combinations and control the dashboard layout. All dashboard widgets are enterprise-aware, so every widget can include data from one or more Work Centers in your hierarchy.

Dashboards are also where you create data export templates. Simply create a table with the desired dimensions and metrics, and XL automatically provides an option to export it as an Excel® spreadsheet.

See Appendix D for step-by-step instructions to create custom Dashboards.

Overview

XL Enterprise™ is a cloud application that provides free and paid services that extend the functionality of XL Productivity Appliance. None of the services are required. XL can fully function without XL Enterprise. Free services include:

- Alerts (real-time email alerts for conditions you configure).
- Email Report Templates (automatically delivered reports at the end of each shift).
- Enterprise Hierarchy (central management of the asset hierarchy across multiple devices).
- Updates (software updates delivered directly to XL devices and installed at your convenience).

Refer to the **Configure XL** guide for information on how to link XL devices to XL Enterprise.

IT NOTE

XL Enterprise receives real-time production information from your XL devices. However, it does **not** store this production data for any extended period. Once the alert or report is sent, the associated data is automatically deleted from XL Enterprise.

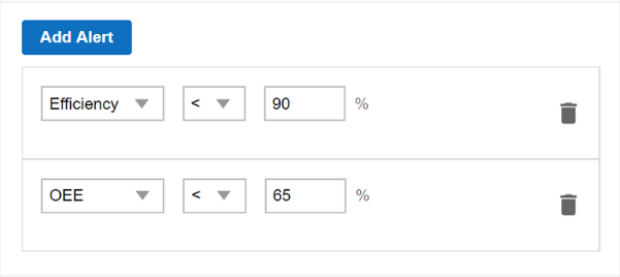
Alerts

The alerts service monitors production in real-time and delivers notifications to your team to help you drive immediate action. There are three types of alerts:

Alert Type	Description	Example
Metric	Monitor normalized metrics such as Efficiency and OEE for the current shift. A typical application is to be alerted if your team is not on track to win the shift.	Efficiency < 95%
Production State	Monitor duration of production state events. A typical application is to be alerted to long down events.	Down > 15 minutes
Target	Compare duration of an event to its target. A typical application is to be alerted to changeovers that take longer than expected.	Changeover 5 minutes over target

Setting up Alerts in XL Enterprise is easy:

- Admins define Alerts that apply to every linked XL Device in the organization (these are subject to User access level limitations).
- Admins create Users and assign them access to applicable levels of the Organization Hierarchy.
- Users subscribe to the Alerts and Work Centers that are most relevant to their area of responsibility.



TIP

We recommend starting with a small number of alerts that represent critical scenarios where attention is clearly needed. Otherwise, alerts can quickly become "noise" that is ignored.

Email Report Templates

XL Enterprise can automatically email you production reports at the end of each shift. You can select from built-in templates, or you can create your own. Templates can focus on a single work center or aggregate information from multiple work centers.

Availability Loss Detail

Enterprise

This is the First Shift report for Thursday, June 30, 2022.

Aggregated Downtime

Availability	Down Time	Planned Stop Time
42.8%	0:26:10	0:01:00

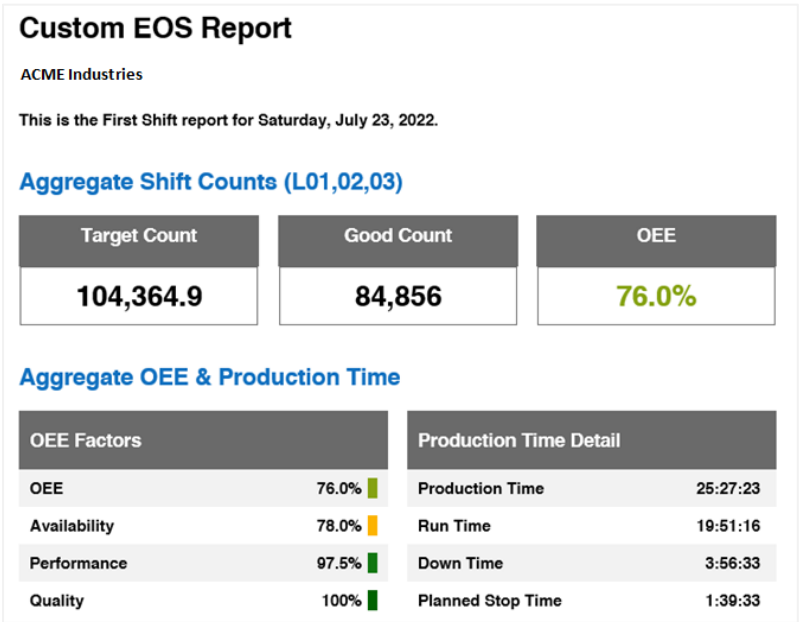
Production Time Detail

Work Center	Availability	All Time	Run Time	Down Time	Planned Stop Time	Not Scheduled Time
Line 1	42.8%	3:02:31	0:20:21	0:26:10	0:01:00	2:14:59

Built-In Views include: Availability Loss Detail, End-of-Shift Report, Part Rate Summary, and Plant Shift Overview

Custom XL Enterprise Reports

XL Enterprise allows select customization of reports sent at the end of each shift. This flexible platform, similar to the Dashboards feature in XL, leverages KPI, KPI Group, and Table Widgets for nearly unlimited data delivery to your doorstep.



Custom EOS Report

ACME Industries

This is the First Shift report for Saturday, July 23, 2022.

Aggregate Shift Counts (L01,02,03)

Target Count	Good Count	OEE
104,364.9	84,856	76.0%

Aggregate OEE & Production Time

OEE Factors	
OEE	76.0%
Availability	78.0%
Performance	97.5%
Quality	100%

Production Time Detail	
Production Time	25:27:23
Run Time	19:51:16
Down Time	3:56:33
Planned Stop Time	1:39:33

Overview

While fully functional and valuable on its own, the XL platform offers a wide range of **Integration Tools** to meet your data integration needs with external systems.

Built-In

Built-in integration tools use information from other systems without having to establish direct connections to those systems. They are particularly useful for smaller companies with limited IT resources. Built-in integration tools include:

- **Part Lookup**: If your product packaging or work order includes a barcode representing the unique part, XL can be configured to automatically start a part run when that barcode is scanned.
- **Job Lookup**: Alternately, if your work order includes a job barcode generated by your ERP/MES system, XL can be configured to automatically start that job when that barcode is scanned OR to simply add that job ID to the currently running part run.
- **Import Parts and Jobs**: It's simple to export parts or jobs from XL as a spreadsheet, make any desired updates, and then import the updated parts or jobs back into XL.

XL API

The XL API is a REST-based interface that enables you to directly integrate XL with other systems and applications. You can use this API to push information to XL (e.g., job parameters) or to retrieve information from XL (e.g., job metrics). The XL API can also be used to encode information into 2D barcodes that can be scanned to start jobs with information directly generated by your ERP/MES system.

The XL API is particularly useful for larger companies with well-staffed IT departments that have the resources to create and maintain custom integrations. The **XL API** guide provides detailed instructions on how to programmatically interact with XL. Please note that the XL API is subject to change as we continue to add to and improve the XL platform.

To learn more about the XL API, contact support@vorne.com

Third-Party

Third-party integration tools are products and services offered by partner companies. This is a great choice for any company that wants to leverage standard products to achieve fast progress and avoid maintaining custom IT projects. Examples of third-party tools include:

- **Data Collector**: Automatically harvest data from multiple XL devices into an SQL database.
- **Data Link ERP**: Transmit production standards from your ERP system to XL, and transfer production data for completed shifts and jobs from XL to your ERP system.
- **Data Link PLC**: Transmit information from PLCs to XL devices (e.g., down reasons).
- **PiXL**: Display custom graphics or messages on the XL scoreboard based on various triggers.

To learn more about third-party tools visit www.vorne.com/tools.

TIP

We recommend implementing integrations between XL and other systems once XL is firmly established and adding value to your day-to-day operations (i.e., collecting high-quality data and using that data to drive improvement). Otherwise, it is far too easy to get hung up on technical projects and lose sight of how much you can accomplish with XL right out of the box.

Overview

Each XL device monitors one manufacturing process. We recommend starting with a single sensor (see **Get Started**) and refining your installation over time with additional sensors (see **Track Quality** and **Focus on the Constraint**). A single sensor is EASY and still generates a huge amount of actionable information, including detailed information about down events, changeovers (OEE Availability), cycle losses and small stops (OEE Performance). And the benefit is you get started quickly.

Get Started

You only need four things:

In Count Sensor – A single sensor that XL uses to calculate counts and track cycles. Take this input from wherever it is easiest to access a signal that represents the cyclical flow of parts. If each cycle produces multiple parts XL can apply a count multiplier (**Settings > Parts and Run States > Parts**).

2D Barcode Scanner – The operator typically uses a 2D barcode scanner to start new part runs and to tag reasons on down events automatically detected by XL. If desired, the operator can use the 2D barcode scanner to start jobs (instead of parts), changeovers (instead of changeovers automatically starting with part runs), and breaks (instead of using the time schedule), etc.

Ethernet – Connect XL to your network and use a browser to configure XL and to access its powerful integrated reporting capabilities (including rollup of metrics across multiple devices).

Power – The scoreboard is powered off mains voltage (100 to 240 VAC) so you will need power where you plan to hang the scoreboard.

Track Quality

Once you are collecting data and using that data to drive improvement actions, the logical next step is to collect quality information (OEE Quality). You can add a Reject Count or Good Count sensor or alternately you can use a 2D barcode scanner to enter reject counts with reasons. Either way, your OEE score will now be complete with the addition of OEE Quality.

Focus on the Constraint

If you are monitoring a manufacturing process with multiple steps, it is a best practice to measure down time and cycle losses from the perspective of the constraint. To do so, bring a dedicated cycle input to XL from the constraint step of the line.

For an in-depth review of different installation scenarios refer to the **Install XL** guide.

Overview

Establishing an accurate data foundation is essential to making effective decisions. This chapter provides tips on how to collect accurate data – based on real-world experience across thousands of applications.

Start Simple and Iterate

One of the biggest mistakes companies make when deploying any kind of system is adding complexity that reduces adoption by users. So, we recommend starting with a simple deployment and iterating over time to add more detail to the data you collect with XL. Here are tips to help you simplify your initial deployment, while still collecting highly accurate and actionable data.

Setting	Recommendation
Inputs	Start by measuring only **In Count**, preferably at the process constraint. Just this one input will generate a huge amount of actionable information.
Down Threshold	Set down thresholds that create no more than 25 down events per shift. This makes it much easier to train operators to scan a reason for EVERY down event.
Down Reasons	Create no more than 25 down reasons (it is easy to add more later). Spend time carefully naming and organizing reasons to make it easy for operators to select and scan the right reason.
Parts	If you have more than 50 parts, either group them into product families to give operators fewer barcodes to scan (see **Group Parts into Product Families** below) or use built-in integration tools to enable operators to scan existing part barcodes (see the **XL Integration Tools** chapter).
Scoreboard	Configure the scoreboard to show metrics that are meaningful to operators. For example, Efficiency is more intuitive than OEE. We recommend TAED (see **Set Clear Targets** in the next chapter).

Confirm and Validate Ideal Cycle Times

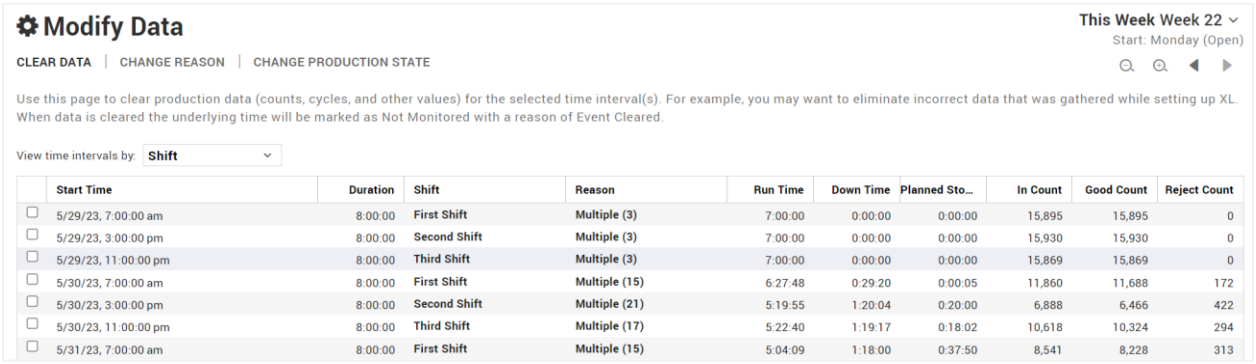
Having an accurate ideal cycle time (ICT) for each part is essential for generating a meaningful OEE score. ICT is the theoretical fastest possible cycle time for the part. It represents perfect production – no cycle losses at all. Many companies base their ICTs on a budget or standard time that is significantly higher (slower) than it should be. This hides production losses and artificially inflates OEE.

To quickly identify if your ICTs are correct, navigate to the **Reports Menu > Analyze > Performance Loss** page. Look at the chart titled "Am I running close to my ideal cycle time?" If any of the left (blue) bars are taller than the right (green) bars – the ICT for that part is set too high (slow).

Hide Erroneous Information

When starting with XL it's common to collect some erroneous data as configuration is refined and operators are trained. We recommend that you clear early data so that it doesn't affect your reports.

1. Log in as Administrator.
2. Navigate to Settings > Management > Modify Data.
3. Click on the **Clear Data** tab.
4. Use the Time Range control in the upper right of the page to select the appropriate time period.
5. Use the dropdown to select the granularity of data to clear (typically **Shift** or **Production Day**).
6. Place a checkmark next to each interval to be cleared.
7. Click the **Clear Data** button at the bottom of the page.



Start Time	Duration	Shift	Reason	Run Time	Down Time	Planned Sto...	In Count	Good Count	Reject Count
5/29/23, 7:00:00 am	8:00:00	First Shift	Multiple (3)	7:00:00	0:00:00	0:00:00	15,895	15,895	0
5/29/23, 3:00:00 pm	8:00:00	Second Shift	Multiple (3)	7:00:00	0:00:00	0:00:00	15,930	15,930	0
5/29/23, 11:00:00 pm	8:00:00	Third Shift	Multiple (3)	7:00:00	0:00:00	0:00:00	15,869	15,869	0
5/30/23, 7:00:00 am	8:00:00	First Shift	Multiple (15)	6:27:48	0:29:20	0:00:05	11,860	11,688	172
5/30/23, 3:00:00 pm	8:00:00	Second Shift	Multiple (21)	5:19:55	1:20:04	0:20:00	6,888	6,466	422
5/30/23, 11:00:00 pm	8:00:00	Third Shift	Multiple (17)	5:22:40	1:19:17	0:18:02	10,618	10,324	294
5/31/23, 7:00:00 am	8:00:00	First Shift	Multiple (15)	5:04:09	1:18:00	0:37:50	8,541	8,228	313

Regularly Review Data Quality Alerts

XL continually monitors incoming production data to identify instances where data quality can be improved. For example, if:

- OEE Performance > 100%, then the ideal cycle time is likely too high/long.
- 25% or more down events are missing reasons, then operators aren't consistently scanning reasons.
- Efficiency >= 110%, then the takt time is likely too high/long.

We recommend reviewing data quality alerts at least once per week and taking action to correct any unresolved issues. To review data quality alerts:

1. Log in as Administrator.
2. Navigate to Settings > Management > Diagnostics.
3. Click on the Data Quality Alerts Tab.

Simplify Down Reason Capture

Down time is the largest source of lost production time for almost all manufacturers, so it's understandable that most companies want to capture very detailed down time information. This often leads to complexity that ironically results in less accurate data. To start simple, we recommend:

- Define no more than 15 down reasons, which will fit nicely on 1-2 barcode pages for the operator.
- Set down thresholds for each part that are high enough that XL captures no more than 25 down events per shift (e.g., start with 3 minutes). Shorter down events will still be captured as small stops.

Doing this will create actionable information without distracting operators from running their equipment. Once operators are accurately scanning a reason for each down event, cautiously consider lowering the down threshold and adding reasons.

Capture Planned Stops

It is important to differentiate between unplanned stops (Down) and planned stops (Changeover and Maintenance). All three are OEE Availability losses, but they have very different improvement strategies.

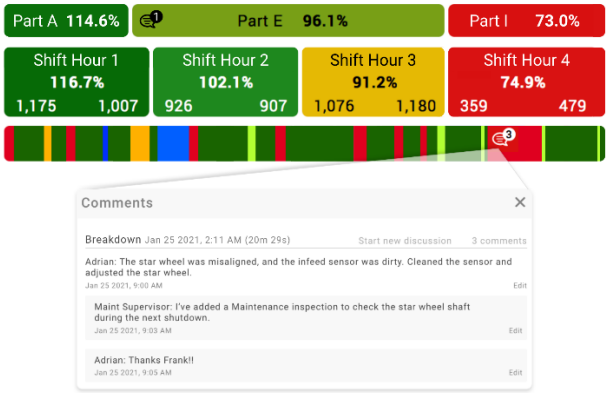
We recommend creating Changeover and Maintenance reasons (**Settings > Plant Floor > Reasons**). Then, decide how you want to trigger each event and how counts should be handled during the event.

- The **End Event** column sets how the event is ended. Choose by Barcode Scan, Definitely Running (Recommended), Target Time, and Target Time or Definitely Running.
- If any have expected durations set a **Default Target**. This will enable the scoreboard to show operators the remaining time.
- In the **Counts** column, configure to count inputs as usual, ignore counts, or automatically convert count inputs to reject inputs.

Capture Details with Comments

Instantly add comments to any production event, such as a down event, changeover, or part run. Simply click on any chronogram event to add a comment.

Use comments to add context to a reason, explain what went wrong, describe how you addressed a problem, or add to the conversation with a reply. Capture details that add value to review meetings or to deep analytics for improvement programs.



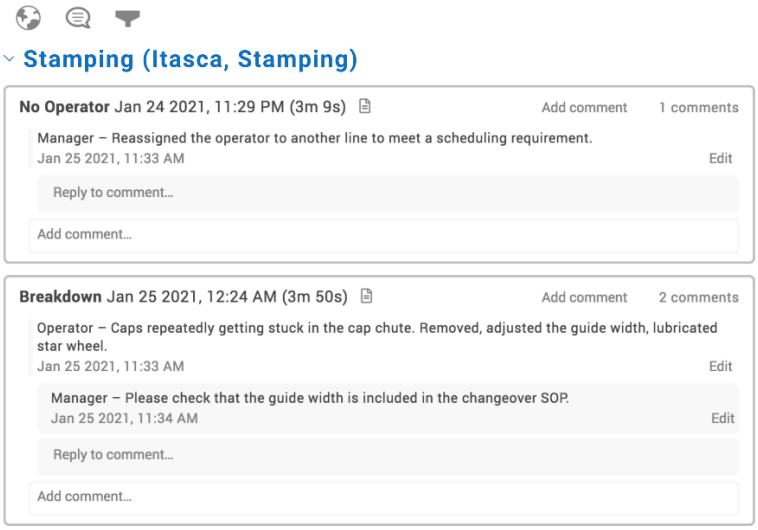
Mine Comments for Insights

Analyze comments to identify follow-up and improvement actions, or simply to verify that your team is following your policies for capturing comments.

The **Reports Menu > Improve > View Comments** page is perfect for exploring comments. Select a built-in view or search for one or more words, such as OEE or conveyor jam. Gain further insights and context with single-click access to a complete loss report for each event.

Alternatively, create your own views to focus on a specific type of event such as down or changeover events. Or look at all comments that occur during a period of time – such as a shift or part run. Add filters to refine your view. Create views that align to or verify company policy, such as:

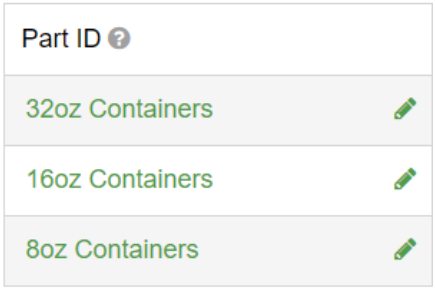
- Part Runs with OEE Below 65%
- Down Events over 15 minutes with No Comments



Group Parts into Product Families

If you have more than 50 SKUs for a manufacturing process, chances are that they can be grouped into logical families for the purposes of tracking them with XL. This makes it easier to configure XL and for operators to scan part barcodes. Simply create parts in XL named with their family name, making sure that all parts covered by a family share the same ideal cycle time and takt time. If you find you need more detail for a given family, you can expand it into individual part numbers.

A more advanced option is for an XL integration partner to help you establish a direct connection between your ERP system and XL that will automatically transfer job and part parameters to XL during production. To learn more, refer to www.vorne.com/tools.

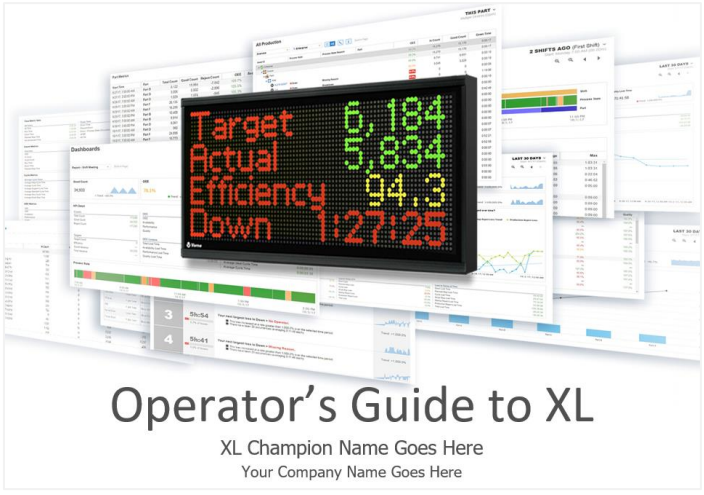


Invest in Operator Training

Deploying XL introduces change for operators. Typically, you will be asking operators to scan barcodes to start part runs and to capture down reasons. In return, the scoreboard will provide your operators with a much better sense for how well production is running and when to address and escalate emergent issues.

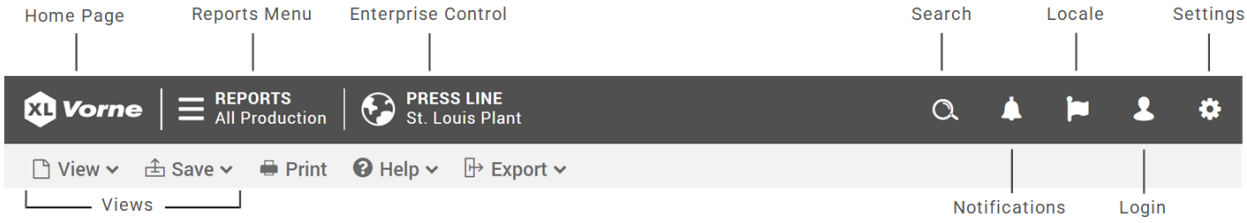
There are two particularly important things you can do to help your operators:

- Invest some time optimizing barcode pages (**Settings > Plant Floor > Print Barcodes**) to make it easier for operators to select and scan the correct barcodes.
- Invest time in training. To help with training, we created the **Operator's Guide to XL** as a PowerPoint® presentation that you can easily modify to best fit your application.



Navigation Overview

XL includes a powerful web interface for reporting and configuration. This chapter highlights key features of the **App Bar** (dark grey), which appears at the top of every page and pertains to the entire application. The **Page Bar** (light grey) is specific to the current page.



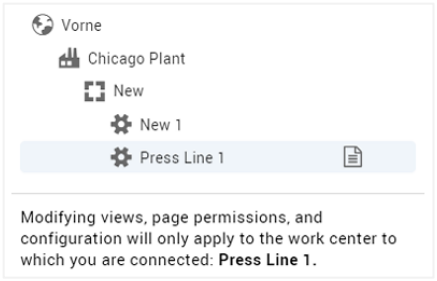
App Bar

The **App Bar** contains buttons that enable you to access the home page, open menus or trigger actions, and toggle within the hierarchy. As you scroll through pages, the App Bar remains easily accessible.

The **Home Page** button will return you to the page that has been set as the Device Default view by the Administrator. This can be adjusted using the View Menu in the **Page Bar**.

The **Reports Menu** houses all built-in reports and displays your Shared Dashboards. It's also home to XL's learning content.

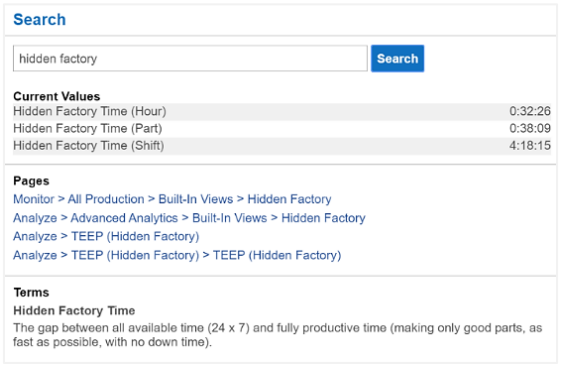
The **Enterprise Control** displays the current level of the hierarchy for which you are viewing data as well as the higher Plant Level (if applicable). The bottom of the Enterprise Control menu will show you the Name of the Device you are connected to via IP address.



TIP

The Reports Menu & Enterprise Control together help you easily navigate between your Reports & Devices. Browse Reports for the same set of devices or explore the devices & nodes in your Hierarchy for the same Report.

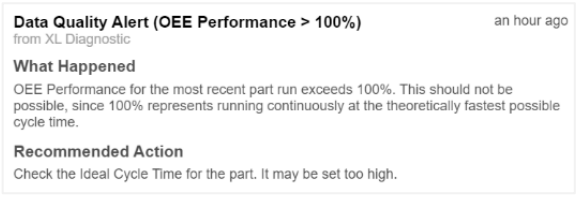
Search is the quickest way to find detailed information about a metric. Type the metric name (or other term) and search will show you: **current values** of the metric (hour, part, and shift), **pages** whose title include the term you typed (with navigation links), **terms** whose definition include the term you typed.

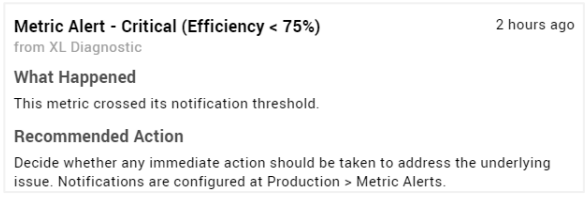


Notifications provide important information about data collection in XL. Alerts tell you the highest priorities but also tell you what happened and will recommend a next step.

Data Quality Alerts notify you when XL identifies a potential problem with your data (e.g., an ideal cycle time that is set too high).

Metric Alerts notify you when XL identifies an aspect of production that is not performing to your expectations (e.g., OEE < 70%). Metric alert thresholds are fully configurable (Settings > Metrics & Dimensions > Metric Alerts).





Locale enables you to override the device locale (**Settings > Device > Locale**) with a locale that applies to just you (i.e., just your browser). Locale controls data formatting and language.

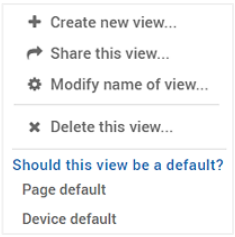
The **Log in** provides access to log in as Administrator or Supervisor, enabling you to adapt XL to your application (as described in Configure XL).

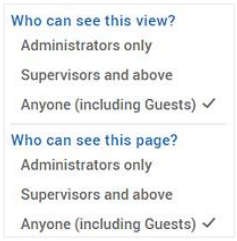
The **Settings Menu** is only accessible when logged in as Administrator or Supervisor, enables you to adapt XL to your application (as described in Configure XL).

Page Bar

The **Page Bar** contains options that enable you to initiate actions that impact the view or page you are currently on. It primarily resides underneath the App Bar at the top of most pages and the selections can vary based on what page you are viewing and your user role.

The **View Menu** has functions that support the ability to create, modify, and delete views. It also enables you to set various default views and control permission settings as an Administrator.





Save options enable you to save the view in its current state or **Save As** to create a copy of your current view.

Print button gives you the ability to print the current view by first taking you to a print preview page before sending to a printer.

Help provides topics and videos for more information on the current page, which is the easiest and fastest way to master a given topic.

Export lists all exportable (tabular) widgets on the page. Selecting any of the listed tables will generate an Excel® file with the data from that table.

View Types consist of 3 main classifications of views primarily determining what views can be modified and how accessible the views are. These are found in most reports and all dashboards.

Type	Description
Built-In	Views that are shipped with the device. They cannot be modified or deleted to ensure that certain reports are always available.
Shared	Views that are created by an Administrator and made available to others. They are stored in the device.
Local	Views that are created by a user for personal use. They are stored in browser-based local storage, and as such can only be accessed from that computer and browser. Local views are deleted if you clear cookies and site data in the browser.

TIP

The **View** and **Save** menus are best used in tandem. They provide access to different views, allow users to create new or modify existing views, and have options to save or copy views.

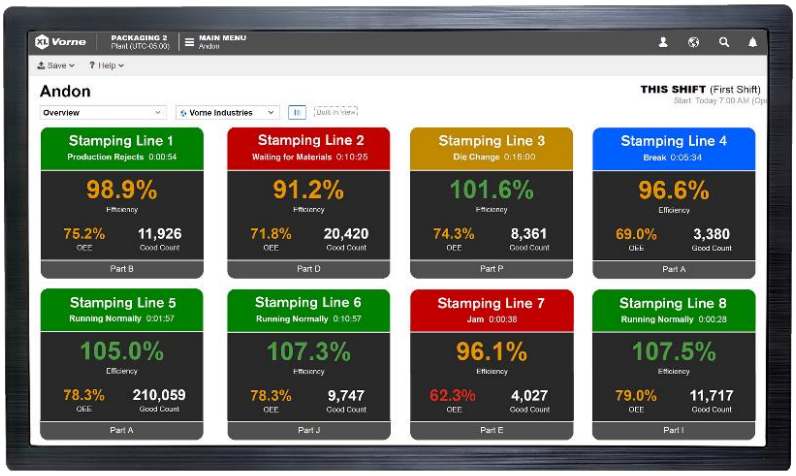
Overview

Once you are collecting accurate data the next step is to leverage that data to drive improvement. This chapter presents proven ways to quickly leverage data from XL to drive action and improvement.

Visualize Your Plant

It is easy to create a beautiful real-time view of production for offices, meeting rooms, and the factory floor. A view that brings a strong focus on productivity to all levels of your company.

Display the real-time **Andon** report on televisions or monitors using the standard XL browser interface. In the example below, we instantly see that **Stamping Line 2** is stopped (red) and will likely miss their production target with only 91.2% Efficiency – time to help them get back on track.

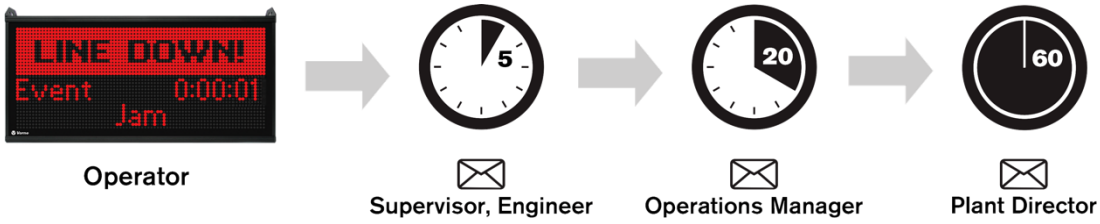


Escalate with Alerts

The XL scoreboard lets your operators know when action is needed. But what about your support and management teams? Configure XL Enterprise to send your support and management teams alerts for specific conditions, such as a manufacturing process being down for an extended time. Use escalation to let the right people know at the right time when action is needed.

Start by setting up a very small number of critical alerts. You can always add more later, but when you start you want to be very sure that anyone receiving alerts finds them to be extremely valuable.

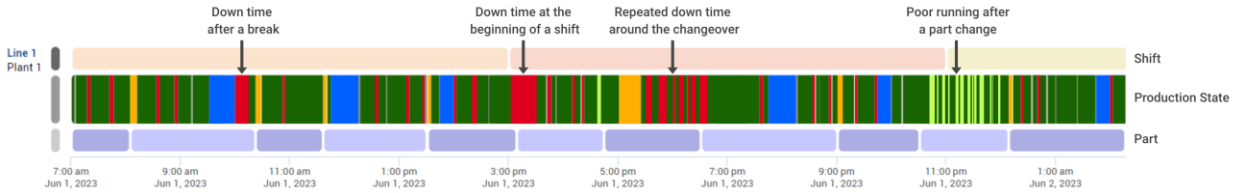
To learn more about configuring alerts, refer to the **Configure XL** guide.



Focus on Transitions

Transitions in production, such as breaks, shifts, changeovers, and part runs often provide significant opportunities for improvement. The **Reports Menu > Monitor > TPT** page provides a visually impactful way to spot problematic transitions. Here are some key things to look for:

- **Breaks** – Slivers of uncategorized down time (red) before or after breaks (blue). These often suggest extended break periods rather than verifiable (legitimate) down time issues.
- **Shifts** – Similarly, slivers of down time (red) at the beginning and end of shifts.
- **Changeovers** – Down time (red) immediately before changeovers (amber). This is often time that should be part of the changeover. XL automatically detects this and intelligently joins down events to changeovers (**Settings > Metrics & Dimensions > Other Dimensions**).
- **Part Runs** – Patterns of down time (red) or poor running (light green) after starting new part runs and after changeovers. These patterns typically indicate opportunities to improve startups.



Share Information

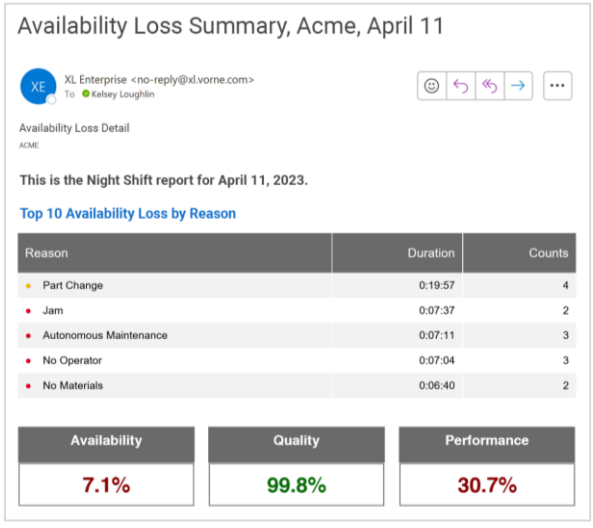
Accurate and timely information is a powerful tool. Empower others on your team by sharing information with them. An easy way to do this is to have XL Enterprise send end-of-shift reports to key employees.

NOTE

If XL Enterprise has not yet been configured with an organization and linked XL devices refer to the Configure XL guide for instructions.

Once you have linked XL devices:

1. Login to XL Enterprise as an Admin and navigate to the **All Users** page.
2. Create accounts for anyone that will benefit from end-of-shift reports.
3. As new users receive their email invites and log in, all they need to do is select the work centers they want to monitor and opt in to end-of-shift reports (**Email Report Subscriptions** page)

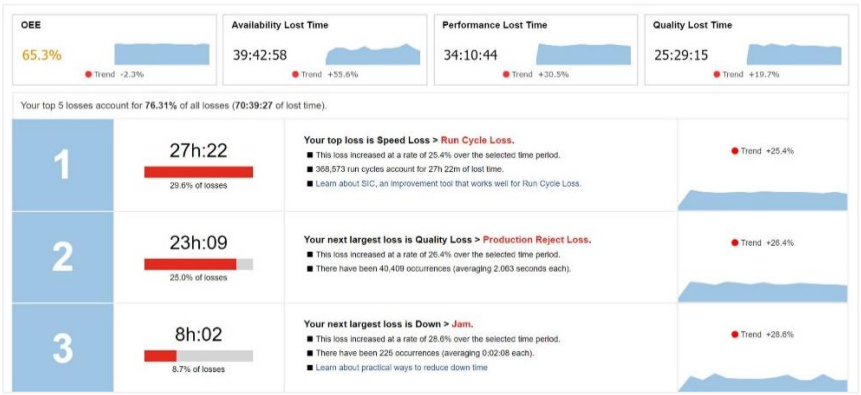


Work on the Right Things

It's often difficult to know where to start. What should you focus on improving?

The **Reports Menu > Improve > Top Losses** page is designed to make it much easier to answer this question. It ranks all losses from largest to smallest and includes detailed information for each loss.

A simple and effective way to select your next improvement project is to focus on the largest loss where your team has ideas on actions they can take, minimal external resources are required, and actions can be taken straightaway. Then the real fun begins – taking action.



Set Clear Targets

People perform best when you establish clear expectations. Make it simple and fun for your operators by giving them an opportunity to "win the shift". We recommend TAED on the scoreboard:

- **Target** (target for good pieces; based on takt time; Settings > Plant Floor > Parts and Run States)
- **Actual** (actual good pieces)
- **Efficiency** (the ratio of actual to target)
- **Down Time** (the largest OEE loss for most companies)

An Efficiency of 100% or higher means your team is winning the shift. Many companies see an immediate improvement in productivity simply by setting a challenging but attainable target (via takt time) and showing operators status in real-time through the XL scoreboard. Learn more about setting takt times in the earlier **Ideal Cycle Time vs. Takt Time** section.

Appendix A: Metrics

This appendix lists all the metrics that are generated by XL, along with their units of measure and descriptions. Some metrics are directly measured by XL, while others are derived through calculations. When metrics are derived the calculation is shown as part of the description.

Metrics and dimensions are fundamental to how XL tracks production information. Metrics are numeric values that measure a quantitative characteristic of production, such as Good Count, OEE, or Labor Efficiency.

Counts

Core Counters

Metric	Units	Description
In Count	Pieces	Number of pieces that have entered the manufacturing process.
Good Count	Pieces	Number of good pieces that have been manufactured.
Reject Count	Pieces	Number of reject pieces that have been manufactured.
End of Line Count	Pieces	Typically used to count product at the end of the line. Product might be pieces, boxes, or pallets.

Additional Counters

Metric	Units	Description
Total Count	Pieces	Total number of pieces that have been manufactured. Calculated as Good Count + Reject Count.
Startup Rejects	Pieces	Number of reject pieces that have been manufactured during and immediately after a changeover.
Production Rejects	Pieces	Number of reject pieces that have been manufactured during steady-state production (after startup). Calculated as Reject Count - Startup Rejects.
WIP Count	Pieces	Number of pieces between the In Count sensor and Good Count sensor. Calculated as In Count - Good Count.

Count Percentages

Metric	Units	Description
Percent Good	Percent	Percentage of manufactured pieces that are good. Identical to Quality metric. Calculated as Good Count / Total Count.
Percent Reject	Percent	Percent of manufactured pieces that are reject. Calculated as Reject Count / Total Count.

Cycles

Number of Cycles

Metric	Units	Description
Run Cycles	Cycles	Number of "normal" cycles – cycles that are shorter than the small stop threshold.
Small Stops	Cycles	Number of "longer" cycles – cycles that are longer than the small stop threshold.
Partial Cycles	Cycles	Number of "boundary" cycles – cycles that are on the boundaries of run events. Each run event has one partial cycle. Whereas Run Cycles and Small Stops are measured from input to input, each partial cycle includes time from the start of the run event to the first input plus time from the last input to the end of the run event.
Total Cycles	Cycles	Total number of cycles. Calculated as Run Cycles + Small Stops + Partial Cycles.
Equipment Cycles	Cycles	Total number of cycles across ALL production states. All other cycle metrics are ONLY measured during run events. This metric is particularly useful for cycle-based work center care programs.

Cycle Loss

Metric	Units	Description
Run Cycle Lost Time	Seconds	Time in excess of ICT for Run Cycles (waste). If this number is negative the ICT is set too high.
Partial Cycle Lost Time	Seconds	Time in excess of ICT for Partial Cycles (waste).
Cycle Lost Time	Seconds	Time in excess of ICT for Run Cycles and Partial Cycles (waste). One of the Six Big Losses. Calculated as Run Cycle Lost Time + Partial Cycle Lost Time.
Small Stop Lost Time	Seconds	Time in excess of ICT for Small Stops (waste). One of the Six Big Losses.

Cycle Times

Metric	Units	Description
Ideal Cycle Time	Seconds	Theoretical fastest possible time to complete one cycle for the currently running part. Configured on a part-by-part basis.
Ideal Time	Seconds	Theoretical fastest possible time that it should have taken to complete all cycles. Used to calculate other metrics and not usually of direct interest to users.
Current Cycle Time	Seconds	Time spent so far in the current cycle. Restarts at zero with every new cycle.
Previous Cycle Time	Seconds	Time it took to complete the most recent cycle.
Total Cycle Time	Seconds	Accumulated time for all cycles. Equals Run Time. Calculated as Ideal Time + Run Cycle Lost Time + Partial Cycle Lost Time + Small Stop Lost Time.

Average Cycle Times

Metric	Units	Description
Avg. Cycle Time	Seconds	Average time for a cycle. Includes all cycles during run time. Calculated as Total Cycle Time / Total Cycles.
Avg. Ideal Cycle Time	Seconds	Theoretical fastest possible time for one cycle as averaged across a time period. Calculated as Ideal Time / Total Cycles.
Avg. Run Cycle Time	Seconds	Average time for each run cycle. Does not include small stops or partial cycles (i.e., it is analogous to the speed of your process when it is running). Calculated as Avg. Ideal Cycle Time + Run Cycle Lost Time / Run Cycles.
Avg. Small Stop Time	Seconds	Average time for each small stop. Calculated as Avg. Ideal Cycle Time + Small Stop Lost Time / Small Stops.

Labor

Team Size

Metric	Units	Description
Current Team Size	People	Number of people currently working at the work center. Used to generate labor time metrics. Note that labor time is accumulated unless production is "not scheduled".
Team Size	People	Average number of people working at the work center. Calculated as Total Labor / Production Time.

Labor per Piece

Metric	Units	Description
Current Target Labor per Piece	Seconds	Expected labor time to manufacture one good piece. Configured on a part-by-part basis.
Target Labor per Piece	Seconds	Expected labor time to manufacture one good piece as averaged across a time period. Calculated as Earned Labor / Good Count.
Labor per Good Piece	Seconds	Actual labor time to manufacture one good piece. Calculated as Total Labor / Good Count.
Labor per Piece	Seconds	Actual labor time to manufacture one piece. Calculated as Total Labor / Total Count.

Pieces per Labor Hour

Metric	Units	Description
Good Pieces per Labor Hour	Pieces	Good pieces manufactured per hour of labor time. Calculated as Good Count / Total Labor Hours.
Pieces per Labor Hour	Pieces	Pieces manufactured per hour of labor time. Calculated as Total Count / Total Labor Hours.

Labor Efficiency

Metric	Units	Description
Earned Labor	Seconds	Labor time "earned" by manufacturing good pieces. Each time a good piece is manufactured the Current Target Labor per Piece is added to Earned Labor.
Lost Labor	Seconds	Labor time "lost" by taking longer than expected to manufacture good pieces. If this number is negative, pieces are taking less than the target labor time to manufacture. Calculated as Total Labor - Earned Labor.
Total Labor	Seconds	The total of labor time on this work center. Note that labor time is accumulated unless production is "not scheduled". The accumulated amount of labor time on this Work Center during Production Time. Each second of Production Time is multiplied by Current Team Size to generate this metric. Total Labor is comprised of two parts - Earned Labor (time "earned" by producing good pieces) and Lost Labor.
Labor Efficiency	Percent	How actual labor time compares to the target, expressed as a percentage. This is the preferred metric for comparisons as it is normalized. In other words, 100% is meeting expectations and better than 100% is exceeding expectations. Calculated as Earned Labor / Total Labor.

OEE

Core OEE

Metric	Units	Description
Availability	Percent	Percentage of planned production time where the process is running. 100% Availability means the process is always running during planned production time. Calculated as Run Time / Production Time.
Performance	Percent	Percentage that compares the theoretical maximum speed (based on ideal cycle time) to the actual speed (based on accumulated run time). 100% Performance means when the process is running it is running as fast as possible. Calculated as Ideal Time / Run Time.
Quality	Percent	Percentage of manufactured pieces that meet quality standards. 100% Quality means there are no rejects. Calculated as Good Count / Total Count.
OEE	Percent	Percentage of planned production time that is fully productive. 100% OEE means perfect production (always running, as fast as possible, manufacturing only good pieces). Calculated as Availability × Performance × Quality.

OEE Loss Percentages

Metric	Units	Description
Availability Loss	Percent	Percentage of planned production time lost to the process not running. Accounts for planned and unplanned stops. Calculated as 100% - Availability.
Performance Loss	Percent	Percentage of planned production time lost to running slower than the theoretical maximum speed. Accounts for cycles longer than the ideal cycle time. Calculated as (100% - Performance) × Availability.
Quality Loss	Percent	Percentage of planned production time lost to manufacturing pieces that do not meet quality standards. Accounts for defects (including parts that need rework). Calculated as (100% - Quality) × Availability × Performance.
OEE Loss	Percent	Percentage of planned production time that is not productive. Calculated as 100% - OEE.

OEE Lost Times

Metric	Units	Description
Availability Lost Time	Seconds	Planned production time lost to the process not running. Calculated as Availability Loss × Production Time.
Performance Lost Time	Seconds	Planned production time lost to the process running slower than the theoretical maximum speed. Calculated as Performance Loss × Production Time.
Quality Lost Time	Seconds	Planned production time lost to manufacturing pieces that do not meet quality standards. Calculated as Quality Loss × Production Time.
OEE Lost Time	Seconds	Planned production time lost to all sources. Calculated as Production Time - Fully Productive Time.
Fully Productive Time	Seconds	Represents perfect production (i.e., the time it would have taken to manufacture only good pieces as fast as possible). Calculated as Percent Good x Ideal Time.

Planning

Metric	Units	Description
Goal Count	Pieces	Production goal for the current part run in terms of good pieces.
Good Count Left	Pieces	Number of good pieces remaining to reach the production goal for the current part run. Calculated as Goal Count - Good Count.
Percent Done	Percent	Progress towards production goal for the current part run. Calculated as Good Count / Goal Count.

Production Times

Impact Times

Metric	Units	Description
Run Time	Seconds	Time the process has been in the run state (e.g., running).
Down Time	Seconds	Time the process has been in the unplanned stop state (identical to Unplanned Stop Time metric).
Planned Stop Time	Seconds	Time the process has been in the planned stop state (e.g., changeover).
Not Scheduled Time	Seconds	Time the process has been in the not scheduled state (e.g., no production).

Combined Times

Metric	Units	Description
Manufacturing Time	Seconds	Time the process is expected to be running. Calculated as Run Time + Down Time.
Production Time	Seconds	Time the process is scheduled for production. Calculated as Manufacturing Time + Planned Stop Time.
All Time	Seconds	Accounts for all time. Calculated as Production Time + Not Scheduled Time.

Impact Percentages

Metric	Units	Description
Percent Run	Percent	Percentage of production time that the process has been running. Calculated as Run Time / Production Time.
Percent Down	Percent	Percentage of production time that the process has been in an unplanned stop (identical to Percent Unplanned Stop metric). Calculated as Down Time / Production Time.
Percent Planned Stop	Percent	Percentage of production time that the process has been in a planned stop. Calculated as Planned Stop Time / Production Time.

Last Impact Event Times

Metric	Units	Description
Last Run Time	Seconds	Duration of the most recent (or current) run event.
Last Down Time	Seconds	Duration of the most recent (or current) unplanned stop event (identical to Last Unplanned Stop Time metric).
Last Planned Stop Time	Seconds	Duration of the most recent (or current) planned stop event.
Last Not Scheduled Time	Seconds	Duration of the most recent (or current) not scheduled event.

General Events

Metric	Units	Description
Duration	Seconds	Duration of a given event (e.g., a shift, part run, or production state).
Start Time	Date Time	Date and time a given event started.
End Time	Date Time	Date and time a given event ended.

Production State Events

Metric	Units	Description
Elapsed Time	Seconds	Time accumulated thus far in the current production state (e.g., changeover time).
Target Time	Seconds	Expected time of the current production state (e.g., changeover target).
Remaining Time	Seconds	Expected time until the current production state ends (e.g., remaining time for a changeover). Calculated as Target Time - Elapsed Time.
Remaining Percent	Percent	Percentage of time expected to be remaining for the current production state (e.g., percent remaining for a changeover). Calculated as Remaining Time / Target Time.

Mean/Quality Times

Metric	Units	Description
MTBF	Seconds	How long on average the process runs before it is stopped by a fault (Mean Time Between Failures). Calculated as Run Time / Down Events.
MTTR	Seconds	How long on average it takes to get the process running once it is stopped by a fault (Mean Time to Repair). Calculated as Down Time / Down Events.

Days

Metric	Units	Description
Calendar Day	Days	Identifies the calendar day of an event (calendar day changes at midnight).
Production Day	Days	Identifies the production day of an event (production day changes on shift boundaries).

Six Big Losses

Six Big Losses Times

Metric	Units	Description
Down Lost Time	Seconds	Production time lost to down events (identical to Down Time and Unplanned Stop Lost Time metrics).
Planned Stop Lost Time	Seconds	Production time lost to planned stop events (identical to the Planned Stop Time metric).
Cycle Lost Time	Seconds	Production time lost to cycles longer than the ideal cycle time and shorter than the small stop threshold. Only time in excess of the ICT is considered lost. Calculated as Run Cycle Lost Time + Partial Cycle Lost Time.
Small Stop Lost Time	Seconds	Production time lost to cycles equal to or longer than the small stop threshold. Only time in excess of the ICT is considered lost.
Startup Reject Lost Time	Seconds	Production time lost to manufacturing rejects during startup. Calculated as Startup Reject Loss × Production Time.
Production Reject Lost Time	Seconds	Production time lost manufacturing rejects during steady-state production. Calculated as Production Reject Loss × Production Time.

Six Big Losses Percentages

Metric	Units	Description
Down Loss	Percent	Percentage of production time lost to down events (identical to Unplanned Stop Loss metric). Calculated as Down Lost Time / Production Time.
Planned Stop Loss	Percent	Percentage of production time lost to planned stop events. Calculated as Planned Stop Lost Time / Production Time.
Cycle Loss	Percent	Percentage of production time lost to cycles longer than ideal cycle time and shorter than the small stop threshold. Only time in excess of the ICT is considered lost. Calculated as Cycle Lost Time / Production Time.
Small Stop Loss	Percent	Percentage of production time lost to cycles equal to or longer than the small stop threshold. Only time in excess of the ICT is considered lost. Calculated as Small Stop Lost Time / Production Time.
Startup Reject Loss	Percent	Percentage of production time lost manufacturing rejects during startup. Calculated as Startup Rejects / Total Count × Availability × Performance.
Production Reject Loss	Percent	Percentage of production time lost manufacturing rejects during steady-state production. Calculated as Production Rejects / Total Count × Availability × Performance.

Speed

Metric	Units	Description
Current In Speed	PPH, PPM	Speed parts are currently entering the manufacturing process.
Current Good Speed	PPH, PPM	Speed good parts are currently being manufactured.
Current Reject Speed	PPH, PPM	Speed reject parts are currently being manufactured.
Current Total Speed	PPH, PPM	Speed parts are currently being manufactured.
Current End of Line Speed	PPH, PPM	Current speed measured at the end of the line.
In Speed	PPH, PPM	Speed that parts entered the manufacturing process, measured against Run Time. Calculated as In Count / Run Time x 60 (PPM) or In Count / Run Time x 3,600 (PPH).
Good Speed	PPH, PPM	Speed that good parts were manufactured, measured against Run Time. Calculated as Good Count / Run Time x 60 (PPM) or Good Count / Run Time x 3,600 (PPH).
Reject Speed	PPH, PPM	Speed that reject parts were manufactured, measured against Run Time. Calculated as Reject Count / Run Time x 60 (PPM) or Reject Count / Run Time x 3,600 (PPH).
Total Speed	PPH, PPM	Speed that parts were manufactured, measured against Run Time. Calculated as (Good Count + Reject Count) / Run Time x 60 (PPM) or (Good Count + Reject Count) / Run Time x 3,600 (PPH).
End of Line Speed	PPH, PPM	Speed at the end of the line, measured against Run Time. Calculated as End of Line Count / Run Time x 60 (PPM) or End of Line Count / Run Time x 3600 (PPH).

Rates

Metric	Units	Description
In Rate	PPH, PPM	Rate which parts entered the manufacturing process, measured against Manufacturing Time. Calculated as In Count / (Run Time + Down Time) x 60 (PPM) or In Count / (Run Time + Down Time) x 3,600 (PPH).
Good Rate	PPH, PPM	Rate which good parts were manufactured, measured against Manufacturing Time. Calculated as Good Count / (Run Time + Down Time) x 60 (PPM) or Good Count / (Run Time + Down Time) x 3,600 (PPH).
Reject Rate	PPH, PPM	Rate which reject parts were manufactured, measured against Manufacturing Time. Calculated as Reject Count / (Run Time + Down Time) x 60 (PPM) or Reject Count / (Run Time + Down Time) x 3,600 (PPH).
Total Rate	PPH, PPM	Rate which parts were manufactured, measured against Manufacturing Time. Calculated as (Good Count + Reject Count) / (Run Time + Down Time) x 60 (PPM) or (Good Count + Reject Count) / (Run Time + Down Time) x 3,600 (PPH).
End of Line Rate	PPH, PPM	Rate at the end of line, measured against Manufacturing Time. Calculated as End of Line Count / (Run Time + Down Time) x 60 (PPM) or End of Line Count / (Run Time + Down Time) x 3,600 (PPH).
Target Rate	PPH, PPM	Target Rate of the process during manufacturing (generated from Takt Time). Calculated as Target Count / (Run Time + Down Time) x 60 (PPM) or Target Count / (Run Time + Down Time) x 3,600 (PPH).
Rate Efficiency	Percent	Ratio of actual good parts to expected good parts (identical to Efficiency metric).

Target

Takt Time

Metric	Units	Description
Takt Time	Seconds	Expected pace of manufacturing for the currently running part. Set on a part-by-part basis (as a cycle time). Includes "budgeted" losses for down time, cycles, and rejects. Does NOT include time where production is not expected to be running (breaks, meetings, changeovers, and planned maintenance). Drives the target counter and efficiency calculations.
Avg. Takt Time	Seconds	Average takt time across any time period. Calculated as Manufacturing Time / Target Cycles.
Pace Timer	Seconds	Paces production by takt time. Each cycle the value starts at the takt time and counts down.

Targets

Metric	Units	Description
Target Count	Pieces	Real-time target for good pieces. Each time the takt time elapses the target count increases. Often shown on the scoreboard together with good count to show operators where they are at as compared to expectations.
Target Cycles	Cycles	Increments each time the takt time elapses. Used to calculate other metrics and not usually of direct interest to users.

Efficiency and Variance

Metric	Units	Description
Efficiency	Percent	How production is doing as compared to expectations. 100% or higher means your team is "winning". Calculated as Good Count / Target Count.
Percent Variance	Percent	How far ahead or below expectations production is doing (as a percentage). Calculated as (Good Count - Target Count) / Target Count.
Time Variance	Seconds	How far ahead or below expectations production is doing (in terms of time). Calculated as Percent Variance × Manufacturing Time.
Count Variance	Pieces	How far ahead or below expectations production is doing (in terms of pieces). Calculated as Good Count - Target Count.

TEEP

Core TEEP

Metric	Units	Description
TEEP	Percent	Percentage of ALL time that is truly productive. Often used for capacity planning. Calculated as OEE × Utilization.
Utilization	Percent	Percentage of ALL time that is used for production. Calculated as Production Time / All Time.
Schedule Loss	Percent	Percentage of ALL time that is NOT used for production. Calculated as 100% - Utilization.
Production Loss	Percent	Percentage of ALL time that is taken up by lost production time (OEE Lost Time). Primarily used when presenting information from the perspective of all time (100%) being the sum of time not scheduled for production (Schedule Loss), time that is scheduled and productive (TEEP) and time that is scheduled and not productive (Production Loss). Can be calculated as OEE Lost Time / All Time OR 100% - Schedule Loss - TEEP.

TEEP Lost Times

Metric	Units	Description
Schedule Lost Time	Seconds	Time lost to not being used for production. Calculated as Schedule Loss × All Time
Production Lost Time	Seconds	Time lost to all sources of lost productivity during planned production time (this is simply another name for OEE Lost Time – a name which aligns with the Production Loss metric).
Hidden Factory Time	Seconds	Untapped capacity of your manufacturing process. The maximum amount of additional production that can be unlocked without capital investment. Fully utilizing this time means around-the-clock perfect production – manufacturing only good pieces, as fast as possible, with no downtime, every hour of every day. Calculated as OEE Lost Time + Schedule Lost Time.

Appendix B: Dimensions

Metrics & Dimensions are fundamental to how XL tracks production. Dimensions are descriptive values that refer to a qualitative attribute of production, such as the Shift, Work Center, or Hour.

Aspects

Dimension	Description
Impact	Four mutually exclusive states that provide a top-level perspective of manufacturing: Run, Unplanned Stop, Planned Stop, and Not Scheduled.
Job	A work order identifier or other categorization that best identifies a specific part run. XL applies a dimension value of "Unknown Job" when production is detected but there is no job identifier.
Part	A part identifier for a specific part run. XL applies a dimension value of "Unknown Part" when production is detected but there is no part identifier.
Production Phase	Three mutually exclusive states that identify sequential phases of a part run: Changeover, Startup (time immediately following the changeover), and Steady State. These phases are important because they often have different loss characteristics.
Production State	A standardized and uniform way for XL to describe what is happening at the manufacturing process: Running, Running Slow, Running Poor Quality, Running Poorly, Down, Changeover, Maintenance, Meal/Break, Meeting, No Production, and Not Monitored.
Reason	A fully customizable way for you to describe what is happening at the manufacturing process from your perspective using terms that are familiar to your company. Reasons are particularly valuable for capturing information that will help you address losses and drive improvement.
Reject Reasons	A fully customizable way for you to describe the underlying reasons for quality loss. Reject reasons are particularly valuable for capturing information that will help you address losses and drive improvement.
Shift	A shift identifier. XL applies a dimension value of "Unknown Shift" when production is detected but no shift is scheduled.
Ordinal Shift	A dimension that orders shifts within a production day. This is especially useful for aligning shifts across work centers and time zones.
Team	An identifier for who is operating the process. Can refer to a single operator, a lead operator, or a crew. XL applies a dimension value of "Unknown Team" when production is detected but there is no team identifier.

Assets

Dimension	Description
Enterprise	The entire organization. Metrics for all work centers monitored by XL are rolled up to the Enterprise.
Site	Manufacturing plants.
Area	Subdivisions within manufacturing plants. May be a physical area or a logical collection of work centers.
Work Center	The manufacturing processes being monitored.

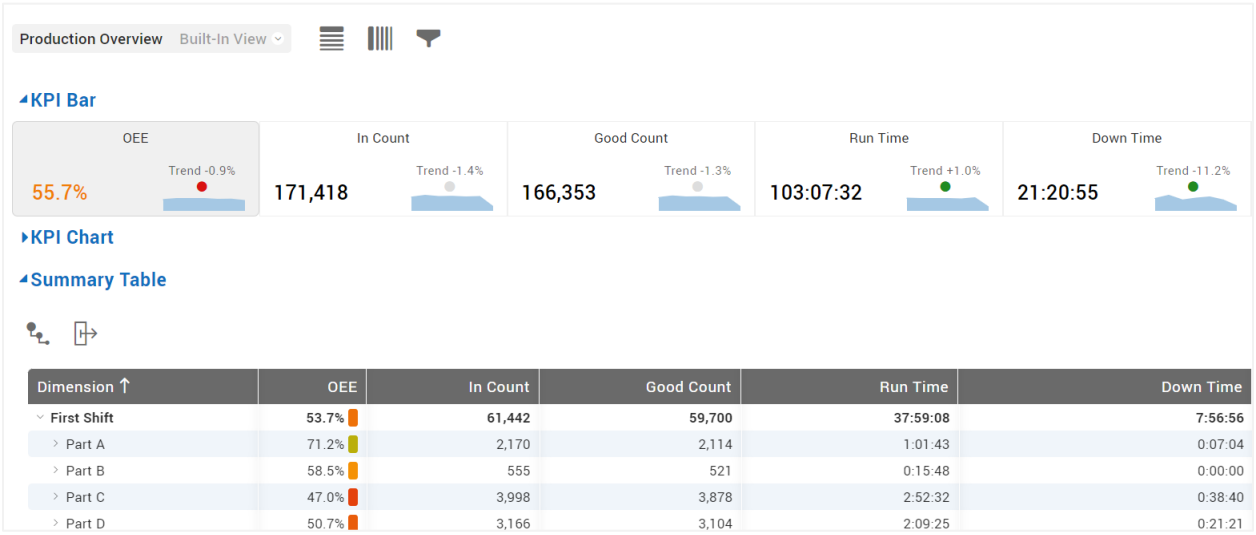
Time

Dimension	Description
Hour	Shift hours, which are relative to the beginning of the shift (e.g., Shift Hour 1, Shift Hour 2).
Day	Production days, which are aligned to shift boundaries to ensure that shifts that cross midnight stay within one day for reporting purposes.
Week	Production weeks, which always run from Monday to Sunday to provide consistency when aggregating information across multiple time zones and geographical areas.
Month	Calendar months (on production day boundaries).
Quarter	Calendar quarters (on production day boundaries).
Year	Calendar years (on production day boundaries).

Appendix C: Built-In Report Pages

Advanced Analytics

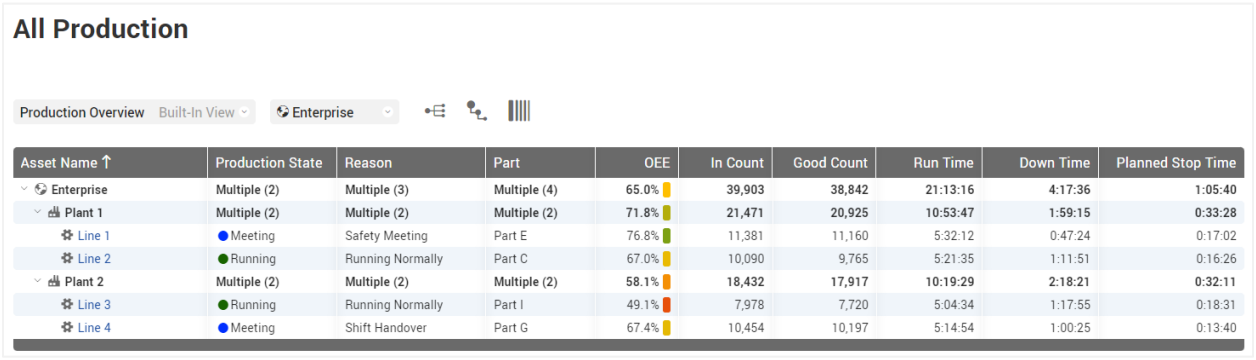
Dynamically explore data through an interactive set of KPI, chart and table widgets. Drag and drop dimensions to slice and dice your data in different ways. Ideal for deep data exploration across multiple dimensions and KPIs for a single manufacturing process.



Dimension	OEE	In Count	Good Count	Run Time	Down Time
First Shift	53.7%	61,442	59,700	37:59:08	7:56:56
Part A	71.2%	2,170	2,114	1:01:43	0:07:04
Part B	58.5%	555	521	0:15:48	0:00:00
Part C	47.0%	3,998	3,878	2:52:32	0:38:40
Part D	50.7%	3,166	3,104	2:09:25	0:21:21

All Production

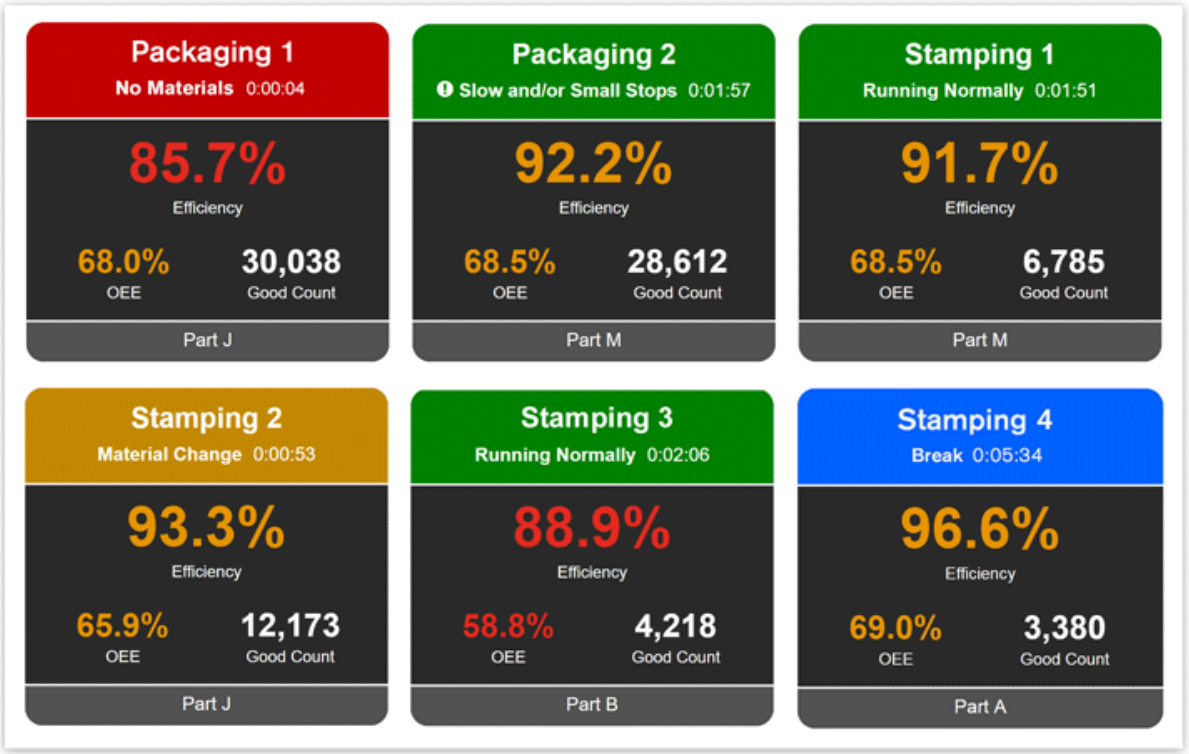
View rolled-up real-time and historical production data for every Manufacturing Process, Area, and Site. Ideal for quickly viewing and comparing any portions of your manufacturing operation across any combinations of metrics.



Asset Name	Production State	Reason	Part	OEE	In Count	Good Count	Run Time	Down Time	Planned Stop Time
Enterprise	Multiple (2)	Multiple (3)	Multiple (4)	65.0%	39,903	38,842	21:13:16	4:17:36	1:05:40
Plant 1	Multiple (2)	Multiple (2)	Multiple (2)	71.8%	21,471	20,925	10:53:47	1:59:15	0:33:28
Line 1	Meeting	Safety Meeting	Part E	76.8%	11,381	11,160	5:32:12	0:47:24	0:17:02
Line 2	Running	Running Normally	Part C	67.0%	10,090	9,765	5:21:35	1:11:51	0:16:26
Plant 2	Multiple (2)	Multiple (2)	Multiple (2)	58.1%	18,432	17,917	10:19:29	2:18:21	0:32:11
Line 3	Running	Running Normally	Part I	49.1%	7,978	7,720	5:04:34	1:17:55	0:18:31
Line 4	Meeting	Shift Handover	Part G	67.4%	10,454	10,197	5:14:54	1:00:25	0:13:40

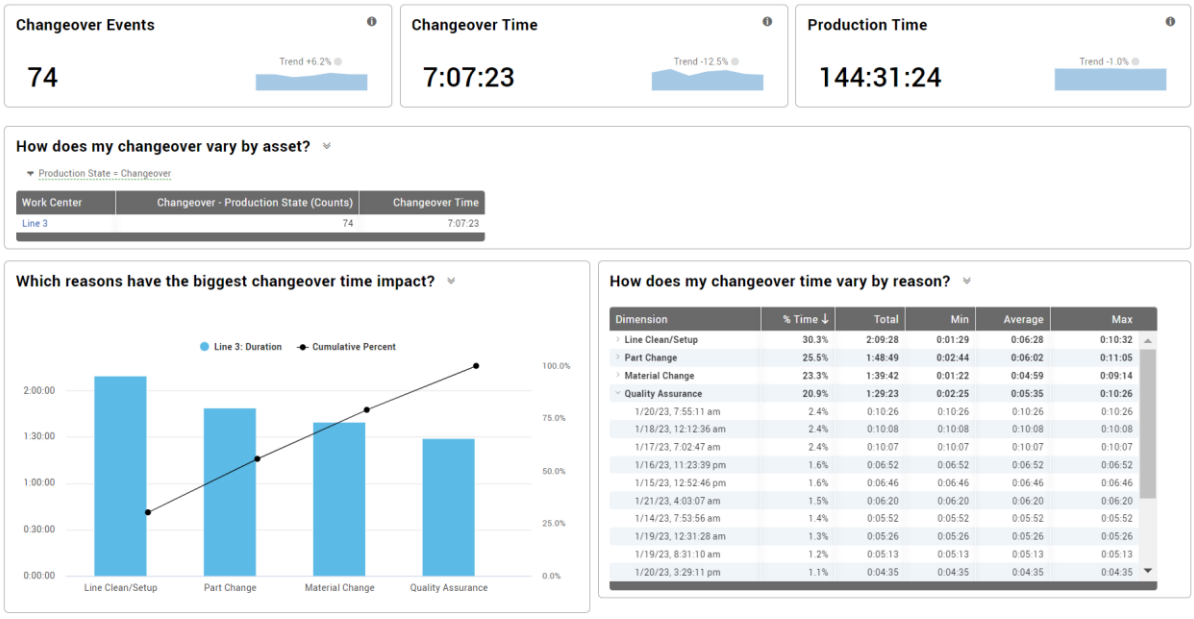
Andon

View the real-time status of every process with a colorful page suitable for display on a large format television or monitor. Ideal for communicating KPI's in meeting rooms and offices to ensure that all personnel understand the current state of production.



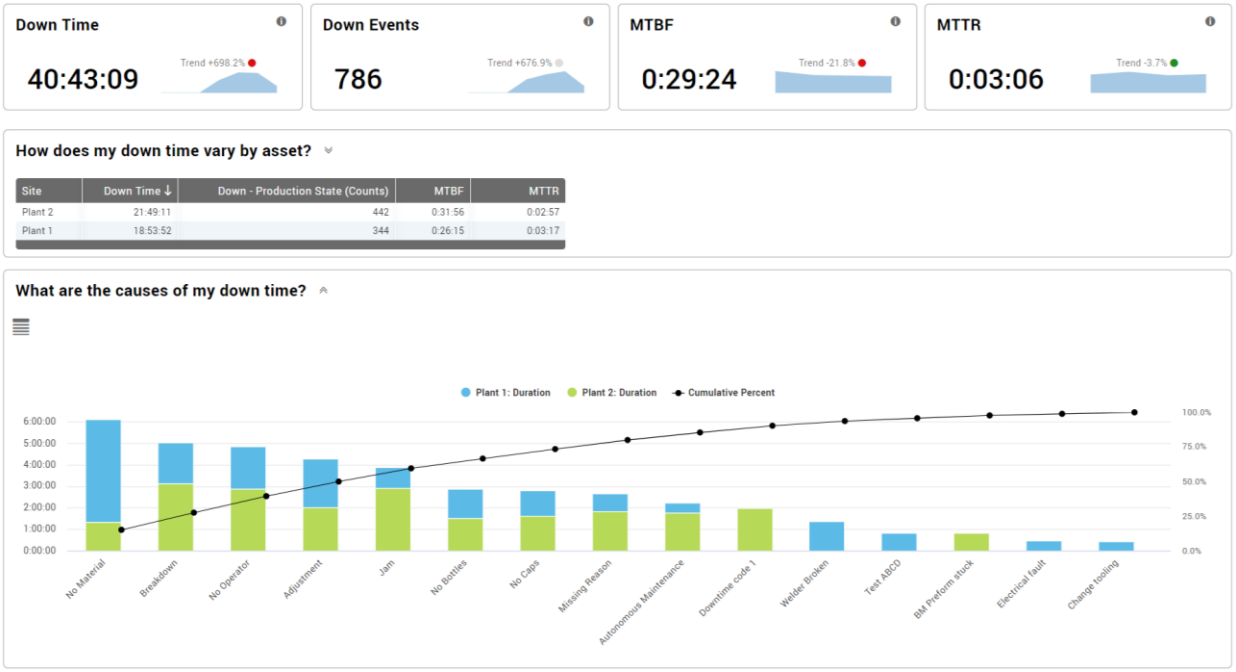
Changeover

Deep dive into changeovers with instant analytics and answers to key questions. Ideal for gaining a better understanding of changeovers and how they compare across parts and part runs.



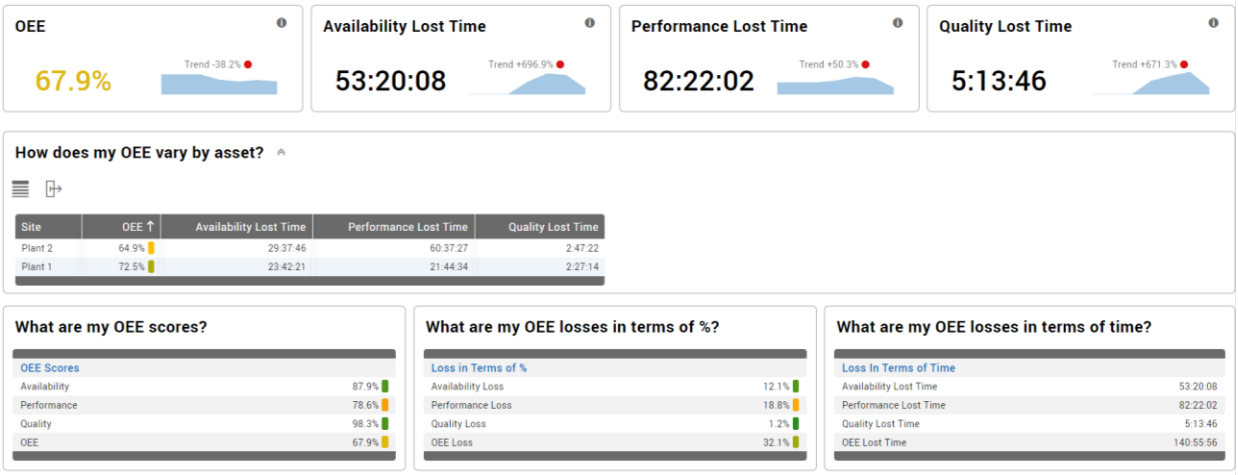
Down Time

Deep dive into down time and its underlying reasons. Ideal for identifying which sources of down time are most important to address (e.g., emergent problems, problems related to specific parts, or by largest overall losses).



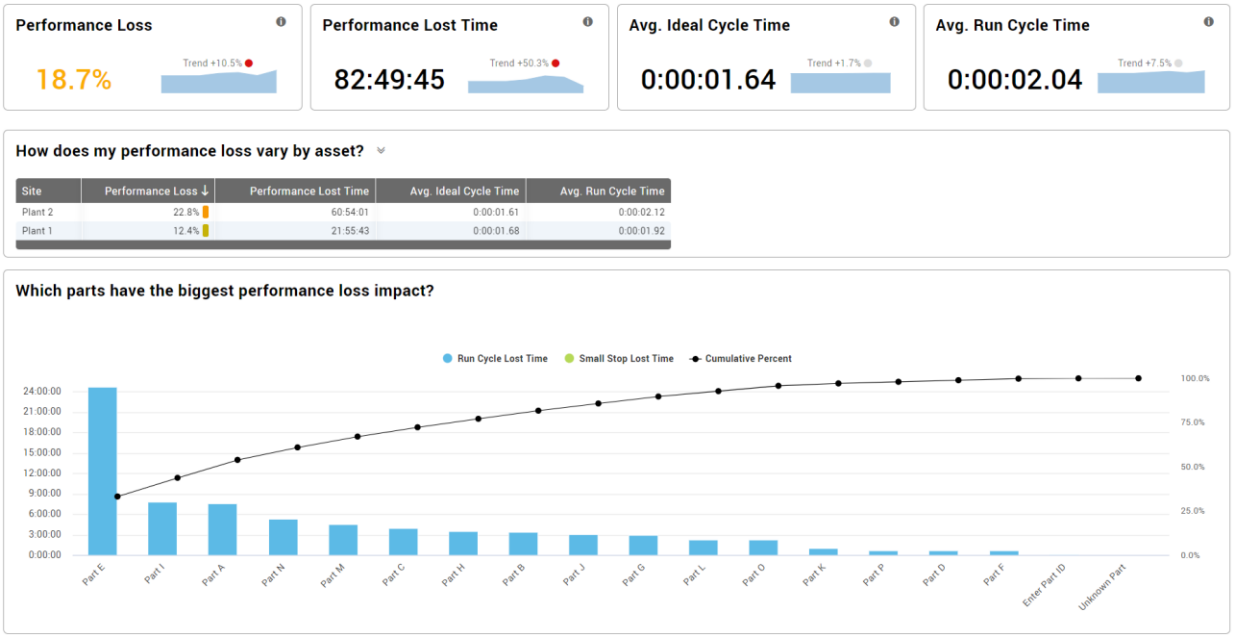
OEE

Deep dive into OEE and its underlying factors: availability, performance, and quality. Ideal for quantifying the major causes of lost productivity using OEE (a best practice metric) and identifying which OEE factor is most important to address.



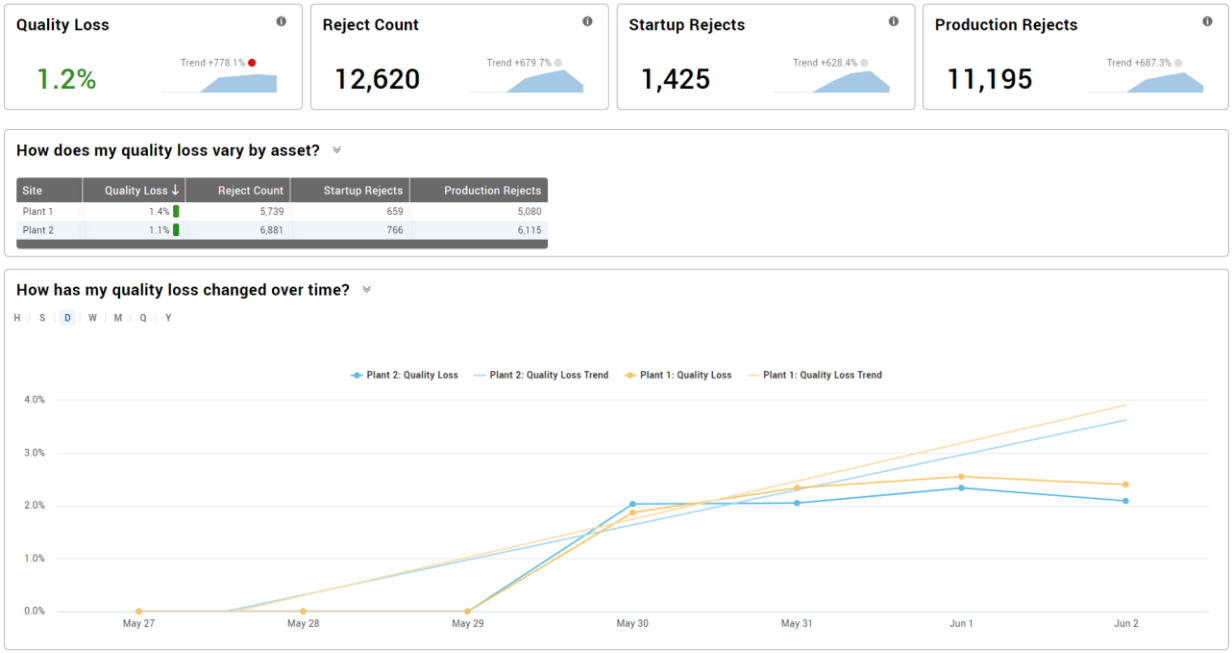
Performance Loss

Deep dive into performance loss and its underlying constituents: cycle loss and small stop loss. Ideal for identifying which parts and shifts are most affected by cycle losses, and for validating your ideal cycle time settings against actual production data.



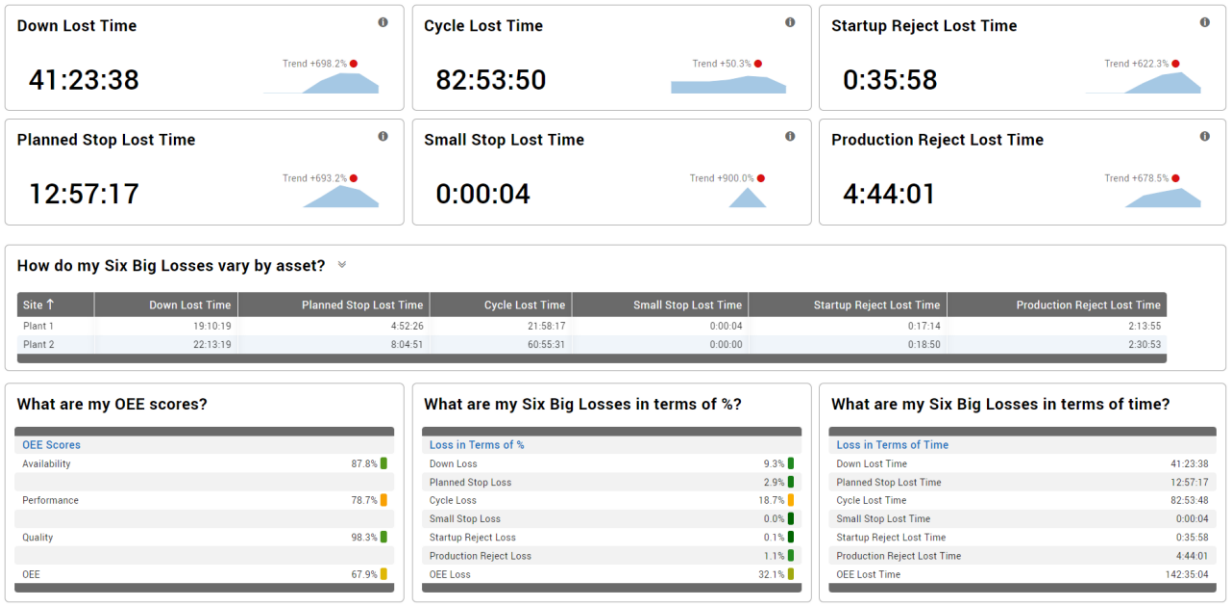
Quality Loss

Deep dive into quality loss and its underlying constituents: startup rejects and production rejects. Ideal for identifying how each part is affected by quality losses and to better understand the underlying reasons.



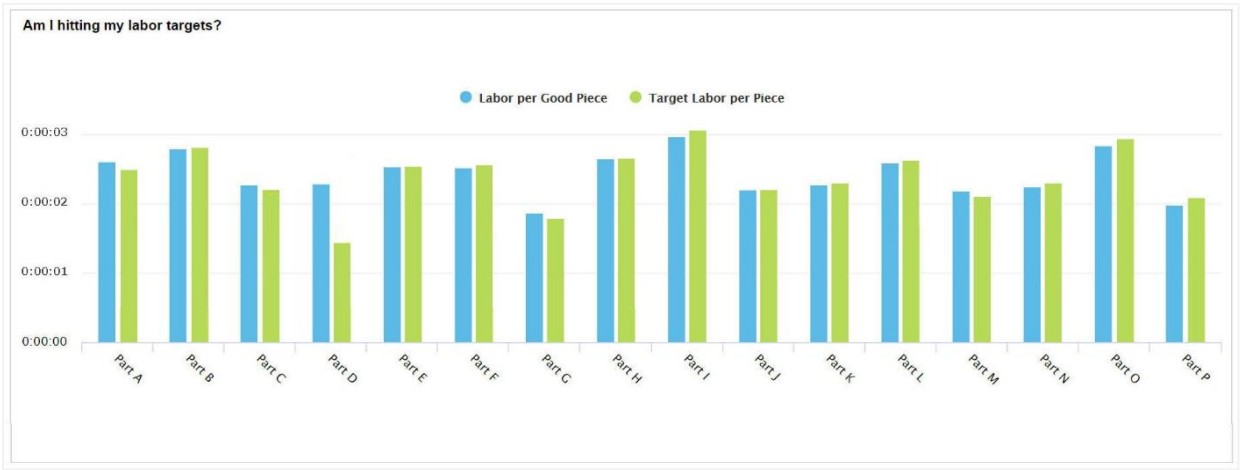
Six Big Losses

Deep dive into the six big losses: down time, planned stops, cycle loss, small stops, startup rejects, and production rejects. Ideal for gaining a deeper understanding of lost production time using a lean manufacturing framework that extends OEE into loss categories that each have a different set of countermeasures.



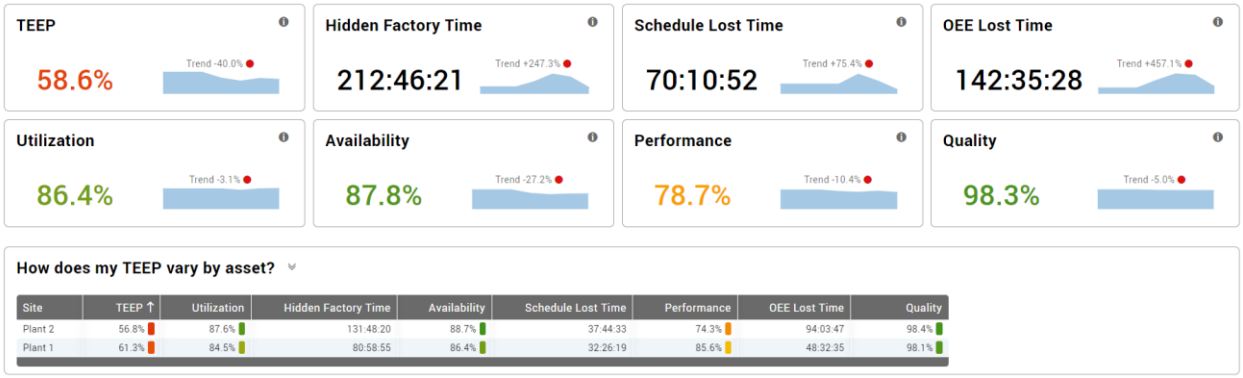
Teams and Labor

Deep dive into teams (an analytical dimension) and labor (metrics). Ideal for identifying best practices and creating standardized work that captures knowledge and transfers that knowledge between teams, as well as evaluating how actual labor efficiency compares to company standards.



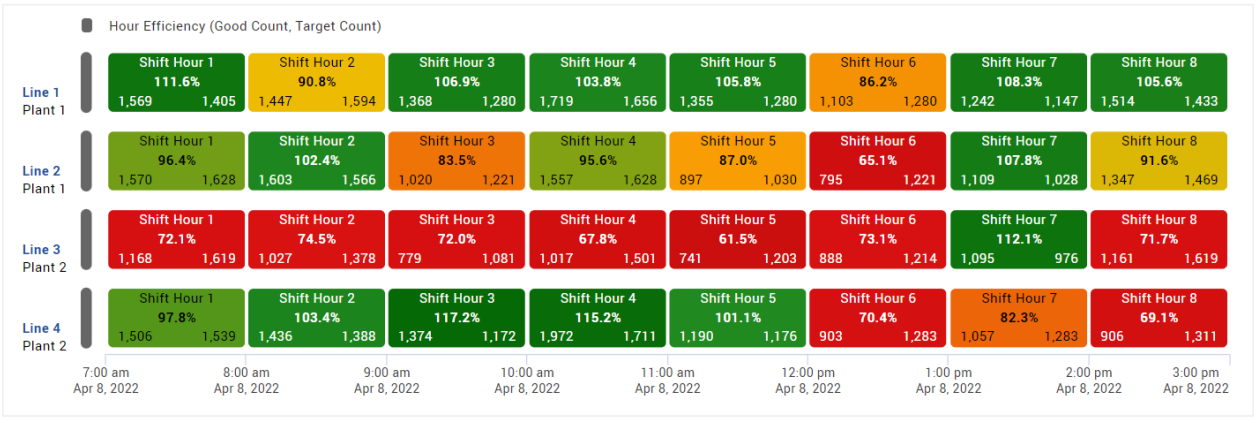
TEEP (Hidden Factory)

Deep dive into TEEP, which fully exposes your "hidden factory" by extending OEE with utilization and schedule loss. Ideal for identifying additional capacity that exists within your current manufacturing processes. Often evaluated as a precursor to new capital investments.



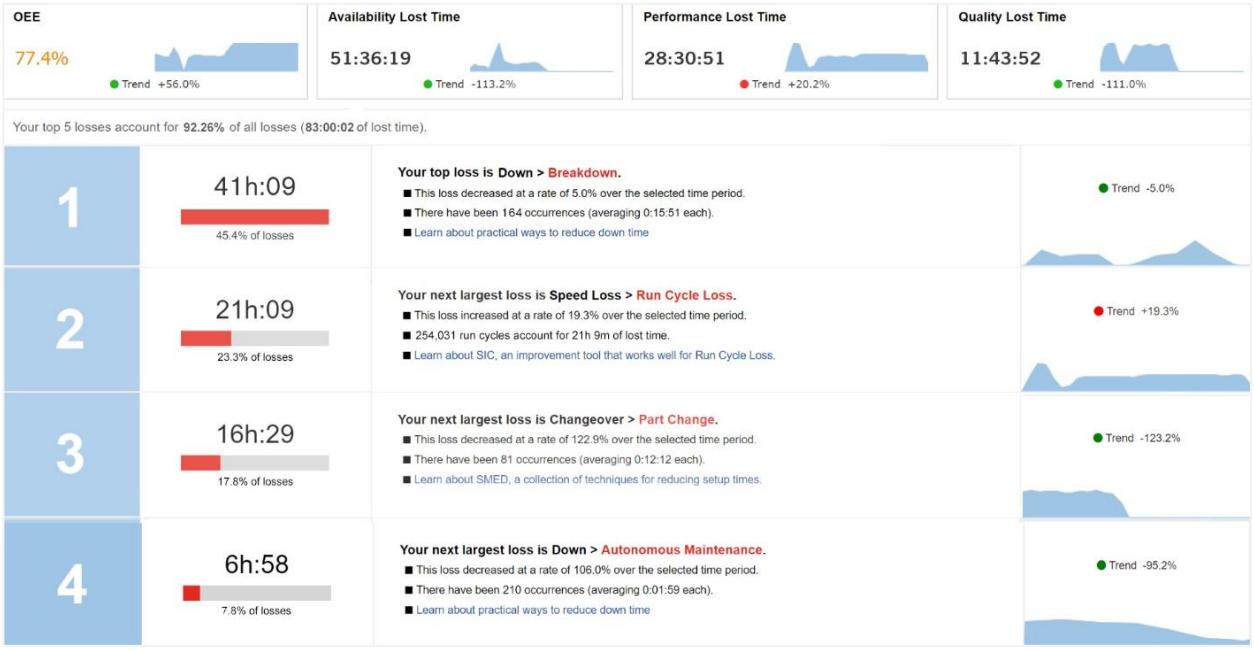
Timeline

View the state of multiple manufacturing processes over time on a synchronized timeline. Ideal for getting a quick picture of production in an area or site, and for finding patterns that exist across the site.



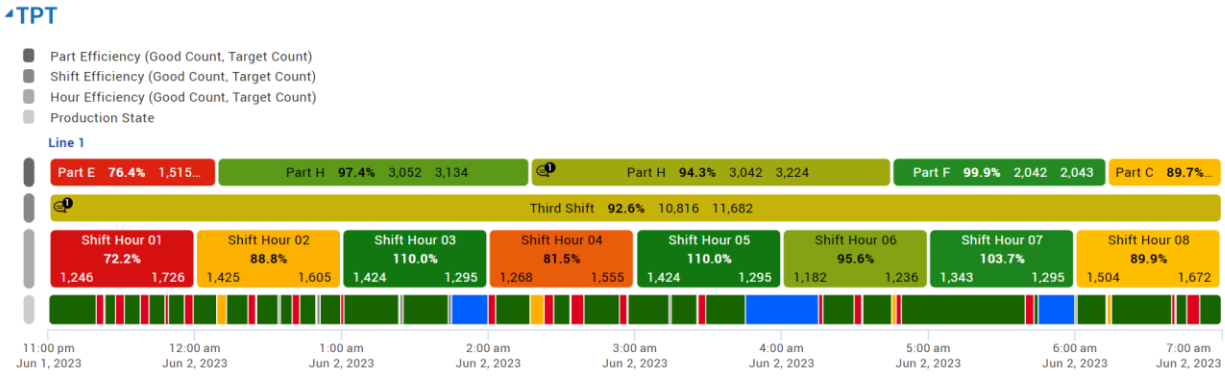
Top Losses

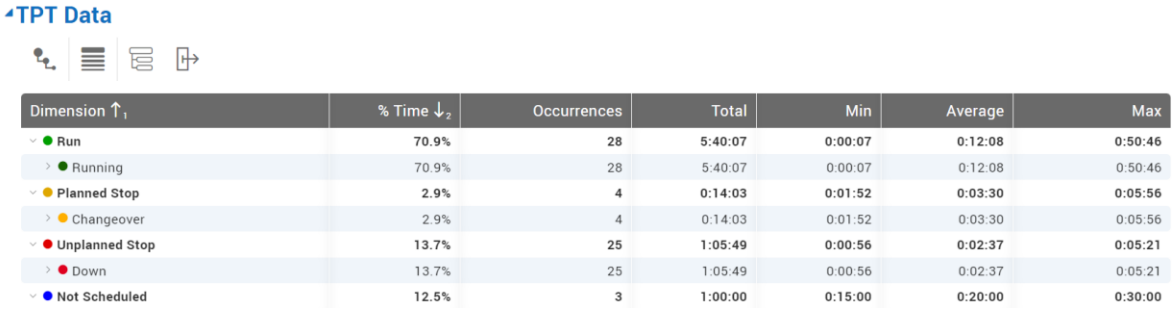
View every loss that impacts OEE, ranked and prioritized by how much production time was lost, with additional details for each loss. Ideal for identifying, prioritizing, and evaluating the effectiveness of improvement projects.



Total Production Timeline

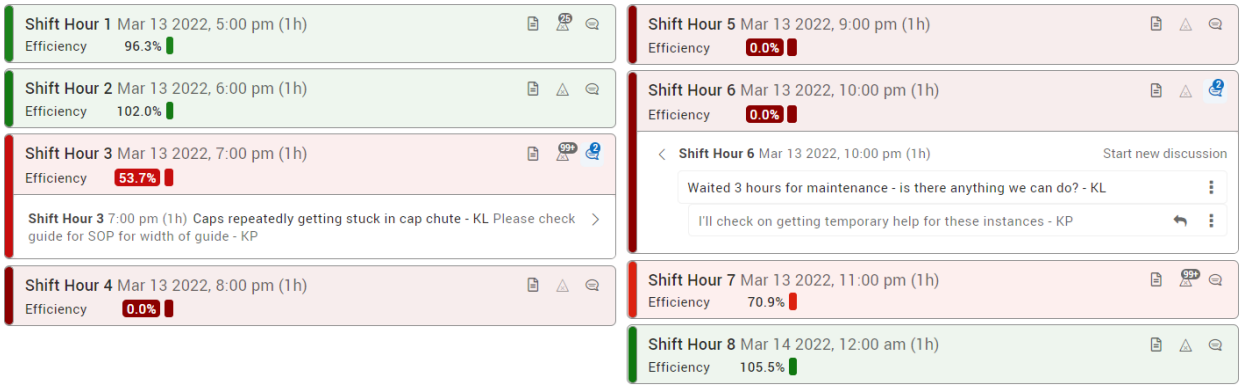
View the state of the manufacturing process over time, including production state, shifts, production hours, and part runs. Ideal for spotting patterns and problematic transitions, such as rough running after a changeover.





View Comments

Analyze comments to identify follow-up and improvement actions – or simply to verify that your team is following your policies for capturing comments. Expand to show metric and reject details or add/remove metrics that are most important to your team.



Appendix D: Dashboards

Dashboards

XL includes a powerful engine for custom reporting via Dashboards. Each Dashboard starts as a blank page, allowing you to add any of the following widget combinations and control the dashboard layout. All dashboard widgets are enterprise-aware, so every widget can include data from one or more Work Centers in your hierarchy.

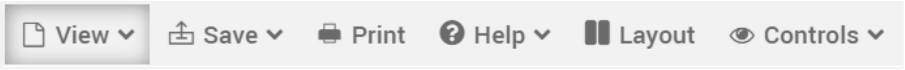
The **View Menu** hosts the functions for dashboards and some reports, including the ability to assign a view as the Page or Device default.

Action	Description
Create new view	Creates a new local view. Only available on dashboard pages.
Share this view	Converts a local view to a shared view so anyone can access it, deleting the local view. You must be logged in to share a view.
Modify name of view	Allows you to change the name of the current view.
Delete this view	Deletes the current view. Not available for Built-In views
Page default	Sets the current view as the default view for this page (e.g. Dashboards or All Production). Only available for built-in and shared views, and when the view visibility is set to Anyone.
Device default	Sets the home page for the device (i.e., when the IP Address is entered). Only available for built-in and shared views, and when the page and view visibility is set to Anyone.
Access Control	Restricts selected view or page.

The **Save Menu** hosts the save and copy functions for dashboards.

Action	Description
Save	Saves the view in its current state.
Save As	Creates a copy of the current view as a local view with a new name.

Create a Report



1. Navigate to Reports Menu > Monitor > Dashboards
2. Click View > + Create new view.
3. Name your new Report.
4. To make dashboard shareable, ensure you are logged in as Administrator, then navigate to **View > Share this View** and click **OK to Share**.
5. If necessary, click the **Layout** control in the page control bar to change the dashboard from view mode to layout mode.
6. Click **+ Add Widget** and select from list.

Layout Mode

Each dashboard can include any number of sections, and each section can be configured using any one of eight column layouts. Each column can hold any number of stacked widgets.

Section Layout Controls:

Control	Description
Add Section	Inserts a new blank section beneath the currently selected section.
Move Section Up	Moves the currently selected section above the prior section.
Move Section Down	Moves the currently selected section below the next section.
Delete Section	Deletes the entire section.
Column Layouts	Allows you to configure column layout within the section. Choose from eight different options with up to six columns per section.

Widget Layout Controls:

Control	Description
Add Widget	Allows you to add a widget to the current section.
Delete Widget	Removes widget from the current section.
Move Widget	Allows you to move the widget within a section.

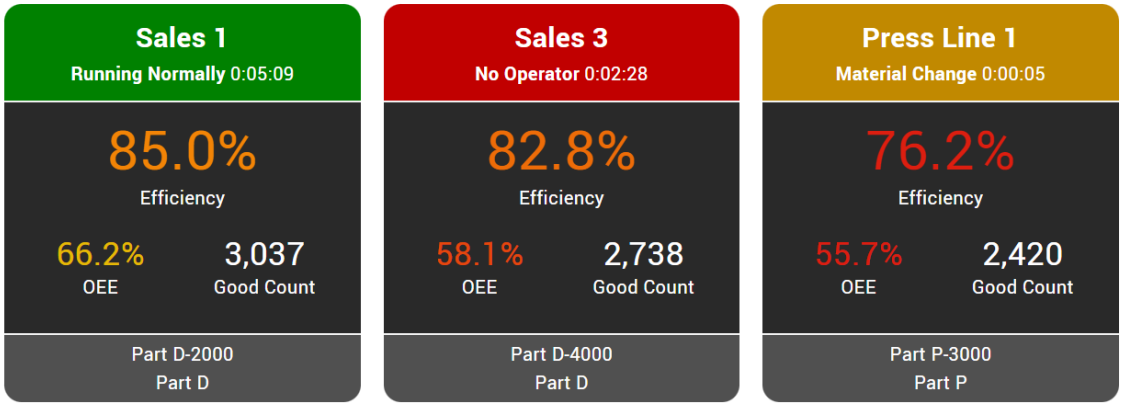
Common Controls

Below are controls consistently present in most widgets:

Control	Description
Show Controls	Allows you to show or hide controls while in either View Mode or Layout Mode.
Enterprise	Allows you to isolate or combine work centers within a widget
Time Range	Choose to follow the main page's time selector or isolate your time range to a specific widget
Metrics	Or Columns, typically contain quantitative metrics
Dimensions	Or Rows, typically contain qualitative values
Filters	Restrict the underlying data by creating expressions for various Metrics and Dimensions
Duplicate	Copy an existing widget in layout mode

Andon

Andon widgets are beneficial for viewing up to four metrics in real-time or looking at historical data. You can show multiple Dimensions in the footer of the widget such as showing the current Job and Part.



Chart

Charts are useful for comparing, contrasting, and trending information for a visual audience.

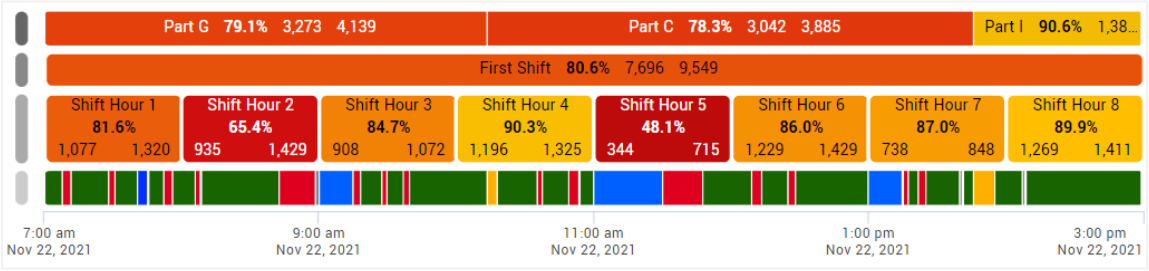
- **Chart Type**: choose from cluster, column, heat map, line, Pareto, stacked column, and stacked Pareto.
- **Data Point:** on time series data, the specific data value; for Pareto charts, the cumulative percentage
- **Trend Line:** shown by default for time series data.
- **Time Units:** enables you to change the time granularity to Hour, Shift, Day, Week, Month, Quarter, or Year.

The Chart widget includes a feature called Quick Charts that enables you to generate a chart by simply selecting metrics and dimensions in a way that resembles a chart title:

Chronogram

Chronograms are useful for visually showing category values over time (e.g., whether the process is running or down). In addition to Common Controls, choose the edit icon to configure:

- **Add Strip**: add data that will be visualized.
- **Strip Height**: short or tall.
- **Heat Metric**: metric that determines color of heat mapping.
- **Text Overlay**: optionally show the dimension value and up to three metrics on chronogram events.
- **Labels**: optionally show site/area/work center labels and legend.
- **Strip Placement**: Move Strip Up, Move Strip Down, Delete Strip



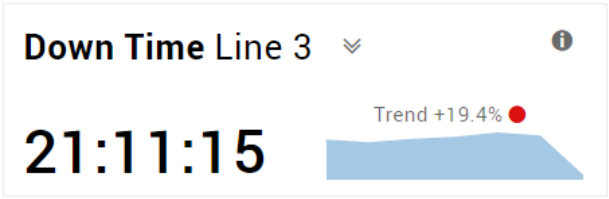
Event List

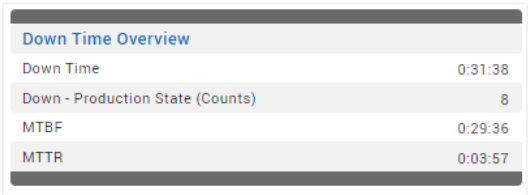
Event Lists enable you to explore production information in a vertical timeline, where time is organized by whatever production- or time-based dimension you choose and search the comments associated with your events. In addition to Common Controls, you can configure:

- **Heat Metric:** the metric that determines color of heat mapping.
- **Metrics:** quantitative values in text overlay.
- **Event Body:** detailed information below each heading.

KPI and KPI Group

KPIs provide detailed information about a single metric while KPI Groups show multiple metrics organized in tabular fashion. You can configure up to 30 metrics and formatting components with KPI Groups.





Table

Tables show tabular information either grouped with drilldown or chronologically by event. In addition to Common Controls, you can configure:

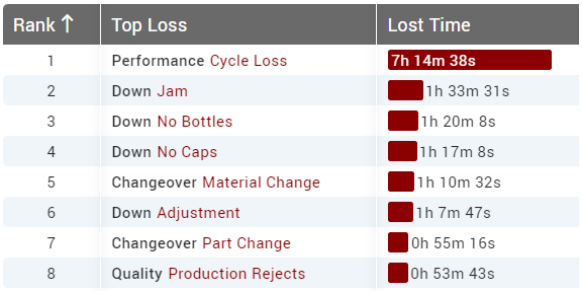
- **Collapse to Level:** show level of detail in rows
- **Sort:** add sort rules of column dimension(s). You can add multiple sorting rules to tables.
- **Group:** organize data by individual event, aggregated, or hierarchical.
- **Export:** export to Microsoft Excel® (.xlsx format).

Shift	Count Overview		Availabil...	Performance	Quality	OEE	Efficiency	Top Down Reasons	
First Shift	In Count	56,701	78.9%	74.0%	97.3%	56.8%	83.6%	Jam 23 events	1h 18m
	Good Count	55,174						Autonomous Maintenance 16 events	1h 9m
	Reject Count	1,549						Downtime code 1 15 events	1h 2m
Second Shift	In Count	50,289	77.9%	69.2%	96.8%	52.2%	76.5%	Jam 26 events	1h 27m
	Good Count	48,664						Downtime code 1 18 events	1h 22m
	Reject Count	1,630						Autonomous Maintenance 16 events	1h 2m
Third Shift	In Count	53,642	79.2%	71.0%	96.5%	54.2%	78.9%	No Operator 22 events	1h 24m
	Good Count	51,764						Jam 19 events	1h 16m
	Reject Count	1,902						Autonomous Maintenance 17 events	1h 6m

Top Losses Table

Top Losses allows you to see your top losses within a larger dashboard page. In addition to Common Controls, you can configure:

- **Row Options:** limit the number of rows visible.
- **Sort:** add multiple sort rules (default by rank).
- **Export:** export to Microsoft Excel® (.xlsx format).

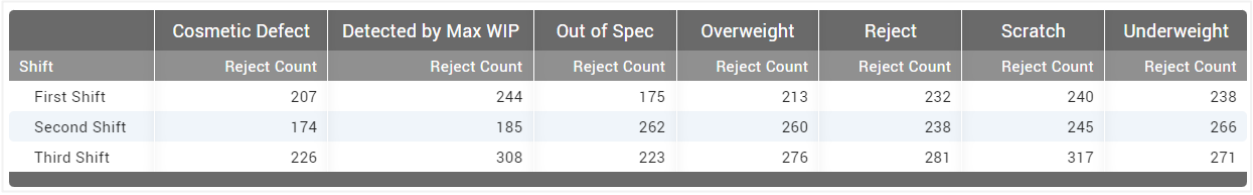


Rank ↑	Top Loss	Lost Time
1	Performance Cycle Loss	7h 14m 38s
2	Down Jam	1h 33m 31s
3	Down No Bottles	1h 20m 8s
4	Down No Caps	1h 17m 8s
5	Changeover Material Change	1h 10m 32s
6	Down Adjustment	1h 7m 47s
7	Changeover Part Change	0h 55m 16s
8	Quality Production Rejects	0h 53m 43s

Pivot Table

Pivot Tables summarize and cross-tabulate data across multiple dimensions, which makes it easier to see patterns in your data. You can configure:

- **Collapse to Level:** show level of detail in rows
- **Row:** qualitative dimensions in rows
- **Column:** overarching category of quantitative data in table columns.
- **Metric:** quantitative data in table columns.
- **Export:** export to Microsoft Excel® (.xlsx format).



	Cosmetic Defect	Detected by Max WIP	Out of Spec	Overweight	Reject	Scratch	Underweight
Shift	Reject Count	Reject Count	Reject Count	Reject Count	Reject Count	Reject Count	Reject Count
First Shift	207	244	175	213	232	240	238
Second Shift	174	185	262	260	238	245	266
Third Shift	226	308	223	276	281	317	271

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