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Siemens Digital Industries Software

Opcenter Intelligence Electronics

A powerful solution for multisite
big data collection and analytics

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Addressing the most pressing challenges in electronics manufacturing

High-variation, low-volume manufacturing

With the rise of customization across almost every manufacturing sector, the days of most orders being high-volume, low-mix are all but gone. High-mix, low-volume (HMLV) production is becoming the norm. In electronics manufacturing, where each new product introduction (NPI) requires significant time and resources to achieve high yield and efficiency, HMLV presents an enormous challenge.

Making data useful

Research shows that while the amount of data generated by manufacturing operations is increasing exponentially, only a small portion is collected, and an even smaller portion is analyzed. The data that is analyzed is often descriptive and diagnostic, focusing on what has already happened, and does not include data-based insights to predict and prevent problems before they occur.

Optimizing material usage

Approximately 70 percent of electronics manufacturing costs are related to material usage, including scrap, moisture-sensitive devices (MSD), surplus materials and inventory turnover. Manufacturers need advanced tools to pinpoint problems, prevent mass recalls and correct errors before they lead to material waste.

Compliance

Manufacturers are required to maintain a full account of every product's history for compliance and traceability purposes. They need massive storage capacity for long-term traceability data and ongoing monitoring to collect data in compliance with customer and regulatory requirements.

Designed specifically for printed circuit board (PCB) assembly and system assembly manufacturing, Opcenter Intelligence Electronics offers a powerful solution for multi-site, big data collection and analytics.

The data challenge: turning big data into smart data

Opcenter Electronics Intelligence offers out-of-the-box reports with the following capabilities:

- Self-service – create custom visualization, custom metrics and more
- Alarms and notifications
- Enrich data with other data sources
- Natural language query
- Schedule regular reports to be sent by email
- Available machine intelligence (MI) and artificial intelligence (AI) formulas
- Mobile access
- Enable big data
- User access control



Opcenter Intelligence Electronics provides out-of-the-box reports that make it easy for manufacturers to understand what's happening, why it's happening and how to improve. By creating a comprehensive digital twin of all operations, Opcenter Intelligence Electronics:

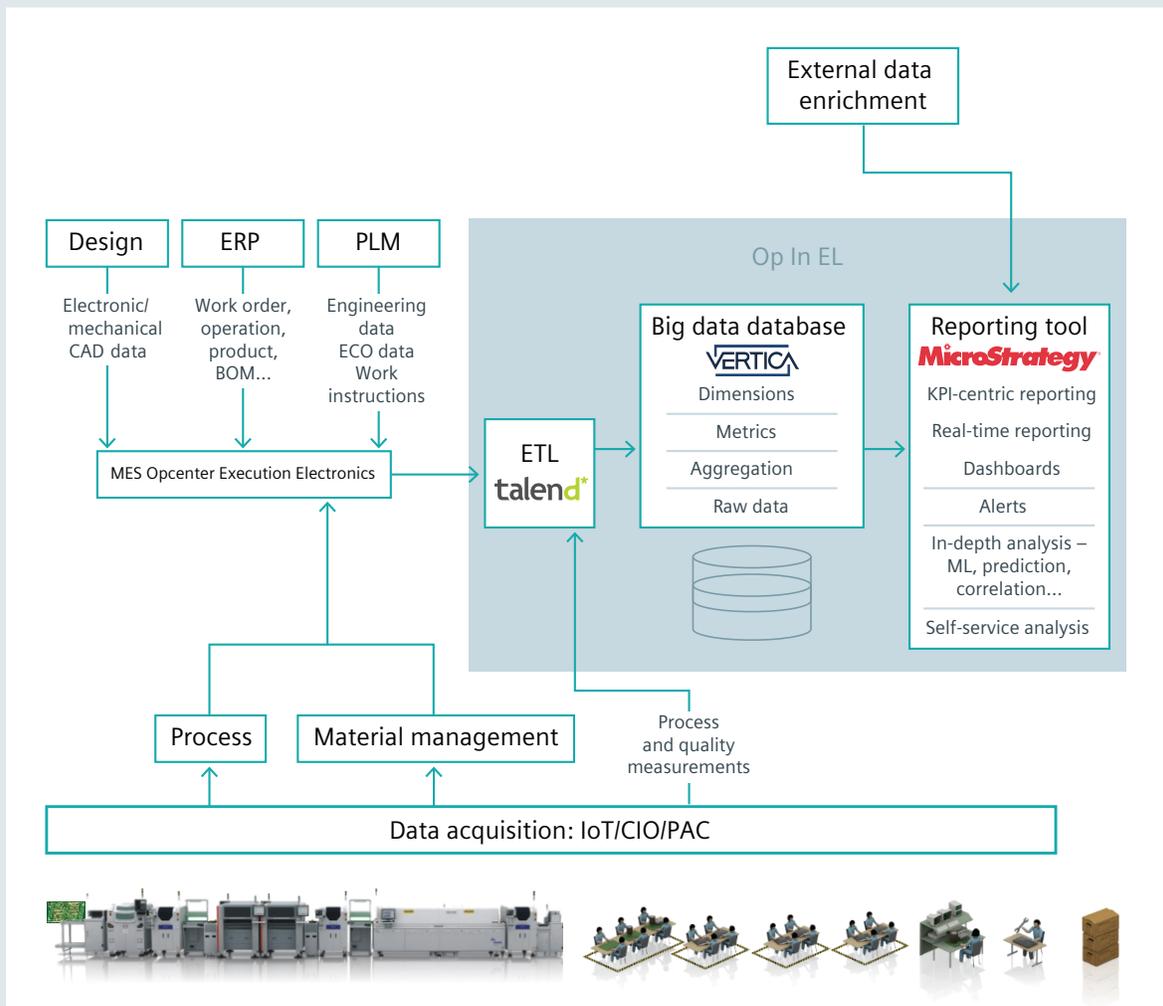
- Improves asset management with accurate, real-time utilization and overall equipment effectiveness (OEE)
- Helps capture and investigate complete material and process traceability data for PCBs and assemblies using big-data, high-availability storage
- Optimizes operation and labor by measuring and analyzing how resources are spent
- Tracks work-in-progress (WIP) in real-time
- Safeguards quality and drives improvement by identifying and analyzing process defects and material and process failures
- Increases design-to-manufacturing efficiency by detecting factors affecting yield and areas for improvement

While Opcenter Intelligence Electronics can be integrated with any MES, it is seamlessly integrated into Siemens' Opcenter Execution Electronics MES. Together, they offer PCB manufacturers a comprehensive solution that includes datasets and key performance indicators (KPIs) specific to the PCB assembly industry and reports that help answer crucial questions for PCB manufacturers.

- Best-in-class, out-of-the-box shop floor connectivity
- Outstanding material management capabilities
- Integrated with product lifecycle management (PLM), enterprise resource planning (ERP) and manufacturing operations management (MOM) software

Opcenter Intelligence Electronics incorporates cutting-edge technologies including the MicroStrategy advanced analytics platform, Vertica data storage and aggregation and the Talend extract, transform, load (ETL) data collection layer.

Opcenter Intelligence Electronics architecture overview



Opcenter Intelligence Electronics acquires data from all shop-floor stations (automated as well as manual) all the way to box-build. Process and material data is sent to the ETL platform through the Opcenter Execution Electronics MES, and process and quality measurements are collected directly into the Opcenter Intelligence Electronics platform.

Our ETL solution Talend pulls data from the MES databases and places it into the big data database, Vertica. Vertica is designed to manage large, fast-growing volumes of data and provide very fast query performance. MicroStrategy is the reporting tool employed by the end user, enabling in-depth analysis of the data and simple visibility.

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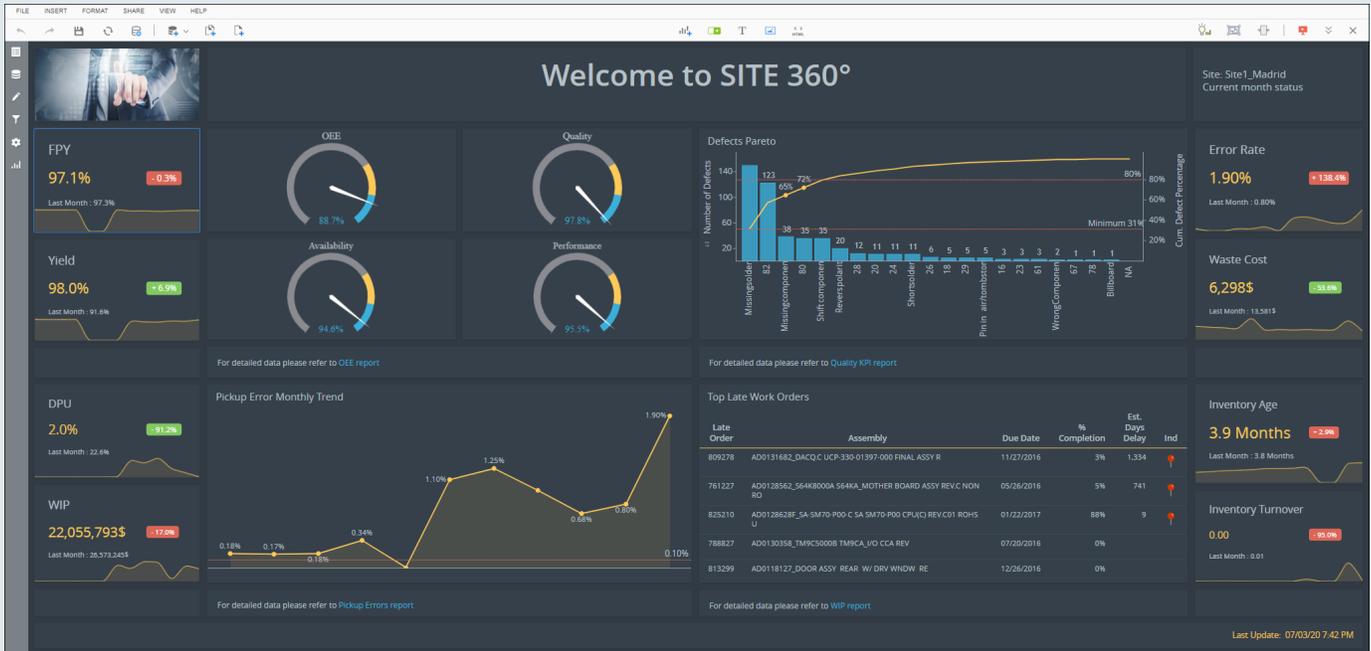
Material, product and process traceability

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Site 360°

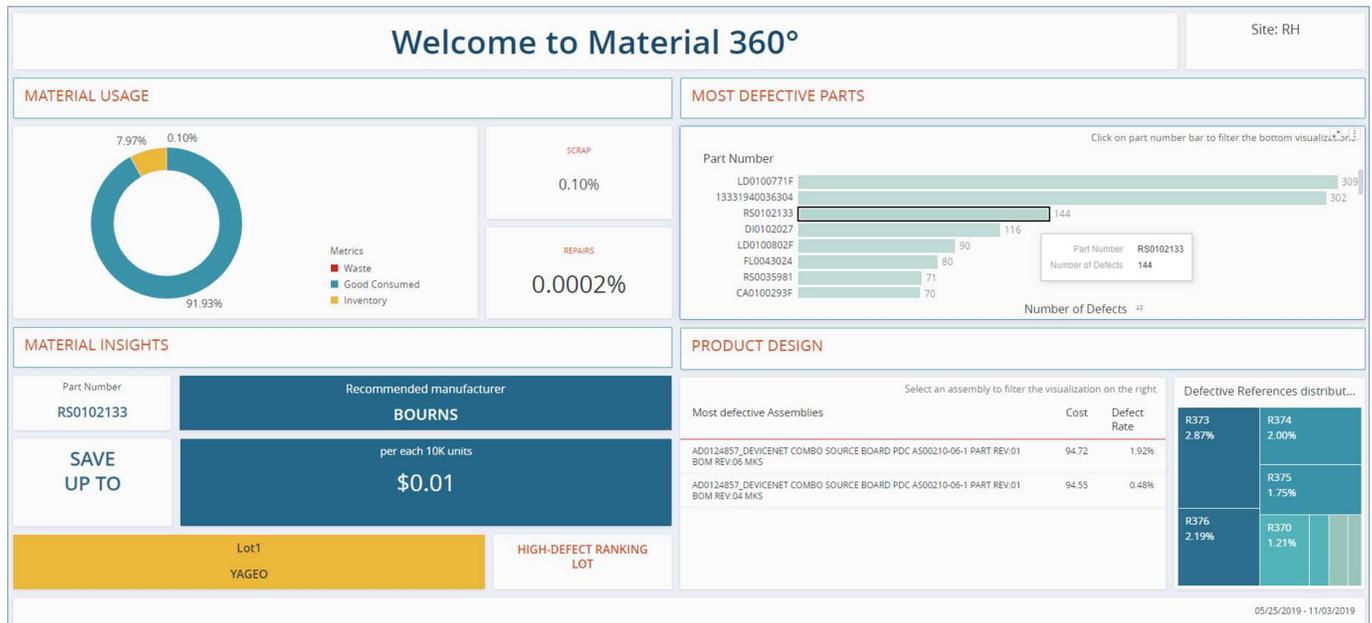


The Opcenter Intelligence Electronics home page displays the Site 360° overview. This dashboard offers a complete production analysis for all business domains including quality, material and line utilization, as well as all KPI scores for the current period compared to the previous 12 months.

Value

- Out-of-the-box “go-to” report
- Complete shop-floor visibility and in-depth analysis with customizable drill-down
- Rapid identification and resolution of shop floor bottlenecks

Material 360°

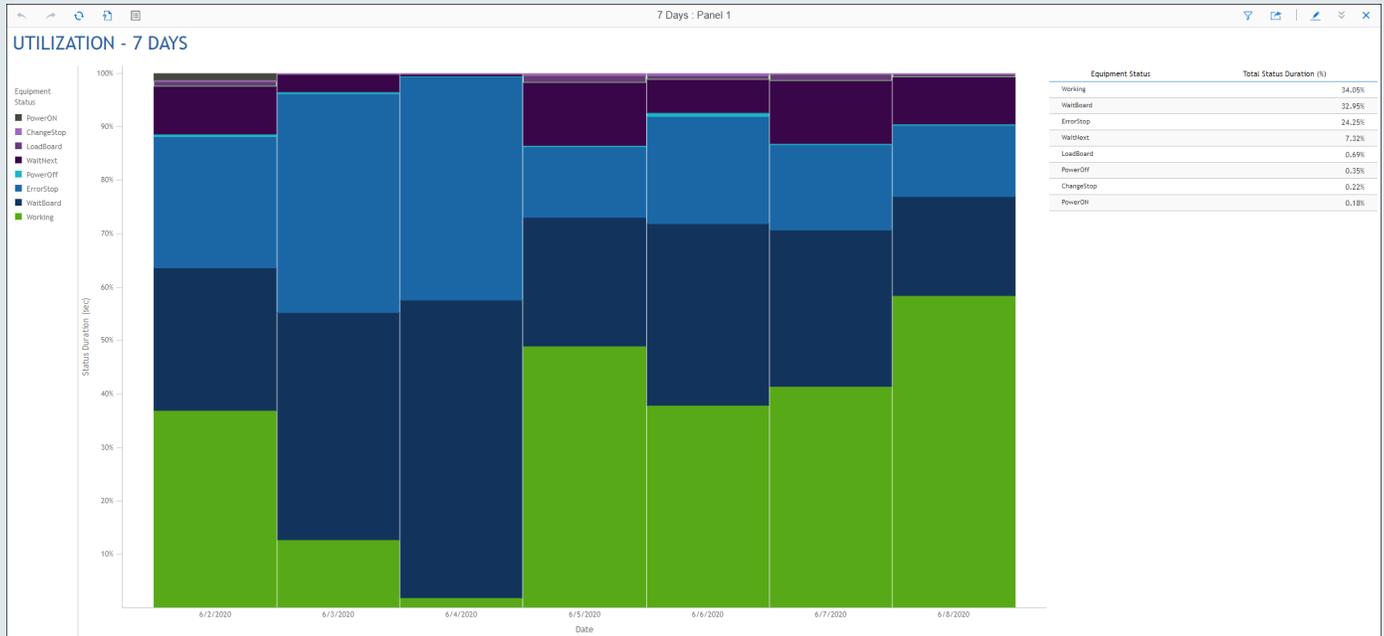


The visualization provides complete material analysis, with data from different points in the site, including material consumption and defects from the shop floor and material inventory from the warehouse. The analysis includes quality data-based insights and part manufacturer recommendations.

Value

- Full visibility of material across the entire site
- "Go-to" report of essential material data for production managers
- One concise dashboard with aggregated data from different material reports
- Highlighted part manufacturer recommendations to support better part selection

Machine utilization

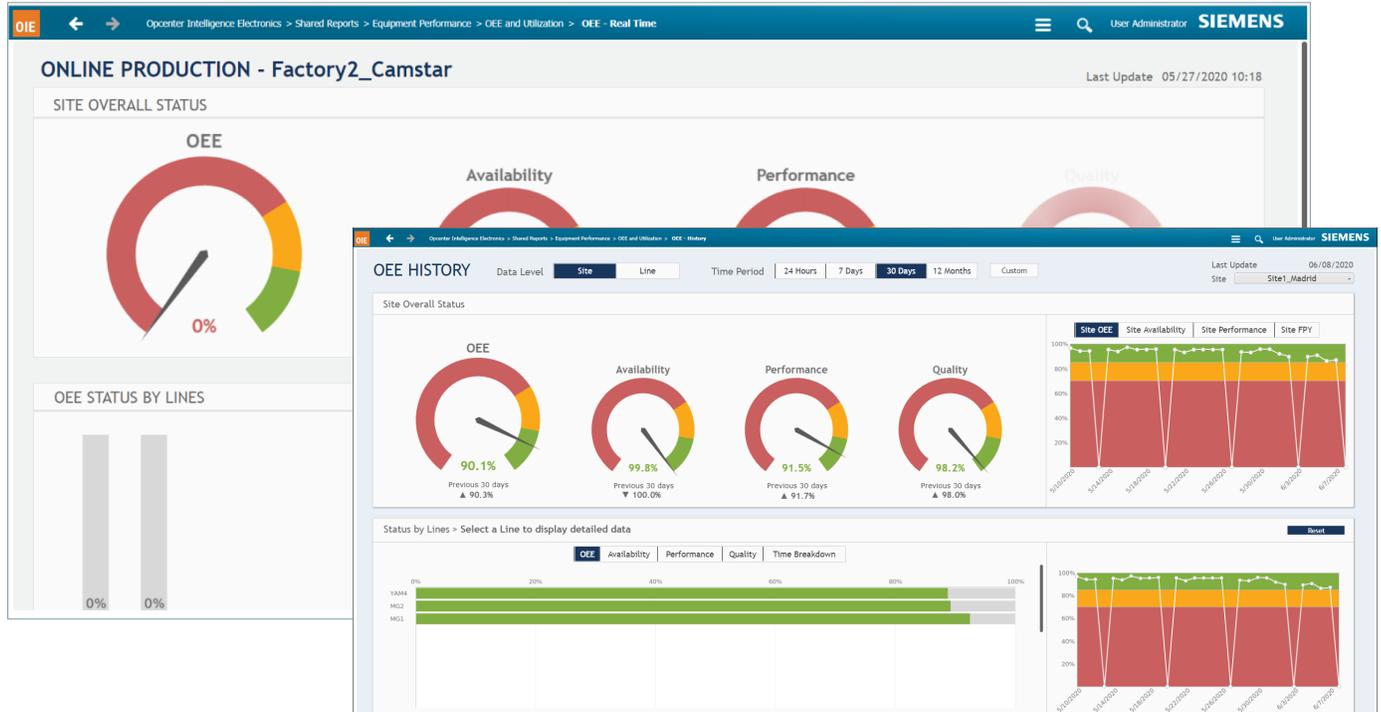


The machine utilization report displays actual machine statuses, availability, and performance metrics for each machine in each line for each day in the selected time period. The report also displays customized statuses to analyze reasons for machine stops.

Value

- Operator visibility of machine utilization
- Bottleneck identification at the machine and line level
- Comparison of actual versus planned machine production times

Overall equipment effectiveness (OEE)



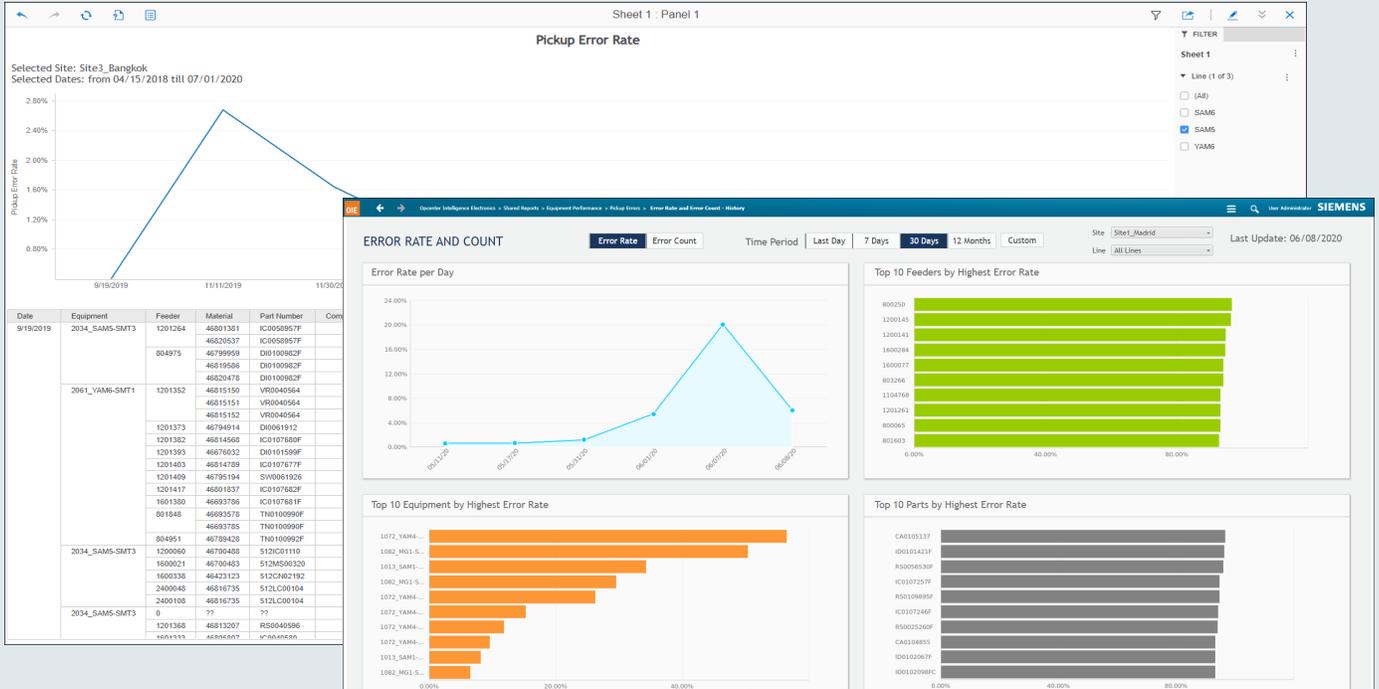
The OEE history report provides statistics on machine availability, performance, quality and overall equipment effectiveness (OEE) for the site or line during pre-defined or custom time periods. The real-time OEE report provides the same data in real time.

Value

- OEE display at site, line or machine level
- Critical line efficiency data for production managers
- Drill-down capabilities at the machine level for in-depth investigation of metrics (using the machine utilization report)

Equipment performance

Pickup errors



The pick-and-place pickup error reports and dashboards provide statistics on the number of errors occurring on each line, machine within the line and feeder used on the machine. The error count represents the difference between the number of picked components and the number of placed components.

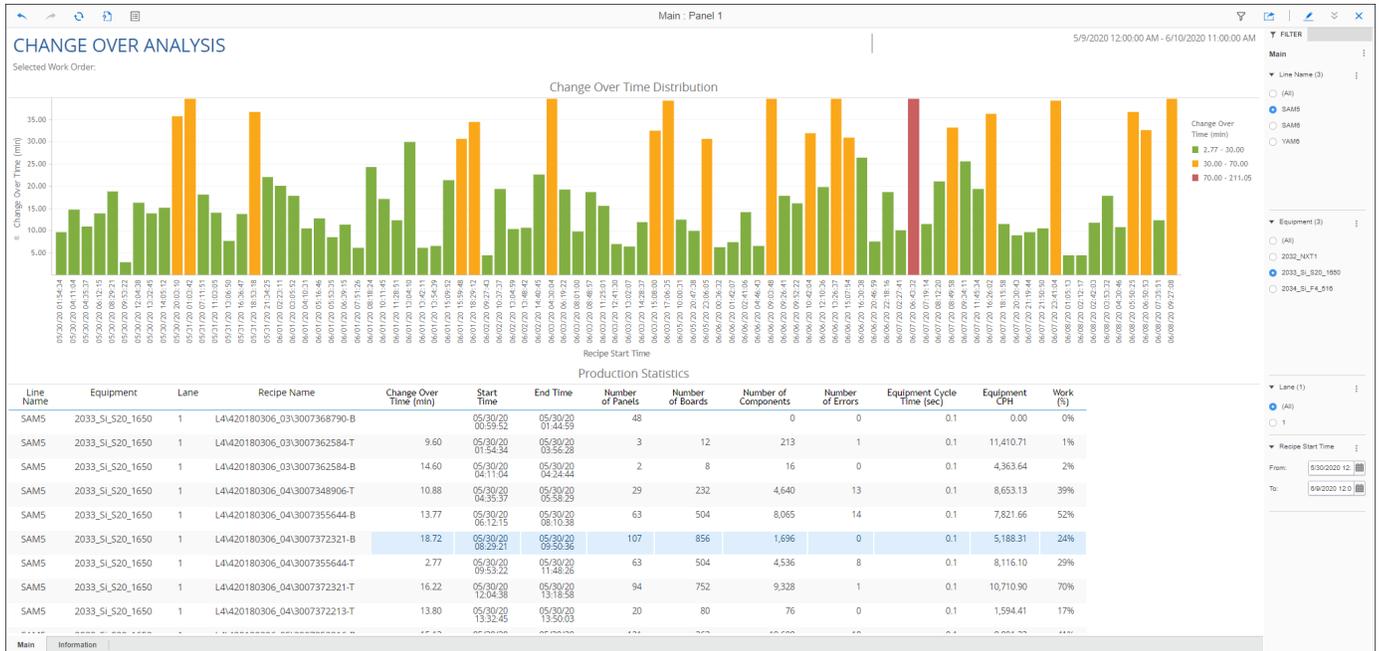
Included reports: real-time, history, self-service

Value

- Machine performance visibility for operators
- Identification of faulty feeders that require maintenance
- Analysis of pickup errors trends

Equipment performance

Changeover analysis



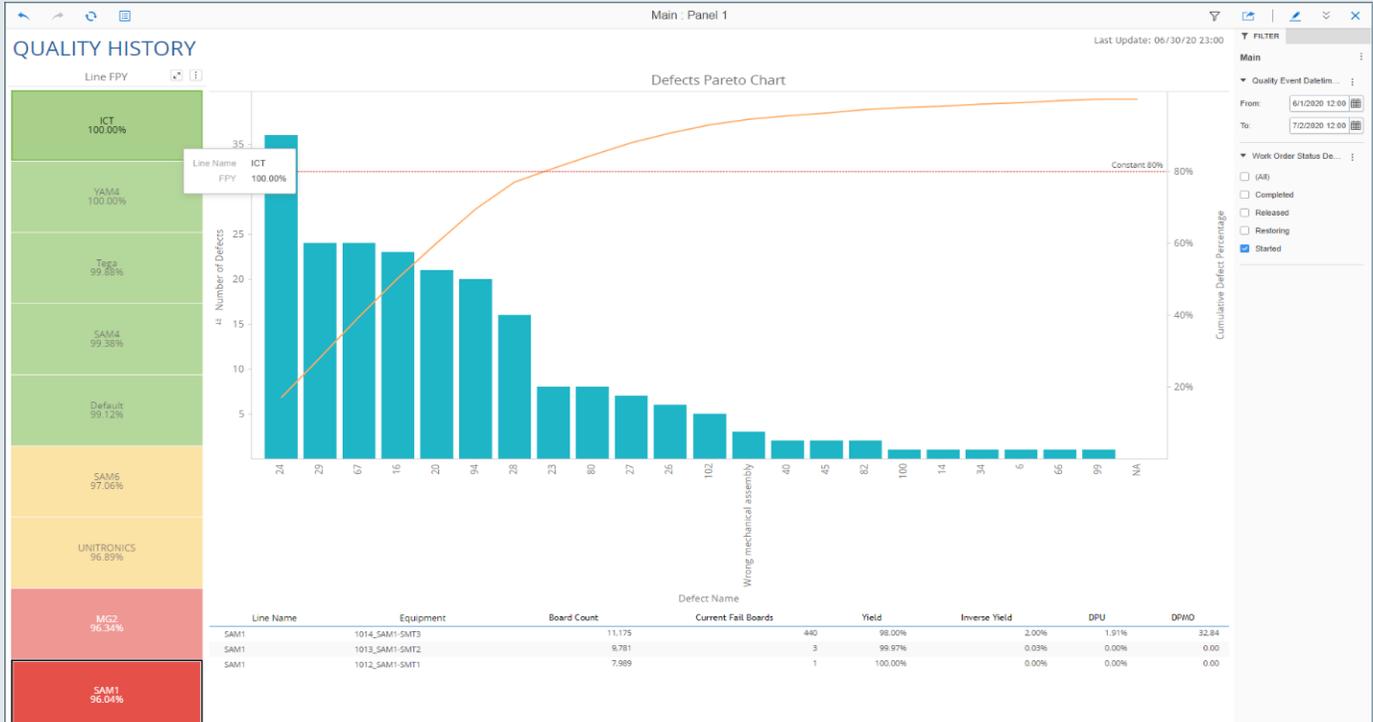
This report displays detailed changeover information for each line, piece of equipment and lane in the factory. It shows the changeover time distribution and overall production statistics per work order, including number of boards, number of errors, cycle time, components per hour (CPH) and work percentage.

Value

- Monitoring of changeover times
- User-defined KPIs for acceptable/unacceptable/mediocre changeover times
- Analysis of changeover times based on custom KPIs
- Information for changeover optimization

Quality and measurements

Quality history KPIs



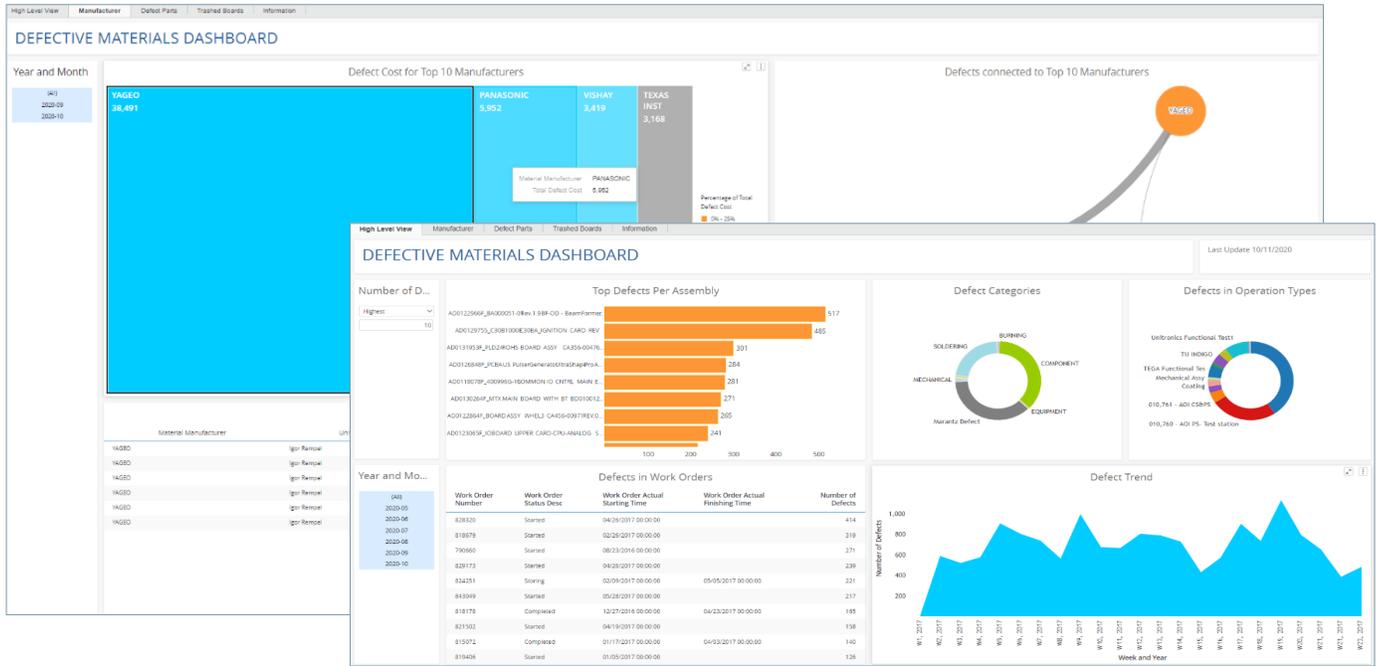
The quality history report analyzes defects, symptoms and repairs from site level down to the specific event. It displays a wealth of attributes and metrics with out-of-the-box KPIs that enable in-depth analysis.

Value

- Quality overview for managers
- Trend analysis and decision support to determine root cause and enable calculated decisions
- Dozens of pre-calculated KPIs can be added to the report according to need

Equipment performance

Defective material

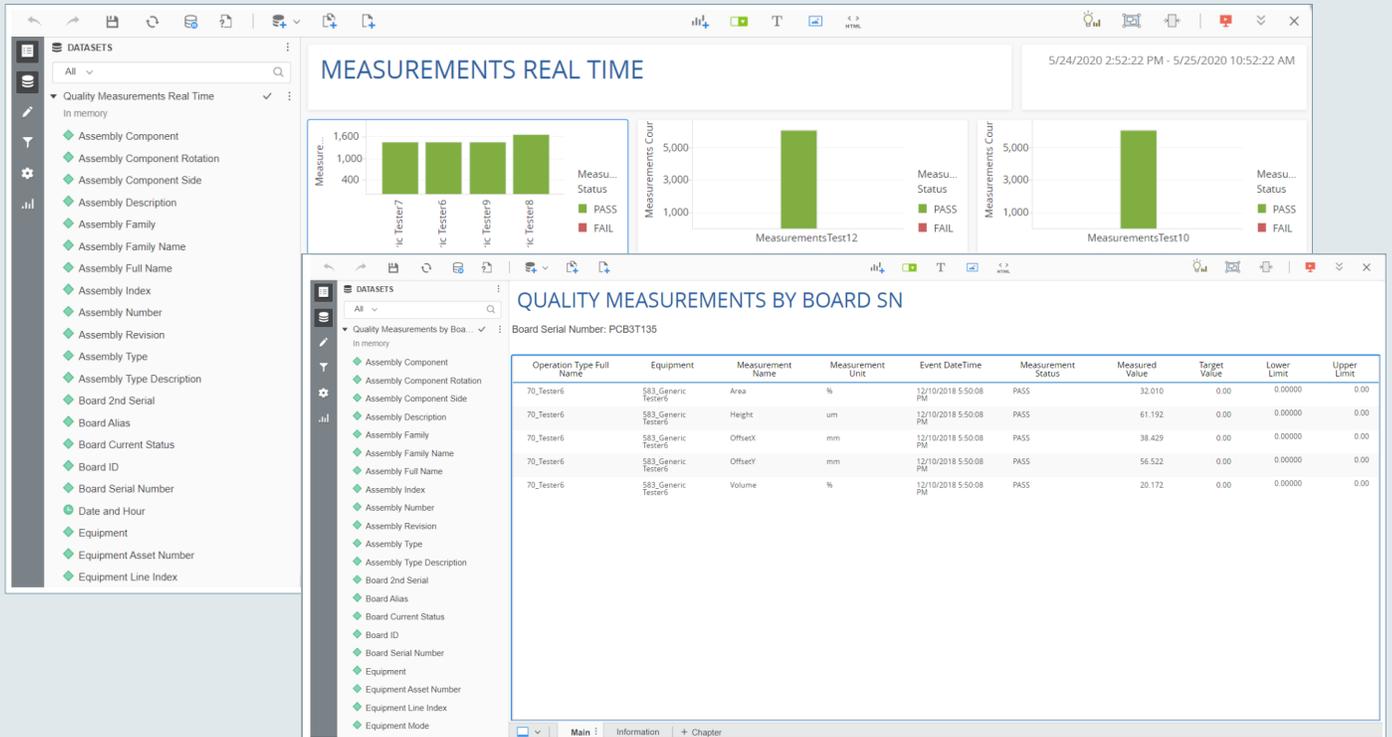


The defective material report aggregates data from two business domains, quality and material traceability, and cross-links defect events and material data. It provides defect analysis and trends, sorted by defect and operation type. The dashboard also provides a highlighted part manufacturer analysis, in both quantity and cost terms.

Value

- Analysis of defect costs per part manufacturer, so operators can choose manufacturers with the lowest defects rate
- Defect trend monitoring to enable quicker action when defect thresholds are crossed
- Defect sorting by category, operation type, assembly, work order, equipment and more, allowing easy detection of abnormal results and urgent issues

Measurements real time



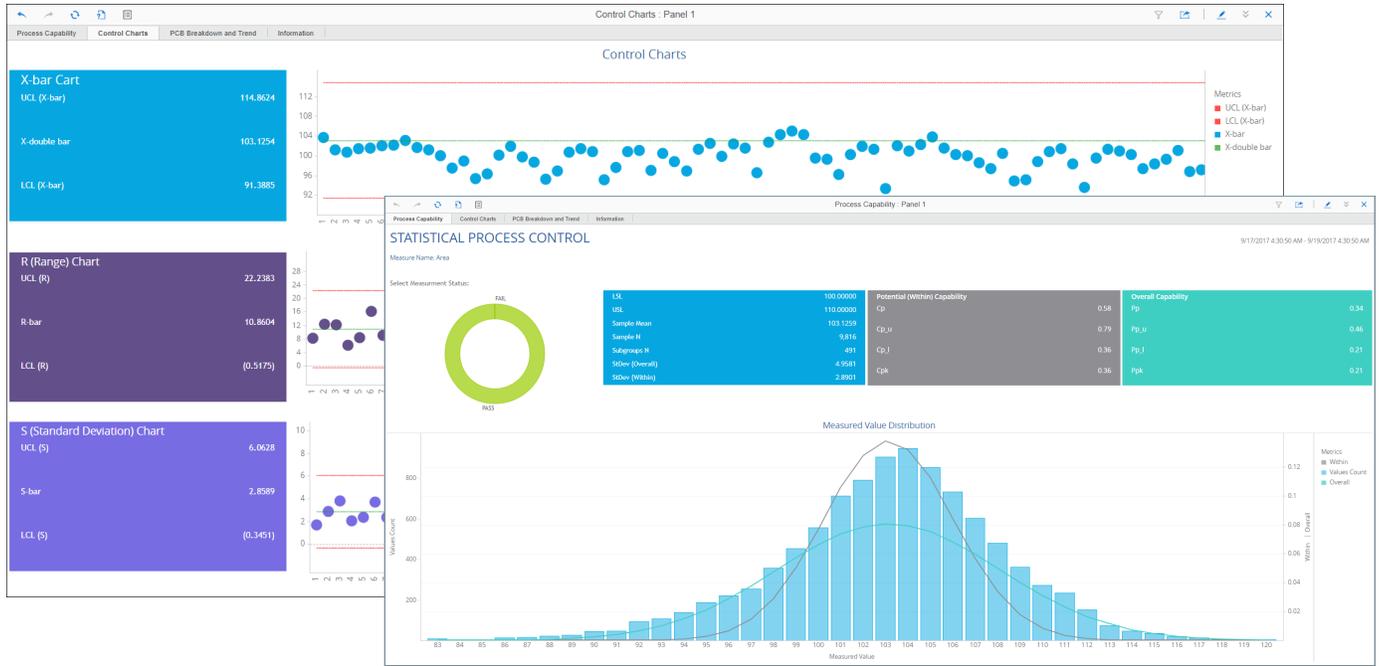
This report displays near-real-time measurements collected from all automated testing machines in the site and aggregated according to assembly, work order, equipment and more. It allows tracking and monitoring of the data collection from automatic testing machines. Quality measurements by board includes all measurements collected for each board from all automated testing machines.

Value

- Monitoring to ensure data is being collected in compliance with customer requirements
- Identification of fails in near-real-time, early reaction to abnormal rates
- Visibility of all measurements collected per board for compliance and traceability purposes

Quality and measurements

Statistical process control (SPC)



Statistical process control is a quality control report that employs statistical methods to monitor and control quality measurements. SPC confirms that the process operates efficiently, producing more specification-conforming product with less waste (rework or scrap).

Value

- Out-of-the-box SPC report
- Insufficient process result detection to optimize processes
- Predefined email alerts of deviation from normal rates
- Assurance that processes are stable and predictable

Material traceability

Material traceability

MATERIAL TRACEABILITY									
General Material Information									
Material	Part Number	Lot Number	Manufacturer	Manufacturer Part Number	Supplier	Receive Date	Work Order Number		
1255407	RS0005360	NA	NA		NA	8/4/2016 10:35:26 AM	??	839509	
Board	Board Processing DateTime	Equipment	Recipe Name	Station	Slot	Subslot	Part Number	Reference	
1495161338	6/17/2019 11:55:38 AM	2053_SAM6-SMT2	APL_AD0105455A_B_CSW_M2(421)	1	39	0	RS0005360	R193	
1495161338	6/17/2019 11:55:38 AM	2053_SAM6-SMT2	APL_AD0105455A_B_CSW_M2(421)	1	39	0	RS0005360	R194	
1495161338	6/17/2019 11:55:38 AM	2053_SAM6-SMT2	APL_AD0105455A_B_CSW_M2(421)	1	39	0	RS0005360	R195	
1495161338	6/17/2019 11:55:38 AM	2053_SAM6-SMT2	APL_AD0105455A_B_CSW_M2(421)	1	39	0	RS0005360	R196	
1495161425	6/17/2019 11:57:19 AM	2053_SAM6-SMT2	APL_AD0105455A_B_CSW_M2(421)	1	39	0	RS0005360	R193	
1495161425	6/17/2019 11:57:19 AM	2053_SAM6-SMT2	APL_AD0105455A_B_CSW_M2(421)	1	39	0	RS0005360	R194	
1495161425	6/17/2019 11:57:19 AM	2053_SAM6-SMT2	APL_AD0105455A_B_CSW_M2(421)	1	39	0	RS0005360	R195	
1495161425	6/17/2019 11:57:19 AM	2053_SAM6-SMT2	APL_AD0105455A_B_CSW_M2(421)	1	39	0	RS0005360	R196	
1495163383	6/17/2019 12:21:35 PM	2053_SAM6-SMT2	APL_AD0105455A_B_CSW_M2(421)	1	39	0	RS0005360	R193	
1495163383	6/17/2019 12:21:35 PM	2053_SAM6-SMT2	APL_AD0105455A_B_CSW_M2(421)	1	39	0	RS0005360	R194	
1495163383	6/17/2019 12:21:35 PM	2053_SAM6-SMT2	APL_AD0105455A_B_CSW_M2(421)	1	39	0	RS0005360	R195	
1495163383	6/17/2019 12:21:35 PM	2053_SAM6-SMT2	APL_AD0105455A_B_CSW_M2(421)	1	39	0	RS0005360	R196	
1495177669	6/17/2019 4:14:39 PM	2053_SAM6-SMT2	APL_AD0047484A_C1_CSW_M2(421)	1	39	0	RS0005360	R193	
1495177669	6/17/2019 4:14:39 PM	2053_SAM6-SMT2	APL_AD0047484A_C1_CSW_M2(421)	1	39	0	RS0005360	R194	
1495177669	6/17/2019 4:14:39 PM	2053_SAM6-SMT2	APL_AD0047484A_C1_CSW_M2(421)	1	39	0	RS0005360	R195	
1495177669	6/17/2019 4:14:39 PM	2053_SAM6-SMT2	APL_AD0047484A_C1_CSW_M2(421)	1	39	0	RS0005360	R196	
1495177754	6/17/2019 4:17:02 PM	2053_SAM6-SMT2	APL_AD0047484A_C1_CSW_M2(421)	1	39	0	RS0005360	R193	
1495177754	6/17/2019 4:17:02 PM	2053_SAM6-SMT2	APL_AD0047484A_C1_CSW_M2(421)	1	39	0	RS0005360	R194	
1495177754	6/17/2019 4:17:02 PM	2053_SAM6-SMT2	APL_AD0047484A_C1_CSW_M2(421)	1	39	0	RS0005360	R195	
1495177754	6/17/2019 4:17:02 PM	2053_SAM6-SMT2	APL_AD0047484A_C1_CSW_M2(421)	1	39	0	RS0005360	R196	

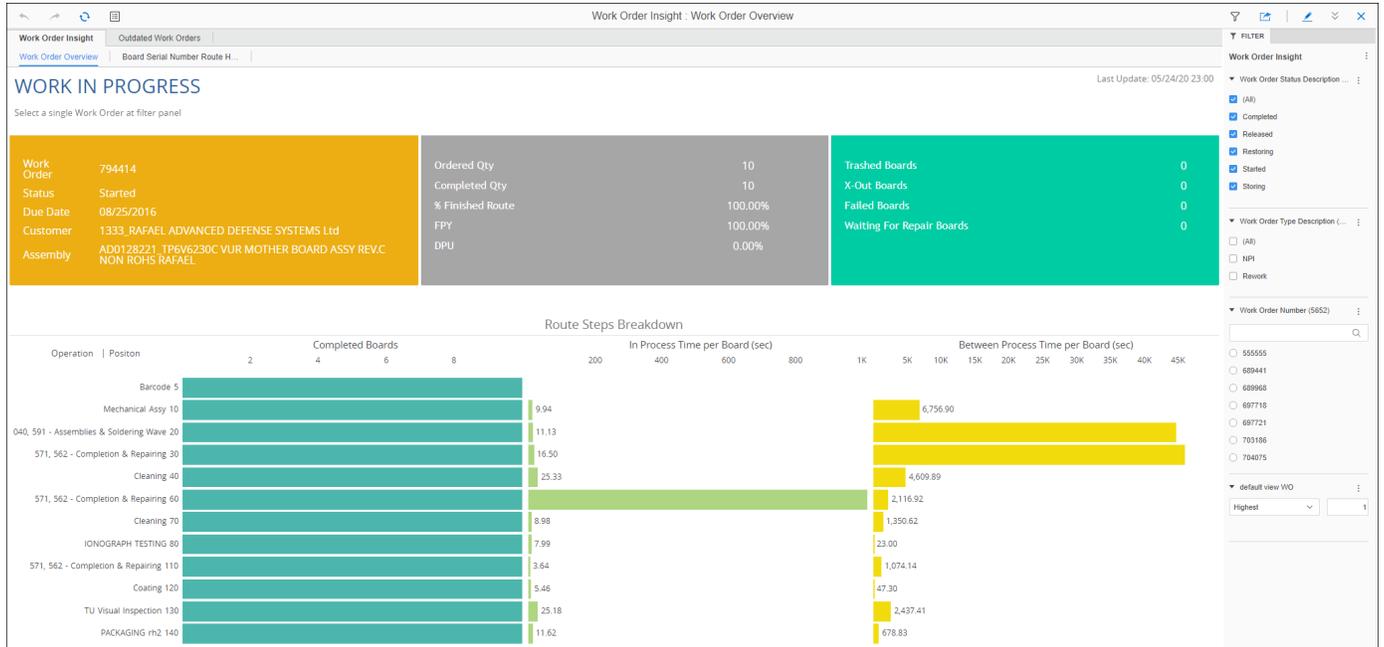
Material traceability data provides information on boards, work orders and material placements. It provides full visibility of materials and processes on each completed board, automatic and manual, as well as the program and machines used in its production, including board, reel and lot traceability.

Value

- Automated traceability reports for compliance with customer requirements
- Quality comparison between material suppliers
- Big database storage for long-term traceability data
- Analysis of trends over extended periods (when paired with Opcenter Intelligence Electronics)
- Reel traceability that can be used in product recalls to minimize the number of recalled boards

Product traceability

Work in process (WIP)



The report shows the progress of each work order, including how many operations have been completed, the average duration for each operation and the average duration between operations.

The report also features work order status, completion percentage and work order quality KPIs.

Value

- Visibility of work order status and complete route per work order, with breakdown for each operation
- Estimation of real versus planned completion time
- Identification of bottlenecks through visibility of long pending times
- Manager-led operational decisions for production improvement

Product traceability

Board process history

BOARD HISTORY

Board ID: 000182607000015

Board 2nd Serial: NA

Board Serial Number: 000182607000015

Board Alias: NA

**Box
Build**

Work Order: (1826070-X-X) 1826070-X-X

Work Order Status	(-1) Released	Assembly	NA_KM936078G01P
Work Order Type	(-1) Manufacturing	Assembly Status	1
Work Order Customer	KONE	Assembly Description	Circuit for demonstrating Unicam with SMT
Work Order Shipped Status	1/1/1970 12:00:00 AM	Board Creation Date	4/7/2020
Work Order Due Date	1/1/1970 12:00:00 AM	Board Current Status	PASS
Work Order Planned Finishing Time	4/9/2020 12:00:00 AM		

[Click symptom value for defect details](#)

Step	Operation	Line	Equipment	Operator Number	Operator First Name	Operator Last Name	Event Status	NFF Text	Symptom Name	In Process (sec)	Between Process (sec)	Start	End
1	101 Printer	Line_7	701 Printer	0004748000000004	CamstarAdmin	NA	PASS		NA	9.70	0.00	04/08/20 13:17:38	04/08/20 13:17:48

[Click symptom value for defect details](#)

Step	Operation	Line	Equipment	Operator Number	Operator First Name	Operator Last Name	Event Status	NFF Text	Symptom Name	In Process (sec)	Between Process (sec)	Start	End
2	102 SPI	Line_7	702 SPI	0004748000000004	CamstarAdmin	NA	PASS		NA	0.00	0.00	04/08/20 13:19:26	04/08/20 13:19:26

[Click symptom value for defect details](#)

Step	Operation	Line	Equipment	Operator Number	Operator First Name	Operator Last Name	Event Status	NFF Text	Symptom Name	In Process (sec)	Between Process (sec)	Start	End
3	103 ASM-1	Line_7	703 ASMX4IS	0004748000000004	CamstarAdmin	NA	PASS		NA	271.59	0.00	04/08/20 13:35:17	04/08/20 13:39:49

[Click symptom value for defect details](#)

Step	Operation	Line	Equipment	Operator Number	Operator First Name	Operator Last Name	Event Status	NFF Text	Symptom Name	In Process (sec)	Between Process (sec)	Start	End
6	106 Reflow	Line_7	706 Reflow	0004748000000004	CamstarAdmin	NA	PASS		NA	0.00	0.00	04/08/20 13:35:30	04/08/20 13:35:30

Board process history displays all production information for a specified board. For each operation, the report shows information such as equipment used, operator, start and end time and operation success or failure.

Value

- A full account of the board process history
- Full visibility of the operations carried out on the board during assembly

Product traceability

Box build report

Opcenter Intelligence Electronics > Shared Reports > Product Traceability > Box Build by Board ID

Board ID: 9980451800012 Board Alias: 416804518012
Board Serial Number: 9980451800012

Parent Board

Level	Board ID	Board SN	Board Alias	Parent Board ID	Assembly	Revision	Assembly Index	Work Order	Work Order Due Date	Reference	Attach Date
0	9980451800012	9980451800012	416804518012	9980915800001	AD0130445F_C-SAS TOP ASSY CA446-15951 REV.01 RH05 HP INDIGO	0	0	804518	11/4/2016 10:06:44 AM	NA	
1	▶ 9980086200069	9980086200069	3968008								
1	▶ 9980912200026	9980912200026	476809								
1	▶ 9980912300011	9980912300011	476809								
1	▶ 9981454800015	9981454800015	496814								

Opcenter Intelligence Electronics > Shared Reports > Product Traceability > Box Build by Work Order

BOX BUILD BY WORK ORDER - 775603

Level	Board ID	Board SN	Board Alias	Parent Board ID	Assembly	Assembly Family	Revision	Assembly Index	Work Order	Status	Work Order Due Date	Customer	Reference	Attach Date
0	9977560300001	9977560300001	RH00075		AD0125217_LDLS CONTROLLER 055014-001 REV.04 RLA	NA	9	0	775603	Completed	05/21/2016 07:39 AM	140K_RLA-TENCOR CORPORATION (ISRAEL)	NA	
1	▶ 9977558500007	9977558500007	9977558500007	9977560300001	AD0117213F_PCA FRONT BOARD LAMP CONTROLLER LCL180 D318440 002 REV AB RLA	NA	1	1	775585	Completed	05/20/2016 11:46 AM	140K_RLA-TENCOR CORPORATION (ISRAEL)	NA	
1	▶ 9977558600005	9977558600005	NA	9977560300001	AD0117213F_PCA REAR BOARD LAMP CONTROLLER LCL180 D318440 000 REV AC RLA	NA	0	0	775586	Completed	05/20/2016 12:04 PM	140K_RLA-TENCOR CORPORATION (ISRAEL)	NA	
1	▶ 9977560600004	9977560600004	RH05713	9977560300001	AD0125225F_0556512 001 PCA MAIN BOARD LAMP CONTROLER LCL180 ENHANCED REV-AA RLA	NA	0	0	775606	Completed	05/20/2016 11:31 AM	140K_RLA-TENCOR CORPORATION (ISRAEL)	NA	
0	9977560300002	9977560300002	RH00076		AD0125217_LDLS CONTROLLER 055014-001 REV.04 RLA	NA	9	0	775603	Completed	05/21/2016 07:39 AM	140K_RLA-TENCOR CORPORATION (ISRAEL)	NA	
1	▶ 9977558500013	9977558500013	9977558500013	9977560300002	AD0117213F_PCA FRONT BOARD LAMP CONTROLLER LCL180 D318440 002 REV AB RLA	NA	1	1	775585	Completed	05/20/2016 11:46 AM	140K_RLA-TENCOR CORPORATION (ISRAEL)	NA	
1	▶ 9977558600004	9977558600004	NA	9977560300002	AD0117213F_PCA REAR BOARD LAMP CONTROLLER LCL180 D318440 000 REV AC RLA	NA	0	0	775586	Completed	05/20/2016 12:04 PM	140K_RLA-TENCOR CORPORATION (ISRAEL)	NA	
1	▶ 9977560600011	9977560600011	RH05720	9977560300002	AD0125225F_0556512 001 PCA MAIN BOARD LAMP CONTROLER LCL180 ENHANCED REV-AA RLA	NA	0	0	775606	Completed	05/20/2016 11:31 AM	140K_RLA-TENCOR CORPORATION (ISRAEL)	NA	

Box build by board ID provides a map of all subassemblies used to build a specific product. Box build by work order provides a listing of all boards and sub-boards within a specific work order.

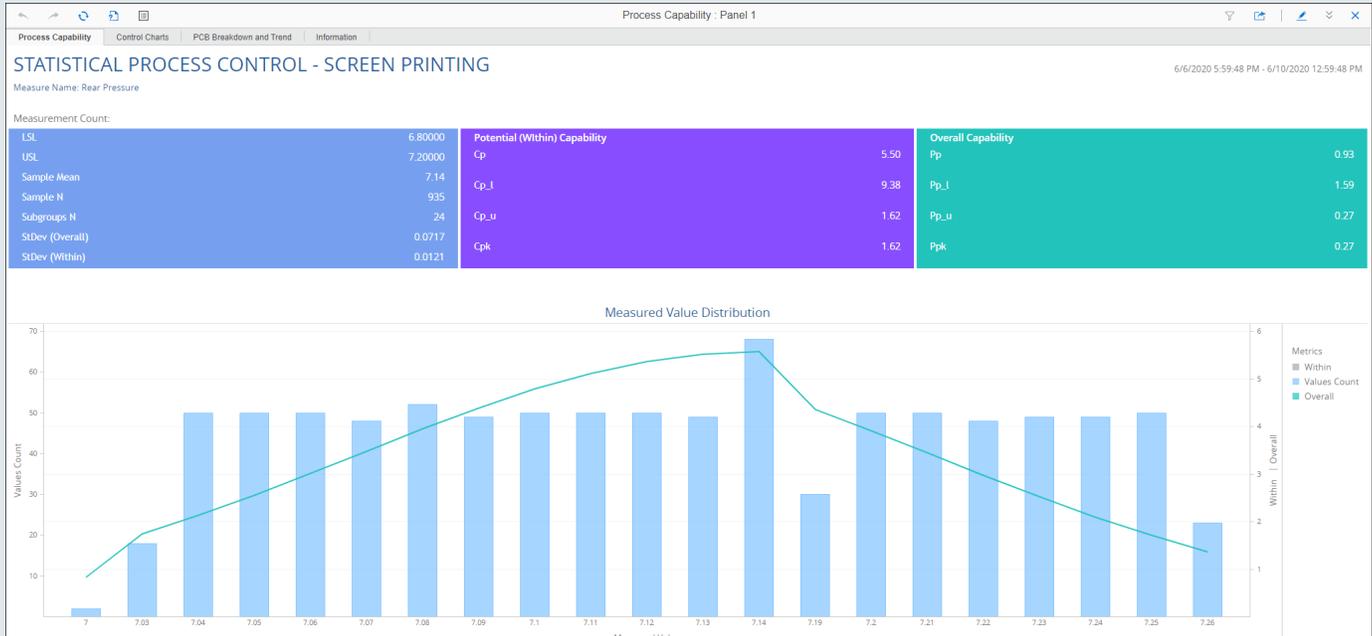
Increasing levels of indentation are used to show the level of sub-boards. The first level shows all boards of the selected board ID. Varying levels of sub-boards are displayed beneath each boxboard build.

Value

- Full visibility of subassemblies associated with a final product
- Easy extraction of product traceability information for customers
- In cases of malfunctioning products, errors can be traced by product, board or component

Process traceability

Process traceability

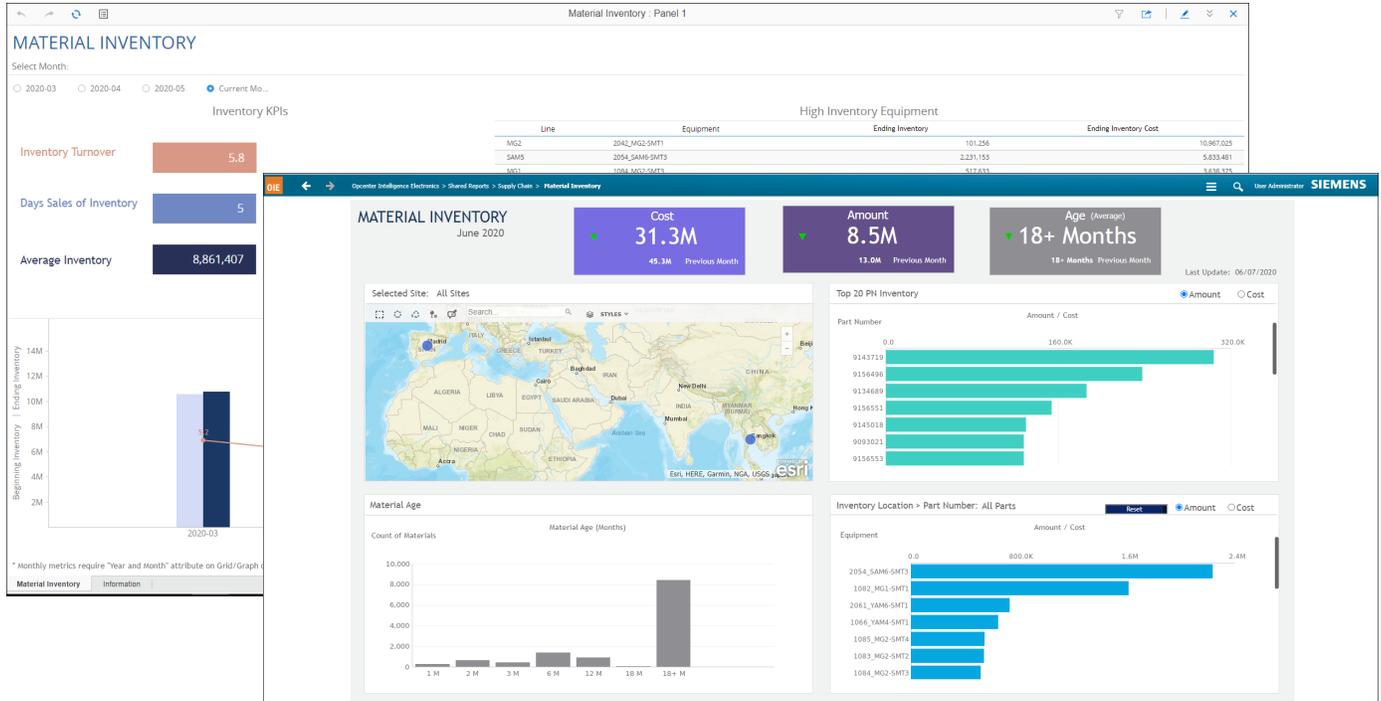


The process traceability domain presents information on the manufacturing process itself. For example, it allows designated reports on each process (screen printer, oven, etc.) and the parameters used in each process. It displays process control charts and detailed information on the boards produced.

Value

- Out-of-the-box SPC calculation for process measurement (screen printer and oven)
- Detection of insufficient trends to optimize processes
- Predefined alerts are sent by email to notify of deviation from normal rates
- Quality managers can confirm that processes are stable and predictable

Material inventory



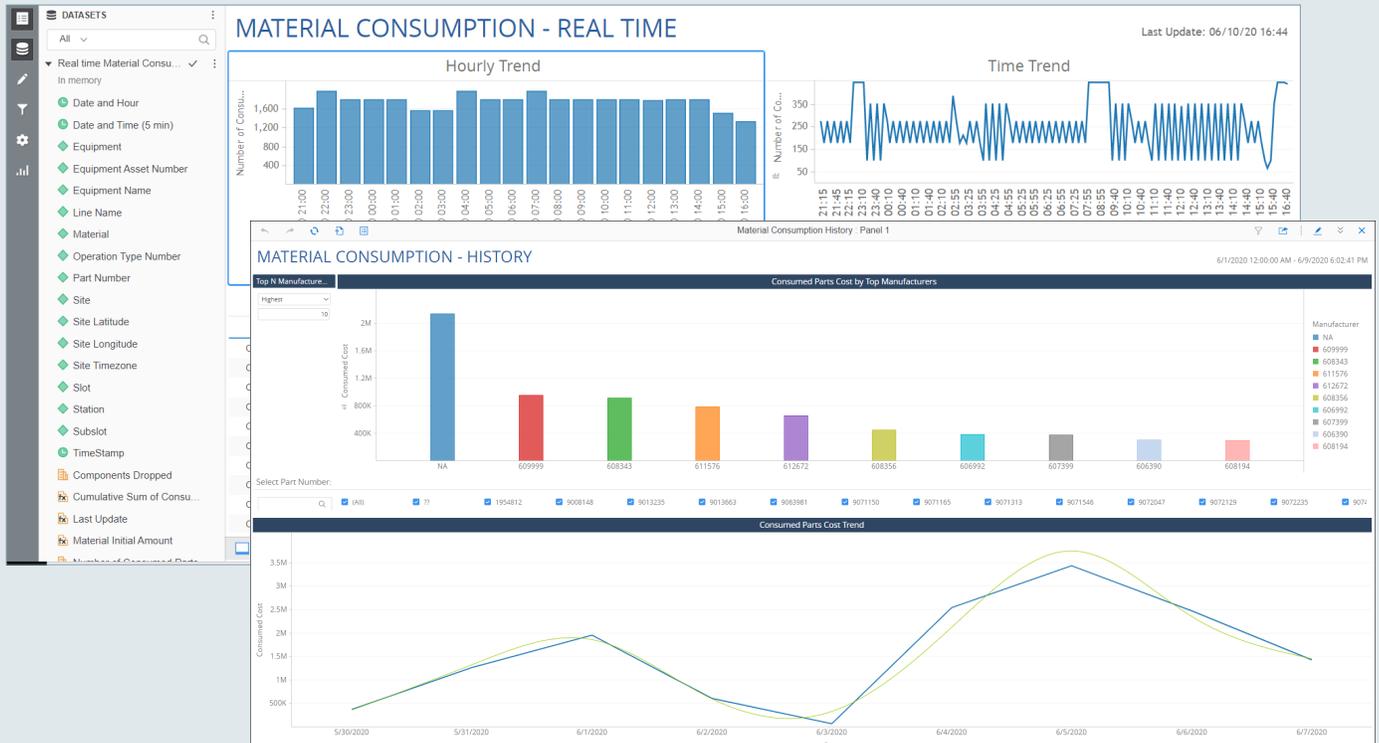
Material inventory presents real-time inventory status on a corporate level, with the option to drill-down into specific sites. It gives the user insights on material location, aging and cost.

Material inventory self service provides insight on material inventory and consumption for the entire history as well as insight on material location, aging, cost and consumption with the basic KPIs: inventory turnover, days of sales and inventory age.

Value

- Full visibility of material inventory in terms of material amounts, costs and location
- Data to support informed decisions about material purchase, transport and disposal
- Trend analysis to optimize material purchase plans, considering the type of materials, amounts and costs

Material consumption



The material consumption history provides in-depth analysis of material consumption over a selected time period using attributes such as manufacturer, part, assembly and work order.

Material consumption real time includes in-depth analysis of material consumption in the last 24 hours using different attributes.

Value

- Real-time material consumption tracking from all consumption points in the shop floor area
- Consumption prediction to improve material purchasing processes

About Siemens Digital Industries Software

Siemens Digital Industries Software is driving transformation to enable a digital enterprise where engineering, manufacturing and electronics design meet tomorrow. The Xcelerator portfolio helps companies of all sizes create and leverage digital twins that provide organizations with new insights, opportunities and levels of automation to drive innovation. For more information on Siemens Digital Industries Software products and services, visit [siemens.com/software](https://www.siemens.com/software) or follow us on [LinkedIn](#), [Twitter](#), [Facebook](#) and [Instagram](#). Siemens Digital Industries Software – Where today meets tomorrow.

For more information about Opcenter Intelligence Electronics, [visit the website](#)

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