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ODB++Process – a model for electronics manufacturing

Industry 4.0 interworking solution for SMT/inspection/test machine programming

Executive summary

In the increasingly dynamic world of electronics manufacturing, in which production of a product may be required to migrate between a variety of machines, lines and sites, the manual conversion of machine programs has become a significant bottleneck, causing production delays and cost overruns.

The ODB++Process (ODB++P) model simplifies and standardizes the exchange of process engineering information among machines on the shop floor – reducing production downtime and enhancing operational efficiency.

This document discusses the problems inherent in the transfer of production programs from machine to machine, and how use of the ODB++P model simplifies and automates this transition.

The problem with transferring machine programs

Today's electronics manufacturing industry, currently facing the dual challenges of supply chain instability and reduced project volumes, is making efforts to improve agility and flexibility by acquiring the ability to shift production from one site or line to another. Each change may involve the use of different assembly, inspection and testing machines – often from different vendors.

With an eye on "smart" Industry 4.0 automation and data exchange, industry forecasts foresee scenarios in which programs will be required to run on a variety of different line configurations over time.

However, the transfer of machine programs from one machine type to another can be extremely difficult, requiring manual efforts that are both time-consuming and error-prone.

For example, in an assembly process, the following properties of the surface mount technology (SMT) machine's program data must be converted:

- The **sequence of placements**, including information about the component, its placement position, and rotation requirement. This sequence, which is optimized for a specific machine, must be re-optimized to suit the target machine's capabilities. The list of placements can be a challenge to convert, as the machine's XY origin, rotation origin, and rotation direction may be different, requiring transposition of the data.
- The **list of materials** (including shape data) to be set up on the machines. Obtaining the part shape information is a formidable challenge, as the source machine program may not contain all of a part's original shape data, instead depending on its own internal, dedicated libraries to fill the knowledge gap. Significant effort is required to correct and complete the shape data for use in the target machine.
- A list of **machine-specific operational parameters** regarding placement and verification methods. The parameters from the source machine program are unlikely to be useful, as they are specific to the original machine. The target machine will require a different set of parameters to be calculated, even when similarities exist. Often, these settings can be derived from the shape data, but they require modification and verification.

Conversion of source machine programs for use in other machines is not the best way to disseminate process engineering data, especially in flexible manufacturing operations, in which production is routinely shifted between sites and lines.

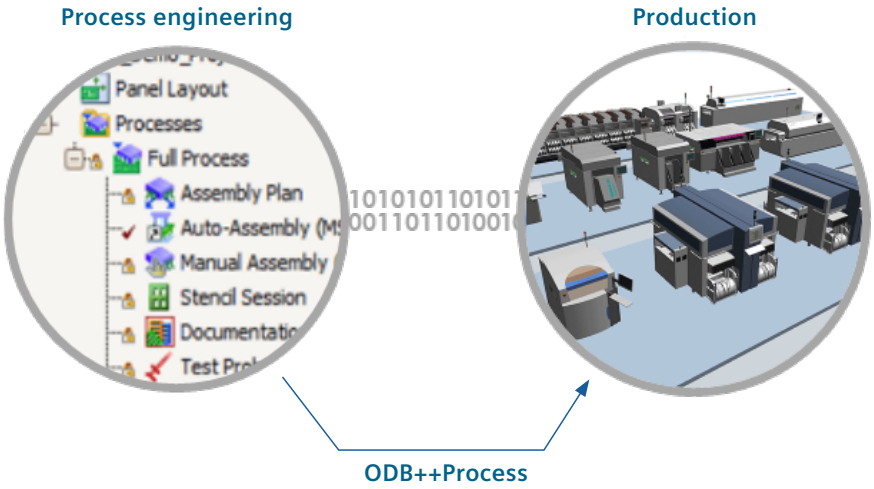
The ODB++P Solution

ODB++Process is a platform for the open exchange of process engineering information between disparate machines and processes. ODB++P was developed to represent the entire dataset of a machine program in a file whose structure is independent of the machine's vendor and its proprietary formats and is machine-agnostic.

The flexibility and agility provided by ODB++P enables manufacturers to transfer the production of products among an array of vendor configurations, quickly and consistently. Since the ODB++P structure contains all of the essential elements of the design data – including fully-detailed part shape descriptions, extracted from the comprehensive Valor® Parts Library, as well as descriptions of complex production requirements – the data can be easily imported into any vendor's platform. Following the import, the machine's dedicated software can immediately perform a final process optimization and execute the program – without significant manual data manipulation or testing.

The ODB++P model is ideal for archiving purposes. At any time in the future, ODB++P-based machine programs for a legacy product can be imported directly into any currently available line configuration and executed in the same way as the original programs. ODB++P data can be imported for use in traceability and compliance systems as well.

The use of ODB++P opens up a new window of opportunity for manufacturers, who can utilize a wider variation of production machines without workload or cost consequences on the shop floor.

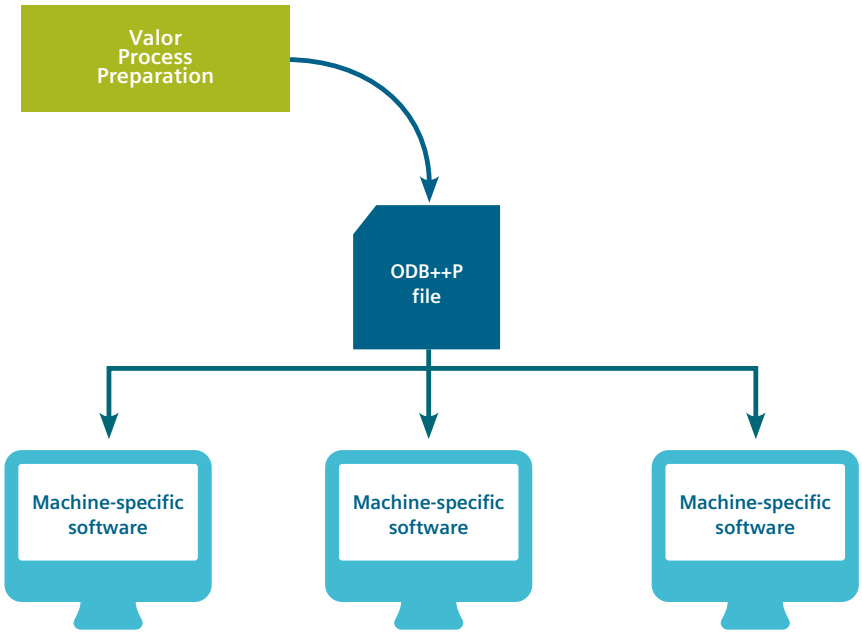


The ODB++P programming flow

ODB++P file generation is a standard feature of the Valor® Process Preparation process engineering tool from Siemens. Valor Process Preparation serves as a process engineering "digital twin" that automatically transforms board designs into line-optimized machine programs.

In addition (as shown in the figure below), Valor Process Preparation can automatically generate an ODB++P file. The file is then exported and transmitted to ODB++P-compliant systems that perform machine-dedicated optimizations, and then upload the resulting program data to the machine.

The specification for the ODB++P file format is available from Siemens to machine vendors and other users who wish to read the format. Machine vendors that support ODB++P benefit from a simplified method of obtaining complete, detailed and accurate information on the product that is to be produced – in a format that is ready for their optimization. Once ODB++P support is achieved, integration efforts are eliminated, and programming times are drastically reduced.



What does the ODB++P data structure contain?

The ODB++P data structure contains all the data required by assembly, inspection and testing work processes, and is generated as extensible markup language (XML) code in the format defined by the XML Schema Definition (XSD):

- Board properties – including placement data, fiducial information, board mark definitions and profile information
- Panel layout hierarchies that represent the board geometries of the panel, top and bottom sides
- BOM parts and associated package definitions, enhanced by the Valor Part Library – a highly accurate knowledgebase of package body and pin definitions
- Outer-layer graphical elements – including silkscreen, solder mask, solder paste and outer copper
- Line setup information – including line, machine, feeder and tray locations
- The manufacturing process plan related to part assignments – incorporating SMT machine placements (including placement order and "place last" designations), feeder type/size assignments, support pin locations, warp detection points, and more
- Extensions containing additional attributes

Conclusion

The ODB++P model simplifies the exchange of process engineering information among machines on the shop floor – reducing production downtime and increasing line productivity and efficiency. ODB++P provides manufacturers with the flexibility and agility to meet the production migration challenges of Industry 4.0.

For further information, or to obtains a copy of the ODB++P format specifications, visit the website: odbplusplus.com/process

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