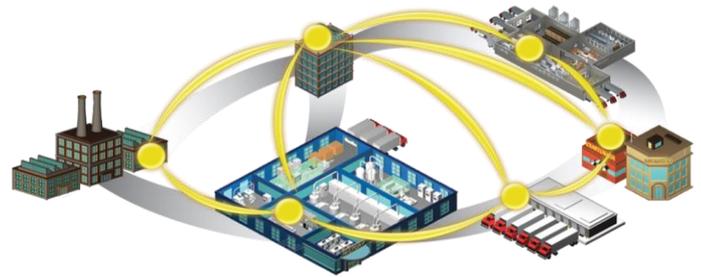


*Grantek's Manufacturing Framework*  
"Providing Connectivity to ERP for Manufacturing"

# Integrating ERP and MES to Improve Operations



Advanced enterprise integration applications enable companies to leverage real-time information exchange between the business layer and the production layer to achieve Operational Excellence in their supply chain.

# Integrating Your ERP and MES to Improve Operations

## Introduction

In the journey toward operational excellence throughout their supply chain, organizations have invested heavily in Enterprise Resource Planning (ERP) systems. Unfortunately, these systems rarely address the integration of manufacturing data and, more often than not, do not have the inherent characteristics to provide a good Manufacturing Execution System (MES) or Manufacturing Operations Management System (MOM). Organizations that have adopted an integrated supply chain that includes manufacturing have spent a significant amount to enable communication between their ERP and MES/MOM systems. These systems speak different languages, and seamless communication requires extensive translations, resulting in added time and costs.

The good news is that the communication gap is narrowing with the introduction of ISA-95, the international standard for the integration of enterprise and control systems. As part of the standard there is a set of standard data exchange schemas defined. B2MML (Business to Manufacturing Markup Language) is a set of XML schemas that implement the data models in the ISA-95 standard. Best in class organizations take advantage of these accepted standards so they can more easily integrate their disparate systems and gain better visibility and coordination between the enterprise and manufacturing systems.

This paper discusses the challenges today's manufacturers need to overcome and the benefits of enabling real-time bi-directional integration between ERP and MES/MOM systems. Tight connectivity is even more crucial in today's fast paced, global market environment. Reduced cycle time between supply and demand and the ability to change and adapt are keys to success. Companies that have successfully integrated the top floor with the shop floor are realizing faster cycle times, higher throughput, more flexibility, better quality and improved decision making for a significant competitive advantage.

## The negative effect of information silos

There are a number of challenges facing manufacturers when it comes to information. Understanding what is happening on the plant floor as well as with customers and suppliers is crucial to making good and efficient decisions. The disparate nature of multiple systems across the enterprise makes it difficult to respond to changing customer demands, to achieve faster time to market and tighter inventory management—all of which contribute to efficiency and cost control across the supply chain.

**Lack of visibility to the plant floor** - Manufacturers need to understand problem-causing events and view them holistically instead of in isolation. The lack of integration and visibility into the plant floor causes decision-making delays. These delays result in longer cycle times for customers, lower customer satisfaction, and the inability to efficiently meet the demands of a fast-changing global marketplace.

Senior management needs to understand the performance and capabilities of manufacturing. Manufacturing operations needs up-to-date information on demand changes to help develop and optimize their schedules. Integrated information at the enterprise layer gives manufacturers the ability to see the “big picture” and to make the appropriate changes based on what is happening on the plant floor to improve the overall efficiency of the operation.

**Lack of integration of disparate systems** - ERP systems know what customers want, and MES/MOM systems know how to build it. However, often times these systems are of different vintages, have been created by different software vendors and, as such, speak different languages. Many manufacturers have resorted to manual data entry or completely custom methods of communication between these systems—both very costly and inefficient models.

Manufacturers need the ability to communicate seamlessly between these systems so they can gain visibility into orders, control inventory costs, and act on up-to-date order changes—critical factors to improving their operations.

**Slow time to market** - As the global marketplace has evolved, some companies have not been able to react quickly to the changing demands of consumers who are working at Internet speed and who have a wide variety of vendor choices. By communicating between the enterprise layer and execution layer, companies can better match supply with actual demand—reducing inventory and responding quickly to customer needs.

**High inventory costs** – Excess inventory—whether as raw materials, work in progress or finished goods—ties up cash in the business that could be put to better use elsewhere. When an organization cannot detect changes in their manufacturing systems and supply chain they will often carry increased inventory to ensure that they are still able to meet production or customer demands. There is a significant cost associated with doing so.

Keeping inventory to a minimum frees up capital and also reduces the risk of having unwanted inventory on hand. If there is a quality or maintenance issue on the floor, real-time notification to the business layer can be made, enabling immediate action to address the issue.

## Enabling flexible integration between MES and ERP

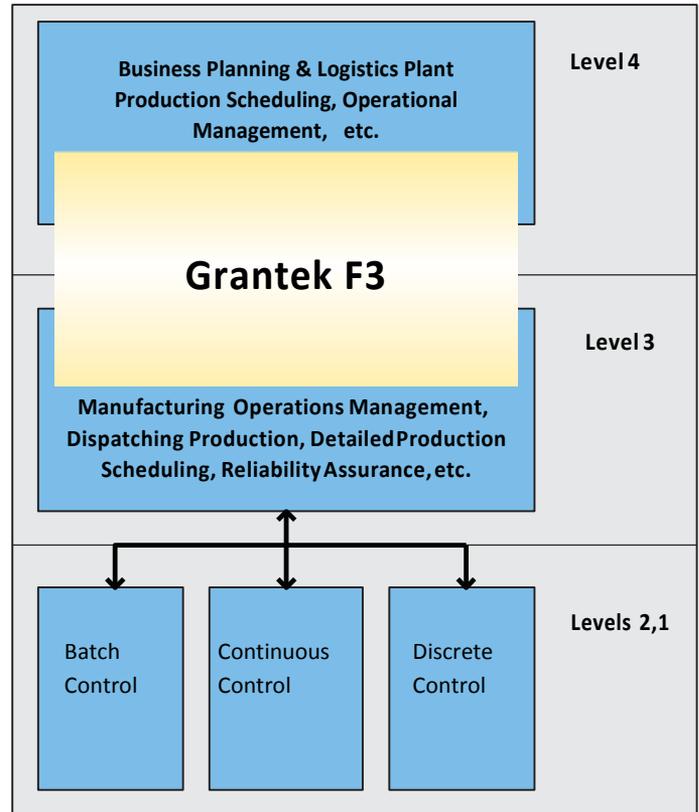
To achieve operational excellence manufacturers need increased visibility into manufacturing. The ability to view the status of orders, inventory changes, and overall process performance is crucial. Seamlessly connecting manufacturing processes with the enterprise layer requires a tightly integrated yet flexible solution that leverages the latest technologies and standards.

Manufacturing Service Bus solutions (MSB) such as Grantek's F3, connects a company's ERP system such as SAP to MES/MOM solutions using ISA-95 and B2MML standards. As a single integration point it allows decision makers at the enterprise level to leverage real-time information about production processes. This provides increased visibility and insight for better business decisions and for plant operations to leverage business information to improve fulfillment.

Such solutions drive operational excellence and lean manufacturing by providing highly actionable information with context that is meaningful to each audience. These audiences can vary from an operator, supervisor, quality personnel, production management to senior management. Each will have information provided with context and provide value based on their individual measurable and goals.

For example, any issue on the plant floor that may affect customer fulfillment can be communicated to the ERP system so steps are taken to mitigate the issue. Real-time notification can help correlate supply with demand—averting the need for a higher level of inventory than necessary and ensuring timely responsiveness.

This next section explains how Grantek's F3 supports industry standards, enables ease of use and closes the communication gap for improved visibility from manufacturing to the enterprise.



### Features of ISA-95:

- International standard that does not change with each new release from a vendor
- Defines the information that must be exchanged between the ERP and MES layers
- Has a broad support base of many companies
- Technology and vendor independent

*By enabling real-time orders to be downloaded into MES from your ERP system and for performance information to be uploaded to your ERP—Grantek's F3 serves as a bi-directional transport of data between the two layers for improved fulfillment and operational efficiency.*

# Integrating Your ERP and MES to Improve Operations

## The benefits of utilizing ISA-95 and B2MML integration standards

In order for companies to survive and even thrive in the fast changing global economy, they need operational flexibility and quick implementations. Due to the challenge of high inventory costs discussed earlier, they can no longer afford to maintain a large safety stock of finished goods inventory on hand. This “safety stock” is essentially tied up cash that can’t be used to grow and run the business until it is sold. Excess inventory should be avoided at all costs and at all levels—raw material, work in progress and finished goods.

Solutions that support ISA-95 standards such as Grantek’s F3 provide easier integration and allow systems at different levels to communicate with each other without the need for costly custom setup or maintenance. The use of standards enables the exchange of information from the enterprise to manufacturing, which is critical as it allows companies to avoid costly issues such as excess inventory.

Furthermore, standards-based (“out-of-the-box”) activities and templates enable companies to leverage quick time to value, which is critical for a competitive edge. The flexibility and speed with which they can execute activities such as aligning manufacturing processes with actual demand helps optimize operational efficiency while maximizing customer satisfaction.

## Grantek’s F3 supports the following ISA-95 models:

### Production Schedule

The ERP system issues a Production Schedule to the MES/MOM system and, based on this schedule, the MES/MOM system creates a detailed production schedule. This detailed production schedule accounts for limitations and other activities that the ERP system has no knowledge about. This includes such items as cleaning of vessels, changeovers, equipment downtime, order sequencing and plant capability. The Production Schedule contains information that Level 4 (ERP) sends to Level 3 (MES/MOM).

The Production Schedule sent by ERP can be for a certain period (e.g., a week). Within this schedule is multiple production requests, for example, “create 90,000 cases of beer.” Within these production requests are details on how the products should be created, specifying the personnel, equipment, material, and material produced and consumed requirements.

As shown in the Production Schedule example below, the ERP system downloads the production parameters, which help define what is to be created and the impact it will have on capability and resources within the plant.

### Production Schedule – e.g., Daily Packaging

Contains:

- Production Requests – 90,000 cases of beer to be completed by midnight
- Production Parameters – Can size, fill size, lid size, case size, machine speeds
- Personnel – Operators, testers
- Equipment – Fillers, pasteurizer, packers, wrappers, palletizer, barcode printers and inline inspection
- Material Produced – 6 pack cases of beer (SKU) 16oz
- Material Consumed – Cans, lids, cases, packaging material and volume of beer (Real-time countdown of inventory to have minimum overruns)

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*To support the large SAP install base worldwide, Grantek’s F3 can easily integrate into SAP using off-the-shelf available middleware such as SAP MII or PI or Junot NLink.*

## Production Performance

Production Performance contains information that Level 3 (MES) sends back to level 4 (ERP) as a result of the production request. The Production Schedule contains the product requests, while Production Performance is a response to those requests. For example, maybe production only had enough inventories to produce a percentage of the requested products, or maybe more material was used than expected due to bad quality results.

In this case, the enterprise layer needs to know this information to control inventory and to order more material if necessary. This consumption information helps the business understand what is actually being used and will identify wastes as they are happening. As well, when inventory needs to be reordered the ERP system will know immediately, not based on the last (or next) estimates.

The Production Performance contains such information as the actual production completed, material consumed to complete production, personnel, and the equipment used. Other information can also be contained within the product response such as comments from the operators. A production response may also include information regarding the status of the request such as the percent complete, and the results of the execution of the order (finished, aborted, etc.)

During production, a MES/MOM system can respond to the ERP system with incremental updates on the progress of an order. This allows the business layer to understand the status and to verify whether the order will meet customer delivery requirements. Once a production schedule is downloaded from ERP to MES/MOM, the MES/MOM system can respond with an order confirmation to the ERP system. This indicates that the order has been received and is queued up for production.

As shown in the following Production Performance example, a production response could send the following information to the enterprise layer. It communicates that the manufacturing system has produced 16,000 of the 90,000 requested cases and has consumed more material than it should have due to reasons on the floor (e.g., material quality issues).

### Personnel Actual:

Palletizer Operator

### Equipment Actual:

Palletizer

### Material Produced Actual:

16,000 Cases (P.O # 1234543216)

### Material Consumed Actual:

105,000 cans (P.O # 1234543216), 13,000 gallons of beer (Batch Id: AEC12343), 110,000 lids, 21,000 units packaging material

### Status:

InProgress

## Supporting B2MML

Not all solutions support B2MML (Business to Manufacturing Markup Language) standards, which are an XML implementation of the ISA-95 standard. Those that do, offer additional flexibility and easier communications, particularly for customers who want to leverage their existing ERP investments. The standards make it easier for businesses to integrate with their MES solutions regardless of the type of ERP system they use (e.g., SAP, Oracle).

Grantek's F3 fully supports B2MML and translation of messages to and from multiple ERP and business management platforms/applications. ERP applications generate a master production schedule and sends this in some type of format (e.g., IDOCs) to a middleware layer (e.g., SAP MII). The middleware layer translates the IDOC into B2MML, which can be passed and processed within Grantek's F3. Grantek's F3 can then save the data within Grantek's F3 ISA-95 model and/or route the message to other applications such as vendor applications. Alternatively, Grantek's F3 can create response messages in a B2MML format and send these messages directly to the ERP systems, bypassing the middleware layer.

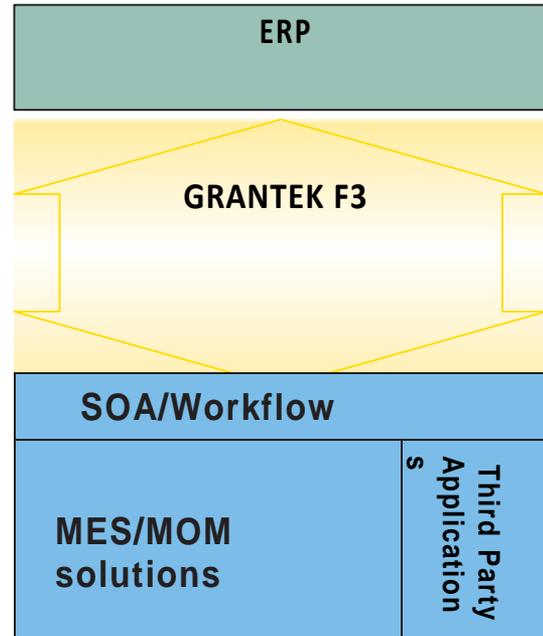
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## Single point of connectivity

In addition to standard translations, it is extremely important to have a single point from which information can be shared between the ERP and MES systems. Having a central point enables information to be routed wherever it needs to be shared, driving true integration and visibility. This allows for better and timelier decision making that impacts operational performance.

Grantek's F3 provides a single point of connectivity for MES solutions using a Service Oriented Architecture (SOA). One of the big advantages of using Workflow is the ability to create business rules that allows organizations to set up the logic for making their products. For example, as a Production Schedule is downloaded into Grantek's F3, the plant floor operator can have a display to verify and potentially make changes to the structure and contents of the schedule.

The visibility into the manufacturing process gives business managers the opportunity to improve processes that will give them an advantage in the marketplace.



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*Automatic data flow can improve the efficiency of the operation significantly, making it imperative that systems have the ability to communicate with each other. It removes the necessity to enter data in two separate systems, which can be prone to error and time consuming. This integration also allows users of different systems to have access to the right information at the right time, for example, with more insight into actual production costs.*

## Summary

As companies strive to achieve operational excellence in today's fast-paced, global market environment, enabling interoperability between business and manufacturing systems is critical for success.

Connecting the ERP and MES/MOM layers can help companies optimize plant operations and improve profitability by increasing visibility and action ability in both layers.

Advanced technology solutions such as Grantek's F3 enable companies to leverage real-time operations management and business information. Supporting ISA-95 and B2MML standards, it

provides bi-directional integration and helps drive the unification of business and manufacturing systems.

The value of integration from the top floor to the shop floor is that it helps organizations drive increased operational efficiency, faster responsiveness to changing customer demands, and tighter inventory control—value-added results that enable a sustainable competitive advantage.

For more information about how Grantek can help you integrate your critical business systems, visit [www.grantek.com](http://www.grantek.com)

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