



# Providing a communication path to align manufacturing operations with the business process

## Integrating Business with Operations

To help drive operational efficiency and business improvements, organizations in the process industry are strengthening the bond between the Enterprise Resource Planning (ERP) at the corporate level, and the process control systems at the plant level.

The challenge is how to implement and integrate these two separate systems, taking thousands of actions, data points and requirements and bringing them together in a comprehensible framework to exchange operational performance information for the entire company. The synergy between business and production operations require well-defined, streamlined and standardized processes that are effectively supported by software solutions and tools.

Doing this on a case-by-case basis is an arduous, manually intensive and time-consuming task to undertake. The complexities are far reaching and impact many facets of the business. These tasks include creating a reference model for manufacturing operations management (MOM), determining a common set of terminology, establishing data models, defining where you want to be in the future and identifying the migration path to achieve it.

It was partly for these reasons that ISA-95 was introduced. ISA-95 is an international standard for developing an automated interface between enterprise and control systems for global manufacturers. The intention was to provide a framework with consistency at its very core for both information and communication. ISA-95



provides standard terminology for supplier and manufacturer communications, with dependable information and operational models, providing a foundation for clarifying application functionality and how information is to be used.

By not having a clear path to map information between systems, it makes it extremely difficult to align and integrate organizational functions and systems. Businesses may not have clear visibility of issues before they affect production. There may be a lack of information and data to know if production throughput is being maximized and where efficiency savings can be targeted. It can also be hard to determine and fully envision where business agility can be increased and if the supply chain is being fully optimized to create a more stabilized business environment.

A well-established customer in the lubricants industry wanted to replace a proprietary interface that integrated two of its plant's process control system with a bespoke ERP system that also incorporated a Laboratory and Composition Management System. The solution would need to facilitate a standards-based integration for both continuous and batch processes, through web services and the ISA-95 Enterprise-Control System Integration standard using B2MML (Business to Manufacturing Markup Language). The purpose was to exchange production schedules/requests and production performance (actual results) between the ERP system and the Yokogawa control system.

## Manufacturing and Business Alignment

Yokogawa provided a solution to replace the proprietary interface. It was important that this would continue to integrate each plant's process control system with the bespoke ERP system and provided clear visibility of production operations across the business enterprise. Additionally, this solution had to be adaptable and be ready for future migrations to a SAP ERP system that is under consideration.

Yokogawa's Exaquantum Manufacturing Data Exchange (Exaquantum/MDX) provides an ISA-95 based model, with an interface that maps production schedules between any ERP (including SAP) to the process control system. This solution enables data to be integrated using recognized standards, exchanging production schedules and/or requests and production performance (actual results) between the ERP system and a control system.

This allows everyone in the organization and across departments to talk and communicate about the same thing using a common language with exact definitions of operations used by both business and manufacturing divisions. It also uses models to represent both business and manufacturing activities that provide a clear map to significantly reduce any misunderstandings across departments.

### Closing the business loop

The solution enables the customer to 'close the business loop' by providing enhanced visibility of production operations and real-time key business metrics. There is a multitude of reasons as to why organizations utilize this interface between enterprise and control systems and benefit from the business improvements gained through this integrated association:

- Enabling of business driven operations
- Visibility of issues before they affect production
- Increased business agility
- Maximized production throughput
- Supply chain optimization
- Common view across the enterprise

### Business Integration

The ISA-95 standard enables faster, easier integration between business systems and control systems with clear functional specifications between operations management and enterprise requirements. Physical configuration and testing is much easier to perform with improved organizational alignments.



## What are the Benefits?

### Standards-based integration

Enables standards-based integration for both continuous and batch processes, through web services and the ISA-95 Enterprise-Control System Integration standard using B2MML (Business To Manufacturing Markup Language). Use of these standards provides a vendor independent data format for the exchange of production schedules/requests and production performance (actual results) between the ERP system and the Yokogawa platform. It is also offers flexibility, with the possible move towards an alternative ERP solution, and minimises the potential reconciliation efforts associated with this possible change in solution provider.

The standards-based interface has proved itself more robust than its custom-built predecessor. The feature-rich B2MML interface also provides greater functionality, allowing for a richer message set and more detailed information than was available previously.

A joint team was established between Yokogawa and the customer to develop the interface. They quickly concluded that it was easy to build and send messages back and forth between the systems.



### Increased accuracy in stock accounting

The home-grown proprietary interface was needing frequent and significant manual interventions to reconcile stock-holding data. With the Yokogawa solution, virtually no reconciliation is required, resulting in a 50 to 60% increase in performance when compared to the old interface. As a consequence, the information provided is now more trusted and reliable and considered a vital component in the decision making process. This was simply not feasible with the older system.

### Automated information dissemination

Production information is now distributed automatically in electronic format, instead of via manual reports. Reports are also being compiled using a standardsbased system to improve the quality and quantity of information. This system has significantly increased the distribution and sharing of information for improved business insight.

### Opportunity for other projects

The customer intends to leverage the experience gained with the interface in other projects: “Now we have a standard interface and find we can use the same concept. So we can leverage our learning and apply ISA-95 to other projects”.

### Integrated support from Yokogawa

Yokogawa’s total solution delivery provides an integrated maintenance and support service from a single vendor. This decreases the amount of time it takes to manage these areas, streamlines the internal administration when dealing with any issues or concerns and is easier to co-ordinate and handle throughout the lifespan of the solution.

### Future integration with SAP

Proven ability to work with SAP’s ISA-95/B2MML interface will enable the customer to significantly minimize costs if/when it replaces its existing system with an alternative ERP system such as SAP.



“ After we began the exercise and began testing, we found we were missing this data element or that data element, but adding this was easy. We didn't have to re-write it because the B2MML language made it easy and flexible. ”

## Project Background

Yokogawa provided a solution to replace a proprietary interface that integrated each plant's process control system with a bespoke ERP system at two of its lubrication plants. The exiting ERP system also incorporates a Laboratory and Composition Management System. The Exaquantum/MDX solution provides enhanced visibility of production operations and real-time key business metrics.

### Information flows

Exaquantum/MDX provides an interface that maps production schedules between the ERP and the control system (Yokogawa's CENTUM Batch DCS). Batches are initiated with the sending of:

- CENTUM Batch system schedules
- CENTUM material-based recipe parameters

Upon receipt of the production schedule message from the ERP, the Yokogawa system automatically creates batches in the CENTUM Batch system. Typically, a single production request is sent from the ERP systems for each order.

The Yokogawa system sends a corresponding production performance message to the ERP system, reporting on actual production results. Multiple production performance messages can be sent from the Yokogawa system to the ERP for each order. Messages can be triggered by a variety of conditions within the Yokogawa system throughout the production cycle in addition to the end of batch results. Using the information, the FBS system is kept up to date with inventory information that is used for scheduling future batches.

INFORMATION TRANSFERRED
Blend
Fill
Load
Unload
Tank to tank transfer
Tank inventory
Order status

SYSTEM SUMMARY
Integrated standards-based interface between CS 3000 Batch and ERP system
Exaquantum/MDX Server
Web Server
Adapter for ERP to support B2MML

### Additional Interfaces

In addition to configuring the Exaquantum/MDX interface, Yokogawa provided assistance to the customer in the development of a B2MML interface to map the business information in the ERP. If in the future, a decision is made to replace this existing ERP system with a SAP system (including the NetWeaver ISA-95 module) it will make the ERP transition to SAP a relatively straightforward task by utilizing standards such as ISA-95 and B2MML.

## Project Scope

The scope of the overall project included a CS 3000 batch control system, Exaquantum/Batch and Exaquantum/MDX and the associated engineering services, training and support.

## Key Takeaways

### Visibility of production operations

By aligning manufacturing operations and business processes it helps to 'close the business loop' by providing enhanced visibility of production operations and real-time key business metrics. This closer alignment is more synchronized providing a more common view across the business organization, where both the business and process can communicate using a consistent language. A distinct advantage of a common interchange language is improved agility, being able to move quickly and react dynamically in response to customer demands, which provides an edge over the competition and can drive profitability.

### Increased accuracy and flow of information

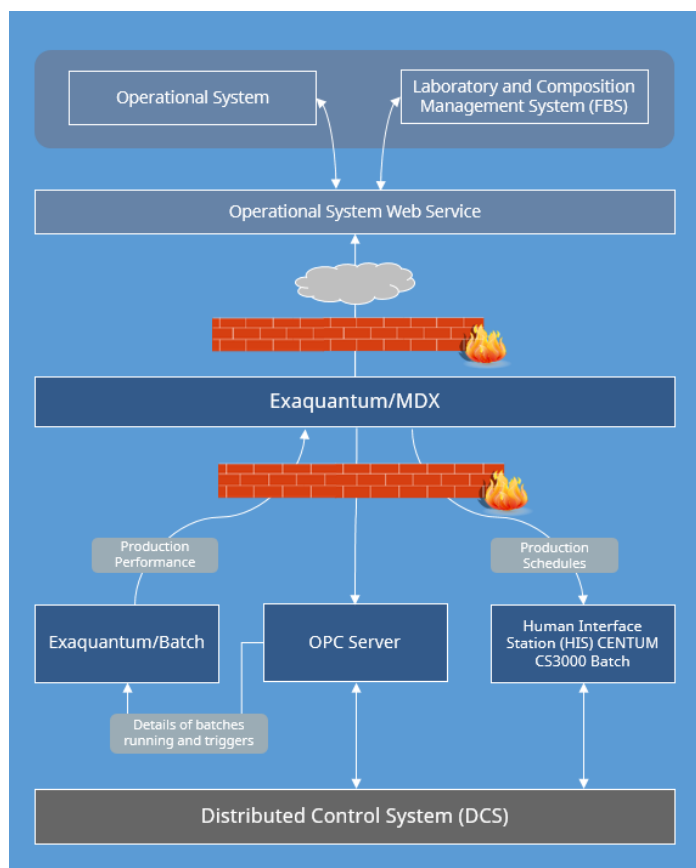
With a more secure and reliable flow of information between the operational control and the process control systems, it streamlines workflows without the need for manual processing. Without the reconciliation effort and work that was required on the previous system, there has been a 50 to 60% increase in performance.

The information used for the production result reports can be accurately corroborated with users having more confidence in the data. Information is easier to maintain with the Laboratory and Composition Management system being kept up to date with inventory information that is used for scheduling all future batches.

### Easy and flexible standards based interface

By utilizing the ISA-95 international standards, it provides a solid platform for this solution. The ISA-95 standard uses B2MML interface provides greater functionality, with a richer message set to provide information that is more detailed. With the standard B2MML language, it is easier to build and send messages back and forth between the systems and modifications are more straightforward and flexible. The Exaquantum/MDX solution is ready to migrate to SAP so any transition from the existing ERP system is pain free through the utilization of the ISA-95 and B2MML standards.

## System Architecture



## Project Update

This application note is based on a project that began in 2008 and was published in September 2018. Over the past few years, the project has evolved considerably, with expansion across multiple sites as part of the companies SAP MII integration project.

### Field-proven solution that was SAP ready

The original project brief was to replace a proprietary interface at two plants, integrating the plant's process control system with a bespoke ERP (OCS) system that also incorporated a Laboratory and Composition Management System. The home-grown proprietary interface was needing frequent and significant manual interventions to reconcile stock-holding data. With the Yokogawa solution, virtually no reconciliation is required, resulting in a 50 to 60% increase in stock accuracy performance with MDX and ERP (OCS) when compared to the old interface. The information being provided to the ERP (OCS) system, was more trusted and reliable.

In addition, these systems had been designed specifically with a migration path to SAP, so that disruption would be minimized when SAP was to be implemented as the ERP system.

### Proprietary ERP interface replaced with SAP

The long-term vision for the customer had always been to move their ERP system to SAP, a vision that became a reality, bringing many changes to the organization. By replacing the proprietary system with an ISA-95 standards based model, SAP integration was made easier and offered greater flexibility for the customer, automating the interface between enterprise and control systems. This helped to close the gap between OT and IT, synchronizing manufacturing operations with back-office business processes using standardized data.

### SAP Project Integration

The project goal was to integrate SAP MII (Manufacturing Integration and Intelligence) and Yokogawa's Control systems to reduce the manual activities within the plant. It required the integration of batch order data from the Control System into SAP, including:

- Sending Production Batch Orders to PCN
- Updating SAP with completed Production Batch Orders
- Retrieving current tank inventories
- Analytics to support KPI reporting

### SAP Workflow & Monitoring

With this SAP upgrade project, there has been a step change in business workflows compared with the old ERP (OCS) System. One such instance which has seen a vast change relates to how material stocks and flow are now being managed, with all stock level work now occurring in SAP. With MDX, it provides regular checks (every ten minutes) of material use / production in processed batches. It provides a closely integrated stock monitoring mechanism between SAP and the process layer.

### Roll-out across 7 plants

In addition to the original two sites located in the US, the SAP integration program was expanded and is currently being rolled-out to an additional five plants across the globe which includes the MDX solution. Installation and SAP MII upgrade began in 2018 and has been completed at two sites in Asia and one site in the US, with the remaining four sites scheduled for completion in 2020.

### MDX Integration

MDX is a vital component in the SAP integration project for this customer. It sits between the ERP system and the Control system to allow information to be easily exchanged, breaking down information silos within the plant. Production information passes bi-directionally, from the business and planning layer to the control system layer for batch and continuous processes.



### References

Exaquantum Plant Information Management System  
Exaquantum Manufacturing Data Exchange  
CENTUM Batch DCS

### Source Information

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