



## Johnson Controls Reduces 4 Hour Engineering Process to 20 Seconds

The Johnson Controls (JCI) ventilation damper division in collaboration with Logic Design Corporation (LDC) devised an online customer web portal that is integrated with ERP, quoting, order entry, engineering, manufacturing, and the shop floor that automatically processes orders for custom ventilation dampers.

Prior to this automated workflow system, it would require JCI engineering to spend an average of 4 hours to process each custom ventilation damper order, that was subsequently reduced to 20 seconds and saved Johnson Controls thousands of engineering hours annually. This article explains the steps involved in automating the order entry to final product shipment workflow process and was accomplished with a series of steps that included:

- 1) **Engineering & Manufacturing Workflow Assessment**
- 2) **Strategic Automation Planning**
- 3) **Establish Engineering & Manufacturing Data Warehouse**
- 4) **Incorporated Automated Workflow**
- 5) **Shop Floor Integration / Production Dashboard**



JCI was provided with the tools to achieve Industry 4.0



*“Without the **Global Edge** – Product Configurator, we would need to create hundreds of bills of materials (the list of damper components), which requires hundreds of engineering and clerical hours to create and maintain. Orders that once took up to four hours are now processed within 20 seconds.”*

*Steve Yoder, Damper Cell Manager  
Johnson Controls – Watertown, Wisconsin*

**Our Proven Methodology &  
Software Technology Can  
Save Your Company  
Thousands of Engineering  
Hours Annually**



## 1) Engineering & Manufacturing Workflow Assessment

The first step to help Johnson Controls (JCI) devise a method to reduce and eliminate many of the steps associated with the processing of custom ventilation damper orders was to perform an **"Engineering & Manufacturing Workflow Assessment"**. This assessment was done to help identify potential improvement areas and determine what was practical and cost-effective to automate.

This included the mapping of the existing steps within the quoting, order entry, engineering, and manufacturing workflow process. This also included the interviewing of key personnel within each workflow area to understand their perspective on challenges and get their suggestions on how workflow tasks could be improved. The **Engineering & Manufacturing Workflow Assessment** included the following:

### ⊕ Software & Hardware Technologies Utilized

This step was to understand the various software and hardware technologies utilized by JCI and how information needed to be integrated with each technology.

- Customer Web Portal (Quoting / Order Entry)
- Legacy Systems
- ERP / Business System
- MES / Scheduling System
- Shop Floor Machine Tools

### ⊕ Documentation of Existing Workflows

This process included the documentation of the existing JCI workflows to determine potential inefficiencies and potential improvement areas. This also included identifying labor intensive workflow tasks that could be supplemented with software automation and data integration.



### ⊕ Current State Workflow Summary

The final step in the Johnson Controls **Engineering & Manufacturing Workflow Assessment** process produced an up to date **"Current State"** workflow map that showed the strengths and weaknesses of current operations. This provided a foundation for the next step to plan for future improvements based on Industry 4.0 principles to create an effective **"Future State"** path forward.



## 2) Strategic Automation Planning

The next step in the process was to develop a **Strategic Automation Plan** based on information mapped and discussed during the **Engineering & Manufacturing Workflow Assessment**. The **Strategic Automation Plan** provided a blueprint to achieve a **"Future State"** Industry 4.0 integrated factory environment.

During development of the Strategic Automation Plan, the following objectives were met and documented:

- ⊕ Defined "Future State" Workflows
- ⊕ Determined Required Modifications to Existing Software
- ⊕ Determined Off-the-Shelf Software Requirements
- ⊕ Determined Custom Programming Requirements
- ⊕ Determined Project Cost Estimates / Timeline

The Johnson Controls (JCI) strategic planning process in conjunction with LDC included discussions with key personnel from the shop floor to the plant manager to determine how current processes worked and what improvements would help strengthen and improve existing workflow processes and add new capabilities. Valuable input was received at every level.

LDC's expert manufacturing consultants used the information gathered to construct the **Strategic Automation Plan** that addressed the cycle times and labor-intensive bottlenecks that were slowing down the existing workflow. This was followed by devising a practical solution that added significant flexibility and new capabilities while significantly reducing costs and the time from order entry to final product shipment.



The **Strategic Automation Plan** worked out the details of the proposed new automated workflow system eliminating significant surprises during the development and implementation process. The details included specifications of dataflows to and from existing software including the customer web portal and ERP system. The plan quantified the manual tasks that were eliminated through workflow automation.

The finished **Strategic Automation Plan** provided a step-by-step plan used for successful development and implementation of an automated workflow system that automated order entry, configuration, and manufacturing execution of custom ventilation dampers.



## 3) Establish Engineering & Manufacturing Data Warehouse

The first step in the actual development and implementation of the Johnson Controls automated workflow system, as specified in the **Strategic Automation Plan**, started by establishing an **“Engineering & Manufacturing Data Warehouse”** to connect the various needed software and hardware technologies throughout the JCI enterprise.

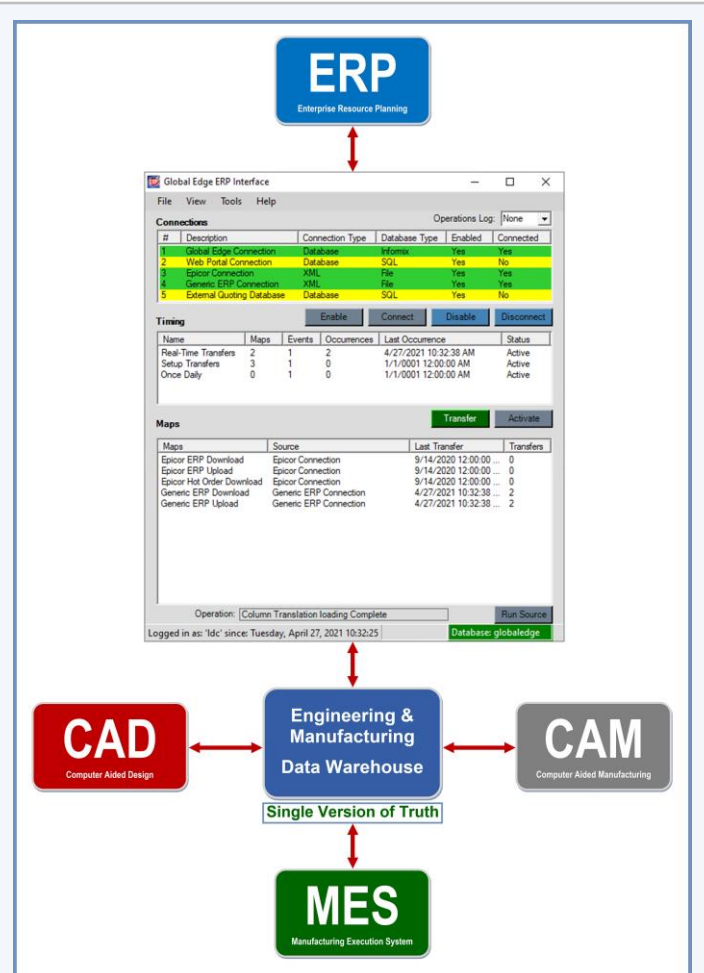
The **Engineering & Manufacturing Data Warehouse**, implemented by JCI, was developed by Logic Design Corporation, and provides a digital framework that serves as a centralized data warehouse that integrates various software and hardware technologies.

Also included and implemented was innovative software technology (**Global Edge ERP Interface**) to provide two-way ERP integration with CAD (Computer Aided Design), CAM (Computer Aided Manufacturing), and MES (Manufacturing Execution System) software.

The **Engineering & Manufacturing Data Warehouse** coupled with the **Global Edge ERP Interface** provided JCI with an easy to configure system to exchange the following information throughout the enterprise:

- ⊕ Sales Quotes / Orders
- ⊕ Job / Production Orders
- ⊕ Part Numbers
- ⊕ CAD Part Parameters
- ⊕ Bill of Materials / Routings
- ⊕ Time & Material Cost Rollups
- ⊕ Shop Floor Production Data

This information helps facilitate a fully automated workflow system that automatically processes custom ventilation damper orders from the JCI order entry web portal through engineering, ERP, and the shop floor without human intervention.



The above diagram illustrates the flow of information and integration implemented at Johnson Controls that provides the necessary IT infrastructure and makes a fully automated workflow system possible.



## 4) Incorporated Automated Workflow

As part of the automated workflow solution for Johnson Controls (JCI), Logic Design Corporation (LDC) provided JCI with innovative and advanced software technology designed to automate many of the manual tasks associated with the quoting, order entry, and engineering workflow process.

This software technology developed by LDC referred to as the “**Global Edge Configuration Engine**” provides JCI with the following capabilities:

- ⊕ Automated Product Configuration
- ⊕ Automated Smart Part Numbering
- ⊕ Automated BOM / Routing Generation
- ⊕ Automated Time & Material Cost Rollups

### Automated Product Configuration

A key challenge that faced JCI was the manual configuration and processing of custom ventilation damper orders. Each time a custom damper order was entered in the Customer Web Portal, an engineer would have to manually process the order by configuring the bill of materials from the top level to the individual components. This included part numbering, adding, or deleting components from a template bill of materials, resizing components, generating routings, and manually typing data into the ERP system. The process time was usually a minimum of four hours, dependent on when an engineer was available to process the order.

The **Global Edge Configuration Engine** provides JCI with an automated workflow solution that eliminates the manual configuration of ventilation dampers with 24/7 availability to automatically process incoming orders. The flexible and easy to setup architecture allows for straight forward modification of user definable configuration rules for simple to complex parts and assemblies when product options change.



### Automated Smart Part Numbering

The **Global Edge Configuration Engine** provides the ability to generate smart part numbers based on configured part parameters for components and assemblies. These smart part numbers provide easily identifiable part numbers by shop floor employees and eliminated duplication of identical parts.

### Automated BOM / Routing Generation

The automated workflow solution implemented by JCI provides the ability to automatically generate a complete engineering and manufacturing bill of materials including the generation of optimal routings based on CAD part and matching machine tool parameters. This includes automation of the scheduling process that is made possible with the complete bill of materials and routing information that is generated. This information can be directly incorporated into an automated job build process.

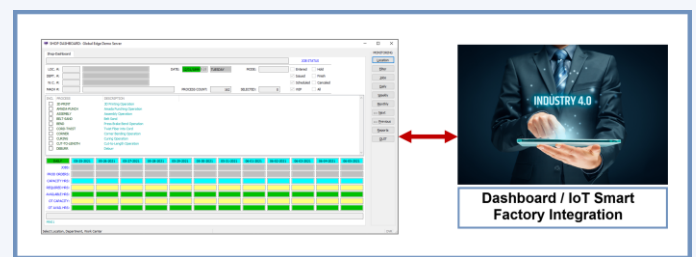
### Automated Time & Material Cost Rollups

In conjunction with the **Engineering & Manufacturing Data Warehouse** which includes the direct integration with ERP, the **Global Edge Configuration Engine** automatically generates accurate time and material cost rollups based on the latest costs and accuracy of the generated bill of materials and routings.



## 5) Shop Floor Integration / Production Dashboard

The final step of the JCI workflow automation project was to expand the flow of information to and from the shop floor. As orders are processed at the customer web portal / order entry level, the **Global Edge Configuration Engine** automates the generation of routing steps based on the parameters of the configured ventilation damper components. These routing steps help facilitate the automated generation of production orders integrated directly with the shop floor.



This also facilitates the automated recording of production data and the capability of a **“real-time”** production dashboard that provides the following information:

- ⊕ Real-Time Counts of Incoming Orders
- ⊕ Status of Current Order Being Processed
- ⊕ Display Count of Failed Orders
- ⊕ Real-Time Count of Orders Sent to Shop Floor
- ⊕ Count of Completed / Shipped Orders

## Summary

The success of the Johnson Controls project was the direct result of an innovative approach and methodology that supplemented existing workflow procedures and applied integration of various systems and workflow automation. This reduces and eliminates labor intensive workflow tasks. This resulted in not only an annual savings of thousands of engineering hours, but significantly improved customer satisfaction with on time product deliveries.

As a four-hour engineering task for processing custom ventilation damper orders is reduced to 20 seconds, completed orders from order entry through fabrication to shipping can be completed in as little as two hours. The system devised and implemented for Johnson Controls has paid for itself many times over and helps JCI better compete in a competitive global marketplace.

Logic Design Corporation (LDC) has a 30-year history of helping small, medium, and large-scale manufacturing operations achieve an integrated Industry 4.0 factory environment resulting in saving thousands of engineering hours each year.

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