

UNDERSTANDING THE INFORMATION CAPABILITIES OF MANUFACTURING INFORMATION (MMI/HMI) SYSTEMS

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Personal Computer based Operator Interfaces (MMI/HMI/OI) sit on top of veritable gold mines of information contained in Programmable Logic Controllers (PLC's), Loop controllers, and other microprocessor based control systems.

In the past, hardwired control panels were the operator interface to these control systems. Due to cost constraints, only those interface controls that were absolutely necessary for the control of the process were provided by the OEM or Systems Integrator. The PLC programmer unit was the only device that could "see" into all of what was going on within the controller.

With the advent of personal computer based operator interfaces, more information could be inexpensively presented to the operator. This information allows the operator to make better decisions due to the graphical nature of these interfaces.

These interfaces have information capabilities that are often overlooked, or under-utilized by the OEM, System Integrator, and the end user. This information can be used to better understand the process, better control the process, and get better yields from the process

Where is the Data?

The process control system contains the raw data that is used for control. PLC's DCS's, Analyzers, etc. all have data buried in them that once exposed can be used to make better decisions. Unfortunately, the data provided to the operator to make operational decisions is often a subset of the data actually available. Other members of the organization can make use of the data by exposing and making available all of the process information to all of the members of the organization.

There are essentially two types of data within the Operator Interface, Real Time, and Historical. Operator Interfaces get their real time data from the field devices through an IO Driver, also known as an IO Server. There are different IO servers for different PLC's, DCS's and other field devices. There are servers available for literally hundreds of field devices. Each data item retrieved from the field device is called a Tag. Usually only a subset of the tags retrieved by the IO server are historically trended. These tags tend to be critical analog and discrete data that is used for operational needs only. Increasing the number of tags historically trended is important because information in the context of time has often more value than real time data.

Why Mine for Data

There are many reasons to mine for data from the process control system. Chief among these reasons is as a Foundation for Improvement. Rare is the control system that is fully understood or optimized for performance and production. A Foundation for Improvement consists of three major areas:

- Understanding the Existing Control System

Understanding the existing control system begins by understanding the relationships between all of the process variables, understanding the cause and effect between process variables, and understanding the relationship between events and the process variables.

- Determining the Points of Major Return

Once the process relationships are understood, abnormalities can be identified and their causes discovered. A value can then be applied to correcting the problem, and there is then evidence to support the claims when selling process improvement to management.

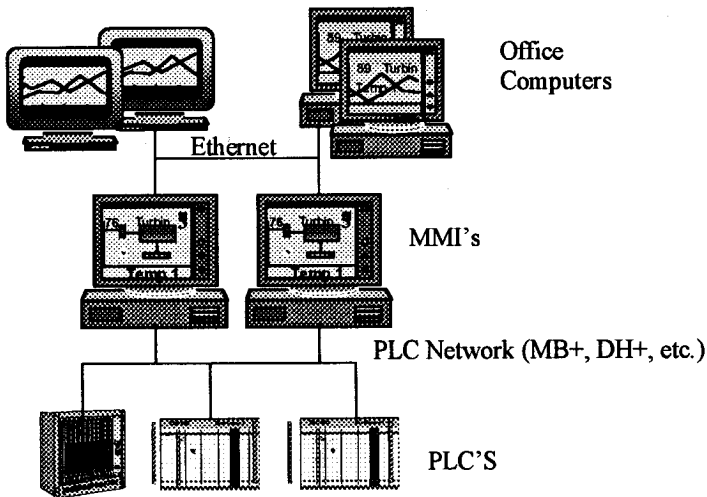
- A Point of Reference

A baseline of process performance is necessary to be able to measure the success of process improvements. This allows comparison of the old and new to determine value and changes in strategy.

The information contained in the MMI is usually as valuable to other members of the organization as it is to the operator. Distribution of this information is what drives improvements to the process.

How is this Done?

An Ethernet network joining the MMI system to the Office network is almost a prerequisite. This allows for the efficient transfer and dissemination of real time data and historic data to other member of the organization.



Most all of the major manufacturers of MMI/HMI systems allow for data export from their systems. The data export can take many forms. Among the oldest of these is an underlying technology of Microsoft Windows[®], and that is Dynamic Data Exchange (DDE). DDE allows real time data transfer from the control system to other computers.

Microsoft Excel is DDE aware and can link to MMI systems from Wonderware, Intellution, Rockwell Software, and others. This functionality is free as it comes with Windows and does not require any additional licenses. The syntax of DDE is Application|Topic|Item. An excel worksheet can then directly access the MMI system via the syntax in a cell of "=\MMINode1\View|Tagname!KilnZone1TDAL," which is to say "Go to the computer named MMINode1, program View, Topic Tagname, and fetch the contents of tag KilnZone1TDAL," If the IO server is DDE aware, then Excel can get data directly from the PLC. The syntax is similar to the Excel example, but the Application, Topic, and PLC item (Tag) would be something like "=\MMINode1\TICVU|PLC1!\ELPV1."

Another method of data export is data files extracted from historical trends. MMI systems generally allow for the export of historical data to CSV, or comma separated variable files. These files can contain thousands of data points for hundreds of tags. Historical trends where the data is plotted against time is very useful, but data plotted against other data can yield understanding not available in time plotted data. This methodology allows for data analysis with many standard software tools.

Under-utilized tools within the MMI systems include Statistical Process Control/Statistical Quality Control (SPC/SQC) and SQL access. SPC/SQC can give insights to the repeatability of processes and can give forewarnings of impending process control problems. On line SPC/SQC tools are not well utilized by industries outside on the food and pharmaceutical industries. Most all processes can benefit from SPC/SQC analysis. Structured Query Language (SQL) Access allows for the reading and writing of data into Open Database Connectivity (ODBC) compliant databases. Databases such as, Oracle, Sybase, Ingress, Foxpro, Microsoft SQL Server and Microsoft SQL Access are all ODBC compliant databases. SQL Access allows the OI to insert process data directly into corporate databases.

Other offerings by MMI vendors include state of the art SQL based historians. The benefits of SQL based historians are just now being realized by the user community. In the above examples techniques were described to extract data out of the MMI system. With SQL based historians, all of the data from all of the process control systems in a facility can be stored an analyzed using commonly available database client tools. The business sides of organizations have benefited from relational database technologies for many years. This technology is now available to the manufacturing side of businesses.

Real Time Relational Databases allow for the acquisition of data at the resolution of the process, but allow for queries at the resolution of the problem being solved. Real Time Relational Databases allow for real-time data queries, historical queries, summaries, and relational queries against business databases. The analysis capabilities of industrial Real Time Relational Databases are endless, allowing for detailed understanding of the industrial processes. The ability of the Real Time Relational Databases to merge process data with business data allows for more accurate and timely costing data, further adding to the profitability of companies using these technologies. Information from these databases can be made available across multiple manufacturing plants using corporate networks and Internet/Intranet technologies. Therefore, process and production data can be accessed by anyone in the organization that has need for that information.

Summary

The Personal Computer based Operator Interface has informational capabilities beyond their perceived use. The MMI/HMI systems of today have many imbedded

features that can aid organizations in improving their process control systems and profitability. The information contained in the OI has value to many members of the organization besides the operator. Established technologies allow for publishing this data to everyone in the organization that needs this information to make their companies more profitable and responsive to their customers. The end user needs to know these imbedded capabilities and how to exploit them.

The Man Machine Interface (MMI) has evolved from a simple stand alone Operator Interface into a networked Manufacturing Management Information System (MMIS) with benefits to all members of the organization.