

High Speed Acquisition and Analysis in Factory Floor Applications

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Overview

The factory floor is a wealth of information. In these applications, the traditional data collection has involved low speed data acquired from PLCs. But there is a whole different realm of information available when acquiring high speed data - data in such mission critical applications as test stands, machine vibration analysis and resonance detection, and many others. This information may be critical to the success of a process, so it is important to have a tool which allows you to access it easily and reliably.

FactorySuite has a series of components designed to monitor, control, and track the traditional low speed data found in most systems today. With the addition of Snap-Master™ as a FactorySuite Partner, you now have a tool that allows you to get high speed data, analyze it, and produce the results in real-time.

What Is Snap-Master?

Snap-Master is an integrated ensemble of data acquisition and analysis software designed to acquire, display, and analyze high speed data. Snap-Master runs on both the Windows95 and Windows NT platforms (capabilities differ depending on the operating system).

At its most basic level, Snap-Master replaces oscilloscopes, strip-chart recorders, spectrum analyzers, and other dedicated equipment with a computer-based system. One of Snap-Master's most impressive capabilities is that it allows you to create "super instruments" that combine and surpass the capabilities found in standard instrumentation equipment.

Snap-Master was created much in the same vein as FactorySuite's components with an easy, intuitive, flow-chart approach to virtual instrumentation. Everything is configured visually, either with individual dialog boxes or grouped in a summary table. Snap-Master avoids the "icon-overload" of other software programs, without sacrificing the power of a "programming environment."

Snap-Master includes features you expect like multiple display types (Y-T plots, X-Y plots, digital meters, dial meters, bar meters), extensive File I/O (CSV, ASCII, and binary formats), and high resolution printing. There are other features that you may not expect, including an arbitrary and function waveform generator which includes over 10 built-in functions (sine, square, sawtooth, triangle, cosine, ramp, etc.) and a Sensor Database which tracks sensor scaling and calibration histories.

Snap-Master and FactorySuite complement each other well because they are designed for different but related applications. FactorySuite is designed for "high channel count / low speed" systems, while Snap-Master is optimized for "low channel count / high speed." It is easy to create solutions using the combination of these two approaches, because you have the tools to cover more applications.

High Speed Acquisition

To most FactorySuite users, "high speed" means more than one sample per second. And for SCADA applications, that is fast enough. But for applications such as test stands, vibration analysis, and predictive maintenance, there is a great deal of information that can be gathered using acquisition rates between 1,000 and 100,000 Hz.

Snap-Master supports a different hardware set than FactorySuite - high speed, multi-channel plug-in boards, parallel port, and PC Card (PCMCIA) devices. Snap-Master has the capability to acquire data from more than one hardware device simultaneously, but the majority of FactorySuite applications will use a single I/O hardware source. Typical I/O hardware has 16 analog input channels and 8 digital I/O channels, and two analog output channels, with some hardware allows up to 256 analog input channels.

Snap-Master's strength lies in reading and processing the high speed analog inputs, because Snap-Master is designed as a real-time system. That means that as the data is brought into the computer via I/O hardware, it is being analyzed, plotted, and stored to disk simultaneously. There is virtually no delay time between when the event occurs and you see the results on screen.

High Speed Analysis

With the capability to acquire burst data up to 1,000,000 samples per second, it is easy to acquire more data than can be reasonably stored or sent across the network without overloading the system. To combat this, Snap-Master includes advanced data analysis and reduction tools, which keeps the smarts inside Snap-Master and sends the answers to FactorySuite.

Rather than use a business spreadsheet program for analysis and data display, Snap-Master's analysis includes the spreadsheet's ease-of-use by pointing and clicking to define your equations, while overcoming several spreadsheet limitations. Because Snap-Master can generate large amounts of data, you need software specially designed for real-time data for analysis and reduction.

Snap-Master easily handles millions of data points (instead of only 16,384 rows), and has over 60 engineering functions such as Statistics, Integration, Differentiation, Logic, Digital Filters, Event Detection, FFTs, Spectral Analysis, and more.

All equations can be created and edited using Snap-Master's "Equation Builders", which provide wizard-like, step-by-step instructions. The Digital Filtering Equation Builders even include a Filter Preview window which shows the response of the filter you have specified.

Built upon extensive logic to make decisions on acquired or analyzed data, Snap-Master's "Intelligent Processing" makes decisions and analyzes only the regions of data that is required (i.e. integration between significant events). This helps to build "Smart Instrumentation," which represents the next wave of PC-based data acquisition and analysis.

IndustrialSQL Input

A special feature unique to the FactorySuite Partners version of Snap-Master is an element which reads data from an IndustrialSQL database. This lets you use Snap-Master as an advanced data analysis tool for your production data. All of the data analysis and display capabilities you use with live data can be used with IndustrialSQL data because Snap-Master features Post Processing and real-time analysis all in one package.

Where Do FactorySuite and Snap-Master Work Together?

Perhaps the following chart best describes where Snap-Master fits with the various FactorySuite components. (Items marked with ✓ are supported, items with ❖ are optional, blank items do not apply).

FactorySuite Component	Snap-Master Relationship	Snap-Master Modules			Operating System		Applications / Benefits
		DA	GA	FA	95	NT	
InTouch	<p><u>Intelligent I/O Server</u></p> <ul style="list-style-type: none"> Acquire high speed data Real-time analysis and decision making Return summary data to InTouch for SCADA and visualization 	✓	✓	❖	✓		<p><u>Test Stands (In-Line, End-of-Line)</u></p> <ul style="list-style-type: none"> Performance testing Reliability / Durability testing <p><u>Advanced Monitoring</u></p> <ul style="list-style-type: none"> Go / No Go production testing Machine monitoring for predictive maintenance Verification of data quality
IndustrialSQL Server	<p><u>Analysis Client</u></p> <ul style="list-style-type: none"> Time and frequency domain analysis Enhanced plotting of data 		✓	❖	✓	✓	<ul style="list-style-type: none"> Reducing raw data to usable format Data Presentation Superior alternative to a spreadsheet program Intelligent Processing with digital filtering, integration, differentiation, algebra, statistics, trigonometry, etc.
InControl	<p><u>Verification and Simulation</u></p> <ul style="list-style-type: none"> Acquire high speed data Real-time analysis and decision making 	✓	✓	❖	✓		<ul style="list-style-type: none"> Verification of InControl's real-time performance. Simulation to develop control algorithms Adaptive Control (monitors environment with ability to change control algorithms) Resonance Detection (if resonance detected, use adaptive control to alter production conditions)

When Should Snap-Master Be Integrated Into a FactorySuite Solution?

The following description defines some of the applications where the combination of Snap-Master and FactorySuite work together to handle demanding applications.

1. Go / No-Go Production Testing

The combination of Snap-Master and InTouch is excellent for in-line and end of line production test stands. InTouch handles the PLC and user interface, while Snap-Master acquires the data, even at speeds of over 100,000 samples per second; performs analysis of the data, and determines the performance benchmarks that will pass or fail the part under test. All of this is achieved in real-time and is set-up without any programming -- just “point and click” using Wizards. InControl often is a viable substitute for a PLC for production test stands and works well with Snap-Master. InTouch handles the user interface and communication of this information to Industrial SQL Server and InTrack. See injector test stand application story for details.

2. Machine Monitoring for Predictive Maintenance

In addition to monitoring the product under test as described in Item #1, Snap-Master and InTouch also monitors the machines used for production. Snap-Master will typically measure the vibration of the machine and compare it to a reference template in both the time and frequency domain to see if the machine is exceeding normal levels. InTouch handles the user interface including setting up the alarm conditions, sending out the alarms, and communication of this information to Industrial SQL Server and InTrack.

3. Industrial SQL Client to Post Process & Plot Archived Data

Snap-Master’s extensive data displays were rated “Second to none” by BYTE magazine, and for analysis of data Snap-Master has the same well-accepted user interface as Microsoft’s Excel. Snap-Master’s powerful engineering analysis offers the following benefits over Excel:

- Handles millions of data points per tag while Excel is limited to 16,000 (and only 5,000 per plot).
- Digital filtering improves signal quality.
- Includes integration, differentiation & frequency domain analysis.
- Real-time analysis with InTouch; reads data directly from Industrial SQL Server for post processing.

4. Simulation & Performance Benchmarking of Control System

Often the user wants to test the control algorithm of InControl and the entire system prior to actual operation. By having both realistic input signals and some classical inputs, it is easier for the developer/ integrator (SI) to understand and predict how the control system will operate under actual conditions. Snap-Master has the ability to generate classical waveforms and also to acquire actual test data. Since Snap-Master is a flexible, independent test tool to benchmark and verify InControl’s performance, Wonderware’s InControl development and Q/A group is using Snap-Master for this purpose. Snap-Master is also valuable to the user and SI to verify InControl’s performance at the customer’s site. See related application story.

5. Adaptive Control Including Resonance Detection

When used in conjunction with InControl, Snap-Master's monitoring capability is a very powerful feature that can alert the control system that something has changed including excessive temperature or vibration that may be due to abnormal wear or resonance of machinery. Subsequently, InControl can adjust the algorithm to meet the new situation. Typically adaptive control is only available in expensive Distributive Control Systems (DCS).

6. Diagnostics & Troubleshooting

Snap-Master's virtual instruments replace and combine a wide range of common test equipment to diagnose problems, including an oscilloscope, meter, stripchart recorder, frequency spectrum analyzer, and data logger. Snap-Master can even automatically verify whether the signals are as expected (amplitude, frequency, shape, etc.), and alert the user if they are not.

How Can I Get Snap-Master?

Snap-Master is one of the premiere programs on the FactorySuite Partners disc. That disc is included with new copies of FactorySuite or with the May 1998 release of Comprehensive Support. If you do not have that disc, contact your local Wonderware distributor.

You can also check out Wonderware's web site at www.wonderware.com or HEM Data's web site at www.hemdata.com.

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