

Painless Data Acquisition – for Business Intelligence

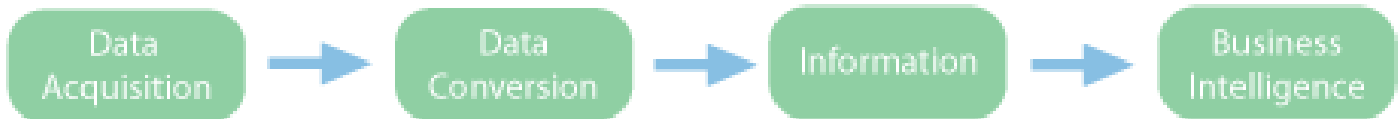
A Solutions Unleashed Whitepaper

Data acquisition is the underpinning technology of manufacturing information from SCADA through to MES and ERP integration.

Without data acquisition there is no intelligence. Data conversion to information and from that producing business intelligence is the role of the increasingly

sophisticated IT packages that are mainly based on Microsoft's .Net framework.

However, Manufacturing Control Systems are awash with potential data sources. The task of obtaining the right information at the right time to provide the right intelligence can be painful... unless you know how_ read on.



The basics

Data acquisition is the purpose of acquiring data manually or automatically. However, automated data acquisition will mean an investment in technology. Before this investment can be justified understanding is needed as to why we may want to use a data acquisition system in place of people with clipboards (which of course do not come free of charge). The data acquisition question is “Will the results of using automated data acquisition be better than they were when we used people with clipboards?”

A frequent justification for automated data acquisition systems is accuracy and immediacy. Put simply, we want to know more, we need to know that we can trust the information, and we need to know it sooner. The right information, which is accurate, and made available at the right time is business intelligence. When deciding to invest in data acquisition the mission is never just “data acquisition for its own sake”, but rather to meet business objectives such as lower inventory, higher quality, better customer service, schedule adherence, more accurate costing and many other Key Performance Indicators (KPI).

Automatic data acquisition has evolved to various methods of data acquisition; such as time and attendance devices, bar code scanning, radio frequency identification (RFID), and sensor based devices which are normally connected to controllers such as automated scales, flow meters, case counters, proximity sensors, photo electrics, switches and vision systems.

The problem...

Although manufacturing is awash with potentially useful data there are some serious issues when considering how to access it. Real time management is enabled through the application of real time intelligence and this is only possible when one has real time information, which comes from real time data. The problem is real time data constantly changes making it difficult to identify the valuable data required. This problem must be resolved if benefits are to be realised.

Which data to acquire?

The question of “Which data to acquire?” from the ocean of potential data available is usually asked as there is an obvious need to get at the valuable data. Compressive databases are adaptive and can acquire data at high rates, apply date/time stamping and cope with interrupted communications. They also allow manual data (such as laboratory data) to be entered in the correct chronological order. Compressive databases allowed all accessible data to be acquired, the low grade elements either disposed of or simply made low resolution (by automatic adaptation) – a guard against the “unknown unknowns” aspect of process control.

How long to keep it?

Data retention policy will vary according to manufacturing requirements. Some systems use stored “perfect data” to produce set-points for similar batches that are to be produced later, others can safely discard the data when the batch is over (and reported). Where manufacturing is undertaken in regulated and validated industries then data will require retention and archiving for many years.

How to acquire?

Assuming that manual data acquisition techniques have been placed to one side as being error-prone, untimely, slow and expensive then automatic acquisition is considered only from this point onwards.

The direct method - access the source device (PLC, Loop Controller, Vision System) by whatever communications technology is available – preferably Ethernet. The diversity of devices both by vendor and technology has been greatly simplified by OPC. Where a device has only a basic serial port and possibly no communications port at all, then other approaches are required.

Anomaly of the direct approach

In theory the simple expedient of Ethernet plus OPC connectivity is a simple to use solution until one considers the effect of this ingress to the device and its controlled machine. There are significant pitfalls for the unwary. This is owing to the effect on controller scan cycle time by supporting the extra communication, and by the potential commercial effects and operational effects of tampering with proven OEM supplied controller software. Clearly when a machine is within guarantee there will be a problem, the converse being where a machine is so old that all programme data has been lost therefore tampering could be terminal! What starts out as a valid Continuous Improvement programme can end up being a nightmare of consequential problems, including machines running slower than when one started.

Solving the anomaly....

As with many tasks the key is in the preparation. If you are about to add automatic data acquisition to a machine, check that you have the documentation (and that it is up to date), backup the software and check the scan cycle time for any zones of inactivity that can be used to absorb the acquisition load. If the communication technology is current (Ethernet or any of the field buses) then you will generally be safer than with legacy communications that were not designed for high speed continuous data acquisition.

Where communication connectivity does not exist or is potentially too risky then indirect data acquisition solutions are needed.

How to acquire?

The indirect method - assuming that a manufacturer's backbone communication scheme is Ethernet then the data acquisition task is to get data onto that backbone and then onwards to the centralised database. This simple fact should be in mind even when considering direct Ethernet connection as opposed to a piggy-back layer.

Simply stated the piggy-back solution is to use a readily available digital IO to Ethernet device such as the Advantech ADAM range (and all the many varieties such as serial to Ethernet, analogue and wireless). These devices provide a cost effective connectivity solution to devices without communication (by making direct connection to the electronics and electrics and using subsequent logic to provide meaningful data such as "waiting for work"). The same devices will allow a device with obsolete/ legacy communication to be better connected.

The more startling observation is that the piggy-back solution is even valid where modern communication is available – this is because it does not affect the machine controller whatsoever – whether by slowing a high speed machine or by invalidating warranty or "importing risk" by tampering with old and forgotten controller software. Using the piggy-back solution can of course miss accessing some high-order information that may exist at the controller level – there is no perfect solution, one should simply do your homework and act according to findings.

The message is to get the data and then apply logic to produce information and then filter this to provide business intelligence, from as many sources as possible in the least disruptive manner.

Adding value...

Having acquired the data there is a remaining major task – 'adding value'. It is here that a firm eye on the business's objectives is needed. Essentially there are two approaches both of which in many ways are complementary.

Data manipulation.....

The bespoke scripting approach

This method, used by many manufacturers is to take the stored data and write many Sequential Query Language (SQL) queries that will effectively convert data to information – the information becoming intelligence once a specialist user's (e.g. Quality) needs have been fully understood. This is a laborious process and frequently can run to man-years of report query writing.

...The integrated 'out of the box' approach

There is a better way. Absorb the whole task into something that was designed to ease this task, and provide better, more consistent and faster results. A good example of this is Wonderware's System Platform which has all the functionality that is needed to provide information from the source data. This includes the database (called the Historian), visualisation, report generation and information dissemination tools. The report generation is of particular interest as it allows functional specialists (say Quality), that will probably not be IT professionals, to obtain their own information. This has obvious advantages as it empowers the specialist and provides a means by which the person can explore and develop their role without the need to make repeated requests to the manufacturing IT department.

Both of the above approaches 'man hours' and 'out of the box', are essentially data manipulation. The latter is vastly more efficient than the former and also provides the underpinning for adding further value, automatically, with modules.

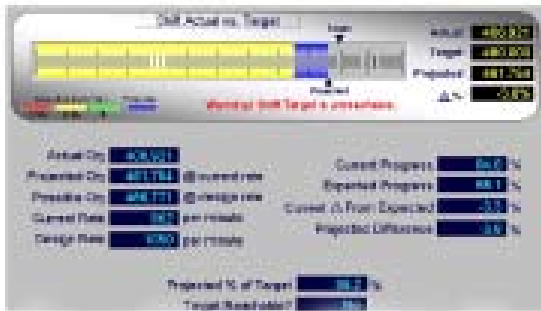
The enhanced module way...

Once the data is properly structured in a single central database there are immediate advantages – the most obvious being a "single set of numbers" and the second "obvious" being that all the data is in one place.

This allows one to do more than produce reports, for example a simple report about production levels may be easy to achieve (especially with Wonderware System Platform®) but there is a further more complex reporting "layer". This requires extra manipulation of data that if attempted by standard reporting tools will prove very complex and therefore time consuming and will additionally run the risk of manipulation and arithmetic errors. Examples are Statistical Quality Control (and who would really attempt and guarantee the complex maths?) and Overall Equipment Effectiveness (OEE) (the maths are relatively easy but manual data handling can make OEE figures slow to appear, and with poor quality presentation).

The functional solution to this is to utilise high powered modules that plug-in to the single name space and work to produce what is needed. SQC, Statistical Process Control and OEE are readily achieved, risk of manipulation and mathematical complexity taken care of by using built in functionality and clear adaptive presentation to show what the business needs to see, not the raw data. Examples are Wonderware Equipment Performance Module (EPM) for OEE and Wonderware Equipment Operations Module (EOM) that automates complex tracking, traceability, and equipment usage and personnel utilisation.

These modules take the strain and allow results to be delivered earlier in a project; you add value rather than labour at programming the basics. In addition to project savings, the same modules enable and provide unrivalled functionality to an environment of Continuous Improvement thereby producing an ongoing return on investment. The remaining stage in the data acquisition task is to disseminate business intelligence – this is almost universally done through web enabled management dashboards – another module!



Data acquisition – made business intelligence From a user...

Having established a passive, predominantly piggy-back data acquisition scheme (owing to a mix of machine technologies, OEM software issues and legacy communications) a user reported that the use of a single real-time database with OEE and SQC modules had produced a system that had become “the heartbeat of the business” and had “enabled real time management”. This had been achieved by undertaking a careful audit of their situation and producing the best solution for their business. OEE and SQC data is available to all at all times through large wall mounted displays and wide intranet dissemination. Everyone knows what is happening and the system has engendered a “let’s do it culture”. KPI’s are provided through web enabled management dashboards connected directly to the real-time system. Data acquisition - made business intelligence.

Summary

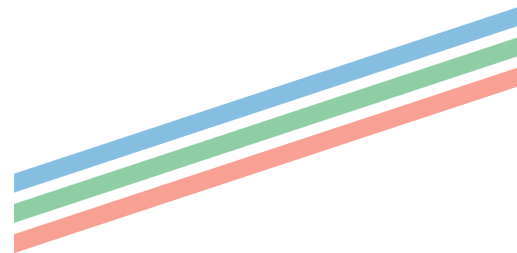
Set in perspective this is all enabled by data acquisition. Without data such databases and modules have nothing to process, nothing to feed upon. It is crucial to get the data acquisition correct, the actual control is the immediate task but ensure that machine suppliers realise and allow for your information requirements. The mix of new and old equipment and various communications can be resolved by piggy-back data acquisition. The impact of direct data acquisition (and host device loading) needs to be considered and practical solutions applied. You need effective hardware and software tools to undertake this effectively.

To get started you may well consider accessing the skills and experience of EmsPT consultants.

SolutionsPT Ltd is a leading supplier of manufacturing solutions to major companies across the UK and Ireland. Using world class industry expertise, quality training and support facilities and a proven range of software and hardware technology products, SolutionsPT specialises in delivering manufacturing management solutions that can increase productivity and supply corporate management with the real-time information they need to make sound business decisions.

SolutionsPT, Unit 1, Oakfield Road, Cheadle Royal Business Park. Cheadle SK8 3GX
Telephone: +44 (0) 161 495 4600 Fax: +44 (0) 161 495 4690
Email: info@solutionspt.com Web: www.solutionspt.com

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