



How Shopfloor-Online Works with CMM Applications

Working with data from CMMs

Shopfloor-Online harnesses all the CMM data in one powerful information system...

Co-ordinate Measuring Machines (CMM) are excellent at dimensional measurement of complex parts. They are used extensively throughout the supply chain in industries like Automotive and Aerospace.

Although the CMM measurement process can be relatively time-consuming, it's not long before CMMs generate a lot of data. For the majority of CMM users the print-out is the primary form of working with the data.

In some cases SPC software packages are used to import the CMM data to provide analysis (indeed Lighthouse Systems have a well established product, SPC-Light, which has many thousands of installations world wide).



Problems working with CMM data

Convenience

The first problem is usually one of convenience: the CMM machine will have a computer (Windows PC or UNIX) but often this is not on the network so access to the data has to be on the CMM machine itself. It seems like an obvious thing, but if you need the data but you have got to go to the machine to get it – it is a real inconvenience. Especially if when you get there the machine is busy!

Work with print-outs is another nightmare: cumbersome; easy to miss things; and virtually impossible to view trends.

Double Trouble!

If there is only one CMM perhaps the inconvenience can be tolerated, but working with two or more the problems multiply.

If the CMMs are from different vendors then the problems really start:

- the print-outs are in different formats – so it is hard to share and analyse
- the software is different – so users have to learn more systems

Using SPC software can help with the analysis – but all too often the SPC software is different for different vendors of CMM machines. So it requires learning to use more than one system.

No consistency

Often the CMM programs are written by different people in the organisation, and they are written in different ways. For example, often there is no strict naming convention, so one programmer names a feature one way, and another programmer a different way. All this makes it very difficult to look at data across programs.

Compound this with the fact that by their very nature CMMs often measure complex parts, with many features, looking across parts and features, and across CMMs is virtually impossible.

Management of Specifications

CMM programs contain the part specifications – the measurement output files compare measurements against the specifications. The problem is that specifications change from time to time, and these specifications must find their way into the CMM programs or else you are no longer measuring with the current specifications. This requires a level of change control discipline – which many companies manage well – however it is an area where mistakes can easily be made.

Typical Requirements

Companies that decide they need to consolidate all the CMM data and make it available for analysis tend to develop the following requirements:

- **Import data from all CMMs** - in an environment with CMMs from different vendors, all data must be imported – which means working with the different output formats
- All data to be stored in a relational database
- Real-time SPC analysis available to those responsible for the process i.e. generate out-of-control and out-of-specification alarms
- Support for management reporting e.g. capability studies
- Support for process improvement activities e.g. SPC analysis charts
- Support customer reporting – ability to create documents to send to customers
- Support to manage the part specifications – especially change control

Shopfloor-Online Capabilities

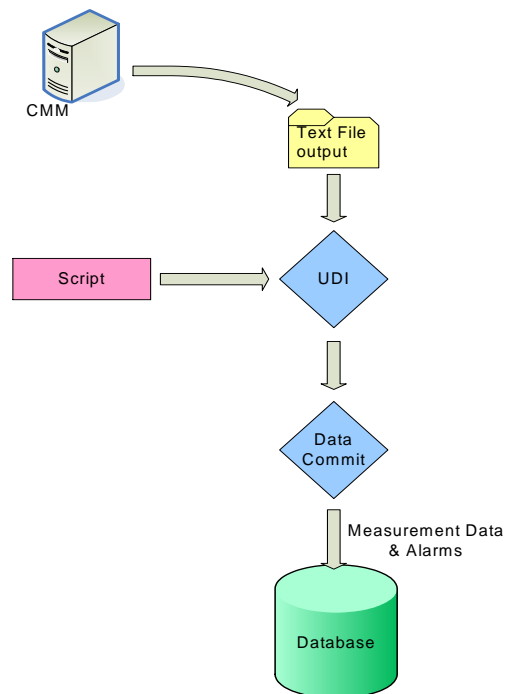
Shopfloor-Online has a number of capabilities that make it especially good at working with CMM data.

Universal Data Interface (UDI)

The UDI is a component within Shopfloor-Online that enables interfaces to be built quickly and cost-effectively. The UDI works by detecting certain events, in this case the arrival of a new text output file from the CMM. It then runs a simple plug-in VB script to read the file and extract the data. Once the data is extracted it is sent to the Web Server running Shopfloor-Online in an XML format, where the Data Commit service picks it up and saves it to the database.

The Data Commit service does several things:

- Checks the measurements against the specifications held in Shopfloor-Online and generate alarms if any measurements are out-of-spec.



- Automatically loads SPC Charts associated with the CMM data (invisibly – “behind the scenes”); adds the new data; looks at the SPC control limits; and look for any trends against the enabled SPC trend rules. If there are any out-of-control violations alarms are raised.
- Saves the data and any alarms raised in the database.

This architecture means that when building an interface all that needs to be done is to write the plug-in VB script.

Lighthouse has written scripts for many CMMs like Mitutoyo, Zeiss, DEA, Brown & Sharp and Sheffield.

Plant- Wide Database

Shopfloor-Online scales up to become a plant-wide database; it contains details of all the Products, Variables, and Specifications for all the CMM programs. All the measurement data is recorded accordingly.

This ability is very powerful since now it allows all data from all CMMs, regardless of manufacturer to be analysed in a consistent way.

However, it often raises an organisational problem: As mentioned before, different CMM programs are often written by different people with different conventions. Whilst all the data was separate it didn't matter. Now to give people the ability to look at all this data it needs to be named (and catalogued) in a consistent way. For example all Variable names should follow a consistent naming convention. This sounds straight forward but does need careful planning and may need some of the CMM programs to be modified to put it into affect.

Access and Visibility

Once the CMMs are connected the data becomes available. Now anyone (with permission) can access the data from anywhere on the network. Shopfloor-Online is a browser based system, so a user can open a standard Internet Explorer browser, navigate to the website and start reviewing data and examining charts. This is obviously powerful for the key users who can access the data from their desks rather than the CMM machine, but it is also useful for a whole slew of occasional users like Maintenance and Engineering who in the past have struggled to get meaningful data when they need it.

It is not long before there is a huge amount of data, especially for complex parts and multiple CMMs. The next problem is “to see the wood from the trees”. In many manufacturing environments where there are complex parts with many features to control manufactured with complex processes, it is important to visualise the data in an accessible way. One technique used by Shopfloor-Online is to create process maps and highlight the process steps where the aberrant features are manifest. In this way attention is directed right back to the point in the process where the problem arises.

Variable Grading

In addition, it is usual that some features are more important than others. Ideally users need to be able to cut the data by the extent to which the features are important.

Shopfloor-Online allows Variables to be classified by a user-defined grading e.g. Critical, Major, Minor etc or A, B, C and D. Once classified, reports use this information to bring out exceptions based on grading.

Enrich the data – aid the diagnosis

Shopfloor-Online is much more than an SPC system. It can collect all aspects of data on the Shopfloor, from quality data; works orders; spoilage; downtime; maintenance; materials used (including supplier); tools used; ... and so on.

By adding this data to the system the core measurement data is greatly enhanced. It is one thing to discover there is an out-of-spec violation on a key feature, the next question is why? This is usually where process engineers have to go down to the shop floor and ask what happened. The more of this data that can be recorded in Shopfloor-Online, the greater the power for diagnosis and traceability.

Reports

Shopfloor-Online contains a wealth of standard reports. For example process capability reports, alarms generated, audit of checks done, and so on.

Each report has the ability to be refined by the user:

- Filter selections allow the report to only consider from selected machines, departments, variables, variable sets, checks, parts, specs... and so on.
- The user can change the columns presented in the report
- The user can change the way the report is sorted

In addition, reports can be presented as charts e.g. pie charts, bar charts, line charts....

All reports can be set up to run on a scheduled basis to automate the production of shift, daily, weekly and monthly reports.

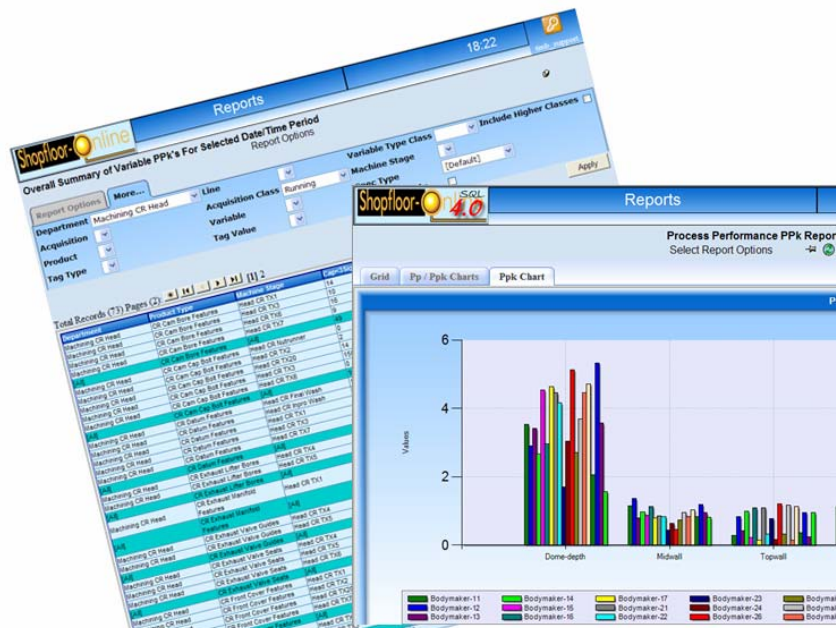
All reports can be printed, or exported to Word or Excel.

Customer reports

It is possible to create Word templates that encapsulate the style of a particular report. When the report is printed it uses the template to format itself. In this way custom templates can be built up to satisfy particular requirements and reports can be generated in a format directly ready for customers.

Auto-build for easy management

Shopfloor-Online builds a library of all the Parts, all the features and all the specifications. With complex parts this soon becomes a big library! It is not uncommon to have many tens of CMM programs, each with hundreds of features. The task of building



the library manually would be daunting as it could easily run into thousands of specifications!

Shopfloor-Online has a unique facility to simplify this task. The UDI scripts that process the CMM output files send the data to the server. If Shopfloor-Online cannot tie the data in the files to known items in the Part-Feature-Specification library the data is denied entry. Instead it is parked in a remedial area. The user can then view the failed files and automatically build the library based on the content of the failed file.

This means that if a file is received for a part the system doesn't know about (e.g. a new part) then the user can automatically build the library, importing the variable names and specifications. This gives the user strict control over the data that enters the database and ensures a high level of data consistency.

The check on the library goes further than new parts. It detects changes in two key senses:

- CMM program changes: Any changes to features included or excluded in a Part program means that the check defined in the library has to be revised.
- CMM specification changes: Any differences detected between the specifications in the CMM program and those in the database means that the user must revise the specifications.

In this way the system automatically captures what changed and when it changed. It forces the user to accept the change through the revision process and document why it changed.

Old data is kept with the revisions in place at that time, so measurement data captured with the old specifications keep those specifications; only data arriving after the specification revision uses the new specifications.

Benefits

- Access the data away from the CMM machine – any where on the network – at your convenience.
 - Its so much easier to share the data, many users can access the data at the same time, can work with and analyse the data, independent of the CMM machine.
 - In multiple CMM environments, with multiple CMM vendors, all the data can be catalogued, accessed, analysed, and reported on in a consistent way
 - Data can be compared across CMMs. If one vendor's CMM looks at part of the process, and another looks at a different part of the process, the data from the two can still be analysed together.
- Consistency – all data from all sources has to be consistent to go into the database. This enforces sound discipline in creating feature names. It means anyone in the company can access the data and know what they are looking at – no longer are there idiosyncrasies in the CMM programs making analysis difficult.
 - Change management – the system detects any changes in CMM programs affecting how the check is done or changes to specifications. Changes have to be approved. Therefore a complete change history is maintained detailing what, when and why.
 - Easy management – the system has a library of Parts, Features, and Specifications. This tends to grow and become extensive, but it is built and maintain by working from the CMM files.