

The EnTech™ Toolkit



Understanding process variability, diagnosing the cause and implementing the solutions.

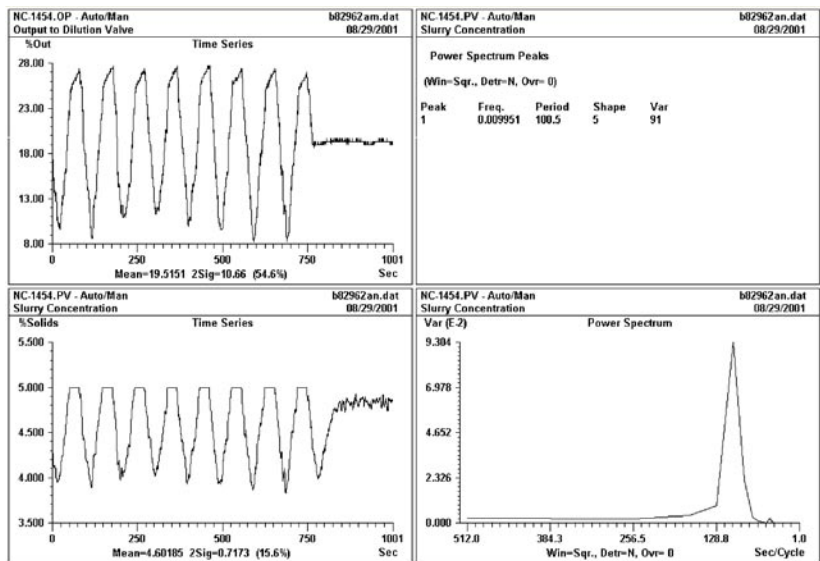
When close enough is just not good enough.

Find Your Hidden Plant

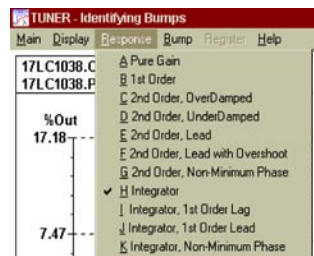
You want to be a best-cost producer in your industry and you're getting close. You want to maximize production rates; minimize feedstock and energy costs; and ensure your product meets specifications. You see the direct link between managing variability and having the attributes of an optimized process. But there are a number of issues in your process that you struggle to define and correct. Finding what is holding a plant back can spell the difference between a minor problem and an unnecessary major capital spend. Before you commit to a large capital expense, be sure to Find Your Hidden Plant.

The Hidden Plant is the lost production potential you have sitting right in front of you. You need the right tools to ensure that your control equipment, and thus your process, is running at peak performance. The EnTech™ Toolkit is an easy-to-use, PC-based solution that distills twenty years of direct experience in helping clients understand and solve their most complex process control problems.

The EnTech Toolkit, a PC-based data collection, analysis and advanced tuning package, provides the control engineer or technician with an easy-to-use vehicle for maintaining and improving control loop health. The EnTech Toolkit manages the collection of process data, analyzes the data using multiple mathematical techniques, and recommends control loop tuning procedures and parameters by referring to EnTech's highly developed data-base of dynamic analysis and control programs.



Time Series Analysis graphs allow the user to quickly identify control loop performance issues.



Intuitive drop down menus allow the user to select the type of dynamic response that the control loop best represents.

Control loop tuning - no longer "tune-by-feel". Backed by Emerson's training and support services, the user will implement realistic and mathematically sound control tuning changes, based on understanding of process dynamics, the analysis and recommendations provided by the Toolkit, and effective tuning strategies.

The user's expertise plus Toolkit's analytical power will get the best possible performance from your existing process control network.

The EnTech Toolkit - Collect Module



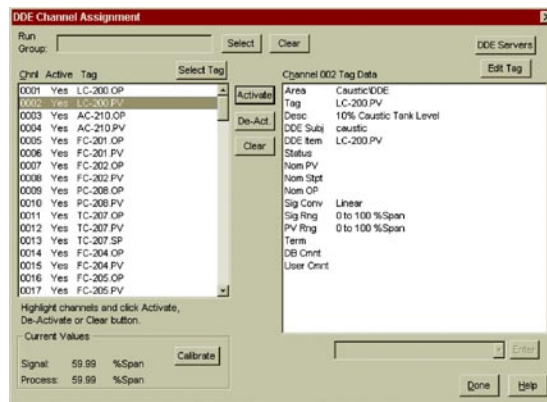
COLLECT is a flexible, high speed data collection tool that prepares and identifies process data for filing and analysis in **ANALYSE** or **TUNER**.

There are two methods of acquiring data. One is to acquire digital data from a DDE or OPC server. The host computer (plant DCS) must provide the anti aliasing protection and the user must confirm that filtering on the inputs to the DCS is not excessive.

The other method is to interface directly to the analog field signals via the Signal Conditioning Module (SCM) and an A/D card that fits in PCMCIA slot of your computer.

Proper organization and filing of data is essential for later recall, interpretation, and problem solution. **COLLECT**'s auto-save feature automatically saves data and increments file numbers at the end of each data run. The file format is automatically readable in **ANALYSE** and **TUNER**.

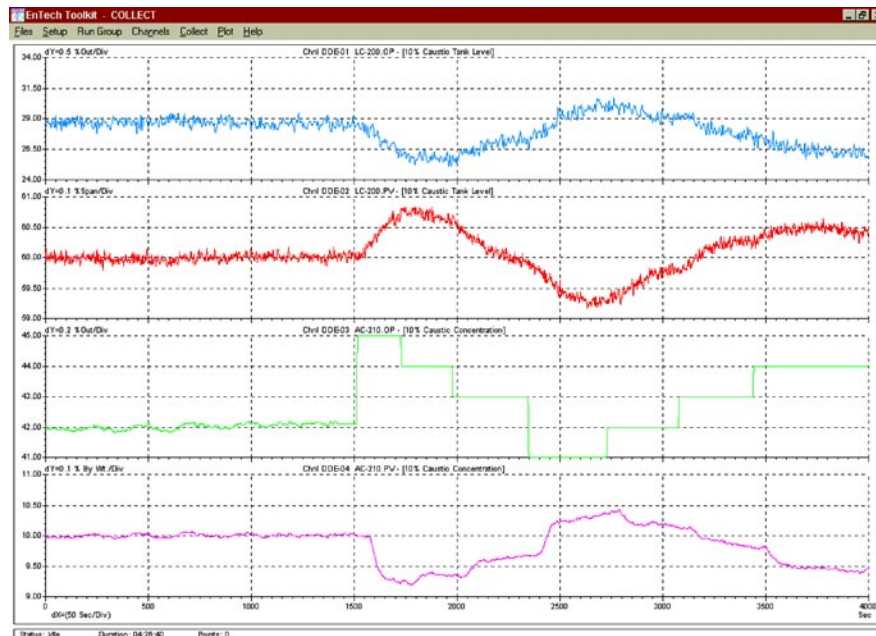
Process signal data is collected at user selectable periods down to 2 milliseconds. Data may be collected for a few seconds, a few minutes, or several hours, on up to 16 analog channels or 256 OPC/DDE channels.



The COLLECT Channel assignment pages show organized information about each output or process variable that is being measured.

During data collection, users may add commentary as an audit trail, re-scale the screen plots, and update channel calibrations. Single-point and two-point calibrations are easily performed

The SCM provides signal isolation, scaling, and (in combination with **COLLECT**) anti aliasing for 8 to 16 channels. Isolation in the SCM prevents loading the process signals or introducing ground loops which would upset the process. Scaling covers four common voltage ranges to maximize resolution, although the isolators can also be replaced with other standard 5B isolators for special signals.



The COLLECT display lets the user see process data that is being captured.

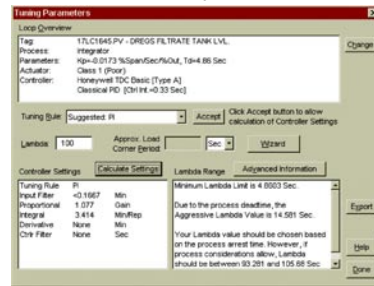
The EnTech Toolkit - Tuner Module

$$K_c = \frac{T_r}{K_p (\lambda + T_d)}$$

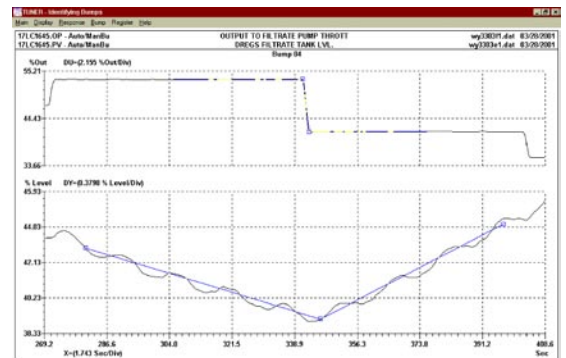
TUNER assesses open loop step tests and, through its database of control loop dynamics and controller algorithms, recommends tuning parameters to help meet process manufacturing objectives. **TUNER**'s recommendations may then be simulated before implementation.

Every part of the process has its own dynamics based on the process design, the process equipment, and production throughput. The dynamics of each process loop must be individually managed for optimum performance. To achieve overall manufacturing and quality control objectives, **TUNER** is designed to optimize the tuning of individual loops and the process as a whole.

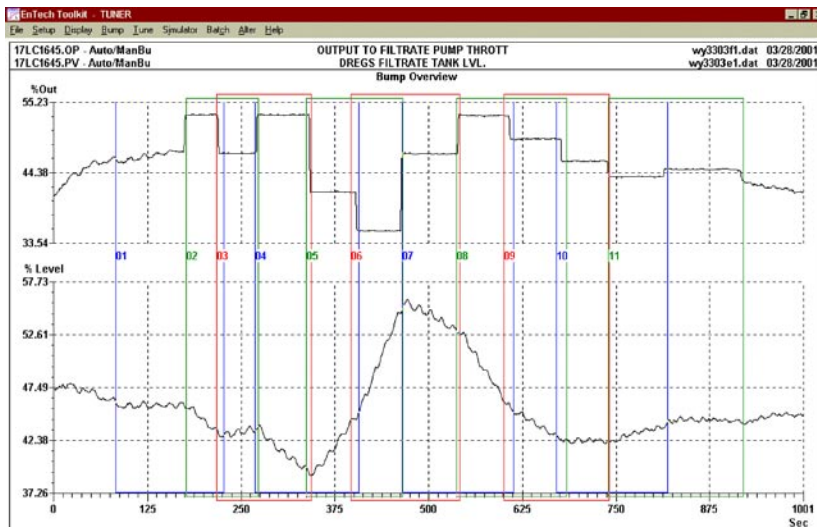
TUNER accepts information regarding the loop type and control element type. The default raw data format is the format saved by **COLLECT**.



From an encyclopedia of models, the user selects the response model that best defines the demonstrated characteristics. This model is fitted to each step response to determine process parameters that best define the response.



TUNER provides guidelines for minimizing variability. The Lambda tuning techniques employed are the most stable method available to industry. **Tuner** makes suggestions for loop tuning aggressiveness and provides warnings if sufficient data are not available. The user selects the value of Lambda (closed loop time constant). The **Tuning Manager** helps keep track of the changes made to tuning of all loops in a process area.



Windowing each test step prior to analyzing the system dynamic responses.



Users may test the solution in a simulator that shows the loop reaction to set point changes, load disturbances, and cyclic variation. Simulation results can be displayed in either frequency domain (Bode plot) or as time response. The user learns what variability can and cannot be removed and what limitations are imposed by the process.

The EnTech Toolkit - Analyse Module



ANALYSE is a powerful analytical tool for assessing the dynamic performance of a process and its instrumentation and for isolating the characteristics of process variability.

Analysis of time series data is useful for defining the dynamics of the process, indicating poor control element response, assessing periodic cycling, or inferring cross correlation of data. The ANALYSE library includes Fourier and Fast Fourier Transforms, Correlation, Cumulative Variability, Histogram charting, filtering in addition to Time Series statistics. The combination of one or more techniques will help the educated user to recognize, understand and isolate the major contributors to process variation. The solution, such as valve maintenance or transmitter replacement, may be obvious. More complex issues, such as optimal control loop tuning, may

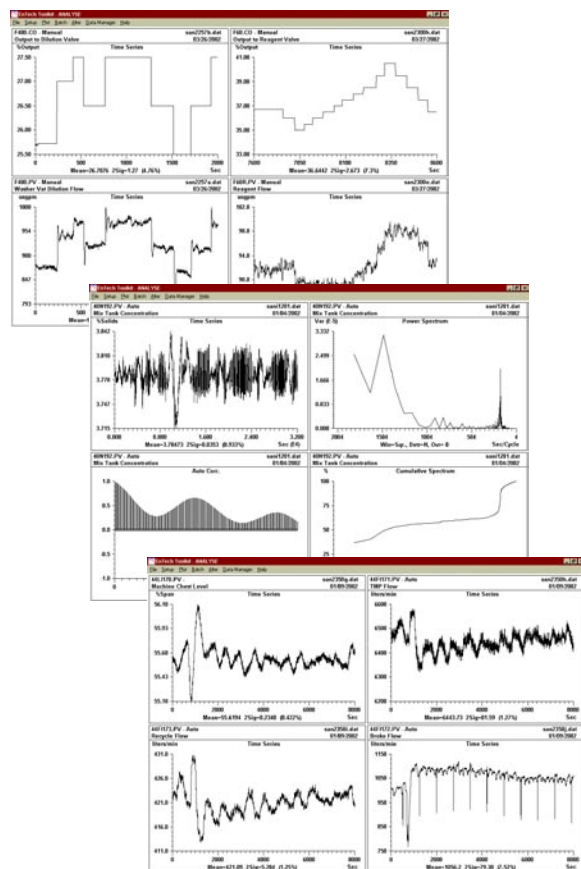
be dealt with by TUNER. Power spectra of the input variables will be similar to spectra of output variables if there is a significant process linkage. Cross-correlation may be used to diagnose interactions between different sources of process variability.

The default file format is the format saved by COLLECT, but data can be imported from ASCII also.

For ease of interpretation, the user can amplify scaling, change from time to frequency scaling (linear or logarithmic) or mix and match the display arrangements.

Batch print operations allow hard-copy generation of multiple data files during off-peak hours.

To make the job of ongoing analysis and data file management even easier, the new Data Manager has been created. Data Manager creates various databases of key information contained in all the



Compatibility with the following Microsoft operating systems has been demonstrated: Windows® 95, Windows® 98, Windows® ME, Windows NT® 4.0, Windows 2000® or Windows® XP.

This brochure is an overview. For details on the Toolkit, or other EnTech variability management technology, contact your local Emerson Process Management sales office, or:
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VariabilityManagement

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