

Seven Ways that Digital Data Recording Benefits Food and Beverage Manufacturers

by Amber Watkin

Executive Summary

Recording and reporting data is essential to meeting critical safety parameters for food and beverage processes, but it can also provide benefits in terms of efficiency. Changing from a manual, paper-based system to digital recording can save time and money, support regulatory compliance, and ensure data integrity. This paper outlines seven ways manufacturers can benefit from digital recording and also offers advice for evaluating an automated solution.

Introduction

Food and beverage manufacturers must maintain strict compliance with local and international regulations and standards for processing safety. As evidenced by the rise of consumer product recalls in recent years, accurate and timely recording and reporting of process data is essential to a quick resolution should a problem occur. Whether or not a manufacturer can provide trustworthy data will impact corporate reputation, and ultimately, profitability.

Ensuring safe, high quality consumable products is the top priority. Since food processing is subject to time and temperature sensitivity, an accurate record of each step of the process is of critical importance, especially when something goes wrong.

However, many manufacturers still rely upon paper records to track the data streams associated with the myriad of food and beverage processes and equipment. By converting a manual recording system to an automated digital method, an organization can save time and money, maintain regulatory compliance, and ensure data integrity.

This paper outlines seven ways manufacturers can benefit from digital recording and also offers advice for evaluating an automated solution.

1. Capture the data

Recorded data enables energy savings

New legislation like the UK Energy Saving Opportunity Scheme (ESOS) is driving larger food and beverage plants to review and report energy usage. However, it can be difficult for manufacturers to determine the amount of energy each process consumes. Under the ESOS scheme, large companies that are not covered by ISO 50001 energy audits need to review all substantial areas of energy use in order to report their performance and identify potential efficiency savings. These energy assessments must be carried out on 12 months' worth of consecutive data and repeated every four years to demonstrate improvement (see **Figure 1**).

Tracking Energy Usage by Process

- Comparing current year energy usage against the previous year in specific areas can prove that implemented energy saving improvements are working.
- Recorded data can also be used for reporting in audits such as ESOS.

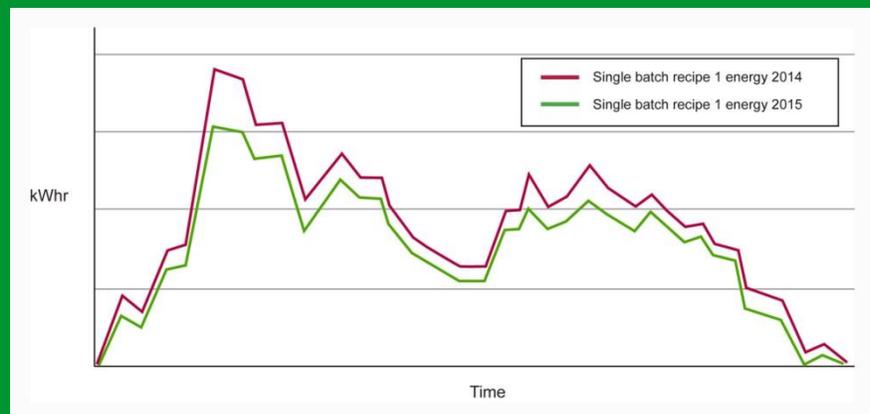


Figure 1

Collecting and analyzing data for each process provides a basis for understanding a plant's energy consumption.

In older factories where production lines are still reliant on utility electricity meters, it is often impossible to determine the energy use of individual lines and processes. Even when modern energy meters and sensors have been fitted at optimum points of measurement, manufacturers need a method for collecting, recording, and calculating the data in a meaningful way for analysis and reporting purposes.

Most modern energy meters have built-in communications, allowing data to be sent to a logger or recorder for analysis and reporting. Data from probes and sensors can also be recorded by feeding the output signals into data loggers' inputs. Full-featured digital recorder models have advanced mathematical functions to carry out calculations on the data. The resulting signals can also be recorded, providing valuable information to engineers who are responsible for meeting energy saving targets and for reporting to management.

2. Benchmark processes

Benchmarking for better predictive maintenance

The equipment used in food and beverage manufacturing can have a hard life, particularly in continuous processes. Equipment like thermocouples, motors, and compressors can degrade over time and may not be operating at full potential. It is difficult to know when components are wearing out and likely to cause problems in the process.

In today's manufacturing industry, Overall Equipment Effectiveness (OEE) and Total Effective Equipment Performance (TEEP) constitute increasingly important Key Performance Indicators (KPIs). OEE quantifies the performance of a piece of equipment or production line relative to its optimum capacity during its planned run time. The result is then measured against the maximum possible running time to calculate the TEEP.

The calculations involve metrics based on loading, availability, performance, and quality, and the resulting information pinpoints efficiency problems like downtime caused by unplanned maintenance and product quality issues (see **Figure 2**).

Leveraging Data for Predictive Maintenance

- When more energy is used to make the same product over time, it can mean a component in the process is starting to fail.
- The point at which a fault occurs can be a clue to which component or piece of equipment is becoming worn.

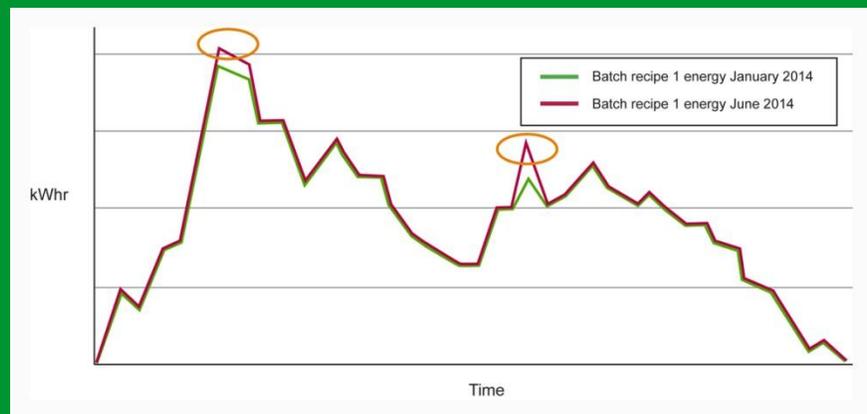


Figure 2

Recording food and beverage processes delivers benchmarking data that enables comparisons over time.

The benefit of recording food and beverage processes is that the data can be used to benchmark aspects of the output for comparison over time. For example, the energy used in a batch can be recorded and compared at monthly intervals. If energy use increases, it may indicate a developing problem within the process, which can then be investigated early before a complete failure occurs. Also, given the benefit of visual data, maintenance personnel are often able to recognise when components are starting to fail, such as the recognisable wave signal of a failing compressor. Using mathematical functionality, the recording product can be configured to trigger an alarm based on aspects of this kind of signal pattern, informing the maintenance team and preventing unplanned downtime.

The ability to make comparisons between recorded benchmarked process data and current process data is becoming a valuable advantage to efficiency during manufacturing, improving profitability through better OEE and TEEP.

3. Secure the data

What is secure data?

Some food safety standards and guidelines dictate that the recording system must be able to determine whether recorded data has been altered or made invalid. Many data recording systems such as those within SCADA, PLCs, and basic data loggers save data in .csv file format. Although useful for easy import into spreadsheets, this format is not tamperproof and cannot indicate whether tampering has occurred. For those reasons, this format cannot be used for processes that require high level data integrity such as third-party audits and government standards.

Another problem can arise from the way data is collected. Some SCADA software packages record data over communication lines rather than from within the recording product. If communication is lost, so is the data, making this kind of system unsuitable for certain applications.

“Full-featured recording products have security management options that provide a tamper-resistant audit trail.”

When choosing a method of recording, a requirement should be a secure file format that is not editable. Data recorders and some precision PLCs are available that save data in binary check summed files, which are resistant to tampering and only viewable using specific software. This is a much better solution than using .csv files, which are easily editable and therefore not secure. An added benefit is that the files can be compressed, so more data can be stored on the product itself before transferring to other media. Data should also be recorded at the point of measurement, i.e., in the recording product, which solves the problem if communications are temporarily lost during data transfer. Products with self-healing store-and-forward strategies that automatically backfill any missing data caused by breaks in communication will save time, compared to manually transferring any missing data.

Full-featured recording products have security management options that provide a tamper-resistant audit trail for recording user names, passwords, and access permissions. All operator activity is logged and recorded in a secure database. Permission to make changes can be via electronic signatures designed to assist with regulations like FDA 21 CFR Part 11 and 21 CFR Part 113. For example, operators may have permission to change configuration by digital signature, or they may need to get a second level of authorisation from a quality engineer. Changes should be logged for quality personnel and auditors to review if needed. Traceability of “who did what” in a process is useful in many applications to help maintain adherence to Good Manufacturing Practises (GMP) and Hazard Analysis and Critical Control Points (HACCP) guidelines.

4. Maintain compliance

Support for local and international standards

An important step for the storage of perishable goods like dairy and meat products within GMP and HACCP guidelines is to measure and record temperatures. For companies that also export products to the U.S. and need to comply with standards such as 21 CFR Part 11 and 21 CFR Part 113, it is vital to prove that the product in question has remained within its critical temperature limits throughout storage, processing, and manufacturing. Basic data loggers/recorders do not have the required high levels of measurement accuracy or secure data storage and transfer strategies to comply with such standards

Forward-thinking European food manufacturers are switching to recording products that aid compliance to 21 CFR Part 11 and 113, in order to future-proof their processing and manufacturing flexibility. This can be a key differentiator in winning contracts over the competition. For example, a European manufacturer of canned meats was recently chosen to supply food for astronauts on the International Space Station based on compliance to FDA and USDA standards. The company had invested in modern digital control and recording equipment with high accuracy I/O and rejection to noise in industrial environments, allowing for precise measurement of the recorded signals.

Secure tamper-resistant data is captured in the form of binary check summed files, which can easily be reviewed by quality engineers and auditors. In addition, the activity of operators and engineering personnel is logged with password authorization in an audit trail in accordance with FDA standards. Features like these make this type of product an ideal solution to prove that critical parameters have been met for the correct amount of time, ensuring the safe processing of meat and dairy products within GMP and HACCP guidelines.

5. Going digital

Moving from paper to digital recorders

For manufacturers who are still using paper recorders, ongoing problems can exist due to the cost and maintenance of replacing charts and pens, plus a lack of secure data storage in paper chart form. If pens or paper run out during a batch run, missing data can result in wasted time for quality engineers as they assess a nonconforming process, and can result in possible scrapping of product.

Full-featured secure digital recorders store data in a secure tamper-resistant file format within the product, which can be securely transferred to removable media (USB, etc.) or servers over a network. The data can then easily be retrieved for quality checking, reporting and auditing, unlike paper charts that can be misfiled, lost, or run out during the process (see **Figure 3**).



Figure 3

Digital recording solutions securely store data in a tamper-resistant, convenient format.

Moving to secure digital recorders offers several benefits:

- Manufacturers save on expenses, as they no longer need to buy, store, and conscientiously dispose of paper and pen consumables.
- Maintenance time will decrease, as there is no need to replace paper and pens on a regular basis, and the product is more reliable due to fewer mechanical parts.
- Data is stored in digital format, which is more convenient to view on a PC, tablet, or smartphone.

For companies that traditionally have used paper circular chart recorders, moving to digital is not a problem, as some digital recorder models are available with circular chart options. The added benefit of this kind of digital recorder is that it can display a chart in a number of different formats including horizontal, vertical, bar, numeric, or circular.

6. Analyze by batch

The benefit of batch recording

Being able to record what happened during a batch process is a powerful advantage, especially if something goes out of limits. A quality engineer will need to assess the data before signing off on a batch, which is a time-consuming task, especially in older plants that still use paper procedures.

Full-featured digital recorder products have batch functionality, which enables an operator to record individual batches with a start-and-stop button on the screen or by external input via a bar code scanner, for example (see **Figure 4**). The data from the batch is then easily retrievable to a PC by the quality engineer for assessment purposes. Software for reviewing the secure files can be used to zoom into areas where problems occurred, and the historical data shows all messages, whether triggered by an alarm or entered manually by an operator. The reviewing software also allows digital signatures to be added to the batch for sign-off. The main advantage of digital batch recording and signing is that it saves time for quality personnel and gives them all the data they need for easy reporting and compliance to standards.



Figure 4

The main advantage of digital batch recording and signing is that it gives quality personnel all the data they need for easy reporting and compliance to standards.

7. Simplify reporting

“Most reports are required on a regular basis, and the solution is a software reporting package designed for industrial automation applications.”

Gathering data and creating reports

All food and beverage manufacturers need to supply reports to prove compliance to process parameters, account for energy usage, and present KPI results. It is still common to see personnel manually creating report documents by pulling data from various sources. This can mean scanning or photocopying data and images like paper charts into digital format, manually manipulating and calculating data, and cutting/pasting information into documents. Operating in this manner can waste several days a month, in some cases.

Most reports are required on a regular basis, and the solution is a software reporting package designed for industrial automation applications. These contain configurable report templates along with drivers for pulling data from a variety of common devices and file sources. The report package pulls data into the required template over the network, saves it as a secure PDF, and sends it to the appropriate individual.

Even if reports are being created manually, collecting data digitally at the source enables personnel to save time in the everyday reporting process. However, the most efficient way of reporting data is to leverage a dedicated software reporting package.

Conclusion

Ensuring the safety of food and beverage products for consumers is of utmost importance to manufacturers. Gathering and recording process data for mandatory reports is an everyday task and an essential part of maintaining regulatory compliance, but without a modern digital recording solution, it can be difficult to achieve in an accurate and timely manner.

While using a paper-based, manual input system is common, many manufacturers today have migrated to digital recording solutions to save time, money and energy.

For manufacturers who need to evaluate and select a digital recording solution, function and benefits to consider are shown in **Table 1**.

Table 1

Converting a manual recording system to an automated digital method helps ensure data integrity.

Function	Benefit
Data capture	Energy savings resulting from audits and monitoring
Benchmarking	Opportunity to improve predictive maintenance
Secure data	Tamper-resistant data and audit trail
Compliance support	Accurate, precise measurement
Secure storage	Convenient data access and retrieval
Batch functionality	Fast and accurate analysis
Simplified reporting	Streamlined data gathering and report generation



About the author

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