industrial technology

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WATLOW®
Powered by Possibility

Leading Transformational Change for Ourselves and our Customers with Industry 4.0 Applications

Summary:

Industry 4.0 represents the latest industrial transformation, a shift where technology is, for the first time, allowing data to be captured and processed in real time proximate both to where it is generated and where it is needed.

Watlow® is currently piloting and implementing several programs to leverage these technologies in order to automate anticipating issues earlier and to speed up implementation of solutions. Growing our experience with Industry 4.0 not only increases the efficiency and profitability of our production, but also provides us the experience and critical knowledge to deliver leadership and assistance to our customers in implementing similar technologies and protocols in order to realize similar benefits.

Industry 4.0—The Fourth Industrial Revolution

Just as steam powered the first revolution in industry and internal combustion and electricity later sped the transportation and transference of people and information—which raced even faster with the advent of the personal computer and information networks—Industry 4.0 is the latest wave of industrial change. Driven by new technologies including Big Data analytics, IIoT, Edge Computing, autonomous robots and cognitive systems, Industry 4.0 promises transformation through automation and ever-faster data delivered in real time for predictive maintenance, facility scaling, supply chain management, process modeling and business intelligence.

Though technologists and vendors have been talking about Industry 4.0 for a decade, what has been said has, so far, been more aspirational than transformational. Only very recently has this next great promise of industrial change tangibly taken hold in actual production environments. Even with fairly small projects, it has achieved considerable cost savings, increased efficiency, and demonstrated huge potential for growth—leading many engineers and managers to ask, “How can our business benefit from implementing such transformation?”

Watlow is leading the way in understanding the advantages Industry 4.0 provides, for both ourselves and our customers.

Watlow’s Industry 4.0 Experience

Today, Watlow is actively investigating the advantages of Industry 4.0 concepts and technology, pursuing five active initiatives presently helping us develop the knowledge crucial to implementing projects that apply these leading-edge technologies.

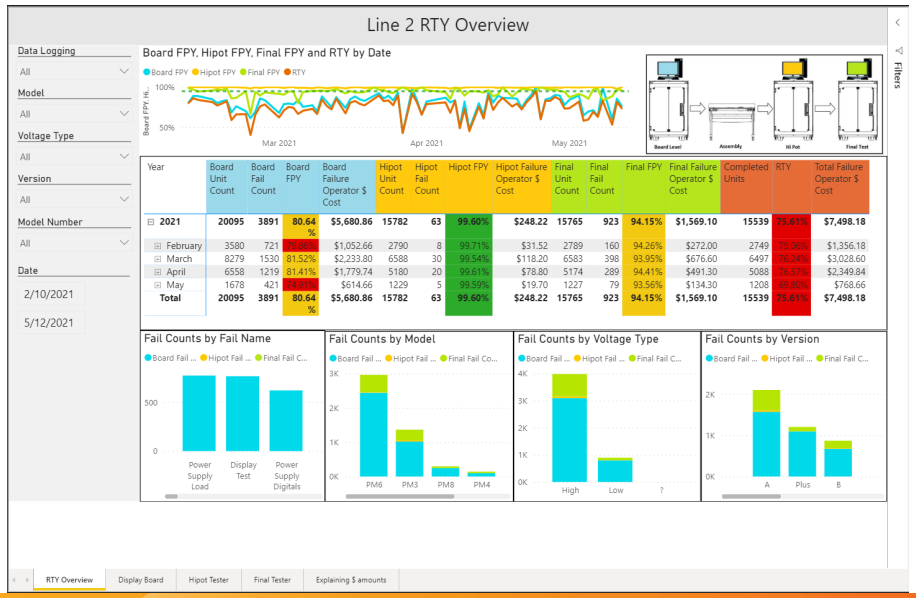
Project: SP-1038 Gateway Device Testing

Our SP-1038 Gateway Device Testing initiative is a critical step in bringing data collection and processing to the equipment level. In this case the approach is a simple version of Edge Computing, where data is collected and processed in real time proximate to where it is needed, distributing processing and services away from the core of the data network and out toward its “edge” where it is collected.

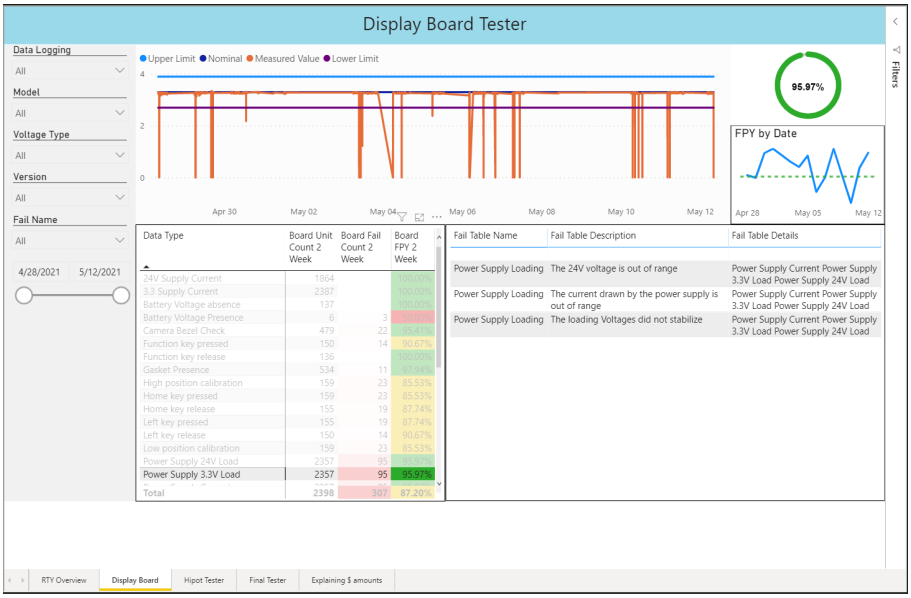
This research initiative is an effort to understand the functionality and capabilities of gateway devices and how they can be leveraged in equipment for collecting data and performing processing on the machine itself, as well as moving that data to a standard storage solution—with applications not just for our own manufacturing efforts, but for customer applications, too.

In this study, the purpose of the gateway is to offload consistent, clean data from a current solution—say, one that simply writes to a .csv file—then perform processing and move that processed data to a storage solution or wherever it might be needed.

The goal here is not to define a standard for collecting or storing data. Rather, the goal is to standardize a gateway device, regardless of how the data is created or where it is stored, in order to create a modular solution for any data collection application, one that can be readily dropped in place with well-defined systems interactions with and storage solutions.

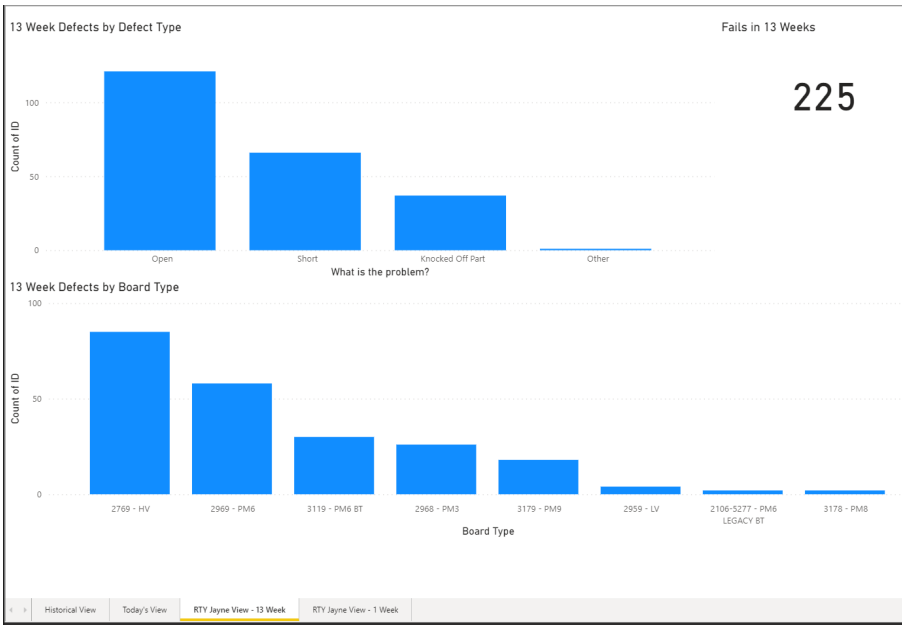


Project: Tester Dashboard



The Tester Dashboard project is an effort to create real-time visibility into circuit board production testing data—including frequency, timing and types of defects—so engineers can discern issues much earlier and root out problems that otherwise would not be visible. Rather downloading and processing testing data themselves, engineers instead use an easily-accessed dashboard to rapidly review testing data for the various failures that have occurred. This approach also makes collected data more accessible for users who have less background in data analysis.

Focused on one specific board production line, Tester Dashboard has been a rapid experiment to put the data analysis closer to the data source. Using data that is already available and a SQL database to create real-time dashboards, this project enables issues to be addressed almost as immediately as they occur. The dashboards show, for each tester, the number of failures versus the number of good units. Those results are then applied to calculations to produce rolled throughput yield (RTY) values for the various board models assembled on the production line. For example, the dashboard can indicate when a line's score has experienced a significant drop due to an increase in unexpected errors. By then facilitating review of detailed historical data to confirm previous scores, the solution can target specific areas of interest and identify the source of the issues.



The goal in creating the Tester Dashboard is for operators on the testing line to be able to troubleshoot issues without the need to engage an engineer—the engineer can set up control limits on the dashboard to recognize trends toward failure as they occur and identify potential issues before they become actual issues.

Project: Digital Tick Sheet

Digital Tick Sheet is an initiative to reduce the time that Quality Assurance requires to gather data and calculate RTY. It replaces a decades-old manual process with a digital one that captures information more quickly and, at the same time, makes the data readily accessible for processing.

Until implementing Digital Tick Sheet, operators recorded production defects using a pen-and-paper process to mark physical forms—a process that could take up to four hours just to gather the data to make the weekly RTY calculations. We updated the process and replaced these forms with a simple interface—a tablet device with an uncomplicated digital form to enter data: one field to select the type of board, one field to select the type of failure and an [Enter] key to save the selections.

Not only does the Digital Tick Sheet save time, but it also provides visibility, reporting sorted historical data as well as the yield

of each production step. It creates understanding of trends and helps operators and engineers make better decisions. It even helps head off problems before they become significant by enabling users to set up thresholds for alerts—for example, the application can be set so that if defects exceed 30 an hour, it automatically emails a notice to the engineering department so they can address the issue immediately.

Project: Housing Cell

Watlow's first effort at RFID tracking, the Housing Cell project looks to expand the data collection capability on our ASP lines and provide visual outputs such as charts and graphs so the information can be used for making decisions and addressing issues immediately.

The current standard process is network-dependent, with part assembly information stored and tracked in a corporate server so that any information to be reviewed must be retrieved from the network.

The project entails embedding an RFID in the fixtures used to transport individual parts from station to station during assembly to track the progress each one makes as it moves through production. All data regarding the work performed on a part then moves with it throughout the assembly process, ensuring it ends up at the correct station for its next stage in construction. This is significant because, rather than depending on a central server or communication between stations, the data regarding each part's progress comes from the part's production fixture housing itself. Each station can then work independently without either records or any input from other stations—the part, with its housing, carries with it all information required to continue work in it. Moreover, because the part's production history is stored with it, the assembly can be put aside for any length of time and then have work resume on it—without any issues of assembly getting out of sequence.

The RFID solution is well suited to low volume/high mix production. This initial effort is being undertaken on a Watlow multi-station line with all Watlow-built equipment. With RFID tracking, database storage and data visualization for reporting are available, with benefits including:

- **Production tracking**
- **Station independence**
- **Process order enforcement**
- **Wire lot tracking**
- **Highlighting of recurring faults**

By employing a local database solution, the cell runs independently from the Watlow network. But because the solution is also web-based, it is still accessible from the Watlow network. The data it collects includes:

- **Product tracking**
- **Production history**
- **Fault messages**
- **Individual cycle times at each station**
- **Wait time between stations**

By tracking all production data with the parts, the solution helps identify critical production issues early on to reduce their impact. For example, if wait times between certain stations increases or if a particular process step is creating slowdowns, the bottleneck is quickly identified through the production process data so it can be addressed immediately—a key consideration targeted in lean manufacturing.

Project: Circulation Lab

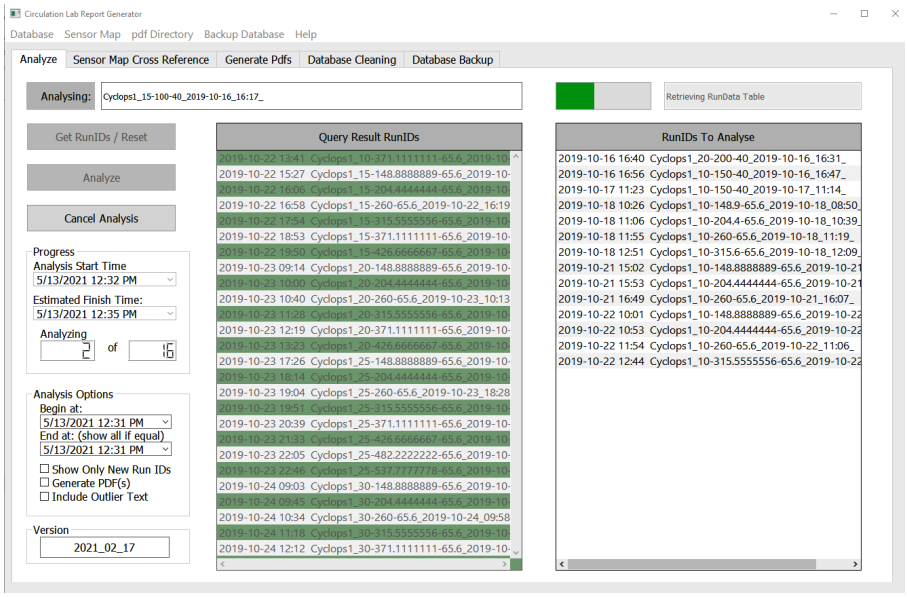
Unlike most other Watlow Industry 4.0 initiatives, the Circulation Lab project is a research and development (R&D) system, not a production system.

Intended to increase access to data from anywhere in the organization, the Circulation Lab project is a template for assembling labs in the future. In this model, data is:

- **Collected from a process at a facility**
- **Stored to a database**
- **Accessed and analyzed from anywhere on our network**

Currently, there is no lab database, and lab equipment data is transferred manually, or sometimes automatically, to a computer. On the computer, it is s formatted into a .csv file, which is then transferred (often manually) to an engineer's computer where the file is again manually loaded into Excel® or another program to generate a report.

The Circulation Lab project automates transfers of equipment data to a computer. It then transfers it automatically to the corporate database, where it is accessible throughout the organization. Stored there, engineers can access the database information and import it via SQL to generate reports—without all the manual steps.



This approach also improves the usefulness of recorded data. SQL storage eliminates the storage challenges of .csv files. Summary statistics can be calculated automatically and in bulk over multiple data sets, which can then be easily compared without importing multiple .csv files, with .pdf presentation files for each data set also readily generated.

The Circulation Lab program is currently in operation.

Industry 4.0 Experience Our Customers Benefit From

Watlow is actively exploring and implementing Industry 4.0 technologies. Through this effort, we hope to gain efficiencies in identifying issues and addressing them quickly and effectively to reduce costs while increasing the overall quality of our products.

But another—and possibly more important—benefit is the knowledge and understanding we are developing regarding these technologies and their implementation. With this firsthand knowledge, we know from our own experience the path to success, along with all the roadblocks and pitfalls we encountered on the way.

We can share our experience with our customers: We can provide leadership and guidance based in implementing Industry 4.0 technologies and methodologies efficiently and successfully—and help them avoid the pitfalls while achieving the same successes.

Further information is available at: www.watlow.com