CASE STUDY

Scaling with One MES to Replace 50+ Legacy Systems

Passives Take Action to be Fit for the Future

Critical manufacturing
an ASM PT company

VISHAY
The DNA of tech.™

Executive overview

As more products become smart and lifestyles become digital, demand for Vishay's Passive Components and Semiconductors is growing. Many new applications put pressure on product variety at the same time as prices. Thus, Vishay seeks to become more cost-effective and efficient through Industry 4.0.

Vishay Passives did some analysis and pegged its 30+ plants at an average of Industry 2.5 based on Gartner's maturity scale. To accelerate the move toward Industry 4.0, it sought to modernize and standardize information systems. One of those systems was MES. Another is ERP, which in the vision integrates tightly with MES.

The pilot site for MES implementation at Vishay is a multi-line plant co-located with Inductors Division headquarters in the US. Another facility in China is implementing, and many Vishay plants are lining up to undergo the dramatic shift in operating made possible with these new IT systems.

## Vishay Passives Looks to Harmonize and Standardize

Electronics are fueling innovation worldwide in automotive, industrial, computing, consumer, aerospace, military, telecommunications, and medical markets. Vishay Intertechnology, Inc.'s electronic devices act as the DNA driving all of these. This Fortune 1000 company has grown by acquisition. They now manufacture one of the world's largest portfolios of discrete semiconductors and passive electronic components. The portfolio breadth is beneficial for customers, but the internal result has been enormous diversity and complexity in the IT landscape, processes, and ways of working.

Vishay's Passives business unit embarked on a program to standardize and harmonize systems across its over 30 plants. Vishay began harmonizing its SAP ERP landscape in 2014. In 2018, they kicked off the long journey to move toward one manufacturing execution system (MES). Their analysis showed that core MES functionality could replace over 50 MES-like legacy systems. That count does not include quality, scheduling, or preventive maintenance, which the new MES can also provide.

Vishay, like many other high-tech manufacturers, has a history of developing their own systems, but also inherited many systems by acquisition. With a strong IT team, the company wants to establish internal expertise for the new world to be built in the coming years. "Vishay is a company that wants to service applications on their own. We want to be independent. That's our approach. We are building that up with each project," according to Dr. Thomas Amrein, VP Planning & Systems Passive Components / Business Process Owner Planning & Manufacturing at Vishay.

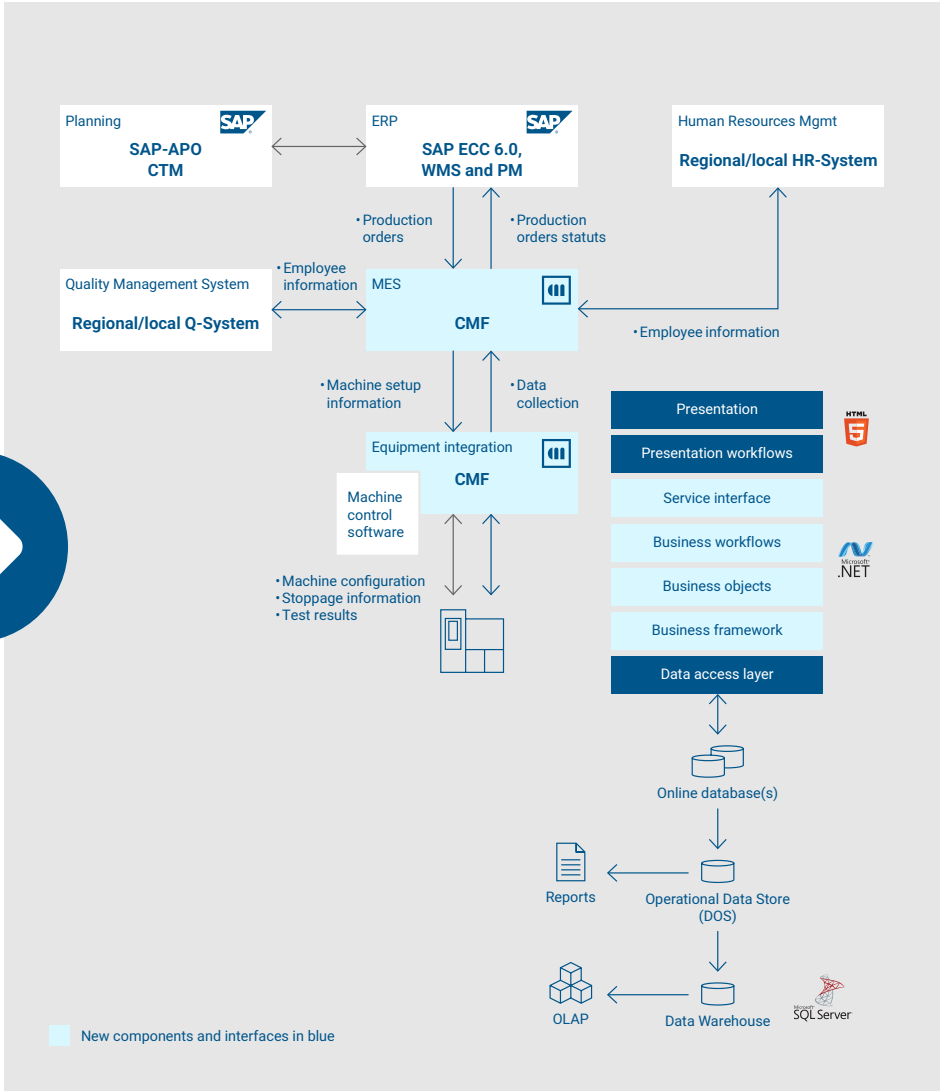**Critical** manufacturing

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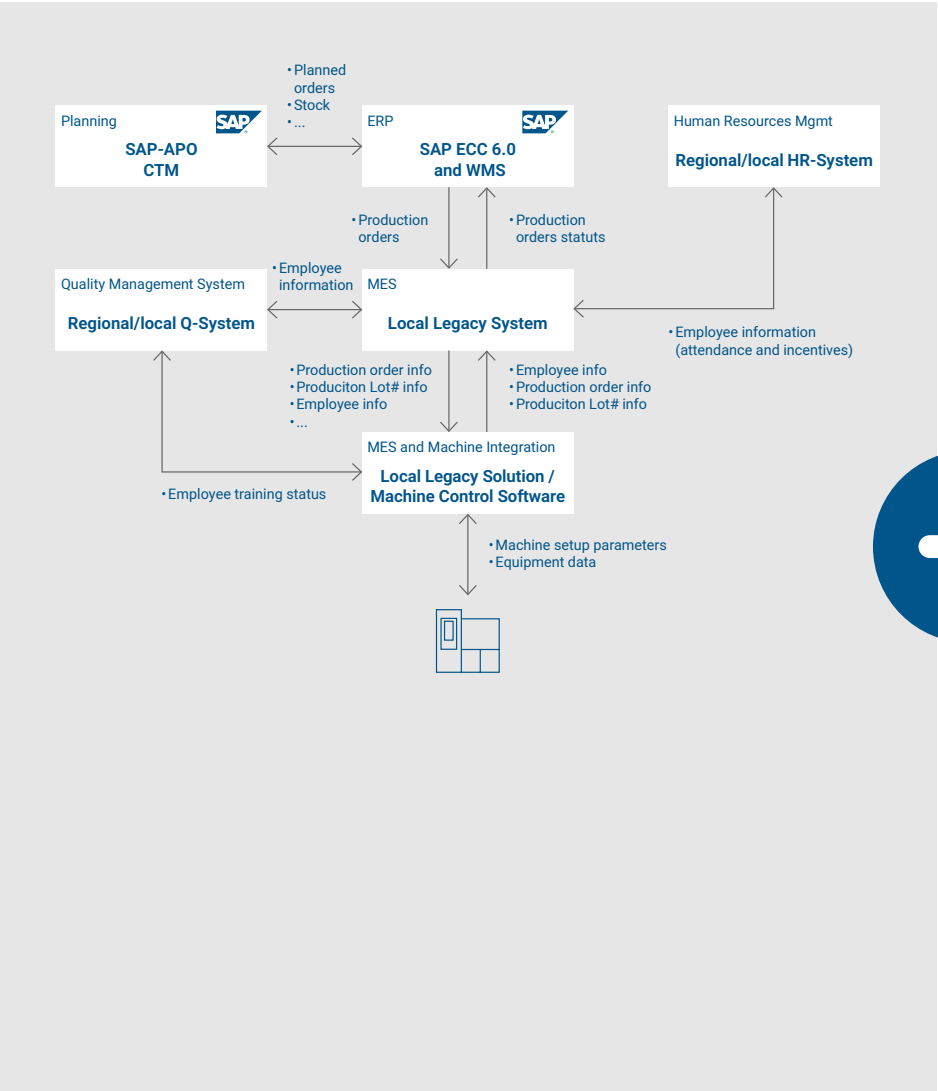
To-Be

Figure 1 Vishay Passives business unit application landscape Before and after

Business Drivers and Justification

The business drivers for the MES standardization initiative were strong:

- Meet increased demand from every site for automation, intelligence, and information systems.
- Reduce costs for information technology (IT) headcount, which averaged two people per legacy system, or 100 people total for the division - just for the systems the MES will replace.
- Mitigate risks of having only one or two knowledgeable administrators for many legacy systems. Plants face the possibility of system downtime when experts are absent or retire. That also interrupts continuous improvement of the software and the plant operations.
- Meet customer requirements such as early warning due to the immense effort required to automate, handle more complex products and processes, and ensure process control.

- Improve quality with greater automation, and the ability to quickly upgrade processes to handle new products and improve product consistency to meet unique customer needs.
- Boost performance by optimizing overall equipment effectiveness (OEE), achieving higher utilization, reliability, and quality.
- Accelerate continuous improvement with a way to share corporate standards across sites faster and at less cost – both for production and for the software itself.
- Cross-train the workforce to be more flexible in where they work, for rotation across work centers.
- Move to Industry 4.0 and leverage industry standards far more rapidly.

Vishay calculated that the savings from reassigning 70 of the 100 IT people supporting 50+ legacy manufacturing systems would pay for the total MES project cost for the 30+ sites in four years. The calculation includes license, maintenance, and implementation costs. The estimate did not include hardware and other project costs or long-term benefits beyond headcount.

Evaluating MES-Automation Vendors

Once the benefits of a standard MES for all passives plants were clear, the company created project called: PID0316 MES Pilot. The scope was to "Evaluate options and select a preferred MES capable to become a Vishay standard. It is the intention (not part of this project) to fully replace all individual commercial and legacy MES systems in all Vishay Passives manufacturing plants by this defined standard. Note: MES in Gartner's definition does not include the automation layer, such as supervisory control and data acquisition (SCADA), human-machine interface (HMI), or programmable

logic controllers (PLCs). However, the automation layer is part of this evaluation and should be purchased together." (Figure 2)

The one-year process was structured to find the best-fit solution provider methodically. (Figure 3). Four of the 12 pre-selection candidates passed the detailed review. Vishay conducted their phase 1 feasibility study with those, including two days of demonstrations to over 50 people plus a two-day 'pilot' case study of the Yankton plant with over 16 people. That narrowed the field to three companies for the selection.

Phase 2 of the selection rested on three main categories of requirements: Technical solution, License & implementation costs, and Vendor/partnership (Figure 4). The technical solution carried more weight than costs and vendor strength combined in the Vishay selection process. Factors in the technical solution category include

fulfilment of requirements, reliability/fault tolerance, scalability and performance, extensibility, user-friendliness, self-enablement, mature technology, IT governance, and IT compliance.

Main solution requirements included:
- General and broad MES software suitable for electronic / discrete industry.
- Highly scalable solution supporting multi-site installations.
- User-friendly, flexible, and configurable using self-service, with no IT to support day-to-day changes over the long term.

Vishay asked the three finalists to quote on an eight-year rollout plan. They based the cost evaluation on 1330 licenses and over 12,000 users. The model included discounted future cash flows at a discount rate of 11%.

None other than the CEO of the company, Dr. Gerald Paul, was the top sponsor of the project. He signed off on the project in
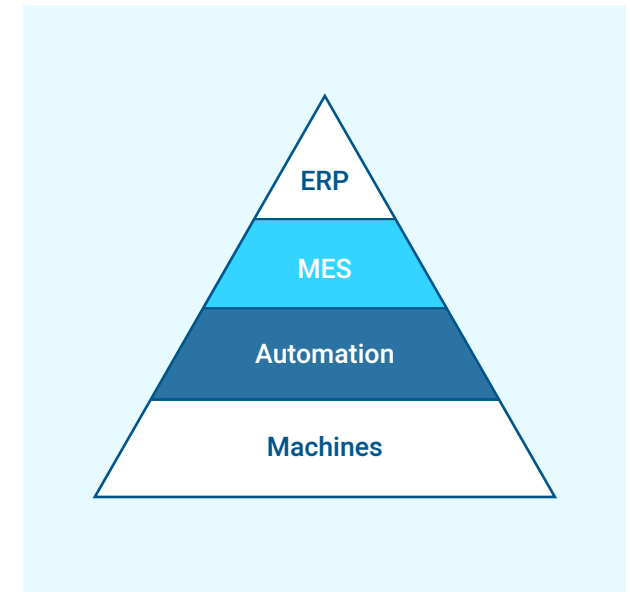

Figure 2 Vishay's standard MES decision focused on making a selection for both the MES and Automation layers
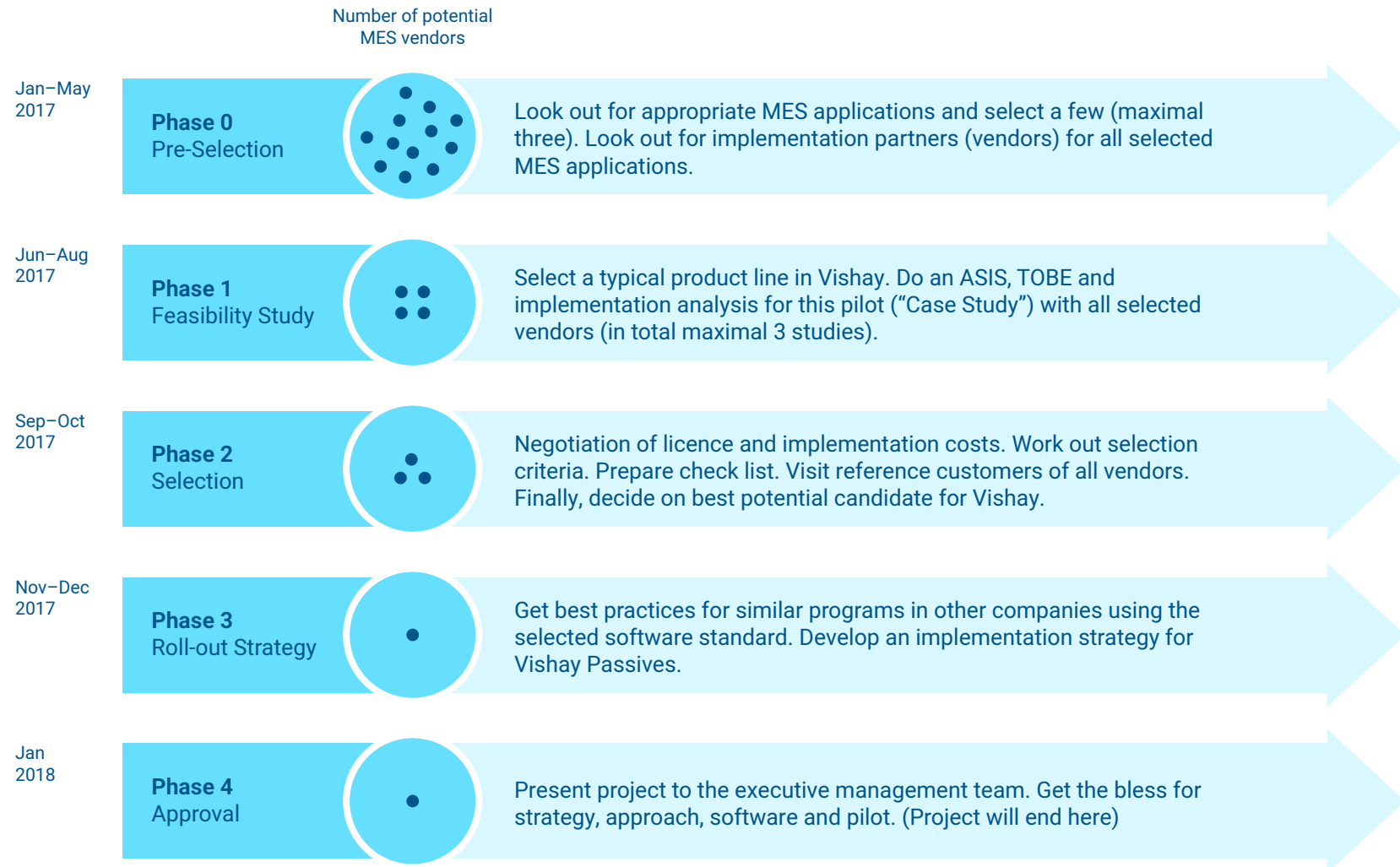
Selection project phases and timeline

Number of potential
MES vendors

**Jan–May
2017**

Phase 0
Pre-Selection

Look out for appropriate MES applications and select a few (maximal three). Look out for implementation partners (vendors) for all selected MES applications.

**Jun–Aug
2017**

Phase 1
Feasibility Study

Select a typical product line in Vishay. Do an ASIS, TOBE and implementation analysis for this pilot ("Case Study") with all selected vendors (in total maximal 3 studies).

**Sep–Oct
2017**

Phase 2
Selection

Negotiation of licence and implementation costs. Work out selection criteria. Prepare check list. Visit reference customers of all vendors. Finally, decide on best potential candidate for Vishay.

**Nov–Dec
2017**

Phase 3
Roll-out Strategy

Get best practices for similar programs in other companies using the selected software standard. Develop an implementation strategy for Vishay Passives.

**Jan
2018**

Phase 4
Approval

Present project to the executive management team. Get the bless for strategy, approach, software and pilot. (Project will end here)

Figure 3 Vishay's MES selection project methodically worked through from many vendors to one.

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early 2018. The rollout to other sites and divisions rested on the success of the pilot implementation in the first site.

The detailed comparison of the three finalists resulted in selecting Critical Manufacturing and its MES. The decision was nearly unanimous, with 19 of 20 on the team recommending Critical Manufacturing.

Pilot Site

Vishay had already selected the mid-size (300-person) plant in Yankton, South Dakota, USA, as its pilot site. Thomas Amrein reports, "They produce a variety of custom and standard products which covers the broader Vishay conceptually quite nicely."

The Yankton production facility has four distinct product lines and processing styles:

• standard inductors,
• medical inductors,
• custom magnetics,
• connectors.

In addition, they produce their own powders for the standard product housing. The mix of products, ranging from brand new to 50 years old, is also representative of the larger company.

Technology fit

Vishay wants tight coupling between ERP and MES (Figure 1), and the Yankton site already uses the ERP standard SAP (version ECC 6.0) selected for supply chain. It also has a relatively low automation and equipment integration need, which allowed the pilot to focus on the "MES backbone".

People available

Amrein points out, "Being the division headquarters with many additional functions makes it very attractive for a pilot project because many leading people and deciders are located here, including operations". He also points out that the people are open-minded and willing to probe and improve software applications.
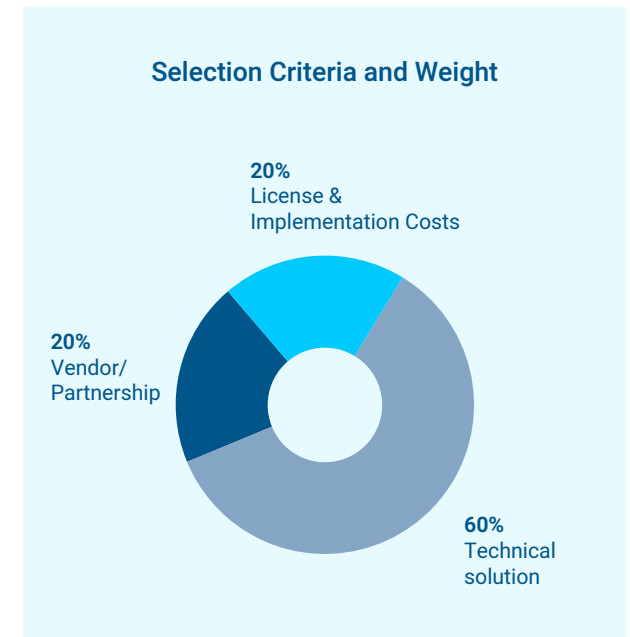

Selection Criteria and Weight

20%
License &
Implementation Costs

20%
Vendor/
Partnership

60%
Technical
solution

Figure 4 Selecting the MES standard for Vishay Passives mainly rested on the strength of the solution to meet requirements; costs and vendor strength also counted.

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Growth

Yankton's continued growth has amplified the need for operational information integrity and process flow control. It is part of the fastest-growing division in Vishay Passives, Inductors. Rapid growth has made operational integrity and process flow controls pressing needs.

Ripe for change

The site responded to a request for volunteers to be the pilot plant for MES. "They have been ready for years to be rid of their old and outdated legacy system," says Amrein.

MES Induction at Yankton

Previously, the Yankton site had a homegrown legacy system called ProdInfo. The intention was to replace that with Critical Manufacturing MES functionality. The initial project was to create a "backbone" and not use all of the functionality they expect to deploy over the long term. Only two portions of ProdInfo remain in Yankton at this point. Vishay expects to replace those two functional areas still in the legacy system in the future.

Site preparation

Some of the initial selection team came from this pilot site. As a result, they formed a cadre of people already excited about the new MES and convinced it would improve their lives. Still, there was some apprehension about it, and the team needed to focus on change management.

Team

"We tried to structure the team to include leaders from accounting, inventory control, production, and each area of engineering: standard, medical, custom, and connectors. We needed people who were not only capable for the project, but also bring product knowledge." says Adam Schilousky, Sr. Director Global Operations Inductors Division – Custom Products.

Business leadership

Schilousky has participated in system projects for his entire 15 years at Vishay. He was part of the team initially representing the accounting needs but stepped into a business lead role for the project shortly after it started. His leadership was crucial since most of the previous projects had not touched engineering and production.

Changing mindset

Some of the definitions and processes that the MES delivers did not meet previous practice. People often felt the new methods were inefficient because the system imposes control. "Accepting new approaches was a challenge, and we did not always achieve it," says Amrein.

Data prep

The MES project required scrubbing, harmonizing, and uploading data from PDFs and other formats that needed

manual work to get ready to load into the database. "That was our biggest struggle in workload and time," says Schilousky. Harmonizing means things like ensuring the units of measure match those in the ERP system.

Mapping processes
Yankton even stored the process maps in PDF form. As a result, they were often outdated or incomplete. To ensure the MES modelled current best practice processes, the team members needed to use their skills to document processes and options.

System set-up
Critical Manufacturing used its agile project management methodology to support the entire set-up of the pilot site system. Yankton required 36 two-week agile sprints to set up all four different areas of the facility completely.

Training
Yankton did two weeks of training before any of the five go-lives. Schilousky says, "That training is not as effective as we would have hoped. It takes repetition and time out on the floor with 'live bullets' for users to retain how to use the system."

Figure 5 The team at Vishay Yankton celebrates their new MES in the Connectors area

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Integration

The MES interfaces to two systems: the company-standard ERP and the time and attendance portion of the old legacy system. Both of these systems require tight integration. ERP owns the bill of materials (BOM), and all material movement data goes from MES to ERP. In addition, MES reports operating hours to the ERP. The site has a specific incentive program based on yield and production output that requires intricate integration between MES and the legacy time and attendance system.

Go-live

The project team knew they could not stop production at Yankton for more than a few days. The intention was to run with the same efficiency as before implementation. Each of the production lines has had a distinct go-live. Vishay mostly implemented the last two lines on their own, which took longer, but built the internal expertise they seek.

Minimal disruption

The pilot has had only a minor, temporary hit to productivity. "Our testing was thorough, so it took a while. We never had an instance where we shut production down or could not get something resolved within a day," says Schilousky.

Radically New Way of Working

The system is now working well, and the pilot is a big success. For Vishay Yankton, the MES has created a profound change, what Schilousky calls moving from "the Stone Age to the 21st Century." The difference is so dramatic that everyone now sees why it would have been difficult to measure benefits to calculate ROI.

The MES as integrated with ERP affects everybody. This includes many areas in the value stream – planning, purchasing, accounting, production, inventory control, read quality, and engineering.

The old way of working did not accommodate the custom line at Yankton well at all. It was designed for a standardized line flow, with the same processes repeated for every product. Nor was it easy to keep up with the frequent changes in the medical product line.

Some examples highlight the shift:

Inventory

Previously, Yankton did a manual inventory count at the end of every month, including both raw and work-in-process (WIP) materials. The resulting handwritten inventory cards were how accounting valued inventory each month. Now, they can see online exactly how much and which material is in each location and step throughout the process.

Kitting

In the old way of working, kitting for a production order involved having a list of

materials needed for the order and hoping it was all there and available. Schilousky says, "Now it's all in front of us on one screen – what inventory, where it is, and when it will be here. We are not chasing down a material handler or production supervisor."

As these examples show, processes are radically streamlined. In addition to basic operations workflows, managers, supervisors, and those in offices now have visibility into the production process that gives them an ability to make better decisions.

The streamlined processes begin at raw materials inspection. Yet, for an operator, it may appear to be cumbersome. For example, it's a challenge to ensure people perform setups up front that attach raw materials to resources before they ever track into the order. If they don't, they cannot track out in a custom product order.

Benefits

Vishay did not try to justify the project with return on investments or quantifying benefits. Yet, they see many benefits at Yankton already, just after the final line went live.

- **Data transparency:** Divisional operations, controlling, quality, and planning are happy about the access to site data.
- **Quality:** Yankton did not have software for raw material quality inspection. They found it easy to set up in the Critical Manufacturing MES. Amrein reports, "People are happy about this solution. It is now competing with other solutions, like the ERP's quality module or dedicated QMS software."
- **WIP visibility:** Vishay controllers and planners now have online access to work in process (WIP) materials, products at each step, and the production status of each running order.

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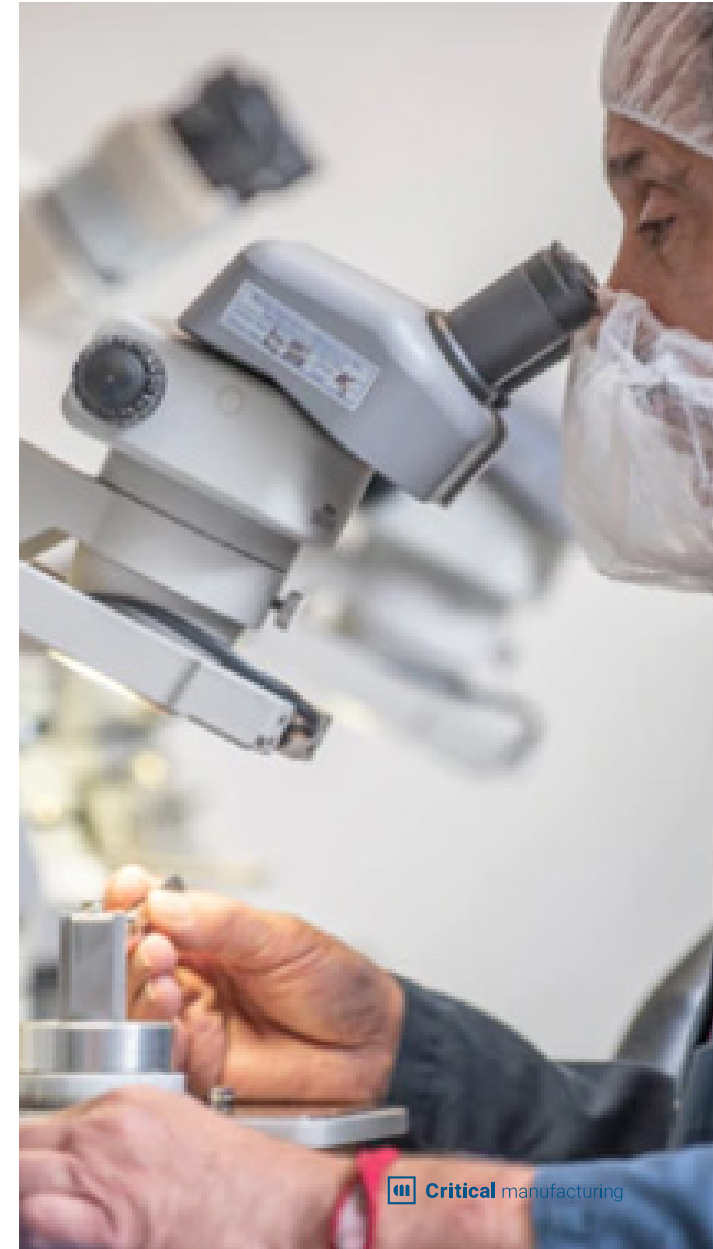
- **Product costing:** The MES reports consumption of person-hours and materials back to the ERP at each production step. So, every production order now has detailed data. This detailed data allows more accurate management of product costing.
- **Yield:** Amrein reports, "We can better track and trace the yield of each step as well as of the total line and use it for many different purposes. The tight process control will improve overall customer satisfaction, especially for those customers in automotive and medical industry segments."
- **Easy audits:** Automatic archiving of all data allows tracking and tracing for easy audits.
- **Smooth flows:** The MES does incoming material quality disposition and only releases an order or lot for production steps when all material is available for use. Job delays and unneeded starts and stops in the plant for material shortages are now history.

Keys to Success and Recommendations

People
'A' Players: Schilousky says, "The biggest key to success was we did not just staff this project with the people who had time. We had to staff it with the people who knew a lot about what was going on, or it would never get off the ground."

Production worker testing: "It is always a problem pulling direct labor people off the line to go test the software. But you will be light-years ahead if you do that before you push the product live into production. They'll give you a much different perspective than an engineer or production supervisor."

Training: Take the time to do intensive system training early. Understanding the system's logic is the key to project success and effectiveness.

Expectations
Limits to vision: Amrein points out: "There is a chicken-and-egg problem because we needed to define the TO-BE processes and make certain decisions at a time where the people haven't fully understood the system and its logic."

Provider expertise: "Critical Manufacturing's people made us realize some things we were not necessarily considering. They came in with a great deal of knowledge and a good approach to find out what it is we're doing exactly and how to best fit it into their product," says Schilousky.

Technology
Clean Data: "Make sure to thoroughly scrub your data, decide what you want to use, and be sure the data is up-to-date in a database-usable form, not PDFs. It's painful to do that as part of project implementation with people who want to get the project done breathing down your neck," says Schilousky.

Adapting to Needs: The Critical Manufacturing product and people can adapt the software to customers' needs. Amrein says, "However, the strength is also a weakness because it tempts users to adapt to old needs and requirements instead of learning from the new possibilities and switching off old, partly bad habits."

What's Next

Yankton is just starting to use the Critical Manufacturing MES across its operations. Two other Passive divisions are using it in their new China plant where the roll-out entered the last phase with focus on equipment integration. Further projects in other sites and involving other divisions will start soon.

Measuring improvements

Vishay expects to measure some improvements once the system has been in place at Yankton and other sites for at least a year.

Business decisions

"We believe this MES will help the company make better business decisions, but it is too early to say. The collection of many more data will surely help to analyze the production processes better and make confident decisions about process and product improvements," says Amrein.

Rollout

Schilousky says, "I got calls from people from all over the world who knew Yankton was implementing this and they wanted to be next. There's been competition about who would get the next place in the line."

Automation layer

The Vishay Passives site in Shatian, China, has started to use the Critical Manufacturing MES in its operations also. Shatian is a new greenfield site and is more highly automated, so it will test the automation layer more completely.

New Product Introduction

The Yankton site does not use PLM software now, but a project is coming to set a PLM standard for Vishay Passives. This will streamline BOM setup and new product introduction.

Preventive maintenance

One of the sites that will be rolling out the MES soon will be leveraging the preventive maintenance module of Critical Manufacturing for the first time. Then, other sites can take over with using the knowledge built during and after the first roll-out.

Scheduling

Another site in the rollout plan will be first to use the production planning and scheduling module of Critical Manufacturing, again to build the knowledge base for the other sites. The idea is to spread the burden of initial development over several shoulders. With

it, the company will also redefine the role of a production planner who would be a primary user of that module. He should sit in the production site, acts as a bridge between divisional planning for all sites in ERP and shop floor management.

Site comparisons

In the future, Vishay Passives plans to use the Critical Manufacturing MES standard for divisional and corporate governance of all production sites, comparing performance, output, yield, and other key performance metrics (KPIs).

Keep expanding functionality

Vishay's aggressive rollout plan for the Passives group ensures they will continue to gain greater benefits as they go. Part of the Vishay rollout strategy is to expand the footprint of which modules and functions to use with each of the sites.

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MES
smart
network

About Critical Manufacturing

Critical Manufacturing provides the most modern, flexible and configurable manufacturing execution system (MES) available. Critical Manufacturing MES helps manufacturers stay ahead of stringent product traceability and compliance requirements; reduce risk with inherent closed-loop quality; integrate seamlessly with enterprise systems and factory automation and provide deep intelligence and visibility of global production operations.

As a result, customers are Industry 4.0-ready. They can compete effectively and profitably by easily adapting their operations to changes in demand, opportunity or requirements, anywhere, at any time.

To learn more visit: www.criticalmanufacturing.com

We champion the continued success of our customers

This Case Study is the result of a joint collaboration between the customer and Critical Manufacturing to showcase the successful implementation of modern MES in a complex high-tech manufacturing environment, all as a part of MES Smart Network.

The MES Smart Network is Critical Manufacturing's Customer Community Program that connects and enables manufacturing champions from across complex and regulated industries to share their knowledge, experiences and best practices on the journey to Industry 4.0.

For more Customer Success Stories, please visit: www.criticalmanufacturing.com/customers