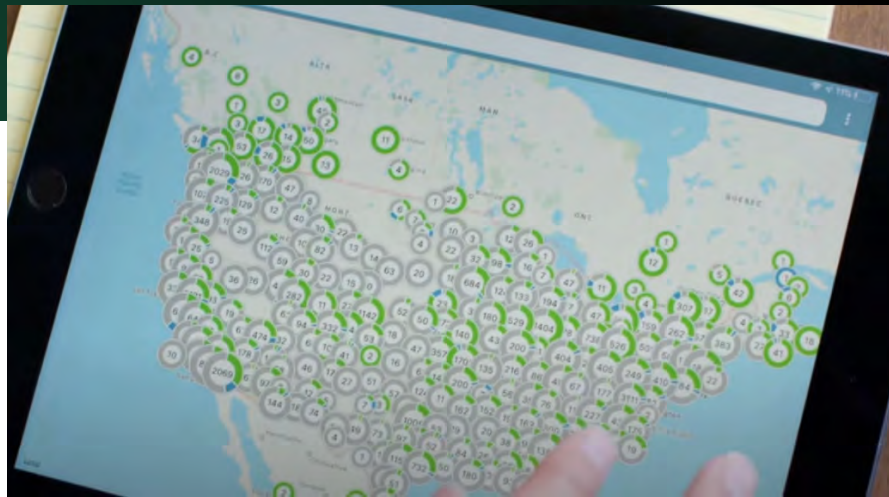


CASE STUDY

ChargePoint ensures consistent product quality within its EV charger assembly operation

ChargePoint adopts Instrumental's manufacturing AI and data platform to introduce greater standardization, scalability within its assembly process.



North America's largest charging network is built by ChargePoint

ABOUT

COMPANY

ChargePoint

PRODUCT

EV Chargers

USE CASE

Digital Transformation

MANUFACTURING LOCATION

Overseas, Mexico

PRODUCTION MIX

Multiple SKUs

VOLUME

25K+/Year

Since 2007, ChargePoint has been creating a fueling network to move people and goods on electricity. With one of the largest EV charging networks available today and a fully integrated portfolio of charging solutions, the company is committed to making it easy for businesses, fleets, and drivers to go electric. The ChargePoint cloud-based subscription platform and software-defined charging hardware are designed to charge any type of EV, anywhere it goes—including passenger cars, delivery vehicles, buses, and more. Just one ChargePoint account provides access to hundreds of thousands of places to charge in North America and Europe, with drivers plugging into the ChargePoint network on average every second.

They strive to build a future where going electric is practical but also seamless and reliable. That's why their focus on reliability and quality is unwavering. They understand the critical importance of ensuring that the charging solutions consistently deliver exceptional performance. Therefore, they take a proactive approach to maintaining the highest standards of quality and reliability. They design for quality from the very beginning of the development process. Every aspect of the solutions, from software requirements to circuit board layouts, is meticulously crafted with quality and reliability in mind. Their unwavering focus on quality and reliability sets them apart from the competition. They are the only charging provider with an advanced in-house test facility spanning an impressive 16,000 square feet. They use this facility to test for a wide range of real-world scenarios like heat, rain, dust, earthquake, etc, to evaluate resilience. This gives them complete control over the accuracy and reliability of their tests.



For illustrative purposes only

Challenges

ChargePoint holds itself accountable for delivering high-quality products that consistently perform at their best. The ChargePoint operations and engineering teams set out to find a solution that could up-level their supply chain and maintain quality control. There were looking for a solution that could help them:



Create a Complete Historical Record for Traceability

ChargePoint wanted comprehensive material traceability and assembly quality throughout manufacturing and deployment to maintain strict control over the entire lifecycle of its products.



Generate Novel Insights About Product Design and Performance

ChargePoint wanted to leverage data-driven insights to improve designs and processes to meet product demand and continuously increase reliability expectations.



Gain Insight Into Remote Factory

They wanted remote insight and visibility into their global manufacturing operations, to optimize processes and resolve defects more efficiently.

Solution

That's how they landed with Instrumental, a Manufacturing AI and Data platform that provides complete data traceability, finding and fixing known and unknown issues, and factory oversight.

✓ 100% Visibility and Oversight of All Units and Factories

They used the solution to gather visual data and get a traceable data record of all their units at each step of their assembly process.

✓ Discover AI for Novel Defect Discovery

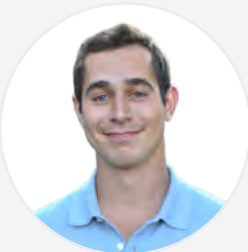
They collected images on the Instrumental cloud-based app and ran them through Discover AI, an automated defect detection solution. It uses machine learning to train what a golden unit looks like and flags anomalies.

✓ Rapid Failure Analysis

They solved problems faster by automatically finding anomalous units and reviewing images across the assembly process to identify potential root causes.

✓ Monitoring for Known Defects

Lastly, they ensured none of the issues escaped during the ramp and set up Live Monitors on their defects, which helped them catch known failures.



Without Instrumental, we would have to start looking deeply at the earlier assembly processes. Using **Instrumental reduced our defect [and root cause] hunt time by half.**

Ali Mansour

Technical Program Manager, Technical Operations

Novel Insights from AI and Data

Thermal Grease Complexity

The engineering and technical operations teams at ChargePoint wanted to improve the thermal performance of the power distribution unit within one of its NPI programs. To start, the teams questioned whether they were applying an excess of thermal grease underneath the transformers, as the grease appeared to be torquing down the components—a serious concern for highly sensitive printed circuit boards (PCBs) and other hardware.

The ChargePoint team cross-checked their own analysis with images made available through the Instrumental platform at that specific assembly station, and they found a clear delta—one image had a very clean machine surface (with no grease), and the next image showed the grease flowing underneath the transformer. “With the Instrumental images, we were able to confirm that we weren’t applying too much grease, rather the grease changes phases when going through the burn-in test sequence,” said Ali Mansour, Technical Program Manager, Technical Operations at ChargePoint.

The use of Instrumental imaging stations provided the ChargePoint team with a digital record to go back and look at evidence of what was causing the grease overflow, ultimately helping them narrow down the root cause instead of acting based on assumption. The images taught the team more about the nature of the process and allowed them to better understand how the thermal grease material behaves so they could monitor other regions where the hardware interfaces with the cold plate to avoid the same challenge.

Importantly, the ChargePoint team was able to revise their assumptions about the material properties of the thermal paste and how it behaves in high-temperature conditions based on the evidence shown by the Instrumental images. They had proof that nothing was missed or overlooked within the assembly and were able to use the images to start a conversation about increasing the thermal paste to address the issue. Alternatively, without the Instrumental images, the team likely would have created thickness specifications on the grease dispensing process that would have not only added considerable complexity to the overall process but could have led to potential issues with the machine later on.



Without the Instrumental images, we had no proof of where the issue occurred. We might have thought it was an escape in the process or that someone made a mistake with the machine, as it’s incredibly difficult to drill down on what happened within a single enclosure. **With the Instrumental images, however, we learned new things about the nature of the materials we’re now leveraging to make long-term improvements to the process,”** said Mansour.

Printing Inconsistencies

The ChargePoint silkscreen printing station was experiencing some inconsistencies in grease clumping due to the manual nature of the screening process. As a result, anomalies were detected at the station through Instrumental’s AI.

By understanding exactly what stage was causing the printing variations, the ChargePoint team could design and implement a new process using new equipment on the line to reduce the inconsistencies. Now, they use an automated squeegee that will repeatedly put the blade in the same position so there’s a higher level of consistency and repeatability from operator to operator and shift to shift.

The Instrumental images also unveiled to the ChargePoint team that they have a loose tolerance at that printing station and don’t necessarily have a pass or fail criteria that could impact the line—essentially, there’s more ‘wiggle room’ than they realized. “Now that we have a much more repeatable process at the printing station, we shifted our focus to other pressing challenges within our process. We got exactly what we needed out of the Instrumental images,” said Mansour.

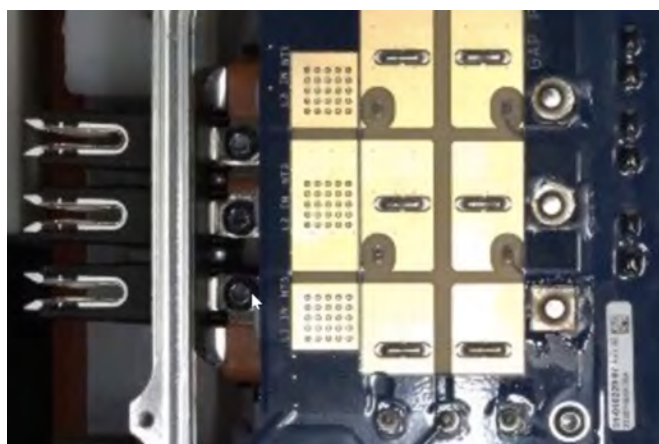
Damaged Bar Clips

The electrical connection that makes ChargePoint EV modules work relies on bar clips that interface with the dispensers that attach to the charging stations. However, some bar clips looked angled. The initial assumption was that the bar clips were bent at the factory, meaning the operators likely misaligned the bar clips at the time of installation.

The ChargePoint team conducted a deeper analysis to confirm where and why the bar clips were damaged, however. They reviewed Instrumental AI images against the bar clip serial numbers and pinpointed three potential avenues that could cause the misalignment. It could either occur during the actual installation of the physical bar clips onto the enclosure, later on in the process when the black plastic front cover slides onto the module during the loading and unloading of the modules into testers or while in the field if mishandled by an operator.

Based on the Instrumental images, the team saw the first step – the actual installation of the bar clips onto the bar – looked consistent and accurate, and they were able to rule out failure at the time of installation. They learned the bar clip damage occurred in the field or when the black plastic front cover was installed, though they could not definitively pinpoint only one cause. “Since we knew the failure could be caused by the plastic cover insert, we kicked off new fixturing that improved the manufacturing process, ensuring the bar clips wouldn’t get stuck, which helped to reduce the number of failures in the field,” said Mansour.

Without Instrumental’s images, the ChargePoint team would have had to look more deeply at earlier stages (stations one through six) within the assembly process to confirm whether there was an issue with the installation of the parts. This would have been an incredible time- and resource-intensive process—instead, they only had to analyze station seven.



First potential failure point: bar clip install



This specific challenge, had we not been able to narrow down the cause, would have spiked many conversations with multiple stakeholders over two weeks—the bar clips are that important,” said Mansour. **“Instrumental AI images gave us hard proof of where the misalignment was likely occurring and allowed the team to implement a solution to help avoid further damage quickly.”**



*Second potential failure point:
black plastic front covers installed onto module*

Custom Module Damages

ChargePoint was experiencing a string of issues on one line where they saw failures in the testers because of some mechanical damage to the corner of one of their custom modules. They needed to assess whether the damage occurred during the assembly process, if it was a supplier issue, or if operators were somehow responsible for the defect.

The team conducted a root cause analysis, closely examining images of the modules to see whether they could pinpoint where, when, and why the damage occurred. They referenced their catalog of Instrumental images against the serial numbers of the damaged modules and found a glare on the corner, with the light hitting it at an angle, indicating that the corner was bent. From there, the team discovered

the root cause of the issue, identifying that metal wires protruded when operators scraped the silkscreens, inflicting damage on the corner of the modules.

The ChargePoint team then implemented a new workflow based on these observations, putting a new fixture on the line to avoid future damage. They now use the Instrumental system to passively track the progress on this station to ensure they're not sourcing the same defect after their corrective actions.



Anomalous module with glare on the corner - image captured by Instrumental

Results

Using Instrumental's AI solutions, ChargePoint ensured consistent quality within its EV Charger assembly operations and achieved greater standardization and scalability within its assembly process.



Enhanced Development Process Resulted in Higher Quality Product

ChargePoint had a comprehensive and transparent view of the entire manufacturing assembly process, which they used to easily track and monitor the quality of each component and process involved. Using AI and referring to the data record, they quickly identified and addressed 17 anomalies during the development phase, preventing potential defects from making it into the final design.



More Efficient and Effective Process and Team

ChargePoint employed DiscoverAI, an automated system, to detect defects early. This proactive approach saved engineering time and resources. Traceable data and AI-driven analysis expedited issue identification, streamlining problem-solving. Despite being an overseas factory, the platform improved coordination between engineering design, manufacturing, and field quality, enhancing efficiency, reducing errors, and boosting productivity.

What's Next?

ChargePoint credits Instrumental in ensuring the high quality and reliability standards ChargePoint is known for. They now have a complete traceable record of all their programs and use it daily to coordinate between different teams. The Instrumental system expands ChargePoint's data-driven tools to ensure each unit bearing ChargePoint's name adheres to its standards. They will continue to use the solution to continuously learn and refine designs and processes to meet sharply increasing product demand and reliability requirements.