WHITE PAPER

Harnessing Industry 4.0 for Quality Inspections and Assembly

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FARO® Visual Inspect™ AR Software enables the intuitive viewing of complex 3D data for (virtual) quality checks of parts and assemblies – even in early stages of an assembly process. Users can, for example, quickly check if all necessary drill holes are in place, and if components (that may not be physically present) will fit in the current assembly.

Use of Technical Assistance Systems to Boost Efficiency & Cut Costs

"Industry 4.0" is quite possibly the manufacturing world's most frequently used buzzword in the 2010s. While it is clearly not just the "flavor of the month", the phenomenon still has some ways to go before it gains complete acceptance across the globe.

For most people, Industry 4.0 mainly refers to the Internet of Things (IoT) — the fact that every piece of equipment is interconnected, and how they have the ability to "talk" to each other. True as that may be, the other principles that characterize Industry 4.0 are just as definitive (if not more so).

The connectivity enables the information transparency, which allows the collection and sharing of vast amounts of data. Industry 4.0 is also characterized by decentralized decisions, where cyber-physical systems act as autonomous agents within their dedicated scope, performing tasks without the need for human intervention. And where humans are still required, Industry 4.0 has shifted their role — from operator of machines to problem-solver — through the use of technical assistance systems.

What Constitutes Technical Assistance Anyway?

Designed to aid operators in their role as decision-makers, assistance systems typically offer either physical support on dangerous, strenuous tasks, or they provide crucial information to enable better decision-making.

Examples of physical support systems include collaborative robots that take on the heavy-lifting parts of a task; exoskeletons to eliminate fatigue and injury; and headsets that optimize order-picking routes to save time and cost. On the other hand, informational support systems include wearables that alert operators to machine faults; tablets or glasses that offer step-by-step guidance on installation or assembly processes; and carriers that provide instructions on assembly, and transport the tools and components required.

In the context of the manufacturing environment today, both types of technical assistance systems play a vital role in alleviating production challenges. While Industry 4.0 may seem like a daunting endeavor to undertake, exploring and implementing technical assistance systems is one relatively uncomplicated way for companies to enter these unchartered territories, and to leverage technology benefits.

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Streamlining Tool & Fixture Building Processes

One such instance of technical assistance is in virtual inspection, in particular for tool and fixture building. Often, in early phases of prototyping, companies would be developing tools, fixtures, or assemblies — where not all components of the whole are in place just yet. However, quality inspection early on in the process is necessary in order to ensure that everything eventually fits in its allocated position. Otherwise, any changes that may be required in later stages can incur additional costs and cause delay with prototypes and pilot lots, likely pushing back production timelines for final inspection, approvals, and series production.

To circumvent that challenge, manufacturers can employ augmented reality software to conduct virtual inspections using CAD data. Advances in mixed reality technology have made it possible for an assembly, a tool, or part to be virtually examined in detail, even with an incomplete set-up. Missing elements – such as the prototype a tool will be used for – can be represented by a virtual instance based on its CAD data. Through an overlay, the virtual object can be inserted into the software to see how it fits with the existing elements.

This way, any difference between the actual and the intended, targeted setup can be identified, documented, and fixed early on. The information gathered by the system can also be documented and shared with team members and stakeholders located anywhere in the world, which enables better collaboration.

Manufacturers who choose to rely on such technical assistance systems stand to gain time- and cost-savings, as any problems with quality can be identified and fixed early-on in the process, even before first prototypes arrive for a physical “real world” testing. By eliminating transfers to-and-fro, companies can ensure a quick transition from the first prototype phase to pilot lots, and series production.

Simplifying Templating & Positioning Tasks

Another scenario where manufacturers can easily introduce technical assistance to embark on their Industry 4.0 journey is in welding assembly and verification. Most basic welding jobs will see technicians relying on blueprints, tools, and tape measures to join and build the parts. While these traditional methods have worked well in the past, companies have also lived with the high levels of error and associated costs — owing to rework, scrap, and lost time.

Originally used in the aerospace and defense industries, laser projection has since been made available to automotive, heavy equipment, and machine shops. The system utilizes 3D CAD data to generate a series of specific points and create a projection outline on a surface. Using advanced optics, galvanometers, and high-precision mirrors, the laser beam “draws” images onto a surface (which need not be flat) and the high-speed motion of the laser beam creates what appears to be a continuous line to the human eye.

Using 3D laser projection or 3D laser imaging systems, manufacturers can achieve significant improvements in efficiency and accuracy, while eliminating physical templates all at once. Instead of blueprints, operators can simply follow a sequential guide through the welding process. Such systems provide clear instructions to users each step of the way, and are capable of indicating where to place each component and feature — down to the detail of each weld bead or hole. This eliminates the risk of less experienced employees welding onto incorrect positions, allowing manufacturers to ensure alignment accuracy every single time.

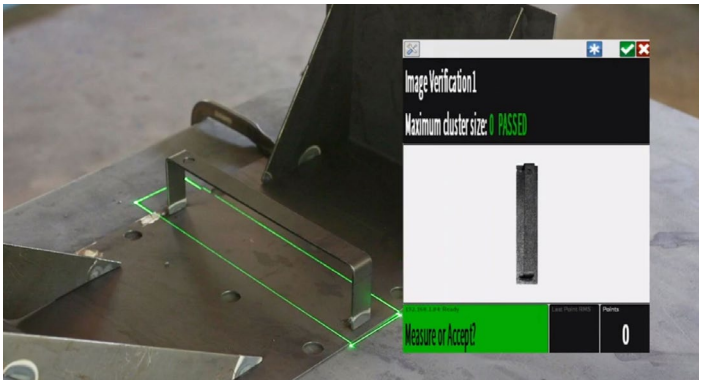
Innovative laser imaging and projection solutions such as the FARO® Tracer^{SI} Laser Projector help welders increase throughput by accurately guiding the placement of each part. The solution also allows users to perform IPV, making it perfectly suited for applications such as assembly, alignment, and composites ply-layup, where mistakes, rework and scrap can be extremely costly.

A virtual templating solution removes the need for physical templates, and also the time and expense associated with the usage — including design, build, maintenance, and storage. In addition, an advanced 3D laser imaging system enables In-Process Verification (IPV) to be performed after any step of the welding and assembly sequence.

This means that manufacturers can evaluate placement and adjust alignment as the project progresses, not just afterwards when the welding has already been completed. For technicians, the ability to assess their work and take appropriate corrective action before investing further effort is invaluable, as it prevents a situation where the end result becomes a flawed assembly.

Embracing Industry 4.0

As Industry 4.0 continues to unfold in the years ahead, most businesses will recognize the need to roll with the punches and not be left behind. Technical assistance systems offer manufacturers tangible benefits of better quality, improved efficiency, and cost-savings, and those that choose to adopt suitable solutions will stand to gain an edge over their competitors in this new era.



With the FARO Tracer^{SI}, operators can easily perform quality inspections at each stage of an assembly or welding process to validate that all components have been put together correctly. IPV detects the presence or absence of features, evaluates placement & alignment, and performs Foreign Object Debris (FOD) detection as early as possible in the assembly process.

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