WHITEPAPER

Networked tool solutions

Increased efficiency and safety in tightening operations in production, maintenance and repair

STAHLWILLE®

Added value of digitalisation. But how?
Networked tool solutions.

Industry 4.0 is becoming more and more concrete. Throughout industry, more and more companies are looking at how they can leverage the potential of digitalization and connectivity for their manufacturing and maintenance processes.

The most frequently asked questions are:
- What are the benefits of digitisation?
- How do I select the right approach from the wide range available?
- How can I affordably implement this approach with my requirements?
- What happens after implementation?

On the following pages, this whitepaper addresses precisely these questions - and explains ways to get started with networked production processes and Industry 4.0 as quickly and successfully as possible.

1st **Digitalization** along the entire value chain.

In the fast-paced production environment, powered tools and robots ensure that all specifications are met. In upstream and downstream areas of the value chain, however, humans continue to play an important role - and will continue to do so in the future.

Manufacturing companies and their suppliers along the value chain are under great pressure: On the one hand, they must be as productive and cost-efficient as possible in order to remain competitive. On the other hand, their customers place the highest demands on quality and delivery capability - even when producing the smallest batch sizes.

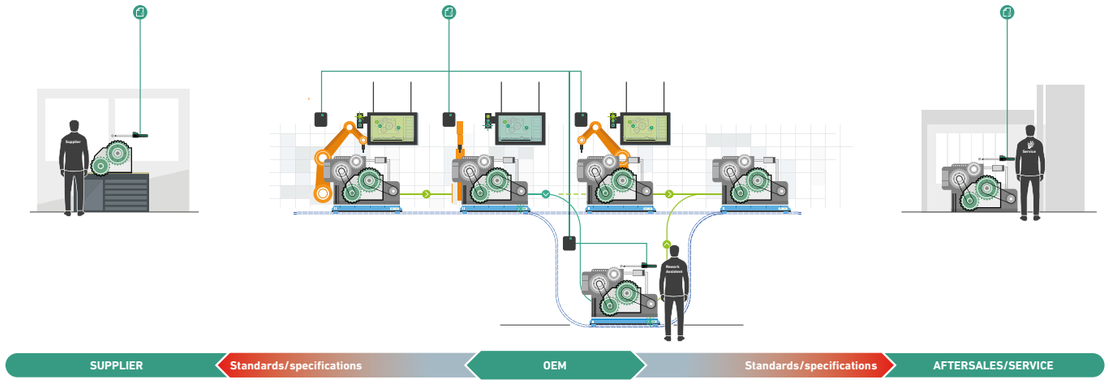
Whether in final production or in the manufacture of parts and components: Companies are required to take a critical look at their processes in order to secure value creation, reduce sources of error and waste to a minimum and deliver consistent quality.

Large companies in the automotive industry, for example, have already taken this step: With great effort, they have built up high-tech Industry 4.0 productions. Many have succeeded in making work processes more flexible, increasing process reliability and reducing set-up costs.

For smaller companies, the question is whether and how similar things can be achieved with less effort. There is also an increasing focus on the aftersales areas of service and maintenance. For example: How can digitalization be used in vehicle service to ensure that all specifications have been verifiably complied with?

The example of controlled bolt tightening shows clearly: Three factors play a role here. People, tools and processes.

Seamless traceability & proven quality



2.1. The **human** factor.

In production environments with a large variety of variants, flexibility is required while maintaining consistent quality. Humans are still ahead of the game here - because they can adapt more quickly to necessary and sometimes unplanned changes. This also applies to bolt tightening.

Individual qualification is decisive for error-free execution of the individual process steps. While welders, for example, must provide regular qualification certificates, comparable binding specifications for the “screwdriver” have not yet been established across the board.

The VDI/VDE-MT 2637-1 directive defines a demand-based qualification for users. However, it cannot guarantee that the specifications will be complied with in practice.

This is where the greatest potential of digitalization lies with regard to the human factor: Anyone who digitally controls and monitors tightening processes can shorten teach-in times and ensure a correct process flow and even optimise it. The worker is not replaced by a machine, but is supported by technology to help avoid unintentional errors.

2.2.
Tool factor.

What potential does digitalization offer in the field of hand tools, for example the torque wrench? There are two things to consider when answering this question.

Firstly: Hand tools are traditionally the “extended arm” of the user. Workers usually want a screwdriving tool that offers them a familiar feel and operation. Integration-capable torque wrenches only achieve the desired acceptance if they meet this requirement and are easy to operate. Like an electromechanical clicking torque wrench that combines digital metrology and precision with the familiar feeling of a mechanical cycle.

Secondly: Depending on which tool manufacturer you choose, you may end up with dependencies because you are bound to a system. Anyone who wants to remain flexible in the long term and use hand tools from different suppliers should therefore pay attention to modular solutions with open communication interfaces.

2.3.
Process factor.

The connecting link between the factors of human and tool is production control. It regulates the interaction of all factors involved in real time.

This is a comparatively simple yet effective way to ensure that errors are avoided as far as possible in advance and do not lead to quality problems.

Another advantage of digitising processes is the documentation and thus the verifiability of individual work steps - for each individual product.

Mechanical feeling, digital precision

The MANOSKOP® torque wrench 766 DAPTIQ® works electromechanically: It measures digitally and can be connected wirelessly. The triggering feel corresponds to that of its mechanical counterpart.

– Intuitive operation and familiar mechanical triggering (»click«): ideal for workers

– Precise electronic measurement and direct feedback on bolted joint quality

– Easy integration into common worker assistance systems

More detailed information on electromechanical tripping:
https://qr.stahlwille.com/heeu0o

3.
From theory **to practice.**

Translating a digitalization strategy into reality is easier in the "greenfield" than where there are mature structures are established ('brownfield'). In practice, companies often encounter the same problem: Their production infrastructure is heterogeneous and complex. It has often grown over years, been constantly expanded, converted and adapted to new market requirements.

The first step to implementation is to analyse the existing architecture, information flows and processes. Because there is no implementation concept that suits every company.

Even if all network-capable tool solutions could be integrated "plug and play" into the leading systems: They only develop their added value when production systems, users and workflows are coordinated. This makes it all the more advisable to start with digitalization projects that are as manageable as possible with the lowest possible complexity.

Let's take a look at some basic scenarios for using connected hand tools using torque wrenches as an example.

3.1.
“Greenfield” approach:
Digital worker assistance systems.

For companies that do not yet have a networked infrastructure, a worker assistance system is a good “entry project”. Two starting scenarios are common for the greenfield:

- On the one hand, there are companies that still rely on mechanical “analogue” torque tools. You set up your tools manually. Work instructions, quality controls and documentation are paper-based.
- On the other hand, there are companies that already use digital torque wrenches, but have not yet networked them. They benefit from the high precision of digital torque tools and from an immediate bolted joint evaluation. However, the worker still has to adjust the tool manually. The bolt tightening values must also be assigned to a product manually.

Both have one thing in common: The quality of the end product is heavily dependent on the user’s know-how, their ability to concentrate and their handling of the tool, as well as the “clean” proper paper-based documentation. Many companies are aware of this and therefore rely on random quality checks, a dual control principle when carrying out bolted joints or 100% checks.

This is time-consuming and costly.
If you instead use a worker assistance system that uses networked torque wrenches to ensure and automatically document the quality of every single bolt tightening, you can significantly improve process reliability, efficiency and quality and ultimately increase cost-effectiveness.

The flexible, scalable entry:
With the MANOSKOP®766 and
GuideMaster worker guidance
https://qr.stahlwille.com/jjut4m

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Digital worker assistance system: how it works

It has long been possible to connect network-capable electronic torque tools to a leading system - such as assembly software or production control - for the purpose of data exchange. This entry-level solution requires comparatively low investments and can be implemented in a short time. Important: When selecting the worker assistance system, it should be ensured that various interfaces are available for connecting tools. This keeps the company flexible in the choice of tools.

In the simplest case, only one assembly cell is equipped with an industrially suitable PC and a worker assistance system (e.g. STAHLWILLE GuideMaster). Provided the appropriate tool is available, the entire assembly process can be controlled digitally and the worker can be guided step by step. The product to be assembled can be identified by means of a barcode or RFID chips, for example. The assistance system also helps with the selection of the necessary parts and tools. In the case of torque-controlled bolted joints, it sets the target torque required for the next bolted joint on the torque wrench, monitors the correct sequence of bolted joints and finally documents the measured tightening values.

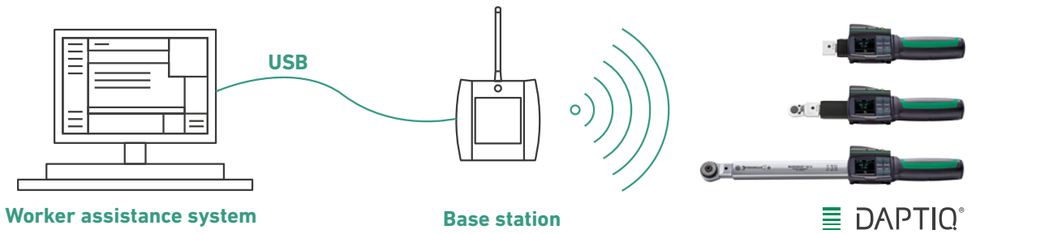
Instructions for the worker appear directly on the torque wrench product display. It is also possible to release the torque tool only after parameterization and selection of the correct attachment tool. The system can also give the worker direct feedback when changing tools within a defined sequence.

Significant increase in efficiency, quality and safety

The benefits are immense: The probability of error is reduced to a minimum. Disturbances in the workflow are actively counteracted. The quality of the product increases. Reworking is reduced and there is less waste. Production becomes more profitable. There is also reliable and complete documentation that assigns the individual tightening results to each individual product. This ensures complete traceability at all times. But that's not all: even in complex production with a wide range of variants, the processes run smoothly and efficiently. All with minimal teach-in effort.

Don't forget about the people

An easy-to-install worker assistance system in combination with the corresponding torque tools therefore allows a low-threshold entry into Industry 4.0 processes. It can be rolled out on a workstation for testing purposes and then scaled up quickly. Either way, one thing must not be overlooked:
the users must want to work with this type of system. Especially in the production environment, many people don't like to move away from their usual tools. In individual cases, there are also reservations about digital technologies, especially in the torque range, as most tools do not offer the usual **click**. Electromechanical tools can significantly reduce the barrier to acceptance here (see page 8/9).



Easy setup
In interactive worker assistance systems, one or more DAPTIQ® torque wrenches communicate with a USB base station connected to the worker assistance system.

Connection to existing system made easy: MANOSKOP® 766 and SmartCheck DAPTIQ®
https://qr.stahlwille.com/aicjiz

3.2.
Another perspective: grown structures.

If a company has an existing production infrastructure that has grown over years (brownfield approach), the situation is more complex than with the approach described above.

Powered tightening tools may already be used in production. They are likely to come from different manufacturers, be of different ages, and have individual integration options. The challenge here is to determine a uniform overall picture of all work islands, all processes and the corresponding data or work results.

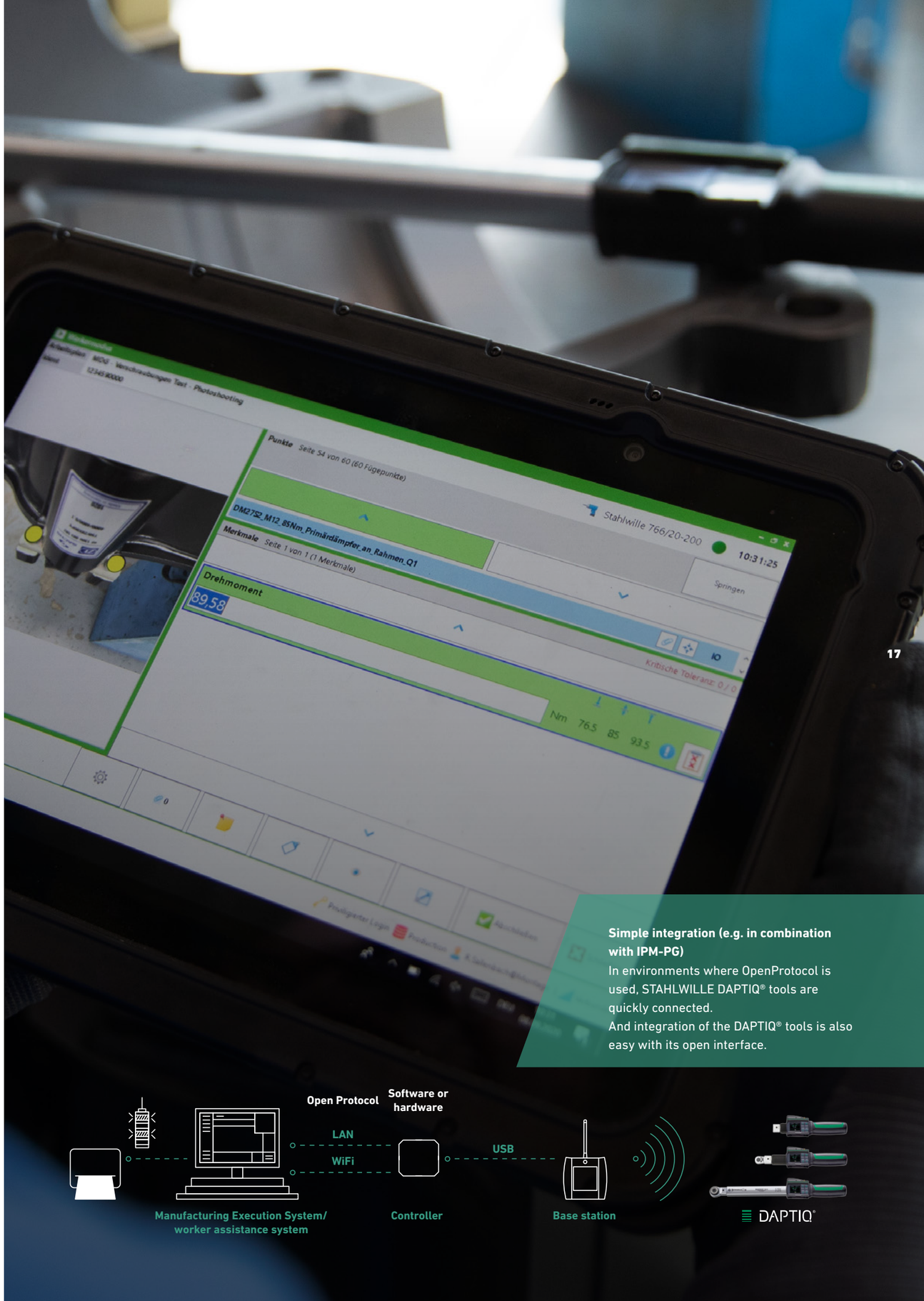
MES consolidates data and controls production

A central database is a possible solution here, as well as a higher-level system for production control ("Manufacturing Execution System", "MES"), which monitors and controls production across processes. It can be used to consolidate and document the data masses that
arise. It also enables statistical evaluations to determine potential for improvement. When introducing such systems, such as the procurement of integration-capable tools, it is essential to ensure open interfaces. They allow systems and tools from a wide range of manufacturers to exchange data.

Open Protocol: open to tools from many manufacturers

Open Protocol, a platform-independent interface, has become established. The advantages of the MANOSKOP® 766 DAPTIQ® from STAHLWILLE are clear: The integration-capable, electromechanical angle-controlled torque wrench can be easily integrated into an open protocol environment. And where workflows cannot be mapped with Open Protocol, integration is easily possible via a separate protocol.

In combination with this type of tool and additional peripherals, a MES system offers a wide range of possibilities. For example, process-related errors can be prevented in advance according to the poka-yoke principle. For example, stacklights signal the current status of a bolt tightening to the user according to the traffic light principle or position tracking is used to determine the correct bolt position.



Simple integration (e.g. in combination with IPM-PG)
In environments where OpenProtocol is used, STAHLWILLE DAPTIQ® tools are quickly connected.
And integration of the DAPTIQ® tools is also easy with its open interface.

3.3.
Keep it simple:
Measurement data capture made easy.

Products are becoming more complex, innovation cycles shorter, customers more demanding. The costs for warranties and complaints are high. That's why effective quality management is crucial to the success of any company.

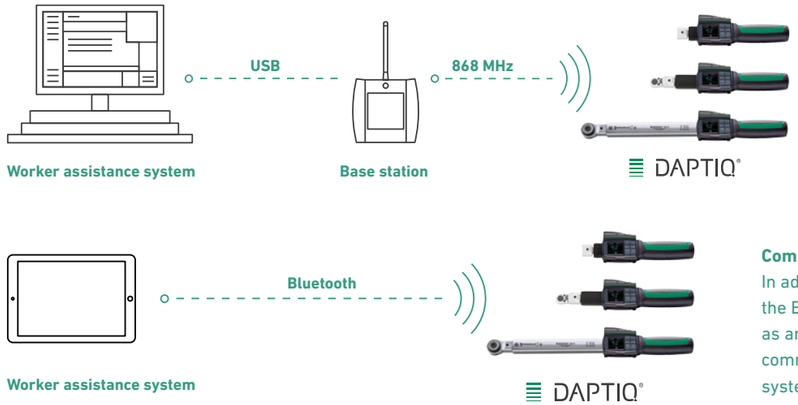
Guaranteed quality with a CAQ

For this reason, many companies also opt for the use of CAQ systems ("Computer-aided Quality"). Such quality management systems support the documentation of quality-critical processes and have standardised interfaces for integrating different measuring instruments into individually created, company-specific test plans that can be clearly assigned to the processes stored in the MES. Depending on the relevant CAQ system, measurement or test plans like these can be displayed on a PC and/or mobile devices such as tablets.

Automatically document screwdriving data

For example, digital measuring equipment such as a MANOSKOP® 766 DAPTIQ® torque wrench can be used for quality assurance in the area of controlled bolt tightening. In this case, the MANOSKOP® provides the CAQ system with all screwdriving data so that it can be digitally recorded and documented - an important addition to other quality-critical measurement data such as length dimensions or roughness values.

Connection to the system is extremely simple: The MANOSKOP® 766 DAPTIQ® communicates via radio (RF868/915) with a base station, which in turn is connected to the PC via USB. Alternatively, a Bluetooth Low Energy Module (BLE) is available for direct communication with the PC, as well as connection via WiFi in the future (see graphic).



Communication via Bluetooth
In addition to communication via radio, the Bluetooth standard is available as an alternative method for wireless communication with the worker assistance system.

4.
Increased flexibility. Because every company is different.

The use cases presented are examples of how DAPTIQ® solutions from STAHLWILLE help to digitalize processes.

Starting small

Companies that want to enter the world of digital and networked processes should start with small projects and develop a rough vision of how they envision the future of their production in advance.

They should not focus too much on whether the necessary tools can be obtained from a single source. It is much more important to identify the tool manufacturer that offers the best product for a specific - digital, networked - use case.

In any case, it is important to avoid the manufacturer's own "quasi-standards" - because they limit future options for action. In contrast, tools that communicate via open interfaces remain as flexible as possible and can integrate systems and tools across manufacturers into existing infrastructures. That's why DAPTIQ® uses similar interfaces.

A partner who knows what it's all about

In addition to technology that opens up all possibilities, companies need a partnership based on trust, reliability and equality - regardless of the scope of a project. A partner who understands individual requirements and can respond flexibly to them. STAHLWILLE can be this partner.

With DAPTIQ®, STAHLWILLE offers the best of all worlds. The security of optimal advice and a reliable system. If you are interested in digital and networked hand tools and test technologies or have questions about automated parameterization, worker assistance systems and documentation, the company's specialists are always happy to help.

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