



SOFTWARE HARDWARE SERVICE

## SCHATZ<sup>®</sup>-INSPECT*pro*

**A versatile instrument for many applications:**

- Random-sample testing in bolted joint assembly processes
- Calibration of torque wrenches
- Analyzing torque and clamping force
- Determining process capability in bolted joint assembly





# SCHATZ®-INSPECT<sup>pro</sup> MOBILE TEST SYSTEM

## ① RANDOM-SAMPLE TESTING IN BOLTED JOINT ASSEMBLY PROCESSES

Random-sample testing is performed in bolted joint assembly processes to monitor the interaction between the assembly tool (driver) and the bolt. For these tests a torque/angle sensor is fitted between the male square drive and the socket. This allows measurement of torque and/or angle as well as graphic analysis of the torque versus angle curve of the entire bolting process.

This in-process testing during assembly is the most effective way to verify the overall assembly process. VDE Guideline 2862 specifies random-sample testing as the minimum requirement for discovering NOK bolted joints which were evaluated as OK.



*The torque/angle sensor is fitted between the male square drive and the socket.*

## ② TORQUE WRENCH CALIBRATION

Torque wrench calibration monitors click-type and indicating torque wrenches, which are important instruments for checking the quality of bolted joints in the assembly process.

Like all instruments, torque wrenches of both types must be calibrated at regular intervals. Information about measurement uncertainty and calibration intervals is provided by ISO 6789. This standard specifies test procedures to be used to ensure reliable assessment of whether assembly tools are meet the requirements and may continue to be used.



*A hand crank mechanism is used to apply the torque for testing the handheld torque wrench.*



### 3 ANALYZING TORQUE AND CLAMPING FORCE

The key parameter in the assembly process for bolted joints is the clamping force, which is the force generated by the bolts to hold the assembled parts together. The clamping force must be high enough to ensure that the joint will not come loose due to relative motion of the bolted joint.

However, the clamping force is not measured directly in production, but instead deduced from the torque. The bolt friction, such as the friction present with the correct lubrication, has a major effect on the relationship between torque and clamping force. When in doubt, it must be possible to check the friction parameters on the assembly line quickly and easily to verify that they are correct.

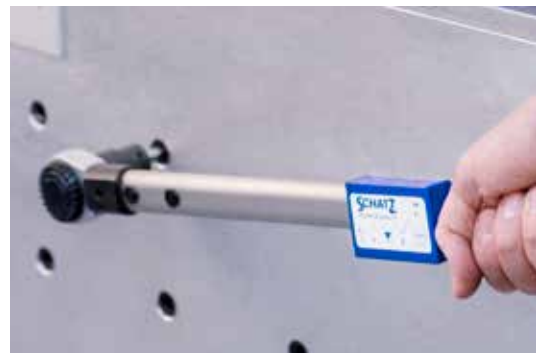


*The torque, angle and clamping force need to be measured to check the bolt.*

### 4 DETERMINING THE PROCESS CAPABILITY IN BOLTED JOINT ASSEMBLY

To monitor bolted joint assembly, finished bolted joints are tested for correct bolt assembly using a handheld torque/angle sensor.

This in-process verification is part of random-sample testing. The retightening torque is measured to check whether the interaction between the tool, the bolt or nut and the bolted parts have delivered the desired result. Process capability testing represents the cumulative effect of a series of factors that play a role in the quality of bolted joints. Proof of process capability is the final process for ensuring reliable bolt assembly.



*The torque is measured when the bolt starts turning.*

# SCHATZ®-INSPECT<sub>pro</sub> IS CONFIGURED FOR YOUR MEASUREMENT TASKS

The SCHATZ®-INSPECT<sub>pro</sub> is a modular system that allows users to configure the instrument according to their needs. The instrument is designed as a two-part housing that specifically fulfills the ergonomic requirements for portable on-site testing and also allows it to be used as a stationary system in a service shop or lab. Power is provided by an easily exchangeable lithium ion battery.

Sensors for measuring torque, angle and clamping force can be connected simultaneously to the INSPECT<sub>pro</sub>. Standard USB-A and USB-B Mini ports are available for data exchange.



*Miniature torque and angle sensors*



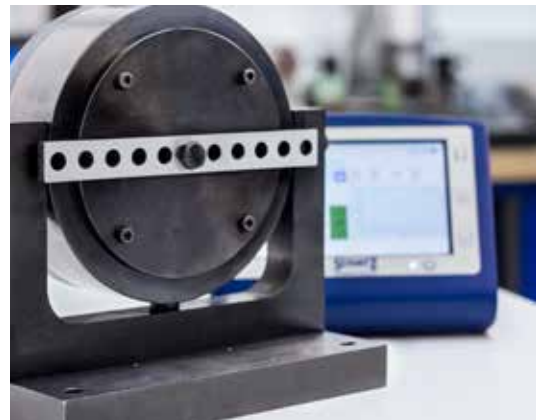
*Torque and angle sensors with rotating shaft*



*Torque sensors with fixed shaft and flange connection*



Handheld sensors for measuring torque and angle



Clamping force sensors for M6 to M16 (with adapters)



Carrying case for safe storage

SCHATZ®-INSPECTpro instrument

Clamping force sensor

Torque sensors with fixed shaft and flange connection

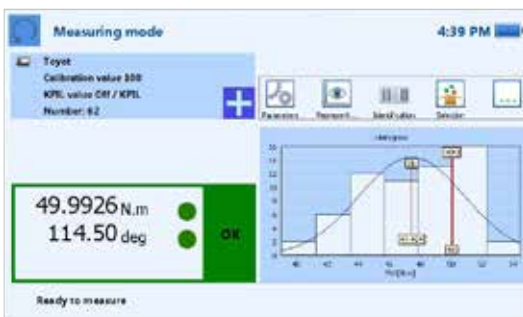
Torque and angle sensor for handheld wrenches

Torque and angle sensors



## RANDOM-SAMPLE TESTING IN BOLTED JOINT ASSEMBLY PROCESSES

All parameters are measured directly at the bolted joint to verify bolting operations during assembly. The miniature torque and angle sensor (5413-1251) is designed for use with battery-powered drivers and pneumatic shaft drivers. The hex drive end can be attached directly to a screwdriver tool for easy in-process measurement. The torque/angle sensors in the 5413-1260 or 5413-1200 series are suitable for larger assembly tools with square drive.



Measurement data is analyzed statistically and displayed in both numeric and graphical form.

The torque/angle sensor is fitted between the male square drive of the driver and the female square drive of the socket.



The INSPECTpro instrument (5413-2071) is connected to the sensor. The sensor sends its identification data via SCHATZ-AUTOCODE®, so no further settings are necessary and the measurement process can start right away.

For this purpose, the torque/angle sensor is fitted between the male square drive of the tool and the female square drive of the socket.

The measurement data can be shown graphically on the screen within the tolerance limits. It is also possible to display measurement curves in order to determine effects during rundown, snugging and assembly.

INSPECTpro has a statistics module for analyzing measurement data. Stored measurement results can be documented, and statistical performance indicators can be calculated automatically and displayed as histograms or bell curves.



*The INSPECTpro has a carrying strap and adjustable display for ease of use.*

## TORQUE WRENCH CALIBRATION





The hand crank mechanism (5413-4611) can be used to attach a torque/angle sensor with a fixed shaft (5413-1030). The sensor is connected to the INSPECT*pro* (5413-2071) and transmits its identification data via SCHATZ-AUTOCODE®. This arrangement is suitable for calibrating click-type torque wrenches as well as digital or analog indicating torque wrenches.

With click-type torque wrenches, a steadily increasing torque is applied with the hand crank mechanism until the handheld torque wrench clicks. It does not matter whether the applied torque from the hand crank mechanism stops exactly at the click point, since the INSPECT*pro* detects, displays and saves the click point of the torque wrench.

With an indicating torque wrench, the torque on the tool is increased until the target value is displayed on the torque wrench. INSPECT*pro* shows the difference between actual and displayed torque values, which indicates whether the torque wrench is still within tolerance.

The measurement curve can be used to check or document whether the torque rate of rise meets the requirements of ISO 6789.

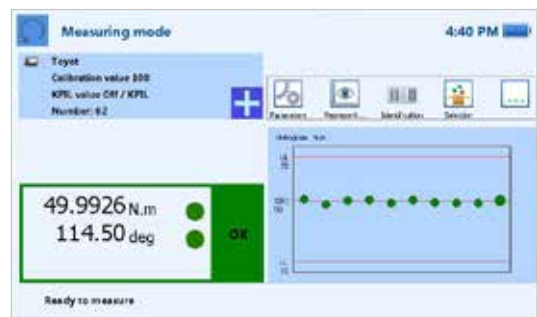
Measurement data can be displayed between tolerance limits, allowing the tester to see, at a glance, whether or not the values are within spec.



*The applied torque is gradually raised with the hand crank mechanism.*



*Static flange-mount sensors can be used for adaptation to torques from 10 N-m to 1000 N-m.*



*The measurement data is shown between the tolerance limits, allowing the quality of the torque wrench to be seen at a glance.*



## ANALYZING TORQUE AND CLAMPING FORCE



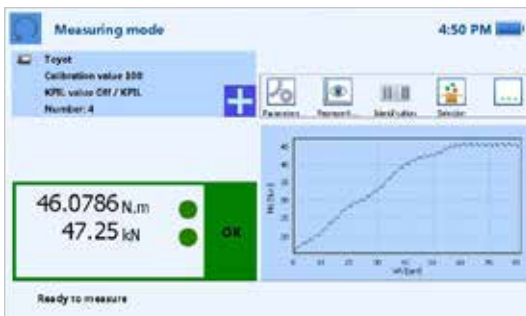
*A handheld torque/angle sensor and a clamping force sensor are connected for testing.*

In order to determine friction coefficients of joint components, applied force and resulting clamping force must be measured simultaneously. Rotational angle provides an additional control parameter.

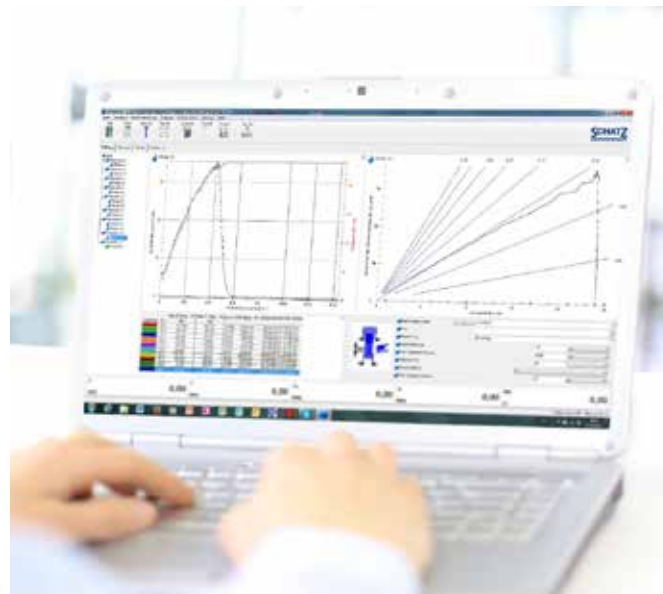
For this purpose, a handheld torque/angle sensor (5413-1500) and a clamping force sensor (5413-1950) are connected simultaneously. INSPECT<sub>pro</sub> identifies both sensors from their SCHATZ-AUTOCODE® data, so the clamping force sensor only has to be adapted to the appropriate bolt size. After this, the relationship between torque and clamping force can be analyzed. Since all measurement parameters are shown on the display, any desired tightening method (based on torque, clamping force or rotation angle) can be used, and the resulting values are shown in the display. It is also possible to display torque/angle, clamping force/angle, torque/clamping force (torque/tension).



For additional evaluation, measured curves can also be exported to testXpert® for further analysis.



*Torque and clamping force are shown on the display. Graphic plots are possible, such as torque and clamping force versus angle or torque versus clamping force.*



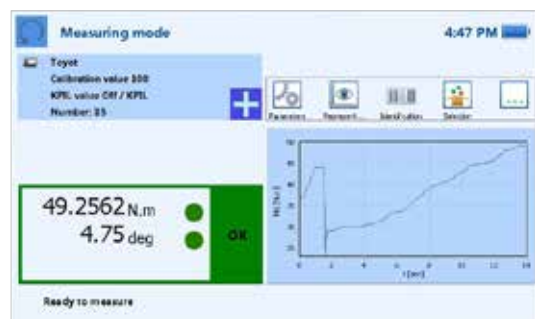
*Additional mathematical or graphical analyses can be carried out with the testXpert® software.*

## DETERMINING PROCESS CAPABILITY IN BOLTED JOINT ASSEMBLY

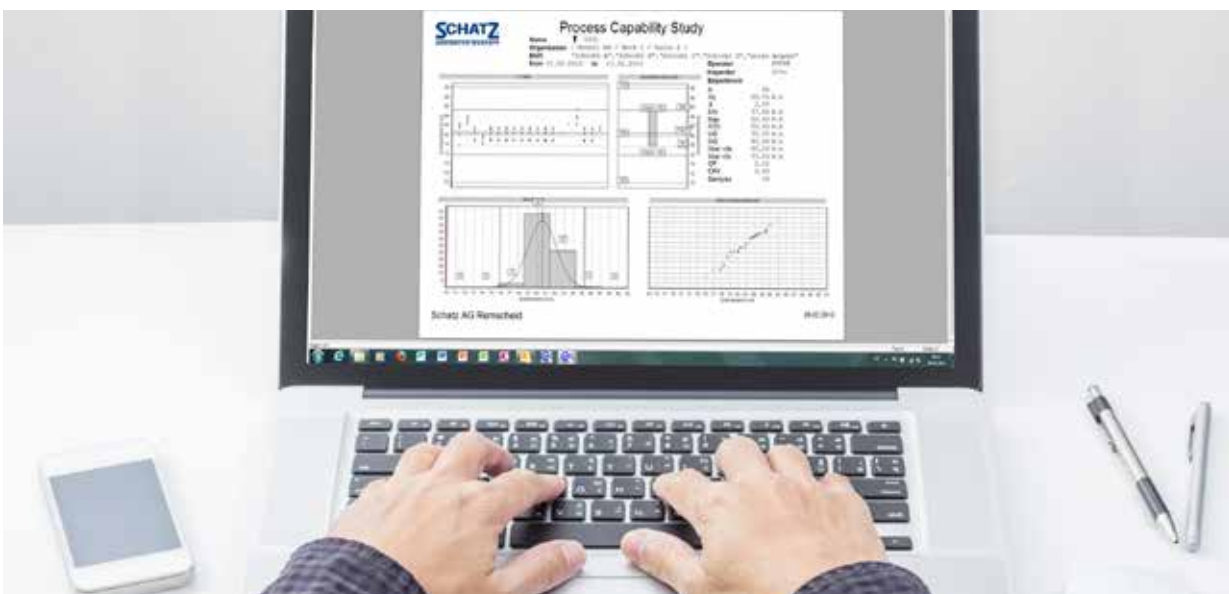


For measuring the retightening torque of already assembled bolts, the handheld torque/angle sensor is connected to INSPECT $pro$  (5413-2071). The handheld sensor identification data is sent to the INSPECT $pro$  via SCHATZ-AUTOCODE®. The retightening torque measurement module determines the point when the bolt starts to turn. If break-away torques appear during retightening due to the transition from static to dynamic friction, the resulting torque is not registered as the retightening torque. However, INSPECT $pro$  will save the break-away torque as additional parameters, along with retightening torque and in particular post-tightening torque, which is the torque resulting from further turning of the bolt. Post-tightening torque is evaluated separately, and INSPECT $pro$  checks whether the bolted joint is still within the specified tolerance limits after the test. This way the process capability is determined, and at the same time it is ensured that the quality of the bolted joint is not altered by the test.

The entire process capability test process can be supported by the CEUS 8.2 software. The test plan documents whether or not the tests have been performed and whether the results are within the tolerance limits. The process capability analysis also gives a direct indication of the statistical capability of the process and whether or not actions are necessary.



*The tester can see the break-free torque, the retightening torque and the post-tightening torque at a glance on the display.*



*Graphical process analysis shows at glance whether the process is capable or actions are necessary.*



## SCHATZ®-INSPECTpro MOBILE TEST SYSTEM

### **SCHATZ®-INSPECTpro portable instrument for torque and angle measurement**

- Modular software for custom configuration
- Interchangeable lithium ion rechargeable battery
- 7.7 -inch TFT color touchscreen display
- Second channel for torque, angle or clamping force measurement
- Receiver module for wireless sensors

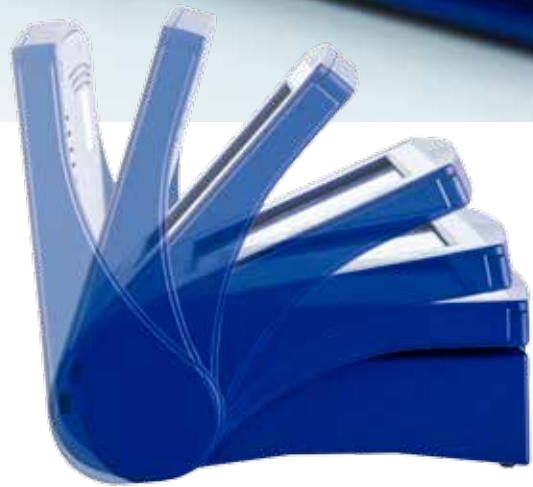
Software and hardware of the new portable INSPECTpro torque and angle instrument create new opportunities for easier random-sample testing, process capability testing and graphical process analysis in assembly operations in order to ensure optimal quality of bolted joint assembly. The instrument is suitable for in-process random sample testing, testing tools and torque wrenches, testing joint components, and determining the process capability of already assembled bolted joints in combination with handheld torque/angle sensors. If an already assembled bolt is post-tightened, the resulting measurement curve is analyzed and three readings are stored: break-away torque, retightening torque and post-tightening torque.

The new instrument is a unique modular system that allows users to configure the instrument according to their needs. The newly developed INSPECTpro is a portable battery-powered measurement and analysis instrument for torque, rotation angle and clamping force.

The rechargeable battery is located in the rotary joint of the INSPECTpro, behind a quarter turn fastener for easy access and fast exchange. The display unit can be pivoted on the base unit in increments of 10° from 0° to 100°. The features and functions of this innovative portable measuring system make it ideal for faster and more effective testing, while at the same time offering extensive analysis and measurement results.



*The INSPECTpro (5413-2071) is a unique modular system that allows users to configure the instrument according to their needs.*



*The display unit can be pivoted from 0° to 100°.*

| Model number            | Item no. 10000026, model no. 5413-2071/ + features |  |
|-------------------------|--|--|
| Measuring channels      | Basic instrument                                   | Analog and incremental channel (torque/angle)  |
|                         | Optional   | Second analog channel  |
| Interfaces              |  | USB Mini, USB, RS232, RJ45   |
|                         | Optional   | Wireless   |
| Power source            |  | Lithium ion rechargeable battery with external charger   |
|                         | Option   | AC power supply for continuous operation   |
| Operating system        |  | Windows Embedded Compact   |
| Display                 |  | 7.7-inch TFT color display, pivotable  |
| Software                | Basic device                                       | INSPECT <sup>pro</sup> Basic 1 channel torque/angle  |
|                         | Option   | Post-tightening<br>Tool testing<br>Tolerance class<br>Statistical parameters<br>Joint management<br>Tool management<br>CEUS connection to bolted joint<br>CEUS connection to tool<br>testXpert <sup>®</sup> connection |
| Languages               |  | Multilingual, selectable online  |
| Measurement uncertainty |  | < 0.5%   |
| Resolution              |  | 5-digit  |
| Memory card             |  | SD 4GB, built-in   |



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