KOMET GROUP

# Modular Assistance System

# ToolScope

TOOLS IDEAS®

# **KOMET®** BRINKHAUS ToolScope

## The assistance system for manufacturing

### A comprehensive Industry 4.0 solution for machining

The KOMET GROUP is marking a milestone for the machining industry in relation to the Industry 4.0 concept: With the introduction of firmware version 11, the ToolScope monitoring system developed by KOMET® BRINKHAUS has become a comprehensive KOMET® assistance system for production machining.

In order to offer the customer independent added value, KOMET® BRINKHAUS has developed a number of applications, known as apps, that are easy to license and activate. The developments focus on customer benefits, ease of operation and modularity.

ToolScope apps allow users to easily access and utilise the recorded machine, operating and process data. ToolScope apps offer varied options for assuring high quality, increasing availability, shortening primary processing times, reducing tool costs, producing process documentation, establishing a cloud connection, and evaluating data.

Our systems help customers around the world to detect tool breakages, analyse tool costs and operate machines with optimum efficiency. KOMET is one of a small number of tool manufacturers to offer their customers the complete package of machining solutions, tool expertise and monitoring of machining results – all from a single source.

This catalogue provides you with an overview of our products.

CONTACT
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## Basic information

### Veritable advantage ToolScope

- In contrast to software solutions::
  → No adverse effect on the machine
  → Real-time data acquisition
  → External sensors can be incorporated
- All apps can be activated modularly
- Up to 16 signals can be visualised and monitored in parallel
- Extensive process documentation, e.g. pdf
- Memory capacity ranges from 10 days to several months

### Simple incorporation into customer's IT system or KOMET cloud

- Simple provision of machine-related data for optimising manufacturing processes
- Preliminary evaluation of data, e.g. wear behaviour
- Process data is processed and visualised in physical variables
- Machine status data and tool data are provided by apps
- Easy to expand for the customer

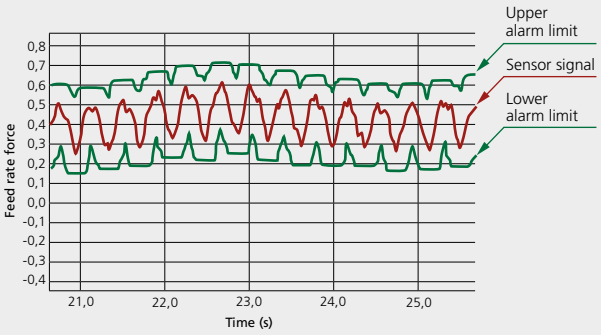
### Benefits of ToolScope

- Saved measurement data and status information can be input using Excel
- Process assurance and optimisation thanks to a range of suitable apps to choose from
- Potential for optimisations in the NC program can be discovered (reduction in primary processing time) through analysing the signal curves
- Rapid qualification of new tools, e.g. optimum cutting edge geometry
- Remote connection/remote maintenance → Global networking with tablet/PC/laptop
- Customer-specific programming
- Data analysis performed by SoftScope at the workplace/in the office

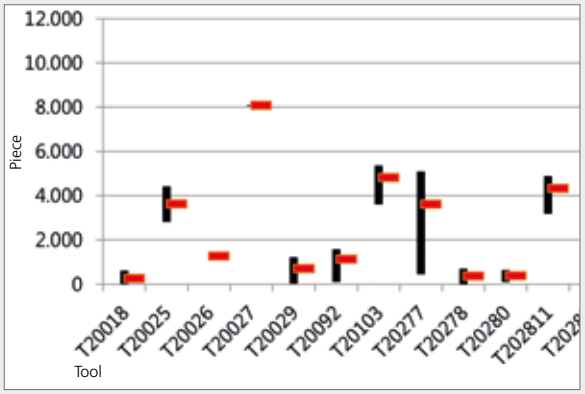
### Wide range of system usage

In addition to standard machining processes such as turning, milling, drilling, etc., the system can also be used in many other processes, e.g. reaming, grinding, punching and broaching.

### View process sequences easily online

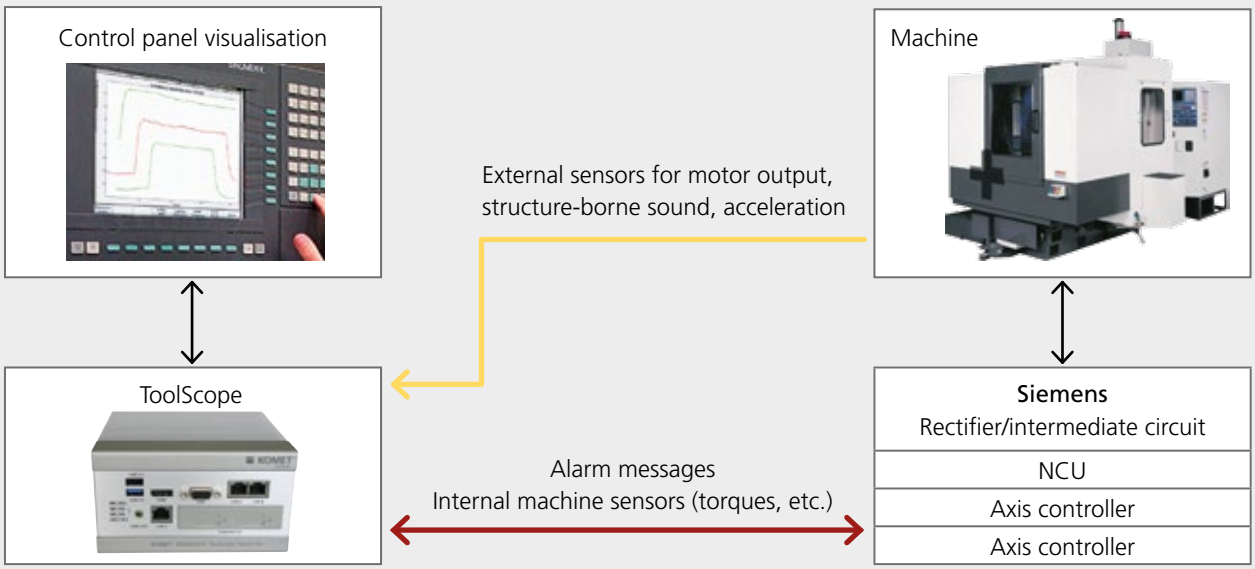



### Record tool life data



## Integration of the system into the machine tool

### Diagram showing integration




### Integration into the control system

- Control systems for which standard integration is possible:
  → Siemens 840D PL/SL, more recent than 2002 (Profibus/Profinet)
  → Heidenhain iTNC530, more recent than 2010 (Profibus only)
  → Fanuc 3xi (30i, 31i, etc.), visualisation via HMI only with OPEN CNC; (Profibus/Modbus)
  → Bosch MTX, more recent than 2010 (Profibus only)
  → Other control systems available on request
- Recording internal machine data via a digital control bus (see above)
- Additional sensors can be incorporated at any time
- Monitoring is started and stopped directly from the NC program. Either automatically during each G0/G1 change or manually via M commands.
- Complete system operability via the human-machine interface (HMI) or via external touchscreen.
- Installation and commissioning takes approx. 1-2 days and is carried out by one of our technicians (machine downtime 3-6 hours).

### Sensors and data transfer rates

- Reading out of internal machine sensors digitally, directly from the control system (with approx. 100Hz)
  → Torque
  → Feed rate speed
  → Motor current
  → Axes position
  → Workpiece number, tool number, etc.
- External sensors: Recording of any analogue signal from -10V to 10V (up to 5kHz)
  → Acoustic emission, acceleration, etc.
  → Sensor data of analogue controlled drives

### Receptiveness and data transparency for user projects

- Open system: Relevant data interfaces are documented
- Extensive use of open protocols and file formats (CSV, SQL, PDF)
- Automatic transfer of recorded measurement data and documentation to server
- Data can be accessed in real time and the machine can be influenced via documented interfaces; examples are documented in C++ and Java®
- We would be happy to develop customer-specific export filters or monitoring strategies with you

Java® is a registered trademark of Oracle.

## TS-PM app

**Tool / Process Monitoring**

### Benefits for you:

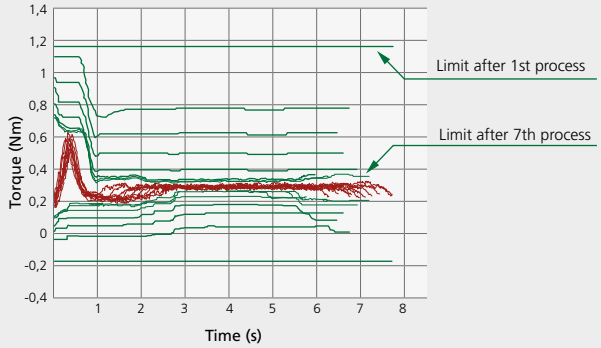
- Self-learning process monitoring with statistical tolerance bands
- Switching between various monitoring modes depending on the process
- Detecting tool breakages, missing workpieces/ tools, incorrect clamping and flaws in processes
- Reducing rejects, rework and breakages of follow-on tools
- Process visualisation provides the machine operator with rapid feedback
- Monitoring results can be documented directly

### Benefits of self-learning process control

- The TS-PM app is self-learning and does not have to be manually adjusted.
- The core elements of the app are statistical procedures which establish how comparable a process is with various learned model processes.
- The procedures take account of the usual production variations involved in any process.
- The system always suggests monitoring limits and tolerance limits, but can be manually adjusted at any time.
- With the aid of TS-PM, very close tolerance limits can be achieved which are adjusted to the production process.

### Teaching-in and monitoring

After just a few process cycles, the learning function of the TS-PM app has found the optimum tolerance limits.




### Fully automatic

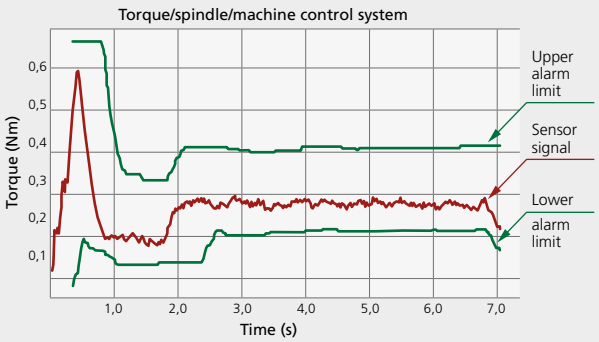
- Fully automatic is a monitoring procedure which is self-learning on the basis of statistical process control
- It is not necessary to adjust the parameters
- Quick and easy to commission. Easy to operate
- Ideal for simple series processes/series machines, e.g. automatic drills

### Fixed, adaptive tolerance limits

- Monitoring procedure which determines the optimum upper and lower alarm limits on the basis of several learning curves for the same process through statistical analyses.
- Procedure: Fixed tolerance limits:
  → Learn several process curves once only
  → Well suited to processes without major variations in wear, e.g. machining aluminium with PCD
- Procedure: Adaptive tolerance limits
  → Constant adaptation to the current process
  → Well-suited to processes with continuous variations in wear

### Taught monitoring

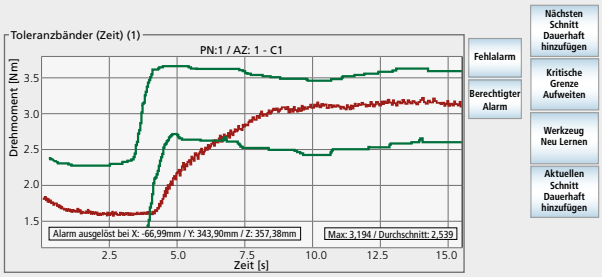
Monitoring limits after learning




### Relearn processes

It is also now particularly easy to relearn processes:

If fault alarms occur, it is not necessary to completely relearn the processes. The process identified as faulty can simply be added to the learning data.



## TS-PM app

**Tool / Process Monitoring**

Dynamic tolerance limits – Benefits for you:

- Monitoring for series processes with high variations in machining allowance, or single-part production through to small-scale series production
- With small to medium batch sizes, it is not possible to record several learning processes. Specific algorithms therefore make it possible to determine the calibration of the tolerance limits from the characteristics or properties of the front of the cutting edge (e.g. from the first 30 seconds of a process)

### Background to dynamic monitoring

Dynamic monitoring establishes the parameters necessary for the calculation of tolerance limits from the interaction between tool and material.

Using the characteristics determined in this way (e.g. speed of torque change), the tolerance limits are calibrated in accordance with the tools.

Increasing wear on tools or unmachined parts with high variations in machining allowance presents no problem for calibration.

## TS-Wear app

**Tool Wear Monitoring**

- Monitoring actual tool wear by applying a process force which is slowly increased
- Optimum utilisation of tool life quantities
- The ToolScope assistance system offers a variety of different methods for determining tool wear.

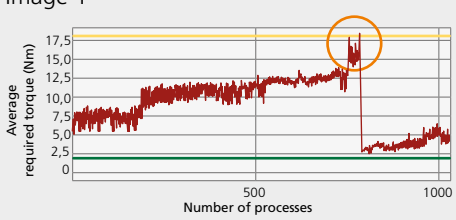
  Examples include:
  → Average torque of a complete cut
  → Average torque at a particular position or time interval
  → Average vibration level during the process when an external sensor is connected
- Together with the tool change log app (TS-TCLog), this also enables the tool life and reasons for tool change to be automatically evaluated
- The wear limit can be set by the customer in line with their specific requirements.

Image 1 clearly shows how wear on the tool leads to a wear alarm. This is the case when the red wear curve goes beyond the yellow wear limit. After the alarm, the tool is changed and the wear value falls to its initial level.

The tool in image 2, however, was not replaced, because it still has a sufficient amount of wear reserve (distance of the red wear curve from the yellow wear limit). As a result, the tools can be replaced individually according to their level of wear. Preventative tool changes are no longer necessary.

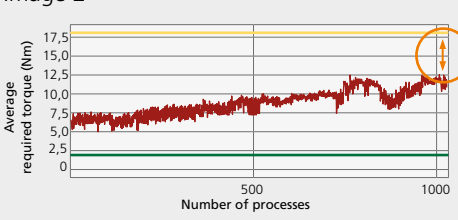
If a tool breaks unexpectedly before reaching the wear limit, this is also detected, because the lower green "Missing" limit of the tool is then not reached.

Wear history
Image 1




The wear history provides a good overview of the progression of tool wear. The tool change can be clearly identified.

Wear reserve
Image 2




The wear reserve is the distance of the red wear curve from the yellow wear limit.
The size of the history shown (number of cuts in this case: 1000) can of course be adjusted.

## TS-AFC app

**Adaptive Feed Control**

### Benefits of the control system

- Reduce cycle time
- Protect tools
- Prevent unstable process conditions
- Prevent load peaks
- Increase speed when face milling

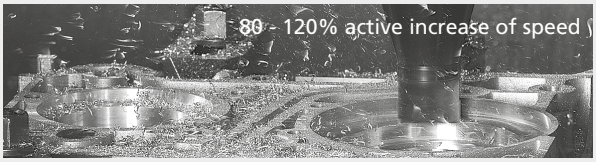
### Technical background

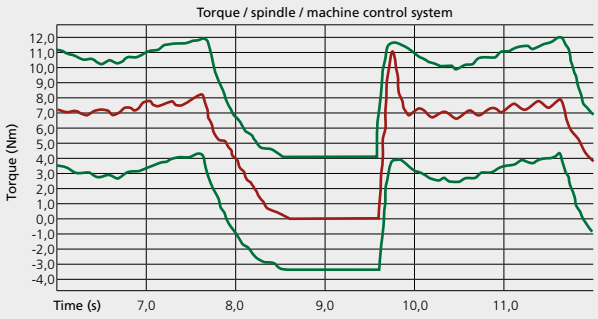
- Process variables (e.g. torque) are controlled by adjusting the process speed (change of the override speed).
- The controller output parameter is the override value of the feed speed expressed as a percentage. This override value is transferred directly to the control system.
- Control variable limitation can be parameterised (e.g to a minimum of 80% or a maximum of 120%).
- All controller parameters can be adjusted depending on the process. The control system can be switched on and off by M commands.
- Control can be specifically centred on different events, amongst others:
  - Feed rate increase in idle phases
  - Feed rate reduction in tool pockets or when chips become jammed
- In combination with vibration sensor: Fast/automatic reaction to excessive vibrations is possible

### Signal inputs and outputs

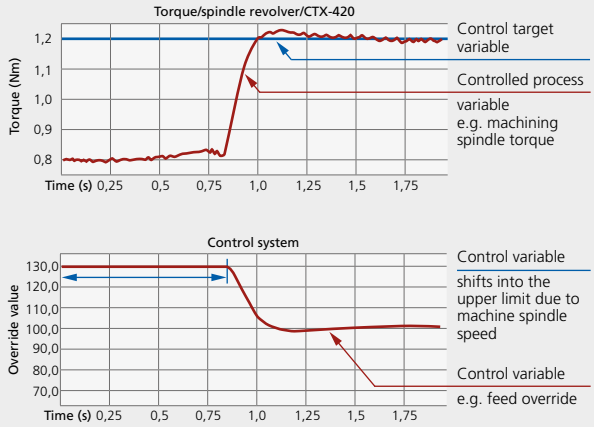
- Various upstream and downstream signal processing mechanisms, which can be parameterised, are connected to the controller which considerably increases the scope of the controller's use in machine tools.
- The input parameter of the controller can be freely selected from among the ToolScope channels.
- The settings and progression of controlled process variables and override values are continuously documented.

### Process control during milling

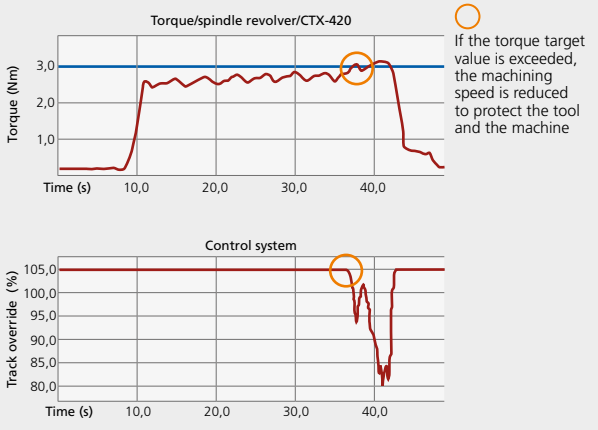



### Acceleration of primary processing time




### Tool protection



## TS-Cloud app

**Cloud Function**

The ToolScope system has a cloud function. All recorded machine/process data is firstly saved on the hard drive. The data can therefore be accessed in the company's network. The process data can be saved in the following formats: *.csv, *.png and *.pdf. The local TS memory typically contains enough storage space for around 10 days of series production (24/7)

- Transferring process data, tool change logs, etc. by pushing them via the network to the company server or KOMET cloud
- Process data can be used or analysed from any company workplace around the world
- Consistent data transparency
- Automatic cyclical and manual copy jobs
- Automatic backup of tool settings
- Exchange of monitoring parameters between machine and server
- Protocols: Windows network, FTP, SFTP

Benefits for you:

- Documentation for every monitored process
- Full ToolScope integration into your IT system
- Cloud provided by KOMET if required

## CD-xDim app

**Collision Detection**

- Repair costs can be significantly reduced as a result of triggering an emergency stop in the event of a collision
- Reduces costs and time spent in the event of a collision and reduces machine downtime
- Use of a vibration or strain sensor to detect a collision
- Detection in multiple dimensions is possible
- Triggering an emergency stop when an impact collision or blunt collision is detected
- System reaction time (emergency stop message to machine) less than 2 ms
- Direct intervention in axle release without having to go via PLC
- Can be used to reduce the insurance premium for a machine

Benefits for you:

- Significant reduction in the reaction time
- CD-xDim acts as an airbag for the machine

Collision


Collision detection with CD-xDim

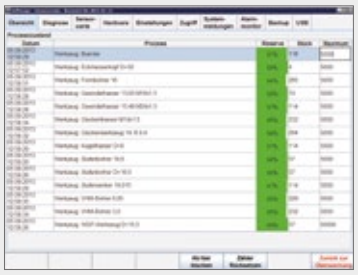
## TS-TCLog app

**Automatic Tool Change Log**

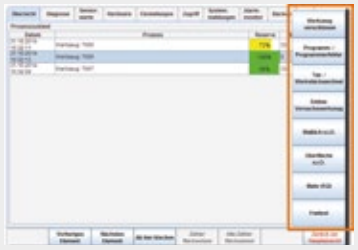
- Tool life quantity counter/counter for tool use (no. of workpieces/no. of drilled holes, etc.)
- Replaces the tool use counter for tool management
- Simple recording of the reasons for tool changes
- Tool evaluation based on wear, together with TS-Wear
- Digital replacement for the tool operation sheet
- Automatic analysis of tool life/reasons for tool changes; graphical overview of tool life distribution per tool and machine over an extended period is possible
- Potential savings are quickly revealed
- Machine-readable data export
- KOMET provides Excel examples for independent evaluation

Gather and evaluate information from the operator

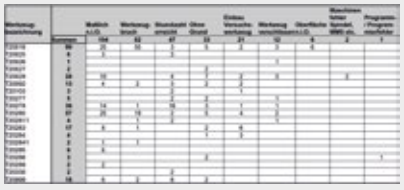
- Use the operator's knowledge of tool changes
- Simple entry of the reasons for tool changes
- Simple text-based export and evaluation of the reasons for tool changes, and the tool life



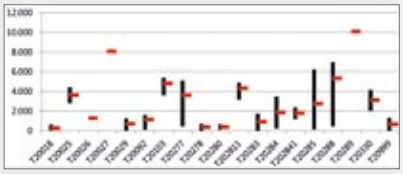
Reasons for tool changes can be defined by the customer in line with their specific requirements.



Simple evaluation of the reasons for tool changes is possible



Evaluation of tool life across all machines and machine stations

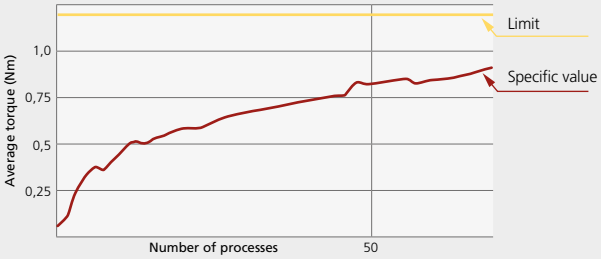


## TS-CM app

**Condition Monitoring**

The importance of the condition of the machine is underestimated all too often as a potential cause of fault. Normally, if a process ceases to run correctly, all other variables that could be responsible for the disturbance are investigated first. This app periodically records and documents the fingerprint of a machine.

Example: Friction on an axle over the course of multiple weeks




Benefits for you:

- Monitoring of sensor values inside the machine, which allow assumptions to be made about the condition of the machine, e.g. feed torques of axles in order to draw conclusions about the friction of bearings (trend values are shown)
- Monitoring vibrations on the machine and the dynamics of axles
- Recording measurement data using a special NC program which is run periodically (e.g. weekly)
- The current condition of the machine can always be viewed
- Assisting the Maintenance department when specifically looking for problems with the machine
- Maintenance measures can be planned more effectively

## TS-QRep app

**Quality Monitoring / Documentation**

Many processes depend on the quality of a manufacturing characteristic. Differences in quality can often be detected using the signals recorded by the machine control system. This app helps document process compliance.

- Automatic creation of PDFs
- PDFs document the process characteristics and relevant curves for each process
- Can be combined with software licences for common aviation standards (GEP11TF12, MTV548-3/4)
- Conclusive displays are oriented towards the requirements of a certifying agent

Benefits for you:

- **Customer-specific expansions of interfaces with QS systems**

## TS-MDA app

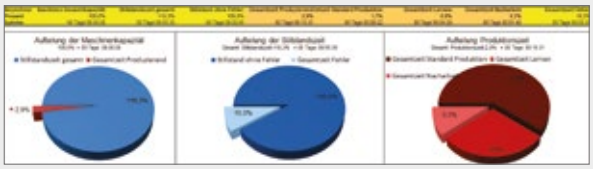
**Automatic Shift Log**

The TS-MDA app collects all of your machine's operating status data for you. The app records status data and writes it in a computer-readable format. The log files are created in such a way that they can be imported into standard evaluation tools and databases.

Examples of data collected for you:

- Active program
- Active tool
- Whether the machine is stationary
- Whether processes are learned
- Whether monitoring has output a fault

The data can be used for statistics within the company. KOMET provides you with Excel examples which import the related data to allow for faster start-up. Our examples generate diagrams about machine utilisation based on your data.



## Unique feature: Offline testing

**Offline analysis tool**

Simulation environment for the assistance system

- Simulation environment can be downloaded free of charge
- Can be used for training and test purposes
- Offline analysis tool for offline visualisation and analysis of recorded process data
- Offline optimisation of process settings, i.e. make adjustments to the assistance system offline
- Significant reduction in machine downtime during process optimisation
- Simple reloading of settings on ToolScope after optimisation

## Additional benefit of KOMET: Our service

**Optimisation as a service**

If our customers can see a need to optimise manufacturing but have neither the time nor the capacity to do so, we can help.

- The only tool manufacturer with expert knowledge in machining tools, machining processes and process monitoring.
- KOMET® is optimising its use of tools, its process times and its production method
- Shortening cycle time by developing combination tools, modifying NC programs and maintenance performed by KOMET®
- KOMET® is not content with being just another tool manufacturer; we want to offer product properties with a consistent quality. Example: A specific number of threads of specific quality for a specific price.
- Wide range of maintenance agreements and leasing agreements for our assistance system, alongside other types of support.

**Simply ask us.**

# KOMET® BRINKHAUS ToolScope

## Technical data

### ToolScope hardware

Configure your hardware:

**E65 1 A B C r**

The resulting order variants cannot be produced due to the hardware:

**E65 1A22r**
**E65 1A41r**
**E65 1A42r**

**A Select an operating system**
2 = Basic operating system, without apps
3 = Basic operating system, without apps, lite (max. 2 windows)

**B Select a hardware version**
2 = DIN rail version
3 = 6.5" touch panel PC
4 = 10" touch panel PC
5 = 12" touch panel PC
6 = 15" touch panel PC

**C Select equipment**
0 = Fieldbus Profibus
1 = Fieldbus Profinet
2 = Additional network port

r Internal revision number

| ToolScope Software | | Order No. |
|---|---|---|
| | **TS-PM app**: Monitoring with tolerance bands<br>Licence bits #2, #6, #7 | E65 21090 |
| | **TS-Wear app:** Wear monitoring with trend display<br>Licence bits #4, #5 | E65 21100 |
| | **TS-AFC app:** Adaptive feed control<br>Licence bits #2, #8 | E65 21030 |
| | **TS-Cloud app:** Ability to access local and external clouds<br>Licence bits #13, #26, #31 | E65 22140 |
| | **TS-MDA app: :** Data export for automatic shift log<br>Licence bit #30 | E65 25030 |
| | **TS-TCLog app:** Data export and data collection for tool change log<br>Licence bit #29 | E65 22040 |
| | **TS-QRep app:** Process documentation with PDFs<br>Licence bit #17 | |
| | **TS-CM app:** Detection of changes to the machine's condition<br>Licence bits #4, #5 | E65 21060 |
| | Multi-NC channel expansion (>1 channels via Fieldbus, >8 sensors via Fieldbus), licence bits #16, #32 | E65 21050 |
| Language | **Italian**, licence bit #20 | E65 22150 |
| | **Spanish,** licence bit #21 | E65 22160 |
| | **French,** licence bit #22 | E65 22170 |
| | **Russian,** licence bit #23 | E65 22180 |
| | **Polish,** licence bit #24 | E65 22190 |
| | **Chinese,** licence bit #25 | E65 22200 |
| | **Japanese,** licence bit #26 | E65 22210 |
| | **Hungarian,** licence bit #28 | E65 22220 |
| Licence bits | Monitoring in accordance with aviation standards GEP11TF12, licence bit #9 | E65 22100 |
| | Monitoring in accordance with aviation standards MTV548, licence bit #12 | E65 22110 |
| | Filter: Signal processing script, licence bit #27 | E65 22060 |
| | Q-DAS export of monitoring data, licence bit #33 | E65 22070 |
| | Automatic backup on network drive, licence bits #31, #13 | E65 22080 |
| | 1 additional window in the monitoring area, licence bit #14 | E65 22120 |
| | >1 additional window in the monitoring area, licence bit #15 | E65 22130 |

| ToolScope IO | Order No. |
|---|---|
| **IO package:**<br>**Bus coupler + analogue input 4x16 bit, ±10 V + digital input 8x24 V** | E65 19000 |
| **IO package**<br>**Bus coupler + 8x analogue input, 4x analogue output, 32x digital input, 16x digital output** | E65 19060 |
| Individual parts: | |
| EtherCAT bus coupler | E65 19010 |
| Analog Input 4x16Bit, ±10V | E65 19020 |
| Analog Output 4x12Bit, ±10V | E65 19030 |
| Digital Input 8x24V | E65 19040 |
| Digital output 8x24 V, 0.5 A per channel | E65 19050 |

| Firmware/basic operating system | Order No. |
|---|---|
| SoftScope – ToolScope firmware on Windows PCs, licence | E65 24010 |

| Sensors/measurement converters | Order No. |
|---|---|
| Effective power: Unipower APM380 | E65 44020 |
| Current sensor, one-phase | E65 44030 |
| IFM one-axis acceleration sensor VSA004 – 10 m cable | E65 40031 |
| IFM one-axis acceleration sensor VSA004 – 30 m cable | E65 40050 |
| CD202 two-channel collision monitor and RMS evaluation | E65 50040 |
| CD303 three-channel collision monitor and RMS evaluation | E65 50050 |
| VC2409 – voltage converter | E65 60060 |
| Measuring adapter for CD202 | E65 60070 |

| Packages | Order No. |
|---|---|
| ToolScope basic system with standard apps for process monitoring on machine tools E65 01013 (Profibus) | E65 01013 |
| ToolScope basic system with standard apps for process monitoring on machine tools E65 01013 (Profinet) | E65 01093 |
| ToolScope basic system touch panel PC without A/D IO | E65 01052 |
| CD-xDim: Collision/vibration monitoring | E65 04020 |
| Measurement and diagnostics case based on ToolScope #2, #4, #5, #6, #8 | E65 04041 |
| Housing for touch panel/TPPC with stationary base | E65 65040 |
| Housing for touch panel/TPPC with rolling base | E65 65060 |
| Housing for touch panel/TPPC with tilt adapter | E65 65070 |

| Manuals, documents | Order No. |
|---|---|
| Printed V10 TS firmware manual, DE | E65 61000 |
| Printed V10 TS firmware manual, EN | E65 61010 |
| Printed CD202 manual, DE | E65 61020 |
| Printed CD202 manual, EN | E65 61030 |

## Technical data

| Expansion hardware for networks and visualisation | Order No. |
|---|---|
| **Wireless expansions** | |
| Wireless expansion for computers with TS firmware – small, plug&play | E65 62000 |
| Wireless expansion for computers with TS firmware – large, control cabinet installation | E65 62010 |
| **Remote control panels** | |
| Rugged Windows PC for remote control/training on TS in the field | E65 12110 |
| Touch panel PC, 10", 24 V, with Windows as TSVNC client | E65 12080 |
| Touch panel PC, 12", 24 V, with Windows as TSVNC client | E65 12090 |
| Touch panel PC, 15", 24 V, with Windows as TSVNC client | E65 12100 |
| **Touch panels** | |
| TS accessories: 12" touch panel for connection via VGA | E65 12070 |
| TS accessories: 15" touch panel for connection via VGA | E65 12031 |
| USB/VGA extension | E65 66100 |

| Commissions and third-party licences | | Order No. |
|---|---|---|
| **Siemens** | | |
| | TPM compile cycle | |
| | 840D sl: 6FC5800-0AM62-0YB0 | E65 30010 |
| | 840D pl: 6FC5251-0AE71-0AA0 | E65 30020 |
| | Evaluation of internal drive variables<br>Required for sending signals to ToolScope without compile cycle | |
| | 840D pl: 6FC5251-0AB17-0AA0 | E65 30050 |
| | 840D sl: 6FC5800-0AM41-0YB0 | E65 30060 |
| | Synchronous actions: Up to 255<br>Required for TS-AFC and in order to use E65 30050/E65 3060, if a licence for synchronous actions has not been granted | E65 30030 |
| **Siemens: Other** | | |
| | SINUMERIK HMI sl Runtime OA program 6FC5800-0AP60-0YB0<br>Required for ToolScope visualisation on 840D operate | E65 30040 |
| | Commissioning of Siemens technology card upgrade by KOMET | E65 30021 |
| **Heidenhain** | | |
| | Remote Desktop Manager; option no. 133<br>Required for ToolScope visualisation on Heidenhain interface | E65 30070 |
| **Training** | | |
| | Intensive training for operating personnel | E65 75010 |
| | Creation of a customised quick guide | E65 77020 |
| **Service** | | |
| | Technical preliminary clarification of tool commissioning | E65 70030 |
| | Service for installation/PLC integration of the tool | E65 71021 |
| | Service for process commissioning | E65 71023 |
| | One day of general service | E65 76010 |
| | One day of general service outside working hours | E65 71060 |
| | One day of general service at the weekend | E65 71070 |
| **Packaging/shipping** | | |
| | Small parts | E65 60000 |
| | Packaging and shipping | E65 71060 |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W80 [42030.088430]
Ø 40 mm

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39901 80500-1T-08/17 Printed in Germany www.wachter.de 

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