KOMET KomTronic® U-Axis system
Economic turning contours on the machining centre when working with a stationary workpiece
KOMET KomTronic® U-Axis system
Replaces separate machining on a lathe

Benefits for you:

- **Lower investment costs**
  - Use of standard instead of special machines
  - Reduction in number of tools
  - No need for clamping devices for finish machining on turning machines

- **Reduced unit costs**
  - Complete machining on one machine.
  - Reduction in machining and throughput times
  - Savings on tool changes
  - Replacement of time consuming circular machining operations
  - Reduced holding times
  - High cutting capacity

- **Lower operating costs**
  - Complete machining on one machine without the workpiece being rotated
  - Minimum power consumption because of U-Axis systems

Machining examples

- Grooving
- Turning valve seats
- Undercutting differential housing
- Bore with coolant passages
- Bearing seat
- Tie rod
- Contour turning, external and internal contour turning
Tool-changeable NC axes for machining centres:

The freely programmable KomTronic® U-Axis system make any contour and turning operations possible on non-rotationally symmetrical parts. Combined with custom-made front tools and the optimum selection of inserts, contours in bores and external machining operations can be successfully carried out. This allows a considerable reduction in production times, with better surface quality and greater accuracy of form. Further savings in time and costs can also be achieved by reducing the number of tools previously required - for example, circular milling a complex internal contour with various form milling tools. The saving in form milling tools and tool changes this achieves also reduces production time and production costs.

Greatly reduced processing times and higher precision

KomTronic® U-Axis systems essentially consist of one compact facing head with single slide that is driven by a servo motor and threaded spindle. The power supplied to the electronics and the drive is transmitted contact-free and inductively to the U-Axis system. Similarly, the data is exchanged inductively with the U-Axis system. A so-called stator is mounted on the spindle side. It is segment-shaped, which permits the U-Axis tools to be changed in and out automatically. The ring-shaped inductive transmission unit on the U-axis side ensures proper data and energy exchange in every angular position. Thanks to the freely programmable cutting edge that is dynamically adjustable during machining, the mechatronic U-Axis systems are automatically changeable NC-axes. Programming is carried out in the usual NC programming language with all its functions and is integrated into the machine control system.

We are also pleased to answer questions via e-mail at KomTronic@kometgroup.com.
KOMET KomTronic® High-Performance-System HPS-115

- With position sensor direct on slide
- With centrifugal force and imbalance compensation
- Spindle speed $n_{\text{max}} = 8000 \text{ min}^{-1}$

HPS-115-HSK32-8

Technical data
- Stroke: 8 (±4) mm, tool connection HSK 32
- External diameter: 115 mm
- Weight: 6.8 kg (with HSK 63); 6.9 kg (with taper shank SK 40)
- Max. feed: within ± 2 mm stroke 400 mm/min above decreasing
- Max. spindle speed: $8000 \text{ min}^{-1}$ (> $6000 \text{ min}^{-1}$ duty = 40%)
- With internal coolant: 40 bar – MQL possible
- Compact design
- Increased accuracy by position sensor direct at the slide

$n_{\text{max}} = 8.000 \text{ min}^{-1}$

Max. stroke/spindle speed diagram up to 0.8 kg front tool with centrifugal force and imbalance compensation

See page 18 for more application details!
Protection class: IP67
Operating modes: full NC axis for interpolation

Together with KOMET® front tooling and KOMET® inserts, the KomTronic® high-performance-system opens up machining possibilities which until now would have been unthinkable on a machining centre.
KOMET KomTronic® U-Axis-System
The u-axis for tool changing

UAS-115-Z-22

Technical data
• U-Axis tool 22 mm stroke with toothed tool connection
• External diameter: 115 mm
• Weight: 6.4 kg (with HSK63)
• Max. feed: 350 mm/min
• Max. spindle speed: 750-4000 min⁻¹, depending on slide position (see stroke/spindle speed diagram)
• With internal coolant: 40 bar
• Optional with direct measuring system on slide

Order No. Article Connection L1 L2
E21 20010 UAS-115-HSK63-E-Z-22-2 HSK63 178 42
E21 22010 UAS-115-SK40-E-Z-22-2 SK40 171 35
E21 24010 UAS-115-CAT40-E-Z-22-2 CAT40 171 35
E21 26010 UAS-115-BT40-E-Z-22-2 BT40 178 42

See page 18 for more application details!
Protection class: IP67
Operating modes: full NC axis for interpolation

Together with KOMET® front tooling and KOMET® inserts, the KomTronic® u-axis-system opens up machining possibilities which until now would have been unthinkable on a machining centre.
KOMET KomTronic® U-Axis-System
The u-axis for tool changing

UAS-160-Z-22

Technical data
• U-Axis tool 22 mm stroke with toothed tool connection
• External diameter: 160 mm
• Weight: 14.2 kg (with HSK100)
• Max. feed: 250 mm/min
• Max. spindle speed: 750–4000 min⁻¹, depending on slide position (see stroke/spindle speed diagram)
• With internal coolant: 40 bar

<table>
<thead>
<tr>
<th>Order No.</th>
<th>Article</th>
<th>Connection</th>
<th>L1</th>
<th>L2</th>
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<td>E21 33010</td>
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<td>BT50</td>
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</table>

Max. stroke/spindle speed diagram up to 2.5 kg front tool incl. adaptor

See page 18 for more application details!
Protection class: IP67
Operating modes: full NC axis for interpolation

Together with KOMET® front tooling and KOMET® inserts, the KomTronic® u-axis-system opens up machining possibilities which until now would have been unthinkable on a machining centre.

Patent applied for inside and outside Germany
KOMET KomTronic® U-Axis-System
The u-axis for tool changing

UAS-160-Z-50

Technical data
• U-Axis tool 50 mm stroke with toothed tool connection
• External diameter: 160 mm
• Weight: 13,3 kg (with HSK100)
• Max. feed: 250 mm/min
• Max. spindle speed: 560–4000 min⁻¹, depending on slide position (see stroke/spindle speed diagram)
• With internal coolant: 40 bar
• Versions with other strokes on request

Technical data
• U-Axis tool 50 mm stroke with toothed tool connection
• External diameter: 160 mm
• Weight: 13,3 kg (with HSK100)
• Max. feed: 250 mm/min
• Max. spindle speed: 560–4000 min⁻¹, depending on slide position (see stroke/spindle speed diagram)
• With internal coolant: 40 bar
• Versions with other strokes on request

See page 18 for more application details!
Protection class: IP67
Operating modes: full NC axis for interpolation

Together with KOMET® front tooling and KOMET® inserts, the KomTronic® u-axis-system opens up machining possibilities which until now would have been unthinkable on a machining centre.
KOMET KomTronic® U-Axis-System

Machining examples

Workpiece: differential housing

Benefits for you:
- Flexibility
- Saves on expensive blanking
- Replaces separate machining on a lathe and thus eliminates the need for a clamping device
- Increase in quality

Machining: turning an inside radius
Cutting speed \( v_c = 80 \text{ m/min} \)
Feed \( f = 0,1 \text{ mm/rev.} \)
Cutting width 1st cut \( a_p = 1,5 \text{ mm} \)
2nd cut \( a_p = 0,2 \text{ mm} \)
Radial stroke 10 mm

Machining: rear planing
Cutting speed \( v_c = 80 \text{ m/min} \)
Feed \( f = 0,12 \text{ mm/rev.} \)
Cutting width \( a_p = 0,3 \text{ mm} \)
Radial stroke 14,5 mm

Workpieces can be completely machined with high precision and cycle time savings utilising these options for turning, undercutting, chamfering and generation of NC controlled contours.
Workpiece: control block

Machining: turning an inside taper

BENEFITS for you:
- Replaces separate machining on a lathe and thus eliminates the need for a clamping device
- Reduced production times
- Increase in quality

The material Inconell 625 was applied to a tapered hole and machined in 2 cuts.

<table>
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<tr>
<th>Cutting speed $v_c$</th>
<th>30 m/min</th>
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<tbody>
<tr>
<td>Feed $f$</td>
<td>0.08 mm/rev.</td>
</tr>
<tr>
<td>1st cut $a_p$</td>
<td>2.5 mm</td>
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<tr>
<td>2nd cut $a_p$</td>
<td>0.5 mm</td>
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</tbody>
</table>

Workpiece: wheelmount

Machining: reverse taper machining

BENEFITS for you:
- Complete machining on one machine
- Replaces separate machining on a lathe and thus eliminates the need for a clamping device
- Reduced processing times
- Increase in quality

The material is Cast aluminum.

<table>
<thead>
<tr>
<th>Cutting speed $v_c$</th>
<th>150 m/min</th>
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<tr>
<td>Feed $f$</td>
<td>0.08 mm/rev.</td>
</tr>
<tr>
<td>Taper angle $\alpha$</td>
<td>9.5° ± 0.05°</td>
</tr>
</tbody>
</table>

Workpieces can be completely machined with high precision and cycle time savings utilising these options for turning, undercutting, chamfering and generation of NC controlled contours.
KOMET KomTronic® U-Axis-System

Machining examples

Workpiece: bearing plate
Machining: turning a bearing plate

BENEFITS for you:
- Reduced processing time
- Reduced tool change time
- Reduced tool costs
- Complete machining
- Flexibility
- Higher precision and process reliability

Material 42CrMo4
Variable diameter

Workpiece: control block
Machining: complete machining on one turning/milling centre

BENEFITS for you:
- Reduced production time
- Reduced tool costs
- Flexibility
- Increase in quality

Material 42CrMo4

Workpiece: control block
Machining: turning an outer contour

BENEFITS for you:
- Complete machining on one machining centre
- Replaces separate machining on a lathe and thus eliminates the need for a clamping device
- Reduced production times
- Increase in quality

Material: Inconel

Workpieces can be completely machined with high precision and cycle time savings utilising these options for turning, undercutting, chamfering and generation of NC controlled contours.
Workpiece: Turbocharger

BENEFITS for you:
- Complete machining on one machine
- Reduced processing time
- Reduced tool costs
- Reduced additional costs
- Flexibility
- Increase in quality

Workpiece: joint plate

Machining: taper machining with radius contour

BENEFITS for you:
- Reduced processing time
- Reduced tool costs
- Reduced production time
- Higher quality and process reliability

Material: Titan

Cutting speed \( v_c = 50 \text{ m/min} \)
Feed \( f = 0,05 \text{ mm/rev.} \)

Workpieces can be completely machined with high precision and cycle time savings utilising these options for turning, undercutting, chamfering and generation of NC controlled contours.
Workpiece: hydraulic cylinder

Machining: springing valves
Boring inner contours and recesses with 2 U-axis systems

**BENEFITS for you:**
- Reduced processing times
- Reduced tool change times
- Reduced tool costs
- Reduced additional costs
- Flexibility

Material: X12CrMoS17

Feed
\[ f = 0.1 - 0.15 \text{ mm/rev.} \]
Spindle speed
\[ n = 2000 \text{ min}^{-1} \]

Complete machining in a closed process chain
Turning and measuring on the machining centre

Complete machining:
- No switching to a turning machine
- Saving on tools, no special tools required
- Higher quality

Measuring of fits:
- Precision measurement using a direct measuring system in a barrel gauge or calliper
- Automatic test cut possible

Workpieces can be completely machined with high precision and cycle time savings utilising these options for turning, undercutting, chamfering and generation of NC controlled contours.
Workpiece: Valve housing

BENEFITS for you:
- Contour-finish machining with a single tool
- Optimum cutting speed thanks to higher rpm, made possible by balance compensation
- High accuracy using a direct measuring system on the slide
- Easy contour modifications possible using NC program

Material: die-cast aluminium
Feed \( f = 0.05 \text{ mm/rev} \)
Spindle speed \( n = 8000 \text{ min}^{-1} \)
Cutting speed \( v_c = 240 \text{ mm/min} \)
Cutting width \( a_p = 0.3 \text{ mm} \)

Material: aluminium
Feed \( f = 0.04 \text{ mm/rev} \)
Spindle speed \( n = 5800 \text{ min}^{-1} \)
Cutting speed \( v_c = 220 \text{ mm/min} \)
Cutting width \( a_p = 0.4 \text{ mm} \)

Workpieces can be completely machined with high precision and cycle time savings utilising these options for turning, undercutting, chamfering and generation of NC controlled contours.
Valve seat machining

BENEFITS for you:
- Machining on standard machines instead of special purpose machinery
- Prototype production, engine reconditioning
- Turning contours in a large range, in one large operation
- Increase in quality
- Increase in productivity

U-axis integrated in the spindle
Valve seat machining with Serdi machine

Workpieces can be completely machined with high precision and cycle time savings utilising these options for turning, undercutting, chamfering and generation of NC controlled contours.
KOMET KomTronic® U-Axis system
Modular systems: modular tool holders

The front tool can be mounted directly onto the slide. The following adaptors are available when using standard tools (others available on request):

<table>
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<tr>
<th>Order No.</th>
<th>ABS-N</th>
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<th>L1</th>
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Further adaptors on request.

Integration of the KomTronic® U-Axis system into different machine control systems

<table>
<thead>
<tr>
<th>Control system</th>
<th>Manufacturer</th>
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<tr>
<td>SINUMERIK 840 C</td>
<td>SIEMENS</td>
</tr>
<tr>
<td>SINUMERIK 840 D</td>
<td>SIEMENS</td>
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<tr>
<td>SINUMERIK 840 Di isl</td>
<td>SIEMENS</td>
</tr>
<tr>
<td>FANUC 15i / 16i / 18i / 21i / 150i / 160i / 180i / 210i</td>
<td>FANUC</td>
</tr>
<tr>
<td>FANUC 30i / 31i / 32i / 300i / 310i / 310is / 320i</td>
<td>FANUC</td>
</tr>
<tr>
<td>HEIDENHAIN TNC 426 / TNC 430</td>
<td>HEIDENHAIN</td>
</tr>
<tr>
<td>HEIDENHAIN iTNC 530 / iTNC 530 HSCI</td>
<td>HEIDENHAIN</td>
</tr>
<tr>
<td>MillPlus</td>
<td>INDAMAT</td>
</tr>
<tr>
<td>INDRAMAT MTC-200 V18</td>
<td>INDRAMAT</td>
</tr>
<tr>
<td>INDRAMAT MTX</td>
<td>INDRAMAT</td>
</tr>
<tr>
<td>Mazatrol Matrix</td>
<td>MAZAK</td>
</tr>
</tbody>
</table>

Nothing new for programming ...
KOMET KomTronic® UAS-115 and HPS-115
Schematic system overview

On machine / spindle

In electrical cabinet

PLC: 13 E 4 A

NC: analogue axis module

48 V connection line (KOMET) Ø 11,1 mm

Bus line (KOMET) Ø 8,2 mm

Power pack 48V

115/230 V 240 W from the machine

24 V 0,5 A from the machine

Machine manufacturer

1 PLC connection
13 inputs and 4 outputs are required on the PLC.
3 M-commands are required for selecting u-axis functions.

2 Nominal value requirement
±10 V nominal speed value from analogue axis module of NC control to the KOMET® NCA.

3 Incremental actual position value
The current position is transmitted from the KOMET® NCA to the analogue axis module for the NC control. The following signal forms are available
• TTL level (5 V) in acc. with RS 422, interpolated, square signal form
• 1 Vpp (1 V peak to peak), sine signal form

The KomTronic® u-axis system does not need a power unit on the NC control.
1. PLC connection
   11 inputs and 3 outputs are required on the PLC. 3 M-commands are required for selecting U-Axis functions.

2. Nominal value requirement
   ±10 V nominal speed value from analogue axis module of NC control to the KOMET NCA.

3. Incremental actual position value
   The current position is transmitted from the KOMET NCA to the analogue axis module for the NC control. The following signal forms are available:
   - TTL level (5 V) in acc. with RS 422, interpolated, square signal form
   - 1 Vpp (1 V peak to peak), sine signal form

The KomTronic® U-Axis system does not need a power unit on the NC control.
In order to ensure that the KomTronic® U-Axis system is correctly incorporated into the machine and is able to carry out the required functions, the customer must provide clarification and comply with the necessary requirements:

1. Fitting the stator for non-contact power and data transmission to the KomTronic® U-Axis system. Care should be taken to ensure that no conflict occurs with other parts of the machine, the tool changer or similar units. KOMET’s obligations do not include provision of the adaptor element for the stator unit.

2. The customer will supply the inputs and outputs required for the KomTronic® U-Axis system on the machine side. The analogue axis unit required for operation with the U-Axis must be provided and configured for the machine control system by the customer.

3. The customer must carry out the necessary software adjustments for the machine sequence control before the installation.

4. Function clarification: Process requirements must be met with reference to machine and processing concept. For example cycle times and machining data must be clarified. The tool changer must be designed for the tool weight and the tool must fit into the tool magazine.

KOMET® will provide the necessary assistance for clarification of the tasks as stated.

Note: The technical notes provided in the application details depend on the environmental and application conditions (such as machine, environmental temperature, lubrication/coolant used and desired machining results); these are based on proper application conditions, use and compliance with the spindle speed limits given for the tools.
Requirements for successful project planning for KomTronic® u-axis systems:
Before detailed clarification of the machining task the following questions on the machine and NC control system need to be answered positively.

1. Questions relating to machine
   • Can the NC control be fitted with an analogue servo interface?
   • Is the machine manufacturer prepared to adapt the machine?
The customer normally needs to ask the machine manufacturer to adapt the machine. There will be additional costs for the work carried out by the machine manufacturer. Depending on the age of machines which are already installed, machine manufacturers may not be prepared to carry this out. The PTP method is available for simple feed movements. In this case no analogue servo interface will be required.
   • Stator: is there sufficient space on the spindle to fit this? Check cable length limit 2 m or 5 m. Can tools be automatically changed without colliding with the stator? Stator holder must be provided by the customer/machine manufacturer.
   • Automatic tool changer: is the changeover weight sufficient?
     Normally for HSK 100/ISO 50 – machines 25 kg no problem. For HSK 63/ISO 40 machines the changeover weight is sometimes not sufficient. For some applications the changeover speed needs to be reduced.
     Does the tool fit into the magazine? Normally adjacent spaces need to be kept free.

2. Questions relating to part being machined
   • Is the stroke sufficient for the operation?
     Range of parts? If parts of different sizes are to be machined, will the stroke be sufficient for all the parts?
   • Maximum spindle speed?
     On KomTronic® tool change systems with a single slide, the speed must be reduced as the slide is extended. Rule of thumb for spindle speed: 2500 / √stroke. See stroke – spindle speed diagram for tool heads.
   • Permissible tool weight and length?
     No figures defined as yet. These will be calculated by our engineers or trial department.

Machine

<table>
<thead>
<tr>
<th>Spindle connection:</th>
<th>Control system:</th>
</tr>
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<tbody>
<tr>
<td>Manufacturer:</td>
<td>Control type:</td>
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<tr>
<td>Type:</td>
<td>Control No.:</td>
</tr>
<tr>
<td>Machine No.:</td>
<td>Year of machine construction:</td>
</tr>
<tr>
<td>Max. change weight:</td>
<td>Maximum permissible tool length?:</td>
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</table>

Parts to be machined

<table>
<thead>
<tr>
<th>Surface quality required:</th>
<th>Cpk value:</th>
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<tbody>
<tr>
<td>Tolerances:</td>
<td>Stroke:</td>
</tr>
<tr>
<td>Cycle time:</td>
<td>Affecting cycle time?</td>
</tr>
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Machine preparation: See “Requirements for u-axis Installations” and “Conditions”

This order is subject to the conditions of supply and payment for the KOMET GROUP GmbH and to the installation and commissioning requirements for KomTronic® products.