OPERATING INSTRUCTIONS
Design and Functions

INDEX

Design and Functions of the Machine

INDEX C42, C65

Control INDEX C200-4D

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Note on applicability

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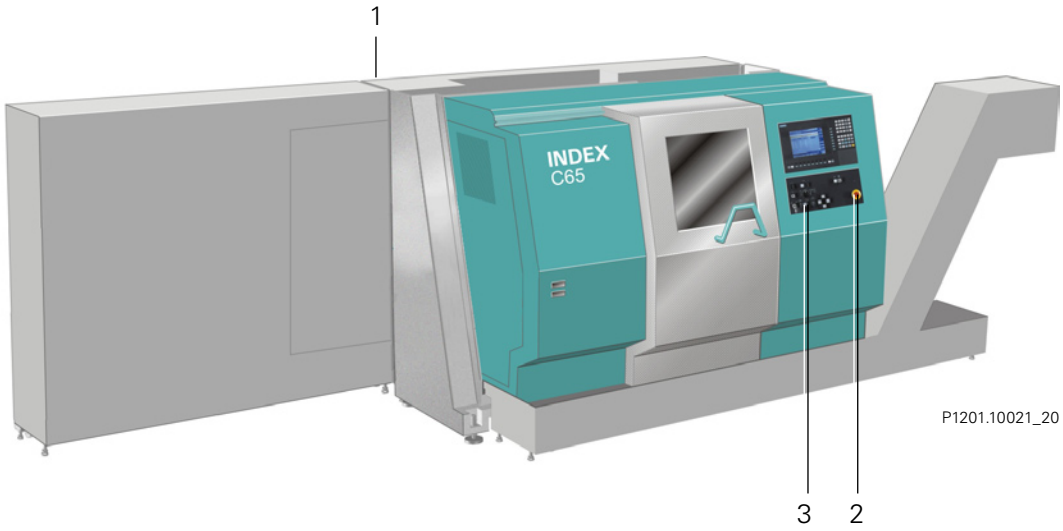
General description

The machine has a cast iron slanting machine bed.
The max capacity of the spindle for bars is 42 mm with the C42 and 65 mm with the C65.



1 Main switch
2 EMERGENCY STOP button
3 Operating pane

The machine can be equipped with up to 3 turrets that can have X-, Z-. Y- axes and a B-correction axis (±1 degree).

The optional Y-axis has a total travel of 70 mm (+40/-30).

The B-axis is a correction axis that can be swiveled within a range of +/-1 degree. It serves, for instance, for the correction of the tool position. It exists too on machines without a Y-axis.

With the cycle L100 (basic program position) the B-axes are automatically positioned to 0°.

For travels refer to the "Working Area Drawings" in the chapter "Technical data".

Guiding plate system

The guiding plate system of the tool carriers slides directly on the machine bed driven by a struts system.

4 ceramic coated steel strips

5 hardened cast iron plate

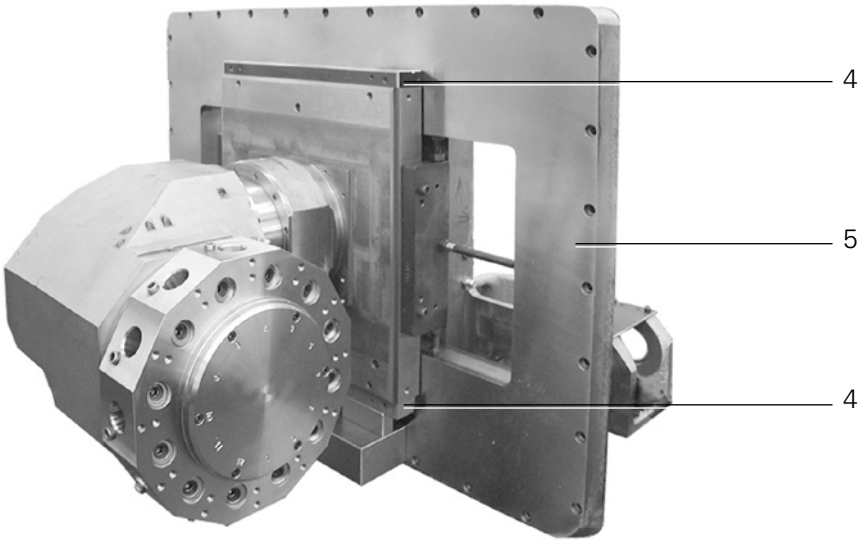


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Fig.: Guiding plate system tool carrier 1

Counter spindle

There is the choice between a design with a Z-axis or X- and Z-axes.

When the counter spindle is equipped with X- and Z-axes there are the following additional functions available:

- **Polygon turning**
  In this case the hob is mounted directly on the face of the clamping means receptacle.

- **Simultaneous rear end machining**
  By a coupling with the turret 7 (superimposed axis coupling) the counter spindle follows automatically the turret movements and thus enables a simultaneous rear end machining.

The Z- and X-axes of the counter spindle run easily and play free on linear antifriction guides.

The axis drive consists of a ball screw drive, a motor, a belt drive and a safety brake.

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Fig.: Counter spindle and hob

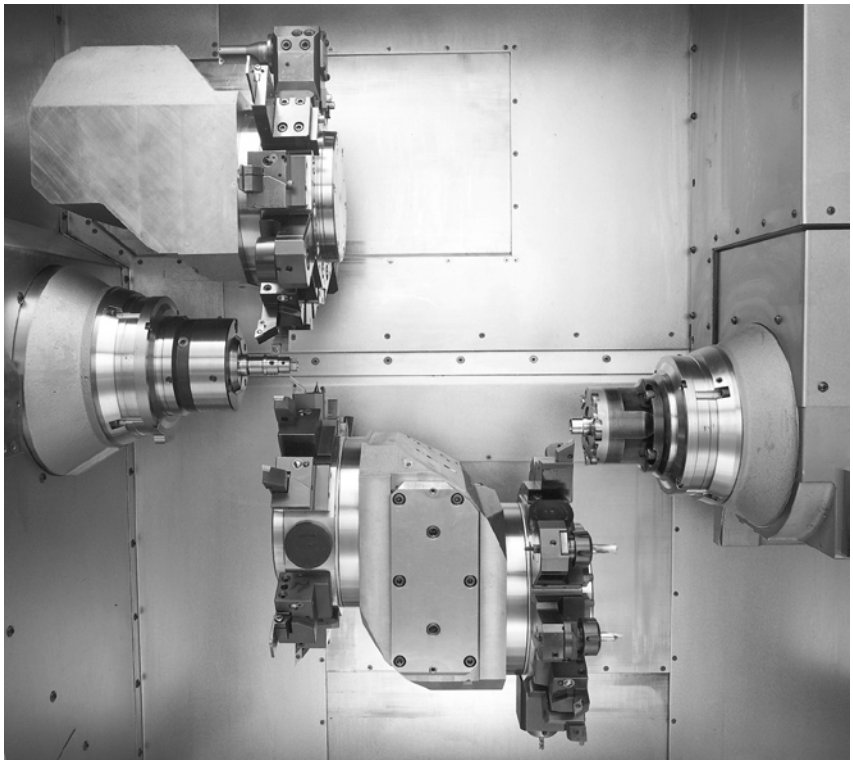

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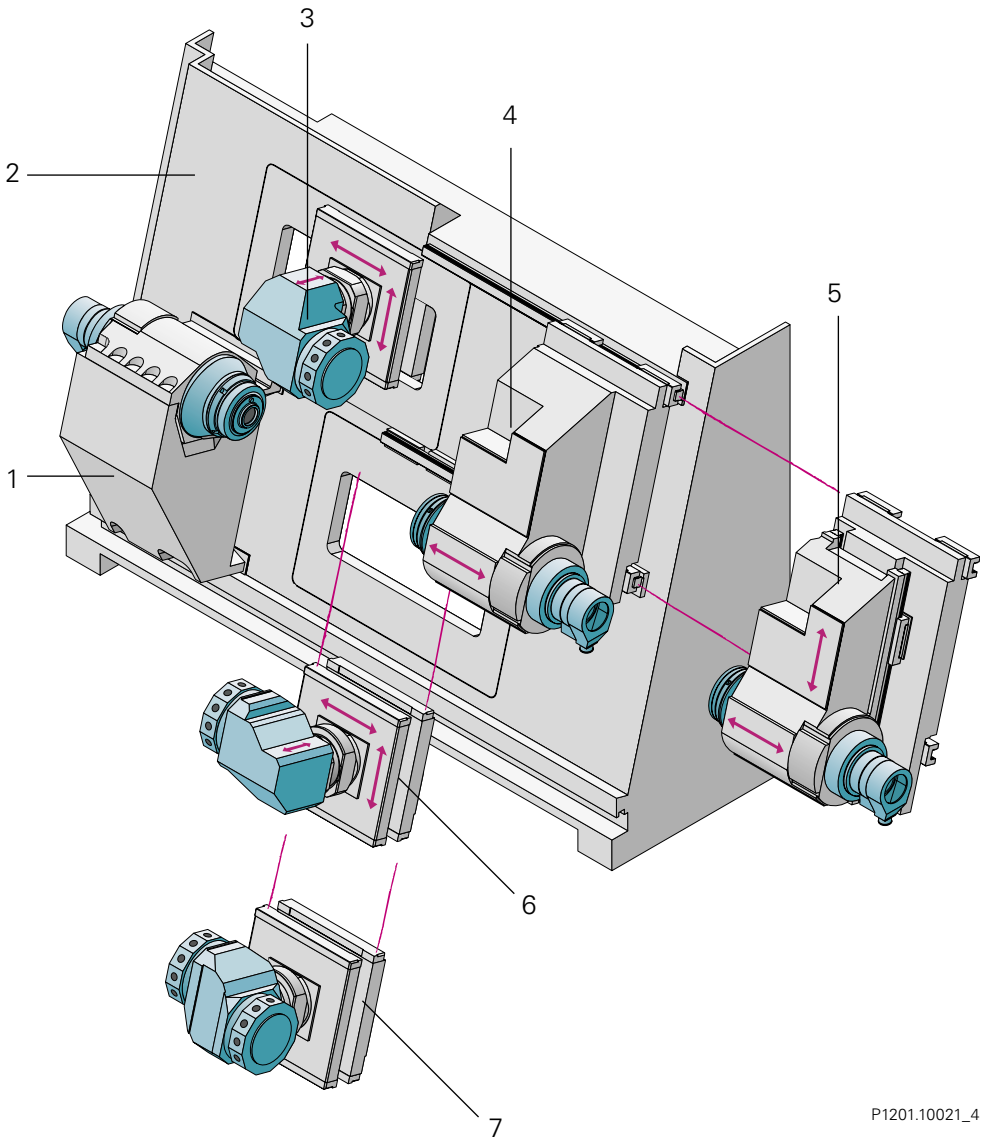
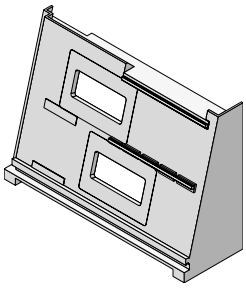
Fig.: Simultaneous rear end machining

Unit Construction System INDEX C42/C65



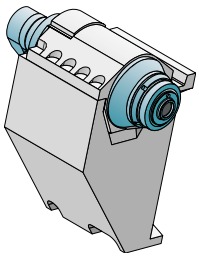
1 Main spindle
2 Machine base
3 Tool carrier 1 XZY[1)] with turret 1
4 Counter spindle with Z-axis
5 Counter spindle with XZ-axes
6 Tool carrier 2 with XZY[1)] with turret 2
7 Tool carrier 2 with XZY[1)] with turrets 2 and 7

[1)] Y-axis is an OPTION



Machine bed

The machine bed is made of cast iron and guaranties a high dynamic rigidity and excellent vibrations dampening



Main spindle

The main spindle is a motorized spindle in synchronized technique driven by an AC-motor. It is supported play free in a thermo-symmetrical headstock.

The main spindle can be equipped with a C-axis.

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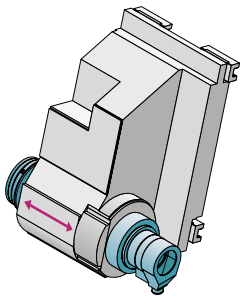
Counter spindle

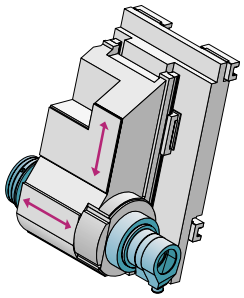
The counter spindle is a motorized spindle in synchronized technique driven by an AC-motor. It is supported play free in a thermo symmetrical headstock.

The counter spindle can be equipped with a C-axis.



The counter spindle is available in two versions:

1. With a Z-axis (longitudinal axis)



2. With a Z-axis (longitudinal axis) and an X-axis (transverse axis)

Material clamping

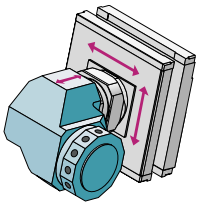
Workpieces and stock bars are clamped in a collet or a chuck respectively, that is mounted on the spindle head of the particular spindle.

The clamping is actuated by a hydraulic clamping cylinder.

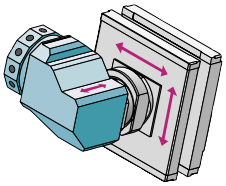
For further information refer to the chapter "Technical data – spindle head dimensions and dimension sheets for the clamping means".

Tool carriers

The machine can be equipped with the following tool carriers:

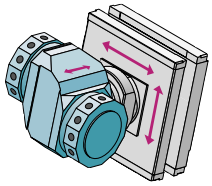


Tool carrier 1 with X-, Z-,Y[1)]-axes and one turret



Tool carrier 2 with X-, Z-,Y[1)]-axes and one turret

or



Tool carrier 2 with X-, Z-,Y[1)]-axes and two turrets

The Y-axis is a linear axis.
Applications: e.g. drilling off center holes, milling of surfaces etc.

Drive motor – Tool carrier 2 with two turrets

For the drive of the tools and the indexing the turret the tool carrier 2 with two turrets has a common drive motor "S2".

The functions "Indexing the turrets 2 and 7" and "Tool drive turrets 2 and 7" cannot be executed separately.

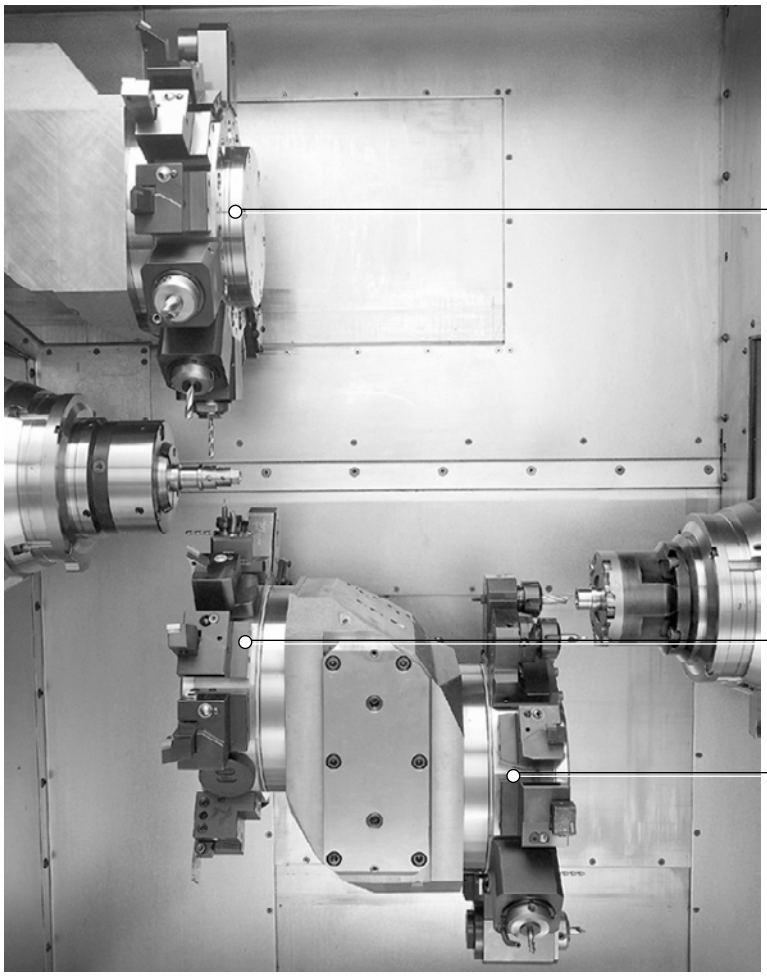
Driven tools are possible in each station of the turrets 2 and 7. Only the tool in working position is rotating.

A drive of its own is available as an option in turret 7 (tool drive and turret indexing). This drive is designated as "S7".

[1)] Y-axis is an OPTION

Turret

The machine can have up to three turrets(1, 2 and 7) with 12 tool stations each. When there is a driving attachment present each station can be equipped with a driven tool.



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1 Turret 1
2 Turret 2
3 Turret 7[1)]

Tooling system used

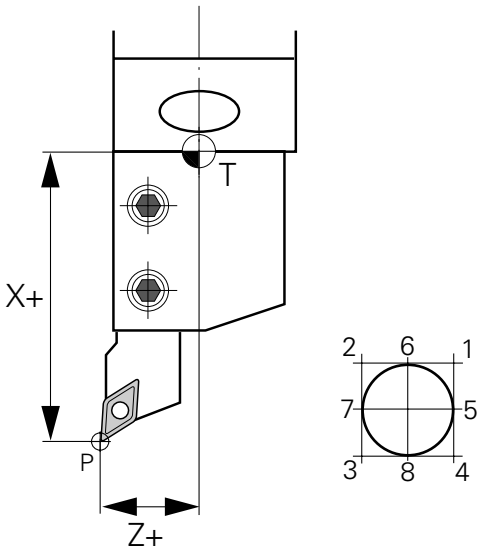
Cylindrical shank to DIN 69880 – 25 Dia

1) This third turret is defined as turret 7 for reason of the programming technique. An indexing to station 5 is programmed as follows: T7 = 5.
The turret 7 is often called turret 3 in prospectus and plans.

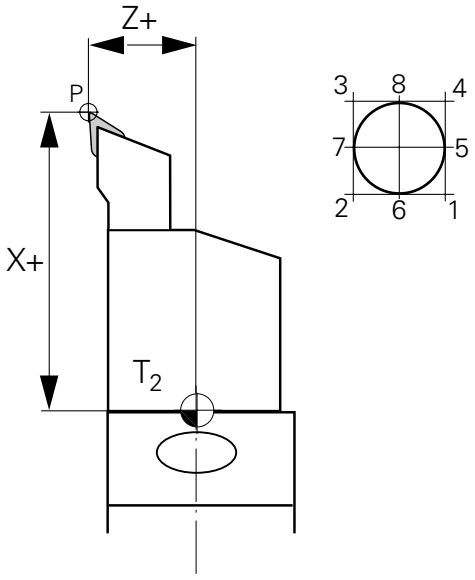
Definition of the tool geometry

The tools reference point "T" is shifted by D-corrections referred to the tool tip "P".

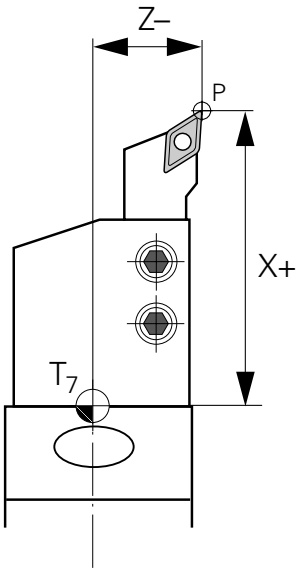
Turret 1



Turret 2



Turret 7



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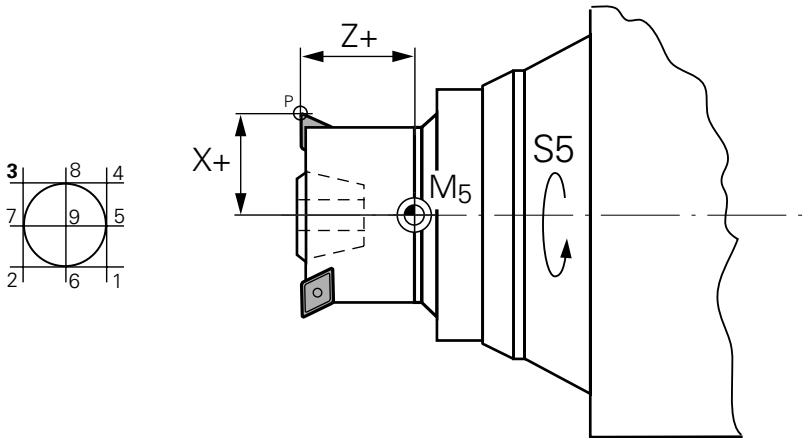
Tool carrier 8 - Counter spindle

When the counter spindle is used as a tool carrier then it is designated as **tool carrier 8**



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Assignment of the D-corrections

There are max. 200 correction numbers available. They can be assigned arbitrarily (D1 – D996).

The following assignment is recommended.

Turrets

Turret	D-numbers
1	D100 … D199
2	D200 … D299
7	D700 … D799

The spindle as a tool carrier

Tool carrier	D-numbers
8	D800 … D899

Maximum permissible tool length in radial direction

In the following are explained the permissible tool lengths depending on the presence or non-presence of the Y-axis.

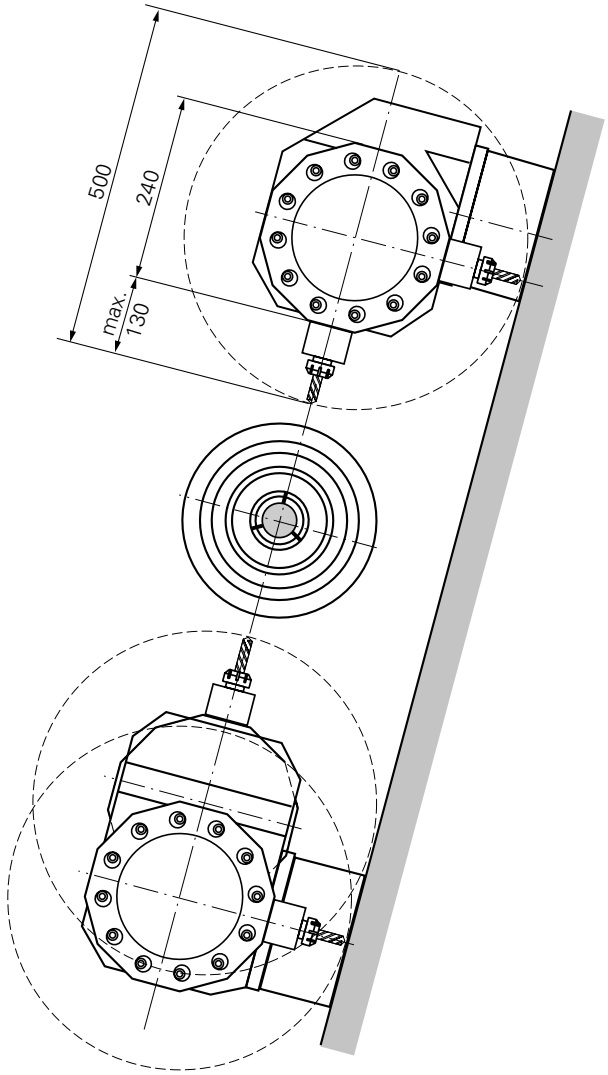
Danger of a collision!

An exceeding of the permissible tool lengths can result in a damage to the machine at turret indexing.

Machine without Y-axis

The max permissible tool length is 130 mm.

This applies to all tool carriers (turret 1, 2 and 7).



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Machine with Y-axis

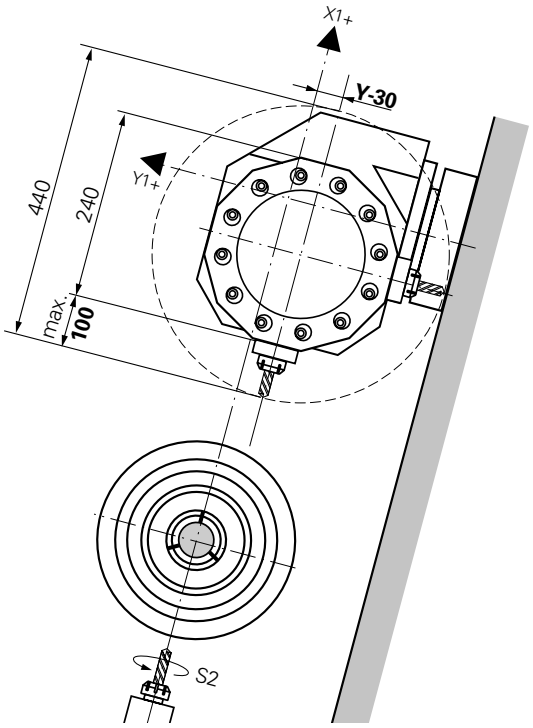
For the position **Y0** the max tool length is **130 mm**.
For the position **Y30** the max tool length is **100 mm**.

This applies to all tool carriers (turret 1, 2 and 7).

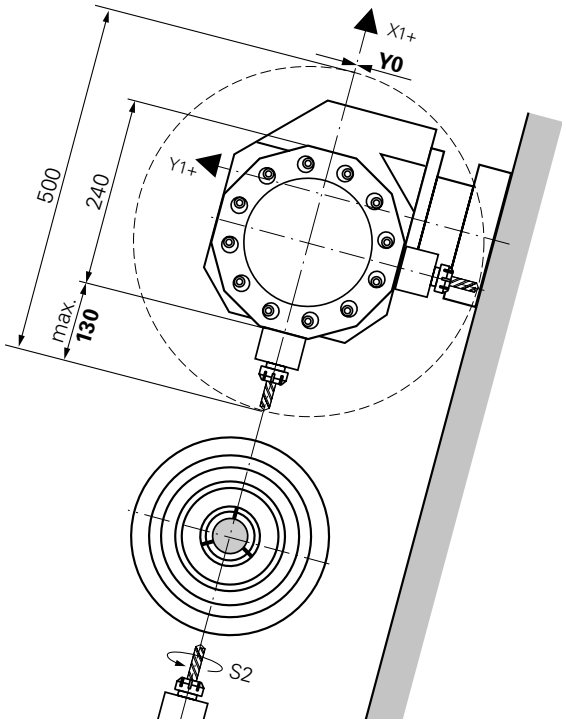
Danger of a collision!

When using the Y-axis for the production of a workpiece a maximum tool length of 100 mm should not be exceeded.

Y-axis position = Y- 30



Y-axis position = Y0



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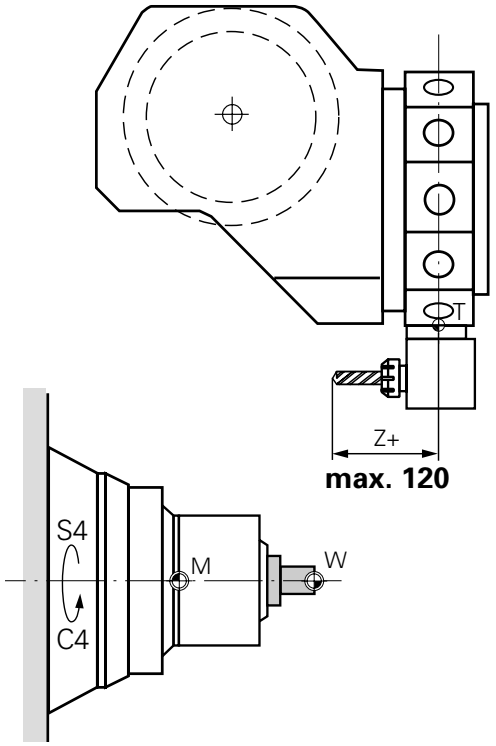
Maximum permissible tool length in axial direction

On turret 1 axial tools can be also mounted inversely (pointing back)
The maximum axial tool length is **120 mm** in this case.



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On the turrets 2 and 7 use of inverse axial tools does not really make sense.

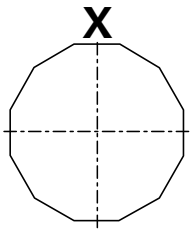
Turret equipment

According to operations to be performed, like e.g. polygon turning with the counter spindle, the equipping of the turret is restricted.

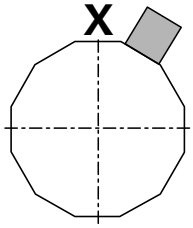
Polygon turning with the counter spindle

Turret 1: - no restriction

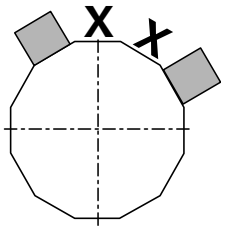
Turret 2: - Up to 44 mm across the flats the turret station in the working position must be kept vacant.



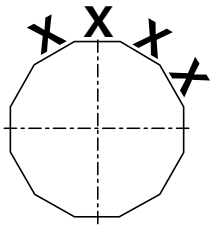
- Over 44 mm across the flats the turret station in the working position must be kept vacant.
  Additionally for the neighboring station a collision check must be carried out.



Turret 7: - Up to 44 mm across the flats the turret station in the working position and the neighboring station must be kept vacant.
  Additionally for both neighboring stations a collision check must be carried out.



- Over 44 mm across the flats the turret station in the working position, the neighboring station and two further neighboring stations must be kept vacant.



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Further hints

The maximum possible width across the flats depends on the following factors:
- The OD of the milling hob
- The clamping means used in the counter spindle
- The current position of the Z5-axis in relation to the, machine zero point "M"

The max possible width across the flats that can be produced is calculated as follows:

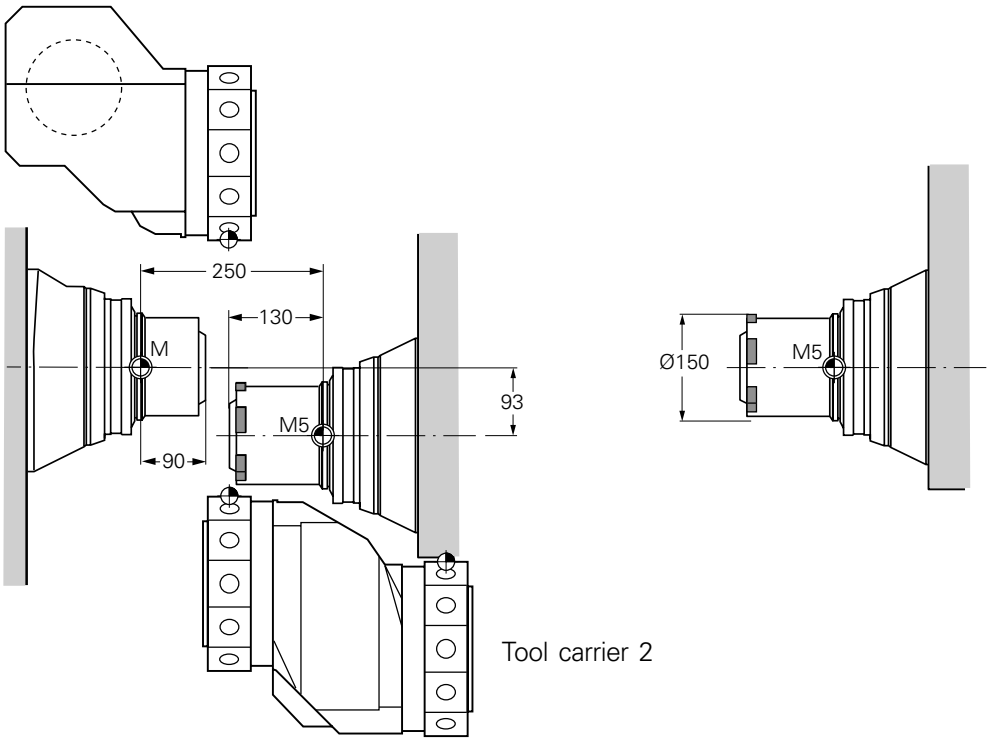
2 • 93 – outside diameter of the hob

The value 93 mm at polygon turning results from the max. counter spindle travel (in X- and Z-direction).
At normal machining the max. travel of the counter spindle is 150 mm.

Example

The hob has an OD of 150 m

2 • 93 – 150 = **36 mm** (max. width across the flats INDEX C65)



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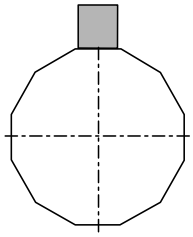
Danger of collision!

Fundamentally danger of a collision exists between the counter spindle and tool carrier 2 (refer to the illustrated example above).

Workpiece taking over by the counter spindle

Turret 1: - The cutting-off operation must be performed by turret 1.

Turret 2: - The maximum tool length in radial direction in the working position = **110 mm** when a chuck with 126 mm diameter is used.



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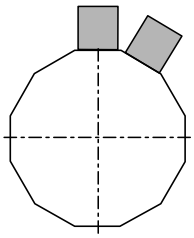
Danger of a collision!
The turret 2 must stand in the furthest possible left hand side position!

Turret 7: - The max. radial tool length in working position = **115 mm** when a chuck with 126 mam diameter is used.

- the max. length of the neighboring tool = **105 mm**.



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Chucks

Chuck < Dia 140

There are no restrictions for these chucks, i.e.:
- Standard tool holders can be used.
- Axial drilling tools can be mounted in stations next to each other.
- The turret 1 can work with axial tools in both directions (main- /counter spindle).

Chuck Dia 140 - 200

For these chuck there are restrictions in reference to the above mentioned points. In each individual case a collision check must be carried out.

Chuck Dia 200 – 350

For these chuck there are severe restrictions. They are suitable only for machines with special tool holders (special purpose machines).

Regarding the max. swing diameter chuck up to 350 mm diameter can be mounted.

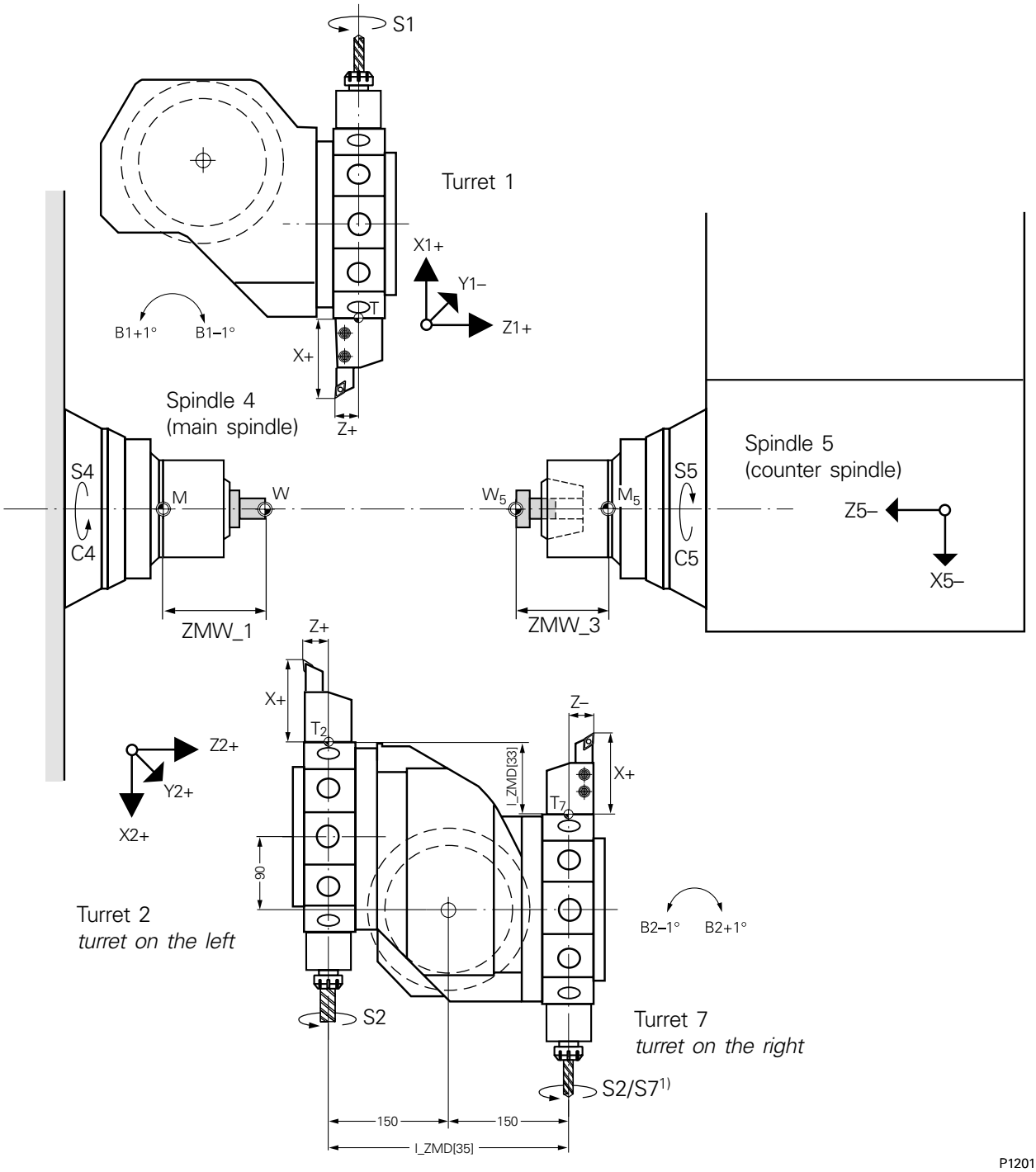
Bar work

The inside diameter of the chucking tube is:

With the machine G42 ->	44 mm diameter
With the machine G65 ->	67 mm diameter

The following guide tube liners are available:

With the machine G42 ->	max up to bar Dia 43 mm
With the machine G65 ->	max up to bar Dia 66 mm



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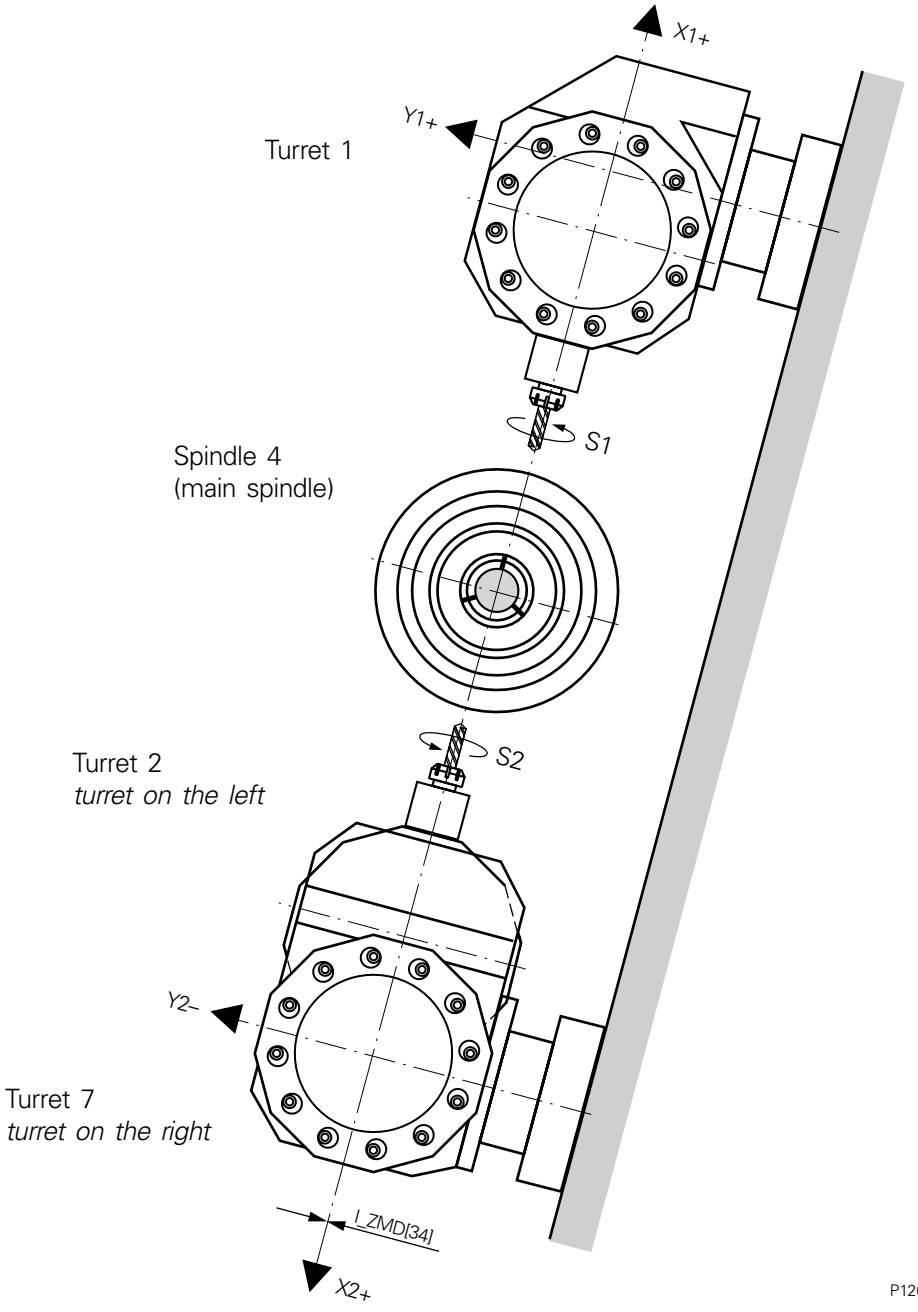
1) Optionally is available a drive of its own for turret 7 (for turret indexing and for the tool drive, respectively). This drive is designated as "S7".

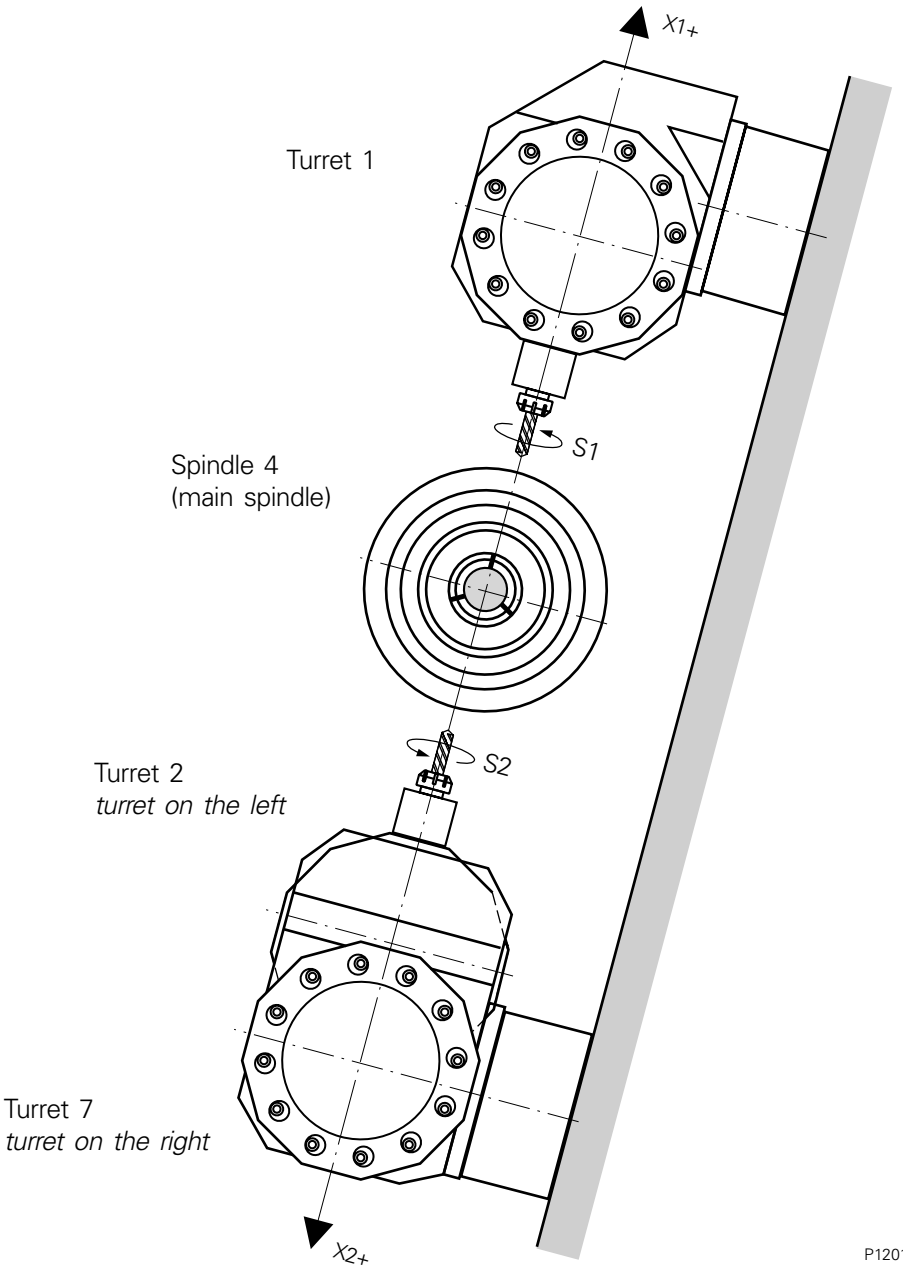
Machine with a Y-axis

The total travel in Y-direction is 70 mm

Y1 -> +40/-30
Y2 -> +30/-40



Machine without a Y-axis



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Selecting Turret 2 or 7

The tool carrier 2 is equipped with a double turret,. Each of these turrets has a zero point of its own ->T_2 and T_7

For the selection of the desired turret serves the cycle L200.

Cycle call: **L200 (x)**

└ Number of the turret -> 2 or 7

With the cycle call for turret 7 the tool carrier reference point is shifted in X-, Y- and Z-directions from the reference point "T_2"(turret 2) to the reference point "T_7" with the aid of the basis point zero offset 'rough'.

Basic position is the reference point "T_2" (turret 2).

By using the cycle L200 the input of the position of turret 7 as adapter dimension is omitted.

The cycle must be programmed only at turret change before calling the T-command. With several machining operations with the same turret the offset will be maintained, in the cycle L100 (basic position) the turret 2 is automatically called..

With the selection of the particular turret this will be selected in the selected in the tools management as well.

L200 (2)	turret 2
L200 (7)	turret 7

Danger of a collision!

At traveling with G53 all zero offsets will be suppressed block by block. Then the programmed positions refer to the machine zero point "M" and the turret reference point "T_2".

Turret 7

The distance of the tools reference points of turret 2 (T_2) to turret 7 (T_7) is input in the following cycles machine data:

Turret	X-axis	Y-axis	Z-axis
7	I _ZMD[33]	I_ZMD[34]	I_ZMD[35]

- ***The input of the data is done in the metric system.***
- ***By calling the cycle L200 the data is loaded into the 1st basic zero point offset 'rough'.***

Counter spindle

The counter spindle zero point can be corrected with the aid of the following cycle machine data.

Channel	X-axis	Y-axis	Z-axis
1	I _ZMD[81]	I_ZMD[82]	I_ZMD[83]
2	I _ZMD[111]	I_ZMD[112]	I_ZMD[113]

- ***The input of the data is done in the metric system.***
- ***By calling the cycles L130 or L225 the data is loaded into the 2nd basic zero point offset 'rough'.***

Main spindle

				C42	C65
Bar dia. collet clamping		mm	43	66	
Spindle diameter front bearing		mm	85	110	
Spindle nose ISO 702/1		size	5	—*	
* Centering diameter 140					
Chuck diameter			mm	140/160	140/160
Power	P_{max}	100% duty	kW	20	20
Power	P_{max}	40% duty	kW	27	27
Torque	Md_{max}	100% duty	Nm	105	105
Torque	Md_{max}	40% duty	Nm	145	145
Speed	n_{max}		min^{-1}	6300	5000
Alignment and indexing attachment			deg.	2,5°	2,5°

Options

C axis	resolution	deg.	0,001	0,001
Speed monitoring DZK				
Thread milling and polygon turning unit				

Counter spindle

				C42	C65
Bar dia. collet clamping			mm	43	66
Spindle diameter front bearing			mm	85	110
Spindle nose ISO 702/1		size	5	—*	
* Centering diameter 140					
Chuck diameter			mm	140/160	140/160
Power	P_{max}	100% duty	kW	20	20
Power	P_{max}	40% duty	kW	27	27
Torque	Md_{max}	100% duty	Nm	105	105
Torque	Md_{max}	40% duty	Nm	145	145
Speed	n_{max}		min^{-1}	6300	5000
Alignment and indexing attachment			deg.	2,5°	2,5°

Options

C axis	resolution	deg.	0,001	0,001
Speed monitoring DZK				
Thread milling and polygon turning unit				

Slide of counter spindle

		X-axis	Z-axis
Slide travel	mm	150	600
Feed force	N	5000	5000
Rapid traverse	m/min	25	45

Tool carrier

Tool carrier 1 XZ / 2 XZ / 7 XZ with disk type turret

Number of tools		12
Cylindrical shank mounting DIN 69 880	mm	25 x 48
Swing diameter * * refer to working area data	mm	500

		X-axis	Z-axis
Slide travel	mm	110	360
Feed force	N	5000	5000
Rapid traverse	m/min	25	45
Resolution	µm	0,1	0,1
B-correction axis ± 1°			

Tool drive unit

Power	P	25% duty	kW	8
Torque	Md_{max}	25% duty	Nm	16
Speed	n_{max}		min^{-1}	6000

Tool carrier 1 XYZ / 2 XYZ / 7 XYZ with disk type turret

Number of tools		12
Cylindrical shank mounting DIN 69 880	mm	25 x 48
Swing diameter * * refer to working area data	mm	500

		X-axis	Z-axis	Y-axis
Slide travel	mm	110	360	70 (+40/-30)
Feed force	N	5000	5000	4000
Rapid traverse	m/min	25	45	12
Resolution	µm	0,1	0,1	0,1
B-correction axis ± 1°				

Tool drive unit

Power	P	25% duty	kW	8
Torque	Md_{max}	25% duty	Nm	16
Speed	n_{max}		min^{-1}	6000

Gantry type receiving attachment

Slide travel (Z-axis)	mm	1600
Rapid traverse	m/min	60
Work piece length max.	mm	250
Work piece diameter max.	mm	65
Work piece weight max.	kg	3

INDEX

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