Product Information PI 21.3

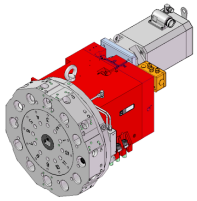
Disk-type tool turret

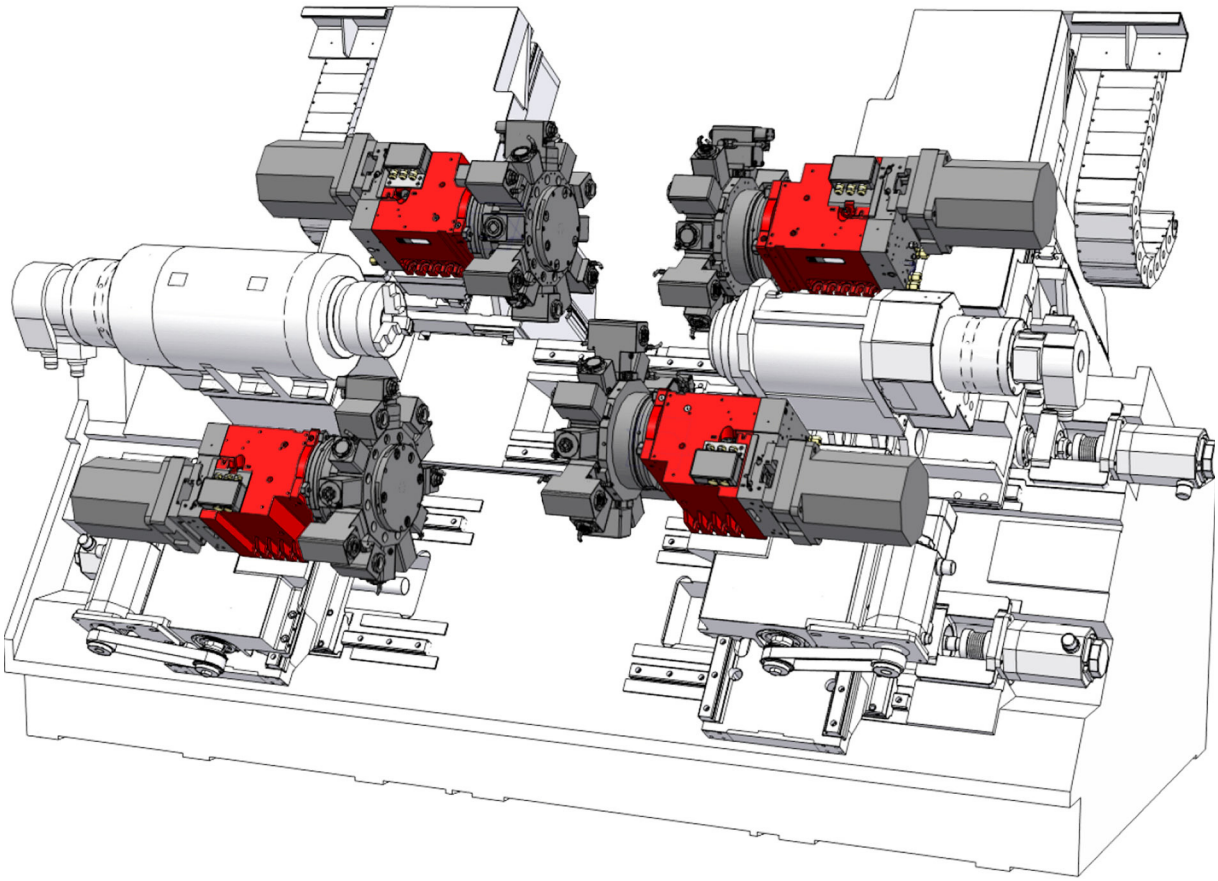
without tool drive
Series **0.5.460.4xx**

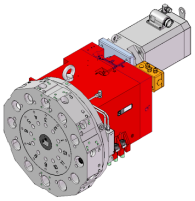
with tool drive
Series **0.5.456.4xx (axial)**
0.5.450.4xx (radial)

2014-01-21

SAUTER







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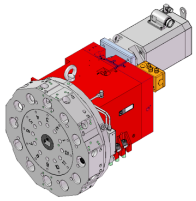
Please request: **Project Planning Guide PA 21.3**

NOTE:

The information contained in this Product Information is in conformity with the knowledge at the point of printing. Subject to modifications which occur within the framework of continuous further development.



Turret system description

These turrets are suitable for use on high-capacity turning machines for forward as well as equipollent reverse machining. They are equipped with all of the features and functions of modern high-performance and high-capacity tool turrets. Their robust design and short switching times mean they are also very well suited for heavy-duty use in series manufacture

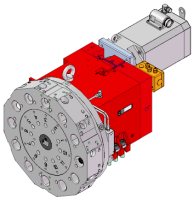
Turret series

- 0.5.460.4xx without tool drive
- 0.5.456.4xx with axial tool drive
- 0.5.450.4xx with radial tool drive

Features:

- Single Motor Technology
  - The turret and the tool drive share one motor; this means lower investment costs and higher level of reliability
- For equal high-performance forward and reverse machining
- Drive with standard servo or spindle motors for fast bidirectional positioning
- High degree of stability due to high locking forces
- Locking device uses special triple generating Hirth-type gear (pat.)
- Not affected by collisions due to safety clutch and annular slot for the disk tool
- Directly controllable with machine controller
- Connection with centralised lubricating system to ensure extremely high service and usage life*)
- Can be installed in any position
- Stable housing with large fastening surface ensuring high stiffness
- High thermal stability

*) High dependance due to seal tool disk by means of sealing with air purge



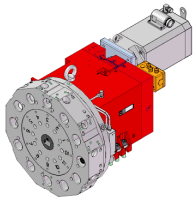
Options:

- Air purge connection for turrets with radial tool drive
- Housing available as block or L-shaped, right and left design
- Central rotary feed-through for fluid-actuated tools and a high-pressure coolant device
- Attachment of transfer elements for switching sensors in tool disk
- Attachment of sensors to monitor cutting force
- Turrets with Y-axis slide units
- Software package for operating the system with a Siemens control Type 840-D
- Fluid rotary feedthrough

  – The turret are available with a central rotary feedthrough

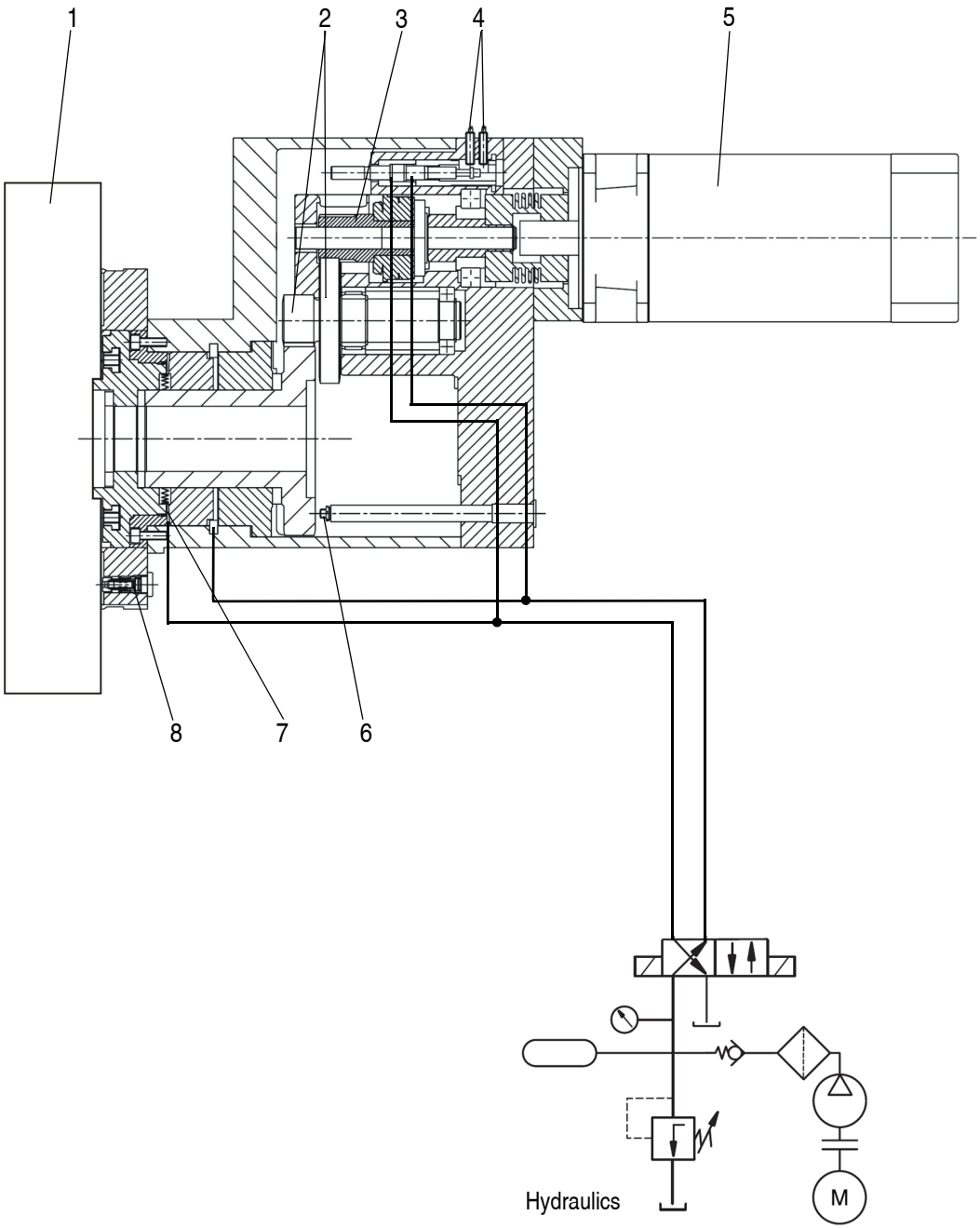
version „uncontrolled“	Feedthrough in all indexing positions e.g. air purge, tool gripper
version „controlled“	Feedthrough in single position e.g. coolant, tool changing

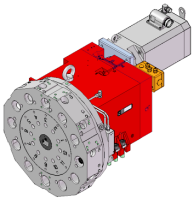
  – Feed through for max. three pipelines in turret center.
  pressure P_{max}= 100 bar (Standard)



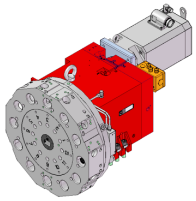
Disk-type tool turret series 0.5.460.4xx without tool drive

Description





1 Tool disk
2 Spur gear
3 Safety clutch for turret drive
4 Electrical locking control
5 Drive motor
6 Reference switches
7 Hirth-type gearing
8 Coolant valve

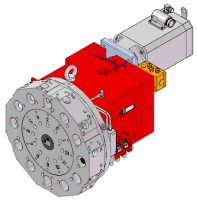


Technical data series 0.5.460.4xx

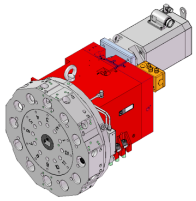
Series 0.5.460.4xx		
Number of switching positions		
Admissible tangential load (turret locked)		kNm
Adm. mass moment of inertia of tools (tool disk and holder)	Standard load stage High load stage	kgm^2 kgm^2
Adm. out-of-balance due to tooling	Standard load stage High load stage	Nm Nm
Indexing times [1]		
Rotate tool disk		
• incl. acceleration and braking per partial step	Standard load stage High load stage	s s
• without acceleration and braking per additional partial step	Standard load stage High load stage	s s
Turret unlock or lock (hydraulic)		s
Adm. indexing frequency [1] (median switching angle φ_m=90°)		min^{-1}
Operating pressure		
Hydraulic ± 10%		bar
Coolant • with medium pressure valve • with central high-pressure coolant device		 bar bar
Fluid absorption volume Turret unlock/lock		cm^3
Mass		
• Turret (incl. standard housing,without tool disk, without motor) • Tool disk and tooling	m m_{zul}	kg kg
Adm. ambient temperature		°C

1) Conditions:
- Direct drive with Siemens servo motors and driving torques in accordance with the table on *page 12*
- Fluid supply sufficiently large
- Turret up to operating temperature
- without controller-related non-productive time
- Attention! Increased indexing times with
  – higher mass moment of inertia of tool disk and toolholders
  – higher mass moment of inertia of other motors
  – lower driving torque

2) Ensure compliance with the required filter fineness for the tools used. For example spindle heads with internal coolant supply.



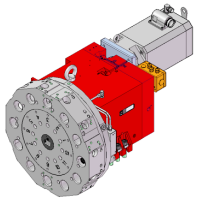
Size															
12			16			20			25			32			
8	12	16	8	12	16	8	12	16	8	12	16	8	12	16	
0,8			1,8			3,6			7,2			12,5			
0,8 1,6			1,8 4,0			3,2 6,3			8 16			25 50			
12 16			25 32			40 63			80 125			160 200			
0,18 0,24	0,12 0,16	- 0,17	0,20 0,27	0,14 0,19	- 0,19	0,22 0,29	0,16 0,21	- 0,20	0,28 0,37	0,20 0,26	- 0,20	0,40 0,50	0,32 0,4	- 0,32	
0,08 0,15	0,05 0,10	- 0,08	0,08 0,15	0,05 0,10	- 0,08	0,09 0,19	0,06 0,10	- 0,09	0,12 0,24	0,08 0,16	- 0,12	0,19 0,38	0,12 0,24	- 0,19	
0,10			0,10			0,12			0,14			0,5			
25			20			16			12,5			8			
50															
5 - 25 Filtering ≤ 100µm[2)] 100 Filtering ≤ 25µm[2)]															
15			30			45			65			114			
55 40			100 80			125 160			200 250			480 500			
+ 10 ... + 40															



Technical data series 0.5.460.4xx

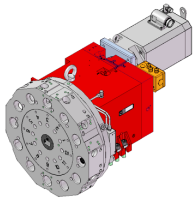
Series 0.5.460.4xx			Size													
			12			16			20			25			32		
Number of indexing positions			8	12	16	8	12	16	8	12	16	8	12	16	8	12	16
Rated speed turret drive	Standard load stage	min^{-1}	1600	1200	-	1600	1200	-	1300	1000	-	1000	750	-	650	500	-
	High load stage	min^{-1}	800	600	800	800	600	800	650	500	650	500	375	500	325	250	325
Driving torque [1]		Nm	18	25	18	30	40	30	48	63	48	75	100	75	120	160	120
Gear ratio		$i = n_1 / n_{rev}$	16	12	16	16	12	16	16	12	16	16	12	16	16	12	16
Recommended drive motors preferred series [2]																	
Siemens Servomotor	1FT6..		..064..			..084..			..086..			..105..			..108..		
Fanuc Servomotor	α..		8/4000 is			12/4000 is			22/4000 is								
Fanuc Spindle motor	α..		..1,5			..2			..3			..6			..8		

1) Torque limitation on the motor converter!
2) The motors are not included in the SAUTER scope of supply
Other motors upon request.



Commodities

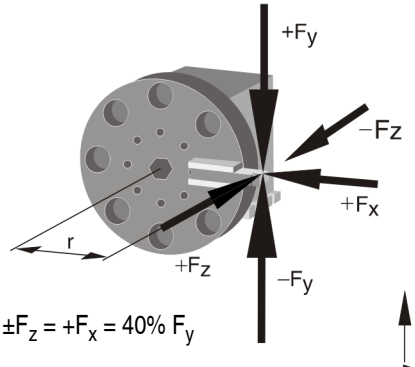
Commodities/Media		Size				
		12	16	20	25	32
Hydraulic (locking)						
pressure	bar	50 ±10%				
flow rate max.	l/min	15 - 20				
Coolant (Standard)						
Druck	bar	5 - 25 (Filtering ≤ 100 µm)				
Central high pressure-coolant device (Options)						
pressure	bar	bis 100 (Filtering ≤ 25 µm)				
air purge (Tool disk and driven tools)						
pressure	bar	0,4 - 0,8				
flow rate	l/min	ca. 6 - 10				
Central lubrication (gear)						
a) Oil consumption	cm^3/h	ca. 0,09 - 0,18				
grease consumption (alternative)	$cm^3/24h$	ca. 0,06 - 0,12				



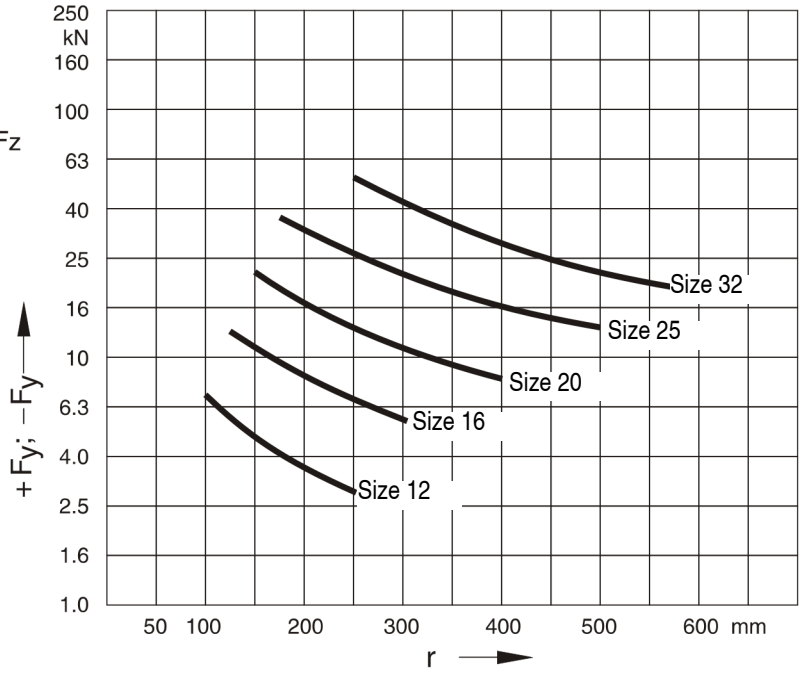
Admissible loads

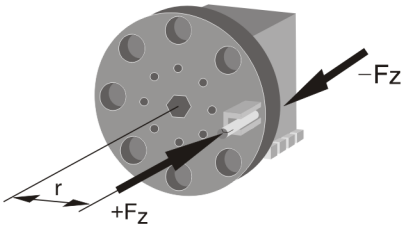
Note: The diagrams only apply to static loads. In the event of shock loads (discontinuous cutting) it is necessary to use significantly lower values.

Combination force $\pm F_y$ ($+F_x$,$+F_z$)
Type Turn- forward- and reverse machining

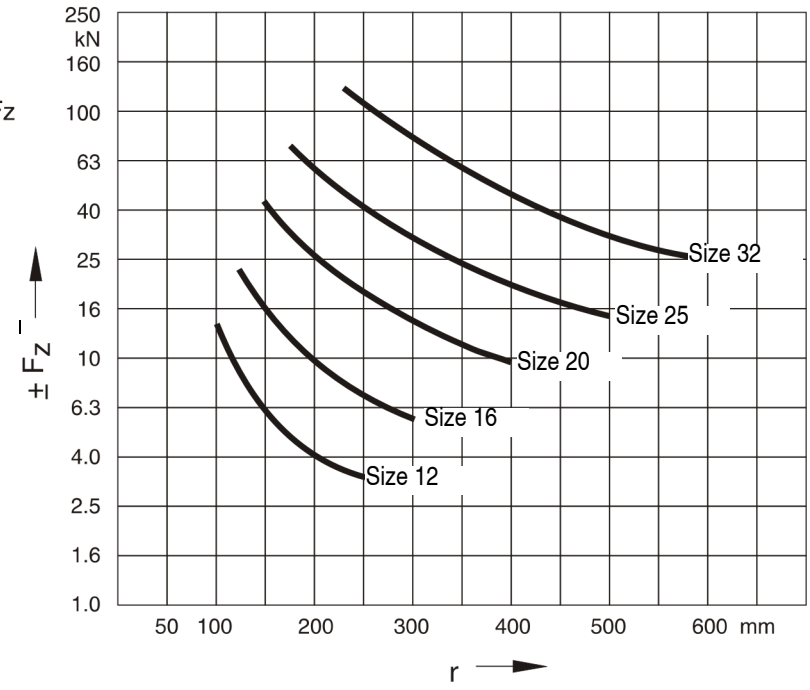


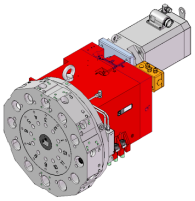
$\pm F_z = +F_x = 40\%\ F_y$



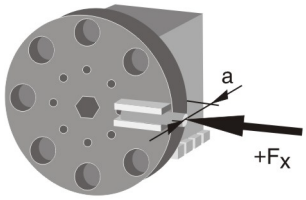


Advance force $\pm F_z$
(drilling forward and backward)

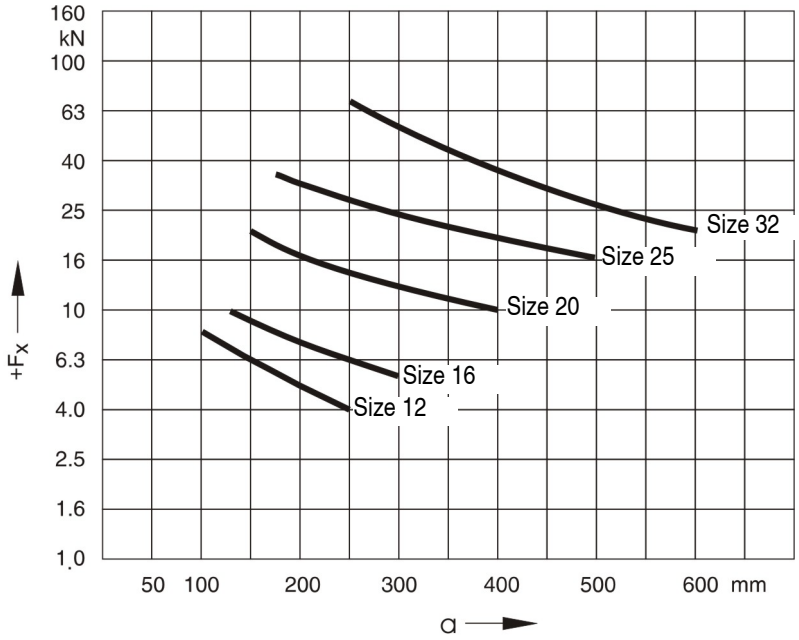


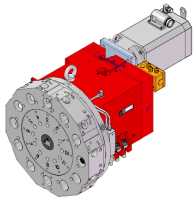


Shunt load $+F_x$

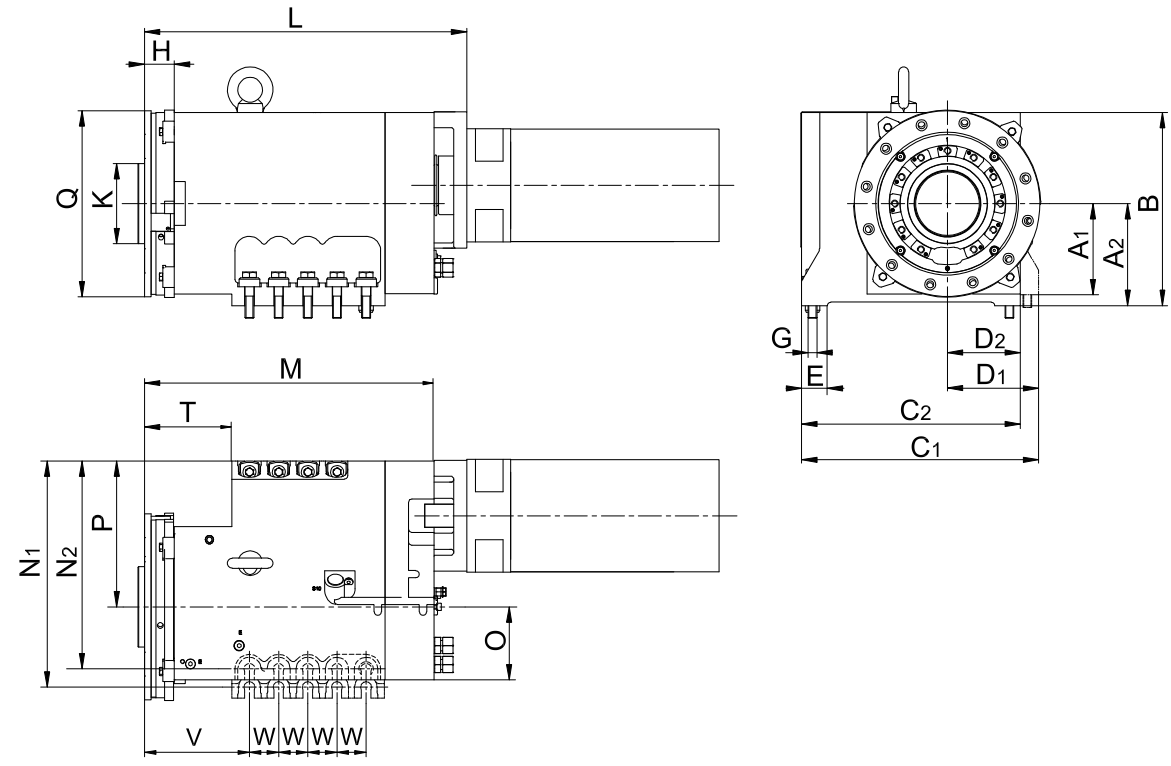


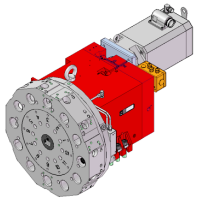
leading edge is the basis
for dimension a





Dimensions Turret series 0.5.460.4xx (L-shape)

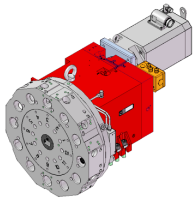




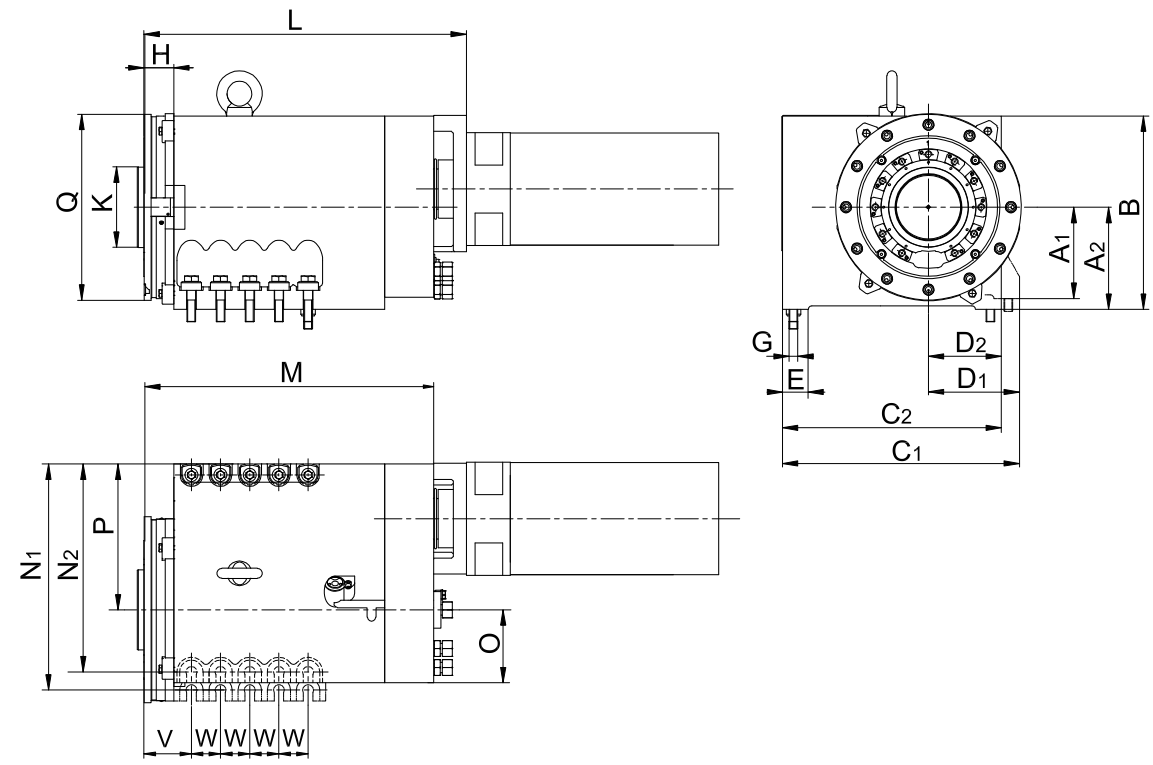
Series	Size				
0.5.460.4xx	12	16	20	25	32
A_1 / A_2 1)	- / 90	100 / 115	125 / 140	150 / 180	200 / -
B	170	200	250	300	400
C_1 / C_2	- /198	264 / 246	350 / 325	406 / 373	520 / -
D_1 / D_2	- / 68	102 / 82	125 / 100	158 /125	198 / -
E	20	30	35	40	48
F	8 x M 8	8 x M 8	11 x M 10	11 x M 12	15 x M 12
G	M 8	M 10	M 12	M 16	M20
H	32	40	41	52	62
Ø K	70	90	105	120	150
L	344 Siemens / 359 Fanuc	373 Siemens / 393 Fanuc	442 Siemens / 462 Fanuc	510 Siemens / 510 Fanuc	656 Siemens / 510 Fanuc
M	300	345	397	445	591
N_1 / N_2	- / 178	240 / 220	295 / 270	370 / 337	476 / -
O	68	80	100	125	160
P	120	150	185	230	300
Ø Q	175	210	255	318	396
Ø S	90	120	145	182	220
T	76	105	120	150	200
V	94	127	144	176	234
W	28	34	40	42	52

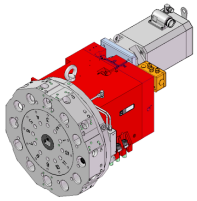
dimensions in mm

1) Option



Dimensions Turret series 0.5.460.4xx (Block-shape)

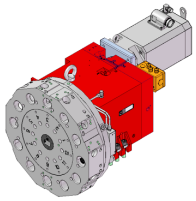




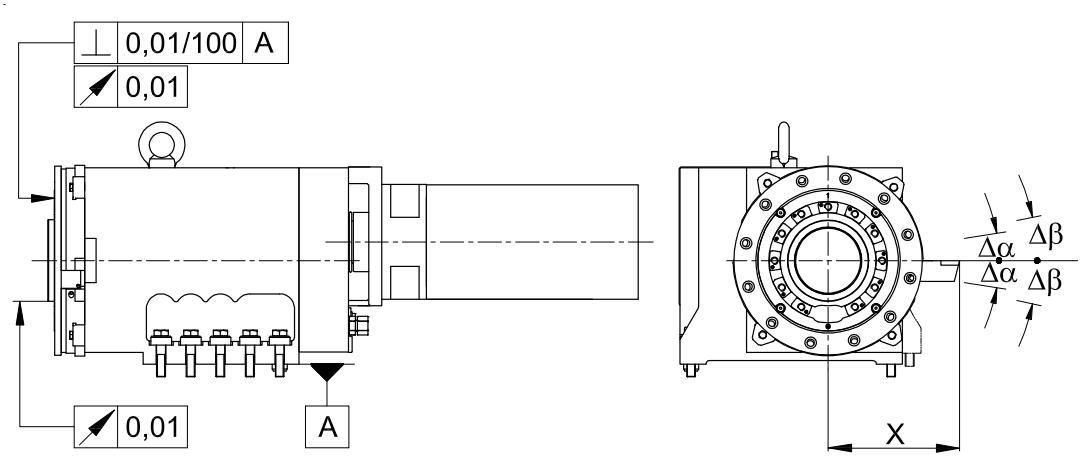
Series	**Size**														
0.5.460.4xx	**12**			**16**			**20**			**25**			**32**		
A_1 / A_2 [1)]	- / 90			100 / 115			125 / 140			150 / 180			200 / -		
B	170			200			250			300			400		
C_1 / C_2	- /198			264 / 246			350 / 325			406 / 373			520 / -		
D_1 / D_2	- / 68			102 / 82			125 / 100			158 /125			198 / -		
E	20			30			35			40			48		
F	8 x M 8			8 x M 8			11 x M 10			11 x M 12			15 x M 12		
G	M 8			M 10			M 12			M 16			M20		
H	32			40			41			52			62		
Ø K	70			90			105			120			150		
L	344 Siemens		359 Fanuc	373 Siemens		393 Fanuc	442 Siemens		462 Fanuc	510 Siemens		510 Fanuc	656 Siemens		510 Fanuc
M	300			345			397			445			591		
N_1 / N_2	- / 178			240 / 220			295 / 270			370 / 337			476 / -		
O	68			80			100			125			160		
P	120			150			185			230			300		
Ø Q	175			210			255			318			396		
Ø S	90			120			145			182			220		
V	50			62			65			78			96		
W	28			34			40			44			52		

dimensions in mm

1) Option



Precision



Repeating accuracy

(Multiple move to a switching position from the same direction)

$$\Delta\alpha = \pm 1,6'' \triangleq \pm\ 0,8 \cdot \frac{X[mm]}{100[mm]}[\mu m]$$

Indexing precision

(Multiple move to a switching position from different direction)

$$\Delta\beta = \pm 4'' \triangleq \pm 2 \cdot \frac{X[mm]}{100[mm]}[\mu m]$$

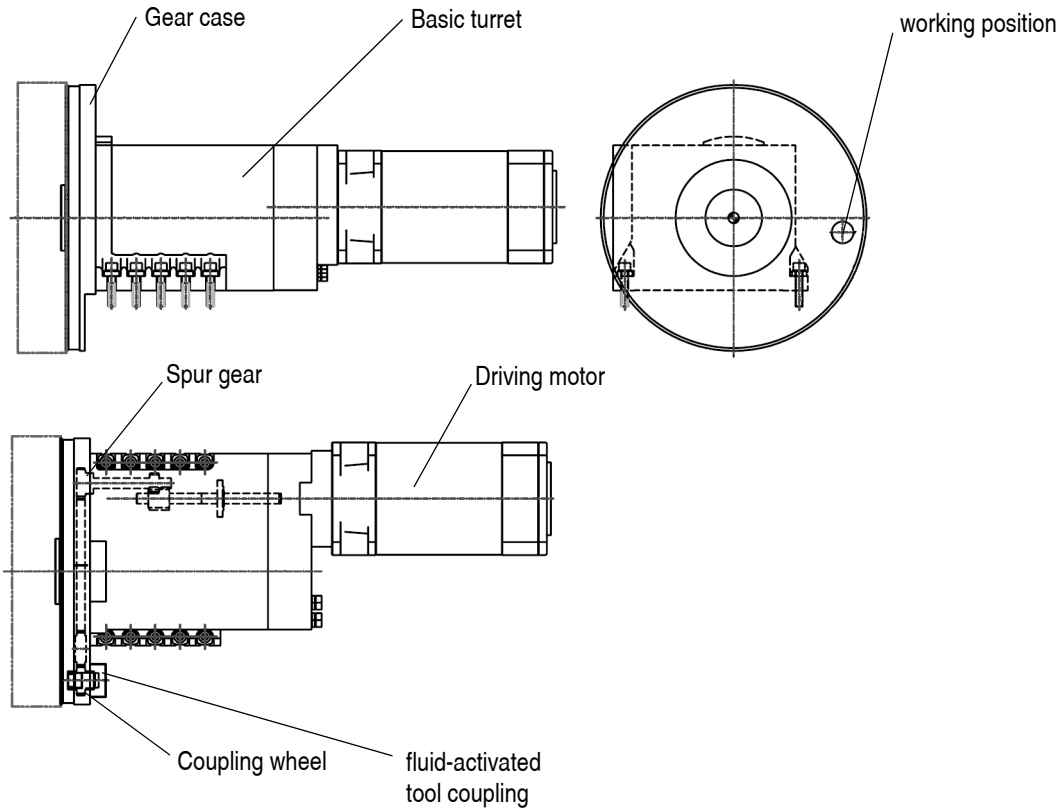
Disk-type tool turret Series 0.5.456.4xx with axial tool drive

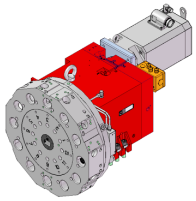
Description

- series and a **decentralized** tool drive for individually switchable, **axially** placed tools for forwards machining.
- Hydraulic operation mode

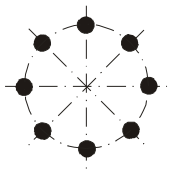
One-motor technology:

- Turret and powered tools (spindle unit) are powered by single motor after the gear switching. Engaging and disengaging the active tool is effected through fluid activation, after positioning of the drive spindle - no tooth on tooth situation! This allows for quick engaging without searching. The tool coupling is designed for spindle heads with coupling toothing in accordance with DIN 5480 and with spindle locking system.
- SAUTER-Spindle units-**Type 0.5.941.xxx**
- Product Information **PI 29.3**.

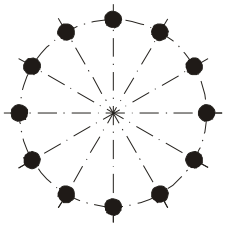




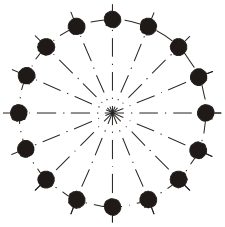
Tool arrangement:



8 Pos.-1 reference circle

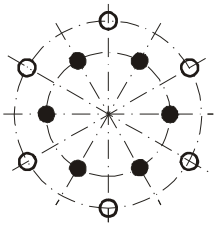


12 Pos.-1 reference circle

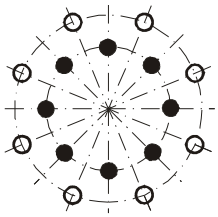


16 Pos.-1 reference circle

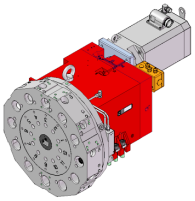
● Position with tool drive
○ Position without tool drive



12 Pos.-2 reference circles



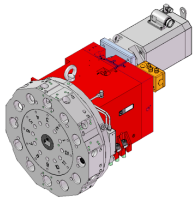
16 Pos.-2 reference circles



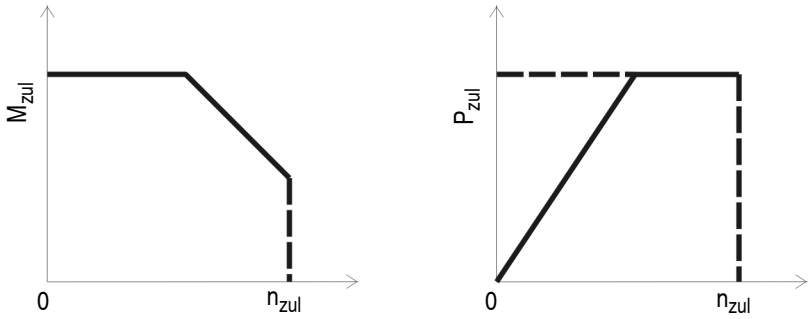
Performance data at tool coupling 0.5.456.4xx

Series 0.5.456.4xx			Size				
			12	16	20	25	32
Gear performance data							
Adm. driv rating[1)]	P_{zul}	kW	6	8	10	12,5	15
Adm. torque [2)]	M_{zu}	Nm	20	32	63	100	160
Adm. rpm [1)3)]	n_{zu}	min^{-1}	6000	5000	4000	4000	3200
Gear ratio	$i = n_1 / n_2$		1,0				
Recommended drive motors[4)]							
Siemens-Servomotor, Typ 1FT6..			..064-AK..	..084-AK..	..086-AH..	..105-AF..	.. 108-A ..
Max. torque [5)]		Nm	14	28	40	68	100
Adm. rpm [5)]		min^{-1}	6000	5000	4000	4000	3200
Fanuc-Servomotor, Typ α			8/4000 is	12/4000 is	22/4000 is	40/4000 is	auf Anfrage
Adm. torque [5)]		Nm	12	18	33	60	
Adm. rpm[5)]		min^{-1}	4000	4000	4000	4000	
Fanuc-Spindelmotor Typ α			1,5	2	3	6	8
Adm. torque [5)]		Nm	11	25	40	56	70
Adm. rpm [5)]		min^{-1}	6000	5000	4000	4000	3200

1) The values are reference values for short-term operation. Higher rpms generate more heat and noise, especially when the belt drive is used!
2) Torque limitation at motor converter required! Admissible torque partially smaller than with turret drive!The listed torque values apply to smooth machining (such as thread-cutting). In the case of machining with severe shock loads (e.g. face milling and similar operations), it is necessary to reduce the motor drive torque by 50% or more.
3) With absolute value encoder.
4) Other motors upon request.
5) At tool coupling 40% WT – 5 min(Angaben der Motorenhersteller)



Performance data at the tool coupling



Admissible duty cycle of the tool drive during short-time operation (reference values)

Admissible duty cycle [DC] (5 min)	100%	80%	60%	40%	25%
Admissible relative drive rating $\left[\frac{P_c}{P_{zul}}\right]$ and Admissible relativ rpm $\left[\frac{n_c}{n_{zul}}\right]$	25%	40%	50%	75%	100%

P_c= required cutting rate [kW]

n_c= required cutting rpm [min-1]

P_{adm}= Adm. drive rating [kW]

n_{adm}= Adm. rpm [min^{-1}] (*see chart S. 23*)

Example calculation:

Wich speed n_c and wich power P_c with 40% DC (5 min) are supported on a tool drive, size 20?
According to the table on *page S. 23*:
P_{Adml} = 10 kW, n_{adml} = 4000 min^{-1}

Acc. to chart page 22, 40% DC: $\frac{n_c}{n_{adm}} = 75\ \%$ und $\frac{P_c}{P_{adm}} = 75\ \%$

$$P_c = P_{adm} \cdot \left[\frac{P_c}{P_{adm}}\right] = 10\ kW \cdot 75\ \% = 7{,}5\ kW$$

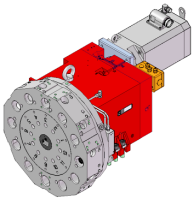
und

$$n_c = n_{adm} \cdot \left[\frac{n_c}{n_{adm}}\right] = 4000\ min^{-1} \cdot 75\ \% = 3000\ min^{-1}$$

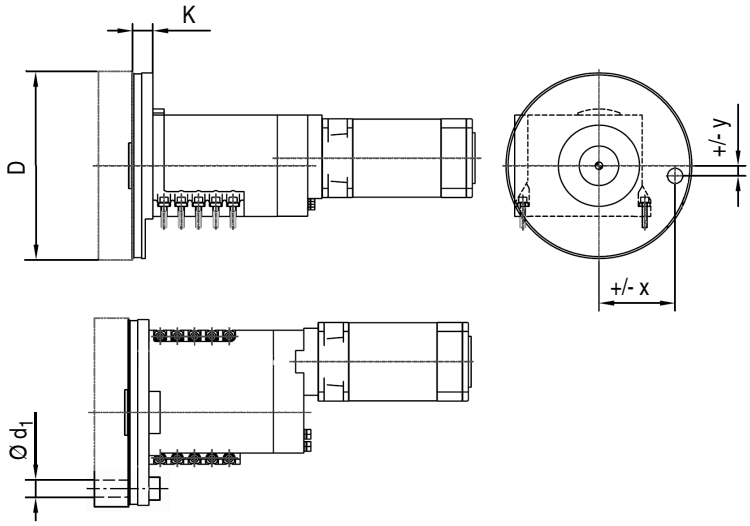
In this example the tool drive can be operated with

P_c = 7,5 kW and
n_c = 3000 min-1

for 2 minutes and then it must rest for 3 minutes.



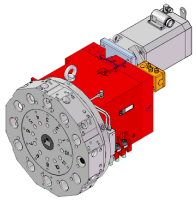
Alternative configurations type series 0.5.456.4xx[2)]



Size	Turret version	Working position Position	Working position x / y	Coupling profile DIN 5480	Toolholder DIN 69880 location Ø d_1	Dimensions D	Dimensions K	Mass[1)] kg (ca.)	Max. possible tool arrangement (*see page 22*)
12	Right	3°°	**+98,54 / -17** +100 / 0 **+142,5 / 0**	14 x 0,8	25	280 280 346	32	90 90 120	**12 - 2** 12 - 2 **12 - 1**
16	Right	3°°	**+117,4 / -25** +125 / -25 **+135 / 0** **+150 / 0** **+170 / 0**	16 x 0,8	30	360 375 342 372	40	155 165 170 180	**12 - 2** 12 - 2 **12 - 2** **12 - 1**
20	Right	3°°	**+155 / 0** **+170 / 0** **+185 / 0** **+210 / 0**	20 x 0,8	40	440 422 452	41	230 245 260	**12 - 2** **12 - 2** **12 - 1**
25	Right	3°°	+198 / -70 **+200 / -20** **+210 / 0** **+235 / -70** **+240 / 0**	24 x 1,25	50	630 590 512 582	52	300 310 310 350	12 - 2 **12 - 2** **12 - 2** **12 - 1**
32	on request								

Dimensions in mm

1) Overall weight of the turret incl. tool disk, without motor
2) further particulars see tool turret 0.5.461.4xx
Variants printed in bold are readily available!
Additonal variants – e.g variation „left-hand“ upon request



Disk-type tool turret Series 0.5.450.4xx with radial tool drive

Description

- Basic turret series **0.5.460.4xx**
- series and a **centralized** tool drive for individually switchable, **radially** placed tools for forwards and backwards machining
- Hydraulic operation mode

One-motor technology:

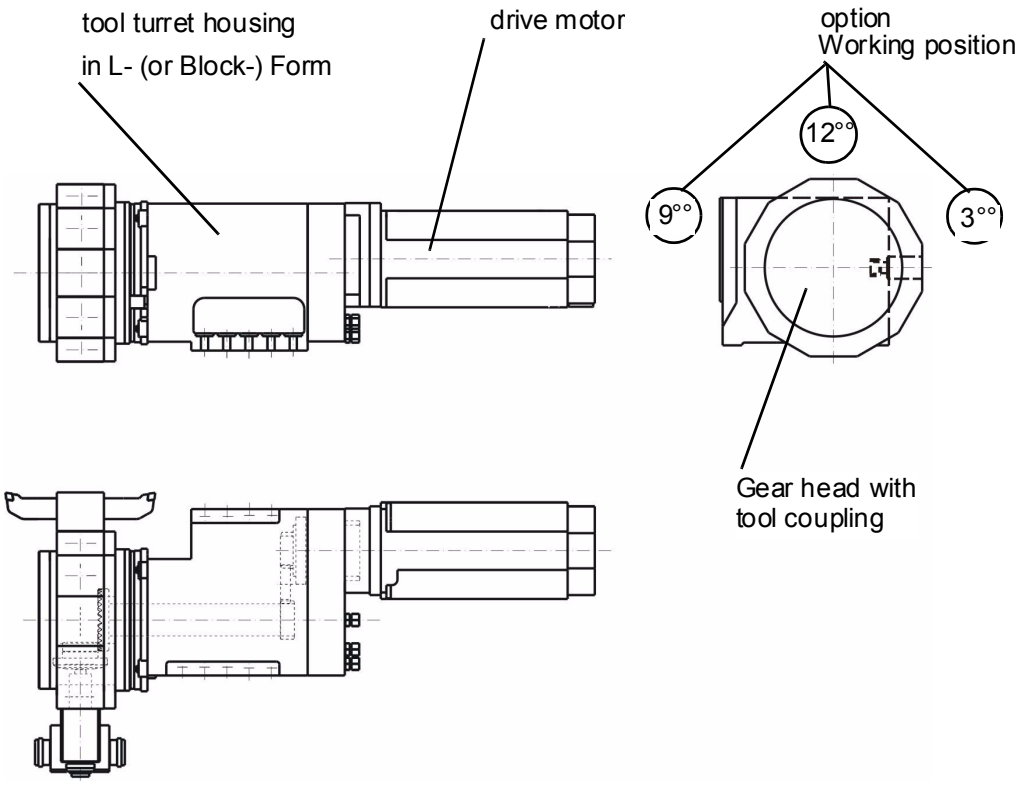
Turret and powered tools (spindle heads) are powered by single motor after the gear switching.

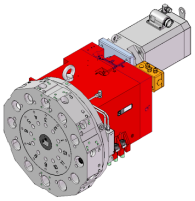
Engaging and disengaging the active tool is effected through fluid activation, after positioning of the drive spindle
- no tooth on tooth situation!
- this allows quick engaging without searching.

The tool coupling is designed for spindle heads with coupling toothing in accordance with DIN 5480 and with spindle locking system.

see

- **Sauter** spindle units **0.5.941.xxx serie**
- Product Information **PI 29.3**

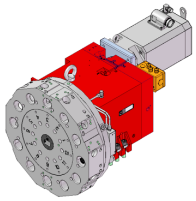




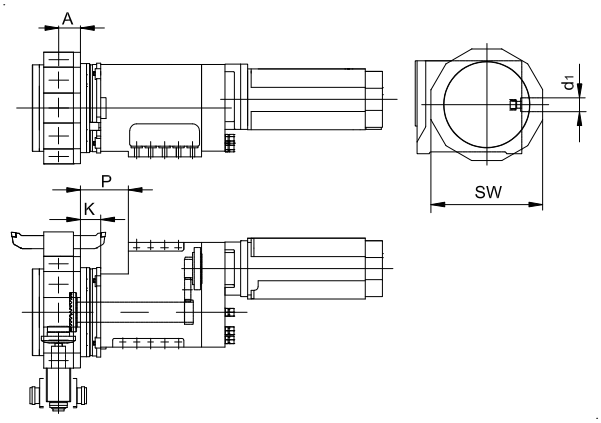
Performance data for the tool coupling 0.5.450.4xx

Series 0.5.450.4xx			Size				
			12	16	20	25	32
Gear performance data							
Adm. drive rating[1)]	P_{zul}	kW	6	8	10	12,5	15
Adm. torque[2)]	M_{zu}	Nm	20	32	63	100	160
Adm. rpm [1)3)]	n_{zu}	min^{-1}	6000	5000	4000	4000	3200
Gear ratio	$i = n_1 / n_2$		1,0				
Recommended drive motors[4)]							
Siemens-Servomotor, Typ 1FT6..			..064-AK..	..084-AK..	..086-AH..	..105-AF..	.. 108-A ..
Adm. torque [5)]		Nm	14	28	40	68	100
Adm. rpm [5)]		min^{-1}	6000	5000	4000	4000	3000
Fanuc-Servomotor, Typ α			8/6000 is	12/6000 is	22/4000 is	40/4000 is	on request
Adm. torque [5)]		Nm	12	18	33	60	
Adm. rpm [5)]		min^{-1}	6000	5000	4000	4000	
Fanuc-Spindle motor			α 1,5	α 2	α 3	α 6	α 8
Adm. torque [5)]		Nm	11	25	40	56	70
Adm. rpm [5)]		min^{-1}	6000	5000	4000	4000	3200

1) The values are reference values for short-term operation. Higher rpms generate more heat and noise, especially when the belt drive is used!
2) Torque limitation at motor converter required! Admissible torque partially smaller than with turret drive!The listed torque values apply to smooth machining (such as thread-cutting). In the case of machining with severe shock loads (e.g. face milling and similar operations), it is necessary to reduce the motor drive torque by 50% or more!
3) With absolute value encoder.
4) Other motors upon request.
5) At tool coupling 40% DC – 5 min (details the engine producer)



Dimensions Series 0.5.450.4xx[6)]



Series 0.5.450.4xx		Size				
		12	16	20	25	32
Coupling profile	DIN 5480	14 x 0,8	16 x 0,8	20 x 0,8	24 x 1,25	30x1,25
Dimensions	K P A	32 76 48	40 105 55	41 120 80	52 150 100	62 200 120
Weight approx. [1)]	kg	85	150	220	360	650
Toolholder system Cylinder shaft DIN 69880 [2)]						
	d_1	25	30	40	50	60
Width across flats	SW_1-Standard[3)]	220	270	320	380	470
	SW_2 [3)4)]	240	-	360	410	-
	SW [3)4)]	300	340	380	-	-
Toolholder system Sandvik Capto [5)]						
	NG	C3	C4	C5	C5	-
Width across flats	SW-Standard[3)4]	280	340	380	420	-

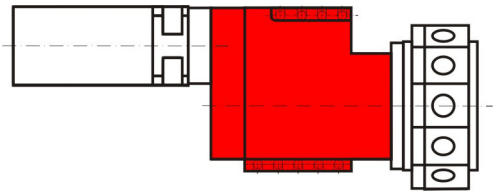
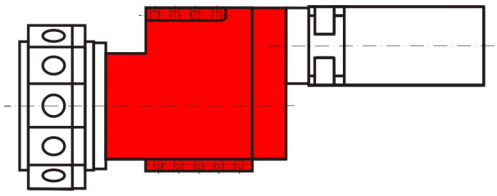
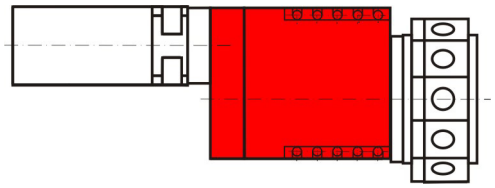
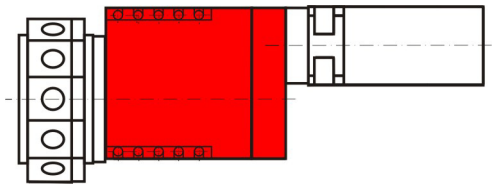
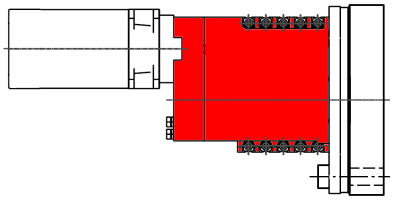
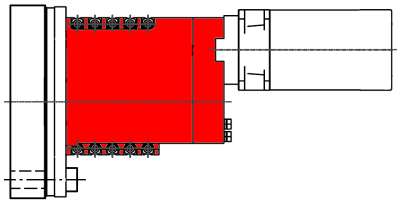
Dimensions in mm

1) Overall weight of the turret incl. tool disk SW1 and without motor.
2) See SAUTER spindle units, type 0.5.941.xxx (Product information PI 29.3) and SAUTER toolholder (Product information PI 07.2).
3) Valid for 8 and 12 tool positions / 16 tool positions on request.
4) High load load stage required.
5) See SAUTER spindle units, type 0.5.935.xxx (Product information PI 45) Other toolholder systems – e.g. HSK – on request.
6) Further particulars see tool turret 0.5.460.4xx

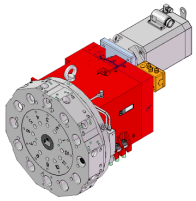
INDICATION: Instruction the operating duration (DC) *see page 24.*

Options

Housining shape

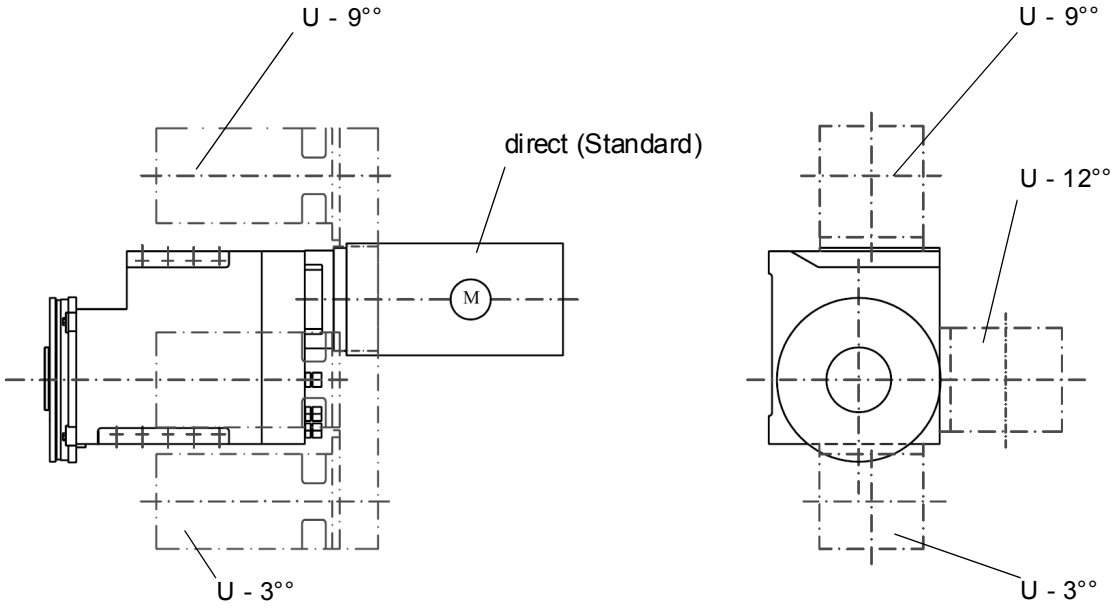
Version Left	Version Right
 **L-shape housing** For forwards and backwards machining with turret type 0.5.460/450	 **L-shape housing** For forward and backwards machining with turret type 0.5.460/450
 **Block-shape housing** For forwards machining with turret type 0.5.460/450	 **Block-shape housing** For forwards machining With turret type 0.5.460/450
 **Block-shape housing** For forwards machining with turret type 0.5.456	 **Block-Form** For forwards machining with turret type 0.5.456

Further housing shapes upon request

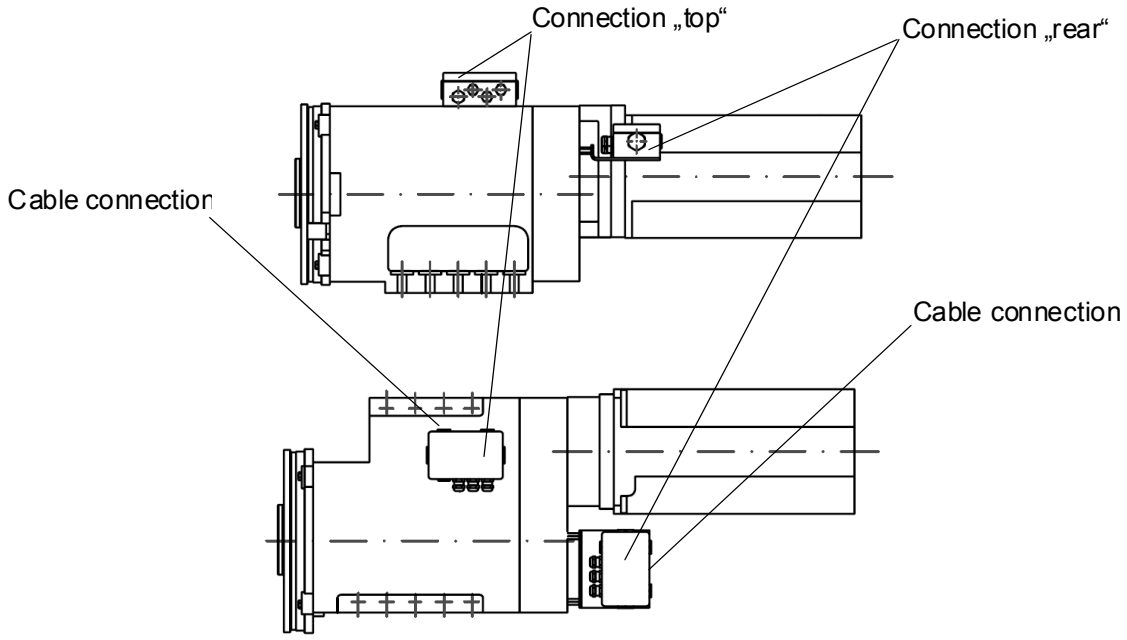


Arrangement of the drive motor for series 0.5.460 / 456 / 450

Redirection: (Option with belt drive)

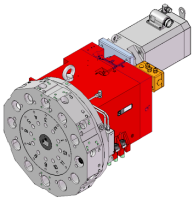


Electrical connection for series 0.5.460 / 456 / 450



Electrical connections:

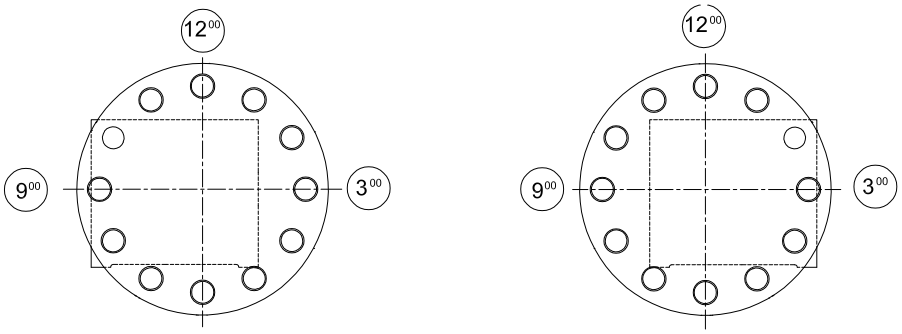
- Terminal box (standard)
- Terminal box with round plug connectors (optional)
- Arrangement "top“ or "rear"



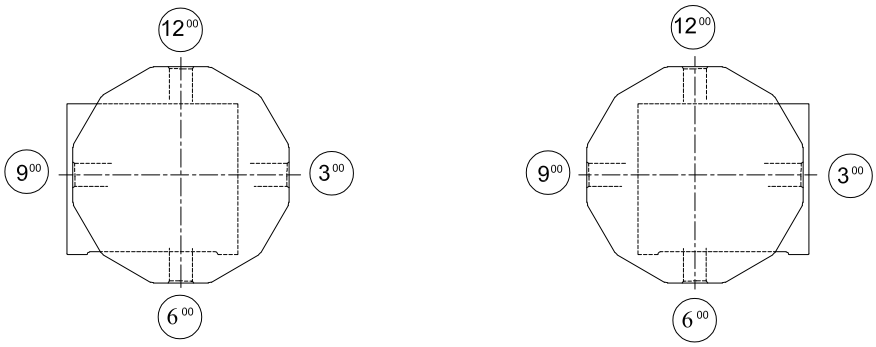
Working position

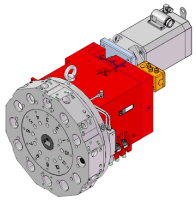
The working position is defined as that turret position, in which the tool is supplied with coolant and
– with turret series 0.5.456.4xx and 0.5.450.4xx - driven.

Tool location axial (Series 0.5.460.4xx, 0.5.456.4xx)



Tool location radial (Series 0.5.460.4xx, 0.5.450.4xx)





Type key

0.5 . 456 . 4 20

Series

0.5.450.4xx	disk-type tool turret with radial tool drive
0.5.456.4xx	disk-type tool turret with axial tool drive
0.5.460.4xx	disk-type tool turret without tool drive

Operating medium

4 - Hydraulics

Size

12

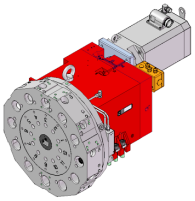
16

20

25

32

[1)] on request



Ordering details

++49 (0) 7123-926-190

++49 (0) 123-926-0

info@sauter-feinmechanik.com

Sauter Feinmechanik GmbH
Postfach 1551
D-72545 Metzingen
Germany

Company: _____

Street: _____

Postal Code: _____
City _____

Name: _____

Phone: _____

Fax: _____

E-Mail: _____

Ordering details	Possible variants	Your selection
Basic turret		
Size	12 / 16 / 20 / 25	
Number of indexing positions	8 / 12 / 16	
Version	right / left	
Housing shape	L / Block	
Axis height	A_1 / A_2	
Intended drive motor	*s. page 12*	
Arrangement of the drive motor	direct / U-3°°/ U-9°°/ U-12°°	
Electrical connections	*s. page 30*	
Installation on a machine	e.g. 60° at horizontal behind the rotating axis	
Tool drive axial		
Working position	X / Y	
Coupling profile	*s. page 25*	
Tool drive radial		
Working position	3°° / 9°° / 12°°	
Coupling profile	*s. page 25*	
Disk-type tool		
Toolholder systemWerkzeughalter-Toolholder	DIN 69880 / Capto	
nominal size		
Working position	x/y / SW	
Clamping direction (with DIN 69880)	right-hand / left-hand	
Support pin position	in front of / rear / both	
Sequence of numbers	right-hand / left-hand	
Options		
Rotary feedthrough	*s. page 7*	
Special requirements:		