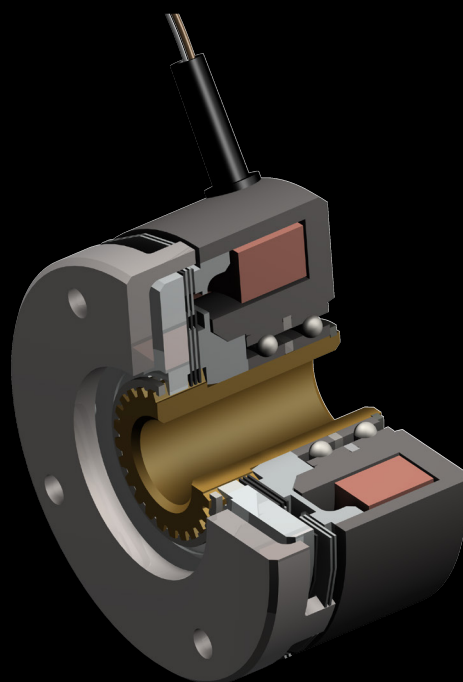


**Mönninghoff**

# **Electromagnetic multiple-disc clutch Type 501**



## Electromagnetic multiple-disc clutch - Type 501

### Characteristics and features

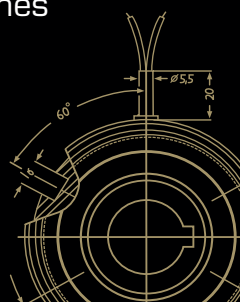
- suitable for torque transmission with increasing differential speed between the drive elements
- high torque transfer despite compact dimensions
- designs up to 2300 Nm possible
- low maintenance due to slip-ring-free power supply and lifetime-lubricated bearings
- negligible wear due to special friction lining
- only oil running
- maintenance free
- suitable for applications in harsh environments
- reduced shift speeds due to adapted control



Mönninghoff power transmission represents an infinite variant diversity that is applied by all areas of modern mechanical engineering.

Our technologies are mostly designed to operate under extreme conditions. We offer high precision products for medical robotics, fail-proof security for aerospace technology or synchronization solutions for the packaging or printing industry.

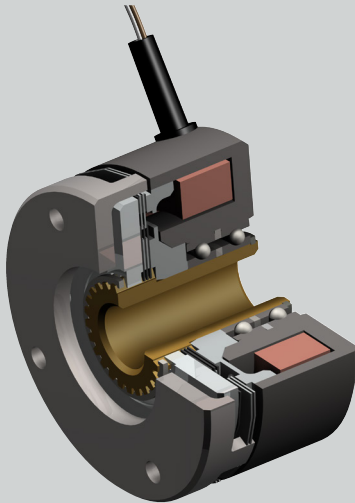
We thus address customers who have the highest standards for their own machines or systems. To them, we can offer highly complex, application-specific solutions.



## Electromagnetic multiple-disc clutch - Type 501

### Match code

Mönninghoff multiple-disc clutches are indicated by the following matchcode:



**501 . A . 3**

**A** clutch size

Other individual characteristics:

- voltage
- bore size with keyway

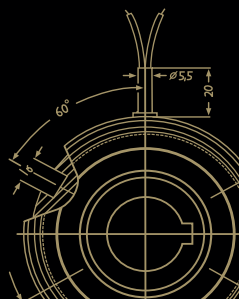
According to these characteristics, we design individual solutions concerning transmitted torque, engaging behavior or rotation speed.

Our engineers can assist with finding an application-specific clutch at any time. Together, we can develop individual and innovative solutions for extreme operating conditions.

### Ordering example

Mönninghoff electromagnetic multiple-disc clutch  
Type 501.21.1.1

Operating mode	oil running
Voltage	24 Vdc
Bore size d	30 mm H7, keyway acc to. DIN 6885/1



## Electromagnetic multiple-disc clutch - Type 501

### Clutch size

The selection of the correct size of a Mönninghoff electromagnetic multiple-disc clutch is determined by the required torque as well as the shift work.

- According to the required torque

$$M_s \geq M_{\text{erf}}$$

- According to the shift work

$$E_h \leq Q_h$$

The clutch must transfer load and acceleration torque ( $M_L$ ;  $M_b$ ). The required safety is obtained by using a corresponding safety factor ( $K$ ).

$$M_{\text{erf}} = (M_b \pm M_L) \cdot K$$

$$M_b = \frac{I \cdot \Delta n}{9,55 \cdot t} \quad [\text{Nm}]$$

$$Q_h = Q \cdot k_1 \cdot k_2 \quad [\text{Nm}]$$

$$E_h = \frac{I \cdot (\Delta n)^2 \cdot Z}{182,4} \quad [\text{Nm}]$$

If the load and acceleration torque cannot be determined, the required torque can be derived from the driving power, taking the required safety into consideration.

$$M_{\text{erf}} = 9550 \cdot \frac{P}{n} \cdot K \quad [\text{Nm}]$$

$M_{\text{erf}}$  = required torque  
 $M_b$  = acceleration torque  
 $M_s$  = shift torque  
 $M_L$  = output load torque

$n$  = speed of rotations [ $\text{min}^{-1}$ ]  
 $\Delta n$  = differential speed of rotations [ $\text{min}^{-1}$ ]  
 $k_1$  = correction factor  
 $k_2$  = correction factor

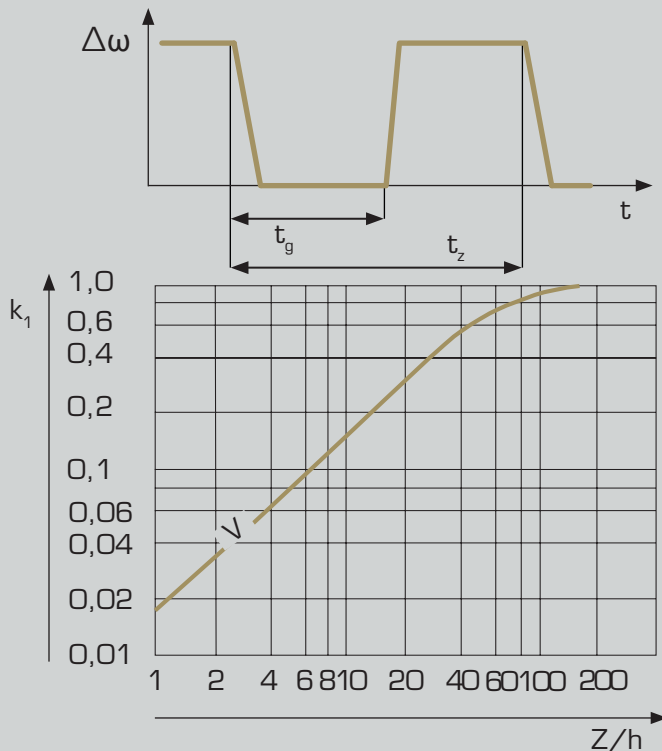
$P$  = driving power [kW]  
 $K$  = safety factor [1,2 to 4]  
 $I$  = moment of inertia [ $\text{kgm}^2$ ]  
 $Z$  = number of shift operations per hour  
 $Q$  = amount of heat  
 $E_h$  = shift energy per hour [Nm]  
 $t$  = acceleration time [sec]  
 based on  $t_1$



## Electromagnetic multiple-disc clutch - Type 501

### Determination of shift work

The energy that is lost in the clutch depends on the shift curve and the shift frequency. The correction factors for the permissible shift work per hour  $Q_h$  can be derived from the tables and graphs.



Course of a shift cycle

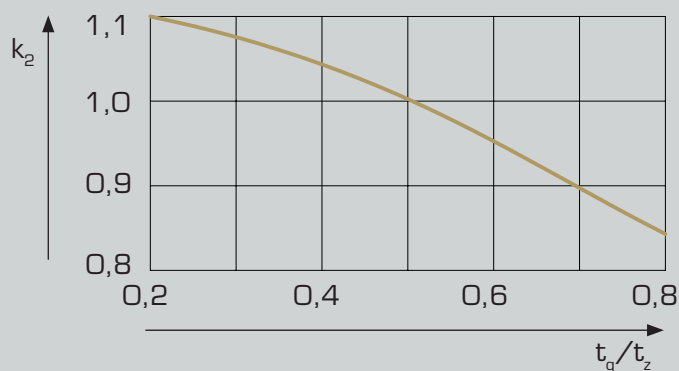
$t_g$  = time during which the clutch is closed

$t_z$  = total cycle time

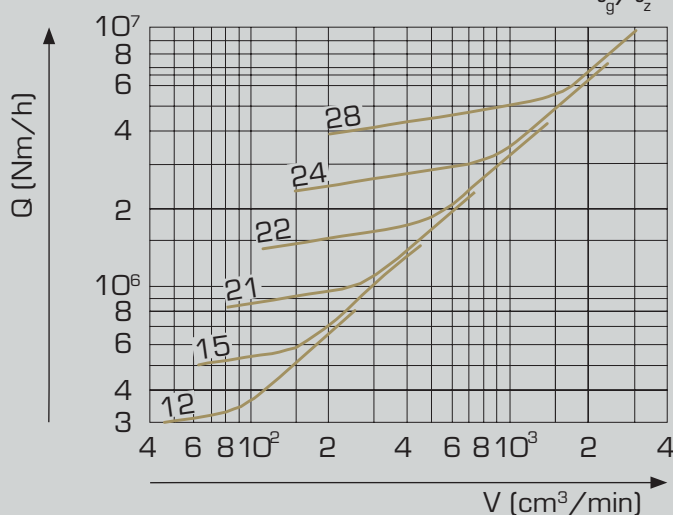
$\Delta\omega$  = differential angular velocity

Correction factor  $k_1$  as a function of the shift frequency per hour

V valid for all sizes and types of clutches whose discs are surrounded by the field of force



Correction factor  $k_2$  as function  $t_g/t_z$



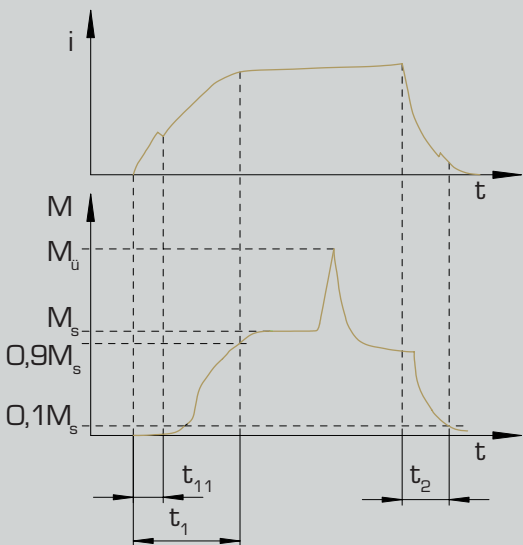
Amount of heat  $Q$  as function of the amount of cooling oil; valid for clutches whose discs are surrounded by the field of force



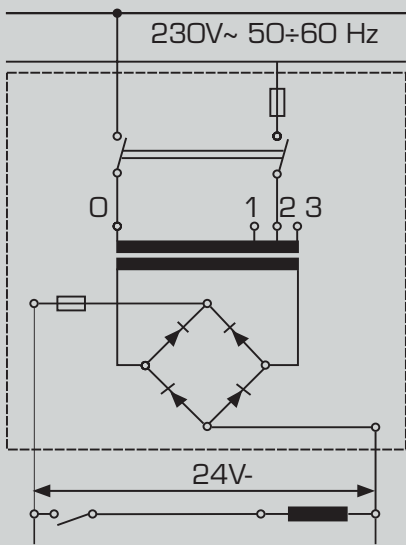
Electromagnetic multiple-disc clutch - Type 501

Switching

Electromagnetic clutches are inductances. Engagement and disengagement are subject to the laws of induction, i. e. the induction current increases according to an e-function.



Shift speeds



Shift diagram: normal shifting

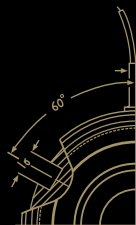
- $t_1$  and  $t_2$  can be electrically influenced by taking appropriate measures
- it is advisable to use direct current for shifting
- when determining the size, the engage time is considered to be approximately 30% of the total acceleration time, which normally results in additional safety

Technical data

Size			16	21	22	24	26	28	normal excitation for oil and dry lubrication
shift speeds acc. to VDE 0580:2011-11	$t_1$	[msec]	220/140	250/160	360/250	450/330	600/450	900/600	
	$t_2$		70/60	90/80	110/100	200/180	250/220	400/350s	

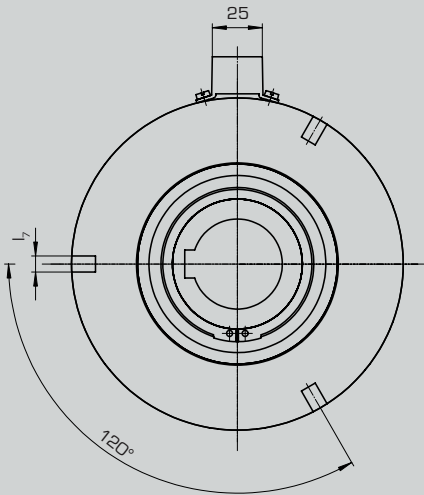
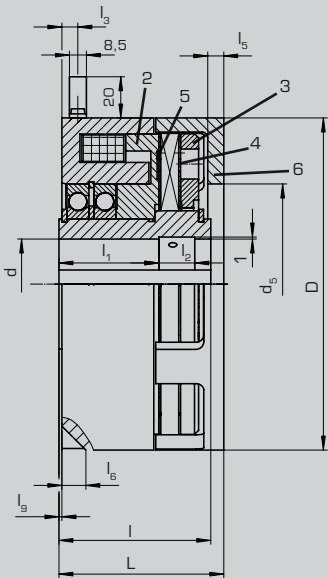
- $i$  = induction current
- $M_u$  = torque to be transferred / static torque
- $M_s$  = torque to be shifted

- $t_1$  = engage time
- $t_2$  = disengage time
- $t_{11}$  = response delay



Electromagnetic multiple-disc clutch - Type 501

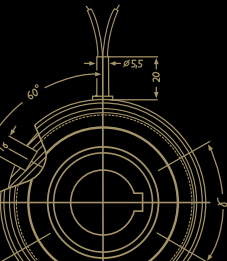
Clutch size



- 2 Rotor
- 3 Armature
- 4 Inner plate
- 5 Outer plate
- 6 Drive ring

Technical data

Size		12	15	21	22	24	28	31
torque	M <sub>d</sub> dyn [Nm]	25	60	120	250	480	960	1200
	M <sub>s</sub> stat	40	100	200	400	800	1600	2300
max. speed [min <sup>-1</sup> ]		3000	3000	2400	2000	2000	2000	1800
input power [W]		24	41	50	70	86	104	128
inertia	parts 2,3,4 [10 <sup>-3</sup> kgm <sup>2</sup> ]	0,75	1,73	4,5	12,5	19,5	73,5	-
	parts 5,6	0,5	1,6	3	7	14,5	50	-
weight [kg]		2,1	3,5	5,4	9,5	14,5	27	28
number of plates	inner plates	5	6	6	6	7	7	9
	outer plates	4	5	5	5	6	6	8
bore	keyway acc. to DIN 6885/1 d H7 [mm]	15 - 25	20 - 32	25 - 40	30 - 45	35 - 60	50 - 75	60 - 75
	keyway acc. to DIN 6885/2	15 - 30	20 - 35	25 - 42	30 - 50	35 - 65	50 - 80	60 - 80
Abmessungen	D [mm]	95	114	134	166	195	240	240
	d <sub>6</sub> H7	45	51	61	75	90	112	112
	L	56	63	73	82,5	93,5	108,5	109
	l - 0,1	52	58,5	68	76	83,5	98	99
	l <sub>1</sub>	38	38,5	46	50	52	61	55
	l <sub>2</sub>	10	12	14	18	18	22	24
	l <sub>3</sub>	5	5	6,5	8	8	12	12
	l <sub>5</sub>	5	6	6	8	9	10	10
	l <sub>6</sub>	6	8	10	12	15	15	12
	l <sub>7</sub> + 0,2	6	8	8	8	12	12	12
	l <sub>9</sub>	0,5	0,5	0,5	1,5	1	1	1



## Electromagnetic multiple-disc clutch - Type 501

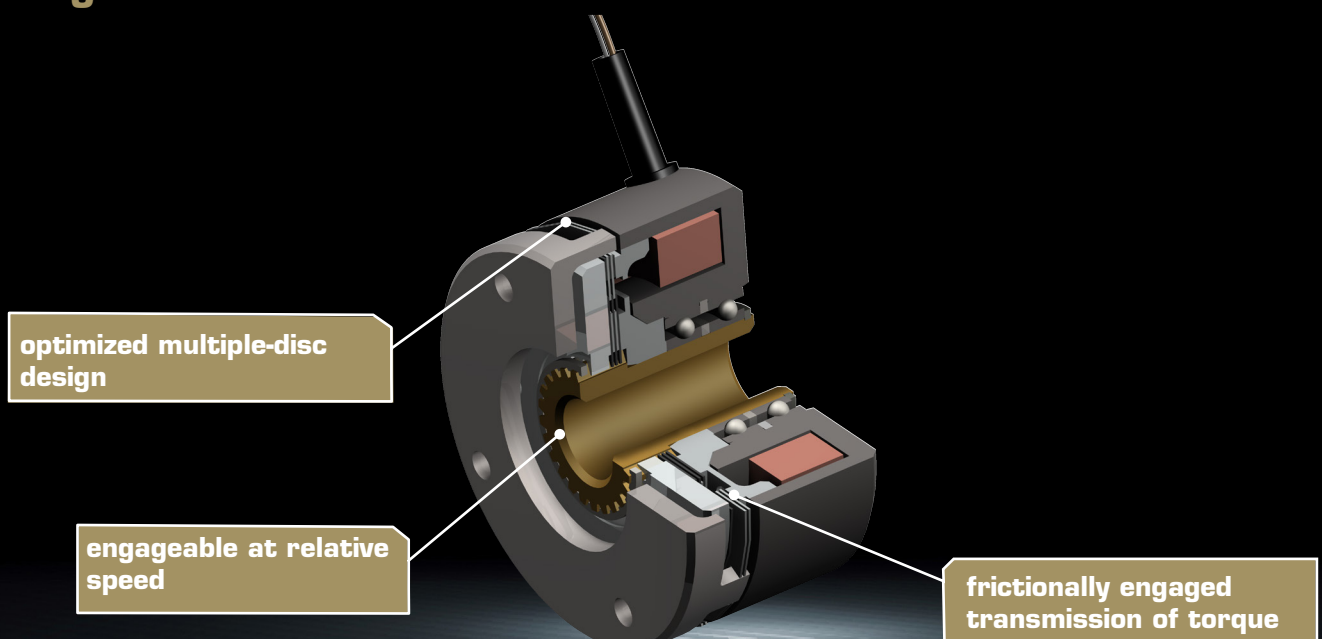
### Voltage

- standard voltage is 24 Vdc direct current
- special voltages as an example 48 Vdc on request

### Technical characteristic

- must run in oil
- the arrangement of the discs between the pole faces and the armature requires the discs to be made of a ferromagnetic material with good friction and wear properties, which are obtained by hardening and nitriding
- residual magnetism resulting from the hardening process is eliminated by the special design of the discs
- the shape of the discs prevents the oil from building up when the temperature drops, thus avoiding shift delays
- clutches whose discs are surrounded by the field of force are particularly suitable for shifting operations with a high energy exchange
- require low maintenance

### At a glance

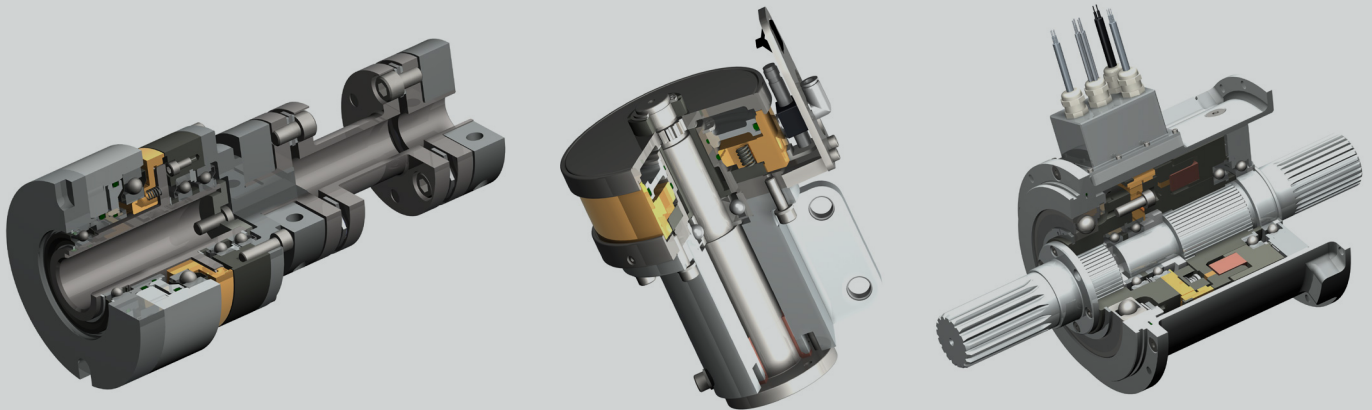




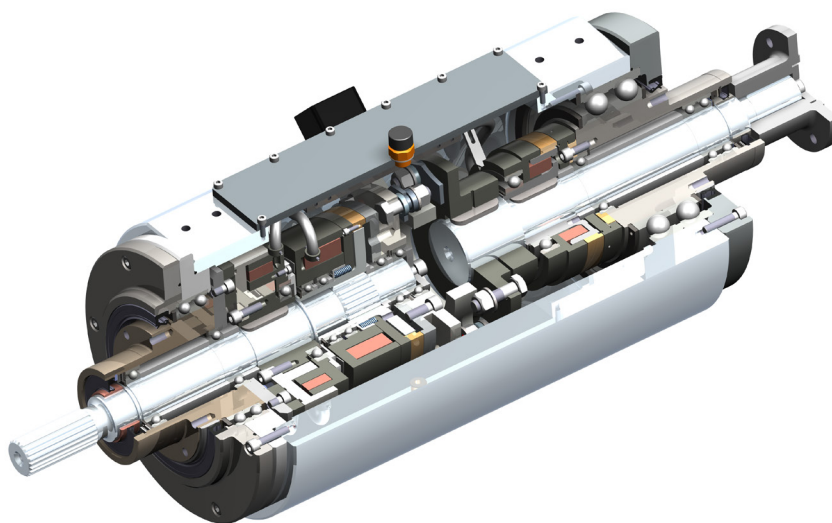
## System solutions

### You need more?

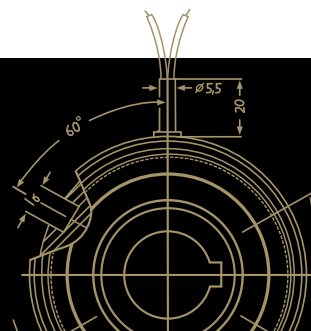
Mönninghoff clutches can be combined with a variety of many other power transmission elements. Such complex high-tech systems can solve any application-specific tasks and can fulfill any customer-specific wishes.



In many cases, a combination of different drive elements is needed to solve the applications particular problems and difficulties. Being not just supplier but technological partner to our customers, our extensive engineering is part of extraordinary and challenging power transmission projects.



**Our product is the know-how,  
with hardware as an added bonus.**



## Driven by excellence

### Why Mönninghoff

- intensive dialog with our customers' engineers
- decades of experience and competence
- deep understanding for all areas of mechanical engineering
- highly modern and flexible machine park
- enthusiasm for quality
- flexibility, inventiveness and communication skills of our employees
- commitment to Germany and Bochum as industrial location

### How to reach us

#### Sales

sales@moenninghoff.de  
+49 234 3335-250



Helps you find a customer-specific power transmission solution for extraordinary circumstances.

#### Order Management

confirmation@moenninghoff.de  
+49 234 3335-353



For the competent processing and smooth handling of your orders and delivery dates.

#### Service

service@moenninghoff.de  
+49 234 3335-333



Feels committed to protect and preserve the high value of your machine and to secure its availability.

