IDAM
INA Drives & Mechatronics

RDDS
Rotary Direct Drive Systems

- RDDS1 Matrix
- RDDS2 Matrix

SCHAEFFLER GROUP

The Perfect Drive for Every Application.

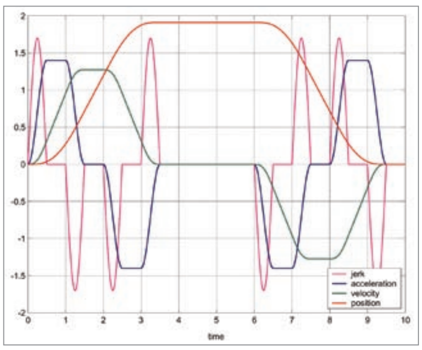
INA - Drives & Mechatronics GmbH & Co. oHG, a company of the Schaeffler Group, specializes in linear and rotary direct drives. These products are supplemented by directly driven positioning systems and related controllers and mechatronics assemblies.
In addition to standard products, IDAM also develops and produces customized drive solutions.
Due to the increasing demands in terms of dynamic performance, precision and cost reduction, direct drives are becoming increasingly more popular in modern machinery and equipment.

The direct connection between motor and accelerated mass increases dynamic and static rigidity, reduces elasticity and therefore enables an extremely high level of positioning performance. Direct drives are non-wearing, as a result of which maintenance and operating costs can be reduced whilst simultaneously increasing availability.
In the industries of machine tools and production machinery, automation, productronics/semicon, measuring technology and medical technology, teams at IDAM have been developing direct drives and complex drive systems since 1990.

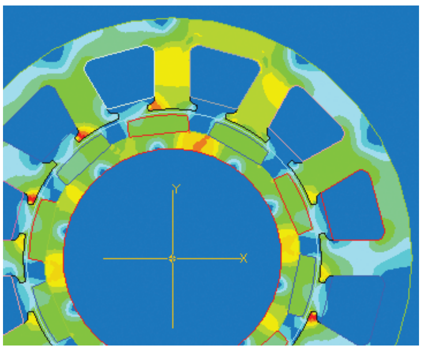
The development of the direct drives and the positioning systems is efficiently supported by the integration of models and simulations.

IDAM employs a state-of-the-art quality management system. At IDAM, quality management is a dynamic process which is examined on a daily basis and is thus continuously improved. IDAM is certified according to standard DIN EN ISO 9001:2008.

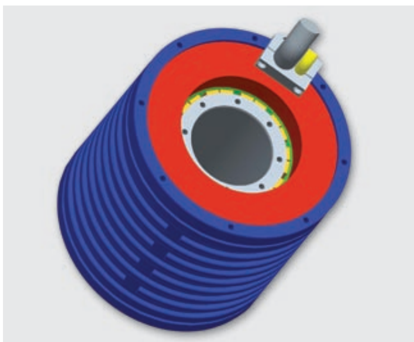
Specially developed tools are used in the development and design of the motors, including tools for mechanical and thermal simulations. The results from these simulations are available to IDAM customers to help them optimize the connection designs.



(1-cos)-shaped acceleration for high-precision applications, since with very small changes in target



FEM model



CAD model

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Advantages of Rotary Direct Drives

Increases dynamic capacity

1. No conversion of motion form
The drive train is free of elasticity, backlash, hysteresis and has few friction caused by transmission or coupling elements.

2. Multi-pole motor
With a multi-pole design, IDAM motors are capable of producing very high torque. In addition, this high torque can be used from rotary speed › 0 right up to the continuous speed.

3. Thin, ring-shaped rotor
Thanks to the thin, ring-shaped design with a large, open inner diameter, the motor has a very low rotor inertia. This allows for very high motor acceleration capabilities.

4. Direct measurement of position
Thanks to direct position measurement and the rigid mechanical structure, positioning is performed dynamically and highly accurate.

Reduces operating costs

1. No additional moving parts
Assembly, adjustment and maintenance work for the drive assembly is reduced.

2. No wear in the drive train
Even under high and frequently alternating loads the drive train is extremely durable. Machine downtimes drop as a result.

3. High availability
In addition to increased service life and reduced wear, the robustness of the torquemotors increases the system availability.

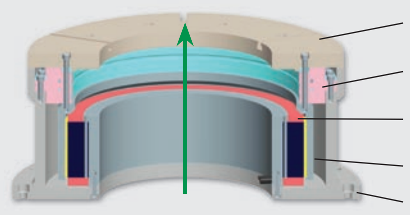
Increases design flexibility

1. Hollow shaft
With its large, open, inner diameter, the hollow shaft design of a torque motor allows for much greater design flexibility. The hollow shaft allows for tubing, fixtures, rotary unions and wiring to travel up through the center of the motor. This adds to the versatility of design capabilities.

2. Component integration RDDS
Thanks to the smaller space required, the system can be easily integrated into the machine design.

3. Compact design
Along with the large, open inner diameter (hollow shaft), systems are very compact relative to the torque output.

4. Low number of components
The mature design facilitates the integration of the system in the overall machine concept.
Fewer and more robust parts result in a low failure rate (high MTBF*).



Large, open inner diameter allows for greater design flexibility

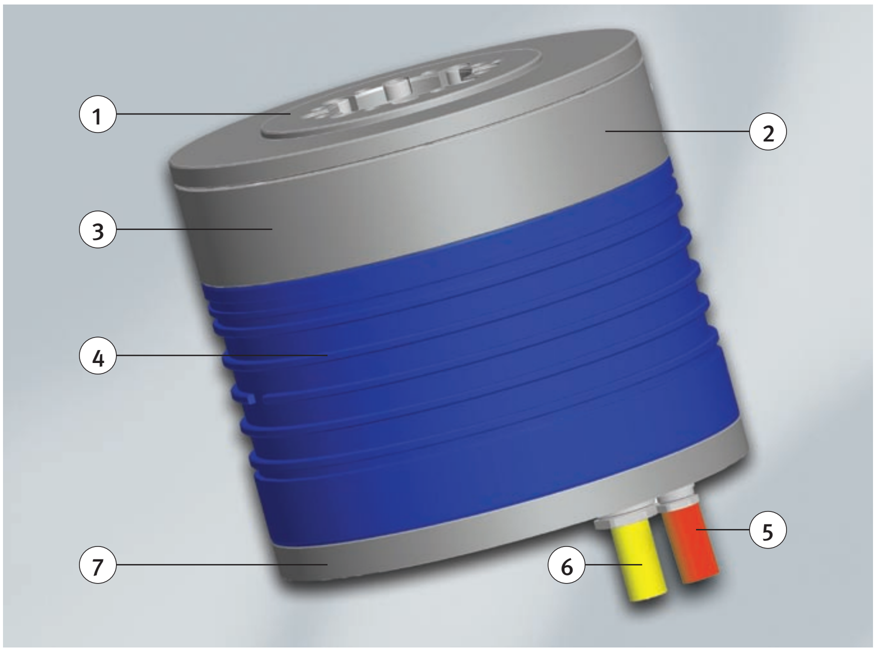
*MTBF: Mean time between failures

System Advantages

- High dynamics and stiffness
- Extremely smooth motion
- High acceleration
- High velocity
- Compact design
- Easy assembly
- Excellent static and dynamic load rigidity
- No backlash
- Low-wear and low-maintenance system
- Small inertia

- Peak torque T_p 8.9 – 369 Nm
- Measuring system
  - Optical measuring principle
  - Several increments depending on model
- Bearing
  - Compact
  - High external tilting torque
  - High stiffness and accuracy
  - Very low axial and radial runout
- Free inner diameter

Standard Design



1. Stage plate
2. Measuring system (inside)
3. Bearing (inside)
4. Direct drive motor (inside)
5. Non detachable cord, measuring system (axial)
6. Non detachable cord, motor (axial)
7. Base plate

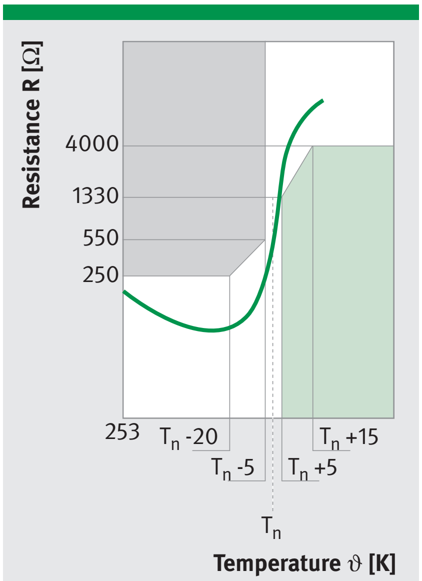
Thermal Motor Protection

Monitoring circuit I and II

Direct drives are often being operated at their thermal performance limits.
In addition, unforeseen overloads can occur during operation which result in an additional current load in excess of the permissible nominal current. For this reason, the servo controllers for motors should generally have an overload protection in order to control the motor current. Here, the effective value (root mean square) of the motor current must only be allowed to exceed the permissible nominal current of the motor for a short time. This type of indirect temperature monitoring is very quick and reliable.
IDAM motors are equipped with temperature sensors (PTC and KTY) which should be used for thermal motor protection.

Monitoring circuit I

The three phase-windings are equipped with three series-connected PTCs to ensure motor protection. A PTC is a positive temperature coefficient thermistor. Its thermal time constant when installed is below 5 s.

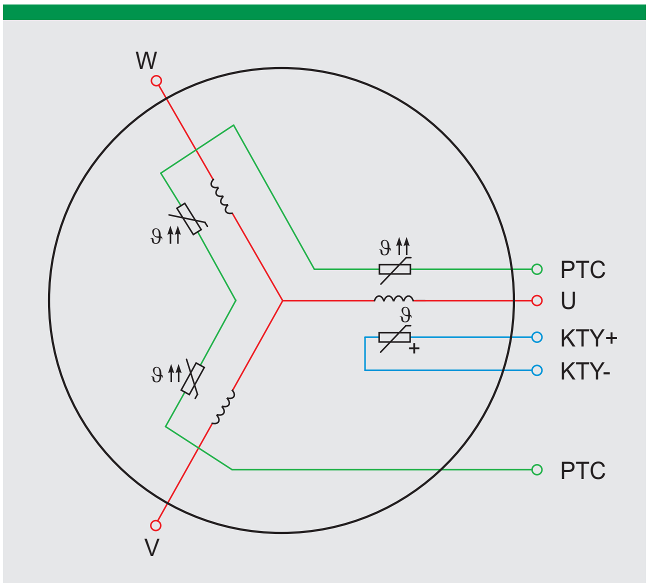


Temperature characteristics PTC

In contrast to a KTY, its resistance increases very sharply when the nominal response temperature T_n is exceeded, increasing to many times the cold value in the process.
With three PTC elements connected in series, this behaviour also generates a clear change in the overall resistance even if only one of the elements exceeds the nominal response temperature T_n.
The use of three sensors ensures that, even if the motor is at a standstill under an asymmetric phase load, there is a signal for a safe shut-down. A commercially available motor protection tripping device which is connected downstream will typically trigger between 1.5 and 3.5 kOhm. In this way, overtemperature is detected to within a discrepancy of a few degrees for every winding.

The tripping devices also react if the resistance is too low in the PTC circuit, which usually indicates a defect in the monitoring circuit. It also ensures secure electrical separation between the controller and the sensors in the motor. The motor protection tripping devices are not included in the scope of supply.
PTCs are not suitable for temperature measurements. The KTY should be used here if required.
Further monitoring sensors can be integrated at the customer’s request.

As a rule, PTC sensor signals must be monitored for protection against overtemperature.



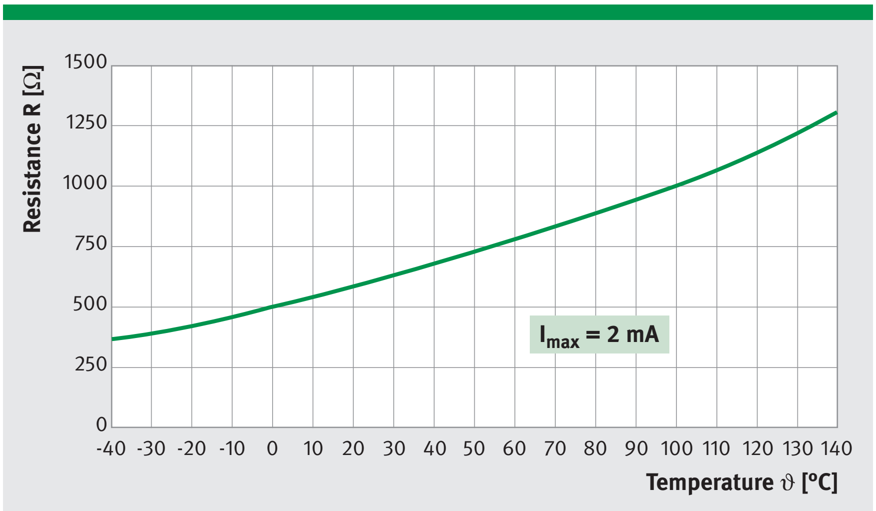
Standard connection of PTC and KTY

Monitoring circuit II

On one phase of the motor there is an additional KTY84-130. This sensor is a semiconductor resistor with a positive temperature coefficient.
A temperature-equivalent signal is generated with a delay which depends on the motor type.

In order to protect the motor against overtemperature, a shut-off limit is defined in the controller. When the motor is at a standstill, constant currents flow through the windings, with the current depending on the respective pole position.

As a result, the motor does not heat up uniformly, which may cause overheating of non-monitored windings. The PTC and KTY sensors have a basic insulation to the motor. They are not suitable for direct connection to PELV/SELV circuits according to standard DIN EN 50178.



Temperature characteristics KTY

The KTY sensor monitors a single winding. Its signal can be used to watching the temperature or issue a warning. Exclusive use for switching off is not permissible.

Electrical Connections

The standard cable connections of the RDDS1 matrix are axial. Their position is defined in the drawings.
The cable length from the motor output is 1.0 m.
The wire ends are open and fitted with end sleeves. The cables which are used are UL approved and suitable for cable drag chains.

Optionally the rotary systems are available with externally mounted plug direct on the casing or with coupler plug on the connecting cables.

Positive direction of rotation of the system
The standard direction of rotation of the stage plate is counter-clockwise, but it can vary depending on connecting type.

Pin layout - cable connection (standard)

Type of cable:
4G1.5 + 2x (2x0.75) KAWEFLEX 5281 ø 12,6 mm, bending radius dynamically 95 mm, bending radius statically 63 mm

Motor	
Core	**Signal**
1	Phase U
2	Phase V
3	Phase W
GNYE	PE
5	PTC (3x series, all phases)
6	PTC (3x series, all phases)
7	+ Temperature sensor KTY84-130 (one phase)
8	- Temperature sensor KTY84-130 (one phase)
Shield	

Type of cable:
12x0.08 NJ AWM STYLE 20963 ø 3.7 mm, bending radius dynamically 40 mm, bending radius statically 8 mm

Measuring system 1 V_{pp}	
Core	**Signal**
GN	U1+
BN	U1-
BK	U2+
RD	U2-
GY	U0+
PK	U0-
WH	GND
BU	+5 V
Shield	

Pin layout - plug connection (option)

- at RDDS1-130xH: 9-pole M17 mounted plug

Motor	
Pin	**Signal**
1	Phase U
2	Phase V
3	Phase W
PE	PE
A	PTC (3x series, all phases)
B	PTC (3x series, all phases)
C	NC
D	+ Temperature sensor KTY84-130 (one phase)
E	- Temperature sensor KTY84-130 (one phase)
Case	Shield

9-pole M17 mounted plug (motor)

- 17-pole M17 mounted plug

Measuring system 1 V_{pp}	
Pin	**Signal**
1	+5 V Sense
2	NC
3	NC
4	GND Sense
5	NC
6	NC
7	+5 V
8	NC
9	NC
10	GND
11	NC
12	U2+
13	U2-
14	U0+
15	U1+
16	U1-
17	U0-
Case	Shield

17-pole M17 mounted plug (encoder system)

Pin layout - plug connection (option)

- **at RDDS1-160xH, RDDS1-180xH, RDDS1-230xH: 8-pole M23 mounted plug**
- **at the connecting variants MA/MU/MD (all sizes): 8-pole M23 coupler plug at the cable**

Motor	
Pin	**Signal**
1	Phase U
4	Phase V
3	Phase W
2 / PE	PE
A	PTC (3x series, all phases)
B	PTC (3x series, all phases)
C	+ Temperature sensor KTY84-130 (one phase)
D	- Temperature sensor KTY84-130 (one phase)
Case	Shield

8-pole M23 mounted plug (motor)

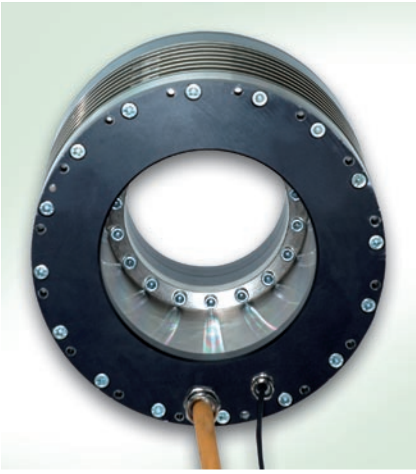
- **12-pole M23 mounted plug**
- **12-pole M23 coupler plug at the cable**

Measuring system 1 V_{pp}	
Pin	**Signal**
1	U2-
2	+5 V Sense
3	U0+
4	U0-
5	U1+
6	U1-
7	NC
8	U2+
9	NC
10	GND
11	GND Sense
12	+5 V
Case	Shield

12-pole M23 mounted plug (encoder system)

Commutation

Rotary direct drive systems are preferably run in commutated operation. As standard, IDAM torque motors are not equipped with Hall sensors.
IDAM recommends measuring system-related commutation, because it is supported by modern servo-inverters and controllers.



Insulation Strength

Insulation strength for link voltages of up to 600 VDC

IDAM motors comply with EC directive 73/23/EEC and European standards EN 50178 and EN 60204.
Prior to delivery they are tested with differentiated high voltage testing methods and casted under vacuum.

Please make sure that the type-related operating voltages of the motors are observed.

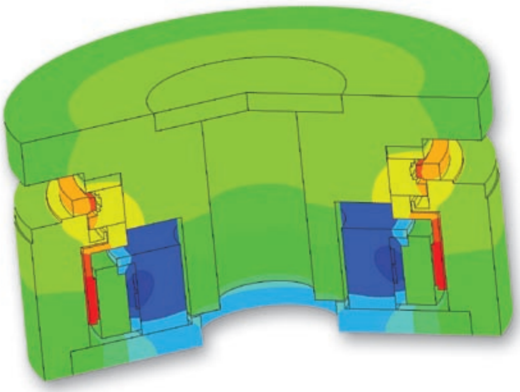
Overvoltages at motor terminals in converter operation

Due to the extremely fast-switching power semiconductors which generate high du/dt loads, significantly higher voltage peaks than the actual converter voltages may occur at the motor terminals, particularly when longer connecting cables (from a length of approx. 5 m) are used between motor and converter. This places a very high load on the motor insulation. The du/dt values of the PWM modules must not exceed 8 kV/µs. The motor connecting cables must be kept as short as possible.

In order to protect the motors, an oscilloscope should always be used in the specific configuration to measure the voltage (PWM) applied to the motor via the winding and in relation to PE. The present voltage peaks should not significantly exceed 1 kV.
From approx. 2 kV a gradual damaging of the insulation should be expected.
IDAM engineers will assist you with your application and help you to determine and reduce excessive voltages.

Please observe the recommendations and configuration notes provided by the manufacturer of the controller.

Cooling and Cooling Circuit



Power loss and thermal loss

In addition to the power loss defined by the motor constant k_m, motors are also subject to frequency-dependent losses occurring especially at higher control frequencies (above 50 Hz). These losses jointly cause the motor and other system assemblies to heat up.

The following rule applies at low control frequencies (‹80 Hz) of the motors: Motors with a high motor constant km produce lower power losses in relation to comparable motors with a lower motor constant.

The power loss generated during motor operation is transmitted via the motor assembly to attached components. The overall system is carefully designed to control the way in which this heat distribution is influenced and controlled through convection, conduction and radiation.

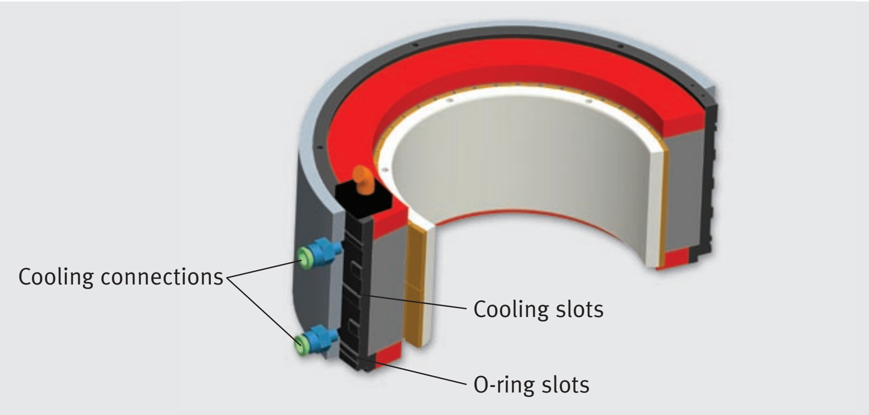
The continuous torques of liquid-cooled motors are around twice as high as those of uncooled motors. The rotary direct drive systems must be selected and integrated into the machine concept in accordance with the requirements for installation space, accuracy and cooling.

Active cooling should be preferably used on machines with high performance and on equipment with highly dynamic operation and correspondingly high bearing loads.

The cooling of the systems is designed as jacket cooling and should be connected by the customer to the cooling circuit of a cooling device. The cooling jacket is optionally supplied as a part of the motor or is already an integral part of the machine construction for the customer.

The cooling medium passes from the inlet to the outlet through holes in the cooling fins at different levels. Inlet and outlet connections can be assigned to the two connections as required. The flow area is sealed to the outside with O-rings.

When using water as the coolant, additives must be used which prevent corrosion and biological deposits in the cooling circuit.



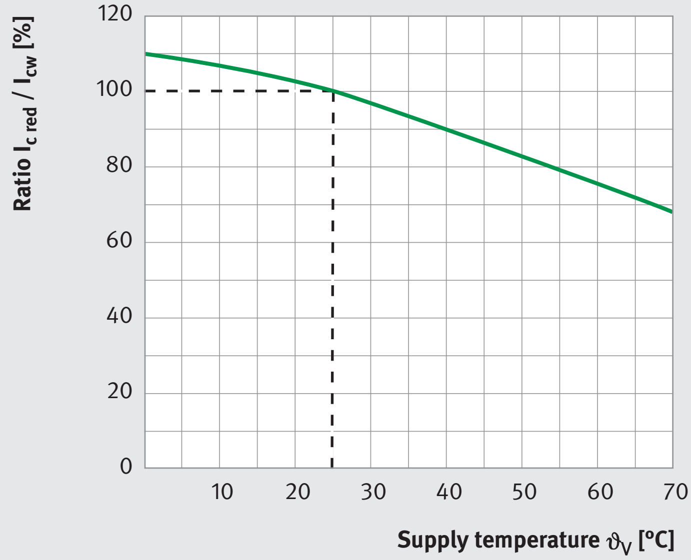
Dependency of Characteristic Data on the Supply Temperature of Cooling Medium

The continuous current I_{cw} indicated in the data sheet for water cooled operation can be achieved at a rated supply temperature ϑ_{nV} of 25 °C. Higher supply temperatures ϑ_V result in a reduction of the cooling performance and therefore also the nominal current. The reduced continuous current $I_{c\ red}$ can be calculated from the following quadratic equation:

$$\frac{I_{c\ red}}{I_{cw}} = \sqrt{\frac{\vartheta_{max} - \vartheta_V}{\vartheta_{max} - \vartheta_{nV}}}$$

$I_{c\ red}$	Reduced continuous current [A]
I_{cw}	Continuous current, cooled at ϑ_{nV} [A]
ϑ_V	Current supply temperature [°C]
ϑ_{nV}	Rated supply temperature [°C]
ϑ_{max}	Maximum permissible winding temperature [°C]

(applies to a constant motor current)



Relative continuous current $I_{c\ red}$ / I_{cw} vs. supply temperature ϑ_V (ϑ_{nV} = 25 °C)

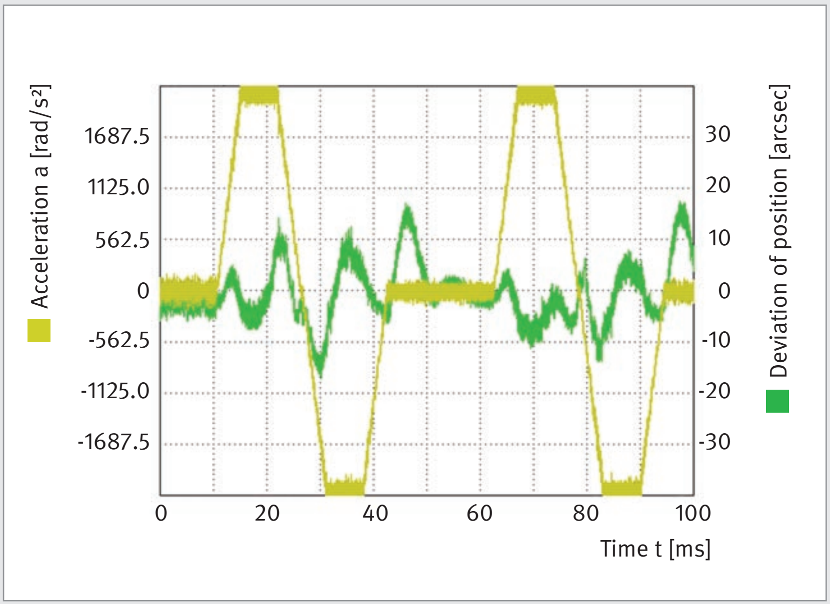
Positioning Cycle

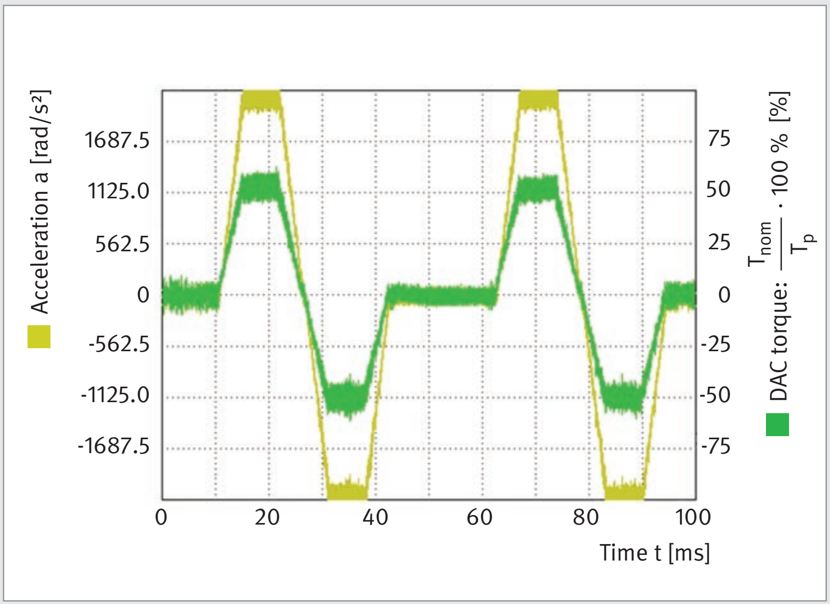
System: RDDS1-160x195-S-B-CA-WM-9000

Rotating motion: 22.5° in 32 ms / pause 20 ms ⟶ 69230 steps/h

Additional mass moment of inerta: 0.0125 kgm^2 (equates to 2.5 x J_{Rotor})

Jerk limitation:	j_{max} = 500000 rad/s^3
Angular acceleration:	α_{max} = 2250 rad/s^2
Angular speed:	ω_{max} = 25 rad/s (= 238 rpm)

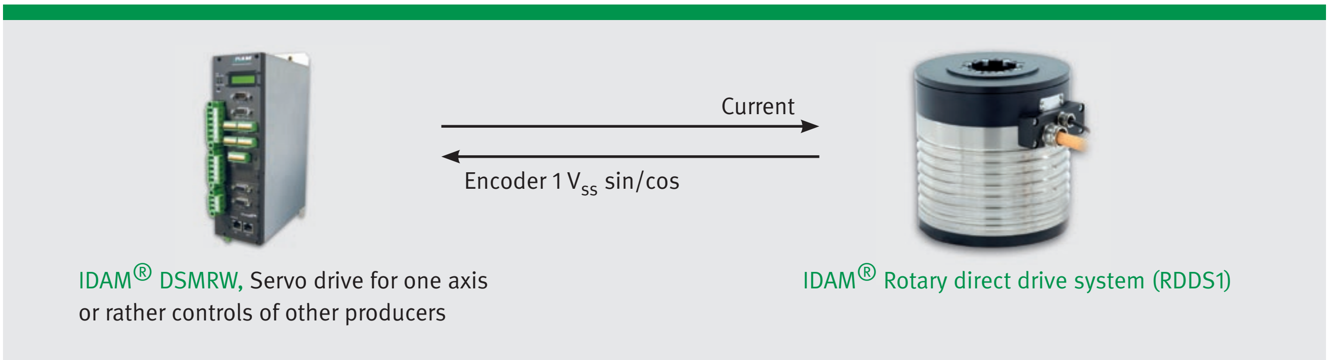


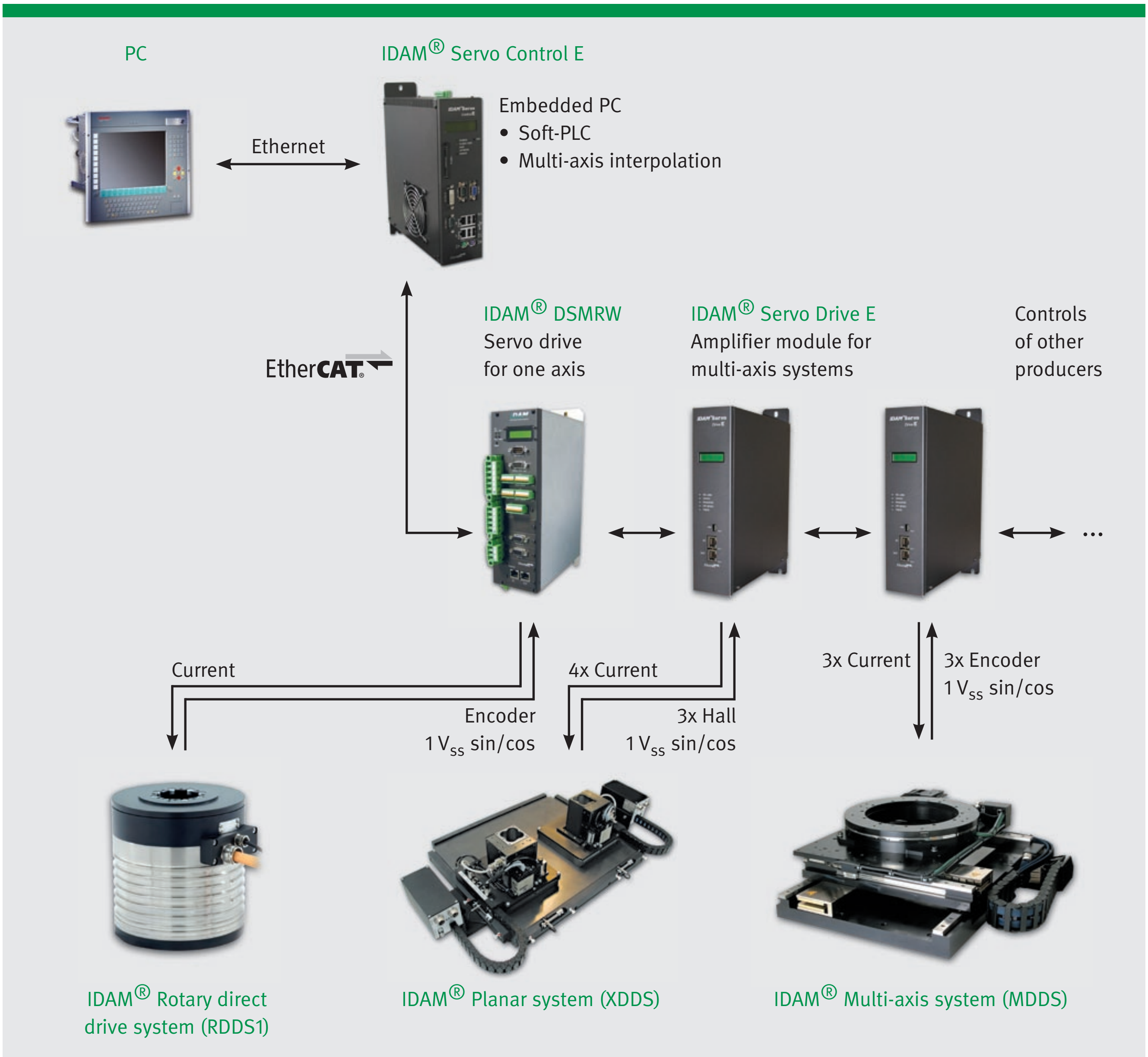


T_p - Peak torque

T_{nom} - Nominal torque

System Configuration





Additional Loads

The following images show possible loading cases of the rotary system.

External forces respectively additional masses cause certain loadings at the rotary system depending on point of application and position.

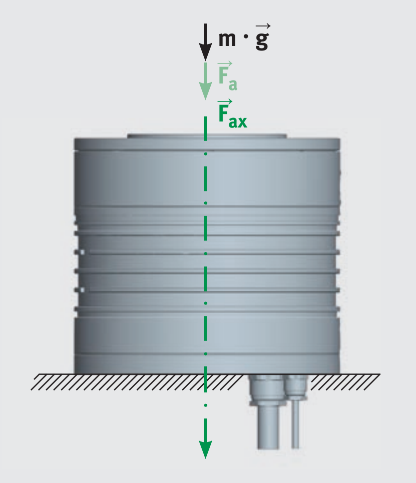


Image 1

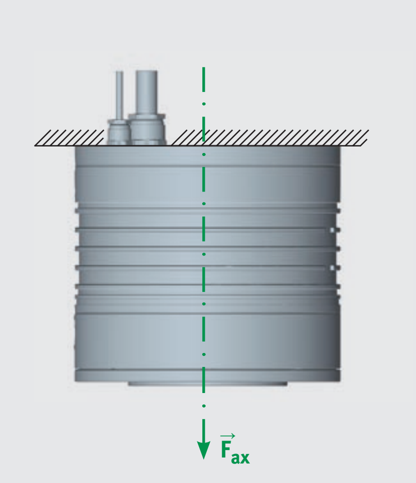


Image 2

External forces affecting in the centre, whose line of action is identical with the rotary axis ($\vec{F}_a$) as well as centrical arranged additional masses (m) lead to a resulting axial force ($\vec{F}_{ax}$) if the rotary systems are assembled like at image 1 and image 2:

$\vec{F}_{ax} = \vec{F}_a + m \cdot \vec{g}$

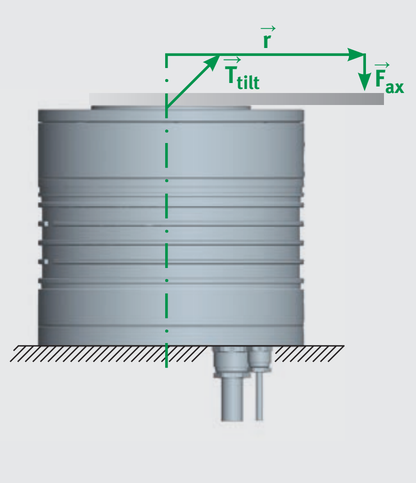


Image 3

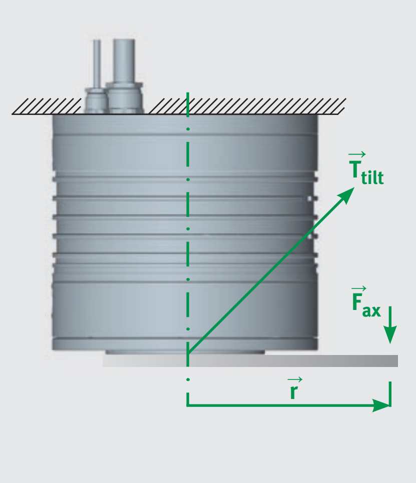


Image 4

If the resulting axial force ($\vec{F}_{ax}$) is excentric to the rotary axis with the distance ($\vec{r}$) (images 3 and 4), the rotary system is strained by an additional tilting torque:

$\vec{T}_{tilt} = \vec{r} \times \vec{F}_{ax}$

In case of lever arm and force being perpendicular to each other:

$|\vec{T}_{tilt}| = |\vec{r}| \cdot |\vec{F}_{ax}| \cdot \sin 90°$

$T_{tilt} = r \cdot F_{ax}$

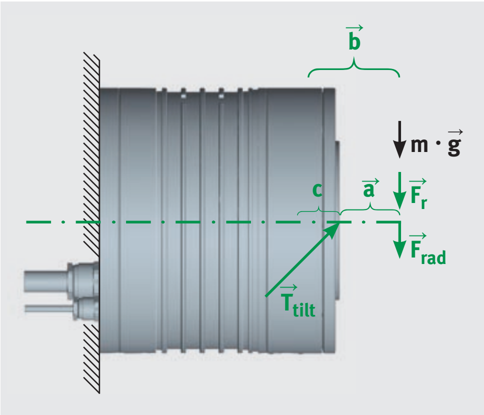


Image 5

External forces ($\vec{F}_r$), radial affecting the centre, which line of action is perpendicular to the rotary axis, as well as centrical arranged additional masses (m) lead to a resulting radial strain ($\vec{F}_{rad}$) if the rotary systems are assembled like at image 5:

$\vec{F}_{rad} = \vec{F}_r + m \cdot \vec{g}$

The point of application of the radial force (F_{rad}) is generally at a distance (a) from the stage plate and the radial load leads additionally to a strain of tilting torque. The tilting torque is according to image 5:

$\vec{T}_{tilt} = \vec{b} \times \vec{F}_{rad}$

If lever arm and force are perpendicular to each other, the tilting torque is analog page 16:

$|\vec{T}_{tilt}| = |\vec{b}| \cdot |\vec{F}_{rad}| \cdot \sin 90°$

$T_{tilt} = b \cdot F_{rad}$

The distance b is according to image 5:

$b = a + c$

From this it follows the tilting torque:

$T_{tilt} = (a + c) \cdot F_{rad}$

c is a particular value for any diameter step.

RDDS1	c [m]
130xH	0.028
160xH	0.032
180xH	0.026
230xH	0.029

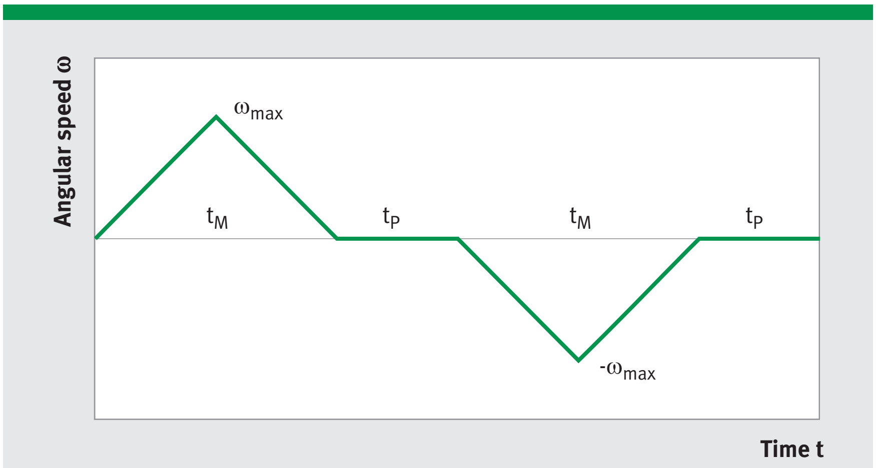
It is important, that in no constellation one of the specified limiting values (F_{ax}, F_{rad}, T_{tilt}) are exceeded. Please contact us, if you have higher demands regarding the loads.

Selection of Direct Drives for Rotary Applications

Cycled applications

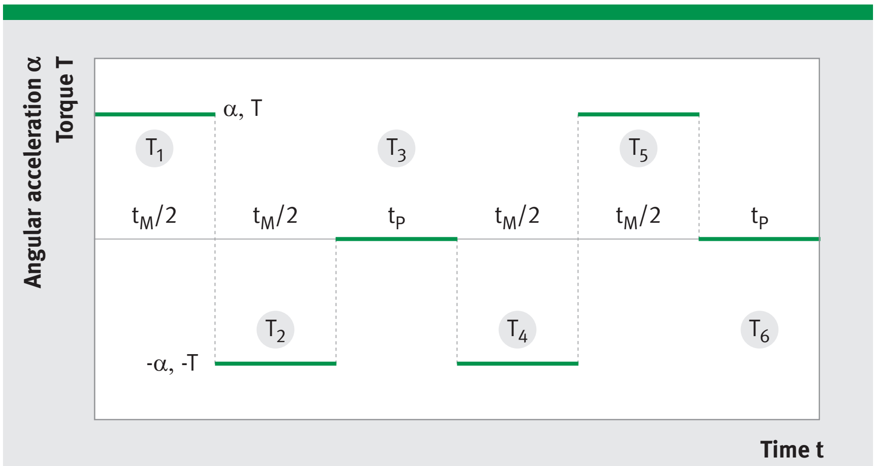
In cycled operation, sequential positioning movements are interspersed with pauses during which no motion takes place.

A simple positioning sequence takes the form of a positively accelerated motion followed by a deceleration (negative acceleration of usually the same magnitude, in which case acceleration and deceleration time are equal). The maximum angular speed ω_{max} is reached at the end of an acceleration phase.



A cycle is described in the ω(t)-diagram (ω: angular speed, t: time). The diagram shows a forward-backward movement with pauses (t_M: motion time, t_P: pause time).

This gives the following α(t)-diagram (α: angular acceleration) as well as the flow of the torque required for the movement : $T = J \times \alpha$
(T: torque in Nm, J: mass moment of inertia in kgm^2, α: angular acceleration in rad/s^2).



According to the torque flow of the desired rhythm cycle, the motor is selected according to three criteria:

- maximum torque in the cycle ≤ T_P according to data sheet
- effective torque in the cycle ≤ T_c (motor uncooled) or T_{cw} (water cooling) according to data sheet
- maximum rotary speed in the cycle ≤ n_{lp} according to data sheet

The effective torque equals the root mean square of the torque curve (six torque cycles) in the rhythm cycle.

$$T_{rms} = \sqrt{\frac{T_1^2 \cdot t_1 + T_2^2 \cdot t_2 + \ldots + T_6^2 \cdot t_6}{t_1 + t_2 + \ldots + t_6}}$$

The safety factor 1.4 in the sample calculation also takes into account the operation of the motor in the non-linear region of the torque-current characteristic, for which the formula for calculating T_{eff} only applies approximately.

With the torques $T_1 = T$; $T_2 = -T$; $T_3 = 0$; $T_4 = -T$; $T_5 = T$; $T_6 = 0$ and the times $t_1 = t_M/2$; $t_2 = t_M/2$; $t_3 = t_P$; $t_4 = t_M/2$; $t_5 = t_M/2$; $t_6 = t_P$ the effective torque is calculated.

$$T_{rms} = T_{nom} \cdot \sqrt{\frac{t_M}{t_M + t_P}}$$

This equation is applied to the effective torque, if torques of the same magnitude act in the rhythm cycle (mass moment of inertia and angular accelerations are constant). Below the root sign appears: „sum of the motion times divided by the total of the motion and pause times“. The denominator is thus the cycle time.

Angular acceleration, maximum angular speed and maximum rotary speed of a positioning movement are calculated with:

$$\alpha = \frac{4 \cdot \varphi}{t_M^2}$$

$$\omega_{max} = \alpha \cdot \frac{t_M}{2}$$

$$n_{max} = \frac{60}{2 \cdot \pi} \cdot \omega_{max}$$

φ	Motion angle (positioning angle) in rad
t_M	Motion time in s
α	Angular acceleration in rad/s^2
ω_{max}	Maximum angular speed in rad/s
n_{max}	Maximum rotary speed in rpm

The positioning movement described takes place with a (theoretically) unending jerk. If a jerk limit is programmed in the servo-inverter, the positioning times extend accordingly. Constant positioning times require, in this case, greater accelerations.

Selection of Rotary Direct Drive Systems

Example: Cycle applications, e. g. for test systems

Preset values:

Mass moment of inertia J [kgm^2]	0.018	Motion angle φ [°]	22.5	Friction torque T_f [Nm]	2
Installation space D (max. outer diameter) [mm]	180	Motion time t_M [ms]	30	Safety factor	1.4
		Pause time t_P [ms]	60		

Calculation:

Conversion motion angle in rad

$$\varphi = \frac{\pi}{180} \cdot 22.5° = 0.3927 \text{ rad}$$

Angular acceleration

$$\alpha = \frac{4 \cdot \varphi}{t_M^2} = \frac{4 \cdot 0.3927 \text{ rad}}{(0.03 \text{ s})^2} = 1745.33 \text{ rad/s}^2$$

Angular speed

$$\omega_{max} = \alpha \cdot \frac{t_M}{2} = 1745.33 \text{ rad/s}^2 \cdot \frac{0.03 \text{ s}}{2} = 26.18 \text{ rad/s}$$

Maximum rotary speed

$$n_{max} = \frac{60}{2 \cdot \pi} \cdot \omega_{max} = \frac{60}{2 \cdot \pi} \cdot 26.18 \text{ rad/s} = 250 \text{ rpm}$$

Together with the friction torque and the safety factor, this yields: maximum torque.

$$T_{nom} = [(J \cdot \alpha) + T_f] \cdot \text{safety factor}$$

$$T_{nom} = [(0.018 \text{ kgm}^2 \cdot 1745.33 \text{ rad/s}^2) + 2 \text{ Nm}] \cdot 1.4 = 46.78 \text{ Nm}$$

The effective torque equals the root mean square of the torque curve (six torque cycles) in the rhythm cycle.

$$T_{rms} = \sqrt{\frac{T_1^2 \cdot t_1 + T_2^2 \cdot t_2 + \ldots + T_6^2 \cdot t_6}{t_1 + t_2 + \ldots + t_6}}$$ (6 torque cycles equate 2 cycles)

In that case the torques for acceleration and braking are equal.

$$T_{rms} = T_{nom} \cdot \sqrt{\frac{t_M}{t_M + t_P}}$$

Effective torque

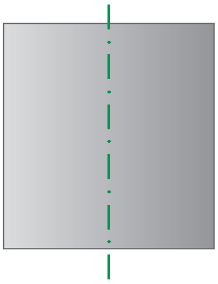
$$T_{rms} = 46.78 \text{ Nm} \cdot \sqrt{\frac{0.03 \text{ s}}{0.03 \text{ s} + 0.06 \text{ s}}} = 27.01 \text{ Nm}$$

System selection without water cooling

$T_{rms} \leq T_c$

RDDS1-180x192.5 fulfills this condition

(T_c = 29.0 Nm).

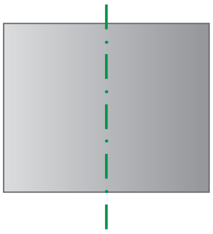


System selection with water cooling

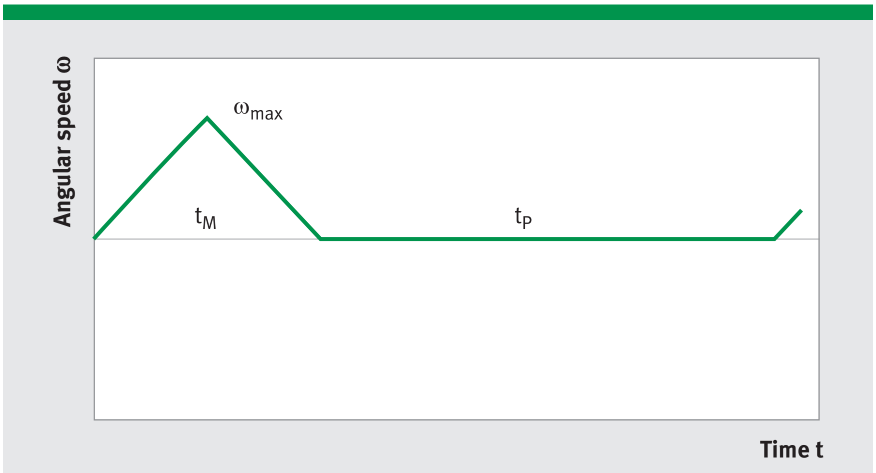
$T_{rms} \leq T_{cw}$

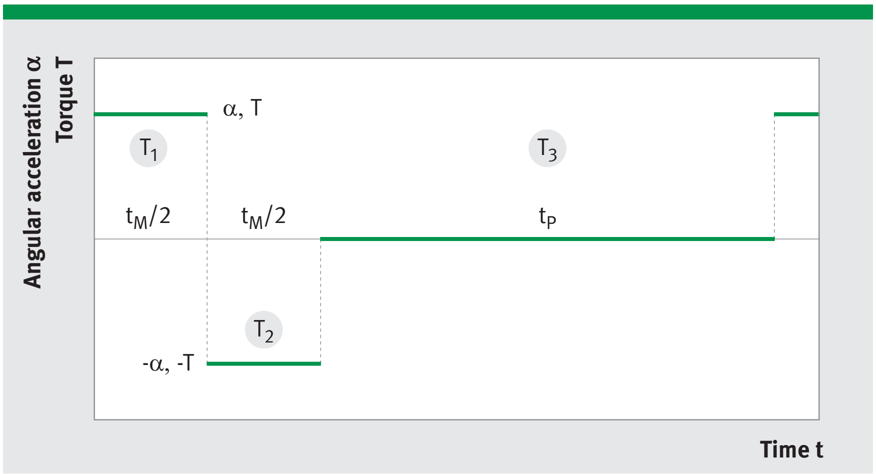
RDDS1-160x145 fulfills this condition

(T_{cw} = 29.2 Nm).



Both selected systems achieve the maximum rotary speed of 250 rpm.





For queries and selection of your application please do not hesitate to contact us.

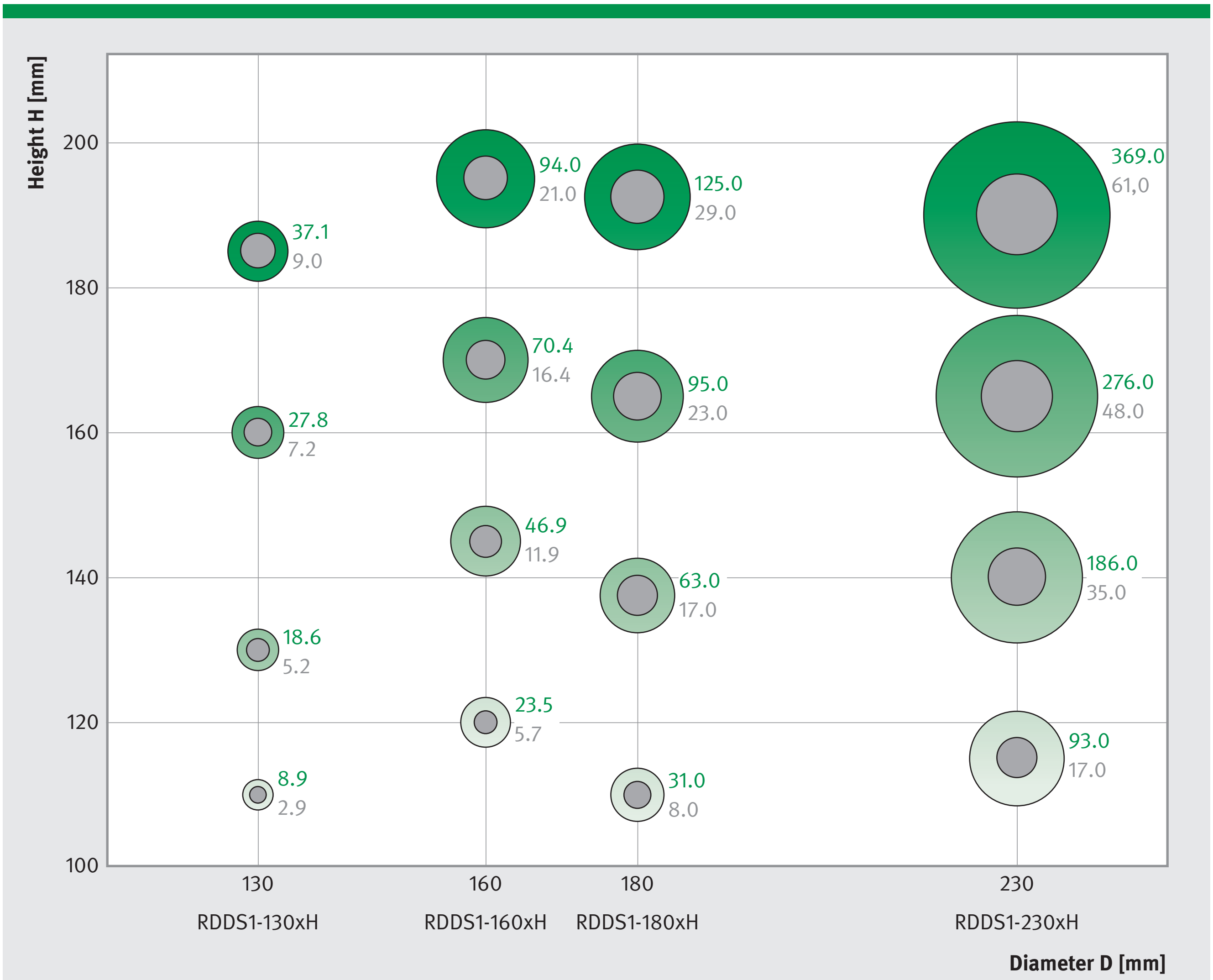
Overview: RDDS1 Matrix

The rotary direct drive systems are predestinated for high precise and high dynamic positioning tasks in the ranges of handling, productronics and automation.

Height H [mm]	RDDS1-130xH	RDDS1-160xH	RDDS1-180xH	RDDS1-230xH
	Diameter 130 mm	Diameter 160 mm	Diameter 180 mm	Diameter 230 mm
	110	120	110	115
	135	145	137.5	140
	160	170	165	165
	185	195	192.5	190

RDDS: Rotary Direct Drive System

Overview: Peak and Continuous Torques (Not Cooled)



Green: peak torques T_p [Nm].

Grey: continuous torques - not cooled - T_c [Nm].

If you need higher continuous torques (not cooled) T_c, please do not hesitate to contact us.

Designation for RDDS1 Matrix

RDDS1 - DxH - X - X - XX - X - X - C - B - R

Type

RDDS1 Rotary Direct Drive System, class 1

Dimensions

DxH Outer diameter x height [mm]

Running precision

S Standard: ± 10 µm

H High: <± 10 µm, on request

Mounting version

B Base plate

F Flange plate

Contact version

C_ Cable connection (open ends, cable length: 1 m)

P_ Plug connection

M_ Cable with tailored plug connector

_A Axial bottom

_U Radial up

_D Radial down

Winding version

WL Winding low dynamic

WM Winding medium dynamic

WH Winding high dynamic

Encoder increments (1 V_{pp})

3600
5400
9000
18000
24000

} Dependent on type

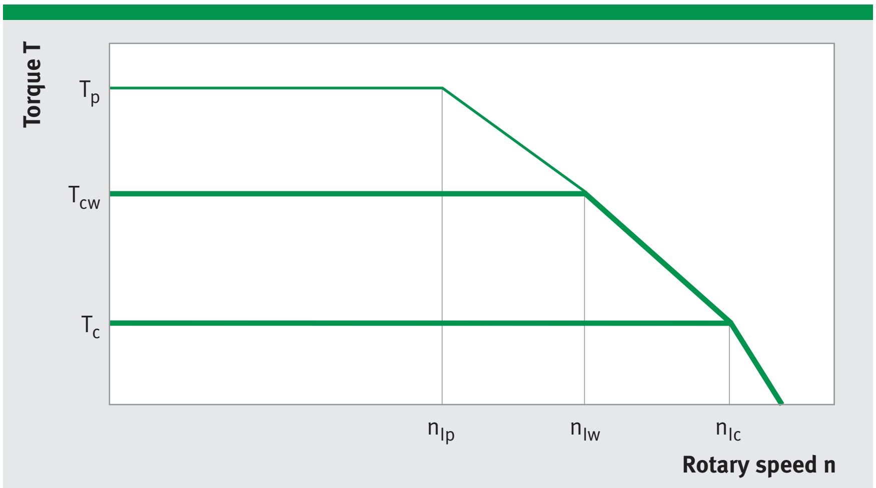
Cooling
Brake
Cleanroom
(on request)

} Inexistent, if not chosen

Underlines signalize the standard.

Not all of the combinations are technically possible. Please ask for your desired designation in advance.

Torque-Rotary Speed Characteristic

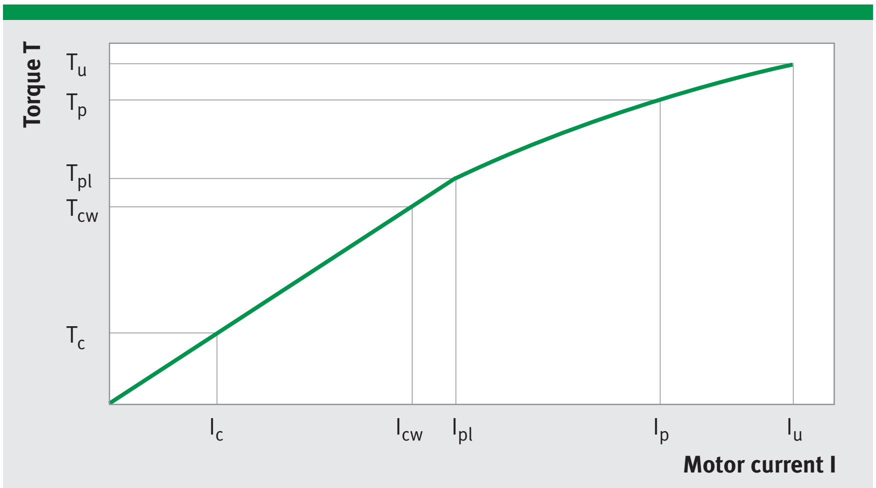


The limiting speed is limited by the bearing, the measuring system or the motor oneself. The maximum speed is specified in the data sheets.

Note:
At lower link voltages the limiting speed of the motor is reduced almost proportionally. This should be noted when selecting the winding version.

Winding specific speed limits are quiet proportional to U_{DCL}.
A continuous running of these motors could be limited in a range around n_{cr} because of additional frequency-dependent losses (see glossary). Then a further reduction of duty cycle or current is required.

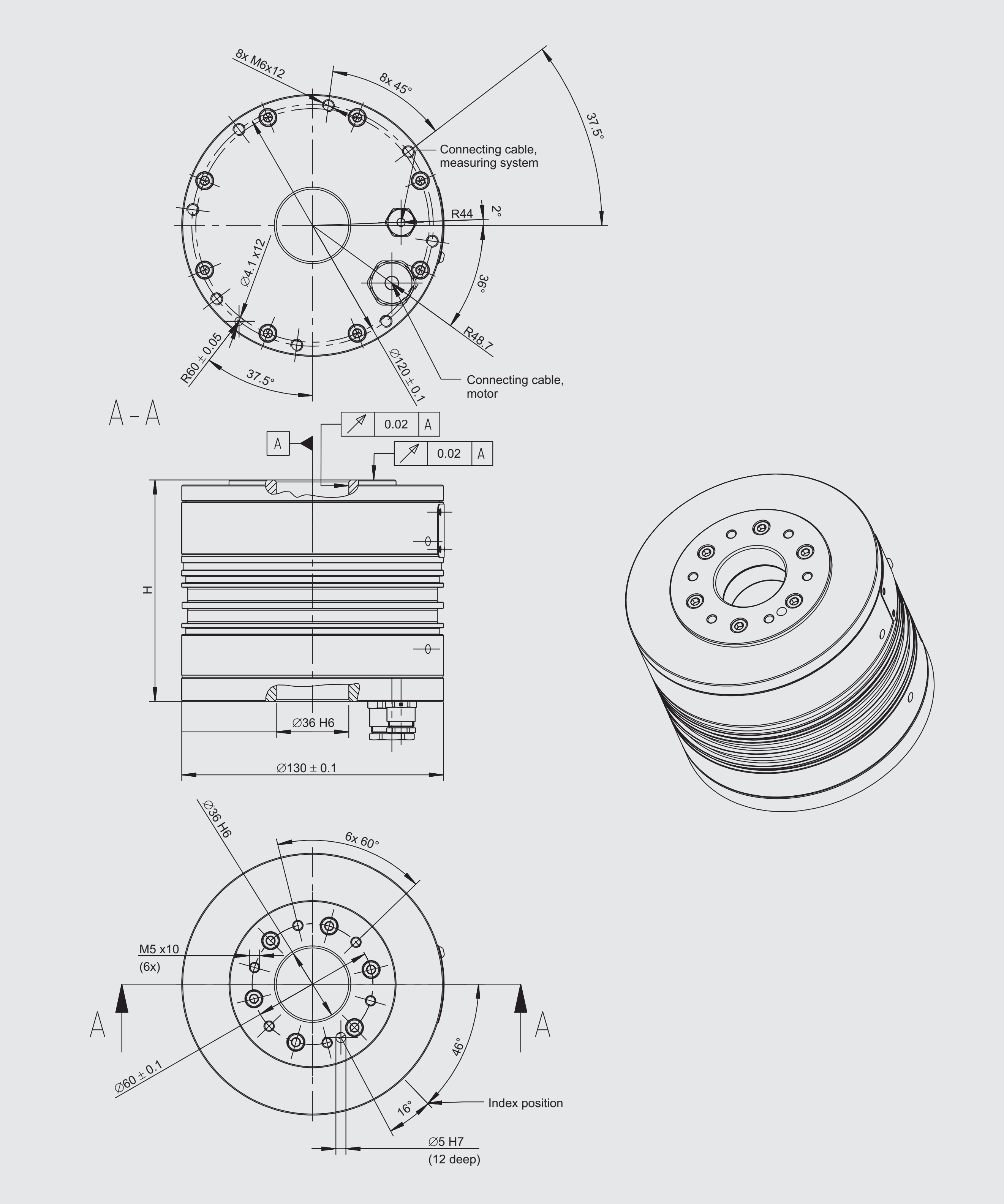
Torque-Current Characteristic



Saturation behavior
The torque increases with growing effective current linearly at first, next, the torque changes into the bent part, and then increases in a flat, linear fashion.
The bend results from the magnetic saturation of the entire magnetic circuit.

Technical Data: RDDS1-130xH

Drawing



Drawing: RDDS1-130x110-S-B-CA

Technical Data: RDDS1-130xH

System data

RDDS1-130xH	Symbol	Unit	RDDS1-130x110	RDDS1-130x135	RDDS1-130x160	RDDS1-130x185
Diameter x height	DxH	mm	130x110	130x135	130x160	130x185
Inner diameter: stage plate	d_{sp}	mm	36	36	36	36
Inner diameter: base plate	d_{bp}	mm	36	36	36	36
Measuring system 1 V_{pp}		inc	3600 9000 18000	3600 9000 18000	3600 9000 18000	3600 9000 18000
Limiting speed of bearing	n_{lim}	rpm	475	475	475	475
Mass	m	kg	7.0	9.6	12.2	14.8
Moment of inertia	J	kgm^2	0.0013	0.0016	0.0019	0.0022
Axial/radial runout	S_R/K_R	µm	±10	±10	±10	±10
Absolute accuracy	$\Delta\varphi_{abs}$	arcsec	≤30	≤30	≤30	≤30
Repeatability	$\Delta\varphi_{rep}$	arcsec	≤5	≤5	≤5	≤5
Axial load	F_{ax}	N	358.0	358.0	358.0	358.0
Radial load	F_{rad}	N	45.0	45.0	45.0	45.0
Moment impact (tilting torque)	T_{tilt}	Nm	8.8	8.8	8.8	8.8

Subject to modification without previous notice.

Tolerance range for values: ±5%

On housing of the rotary system the maximum temperature of 60 °C must not be exceeded by default.

Technical Data: RDDS1-130xH

Motor specifications - independent of winding

Motor specifications	Symbol	Unit	RDDS1-130x110	RDDS1-130x135	RDDS1-130x160	RDDS1-130x185
Number of pole pairs	P		7	7	7	7
Maximum operating voltage	U	V	600	600	600	600
Ultimate torque at I_u	T_u	Nm	10.5	21.8	32.7	43.7
Peak torque (saturation range) at I_p	T_p	Nm	8.9	18.6	27.8	37.1
Peak torque (linear range) at I_{pl}	T_{pl}	Nm	6.5	13.6	20.4	27.3
Continuous torque - water cooled - at I_{cw}	T_{cw}	Nm	6.2	12.4	18.3	24.6
Continuous torque - not cooled - at I_c	T_c	Nm	2.9	5.2	7.2	9.0
Stall torque - water cooled - at I_{sw}	T_{sw}	Nm	4.4	8.8	12.9	17.4
Stall torque - not cooled - at I_s	T_s	Nm	2.1	3.7	5.1	6.4
Ripple torque (cogging) at I = 0	T_r	Nm	0.06	0.125	0.19	0.255
Power loss (copper) at T_p (statical at 25 °C)	P_{lp}	W	389	590	792	956
Power loss (copper) at T_{pl} (statical at 25 °C)	P_{lpl}	W	210	319	427	516
Power loss (copper) at T_{cw}	P_{lw}	W	253	358	463	568
Power loss (copper) at T_c (statical at 25 °C)	P_{lc}	W	42	47	53	56
Thermical resistance (water cooled)	R_{th}	K/W	0.396	0.280	0.216	0.176
Motor constant (at 25 °C)	k_m	$Nm/\sqrt{W}$	0.45	0.76	0.99	1.20
Cooling-water flow-rate	dV/dt	l/min	0.68	1.36	2.04	2.72
Cooling-water temperature-difference	$\Delta\vartheta$	K	5.00	5.00	5.00	5.00

Subject to modification without previous notice.

Tolerance range for values: ±5% • Tolerance range for values „ripple torque“ and „power loss“: ±10%

The stated motor data relate to a fixing of the rotary system on a mounting plate with a surface of ca. 73600 mm^2.

Technical Data: RDDS1-130xH

Motor specifications - dependent of winding

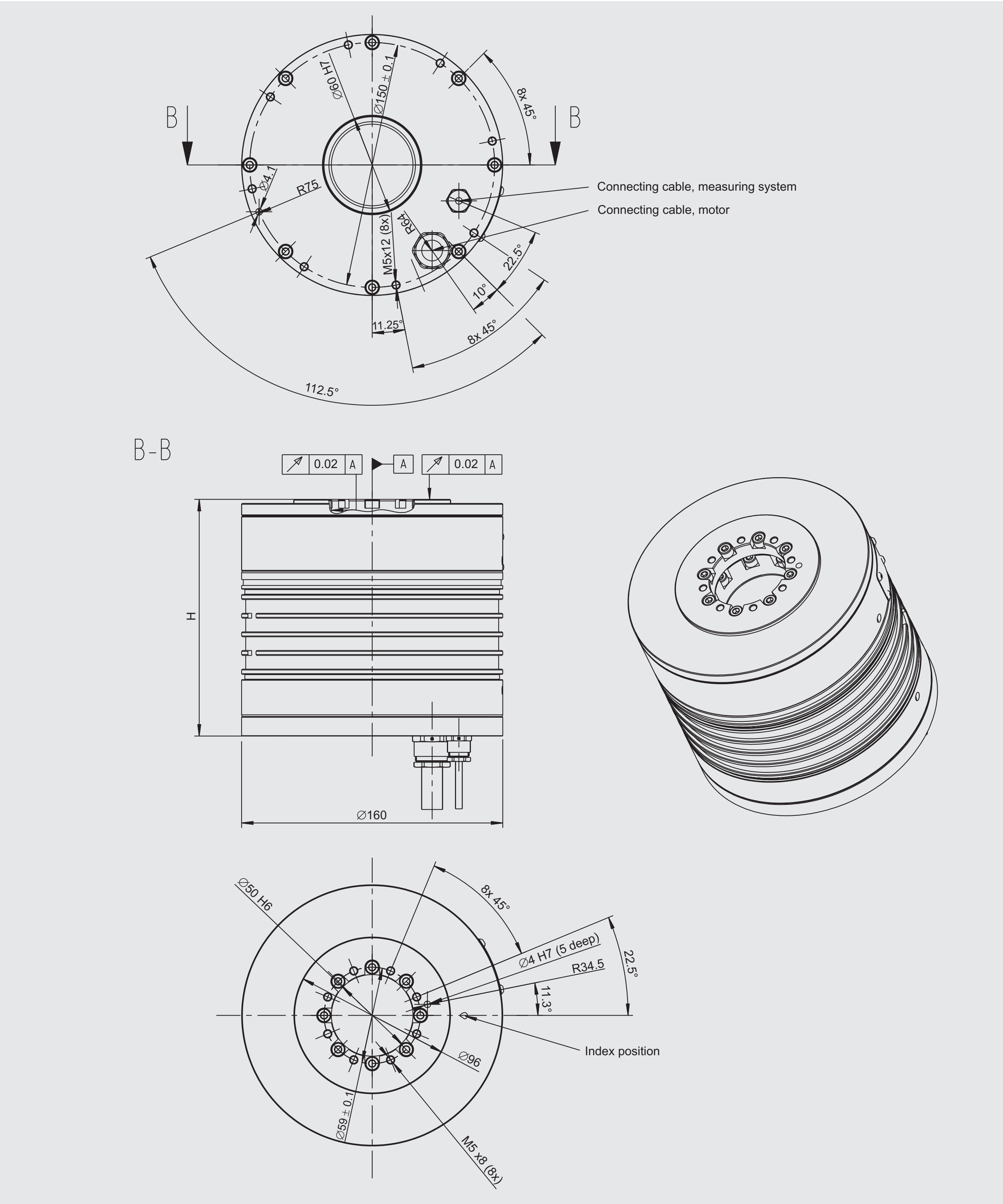
Winding specifications	Symbol	Unit	RDDS1-130x110 WL	RDDS1-130x135 WL	RDDS1-130x160 WL	RDDS1-130x160 WM	RDDS1-130x185 WL	RDDS1-130x185 WM
Torque constant	k_T	Nm/A_{rms}	0.92	1.93	2.89	1.45	3.86	1.93
Back EMF constant	k_u	Vs/rad	0.75	1.58	2.36	1.18	3.15	1.58
Limiting speed at I_p and U_{DCL} = 280 V	n_{Ip}	rpm	2886	1321	841	1844	604	1355
Limiting speed at I_{cw} and U_{DCL} = 280 V	n_{Iw}	rpm	2900	1337	858	1861	618	1370
Limiting speed at I_c and U_{DCL} = 280 V	n_{Ic}	rpm	3025	1433	946	1950	703	1454
Limiting speed at I_p and U_{DCL} = 600 V	n_{Ip}	rpm	5821	2727	1779	3722	1307	2761
Limiting speed at I_{cw} and U_{DCL} = 600 V	n_{Iw}	rpm	5835	2743	1796	3739	1321	2776
Limiting speed at I_c and U_{DCL} = 600 V	n_{Ic}	rpm	5960	2839	1885	3827	1406	2860
Limiting speed for continuous running*	n_{cr}	rpm	1286	1286	1286	1286	1286	1286
Electrical resistance, phase to phase (25 °C)	R_{25}	Ω	2.8	4.25	5.7	1.425	6.88	1.72
Inductance, phase to phase	L	mH	12.9	21.5	31.65	7.9	43.7	10.925
Ultimate current	I_u	A_{rms}	14.15	14.15	14.15	28.30	14.15	28.30
Peak current (saturation range)	I_p	A_{rms}	11.32	11.32	11.32	22.64	11.32	22.64
Peak current (linear range)	I_{pl}	A_{rms}	7.07	7.07	7.07	14.14	7.07	14.14
Continuous current at P_{lw} (water cooled)	I_{cw}	A_{rms}	6.68	6.45	6.33	12.66	6.38	12.77
Continuous current at P_{lc} (not cooled)	I_c	A_{rms}	3.15	2.72	2.50	4.99	2.33	4.66
Stall current at zero speed (water cooled)	I_{sw}	A_{rms}	4.72	4.56	4.48	8.95	4.51	9.03
Stall current at zero speed (not cooled)	I_s	A_{rms}	2.23	1.92	1.77	3.53	1.65	3.30
Maximum winding temperature	ϑ	°C	110	110	110	110	110	110
Interrupting sensor temperature	ϑ	°C	100	100	100	100	100	100

*See glossary • Subject to modification without previous notice.

Tolerance range for values: ±5% • Tolerance range for value „resistance": ±10% • Tolerance range for value „inductance": ±15%

Technical Data: RDDS1-160xH

Drawing



Drawing: RDDS1-160x145-S-B-CA

Technical Data: RDDS1-160xH
System data

RDDS1-160xH	Symbol	Unit	RDDS1-160x120	RDDS1-160x145	RDDS1-160x170	RDDS1-160x195
Diameter x height	DxH	mm	160x120	160x145	160x170	160x195
Inner diameter: stage plate	d_{sp}	mm	50	50	50	50
Inner diameter: base plate	d_{bp}	mm	60	60	60	60
Measuring system 1 V_{pp}		inc	3600 9000 18000	3600 9000 18000	3600 9000 18000	3600 9000 18000
Limiting speed of bearing	n_{lim}	rpm	375	375*	375*	375*
Mass	m	kg	10.1	12.2	14.3	16.5
Moment of inertia	J	kgm^2	0.0031	0.0038	0.0045	0.0052
Axial/radial runout	S_R/K_R	µm	±10	±10	±10	±10
Absolute accuracy	$\Delta\varphi_{abs}$	arcsec	≤30	≤30	≤30	≤30
Repeatability	$\Delta\varphi_{rep}$	arcsec	≤5	≤5	≤5	≤5
Axial load	F_{ax}	N	500.0	500.0	500.0	500.0
Radial load	F_{rad}	N	75.0	75.0	75.0	75.0
Moment impact (tilting torque)	T_{tilt}	Nm	15.1	15.1	15.1	15.1

Subject to modification without previous notice.

Tolerance range for values: ±5%

On housing of rotary system the maximum temperature of 60 °C must not be exceeded by default.

*In few cases the limiting speed is limited by the winding version of the motor.

Technical Data: RDDS1-160xH

Motor specifications - independent of winding

Motor specifications	Symbol	Unit	RDDS1-160x120	RDDS1-160x145	RDDS1-160x170	RDDS1-160x195
Number of pole pairs	P		11	11	11	11
Maximum operating voltage	U	V	600	600	600	600
Ultimate torque at I_u	T_u	Nm	32.4	64.9	97.3	130.0
Peak torque (saturation range) at I_p	T_p	Nm	23.5	46.9	70.4	94.0
Peak torque (linear range) at I_{pl}	T_{pl}	Nm	17.2	34.5	51.7	69.0
Continuous torque - water cooled - at I_{cw}	T_{cw}	Nm	12.6	29.2	46.7	64.0
Continuous torque - not cooled - at I_c	T_c	Nm	5.7	11.9	16.4	21.0
Stall torque - water cooled - at I_{sw}	T_{sw}	Nm	8.9	20.8	33.2	46.0
Stall torque - not cooled - at I_s	T_s	Nm	4.0	8.4	11.6	15.0
Ripple torque (cogging) at I = 0	T_r	Nm	0.07	0.14	0.21	0.30
Power loss (copper) at T_p (statical at 25 °C)	P_{lp}	W	1140	1682	2225	2768
Power loss (copper) at T_{pl} (statical at 25 °C)	P_{lpl}	W	445	657	869	1081
Power loss (copper) at T_{cw}	P_{lw}	W	304	609	913	1218
Power loss (copper) at T_c (statical at 25 °C)	P_{lc}	W	55	89	100	111
Thermical resistance (water cooled)	R_{th}	K/W	0.329	0.164	0.110	0.082
Motor constant (at 25 °C)	k_m	Nm/√W	0.77	1.26	1.64	1.96
Cooling-water flow-rate	dV/dt	l/min	0.87	1.74	2.61	3.48
Cooling-water temperature-difference	$\Delta\vartheta$	K	5.00	5.00	5.00	5.00

Subject to modification without previous notice.

Tolerance range for values: ±5% • Tolerance range for values „ripple torque“ and „power loss“: ±10%

The stated motor data relate to a fixing of the rotary system on a mounting plate with a surface of ca. 73600 mm^2.

RDDS1-160x170-S-B-CU

Technical Data: RDDS1-160xH

Motor specifications - dependent of winding

Winding specifications	Symbol	Unit	RDDS1-160x120 WL	RDDS1-160x120 WM	RDDS1-160x120 WH	RDDS1-160x145 WL	RDDS1-160x145 WM	RDDS1-160x145 WH
Torque constant	k_T	Nm/A_{rms}	2.43	1.22	0.61	4.86	2.43	1.22
Back EMF constant	k_u	Vs/rad	1.99	0.99	0.50	3.98	1.99	0.99
Limiting speed at I_p and U_{DCL} = 280 V	n_{Ip}	rpm	508	1138	2380	219	541	1165
Limiting speed at I_{cw} and U_{DCL} = 280 V	n_{Iw}	rpm	885	1881	3875	380	847	1779
Limiting speed at I_c and U_{DCL} = 280 V	n_{Ic}	rpm	1141	2354	4780	549	1152	2359
Limiting speed at I_p and U_{DCL} = 600 V	n_{Ip}	rpm	1230	2564	5224	588	1258	2589
Limiting speed at I_{cw} and U_{DCL} = 600 V	n_{Iw}	rpm	2028	4164	8447	916	1914	3916
Limiting speed at I_c and U_{DCL} = 600 V	n_{Ic}	rpm	2600	5260	10583	1276	2599	5246
Limiting speed for continuous running*	n_{cr}	rpm	818	818	818	818	818	818
Electrical resistance, phase to phase (25 °C)	R_{25}	Ω	5.9	1.5	0.4	8.6	2.2	0.5
Inductance, phase to phase	L	mH	24.0	6.0	1.5	47.9	12.0	3.0
Ultimate current	I_u	A_{rms}	19.1	38.1	76.2	19.1	38.1	76.2
Peak current (saturation range)	I_p	A_{rms}	11.3	22.7	45.4	11.3	22.7	45.4
Peak current (linear range)	I_{pl}	A_{rms}	7.1	14.2	28.4	7.1	14.2	28.4
Continuous current at P_{lw} (water cooled)	I_{cw}	A_{rms}	5.2	10.3	20.6	6.0	12.0	23.9
Continuous current at P_{lc} (not cooled)	I_c	A_{rms}	2.3	4.7	9.3	2.4	4.9	9.7
Stall current at zero speed (water cooled)	I_{sw}	A_{rms}	3.7	7.3	14.6	4.3	8.5	17.0
Stall current at zero speed (not cooled)	I_s	A_{rms}	1.7	3.3	6.6	1.7	3.5	6.9
Maximum winding temperature	ϑ	°C	130	130	130	130	130	130
Interrupting sensor temperature	ϑ	°C	100	100	100	100	100	100

*See glossary • Subject to modification without previous notice.

Tolerance range for values: ±5% • Tolerance range for value „resistance": ±10% • Tolerance range for value „inductance": ±15%

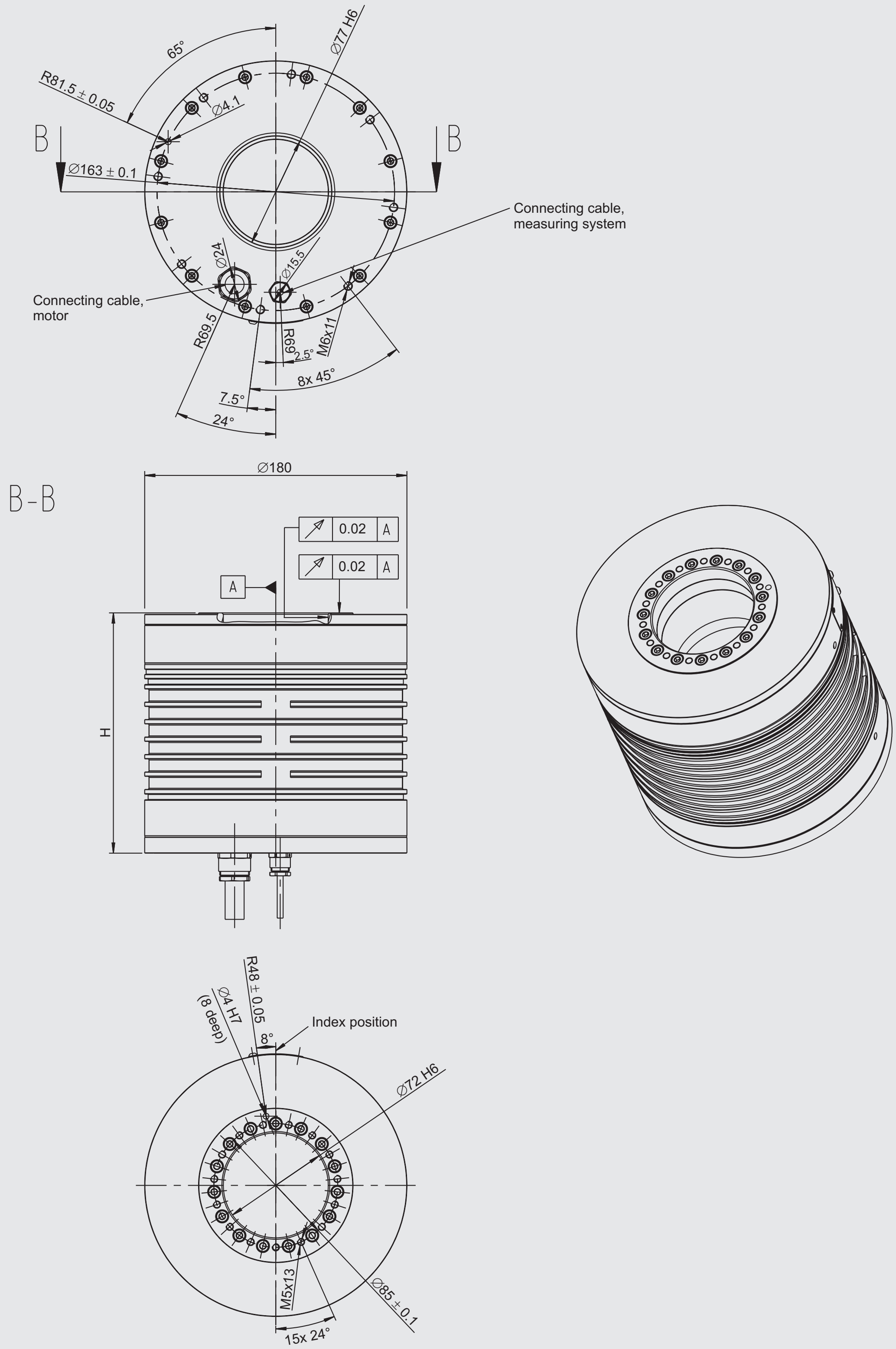
Winding specifications	Symbol	Unit	RDDS1-160x170 WL	RDDS1-160x170 WM	RDDS1-160x170 WH	RDDS1-160x195 WL	RDDS1-160x195 WM	RDDS1-160x195 WH
Torque constant	k_T	Nm/A_{rms}	7.30	3.65	1.82	9.73	4.86	2.43
Back EMF constant	k_u	Vs/rad	5.97	2.98	1.49	7.96	3.98	1.99
Limiting speed at I_p and U_{DCL} = 280 V	n_{lp}	rpm	119	341	760	65	239	556
Limiting speed at I_{cw} and U_{DCL} = 280 V	n_{lw}	rpm	222	526	1130	145	372	817
Limiting speed at I_c and U_{DCL} = 280 V	n_{lc}	rpm	361	768	1580	266	573	1186
Limiting speed at I_p and U_{DCL} = 600 V	n_{lp}	rpm	372	822	1710	263	603	1271
Limiting speed at I_{cw} and U_{DCL} = 600 V	n_{lw}	rpm	571	1217	2510	405	881	1835
Limiting speed at I_c and U_{DCL} = 600 V	n_{lc}	rpm	845	1730	3501	630	1296	2629
Limiting speed for continuous running*	n_{cr}	rpm	818	818	818	0	818	818
Electrical resistance, phase to phase (25 °C)	R_{25}	Ω	11.4	2.9	0.7	14.2	3.6	0.9
Inductance, phase to phase	L	mH	71.9	18.0	4.5	95.9	24.0	6.0
Ultimate current	I_u	A_{rms}	19.1	38.1	76.2	19.1	38.1	76.2
Peak current (saturation range)	I_p	A_{rms}	11.3	22.7	45.4	11.3	22.7	45.4
Peak current (linear range)	I_{pl}	A_{rms}	7.1	14.2	28.4	7.1	14.2	28.4
Continuous current at P_{lw} (water cooled)	I_{cw}	A_{rms}	6.4	12.8	25.5	6.6	13.3	26.4
Continuous current at P_{lc} (not cooled)	I_c	A_{rms}	2.2	4.5	9.0	2.1	4.2	8.5
Stall current at zero speed (water cooled)	I_{sw}	A_{rms}	4.5	9.1	18.1	4.7	9.4	18.7
Stall current at zero speed (not cooled)	I_s	A_{rms}	1.6	3.2	6.4	1.5	3.0	6.0
Maximum winding temperature	ϑ	°C	130	130	130	130	130	130
Interrupting sensor temperature	ϑ	°C	100	100	100	100	100	100

*See glossary • Subject to modification without previous notice.

Tolerance range for values: ±5% • Tolerance range for value „resistance“: ±10% • Tolerance range for value „inductance“: ±15%

Technical Data: RDDS1-180xH

Drawing



Drawing: RDDS1-180x165-S-B-CA

Technical Data: RDDS1-180xH

System data

RDDS1-180xH	Symbol	Unit	RDDS1-180x110	RDDS1-180x137.5	RDDS1-180x165	RDDS1-180x192.5
Diameter x height	DxH	mm	180x110	180x137.5	180x165	180x192.5
Inner diameter: stage plate	d_{sp}	mm	72	72	72	72
Inner diameter: base plate	d_{bp}	mm	77	77	77	77
Measuring system 1 V_{pp}		inc	5400 18000	5400 18000	5400 18000	5400 18000
Limiting speed of bearing	n_{lim}	rpm	340	340*	340*	340*
Mass	m	kg	11.6	15.7	19.8	23.9
Moment of inertia	J	kgm^2	0.0051	0.0064	0.0077	0.009
Axial/radial runout	S_R/K_R	µm	±10	±10	±10	±10
Absolute accuracy	$\Delta\varphi_{abs}$	arcsec	≤30	≤30	≤30	≤30
Repeatability	$\Delta\varphi_{rep}$	arcsec	≤5	≤5	≤5	≤5
Axial load	F_{ax}	N	641.0	641.0	641.0	641.0
Radial load	F_{rad}	N	104.0	104.0	104.0	104.0
Moment impact (tilting torque)	T_{tilt}	Nm	27.5	27.5	27.5	27.5

Subject to modification without previous notice.

Tolerance range for values: ±5%

On housing of rotary system the maximum temperature of 60 °C must not be exceeded by default.

*In few cases the limiting speed is limited by the winding version of the motor.

Technical Data: RDDS1-180xH

Motor specifications - independent of winding

Motor specifications	Symbol	Unit	RDDS1-180x110	RDDS1-180x137.5	RDDS1-180x165	RDDS1-180x192.5
Number of pole pairs	P		13	13	13	13
Maximum operating voltage	U	V	600	600	600	600
Ultimate torque at I_u	T_u	Nm	37	74	111	147
Peak torque (saturation range) at I_p	T_p	Nm	31	63	95	125
Peak torque (linear range) at I_{pl}	T_{pl}	Nm	23	46	69	92
Continuous torque - water cooled - at I_{cw}	T_{cw}	Nm	18	41	66	91
Continuous torque - not cooled - at I_c	T_c	Nm	8	17	23	29
Stall torque - water cooled - at I_{sw}	T_{sw}	Nm	13	29	47	65
Stall torque - not cooled - at I_s	T_s	Nm	6	12	17	21
Ripple torque (cogging) at I = 0	T_r	Nm	0.1	0.2	0.3	0.4
Power loss (copper) at T_p (statical at 25 °C)	P_{lp}	W	1193	1764	2345	2905
Power loss (copper) at T_{pl} (statical at 25 °C)	P_{lpl}	W	466	689	916	1135
Power loss (copper) at T_{cw}	P_{lw}	W	361	722	1089	1444
Power loss (copper) at T_c (statical at 25 °C)	P_{lc}	W	66	105	119	131
Thermical resistance (water cooled)	R_{th}	K/W	0.277	0.139	0.092	0.069
Motor constant (at 25 °C)	k_m	$Nm/\sqrt{W}$	0.99	1.64	2.14	2.55
Cooling-water flow-rate	dV/dt	l/min	1.03	2.06	3.11	4.13
Cooling-water temperature-difference	$\Delta\vartheta$	K	5.00	5.00	5.00	5.00

Subject to modification without previous notice.

Tolerance range for values: ±5% • Tolerance range for values „ripple torque“ and „power loss“: ±10%

The stated motor data relate to a fixing of the rotary system on a mounting plate with a surface of ca. 73600 mm^2.

RDDS1-180x165-S-B-CA

Technical Data: RDDS1-180xH

Motor specifications - dependent of winding

Winding specifications	Symbol	Unit	RDDS1-180x110 WL	RDDS1-180x110 WM	RDDS1-180x110 WH	RDDS1-180x137.5 WL	RDDS1-180x137.5 WM	RDDS1-180x137.5 WH
Torque constant	k_T	Nm/A_{rms}	3.4	1.7	1.2	6.7	3.4	2.4
Back EMF constant	k_u	Vs/rad	2.8	1.4	1.0	5.5	2.8	1.9
Limiting speed at I_p and U_{DCL} = 280 V	n_{lp}	rpm	374	855	1264	156	403	610
Limiting speed at I_{cw} and U_{DCL} = 280 V	n_{lw}	rpm	629	1352	1974	265	605	896
Limiting speed at I_c and U_{DCL} = 280 V	n_{lc}	rpm	817	1694	2450	391	827	1203
Limiting speed at I_p and U_{DCL} = 600 V	n_{lp}	rpm	925	1943	2817	439	950	1388
Limiting speed at I_{cw} and U_{DCL} = 600 V	n_{lw}	rpm	1459	3010	4344	655	1381	2005
Limiting speed at I_c and U_{DCL} = 600 V	n_{lc}	rpm	1866	3784	5436	913	1867	2689
Limiting speed for continuous running*	n_{cr}	rpm	462	462	462	462	462	462
Electrical resistance, phase to phase (25 °C)	R_{25}	Ω	6.6	1.7	0.8	9.8	2.5	1.2
Inductance, phase to phase	L	mH	27.1	6.8	3.3	54.3	13.6	6.6
Ultimate current	I_u	A_{rms}	13.7	27.3	39.1	13.7	27.3	39.1
Peak current (saturation range)	I_p	A_{rms}	10.9	21.9	31.3	10.9	21.9	31.3
Peak current (linear range)	I_{pl}	A_{rms}	6.8	13.7	19.6	6.8	13.7	19.6
Continuous current at P_{lw} (water cooled)	I_{cw}	A_{rms}	5.3	10.6	15.1	6.1	12.3	17.6
Continuous current at P_{lc} (not cooled)	I_c	A_{rms}	2.4	4.8	6.9	2.5	5.0	7.1
Stall current at zero speed (water cooled)	I_{sw}	A_{rms}	3.7	7.5	10.7	4.4	8.7	12.5
Stall current at zero speed (not cooled)	I_s	A_{rms}	1.7	3.4	4.9	1.8	3.5	5.1
Maximum winding temperature	ϑ	°C	130	130	130	130	130	130
Interrupting sensor temperature	ϑ	°C	100	100	100	100	100	100

*See glossary • Subject to modification without previous notice.

Tolerance range for values: ±5% • Tolerance range for value „resistance": ±10% • Tolerance range for value „inductance": ±15%

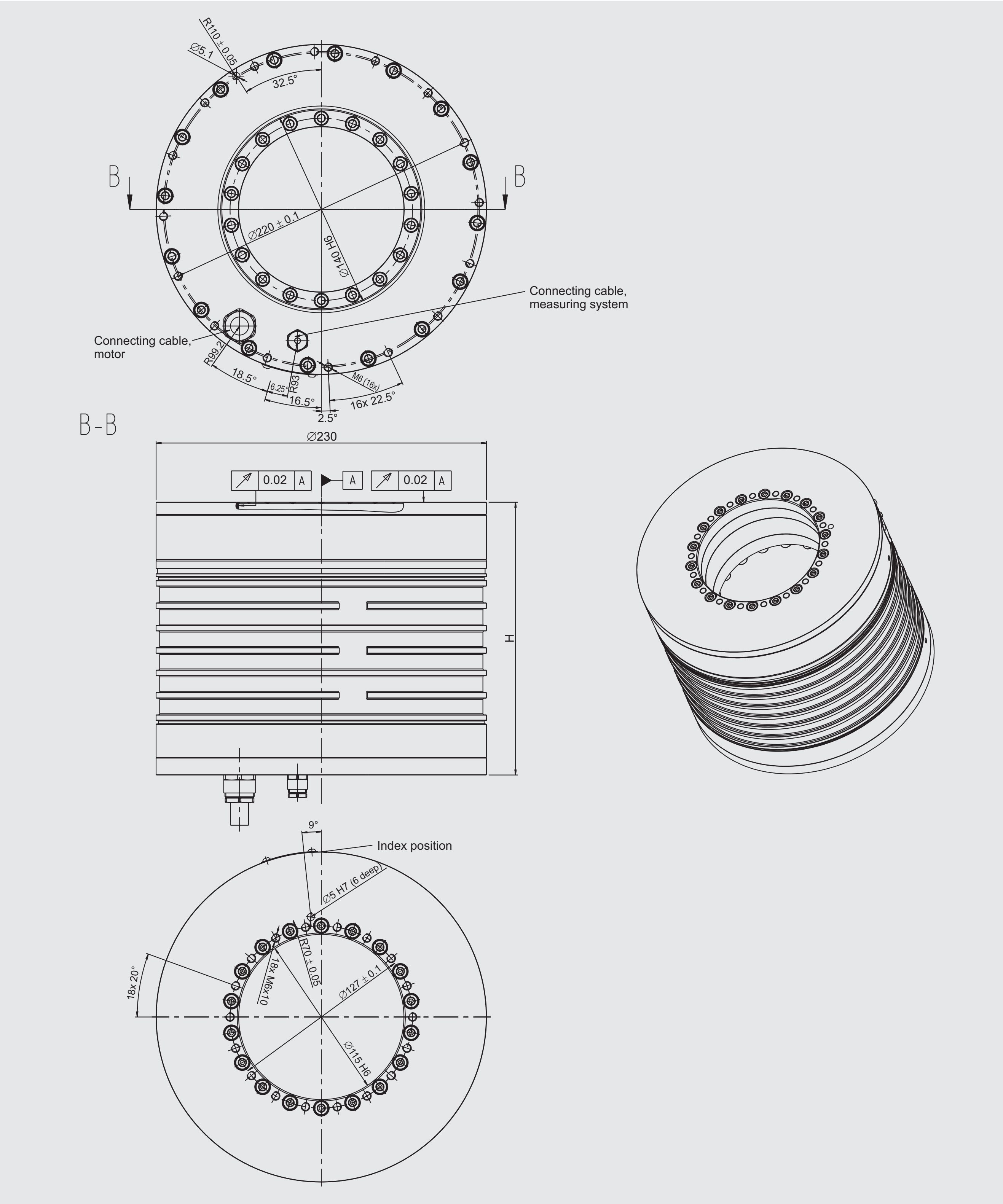
Winding specifications	Symbol	Unit	RDDS1-180x165 WL	RDDS1-180x165 WM	RDDS1-180x165 WH	RDDS1-180x192.5 WL	RDDS1-180x192.5 WM	RDDS1-180x192.5 WH
Torque constant	k_T	Nm/A_{rms}	10.2	5.1	3.6	13.5	6.7	4.7
Back EMF constant	k_u	Vs/rad	8.3	4.2	2.9	11.0	5.5	3.9
Limiting speed at I_p and U_{DCL} = 280 V	n_{Ip}	rpm	78	249	388	37	173	280
Limiting speed at I_{cw} and U_{DCL} = 280 V	n_{Iw}	rpm	149	370	558	95	261	401
Limiting speed at I_c and U_{DCL} = 280 V	n_{Ic}	rpm	254	546	798	188	410	601
Limiting speed at I_p and U_{DCL} = 600 V	n_{Ip}	rpm	273	614	905	192	452	672
Limiting speed at I_{cw} and U_{DCL} = 600 V	n_{Iw}	rpm	403	870	1271	285	633	930
Limiting speed at I_c and U_{DCL} = 600 V	n_{Ic}	rpm	600	1234	1780	449	930	1343
Limiting speed for continuous running*	n_{cr}	rpm	462	462	462	462	462	462
Electrical resistance, phase to phase (25 °C)	R_{25}	Ω	13.1	3.3	1.6	16.2	4.0	2.0
Inductance, phase to phase	L	mH	81.9	20.5	10.0	108.6	27.1	13.3
Ultimate current	I_u	A_{rms}	13.7	27.3	39.1	13.7	27.3	39.1
Peak current (saturation range)	I_p	A_{rms}	10.9	21.9	31.3	10.9	21.9	31.3
Peak current (linear range)	I_{pl}	A_{rms}	6.8	13.7	19.6	6.8	13.7	19.6
Continuous current at P_{lw} (water cooled)	I_{cw}	A_{rms}	6.5	13.1	18.7	6.8	13.5	19.4
Continuous current at P_{lc} (not cooled)	I_c	A_{rms}	2.3	4.6	6.6	2.2	4.3	6.2
Stall current at zero speed (water cooled)	I_{sw}	A_{rms}	4.6	9.3	13.3	4.8	9.6	13.8
Stall current at zero speed (not cooled)	I_s	A_{rms}	1.6	3.3	4.7	1.5	3.1	4.4
Maximum winding temperature	ϑ	°C	130	130	130	130	130	130
Interrupting sensor temperature	ϑ	°C	100	100	100	100	100	100

*See glossary • Subject to modification without previous notice.

Tolerance range for values: ±5% • Tolerance range for value „resistance”: ±10% • Tolerance range for value „inductance”: ±15%

Technical Data: RDDS1-230xH

Drawing



Drawing: RDDS1-230x190-S-B-CA

Technical Data: RDDS1-230xH

System data

RDDS1-230xH	Symbol	Unit	RDDS1-230x115	RDDS1-230x140	RDDS1-230x165	RDDS1-230x190
Diameter x height	DxH	mm	230x115	230x140	230x165	230x190
Inner diameter: stage plate	d_{sp}	mm	115	115	115	115
Inner diameter: base plate	d_{bp}	mm	140	140	140	140
Measuring system 1 V_{pp}		inc	24000	24000	24000	24000
Limiting speed of bearing	n_{lim}	rpm	240*	240*	240*	240*
Mass	m	kg	15.8	20.5	25.3	30.0
Moment of inertia	J	kgm^2	0.027	0.035	0.042	0.049
Axial/radial runout	S_R/K_R	µm	±10	±10	±10	±10
Absolute accuracy	$\Delta\varphi_{abs}$	arcsec	≤30	≤30	≤30	≤30
Repeatability	$\Delta\varphi_{rep}$	arcsec	≤5	≤5	≤5	≤5
Axial load	F_{ax}	N	925.0	925.0	925.0	925.0
Radial load	F_{rad}	N	162.0	162.0	162.0	162.0
Moment impact (tilting torque)	T_{tilt}	Nm	47.3	47.3	47.3	47.3

Subject to modification without previous notice.

Tolerance range for values: ±5%

On housing of rotary system the maximum temperature of 60 °C must not be exceeded by default.

*In few cases the limiting speed is limited by the winding version of the motor.

Technical Data: RDDS1-230xH

Motor specifications - independent of winding

Motor specifications	Symbol	Unit	RDDS1-230x115	RDDS1-230x140	RDDS1-230x165	RDDS1-230x190
Number of pole pairs	P		17	17	17	17
Maximum operating voltage	U	V	600	600	600	600
Ultimate torque at I_u	T_u	Nm	110	220	327	436
Peak torque (saturation range) at I_p	T_p	Nm	93	186	276	369
Peak torque (linear range) at I_{pl}	T_{pl}	Nm	65	129	192	256
Continuous torque - water cooled - at I_{cw}	T_{cw}	Nm	37	86	137	189
Continuous torque - not cooled - at I_c	T_c	Nm	17	35	48	61
Stall torque - water cooled - at I_{sw}	T_{sw}	Nm	26	61	97	134
Stall torque - not cooled - at I_s	T_s	Nm	12	25	34	43
Ripple torque (cogging) at I = 0	T_r	Nm	0.3	0.6	0.8	1.1
Power loss (copper) at T_p (statical at 25 °C)	P_{lp}	W	2790	4059	5327	6595
Power loss (copper) at T_{pl} (statical at 25 °C)	P_{lpl}	W	1090	1585	2081	2576
Power loss (copper) at T_{cw}	P_{lw}	W	455	911	1366	1822
Power loss (copper) at T_c (statical at 25 °C)	P_{lc}	W	83	133	149	166
Thermical resistance (water cooled)	R_{th}	K/W	0.220	0.110	0.073	0.055
Motor constant (at 25 °C)	k_m	$Nm/\sqrt{W}$	1.83	3.03	3.93	4.71
Cooling-water flow-rate	dV/dt	l/min	1.30	2.60	3.90	5.21
Cooling-water temperature-difference	$\Delta\vartheta$	K	5.00	5.00	5.00	5.00

Subject to modification without previous notice.

Tolerance range for values: ±5% • Tolerance range for values „ripple torque“ and „power loss“: ±10%

The stated motor data relate to a fixing of the rotary system on a mounting plate with a surface of ca. 73600 mm^2.

RDDS1-230x190-S-B-CA

Technical Data: RDDS1-230xH

Motor specifications - dependent of winding

Winding specifications	Symbol	Unit	RDDS1-230x115 WL	RDDS1-230x115 WM	RDDS1-230x115 WH	RDDS1-230x140 WL	RDDS1-230x140 WM	RDDS1-230x140 WH
Torque constant	k_T	Nm/A_{rms}	6.73	3.37	1.82	13.47	6.73	3.65
Back EMF constant	k_u	Vs/rad	5.51	2.75	1.49	11.02	5.51	2.98
Limiting speed at I_p and U_{DCL} = 280 V	n_{Ip}	rpm	163	468	965	42	204	456
Limiting speed at I_{cw} and U_{DCL} = 280 V	n_{Iw}	rpm	350	778	1502	144	352	704
Limiting speed at I_c and U_{DCL} = 280 V	n_{Ic}	rpm	419	878	1656	199	428	816
Limiting speed at I_p and U_{DCL} = 600 V	n_{Ip}	rpm	512	1141	2198	226	545	1075
Limiting speed at I_{cw} and U_{DCL} = 600 V	n_{Iw}	rpm	841	1759	3314	383	828	1583
Limiting speed at I_c and U_{DCL} = 600 V	n_{Ic}	rpm	952	1941	3616	465	958	1794
Limiting speed for continuous running*	n_{cr}	rpm	353	353	353	353	353	353
Electrical resistance, phase to phase (25 °C)	R_{25}	Ω	7.9	2.0	0.6	11.4	2.9	0.8
Inductance, phase to phase	L	mH	21.9	5.5	1.6	43.7	10.9	3.2
Ultimate current	I_u	A_{rms}	19.5	38.9	71.9	19.5	38.9	71.9
Peak current (saturation range)	I_p	A_{rms}	15.4	30.7	56.7	15.4	30.7	56.7
Peak current (linear range)	I_{pl}	A_{rms}	9.6	19.2	35.5	9.6	19.2	35.5
Continuous current at P_{lw} (water cooled)	I_{cw}	A_{rms}	5.5	10.9	20.1	6.4	12.8	23.6
Continuous current at P_{lc} (not cooled)	I_c	A_{rms}	2.5	4.9	9.1	2.6	5.2	9.6
Stall current at zero speed (water cooled)	I_{sw}	A_{rms}	3.9	7.7	14.3	4.5	9.1	16.7
Stall current at zero speed (not cooled)	I_s	A_{rms}	1.8	3.5	6.5	1.8	3.7	6.8
Maximum winding temperature	ϑ	°C	130	130	130	130	130	130
Interrupting sensor temperature	ϑ	°C	100	100	100	100	100	100

*See glossary • Subject to modification without previous notice.

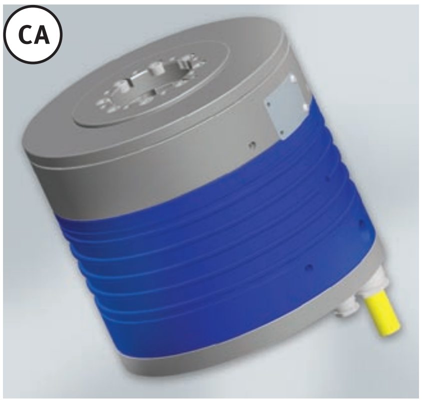
Tolerance range for values: ±5% • Tolerance range for value „resistance": ±10% • Tolerance range for value „inductance": ±15%

Winding specifications	**Symbol**	**Unit**	**RDDS1-230x165 WL**	**RDDS1-230x165 WM**	**RDDS1-230x165 WH**	**RDDS1-230x190 WL**	**RDDS1-230x190 WM**	**RDDS1-230x190 WH**
Torque constant	k_T	Nm/A_{rms}	20.00	10.00	5.41	26.67	13.33	7.22
Back EMF constant	k_u	Vs/rad	16.36	8.18	4.43	21.81	10.91	5.90
Limiting speed at I_p and U_{DCL} = 280 V	n_{lp}	rpm	0	114	287	0	67	200
Limiting speed at I_{cw} and U_{DCL} = 280 V	n_{lw}	rpm	78	217	450	45	149	322
Limiting speed at I_c and U_{DCL} = 280 V	n_{lc}	rpm	130	284	546	94	210	407
Limiting speed at I_p and U_{DCL} = 600 V	n_{lp}	rpm	130	347	703	80	246	514
Limiting speed at I_{cw} and U_{DCL} = 600 V	n_{lw}	rpm	237	532	1032	164	384	755
Limiting speed at I_c and U_{DCL} = 600 V	n_{lc}	rpm	308	641	1204	228	478	901
Limiting speed for continuous running*	n_{cr}	rpm	353	353	353	353	353	353
Electrical resistance, phase to phase (25 °C)	R_{25}	Ω	15.0	3.8	1.1	18.6	4.6	1.4
Inductance, phase to phase	L	mH	65.6	16.4	4.8	87.5	21.9	6.4
Ultimate current	I_u	A_{rms}	19.5	38.9	71.9	19.5	38.9	71.9
Peak current (saturation range)	I_p	A_{rms}	15.4	30.7	56.7	15.4	30.7	56.7
Peak current (linear range)	I_{pl}	A_{rms}	9.6	19.2	35.5	9.6	19.2	35.5
Continuous current at P_{lw} (water cooled)	I_{cw}	A_{rms}	6.8	13.7	25.2	7.1	14.2	26.2
Continuous current at P_{lc} (not cooled)	I_c	A_{rms}	2.4	4.8	8.9	2.3	4.5	8.4
Stall current at zero speed (water cooled)	I_{sw}	A_{rms}	4.9	9.7	17.9	5.0	10.1	18.6
Stall current at zero speed (not cooled)	I_s	A_{rms}	1.7	3.4	6.3	1.6	3.2	6.0
Maximum winding temperature	ϑ	°C	130	130	130	130	130	130
Interrupting sensor temperature	ϑ	°C	100	100	100	100	100	100

*See glossary • Subject to modification without previous notice.

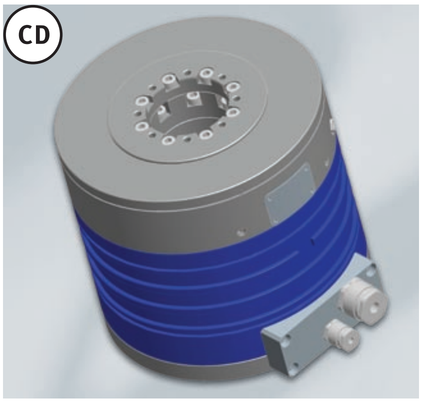
Tolerance range for values: ±5% • Tolerance range for value „resistance": ±10% • Tolerance range for value „inductance": ±15%

Options: Contact Versions

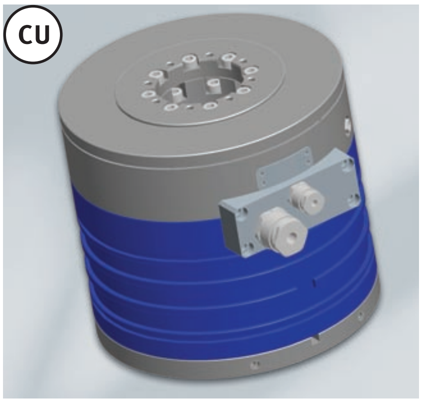


Cord: below axial (standard)

Advantage: no radial connection part and smaller required space

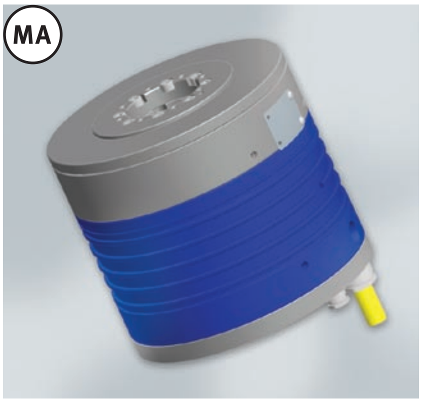


Cord: below radial



Cord: above radial

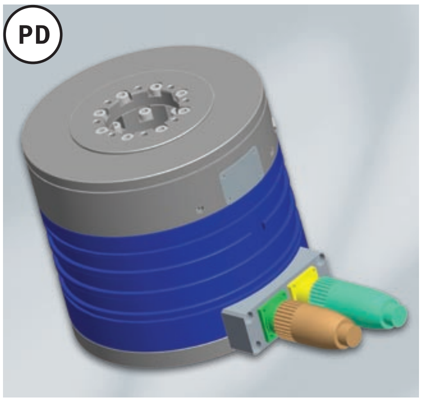
Advantage: smaller required space in cramped installation conditions



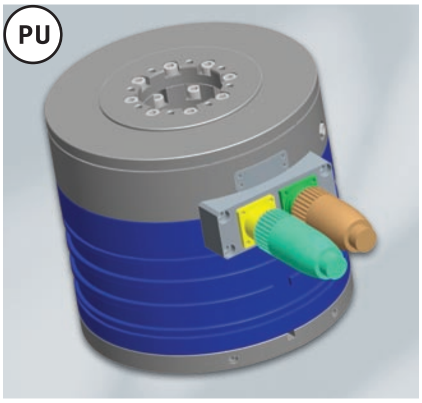
Cable with plug-in connector

Advantage: smaller required space

(also possible: MD, MU)



Plug: below radial



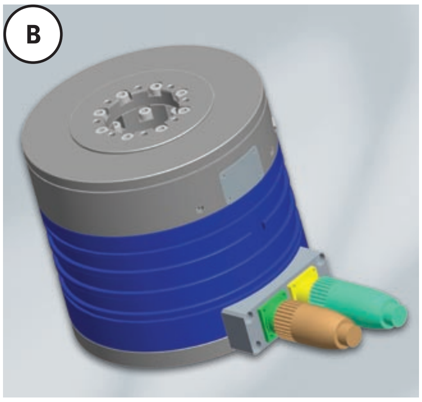
Plug: above radial

Advantage: simple contact or exchange of connecting cables

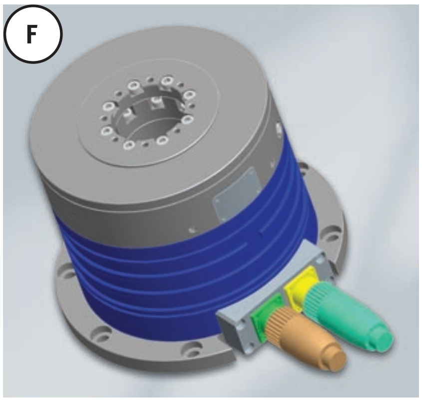
(Terms in circles: see „Designation for RDDS1 Matrix“, page 24)

Options: Mounting and Cooling Versions

Mounting versions



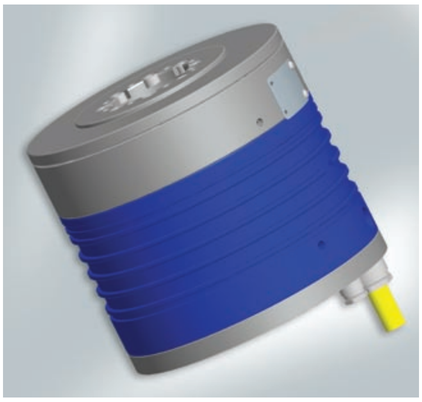
Base plate: mounting from below (standard)



Flange plate: mounting from above

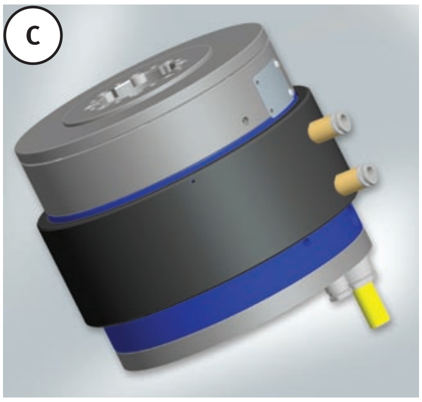
Advantage: mounting from above or below is possible depending on installation conditions

Cooling versions



Air cooling (convection, radiation and thermal conduction, standard)

Advantage: no additional work and expense for cooling



Water cooling in a cooling jacket

Advantage: higher continuous torque by water cooling

(Terms in circles: see „Designation for RDDS1 Matrix“, page 24)

Options: Measuring System, Pneumatic Clamp, Running Precision and Cleanroom

Measuring system

- 3600 - 24000 increments per revolution (depending on type)
- Standard: increment number and options depending on type for every diameter
- Standard: output signal 1 V_{pp} sin/cos + index

Advantage: optimal resolution and accuracy for every application

Pneumatic clamp

On request.
The overall height increases when selecting the option „pneumatic clamp“.

Running precision

Axial and radial runout are ± 10 µm.
On request the systems are available in a higher quality class with a tolerance of <± 10 µm.

Advantage: high precision systems are possible

Cleanroom

RDDS1 rotary systems are qualified for cleanroom class 4 - 6 applications by Fraunhofer IPA. Details are available on request.

Advantage: applications for cleanroom are possible

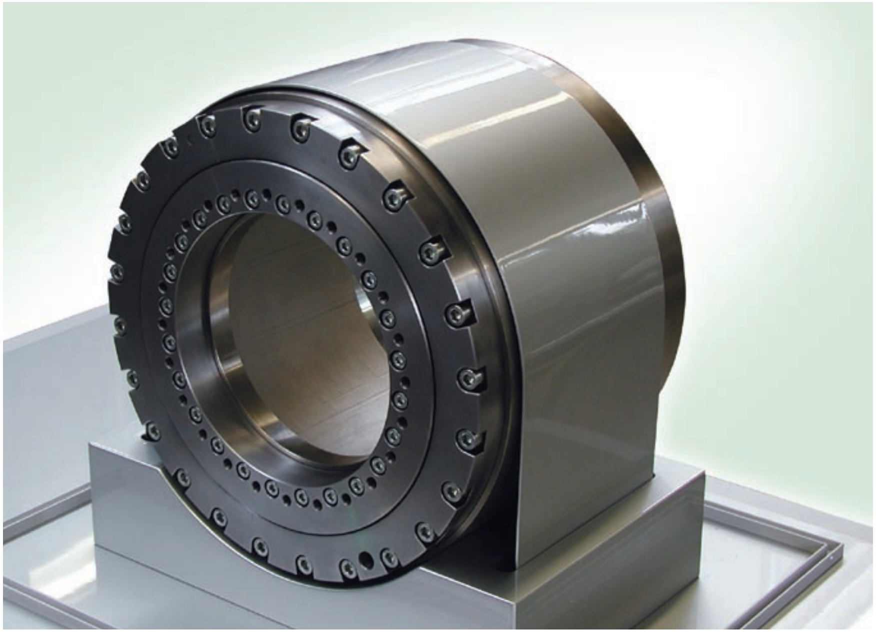

IPA
Fraunhofer
TESTED® DEVICE
IDAM GmbH & Co. oHG
Turntable-Matrix RDDS1
Report No. ID 0612-373
IPA Qualification Certificate

Class 4 - 6 according DIN EN ISO 14644-1 (meets the requirements of US Fed. St. 209 D/E classes 10 – 1000)

Designation	Maximum permissible number of particles per cubic metre					
DIN EN ISO 14644-1	≥ 0.1 µm	≥ 0.2 µm	≥ 0.3 µm	≥ 0.5 µm	≥ 1.0 µm	≥ 5.0 µm
4	10000	2370	1020	352	83	-
5	100000	23700	10200	3520	832	29
6	1000000	237000	102000	35200	8320	293

RDDS2 Matrix

Features, advantages, applications and benefits



Features

- Rotary direct drive system with RI motor (internal rotor) and absolute multiturn measuring system for automation and handling technology, special purpose machinery, productronics
- Crossed roller bearing

Advantages

- Complete system consisting of motor, bearing and absolute measuring system
- Appropriate to multiturn applications
- Total hollow shaft diameter from 130 - 420 mm free for customer-specific design
- Easy commissioning
- All advantages of a direct drive
- Low maintenance

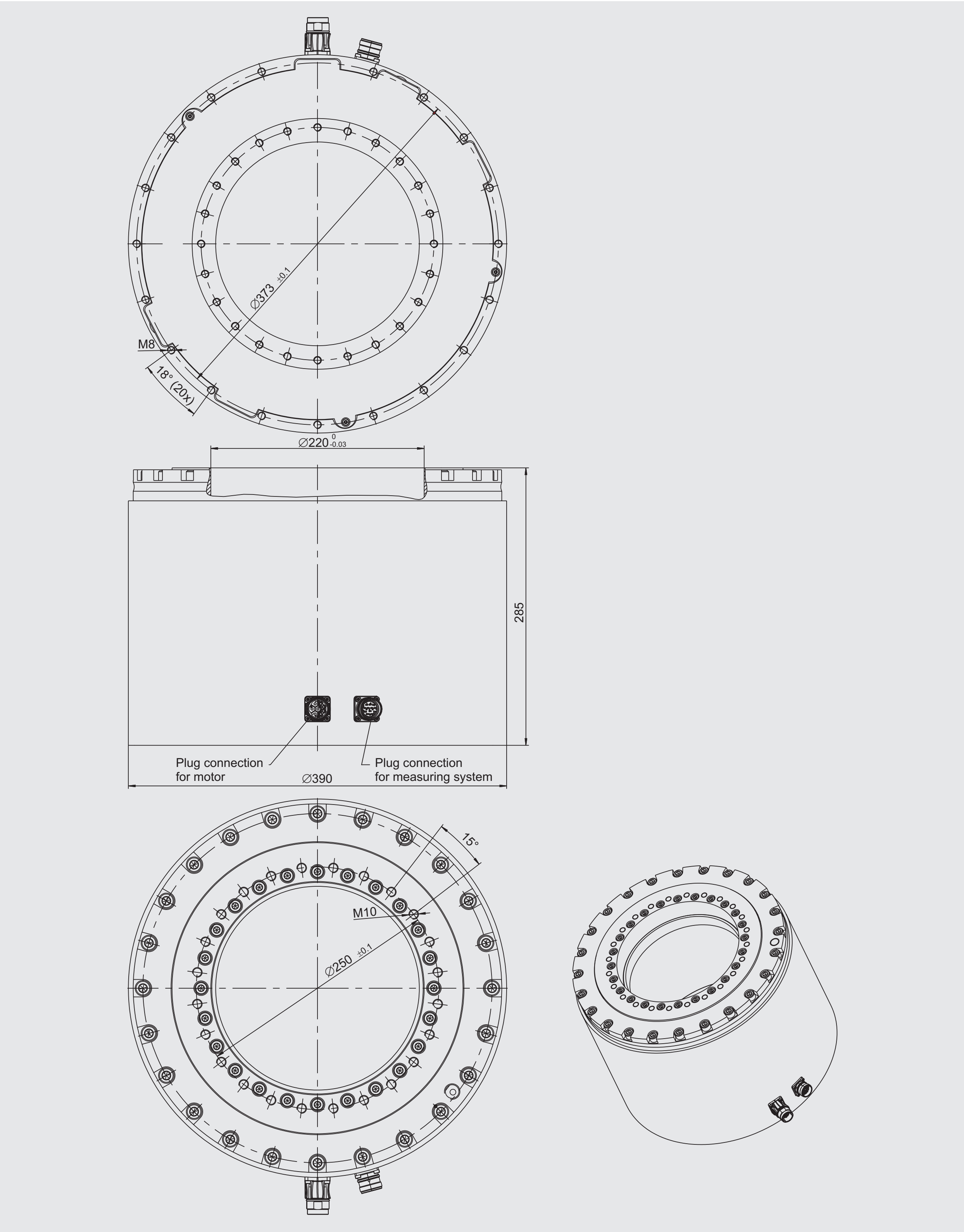
Applications

- Plastics industry
- Automation, handling
- Productronics, turret handler
- Packaging industry
- Printing industry
- Special purpose machinery

Benefits

- No commutation motion or referencing necessary after switching-on
- This matrix replaces hydraulic drives and large geared motors because of significant increased performance.
- Lowering of maintenance costs
- Small space requirements
- Increase of dynamics

RDDS2 Matrix
Drawing



Drawing: RDDS2-390x285

RDDS2 Matrix
Technical data

RDDS2-DxH	Unit	RDDS2-240xH	RDDS2-390xH	RDDS2-460xH	RDDS2-565xH
Outer diameter	mm	ca. 240	ca. 390	ca. 460	ca. 565
Free inner diameter	mm	130	210	320	410
Height	mm	135...235	235...335	175...275	180...280
Motor		**RI17-168x50...150**	**RI13-298x50...150**	**RI11-370x50...150**	**RI19-460x50...150**
Peak torque	Nm	185...545	520...1540	850...2490	1280...3770
Continuous torque	Nm	37...127	150...520	230...780	350...1220
Limiting speed n_{max}	rpm	200	125	100	70
Encoder, resolution		absolute, 6144	absolute, 8192	absolute, 9728	absolute, 12288
Encoder, rotary speed n_{max}	rpm	1000	820	700	560

Subject to modification without previous notice.

Higher rotary speeds and more technical data on request.

Preliminary dimensions. Exact dimensions on request.

Check List for Your Enquiry

Send by fax to: +49 3681 7574-30

This check list can also be downloaded from the download centre at www.ina-dam.de.

Company	**Contact person**	**Industry/appellation of project**
Telephone	**Fax**	**E-mail**

Brief description

Motor ☐ **System** ☐ **Axis within a multi-axis system** ☐

Position of the rotary axis in the space

Type of weight compensation:

Installation conditions for drive

(if required, diagram or drawing)

Max. installation dimensions [mm]:

(length/width/height)

mechanical interface:

Ambient conditions

Temperature [K]:

Contamination:

Degree of protection (IP):

Movement quantities

Angle of rotation φ [degrees]:

Additional mass moment of inertia [kgm^2]:

Interfering forces [Nm]:

Maximum rotary speed [rpm]:

Synchronism variations [%] at rotary speed:

Shortest acceleration

or delay time [ms]:

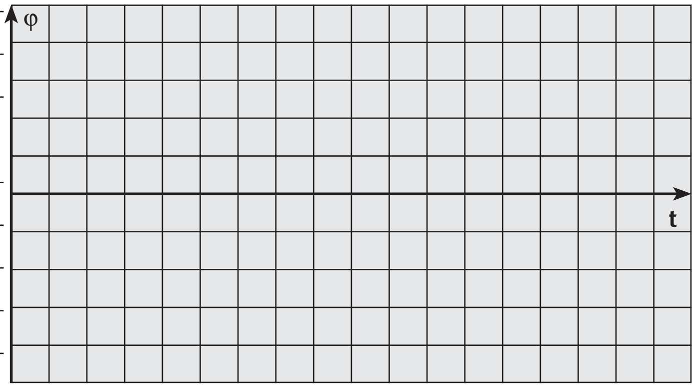
Overswinging in position [degrees]:

Response time [ms]:

Typical cycle per unit of time (diagram):

Life/operating hours [h]:

drawing



Required accuracies

(if applicable, diagram or drawing)

Over diameter [mm]: ______

Radial accuracy [µm]: ______

Axial accuracy [µm]: ______

drawing

Cooling

Cooling permissible

Yes ☐ No ☐

Oil ☐ Water ☐ Air ☐

Max. permissible heating of the

primary [K]: ______

secondary [K]: ______

Controller

Present

Yes ☐ No ☐

Controller type:

Components: Only servo-regulator ☐

Complete controller ☐

Positioning: Point-to-point controller ☐

Track control ☐

Interfaces: ______

Options: ______

General information

Accessories: ______

Individual pieces ☐ Series ☐ Prototype for series ☐

Probable annual requirement: ______

Planned start of production: ______

Price expectation or

costs for existing solution: ______

Desired quotation deadline: ______

Further processing by: ______ Date: ______

Generated by: ______ Date: ______

Feasibility checked by: ______ Date: ______

Technical Information and Consulting Services

Class-leading technology and competent consulting services are two of the major benefits of working with IDAM.
IDAM application engineers are looking forward to support you choose the perfect drive for your application.

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Glossary

System parameters

Symbol	Meaning	Unit	Explanation
J	Mass moment of inertia	kgm²	Resistance quantity of the rotor mass compared to a variation of rotor speed
S_R	Axial runout	µm	Axial runout tolerance of the rotor
K_R	Radial runout	µm	Radial runout tolerance of the rotor
F_{ax}	Maximum axial load	N	Maximum permissible force for the load of the rotor in both axial directions
F_{rad}	Maximum radial load	N	Maximum permissible force for the load of the rotor in radial direction exclusively
T_{tilt}	Maximum tilting torque	Nm	Maximum permissible torque for the load of the rotor relating to its mid-point
n_{lim}	Limiting rotary speed	rpm	Maximum permissible rotary speed of the rotary system in consideration of the bearing, the measuring system and the motor. It must not be exceeded - also at convenient operating and cooling conditions - neither permanent nor short-time. Furthermore the achievable rotary speed can be limited by thermal and mechanical loads.
C_a	Axial stiffness	N/mm	Ratio of the applied force for a certain (material-dependent) deformation at the elastic range in axial direction
C_r	Radial stiffness	N/mm	Ratio of the applied force for a certain (material-dependent) deformation at the elastic range in radial direction
$\Delta\varphi_{abs}$	Positioning accuracy	arcsec	Maximum difference between the required position and the current position for any position within complete rotating range
$\Delta\varphi_{rep}$	Repeatability	arcsec	Accuracy, whereby every position could be moved to once again within complete rotating range after any change in position from both directions (bidirectional).
Z	Number of lines of the measuring system	counts/rev	Number of the readout sinusoidal signal periods per revolution; by means of downstream interpolation electronics or the signal electronics of the servo controller, this value may be increased many times over.

Symbol	Meaning	Unit	Explanation
A	Resolution	inc/rev	Resolution is the smallest possible movement, which can still be detected by the attached evaluation electronics of the servo controller. The resolution A [inc/rev] is calculated with the interpolation rate of the connector board i, the factor of the evaluation mode in the counter N (up to four-fold) and the counts Z: $A = i \cdot N \cdot Z$.

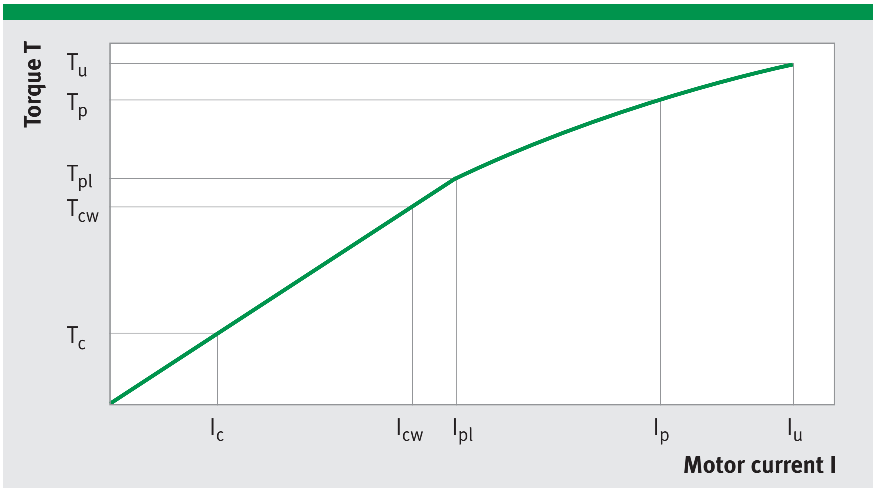
Glossary

Winding independent parameters

Saturation behavior

The torque increases with growing effective current linearly at first, next, the torque changes into the bent part, and then increases in a flat, linear fashion.

The bend results from the magnetic saturation of the entire magnetic circuit.



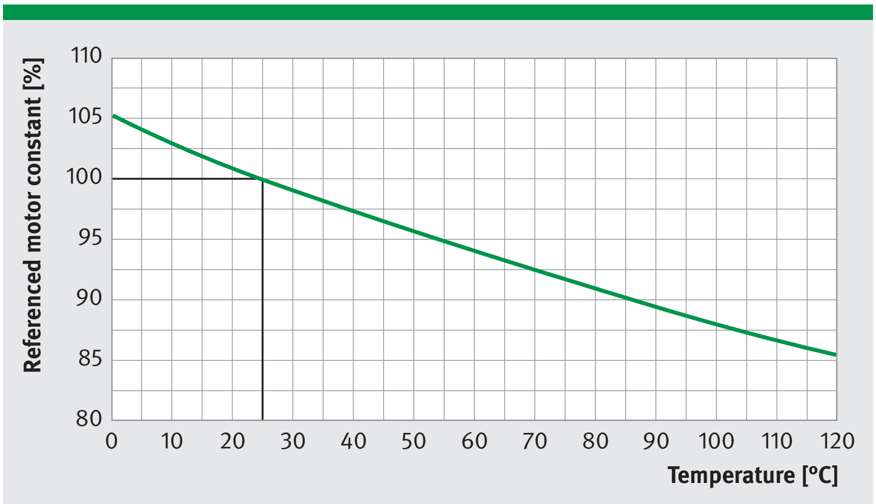
Torque vs. current

Symbol	Meaning	Unit	Explanation
T_u	Ultimate torque	Nm	Ultimate torque at strong saturation of the magnetic circuit. When this force is exceeded there is a risk that the heated motor could become demagnetized or that thermal destruction is immanent shortly! This value must not be used as a dimensioning variable, but must be taken into account in the case of short-circuit braking.
T_p	Peak torque	Nm	Torque, which is excited in the saturation range (I_p). The permissible duration depends on the current motor temperature vastly and it is in the range of few seconds (1...3 s).
T_{pl}	Peak torque, linear range	Nm	Motor torque that can be reached for a short time (a few seconds), which is reached at the end of the linear full output range at $I_{pl} \cdot k_T$.
T_c	Continuous torque, not cooled	Nm	Motor continuous torque at continuous current I_c, at which the motor can be operated without cooling in a thermally stable manner, but gets heated thereby.
T_{cw}	Continuous torque, water cooled	Nm	Motor torque at I_{cw}, which is available at rated operation with water cooling as the continuous torque and at which a temperature drop of about 100 K is obtained between the winding and the cooling system.
T_s	Stall torque, not cooled	Nm	Standstill torque at rest and at triggering frequency up to about 1 Hz, which appears at a respective standstill current value, due to the non-uniform current distribution in the individual motor phases.

Symbol	Meaning	Unit	Explanation
P_l	Power loss	W	The heat that is generated in the motor winding, which depends on the operating method (current) and the ambient conditions (cooling) results in a time-dependent temperature increase. In the upper full power range (at T_p), P_l is particularly high because of the quadratic dependency on the current, whereas in the range of the rated current, only a relatively low heating occurs. P_l is calculated with the help of the motor constant k_m for a movement range with the required torque T: $P_l = (T/k_m)^2$
P_{lp}	Power loss	W	Peak power loss at I_p
P_{lpl}	Power loss, linear	W	Peak power loss at I_{pl}
P_{lc}	Power loss, not cooled	W	Power loss at I_c
P_{lw}	Power loss, cooled	W	Power loss at I_{cw}
ϑ	Winding temperature	°C	Permissible winding temperature that is acquired by means of sensors with a certain offset. The motor surface temperature that results depends on: • the specific installation conditions (dimension of the machine construction) • heat carrying conditions • method of operation and hence the average power inflow and can only be determined when this parameter is known.
R_{th}	Thermical resistance	K/W	Thermal resistance with which the temperature difference between winding - housing or the cooling base can be determined at a certain power loss.
τ_{el}	Electrical time constant	ms	Electrical time constant that describes the ratio L/R. The ratio is – independently of the winding design – approximately constant. The effect on the control circuit (closed loop) is less than the constant itself and depends on the degree of voltage overstepping.

Symbol	Meaning	Unit	Explanation
k_m	Motor constant	Nm/√W	Motor constant that expresses the relation between the generated torque and the power loss, i. e. the efficiency. It depends on the temperature, and can only be used in the static operation case, as well, as in the linear full output range of the motor, e.g. in case of positioning processes with low speeds. At 100 °C winding temperature, it gets reduced to about 0.88 times the value.
T_r	Ripple torque	Nm	Ripple torque as the sum of reluctance-dependent torques (cogging), which upon movement of the powerless motor, works in the direction of thrust and acts as the torque ripple in operation.

Thermal behaviour



Motor constant vs. temperature

The temperature-dependent motor constant k_m with the unit Nm/√W expresses the relationship between generated torque and power loss.

Winding resistance increases if temperature increases, which leads to a reduction of k_m.

At a winding temperature of 100 °C the motor constant is reduced to about 0.88 times the value at 25 °C.

With a constant current or torque, the power loss generated in a warm motor is therefore higher than that of a cold motor, and this in turn increases the motor temperature even further.

Glossary

Winding dependent parameters

Symbol	Meaning	Unit	Explanation
k_T	Torque constant	Nm/A_{rms}	Torque constant, which is in linear full power range multiplied by the current gives the resultant motor torque: $T_c = I_c \cdot k_T$
k_u	Back EMF constant	Vs/rad	Voltage constant that is obtained in generator operation, and when multiplied by the rotational speed gives the armature counter voltage resulting at the motor terminals: $U_{EMF} = k_u \cdot n$
n_{lp}	Limiting speed	rpm	Winding dependent limit speed without consideration of the dynamic heat losses when peak current I_p without field weakening is applied. After this point the motor torque decreases strongly (see diagram).
n_{lw}	Limiting speed	rpm	Winding dependent limit speed without consideration of the dynamic heat losses when water cooled continuous current I_{cw} without field weakening is applied. After this point the motor torque decreases strongly (see diagram).
n_{lc}	Limiting speed	rpm	Winding dependent limit speed without consideration of the dynamic heat losses when air cooled continuous current I_c without field weakening is applied. After this point the motor torque decreases strongly (see diagram).
n_{cr}	Limiting speed	rpm	Limit speed under consideration of additional frequency dependent heat losses (causes by eddy current and cyclic magnetization loss). A continuous, water cooled operation at limit speed n_{cr} is possible if the applied current is not exceeding approx. 45% of the water cooled current I_{cw}. Speed n_{cr} at water cooled current I_{cw} can be operated at a duty-cycle of approx. 20%. In order to reach a duty cycle of 100% at current I_{cw}, a speed reduction to 0.2 x n_{cr} is necessary. The torque (current) or the duty-cycle at speed n_{cr} can be increased by use of a special winding variant (Z winding).
U_{DCL}	Direct current link voltage	V	Intermediate circuit voltage or supply voltage of the power control elements. The higher the speed and the concomitantly rising counter-voltage and frequency-dependent losses are the higher this voltage must be.
R_{25}	Electrical resistance	Ω	Winding resistance at 25 °C. At 130 °C, this increases to about 1.4 times the value.

Symbol	Meaning	Unit	Explanation
I_u	Ultimate current	A_{rms}	Limiting current at which the magnetic circuit is strongly saturated. It is either determined by the maximum current density in the winding or through starting demagnetization danger at a magnet temperature of 80 °C (also see T_u).
I_p	Peak current	A_{rms}	Peak effective current that is in the range of iron saturation and is to be used as a dimensioning quantity (also see T_p). In case of an only moderately hot rotor (magnet temperature max. 60 °C) and pulse operation (max. 1 s), I_p can be increased up to the limiting value I_u.
I_{pl}	Peak current, linear range	A_{rms}	Effective peak current up to which a more or less proportional torque curve occurs.
I_c	Continuous current, not cooled	A_{rms}	Effective rated current, at which the relevant loss power, depending on the size of the screw-on base, without forced cooling, results in a relatively small heating up of the motor.
I_{cw}	Continuous current, cooled	A_{rms}	Effective rated current that is permissible in case of water cooling in continuous operation.
I_s	Stall current, not cooled	A_{rms}	Effective standstill current at rest and at control frequencies up to about 1 Hz. Due to the different current distribution in the motor phases, for preventing local overheating, the motor current has to be reduced to this value, if no noticeable movement takes place beyond a pole pair.

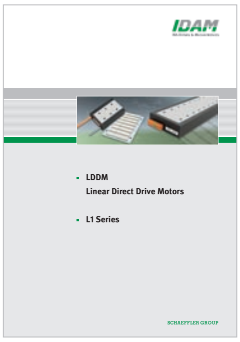
Notes

Notes

At a Glance: IDAM Brochures

You are interested in more detailed technical information?

We would be happy to send you our product brochures. Contact us: info@ina-dam.de



LDDM

Linear motors: L1

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Linear motors: L2U

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Linear motors: FSM

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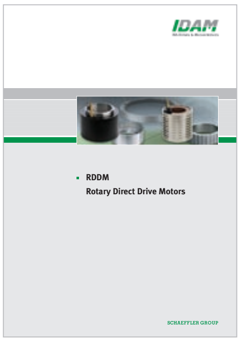
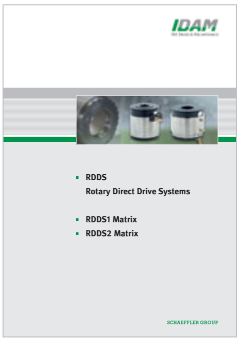
Linear motors: ULIM



RDDM

Rotary direct drive motors



RDDS

Rotary direct drive systems

Planar reluctance motors

Image brochure: „Direct Drive Technology“

All information about our motors and systems you can download on IDAM website: www.ina-dam.de

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