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Operating Instructions

Dual Range Torque Transducer

DRDL

DRDL-n

DRDL-w

English

Content

Important Advice

The torque transducers of type DRDL are suitable for applications in laboratories (for example in testing equipment) as well as in industrial environment.

The torque transducer is not designed with the usual safety factor (2...20), favoring high sensitivity instead.

Pay attention to the overload limit.

You have to protect users from danger of being hurt (metal cover etc.)

The torque transducer is not designed for explosion endangered areas.

Warranty is void if opened or disassembled.

The transducer must only be opened by authorized personnel.

1. Introduction

The torque transducers have different shafts according to measurement range.
Torque transducers' measurement unit is Nm.

2. Application

Torque transducers are able to measure clockwise as well as counter clockwise torque. With clockwise torque the output is positive. The type label indicates the range of the transducer.

The torque transducers measure static torque as precise as dynamic torque. Yet you have to pay attention to the transducer's signal rise time. It is indicated in the Data sheet.

The torque transducers are maintenance-free.

Handle the torque transducer with care, especially when transporting or mounting. Because it can be damaged by hard shocks or by dropping to ground. Even a short peak torque above the allowed overload capacity can damage the measure shaft. In cases where this can happen you have to take precautions to avoid this.

The absolute maximum ratings regarding mechanical, thermal and electric parameters are listed in the data sheet and must be observed in design, mounting and operating.

3. Technical Details

3.1 Torque Shaft

The shaft is fixed in the chasing with two ball bearings.
To measure the torque it causes a proportional bending of the shaft (within the elastic range) and this is measured with applied strain gages. The strain gages are connected as a wheatstone bridge. Additional angle or speed measurement is optionally available. (See the data sheet.)

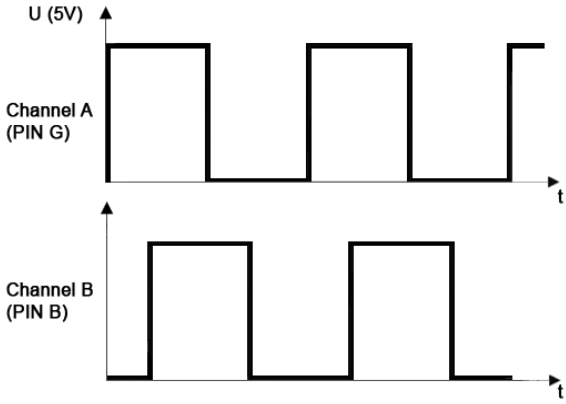
3.2 Case

The housings of the torque transducers are made of high-strength aluminum, the surface is hard anodized for protection. The torsion shaft has two bearings in the housing via deep groove ball bearings. The mechanical attachment of the transducer is carried out using a foot attachment. Evaluation electronics for torque and speed or angle of rotation are mounted on the housing.

3.3. Measurement

The torque causes the bending of the shaft and the strain gages. The resistance of the strain gages changes proportional to the change of their length. And this is converted into an electrical signal that causes a frequency modulation. This modulated signal is transmitted optically to an electronic circuit in the casing. There it is converted back to a proportional analog output voltage. This output voltage has a separate ground that is electrically separated from the transducer's supply.

For speed and angle measurement the pulses of a code wheel are encoded to a square wave signal. With option speed measurement the output is 60 pulses per revolution, with option angle measurement two square wave signals are provided with an output of 360 pulses per revolution. While clockwise rotation the signal of channel A is approximately 90 degrees ahead of channel B.



3.4 Disturbances and their Compensation

Avoid bending, axial and radial forces. When you have problems with this, use ETH clutches.
To connect the transducer to a measurement unit you need a shielded cable.

The transducers are EMC-tested and are complying with EN 55011/03.91 (DIN VDE 0875-11/07.92) respective prEN 50082-2/1993 (E DIN EN 50082-2/03.94).

4. Operating conditions

4.1. Environment Temperature

For best accuracy you have to meet the environment temperature specification. The temperature should be constant or slowly changing. The specified temperature errors apply only for changes less than 5 K/h. Radiation heat or cooling on one side has to be avoided. Or appropriate precautions have to be taken.

4.2 Humidity and Dust

The torque converter corresponds to IP40 according to DIN 40050

Advice: Don’t let humidity seep into the transducer’s connector!

4.3 Chemically Resistance

The torque transducers are not resistant against chemicals.

4.4 Deposition

Dust, dirt and other particles mustn’t accumulate so that they can get into the ball bearings and the connector.

5. Mounting

5.1 Precautions at Assembly

- Handle the transducer carefully
- **Important Note:**
  Do not overload the transducer, not even temporarily. If possible, we suggest connecting the transducer to a display unit before mounting, so you can watch the torque while mounting.
- Avoid false axial and radial alignment.
- Provide good electrical ground contact to the casing.

5.2 General Mounting Instructions

Don't mix up the transducer's drive side and the measuring side, as this causes errors (especially when accelerated).

When you look at the type label the measuring side is on the left.
The measuring side also can be identified by a deepening on the cover.

Bending, axial and radial forces are causing errors. Keep thermal expanding of the construction in mind.

6. Measuring Chain

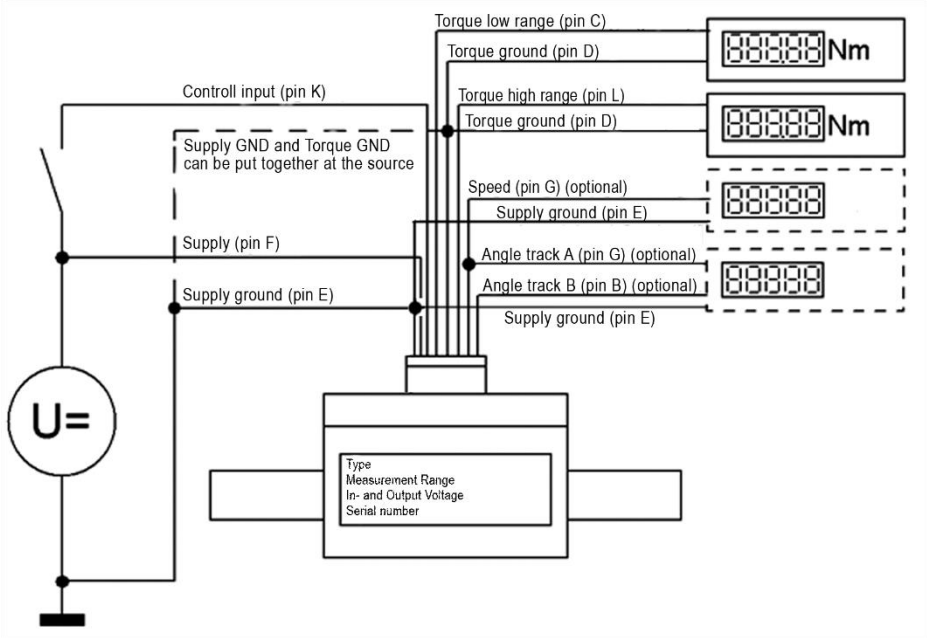
For measuring with the transducer, a whole measuring chain is necessary.

- Torque transducer
- Measuring cable
- Supply and display unit

You need a supply and display unit to supply the transducer with power and to display the measured torque.

7. Connection

Connection of a torque transducer



7.1 Hints for Connection

Electric and magnetic fields cause interference with the measuring signal. This interference is mainly caused by power cords, relays or motors installed nearby. Besides these, interference can be caused by multiple grounding of the measurement chain on more than one point.

Pay attention to the following:

- Use only shielded cables with low capacitance (like our measuring cables).
- Connect supply voltage correctly (no reverse polarity protection).
- Measuring cables shouldn't be nearby high voltage or control cables.
- Magnetic radiation from transformers, motors or relays must be avoided.
- Don't ground transducer and display unit multiple. Connect all devices of the measurement chain to the same ground.

7.2 Connectors

The transducer is equipped with a 12 pin fitted connector.

7.3 Pinout of the Connector

The pinout of the connectors are on the following pages.

The transducer internally generates a galvanically isolated measurement signal.

The masses must not be bridged directly on the transducer, otherwise - depending on the cable length to the supply and evaluation device - leads to measurement errors. If necessary, however, these can be bridged directly on the supply and evaluation device.

The "control activation" is used to test the transducer. This emits its maximum signal of e.g. + 10V (with right-hand load). The control level is 4.5V up to the supply voltage, the reference ground point being the supply ground.

7.4 Prolongation of Cable

Extension cables must be shielded and have low capacitance.
We recommend using the cables we offer that meet these requirements.
In the case of cable extensions, a perfect connection and good insulation must be ensured.
It must be ensured that the cable cross-section is selected to be sufficiently large to ensure sufficient supply voltage on the transducer.
A recalibration is not required when the cable is extended.

7.5 Supply Voltage

Regard to the correct polarity. The rise time for the supply voltage of 12V ±10% (optional 15V + 5% / -10%) should be less than 1ms, otherwise the DC/DC – converter at the electronics might not work properly.

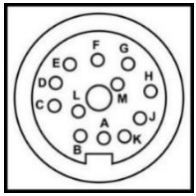
8. Pin Configuration

8.1 Standard-Measuring Cable AK12.4

12-pin connector

Pin	Colour	Connection
A	Green	NC
B	Red / Blue	Angle exit track B = 90 °
C	Yellow	Moment Exit small measuring range
D	White	Moment mass
E	Grey	Supply + angle / speed ground
F	Pink	Supply +12V
G	Grey / Pink	Speed / angle output track A = 0 °
H	Purple	Memory chip small measuring range
J	Black	Memory chip large measuring range
K	Red	Control input
L	Brown	Moment output large measuring range
M	Blue	NC

(Connector at the transducer, view from above)



PIN D (torque GND) and PIN E (supply and speed GND) are internally separated.
If necessary bridge at supply source (not at the transducer!).

Built-in EMC protective circuit

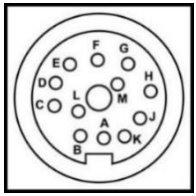
Between Pin E and K; between Pin E and F as well as between Pin C and D there is a high frequency bypass capacitor connected (100nF/50V).
We recommend carrying out this EMI protection at the supply source as well.

8.2 Robot cable AK12.5

12-pin connector

Pin	Colour	Connection
A	Black	NC
B	Red	Angle exit track B = 90 °
C	Brown	Moment Exit small measuring range
D	White	Moment mass
E	Yellow	Supply + angle / speed ground
F	Purple	Supply +12V
G	Green	Speed / angle output track A = 0 °
H	Pink	Memory chip small measuring range
J	Grey	Memory chip large measuring range
K	Grey/Pink	Control input
L	Blue/Red	Moment output large measuring range
M	Blue	NC

(Connector at the transducer, view from above)



PIN D (torque GND) and PIN E (supply and speed GND) are internally separated.
If necessary bridge at supply source (not at the transducer!).

Built-in EMC protective circuit

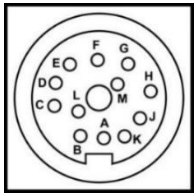
Between Pin E and K; between Pin E and F as well as between Pin C and D there is a high frequency bypass capacitor connected (100nF/50V).
We recommend carrying out this EMI protection at the supply source as well.

8.3 Thin cable AK12.2 for small transducer

12-pin connector

Pin	Colour	Connection
A	Black	NC
B	Red	Angle exit track B = 90 °
C	Brown	Moment Exit small measuring range
D	White	Moment mass
E	Yellow + White/Yellow	Supply + angle / speed ground
F	Purple + Brown/Green	Supply +12V
G	Green	Speed / angle output track A = 0 °
H	Pink	Memory chip small measuring range
J	Grey	Memory chip large measuring range
K	Grey/Pink	Control input
L	Blue/Red	Moment output large measuring range
M	Blue+ shield	NC

(Connector at the transducer, view from above)



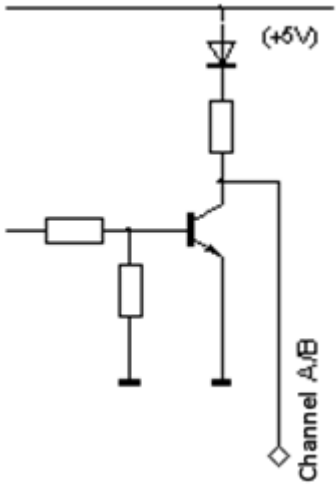
PIN D (torque GND) and PIN E (supply and speed GND) are internally separated.
If necessary bridge at supply source (not at the transducer!).

Built-in EMC protective circuit

Between Pin E and K; between Pin E and F as well as between Pin C and D there is a high frequency bypass capacitor connected (100nF/50V).
We recommend carrying out this EMI protection at the supply source as well.

9. Output

The transducer's output voltage is proportional to torque and ±10V for maximum torque. With clockwise torque the output is positive; with counter clockwise torque the output voltage is negative.
The outputs for rotation speed and angle measurement have an open collector stage, with an internal 10 KΩ pull up resistor in series with a diode. See schematic below.



10. Recalibration

Regardless of the use, the sensor must comply with the one specified by ETH Period (see certificate and sticker sensor).
We also carry out a complete check (e.g. wear parts).

So that the processing can take place as quickly as possible, we recommend before the Return an appointment.

11. Disposal

The transducer can be returned to us free of charge for disposal, complete with measuring cable. As soon as you have packed the sensor, send a message to sales@eth-messtechnik.de, we will then commission our parcel service to collect it. Unfortunately, we cannot accept parcels sent to us without prior notice.

12. Angle and speed measurement at high rotation speeds

(Transducers with 360 pulses per rotation)

Remarks

- **Beware of the maximum speed of your transducer type, listed in the data sheet!**
- When you use a transducer with 60 pulses per rotation, the maximum speed is six times higher than listed below.

With GMV2:

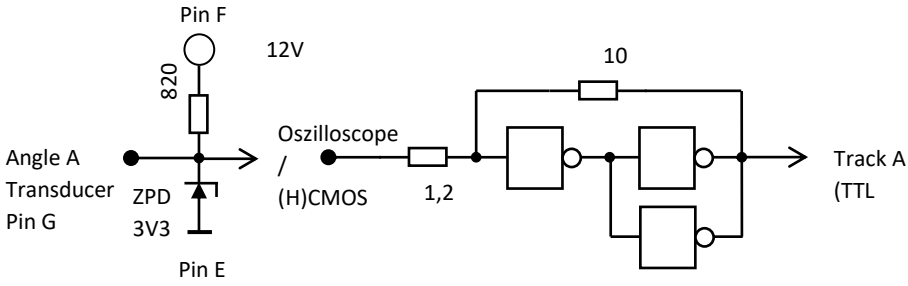
Cable length:	maximum speed:
2,5 m / 8 ft	10.000 min^{-1}
5 m / 16 ft	10.000 min^{-1}
10 m / 32 ft	6000 min^{-1}

With external measurement unit:

Maximum speed in RPM:

Cable length	**R pull up (5V ... 12V)**	
	10 kΩ	1,2 kΩ
2,5 m / 8 ft	4000	15.000
5 m / 16 ft	2000	12.000
10 m / 32 ft	1000	10.000

With this circuit you can measure speed of more than 15,000 RPM and with a cable of up to 32 ft.
The signal level of the circuit on the left hand side is suitable for opto couplers, frequency counters, oscilloscopes and for (H)CMOS logic. If you need standard TTL levels you can add the circuit on the right hand side.



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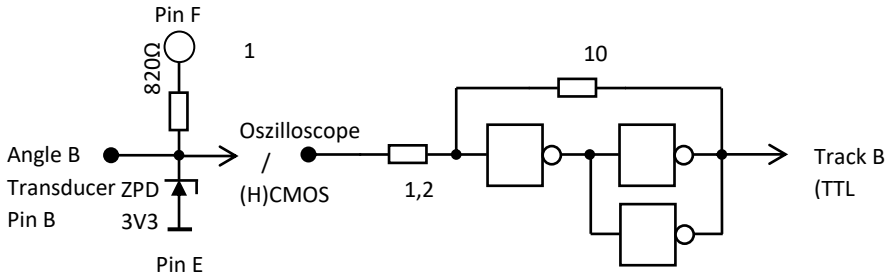

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13. Technical Specifications

Supply voltage:	12 V DC ± 10 %
Current consumption:	< 200 mA
Rise time 10-90 %:	2 ms
Limit frequency –3 dB:	200 Hz
Voltage output:	0 to ± 10 V
Internal resistance:	100 Ω
Ripple:	< 100 mVss
Nonlinearity:	< 0,1 %
Hysteresis:	< 0,1 %
Devitation at zero point:	≤ ± 100 mV
Max measurement error:	0,1 % (FS / of full scale)
Operating temperature:	0 - 60 °C
Compensated temperature range:	5 - 45 °C
Temperature error	
Zero point:	0,02 % / K
Sensitivity:	0,01 % / K
Mechanical overload:	100 %
Internal protection:	IP40
Connection:	12pin- connector

Factory calibration Right-/ left load in 25% steps. Special calibration on request.

EMV Immunity for interference (DIN EN 61326-1 / EN 61000-6) *1

Enclosure	Severity
HF line interference	
150 kHz - 80 MHz (AM)	10 V
ESD (Electrostatic discharge)	Air 8 kV / Contakt 4 kV
Enclosure	
Electromagnetic Field	
80 Mhz - 1000 MHz (AM)	10 V/m
150 kHz - 80 MHz (AM)	20 V/m
Leads - Connection Cable	
Burst (fast transients)	2 kV

*1 Severity / Criterion: industrial environment; Cable lenght ≤ 30 m. Application not outside buildings.

Interference Emission (EN 55011)

Disturbance Voltage (electromagnetic Disturbances)	Class B (150 kHz - 30 MHz)
Radiated Emission (electromagnetic Disruption axis)	Class B (30 MHz - 1000 MHz)

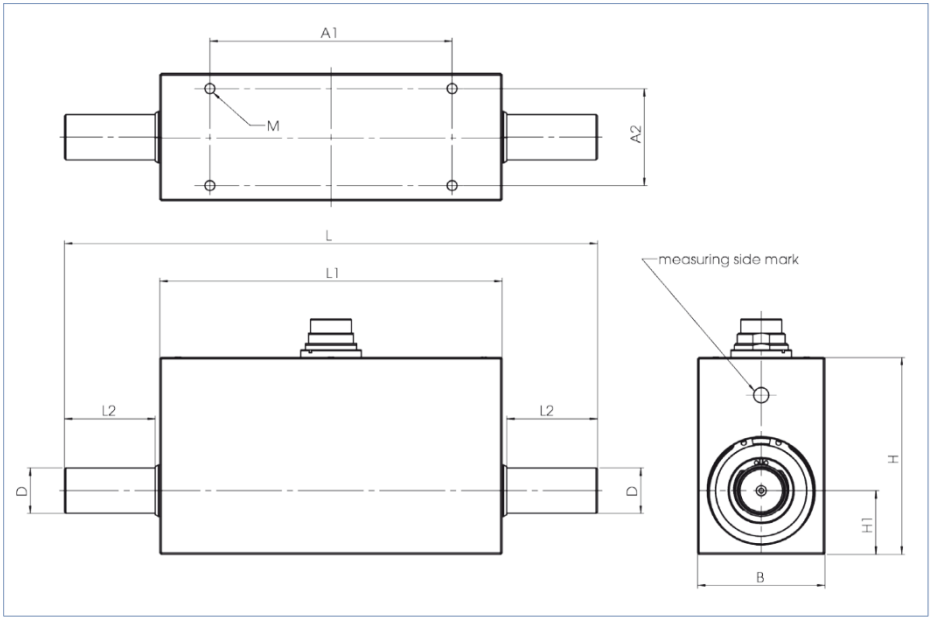
Speed Option (n)	
max. rev.:	up to 10 000 min $^{-1}$ *
Output:	open-collector
Internal pull up:	10 kΩ (5 V Level)
External pull up:	24 V max
I max:	20 mA
Pulses / rev.:	60

* with additional external wiring 20.000 min^{-1} (or speed max.)

Angle Option (w)	
max. rev.:	up to 3 000 min $^{-1}$ **
Output:	open-collector
Internal pull up:	10 kΩ (5 V Level)
External pull up:	24 V max
I max:	20 mA
Pulses / rev.:	360
Resolution:	1°
Phase shift	Channel A 90° at right spin of propulsion side.

** with additional external wiring 15.000 min^{-1} (or speed max.)

13.1 Mechanical Dimensions



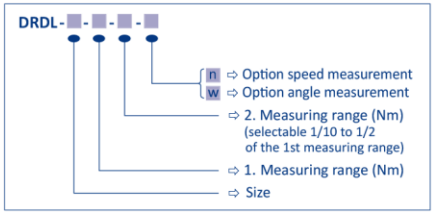
	DRDL-I	DRDL-II	DRDL-III	DRDL-IV	DRDL-V
1. Torque Range	| 0,5 | 1 | 2|	| 5 | 10 | 20 | 50 |	|50|100| |200|300|	|500|1000|1500|	|2000|3000| |4000|5000|
2. Torque Range	selectable when ordering (1/10 to 1/2 of the 1st range) - other measuring ranges on request! -				
L (mm)	108	176	184	280	352
L1 (mm)	76	113	92	107	129
L2 (mm)	14	30	45	85	110
B (mm)	44	42	60	97	125
H (mm)	65	65	75	106	136
H1 (mm)	20	21	28	45	58
D g6 (Ø mm)	6	15	26	45	70
A1 (mm)	60	80	70	70	105
A2 (mm)	32	32	48	70	100
M	M3 x 6 deep	M4 x 8 deep	M5 x 10 deep	M6 x 15 deep	M8 x 16 deep
Weight approx. (g)	420	800	1500	5600	14.000
Speed max. (1/min)	36.000	19.000	13.500	7900	7900

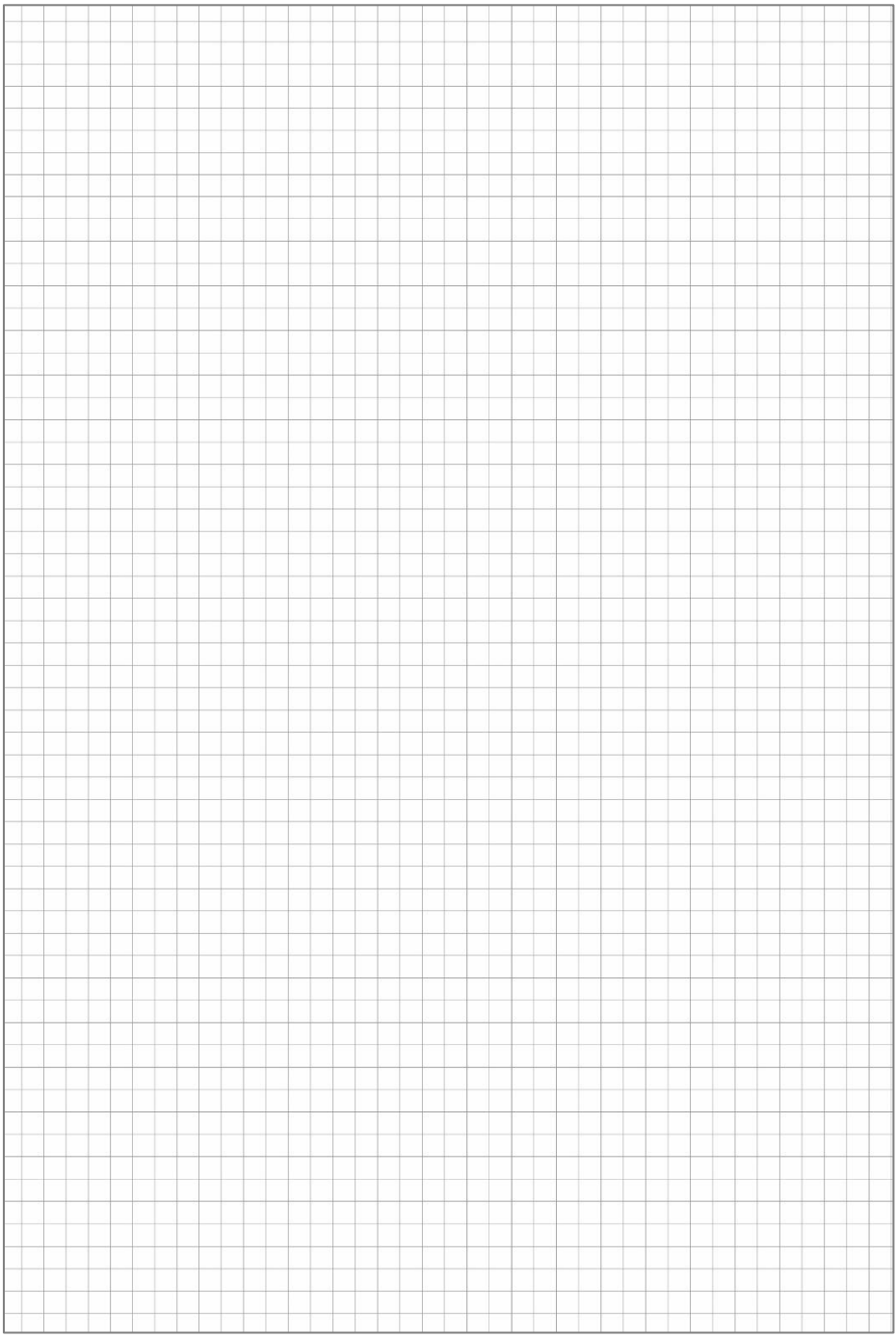
13.2 Mechanical Values and Load Limits

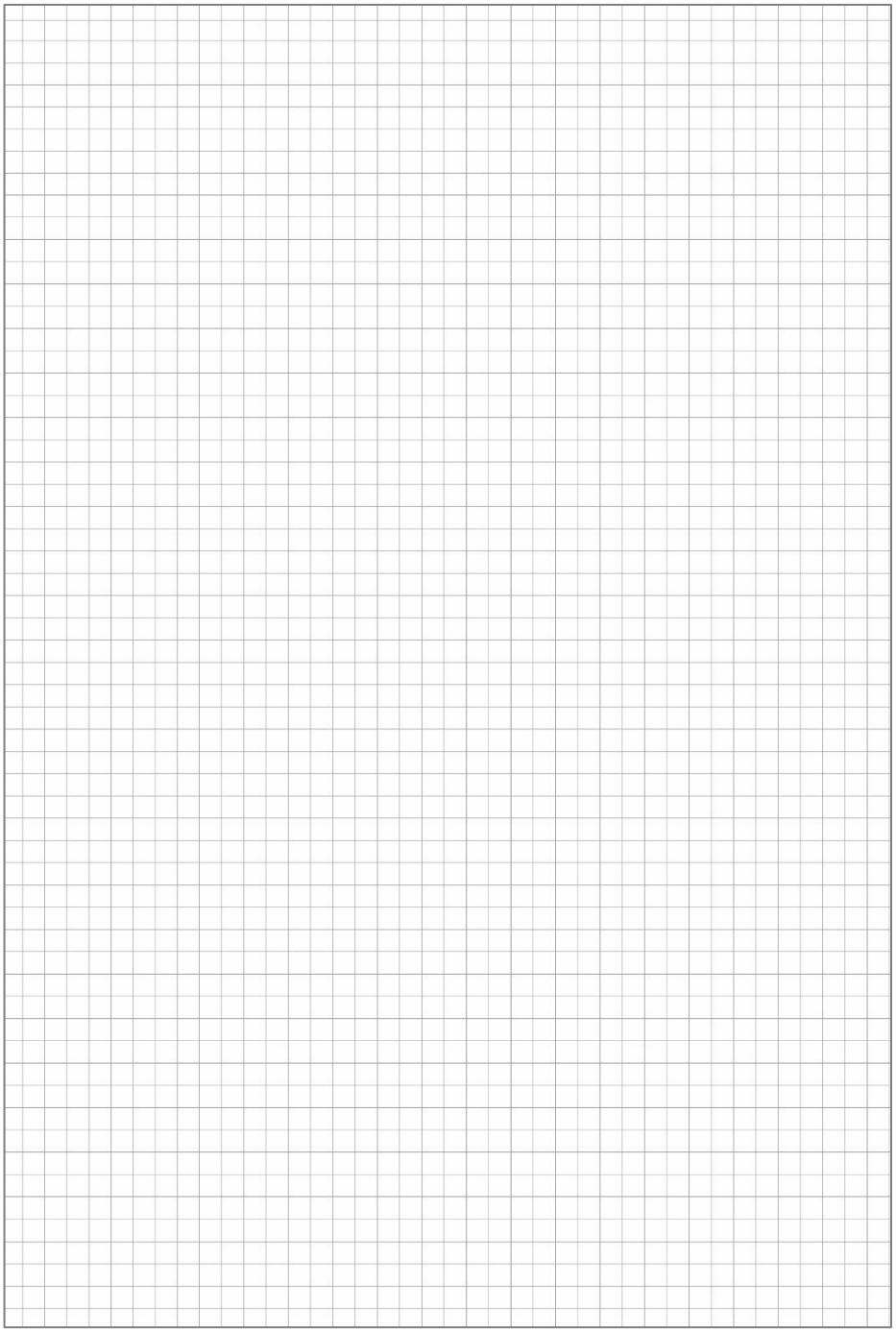
Size	Measuring range (Nm)	spring constant C (Nm/rad)	Mass Moment J (g•cm²)			Permitted Axial load (N) *	Permitted Radial load (N) *
			Total	Drive side	Measuring side		
I	0,5	32	16	16	0,6	120	1,8
	1	59	18	17	1,7	280	3,4
	2	130	18	17	1,7	349	6,9
II	5	508	126	95	32	880	10
	10	1183	127	95	32	1300	20
	20	2318	128	96	32	1300	40
	50	4322	130	97	33	1300	103
III	50	9488	905	565	340	1820	77
	100	20.354	912	569	343	1820	153
	200	37.724	927	576	351	1820	309
	300	49.069	946	586	360	1820	461
IV	500	161.773	10.677	5994	4683	4560	414
	1000	280.730	10.813	6062	4751	4560	829
	1500	350.925	10.975	6143	4832	4560	1199
V	2000	881 x 10^3	71.566	38.833	32.733	5650	6550
	3000	1176 x 10^3	71.970	39.035	32.935	5650	9765
	4000	1385 x 10^3	72.430	39.265	33.165	5650	11.300
	5000	1535 x 10^3	72.931	39.516	33.415	5650	11.300

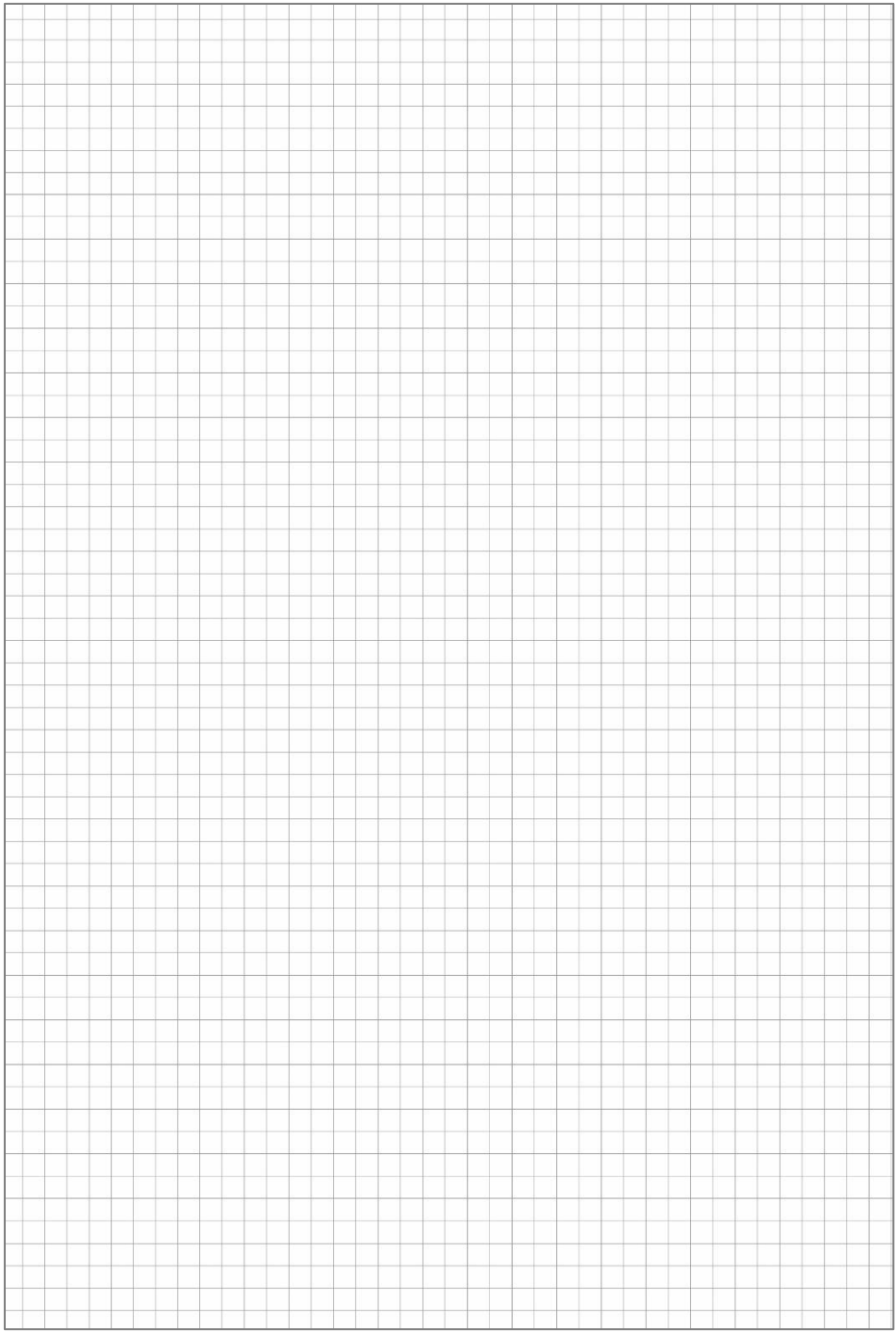
*The values for axial and radial load refer to the non-fixed housing.

Ordering Code









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