alpha

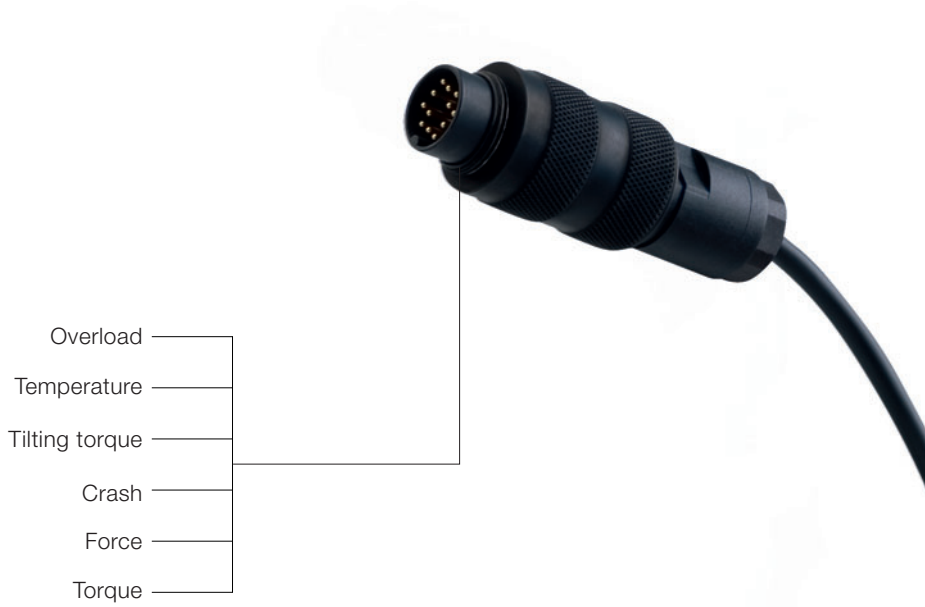
a WITTENSTEIN AG company

Understanding processes through intelligent sensor gearboxes

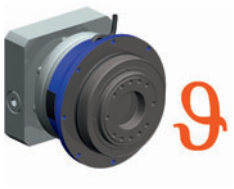
alpha IQ

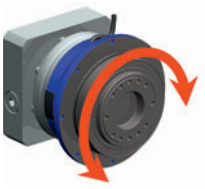
Low backlash planetary gearboxes and intelligent sensor technology

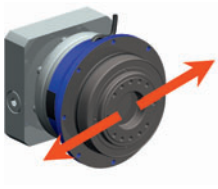
Gearboxes are the components most capable of registering the relevant parameters for your application because they are **directly involved in the process**. alpha IQ **optimises** all applications where **torques and shear forces are critical process parameters**.



alpha IQ – measured parameters


Temperature


Torque


X direction

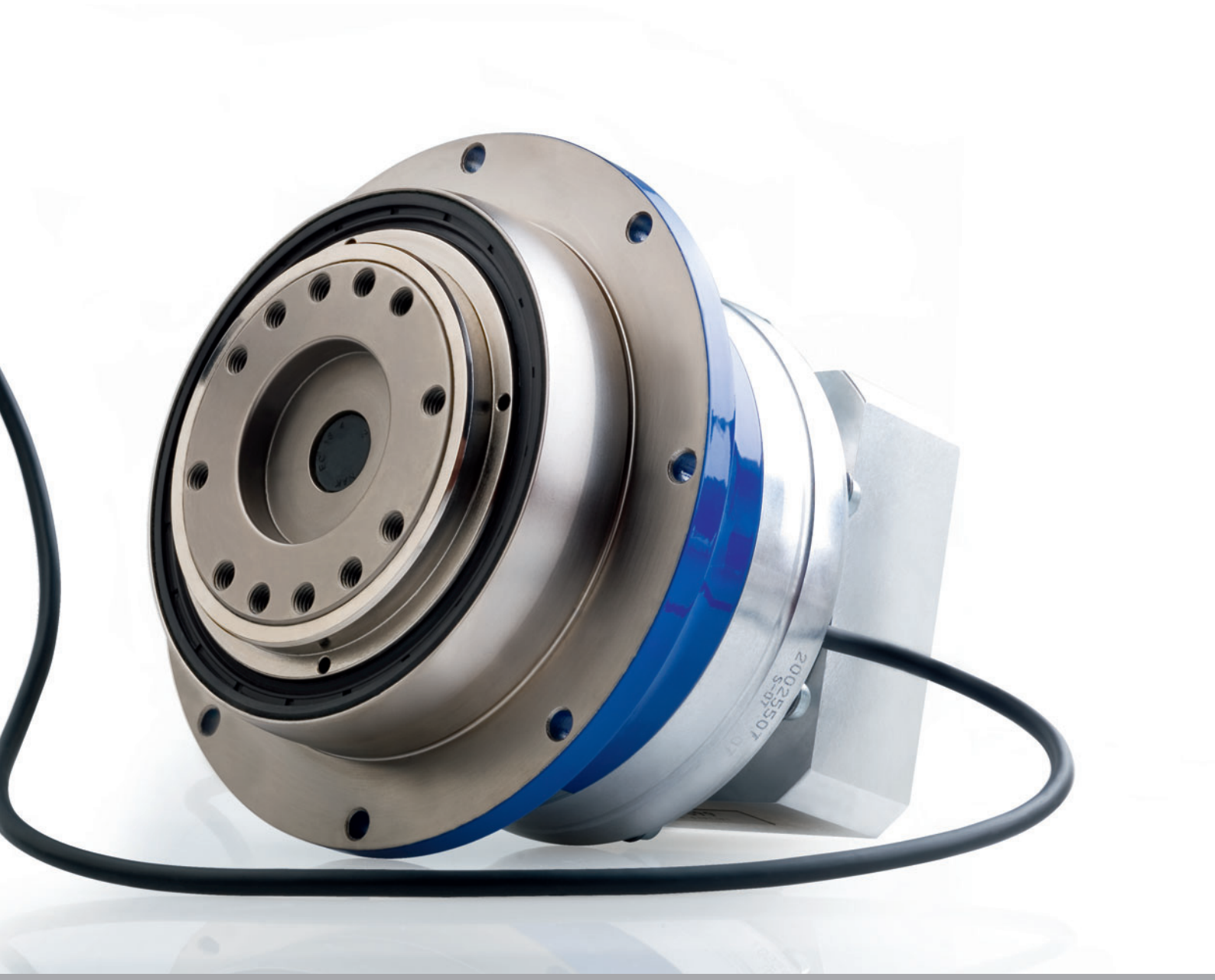

Y direction

alpha IQ

Identifying procedures, optimising processes, responding to changes

Intelligence in the **gearbox**

Monitoring, measuring and **optimising** the process and control quality are the most important requirements in sensor applications. Different sensors can be combined with the overall system, depending on these requirements and the depth of knowledge about the application. All mechanical loads are processed by the gearbox: torques, shear forces, speed, thermal loads, wear and backlash.



Close involvement **in the process**

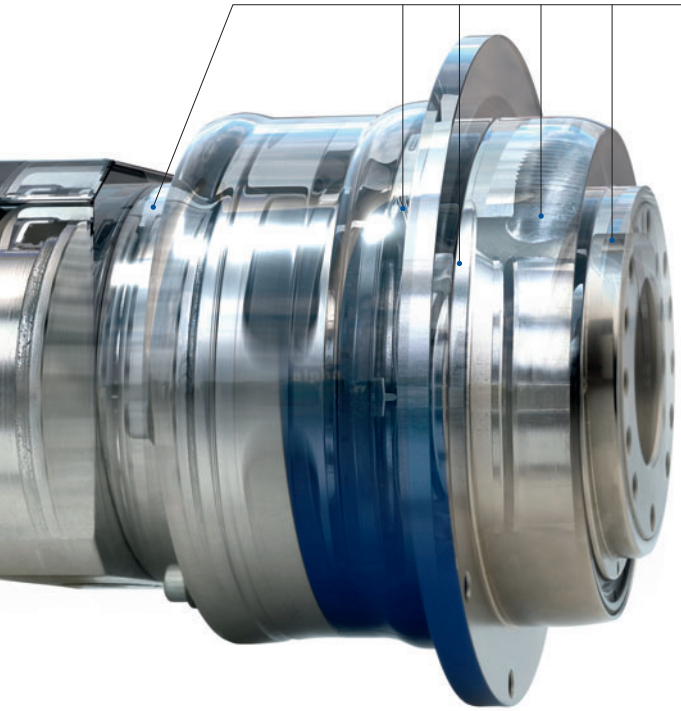
Sensor gearboxes allow you to **measure, diagnose** and **assess** process parameters directly, i.e. process control, process optimisation and adaptive control. The sensor signals enable realtime monitoring, the investigation of unexpected failures (crashes) and the provision of basic information for predicting failures and calculating the remaining service life of the device.

Cost savings due to precision design

The memory function documents the actual load spectrum in order that the workload of the drivetrain can be measured and the design adapted accordingly.
A precision design allows the omission of certain securities and saves costs.

Really get to know your process!

The measured parameters are read out by sensors integrated at close proximity to the application and then used for the following application areas.



Interface to the system

Recording measured parameters, transmission, electronics box processing, response of the control.

Multiple benefits for your processes

Reduction of downtimes, overload detection, damage prevention, exclusion of conventional measuring technology and additional components, diagnosis for maintenance/replacement.

Space-saving solutions

A compact installation resulting from many years of experience working with planetary gearboxes and innovative sensor engineering.

alpha IQ – more **installation** and **application examples**

Valve control
Series installation for process control

An automatic open and close process is used to reliably detect the current status (open, closed or blocked) of redundant monitored valves in nuclear power stations. An analogue output signal was selected as an electronic interface for integration in the system control.
Monitored measured parameters include torque and temperature.

The **3 application areas** of alpha IQ

Diagnosis:

The forces generated in the application are measured.
The sensors make precise measurements during the process so that you can determine whether a sensor, motor or gearbox is suitable for the task or whether it could be replaced with a smaller, less expensive model.
Test results can be transferred to any machine of the same model to avoid superfluous securities – optimisation of the drivetrain design.

Process monitoring:

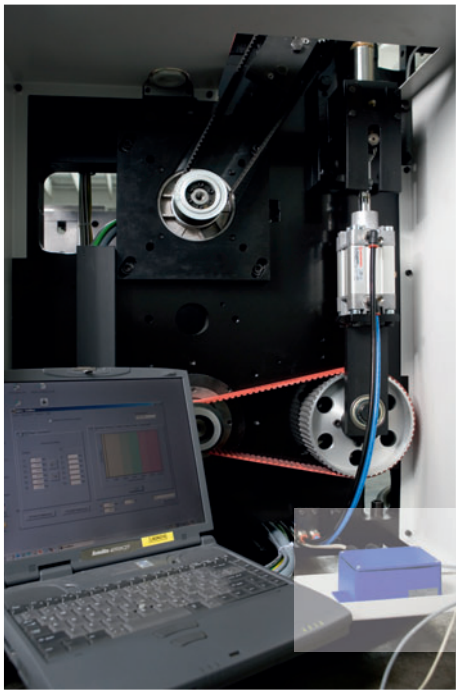
The actual situation is measured.
The sensors enable you to visualise and understand each individual step of your process.

Process control:

Actual values that influence the process directly are measured.
The values measured by the sensors can be used directly for the control and readjustment.

alpha IQ – **Application example**

The **sensor gearbox** with **toothed belt** and **lever mechanism**



LEMO Maschinenbau GmbH from Niederkassel-Mondorf is a globally operating market leader in the manufacture of film sealing machines. LEMO designs and manufactures systems for processing films for carrier bags, hygiene/sanitary bags, food, waste disposal and much more.

The **sensor gearbox** with toothed belt and lever mechanism moves the sealing bar in the systems. The sensor gearbox **analyses** the sealing process to optimise the **closing process and time**. The torque and the radial forces are measured in x and y direction.

Automation
Mechanical debugger

Process-critical parameters produced during movement sequences involving several levers are recorded and used to adapt the design of the drivetrain in the most efficient way possible. Furthermore, the identification of existing securities for streamlining the machine represents another economical aspect that reduces costs.

Packing machine
Series installation for process control

The forces and torques generated in the application toggle lever press, the most powerful of which occur at the dead centre position of the toggle lever, cannot be determined by calculation or motor current measurements. Integrated sensors are used to monitor the forces occurring in the process:
Quality control: product is checked prior to packing
Quantity control: production quantities are monitored
Process monitoring: Upstream processes are monitored (capacity)

TP+ Built for precision

TP+ – the heart and soul of alpha

Maximum power density

And the torques? Although the previous TP produced outstanding results, we managed to increase the torques by up to 40%
If your application requires high torques, the only solution is the TP+ HIGH TORQUE®, which is capable of transferring up to 100% more torque within the same installation space. Raising the limits – typical of alpha gearboxes.

Versatile installation

In whatever position you install your TP+, the gearbox always contains the same quantity of oil. TP+ is so flexible, you can install it vertically, horizontally or with the output facing upwards or downwards.

Quick **gearbox selection**

Size			004	010		025		050	
			MF+	MF+	MA+	MF+	MA+	MF+	MA+
Max. acceleration torque	T_{2B}	Nm	32–50	80–130	230	250–380	480–530	500–750	950
Nominal output torque	T_{2N}	Nm	15–40	35–90	110–180	100–220	260–375	220–400	575–675
EMERGENCY STOP torque	T_{2Emer}	Nm	100	250	525	625	1200	1250	2375
Max. output speed	n_{1max}	min^{-1}	6000	6000	6000	4500–6000	6000	4000–5000	5000
Permitted average output speed	n_{1N}	min^{-1}	3300–5500	2600–4500	4000–4500	2300–4200	3500–4000	1900–3900	3000–3500

Size			110		300		500	
			MF+	MA+	MF	MA	MF	MA
Max. acceleration torque	T_{2B}	Nm	1300–1600	2000–3100	2800–3500	5300	4800–6000	10000
Nominal output torque	T_{2N}	Nm	700–1250	1400–1750	1600–2200	3100	2900–3700	6000
EMERGENCY STOP torque	T_{2Not}	Nm	2750	6500	8750	13250	15000	25000
Max. output speed	n_{1Max}	min^{-1}	3500–4000	4500	3000	3000	3000	3000
Permitted average output speed	n_{1N}	min^{-1}	1400–3400	2500–3000	1600–2200	1500	1300–1800	1500

MF = Standard
MA = High Torque

Superior running thanks to the helical teeth

TP+ “whispers“. Compared to the classic straight-toothed TP, the helical-toothed TP+ is 6 dB(A) quieter during operation. And what a difference to added value 64 instead of 70 decibels makes. You will hardly notice vibration made by the TP+ because it runs so smoothly.

Maximum positioning accuracy

TP used to represent compact precision. However now, the TP+ represents maximum compact precision because we have managed to further reduce the torsional play, compared with the TP, to less than one angular minute to enable you to significantly increase the positioning accuracy in your application.
The extra-rigid TP+ HIGH TORQUE® achieves the best results because torsional rigidity also has an influence on the positioning accuracy. This torsional rigidity of this model exceeds the values of the TP+ by up to 110%.

TP+ IQ – Integrated sensors
Sensors integrated in the gearbox housing to measure the application values at the output for gearbox sizes TP+ 010, 025, 050.

Please refer to the “TP+ Built for precision“ brochure or the main catalogue for specific TP+ gearbox data (not sensor-dependent).

Measuring accuracy ± 2%
(percentage of the measurement range)
Resolution 0.5%
(percentage of the measurement range)
Temperature accuracy ± 2K
If the radial force is 1/5 of the max. tilting torque, the torque signal deviates by about 1%.

Please contact alpha for information on other gearbox types and sizes as well as measurement ranges.

TP+ IQ 010

			Max. permitted load	Measurement range MB
Max. acceleration torque [a] (max. 1000 cycles per hour)	T_{2B}	Nm	T_{2B}	T_{2B} (mind. 90)
EMERGENCY STOP torque [b] (permitted 1000 times during the service life of the gearbox)	T_{2Not}	Nm	200	x [d]
Max. radial force [b] (with x2 = 0 and z2 = 82.7 mm)	F_{2RMax}	N	1580	1580
Max. axial force [b]	F_{2AMax}	N	–	x [d]
Max. permitted housing temperature		°C	+90	+90
Tilting rigidity [b]	C_{2K}	Nm/arcmin	–	
Torsional rigidity [b]	C_{t12}	Nm/arcmin	–	

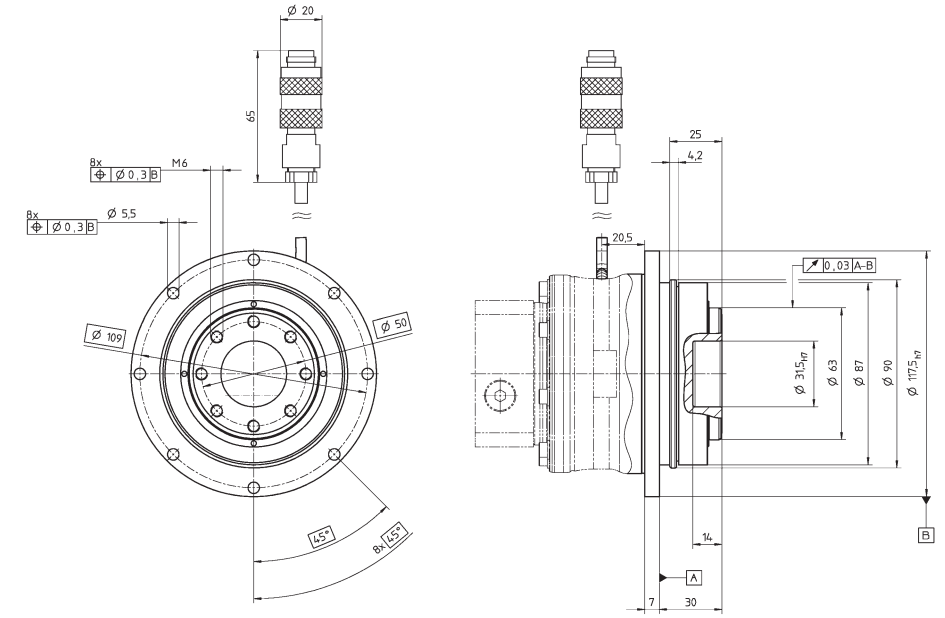
TP+ IQ 025

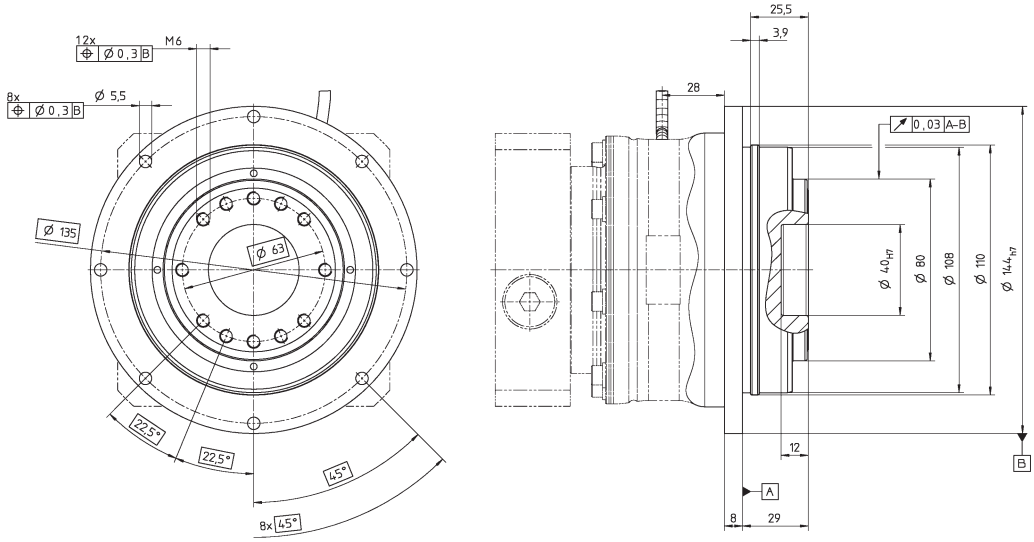
			Max. permitted load	Measurement range MB
Max. acceleration torque [a] (max. 1000 cycles per hour)	T_{2B}	Nm	T_{2B}	T_{2B} (mind. 300)
EMERGENCY STOP torque [b] (permitted 1000 times during the service life of the gearbox)	T_{2Not}	Nm	625	x [d]
Max. radial force [b] (with x2 = 0 and z2 = 94.5 mm)	F_{2RMax}	N	4370	4370
Max. axial force [b]	F_{2AMax}	N	–	x [d]
Max. permitted housing temperature		°C	+90	+90
Tilting rigidity [b]	C_{2K}	Nm/arcmin	–	
Torsional rigidity [b]	C_{t12}	Nm/arcmin	–	

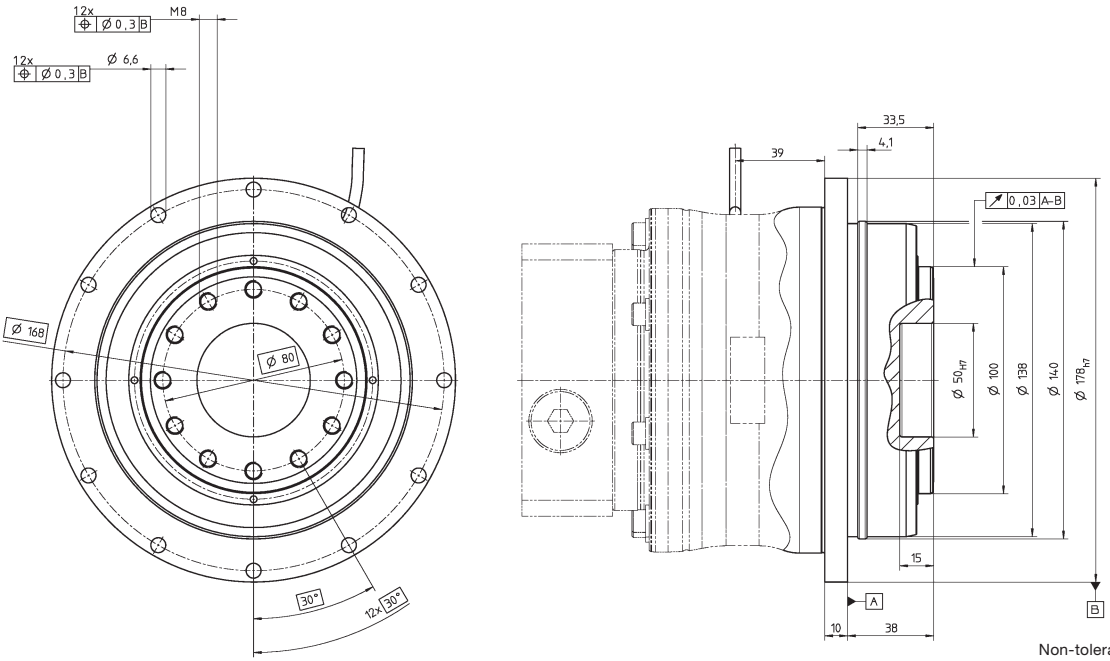
TP+ IQ 050

			Max. permitted load	Measurement range MB
Max. acceleration torque [a] (max. 1000 cycles per hour)	T_{2B}	Nm	T_{2B}	T_{2B} (mind. 500)
EMERGENCY STOP torque [b] (permitted 1000 times during the service life of the gearbox)	T_{2Not}	Nm	800	x [d]
Max. radial force [b] (with x2 = 0 and z2 = 81.2 mm)	F_{2RMax}	N	7500	7500
Max. axial force [b]	F_{2AMax}	N	–	x [d]
Max. permitted housing temperature		°C	+90	+90
Tilting rigidity [b]	C_{2K}	Nm/arcmin	–	
Torsional rigidity [b]	C_{t12}	Nm/arcmin	–	

[a] depending on the gearbox ratio
[b] the value may be less than with standard gearboxes
[d] no measurement range available





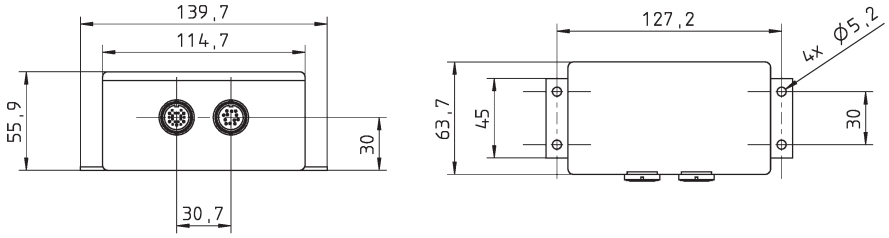


Non-tolerated dimensions ± 1 mm

Electronics box

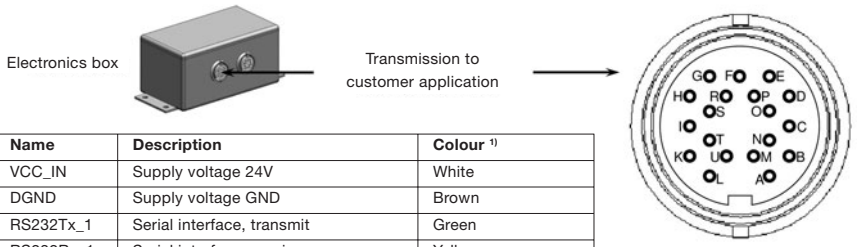
Internal communication
Supply voltage
Data interface

The electronics box must be installed in the direct vicinity of the gearbox, as the cable is only 600 mm long.



Cable configurations

alpha IQ – Electronics box plug assignment

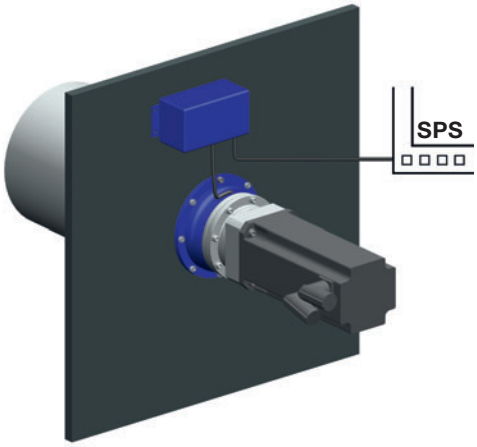


Pin	Name	Description	Colour [1]
A	VCC_IN	Supply voltage 24V	White
B	DGND	Supply voltage GND	Brown
C	RS232Tx_1	Serial interface, transmit	Green
D	RS232Rx_1	Serial interface, receive	Yellow
E	DGND	Serial interface, GND	Grey
F	DGND GND		Pink
G	N/C		
H	N/C		
I	N/C		
K	DGND GND		Blue
L	N/C		
M	Ext_3	Analogue3 output – torque	Black
N	DGNDExt_3	Analogue3 output GND – torque	Purple
O	DGNDExt_1	Analogue1 output GND – radial force x	Grey/Pink
P	Ext_1	Analogue1 output – radial force x	Red/Blue
R	Ext_2	Analogue2 output – radial force y	White/Green
S	DGNDExt_2	Analogue2 output GND – radial force y	Brown/Green
T	N/C		
U	N/C		

[1] Colour code for the connecting cable:
AC 10015474
AC 10015858

Interfaces

RS232
Voltage interface 0…10 V
Current interface 0…20 mA
Field bus via gateway



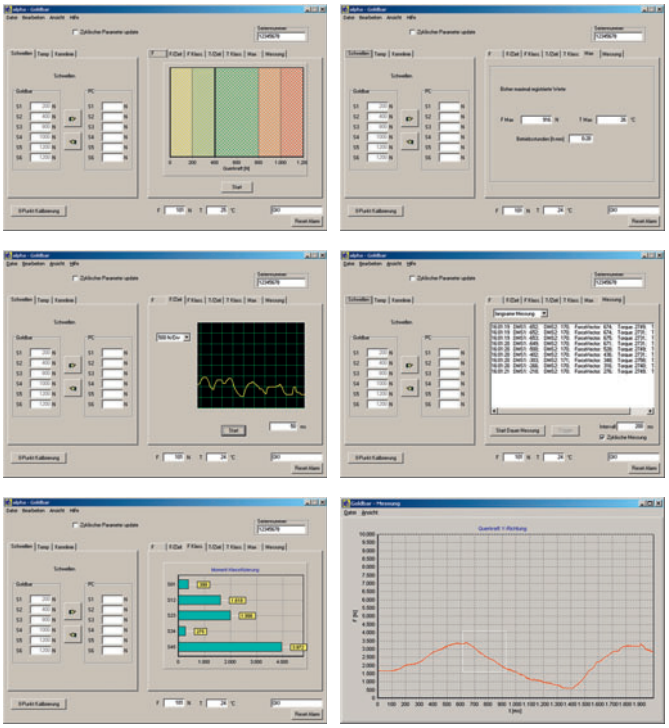
System overview

The illustration shows an example of the structure for a complete system: motor, gearbox, machine bed, electronics box and application. The electronics box registers, processes and transmits the sensor data to a PC/laptop, display, PLC, etc.

alpha IQ – Software

Display data

Maximum values
Statistics
Operating hours
Characteristic curve parameters
Thresholds
Serial numbers



Display functions

Measuring function with graphic display
Oscilloscope function
Triggered measured value acquisition
Maximum values
Histogram function
Defining parameters for gearbox characteristics
Output of actual parameters
Gearbox report (html) for recording current torques

Export of measured data

The export data is based on ASCII format defined by Microsoft Office Software or cymex® calculation software for WITTENSTEIN AG drives.

Order codes

Sensor gearbox = low backlash planetary gearbox + sensor kit
Sensor gearbox TP⁺ IQ = low backlash planetary gearbox incl. sensor element, cable and socket + sensor kit (electronics box)

Sensor gearbox – order code TP⁺ IQ

TP 050***I***–MF2–25 –0G1–2S***KLLK*** alpha IQ TP⁺

I = integrated sensors

K – perm. red. T_2emer in Nm
D = 200
J = 625
K = 800

L – F_{rad}, y
L – F_{rad}, x
Meas. range F_{rad} x- / y-Direction in N
A = 1580
G = 4370
L = 7500

L – Torque
Measurement range in Nm:
D = 90
H = 300
K = 500

Sensor kit–00–I

Sensor kit for integrated sensors

electr. interface
00 = RS232
01 = analogue voltage
02 = analogue current + RS232

alpha

a WITTENSTEIN AG company

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