

DYNATECH
DYNAMICS AND TECHNOLOGY, S.L.

TORNADO SERIES
GEARLESS TRACTION EQUIPMENT

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1. INTRODUCTION

1.1 Description

The TORNADO is the new gearless traction machine designed and manufactured by Dynatech for the lift industry.




The TORNADO traction machine basically consists of a permanent magnet electric motor, a pulley connected directly to the motor shaft, an encoder to monitor the position of the motor shaft and a braking system.

The motor is of the synchronous type with an external stator and internal rotor with permanent, high-capacity magnets.







2. HAZARDS AND SAFETY WARNINGS


2.1 Electrical hazard

	Electrical Hazard	The rotating motor shaft produces a voltage at its terminals. Do not touch the terminals if the machine is moving or may move.
	Electrical Hazard	The rotating motor shaft produces a voltage at its terminals. Do not connect the machine if the lift is moving.
	Electrical Hazard	Do not handle the machine when its terminals are connected to the electricity power supply.



2.2 Hazards and transport precautions

	Falling objects	The transport holes are exclusively for moving the machine. No other loads must be attached or connected to it for any reason.
	Falling objects	The threads on the ends of the shaft must not be used for placing transport rings or any other mechanical device to move the machine-shaft unit.
	Equipment deterioration	Risk of deterioration of the machine. Avoid any kind of blow or shock to the motor when it has stopped, been placed in its final working position or housed in intermediate storage. It has precision, factory-set components which may get damaged or deteriorate, such as the encoder and brakes. Also avoid blows to the pulley or shaft, as this may damage the bearings. Damage in transit is not covered by the Dynatech guarantee.
	Falling objects	During the transport process no person should stand under the suspended load.

2.3 Assembly hazards

	Trapping	There is a risk of entrapment during the machine assembly process. Avoid placing hands or feet under the machine when placing it in its final location or storage.
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2.4 Hazards during machine operation

	Very hot	The motor casing can reach high temperatures which may cause burns. Do not touch the motor while it is running.
	Trapping	With the motor installed, keep clear of the suspension cables and pulley, as limbs or loose clothing may get trapped in them.

3. OPERATION

3.1 Type of facilities

The equipment must be used only in lift facilities.
It can be used for lifts with or without a machine room.

The equipment must only be used in facilities whose requirements match the characteristics contained on the equipment characteristics plate.

It is essential to use the machine in facilities with an automatic rescue system or with sufficient electrical energy storage to activate the brake coils. This is because the machine has no manual aperture or hand wheel for the brakes. Any emergency rescue must therefore be carried out using the electrical power accumulated in the rescue system.

3.2 Disclaimer

DYNATECH DYNAMICS & TECHNOLOGY, S.L. will not be liable for damages caused by any non-observance of the instructions in this document.

It is prohibited to:

- a) Assemble the machine at an angle. In other words, the machine must be bolted to a solid base beneath it.
- b) Use a machine in facilities with different features to those shown on the characteristics plate of the machine.
- c) Attempt to carry out repairs on any part of the machine.

4. MAIN FEATURES

4.1 Technical features

Coil	3-phase, star connection	
Inverter voltage	380 V AC, 3-phase	
Thermal protection	PTC thermistor, 120°C	
Coil insulation	Class F	
IP protection index for machine	IP54	
Standard brake	Warner ERS VAR15-11, with microswitches to verify brake operation.	
	Coil voltage	Maintenance 104 Vdc, overdrive 207 Vdc
	Microswitch voltage	24Vdc
Optional brake	Mayr ROBA-Duplostop 400, with microswitches to verify brake operation.	
	Coil voltage	Maintenance 104 Vdc, overdrive 207 Vdc
	Microswitch voltage	24Vdc
Bearings	SKF	
Absolute encoder	Heidenhain ECN 413, with 5m of cable	

4.2 Operation environmental conditions

Temperature	5 - 40°C
Humidity	15 - 85% without condensation
Altitude	0 - 1000m. Power loss may occur above 1000m.

5. STORAGE

The motor must be stored in a cool, dry place. It must be protected from excessive light and never be exposed to the open air.

Storage temperature: 5 - 40°C.

Storage Humidity: 15 - 85% without condensation.

Maximum storage time: 12 months, without exceeding a temperature of 27°C.

Exceeding this temperature for an extended period of time may lead to the loss or deterioration of bearing lubricant, reducing the life of the bearings.

6. ASSEMBLY

6.1 General instructions

Personnel: All assembly, connection, electrical installation, maintenance tasks, etc must be performed by specialist, approved and appropriately trained personnel.

Avoid any kind of blow or shock to the machine when it is suspended just before being placed in its final working position. It has precision, factory-set components which may get damaged or deteriorate, such as the encoder and brakes. Also avoid blows to the pulley or shaft, as this may damage the bearings. Damage in transit is not covered by the Dynatech guarantee.

Assembly, electrical connection and commissioning must be performed by specialist and appropriately trained personnel.

Protect the machine, and especially the brakes, from dust created during installation work.

The cable run should be vertical or with a maximum angle of 150° to the horizontal.

The machine fittings must not work off or shear.

Suspension cables must be placed as close as possible to the motor (if there are fewer cables than grooves in the pulley), thereby reducing the load on the bearings and extending their lifetime.

The cables must be positioned vertically, so as not to produce thrust loads in the motor.

All traction cables should be subjected to the same tension.

Before assembly, the machine must be checked for damage during transport. The brakes must be released, without dismantling, to verify that the rotor turns freely and smoothly.

No welding work should be performed on the machine, nor can it be used as an earthing point.

To enable cooling, a minimum gap of 50 mm on both sides of machine and the top must be observed.

Sufficient space (minimum 75 mm gap) must be left at the back of the machine to replace the encoder.

The machine must not be directly above the car in its final position.

The machine must be attached to a sufficiently rigid bedplate.

The machine must not be allowed to be in a hanging position.

The machine has 4 x M20 threaded drill holes on its underside for attachment, and it must be properly secured to the bedplate.


A flatness tolerance of 0.2 mm is allowed for the bedplate.

Silent-blocks can be used to dampen vibrations in the equipment.

The cable guard should be fixed at a distance from the ropes to prevent them from jumping out of the grooves if they lose tension.

The control cabinet should have an automatic rescue system.

6.2 Power connections

	Before connecting the electricity supply, check that the control cabinet contactors are discharged.
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The main power supply for the machine must be connected to a regulator or VFD, never directly to the mains. A shielded cable with shielding at both ends must be used.

Motor: the three power cables and the earth cable must be connected to the motor.

Temperature sensors: The PTC temperature sensors must be connected. If not, the machine may be exposed to overheating.

Brakes: The brake coils and microswitches, to monitor their performance, must be connected. If the microswitches are not connected, the lift may continue to operate with a failure in its brake system.

Encoder:

Important: Never touch the electrical contacts of the encoder cable with bare hands.

The encoder must be connected to the inverter.

The person responsible for the assembly must ensure that he is not carrying static charge that could damage the encoder.

The encoder cable is used directly for the connection without splicing any other wires. If a longer length than the one provided is needed, use shielded cable for the Heidenhain encoder. Make the connections according to the encoder manufacturer's instructions.

See the encoder section in this document.

7. OPERATING REQUIREMENTS

7.1 General requirements

The motor must always be operated according to the characteristics plate.

The brake action switches are safety features and must always be connected.

The PTC type temperature sensors are set at 120°C. They must always be connected to the control system; otherwise the motor is left unprotected against overheating.

The machine must only be operated in a building or enclosed lift shaft.

The motor is not equipped to operate in an explosive atmosphere.

The lift manufacturer and installer are responsible for the correct installation and use of the machine in the lift facility.

Recommendations:

It is recommended to have the motor in short-circuit when it is not under power. This way, if there is a widespread failure of the brakes, the motor which is short-circuited works as a generator and produces a braking torque that reduces, but does not prevent, the uncontrolled movement of the car.

Emergency Evacuation

If the electricity in the facility fails, a rescue can be performed automatically by the control cabinet rescue system.

If this fails, the motor terminals can be short-circuited to prevent it from accelerating uncontrollably and the brakes can open due to the current. The car will move up or down depending on its position in the run. When the car reaches the evacuation area, usually the nearest door, the brake coils will no longer operate and the car will stop.

7.2 Brakes

The brakes are designed to operate with the machine stopped. The dynamic applications are limited to emergency situations. Thus, the disc hardly wears down, thereby extending its life.

The braking action under normal operation of the lift must be carried out exclusively by the motor. The brake will act once the pulley shaft has completely stopped.

The brakes have no manual release device; therefore the control cabinet must have a rescue device to release the brakes if there is a power cut.

Brake power supply: 207 Vdc in overdrive, 104 Vdc maintenance.

It is essential to connect the control cabinet sensors (microswitches) to activate the brake.

7.3 Initial commissioning

Before the initial commissioning, the following points must be checked:

- The mechanical installation and electrical connection must be properly done.
- The safety devices have been assembled.
- Tools, assembly accessories, waste, etc have all been removed.
- The earth line is connected.
- The cable inputs to the terminal box are sealed.
- The installation data coincide with those of the characteristics plate.

7.4 Testing before commissioning

7.4.1 Adherence checking tests:

1) Adherence must be checked by making several stops with the strongest braking action appropriate for the lift, ie acting with all the coils. The car should come to a complete stop in each test.

The test must be performed:

- a) Ascending, with the car empty, in the upper part of the run.
- b) Descending, with cab loaded to 125% of its rated load in the lower part of the run.

2) It will be checked that the empty cabin cannot move upwards when the counterweight is resting on its compressed springs.

3) The balance will be checked to correspond with to the value indicated by the installer.

7.4.2 Braking system

Complete braking system test

The test should be performed in descent at nominal velocity and 125% of the nominal load, with the power cut to the motor and brake. The braking system must be able to stop the movement.

For this test, the short-circuit connection must be disabled, to remove the braking effect of the motor.

Microswitch test

The proper performance of the brake microswitches must be checked to monitor the performance of the shoes. If the microswitches are not working properly, the machine must not be used.

7.4.3 Car safety gear

This test is not directly related to the machine but, by performing it, the interlocking action of the safety gear is checked.

It may be that the machine motor torque is not enough to actuate the safety gear. If this happens, a Tractel device or equivalent to unlock the safety gear must be used. It is recommended to have it available while testing the safety gear.

To make it easier for the safety gear to activate, it is recommended that the test be performed with the car door facing a landing door to be able to unload it (see annex not D2.j of the standard EN 81-1).

7.4.4 Emergency evacuation test

The proper functioning of the emergency evacuation system must be checked.

8. MAINTENANCE

8.1 General maintenance instructions

Personnel: All assembly, connection, electrical installation, maintenance tasks, etc must be performed by specialist, approved and appropriately trained personnel.

The motor must not be opened during maintenance operations. Improper handling of the magnetic elements inside can be dangerous to people or equipment in the vicinity.

Only specialist personnel are authorised to remove the encoder, pulley, brake coils and disc, while using auxiliary measures to maintain safety in the facility at all times.

It must always be checked that the car and counterweight are immobilised before performing any maintenance work on the machine.

8.2 Cleaning

Do not clean the machine with high pressure jets.

Do not clean the machine with liquid or material that may affect the proper functioning of the brakes. The friction surfaces must always be dry and free of dust or foreign matter. The brake performance must be checked after cleaning the machine.

8.3 Bearings

The bearings are of the sealed type and contain sufficient lubricant to be operated during the lifetime of the machine. They have no lubrication system and cannot be re-lubricated.

Under normal conditions, they require no maintenance. If lubricant is lost or has deteriorated and it affects the correct operation of the machine, it must be replaced by another bearing. Contact Dynatech or any of its authorised distributors.

8.4 Brake

When the maximum air gap is reached the brake disc must be replaced. To check the air gap, the moving parts of the lift need to be immobilised so that they do not move when the brake coils are actuated. Once the immobilisation is checked, the brake coils must be acted upon to keep the brake open and the gap measured by a suitable process, for example with gauges.

Changing the brakes:

- Stop the free movement of the car and counterweight.
- Check the car and counterweight do not move after opening the brake.
- Remove the encoder.
- Remove the attachment part of the encoder.
- Remove the brake coils.
- Remove the brake disc.
- Replace with a new disc with the same features.
- Insert the coils, using new ones if the old ones are damaged or worn.
- Replace the attachment part of the encoder without tightening the screws.
- Insert the encoder with its central screw and adjust the outer flange.
- Tighten the screws on the support part of the encoder.
- Check the brakes work properly.

8.5 Pulley

When the pulley grooves have reached the end of their life, they must be replaced.

Replacing the pulley:

- Hang the car and counterweight by appropriate means to release the cable pulley.
- Remove the cables from the pulley grooves.
- Remove the screws attaching the pulley.
- Insert a mechanical component between the pulley attachment disc and the shaft to keep them separate.
- Turn the screws in the threaded extraction holes in the pulley until it is free from the shaft.



IMPORTANT: When the pulley is detached from its conical fitting on the shaft, it may move suddenly in the axial direction. Appropriate safety measures must be taken to prevent any danger to persons.

- Insert the pulley and a new pin.
- Assemble the attachment system for the pulley. Use screws and a new locking system`.
- Tighten the screws gradually in a zigzag fashion so the pulley enters straight.
- Once tightened, mark the screw positions with paint or similar to check for future loosening.

8.6 Encoder

Encoder connections:

See the encoder section of this document.

Assembly and disassembly of the encoder:
 See the encoder section of this document.

8.7 Inspections

	Installation and start-up	3-month check	Annual check
Check the distance from the cables to the cable guard.	X		X
Check the brake air gap.	X	X	X
Check for possible loosening of the screws on the pulley brake and casing. The screws are marked at assembly to facilitate this task.		X	X
Control of wear on pulley.			X

8.8 Spare parts

Always use original Dynatech spare parts. Failure to follow this guideline will invalidate the Dynatech guarantee and may also undermine the proper functioning of the machine.

Spare parts available:

Spare part
Cable guard
Pulley.
Pulley attachment system
Complete brake disc set of disc plus 2 coils.
Complete brake disc set of disc plus 3 coils.
Complete brake disc set of disc plus 4 coils.
Brake disc.
Encoder

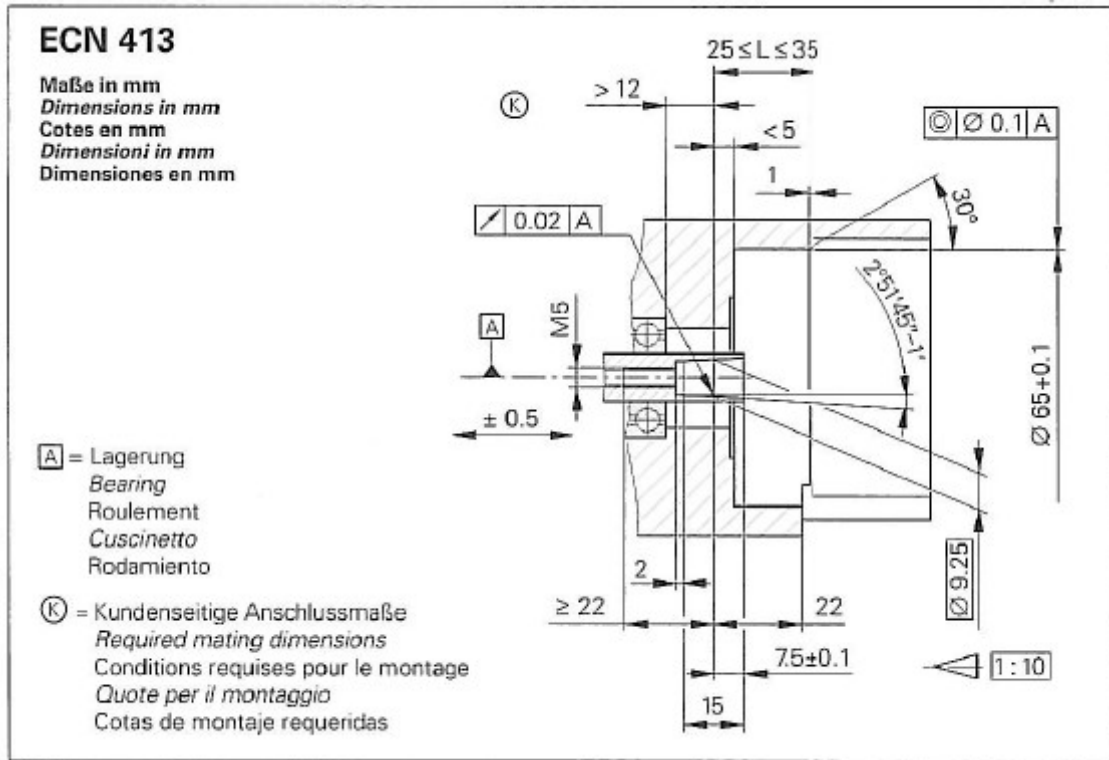
To order a spare, contact Dynatech or any of its authorised dealers.



9. VERSIONS AND FEATURES

model	suspension	Pulley diameter (mm)	payload (kg)	nominal torque (Nm)	maximum torque (Nm)	cable diameter (mm)	nominal velocity (m/s)	Maximum shaft load (kg)*	Service factor	Brake torque (N.m)
D-60	1:1	240	225	135	225	6.5	0.63 / 1 / 1.6	1300	40%	2*350
		320	150	120	225	8	0.63 / 1 / 1.6	1300	40%	
	2:1	240	450	135	225	6.5	0.63 / 1 / 1.6	1200	40%	2*350
		320	320	128	225	8	0.63 / 1 / 1.6	1200	40%	
D-80	1:1	240	320	192	300	6.5	0.63 / 1 / 1.6	1300	40%	2*350
		320	225	180	300	8	0.63 / 1 / 1.6	1300	40%	
	2:1	240	630	189	300	6.5	0.63 / 1 / 1.6	1200	40%	2*350
		320	450	180	300	8	0.63 / 1 / 1.6	1200	40%	
D-120	1:1	240	450	270	450	6.5	0.63 / 1 / 1.6	2500	40%	2*350
		320	320	256	450	8	0.63 / 1 / 1.6	2500	40%	
	2:1	240	800	240	450	6.5	0.63 / 1 / 1.6	2400	40%	2*350
		320	630	252	450	8	0.63 / 1 / 1.6	2400	40%	
D-160	1:1	240	630	378	600	6.5	0.63 / 1 / 1.6	2500	40%	3*350
		320	450	360	600	8	0.63 / 1 / 1.6	2500	40%	
	2:1	240	1000	300	600	6.5	0.63 / 1 / 1.6	2400	40%	2*350
		320	800	320	600	8	0.63 / 1 / 1.6	2400	40%	
D-220	1:1	240	800	480	825	6.5	0.63 / 1 / 1.6	3900	40%	3*350
		320	630	504	825	8	0.63 / 1 / 1.6	3900	40%	
	2:1	240	1250	375	825	6.5	0.63 / 1 / 1.6	3400	40%	3*350
		320	1000	400	825	8	0.63 / 1 / 1.6	3400	40%	
D-280	1:1	240	1000	600	1050	6.5	0.63 / 1 / 1.6	3900	40%	3*350
		320	800	640	1050	8	0.63 / 1 / 1.6	3900	40%	
	2:1	240	1500	450	1050	6.5	0.63 / 1 / 1.6	3400	40%	3*350
		320	1250	500	1050	8	0.63 / 1 / 1.6	3400	40%	
D-360	1:1			0			0.63 / 1 / 1.6			
		320	1000	800	1350	8	0.63 / 1 / 1.6	5000	40%	4*350
	2:1			0			0.63 / 1 / 1.6			
		320	2000	800	1350	8	0.63 / 1 / 1.6	5000	40%	4*350

10. ENCODER

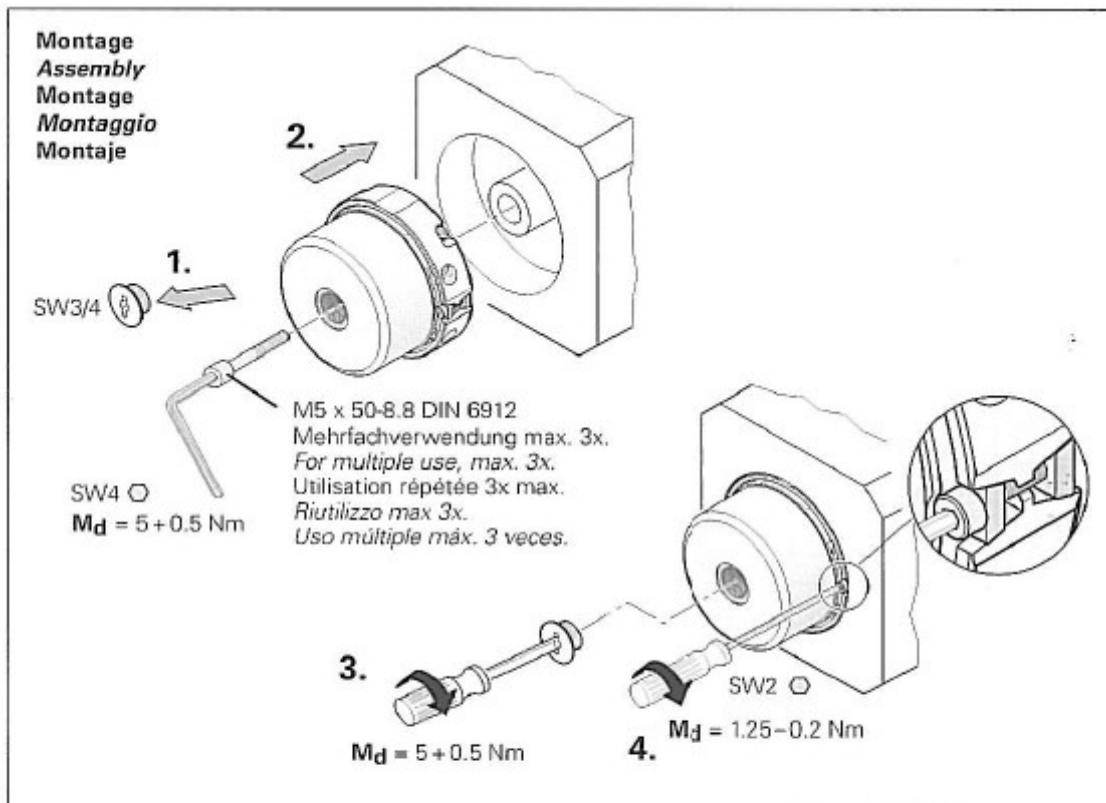


7	1	10	4	15	16	12	13	14	17	8	9	11
Up	Sensor Up	0V	Sensor 0V	A+	A-	B+	B-	DATA	DATA	CLOCK	CLOCK	1)
BNGN	BL	WHGN	WH	GNBK	YEBK	BUBK	RDBK	GY	PK	VT	YE	

Kabelschirm mit Gehäuse verbunden
 Cable shield connected to housing
 Blindage du câble relié au boîtier
 Collegare lo schermo del cavo alla carcassa
 Pantalla del cable conectada a carcasa

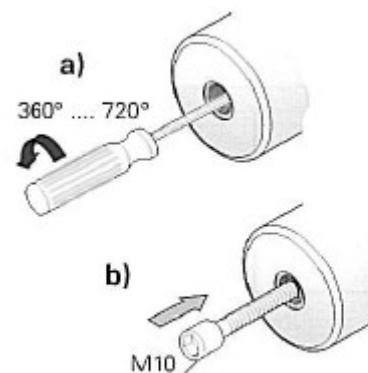
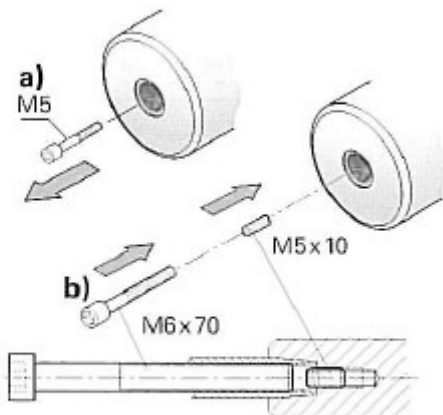
1) Innenschirm
 Internal shield
 Blindage interne
 Schermo interno
 Blindaje interno

Nichtverwendete Pins oder Litzen dürfen nicht belegt werden!
Vacant pins or wires must not be used!
Les plots ou fils non utilisés ne doivent pas être raccordés!
I pin o i fili inutilizzati non devono essere occupati!
¡No conectar los pins o hilos no utilizados!



Demontage in umgekehrter Reihenfolge
Disassembly in reverse order
Demontage dans l'ordre inverse
Smontaggio in sequenza inversa
Desmontaje en orden contrario

Zwei Möglichkeiten zum Abdrücken während der Demontage des Drehgebers
 Two ways of pressing the encoder out during dismounting
 Deux possibilités de démontage du capteur rotatif
 Due possibilità di smontaggio dell'encoder
 Dos posibilidades de aflojar durante el desmontaje del encoder



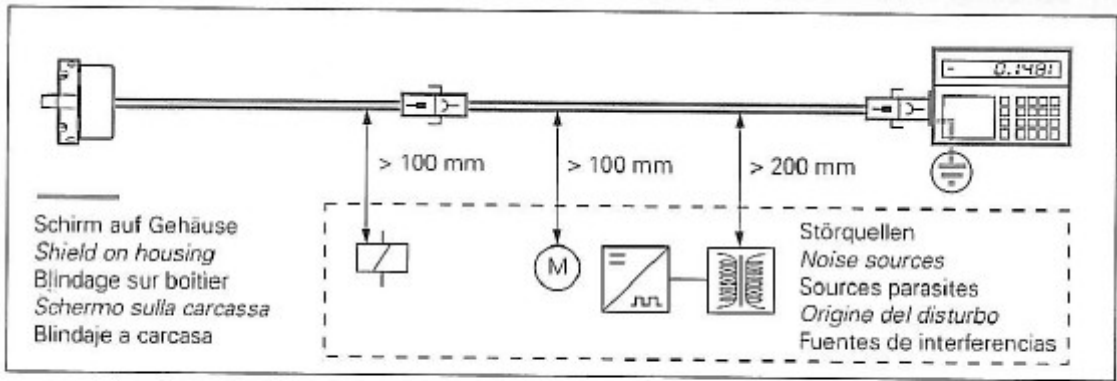
U_p = 3.6 V ... 14 V DC
 am Gerät, at encoder, sur l'appareil, integrato, en el aparato

ohne Last <i>Without load</i> sans charge <i>senza carico</i> sin carga	mit Last, Alterung und Temperatur bei 3,6 V <i>With load, aging and temperature at 3.6 V</i> avec charge, vieillissement et température à 3,6 V <i>con carico, invecchiamento e temperatura a 3,6 V</i> con carga, envejecimiento y temperatura a 3,6 V
I max. 105 mA	+ 60 mA

steigende Codewerte
Rising code values
 valeurs codées croissantes
valori assoluti crescenti
 valores codificados ascendentes

EN 50 178/4.98; 5.2.9.5
 IEC 364-4-41: 1992; 411(PELV/SELV)
 (siehe, see, voir, vedi, véase
 HEIDENHAIN D 231 929)

ohne Laufzeitkompensation
without delay compensation
 sans compensation de la durée du signal
senza compensazione del tempo di ciclo
 sin compensación del tiempo de propagación



Ø 6 mm	R ₁ ≥ 20 mm	R ₁ ≥ 75 mm