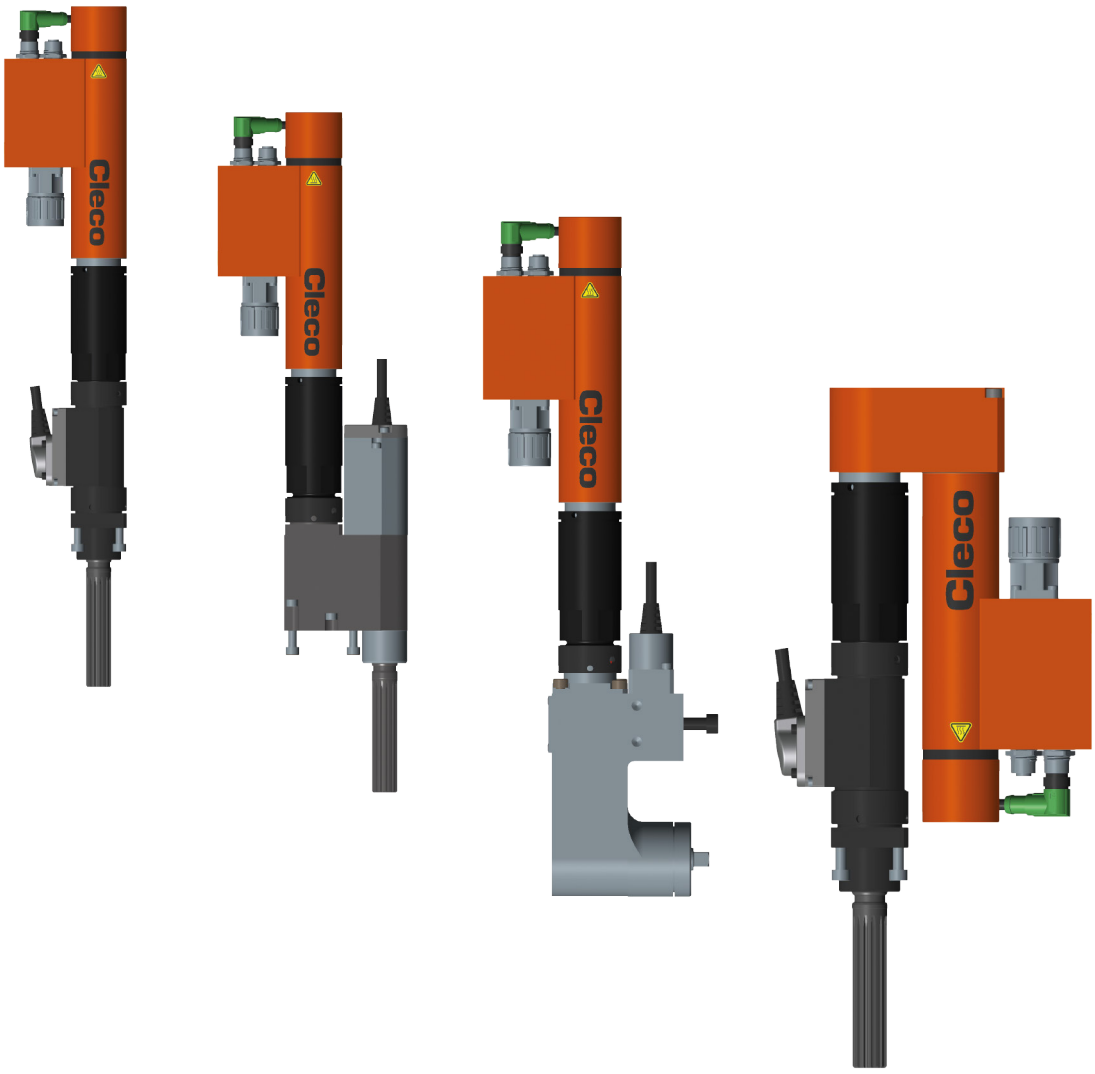
Cleco®
Production Tools

System manual
P2577S-EN
2022-08

BD Series

Fixtured Spindle



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Content

1 About this document

This document is intended for specialists who are responsible for the design, installation and operation of a fastening system: production planners, owners/operators, administrators, maintenance staff, service personnel. This document provides information on the safe, proper and economical operation of the system and serves as a reference work for technical data.

1.1 Other documents

Number	Document
P2552HW	Hardware Description – mPro300GCD-STO
P2578WA	Maintenance instruction – Fixtured Spindle BD Series
P2579MA	Assembly instructions – Fixtured Spindle BD Series
P2585JH	Installation Instruction – Cable Management Fixture Spindel BD Series
P2468TS	Troubleshooting – mPro300GCD
CE-1026	EU Declaration of Conformity – BD Series
P3319H	Declaration of incorporation – BD Series

1.2 Symbols in the text

italic	Menu options (e.g., Diagnostics) input fields, check boxes, radio buttons or dropdown menus.
>	Indicates selection of a menu option from a menu, e.g., *File* > *Print*.
<...>	Specifies switches, pushbuttons or the keys of an external keyboard, e.g., <F5>.
`Courier`	Indicates Filenames and paths, e.g., `setup.exe`.
•	Indicates lists, level 1.
–	Indicates lists, level 2.
a) b)	Indicates options.
➢	Indicates results.
1. (...) 2. (...)	Indicates action steps.
►	Indicates single action steps.

2 Safety

► Read all safety warnings and instructions. Failure to follow the directions and safety instructions could result in an electric shocks, burns and/or serious injuries.

► Read and observe all appropriate, generally applicable and local safety and accident prevention regulations. We do not claim that these safety notes are complete.

2.1 Warnings and Notices

Warning notes are identified by a signal word and a pictogram:

- The signal word describes the severity and probability of the impending danger.
- The pictogram describes the type of danger.

⚠ Danger

A symbol combined with the word Danger indicates a hazard with a high level of risk which, if not avoided, will result in death or serious injury.

	**⚠ Warning** A symbol combined with the word Warning indicates a hazard with a medium level of risk which, if not avoided, could result in death or serious injury.
	**⚠ Caution** A symbol combined with the word Caution indicates a hazard with a low level of risk which, if not avoided, could result in minor or moderate injury.
	**Note** A symbol combined with the word Note indicates a potentially harmful situation which, if not avoided, could result in damage to property or the environment.
	General instructions include application tips and useful information, but no warnings against hazards.

Structure Of Warnings

	**⚠ Caution** **Type and source of danger.** Possible consequences of non-observance. ► Measures to avoid danger.

2.2 Intended Use

The operator is liable for damage caused by improper use. Only use the tightening system under the following conditions.

- Use only in industrial tightening processes.
- Only in conjunction with the components listed in the EU Declaration of Conformity.
- Under the prescribed ambient conditions.
- Within the power range, which is specified in the technical data.
- With equipment parameters set up properly.
- In EMC Limit Class A (electromagnetic immunity for industrial areas). For the currently observed EMC standards, see the EU Declaration of Conformity.
- The spindle must be screwed onto an electrically conductive mounting plate.
- The mounting plate must be provided with a 10 mm² ground wire. The ground wire is connected to the controller.
- The spindle is intended exclusively for stationary operation and for tightening and loosening threaded connections.
- The spindle must be fully assembled.
- Insert and lock all connecting cables.
- Always replace the spindle completely from a system.
- Repairs are only permitted personnel authorized by Apex Tool Group. If the tool is opened, the warranty is voided. In the event of repair, send the complete tool to your Sales & Service Center.

2.3 Foreseeable misuse

► Only use the spindle with controllers that are listed in the EU Declaration of Conformity.
► DO NOT use the spindle as a hammer.
► DO NOT use the spindle in potentially explosive areas.
► DO NOT use the spindle in a damp environment or outdoors.
► DO NOT disassemble or modify the spindle.
► DO NOT use the spindle as a handheld tool.
► Never lift the spindle or individual components by the cable.
► DO NOT use the spindle as a climbing aid.

2.4 Operator Training

The fastening system may only be put into operation, set up and maintained by personnel who have been trained and qualified by the Apex Tool Group.

The product has been preset by the Apex Tool Group. Changes to the factory settings may only be carried out by a specialist [1].
The owner/operator must ensure that new operating and maintenance personnel are instructed in the operation and servicing of the fastening system to the same extent and with the same care.
Personnel undergoing schooling/training/instruction may only work with the fastening system under the supervision of an experienced person.

2.5 Personal Protective Equipment

► Wear safety shoes.

The motor can heat up and cause burns during removal (max. motor temperature 80 °C).

► Wear gloves when touching the motor.
► When working with rotating parts, it is not permitted to wear gloves.
  ➢ Recommendation: Freely rotating u-GUARD protected fastening tools from APEX.
► Wear suitable clothing. Do not wear loose clothing or jewelry.
► Wear protective goggles if there is a risk of dirt or parts being ejected.
► Wear a hair net, if necessary.

2.6 Safety instructions relevant to the system

It is imperative to observe the national, state and local regulations and standards.

► Do not make any changes to the controller, protective devices or accessories without the prior written consent of Apex Tool Group.
► Do not open the controller or components of the controller either for troubleshooting or other work. Any intervention can cause serious injuries in case of a failure.

Risk of injury due to electric shock

In the event of a fault, the controller can carry voltage. An electric shock can lead to cardiovascular arrest, respiratory failure, burns and serious injuries or death.

► Switch off the controller before connecting the power supply and tool cables, when converting, unplugging the plug connector, cleaning or decommissioning.
► Do not operate the fastening system if the housing, cable or tool is damaged.
► In the event of any malfunctions, never repair the fastening system yourself without knowing how to do so! Inform the local repair center or the responsible *Sales & Service Center*.

During installation

► Use suitable lifting equipment to lift the controller to the desired installation location.
► Make sure that the controller is firmly installed and secured (see Quick Reference Guide).
► Route cables and lines such that there is no risk of damage or tripping hazard.
► Comply with the permissible bending radius of the cable.
► Use an approved power cable with suitable ratings.
► For 115 VAC: Use a cable with a larger cross-sectional area.

Before commissioning

► Only operate on an earthed network with a neutral conductor (TN system). Operation without a neutral conductor (IT network) is not permitted.
► Make sure the PE connection is compliant with standards.
► A type "A" residual current operated device (RCD) is recommended to protect the supply line.
► Prior to commissioning, carry out the protective conductor measurement in accordance with the local regulations (in Germany, DGUV Regulation 3).
► Do not switch the controller on until all connections have been properly established.

During operation

► Protect the controller against moisture.
► In the event of unusual noises, heating or vibrations, switch off the controller immediately.
► Pull out the power plug and have the tightening system checked by qualified personnel; have it repaired if necessary.
► Never pull the plug on the cable from the outlet.
► Protect the cables from heat, oil, sharp edges or moving parts.

[1] Specialists are appropriately trained and experienced to recognize potentially hazardous situations. You can take appropriate safety measures and must comply with the applicable regulations

- ► Replace damaged cables immediately.
- ► Keep the connections between the controller and tool clean.
- ► Keep the workstation tidy to prevent injury or damage to the fastening components.
- ► Ensure that there is enough room at the workstation.

Danger due to incorrect torque measurement

An undetected NOK tightening could have life-threatening consequences.

- ► It is imperative that the tool is recalibrated (or a capability analysis performed) after improper use (dropped, mechanical overload ...).
- ► For category A rundowns (VDI 2862) which are critical for safety, activate a redundancy measurement (e.g., current redundancy).
- ► Introduce regular measuring equipment monitoring for the machines and tools.
- ► Only work with a tightening system that is working correctly. If in doubt, contact a *Sales & Service Center*.

Danger due to an unexpected motor start or an expected, but not functioning, stop

Despite redundant control components and monitoring functions, it can happen in very rare cases that the motor starts unexpectedly.
Possible reasons: Remote control of diagnostic functions, bit dump in the memory of the controller.
Starting from the tool, mechanical hazards can result, such as jerks/jolts due to reaction torque and the risk of injury due to being reeled in and seized.

- ► Use sufficiently dimensioned reaction devices for the maximum possible torque.
- ► After switching the controller on, wait until the boot process is complete. This takes about 1 minute. Do not switch on/off until then.

Use of the secondary controller

Up to 15 secondary controllers can be added to a primary controller. When the secondary controller is switched off or fails, the TSnet bus communication is interrupted. The loss of communication to the primary controller affects the secondary controller:

- No results are reported back to the primary controller.
- No more fastenings are started.
- A running fastening process shows the error message SA (aborted by removal of the start signal) if the TSnet connection was interrupted during the fastening process.
- A shutdown signal is no longer received, so shutdown only takes place:
  - by activating the STO safety shutdown
  - after reaching the switch-off criterion or
  - via a safety shutdown after two seconds.

WARNING!
During remote start operation (multiple fasteners), an interruption in the TSnet bus leads to a delayed stop of the tool. This delay is 2 seconds.

During maintenance

- ► The controller is generally maintenance-free.
- ► Comply with local regulations regarding servicing and maintenance for all operating phases of the tightening system.

During cleaning

- ► Only clean the outside of the tool with a dry or slightly damp cloth.
- ► Never immerse the controller or tool in liquids.
- ► Do not use a high pressure cleaner.
- ► Disinfection of the surfaces is permitted with alcohol-based disinfectants.

Risk of injury due to dangerous movements

Inadequate emergency switching-off devices could have potentially fatal consequences.

- ► The necessity of an emergency switching-off and its implementation are the responsibility of the operator and subject of his risk analysis!
- ► Ensure accessible and effective emergency switching-off devices. Unlocking an emergency switching-off device must not cause an uncontrolled restart of the system!
- ► Before switching the system on, check the function of the emergency switching-off devices.

Danger from ejected parts

Components of the spindle can become loose due to rotation and cause serious injuries.

- ► Avoid accelerations in all the axes of over 100 m/s² (10 g).
- ► Note the tightening torque for the cap nut.

Use/handling of the spindle

- ► Only use bits or sockets designed for industrial use with machine-controlled tools.
- ► Make sure that the bit or socket is securely inserted.
- ► Do not attach the bit or socket to the screw head at an angle.
- ► Inspect the bit or socket for visible damage and cracks. Replace damaged screw bits immediately.

3 System Layout

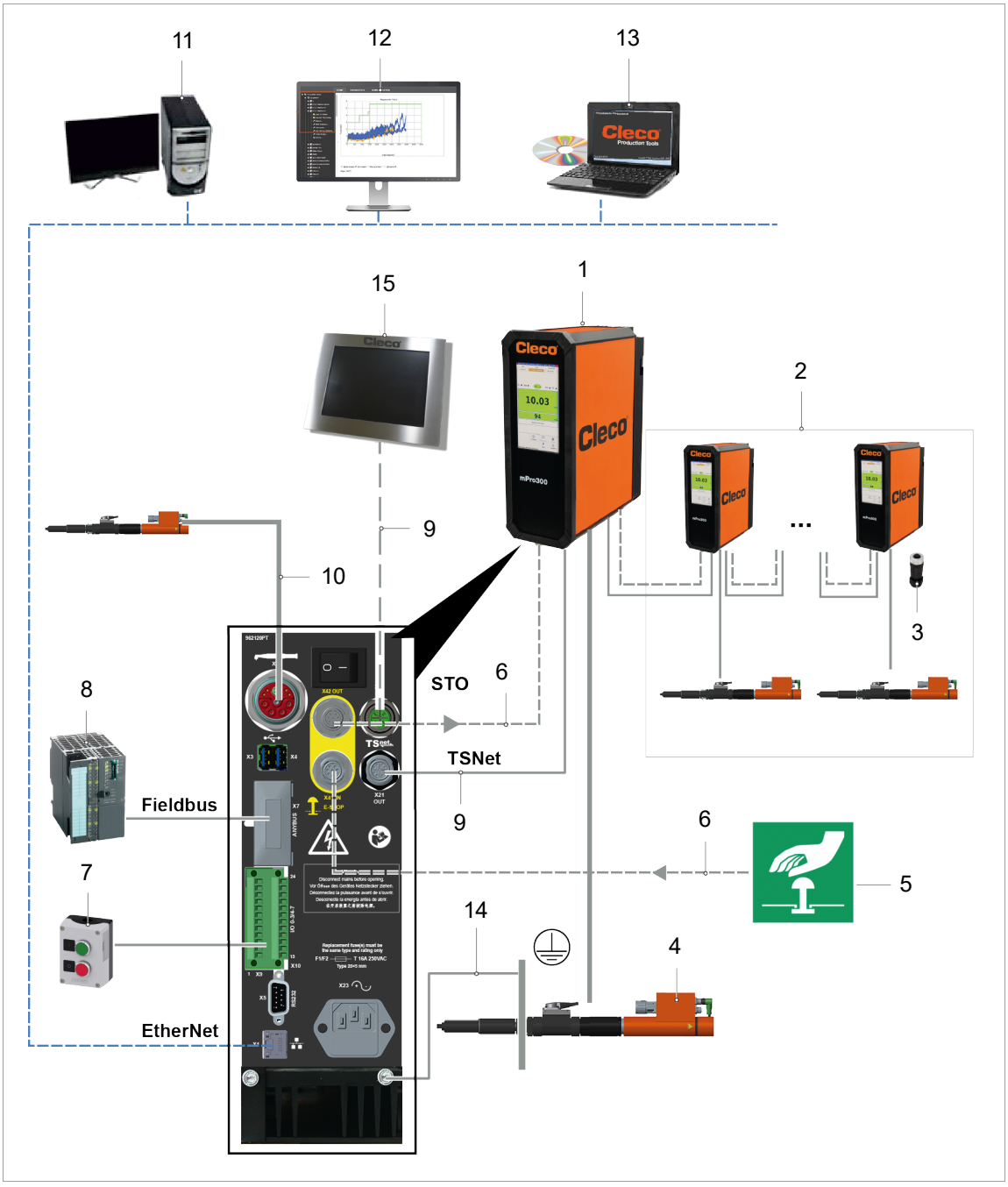


Fig. 3-1: BD Series system design

Pos.	Product	Pos.	Product
1	mPro300GCD-STO Controller (Primary)	9	TSNet cable
2	Up to 15 additional mPro300GCD-STO Controllers (Secondary)	10	Tool cable
3	Terminator connector	11	Control system, customer
4	BD Series spindles	12	TorqueNet, data server
5	Emergency Stop device	13	mPro-Remote, programming
6	STO cable	14	PE cable, grounding mounting plate
7	External I/O unit	15	Option: mPro400GCD-SG Controller
8	Control system, customer: e.g., PLC		

3.1 Components

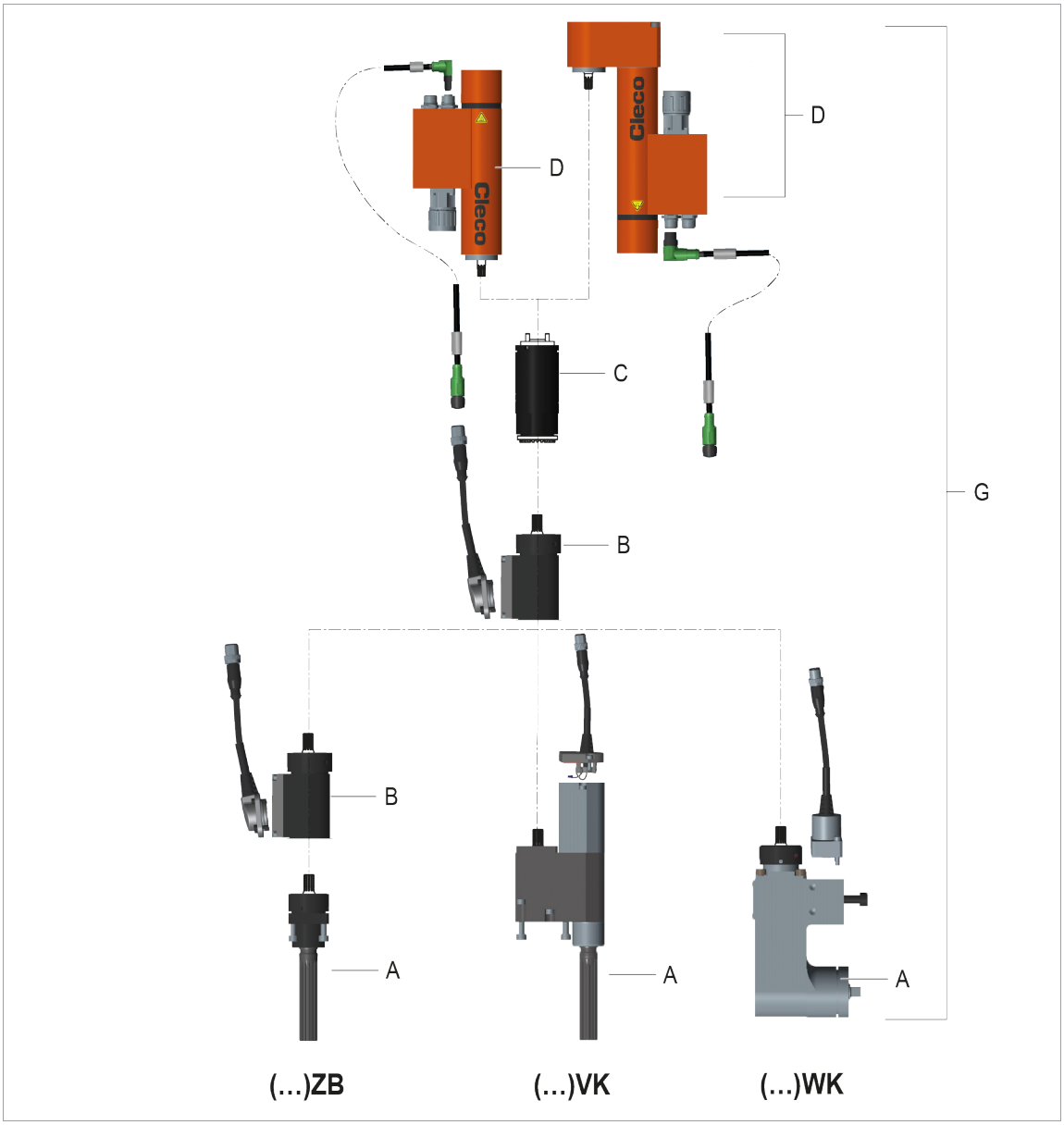


Fig. 3-2: Components, size 1 shown

3.1.1 Size 1

G Spindle		A Attachment	B Transducer	C Gear	D Motor
Order No.	Type	Order No.	Order No.	Order No.	Order No.
1BD12T1S-A	1BD-1B012A-1K3D-1ZB	927222	942612PT	927346	962351PT
1BD12T2S-A	1BD-1B012A-2/1K3D-1ZB	927222	942612PT (2)	927346	962351PT
1BD12T1O-A	1BD-1B012A-1VK3D	942652PT	–	927346	962351PT
1BD12T2O-A	1BD-1B012A-1K3D-1VK3D	942652PT	942612PT	927346	962351PT
1BD12T1A-A	1BD-1B012A-1WK3D	942692PT	–	927346	962351PT
1BD12T2A-A	1BD-1B012A-1K3D-1WK3D	942692PT	942612PT	927346	962351PT
1BD35T1S-A	1BD-1B035A-1K1D-1ZB	927222	942610PT	927344	962351PT
1BD35T2S-A	1BD-1B035A-2/1K1D-1ZB	927222	942610PT (2)	927344	962351PT
1BD35T1O-A	1BD-1B035A-1VK1D	942650PT	–	927344	962351PT

G Spindle		A Attachment	B Transducer	C Gear	D Motor
Order No.	Type	Order No.	Order No.	Order No.	Order No.
1BD35T2O-A	1BD-1B035A-1K3D-1VK1D	942650PT	942610PT	927344	962351PT
1BD35T1A-A	1BD-1B035A-1WK1D	942690PT	–	927344	962351PT
1BD35T2A-A	1BD-1B035A-1K1D-1WK1D	942690PT	942610PT	927344	962351PT
1BD53T1S-A	1BD-1B060A-1K2D-1ZB	927222	942611PT	927345	962351PT
1BD53T2S-A	1BD-1B060A-2/1K2D-1ZB	927222	942611PT (2)	927345	962351PT
1BD53T1O-A	1BD-1B060A-1VK2D	942651PT	–	927345	962351PT
1BD53T2O-A	1BD-1B060A-1K2D-1VK2D	942651PT	942611PT	927345	962351PT
1BD53T1A-A	1BD-1B060A-1WK2D	942691PT	–	927345	962351PT
1BD53T2A-A	1BD-1B060A-1K2D-1WK2D	942691PT	942611PT	927345	962351PT
1BDU12T1S-A	1BDU-1B012A-1K3D-1ZB	927222	942612PT	927346	943785PT
1BDU12T2S-A	1BDU-1B012A-2/1K3D-1ZB	927222	942612PT (2)	927346	943785PT
1BDU12T1O-A	1BDU-1B012A-1VK3D	942652PT	–	927346	943785PT
1BDU12T2O-A	1BDU-1B012A-1K3D-1VK3D	942652PT	942612PT	927346	943785PT
1BDU12T1A-A	1BDU-1B012A-1WK3D	942692PT	–	927346	943785PT
1BDU12T2A-A	1BDU-1B012A-1K3D-1WK3D	942692PT	942612PT	927346	943785PT
1BDU35T1S-A	1BDU-1B035A-1K1D-1ZB	927222	942610PT	927344	943785PT
1BDU35T2S-A	1BDU-1B035A-2/1K1D-1ZB	927222	942610PT (2)	927344	943785PT
1BDU35T1O-A	1BDU-1B035A-1VK1D	942650PT	–	927344	943785PT
1BDU35T2O-A	1BDU-1B035A-1K3D-1VK1D	942650PT	942610PT	927344	943785PT
1BDU35T1A-A	1BDU-1B035A-1WK1D	942690PT	–	927344	943785PT
1BDU35T2A-A	1BDU-1B035A-1K3D-1WK1D	942690PT	942610PT	927344	943785PT
1BDU53T1S-A	1BDU-1B060A-1K2D-1ZB	927222	942611PT	927345	943785PT
1BDU53T2S-A	1BDU-1B060A-2/1K2D-1ZB	927222	942611PT (2)	927345	943785PT
1BDU53T1O-A	1BDU-1B060A-1VK2D	942651PT	–	927345	943785PT
1BDU53T2O-A	1BDU-1B060A-1K2D-1VK2D	942651PT	942611PT	927345	943785PT
1BDU53T1A-A	1BDU-1B060A-1WK2D	942691PT	–	927345	943785PT
1BDU53T2A-A	1BDU-1B060A-1K2D-1WK2D	942691PT	942611PT	927345	943785PT

3.1.2 Size 2

G Spindle		A Attachment	B Transducer	C Gear	D Motor
Order No.	**Type**	**Order No.**	**Order No.**	**Order No.**	**Order No.**
2BD110T1S-A	2BD-2B110A-2K1D-2ZB	927227	942620PT	935548	962352PT
2BD110T2S-A	2BD-2B110A-2/1K1D-2ZB	927227	942620PT (2)	935548	962352PT
2BD110T1O-A	2BD-2B110A-2VK1D	942660PT	–	935548	962352PT
2BD110T2O-A	2BD-2B110A-2K1D-2VK1D	942660PT	942620PT	935548	962352PT
2BD110T1A-A	2BD-2B110A-2WK1D	942700PT	–	935548	962352PT
2BD110T2A-A	2BD-2B110A-2K1D-2WK1D	942700PT	942620PT	935548	962352PT
2BD200T1S-A	2BD-2B200A-2K1D-2ZB	927227	942622PT	935549	962352PT
2BD200T2S-A	2BD-2B200A-2/2K3D-2ZB	927227	942622PT (2)	935549	962352PT
2BD200T1O-A	2BD-2B200A-2VK3D	942662PT	–	935549	962352PT
2BD200T2O-A	2BD-2B200A-2K3D-2VK3D	942662PT	942622PT	935549	962352PT
2BD200T1A-A	2BD-2B200A-2WK3D	942701PT	–	935549	962352PT
2BD200T2A-A	2BD-2B200A-2K3D-2WK3D	942701PT	942622PT	935549	962352PT
2BDU110T1S-A	2BDU-2B110A-2K1D-2ZB	927227	942620PT	935548	943786PT
2BDU110T2S-A	2BDU-2B110A-2/1K1D-2ZB	927227	942620PT (2)	935548	943786PT
2BDU110T1O-A	2BDU-2B110A-2VK1D	942660PT	–	935548	943786PT
2BDU110T2O-A	2BDU-2B110A-2K1D-2VK1D	942660PT	942620PT	935548	943786PT
2BDU110T1A-A	2BDU-2B110A-2WK1D	942700PT	–	935548	943786PT
2BDU110T2A-A	2BDU-2B110A-2K1D-2WK1D	942700PT	942620PT	935548	943786PT
2BDU200T1S-A	2BDU-2B200A-2K3D-2ZB	927227	942622PT	935549	943786PT
2BDU200T2S-A	2BDU-2B200A-2/2K3D-2ZB	927227	942622PT (2)	935549	943786PT
2BDU200T1O-A	2BDU-2B200A-2VK3D	942662PT	–	935549	943786PT
2BDU200T2O-A	2BDU-2B200A-2K3D-2VK3D	942662PT	942622PT	935549	943786PT
2BDU200T1A-A	2BDU-2B200A-2WK3D	942701PT	–	935549	943786PT
2BDU200T2A-A	2BDU-2B200A-2K3D-2WK3D	942701PT	942622PT	935549	943786PT

3.1.3 Size 3

G Spindle		A Attachment	B Transducer	C Gear	D Motor
Order No.	**Type**	**Order No.**	**Order No.**	**Order No.**	**Order No.**
3BD300T1S-A	3BD-3B300A-3K2D-3ZB	927233	942631PT	935590	962353PT
3BD300T2S-A	3BD-3B300A-2/3K2D-3ZB	927233	942631PT (2)	935590	962353PT
3BD300T1O-A	3BD-3B300A-3VK2D	942671PT	–	935590	962353PT
3BD300T2O-A	3BD-3B300A-3K2D-3VK2D	942671PT	942631PT	935590	962353PT
3BD300T1A-A	3BD-3B300A-3WK2D	942711PT	–	935590	962353PT
3BD300T2A-A	3BD-3B300A-3K2D-3WK2D	942711PT	942631PT	935590	962353PT
3BDU300T1S-A	3BDU-3B300A-3K2D-3ZB	927233	942631PT	935590	943787PT
3BDU300T2S-A	3BDU-3B300A-2/3K2D-3ZB	927233	942631PT (2)	935590	943787PT
3BDU300T1O-A	3BDU-3B300A-3VK2D	942671PT	–	935590	943787PT
3BDU300T2O-A	3BDU-3B300A-3K2D-3VK2D	942671PT	942631PT	935590	943787PT
3BDU300T1A-A	3BDU-3B300A-3WK2D	942711PT	–	935590	943787PT
3BDU300T2A-A	3BDU-3B300A-3K2D-3WK2D	942711PT	942631PT	935590	943787PT

3.1.4 Size 4

G Spindle		A Attachment	B Transducer	C Gear	D Motor
Order No.	Type	Order No.	Order No.	Order No.	Order No.
4BD500T1S-A	4BD-4B500A-4K2D-4ZA	927236	942641PT	935780	962353PT
4BD500T2S-A	4BD-4B500A-2/4K2D-4ZA	927236	942641PT (2)	935780	962353PT
4BD500T1O-A	4BD-4B500A-4VK2D	942681PT	–	935780	962353PT
4BD500T2O-A	4BD-4B500A-4K2D-4VK2D	942681PT	942641PT	935780	962353PT
4BD500T1A-A	4BD-4B500A-4WK2D	942721PT	–	935780	962353PT
4BD500T2A-A	4BD-4B500A-4K2D-4WK2D	942721PT	942641PT	935780	962353PT
4BD660T1S-A	4BD-4B660A-4K3D-4ZA	927236	942642PT	935781	962353PT
4BD660T2S-A	4BD-4B660A-2/4K3D-4ZA	927236	942642PT (2)	935781	962353PT
4BD660T1O-A	4BD-4B660A-4VK3D	942682PT	–	935781	962353PT
4BD660T2O-A	4BD-4B660A-4K3D-4VK3D	942682PT	942642PT	935781	962353PT
4BD660T1A-A	4BD-4B660A-4WK3D	942722PT	–	935781	962353PT
4BD660T2A-A	4BD-4B660A-4K3D-4WK3D	942722PT	942642PT	935781	962353PT
4BD750T1O-A	4BD-4B660A-4VK4D	942683PT	–	935781	962353PT
4BD750T2O-A	4BD-4B660A-4K3D-4VK4D	942683PT	942642PT	935781	962353PT
4BD1250T1S-A	4BD-4B360A-4K1D-4Z1250A	S976950	942640PT	929541	962353PT
4BD1250T2S-A	4BD-4B360A-2/4K1D-41250ZA	S976950	942640PT (2)	929541	962353PT
4BD1600T1S-A	4BD-4B500A-4K2D-4Z1600A	S976951	942641PT	935780	962353PT
4BD1600T2S-A	4BD-4B500A-2/4K2D-4Z1600A	S976951	942641PT (2)	935780	962353PT
4BD2800T1S-A	4BD-4B660A-4K3D-4Z2800G	F900750	942642PT	935781	962353PT
4BD2800T2S-A	4BD-4B660A-2/4K3D-4Z2800G	F900750	942642PT (2)	935781	962353PT
4BDU500T1S-A	4BDU-4B500A-4K2D-4ZA	927236	942641PT	935780	943787PT
4BDU500T2S-A	4BDU-4B500A-2/4K2D-4ZA	927236	942641PT (2)	935780	943787PT
4BDU500T1O-A	4BDU-4B500A-4VK2D	942681PT	–	935780	943787PT
4BDU500T2O-A	4BDU-4B500A-4K2D-4VK2D	942681PT	942641PT	935780	943787PT
4BDU500T1A-A	4BDU-4B500A-4WK2D	942721PT	–	935780	943787PT
4BDU500T2A-A	4BDU-4B500A-4K2D-4WK2D	942721PT	942641PT	935780	943787PT
4BDU660T1S-A	4BDU-4B660A-4K3D-4ZA	927236	942642PT	935781	943787PT
4BDU660T2S-A	4BDU-4B660A-2/4K3D-4ZA	927236	942642PT (2)	935781	943787PT
4BDU660T1O-A	4BDU-4B660A-4VK3D	942682PT	–	935781	943787PT
4BDU660T2O-A	4BDU-4B660A-4K3D-4VK3D	942682PT	942642PT	935781	943787PT
4BDU660T1A-A	4BDU-4B660A-4WK3D	942722PT	–	935781	943787PT
4BDU660T2A-A	4BDU-4B660A-4K3D-4WK3D	942722PT	942642PT	935781	943787PT
4BDU750T1O-A	4BDU-4B660A-4VK4D	942683PT	–	935781	943787PT
4BDU750T2O-A	4BDU-4B660A-4K3D-4VK4D	942683PT	942642PT	935781	943787PT
4BDU1250T1S-A	4BDU-4B360A-4K1D-4Z1250A	S976950	942640PT	929541	943787PT
4BDU1250T2S-A	4BDU-4B360A-2/4K1D-41250ZA	S976950	942640PT (2)	929541	943787PT

G Spindle		A Attachment	B Transducer	C Gear	D Motor
Order No.	Type	Order No.	Order No.	Order No.	Order No.
4BDU1600T1S-A	4BDU-4B500A-4K2D-4Z1600A	S976951	942641PT	935780	943787PT
4BDU1600T2S-A	4BDU-4B500A-2/4K2D-4Z1600A	S976951	942641PT (2)	935780	943787PT
4BDU2800T1S-A	4BDU-4B660A-4K3D-4Z2800G	F900750	942642PT	935781	943787PT
4BDU2800T2S-A	4BDU-4B660A-2/4K3D-4Z2800G	F900750	942642PT (2)	935781	943787PT

3.2 Cable

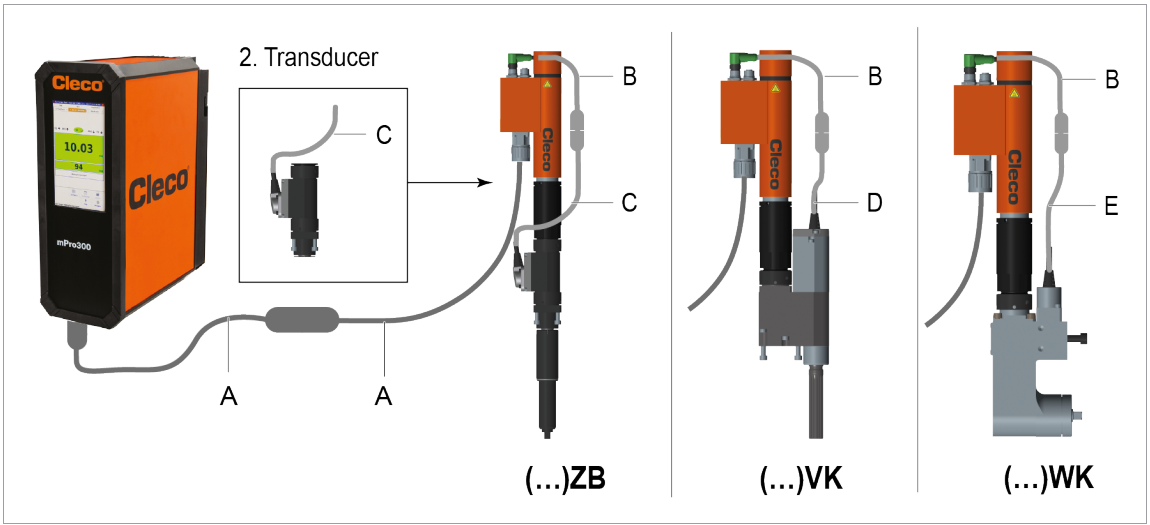


Fig. 3-3: Cable

Size	A Order No.	B Order No.	C Order No.	D Order No.	E Order No.	F Order No.
1	961561-(…)	–	942769PT-002	943290PT-002	943835PT-002	962343-002
2	961561-(…)	961923-(…)	942769PT-002	943290PT-002	943835PT-002	962343-002
3	961561-(…)	961923-(…)	942769PT-002	943290PT-002	943835PT-002	962343-003
4	961561-(…)	961923-(…)	942769PT-002	943290PT-002	943835PT-002	962343-005 962343-007 (4Z2800G)

3.2.1 Tool Cable

Note

Malfunction

The total length of the tool cable must not exceed 50 m.

► Match the length of the tool cable with the extension cable.

Size	Total Length Tool Cable [m]	A 961561-(…) Max. Length [m]	B 961923-(…) Max. Length [m]	Permissible number of cables
1	≤50	50	–	2
1	≤35	35	–	3
1	≤30	30	–	4
2–4	≤50	–	50	2
2–4	≤40	3	37	3
2–4	≤35	5	30	3
2–4	≤30	5	25	4
2–4	≤25	7	18	4
2–4	≤20	10	10	4
2–4	≤15	10	5	4
2–4	≤10	10	–	4

4 Initial operation

1. If necessary, position the components of the spindle with respect to one another via face gear interfaces.
   - Turn size 1 in 15° increments.
   - Turn sizes 2–4 in 10 ° steps.
2. Establish protective grounding of moving machine parts according to EN 60204-1.

⚠ Caution

Risk of falling

Loose cables can lead to tripping and falling.

► Route the connected cables securely.

3. Close and lock the plug connection on the spindle.
4. Connect the power cable to the controller.
5. Close the protective devices (i.e., safety grilles).
6. Switch on the machine control unit (PLC/SPS).
7. Switch on the controller. If there is a fault after switching on, see the chapter entitled "Troubleshooting" in the system manual.
8. The process programming for the controller must be carried out by qualified personnel during initial startup, see programming instructions.

5 Maintenance

Maintenance is only permitted byApex Tool Group authorized personnel. Regular maintenance reduces operational interruptions, repair costs and downtimes. Therefore, implement a safety-related maintenance program that takes into account the local regulations for repair and maintenance for all the operating phases of the tool.

Note

Incorrect calibration data

After replacing a component that has an impact on the accuracy of the tool (motor, gear, output drive), the calibration data may be falsified.

► Carry out a mandatory machine capability test.

► Send the built-in nutrunner to Sales & Service Center for recalibration. This is the only way to ensure that the screwdriver data is updated correctly after the service work.

Note

Loss of warranty

Repairs are only permitted by Apex Tool Group authorized personnel. If the tool is opened, the warranty is voided.

► If repair is required send the complete tool to Sales & Service Center!

6 Technical Data

6.1 Torque speed calibration data

Straight attachment

Size	Type Gear	Torque range		Speed	Torque calibration	
		Min. [Nm]	Max. [Nm]	rpm	Trans-ducer 1	Trans-ducer 2
1	B012A	2	12	3317	12	12
1	B035A	3.5	35	1255	35	35
1	B060A	5.3	53	737	60	60
2	B110A	11	110	890	110	110
2	B200A	20	200	501	200	200
3	B300A	30	300	480	300	300
4	B500A	50	500	269	500	500
4	B660A	66	660	183	660	660
4	B360A + 4Z1250A	320	1250	91	400	400
4	B500A + 4Z1600A	400	1600	72	500	500
4	B660A + 4Z2800G	980	2800	38	660	660

Offset drive

Size	Type Gear	Torque range		Speed	Torque calibration	
		Min. [Nm]	Max. [Nm]	rpm	Trans-ducer 1	Trans-ducer 2
1	B012A	2	12	3151	12	12
	B035A	3.5	35	1192	35	35
	B060A	5.3	53	700	60	60
2	B110A	11	110	830	110	110
	B200A	20	200	468	200	200
3	B300A	30	300	445	300	300
4	B500A	50	500	252	500	500
4	B660A	66	660	172	660	660
4	B660A + 4VK4D	75	750	143	900	660

Angle drive

Size	Type Gear	Torque range		Speed	Torque calibration	
		Min. [Nm]	Max. [Nm]	rpm	Trans-ducer 1	Trans-ducer 2
1	B012A	2	12	3317	12	12
	B035A	3.5	35	1255	35	35
	B060A	5.3	53	737	60	60

Size	Type Gear	Torque range		Speed	Torque calibration	
		Min. [Nm]	Max. [Nm]	rpm	Trans-ducer 1	Trans-ducer 2
2	B110A	11	110	890	110	110
	B200A	20	200	501	200	200
3	B300A	30	300	480	300	300
4	B500A	50	500	269	500	500
	B660A	66	660	183	660	660

6.2 Ambient conditions

Features	Controller	Spindle
Operation site	Indoors	Indoors
Working temperature	0 °C – 45 °C	0 °C – 45 °C
Storage temperature	-25 °C – 70 °C	-25 °C – 70 °C
Type of cooling	Convection (self-cooling)	Convection (self-cooling)
Relative humidity	10% – 90% no condensation	10% – 90% no condensation
Working height	Up to 3,000 m (9,843 ft) above sea level	Up to 3,000 m (9,843 ft) above sea level
Protection class DIN EN 60529 (IEC 60529)	IP42	IP42

6.3 Scribed circle diameter

Size 1

Quantity Spindle	Scribed circle min. [mm]		
	Straight	Offset	Angle
2	43	35	52
3	54	40	60
4	61	50	74
5	81	58	89
6	99	70	105
7	116	85	120

Size 2

Quantity Spindle	Scribed circle min. [mm]		
	Straight	Offset	Angle
2	56	44	59
3	75	50	68
4	80	62	86
5	106	74	101
6	130	89	118
7	151	102	137

Size 3

Quantity Spindle	Scribed circle min. [mm]		
	Straight	Offset	Angle
2	81	59	81
3	94	69	94
4	116	84	116
5	139	102	139
6	164	122	164
7	189	138	189

Size 4

Quantity Spindle	Scribed circle min. [mm]		
	Straight	Offset	Angle
2	91	76	112
3	122	88	130
4	130	108	160
5	174	130	192
6	217	153	224
7	246	180	263

6.4 Weight

[kg]

Size	Motor		Gear	Trans-ducer	Attachment[1]				
	BD	BDU	B(…)A	K(…)D	ZB	V(…)D	W(…)D	VA	WA
1	1,7	2.2	0,7	0,6	0,6	1,7	2,1	1,5	2,0
2	3,3	4,3	1.2	1.2	1,1	3,8	3,2	3.5	3,2
3	6,4	8,3	2,8	2,1	2,0	5,1	7,8	4,7	7,7
4	6,4	7,9	5.3	3.1	5,4	10,0	14,6	9,4	14,5

6.5 Motor

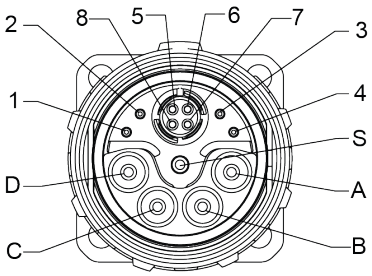
Features	Size		
	1	2	3/4
Diameter [mm]	42	55	80
Number of phases	3	3	3
Number of poles	6	6	6
Intermediate circuit voltage [V]	380	380	380
Max.speed [rpm]	19000	11000	9000
Direction of rotation	Reversible	Reversible	Reversible

[1] Weight of the particular adapter see *see chapter 6.8 Output drive*

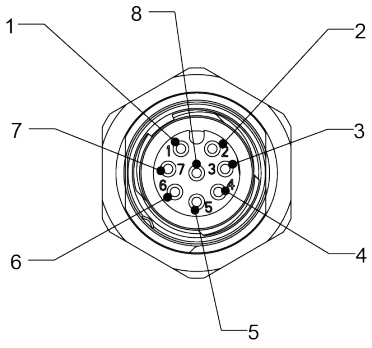
Features	Size		
	1	2	3/4
Voltage constant [12] [V/1000 rpm]	19.5	34	40
Peak TQ [Nm]	2.6	10.5	16
Peak current [A][3]	18	44	54
Rated output [W]	255	500	940
Torque constant[1] [Nm/A]	0.16	0.28	0.33
Connection resistance[2] [ohm]	3.6	1.8	0.5
Inductance[2] [mH]	2.2	3.1	1.8
Motor weight [kg]	1.2	3.1	6.5
Nominal operating mode EN 60034-1	S3	S3	S3
Protection class DIN EN 60529	IP54	IP54	IP54

Pin assignment

Motor connector

Pin	Signal	Wire color	Pin allocation
S	PE	Yellow/Green	
A	Phase U	Red	
B	Phase V	Brown	
C	Phase W	Black	
1, 2, 3, 4	nc	–	
5	RX-	White	
6	RX+	Brown	
7	TX+	Green	
8	TX-	Blue	

Transducer connector

Pin	Signal	Wire color	Socket
1	0 V	White	
2	+12 V	Brown	
3	RX+	Green	
4	RX-	Yellow	
5	TX+	Gray	
6	TX-	Pink	
7	TCS	Blue	
8	Sync_IN	Red	

[1] tolerance -10 %
[2] measured between two phases
[3] Sinusoidal peak value

6.6 Gear

Order No.	Type	Gear ratio [i]
927346	1B012A	5,7273
927344	1B035A	15,1364
927345	1B060A	25,7727
935548	2B110A	12,3595
935549	2B200A	21,9231
935590	3B300A	18,7500
935780	4B500A	33,4219
935781	4B660A	48,9345

6.7 Transducer

Features	Data
Service life in operation [h]	60 000
Load cycles (minimum at maximum torque)	1 000 000
Mechanical overload capacity of the measuring shaft [%]	100
Max.speed [rpm]	3500
Supply voltage nominal value [V]	+12
Supply voltage limit values [V]	+10.75 – +12.5
Supply current [mA]	100
Measuring range resolution [bit]	16
Allowed measuring range [%]	±10 – 125 from the nominal torque
Max. non-linearity of the torque measurement [%]	± 0.25
Accuracy deviation [%]	±0.5 from the nominal torque
Limit frequency for the torque measurement (-3 dB) [KHz]	3
Resolution of angle measuring system	0.25°

6.8 Output drive

Straight attachment

Type	Order No.	Permissible load on output shaft			Lateral force on the adapter[1]		
		Torque [Nm]	Push force[1] [N]	Pull force[1] [N]	Extended [N]	25 mm Retracted [N]	50 mm Retracted [N]
1ZB	927222	53	1900	1500	1150	1350	1600
2ZB	927227	200	4500	3200	2450	2700	3250
3ZB	927233	300	6500	5000	3000	3500	4100
4ZA	927236	660	9000	8800	4300	4800	5400
4Z1250	S976950	1250	9000	8800	4300	4800	5400
4Z1600A	S976951	1600	9000	8800	4300	4800	5400
4Z2800G	F900750	2800	9000	8800	4300	4800	5400

Offset drive

Type	Order No.	Torque calibration [Nm]	Gear ratio [i]	Permissible load on output shaft			Lateral force on the adapter[1]		
				Torque [Nm]	Push force[1] [N]	Pull force[1] [N]	Extended [N]	25 mm Retracted [N]	50 mm Retracted [N]
1VK1D	942650PT	35	1,0526	53	2300	2300	1510	1720	2000
1VK2D	942651PT	60	1,0526	53	2300	2300	1510	1720	2000
1VK3D	942652PT	12	1,0526	20	2300	2300	1510	1720	2000
2VK1D	942660PT	110	1,0714	160	2500	2500	2300	2600	3100
2VK3D	942662PT	200	1,0714	200	2500	2500	2300	2600	3100
3VK2D	942671PT	300	1,0769	300	3600	3600	2850	3250	3750
4VK2D	942681PT	500	1,0667	660	6300	2100	4300	4800	5400
4VK3D	942682PT	660	1,0667	660	6300	2100	4300	4800	5400
4VK4D	942683PT	900	1,0667	750	6300	2100	4300	4800	5400

[1] In the case of continuous loading, multiply the specified values by 0.3

Angle drive

Type	Order No.	Torque calibration [Nm]	Gear ratio [i]	Permissible load on output shaft			Lateral force on the adapter[1]
				Torque [Nm]	Push force[1] [N]	Pull force[1] [N]	[N]
1WK1D	942690PT	35	1,0667	53	1700	3400	3100
1WK2D	942691PT	60	1,0667	53	1700	3400	3100
1WK3D	942692PT	12	1,0667	20	1700	3400	3100
2WK1D	942700PT	110	1,0625	160	1850	3900	4200
2WK3D	942701PT	200	1,0625	160	1850	3900	4200
3WK2D	942671PT	300	1,0385	260	3800	4800	5100
4WK2D	942721PT	500	1,0667	380	12000	6500	5900
4WK3D	942722PT	660	1,0370	650	12000	6500	5900

Floating adapter – straight and offset drive

Size	Order No.	Drive	Permissible load			Lateral force on the adapter[1]			Weight
			Torque [Nm]	Push force[1] [N]	Pull force[1] [N]	Extended [N]	25 mm Retracted [N]	50 mm Retracted [N]	kg
1	922325PT	3/8"	60	2300	1510	1800	2000	2100	0.35
2	910609	1/2"	160	4500	3200	2500	3000	3100	0.45
2	935552	3/4"	200	4500	3200	2500	3000	3100	0.50
3	910613	3/4"	520	6500	5000	3000	3450	3750	0.66
4	912106	3/4"	520	9000	8800	4300	5050	5400	0.85
4	912147	1"	1000	9000	8800	4300	5050	5400	0.90
4	916643	3/4"	520	9000	8800	4300	4800	5400	1.21
4	916642	1"	660	9000	8800	4300	4800	5400	1.24

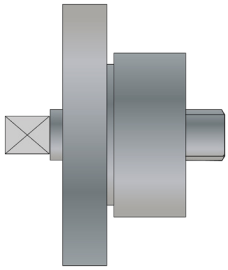
[1] In the case of continuous loading, multiply the specified values by 0.3

Floating attachment for angle drive

Size	Order No.	Attachment	Allowed load on the drive shaft			Lateral force on the adapter[1]		Weight
			Torque [Nm]	Push force[1] [N]	Pull force[1] [N]	Extended [N]	25 mm Retracted [N]	kg
1	929041	3/8"	60	1700	6800	1800	2100	0.54
2	929053	1/2"	170	1850	6800	2500	3000	Upon request
2	929061	3/4"	210	1850	6800	2500	3000	Upon request
3	929065	3/4"	300	3800	7800	3000	3450	2.25
4	929077	3/4"	520	12000	13000	4300	5050	Upon request
	929089	1"	660	12000	13000	4300	5050	Upon request

Adapter for straight attachment

Size 1 and 2



Size	Order No.	Attachment	Permissible load			Lateral force on square drive[1]	Weight
			Torque [Nm]	Push force[1] [N]	Pull force[1] [N]	[N]	[kg]
1	927541	3/8"	53	1900	1500	4300	Upon request
2	927542	1/2"	160	4500	3200	4300	Upon request
2	927544	3/8"	160	4500	3200	4300	Upon request
2	927543	3/4"	200	4500	3200	4300	Upon request

[1] In the case of continuous loading, multiply the specified values by 0.3

7 Torque/angle of rotation measuring system

The torque/angle of rotation measured values are transmitted digitally.

The torque measurement takes place

- as an action measurement in the rotating shaft. The energy and data transfer is contactless and therefore free of wear.
- symmetrical for clockwise and counterclockwise torques (fastening and loosening direction).
- with a full bridge strain gauge.

The angle of rotation is measured magnetically, contactless on the rotating shaft.

8 Redundant structure of a measuring sensor system

A redundant structure in accordance with VDI 2862 can be implemented using a second transducer or by activating the power redundancy. The redundant measuring systems are factory-calibrated with the spindle and do not require any additional adjustments.

9 Troubleshooting

For troubleshooting, see the document *P2468TS Troubleshooting*

10 Disposal

Components and auxiliary materials of the product pose risks to the health and the environment. The tool contains components that can be recycled as well as components that must be specially disposed of.

► Separate the components of the packing and segregate the different materials before disposing of them.

► Catch auxiliary materials (oils, greases) when drained and dispose of them properly.

► Separate the components and dispose of them by segregating them clearly.

► Follow the locally applicable regulations.

Observe generally valid disposal guidelines such as, in Germany, the Electrical and Electronic Equipment Act (ElektroG) and the Battery Act (BattG). Wasted electronic equipment must be disposed of.

► Return the defective product to your company collection facility or to *Sales & Service Center*.

POWER TOOLS SALES & SERVICE CENTERS

Please note that all locations may not service all products.
Contact the nearest Cleco® Sales & Service Center for the appropriate facility to handle your service requirements.

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Service Center

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