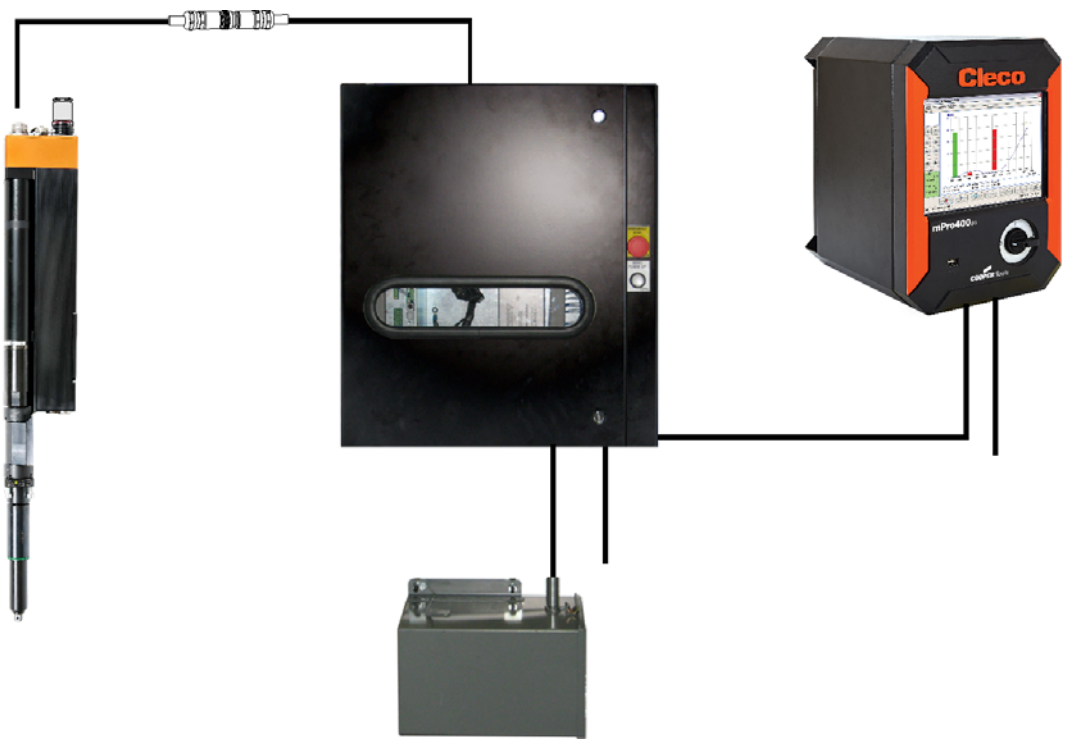
System Handbook
P2077SB/EN
2010-11

mPro400GC-DGD-intelligent-spindle

BTSE series



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Notes on System Handbook

This System Handbook is the original system handbook – and

- provides important information on safe, correct and efficient operation of the system.
- describes the function and operation of the components.
- serves as a lexicon for technical data.
- It points out options.

Secondary information

P1908E	Tightening torques – Assembling the DGD intelligent spindle components
P2074BA	Operating instructions for telemetry system
P2075EL	Data sheet: Transducer
P1913E	Spare parts sheet: Gearing
P2080EL	Spare parts sheet: Transducer
P1914E	Spare parts sheet: Motor
P2085EL	Tightening module spare parts sheet TSE/TUSE
P2076EL	Spare parts sheet: Offset attachment
P2086MA	DGD intelligent spindle assembly instructions
P2078MA	Tightening module assembly instructions TSE/TUSE
P1919E	Supply module assembly instructions CPS3
PL12DE-1001	Programming ManualmPro400GC
PL12DE-1004	Quick Start mPro400GC
P2079WA	DGD intelligent spindle service manual

Symbols in text

➔	Identifies instructions to be followed.
•	Identifies lists.
italics	Indicates menu items such as *Diagnostics* in software descriptions
<…>	Identifies elements that have to be selected or deselected, such as buttons or control boxes, i.e. <F5>
Courier	Indicates the name of paths and files, e.g. **`setup.exe`**
\	A backslash between two names indicates the selection of an item from the menu, e.g. file \ print

Abbreviations

DGD-IS	DGD intelligent spindles
PDB-CPS…	Power distribution box
mPro400GC-M	Nutsetter control unit
TSE/TUSE	Tightening module
CP3-…-JH	Transformer
CPS3	Supply module

Copyright protection

Contents

1 Safety

1.1 Warnings and notes

WARNING!

A symbol combined with the word **WARNING** warns of a **potentially dangerous** situation for the health of personnel, If this warning is not observed, death or serious injury may occur.

CAUTION!

A symbol combined with the word **CAUTION** warns of a **potentially harmful** situation for the health of personnel or damage to property or the environment. If this warning is not observed, injuries, property or environmental damage may occur.

DANGER!

A symbol combined with the word **DANGER** warns of an **impending health risk** or risk of fatal injury to personnel. If this danger note is not adhered to, severest injury that may lead to the death of people, is the consequence.

NOTE

This symbol indicates a **general** instruction.
General instructions include application tips and special useful information, but no warnings against dangers.

1.2 Basic requirements for safe working practices

Only take the fastening system into service after you have read and completely understood the following safety instructions and this document. Failure to observe the instructions below may result in electric shock, fire and serious injuries.

DANGER!

High leakage current –
Fatal electric shock could occur!

- ➔ Establish a protective earth (PE) ground connection to the PDB-CPS… before taking into operation!
- ➔ Always disconnect the power supply before performing maintenance work on the DGD-IS and the PDB-CPS….
- ➔ Always disconnect the system cable or motor cable from the PDB-CPS… or DGD-IS before making throughput, resistance and short circuit measurements.
- ➔ Do not attempt to repair possible faults on the fastening system by yourself if you do not have the required knowledge! Please consult your local service agent or the responsible Sales & Service Center (see backside).

WARNING!

High temperature –
the motor on the DGD-IS may heat up and cause burns during removal. (max. engine temperature 80 °C).

- ➔ Wear gloves.

CAUTION!

Risk of flying parts.
Components of the spindle may rotate, come loose and cause injury.

- ➔ Avoid speed increases of over 3 $^{m}/_{s^2}$ on all axes.

CAUTION! **Work area**

- ➔ Close all safety devices.
- ➔ Ensure that there is enough space in the work area.
- ➔ Keep the work area clean.

Electrical safety

- ➔ Only operate the tightening system indoors.
- ➔ Observe the safety notes on the DGD-IS.

Safe working with and around fastening tools

- ➔ Inspect screw bits and retaining ring for visible damage and cracks. Replace damaged parts immediately.
- ➔ Always disconnect the power supply to the DGD-IS before changing screw bits.
- ➔ Only use screw bits for machine-controlled fastening tools.
- ➔ Make sure that the screw bits are retained securely.

- ➔ We do not claim that these safety notes are complete. Read and observe all applicable, general and local safety and accident prevention rules.
- ➔ Follow a safety-conscious maintenance program which takes into account the local regulations for maintenance and servicing in all phases of operation of the fastening electronics.

1.3 Operator training

- The fastening system may only be operated by personnel that have been trained and instructed correspondingly and authorized by the operator.
- The tightening system must only be serviced by persons who have been instructed by qualified representatives of DGD.
- The operator must make sure that all new operating and maintenance personnel are instructed in the operation and maintenance of the fastening system to the same extent and with the same care and attention.
- Personnel who are being trained may only work on the fastening system under the supervision of an experienced operator.

1.4 Personal protective equipment

When working

- Wear the protective goggles to protect against spurting metal splinters.

Danger of injury by being wound up in and caught by machinery

- Wear close-fitting clothing.
- Do not wear jewelry.

1.5 Designated use

The owner is responsible for using the machine according to its designated use.
The fastening system may be used only under the following conditions:

- Industrial environment EMC limit class value A, DIN EN 550081-2.

- The DGD-IS is designed for stationary operation only and is intended exclusively for fastening and loosening thread connections. Do not use as a hand-held tool.
- Only use the DGD-IS in conjunction with the power distribution box PDB-CPS… and the nutsetter control unit mPro400GC-M.
- The DGD-IS must be fully assembled. Insert and lock all connecting cables.

- Secure the DGD-IS to an electroconductive mounting plate.
- Only cable types approved by DGD may be used.
- Only accessory parts approved by DGD may be used.
- Unauthorized alterations, repairs and modifications are prohibited for reasons of safety and product liability.
- Only operate the tightening system indoors.

NOTE

- ➔ Always remove the complete DGD-IS from a unit.
- ➔ A repair is only permitted by DGD authorized personnel. If repair is required, send the complete DGD-IS to Sales & Service Center (see backside).
- ➔ Do not open the transducer, offset attachment or angle head attachment as this will void the warranty. A repair is only permitted by DGD authorized personnel. If repair is required, send the complete component to Sales & Service Center.
- ➔ Do not open the TSE/TUSE or CPS3 as this will void the warranty.
  This does not include the service panel. A repair is only permitted by DGD authorized personnel. If repair is required, send the complete component to Sales & Service Center.
- ➔ Read the following documents when replacing the DGD-IS
  - This System Handbook (see 15 Maintenance / Service, page 69)
  - Service Manual DGD-IS
  - Assembly instructions DGD-IS
  - Spare part sheets

1.6 Ambient conditions

Do not operate the fastening system in an explosive atmosphere.

System components	Ambient temperature	Relative humidity	Working height
DGD-IS	0 to 40 °C	0 to 90 % no condensation	up to 3000 m above sea level
mPro400GC-M			
PDB-CPS…			
CP3-…-JH			
TSE/TUSE			
Motor			
CPS3	0 to 70 °C		

1.7 EMC (Electromagnetic compatibility)

- The tool complies with the following applicable EMC standards:
  - DIN EN 61000-3-2
  - DIN EN 61000-3-3
  - DIN EN 61000-6-2
  - DIN EN 61000-6-4

- The filters required to fulfill the EMC standards are integrated in the system components.
- Shielded cables offer protection against irradiating and radiating interference.
- All cable shields are connected to the shield terminals on the nutsetter control unit and the plug casing on the DGD-IS.

NOTE

Equipment from EMC limit class value A, DIN EN 550081-2.
This equipment may cause radio interference in residential areas. Should this occur, you may request that the operator pay for and implement relevant EMC measures.

1.8 Noise

DGD-IS	dB(A)
1B(U)TSE-1B012A-…	72
1B(U)TSE-1B035A-…	72
1B(U)TSE-1B060A-…	67
2B(U)TSE-2B110A-…	71
2B(U)TSE-2B200A-…	67
3B(U)TSE-3B300A-…	66
4B(U)TSE-4B500A-…	66
4B(U)TSE-4B660A-…	66

Measured sound pressure level at idling speed (no load) / clockwise rotation in accordance with ISO 3744.

2 Transport / Storage

- Transport only in the original packing.
- If the package is damaged, check the part for visible damage.
  Inform the carrier or DGD if necessary.

System components	Storage temperature	Relative humidity
DGD-IS	-20 to 70 °C	0 to 90 % no condensation
PDB-CPS…		
TSE/TUSE		
Motor		
CPS3	-25 to 70 °C	

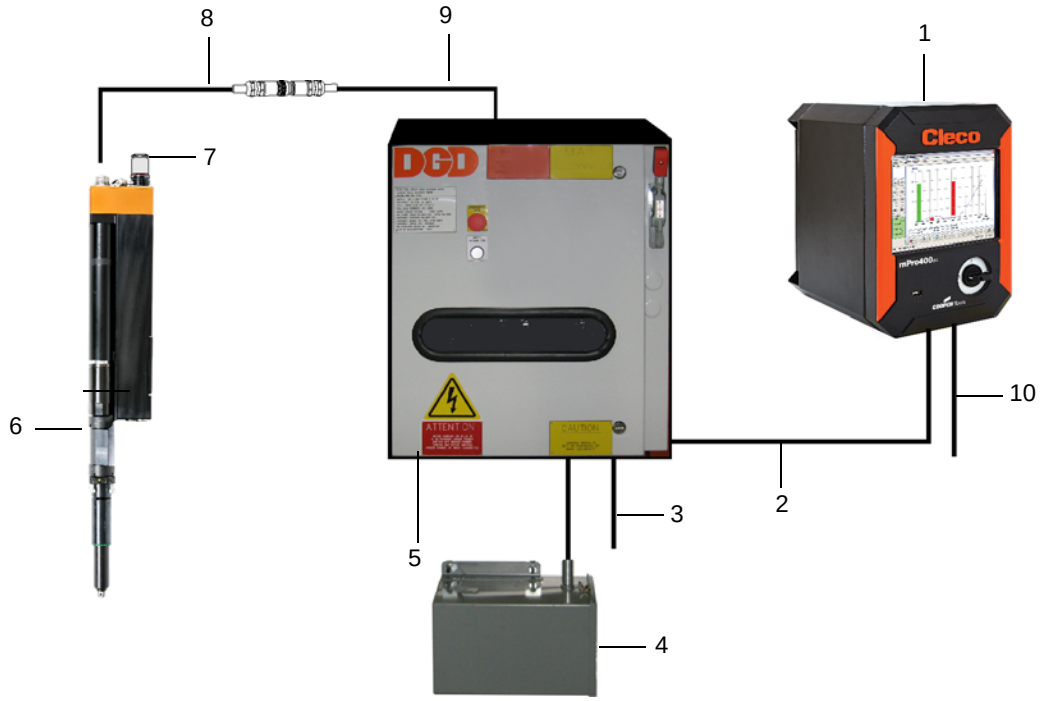
3 System description

The system design is determined by the size and quantity of DGD-IS used and always varies depending on the individual situation. These components can be combined with one another in various sizes.
This chapter includes a brief description of the components. Each respective chapter contains separate technical details.

Special features of the fastening system mPro400GC DGD intelligent spindles

In the mPro400GC DGD intelligent spindles fastening system, the tightening modules are no longer installed in a control cabinet, but directly on the built-in nutsetter, see system "m-Pro-400-tm" with single cable solution.
The intermediate circuit voltage was increased from 320 VDC to 380 VDC compared to the "TM" tightening modules. This increased the maximum speed of the built-in nutsetter by 20%.

3.1 Components



Item	Designation
1	Nutsetter control unit mPro400GC-M
2	ARCNET cable Order no. 960950-××× (××× = length in dm)
3	Mains cable, 3×480 VAC
4	Transformer CP3-…JH
5	Power distribution box PDB-CPS…
6	DGD-IS
7	ARCNET terminator
8	System cable, type A
9	System cable, type C
10	Power cable

77_system.png

3.1.1 DGD-IS

The DGD-IS is available in sizes 1B(U)TSE…, 2B(U)TSE…, 3B(U)TSE… and 4B(U)TSE….
for a torque range of 2 to 1600 Nm.

3.1.2 Nutsetter control unit

Power and logic are supplied via the power distribution box PDB-CPS….
This is controlled by the nutsetter control unit mPro400GC-M.

- A single system cable (PDB-CPS… to the last DGD-IS) may have up to 16 DGD-IS units connected (depending on the size and number).
- A single mPro400GC-M can have up to 32 DGD-IS units connected.

Available channel numbers

Code	Maximum number of DGD-IS				Quantity System cable
	1B(U)TSE…	2B(U)TSE…	3B(U)TSE…	4B(U)TSE…	
PDB-CPS3	16	6	6	6	1
PDB-CPS6	32	12	12	12	2
PDB-CPS9	–	18	18	18	3

The maximum number of DGD-IS units per PDB-CPS… depends on load.
In order to guarantee the number stated, the following settings are to be made:

- Maximum speed at 20% of maximum torque (for 1BTSE, 2BTSE, 3BTSE and 4BTSE)
- Final tightening up to 500 Nm: Maximum speed 50 rpm at maximum torque (for 1BTSE, 2BTSE, 3BTSE and 4BTSE- 4B500A...)
- Final tightening above 500 Nm: Maximum speed 20 rpm at maximum torque (for 4BTSE-4B660A..., 4BTSE-4B660A-4VK4MS, 4BTSE-4B360A-4Z1250A and 4BTSE-4B460A-4Z1600A)

If settings above those stated are selected, the number of channels must be reduced.
If using different types of spindle on one control unit, these must be individually defined.
Please consult your Sales & Service Center (see backside).

3.1.3 Cables

From PDB-CPS… to the last DGD-IS = 50 m maximum length.

3.1.4 ARCNET (System bus)

Communication between the mPro400GC-M and the DGD-IS is achieved via the serial, high-performance field bus ARCNET, based on RS485.

- An ARCNET cable is connected between mPro400GC-M and PDB-CPS….
- ARCNET cables are integrated in the system cable between PDB-CPS… and DGD-IS, and between DGD-IS and DGD-IS.
- Several system wiring harnesses meet at PDB-CPS6 and PDB-CPS9. An ARCNET bus amplifier module (ARCNET HUB 1E3A order no. 961237) is installed for this purpose. The module allows a star-shaped bus topology.

4 First Operation

For initial commissioning, the mPro400GC programming instructions must also be read and applied.

1 Position components of the DGD-IS so that they interlock at toothed interfaces, see Service Manual:
Turn size 1 in 15° increments.
Turn sizes 2 to 4 in 10° increments.

2 Connect all components, see (Chapter "3.1"Components starting on page 9).

CAUTION!

Risk of tripping or falling over loose cables on the ground.
Lay all connected cables safely.

3 Close all plug connectors and lock.

NOTE

The red ring around the outer diameter of plug connectors with a slide lock should not be visible.

NOTE

Always terminate the ARCNET with an ARCNET terminator at the bus end, i.e. at the last DGD-IS, order no. 961127. This terminator is permanently installed in the nutsetter control unit mPro400GC-M (start of bus).

4 Connect the mains cable to the nutsetter control unit.

DANGER!

High leakage current – Fatal electric shock could occur.
Establish a protective earth (PE) ground connection to the nutsetter control unit before taking into operation!

5 Preset the ARCNET address on each DGD-IS under the service panel,
see 6.4.1 ARCNET address preset, page 24.

NOTE

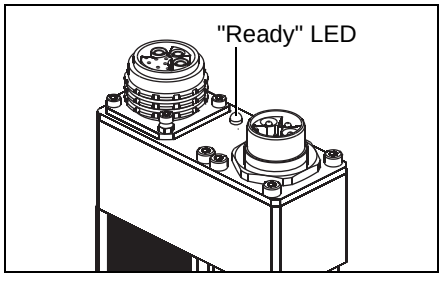
Each address can be used only once in the system!

6 Close the service panel.

7 Close the protective devices (i.e. safety grilles).

8 Switch on the machine control unit (PLC/SPS).

9 Switch on the nutsetter control unit.
If there are no faults pending after switching on the unit, the "Ready" LED on the DGD-IS lights up green.
Otherwise, please refer to 14 Troubleshooting, page 55, troubleshooting.



10 Enter parameters for torque / angle of rotation setting via the mPro400GC-M….
The mPro400GC-M is programmed by DGD technical staff during commissioning.
The first time the nutsetter control unit is switched on, the parameters for controlling fastening sequences must be read in via the keyboard or a valid parameter file. For process programming of the nutsetter control unit, see Programming Manual mPro400GC-M.

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5 DGD intelligent spindles

5.1 General technical data

- torque measurement with integrated pre-amplifier, resulting in greater signal noise spacing
- reverse voltage protected supply
- short-circuit proof outputs
- low voltage monitor
- watchdog for processor
- noise-protected input and output circuit

Features	Data
Protection category	IP54
Service life, operating	40,000 h
Load cycles (min. at maximum torque)	1,000,000, then recalibration
Mechanical overload capacity of the measuring shaft	100 %

5.2 Catalogue data

5.2.1 Size 1 – 1× transducer

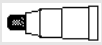
Designation	Order No.	Torque Nm		Speed	Spring travel		min. axis distance	Length	Weight	Spring chuck	
		max.	min.	RPM	mm		mm	mm	kg		+ flange
1BTSE-1B012A-1M3B-1ZB	947626A6[1)]	12	2	1921	50	3/8"	43	486	4.8	922325	S308434
1BTSE-1B035A-1M1B-1ZB	947632A8	35	5	727							
1BTSE-1B060A-1M2B-1ZB	947638A2	53	15	427							
1BTSE-1B012A-1VM3B	947627A5[1)]	12	2	1825			35	474	5.3		S308437
1BTSE-1B035A-1VM1B	947633A7	35	5	690							
1BTSE-1B060A-1VM2B	947639A1[1)]	53	15	405							
1BTSE-1B012A-1WM3B	947628A4[1)]	12	2	1801	25		52	542	5.7	–	929041
1BTSE-1B035A-1WM1B	947634A6[1)]	35	5	681							
1BTSE-1B060A-1WM2B	947640A8[1)]	53	15	400							
1BUTSE-1B012A-1M3B-1ZB	947629A3[1)]	12	2	1921	50		43	393	5.3	922325	S308434
1BUTSE-1B035A-1M1B-1ZB	947635A5[1)]	35	5	727							
1BUTSE-1B060A-1M2B-1ZB	947641A7[1)]	53	15	427							
1BUTSE-1B012A-1VM3B	947630A0[1)]	12	2	1825			35	382	5.8		S308437
1BUTSE-1B035A-1VM1B	947636A4[1)]	35	5	690							
1BUTSE-1B060A-1VM2B	947642A6[1)]	53	15	405							
1BTSE-1B012A-1WM3B	947631A9[1)]	12	2	1801	25		52	370	6.2	–	929041
1BTSE-1B035A-1WM1B	947637A3[1)]	35	5	681							
1BUTSE-1B060A-1WM2B	947643A5[1)]	53	15	400							

1) On request

Smallest scribed circle diameter in mm

Quantity	Attachment		
DGD-IS	Centric	Offset	Angle head
2	43	35	52
3	54	40	60
4	61	50	74
5	81	58	89
6	99	70	105
7	116	85	120

5.2.2 Size 2 – 1× transducer

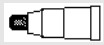
Designation	Order No.	Torque Nm		Speed	Spring travel		min. axis distance	Length	Weight	Spring chuck	
		max.	min.	RPM	mm		mm	mm	kg		+ flange
2BTSE-2B110A-2M1B-2ZB	947644A4	110	25	890	50	1/2"	56	528	7.6	910609	S308435
2BTSE-2B200A-2M3B-2ZB	947650A6	200	40	502		3/4"					
2BTSE-2B110A-2VM1B	947645A3[1)]	110	25	831		1/2"	44	551	9.2		S308438
2BTSE-2B200A-2VM3B	947651A5	200	40	468		3/4"					
2BTSE-2B110A-2WM1B	947646A2[1)]	110	25	838	25	1/2"	59	581	8.7	–	929053
2BTSE-2B200A-2WM3B	947652A4[1)]	200	40	472		3/4"					
2BUTSE-2B110A-2M1B-2ZB	947647A1[1)]	110	25	890	50	1/2"	56	367	8.6	910609	S308435
2BUTSE-2B200A-2M3B-2ZB	947653A3[1)]	200	40	502		3/4"					
2BUTSE-2B110A-2VM1B	947648A0[1)]	110	25	831		1/2"	44	390	10.2		S308438
2BUTSE-2B200A-2VM3B	947648A0[1)]	200	40	468		3/4"					
2BUTSE-2B110A-2WM1B	947649A9[1)]	110	25	838	25	1/2"	59	421	9.7	–	929053
2BUTSE-2B200A-2WM3B	947655A1[1)]	200	40	472		3/4"					

1) On request

Smallest scribed circle diameter in mm

Quantity	Attachment		
DGD-IS	Centric	Offset	Angle head
2	56	44	59
3	75	50	68
4	80	62	86
5	106	74	101
6	130	89	118
7	151	102	137

5.2.3 Size 3 – 1× transducer

Designation	Order No.	Torque Nm		Speed	Spring travel		min. axis distance	Length	Weight	Spring chuck	
		max.	min.	RPM	mm		mm	mm	kg		+ flange
3BTSE-3B300A-3M2B-3ZB	947656A0	300	50	453	50	3/4"	81	589	14.1	910613	S308436
3BTSE-3B300A-3VM2B	947657A9[1)]			421			59	584	15.2		S308439
3BTSE-3B300A-3WM2B	947658A8[1)]			437	25		81	678	17.8	–	929065
3BUTSE-3B300A-3M2B-3ZB	947659A7[1)]			453	50			417	16.1	910613	S308436
3BUTSE-3B300A-3VM2B	947660A4[1)]			421			59	412	17.2		S308439
3BUTSE-3B300A-3WM2B	947661A3[1)]			437	25		81	506	19.8	–	929065

1) On request

Smallest scribed circle diameter in mm

Quantity	Attachment		
DGD-IS	Centric	Offset	Angle head
2	81	59	81
3	94	69	94
4	116	84	116
5	139	102	139
6	164	122	164
7	189	138	189

5.2.4 Size 4 – 1× transducer

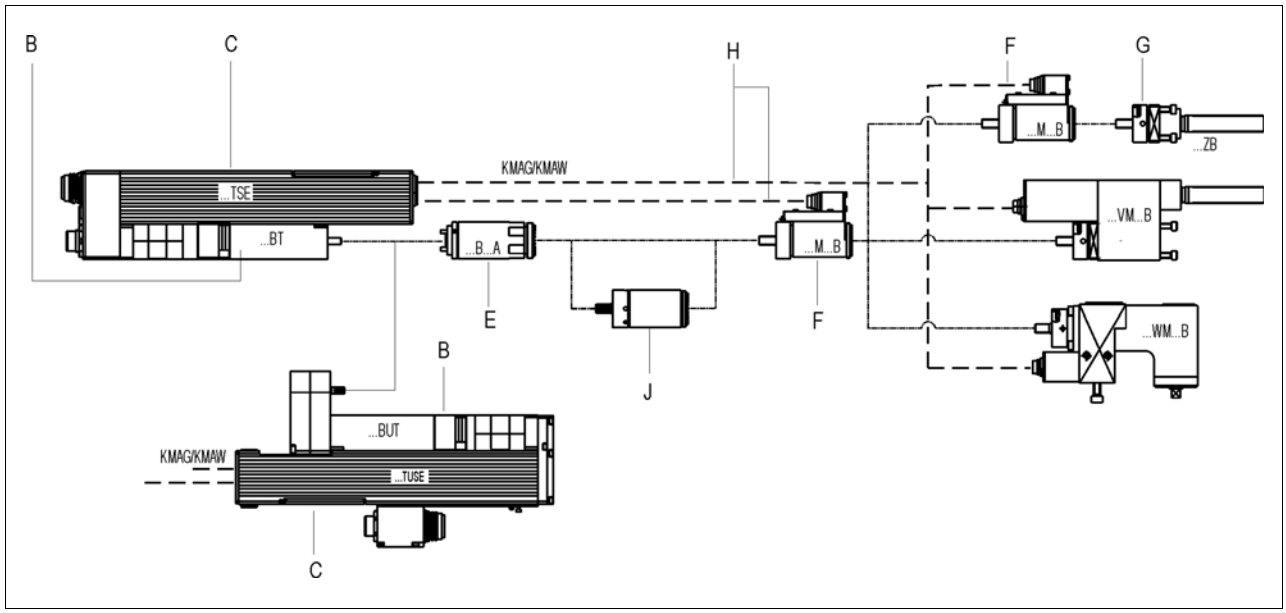
Designation	Order No.	Torque Nm		Speed	Spring travel		min. axis dis-tance	Length	Weight	Spring chuck	
		max.	min.	RPM	mm		mm	mm	kg		+ flange
4BTSE-4B500A-4M2B-4ZA	947662A2	500	100	254	50	3/4"	91	719	21	–	916643
4BTSE-4B660A-4M3B-4ZA	947668A6	660	130	174		1"					916642
4BTSE-4B360A-4M1B-4Z1250A	947676A6[1)]	1250	320	86		1"	121	771	29		S976956
4BTSE-4B500A-4M2B-4Z1600A	947678A4[1)]	1600	400	68		1 1/2"					S308441
4BTSE-4B500A-4VM2B	947663A1[1)]	500	100	238		3/4"	76	684	22.5	912106	S308440
4BTSE-4B660A-4VM3B	947669A5[1)]	660	130	163		1"				912147	
4BTSE-4B660A-4VM4B	947671A1[1)]	750	160	135		1"					
4BTSE-4B500A-4WM2B	947664A0[1)]	500	100	245	25	3/4"	112	729	27.1	–	929077
4BTSE-4B660A-4WM3B	947670A2[1)]	660	130	167		1"					929089
4BUTSE-4B500A-4M2B-4ZA	947665A9[1)]	500	100	254	50	3/4"	91	546	22.5	–	916643
4BUTSE-4B660A-4M3B-4ZA	947672A0[1)]	660	130	174		1"					916642
4BUTSE-4B360A-4M1B-4Z1250A	947677A5[1)]	1250	320	86		1"	121	599	31		S976956
4BUTSE-4B500A-4M2B-4Z1600A	947679A3[1)]	1600	400	68		1 1/2"					S308441
4BUTSE-4B500A-4VM2B	947666A8[1)]	500	100	238		3/4"	76	512	24	912106	S308440
4BUTSE-4B660A-4VM3B	947673A9[1)]	660	130	163		1"				912147	
4BUTSE-4B660A-4VM4B	947675A7[1)]	750	160	135		1"			24.5		
4BUTSE-4B500A-4WM2B	947667A7[1)]	500	100	245	25	3/4"	112	556	28.6	–	929077
4BUTSE-4B660A-4WM3B	947674A8[1)]	660	130	167		1"			28.7		929089

1) On request

Smallest scribed circle diameter in mm

Quantity	Attachment		
DGD-IS	Centric	Offset	Angle head
2	91	76	112
3	122	88	130
4	130	108	160
5	174	130	192
6	217	153	224
7	246	180	263

5.3 Component overview



5.3.1 Size 1 / 1× transducer

DGD-IS		B		C		E		F		G		H		J**
1)	2)	1)	2)	1)	2)	1)	2)	1)	2)	1)	2)	1)	2)	2)
1BTSE-1B012A-1M3B-1ZB	947626A6[3]					1B012A	927346	1M3B	934288PT					
1BTSE-1B035A-1M1B-1ZB	947632A8					1B035A	927344	1M1B	934286PT	1ZB	927222	KMAW	961089-002	
1BTSE-1B060A-1M2B-1ZB	947638A2					1B060A	927345	1M2B	934287PT					
1BTSE-1B012A-1VM3B	947627A5[3]					1B012A	927346			1VM3B	935863PT			
1BTSE-1B035A-1VM1B	947633A7	1BT	935560	TSE	961446PT	1B035A	927344			1VM1B	935865PT	KMAG	961088-004	–
1BTSE-1B060A-1VM2B	947639A1[3]					1B060A	927345	–	–	1VM2B	935864PT			
1BTSE-1B012A-1WM3B	947628A4[3]					1B012A	927346			1WM3B	3)			
1BTSE-1B035A-1WM1B	947634A6[3]					1B035A	927344			1WM1B	3)		961088-003	
1BTSE-1B060A-1WM2B	947640A8[3]					1B060A	927345			1WM2B	3)			
1BUTSE-1B012A-1M3B-1ZB	947629A3[3]					1B012A	927346	1M3B	934288PT					
1BUTSE-1B035A-1M1B-1ZB	947635A5[3]					1B035A	927344	1M1B	934286PT	1ZB	927222	KMAG	961088-004	
1BUTSE-1B060A-1M2B-1ZB	947641A7[3]					1B060A	927345	1M2B	934287PT					935796
1BUTSE-1B012A-1VM3B	947630A0[3]					1B012A	927346			1VM3B	935863PT			
1BUTSE-1B035A-1VM1B	947636A4[3]	1BUT	936321	TUSE	961447PT	1B035A	927344			1VM1B	935865PT			
1BUTSE-1B060A-1VM2B	947642A6[3]					1B060A	927345	–	–	1VM2B	935864PT	KMAG	961088-003	
1BUTSE-1B012A-1WM3B	947631A9[3]					1B012A	927346			1WM3B	3)			
1BUTSE-1B035A-1WM1B	947637A3[3]					1B035A	927344			1WM1B	3)			–
1BUTSE-1B060A-1WM2B	947643A5[3]					1B060A	927345			1WM2B	3)			

1) Code

2) Part no.

3) On request

** Fit as spacer

5.3.2 Size 2 / 1× transducer

DGD-IS		B		C		E		F		G		H	
1)	2)	1)	2)	1)	2)	1)	2)	1)	2)	1)	2)	1)	2)
2BTSE-2B110A-2M1B-2ZB	947644A4	2BT	935561	TSE	961446PT	2B110A	935548	2M1B	934295PT	2ZB	927227	KMAW	961089-002
2BTSE-2B200A-2M3B-2ZB	947650A6					2B200A	935549	2M3B	934294PT				
2BTSE-2B110A-2VM1B	947645A3[3]					2B110A	935548	–	–	2VM1B	934336PT	KMAG	961088-004
2BTSE-2B200A-2VM3B	947651A5					2B200A	935549			2VM3B	934335PT		
2BTSE-2B110A-2WM1B	947646A2[3]					2B110A	935548			2WM1B	3)	KMAG	961088-003
2BTSE-2B200A-2WM3B	947652A4[3]					2B200A	935549			2WM3B	3)		
2BUTSE-2B110A-2M1B-2ZB	947647A1[3]	2BUT	936322	TUSE	961447PT	2B110A	935548	2M1B	934295PT	2ZB	927227	KMAG	961088-004
2BUTSE-2B200A-2M3B-2ZB	947653A3[3]					2B200A	935549	2M3B	934294PT				
2BUTSE-2B110A-2VM1B	947648A0[3]					2B110A	935548	–	–	2VM1B	934336PT	KMAG	961088-003
2BUTSE-2B200A-2VM3B	947648A0[3]					2B200A	935549			2VM3B	934335PT		
2BUTSE-2B110A-2WM1B	947649A9[3]					2B110A	935548			2WM1B	3)	KMAG	961088-004
2BUTSE-2B200A-2WM3B	947655A1[3]					2B200A	935549			2WM3B	3)		

1) Code

2) Part no.

3) On request

5.3.3 Size 3 / 1× transducer

DGD-IS		B		C		E		F		G		H	
1)	2)	1)	2)	1)	2)	1)	2)	1)	2)	1)	2)	1)	2)
3BTSE-3B300A-3M2B-3ZB	947656A0	3/4BT	935562	TSE	961446PT	3B300A	935590	3M2B	934303PT	3ZB	927233	KMAG	961088-002
3BTSE-3B300A-3VM2B	947657A9[3]							–	–	3VM2B	3)	KMAG	961088-004
3BTSE-3B300A-3WM2B	947658A8[3]									3WM2B	3)	KMAG	961088-003
3BUTSE-3B300A-3M2B-3ZB	947659A7[3]	3/4BUT	936323	TUSE	961447PT			3M2B	934303PT	3ZB	927233	KMAG	961088-004
3BUTSE-3B300A-3VM2B	947660A4[3]							–	–	3VM2B	3)		
3BUTSE-3B300A-3WM2B	947661A3[3]									3WM2B	3)		

1) Code

2) Part no.

3) On request

5.3.4 Size 4 / 1× transducer

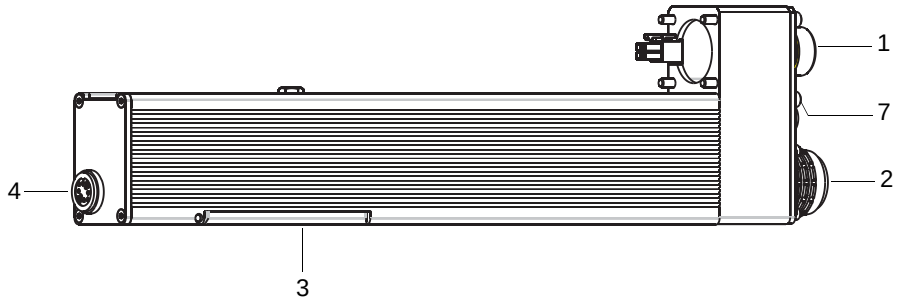
DGD-IS		B		C		E		F		G		H	
1)	2)	1)	2)	1)	2)	1)	2)	1)	2)	1)	2)	1)	2)
4BTSE-4B500A-4M2B-4ZA	947662A2	3/4BT	935562	TSE	961446PT	4B500A	935780	4M2B	934319PT	4ZA	927236	KMAG	961069-002
4BTSE-4B660A-4M3B-4ZA	947668A6[3]					4B660A	935781	4M3B	936496PT				
4BTSE-4B360A-4M1B-4Z1250A	947676A6[3]					4B360A	929541	4M1B	934318PT	4Z1250A	S976950		
4BTSE-4B500A-4M2B1-4Z1600A	947678A4[3]					4B500A	935780	4M2B1	3)	4Z1600A	S976951		
4BTSE-4B500A-4VM2B	947663A1[3]					4B500A	935780	–	–	4VM2B	3)	KMAG	961069-004
4BTSE-4B660A-4VM3B	947669A5[3]					4B660A	935781			4VM3B	3)		
4BTSE-4B660A-4VM4B	947671A1[3]					4B660A	935781			4VM4B	3)		
4BTSE-4B500A-4WM2B	947664A0[3]					4B500A	935780			4WM2B	3)	KMAG	961069-003
4BTSE-4B660A-4WM3B	947670A2[3]					4B660A	935781			4WM3B	3)		
4BUTSE-4B500A-4M2B-4ZA	947665A9[3]	3/4BUT	936323	TUSE	961447PT	4B500A	935780	4M2B	934319PT	4ZA	927236	KMAG	961069-005
4BUTSE-4B660A-4M3B-4ZA	947672A0[3]					4B660A	935781	4M3B	936496PT				
4BUTSE-4B360A-4M1B-4Z1250A	947677A5[3]					4B360A	929541	4M1B	934318PT	4Z1250A	S976950		
4BUTSE-4B500A-4M2B1-4Z1600A	947679A3[3]					4B500A	935780	4M2B1	3)	4Z1600A	S976951		
4BUTSE-4B500A-4VM2B	947666A8					4B500A	935780	–	–	4VM2B	3)		
4BUTSE-4B660A-4VM3B	947673A9[3]					4B660A	935781			4VM3B	3)		
4BUTSE-4B660A-4VM4B	947675A7[3]					4B660A	935781			4VM4B	3)		
4BUTSE-4B500A-4WM2B	947667A7[3]					4B500A	935780			4WM2B	3)		
4BUTSE-4B660A-4WM3B	947674A8[3]					4B660A	935781			4WM3B	3)		

1) Code

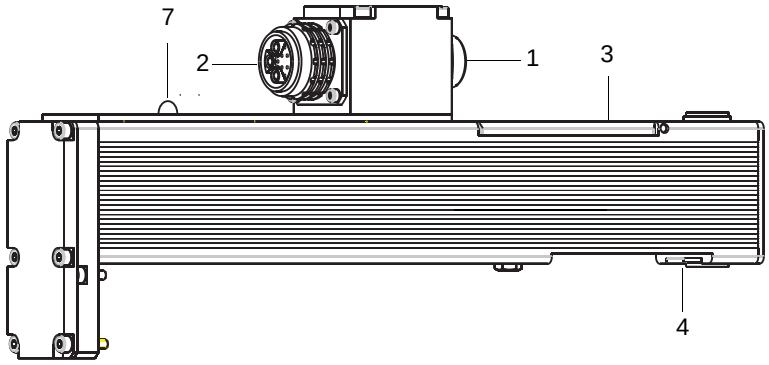
2) Part no.

3) On request

6 Tightening module TSE/TUSE



TSE
Order no. 961446PT



TUSE
Order no. 961447PT

Item	Designation
1	"XS1A" supply input
2	"XS1B" supply output
3	Service panel
4	"XS3" transducer plug connector
7	"Ready" LED, *ready for operation* (green) or fault (red)

77_tse_tuse.eps

6.1 Description

The tightening module TSE/TUSE controls the DGD-IS.
The servo amplifier (output section) and the measuring section (measuring board) are integrated in the tightening module.
Both circuit boards are linked to the connections via cables and plug connectors.

6.2 General technical data

Features	Data
Weight: TSE TUSE	 1480 g 1500 g
Protection category – is attained when all connectors are plugged in and the service panel is closed.	IP54
Cooling type	Convection (self-cooling)
Service life, operating	40,000 h
Usability period if stored	100,000 h (approx. 11 years)
Acceleration of each axis	max. 100 m/s²

6.2.1 Power loss

Low-loss components generate minimal heat.
Extremely good heat dissipation. Overall housing serves as a cooling element.

Standby 9 A

Operation max. 40 W

WARNING!

High temperature –
the tightening module TSE/TUSE may heat up and cause burns during removal (max. temperature 70 °C). Wear gloves.

6.2.2 Power supply 380 VDC

Intermediate power circuit (380 VDC) and logic power (24 VDC) are supplied separately by the PDB-CPS…. In the event of an *emergency stop* the intermediate power circuit is switched off separately by the PDB-CPS…. The logic section remains connected to the power.

Performance data DGD-IS different

Features		Data			
		1B(U)TSE…	2B(U)TSE…	3B(U)TSE…	4B(U)TSE…
Supply voltage	VDC	380 ±10 %			
Rated supply current	A	0.5	1	2	2
Peak supply current	A	6	15	15	15

6.2.3 Logic power supply

The logic power supply in the tightening module generates all supply voltages (24 V from the nutsetter control unit).

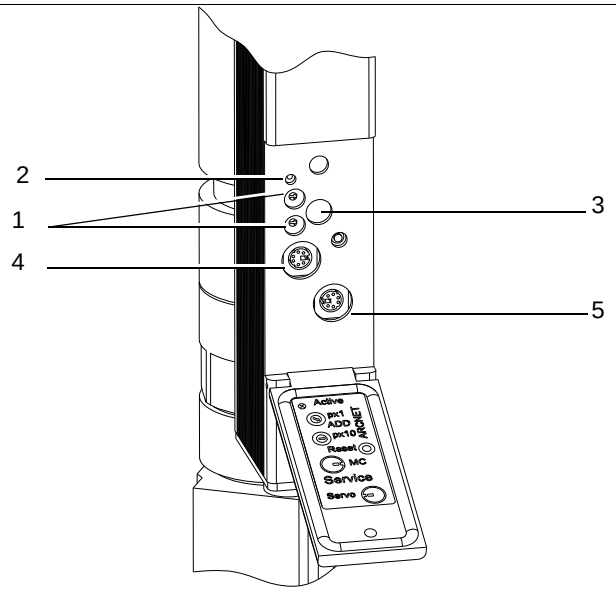
Features		Data
Supply voltage	V	24 +10 %
Rated supply current	A	approx. 0.35
Power loss (standby)	W	9

6.3 "Ready" LED

The "Ready" LED indicates that the system is *ready for operation*:

Signal	Tightening module
Green	Ready for operation
Red	Not ready for operation, an error is pending (see 14 Troubleshooting, page 55)

6.4 Service panel



Item	Designation
1	ARCNET address preset
2	"Active" LED
3	<Reset> button
4	DGD service interface (RS232) for measuring board (MC)
5	DGD service interface (RS232) for servo

a00601.wmf

6.4.1 ARCNET address preset

The ARCNET address is preset via the two 10-stage decode switch.
Permitted settings 01 to 32.

- Switch (x1) for units (00-09),
- Switch (x10) for tens (00-30).

NOTES

- Always switch off the nutsetter control unit before making adjustments.
- Each address can be used only once in the system. Otherwise an error is triggered on the mPro400GC-M.

6.4.2 "Active" LED

The "Active" LED indicates which activities the ARCNET is performing.

Signal	Activity
LED lights up	Data transfer to the ARCNET
LED flashes	ARCNET reconfiguration / transfer is disrupted
LED off	Internal fault / no power available

6.4.3 <Reset> button

Press the <Reset> button to acknowledge faults. You will require a pointed object such as a ball-point pen. Pressing this button resets the processor and reconfigures all functions.

6.4.4 DGD service interface (RS232) for measuring board (MC)

NOTE

only for DGD service

- Connection to PC via special cable
- Plug connector type: PS2

Pin	Signal	Description
1	RxD	±10 V
2	TxD	±10 V
3	VCC	3.3 V ±2% / 20 mA
4, 5, 6	-	-
Housing	GND	0 V

6.4.5 DGD service interface (RS232) for servo

NOTE

only for DGD service

- Connection to PC via special cable
- Plug connector type: PS2

Pin	Signal	Description
1	RxD	±10 V
2	TxD	±10 V
3	VCC	3.3 V ±2% / 20 mA
4	AMON	Analog monitor, 0 V – 3.3 V
5	AIN	Analog preset, 0 V – 3.3 V
6	START	Start signal to servo, 0 V (start) / 3.3 V
Housing	GND	0 V

6.5 Internal assemblies

6.5.1 Power adapters

The internal power adapters supply power to all electronic assemblies in the tightening module.

- All generated voltages are short-circuit proof.
- Galvanic isolation of ARCNET output stage from all other power supplies.
- Pulse frequency of the converter is 80 kHz.

Supply	Generated voltage V	Maximum current A
Internal – servo section logic	3.3 (3.2 – 3.4)	0.5
Internal – servo section analog	5.0 (4.9 – 5.1)	0.5
Internal – servo section analog	15.0 (14.25 – 15.75)	0.12
Internal – measuring section logic	1.9 (1.78 – 2.02)	1
Internal – measuring section analog	2.5 (2.4 – 2.6)	1
Internal – measuring section analog	3.3 (3.2 – 3.4)	0.5
Internal – measuring section analog	12.0 (11.4 – 12.6)	0.5
Transducer	12.0 (11.8 – 12.2)	0.6
ARCNET output stage	5.0 (4.8 – 5.2)	0.2

6.5.2 Motor end stage

- Short-circuit proof: phase – phase, phase – PE, phase – temperature monitor.
- Minimum losses due to IGBT end stage.

Features		Data
Intermediate circuit voltage U_Z	VDC	380 ±10 %
Excess voltage shut-off	VDC	> 480
Low voltage shut-off	VDC	< 160
Rated output at 50 °C	VA	1000
Peak power, momentary	VA	8000
Peak current, maximum	A	65
Current-controlled shut-off, short circuit	A	100
Efficiency	%	approx. 98
Pulse frequency of the PWM	KHz	10

6.5.3 Measuring board

NOTE

The measuring board is a component of the tightening module and should not be replaced separately.

- Separate processors for measuring and communication tasks.
- A measuring channel for torque recording (2 tracks).
- Measuring software in FLASH memory.
  The software is updated by the nutsetter control unit mPro400GC-M via the ARCNET.
- Press the button under the service panel to reset, see 6.4.3 <Reset> button, page 24.
- Torque measuring accuracy 0.2 %.
- Resolution 12 bits at ±6.6 V, therefore approx. 6.5 mV.
- Measurement sampling rate, 3300 measurements per second.
- Analog filter for torque signals 1 KHz.
- Current redundancy possible by measuring the motor current transferred by the servo amplifier.
- Measuring the motor angle signals transferred by the servo amplifier via the synchronous serial interface (SSIO). These are generated from the resolver signals.

Communication between measuring board and servo amplifier

- A synchronous serial interface (SSIO) provides a means of communication between the servo amplifier and the measuring board.
- For safety reasons, the start signal is transferred from the measuring board to the servo amplifier both via a separate input/output and via the SSIO.

Communication between CPS3 and mPro400GC-M

- The two units communicate via the ARCNET high-performance field bus.
- The transfer rate is 2.5 MBd.

7 Attachment

7.1 Centric Attachment

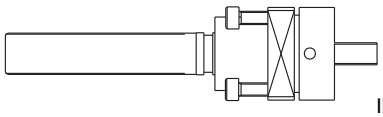
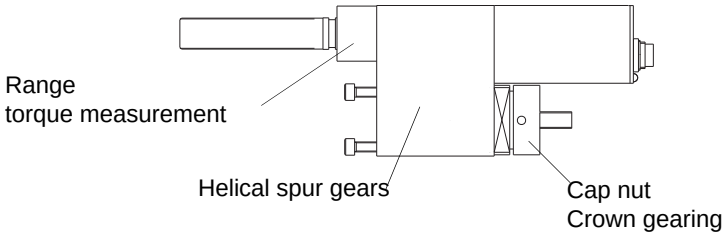


Illustration of 1ZB

Code	Part no.	Ratio i	Permissible load on output shaft			Lateral force at wrench head[1]		
			TQ Nm	Pressure [1] N	Tension [1] N	Extended N	25 mm Retracted N	50 mm Retracted N
1ZB	927222	1:1	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
4Z1250A	S976950	3.7368	1250	9000	8800	4300	4800	5400
4Z1600A	S976951	3.7368	1600					

1) During continuous operation for long periods, multiply the specified values by 0.3

7.2 Offset attachment

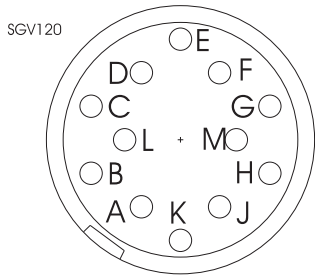


Code	Part no.	Torque Calibration	Ratio i	Permissible load on output shaft			Lateral force at wrench head[1]		
				TQ Nm	Pressure [1] N	Tension [1] N	Extended N	25 mm Retracted N	50 mm Retracted N
1VM1B	935865PT	35	1.0526	53	2300	2300	1510	1720	2000
1VM2B	935864PT	60							
1VM3B	935863PT	12							
2VM1B	934336PT	110	1.0714	110	2500	2500	2300	2600	3100
2VM3B	934335PT	200		200					
3VM2B	[2]	300	1.0769	260	3600	3600	2850	3250	3750
4VM2B	2)	500	1.0667	660	6300	2100	4300	4800	5400
4VM3B	2)	660							
4VM4B	2)	900	1.2857	900					

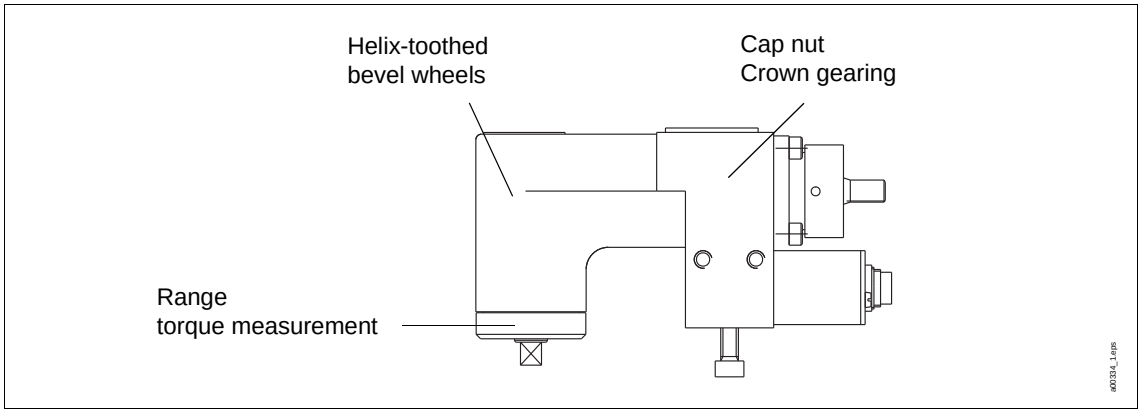
1) During continuous operation for long periods, multiply the specified values by 0.3
2) On request

7.2.1 Pin configuration of offset attachment

Type: 12-pin circular connector Lumberg SGR 120, Binder series 680 no. 09-0331-90-12
with locking connector in accordance with DIN 45 321

Pin	Color	Signal	Description	
A	–	–	nc	
B	Brown	–	nc	
C	green	TQ	Torque output	
D	Yellow	0 VA	0 V torque reference connection	
E	gray	0 V	0 V supply	
F	Pink	+12 V	Supply	
G	Blue	–	nc	
H	Red	RxD+	interface	
Y	Black	RxD-	interface	
K	Violet	CAL	Input calibration voltage	
L	Gray / pink	TxD-	interface	
M	Red / blue	TxD+	interface	
Housing		PE	Shield connection	

7.3 Angle head attachment

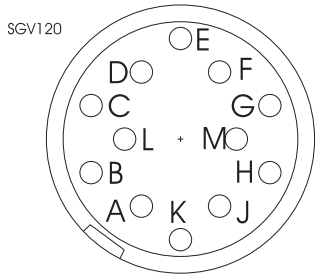


Code	Part no.	Torque Calibration	Ratio i	Permissible load on output shaft			Lateral force on square[1)]
				TQ Nm	Pressure [1)] N	Tension [1)] N	N
1WM1B	[2)]	35	1.0667	53	1700	3400	3100
1WM2B	2)	60					
1WM3B	2)	12					
2WM1B	2)	110	1.0625	110	1850	3900	4200
2WM3B	2)	200		200			
3WM2B	2)	300	1.0385	300	3800	4800	5100
4WM2B	2)	500	1.0370	660	1200	6500	5900
4WM3B	2)	660					

1) During continuous operation for long periods, multiply the specified values by 0.3
2) On request

7.3.1 Pin configuration angle head attachment

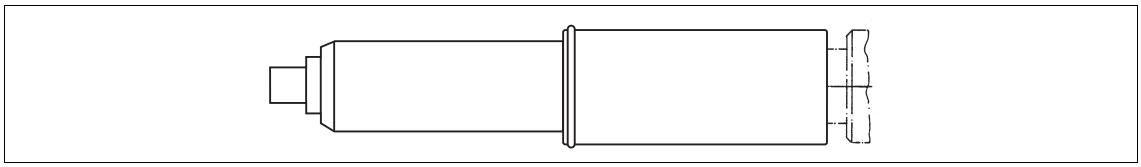
Type: 12-pin circular connector Lumberg SGR 120, Binder series 680 no. 09-0331-90-12
with locking connector in accordance with DIN 45 321

Pin	Color	Signal	Description	
A	–	–	nc	
B	Brown	–	nc	
C	green	TQ	Torque output	
D	Yellow	0 VA	0 V torque reference connection	
E	gray	0 V	0 V supply	
F	Pink	+12 V	Supply	
G	Blue	–	nc	
H	Red	RxD+	interface	
Y	Black	RxD-	interface	
K	Violet	CAL	Input calibration voltage	
L	Gray / pink	TxD-	interface	
M	Red / blue	TxD+	interface	
Housing		PE	Shield connection	

7.4 Spring collet – Optional

7.4.1 For centric / offset attachment

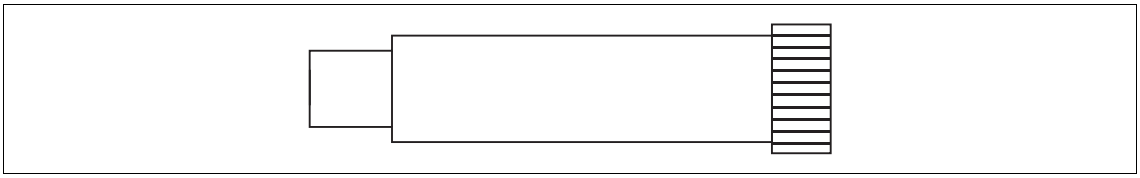
Size 1 – 4



For	Part no.		Permissible load on output shaft			Lateral force at wrench head[1]			Weight
			TQ Nm	Pressure [1] N	Tension [1] N	Extended N	25mm Retracted N	50 mm Retracted N	kg
1Z… / 1V…	922325	3/8"	53	2300	1500	1510	1720	2000	0.33
2Z… / 2V…	910609	1/2"	110	4500	3200	2300	2600	3100	0.45
	935553	3/4"	200						0,48
3Z… / 3V…	910613	3/4"	300	6500	5000	2850	3250	3750	0.67
4V…	912106	3/4"	500	9000	8800	4300	4800	5400	0.87
	912147	1"	750	9000	8800	4300	4800	5400	0.90
including flange housing									
1Z…	S308434	3/8"	53	2300	1500	1510	1720	2000	0.65
2Z…	S308435	1/2"	110	4500	3200	2300	2600	3100	1.05
3Z…	S308436	3/4"	300	6500	5000	2850	3250	3750	1.80

1) During continuous operation for long periods, multiply the specified values by 0.3

Size 4Z..

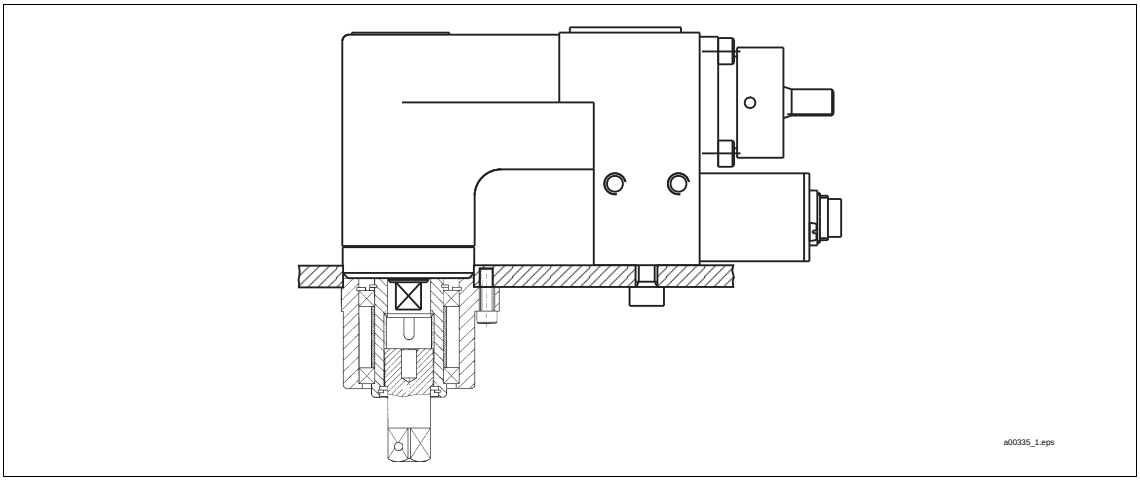


For	Part no.		Permissible load on output shaft			Lateral force at wrench head[1]			Weight
			TQ Nm	Pressure [1] N	Tension [1] N	Extended N	25mm Retracted N	50 mm Retracted N	kg
4Z..	916643	3/4"	460	9000	8800	4300	4800	5400	1.21
	916642	1"	630						1.24

1) During continuous operation for long periods, multiply the specified values by 0.3

7.4.2 For angle head including flange housing

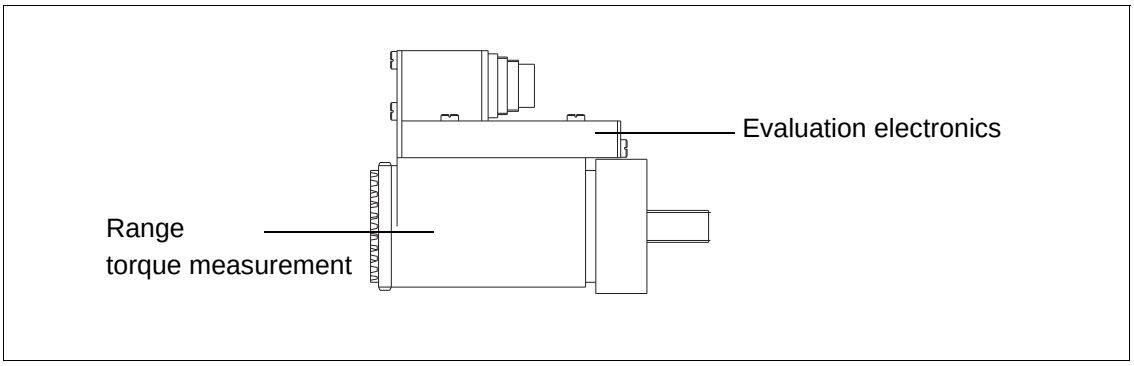
Stroke of spring: 25 mm



For	Part no.		Permissible load on output shaft			Lateral force at wrench head[1]	
			TQ Nm	Pressure [1] N	Tension [1] N	Extended N	25mm Retracted N
1W..	929041	3/8"	53	1700	6800	1800	2100
2W..	929053	1/2"	110	1850	6800	2500	3000
	929061	3/4"	200	3800	7800	3000	3450
3W..	929065	3/4"	300	3800	7800	3000	3450
4W..	929077	3/4"	500	12000	13000	4300	5050
	929089	1"	660				

1) During continuous operation for long periods, multiply the specified values by 0.3

8 Transducer



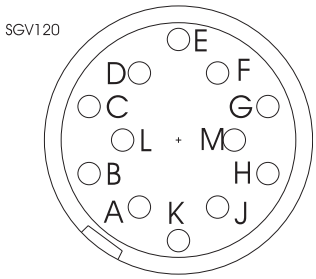
Size	Transducer …M…		
	Code	Part no.	Capacity / calibration value Nm
1	1M1B	934286PT	35
	1M2B	934287PT	60
	1M3B	934288PT	12
2	2M1B	934295PT	110
	2M3B	934294PT	200
3	3M2B	934303PT	300
4	4M1B	934318PT	400
	4M2B	934319PT	500
	4M3B	936496PT	660

8.1 Electrical Data

Torque measurement features		Data
Nominal supply voltage	V	+12
Supply voltage limits	V	+10.75...+12.5
Supply current	mA	80
Measured output voltage – nominal voltage	V	-5…+5
Measured output voltage limits U_N	V	±5.000 ±0.5 % + U_0
Permitted measuring range of rated torque	%	±10...±125
Zero voltage limit value U_0	mV	±100
Nonlinearity / Torque measurement	% of U_N	±0.25
Measuring accuracy	% of U_N	±0.5
Output current, maximum	mA	5
Internal resistance Ri, torque output	Ω	<10
Limit frequency of the torque measurement (-3dB)	KHz	2
Measured output voltage calibration ON U_K	V	U_N ±0.25%
Calibration voltage, input ON	V	> 3.5
Calibration voltage, input OFF	V	< 2.0
Calibration voltage, maximum	V	35
Calibration input impedance	KΩ	5

8.2 Pin configuration of transducer

Type: 12-pin circular connector Lumberg SGR 120, Binder series 680 no. 09-0331-90-12
with locking connector in accordance with DIN 45 321

Pin	Color	Signal	Description	
A	–	–	nc	
B	Brown	–	nc	
C	green	TQ	Torque output	
D	Yellow	0 VA	0 V torque reference connection	
E	gray	0 V	0 V supply	
F	Pink	+12 V	Supply	
G	Blue	–	nc	
H	Red	RxD+	Interface	
Y	Black	RxD-	Interface	
K	Violet	CAL	Input calibration voltage	
L	Gray / pink	TxD-	Interface	
M	Red / blue	TxD+	Interface	
Housing		PE	Shield connection	

9 Gearing

Size	Gearing …B…		
	Code	Part no.	Ratio
1	1B012A	927346	5.7273
	1B035A	927344	15.1364
	1B060A	927345	25.7727
2	2B110A	935548	12.3595
	2B200A	935549	21.9231
3	3B300A	935590	18.7500
4	4B360A	929541	26.3118
	4B500A	935780	33.4219
	4B660A	935781	48.9345

10 Motor

10.1 Technical data

Features		Data					
Code		1BT	1BUT	2BT	2BUT	3/4BT	3/4BUT
Part no.		935560	935563	935561	935564	935562	935565
Speed, maximum	RPM	11000		11000		8500	
Operating mode according to VDE 0530		S 1		S 1		S 1	
Enclosure type according to DIN 40050		IP54		IP54		IP54	
Sense of rotation		Reversible		Reversible		Reversible	
Design		B14		B14		B14	
Connection type		Plug connector		Plug connector		Plug connector	
Mass moment of inertia	$kgm^2 \times 10^{-3}$	0.017		0.06		0.25	
Rated torque	Nm	0.55		1.60		3	
Permanent torque, maximum at a stop	Nm	0.61		1.8		4	
Peak torque	Nm	2.8		10.5		18.3	
Speed change per torque	rpm / Ncm[1)]	12.2		1.9		0.34	
Mechanical time constants	ms	2.1		1.3		1.1	
Friction torque	Nm	0.03		0.07		0.15	
Rotor weight	kg	0.36		0.79		1.54	
Motor weight	kg	1.6		3.1		6.5	
Ball bearing	A/B side	6000/608		6200/6200		6202/6201	

10.2 Electrical Data

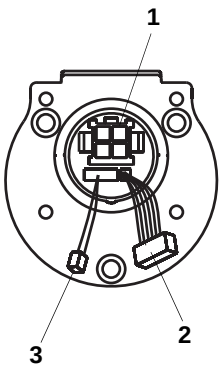
Features		Data		
		1B(U)T	2B(U)T	3/4B(U)T
Intermediate circuit voltage	V	380	380	380
Rated current [1]	A	2.1	6	8.7
Rated output	W	260	500	940
Number of phases		3	3	3
Terminating resistance [2]	Ohms	11	1.8	0.6
Inductance [2]	mH	6.5	3.1	2.4
Voltage constants[3]	mV/RPM	34	34	44
Torque constant [3]	Nm/A	0.28	0.28	0.36
Current at peak torque [1]	A	11	44	59
Max. peak current [1] [4]	A	20	54	73
Electrical time constants	ms	0.59	1.7	4

1) Sine peak value
2) Measured between two phases
3) -10 %
4) The values specified apply to operation within the temperature range of 0 - 40° C. They may not be exceeded, even for a short period of time, since this would lead to the risk of a magnetic weakening.

10.3 Thermal data

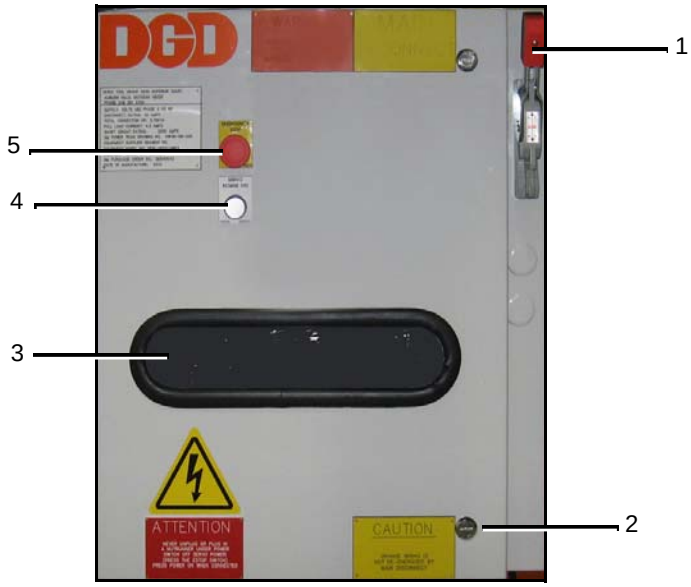
Features		Data		
		1B(U)T	2B(U)T	3/4B(U)T
Insulation class according to VDE 0530		F	F	F
Thermal time constants	min	17.5	25	35
Temperature rise without cooling	K/W	1.30	1.05	0.75

10.4 Pin configuration motor connector



Pin	Signal designation	Wire colors (in motor)	
		Motor type BT	Motor type BUT
Motor (1)			
4	PE	Green/yellow	
1	Phase S	green	green
2	Phase R	Black	Red
3	Phase T	red/black	
Resolver (2)			
1	Resolver R1	Red/white	
2	Resolver R2	Yellow/white	
3	Resolver S1	Red	
4	Resolver S3	Black	
5	Resolver S2	Yellow	Blue
6	Resolver S4	Blue	Yellow
Temperature sensor (3)			
1	0 V	Black	
2	Signal	Red	

11 Power distribution box PDB-CPS…



Item	Designation
1	Rotary switch
2	Seal
3	Supply module CPS3 (integrated)
4	"Ready" indicator
5	Emergency stop

77_power-distribution-box_front.png

11.1 Brief function description

Power distribution box PDB-CPS… supplies the tightening module TSE/TUSE with 380 VDC (CPS3) and 24 VDC.

The machine control unit transmits the signals *Control on* and *Emergency stop*. These switch the intermediate circuit voltage for the DGD-IS on and off.

The integrated emergency stop safety relay PNOZ X3P activates and monitors two relays. The relays activate the supply voltage.

11.2 General technical data

Features		Data		
		PDB-CPS3	PDB-CPS6	PDB-CPS9
Weight	lbs	125	140	155
Protection category		IP54		
Cooling type		Convection (self-cooling)		
Service life, operating	h	40.000		
Usability period if stored	h	100,000 (approx. 11 years)		
On/Off switching cycles		5.000.000		
Safety requirements in accordance with EN 964-1		Category 4		

11.3 Electrical Data

Features		Data		
		PDB-CPS3	PDB-CPS6	PDB-CPS9
Supply voltage	VAC	3 × 480 ±10%		
Frequency	Hz	50-60		
Rated current	A	3 x 4	3 x 8	3 x 12
Peak current, momentary	A	3 x 20	3 x 40	3 x 60
Rated output	VA	3000	6000	9000
Peak power, momentary	VA	30.000	60.000	90.000
Output voltage of intermediate power circuit	VDC	380 ±10%		
Nominal output current (380 VDC)	A	8	16	24
Output current, maximum (5 s)	A	80	160	240
Circuit breaker, 3-pin	A	32	32	50
Tripping characteristic		C	D	D
Control voltage / Output voltage	VDC	24 ±10%		
Output current, maximum (24 VDC)	A	5	10	20

11.3.1 Intermediate power circuit 380 VDC

The intermediate power circuit supplies the DGD-IS with 380 VDC.

- A safety isolating transformer converts the supply voltage to 3× 270 VAC, which is then supplied to the CPS3.
- The processor controls two integrated relays that limit the switch-on current. The main relay switches on after the system initializes. The intermediate circuit capacitors are charged via a resistor until the intermediate circuit voltage reaches approx. 380 VDC. The resistor is then bridged via a start-up relay.
- Energy is generated when the motor brakes, which causes the voltage to increase. The braking chopper with braking resistor integrated in the CPS3converts the excess energy into heat.
- When the circuit is switched off, the intermediate circuit capacitors is discharged via the braking resistor.

WARNING!

Unplugging the system cable while still live may generate an electric arc and cause serious burns. The contacts may become damaged.

➔ Switch off the power supply to the PDB-CPS… before unplugging or inserting the system cable!

11.4 Installation

➔ Secure the PDB-CPS… to the machine using 4 x M8 8.8 screws (Tq = 25 Nm).

11.4.1 Guidelines

The PDB-CPS… is ventilated by a natural convection system, an active fan is not required.

NOTE

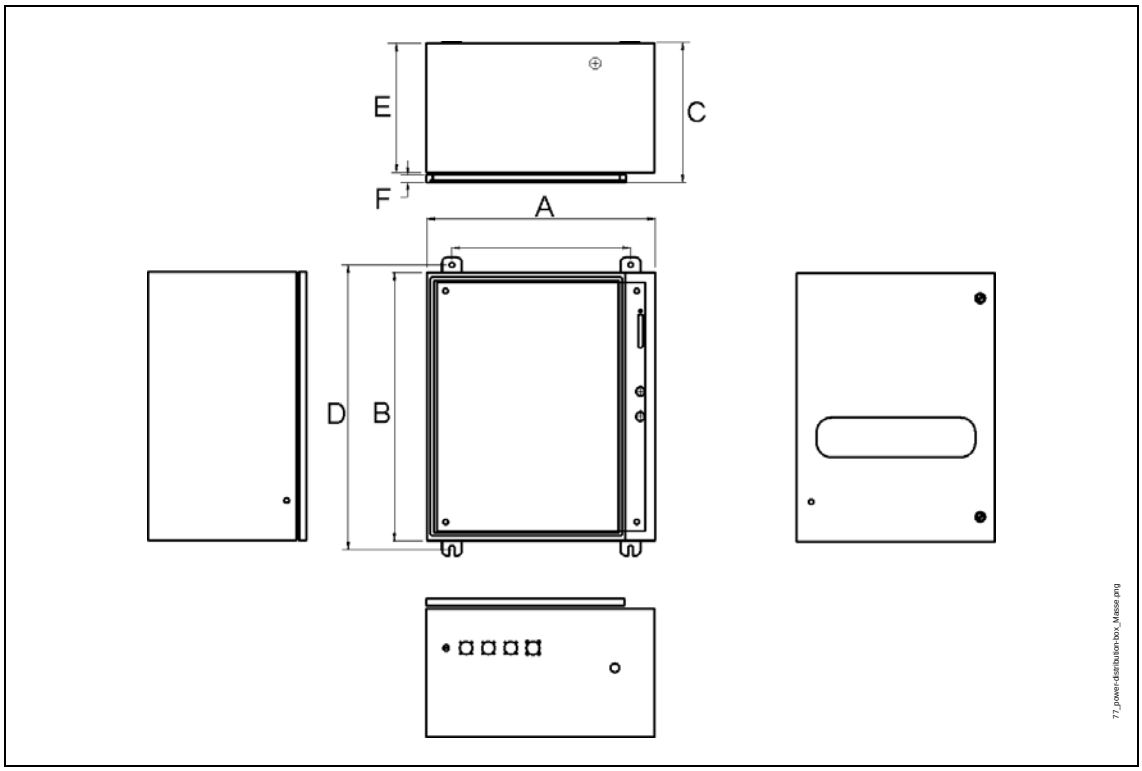
➔ Warm air must not enter below the housing.

➔ No objects are allowed to obstruct the air flow below and above the housing (see hatching in the graphic Dimensions / drilling pattern, page 39).

➔ The PDB-CPS… should not be exposed to direct sunlight.

Dimensions / drilling pattern

Power distribution box	A mm (")	B mm (")	C mm (")	D mm (")	E mm (")
PDB-CPS3	584 (23.00)	686 (27.00)	356 (14.00)	724 (28.50)	330 (13.00)
PDB-CPS6					
PDB-CPS9					



11.5 Supply module CPS3

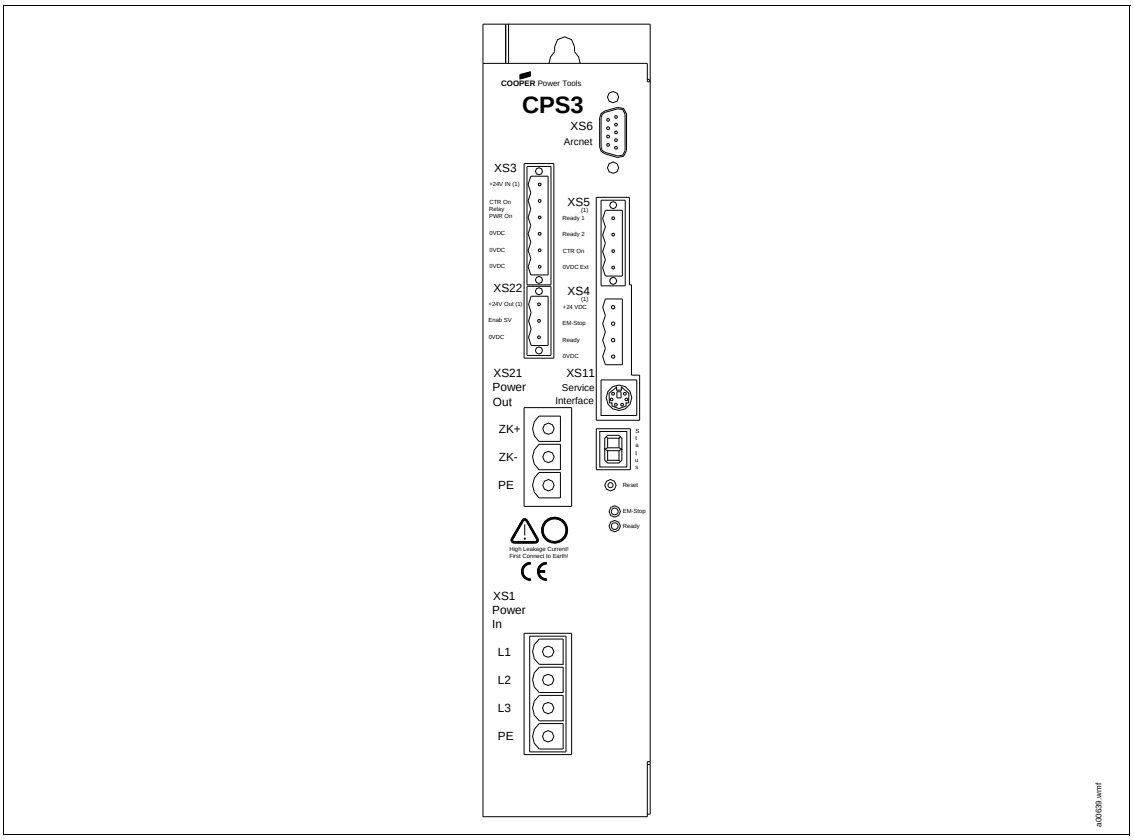
11.5.1 Description

The supply module CPS3 (Central Power Supply 3 KVA) is integrated in the power distribution box PDB-CPS:

- 1× in PDB-CPS3
- 2× in PDB-CPS6
- 3× in PDB-CPS9

The CPS3 has the following functions:

- Rectification and smoothing of the intermediate circuit voltage to 380 VDC for the tightening module TSE/TUSE
- Switch-on current limiting
- Braking chopper
- Excess and low-voltage monitoring with intermediate circuit shut-off
- Short circuit and overcurrent monitoring
- Generation of *Ready* signal on the mPro400GC-M and machine control
- Evaluation of signal *Emergency stop*



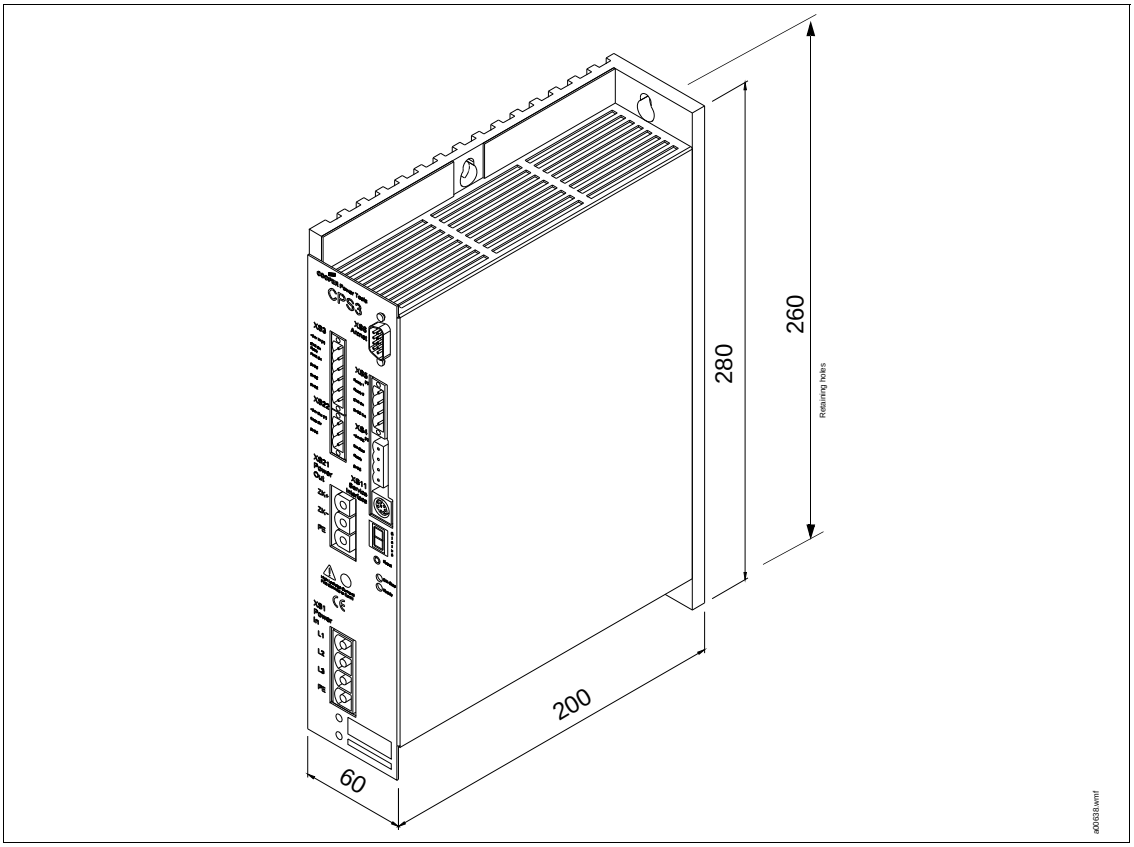
11.5.2 General technical dataCPS3

Features		Data
Order No.		961112
Weight	G	3650
Protection category		IP20
Cooling type		Convection (self-cooling)
Service life, operating	h	40.000
On/Off switching cycles		5.000.000
Usability period if stored	h	100,000 (approx. 11 years)

11.5.3 Electrical DataCPS3

Features		Data
Supply voltage power	VAC	3 × 270 ±10%
Frequency	Hz	50 – 60
Rated current	A	3 × 7
Peak current, momentary in RMS mode	A	3 × 25
Rated output	VA	3000
Peak power, momentary in RMS mode	VA	30.000
Output voltage of intermediate power circuit	VDC	380 ±10 %
Nominal output current (380 VDC)	A	8
Output current, maximum (5 s)	A	80
Control supply voltage	VDC	24 ±10 %
Input current (without external load)	A	0.5
Control voltage / Output voltage	VDC	24 ±10 %
Output current, maximum (24 VDC)	A	8

11.5.4 Size



11.5.5 Indicators

LED

Signal	LED	CPS3
Green	"Ready"	Ready for operation
Red	"EM stop"	*Emergency stop* or *Control on* signal unavailable. The intermediate power circuit (380 VDC) is deactivated.

7-segment "Status" display

Error indicators, see 14.3.3 7-segment "Status" display, page 58.

11.5.6 <Reset> button

Press the <Reset> button to acknowledge faults. You will require a pointed object such as a ball-point pen. Pressing this button resets the processor and reconfigures all functions.

11.5.7 Plug connectors and configuration

WARNING!

- Unplugging the system cable while still live may generate an electric arc and cause serious burns.
- The contacts may become damaged.

➔ Switch off the power supply to the PDB-CPS… before unplugging or inserting the system cable!

"XS1 Power in"

Required connector type:
Phoenix Power Combicon PC6/4-ST-10,16
Order No. 961175

Contact	Signal	Description
L1	L1	Supply voltage 3 × 270 VAC
L2	L2	
L3	L3	
PE	PE	Earth conductor, connection to housing

"XS21 Power out"

Power supply DGD-IS 380 VDC
Required connector type:
Phoenix Power Combicon IPC6/3-ST-10,16
Order No. 961188

Contact	Signal	Description
IC+	+380 VDC	Intermediate circuit voltage +380 VDC ±10%
IC-	0 VDC	Intermediate circuit voltage 0 V
PE	PE	Earth conductor, connection to housing

"XS22" TSE/TUSE

24 V supply and *Enable servo* signal (end stage release signal) to DGD-IS
Required connector type:
Phoenix Combicon MSTB2.5/3-STF-5.08
Part no. S959935

Contact	Signal	Description
24 V	+24 V Out	Supply TSE/TUSE, 24 V +10%, max. 4 A (8 DGD-IS)
Enab SV	Enable servo	Enable servo output; End stage release; Active when no errors or *Emergency stop* pending 24 VDC, max. 0.3 A
0VDC	0V	Supply TSE/TUSE, 0 V

"XS3" Logic supply and control-on relay output

24 V supply for the CPS3 and control on relay connection for the power supply
Required connector type:
Phoenix Combicon MSTB2.5/6-STF-5.08
Order No. 961177

Contact	Signal	Description
+24 V IN (1)	+24 V IN	Supply of the logic in the CPS3, 24 V +10%
CTR on relay	CTR on relay	Control-on output for external relay 24 VDC, max. 0.3 A
PWR on	PWR on	Power on output, 24 VDC, max. 0.3 A
0 VDC	0 VDC	0 V of 24 V
0 VDC	0 VDC	
0 VDC	0 VDC	

"XS4" mPro400GC-M

Emergency stop signal from the mPro400GC-M and *Ready* signal to the mPro400GC-M
Required connector type:
Phoenix Combicon IC2.5/4-STF-5.08,
Order No. 961178

Contact	Signal	Description
+24 VDC	+24 VDC	Supply output, 24 V, max. 2 A
EM stop	*Emergency Stop*	*Emergency stop* input from mPro400GC-M
Ready	*Ready for operation*	*Ready* output to the mPro400GC-M, 24 VDC, max. 0.3 A
0 VDC	0 VDC	0 V

»XS5« machine control

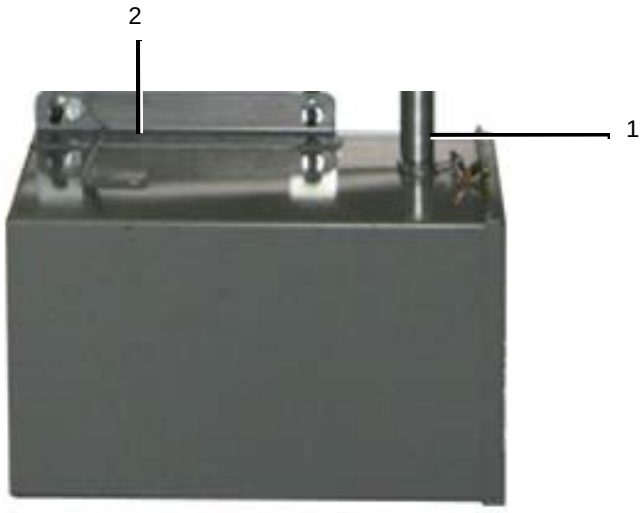
Emergency stop signal from the machine control and *Ready* signal to the machine control
Required connector type:
Phoenix Combicon MSTB2.5/4-STF-5.08,
Order No. 961179

Contact	Signal	Description
Ready 1	*Ready for operation* Relay contact 1	*Ready* output, relay contact 1, max. 26 V, max. 100 mA
Ready 2	*Ready for operation* Relay contact 2	*Ready* output, relay contact 2, max. 26 V, max. 100 mA
CTR on	*Control on*	*Control on* or *Emergency stop* input, 24 V, 10 mA
0 VDC Ext	0 VDC Ext	0 V from input

"XS6" ARCNET

The CPS3 is not equipped with ARCNET.

11.6 Transformer



Item	Designation
1	Connection to PDB-CPS…
2	Bracket for mounting on wall / machine

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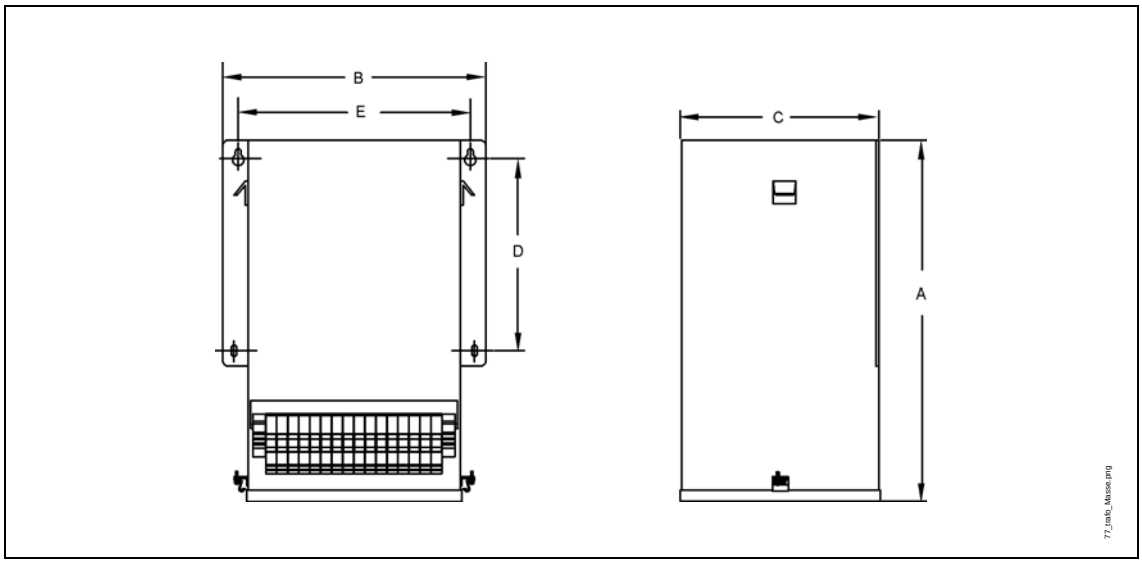
11.7 General technical data

Part no.	Power Nominal KVA	Weight lbs	Protection category	Type
CP3-3750-JH	3	125	IP54	Dry type, class AA, encapsulated NEMA 1
CP3-6750-JH	6	150		
CP3-9750-JH	9	200		

Dimensions / drilling pattern

Transformer	A mm (")	B mm (")	C mm (")	D mm (")	E mm (")
CP3-3750-JH3	387 (15.25)	314 (12.38)	229 (9.00)	286 (11.25))	454 (8.50))
CP3-6750-JH6					
CP3-9750-JH9	406 (16.00)	486 (19.12)	222 (8.75)	216 (8.50)	216 (17.88)



NOTE

➔ When installing, keep a distance of 25.4 mm from voltage-conducting components.

12 Cables

CAUTION!

There is a risk of tripping or falling over loose cables on the ground.

➔ Lay all connected cables safely.

NOTE!

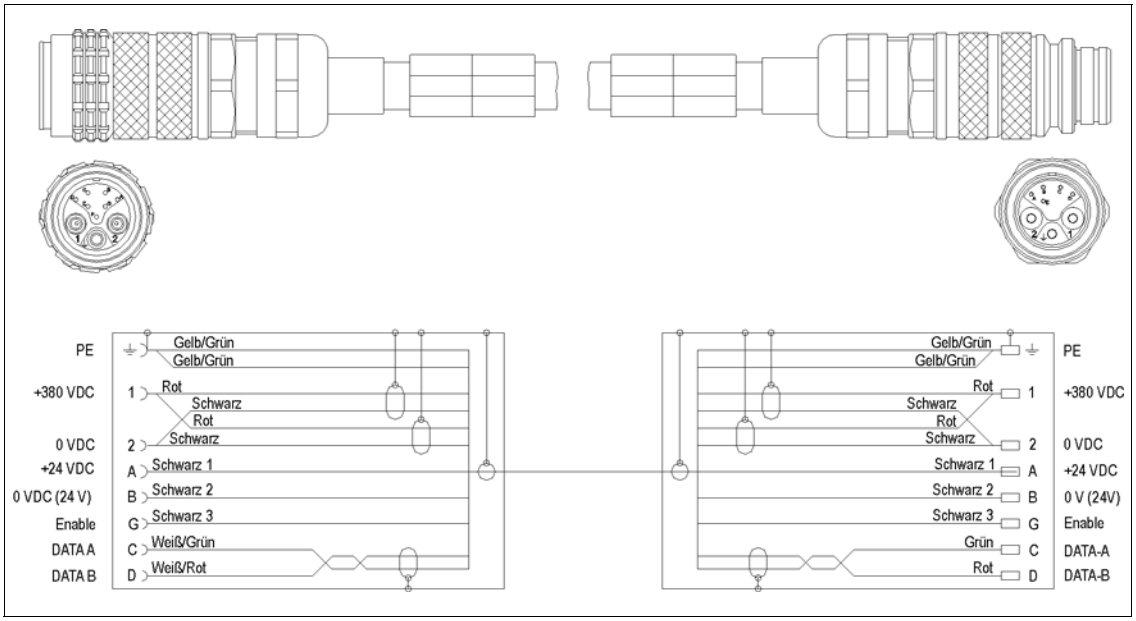
Remember that the maximum cable length is 50 m.
Close or lock all plug connectors.
The red ring around the outer diameter of plug connectors with a slide lock should not be visible.

12.1 High-Flex quality, suitable for flexible cable ducts

Thermal properties		
Ambient temperature	°C	-20…+80
Flammability		Flame-retardant and self-extinguishing in accordance with EN 50265-2-1, IEC 60332-1 and UL1581
Chemical properties of the coating		
Coating material		PUR, low-adhesion, resistant to hydrolysis and microbes, UV-resistant, abrasion-resistant, tear-resistant, cut-resistant, notch-resistant
Oil resistance		Oil-resistant in accordance with DIN VDE 0472, part 803 ASTM oil 1 to 3 and HD 505.2.1
Resistance to hydrolysis		In accordance with VDE 0283, part 10
Color		Orange RAL 2003 matt
Mechanical properties		
Diameter	mm	approx. 16
Bending radii: Single bends Multiple bends	mm	30 min. 95 mm min. flexing action 130 min alternate bending
Torsional length (±180 ° around separate central axis)	mm	500 min.
Max. acceleration	m/s²	100

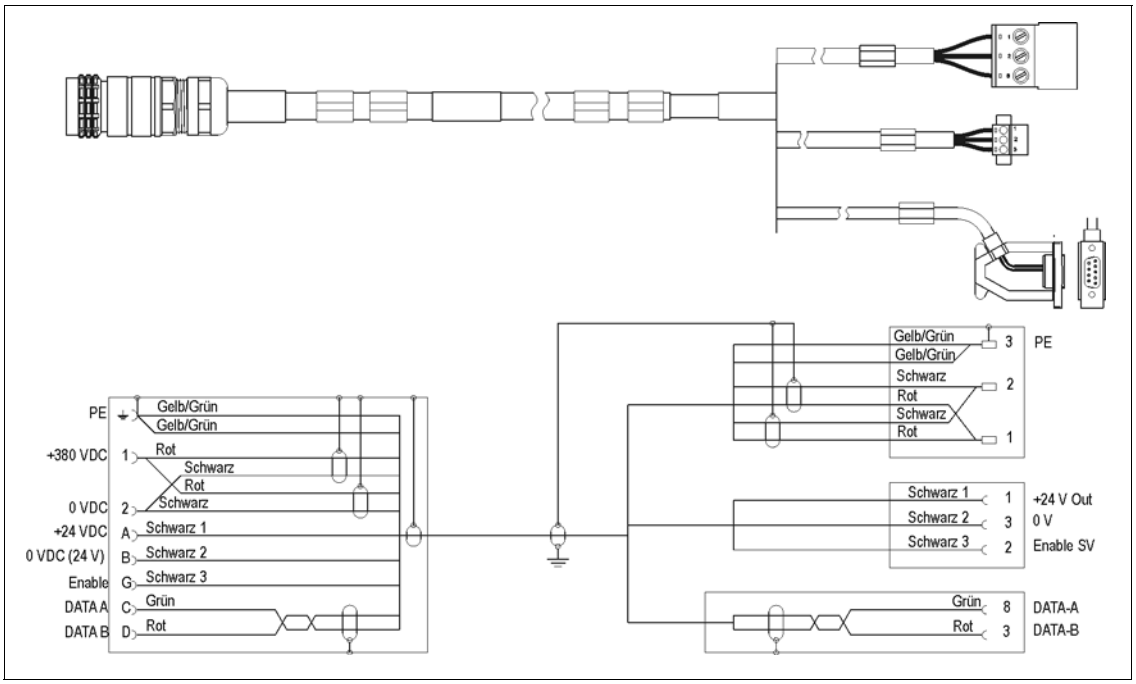
12.1.1 System cable, type A

Use	Extension: cable type C – DGD-IS
Order No.	961104-××× (…-××× = cable length in dm)



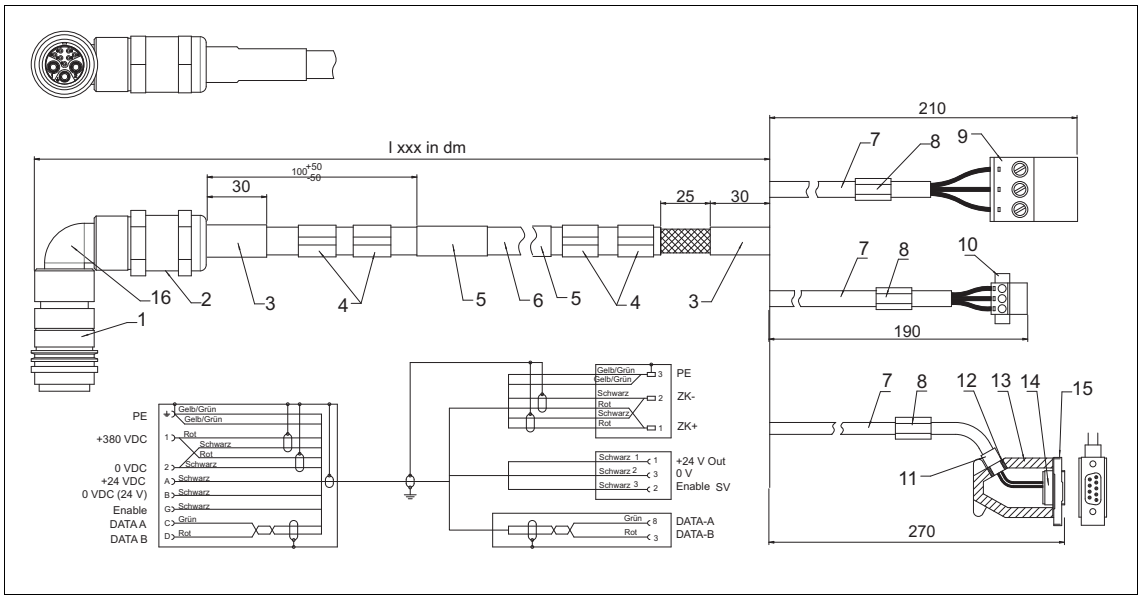
12.1.2 System cable, type C

Use	Connection: PDB-CPS… – DGD-IS / cable type A
Order No.	961109-××× (…-××× = cable length in dm)



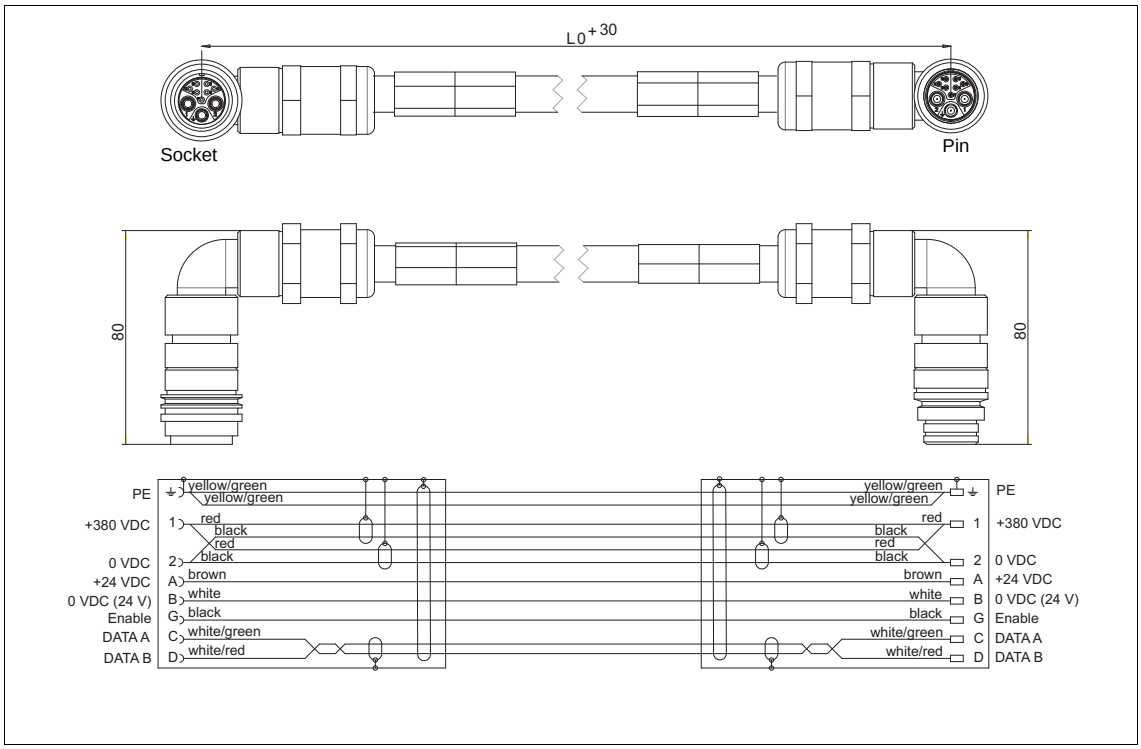
12.1.3 System cable, type I

Use	Connection: PDB-CPS… – DGD-IS
Order No.	961294-××× (…-××× = cable length in dm)



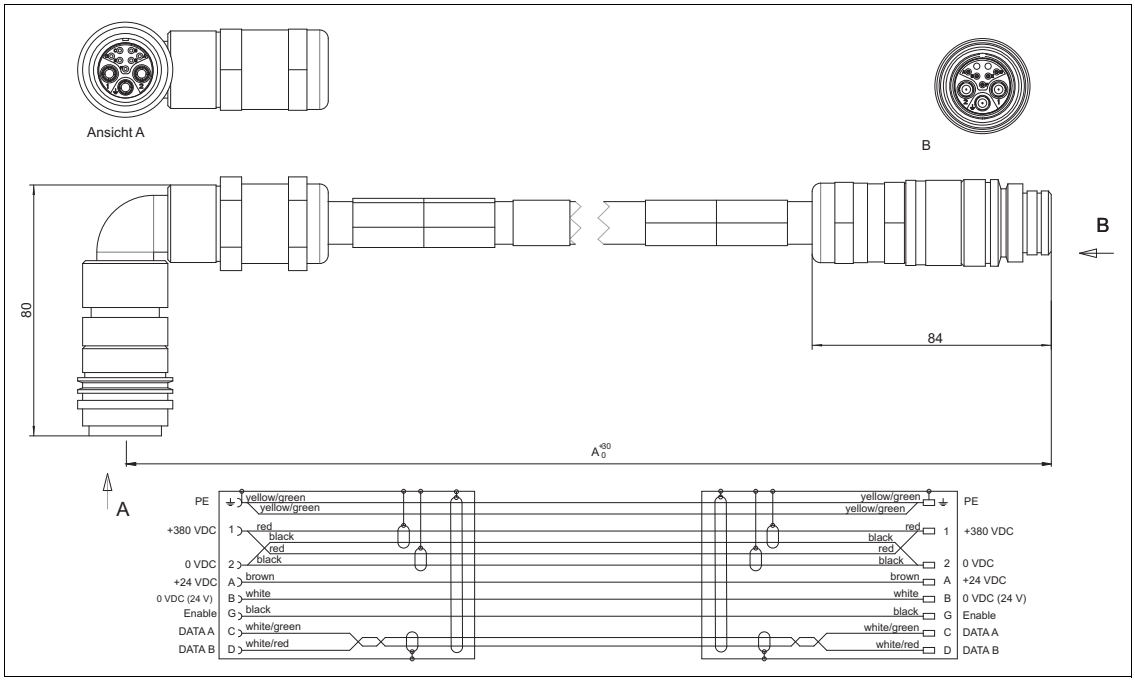
12.1.4 Jumper cable, type E

Use	DGD-IS – DGD-IS
Order No.	961299-××× (…-××× = cable length in dm)



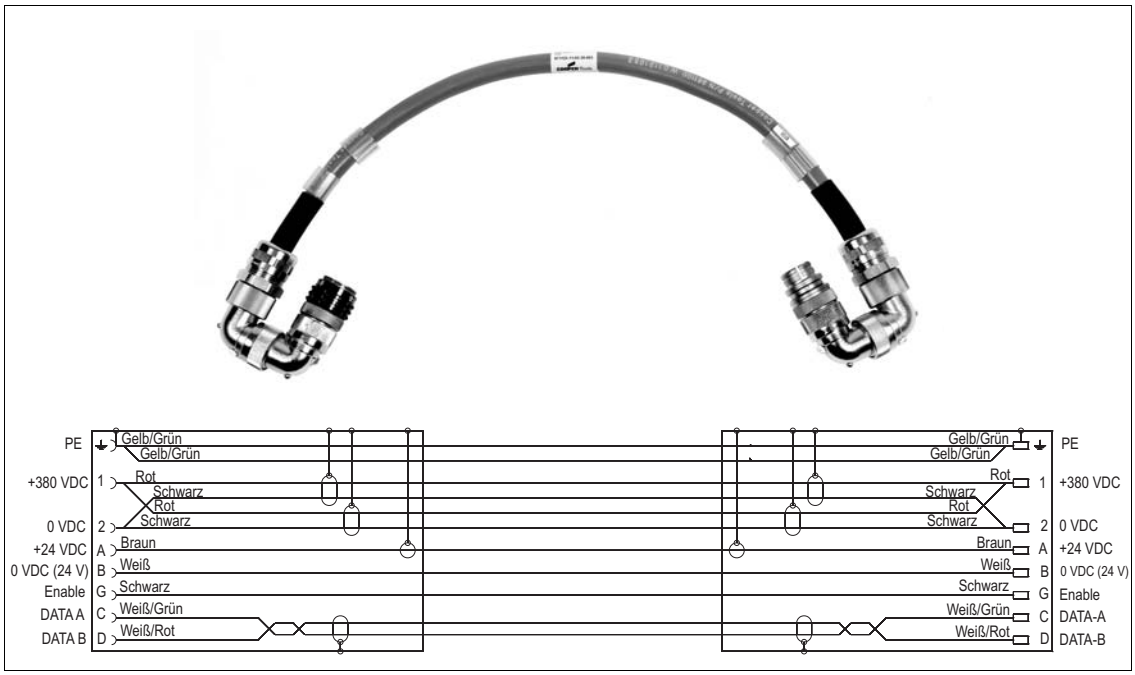
12.1.5 Jumper cable, type F

Use	DGD-IS – DGD-IS
Order No.	961295-××× (…-××× = cable length in dm)



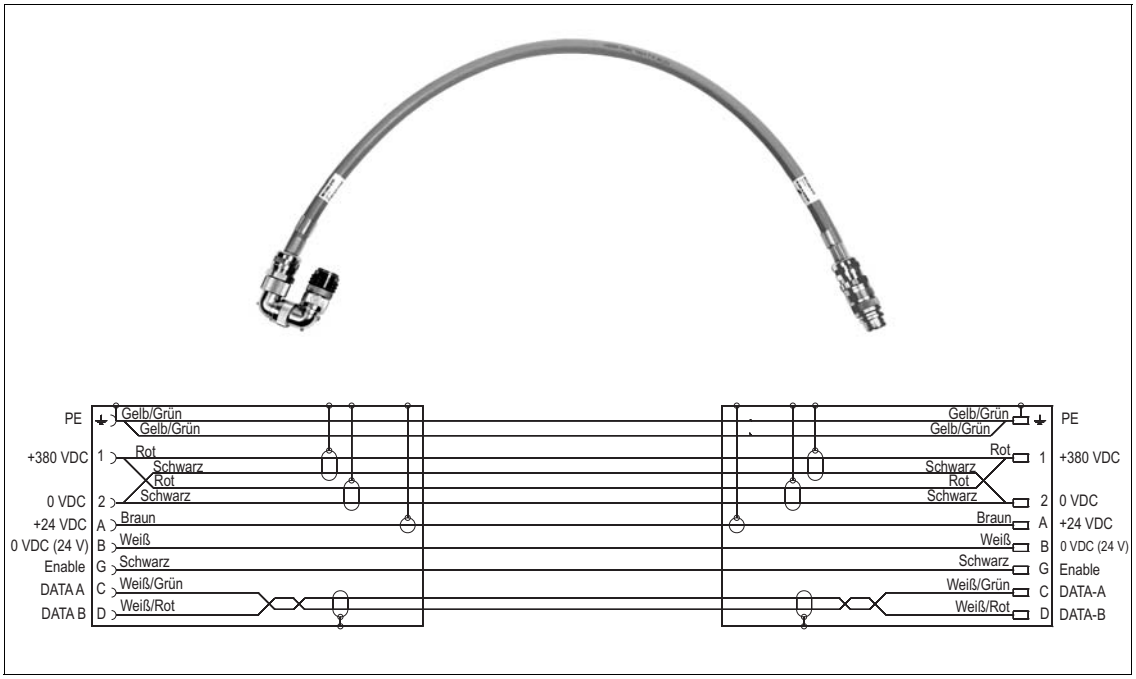
12.1.6 Jumper cable, type G

Use	DGD-IS – DGD-IS
Order No.	961298--××× (…-××× = cable length in dm)



12.1.7 Jumper cable, type H

Use	DGD-IS – DGD-IS
Order No.	961297--××× (…-××× = cable length in dm)



12.2 Instructions on laying cables

Preparation

- ➔ Unroll the cable from the cable drum at least 4 hours before installation.
- ➔ Do not kink the cable or allow loops to form when unrolling.
- ➔ When cutting the cable to length, remember that a strain relief clamp and compression set must be incorporated within the bending radius.

Strain relief clamp

- ➔ For moving cables: Position the strain relief clamp in front of the DGD-IS plug connector. The plug connector must not be subjected to alternating forces!
- ➔ Position the strain relief clamps so that the cables have maximum freedom of movement.
- ➔ Only secure cables with strain relief clamps designed for the corresponding cable diameter. Use screw-on cable clips if possible.
- ➔ Avoid crushing individual wires or subcomponents. We recommend applying a clamping force around the entire circumference of the cable.
- ➔ Only secure the cables at the strain relief clamp.
- ➔ A secure strain relief clamp prevents the cable from shifting inside the flexible cable duct.
- ➔ Position the cable sleeve about 100 mm above the clamp in the fixed area.
- ➔ Lay insulated wires in small loops in order to avoid a tensile load on the clamp.

We recommend running some motion cycles after the first installation of the cables. Then the cable layout should be checked again, and, if necessary, optimized.

Laying "High-Flex" cables in cable ducts

In order to achieve an optimal service life of cables in flexible cable ducts, comply with the following points when laying the cables.

- ➔ The cables should lay straight in the drag chain.
- ➔ Insert the cables into the cable ducts one by one.
- ➔ Separate the cables using cut-off bridges.
- ➔ Lay a maximum of 2 cables per partition.
- ➔ Never lay cables with different diameters (> 3 mm) together in the same partition.

13 Function description

13.1 Torque measurement

The transducer is equipped with a telemetry system and therefore has no slip rings.
The transducer is either installed in the DGD-IS as a component or integrated in an offset attachment or angle head attachment.
All components of the transducer (measuring shaft, antenna system, rotor electronics and stator electronics) belong together as one unit, i.e. individual assemblies cannot be replaced.
The rotor electronics are attached to the measuring shaft and are connected to the full strain gage bridge and the rotor antenna system.
The stator electronics are located in the transducer housing. They incorporate the evaluation circuit, the stator antenna system and the 12-pin system connector.
The torque is measured directly at the attachment. Exception: the angle of the angle head attachment is measured at the drive wheel. Torque measurement is made symmetrically for right and left-rotating torques (tightening and loosening direction). The measured torque values are transferred from the transducer to the measuring electronics via an amplified analog voltage (0...±5 V).

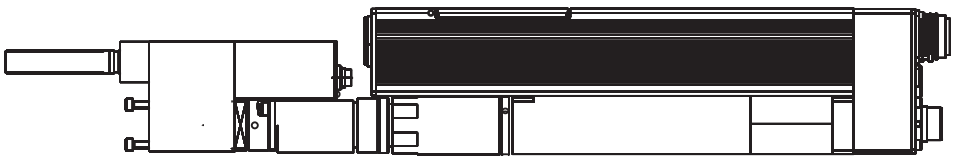
NOTE

Always use measuring devices that are galvanically isolated from the protective earth (PE) ground connection for measuring the torque signals directly on the transducer (i.e. oscilloscope with isolation transformer).
When measuring, ensure that both 0 V reference connections of the transducer (0 V-torque/Pin D and 0 V-supply/Pin E) cannot be short-circuited.
Ignoring this may result in failures or measuring errors from potential equalization currents (between PE, 0 V TQ and 0 V supply) in the torque measurement circuit.

Calibration takes places in the rotor unit by means of a switched shunt resistor parallel to a strain gage measuring bridge section. The calibration signal has the following time characteristics:

Input pulse duration (pin K)	Output signal delay (pin C)
0...1.5 ms	No output signal
1.5 ms...random	Max. rise delay < 3 ms Max. drop delay < 16 ms

Example of a DGD-IS standard



77_DGD-IS_BTSE.eps

Offset version	
1BTSE-1B012A-1VM3B	Order no. 947627A5
Speed	1824 RPM
Torque	max. 12 Nm
Kal Md	12 Nm, 5V DC
voltage	380 V DC

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14 Troubleshooting

The following displays will help you to troubleshoot

- Nutsetter control unit mPro400GC-M
- Supply module CPS3 (in PDB-CPS…)
- Tightening module TSE/TUSE (on DGD-IS) .

DANGER! High leakage current –
Fatal electric shock could occur!

➔ It is essential for the system cable or motor cable to be disconnected from the PDB-CPS… or DGD-IS before making throughput, resistance and short circuit measurements.

NOTE

- Always replace the CPS3 and the TSE/TUSE completely.
- Opening the CPS3 or TSE/TUSE will void the warranty. This does not include the service panel.
- Observe the conditions for operation, see 4 First Operation, page 11.

14.1 Acknowledgment of Errors

➔ Eliminate the malfunction and press the <Reset> button on the CPS3 or TSE/TUSE. The system is again operational.

- The measuring board acknowledges faults pending in the TSE/TUSE each time a spindle starts.
- If the failure is brief (i.e. undervoltage), the TSE/TUSE becomes ready to operate automatically after the next acknowledgment signal.
- All malfunctions in the DGD-IS (on in the CPS3) are archived in the mPro400GC-M. The error information is displayed here during troubleshooting.
- The error is permanent if the error mode cannot be acknowledged.

14.2 DGD-IS

Error Description	Possible causes	Measures and remedies
DGD-IS does not turn	Motor defective Gearing defective Tightening module TSE/TUSE defective	➔ Replace the DGD-IS
	Cable defective	➔ Replace the cable
Loud noises	Gearing wear	➔ Replace the DGD-IS

14.2.1 Transducer

When an operating failure occurs, the torque output is set to an output value of > 6.5 V and an error bit is set in the operating data memory.

Error Description	Possible causes	Measures and remedies
Output signal is not linear	Measuring hub was over-stretched	➔ Send the transducer to DGD for repair / recalibration
Offset voltage is too high	Measuring hub was over-stretched	
No output signal	Pre-amplifier is defective	
Torque output is set to an output value > 6.5 V Error bit is set in the operating data memory	**CPU NOK** • internal transmission to D/A converter fails	
	HF section NOK • HF telemetry transmission fails • no measuring shaft (rotor) present • rotor electronics defective • gap between rotor and stator antenna too large	
	Supply voltage • voltage under low supply voltage limit	

After an operation error, the transducer remains in the "operation error" state until one of the following events occurs:

- the operating voltage of the transducer is disconnected
- the transducer receives a calibration signal via the CAL input (pin K).
- the error bit in the operating memory is reset via the RS422 RS422 interface.

14.3 Tightening module CPS3 in power distribution box PDB-CPS…

14.3.1 "Ready" LED

Error Description	**Possible causes**	**Measures and remedies**
"Ready" LED does not light up	24 V supply is unavailable	➔ Check the 26 V voltage at "XS3" terminals 1 and 4
	PDB-CPS… is disconnected from the power supply	➔ Check the mains supply
	24 V power adapter is disconnected from the power supply	➔ Check the fuse
	Fuse in the CPS3 is high-resistance	➔ Check the 26 V voltage at "XS4" terminals 1 and 4 ➔ Switch off the PDB-CPS… and switch back on again after a minute. ➔ Replace the CPS3

14.3.2 "EM stop" LED (emergency stop)

Error Description	**Possible causes**	**Measures and remedies**
"EM stop" lights up CPS3 is in *Emergency stop* status.	Intermediate power circuit (380 VDC) is deactivated. No signals at the inputs Emergency stop "XS4", terminal 2 or Control on "XS5", terminals 3 and 4.	➔ Check voltage 24 V at CPS3: Plug connector "XS4" Terminals 2 and 4; Plug connector "XS5" Terminals 3 and 4 ➔ Check voltage 24 V at CP: Plug connector "XS3" Terminals 2 and 6; Plug connector "XS2" Terminals 5 and 6 Conclusion: the signals are not generated by external controls.

14.3.3 7-segment "Status" display

Encoded errors are displayed in a 7-segment display on the CPS3. The display alternates between the first and second digit at brief intervals:

Display	Duration	Pause
1st digit	0.5 s	0.2 s
2nd digit	0.5 s	1 s
1st digit	0.5 s	0.2 s etc.

A period (.) in the display means NO error.
If several errors occur, the error with the highest priority is displayed, i.e. with the lowest number.
No information about faults and malfunctions that are detected by the CPS3 is transmitted to the mPro400GC-M by ARCNET and displayed in the screen there.

Display	**Error** Description	**Possible causes**	**Measures and remedies**
0-0	**Error loading the intermediate circuit capacitors after switching on**	Short circuit in the intermediate circuit CPS3	→ Replace the CPS3
		• Cables	→ Check the cables for short circuiting between contacts 1 and 2 on the plug connectors and replace if necessary
		• TSE/TUSE	→ Replace the TSE/TUSE
		• Main relay (Q4 or Q5 in PM) does not switch	→ Check the main relay, replace if necessary
0-1	**Faulty supply 3 x 270 VAC**	Phases missing	→ Check phases → Check mains supply
		Safety relay PNOZ K2 in the power module has triggered an *emergency stop*	→ Check the *emergency stop* circuit → Read the operating instructions for the PNOZ type X3P
		Relay Q2 or Q3 has not switched	→ Check the relay, replace if necessary
		Supply voltage • is too high, U phase – phase > 300 VAC • too low, U phase – phase < 240 VAC	→ Check the supply voltage → Check mains supply
0-2	**Excess current or short circuit on braking chopper**	Braking current > 200 A: Short circuit in the braking resistor	→ Replace the CPS3
0-4	**Braking chopper overload**	Braking resistor is overloaded. The braking power is > 100 $W_{eff.}$	→ Reduce the number of mPro400GC-M
		Excessive number of DGD-IS.	DGD-IS is powered externally → Check the mechanics of the fastening station

Display	Error Description	Possible causes	Measures and remedies
1-1	**Excessive voltage between artificial neutral point of the power supply and PE or the center of the intermediate circuit (approx. 190 VDC) and PE** Voltage > 100 V	Short circuit between IC and PE:	➔ Check connection of intermediate circuit voltage +380 VDC and 0 VDC to PE
		• CPS3	➔ Check CPS3 – Replace
		• System cable	➔ Replace the system cable
		• TSE/TUSE	➔ Replace the TSE/TUSE
		• Motor	➔ Replace the motor or DGD-IS
1-2	**Excessive current or short circuit in the intermediate circuit** Current > 250 A		Check the system cable between the +380 VDC and 0 V wires for short circuiting
		• System cable short circuit	➔ Replace the cable
		• Short circuit TSE/TUSE	➔ Replace the TSE/TUSE
1-3	**Temperature of the cooling element is too high** Temperature of CPS3, cooling element is > 90 °C	Constant overload CPS3	Excessive number of DGD-IS. ➔ Reduce the number of PDB-CPS…
		Ambient temperature PDB-CPS… > 40 °C	➔ Improve the ambient conditions
		PDB-CPS… is exposed to other heat sources, i.e. sunlight	➔ Improve the ambient conditions, attach covers if necessary
		Heat dissipation from the PDB-CPS… is inadequate due to external conditions	➔ Ensure that air can circulate through the cooling fins
1-4	**I²t Error in intermediate circuit** The intermediate circuit is overloaded.	Excessive number of DGD-IS.	➔ Reduce the number of PDB-CPS…
1-6	**The intermediate circuit voltage is too high** Intermediate circuit voltage 480 VDC May also occur momentarily	Braking chopper is defective	➔ Replace the CPS3
		Excessive number of DGD-IS is causing the braking chopper to overload	➔ Reduce the number of PDB-CPS…
		Intermediate circuit capacitors no longer have sufficient capacity	Life span exceeded ➔ Replace CPS3
1-7	**Intermediate circuit voltage is too low** Intermediate circuit voltage <250 VDC	Mains supply is not powerful enough	Check the mains supply ➔ More powerful mains supply required
		Relay to the switch-on current limiter is defective and permanently open	➔ Replace the CPS3
		Excessive number of DGD-IS. The voltage drops during fastening	➔ Reduce the number of PDB-CPS…

Display	Error Description	Possible causes	Measures and remedies
2-0	**Temperature in CPS3 is too high or too low** Temperature is outside of the -40 °C to +85 °C range	Excessive number of DGD-IS. Constant overload of the CPS3	➔ Reduce the number of PDB-CPS…
		Ambient temperature PDB-CPS… > 40 °C	➔ Improve the ambient conditions
		PDB-CPS… is exposed to other heat sources, i.e. sunlight	➔ Improve the ambient conditions, attach covers if necessary
		Heat dissipation from the PDB-CPS… is inadequate due to external conditions	➔ Ensure that air can circulate through the cooling fins
		Housing openings on the CPS3 are covered	➔ Clear the housing openings
2-1	**Switch-on relay contact does not open** Relay for switch-on current limitation in the CPS3 is stuck. Detection only occurs when switching on. The relay contact is closed during operation	Subsequent error – a different fault destroyed the relay	➔ Replace the CPS3
		Maximum number of switch-on cycles exceeded	➔ Replace the CPS3
2-2	**Intermediate circuit (380 VDC) discharge not possible** The intermediate circuit cannot be discharged	Subsequent error, a different fault destroyed the relay	
		Main relay Q4 or Q5 in PM does not open	➔ Replace the main relay Q4 or Q5
		Braking chopper in the CPS3 is defective	➔ Replace the CPS3
		Braking resistor is highly resistive or burnt through	➔ Replace the CPS3
2-3	**24V supply** 24 V supply is not within the range 21.5 V - 27.3 V		➔ Measure the voltage at "XS3", terminals 1 and 6
		24 V power adapter in PDB-CPS… is defective	➔ Replace the power adapter
		Power adapter T2 in PDB-CPS… is overloaded	➔ Check the maximum load (8 A) on the CPS3
		Voltage on power adapter in PDB-CPS… is incorrect	➔ Set the voltage on the power adapter to 26.0 V
		Fuse (thermal) 24 V in the CPS3 is highly resistive	➔ Switch off the PDB-CPS… and switch back on again after a minute. ➔ Check the maximum load – replace the CPS3

Display	Error Description	Possible causes	Measures and remedies
2-5	**5 V supply (internal)** Internal 5 V supply is not within the 4.5 V – 5.5 V range	Internal voltage, external check not possible	
		Power adapter in the CPS3 is defective	➔ Replace the CPS3
		Power adapter in the CPS3 is overloaded	➔ Replace the CPS3
2-7	**Error in 15 V driver supply for the braking chopper**	The internal 15 V supply is <12.5 V	Internal voltage can not be checked externally
		Power adapter in the CPS3 is defective	➔ Replace the CPS3
		Power adapter in the CPS3 is overloaded	➔ Replace the CPS3
3-3	**Initialization or program error**	Internal program error, no external actions possible	
		Error during program initialization	➔ Inform DGD service ➔ Switch the PDB-CPS… off and on again
		Communication error with a service PC	➔ Reconnect PC to CPS3
		Checksum error	➔ Inform DGD service ➔ Switch the PDB-CPS… off and on again

14.4 Tightening module TSE/TUSE

14.4.1 "Ready" LED

Error Description	**Possible causes**	**Measures and remedies**
"Ready" LED lights up red	Error in the TSE/TUSE	For fault description on the mPro400GC-M display, see 14.5Nutsetter control unit mPro400GC-M
"Ready" LED does not light up	24 V supply is unavailable, the TSE/TUSE is not connected to the power supply	➔ Measure the voltage 24 – 26 V at "XS1B", sockets A and B ➔ Check the error display for the PDB-CPS… on the CPS3. ➔ If error present, go to 14.3 Tightening module CPS3 in power distribution box PDB-CPS…, page 57 ➔ Replace the system cable
	TSE/TUSE is defective	➔ Replace the TSE/TUSE

14.5 Nutsetter control unit mPro400GC-M

14.5.1 Display on the Control Unit

All faults and malfunctions that the TSE/TUSE fastening electronics detect are transmitted to the mPro400GC-M via ARCNET and then displayed on the screen.

If a malfunction develops in the TSE/TUSE or DGD-IS during tightening, the faults reported by the TSE/TUSE in the rundown data table will appear:
IP, FLT, FMK, FHW, KAL1, KAL2, OFF1, OFF2, VAP, VLP, AN1F, AN2F.

In the bus map window system (see Programming Manual mPro400GC), all current errors are displayed in plain text in the system information and listed in the following table.

Error Description	**Possible causes**	**Measures and remedies**
Servo: **IP monitoring: NOK** (also displayed in the rundown data table) Overload If a current higher than the maximum permissible current is required for fastening, the servo amplifier switches off automatically.	Error in motor position tracing, i.e. resolver cable	Check the resolver wires in the nutsetter cable ➔ Replace the nutsetter cable and check the resolver wires in the nutsetter cable for breaks ➔ Replace the DGD-IS or motor
	Error in the motor circuit, i.e. motor does not attain the required torque	➔ Check motor for short circuit to PE and phase resistances: 1BT… approx. 11 Ω, 2BT approx. 2 Ω, 3/4BT… approx. 0.6 W. ➔ Replace motor
	Incorrect programming	➔ Check programming in mPro400GC-M – Spindle constants – Calibration values – Fastening process (sequence) – Parameter set – Targets
Servo: **Intermediate circuit voltage: too high** The voltage in the intermediate power circuit is > 440 VDC	Constant error	See CPS3 troubleshooting – no error on CPS3 ➔ Replace the TSE/TUSE
	The error is triggered during braking, i. e. when the DGD-IS stops	See CPS3 troubleshooting – no error on CPS3 ➔ Replace the TSE/TUSE
	Sporadically, the voltage is temporarily too high	See CPS3 troubleshooting – no error on CPS3 ➔ Replace the TSE/TUSE
Servo: **Intermediate circuit voltage: too low** The voltage in the intermediate power circuit is < 190 VDC	Constant error	See CPS3 troubleshooting – no error on CPS3 ➔ Check the system cable for interruptions ➔ Replace the system cable System cable OK ➔ Replace the TSE/TUSE
	During fastening, error is triggered during the fastening process	See CPS3 troubleshooting – no error on CPS3 ➔ Replace the TSE/TUSE
	Sporadically, the voltage is temporarily too low	See CPS3 troubleshooting – no error on CPS3 ➔ Check the mains power supply for voltage drops

Error Description	**Possible causes**	**Measures and remedies**
Servo: **Temperature output section: too high** The temperature in the TSE/TUSE output section is > 80 °C	The temperature sensor in the TSE/TUSE measures a temperature > 80 °C	Check temperature if > 80 °C ➔ ensure adequate ventilation of the DGD-IS DGD-IS is ventilated sufficiently ➔ Replace the TSE/TUSE
Servo: **Driver supply output section: NOK** The power adapter for the internal supply to the output section is overloaded or defective.	Internal error	➔ Replace the TSE/TUSE
Servo: **Offset of current measurement: NOK** The zero point of the integrated motor current measurement has moved	Internal error	➔ Replace the TSE/TUSE
Servo: **SSIO communication: NOK** The communication interface between the servo amplifier and the measuring board is faulty	Internal error	➔ Replace the TSE/TUSE
Servo: **Node guarding: NOK** The servo amplifier monitors the function of the measuring board (watchdog).	Sporadic malfunction of the measuring board Internal error	➔ Replace the TSE/TUSE
Servo: **Flash: NOK** The flash memory in the servo amplifier indicates an error	Internal error	➔ Replace the TSE/TUSE
Servo: **Program: NOK** Error in the program execution for the servo amplifier	Internal error	➔ Replace the TSE/TUSE ➔ Inform CPT Service
Motor: **Motor cable: NOK** Motor wire in DGD-IS is interrupted	Cable break in TSE/TUSE motor wires	➔ Check the motor wires for breaks and short circuits
	Motor phases interrupted	➔ Check motor for short circuit to ground and phase resistances: 1BT… approx. 11 Ω, 2BT approx. 2 Ω, 3/4BT… approx. 0.6 W. ➔ Replace motor
	Test current for cable monitoring is misdirected	➔ Replace motor Internal error ➔ Replace the TSE/TUSE

Error Description	**Possible causes**	**Measures and remedies**
Motor: **Short circuit surveillance: NOK** Motor short circuit monitoring There is a short circuit in the motor circuit on the DGD-IS	in the motor	Check the motor for short circuits (for phase impedances, see above) ➔ Replace motor
	In the TSE/TUSE	Internal error ➔ Replace the TSE/TUSE
Motor: **Temperature: NOK** The motor temperature is > 90 °C	The temperature sensor in the motor measures a temperature > 90 °C	Check the motor temperature, if > 90 °C ➔ ensure adequate ventilation of the motor
	Measuring cable in the motor is interrupted	Check the thermosensor for breaks. The resistance should be approx. 1 KΩ at 20 °C ➔ Replace motor
	Measuring current is misdirected	Check the wires in the DGD-IS for breaks and short circuits ➔ Replace motor
	Measuring current is not measured	Internal error, ➔ Replace the TSE/TUSE
	Motor is not connected	➔ Connect the motor
Motor: **I^2t monitoring: NOK** The I^2t monitor has measured excessive power on the DGD-IS	Motor power required is too high	Check the motor temperature, if > 80 °C ➔ Shorten the fastening time by increasing the speed
	DGD-IS is defective (i.e. gearing, bearings)	Check the ease of movement of the gearing and motor on the DGD-IS ➔ Replace the DGD-IS or motor
Motor: **Resolver: NOK** No resolver signals measured	Signals are not present	Check whether the motor is connected ➔ Connect the motor
	Signal interruption	Check the resolver wires in the DGD-IS ➔ Replace motor
	Short circuit of signals	Check the resolver wires in the DGD-IS for short circuits ➔ Replace motor
	Supply to the resolver is defective	Internal defect ➔ Replace the TSE/TUSE
Measurement card: **Task monitoring: NOK** Error at the program execution end of the measuring board	Internal error	➔ Replace the TSE/TUSE ➔ Inform DGD service
Measurement card: **RAM:** Insufficient RAM available in the measuring board	Internal error	➔ Replace the TSE/TUSE ➔ Inform DGD service

Error Description	**Possible causes**	**Measures and remedies**
Measurement card: **Sampling clock from servo: NOK** The system clock from the servo amplifier is missing	Internal error	➔ Replace the TSE/TUSE
Measurement card: **Servo type correct: NOK** The selected servo amplifier type is incorrect	Error in programming	➔ Check the system programming
	Self-identification of transducer is not OK	Check the transducer ➔ Replace the transducer
	Internal error	➔ Replace the TSE/TUSE
Measurement card: **Servo par. matching servo: NOK** The parameter set selected from the measuring board is not present in the TSE/TUSE.	Error in programming	➔ Check the system programming
	Self-identification of transducer is not OK	Check the transducer ➔ Replace the transducer
	Internal error	➔ Replace the TSE/TUSE
Measurement card: **ARCNET communication: Dup-ID** The same ARCNET addresses are preset	Several TSE/TUSE are preset to the same ARCNET address	Check the preset ARCNET addresses ➔ Set different addresses
Measurement card: **ARCNET communication: Recon** The ARCNET is temporarily disrupted	ARCNET terminator missing	➔ Plug in the ARCNET terminator
	No power supply to the ARCNET terminator	➔ Switch on the power supply for the last device
	Error in cabling	➔ Plug in all cables and lock
	Error in potential equalization	➔ Connect potential equalization cable
	Internal error	➔ Replace the TSE/TUSE
Measurement card: **Initialization: NOK** Initialization error in measuring board	Internal error	➔ Replace the TSE/TUSE ➔ Inform DGD service
Measurement card: **Flash image: NOK** Flash image in the measuring board is not OK	The incorrect program has been transmitted by mPro400GC-M	➔ Check the program version
	The program transfer was interrupted	➔ Repeat the program transfer
	Internal error	➔ Replace the TSE/TUSE
Measurement card: **Voltage +3.3 V (…): NOK** The +3.3 V supply to the measuring board is outside the limits of +3.24 V... +3.53 V	The power adapter for the internal supply to the measuring board is overloaded or defective. Internal error	➔ Replace the TSE/TUSE

Error Description	**Possible causes**	**Measures and remedies**
Measurement card: **Voltage +12 V (…): NOK** The +12 V supply to the measuring board and the transducer is outside the limits of +11.4 V... +12.6 V	+12 V short circuiting in the KMAG/KMAW or DGD-IS	Check the mPro400GC-M in the *Diagnosis>Voltages* menu. If values are outside permissible limits, check the KMAG/KMAW cables (transducer – TSE/TUSE), especially the +12 V and 0 V wires. ➔ Replace the cable ➔ Replace the transducer or DGD-IS
	Internal power adapter defective	➔ Replace the TSE/TUSE
Measurement card: **Voltage +24 V (…): NOK** The +24 V supply of the TSE/TUSE is outside the limits of +20.4 V…+27.6 V	Supply is overloaded	Check the mPro400GC-M in the *Diagnosis>Voltages* menu. If values are outside permissible limits ➔ Check the load
	Voltage on power adapter in PDB-CPS… is incorrect	➔ Set the power adapter to 26.0 V
Measurement card: **Temperature (…): NOK** The temperature on the measuring board is > 80 °C	The temperature sensor in the TSE/TUSE measures a temperature > 80 °C	➔ ensure adequate ventilation of the DGD-IS
	Internal error	DGD-IS is ventilated sufficiently ➔ Replace the DGD-IS
Transducer: **…Connected: NOK** The signals from the transducer are not OK	The connection to the transducer is – interrupted	Check the KMAG/KMAW cable (transducer – TSE/TUSE) for breaks ➔ Replace the cable ➔ Replace the transducer
	– short-circuited	Check the KMAG/KMAW cable for short circuits ➔ Replace the cable ➔ Replace the transducer
	– unavailable	➔ Connect the transducer ➔ Replace the cable
	Internal error	➔ Replace the TSE/TUSE
Transducer: **Calibration voltage: NOK** The calibration voltage is outside the permissible range of +4.85 V...+5.15 V	The calibration signal is interrupted	➔ Check the KMAG/KMAW cable for breaks, especially the calibration signal wire
	The calibration signal is short circuiting with another signal	Check the KMAG/KMAW cable (transducer – TSE/TUSE) for short circuits ➔ Replace the cable
	Error in the transducer	➔ Replace the transducer
	Internal error	➔ Replace the TSE/TUSE

Error Description	**Possible causes**	**Measures and remedies**
Transducer: **Offset value: NOK** The zero-point voltage is outside the permissible range of -200 mV...+200 mV	The torque signal is interrupted	Check the mPro400GC-M in test mode *Diagnosis>Voltages*. If values are outside permissible limits: Check the KMAG/KMAW cable (transducer – TSE/TUSE) for breaks ➔ Replace the cable
	The torque signal is short circuiting with another signal	Check the KMAG/KMAW cable (transducer – TSE/TUSE) for short circuits ➔ Replace the cable
	Error in the transducer	➔ Replace the transducer
	Internal error	➔ Replace the TSE/TUSE
Transducer: **CRC of service memory: NOK** Could not read in the data for self-identification correctly	The data cables are – interrupted	Check the KMAG/KMAW cable (transducer – TSE/TUSE) for breaks, especially the signal wires for data transfer (RS422) ➔ Replace the cable
	– short circuiting with another signal	Check the KMAG/KMAW cable (transducer – TSE/TUSE) for short circuits ➔ Replace the cable
	Error in the transducer	➔ Replace the transducer
	Communication was disrupted when the transducer was plugged in	➔ Unplug and plug in again
Transducer: **Tool identification: NOK** The data for self-identification of the transducer are not verified by the mPro400GC-M	Data communication failed	Copy data to mPro400GC-M, see Programming Manual mPro400GC ➔ Acknowledge the TSE/TUSE with <Reset>
	Data communication not completed yet	Copy data to mPro400GC-M, see Programming Manual mPro400GC ➔ Acknowledge the TSE/TUSE with <Reset>

15 Maintenance / Service

Only trained personnel are permitted to perform maintenance. Please refer to the Service Manual DGD-IS.

DANGER!

High leakage current –
Fatal electric shock could occur!

- ➔ Always disconnect the power supply before performing maintenance work on the DGD-IS and the mPro400GC-M.
- ➔ Always disconnect the system cable, motor or motor cable from the mPro400GC-M or DGD-IS before making throughput, resistance and short circuit measurements.
- ➔ Do not attempt to repair possible faults on the fastening system by yourself if you do not have the required knowledge! Please consult your local service agent or the responsible Sales & Service Center (see backside).
- ➔ Establish a grounding connection (PE) to the nutsetter control unit mPro400GC-M before taking into operation!

WARNING!

High temperature –
the motor on the DGD-IS may heat up and cause burns during removal.
(max. engine temperature 90 °C). Wear gloves.

Regular maintenance reduces operating faults, repair costs and downtime. Implement a safety-related maintenance program that takes the local regulations for repair and maintenance for all operating phases of the tool into account.

16 Disposal

CAUTION!

Injuries and environmental damage from improper disposal.
Components of the DGD-IS pose risks to the health and the environment.

- ➔ The DGD-IS contains components that can be reused as well as components that require special disposal. Separate the components and dispose of them by segregating them clearly.
- ➔ Catch auxiliary materials (oils, greases) when drained and dispose of them properly.
- ➔ Separate the components of the packing 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):

- ➔ Hand in the DGD-IS at your company collection point or return to Sales & Service Center (see backside).

Sales & Service Centers

Note: All locations may not service all products. Please contact the nearest Sales & Service Center for the appropriate facility to handle your service requirements.

Dallas, TX
Apex Tool Group
Sales & Service Center
1470 Post & Paddock
Grand Prairie, TX 75050
Tel: 972-641-9563
Fax: 972-641-9674

Detroit, MI
Apex Tool Group
Sales & Service Center
2630 Superior Court
Auburn Hills, MI 48326
Tel: 248-391-3700
Fax: 248-391-7824

Houston, TX
Apex Tool Group
Sales & Service Center
6550 West Sam Houston
Parkway North, Suite 200
Houston, TX 77041
Tel: 713-849-2364
Fax: 713-849-2047

Lexington, SC
Apex Tool Group
670 Industrial Drive
Lexington, SC 29072
Tel: 800-845-5629
Tel: 803-359-1200
Fax: 803-358-7681

Los Angeles, CA
Apex Tool Group
Sales & Service Center
15503 Blackburn Avenue
Norwalk, CA 90650
Tel: 562-926-0810
Fax: 562-802-1718

Seattle, WA
Apex Tool Group
Sales & Service Center
2865 152nd Avenue N.E.
Redmond, WA 98052
Tel: 425-497-0476
Fax: 425-497-0496

York, PA
Apex Tool Group
Sales & Service Center
3990 East Market Street
York, PA 17402
Tel: 717-755-2933
Fax: 717-757-5063

Canada
Apex Tool Group
Sales & Service Center
5925 McLaughlin Road
Mississauga, Ont. L5R 1B8
Canada
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