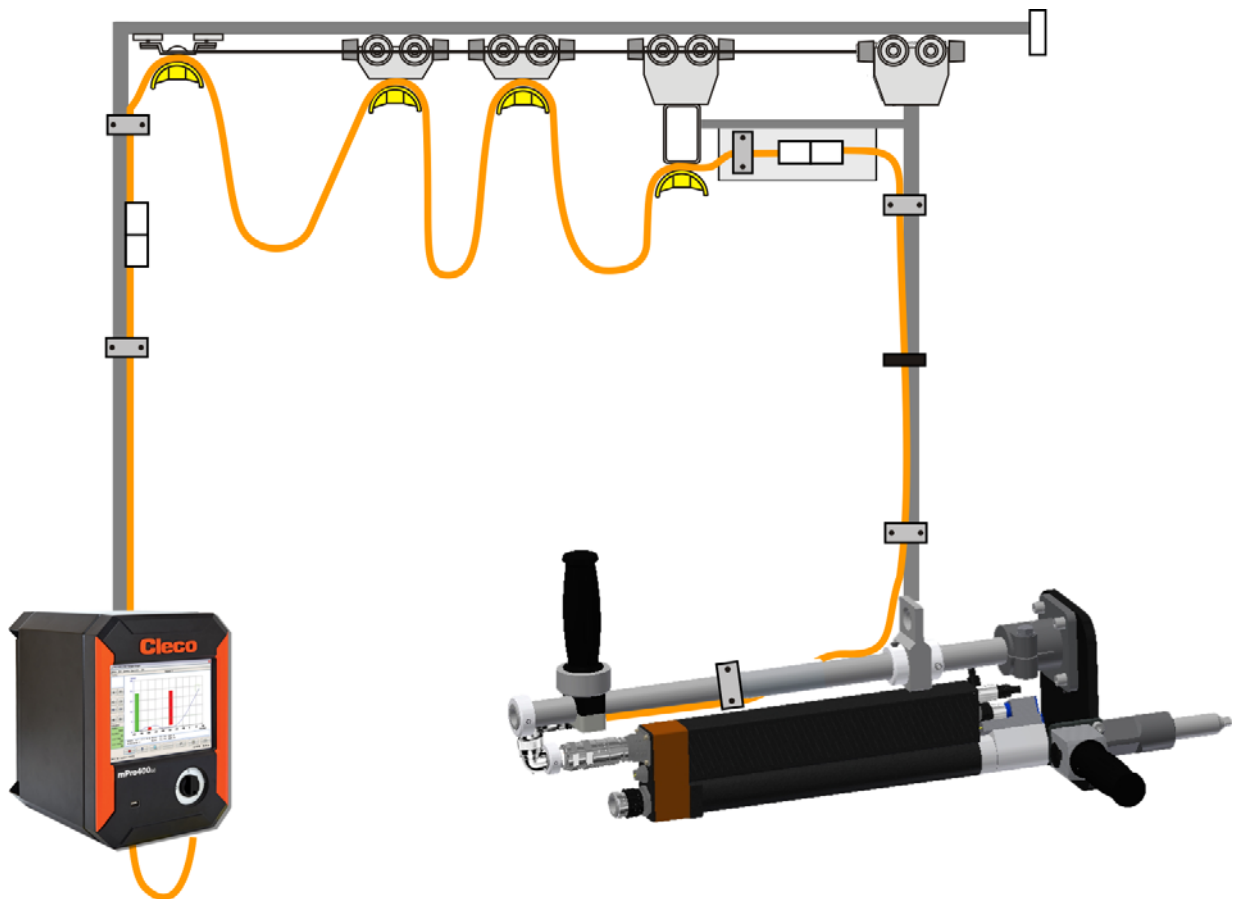


Cable Management Reference Guide

BB Series / BTS(E) Series



About these installation instructions

These installation instructions are the – translation of Original Installation Instructions – and

- provide important information about proper and safe laying of cables.
- serve as a lexicon for technical data.

Symbols in text

- Identifies instructions to be followed.
- Identifies lists.

Abbreviations

BTS(E) series	DGD intelligent spindles
BB series	DGD built-in nutrunner, Single-cable version

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1 Instructions on laying cables

When referring to cables, "Cable Connectors" are assumed in the term "Cables".

1.1 Why Cable Management?

Approximately 60% of all Apex Tool Group Tools and Assembly equipment failures relate to cables. Proper Cable Management leads to lower life cycle costs.

1.2 General

- Don't bend cables while unrolling them. Don't create any loops or twists.
- Don't use extra-long cables and wires (reserve).



- Avoid mutual interference. Lay so-called "hot" and "cold" signal lines separately. For this, use cable ducts in the control cabinet that are physically separated from each other
 - Hot signal lines: System cable, mains, nutrunner control power supply, cooling unit
 - Cold signal lines: 24 VDC, PE, ARCNet cable, bus cable, separate cables from transducers

CAUTION!



- There is a risk of tripping or falling over loose cables on the ground.
- Lay all connected cables safely.

NOTE!



- Only cable types approved by Apex Tool Group may be used.
- Remember that the maximum total cable length is **50 m**.
- Take appropriate measures to limit cable bending radii and torsion. Observe the respective allowed bending radii and torsional lengths.
- All plug connections must be closed. The red ring around the outer diameter of plug connectors with a slide lock should not be visible.

2 Hand-operated built-in nutrunner – Measures

2.1 Strain relief

NOTE!



No tensile stresses can occur at connectors, plugs and rundowns

- All cable and hose components must be provided with traction reliefs at the beginning and end of the sections.
- For additional fixing or bundling of cables, use a Velcro strap.

We recommend further measures for strain relief according to the following example:

- ① The first and the last carriages are fixed.
- ② The one carriage before is combined mechanically with the last one.
- ③ The paths of the carriages are limited by using a short or several short wire ropes.

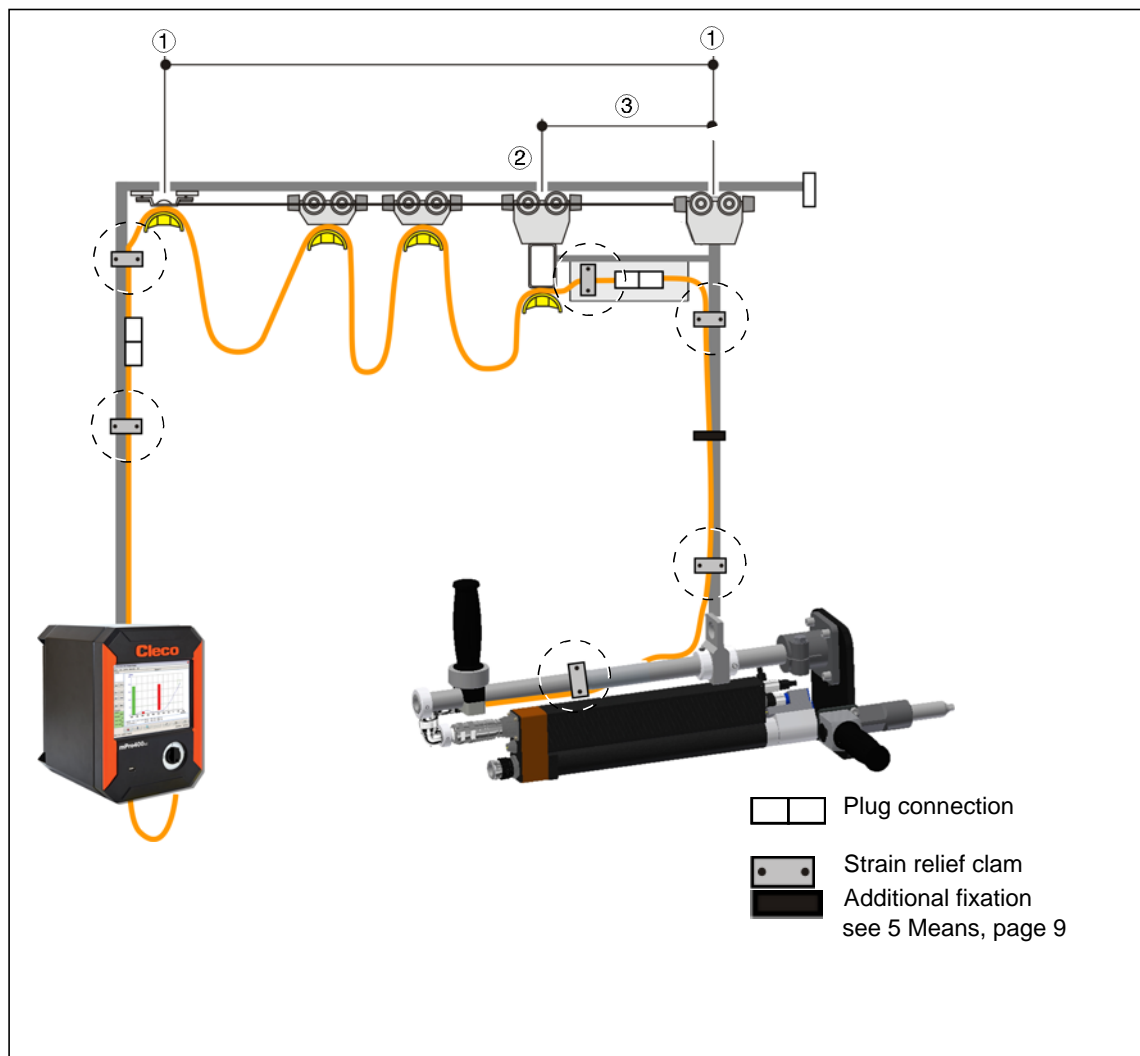


Abb. 2-1 Use with hand-operated built-in nutrunner (example, other installations possible)

2.2 Wiring

In order to achieve an optimal service life of cables, comply with the following points when laying the cables:

- Lay cables in slight loops. The cables must never become taut with maximum freedom of movement.
- Only secure the cables at the strain relief clamp.
- Lay the cables so that the sleeves do not rub during operation.
Cables should not knock against parts, rub or hang loose.
- Do not exceed the minimum specified bending radii and torsional length.
The size of the bending radius is proportional to length of the service life.
- Make sure that the length of the cable compensates for torsional loads.

- To secure the plug connector against extreme forces such as vibrations, shaking or rotary movements, use a *Safeguard Tool Cable* from Apex Tool Group.
- Do not use wire ties on cable because they tend to cause conductor stress and reduce cable life expectancy. For additional fixing or bundling of cables, use a Velcro strap.
- Run a few motion cycles after the initial installation of cables. Afterwards, check the cable installation once more and optimize it if possible.

3 Robot – Measures

3.1 Strain relief

NOTE! No tensile stresses can occur at connectors, plugs and rundowns



- All cable and hose components must be provided with traction reliefs at the beginning and end of the sections.
- For additional fixing or bundling of cables, use a Velcro strap.

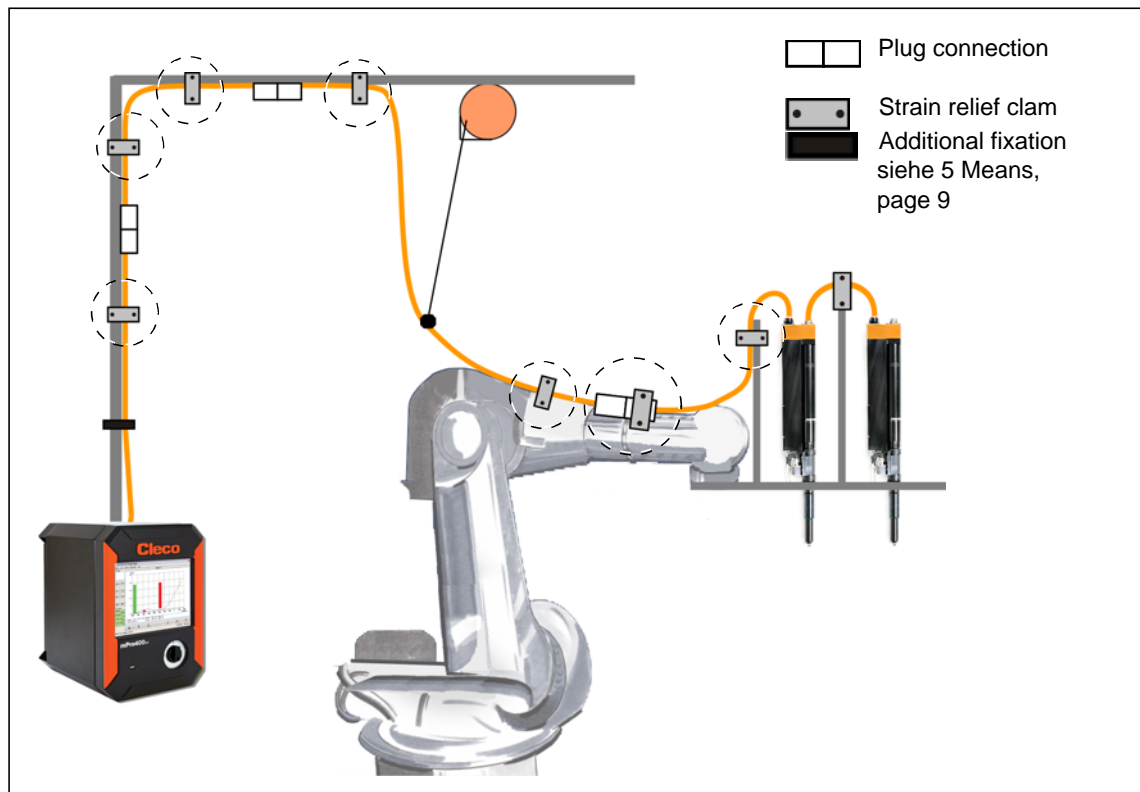


Abb. 3-1: Use with robot (example, other installations possible)

3.2 Wiring

In order to achieve an optimal service life of cables in robotics applications, comply with the following points when laying the cables:

- Lay cables in slight loops. The cables must never become taut with maximum freedom of movement.
- Only secure the cables at the strain relief clamp.
- Lay the cables so that the sleeves do not rub during operation.
Cables should not knock against parts, rub or hang loose.
- Do not exceed the minimum specified bending radii and torsional length.
The size of the bending radius is proportional to length of the service life.
- Make sure that the length of the cable compensates for torsional loads.
- Avoid crushing individual wires or subcomponents.
We recommend applying a clamping force around the entire circumference of the cable.
- To secure the plug connector against extreme forces such as vibrations, shaking or rotary movements, use a *Safeguard Tool Cable* from Apex Tool Group.
- Do not use wire ties on cable because they tend to cause conductor stress and reduce cable life expectancy. For additional fixing or bundling of cables, use a *Velcro strap*.
- Run a few motion cycles after the initial installation of cables. Afterwards, check the cable installation once more and optimize it if possible.

4 Flexible Cable Ducts – Means

4.1 Strain relief

NOTE!

No tensile stresses can occur at connectors, plugs and rundowns



→ By use of a firmly fixed strain relief clamp prevent the cable from shifting. All cable and hose components must be provided with traction reliefs at the beginning and end of the Flexible Cable Ducts.

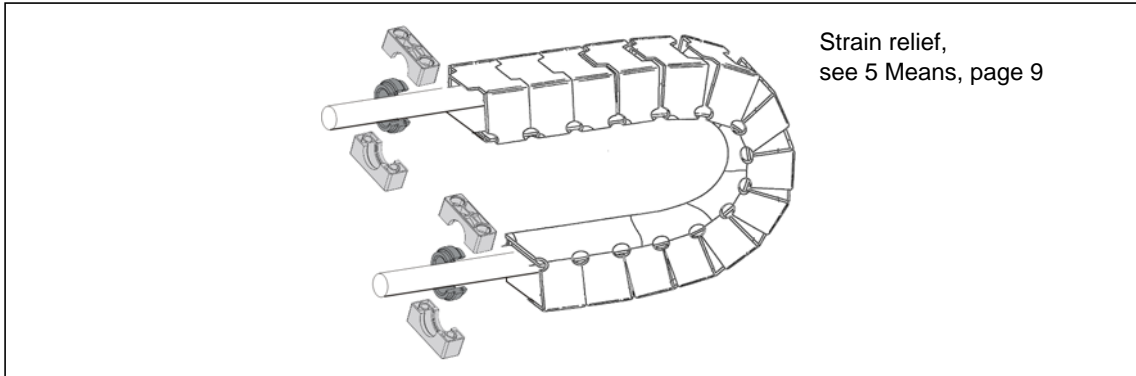


Abb. 4-1: Use with Flexible Cable Ducts

4.2 Laying

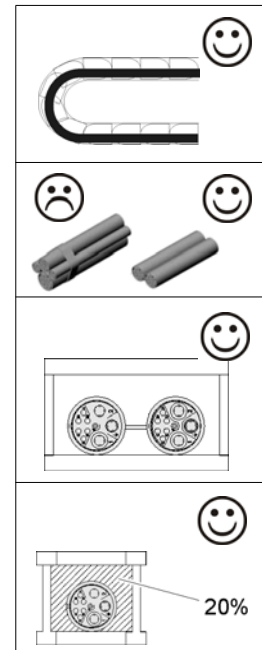
The laying of lines and protection hoses in cable ducts must be carried out with the greatest possible care. Generally, the following points must be observed:

- All edges of the cable duct should always be designed with a radius and provide maximum protection to the cables to prevent any chafing, stress or pinch points.
- The cables should lie free of twists in the cable duct. Prior to assembly, lay the cables on an even surface so that they can be inserted while stretched out.
- Cables must be able to follow the radius of curvature without being forced around it. Do not cross cables or hoses in the cable duct.

- Don't bundle cables . Lay the cables in the cable duct individually, lying loosely adjacent to each other whenever possible. Lay a maximum of 2 cables per partition.
- Separate cables lying adjacent to each other using cut-off bridges whenever possible.



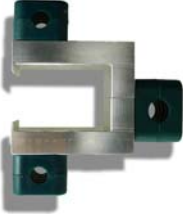


Vertical installation:

- Leave about 20% clearance within the partition height. The lines hang out downward due to the cable weight, including the chain. This lengthening due to sagging must be monitored at regular intervals and adjusted if necessary.



- Never lay cables with different diameters (> 3 mm) together in the same partition.
- 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.
- Do not use wire ties on cable because they tend to cause conductor stress and reduce cable life expectancy. For additional fixing or bundling of cables, use a Velcro strap.
- Run a few motion cycles after the initial installation of cables. Afterwards, check the cable installation once more and optimize it if possible

5 Means

Item		Advantage
Clam STAUFF with elastomer insert Series BB + Serie B(U)TS Type RI, 414PPR Order no. 961509PT		For fixing cable and hose components at the beginning and end of each section. Broad, padded clamping surfaces. Adjusts to the cable diameter used.
Clam STAUFF Series BB Typ 535PP Order no. 917902 Series B(U)TS Type 430PP Order no. S958364		For securing the plug connector against extreme forces such as vibrations, shaking or rotary movements.
Holder, inclusive installation parts Series 1BTS -4BTS Order no. S390083 Series 1BUTS -4BUTS Order no.S390095		For fixing the cable directly at the built-in nutrunner, if there are no suitable installation facilities for traction relief, especially in the area of the robot stations.
Safeguard Tool Cable Series BB Order no. S800556 Series BTS Order no. S800555		For securing the plug connector against extreme forces such as vibrations, shaking or rotary movements.
Velcro Strap z. B. Type ONE_WRAP Strap		More cost-effective cable management solution for additionally fixing or bundling cables. Cables are not clamped too tightly and make the package flexible, in contrast to cable ties. Do not use it as traction relief!

6 Installation example



Abb. 6-1: Installationsbeispiele

7 Shielding

The shielding in the lines limits the expansion of perturbation energy into the surroundings and shields the system against disturbances.

The cables between tightening module or Power modul and Built-in nutrunner are shielded against exterior disturbances. However, this measure also counteracts interference emissions.

- Generally connect it to both ends.
- Extensively connect the shielding of the nutrunner cables (skin effect) to the lower edge of the tightening module housing or Power Module with the aid of shield connecting elements.

For this, use the following shield clamps:

Cables	Shield clamp		
	Order No.	Phoenix Name	Phoenix Item number
DGD built-in nutrunner cable, BB series	S961062	SK14	30 25 17 6
DGD-IS cable, BTS series	S961062	SK14	30 25 17 6

The shielding in the transducer and resolver line is connected to the connector housing. The front panel of the measuring board is grounded via the STM housing and ensures good shielding connection.

- Maximum unshielded area of the motor line, between shield end and plug connection on tightening module = 50 mm.

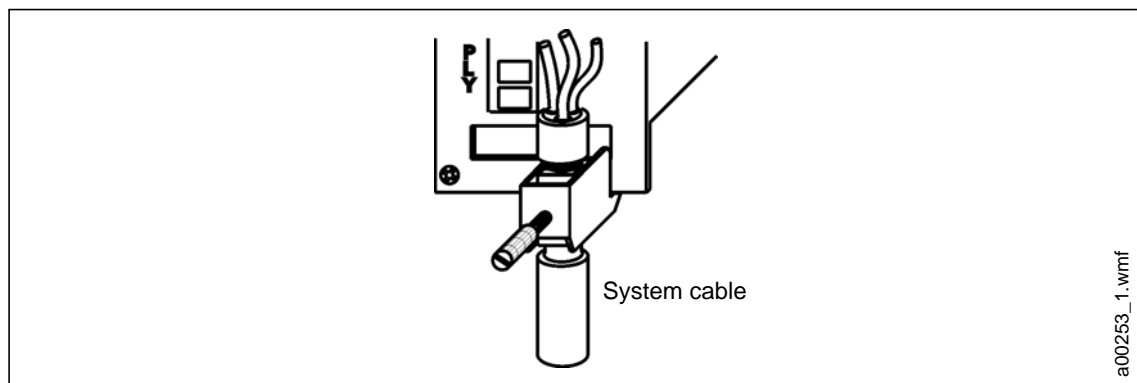

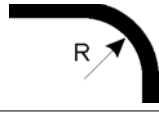



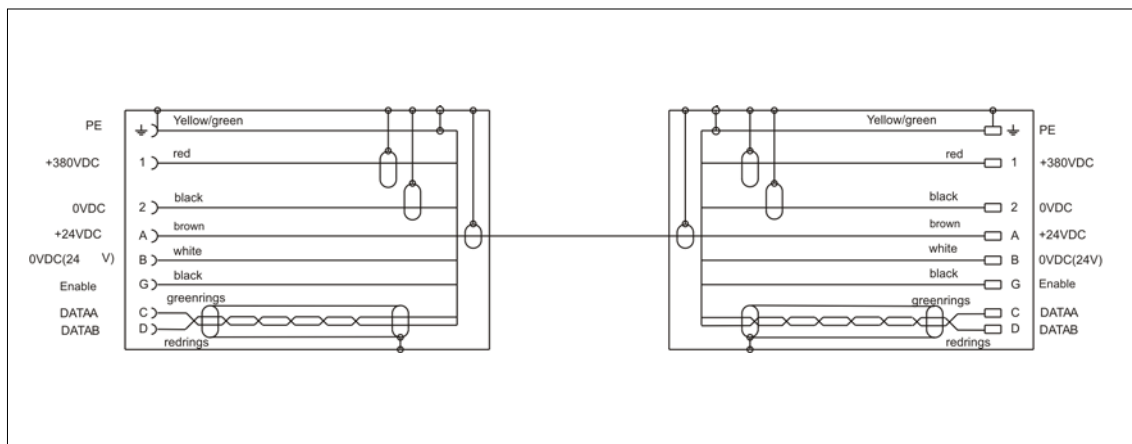
Abb. 7-1

8 Cable BTS(E) series

8.1 HighFlex Quality, suitable for cable ducts

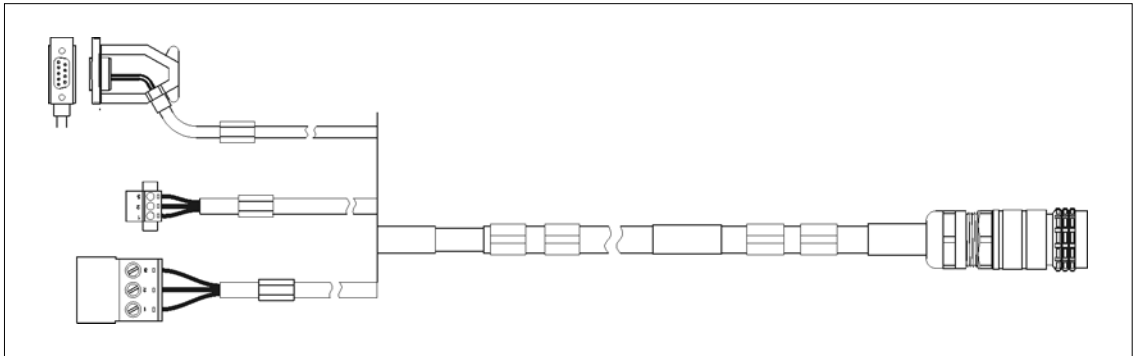
Thermal properties		
Ambient temperature	°C	-20...+80
Flammability		Flame-retardant and self-extinguishing in accordance with IEC 60332-1
Chemical properties of the coating		
Coating material		PUR, low-adhesion, resistant to hydrolysis and microbes, UV-resistant, abrasion-resistant, tear-resistant, cut-resistant, 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		RAL 2003 matt
Mechanical properties		
Diameter	mm	approx. 13,8
 Bending radii: Single bends Multiple bends	mm	R = 30 min. 95 mm min. flexing action 130 min alternate bending
		
 Torsional length (±180 ° around separate central axis)	mm	500 min.
	Max. acceleration	m/s ²

Wiring diagram



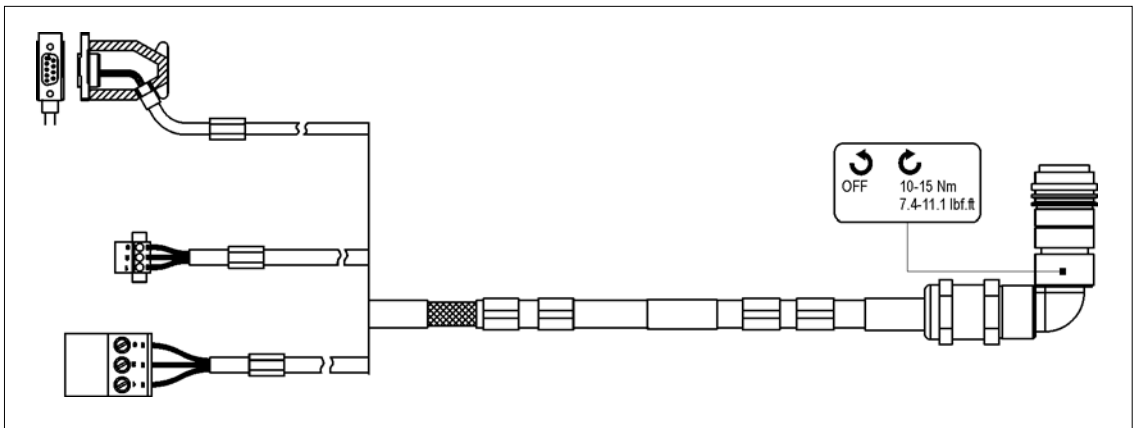
8.1.1 System cable, type C

Use	Nutrunner control unit – DGD-IS
Order No.	961109-xxx (...-xxx = cable length in dm)



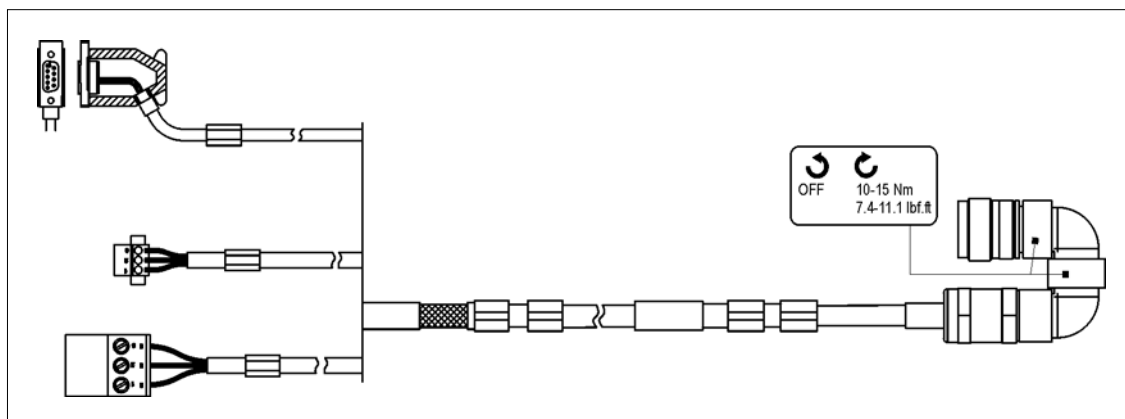
8.1.2 System cable, type I

Use	Nutrunner control unit – DGD-IS
Order No.	961294-xxx (...-xxx = cable length in dm)



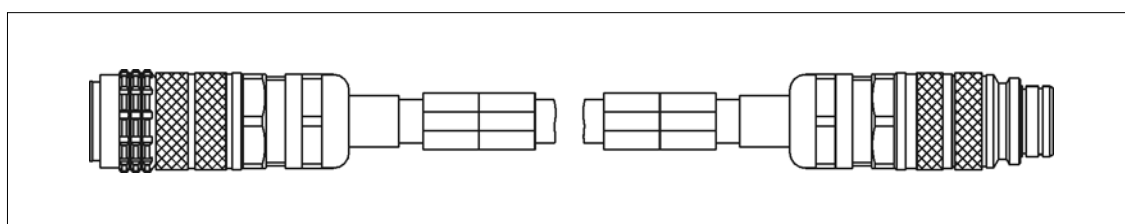
8.1.3 System cable, type J

Use	Nutrunner control unit – DGD-IS
Order No.	961289-xxx (...-xxx = cable length in dm)



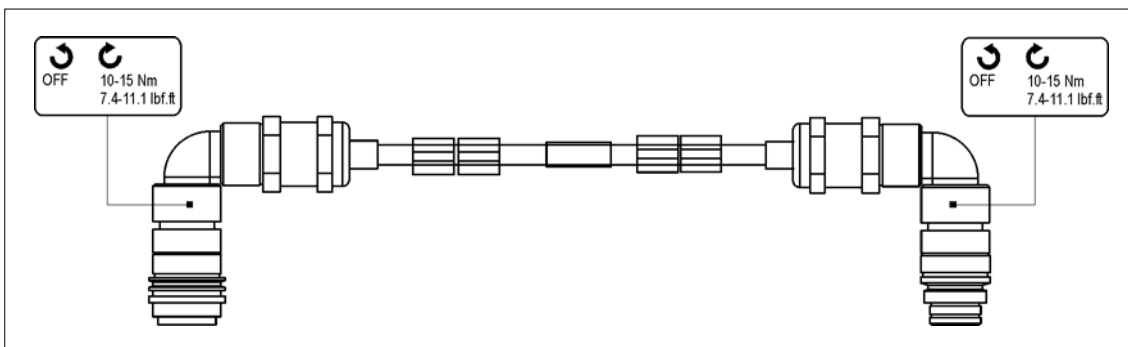
8.1.4 System cable, type A

Use	Intermediate plug position – DGD-IS
Order No.	961104-xxx (...-xxx = cable length in dm)



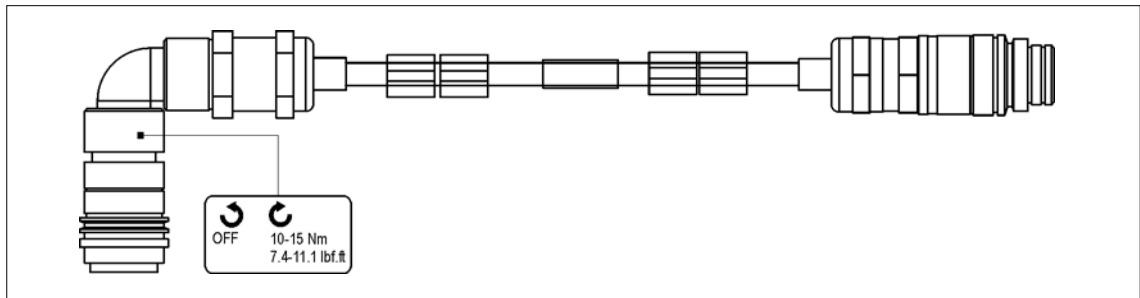
8.1.5 Jumper cable, type E

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



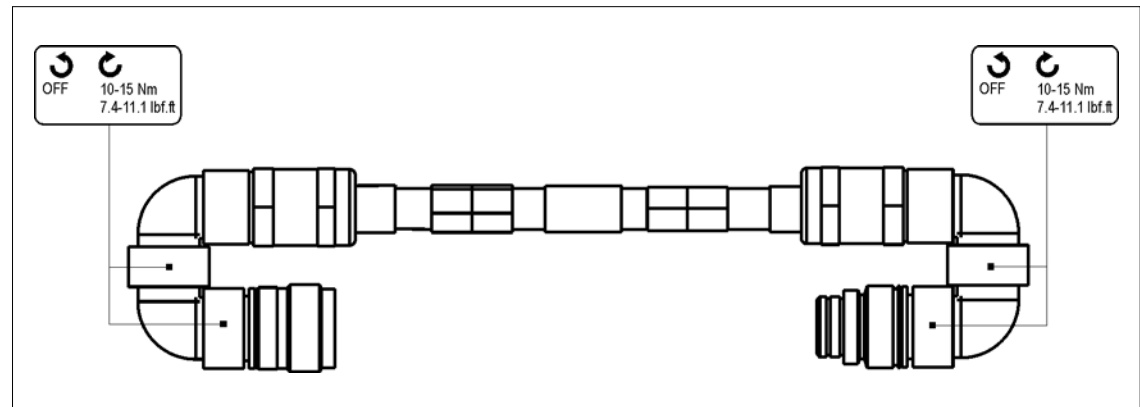
8.1.6 Jumper cable, type F

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



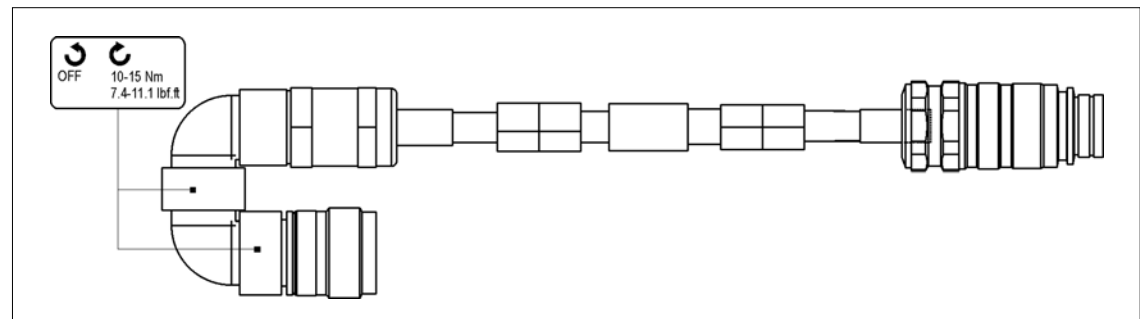
8.1.7 Jumper cable, type G

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



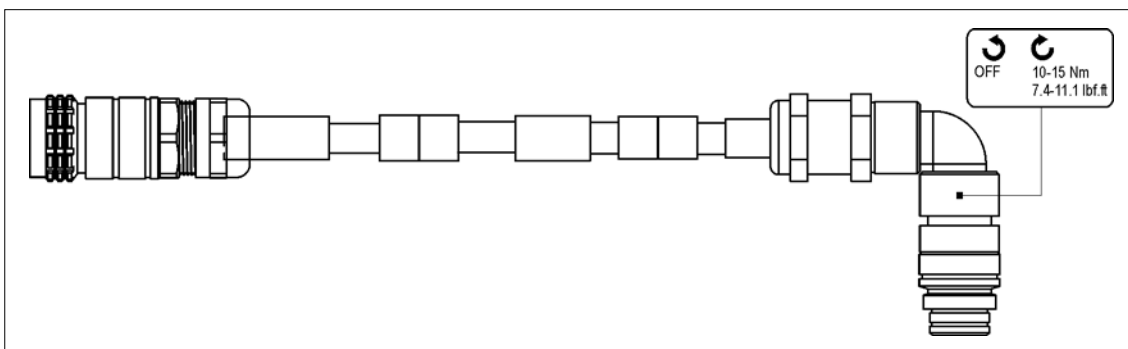
8.1.8 Jumper cable, type H

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



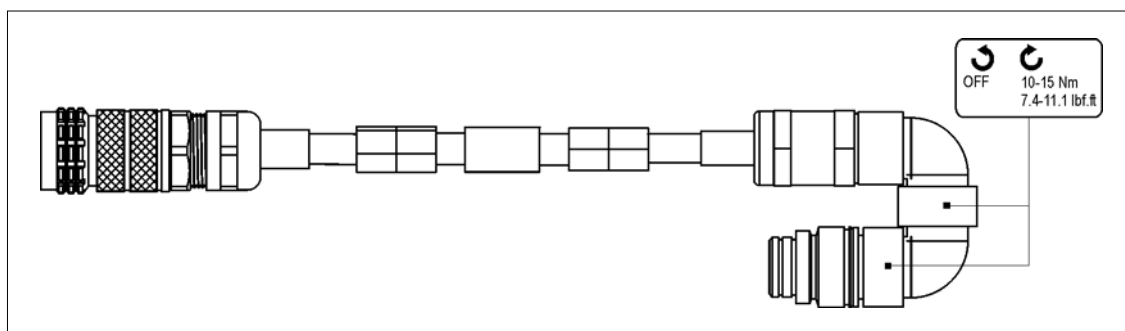
8.1.9 Jumper cable, type K

Use	DGD-IS – DGD-IS
Order No.	961292-xxx (...-xxx = cable length in dm)



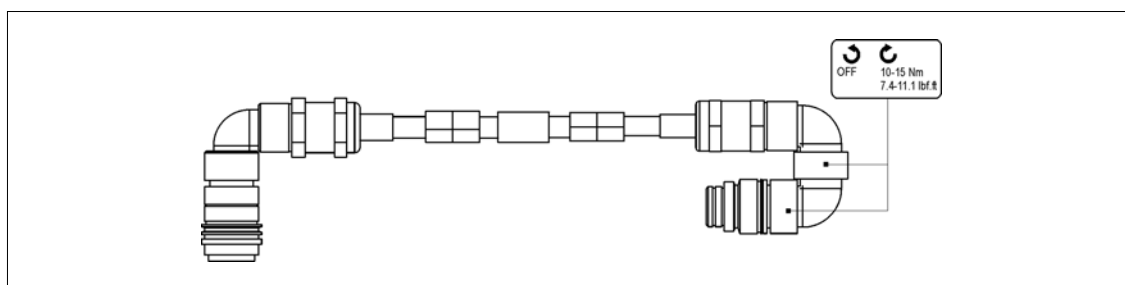
8.1.10 Jumper cable, type L

Use	DGD-IS – DGD-IS
Order No.	961293-xxx (...-xxx = cable length in dm)


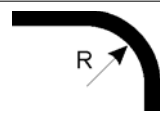



8.1.11 Jumper cable, type M

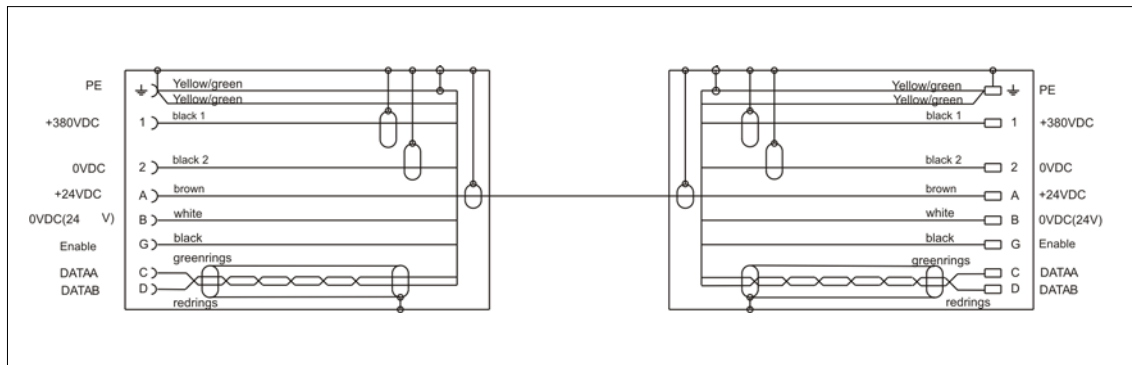
Use	DGD-IS – DGD-IS
Order No.	961296-xxx (...-xxx = cable length in dm)



8.2 Super Highflex, suitable for robots

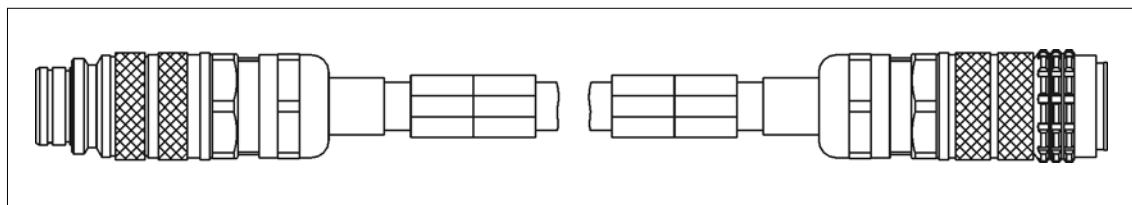
Thermal properties			
Ambient temperature	°C	-20...+90	
Flammability		Flame-retardant and self-extinguishing in accordance with IEC 60332-1	
Chemical properties of the coating			
Coating material		PUR, low-adhesion, resistant to hydrolysis and microbes, UV-resistant, abrasion-resistant, tear-resistant, 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. 14	
 Bending radii: Single bends Multiple bends	mm	R = 30 min. 60 mm min. flexing action 130 min alternate bending	
	 Torsional length (±180 ° around separate central axis)	mm	
Max. acceleration	m/s ²	100	

Wiring diagram



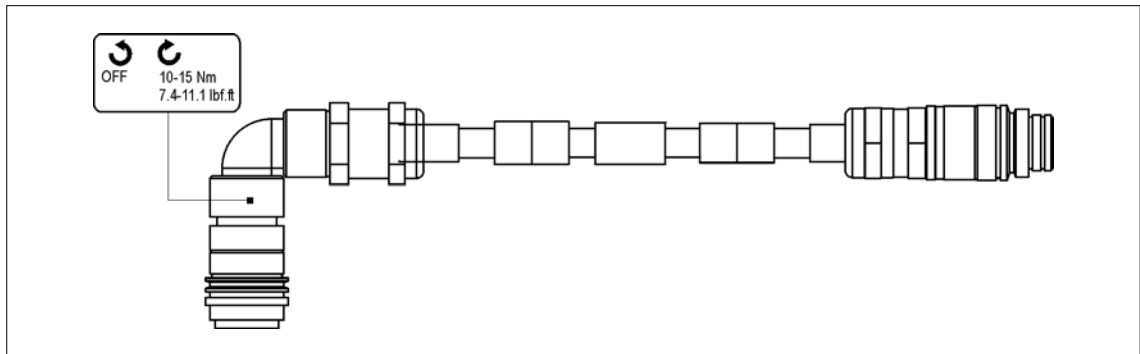
8.2.1 System cable, type A

Use	Intermediate plug position – DGD-IS
Order No.	961103-xxx (...-xxx = cable length in dm)



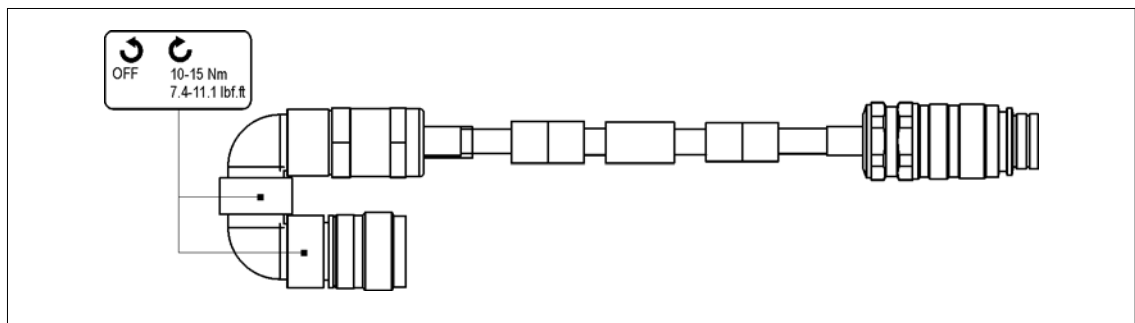
8.2.2 Jumper cable, type F

Use	DGD-IS – DGD-IS
Order No.	961395-xxx (...-xxx = cable length in dm)



8.2.3 Jumper cable, type H

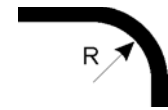
Use	DGD-IS – DGD-IS
Order No.	961397--xxx (...-xxx = cable length in dm)



9 Cable BB series (single-cable design)

9.1 Field quality, for fixed installation

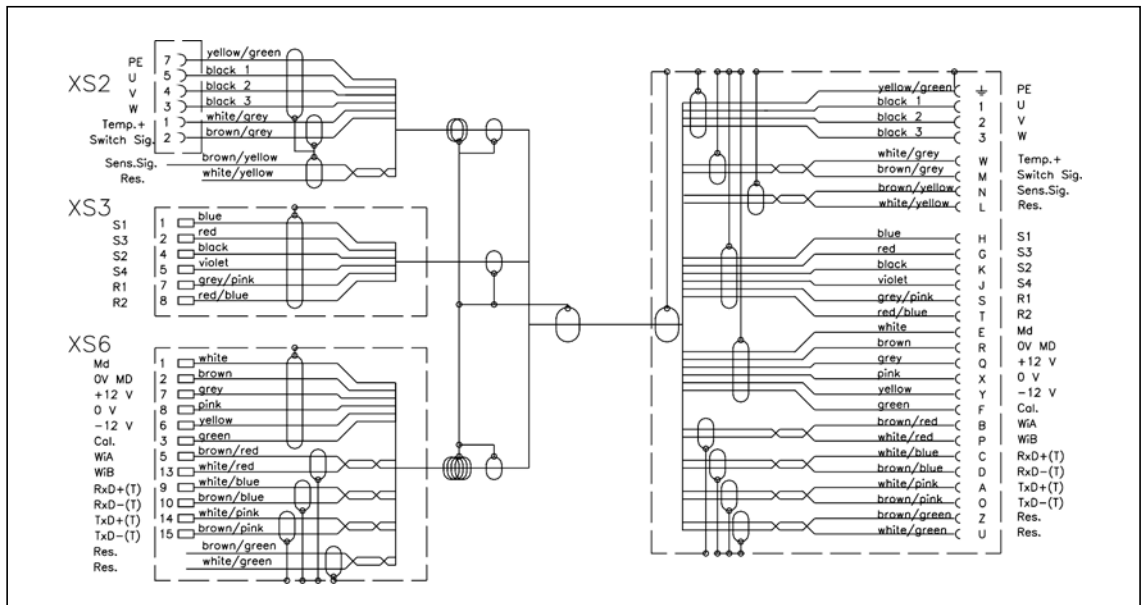
Thermal properties		
Ambient temperature	°C	-20 ... +80° C
Flammability		Self-extinguishing in accordance with UL1581
Chemical properties of the coating		
Coating material		PUR flame-retardant, matt, low-adhesion, abrasion-resistant, notch-resistant, tear- and cut-resistant
Oil resistance		Oil-resistant 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		Black
Mechanical properties		
Diameter	mm	approx. 17
Bending radii: Single bends Multiple bends	mm	R = 80 min. 300 min. (not with continuous bending)
Max. acceleration	m/s ²	100 (10 G max.)

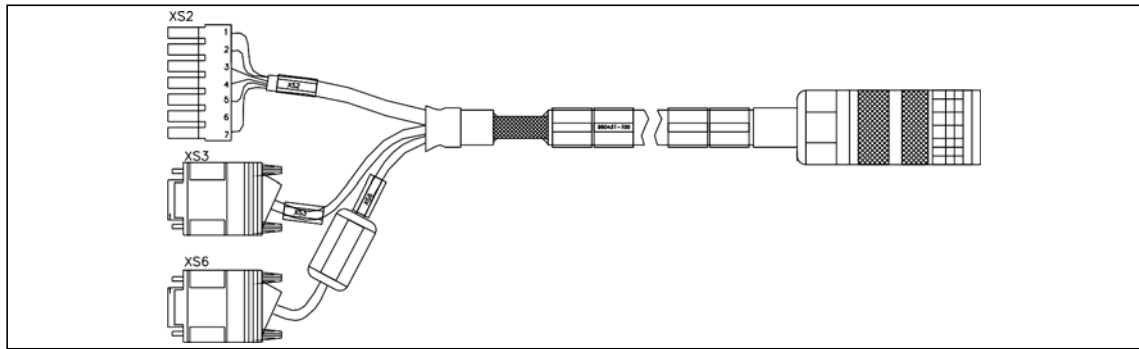


9.1.1 System cable, type B

Use	Nutrunner control – intermediate plug position –
Order No.	960431-xxx (...-xxx = cable length in dm)

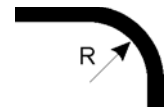
Wiring diagram





9.2 HighFlex Quality, suitable for cable ducts, robots

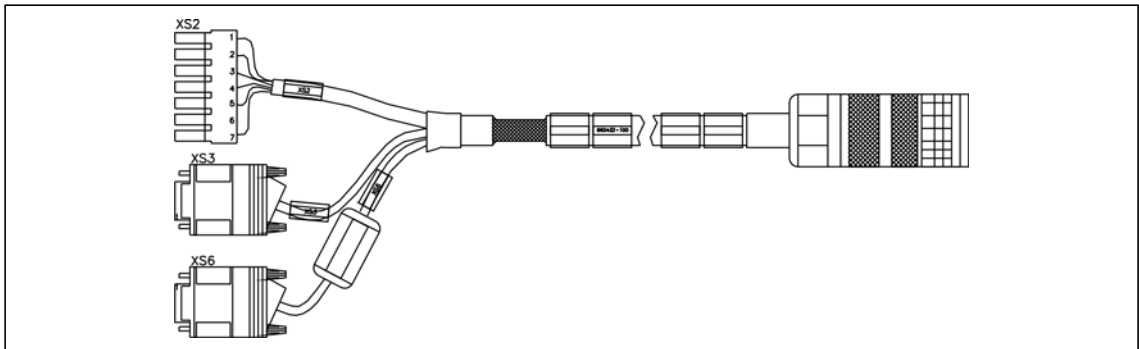
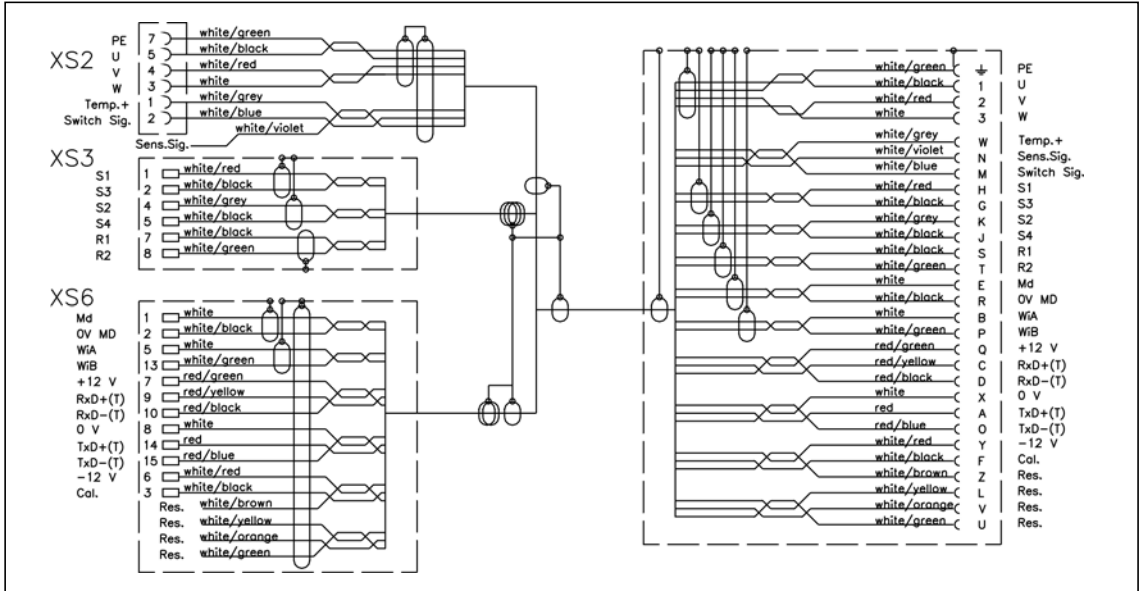
Thermal properties		
Ambient temperature	°C	-20 ... +90° C
Flammability		Self-extinguishing in accordance with UL1581
Chemical properties of the coating		
Coating material		PUR flame-retardant, UV-resistant, abrasion-resistant, notch-resistant, tear- and cut-resistant
Oil resistance		Oil-resistant in accordance with DIN VDE 0472, part 803 ASTM oil 1 to 3
Resistance to hydrolysis		In accordance with VDE 0283, part 10
Color		Black
Mechanical properties		
Diameter	mm	approx. 13,5
Bending radii: Single bends Multiple bends	mm	R = 30 min. 95 mm min. flexing action 130 min alternate bending
Torsional length (±180 ° around own center axis)	mm	500 min.
Max. acceleration	m/s ²	100 (10 G max.)



9.2.1 System cable, type C

Use	Nutrunner control – DGD built-in nutrunner
Order No.	960432-xxx (...-xxx = cable length in dm)

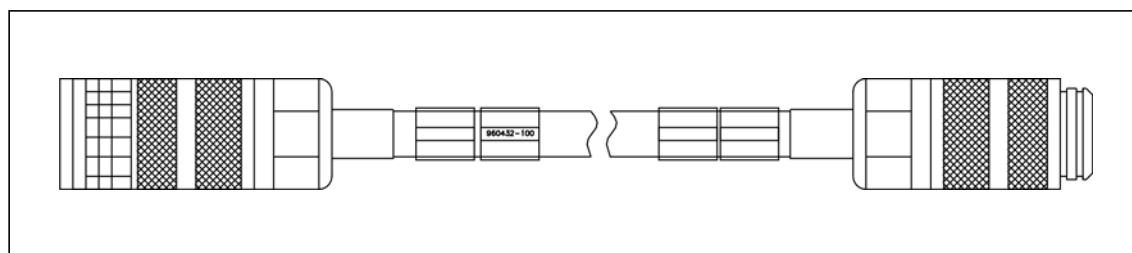
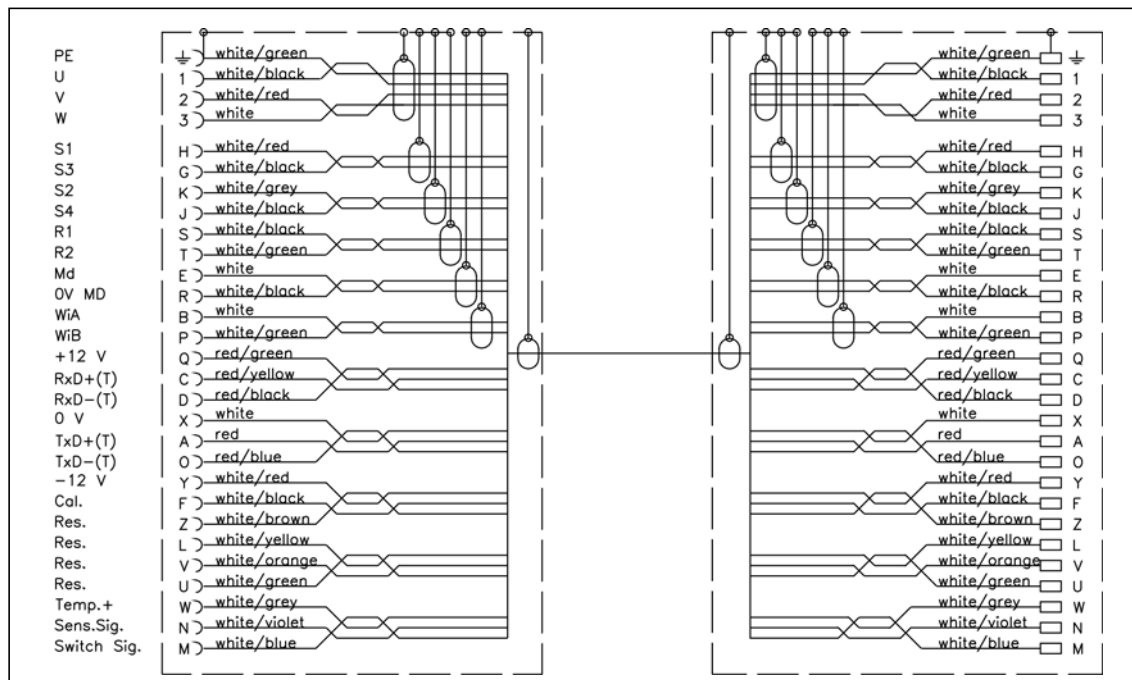
Wiring diagram



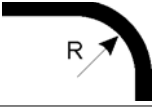
9.2.2 Extension cable, type A1

Use	DGD built-in nutrunner – intermediate plug position
Order No.	960430-xxx (...-xxx = cable length in dm)

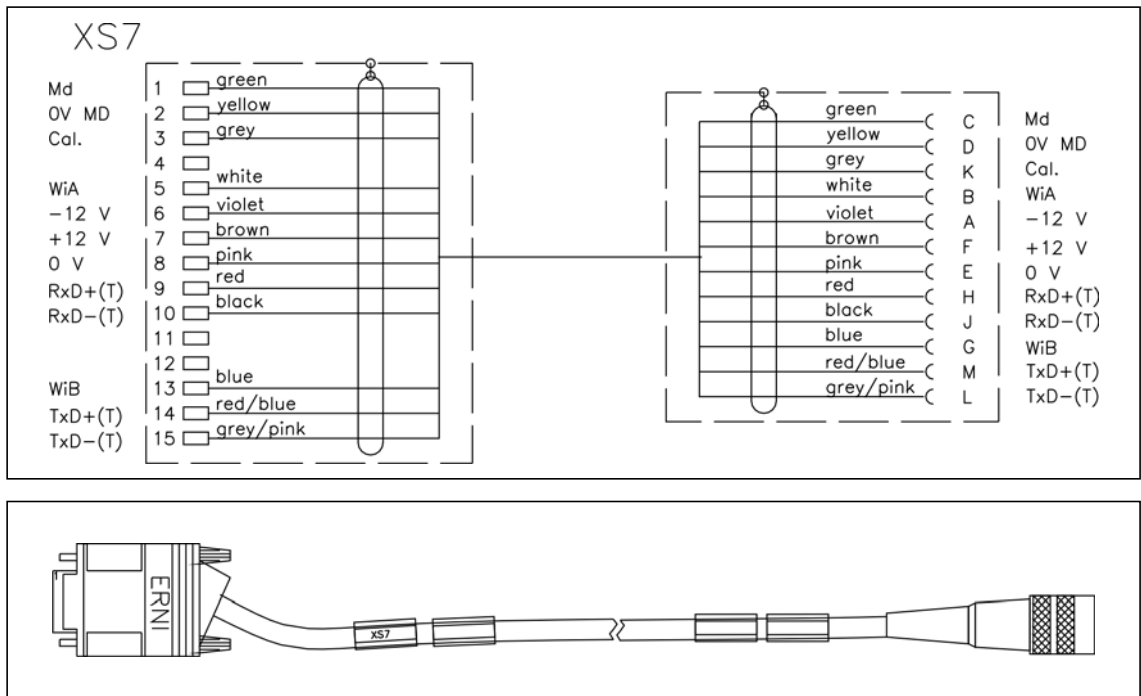
Wiring diagramm



9.2.3 For redundant transducer

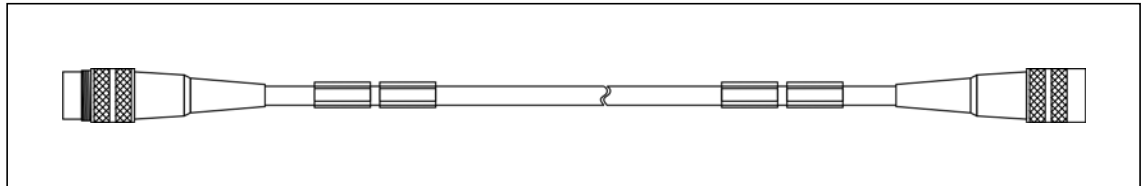
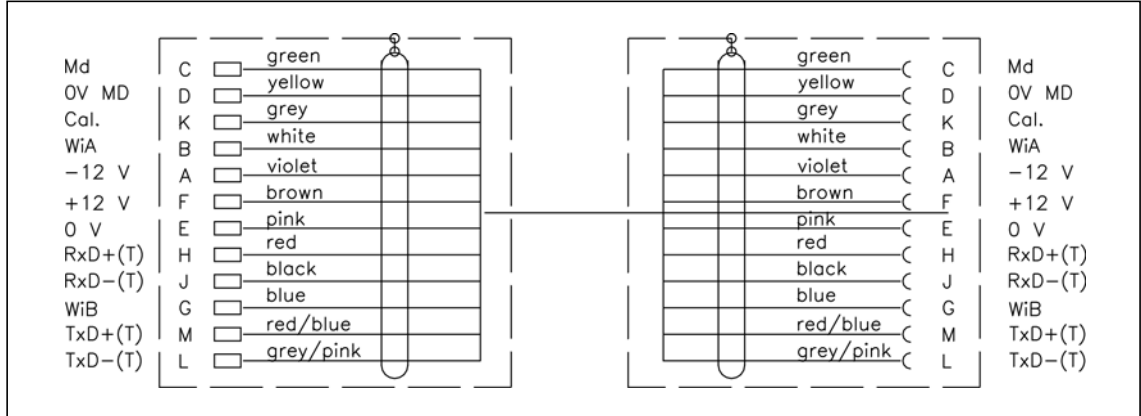
Thermal properties		
Ambient temperature	°C	-40 ... +70° C
Flammability		Self-extinguishing in accordance with UL1581
Chemical properties of the coating		
Coating material		PUR flame-retardant, UV-resistant, abrasion-resistant, notch-resistant, tear- and cut-resistant
Oil resistance		Oil-resistant in 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		gray
Mechanical properties		
Diameter	mm	approx. 8
Bending radii: Single bends Multiple bends	mm	R = 30 min. 80 min. flexing action
		
Torsional length (±180 ° around own center axis)	mm	500 min.
Max. acceleration	m/s ²	100 (10 G max.)
Use		Parallel to type B and type C
Order No.		960960-xxx (...-xxx = cable length in dm)

Wiring diagram

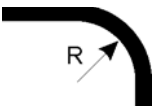


Use	Parallel to type A1 and type A2 (extension cable)
Order No.	960961-xxx (...-xxx = cable length in dm)

Wiring diagram



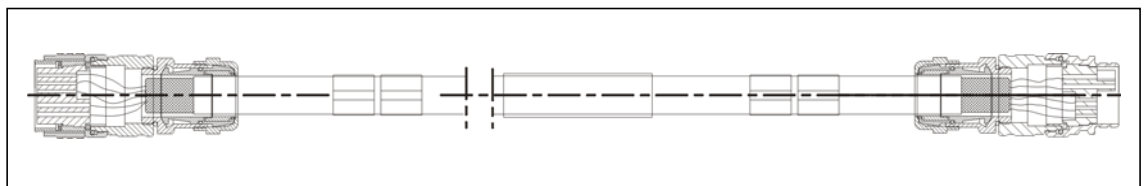
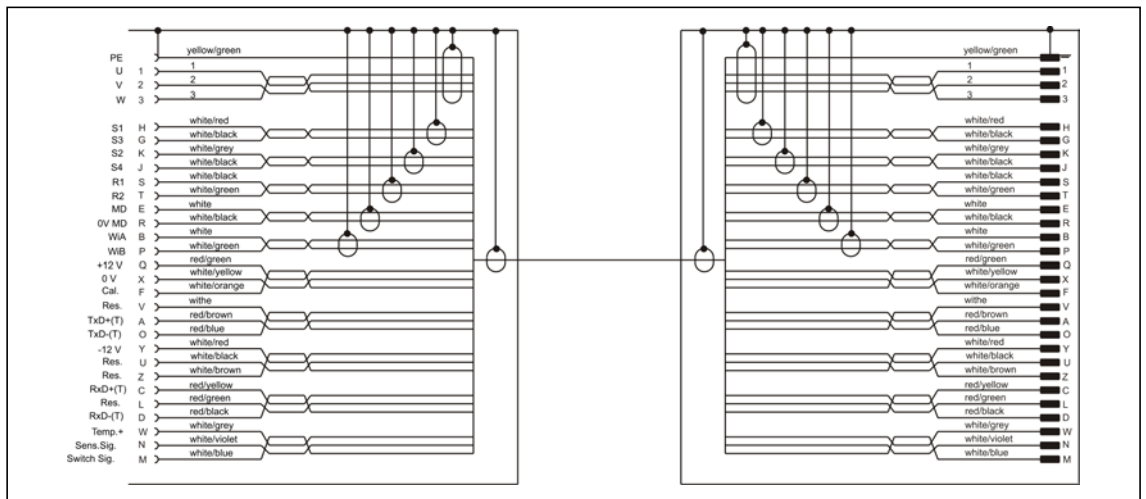
9.3 Super Highflex Quality, suitable for robots

Thermal properties		
Ambient temperature	°C	-30 ... +90° C
Flammability		Self-extinguishing in accordance with IEC 60332-1-2
Chemical properties of the coating		
Coating material		PUR flame-retardant, UV-resistant, abrasion-resistant, notch-resistant, tear- and cut-resistant
Oil resistance		Oil-resistant in accordance with DIN VDE 0472, part 803, ASTM oil 1 to 3
Resistance to hydrolysis		In accordance with VDE 0283, part 10
Color		Orange
Mechanical properties		
Diameter	mm	approx. 16,5
Bending radii: Single bends Multiple bends	mm	R = 30 min. 60 min. flexing action 45 mm alternate bending
		
Torsional length (±180 ° around own center axis)	mm	500 min.
Max. acceleration	m/s ²	100 (10 G max.)

9.3.1 System cable, type A2

Use	DGD built-in nutrunner – intermediate plug position
Order No.	960433-xxx (...-xxx = cable length in dm)

Wiring diagram



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.

Detroit, MI

**Apex Tool Group
Sales & Service Center**
2630 Superior Court
Auburn Hills, MI 48326
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Fax: +1-248-391-6295

Seattle, WA

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Sales & Service Center**
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Redmond, WA 98052
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England

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Co. OHG**
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India

**Apex Power Tools India
Private Limited**
Gala No. 1, Plot No. 5
S. No. 234, 235 & 245
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Houston, TX

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