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Other functions not described in this documentation may be operable in the controller. The user has no claims to these functions, however, in the case of a replacement or service work.

We have checked the content of this documentation for conformity with the hardware and software described. Nevertheless, discrepancies cannot be precluded, for which reason we are not able to guarantee total conformity. The information in this documentation is checked on a regular basis, however, and necessary corrections will be incorporated in the subsequent edition.

Subject to technical alterations without an effect on the function.

Translation of the original documentation

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1 Introduction

1.1 Documentation for the options

The documentation for this option consists of the following parts:

- Assembly and operating instructions for energy supply systems for this robot model (basic documentation)
- Assembly and operating instructions for the article number-specific energy supply system
- Parts catalog for this option on storage medium
- Assembly and operating instructions for the higher-level system


Each of these sets of instructions is a separate document.


The basic documentation “Assembly and operating instructions for energy supply system” contains all essential information for all energy supply systems for this robot model, but does not go into the specific details of a particular energy supply system. This information can be found in another document, the “Article number-specific assembly and operating instructions”. This contains all the information which only applies to a specific energy supply system (article number). Both documents must be consulted for basic information.


1.2 Representation of warnings and notes

Safety


These warnings are relevant to safety and **must** be observed.

 DANGER	These warnings mean that it is certain or highly probable that death or severe injuries will occur, if no precautions are taken.
---	---

 WARNING	These warnings mean that death or severe injuries may occur, if no precautions are taken.
--	--

 CAUTION	These warnings mean that minor injuries may occur, if no precautions are taken.
--	--

NOTICE	These warnings mean that damage to property may occur, if no precautions are taken.
---------------	--


	These warnings contain references to safety-relevant information or general safety measures. These warnings do not refer to individual hazards or individual precautionary measures.
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This warning draws attention to procedures which serve to prevent or remedy emergencies or malfunctions:

SAFETY INSTRUCTIONS	Procedures marked with this warning must be followed exactly.
----------------------------	--

Notices

These notices serve to make your work easier or contain references to further information.

	Tip to make your work easier or reference to further information.
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2 Purpose

2.1 Target group

This documentation is aimed at users with the following knowledge and skills:

- Advanced knowledge of mechanical engineering
- Advanced knowledge of electrical and electronic systems
- Knowledge of the robot controller system



For optimal use of our products, we recommend that our customers take part in a course of training at KUKA College. Information about the training program can be found at www.kuka.com or can be obtained directly from our subsidiaries.

2.2 Intended use

Use

The intended use of the energy supply system is the supply of energy to tools and fixtures on the robot. This includes the transmission of control and measuring signals for activating and monitoring tools and fixtures and the supply of air and water.

Operating the system within the limits of its intended use also involves continuous observance of the operating and assembly instructions of the robot system and its options, with particular reference to the maintenance specifications.

Misuse

Any use or application deviating from the intended use is deemed to be misuse and is not allowed. This includes e.g.:

- Operation with non-specified fluids
- Operation outside the permissible operating parameters
- Use in potentially explosive environments
- Use in underground mining
- Use with unauthorized robot systems

NOTICE

Changing the energy supply system and the structure of the manipulator, e.g. by drilling holes, etc., can result in damage to the components. This is considered improper use and leads to loss of guarantee and liability entitlements.



This assembly is an integral part of an overall system and may only be operated in a CE-compliant system.

3 Product description

3.1 Description of energy supply system A3 - A6

Overview

This description applies to standard robots of the QUANTEC product series. Different reaches have no effect on the structure and function of the energy supply system. The installation situation varies, however, according to the arm length.

The energy supply system consists of the following principal components:

- Dress package
- Fastening materials
- In-line wrist cover

For use in certain production technologies, the robot can be equipped with an energy supply system (>>> Fig. 3-1) between the arm and the in-line wrist. An energy supply system consists of a dress package for transmitting the energy, fluids and signals typical of the technological process concerned, and the holder assembly required for attaching it to the robot.

The energy supply system A3 - A6 is fastened to the arm and in-line wrist in such a way that it does not impair the robot motion and is protected against damage. The dress package is secured inside a K box that is installed on the arm of the robot. It is secured in holder A6 in a ball joint and at the entrance to the K box on interface A3 in the box clamp. The mounting on axis 6 is designed to permit the flexible tube to rotate but to prevent it from moving in an axial direction. The multiple-piece spring stubs pull the dress package back into its starting position in the K box after every motion and keep it lightly tensioned. Using a protector, the compression springs must be adjusted for each application in order to ensure optimized spring travel. It must be ensured, however, that the compression springs are not completely compressed as this could cause damage to the system. The extent to which the dress package can be pulled out has an effect on the range of motion of the in-line wrist.

Fastening to the robot is carried out using the "fastening materials" assembly. This contains all parts required for fastening the energy supply system to the robot in accordance with the arm length. The K box is also part of this assembly and is available in several variants.

The energy supply system also includes the in-line wrist cover. Its function is to enable the flexible tube of the energy supply system to slide over the contours of the arm and in-line wrist with as little stress as possible during operation of the robot.

The compact unit can be quickly exchanged without great effort.

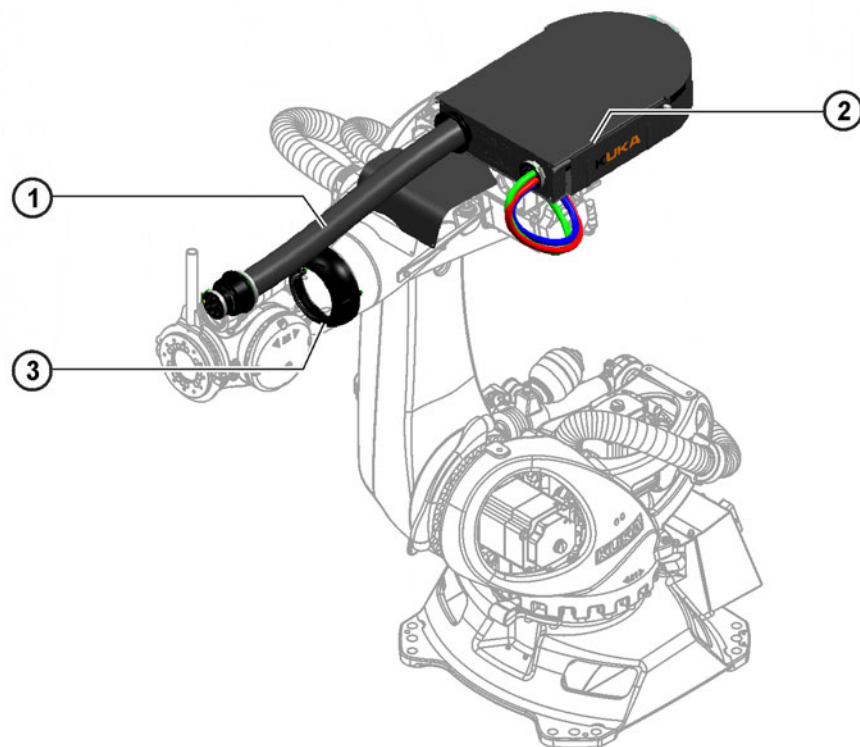


Fig. 3-1: Principal components

- | | | | |
|---|-------------------------------------|---|-----------------------------|
| 1 | Energy supply system, dress package | 3 | In-line wrist cover package |
| 2 | Fastening materials | | |

Dress package

The energy supply system A3 - A6 is centered on the dress package (>>> Fig. 3-2). It bundles all the hoses and electric cables in the energy supply system for compact routing from interface A3 on the arm to interface A6 on the tool.

The contents of the dress package depend on the specific application and may therefore vary greatly. At the two extremes, the dress package can either be empty, or filled to a maximum of 70% of the cross-sectional area of the flexible tube. The following figure shows the composition of this dress package.

Interface A3 is located on the arm. From this interface, the cables and hoses are routed to the box clamp of the K box. The flexible tube of the dress package is routed through the K box in a loop to the outlet and from here to clamp A6 on the holder of the mounting flange.

A cable star is fitted at each end of the dress package. These serve to adjust and locate the cables and hoses in the dress package and at the transitional points. The number and size of the holes in the cable star piece are determined by the composition of the dress package. Unused holes are sealed by means of plugs.

Further information and detailed specifications about the dress package can be found in the parts catalog and Chapter (>>> 4 "Technical data" Page 13).

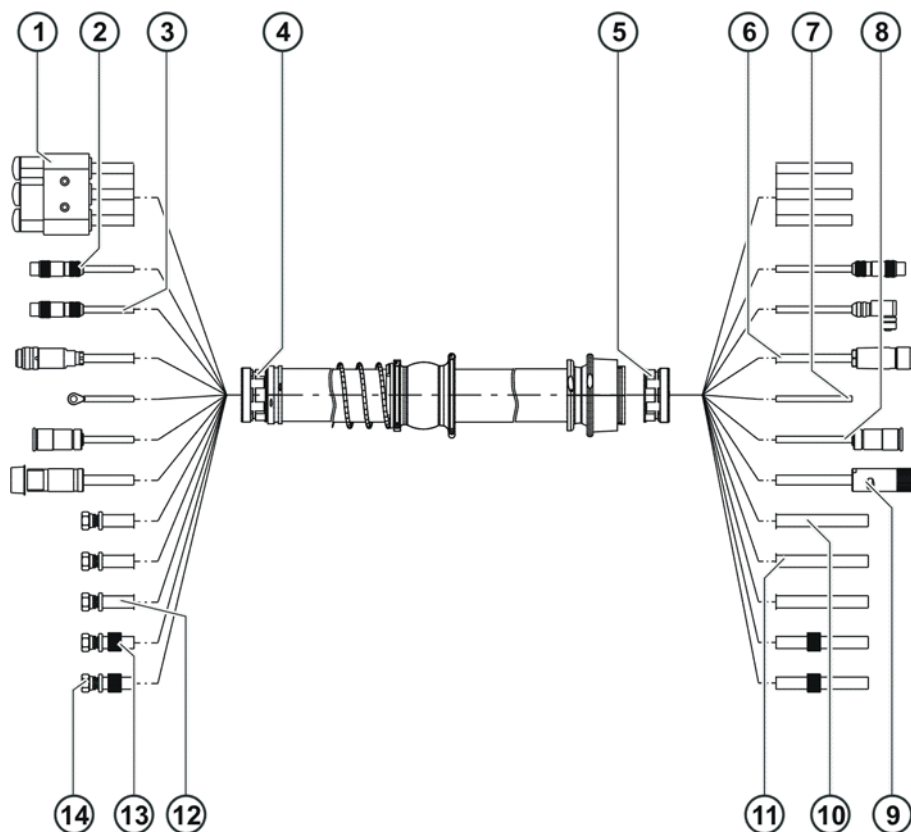


Fig. 3-2: Dress package A3 - A6

1	Welding cable, X93 - X103	8	Control cable for single axis, XP7.2 - XP7
2	Profinet cable, XPN3 - XPN6	9	Motor cable for single axis, XM7.3 - XM7
3	Profinet cable, X99.1-X109.1	10	Air line 3/8", blue
4	Cable star	11	Water line 3/8", green
5	Cable star	12	Water line 3/8", red
6	Power supply, XPP3 - XPP6	13	Water line 3/8", green
7	Ground conductor	14	Water line 3/8", red

The flexible tube is fixed to the spring holder in the box clamp by means of the support shell. The support shell constitutes the fixed point of the flexible tube, while the flexible tube is able to slide through the spring holder. The spring stubs are compressed during motions of the in-line wrist and thus tensioned so that the flexible tube is pulled back into the K box in the case of motions in the opposite direction. The pre-tension of the dress package can be modified by adjusting the protector; this changes the extent to which the dress package can be pulled out.

The two cable stars serve to adjust and locate the cables and hoses in the dress package and at the transitional points. The number and size of the holes in the cable stars are determined by the composition of the dress package. Holes that are present but not used must be sealed.

Fastening materials

The "fastening materials" assembly contains all parts required for fastening the dress package to the arm (>>> Fig. 3-3). This assembly also contains the fastening materials for connecting the cables and hoses. The scope of the assembly varies according to the arm length. The figure shows the assemblies

for all three arm lengths (AL). A plate between the arm and K box is not used with an arm length of 1200 mm, and the match plate is used with an arm length of 1400 mm.

The match plate is used to fasten the K box on the arm. Its mounting position depends on its use with this arm length. Further information is given on the match plate.

The clip for fastening clamp A6 to the in-line wrist is not part of the “fastening materials” assembly.

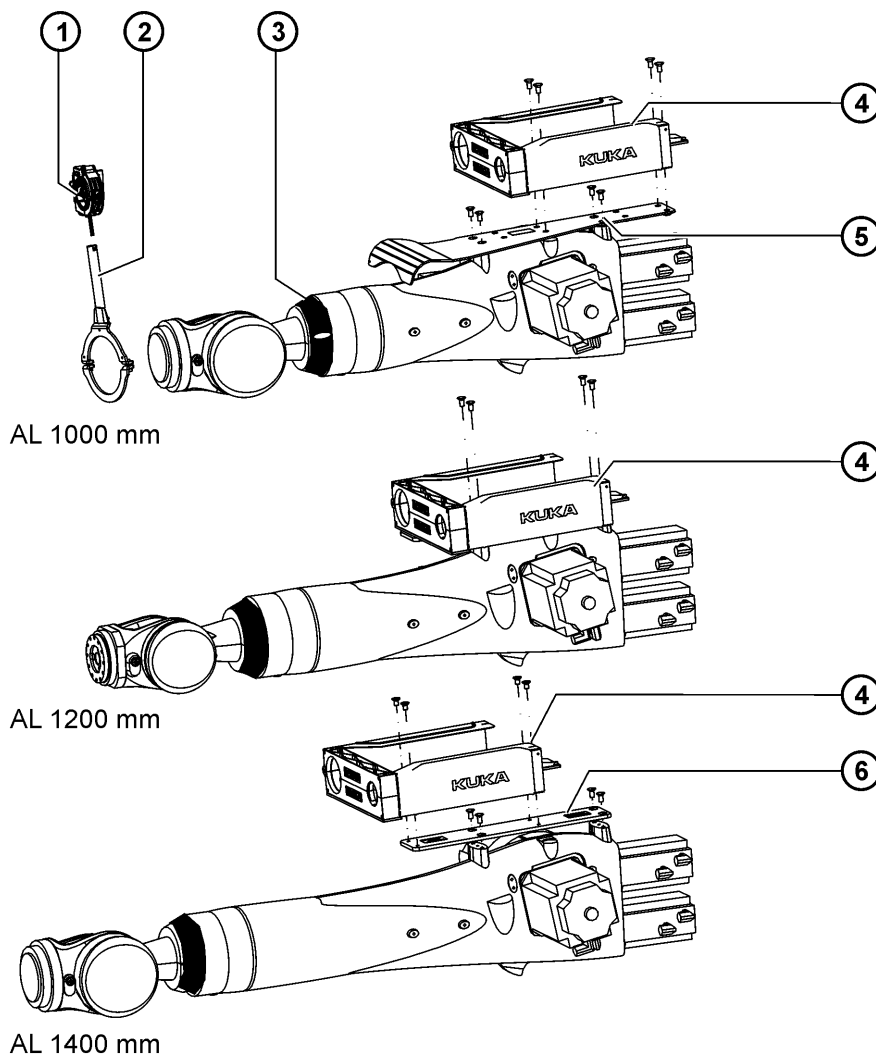


Fig. 3-3: Fastening materials

- | | | | |
|---|---------------------|---|-------------|
| 1 | Clamp, A6 | 4 | K box |
| 2 | Clip | 5 | Cover A3 |
| 3 | In-line wrist cover | 6 | Match plate |

4 Technical data

4.1 Basic data

NOTICE Thermal and electrical overloading of multi-strand cables can damage the energy supply system. Observe and comply with EN 60204-1.

Ambient temperature

Operation	283 K to 328 K (+10 °C to +55 °C)
Storage and transportation	233 K to 333 K (-40 °C to +60 °C)
Humidity rating	DIN EN 60721-3-3, Class 3K3

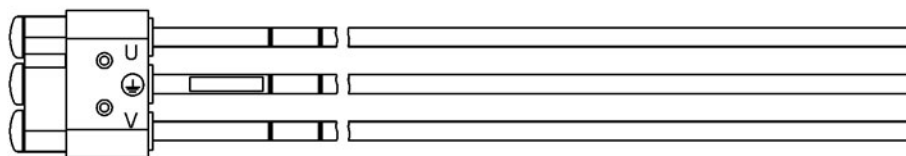
CAUTION The technical data and additional information about interfaces, hoses and cables can be found in the following sections.
Violation of the permissible operating parameters may result in injuries or damage to property. Observe the permissible operating parameters.

4.2 Dress package

Information about the configuration and contents of the dress package is given in Chapter (>>> 3 "Product description" Page 9). Detailed specifications for the supply lines contained in the dress package can be found in the following sections.

4.2.1 Welding cable, open

ID no.	003.46-01
Configuration	1x 35 mm ² , GNYE 2x 35 mm ² , BKMissing inline element 'sup'.
Rated voltage	600 V
Current	EN 60204-1 (derating factor must be taken into account)
Connection A3	Pin housing RobiFix S 35 MTB
Connection A6	Open
Minimum bending radius	10x outer diameter
Protection class when connected	IP65



X93

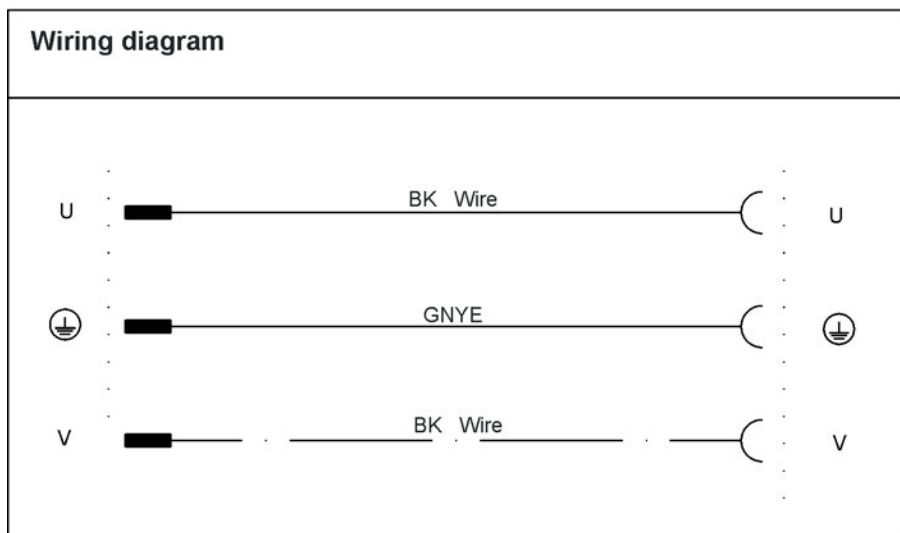


Fig. 4-1: Welding cable, open

4.2.2 Profinet cable

ID no.	024.10-01
Configuration	2x (2x AWG22), shielded
Rated voltage	30 V AC/DC
Current	EN 60204-1 (derating factors must be taken into account)
Connection A3	Connector M12, D-coded, ProfiNet, male
Connection A6	Connector M12, D-coded, ProfiNet, male
Minimum bending radius	10x outer diameter
Protection class when connected	IP65



XPN3.2
XF3.1
X92.1
XPN3
XPN

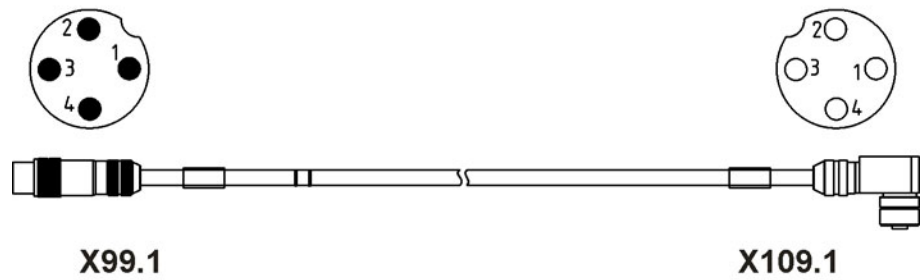
XPN6.2
XF6.1
X102.1
XPN6
XPN1

Wiring diagram							
Connector	Pin	Wire	Strip	Wire	Connector	Pin	Signal name
X...					X...		
	1	AWG 22		YE		1	TD+
	3	AWG 22		OG		3	TD-
	2	AWG 22		WH		2	RD+
	4	AWG 22		BU		4	RD-
Housing						Housing	

Fig. 4-2: Profinet cable

4.2.3 Profinet cable

ID no.	024.66-01
Configuration	2x (2x AWG22), shielded
Rated voltage	30 V AC/DC
Current	EN 60204-1 (derating factors must be taken into account)
Connection A3	Connector M12, A-coded, 4-pole, Profinet, male
Connection A6	Connector M12, A-coded, 4-pole, angled, female
Minimum bending radius	10x outer diameter
Protection class when connected	IP65



Wiring diagram							
Connector	Pin	Wire	Strip	Wire	Connector	Pin	Signal name
X...					X...		
	1	AWG 22	X	YE	X	1	
	3	AWG 22		OG		3	
	2	AWG 22	X	WH	X	2	
	4	AWG 22		BU		4	
Housing					Housing		

Fig. 4-3: Profinet cable

4.2.4 Power supply

ID no.	015.09-01
Configuration	4x 1.5 mm ²
Rated voltage	300 V Uo/U acc. to UL-CSA 250 V Uo/U acc. to VDE
Current	EN 60204-1 (derating factors must be taken into account)
Connection A3	Connector 7/8", 4-pole, male
Connection A6	Coupling 7/8", 4-pole, female
Minimum bending radius	10x outer diameter
Protection class when connected	IP65



X92.2
XPP3
XPP5

X102.2
XPP6
XPP6

Wiring diagram							
Connector	Pin	Wire	Strip	Wire	Connector	Pin	Signal name
X...	1		1.5 mm ²	1	X...	1	AUX V+ (switched)
	2		1.5 mm ²	2		2	AUX V+ (not switched)
	3		1.5 mm ²	3		3	AUX V- (not switched)
	4		1.5 mm ²	4		4	AUX V+ (switched)
	5		1.5 mm ²	YE		5	n. c.

Fig. 4-4: Power supply

4.2.5 Ground conductor

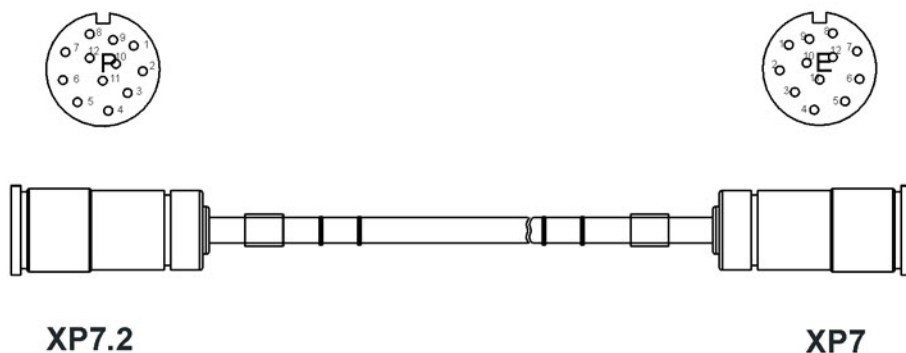
ID no.	017.07-01
Configuration	1x 10 mm ²
Connection A3	Ring cable lug 8 mm, 10 mm ²
Connection A6	Open
Minimum bending radius	10x outer diameter



Fig. 4-5: Grounding cable 10 mm², GN/YE

4.2.6 Control cable

ID no.	005.36-01
Configuration	4x (2x 0.25 mm ²), shielded in pairs
Rated voltage	160 V AC/DC
Current	EN 60204-1 (derating factors must be taken into account)
Connection A3	Signal connector, 12-pole, P-part
Connection A6	Signal connector, 12-pole, E-part
Minimum bending radius	10x outer diameter
Protection class when connected	IP65

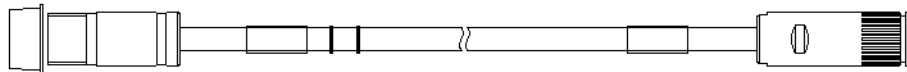


Wiring diagram							
Connector	Pin	Wire	Strip	Wire	Connector	Pin	Signal name
X...	9		0.25 mm ²	BN	X...	9	Temp.
	8		0.25 mm ²	WH		8	Temp.
	4					4	Shield
	7		0.25 mm ²	YE		7	R2
	10		0.25 mm ²	GN		10	R1
	2		0.25 mm ²	PK		2	S4
	1		0.25 mm ²	GY		1	S2
	12		0.25 mm ²	RD		12	S3
	11		0.25 mm ²	BU		11	S1
	5					5	Shield
	3					3	Shield
	6					6	Shield

Fig. 4-6: Control cable for single axis

4.2.7 Motor cable

ID no.	010.03-01
Configuration	4x 2.5 mm ² + 2x 1 mm ² , overall shield
Rated voltage	450/750 V
Current	EN 60204-1 (derating factors must be taken into account)
Connection A3	Power coupling, 6-pole, size 1
Connection A6	Circular power connector, 6-pole, size 1
Minimum bending radius	10x outer diameter
Protection class when connected	IP65



XM7.3
 XM7.5
 XM8.3
 XM9.3
 XM10.3
 XM11.3

XM7
 XM8
 XM9
 XM10
 XM11

Wiring diagram							
Connector	Pin	Wire	Wire	Wire	Connector	Pin	Signal designation
X...	1		1		X...	1	U XM8.5
	2		2			2	V
	6		3			6	W
	4		RD			4	Brake +
	5		BU			5	Brake -
			GNYE				Ground conductor
	Housing						Shield Housing connector

Fig. 4-7: Motor cable

4.2.8 Air line, blue

ID no.	523.15-01
Hose line	Hose 3/8", blue
Connection A3	Sealing head, straight, 9/16 - 18 UNF
Connection A6	Open
Rated pressure _{max.}	1.6 MPa (16 bar)
Hose length	See parts catalog
Minimum bending radius	10x outer diameter
Permissible thermal loading	243 K to 353 K (-30 °C to +80 °C)



Fig. 4-8: Air line, blue

4.2.9 Water line, green

ID no.	521.14-01
Hose line	Hose 3/8", green
Connection A3	Sealing head, straight, 9/16 - 18 UNF
Connection A6	Open
Rated pressure _{max.}	1.6 MPa (16 bar)

Hose length	See parts catalog
Minimum bending radius	10x outer diameter
Permissible thermal loading	243 K to 353 K (-30 °C to +80 °C)



Fig. 4-9: Water line, green

4.2.10 Water line, green

ID no.	522.16-01
Hose line	Hose 3/8", red
Connection A1	Sealing head, straight, 9/16 - 18 UNF
Connection A3	Open
Rated pressure _{max.}	1.6 MPa (16 bar)
Hose length	See parts catalog
Minimum bending radius	10x outer diameter
Permissible thermal loading	243 K to 353 K (-30 °C to +80 °C)



Fig. 4-10: Water line, green

5 Safety

5.1 Safety of the option

For this assembly or option, the safety instructions of the higher-level system with which it is operated apply. The general safety instructions also apply. All applicable safety measures required by national law, as well as all regulations and ordinances for the avoidance of personal injury and material damage, must likewise be observed at all times.

The relevant personal protective equipment must be worn during performance of all work on the system, system components or equipment.

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