Technický popis

Technický popis nabízeného plnění, který prokazuje splnění minimálních požadavků zadavatele na vlastnosti předmětu výběrového řízení s názvem Řídící systémy, část 3 - Sada zatěžovacích pracovišť. Použity budou následující komponenty:

Název	množství
C6015-0010:''Economy'' Control cabinet PC Housing - fanless Industrial PC for space-saving control	2
C9900-C583:processor Intel® Atom™ E3845, 1.91GHz, 4 cores (TC3: 50) and memory extension to 4 GB DDR	2
C9900-H591:60 GB M.2 SSD, 3D flash, extended temperature range	2
C9900-S477:Microsoft Windows 10 IoT Enterprise, Long Term Servicing Branch (LTSB), 64 bit, English,	2
TC1260-0050:TC3 PLC/NC PTP 10/NC I, platform 50 (Performance Plus)	2
TF1800-0050:TC3 PLC-HMI, platform 50 (Performance Plus)	2
AM8052-1J00-0000:Servomotor 8.2Nm	4
AX5206-0000-0210:Digital Compact Servo Drives (2-channel)	2
AX5801-0200-0000:TwinSAFE drive option card for AX5000 up to 40 A, HW 2.0: STO, SS1 (1)	2
AX2090-NF50-0032:mains filter C2 up to AX5125 Servo Drives, 58 x 265 x 90 mm (W x H x D), 1.75 kg	2
ZK4500-8023-0060:motor cable with	4
M23 speedtec® connector, both ends	
prepared servo motors	
AM804x-AM806x/A	
ZK4530-8010-0060:resolver cable for	4
AX5000, both ends prepared for	
connection between AM804x-AM807x, AM85	

Brzdný odpor s výkonem minimálně 1 kW na zatěžovací jednotku	4
Spojky	12
Montážní přípravek pro uchycení přírubového motoru na desku	12
Desky pro uchycení motorů	4
Sada 10 ks šroubů a matic na uchycení	4
Kryt rotujících částí	4
Cena celkem bez DPH	**432 128,- Kč**

Celková cena je 432 128,- Kč,- Kč bez DPH

DPH bude účtováno podle zákona č. 235/2004 Sb., o dani z přidané hodnoty

Vytvořil: Dne: 5.6.2018

AM8052 | Servomotor 8.2 Nm (standstill torque)

Data for 400 V AC	AM8052-wFyz	AM8052-wJyz	AM8052-wLyz
Standstill torque	8.20 Nm		
Rated torque	7.50 Nm	6.90 Nm	5.40 Nm
Cooling	convection		
Rated speed	2000 min-1	4000 min-1	7300 min-1
Rated power	1.57 kW	2.89 kW	4.13 kW
Peak torque	35.0 Nm		
Standstill current	3.30 A	6.30 A	11.3 A
Peak current	17.9 A	33.6 A	60.7 A
Torque constant	2.48 Nm/A	1.29 Nm/A	0.72 Nm/A
Voltage constant	167 mV/min-1	89 mV/min-1	49 mV/min-1
Number of poles	8		
Rotor moment of inertia	4.09 kgcm²		
Weight	6.60 kg		
Holding torque brake (M_{br})	9 Nm		
Power consumption (brake) at 24 V DC (P_{br})	18 W		
Rotor moment of inertia incl. brake (J)	4.711 kgcm²		
Weight incl. brake (m)	7.40 kg		
Connection technology	M23 speedtec® plug		
One Cable Technology (OCT)	yes		

Data for 400 V AC	AM8052-wGyz	AM8052-wKyz	AM8052-wNyz
Standstill torque	10.7 Nm	10.7 Nm	9.6 Nm
Rated torque	9.7 Nm	9.1 Nm	5.4 Nm
Cooling	external axial ventilation*		
Rated speed	2000 min-1	4000 min-1	6000 min-1
Rated power	2.03 kW	3.77 kW	4.08 kW
Peak torque	35.3 Nm		
Standstill current	4.30 A	8.50 A	13.6 A
Peak current	17.9 A	33.6 A	60.7 A
Torque constant	2.49 Nm/A	1.26 Nm/A	0.71 Nm/A
Voltage constant	167 mV/min-1	89 mV/min-1	49 mV/min-1
Number of poles	8		
Rotor moment of inertia	4.08 kgcm²		
Weight	6.8 kg		
Holding torque brake (M_{br})	9 Nm		
Power consumption (brake) at 24 V DC (P_{br})	18 W		
Rotor moment of inertia incl. brake (J)	4.74 kgcm²		
Weight incl. brake (m)	7.7 kg		
Connection technology	M23 speedtec® plug		
One Cable Technology (OCT)	yes		

*Thanks to the external axial ventilation the servomotor series offer high torques in the forced cooling version even at high speeds. Please see here for an overview.

Order reference AM80uv-wxyz	
u	flange code F
v	motor length
w = 0	smooth shaft
w = 1	shaft with groove and feather key according to DIN 6885
w = 2	shaft with IP 65 sealing ring and smooth shaft
w = 3	shaft with IP 65 sealing ring and shaft with groove and feather key
x	winding code A…Z
y = 0	2-cable standard: feedback resolver
y = 1	One Cable Technology for power and feedback: feedback transmission via motor cable, no feedback cable necessary, electronic identification plate, single-turn, absolute position within one revolution, 18 bit resolution
y = 2	One Cable Technology for power and feedback: feedback transmission via motor cable, no feedback cable necessary, electronic identification plate, multi-turn, absolute position within 4096 revolutions, 18 bit resolution
y = A	One Cable Technology for power and feedback: feedback transmission via motor cable, no feedback cable necessary, electronic identification plate, single-turn, absolute position within one revolution, resolution 23 bit (only for AM803x to AM807x and AM853x to AM856x)
y = B	One Cable Technology for power and feedback: feedback transmission via motor cable, no feedback cable necessary, electronic identification plate, multi-turn, absolute position within 4096 revolutions, resolution 23 bit (only for AM803x to AM807x and AM853x to AM856x)
y = N	without feedback (sensorless)
z = 0	without holding brake
z = 1	with holding brake
z = A	forced cooling, without holding brake, for AM805x, AM806x, AM807x (1)
z = B	forced cooling, with holding brake, for AM805x, AM806x, AM807x (1)
	(1) The EL2022 or KL2022 digital output terminal with matching ZK4054-6400-xxxx supply cable is recommended for controlling the external 24 V DC ventilation.
	All electric quantities are RMS values.
	The options cannot be installed in the field.

AX52xx | Digital Compact Servo Drives (2-channel)

The AX5000 Servo Drive series is available in single- or multi-channel form and is optimised in terms of function and cost-effectiveness. Integrated control technology supports fast and highly dynamic positioning tasks. EtherCAT as a high-performance communication system enables ideal interfacing with PC-based control technology.

The AX52xx 2-channel Servo Drive enables operation of two motors with identical or even with different power, up to a total current of 12 A. The multi-axis drives with variable motor output allocation offer optimised packaging density and costs per drive channel.

The AX5000 system enables simple and fast connection of several AX5000 devices to form a multi-axis system through the AX-Bridge quick connection system. The pluggable supply and connection module combines power supply, DC-Link and 24 V DC control and braking voltage.

A wide range of motor types can be connected to the AX5000. Motors of different size and type can be connected without additional measures. Examples include synchronous, linear, torque and asynchronous motors. The multi-feedback interface supports all common standards.

The AX5000 was developed specifically for use with EtherCAT. The outstanding features of EtherCAT are particularly beneficial for Drive Technology. They include short cycle time, synchronicity and simultaneity. EtherCAT enables very short cycle times, even in networks containing a large number of devices.

Features

- high-speed EtherCAT system communication
- rated current: 2 x 1.5 A, 2 x 3 A, 2 x 6 A
- wide voltage range: 1 x 100…240 V AC ±10 % and 3 x 100…480 V AC ±10 %
- active DC-Link and brake energy management
- multi-feedback interface
- flexible motor type selection
- scalable, wide range motor current measurement
- high-speed capture inputs
- diagnostic and parameter display
- integrated mains filter Cat. C3, according to EN 61800-3
- optional safety functions: protection against inadvertent restart of the drive axis (STO/SS1), intelligent TwinSAFE safety functions
- compact design for simple control cabinet installation
- AX-Bridge – the quick connection system for power supply, DC-Link and control voltage
- optimised cooling concept

Technical data	AX5201	AX5203	AX5206
Function	servo drive for two drive axes with flexible distribution of the total device current		
Rated output current at 50 °C	2 x 1.5 A	2 x 3 A	2 x 6 A
Minimum rated motor current at full current resolution	0.35 A		
Minimum rated channel current at full current resolution	0.35 A	1 A	1 A
Max. rated channel current at full current resolution (1-phase connection)	3 A	4.5 A	9 A
Max. rated channel current at full current resolution (3-phase connection)	3 A	6 A	9 A
Rated supply voltage	3 x 100…480 V AC ±10 % 1 x 100…240 V AC ±10 %		
DC-Link voltage	max. 875 V DC		
Peak output current (1)	2 x 5 A	2 x 10 A	2 x 13 A
Peak output current as total device current (1)	10 A	20 A	26 A

Rated apparent power for S1 operation (selection) **120 V (1-/3-phase connection)** **230 V (1-/3-phase connection)** **400 V (only 3-phase connection)** **480 V (only 3-phase connection)**	 0.6 kVA 1.2 kVA 2.1 kVA 2.5 kVA	 1.2 kVA 2.4 kVA 4.2 kVA 5.0 kVA	 2.5 kVA 4.8 kVA 8.3 kVA 10.0 kVA
Continuous braking power (2)	50 W	150 W	90 W
Max. braking power (2)	14 kW		
Power loss (3)	55 W	85 W	160 W
System bus	EtherCAT		
Weight	5.0 kg	6.0 kg	6.0 kg

(1)RMS for max. 7 seconds, (2)internal brake resistor, (3)S1 operation, incl. power supply, without brake chopper

Dimensions	**AX5201**	**AX5203**	**AX5206**
Height without connectors	274 mm		
Width	92 mm		
Depth without connectors	232 mm		

Ordering information	**AX520x-0000-0x0x**
AX5201-0000-0202	Digital Compact Servo Drive, 2-axis module, 100…480 V AC, rated output current 2 x 1.5 A, EtherCAT interface, OCT, hardware version 2.0, firmware version ≥ 2.10 (2)
AX5201-0000-0200	Digital Compact Servo Drive, 2-axis module, 100…480 V AC, rated output current 2 x 1.5 A, EtherCAT interface, OCT, hardware version 2.0, firmware version 2.06 (2)
AX5201-0000-0000	Digital Compact Servo Drive, 2-axis module, 100…480 V AC, rated output current 2 x 1.5 A, EtherCAT interface, hardware version 1.0 (1)
AX5203-0000-0202	Digital Compact Servo Drive, 2-axis module, 100…480 V AC, rated output current 2 x 3 A, EtherCAT interface, OCT, hardware version 2.0, firmware version ≥ 2.10 (2)
AX5203-0000-0200	Digital Compact Servo Drive, 2-axis module, 100…480 V AC, rated output current 2 x 3 A, EtherCAT interface, OCT, hardware version 2.0, firmware version 2.06 (2)
AX5203-0000-0000	Digital Compact Servo Drive, 2-axis module, 100…480 V AC, rated output current 2 x 3 A, EtherCAT interface, hardware version 1.0 (1)
AX5206-0000-0202	Digital Compact Servo Drive, 2-axis module, 100…480 V AC, rated output current 2 x 6 A, EtherCAT interface, OCT, hardware version 2.0, firmware version ≥ 2.10 (2)
AX5206-0000-0200	Digital Compact Servo Drive, 2-axis module, 100…480 V AC, rated output current 2 x 6 A, EtherCAT interface, OCT, hardware version 2.0, firmware version 2.06 (2)
AX5206-0000-0000	Digital Compact Servo Drive, 2-axis module, 100…480 V AC, rated output current 2 x 6 A, EtherCAT interface, hardware version 1.0 (1)

(1) compatible with AX5801-0000, not recommended for new projects

(2) compatible with AX5805, AX57xx, AX5021 and AX5801-0200

Ordering information	**AX5xxx | Options**
AX5021-0000-0000	brake module unit with internal braking resistor (250 W) and option for connecting an external braking resistor (up to 6 kW) as well as an additional DC link expansion capacity for storing brake energy efficiently

Accessories	
TE5910	TC3 Motion Designer
AX57xx, AX58, AX59xx	Option cards and quick connection system
AX5021, ZKxxxx-xxxx, AX2090-xxxx	Grid feed-in, EMC accessories, DC-link
AM80xx	Servo motors: Dynamic power packages made in Germany
AM85xx	Servomotors with increased rotor moment of inertia
AM88xx	stainless-steel motors with hygienic design

AX5000 Brake module AX5021

Documentation

Version: 1.3
Date: 2016-10-18
Order No.: TDmIAX-5021-0000-0200

BECKHOFF

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1 Foreword

Appropriate use

The brake module may only be used together with servo drives of the AX51xx-xxxx-02xx or AX52xx-xxxx-02xx series. These devices have serial numbers above 100.000. In addition to the AX5021, the drive system must include at least two further servo drives from the AX5000 range.

Safety

Safety regulations

Please note the following safety instructions and explanations!
Product-specific safety instructions can be found on following pages or in the areas mounting, wiring, commissioning etc.

 DANGER	**Caution – Danger of death!** Even when the AX5000 is disconnected from the mains voltage, dangerous voltage continues to be present at the “X02” terminals of the DC link for 15 minutes. Never touch the terminals within this period.
 WARNING	**Caution – Risk of injury!** Electronic equipment is not fail-safe. The machine manufacturer is responsible for ensuring that the connected motors and the machine are brought into a safe state in the event of a fault in the servo drive.

Personnel qualification

This description is only intended for trained specialists in control, automation and drive engineering who are familiar with the applicable national standards.

Notes on the documentation

This description is only intended for the use of trained specialists in control and automation engineering who are familiar with the applicable national standards.
It is essential that the documentation and the following notes and explanations are followed when installing and commissioning the components.
It is the duty of the technical personnel to use the documentation published at the respective time of each installation and commissioning.

The responsible staff must ensure that the application or use of the products described satisfy all the requirements for safety, including all the relevant laws, regulations, guidelines and standards.

Disclaimer

The documentation has been prepared with care. The products described are, however, constantly under development.
We reserve the right to revise and change the documentation at any time and without prior announcement.
No claims for the modification of products that have already been supplied may be made on the basis of the data, diagrams and descriptions in this documentation.

Copyright

2 Product overview

2.1 AX5021 brake module

Using a brake module it is possible to take up additional braking power in a drive system, because the connection of an external brake resistor without a brake module in a drive system with devices up to max. 25 A rated current is not permissible. A further advantage is the simple installation and the small space requirement of the brake module. The brake module is equipped with a complete DC link and an internal brake resistor and enables the connection of an external brake resistor with the integrated brake chopper. Several brake modules can be integrated into a drive system.

2.2 Electrical data

Electrcal data	AX5021
int. Resistance[1] [W]	150
int. Resistance[2] [W]	14.000
ext. Resistance min. [Ω]	22
ext. Resistance[3] [W]	6.000
ext. Resistance[4] [W]	max. 32.000
Power loss P [W]	max. 250
Charging rate 24 V_{DC} [A]	0.3 – 0.4
DC link capacity [µF]	705

[1] Durability break power P_{rms}

[2] Peak break power P_{peak}

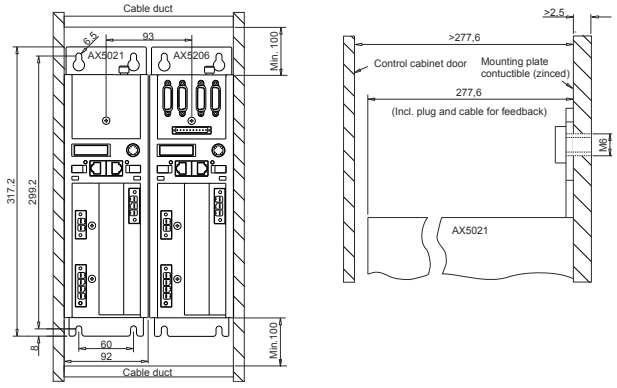
[3] Durability brake power P_{rms}

[4] Peak brake power P_{peak}

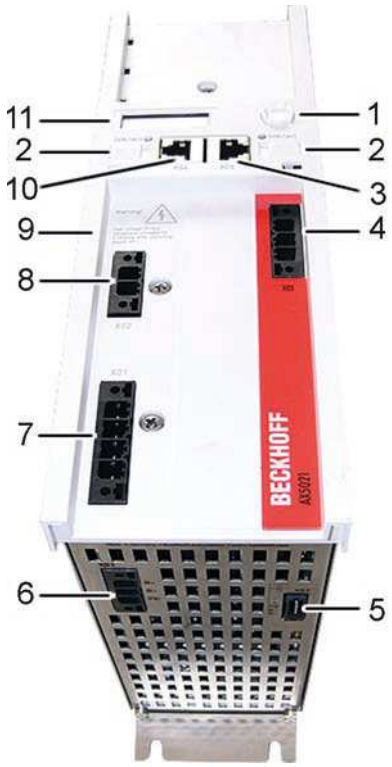
2.3 Mechanical data

The external dimensions of the brake module are identical to the dimensions of the servo drives from the AX5000 series up to 12 A.

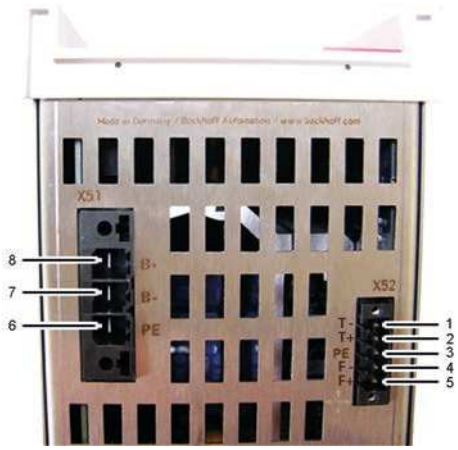
Mechanical data	AX5021
Weight	ca. 4 kg
Width	92 mm
Height without connector	274 mm
Depth without connector / accessories	232 mm



2.4 General overview

No.	Name	
1	Navigation rocker	
2	Labelling field	
3	X05 - socket for EtherCAT output	
4	X03 – power supply 24 V DC Input	
5	X52 - connection of the temperature monitor and the fan of the external brake resistor	
6	X51 - connection of the external brake resistor	
7	X01 – mains supply 100 – 480 V	
8	X02 – DC link output (890 V DC voltage).	
9	**DANGER**	Max. voltage 890 V DC at the DC link terminals (X02). Once the device has been switched off dangerous voltage will still be present for a further 15 minutes. The device is safe once the voltage has fallen below 50 V.
10	X04 - socket for EtherCAT input	
11	Display	

2.5 Pin strip assignment of X51 and X52

No.	Name	
1	**T-** = input of the temperature measurement sensor of the external brake resistor	
2	**T+** = input of the temperature measurement sensor of the external brake resistor	
3	**PE** = protective conductor	
4	**F-** = output to the fan controller of the external brake resistor	
5	**F+** = output to the fan controller of the external brake resistor	
6	**PE** = protective conductor	
7	**B-** = output to the controller of the external brake resistor	
8	**B+** = output to the controller of the external brake resistor	

Please refer to the servo drive ‘Startup’ manual for the pin assignments of the remaining inputs and outputs.

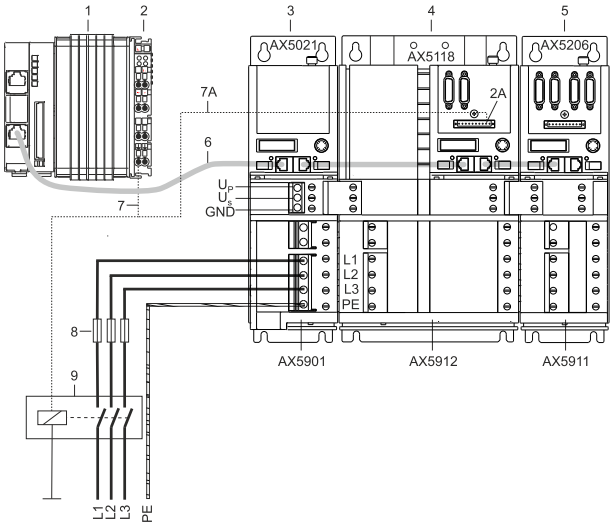
Note	**Temperature rise in the external brake resistor** The temperature rise of the external brake resistor should be monitored continuously via temperature contacts (1) and (2).

2.6 Electrical connection (example)

DANGER	**Serious risk of injury through high electrical voltage!** Due to the DC link capacitors dangerous voltage may persist at the DC link contacts "X02" after the servo drive has been disconnected from the mains supply. Wait 5 minutes after disconnection and measure the voltage on the DC link contacts DC+ and DC-. The device is safe once the voltage has fallen below 50 V.

The example below describes the brake module and several servo drives, which are linked via AX-Bridge modules to make up a drive system. We recommend that the brake module be placed in the first position with the AX-Bridge power supply module (AX5901) and after that the servo drives with decreasing rated current; we assume here that the most powerful servo drive also releases the greatest brake energy.

Attention	**Damage to devices** Please analyze your application. The brake module should always be placed directly beside the servo drive that releases the greatest brake energy. This rule should also be applied if several brake modules are used in a drive system.



Pos.	Name		Pos.	Name
1	PC with TwinCAT and PLC		6	Patch cable
2	Output terminal		7	Control cable from the output terminal
2A	Output "8" of the servo drive digital I/Os		7A	Control cable from output ‘8’ of the servo drive digital I/Os
3	Brake module		8	Mains fuses
4	Servo drive (with the greatest brake energy)		9	Mains contactor
5	Servo Drives			

CAUTION	**Uncontrolled movements!** If the drive system is disconnected from the mains due to a mains failure, all axes of the drive system make uncontrolled movements. Take suitable measures to ensure than no persons are endangered during this time. Vertical axes are particularly dangerous.

2.7 Integration into TwinCAT

The brake module can be integrated in the TwinCAT System Manager as a completely normal I/O device (1) and is parameterized (3) with the TCDrive Manager (2).

Power Management

Configuration in the TC Drive Manager

Pos.	Name		Pos.	Name
1	Power management		6	Activation / deactivation of the internal brake resistor
2	Mains voltage selection		7	External brake resistor parameter list
3	Phase monitoring (deactivate for single-phase mains)		8	0 = Deactivation of the external brake resistor (**not** recommended) 1 = Standard energy management with external brake resistor 2 = Energy management with external brake resistor (standalone)
4	Delay time until the phase monitoring responds (activate if mains is unclean)		9	Enabling / disabling the fan of the external brake resistor and setting the switching thresholds Switch on Level: Percentage specification of the rated capacity value of the external brake resistor.Switch on Temp.: Max. temperature value for the external brake resistor in "°C".
5	Internal brake resistor parameter list			

2.8 Energy management

Intelligent energy management ensures that energy is distributed evenly to the DC links and the internal brake resistors when devices are used commonly in the drive system. This reliably prevents the undesirable permanent load of only one device.

2.8.1 DC link

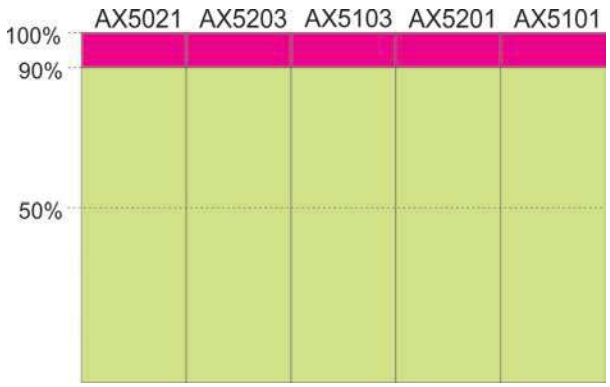
The connected servomotors are supplied with energy from the DC link. It serves as an energy storage and first needs to be charged up after switching the device on, before it can supply the servomotors. The DC link is designed such that it can take up and store a certain degree of surplus energy from the motor (brake energy) and subsequently supply the motor again with this stored energy. If the upper limit of the energy storage is reached, the brake chopper feeds any further brake energy into the internal or external brake resistor, where it is converted into heat; it is then no longer available for the further operation of the motor. The voltage is taken and evaluated as the indicator for the current energy level of the DC link. As soon as the brake resistors have also reached their energy limit, the error ‘FD4C, DC link – overvoltage’ appears and the energy flow to and from the motor is interrupted, i.e. the motor makes uncontrolled movements.

In a drive system, the DC links of the individual devices are connected so that the energy level of all devices is the same, regardless of which motor the brake energy is currently being fed back from. In many cases these feedbacks do not happen at the same time, and **without** a DC link system, for example, a device would be at the limit and would already have to "destroy" energy in a brake resistor, even though other devices could still store energy in the DC link. In a DC link connection the energy could be stored, since the DC link of all linked devices would be loaded first, before the energy in the brake resistors would be converted to heat.

2.8.2 Operation modes of the AX5021

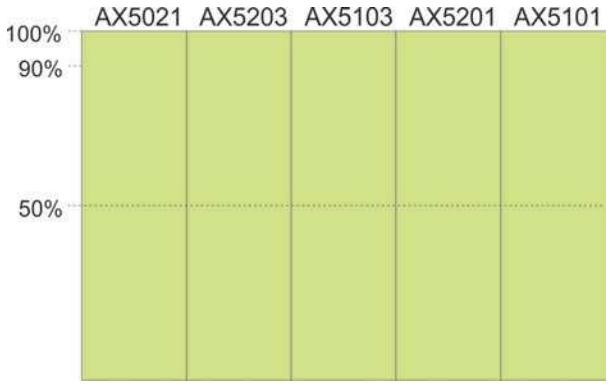
It can be assumed that a brake module is used only if the brake energy cannot be dissipated despite a DC link system and internal brake resistors. The brake module can be operated in two different operation modes, which have a direct influence on the energy management. The operation modes can be selected when using the external brake resistor. The following sketches show the storage capacity of the DC link of the individual devices in relation to the operation modes.

Default operation mode 1 - Ext. brake resistor enabled (system / standard)



In this operation mode the capacity of the DC link of the brake module is reduced by approx. 10%. At 90% DC link load the brake chopper then directs the generated braking energy to the external brake resistor and, when this has reached its capacity limit, into the internal brake resistor. In this case the brake energy is first fed into the brake module, since the brake choppers in the other servo drives are only activated at 100% utilization of the DC link. This operation mode is set as the default, because no further configuration of the devices in the DC link system is necessary apart from the basic configuration of the brake module. If the external brake resistor of the brake module is mounted outside the control cabinet, then the thermal load in the control cabinet is also lower.

Default operation mode 2 - Ext. brake resistor enabled (standalone brake chopper)



In this case the capacity of the DC links is fully utilized. This operation mode must be selected and, apart from the basic configuration of the brake module, the internal brake resistors of the devices in the DC link system should be deactivated, as otherwise the thermal load in the control cabinet will also increase. In order to reduce the thermal load further, it is a good idea to mount an external brake resistor on the brake module outside the control cabinet.

2.8.3 Braking power diagnosis

The current continuous output of the brake resistor can be read via the IDNs P-0-0209 (int. brake resistor) and P-0-0210 (ext. brake resistor). The unit is watts. Loads above 90% of the continuous output of the brake resistor should be avoided. The IDNs can be read cyclically as process data.

The current impulse energy load of the brake resistor can be read via the IDNs P-0-0218 (int. brake resistor) and P-0-0219 (ext. brake resistor). It is specified in % with one decimal place. Loads above 90% should be avoided. The IDNs can be read cyclically as process data.

The maximum energy values since the last reset are stored in IDNs P-0-0220 (int. brake resistor) and P-0-0221 (ext. brake resistor). The values can be reset by entering zero. Duty cycle corresponds to 100 seconds. The energy values are monitored at the specified intervals (100 ms, 1 s, 10 s, 20 s, 40 s and 100 s). The values for 100 s correspond to the continuous output. The maximum values should be approx. 10% below the resistor limits (P-0-0207 or P-0-0208). If a current energy value exceeds the limit value of a brake resistor, this brake resistor is not enabled. In a drive systems or in a configuration with active internal chopper the other brake resistors have to absorb the energy. If this is not possible the DC link voltage will continue to increase until an overvoltage error occurs, followed by disabling of the axes with "Torque off". It is therefore important to ensure that adequate braking power is available in the systems, in order to avoid uncontrolled movements of the axes. The diagnostics should cover the whole system. If not enough reserve capacity is available, an external brake resistor with a higher output should be selected. If the performance limit is still reached, several AX5021 may be used.

Note	**Energy balance** The energy balance is affected positively whenever an axis requires energy and another axis produces generative energy (braking energy). This rule should be observed in all applications.

AX5101, AX5103, AX5106, AX5112

AX5118, AX5125, AX5140

AX51xx | Digital Compact Servo Drives (1-channel)

Performance class up to 28 kW

The AX5000 Servo Drive series is available in single- or multi-channel form and is optimised in terms of function and cost-effectiveness. Integrated control technology supports fast and highly dynamic positioning tasks. EtherCAT as a high-performance communication system enables ideal interfacing with PC-based control technology.

The AX51xx 1-channel Servo Drives are designed for rated currents up to 40 A.

The AX5000 system enables simple and fast connection of several AX5000 devices to form a multi-axis system through the AX-Bridge quick connection system. The pluggable supply and connection module combines power supply, DC-Link and 24 V DC control and braking voltage.

A wide range of motor types can be connected to the AX5000. Motors of different size and type can be connected without additional measures. Examples include synchronous, linear, torque and asynchronous motors. The multi-feedback interface supports all common standards.

The AX5000 was developed specifically for use with EtherCAT. The outstanding features of EtherCAT are particularly beneficial for Drive Technology. They include short cycle time, synchronicity and simultaneity. EtherCAT enables very short cycle times, even in networks containing a large number of devices.

Features

- high-speed EtherCAT system communication
- rated current: 1.5 A, 3 A, 6 A, 12 A, 18 A, 25 A, 40 A
- wide voltage range: 1 x 100…240 V AC ±10 % and 3 x 100…480 V AC ±10 %
- active DC-Link and brake energy management
- multi-feedback interface
- flexible motor type selection
- scalable, wide range motor current measurement
- high-speed capture inputs
- diagnostic and parameter display
- integrated mains filter Cat. C3, according to EN 61800-3
- optional safety functions: restart lock, intelligent TwinSAFE safety functions
- compact design for simple control cabinet installation
- AX-Bridge – the quick connection system for power supply, DC-Link and control voltage
- optimised cooling concept

Servo Drives with rated output currents > 40 A see page 780

Technical data	AX5101	AX5103	AX5106	AX5112	AX5118	AX5125	AX5140
Rated output current at 50 °C (1-phase connection)	1 x 1.5 A	1 x 3 A	1 x 4.5 A	–	–	–	–
Rated output current at 50 °C (3-phase connection)	1 x 1.5 A	1 x 3 A	1 x 6 A	1 x 12 A	1 x 18 A	1 x 25 A	1 x 40 A
Minimum rated motor current at full current resolution	0.35 A	1 A	1 A	6 A	12 A	12 A	18 A
Rated supply voltage	3 x 100…480 V AC ±10 % 1 x 100…240 V AC ±10 %			3 x 100…480 V AC ±10 %			
DC-Link voltage	max. 890 V DC						
Peak output current [1]	4.5 A	7.5 A	13 A	26 A	36 A	50 A	80 A
Rated apparent power for S1 operation (selection)							
120 V (1-/3-phase connection)	0.3 kVA	0.6 kVA	1.2 kVA	2.5 kVA	3.4 kVA	4.8 kVA	8.3 kVA
230 V (1-/3-phase connection)	0.6 kVA	1.2 kVA	2.4 kVA	4.8 kVA	7.2 kVA	10.0 kVA	16.0 kVA
400 V (only 3-phase connection)	1.0 kVA	2.1 kVA	4.2 kVA	8.3 kVA	12.5 kVA	17.3 kVA	28.0 kVA
480 V (only 3-phase connection)	1.2 kVA	2.5 kVA	5.0 kVA	10.0 kVA	15.0 kVA	20.8 kVA	33.0 kVA
Continuous braking power [2]	50 W	50 W	150 W	90 W	200 W	200 W	200 W
Max. braking power [2]	14 kW	14 kW	14 kW	14 kW	27 kW	27 kW	27 kW
Power loss [3]	35 W	50 W	85 W	160 W	255 W	340 W	550 W
System bus	EtherCAT						
Weight	4.0 kg	4.0 kg	5.0 kg	5.0 kg	11.0 kg	11.0 kg	14.0 kg
Further information	www.beckhoff.com/AX51xx						

[1] RMS for max. 7 seconds, [2] internal brake resistor, [3] S1 operation, incl. power supply, without brake chopper

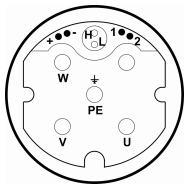
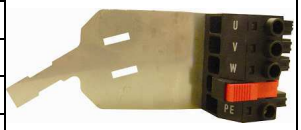
Dimensions	AX5101	AX5103	AX5106	AX5112	AX5118	AX5125	AX5140
Height without connectors	274 mm	274 mm	274 mm	274 mm	274 mm	274 mm	274 mm
Width	92 mm	92 mm	92 mm	92 mm	185 mm	185 mm	185 mm
Depth without connectors	232 mm	232 mm	232 mm	232 mm	232 mm	232 mm	232 mm

Ordering information	AX51xx-0000-0200
AX5101-0000-0200	Digital Compact Servo Drive, 1-axis module, 100…480 V AC, rated output current 1.5 A, EtherCAT interface, OCT
AX5103-0000-0200	Digital Compact Servo Drive, 1-axis module, 100…480 V AC, rated output current 3 A, EtherCAT interface, OCT
AX5106-0000-0200	Digital Compact Servo Drive, 1-axis module, 100…480 V AC, rated output current 6 A, EtherCAT interface, OCT
AX5112-0000-0200	Digital Compact Servo Drive, 1-axis module, 100…480 V AC, rated output current 12 A, EtherCAT interface, OCT
AX5118-0000-0200	Digital Compact Servo Drive, 1-axis module, 100…480 V AC, rated output current 18 A, EtherCAT interface, OCT
AX5125-0000-0200	Digital Compact Servo Drive, 1-axis module, 100…480 V AC, rated output current 25 A, EtherCAT interface, OCT
AX5140-0000-0200	Digital Compact Servo Drive, 1-axis module, 100…480 V AC, rated output current 40 A, EtherCAT interface, OCT

Compatible with AX5021, AX57xx, AX5801-0200 and AX5805

Options, pre-assembled cables and accessories see page 782

Motor cable ZK4500-8027-zzzz

Plug connector	Contact	Function	Core identification	Contact	Plug connector
	U	U	black / 1	U	
	V	V	black / 2	V	
	W	W	black / 3	W	
	PE	PE	green/yellow	PE	
	N	n. c.		n.c.	
	+	Brake +	black / 5	Brake +	
	-	Brake -	black / 6	Brake -	
	1	n. c.		n. c.	
	2	n. c.		n. c.	
Mating view 	H	OCT + / Temp. +	white	OCT + / Temp. +	
	L	OCT - / Temp. -	blue	OCT - / Temp. -	

Catalog data	
Catalog text	10 mm² with M40-speedtec® plug , highly flexible, for drag-chain use
Servomotor	AM806x-xTxxx and AM807x
Servo Drive	AX5000 (40 A)
Catalog description	(4x10mm² + (2x1.5mm²)C + (2xAWG22))

Electrical properties at 20°C	
Max. operating voltage	1000 VAC (UL)
Direct current resistance	≤ 55.0 Ω/km (AWG22) / ≤ 13.3 Ω/km (1.5 mm²) / ≤ 1.91 Ω/km (10 mm²), DIN EN 50395
Insulation resistance	≥ 500 MΩ x km, DIN EN 50395
Operating capacity at 800 Hz	score / screen ≤ 150 pF/m (10 mm²), EN 50289-1-5

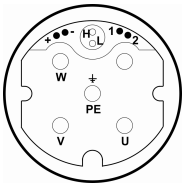
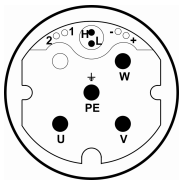
Mechanical properties	
Outside diameter d	20.9 ± 0.5 mm
Min. bending radius	10 x d
Max. driven speed	240 m/min
Max. acceleration	30 m/s² (at 5 m movement)
Max. allowable travelling distance	20 m horizontal / 5 m vertical
Max. torsion	± 30°/m
Max. bending cycles	5 Mio.
Operating temperature	-20°C to +60°C
Shield optical	>85 %

Properties cable	
Material outer sheath	TPU, flame retardant, halogen free
Color	Orange, like RAL 2003
Weight	0.76 kg/m
RoHS conformity	Yes
Silicon-free	Yes
Halogen-free	DIN VDE 0472 T815
Flame resistance	IEC 60332-1-2 / UL758 cable flame test
Oil resistance outer sheath	HD 22.10 Appendix A / DIN EN60811-2-1
UL Approbation	UL758 (AWM) Style 21223 (Outer sheath) and Style 10492 (Core)

Properties motor plug	
Housing	brass, zinc diecast; nickel-plated and chromated
Connecting Nut	Brass, zinc diecast; nickel-plated
Contacts	brass gold plated
Seals	FPM/HNBR (Viton)
Clamp Ring	brass nickel-plated
Protection Type	connected: IP65 (IEC 60529)
Mating Cycles	min. 500

Properties AX5000 plug	
Contact material	Cu-Leg
Contact surface	tin-plated
Insulator	PBT
Licence	CSA, UL 1059
RoHS conformity	yes

Motor cable extension ZK4501-8027-zzzz

Plug connector	Contact	Function	Core identification	Contact	Plug connector
	U	U	black / 1	U	
	V	V	black / 2	V	
	W	W	black / 3	W	
	PE	PE	green/yellow	PE	
	N	n. c.		n.c.	
	+	Brake +	black / 5	+	
	-	Brake -	black / 6	-	
	1	n. c.		n. c.	
Mating view	2	n. c.		n. c.	Mating view
	H	OCT + / Temp. +	white	H	
	L	OCT - / Temp. -	blue	L	

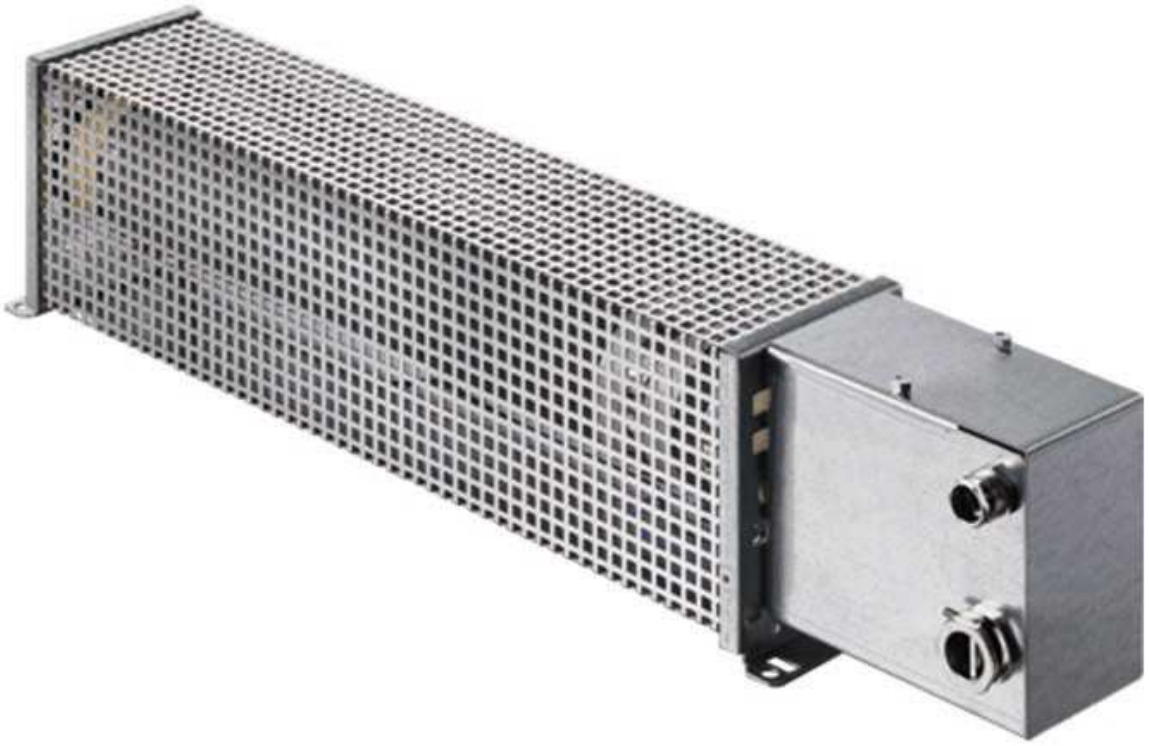
Catalog data	Motor cable extension for motor cable ZK4500-8027-zzzz
Catalog text	10 mm² with M40-speedtec® plug , highly flexible, for drag-chain use
Servomotor	AM806x-xTxxx and AM807x
Servo Drive	AX5000 (40 A)
Catalog description	(4x10mm² + (2x1.5mm²)C + (2xAWG22))

Electrical properties at 20°C	
Max. operating voltage	1000 VAC (UL)
Direct current resistance	≤ 55.0 Ω/km (AWG22) / ≤ 13.3 Ω/km (1.5 mm²) / ≤ 1.91 Ω/km (10 mm²), DIN EN 50395
Insulation resistance	≥ 500 MΩ x km, DIN EN 50395
Operating capacity at 800 Hz	score / screen ≤ 150 pF/m (10 mm²), EN 50289-1-5

Mechanical properties	
Outside diameter d	20.9 ± 0.5 mm
Min. bending radius	10 x d
Max. driven speed	240 m/min
Max. acceleration	30 m/s² (at 5 m movement)
Max. allowable travelling distance	20 m horizontal / 5 m vertical
Max. torsion	± 30°/m
Max. bending cycles	5 Mio.
Operating temperature	-20°C to +60°C
Shield optical	>85 %

Properties cable	
Material outer sheath	TPU, flame retardant, halogen free
Color	Orange, like RAL 2003
Weight	0.76 kg/m
RoHS conformity	Yes
Silicon-free	Yes
Halogen-free	DIN VDE 0472 T815
Flame resistance	IEC 60332-1-2 / UL758 cable flame test
Oil resistance outer sheath	HD 22.10 Appendix A / DIN EN60811-2-1
UL Approbation	UL758 (AWM) Style 21223 (Outer sheath) and Style 10492 (Core)

Properties motor plug	
Housing	brass, zinc diecast; nickel-plated and chromated
Connecting Nut	Brass, zinc diecast; nickel-plated
Contacts	brass gold plated
Seals	FPM/HNBR (Viton)
Clamp Ring	brass nickel-plated
Protection Type	connected: IP65 (IEC 60529)
Mating Cycles	min. 500



Documentation

External brake resistor AX2090-BW5x

Accessories for Beckhoff servo drive AX5000

Version: 1.3
Date: 2018-03-14

BECKHOFF

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1 Foreword

1.1 Notes on the documentation

This description is only intended for the use of trained specialists in control and automation engineering who are familiar with the applicable national standards.
It is essential that the documentation and the following notes and explanations are followed when installing and commissioning the components.
It is the duty of the technical personnel to use the documentation published at the respective time of each installation and commissioning.

The responsible staff must ensure that the application or use of the products described satisfy all the requirements for safety, including all the relevant laws, regulations, guidelines and standards.

Disclaimer

The documentation has been prepared with care. The products described are, however, constantly under development.
We reserve the right to revise and change the documentation at any time and without prior announcement.
No claims for the modification of products that have already been supplied may be made on the basis of the data, diagrams and descriptions in this documentation.

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Patent Pending

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EP1590927, EP1789857, DE102004044764, DE102007017835
with corresponding applications or registrations in various other countries.

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1.2 Documentation issue status

Version	Comment
1.3	**Chapter update:** Appropriate use **1.3**; For your safety **2**; Product identification **3**; Technical data **6**
1.2	**Chapter update:** 5.5.1
1.1	General update
1.0	First published

1.3 Appropriate use

The brake resistors from the AX2090-BW5x-xxxx series are exclusively designed for direct application with an AX5000 series servo drive or the AX5021 brake module. They are designed for installation as components in electrical installations and machines together with the servo drive or the brake module, and this is their only purpose.

 **WARNING**	**Caution – Risk of injury!** Basically, electronic devices are not fail-safe. The machine manufacturer is responsible for ensuring that the connected motors and the machine are brought into a safe state in the event of a fault in the drive system.

The external brake resistors of the AX2090-BW5x-xxxx series are able to convert the dynamic energy generated during braking of a servomotor into heat. The series covers a wide continuous power and peak power range. The built-in temperature switch enables the system to respond immediately to any overload of the brake resistor through analysis in the AX5000 or the PLC. All brake resistors of the AX2090-BW5x-xxxx series are UL and CSA approved.

Improper use

The external brake resistor AX2090-BW5x-xxxx is **not** suitable for use in the following areas:

- in ATEX zones without a suitable housing
- in areas with aggressive environments (e.g. aggressive gases or chemicals)

The relevant standards and directives for EMC interference emissions must be complied with in residential areas. The servo drives may only be installed in housings and control cabinets with appropriate shielding attenuation.

2 For your safety

Read the section on safety and heed the notices to protect yourself against personal injury and material damages.

Liability limitations

All the components of the external brake resistor AX2090-BW5x-xxxx are supplied in certain hardware and software configurations appropriate for the conditions of the application. Unauthorized modifications to the hardware and/or software configurations other than those described in the documentation are not permitted, and nullify the liability of Beckhoff Automation GmbH & Co. KG.

In addition, the following actions are excluded from the liability of Beckhoff Automation GmbH & Co. KG:

- Failure to comply with this documentation
- Improper use
- Untrained personnel
- Use of unauthorized spare parts

2.1 Staff qualification

Only technical personnel with knowledge of control and automation technology may carry out any of the illustrated work steps on the Beckhoff software and hardware, in particular on the external brake resistor AX2090-BW5x-xxxx.

The technical personnel must have knowledge of drive technology and electrical systems and must also know how to work safely on electrical equipment and machines.

This also includes:

- production planning and
- securing of the working environment (e.g. securing the control cabinet against being switched on again).

The technical personnel must be familiar with the current and necessary standards and directives for the automation and drive environment.

2.2 Description of symbols

In this documentation the following symbols are used with an accompanying safety instruction or note. The safety instructions must be read carefully and followed without fail!

Symbols that warn of personal injury:

 DANGER	**Serious risk of injury!** This is an extremely dangerous situation. Disregarding the safety notice will lead to serious permanent injuries or even death.
 WARNING	**Risk of injury!** This is a dangerous situation. Disregarding the safety notice may lead to serious injuries.
 CAUTION	**Personal injuries!** This is a dangerous situation. Disregarding the safety notice may lead to minor injuries.

Symbols that warn of damage to property or equipment:

 Attention	**Warning of damage to property or the environment!** This notice indicates disturbances in the operational procedure that could damage the product or the environment.

Symbols indicating further information or tips:

 Note	**Tip or pointer!** This notice provides important information that will be of assistance in dealing with the product or software. There is no immediate danger to product, people or environment.
	**UL note!** This symbol indicates important information regarding UL certification.

2.3 Safety rules

The responsible staff must ensure that the application or use of the products described satisfy all the requirements for safety, including all the relevant laws, regulations and guidelines.

 DANGER	**Serious risk of injury through electric shock!** Due to the DC link capacitors dangerous voltage (> 890V_{DC}) may persist at the DC link contacts “ZK+ and ZK- (DC+ and DC-)“ and “RB+ and RB-“ after the servo drive has been disconnected from the mains supply. After disconnecting the servo drive wait at AX5101 - AX5125 and AX520x; 5 minutes, at AX5140/AX5160/AX5172; 15 minutes, at AX5190/ AX5191; 30 minutes and at AX5192/AX5193; 45 minutes and measure the voltage at the DC link contacts ZK+ and ZK- (DC+ and DC-). The device is safe once the voltage has fallen below 50 V.
 WARNING	**Caution - Risk of injury through hot surfaces!** The temperature of the brake resistor housing surface may reach over 200 °C. Please ensure that the housing has cooled down below 40 °C before touching it.
	**UL-Listing!** It is essential to observe directives and standards if you wish to operate an AX5000 in an economic area that requires a UL-Listing.

3 Product identification

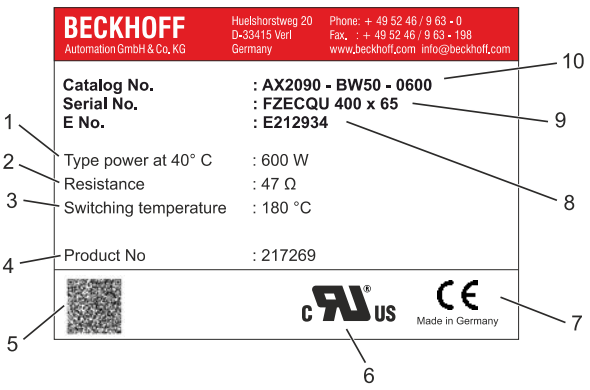
Scope of supply

The scope of delivery may vary depending on the ordered configuration. Before installing the device please ensure that all ordered components were delivered and that they are undamaged. In the event of any damage please contact the carrier immediately and document the damage.

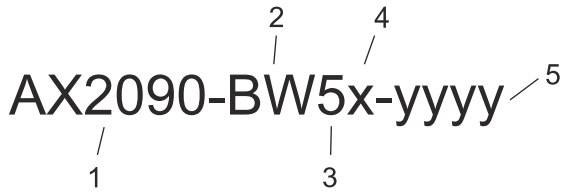
The scope of supply always includes:

- Brake resistor of the appropriate performance class
- Technical documentation (this documentation)
- Packaging

Name plate

Figure	Pos.-No.	Description
	1	Type power at 40 °C
	2	Resistance
	3	Switching temperature
	4	Product no
	5	Barcode
	6	UL-Recognized Component – certification
	7	CE – certification
	8	E no.
	9	Serial no.
	10	Catalog no.

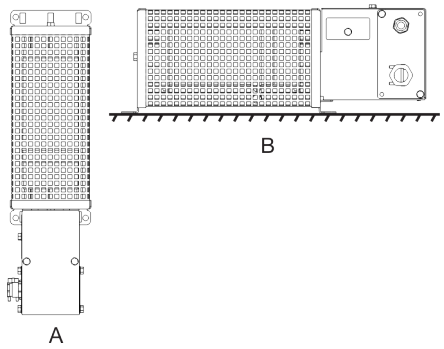
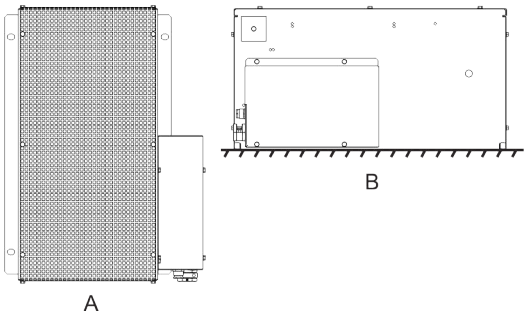
Type key

Figure	Pos.-No.	Description
	1	Drive Technology Acessories
	2	BW = brake resistor
	3	Servo drive AX5000
	4	0 = AX5000 up to 12 A rated channel current 1 = AX5118 up to AX5140 2 = AX5160 up to AX5172 3 = AX5190 up to AX5191 4 = AX5192 up to AX5193
	5	AX5000

4 Mechanical installation

4.1 Mounting positions and distances

(A) = vertical installation is only permitted according to the diagram (terminal box facing downwards).
(B) = horizontal installation

Assignment of the device classes	
	
AX2090-BW50-xxxx AX2090-BW51-1000	AX2090-BW51-3000 and AX2090-BW51-6000 AX2090-BW52-3000 and AX2090-BW52-6000 AX2090-BW53-3000 and AX2090-BW53-6000 AX2090-BW54-3000 and AX2090-BW54-6000

For all mounting positions the following minimum distances must be adhered to:

200 mm to adjacent components, walls etc. and 300 mm to components, ceilings etc. above. If the device is installed vertically (A), the minimum distance to components, floors etc. below is 200 mm in order to allow unobstructed flow of air to the brake resistor.

5 Electrical installation

5.1 Important notes

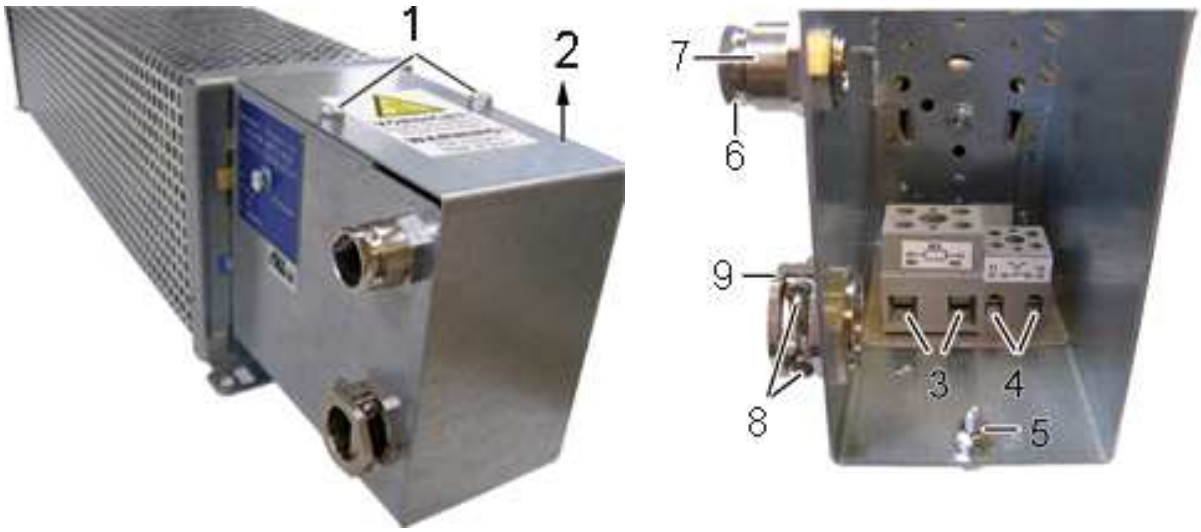
DANGER	**Serious risk of injury through electric shock!** Only staff qualified and trained in electrical engineering are allowed to wire up the brake resistors. • Check the assignment of the servo drive and the brake resistor. Compare the rated voltage and the rated current of the devices. • Always make sure that the brake resistors are de-energized during assembly and wiring, i.e. no voltage may be switched on for any piece of equipment which is to be connected. Ensure that the control cabinet remains turned off (barrier, warning signs etc.). The individual voltages will only be turned on again during commissioning. • Due to the DC link capacitors, the DC link contacts "ZK+ and ZK- (DC+ and DC-)" and "RB+ and RB-" may be subject to dangerous voltages exceeding 890V_{DC}, even after the servo drive was disconnected from the mains supply. Wait 5 minutes for the AX5101 - AX5125 and AX520x; 15 minutes for the AX5140/ AX5160/AX5172; 30 minutes for the AX5190/AX5191; 45 minutes for the AX5192/ AX5193 after disconnecting, and measure the voltage at the DC links "ZK+ and ZK- (DC+ and DC-)". The device is safe once the voltage has fallen below 50 V.

5.2 Connection the brake resistor

Remove the two screws (1) and remove the cover (2) in direction of the arrow. Connect an adequately dimensioned cable (see chapter "Cables") to the connections (3) of the resistor and the earthing stud (5) and take it out of the terminal box through the strain-relief assembly (9). Ensure adequate strain relief with the two screws (8). Connect the other side of the cable to the DC link contact connector "X2" of the AX5000. The connector is supplied with the AX5000. Connect the earthing cable to the earthing conductor of the control cabinet.

Connect an adequately dimensioned cable to the potential-free N/C contact (4) of the temperature switch and take it out of the terminal box through the strain-relief assembly (7) (see chapter "Temperature switch"). Ensure adequate strain relief with the nut (6).

Install the cover (2) in reverse order.



5.3 Cables

Beckhoff offers pre-assembled cables for safe, faster and flawless installation of the motors. Beckhoff cables have been tested with regard to the materials, shielding and connectors used. They ensure proper functioning and compliance with statutory regulations such as EMC, UL etc. The use of other cables may lead to unexpected interference and invalidate the warranty.

WARNING

Caution - Fire hazard!

The brake resistors can reach temperatures of almost 200 °C. Therefore, ensure adequate thermostability of the cables! Cables with inadequate thermostability can cause a cable fire!

Attention

EMC safety

Use only shielded cables.

Type	Brake resistor		Temperature switch	
	[mm²]	[AWG]	[mm²]	[AWG]
AX2090-BW50-0300	1,5	16	0.75	18
AX2090-BW50-0600	1,5	16	0.75	18
AX2090-BW50-1600	1,5	16	0.75	18
AX2090-BW51-1000	2,5	12	0.75	18
AX2090-BW51-3000	2,5	12	0.75	18
AX2090-BW51-6000	2,5	12	0.75	18
AX2090-BW52-3000	4,0	12	0.75	18
AX2090-BW52-6000	4,0	12	0.75	18
AX2090-BW53-3000	6,0	12	0.75	18
AX2090-BW53-6000	6,0	12	0.75	18
AX2090-BW54-3000	6,0	12	0.75	18
AX2090-BW54-6000	6,0	12	0.75	18

We recommend wire end sleeves.

5.4 Temperature switch

Attention	**Destruction of the brake resistor!** The temperature switch is exclusively used for temperature monitoring. The brake resistor is not switched off.

The temperature switch has a potential-free N/C contact, which enables immediate response to any overload of the brake resistor through analysis in the AX5000 or the PLC. Connect the cable directly to a free input of plug "X06". Then parameterize it such that the AX5000 stops the motor(s) with an emergency ramp or the PLC reads and processes this input.

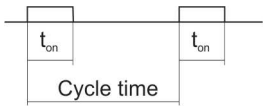
Type	Switching temperature	Switching current 24 VDC or 230 VAC
	[°C]	[A]
AX2090-BW50-0300	180	2
AX2090-BW50-0600	180	2
AX2090-BW50-1600	180	2
AX2090-BW51-1000	180	2
AX2090-BW51-3000	85	2
AX2090-BW51-6000	85	2
AX2090-BW52-3000	85	2
AX2090-BW52-6000	85	2
AX2090-BW53-3000	85	2
AX2090-BW53-6000	85	2
AX2090-BW54-3000	85	2
AX2090-BW54-6000	85	2

5.5 Short-term capacity

Brake resistors are usually not operated continuously, but only exposed to short-time duty. In the following section the permitted short-term capacity is calculated based on the continuous power, overload factor and duty cycle.

5.5.1 Duty cycle

The duty cycle is a relative value that depends on the switch-on time (t_{on}) and the cycle time. Cycle times up to 120 sec. are used directly in the calculation. Should the cycle time exceed 120 sec., the maximum relevant cycle time of 120 sec. is used in the calculation.



$$\text{duty cycle} = \frac{t_{on}}{\text{Cycle time}} \times 100\ \%$$

Sample 1
T_{on} = 60 s
Cycle time = 280 s
Duty cycle = 50%

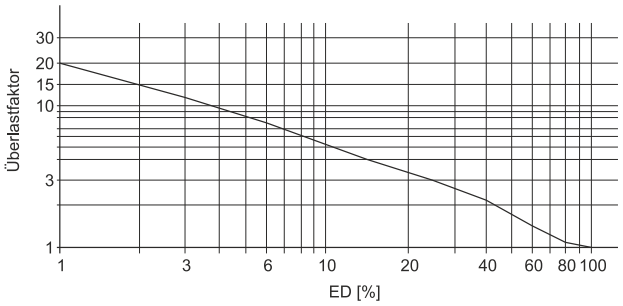
Sample 2
T_{on} = 40 s
Cycle time = 100 s
Duty cycle = 40 %

Note	**Further information of external brake resistors:** For further information on the configuration and diagnostics of external brake resistors, please refer to the function description of the servo drive AX5000: “Diagnostic of external brake resistors”.

5.5.2 Overload factor

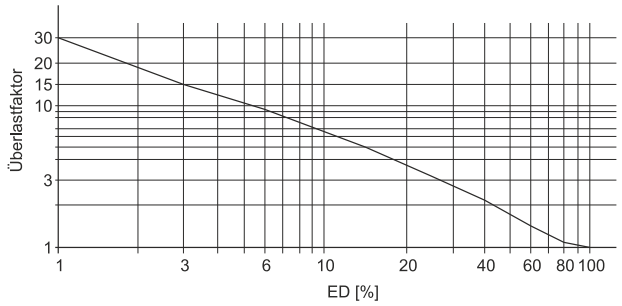
AX2090-BW51-3000 and AX2090-BW51-6000
AX2090-BW52-3000 and AX2090-BW52-6000
AX2090-BW53-3000 and AX2090-BW53-6000
AX2090-BW54-3000 and AX2090-BW54-6000

Overload factor depending on duty circle



AX2090-BW50-xxxx and AX2090-BW51-1000

Overload factor depending on duty circle

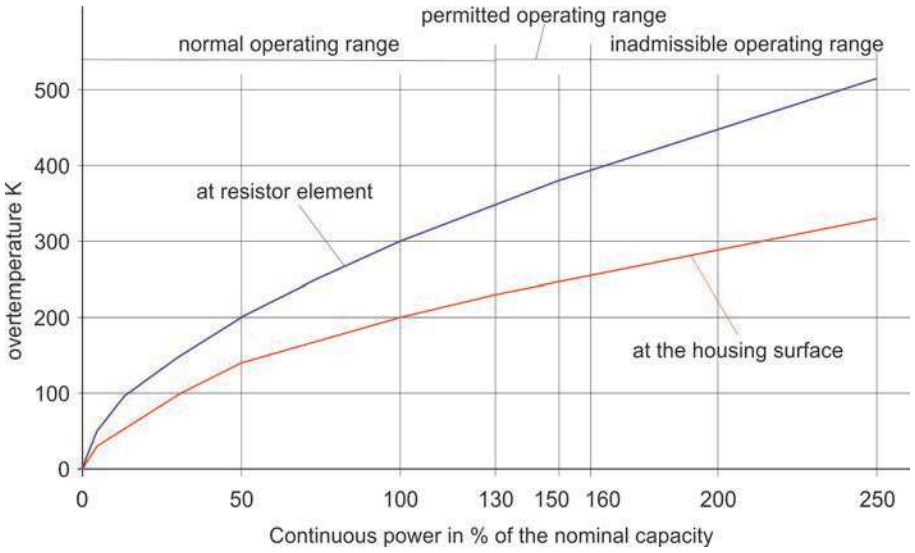


Calculation formula

Short-term capacity = continuous power x overload factor

5.6 Overtemperature and continuous power at 100% duty cycle

If your application requires a higher continuous power than the specified nominal capacity, you can accept this state if a higher brake resistor temperature is permitted. The following diagram shows the overtemperature v. the continuous power.



Normal operating range, max. 130%	Permitted operating range, max. 160%	Inadmissible operating range, more than 160%
This operating range is recommended for maximum service life and error-free operation.	This operating range is still permitted, although it results in shorter service life with higher failure probability	In this operating range there is a risk of destruction of the brake resistor through overheating. Due to the high temperatures the adjacent components are also at risk.

Attention	**Destruction of the brake resistor and adjacent components** Always ensure adequate ventilation of the brake resistor, since the temperatures of the housing surface may exceed 200 °C.

6 Technical data

Dimensions

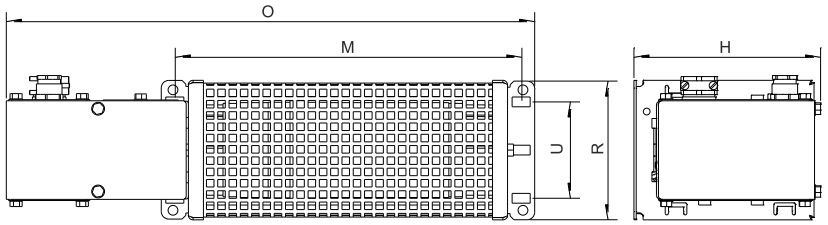
Type[1)]	Type power [W] * at 40 °C	Resistance [Ω]	O [mm]	R [mm]	H [mm]	M [mm]	U [mm]	Weight [kg]	AX5000
AX2090-BW50-0300	300	47	349	92	120	230	64	2	AX5x01-AX5112
AX2090-BW50-0600	600	47	549	92	120	430	64	3	AX5x01-AX5112
AX2090-BW50-1600	1600	47	649	185	120	530	150	5,8	AX5x01-AX5112
AX2090-BW51-1000	1000	23	749	92	120	630	64	4	AX5118-AX5140
AX2090-BW51-3000	3000	23,4	490	355	255	380	270	8	AX5118-AX5140
AX2090-BW51-6000	6000	23,2	490	455	255	380	370	12	AX5118-AX5140
AX2090-BW52-2000	3000	13,2	490	355	255	380	270	8	AX5160-AX5172
AX2090-BW52-6000	6000	13,0	490	455	255	380	370	12	AX5160-AX5172
AX2090-BW53-3000	3000	10,2	490	355	255	380	270	8	AX5190-AX5191
AX2090-BW53-6000	6000	10	490	455	255	380	370	12	AX5190-AX5191
AX2090-BW54-3000	3000	6,6	490	355	255	380	270	8	AX5192-AX5193
AX2090-BW54-6000	6000	6,5	490	455	255	380	370	12	AX5192-AX5193

*) 4% decrease in performance per 10K temperature difference

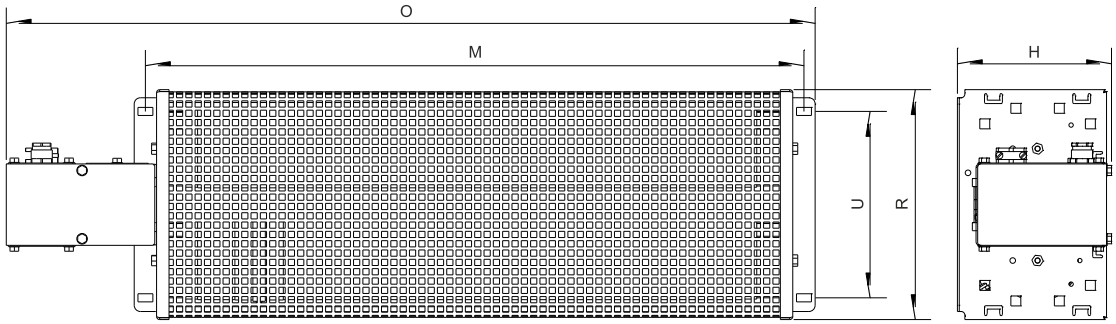
[1)] All external brake resistor have the protection class IP20

Technical drawings

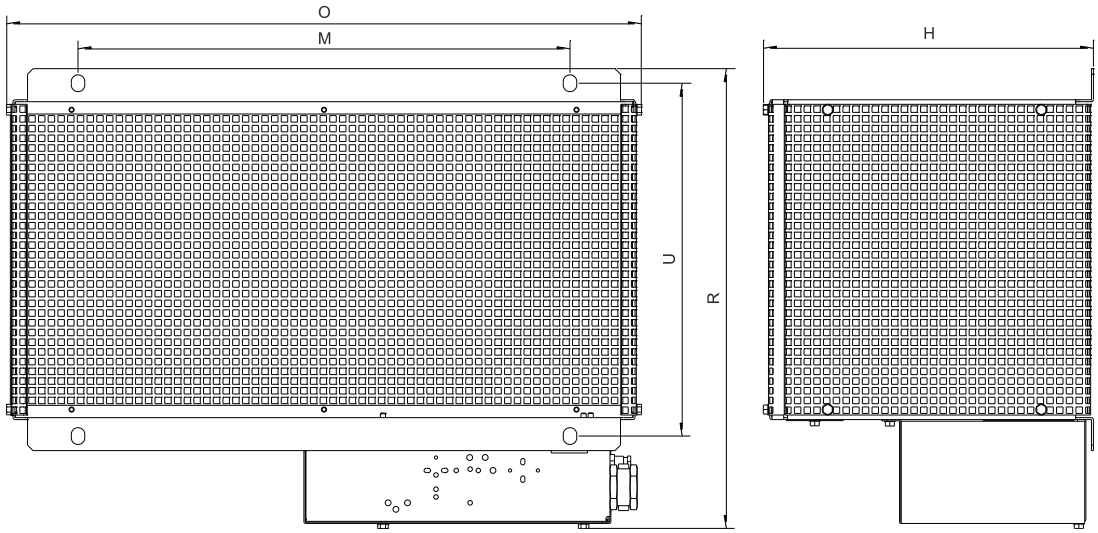
AX2090-BW50-0300
AX2090-BW50-0600
AX2090-BW51-1000



AX2090-BW50-1600



AX2090-BW51-3000
AX2090-BW51-6000
AX2090-BW52-3000
AX2090-BW52-6000
AX2090-BW53-3000
AX2090-BW53-6000
AX2090-BW54-3000
AX2090-BW54-6000



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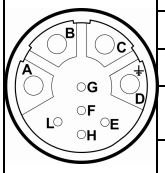
Motor cable ZK4500-8023-zzzz



Mating view

Plug connector	Contact	Function	Core identification	Contact	Plug connector
	A	U	black / 1	U	
	B	V	black / 2	V	
	C	W	black / 3	W	
	D	PE	green / yellow	PE	
	E	Temp. - / OCT -	blue	Temp. -	
	F	Screen	Screen	Screen	
	G	Brake +	black / 5	Brake +	
	H	Temp. + / OCT +	white	Temp. +	
	L	Brake -	black / 6	Brake -	

Catalog data	
Catalog text	1.5 mm² with M23-speedtec® plug, highly flexible, for drag-chain use
Servomotor	AM883x and AM8x4x up to AM8x6x
Servo Drive	AX5000 (1.5….12 A)
Catalog description	(4x1.5mm² + (2x0.75mm²) + (2xAWG22))

Electrical properties at 20°C	
Max. operating voltage	1000 VAC (UL)
Direct current resistance	≤ 55.0 Ω/km (AWG22) / ≤ 26.0 Ω/km (0.75 mm²) / ≤ 13.3 Ω/km (1.5 mm²), DIN EN 50395
Insulation resistance	≥ 500 MΩ x km, DIN EN 50395
Operating capacity at 800 Hz	score / screen ≤ 150 pF/m (1.5mm²), EN 50289-1-5

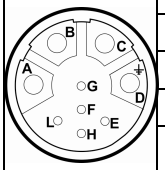
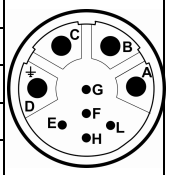
Mechanical properties	
Outside diameter d	12.7 ± 0. 4 mm
Min. bending radius	5 x d for fixed installation / 7 x d for dynamic use
Max. driven speed	240 m/min
Max. acceleration	30 m/s² (at 5 m movement)
Max. allowable travelling distance	20 m horizontal / 5 m vertical
Max. torsion	± 30°/m
Max. bending cycles	5 Mio.
Operating temperature	-20°C to +60°C
Shield optical	>85 %

Properties cable	
Material outer sheath	TPU, flame retardant, halogen free
Color	Orange, like RAL 2003
Weight	0.25 kg/m
RoHS conformity	Yes
Silicon-free	Yes
Halogen-free	DIN VDE 0472 T815
Flame resistance	IEC 60332-1-2 / UL758 cable flame test
Oil resistance outer sheath	HD 22.10 Appendix A / DIN EN60811-2-1
UL Approbation	UL758 (AWM) Style 21223 (Outer sheath) and Style 10492 (Core)

Properties motor plug	
Housing	brass, zinc diecast; nickel-plated and chromated
Connecting Nut	Fiber-glass reinforced for high mechanical stress
Contacts	brass gold plated
Seals	FPM (Viton)
Clamp Ring	brass nickel-plated
Protection Type	connected: IP 65 (IEC 60529)
Mating Cycles	min. 500

Properties AX5000 plug	
Contact material	Cu-Leg
Contact surface	tin-plated
Insulator	PBT
Licence	CSA, UL 1059
RoHS conformity	yes

Motor cable extension ZK4501-8023-zzzz

Plug connector	Contact	Function	Core identification	Contact	Plug connector
	A	U	black / 1	A	
	B	V	black / 2	B	
	C	W	black / 3	C	
	D	PE	green / yellow	D	
	E	Temp. - / OCT -	blue	E	
	F	Screen	Screen	F	
Mating view	G	Brake +	black / 5	G	Mating view
	H	Temp. + / OCT +	white	H	
	L	Brake -	black / 6	L	

Catalog data	Motor cable extension for motor cable ZK4500-8023-zzzz
Catalog text	1.5 mm² with M23-speedtec® plug, highly flexible, for drag-chain use
Servomotor	AM883x and AM8x4x up to AM8x6x
Servo Drive	AX5000 (1.5…12 A)
Catalog description	(4x1.5mm² + (2x0.75mm²) + (2xAWG22))

Electrical properties at 20°C	
Max. operating voltage	1000 VAC (UL)
Direct current resistance	≤ 55.0 Ω/km (AWG22) / ≤ 26.0 Ω/km (0.75 mm²) / ≤ 13.3 Ω/km (1.5 mm²), DIN EN 50395
Insulation resistance	≥ 500 MΩ x km, DIN EN 50395
Operating capacity at 800 Hz	score / screen ≤ 150 pF/m (1.5mm²), EN 50289-1-5

Mechanical properties	
Outside diameter d	12.7 ± 0. 4 mm
Min. bending radius	5 x d for fixed installation / 7 x d for dynamic use
Max. driven speed	240 m/min
Max. acceleration	30 m/s² (at 5 m movement)
Max. allowable travelling distance	20 m horizontal / 5 m vertical
Max. torsion	± 30°/m
Max. bending cycles	5 Mio.
Operating temperature	-20°C to +60°C
Shield optical	>85 %

Properties cable	
Material outer sheath	TPU, flame retardant, halogen free
Color	Orange, like RAL 2003
Weight	0.25 kg/m
RoHS conformity	Yes
Silicon-free	Yes
Halogen-free	DIN VDE 0472 T815
Flame resistance	IEC 60332-1-2 / UL758 cable flame test
Oil resistance outer sheath	HD 22.10 Appendix A / DIN EN60811-2-1
UL Approbation	UL758 (AWM) Style 21223 (Outer sheath) and Style 10492 (Core)

Properties motor plug	
Housing	brass, zinc diecast; nickel-plated and chromated
Connecting Nut	Fiber-glass reinforced for high mechanical stress
Contacts	brass gold plated
Seals	FPM (Viton)
Clamp Ring	brass nickel-plated
Protection Type	connected: IP 65 (IEC 60529)
Mating Cycles	min. 500