AMKASYN
Device description
Controller Cards
KW-R06, -R16, -R07, -R17

Version: 2023/25
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Translation of the "Original Dokumentation"

AMKmotion
MEMBER OF THE ARBURG FAMILY

Imprint

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Version:

Version: 2023/25	
Change	**Letter symbol**
• AMKmotion Design	LeS

Previous version: 2020/02

Product version:

Product	Firmware version (Part no.)
KW-R06	AE-R05/R06 V1.16 2018/25 (207207)
KW-R16	
KW-R07	AE-R05/R06 V1.16 2018/25 (207207) AE-SF1 V1.07 2016/11 (206082)
KW-R17	

Reservation: We reserve the right to modify the content of the documentation as well as the delivery options for the product.

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For fast and reliable troubleshooting, you can help us by informing our Customer Service about the following:

- Type plate data for each unit
- Software version
- Device configuration and application
- Type of fault/problem and suspected cause
- Diagnostic messages (error messages)

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Content

1 About this documentation

1.1 Where is what?

Topic	Chapter	Chapter number
Validity, use and the propose of the documentation	Imprint	-
	About this document	1
Basic safety information	For your safety	2
Specific safety instructions (thematic safety instructions)	Located in the various chapters	
Information for planning and projecting personnel	Product overview	3
	Environmental conditions	4
	Accessories and options	8
Practice information for startup, operating or maintenance personnel	Assembly / disassembly	5
	Electrical connections	6
	Startup and operation	7
	Service	9
Abbreviations and terms will be explained	Glossary	-

1.2 Keeping this document

This document must permanently be available and readable at the place where the product is in use. If the product is used at another place or changed the owner, the document must be passed on.

1.3 Purpose

This document is addressed to any person who handles the product. It gives information about the following topics:

- Safety messages which are absolutely necessary to take care of during handling the product
- Product identification
- Projecting, planning and dimensioning of the application
- Environmental conditions for storage, transportation and operation
- Assembly
- Electrical connections
- Startup and operation
- Replacement
- Diagnosis
- Decommissioning and disposal
- Technical data

1.4 Target group

Any person that is qualified and intends to work with this product must read, understand and follow this document:

- Transportation and storage
- Unpacking and installation
- Projecting
- Connection
- Parameterization
- Startup
- Service and repair
- Decommissioning and disposal
- Replacement

1.5 Display conventions

Display	Meaning
	This symbol points to parts of the text to which particular attention should be paid!
	The red hand symbol indicates the button or menu item to click on. The red hand symbol indicates the option to be selected.
'Names'	Names are represented with apostrophes e. g. parameters, variables, etc.
'Text'	Menu items and buttons in a software or on a controller, e. g.: Click the **'OK'** button in the **'Options'** menu to call up the 'Delete PLC program' function
See 'chapter name' on page x	Executable cross-reference in electronic output media

1.6 Appendant documents

Device descriptions

Part-no.	Title
28932	Servo drives KE/KW

Functional documentations

Part-no.	Title
25786	Diagnostic messages
203446	Safety manual; functional safety excerpt for KW-R07 / -R17 / -R27
203704	Parameter description KW-R06 / -R16 / -R07 / -R17
203771	Software description ATF - AMK Tool Flasher (PC software for firmware update)
	Function descriptions
204539	Initial startup KE/KW
204979	Software description AIPEX PRO V3 (PC software for startup and parameterization)

2 For your safety

2.1 Basic notes for your safety

- At electrical drive systems, hazards are present in principle that can result in death or fatal injuries:
  - Electrical hazard (e. g. electric shock due to touch on electrical connections)
  - Mechanical hazard (e. g. crush, retract due to the rotation of the motor shaft)
  - Thermal hazard (e. g. burns due to touch on hot surfaces)
- These hazards are present while starting up and operating the unit, and also during servicing or maintenance work.
- Safety instructions in the documentation and on the product warn about the hazards.
- Personnel must have read and understood the safety instructions before installing and operating the product. In the documentation about the product the usage warnings pertain to direct hazards and must therefore be followed directly when operating or handling the product by the operator.
- AMKmotion products must be kept in their original order, that means it is not allowed to do a significant constructional change on hardware side and software is not allowed to be decompiled and change the source code.
- Damaged or faulty products are not allowed to be integrated or put into operation.
- Do not start the system in which the AMKmotion products are installed (begin of intended use) until you can determine that all relevant standards, laws, and directives have been complied with, e. g. low voltage directive, EMC directive, and the machinery directive, and possible further product standards. The plant manufacturer is responsible for the compliance with the laws, directives, and standards.
- The devices must be installed, electrically connected and operated as shown in the device description documentation. The technical data and the required environmental conditions must be observed at all times.

2.2 Safety rules for handling electrical systems

In particular on drive systems, the instructions pertaining to safety and the following five safety rules have to be kept in the specified sequence:

1. Switch off electrical circuits (also electronic and auxiliary circuits).
2. Secure against being switched on again.
3. Determine that there is no voltage.
4. Ground and short circuit.
5. Cover or close off neighboring parts that are under voltage.

Reverse the measures taken in reverse order after completing the work.

2.3 Presenting safety messages

Any safety information is configured as follows:

⚠ SIGNAL WORD	
	**Type and source of risk** Consequence(s) of non-observance **Steps to prevent:** • ...

2.4 Class of hazard

Safety and warning messages are graduated into classes of hazard (according to ANSI Z535). The class of hazard defines the potential risk of harm and is described by a single word, if the safety information is ignored. The signal word is followed by a safety alert symbol (ISO 3864, DIN EN ISO 7010). In accordance with ANSI Z535, the following signal words are used to define the class of hazard.

Safety alert symbol and signal word	Class of hazard and its meaning
⚠ DANGER	DANGER indicates a hazardous situation which, if not avoided, **will** result in death or serious injury
⚠ WARNING	WARNING indicates a hazardous situation which, if not avoided, **could** result in death or serious injury
⚠ CAUTION	CAUTION, used with the safety alert symbol, indicates a hazardous situation which, if not avoided, **could** result in minor or moderate injury
NOTICE	NOTICE is used to address preventions to avoid material damage, but not related to personal injury.

2.5 Safety alert symbols used in this document

Safety symbol	Meaning
	Generic warning!
	Warning against dangerous electrical voltage!

2.6 Intended use

The controller cards are intended for installation into the compact inverters KW and KWD.

KW-R07 and KW-R17 are not released for the KWD.

2.7 Requirements for the personnel and their qualification

Only authorized and qualified personnel may work on and with the AMKmotion drive systems.

Specialised personnel must:

- Perform mechanical and electrical work that is described in this documentation, such as mounting and connecting
- Observe all information in the documentation accompanying the product in order to work with the product safely and in an error-free manner
- Understand and know hazards that occur when handling the product
- Know connections and functions of the system
- Be familiar with the control concept in order to operate the drive system
- Be authorized to switch circuits and devices on and off, ground and label them
- Observe local specific safety requirements

2.8 Warranty

- All information in the documents accompanying the product must be complied with for a safe and trouble-free operation.
- The assertion of warranty claims is excluded if the information in the documents is not observed completely.
- Hardware and firmware may not be modified except by personnel authorized by AMKmotion and after consultation with AMKmotion.
- The company AMKmotion GmbH + Co KG is not liable for damages from unintended use, incorrect installation or operation, exceeding rated values and non-observance with the environmental conditions.

3 Product overview

3.1 Product name and ordering data

Product name	Controller card	Option (Communication)		
		SECS EtherCAT SoE	SECC EtherCAT CoE	SVNS VARAN SoV
	Order number	O823	O948	O824
KW-R06	O835	x		x
KW-R16	O872	x		x
KW-R07	O807	x		x
KW-R17	O873	x		x

The option (communication) and the firmware are not included in the order number of the controller card and must be ordered separately.

3.2 Scope of delivery

Please check whether the delivered parts correspond with the delivery note. If the delivery is incomplete, please contact your nearest AMKmotion representative.

Check the components for signs of transport damage after their arrival. Do not install and operate any damaged components.

If there is any transport damage, immediately inform the delivering freight carrier and inform your AMKmotion representative.

3.3 Prerequisites

The following prerequisites must at least be met to operate the controller cards.

Hardware revisions of the devices	KW-R06, -R16	KW-R07, -R17
KW	Rev. 3.20	Rev. 3.20
KWD	Rev. 3.20	not possible
KW100	Rev. 4.01	Rev. 4.01

3.4 Product description

The controller card KW-R06 is the successor of the KW-R05 and replaces its function compatible. It controls servo drives in the operating modes position control, speed control and torque control. The actual values are sent via the encoder inputs from absolute encoders for example to the controller card and are evaluated.

The controller card KW-R07 includes the circuit board AE-SF1 with the interface XS20. On this card, the functional safety is implemented.

The controller cards KW-R16 and -R17 are cost-optimised. Their functions are the same as the basic variants, but resolver, square wave pulse encoder and ACC interface are not available.

To all four controller cards applies:

A total of 255 nodes can be operated using the real-time Ethernet interface at short cycle times (typical 1 ms). Of the 255 nodes, a maximum of 100 can be drives that are supplied synchronously with cyclic setpoints.

For connection to a controller and the forwarding to the next participant, the real-time Ethernet interface EtherCAT with the protocol servo drive profile over EtherCAT (SoE) acc. to IEC 61800-7-300 is available.

Alternatively to the EtherCAT, the real-time system VARAN with the protocol SoV is supported..

With the AMK software tool AIPEX PRO, the controller card is adapted to the respective application, configured and optimised. Process values can be recorded as well and diagnostic messages can be read out.

To KW-R06 and -R07 applies:

Using the additional ACC bus master interface, devices without own EtherCAT interface can be reached by the EtherCAT master controller in real-time.

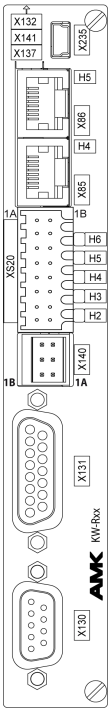
The controller card converts the data coming from the EtherCAT master on the ACC bus interface and forwards the data in message packages (PDO) according to CANopen standard. At the most 7 devices (e.g. AMKASMART IDT4 drives, AMKASYN KE module, CANopen I/O terminals) can be connected to the ACC bus interface.

The controller card has an optional card slot by which the system can be extended for example by binary I/Os.

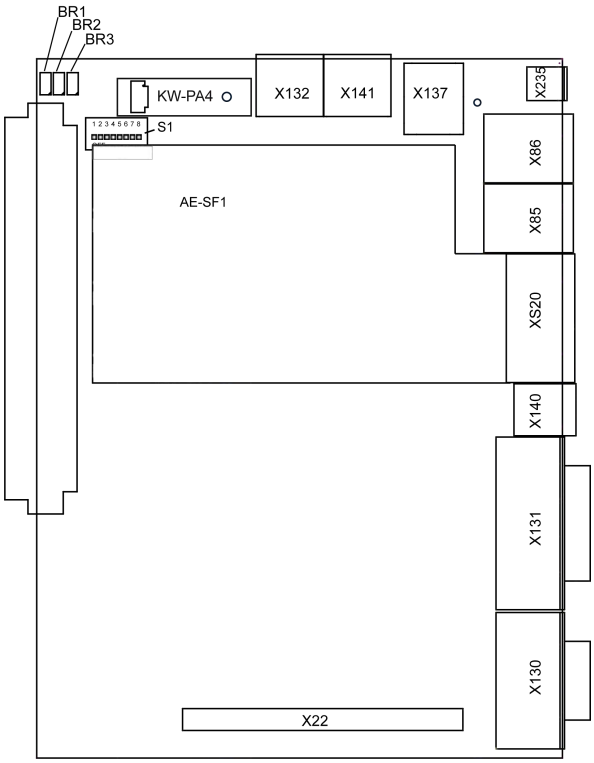
3.5 Views and interface overview

The KW-R07 controller card is shown next. In the following table is shown which interfaces are available on KW-R06, -R16 and KW-R17.

Front side



Board



The lettering H4 and H5 next to the terminals X85 and X86 describes that the LEDs H4 and H5 of the LED line H4-H5 are related to X85/X86.

Interfaces	Function	KW-R06	KW-R16	KW-R07	KW-R17
LED Hx	Status LEDs: Siehe 'Status LEDs' auf Seite 12.	H2-H5	H2-H5	H2-H6	H2-H6
BR1 [1]	Service jumpers	■	■	■	■
BR2		■	■	■	■
BR3		■	■	■	■
S1	DIP switch: EtherCAT and FSoE address	■	■	■	■
Parameter module **KW-PA4**	Parameter module	■ [4]	■	■ [4]	■
X132	Square-wave pulse interface Connection for an external pulse encoder or output for pulse transmission	■	-	■	-
X141	Binary I/Os and analogue inputs	■	■	■	■

Interfaces	Function	KW-R06	KW-R16	KW-R07	KW-R17
X137	ACC bus master (parameter instance 0) For connection of AMKASMART IDT drives, compact power supplies, I/O terminals	■	-	■	-
X235	USB V1.1 (slave) Connection to the PC for the software AIPEX PRO and ATF 2.0 for firmware update.	■	■	■	■
X86	Real-time Ethernet OUT (parameter instance 1)	■	■	■	■
X85	Real-time Ethernet IN (parameter instance 1)	■	■	■	■
XS20 (AE-SF1)	Functional Safety: Safety I/Os	-	-	■	■
X140	Binary I/Os	■	■	■	■
X131	Sine encoder input	■	■	■	■
X130	Resolver input	■	-	■	-
X22	Connector for option card	■	-	■	-

1) depending on revision of the controller card

4) Parameter module removable

3.5.1 Status LEDs

LED	Class	Status	Note
H2	Drive status	Green	System Ready (SBM)
		Green flashing	Drive under control (SBM and QRF)
		Orange flashing	Warning occurs during active controller enable
		Orange	Warning occurs during inactive controller enable / flash mode
		Red	Error with reaction depending on the error number
H3	Bus status (EtherCAT)	Off	Initialisation
		Green flashing	Pre-operational
		Green single flash	Safe-operational
		Green	Operational
		Red flashing	Configuration error
		Red flashing (1 time)	Error-dependent switch back to the Operational, Safe-operational, Pre-operational or Initialising states
H4	Ethernet bus (link status) [X85]	Off	No connection
		Green	Link connection
		Flashing	Link/Activity – connection and data exchange
H5	Ethernet bus (link status) [X86]	Off	No connection
		Green	Link connection
		Flashing	Link/Activity – connection and data exchange

<table>
<tr><th>LED</th><th>Class</th><th>Status</th><th>Note</th></tr>
<tr><td>H6</td><td>Functional Safety</td><td colspan="2">
After power on
<table>
<tr><th>Colour</th><th>Meaning</th></tr>
<tr><td>LED OFF</td><td>Safe parameter set is NOT valid
The reason can be detected by diagnostic message</td></tr>
<tr><td>Green</td><td>Safe parameter set is valid</td></tr>
</table>
During transmission of safe parameter set to the device
<table>
<tr><th>Colour</th><th>Meaning</th></tr>
<tr><td>Green flashing
(1 second cycle)</td><td>Validation request: Enter the check sum</td></tr>
<tr><td>Orange</td><td>Safe parameter set was successfully transmitted
Switch the device OFF and ON again</td></tr>
<tr><td>LED OFF</td><td>Safe parameter set was NOT transmitted successfully
The reason can be detected by diagnostic message</td></tr>
</table>
</td></tr>
</table>

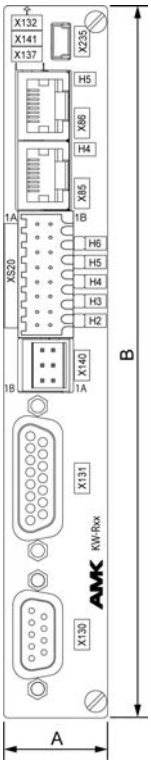
blinking: T_{Ein} = 200 ms, T_{Aus} = 200 ms (2,5 Hz)

single flash: T_{Ein} = 200 ms, T_{Aus} = 1000 ms (0,83 Hz)

3.6 Dimensions

Shown is a KW-R07 controller card.

Front side



Board

Dimensions / mm:

	KW-R06 / KW-R07 / KW-R16 / KW-R17 /
A	23.8
B	164
C	138

4 Ambient conditions

4.1 Transport

- Any AMKmotion products may only be transported in its original packaging.
- Shocks during transport must be prevented.
- Check the components for signs of transport damage after their arrival. Do not install and operate any damaged components.

4.2 Storage

Ambient temperature	-25 °C up to +75 °C
Maximum relative humidity	95 %
Maximum height	2000 m above NHN
Storage period	up to 1 year
Storage conditions	acc. to EN 61800-2
Storage	in the original packaging, clean, dry protected from • condensation • weather conditions • sudden temperature and humidity changes • salt fog, industrial fumes, corroding liquids • vermin and mildew

4.3 Operation

Ambient conditions	according to EN 61800-2
Ambient temperature	+5 °C - +40 °C
Relative humidity	5 % - 85 % no condensation
Altitude	Up to 2000 m over sea level (NHN). For altitudes between 1000 m and 2000 m, the rated data of the converters must be reduced by 1 % per 100 m. The controller cards can be used unrestricted up to 2000 m over sea level.
Shock resistance	15 g for 11 ms according to EN 60068-2-27
Vibration conditions	1 g at 10 - 150 Hz according to EN 60068-2-6

4.4 Disposal

Clarify with your local waste disposal company which materials and chemicals need to be separated and how to dispose of them. Observe the local regulations for disposal.

Examples of materials to be disposed of separately:

Components

- Electronic scrap, e. g., encoder electronics
- Iron scrap
- Aluminium
- Non-ferrous metal, e. g., motor windings
- Insulating materials

Chemicals

- Oils (disposal as hazardous waste, in acc. with the pertinent legislation; in Germany, the Waste Oil Ordinance (AltölV) applies)
- Grease
- Solvents
- Paint residue
- Coolant

5 Assembly / disassembly

5.1 For your safety

⚠ DANGER	
	**Danger to life from touching electrical connections!** Electrical terminals and connectors carry voltages that may cause death or serious injury upon contact. The teminals of the DC circuit capacitors (UZP, UZN) on the front panel of the device may retain hazardous DC voltage for up to 5 minutes after switching off the device! In OFF state, the LED indicators on the device front panels do not indicate the voltage status of the terminals. **Steps to prevent:** • Provide shock-hazard protection • Prior to any work on the device: Turn off the main switch to disconnect the power supply, and secure switch against being turned on again. • Wait at least 5 minutes for components to discharge. • Connection or disconnection of terminals is only allowed if they are free of voltage. • Measure the terminals voltage to verify that the terminal is de-energized. One suitable measuring point is the DC bus between the UZP and UZN terminals. • If the PE connection between the modules is open, avoid touching the casing since dangerous voltages may be present. During the proper operation of the there is an earth leakage current of more than 3.5 mA. In this case, the standard requires that the devices be firmly connected to PE. The PE conductor must have a cross section of at least 10 mm^2. • Do not connect, disconnect and/or install the electrical lines (terminal cables, plugs, sockets) and optional modules until they have been electrically de-energized.

5.2 Avoiding material damage

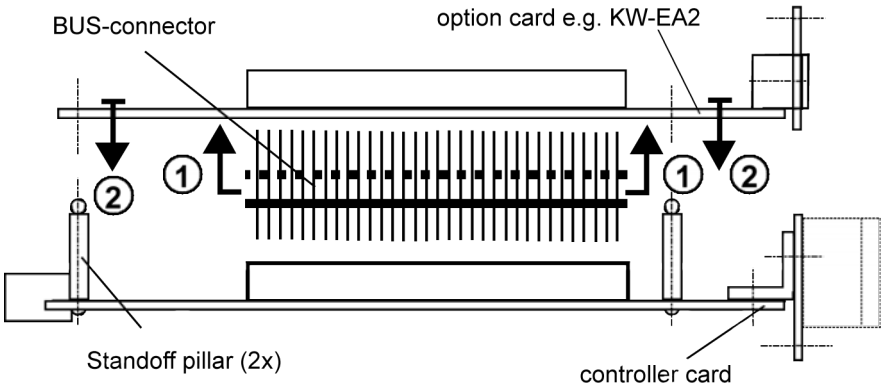
NOTICE	
Material Damage!	**Electronic components could be destroyed through static discharge!** Therefore touching of the electrical connections (e. g. signal and power supply cable or option and controller cards) must be avoided. Otherwise you can be damaged the components when touching by static discharge. **Steps to prevent:** • Avoid touching electrical connections and contacts.

5.3 Disassemble the controller card

1. Remove all connectors on the front side and the top side of the controller card.
2. Remove all connections on the optional card if there are any.
3. Loosen the collar screw below of the controller card and of the optional card is existing (2 collar screws each).
4. Pull the controller card and optional card as a unit out of the card slot.
5. Place the card(s) only on a non-conducting, padded surface.

5.4 Assemble an option card onto the controller card

1. Place the controller card and the optional card on a non-conducting, padded surface.
2. Press the two lockable plastic standoffs into the corresponding holes on the controller card.
3. Plug in the BUS connector until the side containing the longer pins is deep inside the slotted plugs of the optional card and the BUS connector pins are flush with the socket plugs on the top.
4. Take the BUS connector on the optional card with the short pins and press it into the corresponding socket connector on the controller card. At the same time, press the standoff into the holes of the optional card until they snap into place.



5.5 Installing the controller card

1. If you have mounted an optional card on the controller card, remove the blind cover of the optional card slot with a screwdriver.
2. Carefully insert the controller card with any existing optional card as a unit into the card slot and guide rail.
3. Slide the card(s) into the device until the controller card is plugged in securely into the connector.
4. Make sure the front panel of the controller card and the optional card rest on the device casing.
5. Fasten the controller card and the optional card with 2 collar screws each.
6. You can assign the connections of the controller card now.

The controller card needs to be parameterised on new devices or after an exchange according to the application.

6 Electrical connections

6.1 Controller card KW-Rx7: [XS20] safety I/O

Description

- 3 safe input pairs
- 2 secure short-circuit proof output pairs
- Parameterizable dynamic sampling
- Electrically isolated
- Two-channel
- Dynamic sampling signal via SDYN1 and SDYN2 outputs available

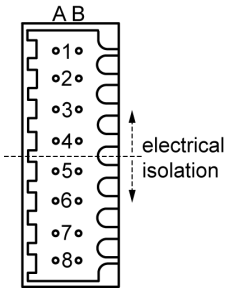
Technical data

- Norm IEC 61131-2 type 3 digital inputs:
  Rated input voltage 0-30 VDC, maximal input current at 30 VDC = 15 mA
  Level 0-5 VDC: low, 11-30 VDC: high
  Electrically delay of T_{on} = 3-8 µs, T_{off} = 48-57 µs
- Norm IEC 61131-2 digital outputs:
  Rated output voltage 24 VDC, rated output current maximal 0.5 A, short-circuit safe, electrically isolated, electrically delay of T_{on} 8-20 µs, T_{off} = 50-55 µs at 200 mA load
- Reference potential: PE bus bar
- Maximal cable length: 30 m

Design

Type	Poles	Class
Connector with spring connection	16	2-row pin strip

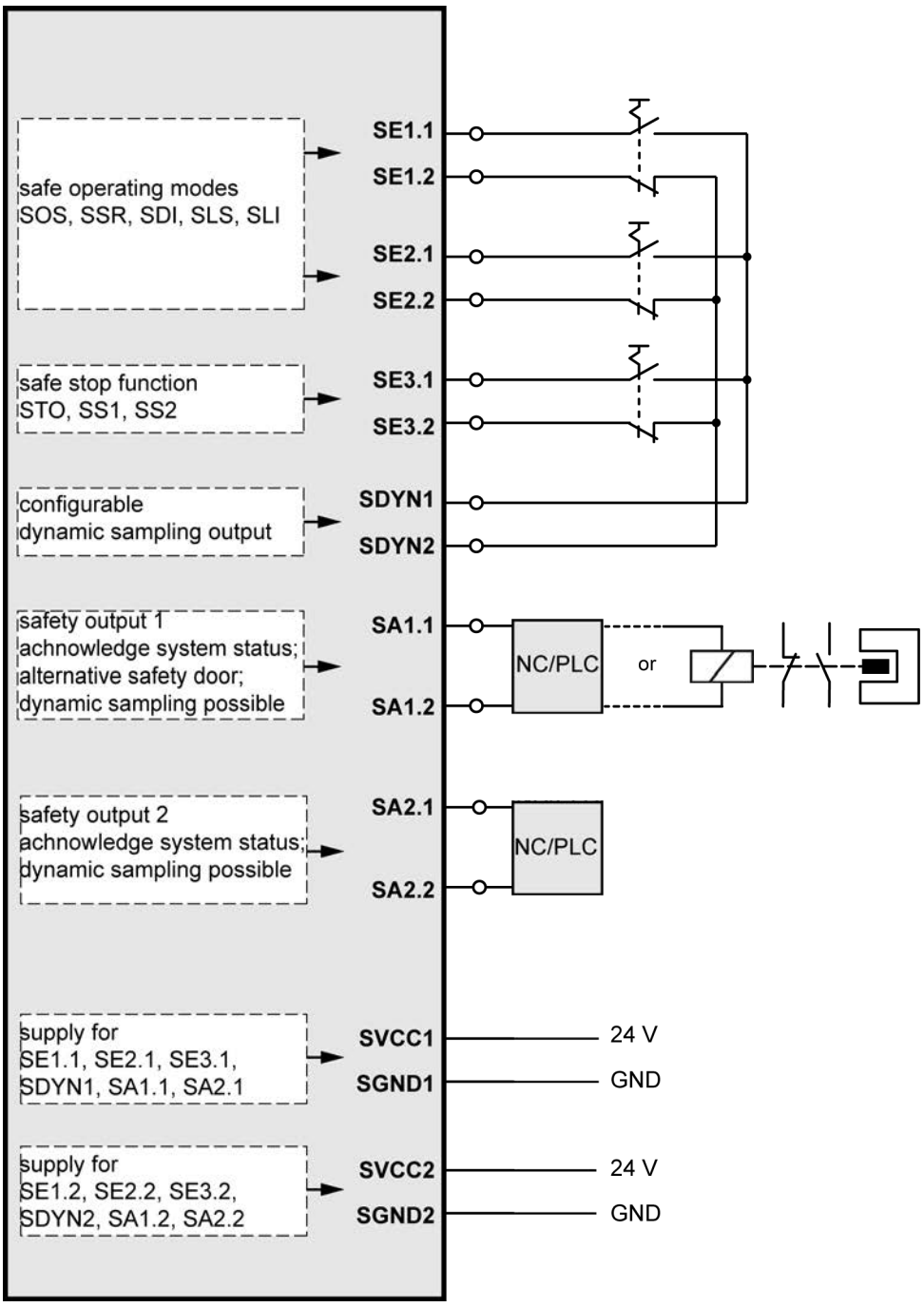
Assignment

[XS20]	Connection	Signal	Description
front view, device side 	A1	SA1.1	Binary output SA1.1/SA1.2 500 mA, High Side min. 20 mA on differential load. See document Safety manual; functional safety (AMK part-no. 203446), chapter Prm104 'SA1.2 output type'.
	A2	SA2.1	Binary output SA2.1/SA2.2 100 mA, High Side
	A3	SDYN1	Dynamic sampling output 1 100 mA, High Side
	A4	SGND1	Reference potential 0 V for SVCC1
	B1	SE1.1	Binary input SE1.1/SE1.2 24 V, I_{max} = 15 mA
	B2	SE2.1	Binary input SE2.1/SE2.2 24 V, I_{max} = 15 mA
	B3	SE3.1	Binary input SE3.1/SE3.2 24 V, I_{max} = 15 mA
	B4	SVCC1	Supply SVCC1, 24 V ± 20 %
	---------- Potential separation ----------		
	A5	SA1.2	Binary output SA1.1/SA1.2 500 mA, High Side and Low Side
	A6	SA2.2	Binary output SA2.1/SA2.2 100 mA, High Side
	A7	SDYN2	Dynamic sampling output 2 100mA, High Side
	A8	SGND2	Reference potential 0 V for SVCC2
	B5	SE1.2	Binary input SE1.1/SE1.2 24 V, I_{max} = 15 mA
	B6	SE2.2	Binary input SE2.1/SE2.2 24 V, I_{max} = 15 mA
	B7	SE3.2	Binary input SE3.1/SE3.2 24 V, I_{max} = 15 mA
	B8	SVCC2	Binary supply SVCC2, 24 V ± 20 %

Connection

Mating connector	Weidmüller socket connector, 16-poles AMK part no. 202020
Cable	16-wire, shielded
Cross-section min.-max.	0,2 mm^2 - 1 mm^2 AWG 28 - AWG 18
Shield connection	Shield on one side on the module housing
Note	The supply must be carried out mandatorily as a PELV power supply acc. to IEC/EN 60950 which provides at least 3 A.

Circuit principle



(Example for dynamic sampling of the safe inputs)

Further information about use of safety inputs and outputs: See document Safety manual; functional safety (AMK part-no.203446), chapter Safety functions via local safety inputs and outputs.

Application examples how to use the safe inputs can be found in the document Functional safety, application examples (AMK part no. 204364)

6.2 [X85/X86] real-time Ethernet

Description

The interface is constructed as a real-time Ethernet interface and supports the following protocols:

- EtherCAT SoE (Servo Drive Profile over EtherCAT according to IEC 61800-7-300)
- EtherCAT CoE (Drive profile CiA 402 according to IEC 61800-7-201/301)
- EtherCAT EoE (Ethernet over EtherCAT)
- EtherCAT FoE (File Access over EtherCAT)

- VARAN SoV (Servo Drive Profile over VARAN (SoV) according to IEC 61800-7-300)
- VARAN EoV (Ethernet over VARAN)

X85: Connection master or previous node
X86: Connection next node

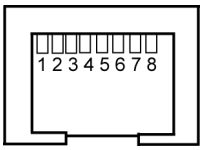
Technical data

- 100BASE-T 100 Mbit/s Ethernet standard
- Data frame and assignment of the RJ45 socket acc. to IEEE802.3
- Maximum line length: 50 m (industrial environment)

Design

Type	Poles	Class
RJ45	8	Socket

Assignment

[X85] / [X86]	Connection	Signal	Description
front view, device side 	1	Tx+	Transmit data +
	2	Tx-	Transmit data -
	3	Rx+	Receive data +
	4	-	Reserved
	5	-	Reserved
	6	Rx-	Receive data -
	7	-	Reserved
	8	-	Reserved

Connection

Cable	Patch cable of the category min. CAT5, shielded
Shield connection	Both sides
Cable assembly	RJ45 connector, prefabricated cables: Siehe 'Ethernet cable' auf Seite 37.

6.3 [X130] resolver / Hall encoder

Description

This connection supports following encoder types: R and H

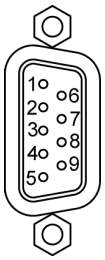
Technical data

- Maximum encoder line length: 100 m

Design

Type	Poles	Class
D-SUB	9	Socket

Assignment

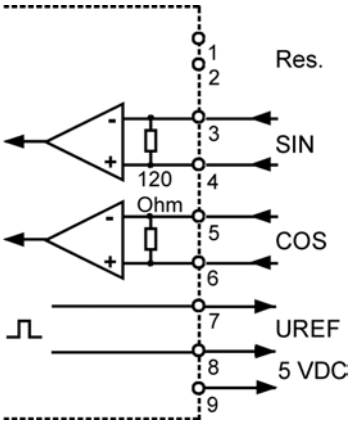
[X130]	Connection	Signal
front view, device side 	1	-
	2	-
	3	+SIN
	4	-SIN
	5	+COS
	6	-COS
	7	+UREF 2)
	8	-UREF / GND 1) 2)
	9	5 VDC 1)

1) Supply voltage for Hall encoder
2) Excitation voltage for Resolver

Connection

Cable	4 x 2 x 0.25 mm^2 twisted pair + 4 x 0.5 mm^2 shielded
Shield connection	Shield on both sides
Cable assembly	D-SUB connector 9-pin with metalized housing Assembly instruction: see Assemble cable with D-SUB connector on page 32 Prefabricated cables: Siehe Encoder cable auf Seite 37.
Note	The shield of the cable has to be grounded by the screw connection in the plug housing on the motor side. The shield mesh is everted over the terminal insert. After screwing together, the shield is placed over the contact spring and the plug housing on the mass.

Controller input circuit



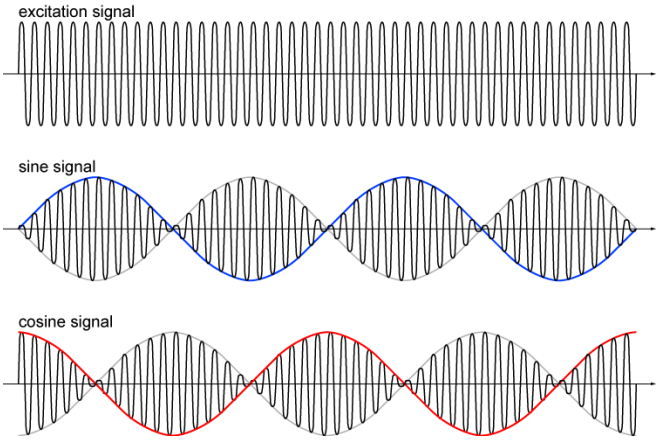
Requirements to the encoder

Encoder evaluation according ID32953		R-encoder	H-encoder
Data	**Units**	**Resolver**	**Hall encoder**
Excitation signal			
Primary voltage	**VDC**	6 ±8 %	5 ±5 %
Input current without load	**mA**	max. 75	max. 350
Frequency [kHz]	**kHz**	8	-
Output signals			
Transmission ratio		0.5 ±5 %	-
Number of pole pairs 1)		1	1
Output voltage	**V_{SS}**	1 - 1.8	0.6 - 1.1

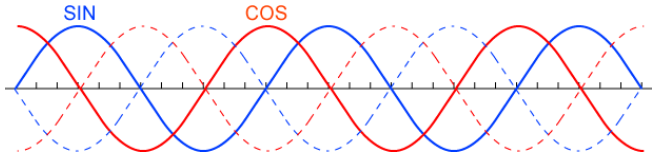
1) Resolvers / Hall encoders with one pole pair are exclusively permitted!

Encoder signal

Resolver



Hall encoder



Encoder signal evaluation

In ID32953 'Encoder type' is defined how to evaluate the incoming encoder signals.

6.4 [X131] sine encoder

Description

This interface supports the following encoder types:
E, F, I, P, Q, S, T, U, V,

Technical data

- The maximum input frequency is 200 kHz
- Input signals according to RS485 specification
- Encoder line length:

Encoder designation	ERN 1380 ERN 1381	ECN 1113 ECN 1313 EQN 1125 EQN1325	ECN 113*)	ECI 119 ECI 1118 ECI 1319 EQI 1130 EQI 1331	SKS 36 SRS 50 SKM 36 SRM 50	SEK 37 SEL 37
AMK Encoder designation	**I**	**E / F**		**P / Q**	**S / T**	**U / V**
max. Encoder line length [m]	100	100	25	100	100	100

*) The encoder ECN113 does not have a extended voltage range and can therefore only be employed with line lengths up to a maximum of 25 m. The encoder is built into the following motors:

- DT7-28-20-EOO-2600-B5 (part no.: A1216AD)
- SKT7-55-20-EBW-5200-DB-B9 (part no.: A1706ED)
- SKT7-55-20-EOW-5200-DB-B9 (part no.: A1706ED)
- SKWS13-150-6-EOW-800-B5 (part no.: A1024AC)
- SKWS13-150-6-EOW-800-B5*AT (part no.: D611AC)

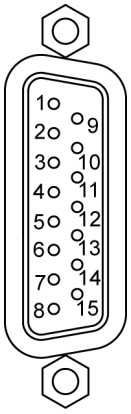
From firmware AER5-6 V1.07 2011/10 onwards linear scales of types LC481and LC183 also LC483 are supported.

The above mentioned line lengths are valid only with the specified voltage ranges and the cable cross-sections recommended by AMKmotion.

Design

Type	Poles	Class
D-SUB	15	Socket

Assignment

[X131]	Connection	I-encoder	E- / F-encoder	P- / Q-encoder	S- / T-, U- / V-encoder
front view, device side 	1	-REF	-	-	-
	2	+REF	-	-	-
	3	-COS	-COS	-	-COS
	4	+COS	+COS	-	+COS
	5	-SIN	-SIN	-	-SIN
	6	+SIN	+SIN	-	+SIN
	7	5 VDC 1)	5 VDC 1)	5 VDC 1)	-
	8	GND	GND	GND	GND
	9	-	-EN_DAT	-EN_DAT	-RS485
	10	-	+EN_DAT	+EN_DAT	+RS485
	11	-	-EN_CLK	-EN_CLK	-
	12	-	+EN_CLK	+EN_CLK	-
	13	-	5 VDC1)	5 VDC1)	-
	14	GND	GND	GND	GND
	15	-	-	-	9 VDC 2)

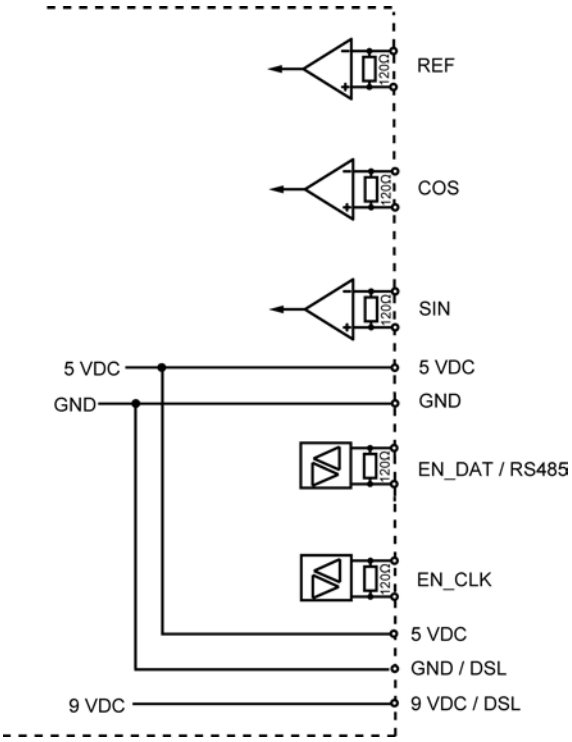
1) 5 VDC ±5 % max. 350 mA

2) KW-R06 / KW-R16 / KW-R07 / KW-R17 /
9 VDC ±15 % at load; max. 400 mA, 12 VDC ±20 % in idle

Connection

	E- / F- / I- /P- / Q- / S- / T- / U- / V-encoder
Cable	E- / F- / P- / Q- encoder: 4 x 2 x 0.25 mm^2twisted pair, + 4 x 0.5 mm^2 shielded I- / S- / T- / U- / V-encoder: 4 x 2 x 0,5 mm^2 twisted pair shielded
Shield connection	Shielded on both sides
Cable assembly	D-SUB connector 15-pin with metallized casing Assembly instruction: Siehe 'Assemble cable with D-SUB connector' auf Seite 32., Prefabricated cables: Siehe Encoder cable auf Seite 37.
Note	The shield of the cable has to be grounded by the screw connection in the plug housing on the motor side. The shield mesh is everted over the terminal insert. After screwing together, the shield is placed over the contact spring and the plug housing on the mass.

Controller input circuit



Requirements for the encoder

Encoder evaluation in accordance with ID32953		I-encoder	E- / F-encoder	S- / T-, U- / V-encoder	P- / Q-encoder
Data		**Sine encoder**	**EnDat 2.1**	**Hiperface**	**EnDat 2.2 light (digital) 3)**
Voltage supply to the encoder					
Input voltage	**VDC**	5 ±5 % 1)	5 ±5% 1)	9 ±15% 2)	5 ±5% 1)
Output signals of the analog tracks					
Output voltage	**V_{SS}**	0.6 - 1.1			-
Offset	**V**	2.5 ±0.5			-
Output signal of the homing track					
Resting value	**mV**	200	-	-	-
Signal width	**° el.**	90 ... 270	-	-	-

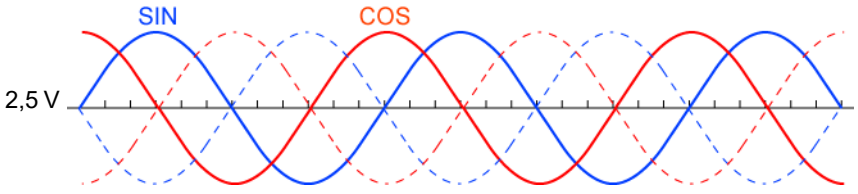
1) 5 VDC ±5 % max. 350 mA

2) 9 VDC ±15 % at load; max. 400 mA, 12 VDC ±20 % in idle

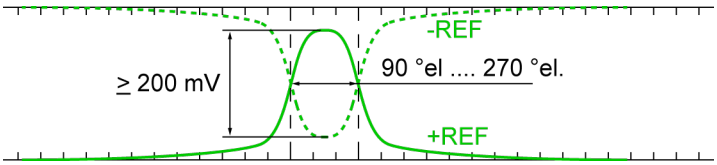
3) EnDat 2.2 light means, that the encoder supports EnDat 2.2, which is used only with the commands of EnDat 2.1 from the AMK controller.

Encoder signal

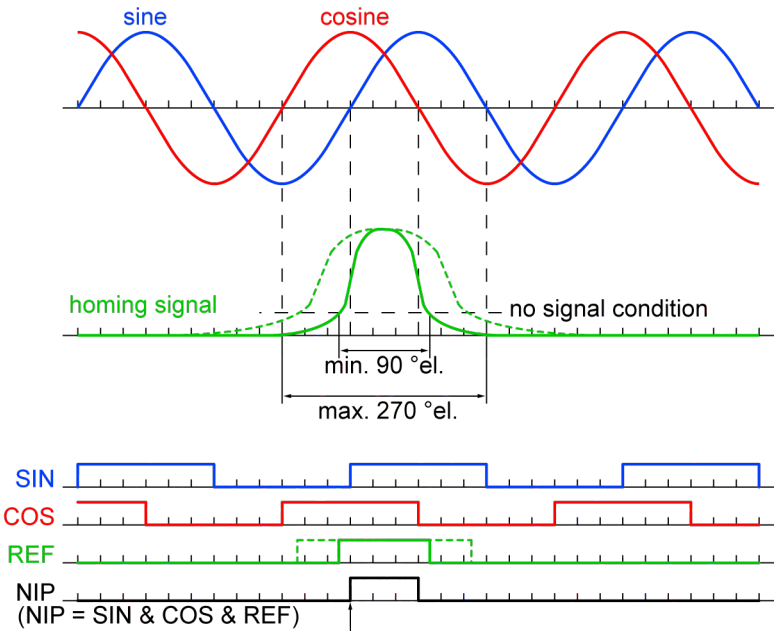
Analog tracks



Homing signal



To receive a unique signal, the homing signals (+REF and -REF) must overlap by at least 200 mV. The overlap range must be at least 90 °el. and maximum 270 °el. long.

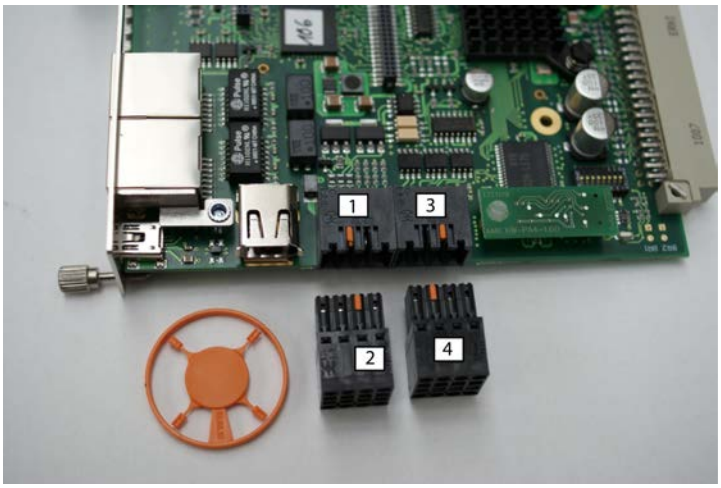


The zero pulse NIP is determined in the controller. A logic AND link of SIN, COS and REF results in the NIP signal. The positive edge (for right-turning motor) is evaluated for exact determination of the zero pulse.

Encoder signal evaluation

In ID32953 'Encoder type' is defined how to evaluate the incoming encoder signals.

6.5 [X132] pulse encoder

NOTICE	
Material Damage!	**Material damage!** A hardware defect will occur if the connections X141 and X132 are exchanged. **Steps to prevent:** • Observe the connector coding.  Legend for the picture: 1 Connection X141, pins, coding on position 2 2 Connector for connection X141, socket, coding on position 3 3 Connection X132, pins, coding on position 3 4 Connector for connection X132, socket, coding on position 2

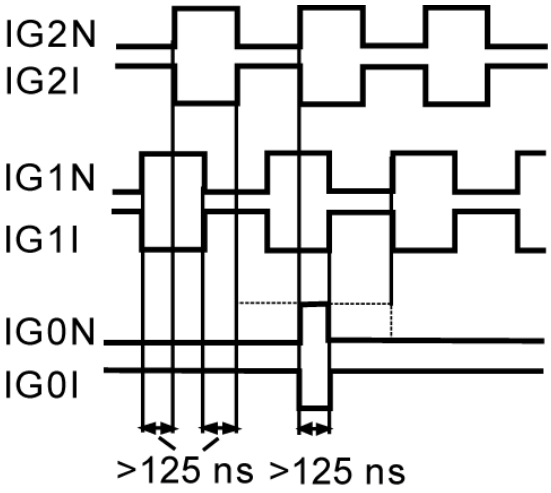
Description

The potential-bound pulse encoder interface can be used as an input or as a software pulse transmission (SIWL).

The difference inputs IG1N, IG1I, IG2N, IG2I of the square-wave pulse input make the position feedback value detection possible by an external position sensor with square-wave pulse output. The external position feedback value system needs to be equipped with difference outputs (line drivers acc. to RS422).

The following signal form is the only one supported as pulse encoder input:

2 square-wave pulses with a 90° offset



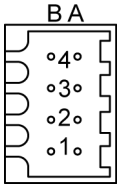
Technical data

- Square-wave signal (Input and Output) acc. to RS422 interface.
- The maximum input frequency is 4 MHz.
- The maximum output frequency is 2 MHz.
- Incoming encoder signals are evaluated 4 times (edge evaluation).
- Input impedance 120 ohm (max. input current ≤ 20mA).

Design

Type	Poles	Class
Connector with spring connection	8	2-row pin strip, coded to position 3

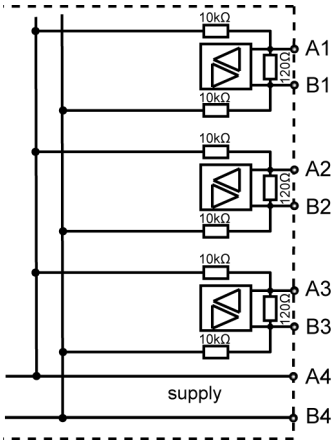
Assignment

[X132]	Connection	Signal
front view, device side 	A1	IG0I
	B1	IG0N
	A2	IG1I
	B2	IG1N
	A3	IG2I
	B3	IG2N
	A4	5 VDC ± 5% max. 350 mA
	B4	GND
	Shield	PE

Connection

Cable	4 x 2 x 0.8 mm² (max.) / AWG 18, twisted pair, shielded
Shield connection	Shield on on one side on the module housing
Cable assembly	Weidmüller socket connector, 8-poles, coded to position 2 AMK part no. 28759

Input circuit



6.6 [X137] ACC bus

Description

The ACC bus interface is completed as master. The EtherCAT master control unit uses the ACC bus interface for the communication to the compact power supply, to AMKASMART IDT4 drives or to external CANopen components.

The ACC bus cable has to be plugged from X137 to X136 to the slave. Set a bus-terminating plug (120 Ohm) to the last ACC bus slave. The controller card features an internal bus terminal (120 Ohm).

Not the maximum permitted cable lengths for the ACC bus depends on the transfer rate and the number of connected bus participants. Details can be found in the application note AP_2006_08_1d 'Maximum available CAN bus length'.

A total of any 7 participants can be connected to the ACC bus. The participant addresses must necessarily be awarded as follows:

Participants	Addresses
IDT4 drives or external CANopen components	2, 3, 4, 5, 6, 7, 8
Compact power supply(s) KE	33, 34, 35, 36, 37, 38, 39

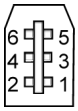
Technical data

CAN Standard 2.0 B

Design

Type	Poles	Class
IEEE 1394 connector	6	Socket

Assignment

[X137]	Connection	Signal	Description
front view, device side 	1	GND	Reference potential
	2	GND	Reference potential
	3	CAN_H	CAN high
	4	CAN_L	CAN low
	5	SYNC_H	SYNC high
	6	SYNC_L	SYNC low

Connection

Cable	6 x - 0.8 mm² / AWG 18, twisted pair, shielded
Shield connection	Shield on both sides
Cable assembly	Prefabricated cables: Siehe ACC Bus Cable auf Seite 37.

6.7 [X140] binary inputs and outputs

Description

The controller card features 6 binary I/Os, 3 binary inputs and 3 binary outputs at terminal X140/X141. With the optional card KW-EA2, the system is extended by 12 binary inputs and 8 binary outputs.

Preassignment of the binary inputs and outputs

Input / output	Port	Parameter	Code	Meaning
BE1	3 bit 0	ID32978	32904	RF (Controller enable)
BE2	3 bit 1	ID32979	32913	FL (Delete error)
BA3	3 bit 2	ID32867	33052	Motor brake control

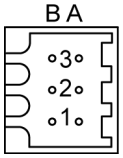
Technical data

- Norm IEC 61131-2 type 3 digital inputs:
  Rated input voltage 0-30 VDC, maximal input current at 30 VDC = 15 mA
  Level 0-5 VDC: low, 11-30 VDC: high
  Electrically delay of T_{on} = 3-8 µs, T_{off} = 48-57 µs
- Norm IEC 61131-2 digital outputs:
  Rated output voltage 24 VDC, rated output current maximal 0.5 A, short-circuit safe, electrically isolated, electrically delay of T_{on} 8-20 µs, T_{off} = 50-55 µs at 200 mA load

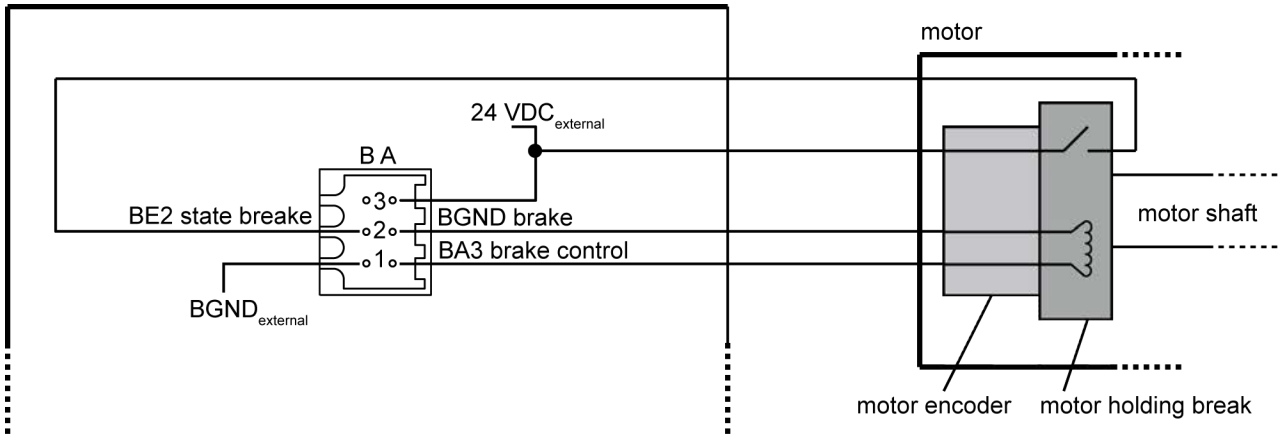
Features

Type	Poles	Class
Connector with spring connection	6	2-row pin strip

Assignment

[X140]	Connection	Signal	Description
front view, device side B A  	1A	BA3	Binary output 3, 24 VDC, 2.5 A [1], potential separated, permanently short-circuit safe , e.g. to control a motor holding brake [2].
	1B	BGND	Reference potential 0 V for supply of the binary inputs and outputs
	2A	BGND	Reference potential 0 V for supply of the binary inputs and outputs
	2B	BE2	Digital input 2, 24 VDC ± 15 %, max. 10 mA, potential separated, e.g. probe input, cam
	3A	BVCC	Supply of the binary outputs 24 VDC ± 15 %
	3B	BE1	Digital input 1, 24 VDC ± 15 %, max. 10 mA, potential separated, e.g. RF

1) Motor holding brakes with higher power requirements, must be controlled with an external auxiliary relay.
2) Example wiring motor holding brake with acknowledgment. Functional description see: FKT_Ansteuerung_der_ Motorhaltebremse_en

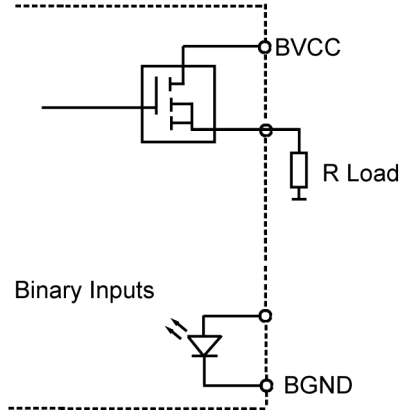


Connection

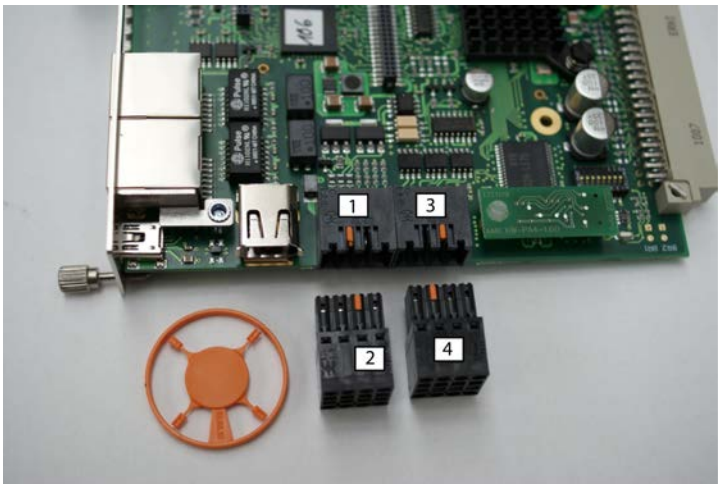
Cable	6 x 8 mm² (max.) /AWG 18, shielded
Shield connection	Shield on one side on the module housing
Cable assembly	Weidmüller socket connector, 6-poles (Designation: B2L 3.5/6 SN SW) AMK part no. 202700 (0.08 mm^2 - 1.0 mm^2 / AWG 28 - AWG 18) optional Weidmüller socket connector, 6-poles (Designation: B2CF 3.50/06/180 SN OR BX) AMK part no. 207746 (0.14 mm^2 - 1.5 mm^2 / AWG 26 - AWG 16)

Circuit principle

Binary Outputs



6.8 [X141] binary inputs and outputs and analog inputs

NOTICE	
Material Damage!	**Material damage!** A hardware defect will occur if the connections X141 and X132 are exchanged. **Steps to prevent:** • Observe the connector coding.  Legend for the picture: 1 Connection X141, pins, coding on position 2 2 Connector for connection X141, socket, coding on position 3 3 Connection X132, pins, coding on position 3 4 Connector for connection X132, socket, coding on position 2

Description

Use analogue input A1 to assign a torque or speed setpoint, depending on the selected operating mode.

The analogue input A2 limits the torque linear to the applied voltage if the function in the operating mode parameter ID32800ff is activated..

Preassignment of the binary inputs and outputs

Input / output	Port	Parameter	Code	Meaning
BI3	3 bit 2	ID32980	32905	NK (Cam signal)
BO1	3 bit 0	ID32865	33031	QRF (Acknowledgement controller enable)
BO2	3 bit 1	ID32866	33029	SBM (System ready message)

Technical data

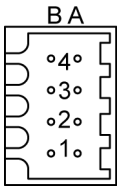
- Norm IEC 61131-2 type 3 digital inputs:
  Rated input voltage 0-30 VDC, maximal input current at 30 VDC = 15 mA
  Level 0-5 VDC: low, 11-30 VDC: high
  Electrically delay of T_{on} = 3-8 µs, T_{off} = 48-57 µs
- Norm IEC 61131-2 digital outputs:
  Rated output voltage 24 VDC, rated output current maximal 0.5 A, short-circuit safe, electrically isolated, electrically delay of T_{on} 8-20 µs, T_{off} = 50-55 µs at 200 mA load
- Analog inputs
  - Differential inputs, potential-bound
  - Input voltage: ±10 VDC (maximum 12VDC)
  - Resolution: 12 bit for ±10 VDC
  - Scanning cycle 250 µs

The GND potential of the setpoint source may deviate in relation to the PE by a maximum of ±10 VDC.

Design

Type	Poles	Class
Connector with spring connection	8	2-row pin strip, coded to position 2

Assignment

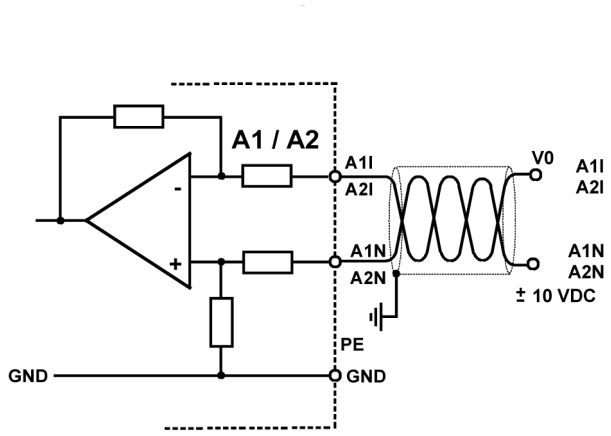
[X141]	Connection	Signal	Description
front view, device side 	1A	BE3	Binary input 3, 24 VDC ± 15%, max. 10 mA, potential separated, e.g. probe input
	1B	BGND	Reference potential
	2A	BA1	Binary output 1, 24 VDC, 100 mA, potential separated, permanently short-circuit safe
	2B	BA2	Binary output 2, 24 VDC, 100 mA, potential separated, permanently short-circuit safe
	3A	A1N	Analog channel 1 not inverted, ±10 VDC, max. 10 mA
	3B	A2N	Analog channel 2 not inverted, ±10 VDC, max. 10 mA
	4A	A1I	Analog channel 1 inverted, ±10 VDC, max. 10 mA
	4B	A2I	Analog channel 2 inverted, ±10 VDC, max. 10 mA

Connection:

Cable	8 x 0.8 mm² (max.)/ AWG 18, shielded
Shield connection	Shield on on one side on the module housing
Cable assembly	Weidmüller socket connector, 8-pin, coded to position 3, AMK part no. 28759

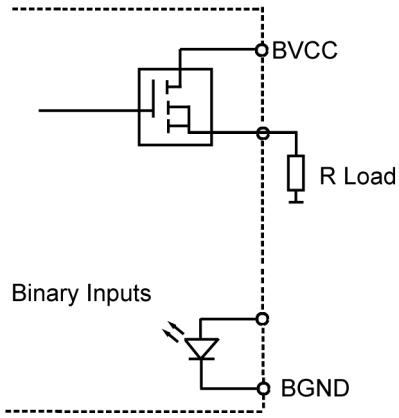
Circuit principle:

Analog inputs



Binary inputs and outputs

Binary Outputs



6.9 [X235] USB

Description

Via the mini-USB interface, the controller card can be connected to a PC and the software AIPEX PRO for startup and diagnosis.

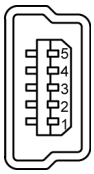
Technical data

USB V1.1 Slave

Design

Type	Poles	Class
USB V1.1 type A to mini-USB type B	5	Socket

Assignment

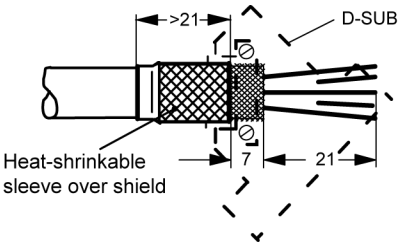
[X235]	Connection	Signal	Description
front view, device side 	1	5 VDC	External 5 VDC supply from USB master, max. 50 mA current consumption
	2	D–	Data –
	3	D+	Data +
	4	5 VDC	Reserved for AMK
	5	GND	Reference potential

Connection

Cable	0.08 mm² / AWG 28 Data+ and Data- twisted pair, shielded
Shield connection	Attached on both sides
Cable assembly	Prefabricated cables: Siehe 'Cable for PC connection' auf Seite 37.
Note	Maximum 3 m length permitted for USB cable! With active USB repeater, longer cable lengths are possible.

6.10 Assemble cable with D-SUB connector

1. Metallic D-SUB casing with a side cable output have to be used. The cable shield is earthed through the D-SUB casing on the KE/KW module.
2. Remove outer cable insulation (to about 21 mm for 9-pin D-SUB connector).
3. Evert cable shield over the outer insulation sheath.
4. Fix and insulate the shield with heat-shrinkable sleeve so that a blank shielding edge of about 7 mm width remains.
5. Connect the plug.
6. Relieve the cable with strain relief clamp and securely connect the everted blank shield edge with the metallic plug casing.
7. After plugging the corresponding plug pedestal into the casing, the D-SUB connector has to be screwed onto the pedestal.
8. If shielded cables have to be interrupted by a plug connector, a continuing shield connection has to be ensured by placing the shield onto the connector casing. The shield may not lead over connector contacts.
9. Cables leading into the casing have to be secured with grounding cable screw connections with which the cable shield is directly attached to the casing of the screwed cable gland.



7 Startup and operation

The startup includes the parameterization and optimization of the drives and is supported by the PC software AIPEX PRO (from Version V3.00 2013/50 (204905)). AIPEX PRO supports a central access to the drive controller cards via controller with active bus communication or via point-to-point connection to the USB interface X235 of the controller card. The procedure during startup is described in the following document:

See document Initial startup KE/KW(Part no. 204539)

7.1 For your safety

⚠ DANGER	
	**Danger to life!** The controller cards KW-R07 / KW-R17 are safety modules according to the Machinery directive MRL 2006/42/EG. Before the cards are put into operation, the executing person must have read and understood the device description and the safety manual. During the startup, all information in these documentation must be taken into account.

⚠ DANGER	
	**Motor shaft movement (rotating parts)!** Hair, body parts and clothes can be captured and wrapped by rotating parts and people result suffer fatal injuries. Hazardous motor movement occurs when the motor shaft moves in an uncontrolled or unintentional manner. Even the intended drive movement may be hazardous, if persons remain inside the machine's range of movement. **Uncontrolled motor shaft movement** occurs when the motor is no longer controllable. Depending on the type of machine, this may have lethal consequences. Possible causes include the following: • Faulty wiring, e.g., faulty phase sequence while connecting motor • Faulty components • Faulty motor parameters • Software error **Unintended motor shaft movement** is caused by errors in the motor control. Depending on the type of machine, this may have lethal consequences. Possible causes include the following: • Operator errors • Controller or application program faults • Faulty setpoint specification and scaling • Improper operating mode The monitoring devices in the drive system are capable of detecting various fault states. Their purpose is to reduce the drive speed to zero in a controlled manner before switching off the power supply. However, the monitoring devices by themselves are not sufficient to completely and reliably prevent uncontrolled movement. Uncontrolled movement cannot be prevented completely, even if it occurs only for a brief period of time before a monitoring device trips and shuts down the drive or switch off power supply. **Steps to prevent:** • Never allow personnel to remain in the vicinity of the machine while it is operating. • Always ensure that the machine is fully de-energized before commencing work on the machine or within the machine's vicinity. • Install an emergency off / stop switch. • Only use modules with the optional Output Stage Release feature according to EN ISO 13849-1 Cat. 4, PL e. • All suspended axles must be mechanically secured against falling down. • Check the limit values for torque, speed, and position, as well as the acceleration and deceleration ramps. • Specify the maximum permissible process speed and set ID113 accordingly.

7.2 Avoiding material damage

NOTICE	
Material Damage!	**Material damages due to erroneous parameterization!** The drive configuration lies in the responsibility of the machine manufacturer. The entry of erroneous parameters can lead to malfunctions and thereby to faults and damages in the system. **Steps to prevent:** • Only personnel trained by AMK may configure the drives.

7.3 Drive addressing

Within a machine, the higher-ranking controller acts as fieldbus master. The subordinated drives are slaves.

The addressing of the drives can either be done automatically by the master, or the address can be set by dip switch or by parameter.

Fieldbus	Addressing possible by ...			Range
	Bus master (automatic)	DIP switch S1	Parameter	
KW-R06				
ACC Master	-	-	ID34023 Instance 0	ID34023 = 1
EtherCAT Slave	■	■	ID34023 Instance 1	1 ≤ ID34023 ≤ 65535 1 ≤ S1 ≤ 63
VARAN Slave	■	-	-	The VARAN master will assign addresses to the slaves; no address presetting is possible
KW-R16				
EtherCAT Slave	■	■	ID34023 Instance 1	1 ≤ ID34023 ≤ 65535 1 ≤ S1 ≤ 63
VARAN Slave	■	-	-	Der VARAN-Master ordnet den Slaves Adressen zu; es ist keine Adressvorgabe möglich
KW-R07				
ACC Master	-	-	ID34023 Instance 0	ID34023 = 1
EtherCAT Slave	■	■	ID34023 Instance 1	1 ≤ ID34023 ≤ 65535 1 ≤ S1 ≤ 63
VARAN Slave	■	-	-	The VARAN master will assign addresses to the slaves; no address presetting is possible
FSoE	-	■	ID33201	See document Safety manual; functional safety, Part no. 203446
KW-R17				
EtherCAT Slave	■	■	ID34023 Instance 1	1 ≤ ID34023 ≤ 65535 1 ≤ S1 ≤ 63
VARAN Slave	■	-	-	The VARAN master will assign addresses to the slaves; no address presetting is possible
FSoE	-	■	ID33201	See document Safety manual; functional safety, Part no. 203446

7.3.1 EtherCAT: Automatic addressing

On delivery ex works AMK, the DIP switch S1 as well as the parameter ID34023 'BUS address participant' are set to 0 in all instances.

In this case the EtherCAT master will assign an address automatically to each bus participant in order to start communication between master and slaves.

The slave addresses correspond to the physical slave positions in the EtherCAT bus.

Within the PLC, the bus participants are identified by their addresses. If you change the system configuration, e.g. adding, changing, removing bus participants, the EtherCAT master sets new addresses to the bus participants.

Therefore, the addresses of the bus participant change.

This means that an EtherCAT master with EtherCAT configuration file (ID1204 ff) generate at start up 'Error EtherCAT configuration 2727 Info1 = 2'.

Then the slaves change to state 'Pre-Operational'. In the state 'Pre- Operational', it is possible to get access to the slaves (ID read and ID write). The used addresses are given by the EtherCAT master. In this case the PLC accesses, via the service channel a wrong bus participant.

The bus address can be set as fix address by DIP switch S1 or by Parameter ID34023 'BUS address participant'.

Automatic addressed devices can not be marked as 'optional' bus participant in the AIPEX PRO software.

7.3.2 EtherCAT: Addressing by parameter ID34023 'BUS address participant'

If the DIP switch S1 is set to 0, the address can be set by parameter ID34023 'BUS address participant'.
The setting of the parameter can be done by means of software AIPEX PRO via the EtherCAT master without connecting point-to-point to each single device.

(See document Software description AIPEX PRO V3 (Part no. 204979), chapter 'Direct mode', function 'Communication'.)

7.3.3 EtherCAT and FSoE: Addressing by DIP switch S1

Relevant for any type of drive controller:

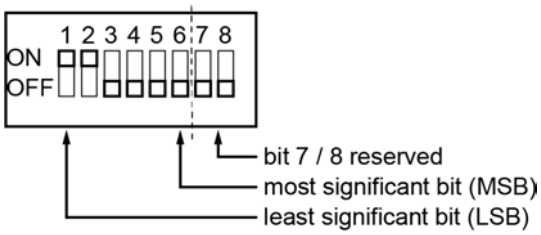
NOTICE	
Material Damage!	On the open unit a dry, non-conductive pollution may only occur. The penetrating pollution into the open housing may not affect the functionality of the device (EN 61800-5-1, pollution degree 1). Ensure that no objects fall into the housing when working on the open housing. Foreign objects can cause short-circuits during operation and thereby destroy the device.

By means of the DIP switch, the EtherCAT and FSoE address of the controller will be set **simultaneously**.

FSoE addressing:
See document Safety manual; functional safety, Part no. 203446

The address setting by DIP switch is prior to addresses via parameter ID34023 'BUS address participant'.
The value, set in the DIP switch will be written to parameter ID34023.

Address range up to 63



Example: address = 3

If you change a fieldbus participant which is addressed by DIP switch, make sure that the address is set correctly to the new device.

Consequence of addressing

DIP switch	Parameter ID34023	Active EtherCAT address
= 0	= 0	address automatically set by master
= 0	≠ 0	address according ID34023 parameter setting
≠ 0	= 0	address according DIP switch setting
≠ 0	≠ 0	address according DIP switch setting

7.3.4 ACC bus master

KW-R06 and KW-R07 can run as ACC bus master.

Parameter ID34025 'BUS mode' defines the fieldbus-specific functionality. The parameter is instanced. Instance 0 declares the controller to ACC-bus master: ID34025 = 0x2.

Parameter ID34023 'BUS address participant' assigns the address of the ACC master: ID34023 = 1.

ID34026 'BUS mode attribute' specifies the properties of the acc master, e.g. hardware synchronisation or initialisation after clear error (FL).
See documentParameter description KW-R06 / -R16 / -R07 / -R17, Kapitel ID34026, Unterthema Aufbau ID34026 'BUS mode attribute' KW-R06 / KW-R07 / - Instanz 0 - ACC-Bus Master X137.

8 Accessories and options

8.1 Optional Cards

Designation	AMK part no.:	Description
KW-EA2	O664	Binary in-/output card for attaching to the controller card. 12 binary inputs, 8 binary outputs

8.2 Encoder cable

Designation	AMK part no.:	Description
AG-GD15S+T-KW...M	101612	S+T-encoder, connector straight
AG-GD15E+F-KW...M	101613	E+F+P+Q-encoder, connector straight
AG-WD15S+T-KW...M	101614	S+T-encoder, angular connector
AG-WD15E+F-KW...M	101615	E+F+P+Q-encoder, angular connector
AG-GD15I	101763	I-encoder, connector straight
AG-GD9R	101761	R-encoder, connector straight
AG-WD15I	101764	I-encoder, angular connector
AG-WD9R	101762	R-encoder, angular connector

8.3 Ethernet cable

Designation	AMK part no.:	Description
Cable RJ45 CAT5e PUR 0.20 m	202665	0.20 m length with straight plug, snap in
Cable RJ45 CAT5e PUR 0.30 m	202666	0.30 m length with straight plug, snap in
Cable RJ45 CAT5e PUR 0.40 m	202667	0.40 m length with straight plug, snap in
Cable RJ45 CAT5e PUR 1.00 m	202668	1.00 m length with straight plug, snap in
Cable RJ45 CAT5e PUR 2.00 m	202669	2.00 m length with straight plug, snap in
Cable RJ45 CAT5e PUR 5.00 m	202670	5.00 m length with straight plug, snap in
Cable RJ45 CAT5e PUR 10.00 m	202671	10.00 m length with straight plug, snap in

8.4 ACC Bus Cable

Designation	AMK part no.:	Description [1)]
Cable IEEE 1394 140 mm	29237	0.24 m length with connector
Cable IEEE 1394 210 mm	29231	0.31 m length with connector
Cable IEEE 1394 300 mm	200053	0.4 m length with connector
Cable IEEE 1394 1 m	29523	1.1 m length with connector
Cable IEEE 1394 1.8 m	29543	1.9 m length with connector
Cable IEEE 1394 4 m	29544	4.1 m length with connector
Cable IEEE 1394 5 m	200507	5.1 m length with connector
Cable IEEE 1394 10 m	29545	10.10 m length with connector
Bus terminating plug IEEE 1394	29240	2 x 120 Ohm bus terminator

1) Cable length without connector = length with connector - 2 x 0.05 m

8.5 Cable for PC connection

Designation	AMK part no.:	Description
USB cable	47058	USB type A acc. to mini-USB type B, length 3 m with ferrite shell

8.6 Software

Designation	AMK part no.:	Description
Program system AIPEX PRO V3	O907	PC software AIPEX PRO V3 (for startup, parameterisation, optimisation, diagnosis and programming) USB cable assembled (USB type A acc. to mini-USB type B) 3 m with ferrite shell

9 Service

9.1 Controller card exchange

When exchange the controller card, the application specific data (parameters) have to be transferred to the new controller card. With the PC software AIPEX PRO the parameter can be read out of a controller card, can be saved on the PC and can be transferred from PC to the new controller card.

See document Software description AIPEX PRO V3 (Part no. 204979).

9.2 Diagnostics

Diagnostic messages can be error messages or warning messages and are generated automatically. Existing diagnostic messages are displayed by the LEDs on the front of the controller card. In case of warning messages, the drive remains in regulated operation.

In case of malfunctions, the SBM is withdrawn and an attempt is made automatically to brake the drive to a standstill and to withdraw the controller enable afterwards. If no braking can be carried out successfully, the power output stage enable is withdrawn automatically and the drive runs out.

If an error causes a coasting motor (e. g. EF is withdrawn while RF is active or encoder error) the brake output will be set and a potential motor holding brake engages.

In order to avoid brake wear, the application has to ensure in cases of errors with previous warning that the drive is braked before EF is withdrawn.

Diagnostic messages can be read out by AIPEX PRO or the superordinate controller via the fieldbus and are described in the 'PDK_025786_Diagnose' documentation.

9.3 Loading firmware

NOTICE	
	Firmware Download Due to downloading a firmware, application specific parameter settings are overwritten and become invalid! **Steps to prevent:** • Before you download a new firmware, please make really sure that application specific data is saved as backup.

The controller card operates with a firmware that has been installed in the factory.
A new firmware can be loaded by means of the AMK software ATF, which can be installed together with AIPEX PRO.

Preparations

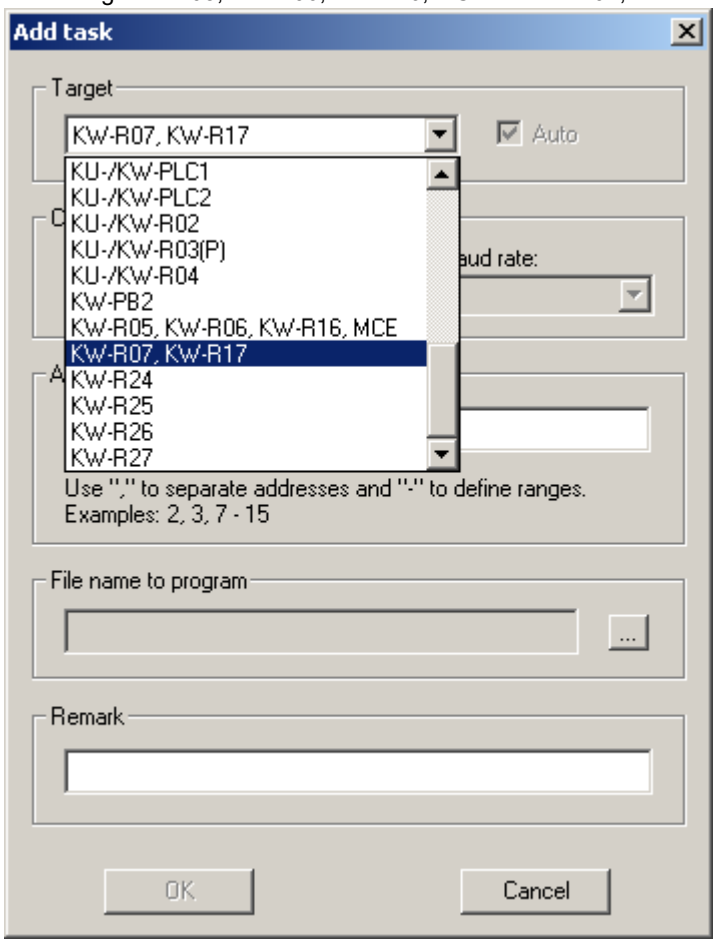
1. Install the controller card into the compact inverter where it will run.
2. Connect your PC with the USB interface X235 of the controller card.
   Connect the compact inverter to the 24 VDC supply voltage.
   Wait until the compact inverter is run-up.
   - LED H2 green continuous light: SBM (system ready message)
   - LED H2 red continuous light: Error
3. If LED H2 displays an error, you may read it with AIPEX PRO.
   Start AIPEX PRO and log on to the drive. (See documentSoftware description AIPEX PRO V3, Part no. 204979).
   In the tab 'Diagnostics', you will see some error messages which are based on the new combination of compact inverter and controller card.
   You may initially ignore these messages.
   Log out and close AIPEX PRO.

4. Start the program ATF - AMK Tool Flasher
   You will get information about the use of this software from the document Software description ATF - AMK Tool Flasher (Part no. 203771).

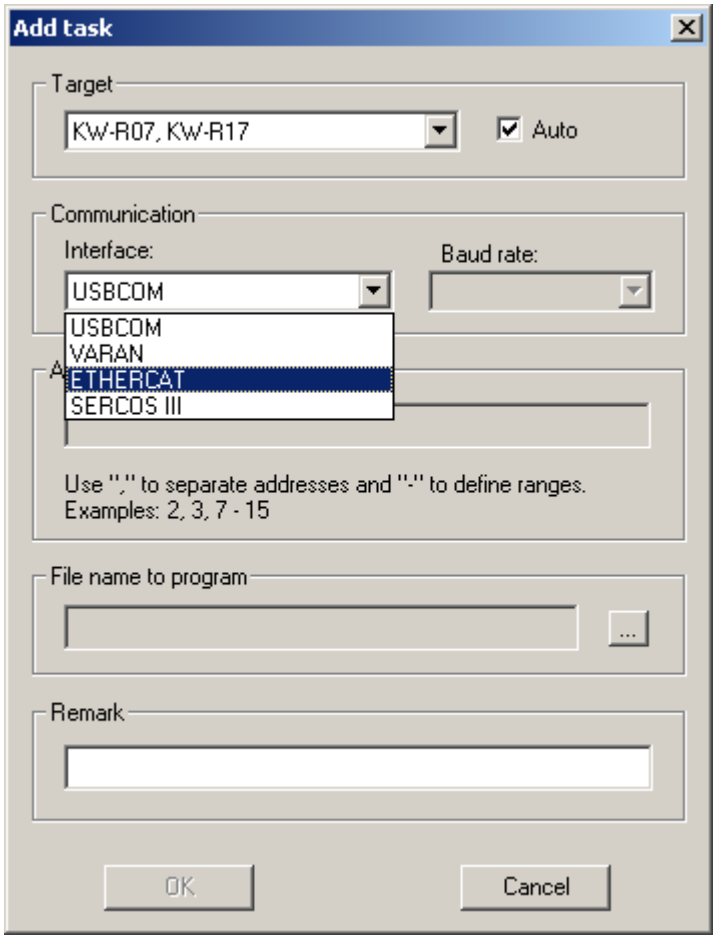
For using the ATF software:
See document Software description ATF - AMK Tool Flasher, Part no. 203771

1. step: selecting target hardware and firmware

1. Select 'Task' -> 'Add...'
2. Select e. g.'KW-R05, KW-R06, KW-R16, MCE' or 'KW-R07, KW-R17' as target.



3. With 'Communication', select USBCOM as interface.

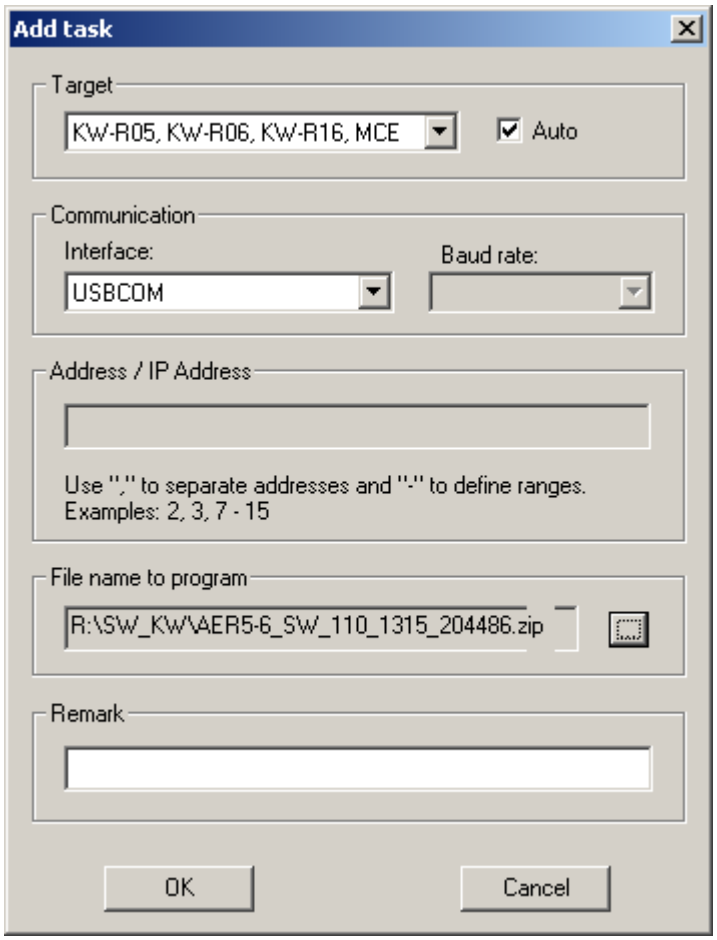


4. With 'File name to program', select the firmware file:

KW-R06 / -R16	AER5-6_SW_vvv_yyww_nnnnnn.zip [1]	controller firmware
KW-R07 / -R17	AER5-6_SW_vvv_yyww_nnnnnn.zip [1]	controller firmware
	AESF1_SW_vvv_yyww_nnnnnn.zip [1]	firmware for functional safety [2]

1) vvv - version
yyww - year and calendar week
nnnnnn - Part no.

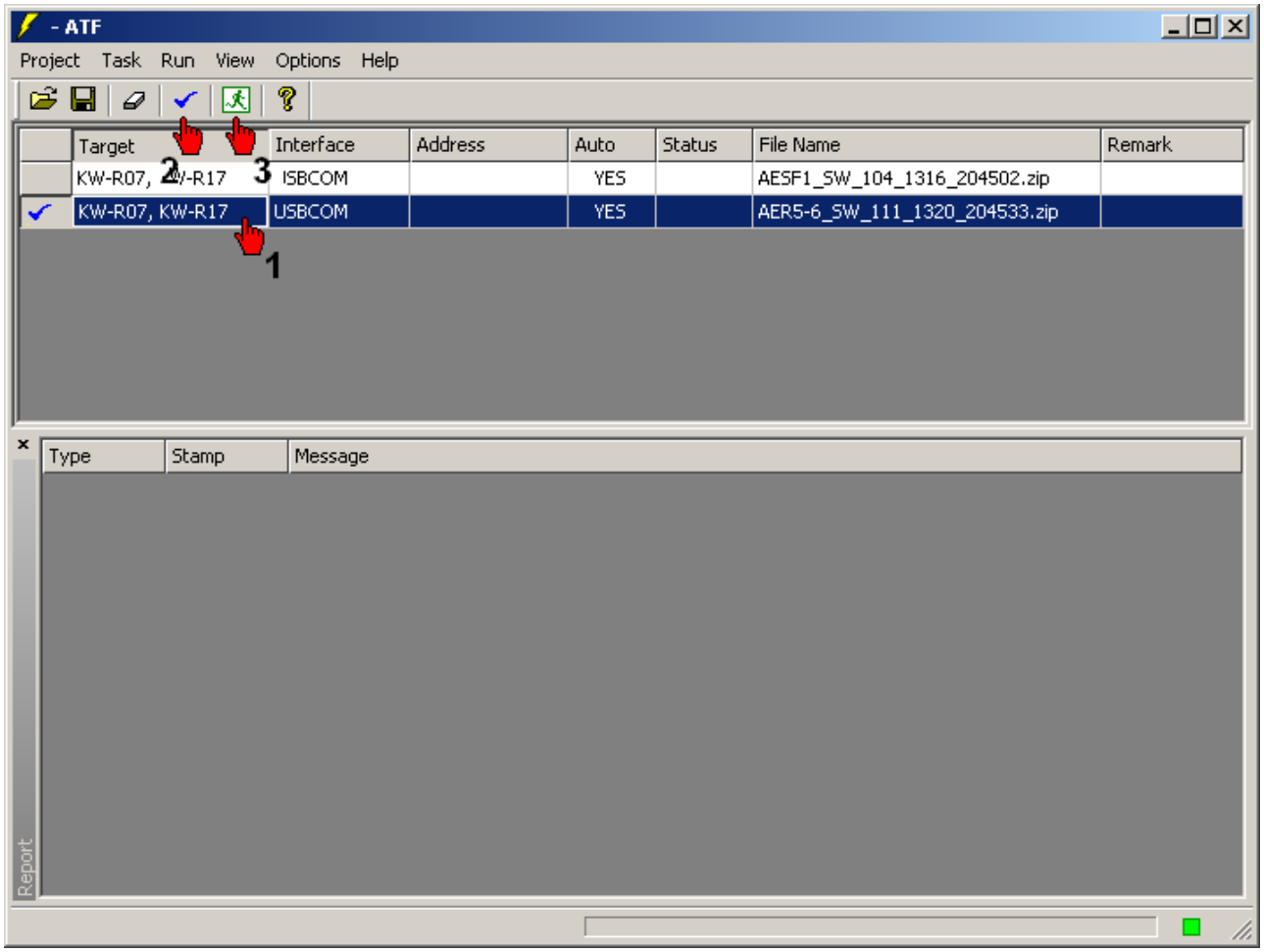
2) Flashing and properties of functional safety: See document Safety manual; functional safety, Part no. 203446



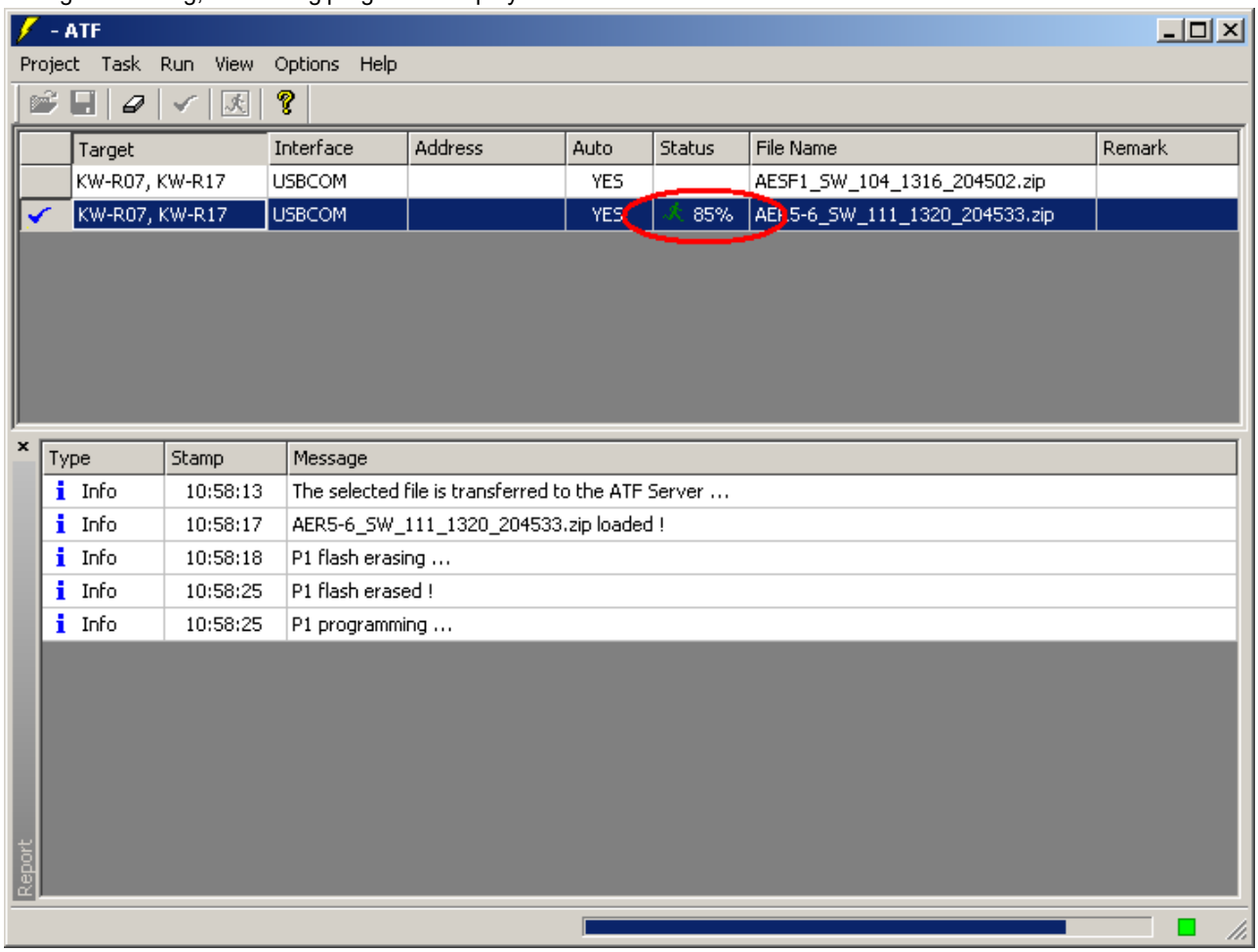
5. Confirm all entries with **'OK'**

2. step: transferring the firmware to the controller card

1. Select the task to flash by clicking into the respective line.
2. Activate the task by clicking the button  .
3. Start the update with  .



4. During the flashing, the loading progress is displayed.



Do not interrupt the flashing sequence!

5. Exit the ATF after the firmware was completely transferred.
6. Switch the controller off and on again. The new firmware will be activated.

Depending on the compatibility class of the old and new firmware, it may be that you are prompted to do an initial program loading by the diagnostic message 1293 'Boot strap EEPROM'. Execute the function and then transfer the application-specific data to the controller card using your backup copy. If you are not prompted to initial program loading, all application-specific settings are kept.

Setting the controller card to boot mode manually

If the flashing sequence was interrupted, e.g. because the USB cable was removed of the 24 VDC supply was interrupted, the controller card must be set to boot mode and the flash procedure must be repeated.

Therefore, plug the service jumper BR3 and BR1 if present (Siehe 'Views and interface overview ' auf Seite 11.).

Re-install the controller card to its compact inverter, connect it to your PC and switch on the 24 VDC supply.

Again, transfer the firmware to the controller card (see step 2).

Afterwards, remove the service jumper(s).

Glossary

A

A1
Analog input 1

A
Outputs

ACC
AMK CAN Communication (CAN bus interface with standard CANopen protocol DS301 and additional hardware synchronization signal)

AIPEX
AMK startup and parameterizing software (PC software): Programming, parameterization, configuration, diagnosis, oscilloscope, status information

ASCII
American Standard Code for Information Interchange

AT
Drive telegram from slave to master

ATF
AMK Tool Flasher (PC software for transferring firmware to device)

A-encoder
Inductive magnetoresistor sensor with sine and cosine track and homing signal (zero pulse)

AWG
American Wire Gauge (Coding of wire diameter)

B

BA
Binary output

BAx
Digital output on controller card (BA1, BA2, BA3)

BE
Digital input

BEx
Digital input on controller card (BE1, BE2, BE3)

BIN
Binary (digital)

C

CRC
Cyclic redundancy check (Checksum)

COB-ID
Communication Object Identifier (Address of a telegram in CANopen protocol)

CMD
Commanding

CAN
Controller Area Network

D

DO
Digital output

DC
Distributed Clock (EtherCAT)

DC bus on
Converter on

Default
Factory setting

DEZ
Decimal

DRIVE
Drive-specific parameter (Value is valid inside only one parameter set)

DZR
Speed control

DI
Digital input

E

Ex
Inputs, binary inputs

EtherCAT
Real-time Ethernet bus

ESD
Electrostatic discharge

EnDat 2.2
Motor encoder interface protocol of the company Heidenhain

EMC
Electromagnetic compatibility

EnDat 2.1
Motor encoder interface protocol of the company Heidenhain

EGB
Electrostatic endangered component

E-encoder
Absolute encoder, singleturn, EnDAT 2.1 with additional sine and cosine track

EF2
Power output stage enable

EF
Power output stage enable

EMV
Electromagnetic compatibility

E/A
In- and outputs

F

FL
Command (Causes a new system run-up)

F-encoder
Absolute encoder, multiturn, EnDAT 2.1 with additional sine and cosine track

FIPO
Fine interpolator

Firmware
System software, loaded by AMK

FORMAL
Formal parameter

Formal parameter
Formal parameters don't have remanent values in parameter handling

FSoE
Fail-Safe over EtherCAT

FTP
File transfer protocol

G

GND
Ground potential

GLOBAL
Global parameter; valid for all parameter sets

H

Homing switch
Cam

Homing point
Zero position after homing cycle

HEX
Hexadecimal, 0x...

Hiperface
Motor encoder interface protocol of the company Sick Stegmann

H-encoder
Encoder with Hall sensors (Contains one sine and cosine track per rotation or per pair of poles on linear measuring systems)

Hiperface DSL
Motor encoder interface protocol of the company Sick Stegmann

I

i^2t
Integral of the squared current over time

ID
Parameter identification numbers acc. to SERCOS Standard

I-encoder
Incremental encoder, optical encoder with sine and cosine track and zero pulse

IGBT
Power electronic component, e. g. transistor

IM
Magnetizing current

Instance
Parameters, depending on the fieldbus, are instanced. For each bus, different values can be parameterized (bus depending participant address, transmission rate etc.). Field bus interfaces and slots where field bus option cards can be installed are allocated to instances (see product documentation)

IPO
Interpolator

K

KW-Rxx
AMKASYN controller card for installation into compact inverter

KWD
AMKASYN compact double inverter to control two motors

KTY
Type of a temperature sensor

KW
AMKASYN compact inverter

Kv
Position loop factor

KES
AMKASYN compact power supply with sinusoidal voltage and current

KEN
AMKASYN compact power supply without recovery

KE/KW
Modular AMK drive system (contains compact power supply KE, compact inverter KW with controller card and applicable option card)

KP
Proportional gain (speed control, PID controller)

KE
AMKASYN compact power supply with recovery

L

LSB
Least Significant Bit

Latched
'To latch a value' means: 'to save a value'

LR
Position control

latch
'To latch a value' means: 'to save a value'

M

MTx
Touch probe; function for acquiring external signals in real time, e.g. printing mark control

MST
Master synchronization telegram

MSB
Most Significant Bit

Max. No. list element
Maximum number of list elements of a list parameter without header elements

Movement direction
With a positive setpoint value, a rightward movement when looking at the motor shaft (on the A-bearing side) results for rotary motors

Modulo
Modulo processing of position setpoint and actual values

M(N)
Nominal torque

MDT
Master Data Telegram from master to slave

MPU
Measuring steps of the encoder per revolution (digital value for P- and Q-encoders)

N

n
Speed

n(act)
Actual speed value

NHN
Heights measured above the base height levelReference plane for heights over the sea level for Germany since 1992. The reference plane is located in Germany on the church in Wallenhorst.

NIP
Zero pulse of encoder

NK
Cam switch

NMT
Network management (CANopen)

O

Operational
In state operational, data are transferred cyclically via fieldbus

Open loop
Open controller loop, no measurement return by encoder system

OSC
Oscilloscope

P

Parameter
Identification number acc. to SERCOS standard

PELV
Protective Extra Low Voltage

P-encoder
Absolute encoder singleturn, EnDAT 2.2 light

PGT
Periphery basic clock Fetch cycle in the basic device to which the drive controller is synchronized (The cycle time is according to ID2)

Pre-operational
In pre-operational state, the controller can access the bus participants via the service channel. No cyclic data is exchanged.

PTC
PTC resistor

PWM
Pulse width modulation

PDK_xxxxxx_abcdefgh
Product documentation; xxxxxx - AMK part no. , abcdefgh - name

Q

QBR
Acknowledgment motor holding brake

Q-encoder
Absolute encoder multiturn, EnDAT 2.2 light

QRF
Acknowledgment controller enable; the drive is controlled in the activated operation mode

QUE
Acknowledgment DC bus on; shows that DC bus is loaded

R

Rooting
Access to AMK devices in any network architecture.

Routing
Access to AMK devices in any network architecture.

RF
Command 'Controller enable'; the drive is energized and will be controlled depending on the selected operation mode. Controller enable can only be set if the device is error-free (SBM = TRUE) and acknowledgement DC bus on is set (QUE = TRUE).Acknowledgement controller enable (QRF) is set.

R-encoder
Absolute angle encoder singleturn (1 sine and cosine track per rotation)

Resolver
Absolute angle encoder singleturn (1 sine and cosine track per rotation)

Rated speed
Nominal speed

S

SBM
System ready message; shows that the device is error-free In case of error. SBM will be reset

SAK
Following distance error compensation

SA
Safe output

SW
Software

SV
Synchronous ratio

STO
Safe torque off (Safety function acc. to DIN EN 61800-5-2)

SS1
Safe Stop 1 (Safety function acc. to DIN EN 61800-5-2)

SoV
Servo Drive Profile over VARAN (Nach IEC 61800-7-300)

SWK
Software commutation

SL
Sensorless (Operation without encoder return)

SoE
Servodrive Profile (SERCOS) over EtherCAT (Acc. to IEC 61800-7-300)

SE
Safe input

SEEP
Device-internal memory, serial EEPROM

SWC
Software commutation

SERCOS
Standardized digital interface for communication between controller and field bus participants.

SIWL
Software pulse transmission

S-encoder
Absolute encoder, singleturn, RS485 Hiperface with sine and cosine track

T

Td
Differentiating time in speed control (PID controller)

T-encoder
Absolute encoder, multiturn, RS485 Hiperface with sine and cosine track

Tn
Integral-action time in speed control (PID controller)

TR
Rotor time constant

TZK
Dead-time compensation

U

U/f
Voltage / frequency control (open loop)

V/f
Voltage / frequency control (open loop)

U-encoder
Absolute encoder, singleturn, RS485 Hiperface with sine and cosine track

UE
Command 'DC bus on' control signal to load the DC bus e.g. in KE. DC bus on can only be set if the device is error-free (SBM =

TRUE). After the DC bus is loaded, the acknowledgement message QUE is set.

UZ
DC bus (voltage)

UZN
DC bus voltage pole negative

UZP
DC bus voltage pole positive

V

V-encoder
Absolute encoder, multiturn, RS485 Hiperface with sine and cosine track

Your opinion is important!

With our documentation we want to offer you the highest quality support in handling the AMKmotion products.
That is why we are now working on optimizing our documentation.
Your comments or suggestions are always of interest to us.
We would be grateful if you take a bit of time and answer our questions. Please return a copy of this page to us.

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or
fax no.: +49 7021/50 05-199

Thank you for your assistance.
Your AMKmotion documentation team

1. How would you rate the layout of our AMKmotion documentation?

   (1) very good (2) good (3) satisfactory (4) less than satisfactory (5) poor

2. Is the content structured well?

   (1) very good (2) good (3) moderate (4) hardly (5) not at all

3. How easy is it to understand the documentation?

   (1) very easy (2) easy (3) moderately easy (4) difficult (5) extremely difficult

4. Did you miss any topics in the documentation?

   (1) no (2) if yes, which ones:

5. How would you rate the overall service at AMKmotion?

   (1) very good (2) good (3) satisfactory (4) less than satisfactory (5) poor

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