AMKASYN
Product description
Controller card KW-R05

Version: 2011/15
Part no.: 202184
Translation of the "Original Beschreibung"

Notes on this document

Name: PDK_202184_KW-R05_en

Version:

Version	Change	Letter symbol
2011/15	chapter connector technology X133: cable must be 12 wires not 6	LeS

Previous version: 2010/05

Product version:

Device	Firmware Version	Hardware Version
KW-R05	AE-R05 V1.03 2009/47 (T-Nr.: 202758)	-

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- 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 Product description

1.1 Product name and Ordering data

Product name	Order number
KW-R05	O806

1.2 Prerequisites

Hardware revision KW modules:	Rev. 3.20
Exception KW100:	Rev. 4.01

1.3 Product overview

The controller card KW-R05 is a new controller platform for the AMK drive system KE/KW. It differs from the KW-R03 by new processor technology, which opens the way to increased power in regards to the control performance as well as to bus connections. The controller card KW-R05 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 value encoder for example to the controller card and are evaluated. The real-time Ethernet interface supports 255 nodes at short cycle times (typically 1 ms). Up to100 of the 255 nodes can be drives,which are controlled synchronously with setpoints. For connection to a controller and further nodes, the real-time Ethernet interface EtherCAT with the protocol Servo Drive Profile over EtherCAT (SoE) acc. to IEC 61800-7-300 is available. 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.

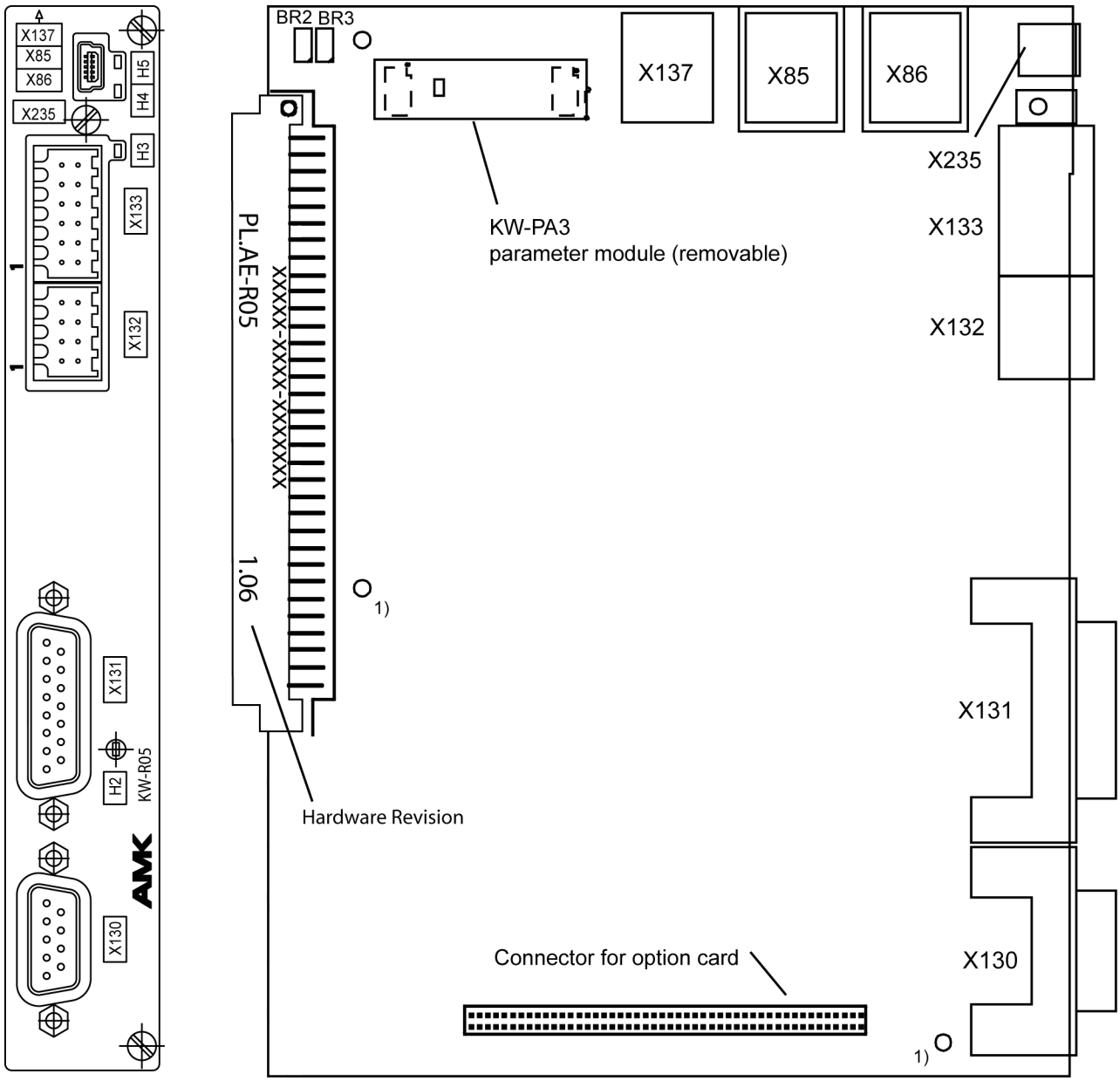
The controller card has an option card slot by which the system can be extended for example by binary I/Os.

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.

1.4 Intended use

The controller card KW-R05 is intended for installation into the compact inverters KW and KWD. The specifications for the proper intended use of the KW and KWD modules are therefore also valid for the controller card KW-R05.

1.5 Front view and interface overview



1) holes for the standoff-pillar between controller card and option card

Interface	Function
X85	Real-time Ethernet IN (parameter instance 1)
X86	Real-time Ethernet OUT (parameter instance 1)
X130	Resolver input
X131	Sinus encoder input
X132	Square-wave pulse interface Connection for an external pulse encoder or output for pulse transmission
X133	Binary I/O and analogue inputs
X137	ACC-bus master (parameter instance 0) For connection of AMKASMART IDT4 drives, KE module, I/O terminals
X235	USB interface V1.1 (slave) Connection to the PC with AIPEX PRO, firmware update (ATF2.0)
H2	LED drive status

Interface	Function
H3	LED real-time bus status (EtherCAT)
H4	LED Ethernet (link status)
H5	LED Ethernet (link status)
KW-PA3	The parameter module has a memory to store all drive parameters. If the parameter module will be removed from one card and put on another, all parameter settings are transfered to this controller card. ☞ The firmware version of both controller cards must be equal, otherwise an "initial loading" is required which resets all parameters to factory configuration.

2 For your safety

Safety and Warning messages are graduated into the class of hazard (according ANSI Z535). The class of hazard defines the risk if the safety message is not avoided and is defined by the signal word. The signal word is followed by a safety alert symbol (ISO 3864). In concurrence with ISO 3864 and ANSI Z535 the following signal words are used to define the class of hazard.

Safety Alert Symbols and Signal Words	**class of hazard and 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 property damage, but not related to personal injury.

The following symbols indicate text phrases, which should be highlighted, but they are not safty-related.

Symbols	**Meaning**
☞	This symbol indicates text phrases, which you should attend to.
💡	This symbol indicates tips and advices.

3 Assembly

3.1 For your safety

⚠ DANGER

Lethal electrical hazard when 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 intermediate circuit 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 KE/KW modules 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-energised.

3.2 Notes on avoiding material damage

NOTICE

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.

Steps to prevent:

- Avoid touching electrical connections and contacts
- During handling the electronic component discharge yourself by touching PE
- Pay attention to the ESD-notes (electrostatic discharge)

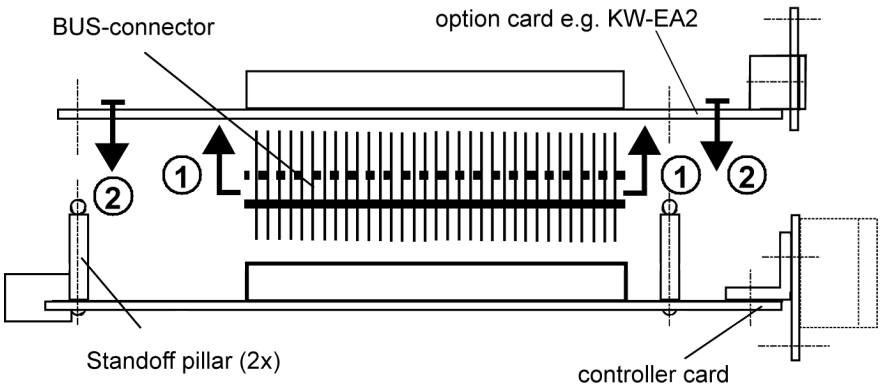
3.3 Dismounting the controller card

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

3.4 Mounting an option card on the controller card

1. Place the controller card and the option card on a non-conducting, padded surface.
2. Press the two lockable plastic standoff pillars 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 option card and the BUS connector pins are flush with the socket plugs on the top.
4. Take the BUS connector on the option card with the short pins and press it into the corresponding socket connector on the controller card. At the same time, press the standoff pillar into the holes of the option card until they snap into place.



3.5 Installing the controller card

1. If you have mounted an option card on the controller card, remove the blind cover of the option card slot with a screwdriver.
2. Carefully insert the controller card and option card into the card slot and guide rail as a unit.
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 option card rest on the device casing.
5. Fasten the controller card and the option 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.

4 Connector technology

4.1 X85 RJ45 (Ethernet IN)/X86 RJ45 (Ethernet OUT)

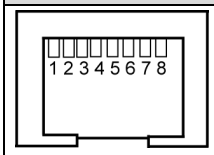
Connenctor X85 has to be connected to the master or a previous node. The connector X86 has to be connected to X85 of the following node.

Technical Data

- 100BASE-T 100-Mbit/s Ethernet standard
- maximum length 75m (industrial area condition)

Plug and signal assignment

Assignment of the sockets acc. IEEE 802.3 Ethernet standard. The assignment is the same for all protocols (e.g. EtherCAT).

	Pin[1)]	Signal	Type	Note
	1	TD+	O	Transmit data +
	2	TD-	O	Transmit data -
	3	RD+	I	Receive data +
	4	-	-	Reserved
	5	-	-	Reserved
	6	RD-	I	Receive data -
	7	-	-	Reserved
	8	-	-	Reserved

[1)] acc. IEEE 802.3

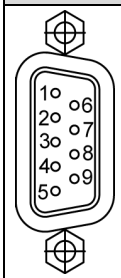
I: Input; O: Output

Cable properties

Terminal	X85 / X86
Designation	Ethernet cable
Cable type	Patch cable of the category CAT5e, shielded
Cross-section	0.32 mm²/AWG22
Shield connection	Both sides
Cable assembly on the module	RJ45 connector
Note	Recommendation from AMK: Industrial Ethernet standard cable Cat 5 E * 22AWG (shielded) Plug with locating lug actuation Accessories and Options

4.2 X130 Resolver

Plug and signal assignment

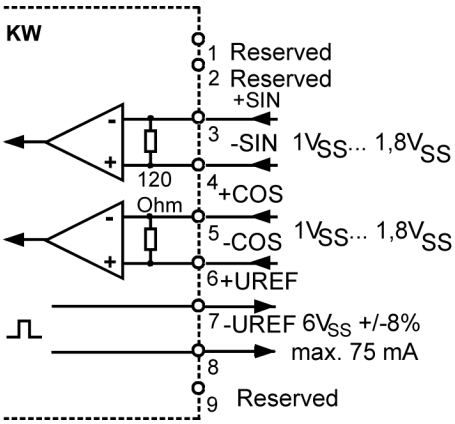
	Pin	Type	Resolver
	1	-	Reserved
	2	-	Reserved
	3	I	+SIN
	4	I	-SIN
	5	I	+COS
	6	I	-COS
	7	O	+UREF
	8	O	-UREF
	9	-	Reserved

I: Input; O: Output

Cable properties

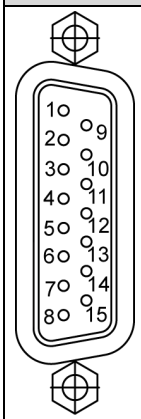
Terminal	X130
Designation	Resolver connection
Cable type	4 x 2 x 0.25 pair-stranded, + 4 x 0.5 shielded
Cross-section	0.25 mm² / 0.5 mm²
Shield connection	Attached on both sides
Cable assembly on the module	D-SUB plugs 9 pin with metalised casing
Note	The shield of the cable has to be grounded by the screw connection in the plug casing 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 casing on the mass.

Circuit principle



4.3 X131 Sinus - encoder input

Plug and signal assignment

	Pin	Type	EnDat standard E-encoder F-encoder	Type	EnDat 2.1 (digital) P-encoder Q-encoder	Type	Sine generator I-encoder	Type	Hiperface S-encoder T-encoder
	1	-	-	-	-	I	G0I	-	-
	2	-	-	-	-	I	G0N	-	-
	3	I	G1I	-	-	I	G1I	I	G1I
	4	I	G1N	-	-	I	G1N	I	G1N
	5	I	G2I	-	-	I	G2I	I	G2I
	6	I	G2N	-	-	I	G2N	I	G2N
	7	O	5 VDC[1)]	O	5 VDC[1)]	O	5 VDC[1)]	-	-
	8	O	GND	O	GND	O	GND	O	GND
	9	I/O	-EN_DAT	I/O	-EN_DAT	-	-	I/O	RS485 -
	10	I/O	+EN_DAT	I/O	+EN_DAT	-	-	I/O	RS485 +
	11	O	-EN_CLK	O	-EN_CLK	-	-	-	-
	12	O	+EN_CLK	O	+EN_CLK	-	-	-	-
	13	O	5 VDC[1)]*	O	5 VDC[1)]	-	-	-	-
	14	O	GND	O	GND	-	GND	-	GND
	15	-	-	-	-	-	-	O	9 VDC[2)]

I: Input; O: Output

[1)] 5 VDC ± 5 % max. 350 mA

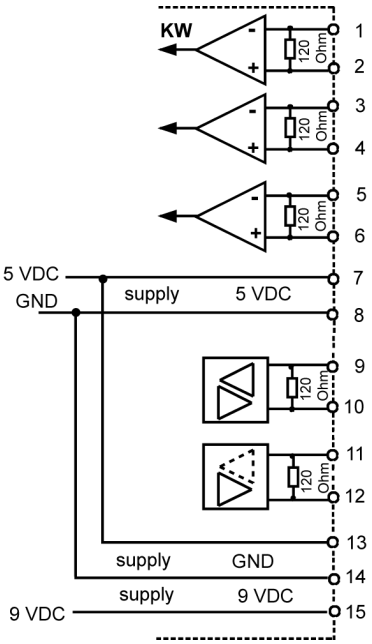
[2)] 9 VDC ± 15 % at load, max 400 mA, 12 VDC ± 20 % in idle

The maximum input frequency is 100kHz.

Cable properties

Terminal	X131
Designation	Sinus - encoder connection
Cable type	4 x 2 x 0.25 pair-stranded, + 4 x 0.5 shielded
Cross-section	0.25 mm² / 0.5 mm²
Shield connection	Attached on both sides
Cable assembly on the module	D-SUB plugs 15 pin with metalised casing
Note	The shield of the cable has to be grounded by the screw connection in the plug casing 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 casing on the mass.

Circuit principle

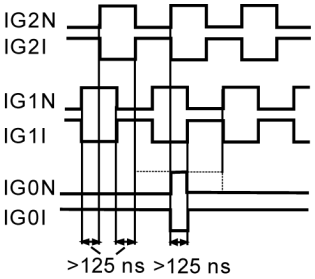


4.4 X132 Pulse encoder

The potential-bound pulse encoder interface (square-wave signals according RS422 interface) can be used as an input or as a signal routing (software pulse transmission). The maximum output frequency at pulse transmission is 2 MHz.

As pulse encoder input the two following signal form is supported:

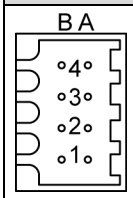
2 square-wave pulses with a 90° offset ("mode 0")



The maximum input frequency is 2 MHz.

The encoder signals are evaluated 4 times by the KW device.

Plug and signal assignment

	Pin	Type	Signal
	A1	I/O	IG0I
	B1	I/O	IG0N
	A2	I/O	IG1I
	B2	I/O	IG1N
	A3	I/O	IG2I
	B3	I/O	IG2N
	A4	O	5V[1)]
	B4	O	GND
	Shield Casing	I	PE

I: Input; O: Output

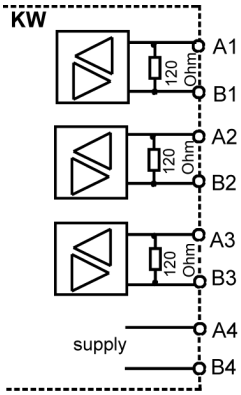
[1)] 5 VDC ± 5% max. 350 mA

Input impedance 120ohm (max. input current ≤ 20mA).

Cable properties

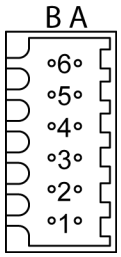
Terminal	X132
Designation	Pulse encoder
Cable type	4 x 2 pair-stranded, shielded
Cross-section	max. 0.8 mm² / AWG18
Shield connection	One side on module
Cable assembly on the module	Weidmüller socket board, 8-pin AMK part no. 28759
Note	A shielded cable has to be used for the pulse encoder. The shield of the cable has to be placed at one side of the KW controller card.

Circuit principle



4.5 X133 Binary I/O and analogue inputs

Plug and signal assignment

	PIN	Signal	Type	Note	Properties / Use
	A1	A1N	I	Analogue channel 1 not inverted	±10V scaling
	B1	A2N	I	Analogue channel 2 not inverted	±10V scaling
	A2	A1I	I	Analogue channel 1 inverted	±10V scaling
	B2	A2I	I	Analogue channel 2 inverted	±10V scaling
	A3	BGND	I	Binary ground	
	B3	BVCC	I	Binary supply binary outputs	24 VDC ± 15%
	A4	BE1	I	Binary input 1	24 VDC ± 15%, max. 10 mA, electrically isolated
	B4	BA1	O	Binary output 1,	24 VDC, 100 mA, electrically isolated, continuous short circuit protection
	A5	BE2	I	Binary input 2	24 VDC ± 15%, max. 10 mA, electrically isolated, probe input 1
	B5	BA2	O	Binary output 2	24 VDC, 100 mA, electrically isolated, continuous short circuit protection
	A6	BE3	I	Binary input 3	24 VDC ± 15%, max. 10 mA, electrically isolated, probe input 2
	B6	BA3	I/O	Binary output 3,	24 VDC, 2.5 A, electrically isolated, continuous short circuit protection, to control a motor holding brake

I: Input; O: Output

[1)] The PIN X133 B6 can be configured as binary input or as binary output.

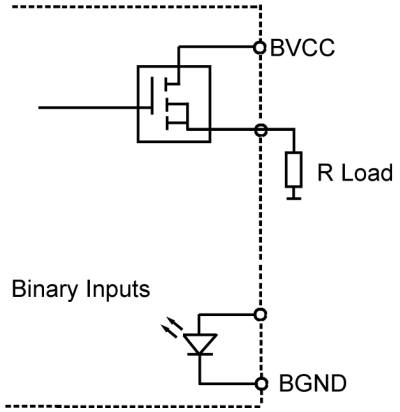
The cable shield has to be placed onto the casing.

Cable properties

Terminal	X133
Designation	Binary inputs/outputs, analogue inputs
Cable type	12-wire, shielded
Cross-section	max. 0.8 mm² / AWG18
Shield connection	One side on module
Cable assembly on the module	Weidmüller socket board, 12-pin AMK part no. 28761
Note	-

Circuit principle

Binary Outputs



Analogue inputs A1 and A2

Input voltage: Nominal ±10 VDC

Input current: max. 10 mA

The differential analogue inputs (potential-bound) permit a maximum input voltage of ±12 VDC!

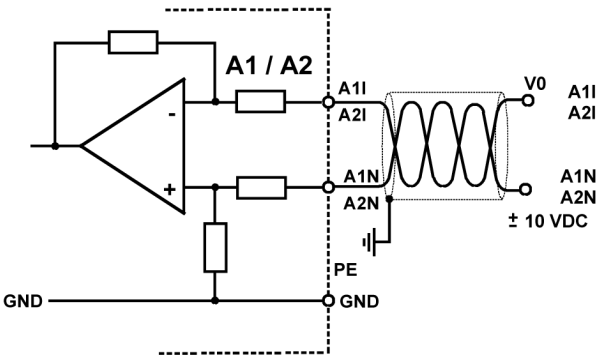
The resolution is 12 bit for ±10 VDC. The request by the microcomputer is carried out cyclically every 250 µs.

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

The limit torque can be influenced by the analogue input A2 by varying the analogue voltage.

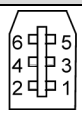
Connection by a shielded cable (parallel stranded). The cable shield has to be placed onto the KW casing. The GND potential of the setpoint source may deviate in relation to the PE by a maximum of ±10 V.

Circuit principle



4.6 X137 ACC (master)

Plug and signal configuration

	Pin	Signal	Type	Note
X137 	1	GND	I/O	GND
	2	GND	I/O	GND
	3	CAN_H	I/O	CAN High
	4	CAN_L	I/O	CAN Low
	5	SYNC_H	I/O	SYNC High
	6	SYNC_L	I/O	SYNC Low

I: Input; O: Output

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 KW-R05 features an internal bus terminal (120 ohm).

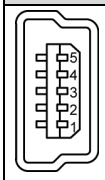
Cable properties

Terminal	X137
Designation	ACC-bus cable
Cable type	Pair-stranded, shielded
Cross-section	0.8 mm² / AWG18
Shield connection	Both sides
Cable assembly on the module	ACC-bus cable IEEE 1394 completely assembled
Note	140 mm cable length, complete length 240 mm – AMK order no. 29237 210 mm cable length, complete length 310 mm – AMK order no. 29231 300 mm cable length, complete length 400 mm – AMK order no. 200053 1 m cable length, complete length 1.10 m – AMK order no. 29523 1.8 m cable length, complete length 1.90 m – AMK order no. 29543 4 m cable length, complete length 4.10 m – AMK order no. 29544 5 m cable length, complete length 5.10 m – AMK order no. 200507 10 m cable length, complete length 10.10 m – AMK order no. 29545

4.7 X235 USB V1.1 (slave)

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

Plug and signal configuration

	Pin	Signal	Note
	1	5 V DC input	External 5 V DC master supply, max. 50 mA current consumption
	2	D–	Data –
	3	D+	Data +
	4	5 VDC output	Reserved for AMK
	5	GND	Earth

Cable properties

Terminal	X235
Designation	USB cable
Cable type	Data+ and Data– pair-stranded, shielded
Cross-section	0.08 mm^2 / AWG28
Shield connection	Both sides
Cable assembly on the module	USB cable assembled (USB type A to mini-USB typ B) 3 m with ferrite shell – AMK part no. 202375
Note	Maximum 3 metres length permitted for USB cable! With active USB repeater, longer cable lengths are possible.

Notice the maximum ACC-bus cable length depending on the transmission rate and the number of bus nodes. For more details please have a look to the application note AP_2006_08_1e *Maximum CAN-bus length*

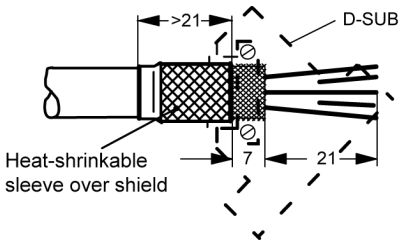
4.8 LED Codes

LED	Class	Status	Note
H2	Drive status	Green	System Ready (SBM)
		Green blinking	Drive under control (SBM and QRF)
		Orange flashing	Warning with active controller enable signal RF
		Orange	Warning during inactive controller enable signal RF / Flash mode
		Red	Error with reaction
H3	Bus status (EtherCAT)	Off	Initialisation
		Green blinking	Pre-operational
		Green single flash	Safe-operational
		Green	Operational
		Red blinking	Configuration error
		Red single flash	Error dependent switch back to the operational statuses Operational, Safe operational, Pre-operational or Initialising
H4	Ethernet bus (link status)	Off	No connection
		Green	Link connection
		Blinking	Link/Activity – connection and data exchange
H5	Ethernet bus (link status)	Off	No connection
		Green	Link connection
		Blinking	Link/Activity – connection and data exchange

Blinking: T_{on}=200ms, T_{off}=200ms
Single flash: T_{on}=200ms, T_{off}=1000ms

4.9 Assembly cable with D-sub plug

1. Metallic D-sub casings 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 approx. 21 mm for 9-pin D-sub plug).
3. Evert cable shield over the outer insulation sleeve.
4. Fix and insulate the shield with heat-shrinkable sleeve so that a blank shielding edge of approx. 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 plug 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 plug casing. The shield may not lead over plug 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 cable crew.



5 Functionality

5.1 Cycle times of the controller

Controller	Time	Comment
Current controller	62.5 µs	-
Speed controller	125 µs	-
Position controller	250 µs	Cyclic position setpoint specification intern
Interpolator	1 ms	homing cycle
Shortest possible bus cycle time	500 µs	EtherCAT and ACC-bus have the same cycle time (ID2).

5.2 EtherCAT interface

The KW-R05 is a controller card with real-time Ethernet connection and supports the EtherCAT SoE protocol (Servo Drive Profile acc. to IEC 61800-7-300). The drive is controlled by the superordinate EtherCAT controller by specifying setpoints and evaluating the drive status. In the SoE protocol a series of command IDs are defined with which the drive can be commanded, such as referencing or calliper. Access to the IDs is by the EtherCAT controller via the mailbox as service channel. The bus device address is automatically assigned via the EtherCAT master or with parameter ID34023 *BUS address participant* instance 1.

The controller card KW-R05 EtherCAT slave can exchange with the EtherCAT master 40 double words in transmit and receive direction each. The configuration is done from the EtherCAT master in the KW-R05 parameters ID16 *Configuration list MDT* and ID24 *Configuration list AT*.

5.3 ACC-bus interface

The ACC-bus interface is completed as master. The EtherCAT master controller uses the ACC-bus interface for the communication to the KE, to AMKASMART IDT4 drives or to external CANopen components. The issuing of the ACC-bus device address is done via ID34023 *BUS address participant*instance 0 of the KW-R05 controller card.

In total, 7 devices can be connected to the ACC-bus; of that a maximum of 6 AMKASMART IDT drives (with the ACC-bus address 2,3,4,5,6,7) and an AMKASYN KE module with the address 33. External I/O terminals can be connected as long as 7 devices are not exceeded.

5.4 Drive functions

Drive functions are permanently stored in the firmware of the servo drive and can by adapted to the applications by parameter settings (e.g. honing cycle, operating mode switching, ...). The access to the various functions is done via the access mechanisms (ID numbers) available in the SoE protocol.

5.5 Parameter set switch over

Drive specific identnumbers (they are marked as DRIVE in the parameter index list see Parameter Index on page 43) are set new for each parameter set . 4 Parameter sets are available and it can be switched over between them.

5.6 Homing cycle

The position reference of the drive is established automatically during the system startup. Prerequisite is a drive with an absolute encoder such as E-/F-, S-/T-, P-/Q- or R-encoder. The absolute value is read on multiturn encoders, on the single-turn the angle within an encoder revolution.

A homing cycle command causes the actual position value to be read out again on the multiturn encoder. On the single-turn absolute encoder, a homing cycle is started according to the settings in the parameters ID147 *Homing parameter* and ID32926 *AMK homing parameter (e.g.* homing cycle onto fixed stop or cam signal).

5.7 Probe function

5.7.1 Continuously measuring the pulse encoder input X132 with zero pulse

During continuously measuring of the pulse encoder input with zero pulse the counter of the pulse encoder input is buffered with every zero pulse. In parameter ID32948 *Message 4x32*, code 0x03 needs to be parameterised in the

message 1 or 2. The maximum input frequency is 2 MHz. The saved value for message 1 (message 2) is saved in the parameter ID34074 *Homing Counter 1* (ID34076 *Homing Counter 2*). The current value is located in ID34075 *Actual Counter 1* (ID34077 *Actual Counter 2)*. By the calculation of the reference counters with the current value, the real-time reference to the external signal is possible. The calculation needs to be done in the controller.

5.7.2 Continuously measuring the pulse encoder input X132 with trigger at BE2/BE3

During continuously measuring of the pulse encoder input the counter of the pulse encoder input is buffered with every positive edge at BE2/BE3. The parameter settings are depending on the used binary input:

BE2:

ID32948 *message 4x32* message 2 = 0x23

ID32979 port 3 bit 1 = 402

or

BE3:

ID32948 *message 4x32* message 1 = 0x23

ID32980 port 3 bit 2 = 401

Code 0x23 is not allowed to assign to message 1 and 2 at the same time!

The maximum input frequency is 2 MHz. The saved value for message 1 (message 2) is saved in the parameter ID34074 *Homing counter 1* (ID34076 *Homing counter 2*). The current value is located in ID34075 *Actual counter 1* (ID34077 *Actual counter 2*). By the calculation of the reference counters with the current value, the real-time reference to the external signal is possible. The calculation needs to be done in the controller.

5.7.3 Continuously measuring the actual position value with trigger at BE2/BE3

During continuously measuring the actual position value of the motor encoder is buffered according to ID32953 *Encoder type* with each edge according to ID169 *Probe control parameter* on the binary input BE2/BE3. The parameter settings are depending on the used binary input:

BE2:

ID32948 *message 4x32* message 2 = 0x24

ID32979 port 3 bit 1 = 402

or

BE3:

ID32948 *message 4x32* message 1 = 0x24

ID32980 port 3 bit 2 = 401

The time between 2 measuring edges at BE3 may not be less than 1 ms. The saved actual position value for message 1 (message 2) is saved in the reference counter ID34074 *Homing counter 1* (ID34076 *Homing counter 2*). The current actual position value is located in ID34075 *Actual counter 1* (ID34077 *Actual counter 2*). Additional the measured actual position value is stored in ID130/ID131 or rather ID132/133. By the calculation of the reference counters with the current actual position value, the real-time reference to the external signal is possible. The calculation needs to be done in the controller.

5.7.4 Probe MT1 and MT2

The function is activated by the parameter ID170 *Cmd. Probe.cycle*. This function makes it possible to make a single measurement as well as a multiple, quick measurements using real-time bits. Certain edges of the probe 1 and 2 can be selected by the parameter ID169 *Probe control*. The measuring is directly enabled by the parameters ID405 *Probe 1 enable*/ID406 *Probe 2 enable*.

If a selected edge occurs at the measuring gauge, the drive latches the actual position value in the parameter ID130 *Probe value 1 positiv edge*- ID133 *Probe value 2 negative edge* assigned to the edge and sets the corresponding bit in ID179 *Probe status*. The status bits in the parameter ID179 *Probe status* can be accessed individually by the parameters ID409 *Probe 1 positive.latched*- ID412 *Probe 2 negative.latch*ed and can thereby be assigned to a binary output.

Once an active edge occurs, the effect of an identical edge is blocked. This block is lifted by the withdrawal of the probe enable 1/2. The probe is enabled again by the following setting of the probe enable 1/2.

Between two measurements there needs to be at least t_{min} = 1 ms.

The controller card KW-R05 supports 2 probes (MT1 and MT2).
probe 2 (MT2): Binary input BE2 (parameterisation: ID32979 *Input Port 3 bit 1* = 0x402)
probe 1 (MT1): Binary input BE3 (parameterisation: ID32980 *Input Port 3 bit 2* = 0x401)

Relevant parameters

Parameters	Explanation
ID169 *Probe control*	probe edge to be evaluated Bit 0 = 1: positive edge MT1 Bit 1 = 1: negative edge MT1 Bit 2 = 1: positive edge MT2 Bit 3 = 1: negative edge MT2
ID170 *Command Probe cycle*	probe function command ID170 = 0x3 Drive waits for the release MT1 (ID405) or MT2 (ID406)
ID405 *Probe 1 enable*	enable probe 1 Requirement ID170 = 0x3 For each measurement, the release needs to be set again with a 0-1 edge in Bit 0
ID406 *Probe 2 enable*	Release MT2 Requirement ID170 = 0x3 For each measurement, the release needs to be set again with a 0-1 edge in Bit 0.
ID179 *Probe status*	Bit 0: MT1 positive edge latched (see ID409) Bit 1: MT1 negative edge latched (see ID410) Bit 2: MT2 positive edge latched (see ID411) Bit 3: MT3 negative edge latched (see ID412) ID405 = 0x0 / ID406 = 0x0 reset the respective bits in measuring value status. All bits are reset when ID170 = 0x0 is written.
ID409 *Probe 1 positive latched*	Real-time acknowledgment bit, see ID169 Bit 0 The measured actual position value is entered in ID130. Requirement ID405 = 0x1, and positive edge to MT1 (ID401)
ID410 *Probe 1 negative latched*	Real-time acknowledgment bit, see ID169 Bit 1 The measured actual position value is entered in ID131. Requirement ID405 = 0x1, and negative edge to MT1 (ID401)
ID411 *Probe 2 positive latched*	Real-time acknowledgment bit, see ID169 Bit 2 The measured actual position value is entered in ID132. Requirement ID406 = 0x1, and positive edge to MT2 (ID402)
ID412 *Probe2 negative latched*	Real-time acknowledgment bit, see ID169 Bit 3 The measured actual position value is entered in ID133. Requirement ID406=0x1, and negative edge to MT2 (ID402)
ID130 *Probe value 1 positive edge*	Measured actual position value at event MT1 positive edge
ID131 *Probe value 1 negative edge*	Measured actual position value at event MT1 negative edge
ID132 *Probe value 2 positive edge*	Measured actual position value at event MT2 positive edge
ID133 *Probe value 2 negative edge*	Measured actual position value at event MT2 negative edge
ID34047 *Dead time compensation probe 1*	The parameter compensates the signal runtimes of the sensor, the input switching and the actual position value detection. An additional path is added to the measured actual position value that takes the delay into account. This means that so much path is added as the drive would travel at the current speed in the specified time.
ID34210 *Dead time compensation probe 2*	The parameter compensates the signal runtimes of the sensor, the input switching and the actual position value detection. An additional path is added to the measured actual position value that takes the delay into account. This means that so much path is added as the drive would travel at the current speed in the specified time.

5.8 Operating modes according parameter ID32800..

5.8.1 Position control

The position setpoint (ID47) is specified as a 32-bit reference variable, cyclically in increments. Additionally, a position setpoint can be fed in via the square-wave pulse input X132. The minimum cycle time for the setpoint specification is determined by the bus cycle time. Both setpoints superposes to one new position setpoint.

5.8.2 Digital speed control

The speed setpoint (ID36) is specified as 32-bit value in the format 0.0001 rpm (example: setpoint 10000 equals 1 rpm). The minimum cycle time for the setpoint specification is determined by the bus cycle time.

5.8.3 Analogue speed control

The speed setpoint is specified at the analogue input X133 A1 of the controller card with a resolution of 12 bits as ± 10 V signal. The analogue input is read once per 250 µs. The applied voltage can be read from the ID number ID32897 *Analog input A1*. In the ID number ID34037 *Offset analog input A1* a compensation value can be specified in 0.01 volt. In ID32779 *Velocity offset for A1*, the compensation can be specified in 0.0001 rpm. The speed limit at 10 V input voltage has to be entered in ID32778 *Velocity related to 10V at A1*.

The parameters ID34037 *Offset analog input A1* und ID32779 *Velocity offset for A1* both infuences the output value of the AD-converter. To avoid errors we recommend to use only one of both parameters.

5.8.4 Digital torque control

With the digital torque setpoint specification the drive is regulated by the subordinate current control circuit. The torque setpoints (ID80) are specified as 16-bit values by the controller. The actual torque value is formed from the actual current value. The minimum cycle time for the setpoint specification is determined by the bus cycle time.

5.8.5 Analogue torque control

The torque setpoint is specified at the analogue input A1 of the controller card X133 with a resolution of 12 bits as ±10 V signal. The analogue input is read once per 250 µs. In the parameter ID32777 *Torque setpoint at 10 V*, specification is made how much torque in 0.1 $\%M_N$ should be generated at 10 V. With the identnumber ID34037 *Offset analog input A1* a compensation value can be entered scaled in 0.01 Volt.

5.9 U/f-Mode

In the U/f-mode a motor operates without an encoder feedback. The speed setpoint is set depending on the setpoint source according to ID32800 *AMK main operation mode* and works the same like in a closed loop system. The identnumber ID32991 *U/f-start up* defines the motor acceleration characteristic. The U/f-mode must be activated by setting in ID32953 *Encoder type*.

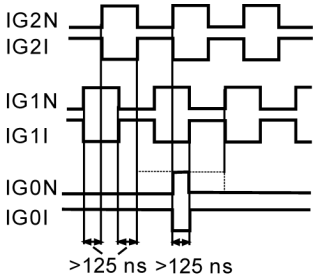
5.10 Pulse encoder interface

With the firmware AE-R05 V1.03 2009/47 the pulse encoder interface can not be used as command value source for synchronous control!

The firmware version can be read out of ID30.

The square-wave pulse interface X132 can be used as square-wave pulse input or as pulse transmission. The difference inputs IG1N, IG1I, IG2N, IG2I of the square-wave pulse input make the actual position value detection possible by an external position sensor with square-wave pulse output. The external actual position value system needs to be equipped with difference outputs (line drivers acc. to RS422).

2 square-wave pulses with a 90° offset



The maximum input frequency is 2 MHz. The encoder signals are evaluated 4 times by the KW device.

Example:

2 MHz are 2 000 000 periodes / s. Each periode generates 4 increments do to 4 times evaluation. Thus there is a maximal frequency of 8 000 000 Incr./ s = 8000 Increments./ ms.

During the pulse transmission, 2 square wave pulses with a 90° offset and zeropulse can be signalled. The signal source is specified in the ID32964 *SIWL source*. If the signal source ID32964 = 33911 is set, then the controller needs to write the SIWL setpoint into the ID33911 *Setpoint SIWL*. The setpoints are generated by the controller in ID2 *SERCOS Cycle time* time interval. At The pulse output interface a fine interpolator generates signals in 250 µs time interval. The maximal output frequency is 2 MHz (A SIWL setpoint of 8000 Incr./ms corresponds 2000 Periodes/ms (2 MHz) at the pulse encoder interface output).

5.11 Monitoring functions

- Short-circuit/ earth fault monitor of the output terminals to the motor
- Inverter current overload acc. to i²t
- Encoder signal monitor
- Hardware watchdog for processor monitor
- Motor current overload acc. to i²t
- Excess temperature motor
- Excess temperature inverter (temperature cooler and IGBT-temperature monitoring over the temperature model)
- Under and overvoltage intermediate circuit is monitored by KE
- Logic voltages
- Run-down monitor for Inverter ON removal

5.12 Monitor deceleration time for Inverter ON inactive

After removing Inverter ON, the drive is slowed down acc. to ramp ID32782 *Deceleration ramp time RF inactive*. The entered time is valid for the deceleration from ID113 *Maximum v*elocity to speed 0.

The axis is coasting if an axis acceleration is detected by the system during the braking. This monitor can be deactivated by the parameter ID32773 *Service bits* bit 2.

5.13 Safety functions

The output stage release (EF) triggers a secure block against unintended motor start-up in the drive that corresponds to safety category 4 according to EN954-1.

Prerequisite is an inverter module equipped with EF.

5.14 Control motor holding brake

A motor holding brake serves to fixate the motor shaft at non-powered drive (e.g. application of hanging drive). The AMK drive is capable of independently coordinating the activation and deactivation of the inverter on as well as the control of the holding brake. Holding brakes have different reaction times (during applying and releasing). With ID206 *Drive ON delay time* and ID207 *Drive OFF delay time*, the control of the inverter on is regulated internally so that various reaction times can be reliably bridged. Using the binary output BA3 (terminal X133 pin B6), a holding brake can be controlled directly with 24 VDC and max. 2.5 A (I_{Br}). The function Motor brake control is activated by the code 33052 in the ID32867 *Output port 3 bit 2*.

BA3=0 Holding brake closed

BA3=1 Holding brake open

With holding brakes with acknowledgement signal, the binary input wired to the acknowledgement signal has to be occupied with the code 33906 (QBR Acknowledge signal motor brake).

The monitor of the acknowledge bit has to be activated by ID32773 *Service bits* bit 13 .

Acknowledge signal holding brake QBR = 1 Holding brake closed

Acknowledge signal holding brake QBR = 0 Holding brake opened

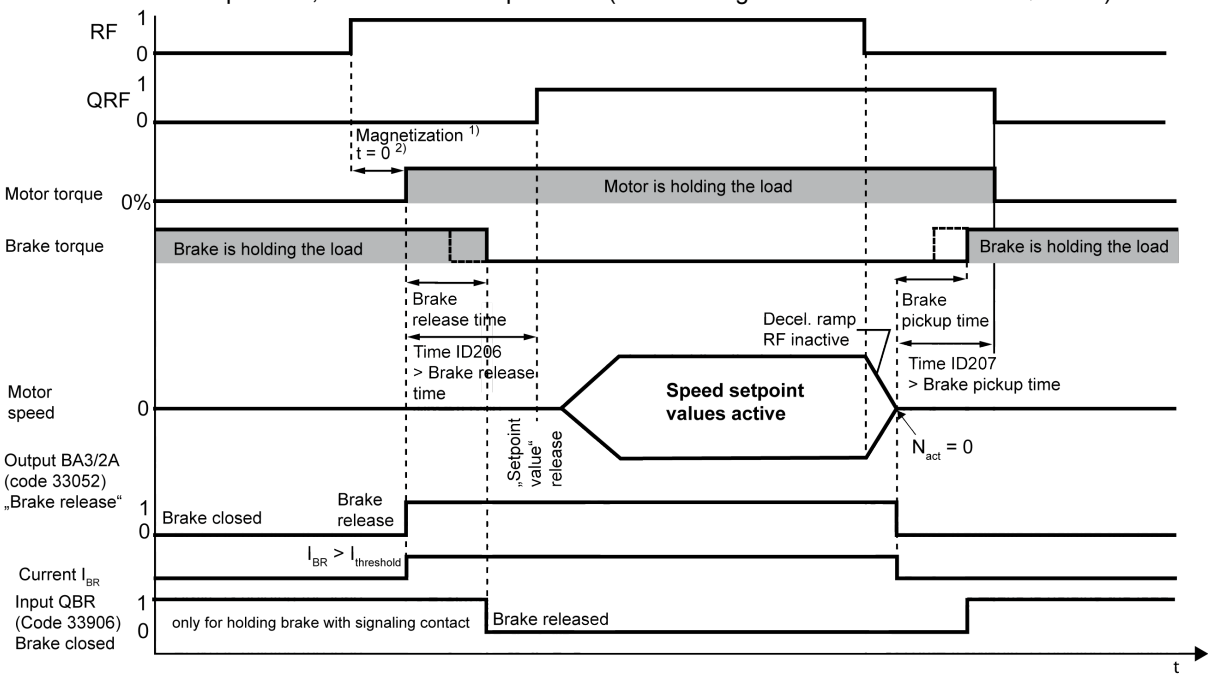
Sequence during switching on:

1. The holding brake is active, the motor is without power
2. Inverter ON, the motor is energized
3. The motor holds the position, the brake is released.
4. After the time in ID206 expires, the acknowledgement controller enable QRF (QRF = 1) is set.

The controller is allowed to generate setpoints after QRF is set, otherwise the drive woks against the brake.

Sequence during switching off

1. Inverter ON, the motor deceleration is activated.
2. n_{act} = 0 (axis standstill), the holding brake is activated
3. After the time in ID207 expires, the motor regulation is deactivated.
4. The brake holds the position, the motor is non-powered (Acknowledgement controller enable QRF = 0)



1) Asynchronous motors
2) Synchronous motors

5.15 Binary inputs and outputs

The controller card KW-R05 features 6 binary I/Os, 3 binary inputs and 3 binary outputs at terminal X133. With the option card KW-EA2 the system is extended by 12 binary inputs and 8 binary outputs.

Preassignment of the binary in- and outputs on the KW-R05 terminal X133

Input	Port	ID	Code	Explanation
BE1	3 bit 0	32978	33904	Inverter ON (RF)
BE2	3 bit 1	32979	32913	Clear error (FL)
BE3	3 bit 2	32980	032905	Cam (NK)
BA1	3 bit 0	32865	33031	Acknowledgement controller enable (QRF)
BA2	3 bit 1	32866	33029	SBM / System Ready
BA3	3 bit 2	33867	33052	Acknowledgement motor brake

The firmware of the KW-R05 controller card provides 3 binary in- and output ports with 8 bits each. Access to the in- and output ports 1 and 2 is possible via the option card KW-EA2 or via an AMK controller.
The in- and output port 3 is used for the binary in- and outputs in the terminal X133 and are permanently assigned to it.

The assignment of the input port is done with the following addressing parameters:
ID32873 *Address input port 1*
ID32968 *Address input port 2*
ID32977 *Address input port* 3 : Fixed allocation "Code 32"

The assignment of the output port is done with the following addressing parameters:
ID32846 *Address output port 1*
ID32855 *Address output port 2*
ID32864 *Address output port 3*: Fixed allocation "Code 544"

By entering the address code, the input ports 1 and 2 are assigned to the slot and hence the KW-EA2 option card.
By means of a controller, the entire binary address range can be used as a virtual I/O, irrespective of whether the hardware is available.

Address code	Explanation
48	Option card KW-EA2 Inputs E1 to E8 active
49	Option card KW-EA2 Inputs E9 to E16 active The KW-EA2 supports 12 inputs!
560	Option card KW-EA2 Outputs A1 to A8 active
32	ID34100 *Binary input word 0* (bit 0 to bit 2) Binary inputs BE1, BE2, BE3 on the controller card
40	ID34101 *Binary input word 1* (bit 0 to bit 7)
41	ID34101 *Binary input word 1* (bit 8 to bit 15)
42	ID34102 *Binary input word 2* (bit 0 to bit 7)
43	ID34102 *Binary input word 2* (bit 8 to bit 15)
544	ID34120 *Binary output word 0* (bit 0 to bit 2) Binary outputs BA1, BA2, BA3 on the controller card
552	ID34121 *Binary output word 1* (bit 0 to bit 7)
553	ID34121 *Binary output word 1* (bit 8 to bit 15)
554	ID34122 *Binary output word 2* (bit 0 to bit 7)
555	ID34122 *Binary output word 2* (bit 8 to bit 15)

The access of a controller on the binary outputs is only possible if the parameter "Address output port 1/2" is occupied by the value 0.

The in- and output bits can be freely configured according to the following tables. For that the corresponding codes are allocated to the input bits. By setting the binary input (positive edge), an operating mode change is triggered for instance.

By entering the corresponding code into the ID no. of the output bit, internal bit signals from the drive can be assigned to the binary outputs. The evaluation of this output information is done in a superordinate controller.

Example for the parameterisation of the KW-EA2 option card:

The following functions should be carried out with the binary inputs of the KW-EA2.

Binary input 1: Change to the main operating mode

Binary input 2: Change to the secondary operating mode 1

Binary input 3: Change to the secondary operating mode 2

The respective active operating mode should be signalled by the binary outputs.

Parameterisation:

ID	Value	Description
ID32864 *Address input port 1*	48	Activation of the KW-EA2 option card (BE Bit0 to Bit7)
ID32874 *input port 1 Bit 0*	33700	E1: Activate main operating mode (ID32800)
ID32875 *input port 1 Bit 1*	33701	E2: Activate secondary operating mode 1 (ID32801)
ID32876 *input port 1 Bit 2*	33702	E3: Activate secondary operating mode 2 (ID32802)
ID32877 *input port 1 Bit 3*	0	E4: Freely configurable
ID32878 *input port 1 Bit 4*	0	E5: Freely configurable
ID32879 *input port 1 Bit 5*	0	E6: Freely configurable
ID32880 *input port 1 Bit 6*	0	E7: Freely configurable
ID32880 *input port 1 Bit 7*	0	E8: Freely configurable
ID32968 *Address input port 2*	49	Activation of the KW-EA2 option card (BE Bit8 to Bit15)
ID32969 *input port 2 Bit 0*	0	E9: Freely configurable
ID32970 *input port 2 Bit 1*	0	E10: Freely configurable
ID32971 *input port 2 Bit 2*	0	E11: Freely configurable
ID32972 *input port 2 Bit 3*	0	E12: Freely configurable
ID32973 *input port 2 Bit 4*	0	Free (no access by the KW-EA2 option card)
ID32974 *input port 2 Bit 5*	0	Free (no access by the KW-EA2 option card)
ID32975 *input port 2 Bit 6*	0	Free (no access by the KW-EA2 option card)
ID32976 *input port 2 Bit 7*	0	Free (no access by the KW-EA2 option card)
ID32846 *Address output port 1*	560	Activation of the KW-EA2 option card (BA Bit0 to Bit7)
ID32847 *output port 1 Bit 0*	33062	A1: Main operating mode active
ID32848 *output port 1 Bit 1*	33063	A2: Secondary operating mode 1 active
ID32849 *output port 1 Bit 2*	33064	A3: Secondary operating mode 2 active
ID32850 *output port 1 Bit 3*	0	A4: Freely configurable
ID32851 *output port 1 Bit 4*	0	A5: Freely configurable
ID32852 *output port 1 Bit 5*	0	A6: Freely configurable
ID32853 *output port 1 Bit 6*	0	A7: Freely configurable
ID32854 *output port 1 Bit 7*	0	A8: Freely configurable
ID32855 *Address output port 2*	561	Activation of BA Bit8 to Bit15
ID32856 *output port 2 Bit 0*	0	Free (no access by the KW-EA2 option card)
ID32857 *output port 2 Bit 1*	0	Free (no access by the KW-EA2 option card)
ID32858 *output port 2 Bit 2*	0	Free (no access by the KW-EA2 option card)
ID32859 *output port 2 Bit 3*	0	Free (no access by the KW-EA2 option card)
ID32860 *output port 2 Bit 4*	0	Free (no access by the KW-EA2 option card)
ID32861 *output port 2 Bit 5*	0	Free (no access by the KW-EA2 option card)
ID32862 *output port 2 Bit 6*	0	Free (no access by the KW-EA2 option card)
ID32863 *output port 2 Bit 7*	0	Free (no access by the KW-EA2 option card)

5.15.1 Assignments for Binary Inputs

Code (hex)	Designation	Description
401	MT1	Measuring signal 1 for calliper function at BE3 (ID32980 Input port 3 Bit 2)
402	MT2	Measuring signal 2 for calliper function at BE2 (D32979 Input port 3 Bit 1)
32903	UE	DC bus enable (in case a KE is connected to the ACC-bus)
32904	RF	Inverter on
32905	NK	Cam signal
32912	Reset homing point known	Delete "Reference point known" known bit
32913	FL	Clear error
33700	Activate main operating mode	Operating mode switch into main operating mode (ID32800)
33701	Activate secondary operating mode 1	Operating mode switch into secondary operating mode 1 (ID32801)
33702	Activate secondary operating mode 2	Operating mode switch into secondary operating mode 2 (ID32802)
33703	Activate secondary operating mode 3	Operating mode switch into secondary operating mode 3 (ID32803)
33704	Activate secondary operating mode 4	Operating mode switch into secondary operating mode 4 (ID32804)
33705	Activate secondary operating mode 5	Operating mode switch into secondary operating mode 5 (ID32805)
33708	Stop/cancel	The drive is changes to the operating mode digital speed regulation by setpoint 0, regardless of the operating mode it is in.
33730	System startup without Inverter ON	Complete parameter calculation with inactive inverter on. This is done otherwise only after power on, clear error, and Inverter ON activation after changing parameters.
33906	QBR Acknowledge signal motor brake	The evaluation and monitoring of the signal has to be activated by ID32773 Bit13. QBR=1 Holding brake closed QBR=0 Holding brake open see ID206 / ID207
33909	Stop positive setpoint processing	If the configured binary input drops to zero volt (low active), the setpoint block in position or speed control is executed within 2ms. If the input is set, the setpoint clearance is executed within 2ms.
33910	Stop negative setpoint processing	If the configured binary input drops to zero volt (low active), the setpoint block in position or speed control is executed within 2ms. If the input is set, the setpoint clearance is executed within 2ms.

5.15.2 Assignments for Binary Outputs

Code (hex)	Designation	Description
308	Signal angle synchronisation	$\lvert X_{sm} - X_{im} \rvert \leq$ ID228 *Angle synchronisation window*
310	Warning overload motor	Motor current overload acc. to integral i²t
330	$n_{act} = n_{nom}$	$\lvert n_{nom} - n_{act} \rvert <$ ID157 *Velocity window*
331	$n_{act} < n_{min}$	$\lvert n_{act} \rvert <$ ID124 *Standstill window*
332	$n_{act} < n_x$	$\lvert n_{nom} - n_{act} \rvert <$ ID125 *Velocity Threshold*
333	$M_d \geq M_{dx}$	ID126 *Torque threshold*
334	$M_{nom} \geq M_{limit}$	$Nominal_{torque} \geq$ ID82/ID83 *Limit torque*
335	$n_{nom} \geq n_{limit}$	$Nominal_{speed} \geq$ ID38/ID39 *Limit speed*
336	In position	$\lvert x_{nom} - x_{act} \rvert <$ ID57 *Position window*
337	$P \geq P_x$	ID158 *Power threshold*
400	Cam signal	Cam, Cam switch for homing
403	homing point known	homing position is valid
409	Measuring value of positive edge MT1 saved	Actual position value is saved in ID130
410	Measuring value of negative edge MT1 saved	Actual position value is saved in ID131
411	Measuring value of positive edge MT2 saved	Actual position value is saved in ID132
412	Measuring value of negative edge MT2 saved	Actual position value is saved in ID133
33013	$X_i \leq$ -Soft-end	ID49 Position limit value positive reached
33014	Signal position synchronisation	|Position control deviation| ≤ ID32952 *Synchronous velocity window*
33015	$X_i \geq$ +Soft-end	ID50 Position limit value negative reached
33016	Warning overcurrent inverter	Inverter current overload acc. to integral i²t according ID32999, diagnosis message 2357 *Unit overload warning*
33017	Warning over-temperature inverter	Temperatur of the module back or value of the temperature model to high, diagnosis message 2350 *Device over temperature warning*
33018	Warning over-temperature motor	Value at motor temperature sensor at input X12 or according ID34166 to high,
33029	SBM / System Ready	System ready message
33030	DC Bus Enable	Acknowledgement DC bus enabled
33031	Acknowledgement controller enable (QRF)	Acknowledgement controller release
33032	Inverter ON set	Inverter on is set
33034	KMD active	Drive function is active
33035	IPO active	Internal interpolator is active
33036	homing point known	homing point known
33040	Input Bit 0 active	Acknowledgement binary input E1 according ID32874
33041	Input Bit 0 active	Acknowledgement binary input E2 according ID32875
33042	Input Bit 0 active	Acknowledgement binary input E3 according ID32876
33043	Input Bit 0 active	Acknowledgement binary input E4 according ID32877
33044	Input Bit 0 active	Acknowledgement binary input E5 according ID32878
33045	Input Bit 0 active	Acknowledgement binary input E6 according ID32879

Code (hex)	Designation	Description
33046	Input Bit 0 active	Acknowledgement binary input E7 according ID32880
33047	Input Bit 0 active	Acknowledgement binary input E8 according ID32881
33048	Residual distance deleted	| dx | > ID32922 *Residual distance.erase window*.
33052	Control motor holding brake	BR=0 Holding brake closed BR=1 Holding brake open see ID206/ID207. For braking with acknowledge signal the monitoring of the acknowledgment bit has to be switched on by ID32773 Bit13 and the binary input needs to be occupied with code 33906
33058	Parameter set 0 active	valid if QRF is set
33059	Parameter set 1 active	valid if QRF ist set
33060	Parameter set 2 active	valid if QRF ist set
33061	Parameter set 3 active	valid if QRF ist set
33062	Main operating mode active	Main operating mode acc. to ID32800 is active
33063	Secondary operating mode 1 active	Secondary operating mode 1 acc. to ID32801 is active
33064	Secondary operating mode 2 active	Secondary operating mode 2 acc. to ID32802 is active
33065	Secondary operating mode 3 active	Secondary operating mode 3 acc. to ID32803 is active
33066	Secondary operating mode 4 active	Secondary operating mode 4 acc. to ID32804 is active
33067	Secondary operating mode 5 active	Secondary operating mode 5 acc. to ID32805 is active
33068	Internal operating mode 6 active	Internal secondary operating mode 6 acc. to ID32906 is active
33069	Internal operating mode 7 active	Internal secondary operating mode 7 acc. to ID32907 is active
33070	Internal operating mode 8 active	Internal secondary operating mode 8 acc. to ID32908 is active
33071	Internal operating mode 9 active	Internal secondary operating mode 9 acc. to ID32909 is active
33074	Group warning active	Group warning (all warning signals OR linked)
33076	Second cycle output	The output signal changes cyclically between 1 second ON and 1 second OFF
33131	Acknowledgement stop for positive set-point processing	Positive setpoint specifications in position or speed regulation are not executed
33132	Acknowledgement stop for negative set-point processing	Negative setpoint specifications in position or speed regulation are not executed
33133	EF signal (EF AND EF2)	The output stage release signal is acknowledged as binary output and can be evaluated for example by PLC.
33135	EF Control signal output stage release	The input signal EF is mirrored onto the outputs, which can be read for example by a PLC.
33136	EF2 Control signal output stage release	The input signal EF2 are mirrored onto the outputs, which can be read for example by a PLC.

5.16 Oscilloscope function

Using the AMK software tool AIPEX PRO, all binary signals from the section "Binary inputs and outputs" can be recorded.

Additionally, the oscilloscope can display the following 16-bit and 32-bit values:

16-bit values

ID/Code	Designation	Scaling
80	Torque command value	0.1% M_N
81	Additive torque command value	0.1% M_N
82	Positive torque limit value	0.1% M_N
83	Negative torque limit value	0.1% M_N
84	Torque feedback value	0.1 % M_N
100	Velocity loop proportional gain K_P	-
101	Velocity loop integral action time T_n	0.1 ms
102	Velocity loop differential time T_d	0.1 ms
144	Signal status word	-
179	Probe status	-
32827	Magnetizing current feedback i_{sd}	0.1 A
32831	Resolver angle	Incr.
32834	Torque current feedback i_{sq}	0.1 A
32835	Torque command value intern	0.1% M_N
32836	DC-bus voltage	V
32897	Analog input A1	0.1 V
32914	Sum additive velocities	0.0001/min
32915	Sum additive torques	0.1 %
33090	velocity feedback value calculated	1/min
33100	Actual power value (Unsigned)	0.1 W
33101	Display overload inverter	0.1 %
33102	Display overload motor	0.1 %
33116	Temperature internal	0.1° C
33117	Temperature external	0.1° C
34074	Actual counter 1	Incr.
34075	Homing counter 1	Incr.
34076	Actual counter 2	Incr.
34077	Homing counter 2	Incr.
34100	Binary input word	-
34101	Binary input word 1	-
34102	Binary input word 2	-
34120	Binary output word	-
34121	Binary output word 1	-
34122	Binary output word 2	-
34212	Voltage Usq	0.1 V
34213	Voltage Usd	0.1 V
34215	Temperature IGBT	0.1 °C

32-bit values

ID/Code	Designation	Scaling
36	Velocity command value	0.0001/min
37	Additive velocity command value	0.0001/min
38	Positive velocity limit value	0.0001/min
39	Negative velocity limit value	0.0001/min
40	Velocity feedback value	0.0001/min
47	Position command value	Incr.
51	Position feedback value	Incr.
53	Position feedback value external encoder	Incr.
130	Probe value 1 positive edge	Incr.
131	Probe value 1 negative edge	Incr.
132	Probe value 2 positive.edge	Incr.
133	Probe value 2 negative.edge	Incr.
189	following distance	Incr.
32824	Following distance without SAK	Incr.
32826	Following error compensation value SAK	Incr.
32891	velocity setpoint value intern	0,0001/min
33104	Position feedback value 2PI	Incr.
33911	SIWL setpoint	Incr.
34199	Actual power value (signed)	W

6 Startup

The commissioning consists mainly of the parameterisation and optimisation of the drives and is supported by the PC Software AIPEX PRO. With AIPEX PRO you have central control of the drives via a controller with active fieldbus or by direct connection via the USB interface X235 of the controller card.

6.1 For your safety

⚠ DANGER

Motor shaft movement!

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 encoder
- Faulty motor parameters
- Faulty component
- 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 faults
- Faulty application programs
- Faulty setpoint specification and scaling
- Improper limit values
- Improper transmission ratios
- Improper operating mode
- Faulty configuration

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. Suitable measures to guard against approach include protective doors, screens, covers, monitoring sensors, or photoelectric barriers that shut down the machine when breached.
- Always ensure that the machine is fully de-energised before commencing work on the machine or within the machine's vicinity. (Disconnect the machine from the mains using the main power switch and secure the switch from being turned on again)
- Install an emergency off / stop switch (periodically test the machine for proper function).
- Only use modules with the optional Output Stage Release feature. The two-channel output stage release feature is an effective means of locking the motor from starting up unexpectedly and complies with EN954-1 category 4/ EN ISO 13849-1 Cat. 4, PL e. The system will remain connected to the main power but can be approached safely.
- All suspended axles must be mechanically secured against falling down using a fall arrester or a supplementary external brake, for instance. The optional brake for the motor is a holding brake and does NOT suffice for protecting personnel!
- Check the motor parameters and the parameters for setting the limit values for torque, speed, and position, as well as the acceleration and deceleration ramps. Make sure that the configured values have been adjusted according to the process and that they are within the permissible limits.
- Enter the limit speed ID113 so that the maximum motor velocity will not be exceeded, and to prevent damage to mechanical components. If this speed is exceeded by 25%, the drive will shut down, issue a fault message and gradually come to a standstill.

6.2 Notes on avoiding material damage

NOTICE

Material damages due to erroneous parameterisation!

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.

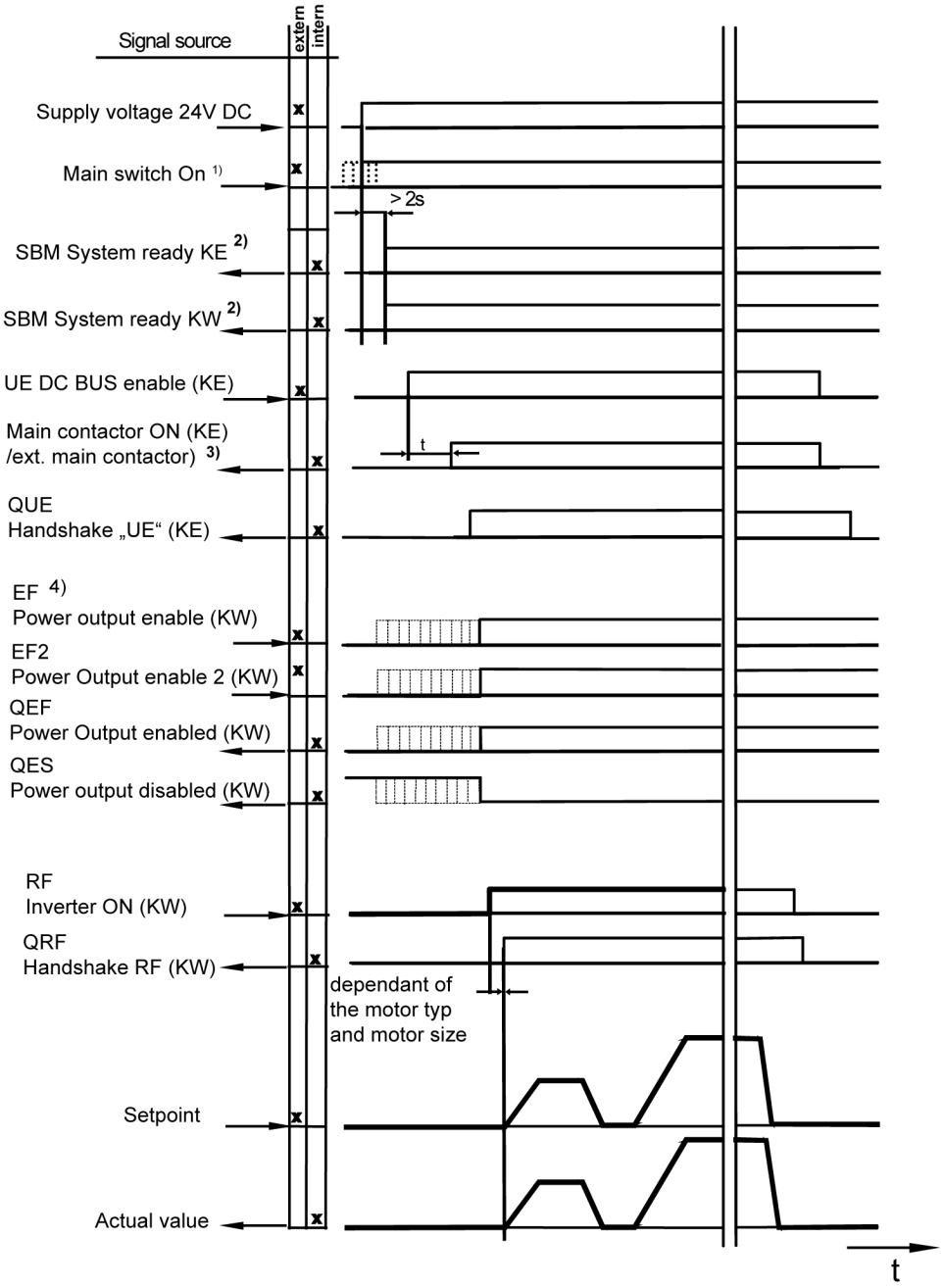
Steps to prevent:

- Only personnel trained by AMK may configure the drives.

6.3 Switch-on and -off diagram

Before switching on the devices/system, the installation needs to be inspected for faults:

1. Check of the proper wiring/connections and fault-free electrical connection.
2. Check of the screw and terminal connections.
3. All cables have to be installed with strain relief (shield terminals). The shields of all motor cables have to be connected to PE at both ends.
4. The motor PTC thermistor is connected to X05 (RT1/RT2) (resistance of the PTC thermistor in cold condition is about 200 Ohm).
5. Make sure that all protection and safety equipment as well as the emergency off circuit in the system are functioning.
6. In case available in the drive: Check whether the motor brake releases when activated. Careful with hanging axles! Attach safety stop for the test and then remove again.
7. On motors with external fans: Check whether the fan motor runs.



1) The line voltage and the supply voltage 24V DC can be applied independently from each other.

2) The module specific "System Ready Message" (SBM = 1) for KE and KW signal the fault-free status of the modules. Monitoring these signals needs to be done by the superordinate control.

3) Only for devices with external main contactor.

4) Only for devices with EF logic.

6.4 Signal configuration

Terminal	ID	Assignment	Explanation	Function
X133 Pin A4	32978	33904	Controller enable	Input RF, edge controlled Input voltage of +24 Vext. to RF releases the cycle pulses in the inverter. The motor is energized, control is active. **Prerequisite:** Successful system startup after Power ON, acknowledged with SBM = 1. DC link voltage available, output stage release EF is set. If one of these prerequisites is not fulfilled, the system will signal an error. The message SBM is reset and an error message is created. Removal of the controller enable (RF = 0) during operation will trigger braking of the revolving motor according ID32782 *Decel.ramp RF inactive*. During standstill, the cycle pulses for the output stages are blocked; the motor is without torque (QRF = 0). **In case of an emergency off, RF has to be interrupted in its hardware by a contact of the emergency off circuit.** The described emergency off function is not a safety related function.
X133 Pin A5	32979	32913	Clear error (FL)	Input FL **Prerequisite:** RF inactive. In case of an error, the inverter module has to be re-initialised after the error has been removed through FL. After proper start-up, the output SBM is set. FLis set by a pulse (≥100ms) at input FL or is carried out from the higher ranking controller via fieldbus interface.
X133 Pin B4	32865	33031	Acknowledgement controller enable (QRF)	Output QRF The output QRF is set if the drive is in control after RF = 1. The drive system is now ready to process setpoints. After removing controller enable (RF = 0), the drive is slowed down according ID32782 *Decel.ramp RF inactive*. Once a speed of zero is reached, the QRF is reset and the motor is without torque.
X133 Pin B5	32866	33029	System Ready	Output SBM The SBM output is set as long as no error condition is detected in the inverter module. SBM is reset in case of an error and reacts depending on the type of error (see documentation AMKASYN diagnostic messages AMK part.-no.: 25786): The motor is slowed down according ID32782 *Decel.ramp RF inactive* or is coasting. Errors in the voltage supply, in the controller or in the motor generator lead directly to a removal of the internal controller enable as well as to a block of the control pulses in the power part. The motor is coasting. Thermal errors generate warnings, a warning bit is set internally, which can be assigned to a binary output. After 4 seconds, the warning becomes always error status (SBM is reset) and the stop process is initiated (braking after ID32782). Within the warning time, the superordinate control has the option to initiate the desired measures by the setpoint specifications.

6.5 Parameter setting

The parameter memory of the controller card is preset by a default set. The ident numbers must be parameterised application specific.

The parameters are divided into the following parameter groups: System / Motor / Operating mode / Torque / Speed / Position / Positioning / Synchronisation / Inverter parameter / Allocation binary inputs, binary outputs, analogue outputs / Weighting / Communication / Special applications / Sercos and general parameters.

Parameterisation for the initial startup:

ID no.	Name	Note
32800	*AMK Main operating mode*	Specify the operating mode
32795 32796	*Source UE* *Source RF*	System parameter (switch-on conditions)
group motor parameters	*Motor- / encoder data*	Motor parameters, maximum permitted process velocity, motor encoder, resolution
82 83	*Positive torque limit* *Negative torque limit*	Torque parameters (torque limits)
38 39	*Pos. velocity limit.* *Neg. velocity limit*	Speed parameters
113	*Maximum process velocity*	ID113 defines the maximum permitted process velocity! In case the feedback value exceeds the value in ID113 by the factor 1.25, then the power output stage of the system is blocked and the motor is coasting.
32780 32781	*Accel. ramp* *Decel. ramp*	Acceleration an deceleration times for the closed loop speed control operation mode.
32782	*Decel.ramp RF inactive*	Braking time of the drive to run-down from maximum permittet process velocity (ID113) to standstill with removal of the Inverter On RF, e.g. at emergency off.
ID2	*SERCOS cycle time*	Bus cycle time
ID34023 ...	*BUS address part.* *Instance 0* *Instance 1* ...	The group of the communication parameters as of ID34023 need to be parameterised in the respective instances: ACC-bus: Instance 0 EtherCAT: Instance 1

6.6 Optimisation of the control circuits

Setting the PIDcontroller

The PID speed controller needs to be set and optimised depending on the application. The precise mathematical description of all parameters of the control circuit has been shown often to be rather extensive and difficult in practical applications. Therefore, a simple procedure shall be presented here by which the controller can be systematically calibrated. For that a speed jump (without ramp) needs to be given as a reference variable at the input of the speed controller. The jump answer (speed actual value) should be taken for evaluating the controller setting. When specifying the speed jump make sure that the drive remains operated below the torque limit.

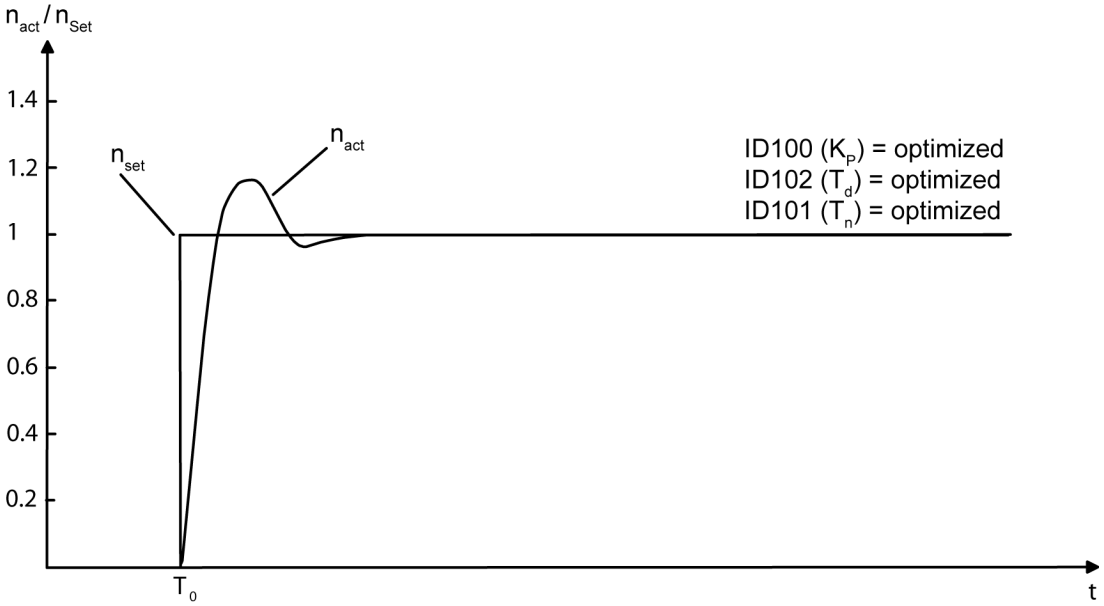
Proceed as follows for the setting:

1. Tuning proportional gain K_P (ID100)
   T_d and T_N to 0, the controller then works as proportional controller. By increasing the K_P value, the controller should be made to overshoot (50% overshot). The actual speed has a course similar to the curve with the solid line in the diagram "Crossover function of the speed control circuit, effect K_P (ID100 Prop.gain speed control KP)".
   The K_P value thus determined is now halved and entered into ID100.
2. Calibration reset time T_N (ID101)
   Now the integration time is reduced (starting at an initial value e.g. 100ms) until the settling time is minimal. If the reset time is set optimally, the actual speed value curve (jump answer) roughly follows the solid line, refer to diagram "Crossover function of the speed control circuit, effect T_N (ID101 Integr.act.time sp.ctrl TN)".
   For an optimally set PIcontroller, the actual speed may overshoot the setpoint jump by no more than 20% as an answer.
3. Tuning differentiating time T_d (ID102)
   The differentiating time T_d is extended until the desired dampening of the jump answer is reached. The curve with the solid line serves as a reference point for setting the PID controller (refer to diagram "Crossover function of the speed control circuit, effect T_d ID102 Speed regulation differentiating time Td (rate time)"

For an optimally set PID controller, the actual speed may overshoot the setpoint jump by no more than 20% as an answer.

On the output of the speed controller two P-T1 filter can be configured. See ID32928 *time filter 1* and ID32929 *time filter 2*

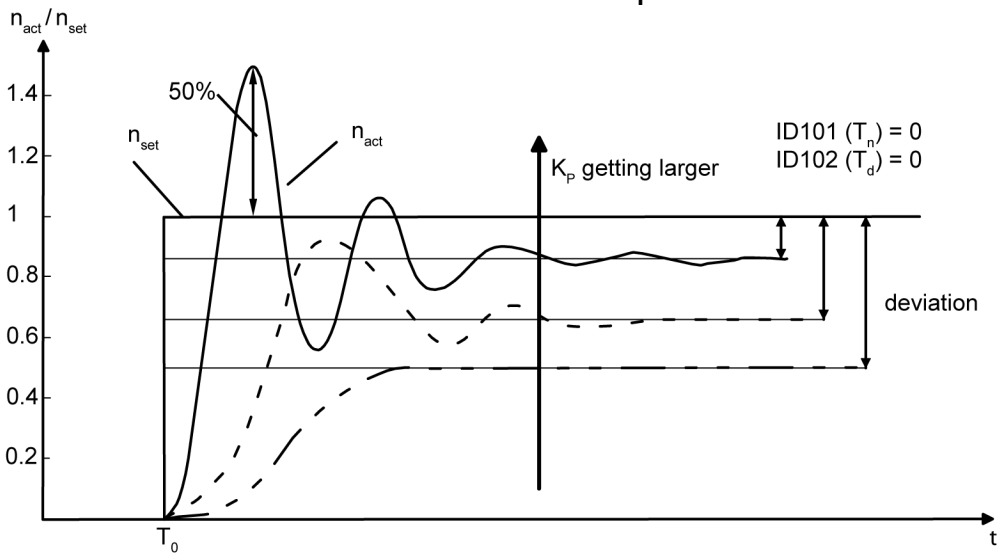
Crossover function of the speed control circuit



6.6.1 ID100 Proportional gain speed control K_P

The proportional gain K_P of the speed controller needs to be optimised for the respective application.

Crossover function of the speed control circuit, effect K_P (ID100)



Course of the actual speed of the speed control circuit with sudden change of the speed setpoint depending on K_P (ID100).

Formula: Parameter dependencies ID100

$$kpdzl = ID100 \cdot \frac{4\sqrt{(ID111^2 - ID32769^2)}}{ID110}$$

Condition:1 ≤ kpdzl ≤ 32767

Formula: Torque dependency

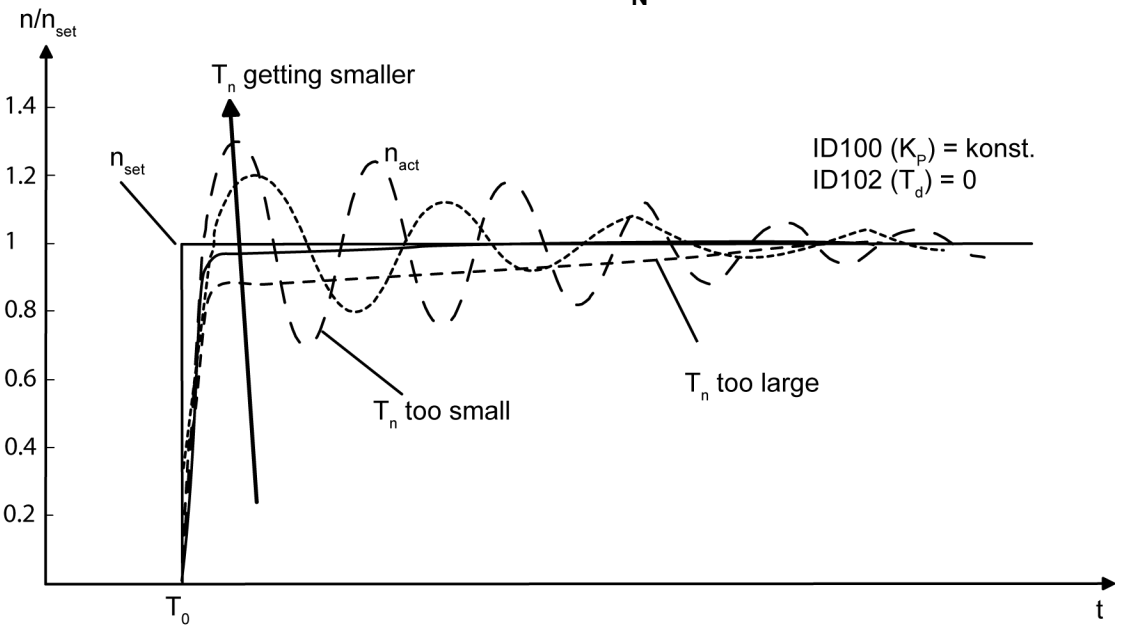
$$M[Nm] = \Delta n \left[0{,}0001 \cdot min^{-1}\right] \cdot \frac{ID100 \cdot ID32771}{16384^2}$$

kprpm: system internal K_P factor
ID100 *DZR prop. gain* K_P
ID110 *Inverter maximum current*
ID111 *Rated current motor* I_N
ID32769 *Magnetisation current* I_M
ID32771 *Nominal motor torque* M_N [Nm] torque
Δn: speed controller input value $\Delta n = n_{nom} - n_{act}$

6.6.2 ID101 Integral action time speed control T_N [0.1 ms]

The reset time T_N (integral share) of the PI speed controller needs to be optimised by the operator.
Using the integration share in the controller, the deviation resulting from the P-regulator is tuned.
With T_N = 0ms the reset time, i.e. the integral share of the PI speed controller becomes ineffective. The speed controller then works as a plain proportional controller.

Crossover function of the speed control circuit, effect T_N (ID101)



Course of the actual speed of the speed control circuit with sudden change of the speed setpoint depending on T_N (ID101).

Formula: Parameter dependency ID101

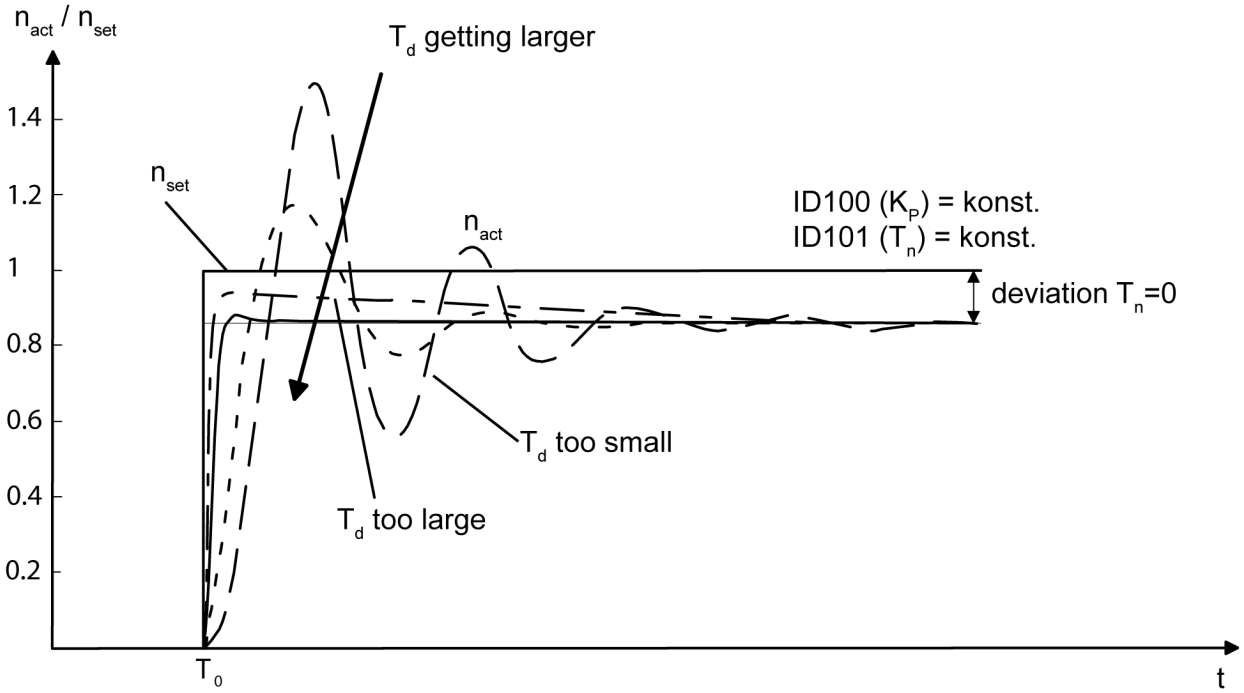
$$kidzl = \frac{ID100}{ID101} \cdot \frac{64\sqrt{\left(ID111^2 - ID32769^2\right)}}{ID110}$$

Condition:1 ≤ kidzl ≤ 32767
kidzl= system internal factor
ID100 *Prop.gain speed control* K_P
ID101 *Integr.act.time sp.ctrl* T_N
ID110 Inverter peak current
ID111 *Motor nom. current* I_N
ID32769 *Magnet. current* I_M

6.6.3 ID102 Differential time speed control T_d [0.1 ms]

The differentiating time T_d (differential share) of the PI speed controller needs to be optimised by the operator. The D-share acts as a dampening link in the PID controller.
With ID102=0 the differential share is not effective in the speed controller.

Crossover function of the speed control circuit, effect T_d (ID102)



Course of the actual speed of the speed control circuit with sudden change of the speed setpoint depending on T_d (ID102).

Formula: Parameter dependencies ID102

kdrpm = ID102 · kprpm

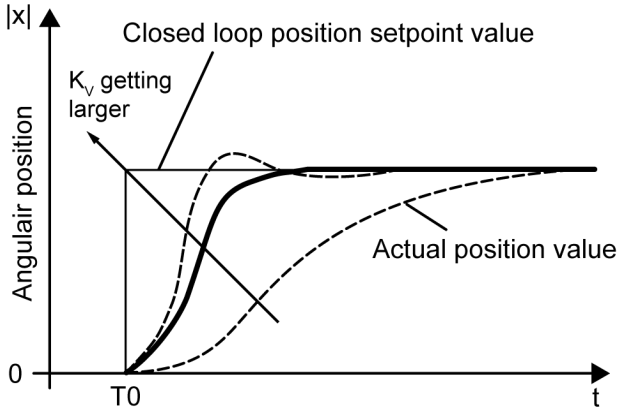
Condition:1 ≤ kdrpm ≤ 32767

kdrpm: system internal K_d factor
kprpm: system internal K_P factor

6.6.4 ID104 Position controller gain K_V [min^{-1}]

Proportional gain K_V of the P-position controller.

Crossover function of the position control circuit, effect K_V (ID104)



Course of the actual position value sudden specification of a position setpoint.
The following conditions need to be kept:

Formula: System internal limitation of the position controller gain K_V

$$0{,}0555 \leq \frac{KV}{0{,}0001 \cdot LA} \leq 32767$$

LA = Factor "Lageauflösung" (position resolution) (depends on encoder)

Motor encoder as actual position encoder:

LA = ID116 *Resolution motor encoder*

External encoder rotative:

Formula: Factor position resolution with external actual position encoder

$$LA = \frac{ID117 \cdot ID122}{ID121}$$

ID117 *Resol. ext.pos.feedb.* (line count per rotation [at gear output])

ID122 *Load gear output rev.*

ID121 *Load gear input rev.*

6.7 Firmware download

The controller card operates with a Firmware downloaded by AMK factory. A firmware can be downloaded with the AMK software ATF which can be installed with AIPEX PRO.

NOTICE

Firmware Download

Doe to download 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.

If a firmware version from 1.03 should be downloaded to a controller card with a hardware revision before 1.06, please note:

Is the actual firmware version of the controller card before V1.02, first firmware V1.02 must be downloaded, before the desired firmware version up from 1.03 can be downloaded.

Depending on the compatibility class of the old and the new firmware it can happen, that the diagnosis message 1293 *Boot strap EEPROM* asks you to start the function initial loading. Follow them and download afterwards with the help of your backup copy the application specific data to the KW-R05 controller card. If you are not asked to do initial loading, all application specific data are already there.

7 Accessories and Options

7.1 Option cards

Designation	AMK part no.:	Description
KW-EA2	O664	Binary in-/output card for attaching to the KW-R05 controller card. 12 binary inputs, 8 binary outputs

7.2 Software

Designation	AMK part no.:	Description
Program system AIPEX PRO	O814	CD software AIPEX PRO (for startup, configuration, optimisation, diagnostics and programming) USB cable 3m for the connection from the PC to the controller card

7.3 Cable for PC connection

Designation	AMK part no.:	Description
Cable	47058	USB-cable ready-made (USB type A to mini-USB type B) 3 m with ferrite shell for connection PC to the controller card.

7.4 Ethernet cable

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

7.5 Secondary documentation

Designation	AMK part no.:	Description
PDK_025786_Diagnose_en	25786	Documentation of the AMK diagnosis messages

8 Parameter Index

ID-No.	Designation	Default	Unit	Characteristics			
				Allocation	temp. changeable	AT	MDT
1	NC cycle time	10000	0.001ms	GLOB	-	-	-
2	SERCOS cycle time	1000	0.001ms	GLOB	-	-	-
17	List of all IDs	0	-	GLOB	-	-	-
26	Configuration list for signal status word	0	-	GLOB	-	-	-
30	Firmware version	0	-	INST	-	-	-
36	Velocity command value	10000000	0.0001/min	DRIVE	■	-	■
37	Additive velocity command value	10000000	0.0001/min	DRIVE	-	-	■
38	Positive velocity limit value	40000000	0.0001/min	DRIVE	■	-	■
39	Negative velocity limit value	-40000000	0.0001/min	DRIVE	■	-	■
40	Velocity feedback value	-	0.0001/min	DRIVE	-	■	-
41	Homing velocity	1000000	0.0001/min	DRIVE	■	-	-
43	Velocity polarity	0	-	DRIVE	-	-	-
47	Position command value	0	Incr.	DRIVE	-	-	■
49	Positive position limit value	2147483647	Incr.	DRIVE	■	-	-
50	Negative position limit value	2147483648	Incr.	DRIVE	■	-	-
51	Position feedback value	0	Incr.	DRIVE	-	■	-
55	Position polarity	0	-	DRIVE	-	-	-
57	Position window	1000	Incr.	DRIVE	-	-	-
76	Position data scaling type	0	-	DRIVE	-	-	-
80	Torque command value	100	0.1%M_N	DRIVE	■	-	■
81	Additive torque command value	100	0.1%M_N	DRIVE	-	-	■
82	Positive torque limit value	1200	0.1%M_N	DRIVE	■	-	■
83	Negative torque limit value	-1200	0.1%M_N	DRIVE	■	-	■
84	Torque feedback value	0	0.1%M_N	DRIVE	-	■	-
85	Torque polarity	0	-	DRIVE	-	-	-
91	Bipolar velocity limit value	0	0.0001/min	DRIVE	-	■	-
92	Bipolar torque limit value	0	0.1%M_N	DRIVE	-	■	-
96	Slave identifier	0	-	DRIVE	-	-	-
100	Velocity loop proportional gain K_P	200	-	DRIVE	■	-	-
101	Velocity loop integral action time T_n	100	0.1ms	DRIVE	■	-	-
102	Velocity loop differential time T_d	0	0.1ms	DRIVE	■	-	-
103	Modulo value	65536	Incr.	DRIVE	-	-	-
104	Position loop K_V-factor	400	1/min	DRIVE	■	-	-
109	Motor peak current	5000	0.001A	DRIVE	-	-	-
110	Inverter peak current	20000	0.001A	DRIVE	-	-	-
111	Motor nominal current	2500	0.001A	DRIVE	-	-	-
112	Inverter nominal current	2500	0.001A	DRIVE	-	-	-
113	Maximum process velocity	60000000	0.001/min	DRIVE	-	-	-
114	Load limit of the motor	500	0.1%M_N	DRIVE	-	-	-
115	External position feedback type	0	-	DRIVE	-	-	-
116	Resolution motor encoder	65536	Incr.	DRIVE	-	-	-

ID-No.	Designation	Default	Unit	Characteristics			
				Allocation	temp. changeable	AT	MDT
117	Resolution external position feedback	100	Incr.	DRIVE	-	-	-
121	Load gear input revolution	10	Rev.	DRIVE	-	-	-
122	Load gear output revolution	10	Rev.	DRIVE	-	-	-
123	Feed constant	100000	0.0001 mm/Rev.	DRIVE	-	-	-
124	Standstill window	500000	0.0001/min	DRIVE	■	-	-
125	Velocity threshold	10000000	0.0001/min	DRIVE	■	-	-
126	Torque threshold	1000	0.1%M_N	DRIVE	■	-	-
130	Probe value 1 positive edge	0	Incr.	DRIVE	-	■	-
131	Probe value 1 negative edge	0	Incr.	DRIVE	-	■	-
132	Probe value 2 positive edge	0	Incr.	DRIVE	-	■	-
133	Probe value 2 negative edge	0	Incr.	DRIVE	-	■	-
134	Drive control word	0	-	DRIVE	-	-	■
135	Drive status word	0	-	DRIVE	-	■	-
136	Positive acceleration limit value	100000	0.001Rev./ss	DRIVE	■	-	-
137	Negative acceleration limit value	-100000	0.001Rev./ss	DRIVE	■	-	-
141	Motor type	0	-	DRIVE	-	-	-
144	Signal status word	0	-	DRIVE	-	■	-
147	Homing parameter	8000h	-	DRIVE	■	-	-
150	Reference offset 1	0	Incr.	DRIVE	■	-	-
157	Velocity window	1000000	0.0001/min	DRIVE	■	-	-
158	Power threshold	100	WATT	DRIVE	■	-	-
159	Excessive position deviation	10000	Incr.	DRIVE	■	-	-
169	Probe control	0	-	DRIVE	■	-	■
173	Marker position A	0	Incr.	DRIVE	-	■	-
179	Probe status	0	-	DRIVE	-	■	-
182	Manufacturer Status	0	-	GLOB	-	-	-
189	Following distance	0	Incr.	DRIVE	-	■	-
206	Drive ON delay time	350	0.1ms	DRIVE	-	-	-
207	Drive OFF delay time	550	0.1ms	DRIVE	-	-	-
209	Lower adaptation limit	0	0.0001/min	DRIVE	-	-	-
210	Upper adaptation limit	0	0.0001/min	DRIVE	-	-	-
211	Adaptation proportional gain	1000	0.1%	DRIVE	-	-	-
212	Adaptation integral action time	1000	0.1%	DRIVE	-	-	-
217	Parameter set preselection	0	-	DRIVE	■	-	-
228	Synchronization position window	1000	Incr.	DRIVE	■	-	-
265	Language selection	0	-	GLOB	■	-	-
269	ID storage mode	0	-	GLOB	-	-	-
270	Temporary parameter list	0	-	GLOB	-	-	-
390	Diagnostic number	0	-	GLOB	-	-	-
392	Velocity feedback filter	0	-	DRIVE	-	-	-
398	ID list of configurable status bits	0	-	GLOB	-	-	-
405	Probe 1 enable	0	-	DRIVE	-	-	-
406	Probe 2 enable	0	-	DRIVE	-	-	-
409	Probe 1 positive latched	0	-	DRIVE	-	-	-

ID-No.	Designation	Default	Unit	Characteristics			
				Allocation	temp. changeable	AT	MDT
410	Probe 1 negative latched	0	-	DRIVE	-	-	-
411	Probe 2 positive latched	0	-	DRIVE	-	-	-
412	Probe 2 negative latched	0	-	DRIVE	-	-	-
32768	Nominal motor voltage	3500	0.1V	DRIVE	-	-	-
32769	Magnetizing current I_M	1500	0.001A	DRIVE	-	-	-
32770	Magnetizing current I_{M1}	1000	0.001A	DRIVE	-	-	-
32771	Nominal torque	20	0.1Nm	DRIVE	-	-	-
32772	Nominal velocity	10000000	0.0001/min	DRIVE	-	-	-
32773	Service bits	0x1005	-	DRIVE	-	-	-
32774	Rotor time constant	360	0.0001s	DRIVE	-	-	-
32775	Pole number motor	4	-	DRIVE	-	-	-
32776	Sinus encoder period	1024	-	DRIVE	-	-	-
32777	Torque related to 10V at A1	100	0.1 $\%M_N$	DRIVE	-	-	-
32778	Velocity related to 10V at A1	30000000	0.0001/min	DRIVE	■	-	-
32779	Velocity offset for A1	0	0.0001/min	DRIVE	■	-	-
32780	Acceleration ramp time	1000	0.1ms	DRIVE	■	-	-
32781	Deceleration ramp time	1000	0.1ms	DRIVE	■	-	-
32782	Deceleration ramp time for RF inactive	1000	0.1ms	DRIVE	-	-	-
32795	Source UE	0	-	GLOB	-	-	-
32796	Source RF	0	-	GLOB	-	-	-
32798	User list 1	0	-	GLOB	-	-	-
32800	AMK main operation mode	0x03C0043	-	DRIVE	-	-	-
32801	AMK secondary operation mode 1	0x0010043	-	DRIVE	-	-	-
32802	AMK secondary operation mode 2	0x0010043	-	DRIVE	-	-	-
32803	AMK secondary operation mode 3	0x0010043	-	DRIVE	-	-	-
32804	AMK secondary operation mode 4	0x0010043	-	DRIVE	-	-	-
32805	AMK secondary operation mode 5	0x0010043	-	DRIVE	-	-	-
32821	Password	0	-	GLOB	-	-	-
32824	Following distance without SAK	0	Incr.	DRIVE	-	■	-
32827	Magnetizing current feedback i_{sd}	0	0.1A	DRIVE	-	■	-
32834	Torque current feedback i_{sq}	0	0.1A	DRIVE	-	■	-
32836	DC-bus voltage	0	V	GLOB	-	■	-
32837	DC-bus monitoring	0	0.1V	GLOB	-	■	-
32840	Diagnostic list	0	-	GLOB	-	-	-
32841	List of motor-IDs stored in encoder storage	0	-	GLOB	-	-	-
32842	List of user-IDs stored in encoder storage	0	-	GLOB	-	-	-
32843	Service command	0	-	GLOB	-	-	-
32846	Address output port 1	0	-	GLOB	-	-	-
32847	Output port 1 bit 0	0	-	GLOB	-	-	-
32848	Output port 1 bit 1	0	-	GLOB	-	-	-
32849	Output port 1 bit 2	0	-	GLOB	-	-	-

ID-No.	Designation	Default	Unit	Characteristics			
				Allocation	temp. changeable	AT	MDT
32850	Output port 1 bit 3	0	-	GLOB	-	-	-
32851	Output port 1 bit 4	0	-	GLOB	-	-	-
32852	Output port 1 bit 5	0	-	GLOB	-	-	-
32853	Output port 1 bit 6	0	-	GLOB	-	-	-
32854	Output port 1 bit 7	0	-	GLOB	-	-	-
32855	Address output port 2	0	-	GLOB	-	-	-
32856	Output port 2 bit 0	0	-	GLOB	-	-	-
32857	Output port 2 bit 1	0	-	GLOB	-	-	-
32858	Output port 2 bit 2	0	-	GLOB	-	-	-
32859	Output port 2 bit 3	0	-	GLOB	-	-	-
32860	Output port 2 bit 4	0	-	GLOB	-	-	-
32861	Output port 2 bit 5	0	-	GLOB	-	-	-
32862	Output port 2 bit 6	0	-	GLOB	-	-	-
32863	Output port 2 bit 7	0	-	GLOB	-	-	-
32864	Address output port 3	544	-	GLOB	-	-	-
32865	Output port 3 bit 0	33031	-	GLOB	-	-	-
32866	Output port 3 bit 1	33029	-	GLOB	-	-	-
32867	Output port 3 bit 2	33052	-	GLOB	-	-	-
32868	Output port 3 bit 3	0	-	GLOB	-	-	-
32873	Address Input port 1	40	-	GLOB	-	-	-
32874	Input port 1 bit 0	0	-	GLOB	-	-	-
32875	Input port 1 bit 1	0	-	GLOB	-	-	-
32876	Input port 1 bit 2	0	-	GLOB	-	-	-
32877	Input port 1 bit 3	0	-	GLOB	-	-	-
32878	Input port 1 bit 4	0	-	GLOB	-	-	-
32879	Input port 1 bit 5	0	-	GLOB	-	-	-
32880	Input port 1 bit 6	0	-	GLOB	-	-	-
32881	Input port 1 bit 7	0	-	GLOB	-	-	-
32892	Synchronous setpoint pulses divider	655360	-	DRIVE	■	-	-
32893	Synchronous setpoint pulses multiplier	655360	-	DRIVE	■	-	-
32897	Voltage Analog input A1	0	0.01V	GLOB	-	■	-
32898	Voltage Analog input A2	0	0.01V	GLOB	-	■	-
32913	Clear error	0	-	GLOB	-	-	-
32920	Overload time motor	50	0.1s	DRIVE	-	-	-
32922	Residual distance erase window	10000000	Incr.	DRIVE	-	-	-
32926	AMK homing parameter	0x800	-	DRIVE	■	-	-
32928	Time filter 1	0	0.1ms	DRIVE	■	-	-
32929	Time filter 2	0	0.1ms	DRIVE	■	-	-
32932	Barrier frequency	0	Hz	DRIVE	-	-	-
32933	Band width	0	Hz	DRIVE	-	-	-
32934	Pulse encoder period	1000	Incr.	DRIVE	-	-	-
32935	Voltage standstill	0	0.1V	DRIVE	■	-	-
32936	Window	1000	Incr.	DRIVE	-	-	-
32938	Customer variable 1	0	-	DRIVE	-	-	-
32940	High homing velocity	10000000	0.0001/min	DRIVE	-	-	-
32942	Service help	0	-	DRIVE	-	-	-
32948	Message 4x32	0	-	DRIVE	-	-	-

ID-No.	Designation	Default	Unit	Characteristics			
				Allocation	temp. changeable	AT	MDT
32952	Synchronous velocity window	1000	Incr.	DRIVE	-	-	-
32953	Encoder type	-	-	DRIVE	-	-	-
32956	Additional acceleration value	10	-	DRIVE	-	-	-
32958	cycle time setpoint 1	500	0.001ms	DRIVE	-	-	-
32959	Offset resolver	0	-	DRIVE	-	-	-
32960	Input motor encoder gear	1	Rev.	DRIVE	-	-	-
32961	Output motor encoder gear	1	Rev.	DRIVE	-	-	-
32964	SIWL source	0	-	DRIVE	-	-	-
32965	SIWL NIP distance	0	Incr.	DRIVE	-	-	-
32966	SIWL output resolution	8	-	DRIVE	-	-	-
32967	SIWL input resolution	1	-	DRIVE	-	-	-
32968	Address input port 2	0	-	GLOB	-	-	-
32969	Input port 2 bit 0	0	-	GLOB	-	-	-
32970	Input port 2 bit 1	0	-	GLOB	-	-	-
32971	Input port 2 bit 2	0	-	GLOB	-	-	-
32972	Input port 2 bit 3	0	-	GLOB	-	-	-
32973	Input port 2 bit 4	0	-	GLOB	-	-	-
32974	Input port 2 bit 5	0	-	GLOB	-	-	-
32975	Input port 2 bit 6	0	-	GLOB	-	-	-
32976	Input port 2 bit 7	0	-	GLOB	-	-	-
32977	Address input port 3	32	-	GLOB	-	-	-
32978	Input port 3 bit 0	32904	-	GLOB	-	-	-
32979	Input port 3 bit 1	32913	-	GLOB	-	-	-
32980	Input port 3 bit 2	32905	-	GLOB	-	-	-
32981	Input port 3 bit 3	0	-	GLOB	-	-	-
32989	Torque setpoint filter time	0	ms	DRIVE	-	-	-
32990	NK shift	0	Incr	DRIVE	-	-	-
32991	U/f-start up	0	%	DRIVE	-	-	-
32992	Dead time compensation set-point 1	0	0.001ms	DRIVE	-	-	-
32993	Dead time compensation set-point 2	0	0.001ms	DRIVE	-	-	-
32999	Overload limit inverter	500	0.1%	DRIVE	-	-	-
33100	Actual power value (unsigned)	0	WATT	DRIVE	-	■	-
33101	Display overload inverter	0	0.1%	DRIVE	-	-	-
33102	Display overload motor	0	0.1%	DRIVE	-	-	-
33116	Temperature internal	0	0.1°C	GLOB	-	■	-
33117	Temperature external	0	0.1°C	GLOB	-	■	-
33730	System booting	0	-	GLOB	-	-	-
33911	SIWL setpoint	0	Incr.	DRIVE	-	-	■
34000	Variable 0	0	-	DRIVE	-	-	-
34001	Variable 1	0	-	DRIVE	-	-	-
34002	Variable 2	0	-	DRIVE	-	-	-
34003	Variable 3	0	-	DRIVE	-	-	-
34004	Variable 4	0	-	DRIVE	-	-	-
34005	Variable 5	0	-	DRIVE	-	-	-
34006	Variable 6	0	-	DRIVE	-	-	-
34007	Variable 7	0	-	DRIVE	-	-	-
34008	Variable 8	0	-	DRIVE	-	-	-
34009	Variable 9	0	-	DRIVE	-	-	-

ID-No.	Designation	Default	Unit	Characteristics			
				Allocation	temp. changeable	AT	MDT
34010	Variable 10	0	-	DRIVE	-	-	-
34011	Variable 11	0	-	DRIVE	-	-	-
34012	Variable 12	0	-	DRIVE	-	-	-
34013	Variable 13	0	-	DRIVE	-	-	-
34014	Variable 14	0	-	DRIVE	-	-	-
34015	Variable 15	0	-	DRIVE	-	-	-
34016	Variable 16	0	-	DRIVE	-	-	-
34017	Variable 17	0	-	DRIVE	-	-	-
34018	Variable 18	0	-	DRIVE	-	-	-
34019	Variable 19	0	-	DRIVE	-	-	-
34023	BUS address participant Instance 0 Instance 1	 1 0	-	INST	-	-	-
34024	BUS transmission rate	0	-	INST	-	-	-
34025	BUS mode	0001h	-	INST	-	-	-
34026	BUS mode attribute	0x800	-	INST	-	-	-
34027	BUS failure characteristic	0	-	INST	-	-	-
34037	Offset analog input A1	0	0.01V	GLOB	■	-	-
34038	Offset analog input A2	0	0.01V	GLOB	■	-	-
34045	Inductance L_Q	0	0.01mH	DRIVE	-	-	-
34046	Inductance L_D	0	0.01mH	DRIVE	-	-	-
34047	Dead time compensation probe 1	0	0.001ms	DRIVE	-	-	-
34048	PWM frequency	8	kHz	GLOB	-	-	-
34050	T_n current Q	0	0.1ms	DRIVE	■	-	-
34052	T_n current D	0	0.1ms	DRIVE	■	-	-
34055	EF type	4	-	DRIVE	-	-	-
34070	Home signal distance	0	Incr.	DRIVE	-	-	-
34071	System name	0	-	GLOB	-	-	-
34072	Data set name	0	-	GLOB	-	-	-
34074	Homing counter 1	0	Incr.	GLOB	-	■	-
34075	Actual counter 1	0	Incr.	GLOB	-	■	-
34076	Homing counter 2	0	Incr.	GLOB	-	■	-
34077	Actual counter 2	0	Incr.	GLOB	-	■	-
34088	Event trace	0	-	GLOB	-	-	-
34094	Rise time software com-mutation	0	0.001A/s	ANTR	-	-	-
34095	Final value software com-mutation	0	0.1A	ANTR	-	-	-
34096	Standstill current	0	0.001A	ANTR	-	-	-
34100	Binary input word	0	-	GLOB	-	■	■
34101	Binary input word 1	0	-	GLOB	-	■	■
34102	Binary input word 2	0	-	GLOB	-	■	■
34120	Binary output word	0	-	GLOB	-	■	■
34121	Binary output word 1	0	-	GLOB	-	■	■
34122	Binary output word 2	0	-	GLOB	-	■	■
34142	Node list	0	-	INST	-	-	-
34148	Voltage loop proportional gain K_P	500	0.001A/V	DRIVE	■	-	-

ID-No.	Designation	Default	Unit	Characteristics			
				Allocation	temp. changeable	AT	MDT
34149	Voltage loop integral action time T_n	50	0.1ms	DRIVE	■	-	-
34151	K_P current Q	0	0.01V/A	DRIVE	■	-	-
34152	K_P current D	0	0.01V/A	DRIVE	■	-	-
34153	Maximum velocity motor	1000000000	0.0001/min	DRIVE	-	-	-
34160	Part number motor	0	-	DRIVE	-	-	-
34161	Production date motor	0	-	DRIVE	-	-	-
34162	Serial number motor	0	-	DRIVE	-	-	-
34164	Resistance R_{tt}	0	0.01W	DRIVE	-	-	-
34165	Holding torque brake	0	0.1Nm	DRIVE	-	-	-
34166	Temperature sensor motor	0	-	DRIVE	-	-	-
34167	Inductance L_{tt}	0	0.1mH	DRIVE	-	-	-
34168	Time I_{max} motor	0	0.1s	DRIVE	-	-	-
34171	Event filter	0	-	DRIVE	-	-	-
34177	Lower threshold current adaptation	100	%	DRIVE	■	-	-
34178	Upper threshold current adaptation	100	%	DRIVE	■	-	-
34179	Gradient $K_{P,Q}$	100	%	DRIVE	■	-	-
34180	Gradient $T_{N,Q}$	100	%	DRIVE	■	-	-
34182	Position increase limit value	0x7FFFFFFF	Incr.	DRIVE	■	-	-
34199	Actual power value (signed)	0	W	DRIVE	-	■	-
34200	Bit mask port 1	0	-	GLOB	-	-	-
34201	Bit mask port 2	0	-	GLOB	-	-	-
34202	Bit mask port 3	0	-	GLOB	-	-	-
34203	Voltage at 25 degree	0	0.001V	GLOB	-	-	-
34204	Voltage at 75 degree	0	0.001V	GLOB	-	-	-
34205	Voltage at 125 degree	0	0.001V	GLOB	-	-	-
34210	Dead time compensation probe 2	0	0.001	GLOB	-	-	-
34215	Temperature IGBT	0	0.1°C	GLOB	-	■	-

9 Index

10 Glossary

A

ACC-Bus
CAN-bus interface with standard CANopen protocol DS301and additional hardware synchronization trigger signal.

AT
Drive telegram

Ax
Outputs, binary outputs

B

BA
Operation mode

BAx
Binary outputs on the controller card BA1, BA2, BA3

BEx
Binary inputs on the controller card BE1, BE2, BE3

D

DRIVE
Drive specific parameters; can be set in each parameter set differently.

DZR
Speed controller (closed loop)

E

EF
Enable signal for the power output stage signal

EtherCAT
Real-time Ethernet bus

Ex
Inputs, binary inputs, e.g. E2 binary input no. 2

F

Firmware
Operating system or system software which is loaded to the device by AMK

FL
Clear error, causes a new system initialization

G

GLOB
Global parameters; valid for all parameter sets

I

INST
Instance parameters; can be set in each instance differently.

Instance
Parameter settings which need to be done individually for each fielbus are instanced, that means they can be assigned to different values one for each bus (e.g. node address, transmission rate…). Fieldbus interfaces and slots where fielbus options can be plugged in, are assigned to instances. The instances are device specific assigned.

K

KE/KW
KE/KW is the modular AMK drive system which consist the modules compact power supply KE and compact inverter KW with the controller card KW-R0x and in case of need an option card.

KWD
Double inverter module to control 2 motors

L

Latched
To latch a value means to store a value

M

Mailbox
Device profile and mailbox protocol describes user parameter and the functional behavior of the devices. The mailbox is used as box for data exchange.

MDT
Master data telegram

N

NIP
zero pulse of the encoder feedback

NK
cam, cam-switch

P

Parameter
Identnumber according SERCOS standard

PDO
Process data object according to CANopen DS301 for exchange application data

PUR
Polyurethane PU, DIN -shortcut : PUR

Q

QRF
Acknowledgement controller enable

QUE
Acknowledgement inverter ON (DC-bus enable)

R

RF
Controller enable, motor controller is active

S

SAK
Following error compensation

Service channel
The service channel defines a communication object to read or write parameters.

SIWL
Software pulse transmission

SoE
EtherCAT protocol (Servo Drive Profile according IEC 61800-7-300)

U

U/f
Velocity-/frequency control (open loop)

UE
Inverter ON, control signal to load the DC-bus of the KE modules.

UZ
Voltage DC-bus

11 Your Opinion is Important!

With our documentation we want to support you best in handling the AMK products.
Therefore we are ready to optimize our documentations.
Your comments or suggestions are always interesting for us.
We would be please if you take a bit time and answer our questions. Please return a copy of this page to us.

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Thank you for your assistance.
Your AMK documentation team

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