AMKASYN
Compact Servo drives KU
KU 0,5; KU 0,7; KU 1,5; KU 2
Hardware description

Version: 2002/22
Part No.: 26496

Table of contents

1 Safety instructions

The KU module must be permanently installed in a closed control cabinet. Installation, connection and earthing must be performed in compliance with the relevant standards and regulations.

All inverters with controlled or uncontrolled input rectifiers can lead in case of a fault to a ground current incompatibility according to VDE 0664. Connection of such units to the power supply using only the residual-current-operated circuit-breaker (r.c.c.b) is not permissible.

On normal operation of the KU inverter there is an earth leakage current of > 3,5 mA. According to VDE 0160 in this case a permanent connection of the modules is required!
For PE connection an at least 10 mm^2 cross-section wire (AWG 6) must be used or a second PE wire electrically parallel to the protective earth conductor through a separate terminal must be installed (VDE 160, paragraph 5.3.2.1)!

Danger

On interruption of the PE connection dangerous contact voltages can occur at the housing!

Operating equipment connected to the KU-system and used according to its intended application must meet the electrical safety regulations set forth in prEN 50178 / EN 60204.

Danger

Each time before working on the KU module: Interrupt the power supply using the main switch! Working under voltage is dangerous to life!

Discharge time longer than 3 minutes! Don't touch electrical connections for 3 minutes after switching power off!

The option cards and all plug connectors must only be inserted or removed when the modules are voltage-free!

Never push in plug connectors/optional cards with force!

Never losen or tighten terminals under voltage!

In order to avoid the risk of damage to components due to static discharge, avoid touching the electrical connections on the plug-in modules.

All work on the drive system must only be performed by trained and authorized specialist personnel.

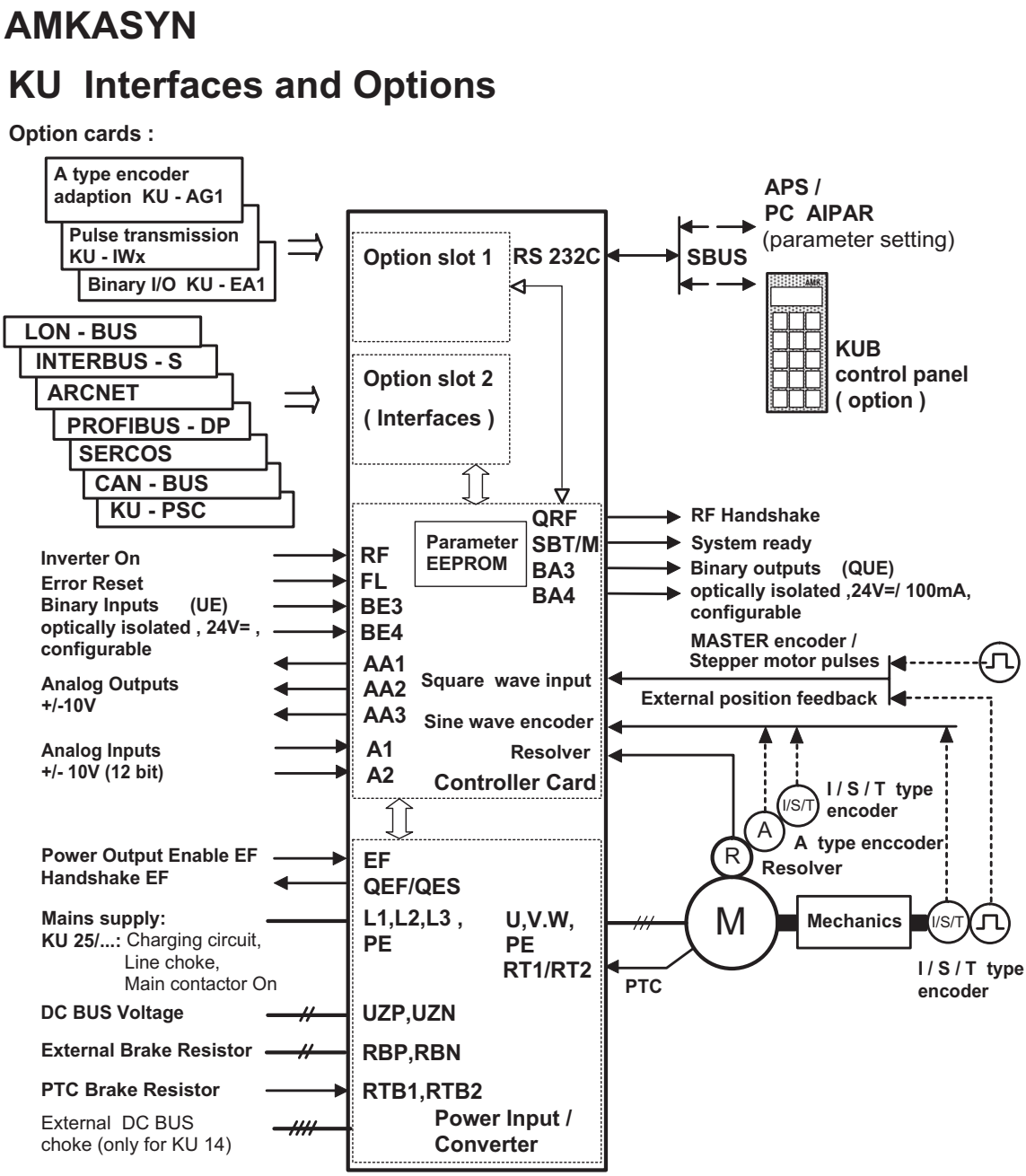
Warning

Drive system parameters may only be set or modified by the machine manufacturer!
Entry of non-confirming parameter values is effecting the drive behaviour and increasing the risk of accidents and damage!

The AMKASYN KU series is used for controlling AMK AC servo and main spindle motors. The manufacturer/operator of the installation as a whole is responsible for any damage resulting from use of the drive system in any way other than in the intended manner.

2 Brief system description

The AMKASYN KU inverter is designed for feeding AMK AC motors. The digital inverter regulates the drive in 4 quadrant mode precisely and with high dynamic response. The feed is direct from a three-phase power supply . The latest power semiconductor technology in conjunction with high-grade integration guarantee high reliability. The units are protected against overcurrent.



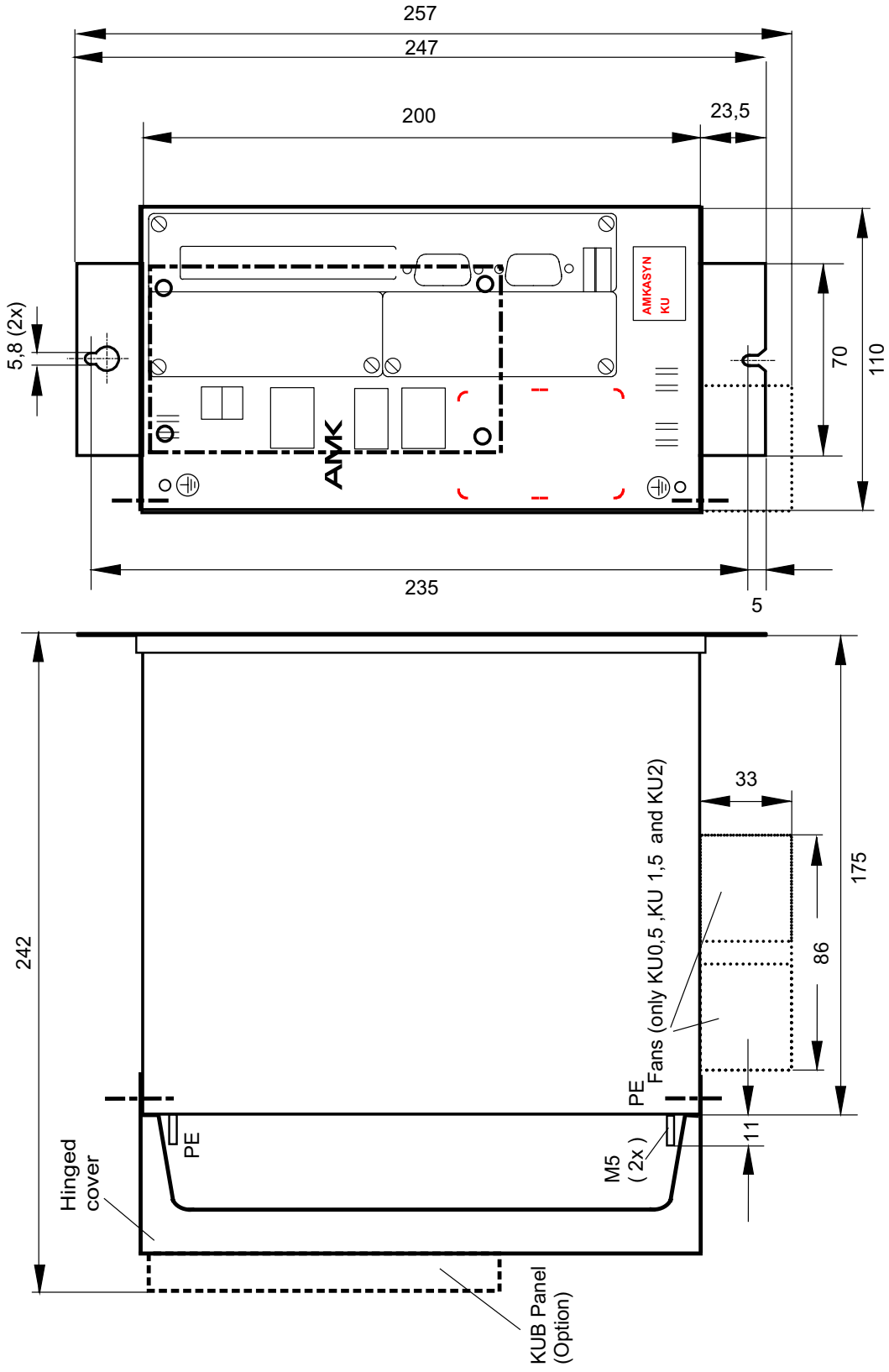
3 Technical data

3.1 KU Specifications

Type	KU 0,5	KU 0,7	KU 1,5	KU 2
Input voltage	3 x 42V ±10%	1 x 230V ±10%		3 x 230V ±10%
Input frequency	47...63 Hz			
DC BUS voltage	to 82V DC	to 420V DC		
Efficiency	approx. 83%	approx. 92%		approx. 94%
Power factor λ, approx.	approx. 0,9	approx. 0,5	approx. 0,57	approx. 0,7
Cooling	forced convection	convection	forced convection	
Input current	8,5 A	5,0 A	8,0 A	5,7 A
Recommended supply fuse 1)	16 A	6 A	10 A	
Nominal output power	0,5 kVA	0,7 kVA	1,5 kVA	2 kVA
Output voltage	to 3 x 28V	to 3 x 190V		
Output frequency	0 - 800 Hz			
Nominal output current	10,3 A	2,1 A	4,6 A	6,1 A
Peak output current	15,4 A / 60 s	4,2 A / 25 s	9,1 A / 25 s	12,2 A / 25 s
Braking transistor	without	integrated		
Ext. brake resistor (option)	-	min. 110 Ohm		
Radio interference level	external filter required	A acc. to EN 55011		external filter required
Protective functions	Overcurrent protection			
Control procedure	PWM			
Switching frequency	8 kHz			
Recommended cable cross sections [mm²]/AWG **X01 Power input** **X02 Motor** 3) **X04 Brake resistor** 3) **X05 Motor PTC** 3) **X06 Brake resistor PTC** 3)	 3x1,5 / AWG14 4x1 / AWG16 - 2x0,5 / AWG20 -	 2x1 / AWG14 4x1 / AWG16 2x0,75/AWG18 2x0,5/AWG20 2x0,5/AWG20		 3x1 / AWG16 4x1 / AWG16 2x0,75/AWG18 2x0,5/AWG18 2x0,5/AWG20
PE connection [mm²]/AWG 2)	2x1,5/AWG14 or 1x10/AWG6	2 x 1/AWG6 or 1 x 10/AWG6		
Weight [kg]	3,2 kg/7,1 lb	2,9 kg/6,4 lb	3,2 kg/7,1 lb	

1) Fuses for cable protection, „gL“ classification acc. to DIN/VDE 0636
2) Acc. to VDE 0160: at least 10 mm²/AWG6 or installation of a second PE wire electrically parallel to the protective earth conductor through a separate terminal.
3) Shielded cable

3.2 Dimensions



3.3 External brake resistor

Excess brake energy has to be converted to heat with an external brake resistor. The brake transistor is integrated in the KU inverter (only with KU 0,7, KU 1,5 and KU 2).

The external brake resistor has to be connected via terminal X04 (RBP/RBN) with shielded cable. The shield must be grounded to PE at both ends.

An internal temperature sensor monitors the temperature of the brake resistor. The temperature sensor has to be connected via terminal X06 (RTB1/RTB2) with shielded cable. The shield must be grounded to PE at the inverter end only.

Technical data:

	For KU 0,7, KU, 1,5, KU 2: AR 45
Resistance	110 Ω
Continuous power	45 W
Peak power (for 15 min. duty cycle)	1,3 kW for 1s
Cross section for connection	0,75 mm^2 / AWG 20
Weight (approx.)	0,5 kg/1,1 lb

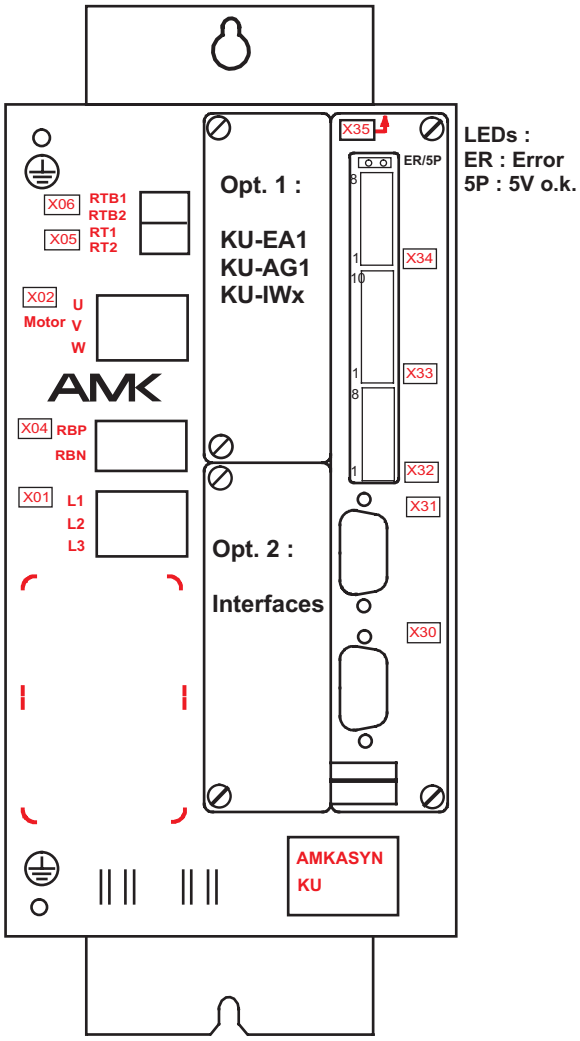
The air flow around the brake resistor can reach a maximum of 200°C / 392°F. The brake resistor must not be mounted in the inverter cooling air flow.

Overhead mounting of the brake resistor is not permissible because of cooling requirement!

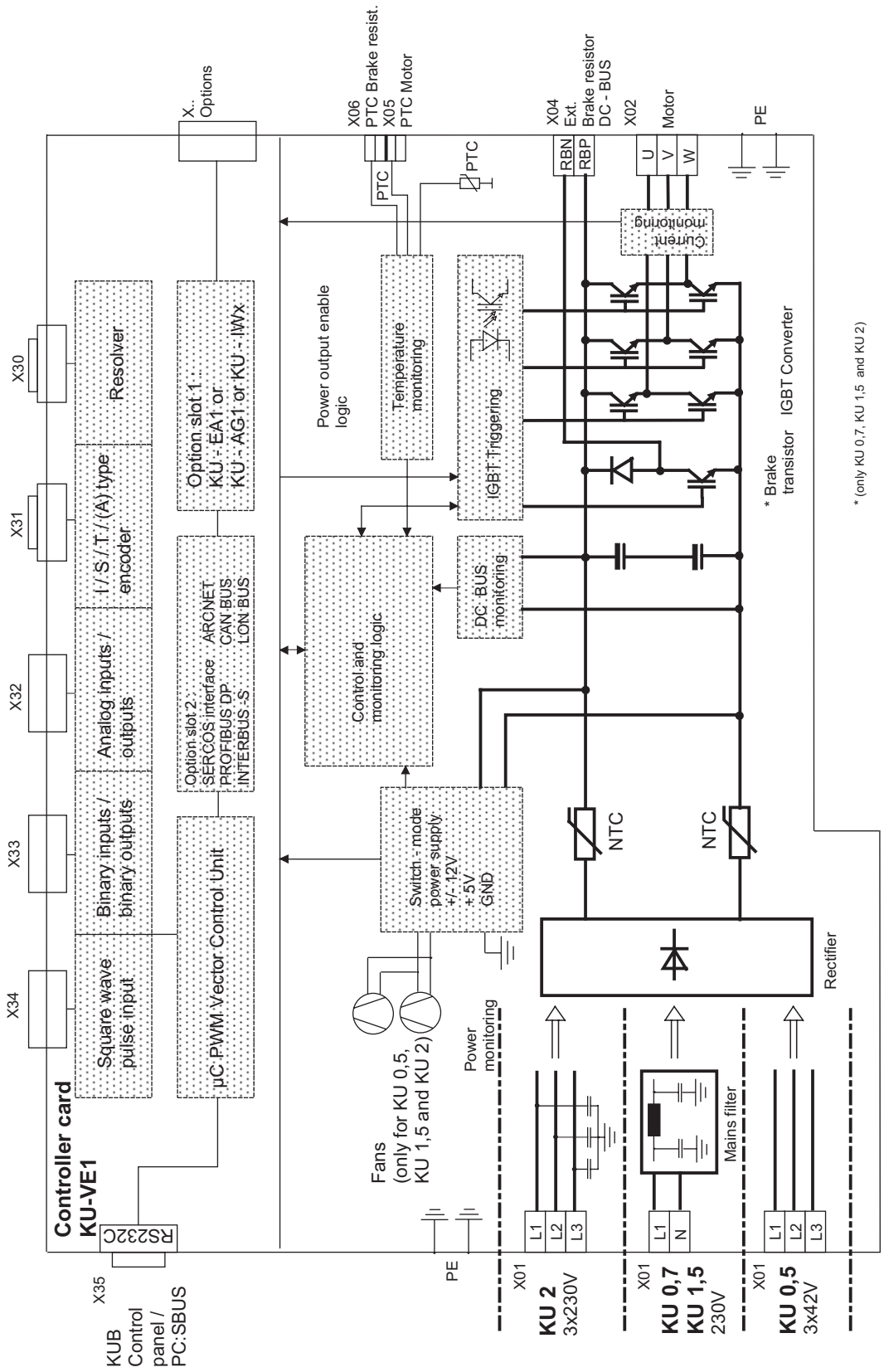
The surface temperature of the housing can exceed 80°C / 176°F.
The brake resistor installation must be guarded from contact and have a warning label!

4 Description

4.1 Front view



4.2 KU 0,5 / KU 0,7 / KU 1,5 / KU 2 Block Diagram



4.3 Functional description

The KU inverter contains the following functional groups:

- **Rectifier** for generating the DC-Bus voltage.

- **Charging device for the DC-Bus**

- **Brake transistor (only with KU 0,7, KU 1,5 and KU 2)**
  Braking energy from the motor is first fed into the DC-Bus. If the DC-Bus voltage exceeds its limit value, the brake transistor is activated and the surplus braking energy is converted into heat through the brake resistor. The brake transistor is integrated in the KU 0,7, KU 1,5 and KU 2 inverter, the brake resistor must be installed externally.

  The brake resistor AR 45 is monitored by a thermal protector. The evaluation takes place in the KU. Without protector KU terminals RTB1-RTB2 must be jumpered.

Danger

After the power is shut down, the buffer capacitors for the DC-Bus can still be charged and carry dangerous voltage. Wait at least 3 minutes for the capacitors to discharge before working on the inverter!

- **Switched mode power supply**
  The switched mode power supply generates the internal supply voltages +5V, +12V, -12V. The switched mode power supply is supplied from the DC-bus.

  LED indicators

  The **green LED "5P"** indicates Power On and V supply ready. KU in ERROR status is indicated by the **red LED "ER"**. TheLEDs are located at the top of the KU controller card.

- **Monitoring/switch-on logic**
  Power supply, DC-Bus and internal supply voltages are monitored for limit values. When the limits are exceeded, error messages are generated.

  After „Power On“ the output „SBT“ (System Ready) is set provided there are no start-up errors. Now binary input „RF Inverter on“ must be set. Binary output „QRF Handshake RF“ is signalling that the drive is under control.

  After cause of trouble elimination error messages must be reset e.g. through binary input „FL Error reset“ (pulse width >100ms) with RF inactive.

- **Inverter cooling**
  The inverters KU 0,5, KU 1,5 and KU 2 are fan ventilated. Fan voltage supply through internal 12V.

- **Inverter, equipped with IGBT, power semiconductors**

- **Microcontroller for**
  Field orientation
  Motor encoder evaluation and monitoring
  Speed control
  Closed loop position control
  IGBT triggering
  Current control
  Monitor functions

  The micro controller calculates cyclically the instantaneous values of the nominal currents for the phases from the specified setpoint, the actual phase currents as well as the rotor position.

  The IGBT triggering is synchronized with the basic clock of 8 kHz, PWM based, in the form that the motor windings carry sinusoidal currents when stationary. The entire control system is digital. Logic and power units are optically isolated. The inverter currents are I^2t monitored. The inverter output is protected against overcurrent.

  The speed and position control circuits are implemented by the micro controller. The system derives actual values for speed and position from the motor encoder signals.
  Motor encoders type „I“, „T“ and „R“ (resolver) can be connected directly.

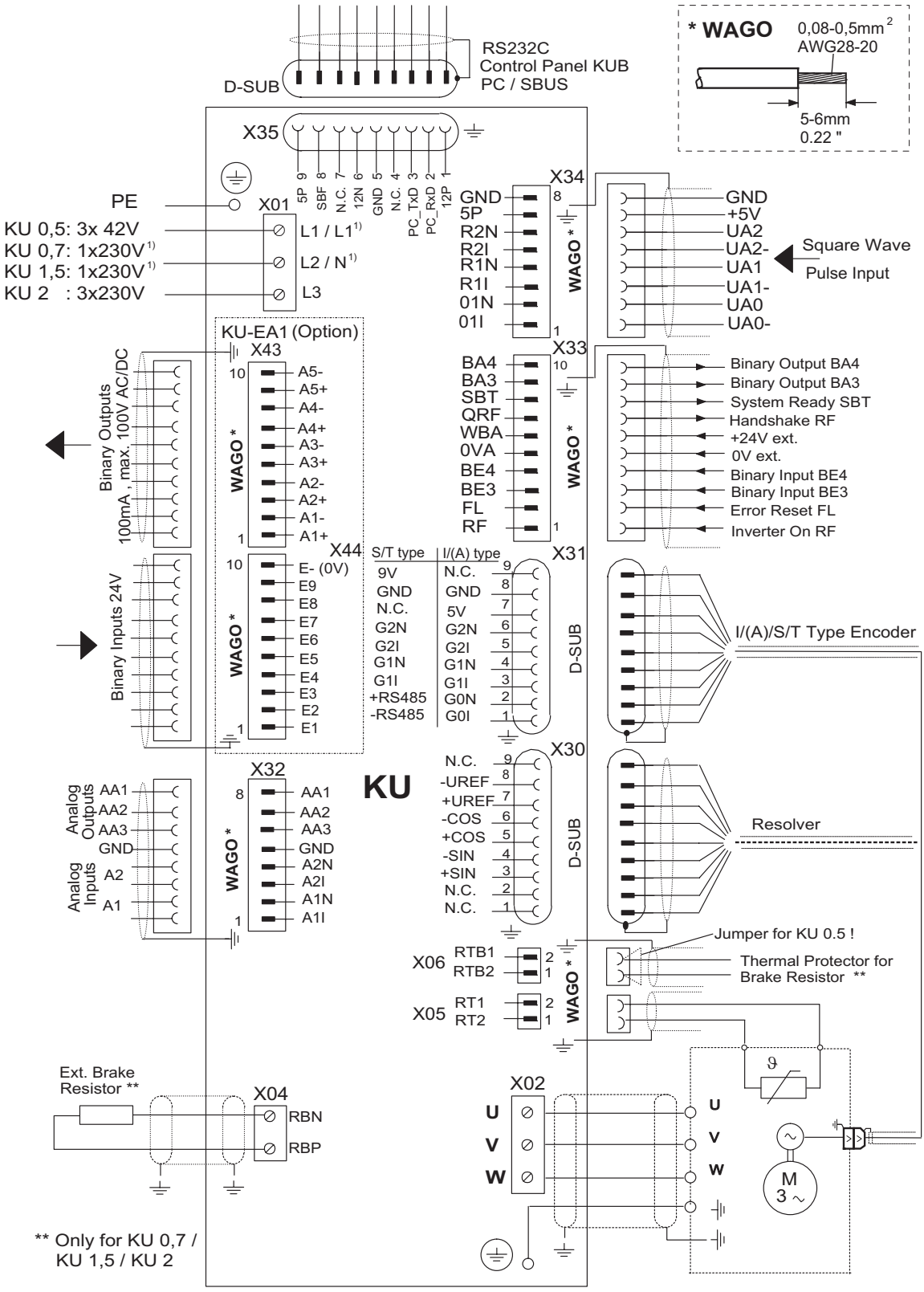
For the „A“ type encoder the option card KU-AG1 in slot 1 is required.
On commissioning the motor encoder adjustment must be performed (see 7.3)

The encoder signals are monitored. On encoder failure „System ready“ (SBT) is reset, the IGBT trigger pulses are blocked, the drive coasts.

The AMKASYN synchronous motors are equipped with resolvers (or T type encoders). The resolver also is evaluated in the KU inverter.

2 analog inputs ± 10V are integrated.
The effect of the analog inputs is determined by parameters.
Analog input A1 serves as speed or torque setpoint input. Change of torque limit is possible through A2 by altering the analog voltage.

4.4 KU connection drawing



4.5 Interfaces

X01 Power input

		KU 0,5	KU 2
L1:	Phase L1	3 x 42V	3 x 230V
L2:	Phase L2	50/60 Hz	50/60 Hz
L3:	Phase L3		

	KU 0,7	KU 1,5
Phase L1 Neutral N	1 x 230V 50/60 Hz	

X02 Motor connection

U: Motor phase U
V: Motor phase V
W: Motor phase W

Connection through shielded cable. The cable shield must be grounded at both ends (contact area as large as possible). The motor must be connected in correct phase sequence!

X04 External brake resistor (not KU 0,5)

RBP/RBN: Connection through shielded cable. Cable shield must be grounded at both ends (contact area as large as possible).

X05 Motor PTC

(WAGO 2 pole female connector)

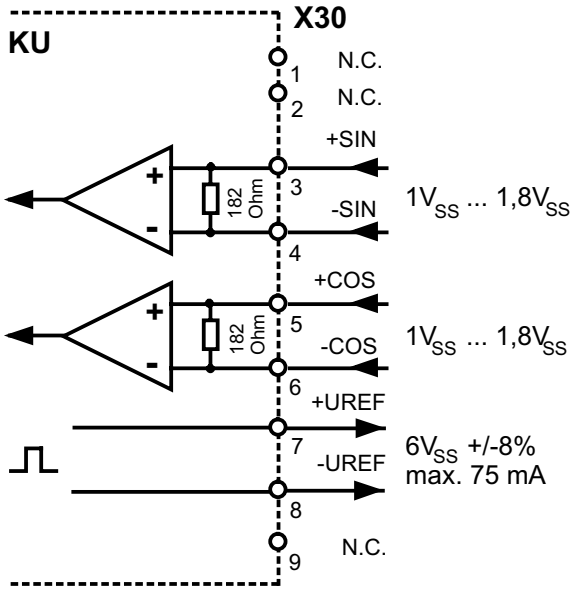
RT1, RT2: Motor PTC connections
The motor PTC resistance is approx. 170 Ω at approx. 20°C / 68°F.
Connection through shielded cable. Connect cable shield to PE single-ended at the KU inverter!

X06 Brake resistor PTC / Bimetal thermal protector (not KU 0,5)

(WAGO 2 pole female connector)

RTB1, RTB2: Connection for brake resistor PTC / bimetal thermal protector
Connection through shielded cable. Connect cable shield to PE single-ended at the KU housing. Without external brake resistor, terminals RTB1 and RTB2 must be jumpered.

X30 **Resolver connection**
(9 pole female D-SUB connector)



X30

Pin	Resolver
1	N.C.
2	N.C.
3	+SIN
4	-SIN
5	+COS
6	-COS
7	+UREF
8	-UREF
9	N.C.

Connection through twisted-pair shielded cable.

The shield of the resolver cable must be grounded at both ends !

X31 **Motor encoder connection for I / S / T / (A) type encoder**
(9 pole, female D-SUB connector)

X31, Pin:	I / (A) encoder	S/T encoder	
1	G0I	-RS485	
2	G0N	RS485	
3	G1I	G1I	
4	G1N	G1N	
5	G2I	G2I	
6	G2N	G2N	
7	5V	N.C.	5V: max. 250 mA
8	GND	GND	
9	N.C.	9V	9V: max. 400 mA

Maximum input frequency from motor encoder: 100 kHz. For A type encoder connection option card KU-AG1 in slot 1 is required.
Connection through twisted-pair shielded cable.
The shield of the motor encoder cable must be grounded at both ends!

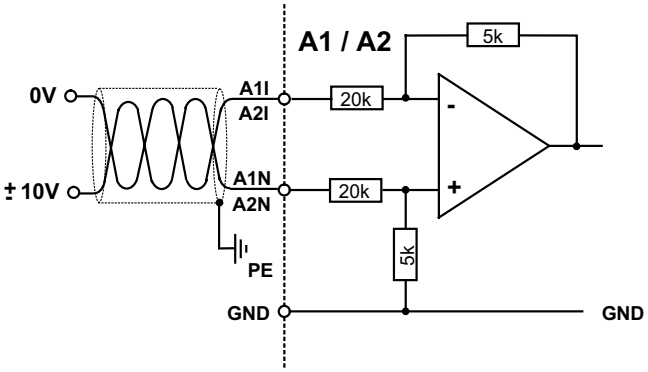
Erroneous connection of the motor encoder connector X31 to socket X35 (KUB panel/PC) is damaging the I type encoder!

X32 **Analog inputs / Analog outputs**
(WAGO 8 pole female connector)

Analog inputs A1, A2:
Nominal input voltage: 0 ... ± 10V
Two analog inputs are provided for setpoint values and torque limiting via analog voltage ± 10V. They are designed as differential inputs related internally to „GND“.
The resolution is 12 bits for ± 10V. Interrogation by the microcomputer cyclically every 250 µs.
Depending on the selected mode analog input A1 serves as input for speed or torque setpoint value.
By variation of the input voltage at analog input A2 torque limitation is effected.

Pin 1: A1I Analog input A1 (inverted)
Pin 2: A1N Analog input A1 (not inverted)
(Differential input)
Pin 3: A2I Analog input A2 (inverted)
Pin 4: A2N Analog input A2 (not inverted)
(Differential input)
Pin 5: GND

Connection through twisted-pair shielded cable. It is recommended to connect the cable shield to PE at analog signal source-end. The GND reference of the setpoint source may deviate from PE reference in the drive at most ± 10V.



Maximum input voltage at A1/A2: ± 12V!

Analog outputs AA1 ... AA3:
3 configurable analog outputs are available:

AA1 / AA2 / AA3: Output voltage ± 10V, max. 10 mA
8 bit resolution

By parametrizing the wanted function is assigned to the analog outputs. The scanning time for the analog outputs is 1 ms.

Pin 8: Analog output AA1 (± 10V)
Pin 7: Analog output AA2 (± 10V)
Pin 6: Analog output AA3 (± 10V)

Connection through shielded cable. The cable shield must be connected to PE single-ended at the KU housing.

X33 **Binary inputs / outputs**
(WAGO 10 pole female connector)

Optically isolated

Nominal input voltage:	+24V $_{ext.}$
Nominal output voltage:	+24V $_{ext.}$
Nominal input current:	8 mA
Nominal output current:	100 mA, short-circuit-proof
Scanning time for binary I/O:	2 ms

Connection through shielded cable. The cable shield must be connected to PE single-ended at the KU housing.

Pin 1: RF **„Inverter On“,** edge-controlled
(BE1)
Input voltage of +24$V_{ext.}$ at RF enables the trigger pulses for the power transistors. The motor is energized, the control is active.

Prerequisite: System booting after Power On terminated by setting SBT = 1. Removal of „Inverter on RF“ (RF=0) in operation causes the motor to be decelerated according to a braking ramp which is specified by parameter ID32782. At standstill the trigger pulses for the power transistors are disabled, the motor is without torque (QRF = 0).

In case of emergency stop, RF must be interrupted by hardware through a contact of the emergency stop circuit.

Pin 2: FL **„Error reset“**
(BE2)
Prerequisite: „Inverter On RF“ inactive
After a system malfunction the cause of trouble must be eliminated first. Then the system has to be booted through an „Error reset“ pulse (≥ 100 ms) at „FL“ input or „Error reset“ must be initiated via the KUB panel or via the connected field bus system „System Ready“ (SBT) then is set again.

Pin 3: BE3 **Binary input BE3** (configurable)
(Default setting is „DC BUS Enable“, not used with KU 0,5 / 0,7 / 1,5 / 2).

Pin4: BE4 **Binary input BE4** (configurable)
(Default setting is „Homing cycle“.)

Pin 5: 0VA Reference potential of the external control voltage +24$V_{ext.}$ for supplying the binary inputs and outputs.

Pin 6: WBA Common feed of the external supply voltage +24$V_{ext.}$ for binary outputs.

Pin 7: QRF **„RF Handshake“**
(BA1)
Output QRF is set after RF = 1 (Inverter On) with drive under control. The drive now is ready to process setpoints.
After removal of RF (RF = 0), the drive is decelerated according to „Deceleration ramp for RF inactive“ (ID32782) QRF is reset only if the motor is at standstill, it is without torque then.

Pin 8 : SBT **System Ready**
(BA2)

Output SBT is set as long as no error status is detected in the drive.
With drive status „ERROR“ output SBT is reset immediately. Depending on the kind of error (c.f. AMKASYN Diagnosis messages) the motor either is decelerated to zero speed according to ID 32782 or is coasting.
Through a defective auxiliary power supply (SMP), a malfunction of the main processor or of the motor encoder, the IGBT trigger pulses immediately are inhibited, the motor is coasting.
A thermal overload in the drive system first is generating a warning. Internally a warning bit is set which can be assigned to a binary output.
After 4 seconds the warning is converted into an „ERROR“, output „SBT“ then is reset, the motor is decelerated to „0“ according to ID 32782.
It is possible for the higher ranking controller to initiate the wanted measures via the setpoint setting within this warning time.

Pin 9: BA3 **Binary output BA3** (configurable)
(Default setting is „$n_{act} = n_{set}$“)

Pin 10: BA4 **Binary output BA4** (configurable)
(Default setting is „In Position“)

X34 **Square-wave pulse input**
(WAGO 8 pole female connector)

Connection via twisted-pair shielded cable. The cable shield must be connected to PE at the inverter housing.

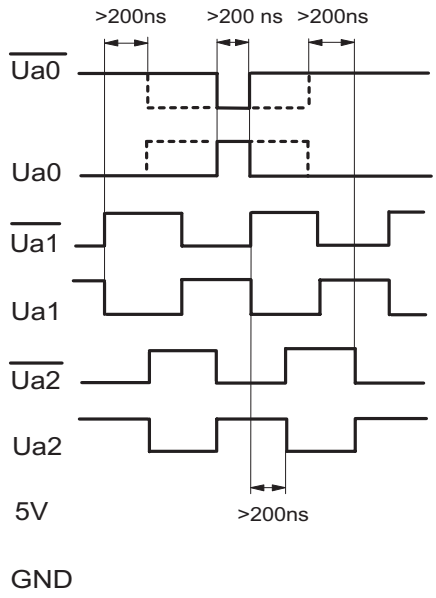
An actual position acquisition is possible through differential inputs R1N, R1I, R2N, R2I by an external position measuring system with square-wave output. Also setpoint pulses e.g. for slepping motor control, synchronous control can be fed in through these inputs. The source for the square-wave pulses must be designed with differential outputs (line drivers according to RS422).

The inputs are direct galvanically coupled. Input impedance 180 Ohm (max. input current $\leq$ 20 mA).

On the KU side a supply voltage (+5V, max. 250 mA) for the external encoder is made available.
It is determined by system parameters in which form the signals are evaluated. The following signal forms can be processed.

2 square-wave pulses in quadrature (offset 90°)

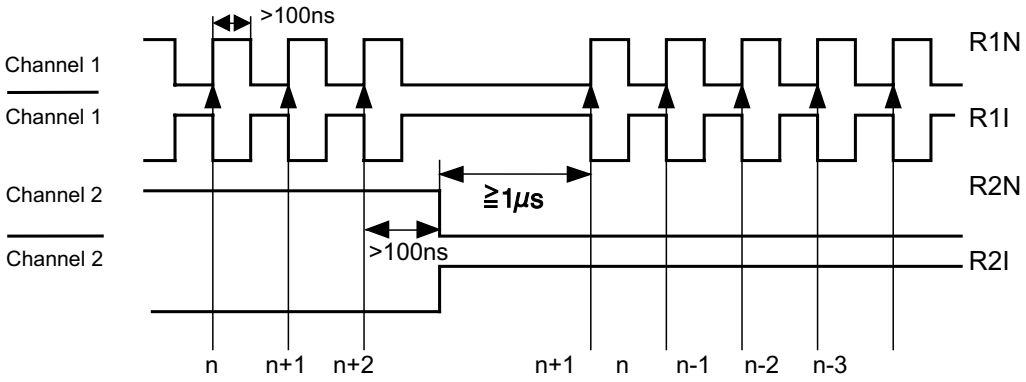
The maximum input frequency is 1 MHz.
The encoder signals are evaluated 4-fold by the AMKASYN system.



X34

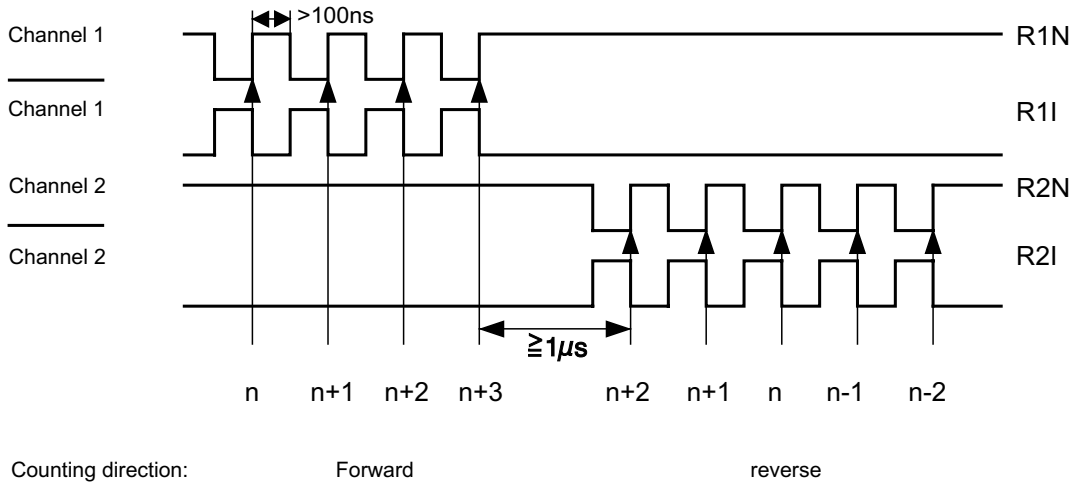
O	O1I	Reference pulse inverted
O	O1N	Reference pulse
O	R1I	Track 1 inverted
O	R1N	Track 1
O	R2I	Track 2 inverted
O	R2N	Track 2
O	5P	Supply +5V (max.250mA)
O	GND	Reference potential GND

Counting pulses channel 1, direction signal channel 2



The maximum input frequency is 4 MHz.
This type of setpoint pulses permits only single evaluation of pulses.

Forward pulses on channel 1
Reverse pulses on channel 2



The maximum input frequency is 4 MHz.
This type of setpoint pulses permits only single evaluation of the pulses.

X35 **KUB control panel / PC connection**
(9-pole D-SUB female connector, located at the top surface of the KU)

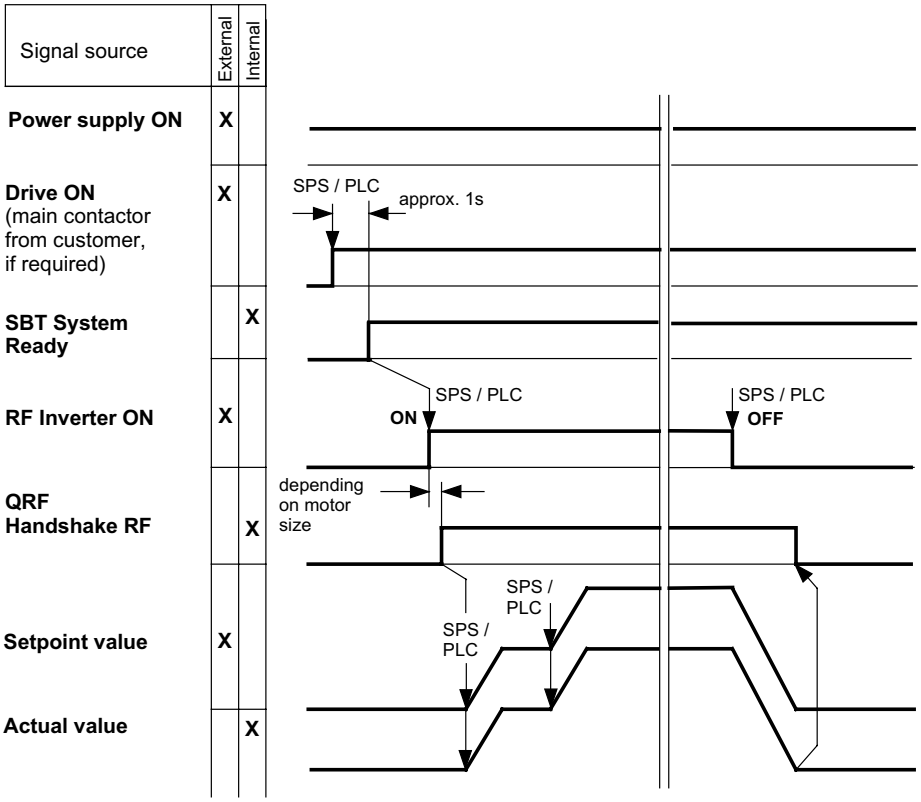
Communication interface (RS 232 C):
Interface for drive parametrization and diagnosis either through option KUB panel or through an external PC with AMK software AIPAR. Access to certain data groups is protected by password. Status and error messages can be called up and displayed in plain language. With AIPAR the parameters are set menu-assisted fast and comfortable, online or offline. Already existing parameter sets are simply down loaded to the drive on start-up. The internal PC power supply must have „Safe electrical separation“ according to VDE 0160.

PIN	CODE	Meaning
1	12P	+12V Supply
2	PC_RxD	Receive Data (RS232)
3	PC_TxD	Transmit Data (RS232)
4	nc	
5	GND	Signal Ground
6	12N	-12V Supply
7	nc	
8	SBF	Hardware identifier bit 0 = Control panel AZB Not connected = SBUS
9	5P	+5V Supply
Shell	SSS	Shield connected to metallized connector shell

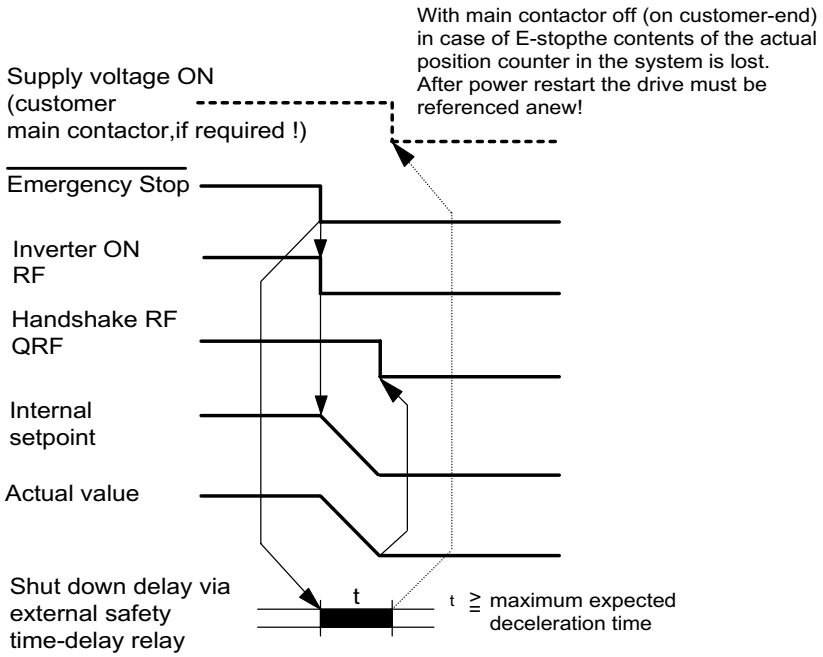
For PC connection only 3 wires are permitted in the D-SUB connector: signals RXD (Pin 2), TXD (Pin 3) and GND (Pin 5) !

Standard PC interface cables can cause damages!

4.6 Pulse diagram Switching On/Off



4.7 Pulse diagram Emergency Stop



5 KU Option cards

5.1 KU Option cards for slot 1

As an option one of the following option cards can be installed in slot 1:

KU-EA1 „Binary Inputs/Outputs“
(9 binary inputs, 24V DC, 5 binary outputs 10V...10V AC/DC, 100 mA)

KU-AG1 „A Type encoder adaption“
Adaption of the A type encoder signals to the internal required signal levels.

KU-IWI „Pulse transmission“ (for motors with I type encoder)
The sine-wave I type encoder signals are converted into square-wave pulses (two channels in quadrature and a reference pulse) and output e.g. for transmission as MASTER pulses or position feedback pulses.

KU-IWR „Pulse transmission“ (for motor with resolver or I type encoder)
Transmission of the resolver signals as square wave pulses (two channels in quadrature and a reference pulse) with a fix output of 1024 pulses per revolution.
Connected to an I type encoder the encoder signals are converted into square wave pulses and output 1:1. Pulse multiplication via ID32890 is not possible!

KU-IWA „Pulse transmission“ (for motors with A type encoder)
Adaption of the A type encoder signals to the internal required signal levels. Additionally the sine-wave encoder signals are converted into square-wave pulses (two channels in quadrature and a reference pulse) and output e.g. for transmission as MASTER pulses or position feedback pulses.

5.2 Option cards for slot 2

As an option one of the following interface cards can be installed in option slot 2:

Interface card for	**PROFIBUS-DP**	**KU-PB1**
	LON	**KU-LN1**
	ARCNET	**KU-ARC**
	CAN	**KU-CAN**
	INTERBUS-S	**KU-IB1**
	SERCOS interface	**KU-SC1**

6 Parameters

Overview

For a detailed description of the actual drive parameters see separate documentation „AMKASYN Parameters KU“ (related to the latest KU software release).

K: Number of places behind decimal point for parameter entry through operator keyboard or PC software AIPAR.

Example: **ID-Nr. 00036, Velocity command value**
Editing of the velocity command value is only possible in [RPM] although the internal speed resolution is 0,0001 RPM.

ID-Nr. 32774, Rotor time constant TR
Editing of the rotor time constant is only possible in [ms] although an internal time resolution of 0,1 ms is used.

ID-No.	Designation	K		Minimum	Maximum	Unit
00001	NC cycle time	3		0.500	65.535	ms
00002	SERCOS cycle	3		0.500	65.535	ms
00017	List all op.data					
00036	Veloc. cmd.value	1		-100000.0000	100000.0000	rpm
00038	Pos. veloc.limit	0		0.0000	100000.0000	rpm
00039	Neg. veloc.limit	0		-100000.0000	0.0000	rpm
00041	Homing velocity	0		1.0000	100000.0000	rpm
00043	Veloc. polarity	0		0000h	0007h	
00049	Pos.posit. limit	0		-2147483648	2147483647	Incr.
00050	Neg.posit. limit	0		-2147483648	2147483647	Incr.
00055	Posit. polarity	0		0000h	0009h	
00057	In posit. window	0		0	65535	Incr.
00080	Torque cmd.value	1		-1000.0	1000.0	% MN
00082	Pos.torque limit	0		0.0	1000.0	% MN
00083	Neg.torque limit	0		-1000.0	0.0	% MN
00085	Torque polarity	0		0000h	0001h	
00096	Slave identifier	0		0000h	FEFEh	
00097	Mask st.class 2	0		0000h	FFFFh	
00098	Mask st.class 3	0		0000h	FFFFh	
00100	Veloc. gainKP	0		1	30000	
00101	Int.time veloc.	0		0.0	1000.0	ms/4
00103	Modulo value	0		1	4294967295	Incr.
00104	Position loop KV	0		20	30000	min^{-1}
00110	Invert.peak curr	1		0.000	200.000	A
00111	Motor nom. curr.	1		0.000	200.000	A
00112	Invert.nom.curr.	1		0.000	200.000	A
00113	Max. motor speed	0		180.0000	100000.0000	rpm

ID-No.	Designation	K		Minimum	Maximum	Unit
00115	Posit.feedb.type	0		0000h	000Fh	
00116	Resol.mot.encod.	0		200	1280000	Incr.
00117	Resol.ext.encod.	0		0	4294967295	Incr.
00121	Gear input rev.	0		1	30000	Rev.
00122	Gear output rev.	0		1	30000	Rev.
00123	Feed constant	4		0.0000	429496.7295	mm/rev
00124	Zero veloc.wind.	0		0.0000	60000.0000	rpm
00125	Veloc. limit Nx	0		0.0000	100000.0000	rpm
00126	Torque limit Mdx	0		0.0	1000.0	% MN
00136	Positive accel.	0		1.000	60000.000	Rev/ss
00137	Negative accel.	0		-60000.000	-1.000	Rev/ss
00147	Homing par.	0		0000h	FFFFh	
00150	Reference offset	0		-2147483648	2147483647	Incr.
00153	Angle position	0		-2147483648	2147483647	Incr.
00154	Spindle pos.par.	0		0000h	FFFFh	
00157	Velocity window	0		1.0000	60000.0000	rpm
00158	Power limit Px	0		1	100000	VA
00159	Excess Error	0		0	32767	Incr.
00180	Spindle pos.rel.	0		-2147483648	2147483647	Incr.
00209	Low. adapt.limit	0		0.0000	100000.0000	rpm
00210	Upp. adapt.limit	0		0.0000	100000.0000	rpm
00211	Gain adaption	0		0.0	500.0	%
00212	Integr. adaption	0		0.0	500.0	%
00222	Spindl.pos.speed	0		1.0000	100000.0000	rpm
00225	Synchron par.	0		0000h	FFFFh	
00228	Angle syn.window	0		0	65535	Incr.
00230	Syn. pos. offset	0		-2147483648	2147483647	Incr.
00265	Language	0		0000h	0002h	
00268	Syn.angle posit.	0		-2147483648	2147483647	Incr.
00270	List temp. par.					
00278	Syn. add. posit.	0		-2147483648	2147483647	Incr.
32768	Nom.motor volt.	1		0.0	1000.0	V
32769	Magnet.curr. IM	1		0.000	200.000	A
32770	Magnet.curr. IM1	1		0.000	200.000	A
32771	Nom. torque	1		0.0	2000.0	Nm
32772	Nom. velocity	0		10.0000	100000.0000	rpm
32773	Service switch	0		00000000h	FFFFFFFFh	
32774	Rotor const. TR	3		0.0100	1.5000	s
32775	Pole number mot.	0		2	16	
32776	Motor enc.period	0		50	5000	
32777	Torque 10V [Va]	0		0.0	1000.0	% MN
32778	Speed 10V [Va]	0		0.0000	100000.0000	rpm
32779	Speed offs. [Va]	4		-100.0000	100.0000	rpm
32780	Accel. ramp	0		1.0	1200000.0	ms
32781	Decel. ramp	0		1.0	1200000.0	ms

ID-No.	Designation	K		Minimum	Maximum	Unit
32782	Ramp RF inactive	0		1.0	1200000.0	ms
32785	KU message 16	0		0	65535	
32786	KU message 32	0		0	65535	
32787	Source analog 1	0		0	4294967295	
32788	Final analog 1	0		-2147483648	2147483647	
32789	Source analog 2	0		0	4294967295	
32790	Final analog 2	0		-2147483648	2147483647	
32791	Source analog 3	0		0	4294967295	
32792	Final analog 3	0		-2147483648	2147483647	
32795	Source UE	0		0	65535	
32796	Source RF	0		0	65535	
32798	User list 1					
32799	Conf. peripherie	0		00000000h	FFFFFFFFh	
32800	AMK main op.mode	0		00000000h	FFFFFFFFh	
32801	AMK op. mode 1	0		00000000h	FFFFFFFFh	
32802	AMK op. mode 2	0		00000000h	FFFFFFFFh	
32803	AMK op. mode 3	0		00000000h	FFFFFFFFh	
32804	AMK op. mode 4	0		00000000h	FFFFFFFFh	
32805	AMK op. mode 5	0		00000000h	FFFFFFFFh	
32811	Ext.feedb.source	0		0	65535	
32813	Par.set 1	0		00000000h	FFFFFFFFh	
32821	Password	0		0	4294967295	
32846	Output port 1	0		0	65535	
32847	Port 1 bit 0	0		0	4294967295	
32848	Port 1 bit 1	0		0	4294967295	
32849	Port 1 bit 2	0		0	4294967295	
32850	Port 1 bit 3	0		0	4294967295	
32851	Port 1 bit 4	0		0	4294967295	
32852	Port 1 bit 5	0		0	4294967295	
32853	Port 1 bit 6	0		0	4294967295	
32854	Port 1 bit 7	0		0	4294967295	
32855	Output port 2	0		0	65535	
32856	Port 2 bit 0	0		0	4294967295	
32857	Port 2 bit 1	0		0	4294967295	
32858	Port 2 bit 2	0		0	4294967295	
32859	Port 2 bit 3	0		0	4294967295	
32860	Port 2 bit 4	0		0	4294967295	
32861	Port 2 bit 5	0		0	4294967295	
32862	Port 2 bit 6	0		0	4294967295	
32863	Port 2 bit 7	0		0	4294967295	
32864	Adr. Ausg.port 3	0		0	65535	
32865	Port 3 bit 0	0		0	4294967295	
32866	Port 3 bit 1	0		0	4294967295	
32867	Port 3 bit 2	0		0	4294967295	
32868	Port 3 bit 3	0		0	4294967295	

ID-No.	Designation	K		Minimum	Maximum	Unit
32873	Input port 1	0		0	65535	
32874	Port 1 bit 0	0		0	4294967295	
32875	Port 1 bit 1	0		0	4294967295	
32876	Port 1 bit 2	0		0	4294967295	
32877	Port 1 bit 3	0		0	4294967295	
32878	Port 1 bit 4	0		0	4294967295	
32879	Port 1 bit 5	0		0	4294967295	
32880	Port 1 bit 6	0		0	4294967295	
32881	Port 1 bit 7	0		0	4294967295	
32890	Puls multiplier	0		1	10	
32892	Pulse divider	0		65536	2147483647	
32893	Pulse multipl.	0		-2147483648	2147483647	
32922	Resid.dist.wind.	0		0	65535	Incr.
32925	AMK posit. par.	0		0000h	FFFFh	
32926	AMK homing par.	0		0000h	FFFFh	
32927	AMK syn. par.	0		0000h	FFFFh	
32928	Time filter 1	1		0.0	2000.0	ms
32929	Time filter 2	1		0.0	2000.0	ms
32935	Volt. standstill	1		0.0	1000.0	V
32940	High hom. veloc.	0		0.0000	100000.0000	rpm
32948	KU message 4x32	0		00000000h	FFFFFFFFh	
32952	Posit.syn.window	0		0	65535	Incr.
32953	Encoder type	0		0000h	FFFFh	
32954	Ramp down contr.	2		0.00	655.35	s
32955	Delay time	2		0.00	655.35	s
32956	Add. accel.value	0		4	255	
32959	Offset resolver	0		0	65535	Incr.
32960	Input M.enc.gear	0		1	65535	Rev.
32961	Outp. M.enc.gear	0		1	65535	Rev.
32968	Input port 2	0		0	65535	
32969	Port 2 bit 0	0		0	4294967295	
32970	Port 2 bit 1	0		0	4294967295	
32971	Port 2 bit 2	0		0	4294967295	
32972	Port 2 bit 3	0		0	4294967295	
32973	Port 2 bit 4	0		0	4294967295	
32974	Port 2 bit 5	0		0	4294967295	
32975	Port 2 bit 6	0		0	4294967295	
32976	Port 2 bit 7	0		0	4294967295	
32977	Input port 3	0		0	65535	
32978	Port 3 bit 0	0		0	4294967295	
32979	Port 3 bit 1	0		0	4294967295	
32980	Port 3 bit 2	0		0	4294967295	
32981	Port 3 bit 3	0		0	4294967295	
34000	Variable 0	0		-2147483648	2147483647	
34001	Variable 1	0		-2147483648	2147483647	

ID-No.	Designation	K		Minimum	Maximum	Unit
34002	Variable 2	0		-2147483648	2147483647	
34003	Variable 3	0		-2147483648	2147483647	
34004	Variable 4	0		-2147483648	2147483647	
34005	Variable 5	0		-2147483648	2147483647	
34006	Variable 6	0		-2147483648	2147483647	
34007	Variable 7	0		-2147483648	2147483647	
34008	Variable 8	0		-2147483648	2147483647	
34009	Variable 9	0		-2147483648	2147483647	
34010	Variable 10	0		-2147483648	2147483647	
34011	Variable 11	0		-2147483648	2147483647	
34012	Variable 12	0		-2147483648	2147483647	
34013	Variable 13	0		-2147483648	2147483647	
34014	Variable 14	0		-2147483648	2147483647	
34015	Variable 15	0		-2147483648	2147483647	
34016	Variable 16	0		-2147483648	2147483647	
34017	Variable 17	0		-2147483648	2147483647	
34018	Variable 18	0		-2147483648	2147483647	
34019	Variable 19	0		-2147483648	2147483647	
34020	List function					
34021	PID controller 1					
34022	Ramp 1					
34023	BUS addr. part.	0		0000h	FFFFh	
34024	BUS transm. rate	2		0.00	99000.00	
34025	BUS mode	0		0000h	FFFFh	
34026	BUS mode attrib.	0		0000h	FFFFh	
34027	BUS fail.charac.	0		0	65535	
34028	BUS output rate	0		0000h	03FFh	
34029	BUS status bits					
34030	ANP1 Cond. mod.					
34031	ANP2 Cond. mod					
34032	ANP3 Cond. mod					
34033	ANP4 Cond. mod					
34034	ANP5 Cond. mod					
34035	Ramp 2					

7 Exchange of drive modules

7.1 Exchange of KU inverter

Warning

Absolutely pay attention to:
Exchange of the KU inverter is only permitted after consultation of the machine manufacturer and his release.
All system specific parameters are stored in the EEPROM on the controller card KU-R01. The machine manufacturer first has to load the actual and valid parameter set into the EEPROM of the new KU inverter before restart of the system.
Non-observance of these instructions leads to functional problems, malfunction and machine damages!

1. **MASTER SWITCH OFF, AWAIT DC BUS DISCHARGE TIME > 3 MINUTES!**
2. Swing open KU front cover

If used:
Remove D-SUB connector X35 (for KUB control panel) after loosening of the fixing screws, remove control panel from the 4 fixing holes in the front cover.

3. Remove all strain reliefs/cable shield connections.
4. Unplug all WAGO connectors.
   Remove D-SUB connector X31 (X30 with resolver) after loosening the fixing screws.
5. Unscrew single wires for power input (X01).
6. Unscrew motor connection terminals (X02). Be aware of clear wire marking.
7. If used: Disconnect external brake resistor (X04).
8. Unscrew PE connections at the PE bolts.
9. Loosen KU fastening screws at the mounting panel.

10. Slightly lift the KU inverter and take it out towards you.
11. Insert new KU inverter, lower it and securely tighten the fastening screws.
12. Swing open KU front cover.
13. Securely tighten all PE connections at the PE bolts.
14. Securely reconnect power input (X01).
15. Securely tighten motor connections U, V, W.

Warning

Pay attention to the correct phase-sequence! Incorrect phase-sequence reverses motor direction! By this false control direction!

Switching on with false phase sequence results in an uncontrolled rotation of the motor shaft with possible damages in the installation!

16. If used: Securely connect brake resistor (X04).
17. Plug-in all WAGO connectors, correctly assigned to the corresponding sockets.
18. Insert D-SUB connector X31 for motor encoder (X30 for resolver) and secure it by the two fixing screws.
19. For strain relief and cable shield connection fix all cables to the bare metal front panel with cable ties.
20. Snap-in the KUB panel into the 4 fixing holes in the front cover. Insert D-SUB connector X35 and secure it by the two fixing screws.
21. Close and snap-in KU front cover.

If it is guaranteed that the correct system parameters are already stored on the controller card KU-R01, power can be applied to the machine again.
For motors with motor encoder type A (motor designation DV [DH] - xx - yy - 4**A**..., option card KU-AG1/KU-IWA must be installed in option slot 1):
Before start of the machining process the encoder adjustment procedure must be initiated.

If the original controller card KU-R01 can be used further on, the original drive parameters remain effective. The controller card must be removed and then installed in the new KU inverter. After this the machine can be switched on again and the machining process can be continued.

7.2 Exchange of the controller card KU-R01:

Please pay attention: The option cards are connected to the controller card. Controller card KU-R01 and Option card(s) must be manipulated as one unit!

1. Unplug WAGO connectors and motor encoder connector.
2. Unscrew fixing screws of controller card KU-R01 and all option cards (2 captive screws each).
3. Carefully pull out controller card and option cards. Don't squeze or damage the ribbon cable.
4. Carefully plug-in the new controller card KU-R01 including the option cards until the card is safely inserted in the backplane connector.
5. Securely tighten the captive screws for the controller card and the option cards.
6. Pug-in all WAGO connectors, correctly assigned to the corresponding sockets.
7. Insert D-SUB connector X31 for motor encoder (X30 for resolver) and secure it by the two fixing screws.

7.3 Information for motor exchange

For all mechanical works contact the machine manufacturer, follow his instructions for motor disassembling and assembling again!

1. **MASTER SWITCH OFF: Await DC BUS discharging time > 3 minutes!**
2. Remove motor terminal box cover plate by loosening of the 4 screws.
3. Be aware of clear wire marking in the terminal box! Loosen motor connections U, V, W, PE, cable shield and PTC resistor connections.
   If used: Loosen connections for holding brake and motor fan.
4. Loosen all screwed cable glands.
   Pull out all cables including the cable glands of the terminal box.
5. Loosen knurled nut of circular motor encoder connector. Disconnect motor encoder connector.
6. **Disassemble motor, assemble new motor according to the instructions of the machine manufacturer.**
7. Insert cables with cable glands into motor terminal box. Tighten cable glands safely.
8. Carefully connect all wires to the corresponding terminals. Connect PE and cable shield.

Warning

Caution:
Incorrect phase sequence U, V, W reverses motor direction, by this false control direction!
Switching on with false phase sequence results in an uncontrolled rotation of the motor shaft with possible damages in the installation!

9. Close tight the cover plate of the motor terminal box by tightening the 4 screws.
10. MASTER SWITCH ON.
11. Only motors with encoder type A (motor designation DV [DH] -xx-yy-4**A**..., option card KU-AG1/KU-IWA must be installed in option slot 1):
    Before start of the process the encoder adjustment procedure must be initiated through the KUB panel.

7.4 Motor encoder adjustment via KUB panel

Only for motors with A type encoder. The attempt, to carry out the encoder adjustment for a motor with a different encoder type is indicated by the message " Encoder adjustment not successful " in the step before the request "cw-rot. / ccw-rot.".
To avoid "Timeout": Follow the input sequence without delay between the single steps.

After POWER ON :

System ready !	F1 → DIAGNOSIS START-UP
↑ , ↑	ACTUAL VALUES ENCODER ADJUST
SP	Enter password: *****
Enter password : **"1", "2", "3", "4", "5",** SP	
	Rotate motor MANUAL | JOG MODE
Shift & F2 " JOG MODE " Turn on Inverter On RF, the drive is under control now.	Activate RF !
	Enter speed : 247 | RPM
Enter low speed, e. g. **"2", "4", "7",** SP	
If the encoder adjustment is not successful with this speed, try again with a speed > 500 rpm !	ABORT | cw-rot. | ccw-rot.

By pressing simultaneously Shift & F1 or Shift & F2 the motor rotates with the above set speed in positive or negative direction.

CAUTION at operation with coupled load !
It is the operators responsibility to prevent possible collisions in the machine. The interlocks used on normal operation are not effective during the encoder adjustment procedure !

Motor must be rotated until the display shows:

Encoder data are stored

After acceptance of the new data into the EEPROM the display shows:

Successful enc. adjust
CONTINUE |

Now the drive can be used in normal operation.

8 Imprint

Title **Hardware description KU 0,5; KU 0,7; KU 1,5; KU2**

Objective **Technical data of the KU inverters from 0,5 – 2 kVA**

Part-Number **26496**

History

Date
2000/13
2002/22

Copyright notice

Reservation

Modifications to the content of the documentation and the delivery options for the products are reserved.

Service

Tel. no. **+49/(0)7021 / 5005-191, Fax -193**

Office hours:
Mon.-Fri. 7:30 - 16:30, on weekends and public holidays the phone number of the standby service personnel is available on the answering machine.

You can assist us in finding a fast and reliable solution for the malfunction by providing our service personnel with the following:

- Information located on the ID plate of the devices
- The software version
- The device setup and the application
- The type of malfunction, suspected cause of the failure
- The diagnostic messages (error codes)

Publisher

AMK Arnold Müller Antriebs- und Steuerungstechnik GmbH & Co. KG
Gaußstraße 37 – 39, 73230 Kirchheim/Teck

Tel.: 07021/5005-0, Fax: 07021/5005-176
E-mail: info@amk-antriebe.de

Additional information www.amk-antriebe.de

AMK Arnold Müller GmbH & Co. KG
Antriebs- und Steuerungstechnik
Gaußstrasse 37 – 39
D-73230 Kirchheim/Teck
Telefon: +49 (0) 70 21 / 50 05-0
Telefax: +49 (0) 70 21 / 50 05-199
info@amk-antriebe.de
www.amk-antriebe.de