AMKmotion
First steps
Initial startup
Drive system AMKASYN KE/KW
Controller card KW-R06 / -R16 / -R07 / -R17
KW-R24(-R) / -R25 / -R26
Controller AMKAMAC A-series

Version: 2023/26
Part no.: 204539

Translation of the "Original Dokumentation"

AMKmotion

MEMBER OF THE ARBURG FAMILY

Imprint

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Version: 2023/26	
Changes	**Letter symbol**
AMKmotion Design	LeS

Previous version: 2018/04

Product version:

Product	Firmware version (Part no.)	Hardware version (Part no.)
AMKASYN KE/KW with KE-E10 built-in: KE xx -0EU KES xx - 0EU Controller cards: KW-R06 / -R16 / -R07 / -R17 / -R24(-R) / -R25 / -R26	-	

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

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

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

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Content

1 About this document

1.1 Structure of this document

Content	Title	Chapter no.
Validity, usage and purpose of this documentation	Imprint	-
	About this document	1
Safety	For Your safety	2
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Practical information for carrying out (step by step instructions)	Preparation for startup	5
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Reading diagnostic messages	Error diagnosis with AIPEX PRO	9
Abbreviations and definitions	Glossary	-

1.2 Keeping this document

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

1.3 Target group

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

- Unpacking and installation
- Connection
- Parameterization
- Startup

1.4 Purpose

The document at hand describes the initial startup of an AMK drive system containing the following components:

- compact power supply KE (EhterCAT field bus)
- compact inverter with controller card (KW-R06 used in the examples)
- PLC controller A-series (A5 switch cabinet device without display used in the examples)

KW-R07 / -R17 and iC / iX / iDT5 (with functional safety)

The startup of the functional safety is not part of this document.

Any information about functional safety (e. g. properties, parametrization, diagnostic messages) can be found in the Software description Safety manual; functional safety (Part no. 203446).

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

- Safety messages which are absolutely necessary to take care of during handling the product
- Assembly
- Electrical connections
- Startup and operation

1.5 Display conventions

Display	Meaning
	This symbol points to parts of the text to which particular attention should be paid.

Display	Meaning
'Text'	Parameter names, e.g. ID2 'SERCOS cycle time' Diagnostic message, e.g. 1042 'Mains phase fault' Name, e.g. Call up the function 'Delete PLC programme'
0x	0x followed by a hexadecimal number, e.g. 0x500A
	The red hand symbol indicates the button or menu item to click on. The red hand symbol indicates the option to be selected.
 RMB	Click the right mouse button

1.6 Appendant documents

Device descriptions

Part no.	Title
28932	Servo drives KE/KW
202744	Controller cards KW-R06 / -R16 / -R07 / -R17
204918	Controller cards KW-R24(-R) / -R25 / -R26 / -R27
202975	Controllers A4 / A5 / A6

Functional descriptions

Part no.	Title
25786	Diagnostic messages
204979	Software description AIPEX PRO V3 • (PC software for startup and parameterization) • (AFL - AMK function libraries)
203704	Parameter description KW-R06 / -R16 / -R07 / -R17, KW-R24(-R) / -R25 / -R26 / -R27, KE (CAN / Ethernet), A4 / A5 / A6
204019	Basic knowledge AMK PLC programming in structured text

2 For Your safety

2.1 Basic notes for your safety

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

2.2 Safety rules for handling electrical systems

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

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

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

2.3 Presenting safety messages

Any safety information is configured as follows:

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

2.4 Class of hazard

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

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

2.5 Used safety alert symbols

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

2.6 Requirements for the personnel and their qualification

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

Specialised personnel must:

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

2.7 Warranty

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

2.8 Always to observe!

⚠ DANGER

Danger to life!

The controller cards KW-R07 / KW-R17 / KW-R27 are safety modules according to the Machinery directive MRL 2006/42/EG. Before the cards are put into operation, the executing person must have read and understood the device description and the safety manual. During the startup, all information in these documentation must be taken into account.

⚠ DANGER

Danger to life from touching electrical connections!

Electrical terminals and connectors carry voltages that may cause death or serious injury upon contact.

Steps to prevent:

- Prior to any work on the device: Observe the 5 safety rules.
- Measure the terminal voltages. There may be no voltage present.
- Plug and pull connections only when there is no voltage.
- For devices that are connected to a DC bus, or generate it yourself, you need to consider the discharge times of the dc bus capacitors mentioned in the converter documentation
- Before commencing work, the connections must be isolated from the voltage supply at both ends! (both ends mean: AC and DC bus supply side)

⚠ DANGER

Danger to life due to unexpected movements!

The drive will be torque-free in the status 'Safe torque off (STO)', in case of mains failure or in case of faulty drive controller. External application of force on the drive axis may result in life-threatening movements (e.g. hanging axes can fall down).

Steps to prevent:

- Install an external, mechanical brake that prevents a movement.
- Install a counterweight in order to maintain the axis in balance.

⚠ DANGER

Motor shaft movement (rotating parts)!

Hair, body parts and clothes can be captured and wrapped by rotating parts and people result suffer fatal injuries.

Hazardous motor movement occurs when the motor shaft moves in an uncontrolled or unintentional manner.

Even the intended drive movement may be hazardous, if persons remain inside the machine's range of movement.

Uncontrolled motor shaft movement occurs when the motor is no longer controllable. Depending on the type of machine, this may have lethal consequences. Possible causes include the following:

- Faulty wiring, e.g., faulty phase sequence while connecting motor
- Faulty components
- Faulty motor parameters
- Software error

Unintended motor shaft movement is caused by errors in the motor control. Depending on the type of machine, this may have lethal consequences. Possible causes include the following:

- Operator errors
- Controller or application program faults
- Faulty setpoint specification and scaling
- Improper operating mode

The monitoring devices in the drive system are capable of detecting various fault states. Their purpose is to reduce the drive speed to zero in a controlled manner before switching off the power supply. However, the monitoring devices by themselves are not sufficient to completely and reliably prevent uncontrolled movement. Uncontrolled movement cannot be prevented completely, even if it occurs only for a brief period of time before a monitoring device trips and shuts down the drive or switch off power supply.

Steps to prevent:

- Always ensure that the is fully de-energized before commencing work on the .
- Check the limit values for torque, speed, and position, as well as the acceleration and deceleration ramps.
- Specify the maximum permissible process speed and set ID113 accordingly.

⚠ DANGER

Danger to life from touching electrical connections!

The permanent magnets of the rotor induce dangerous voltage at the motor connections when the axis rotates, even when the motor is not electrically connected. If the motor is connected to an inverter, the induced DC voltage is linked to the .

Steps to prevent:

- Make sure that the motor shaft does not rotate.
- Make sure that shock-hazard protection is installed at the motor connections.
- Make sure that the terminals are free of voltage.

⚠ DANGER

Risk of injury from hanging axes

The optional motor brake is a holding brake and does NOT provide sufficient protection for persons.

Hanging axes can fall and lead to severe injury.

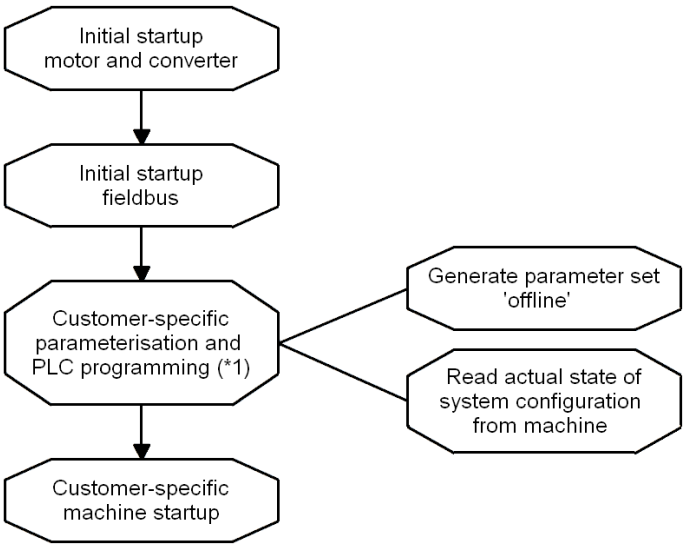
Steps to prevent:

- All hanging axes must be mechanically secured against falling with a fall arrester or a supplementary external brake, for instance.
- People must not stand under hanging loads

⚠ WARNING	
	**Risk of burns when touching hot surfaces!** The casing temperature, for example of the line filter, the choke or the brake resistor, can be more than 70 °C during and even after operation. Contact causes burns. **Steps to prevent:** • Make sure that the surfaces have cooled down before you touch. • Wear protective clothing such as gloves if hot parts need to be touched. • Fit a warning sign with warning hot surface. • Do not mount any flammable objects near the device.

3 Overview machine startup

The startup of a machine, depending on the drive system, is separated into different steps. The following flow chart shows the sequence of the steps.



(*1) The PLC programming is part of the 'Software description AFL - AMK function libraries', Part no. 205795.

KW-R07 / -R17:

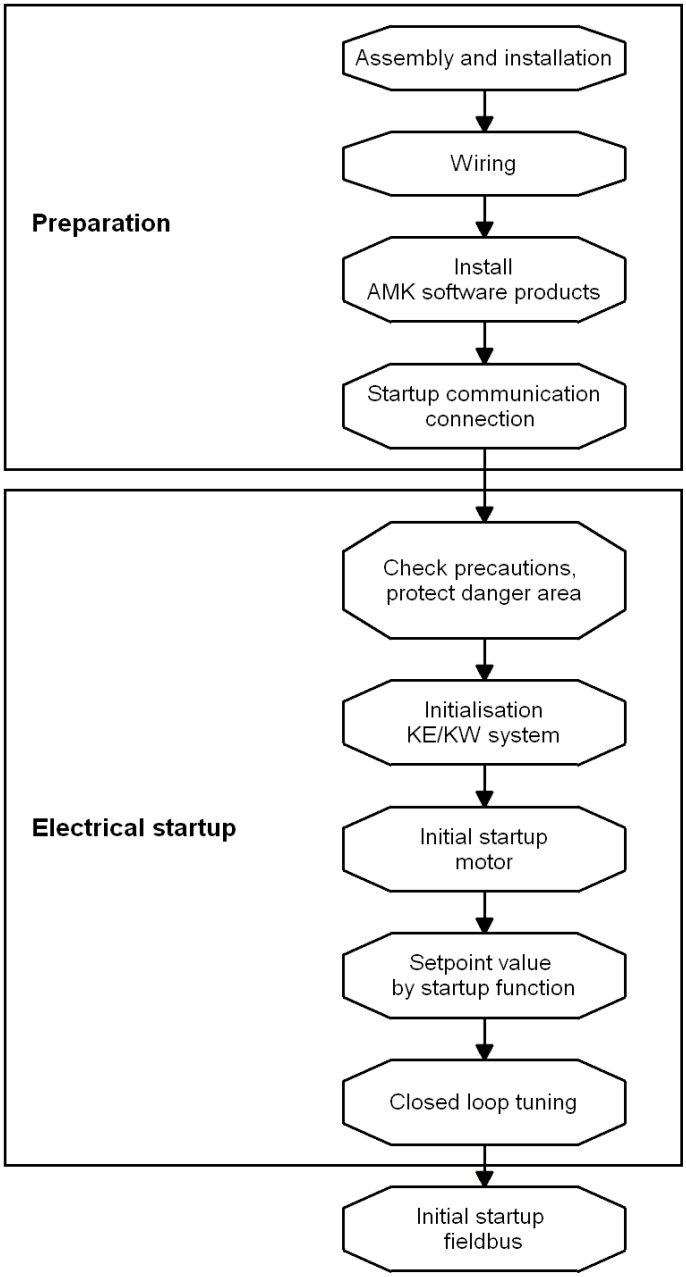
For the machine startup of a controller card with functional safety, the safety functions must be de-activated.

Therefore, the safe inputs must be connected stringently, and the SafePMT parameter set must be adapted. Without these adaptations, the startup of a servo motor is not possible.

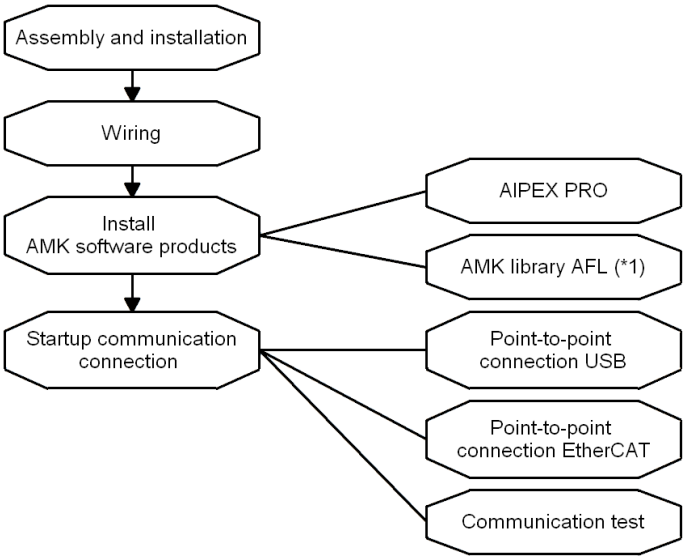
See document 'Safety manual; functional safety' (Part no. 203446), chapter 'Running KW-R07 / -R17 without functional safety'.

4 Overview startup motor and converter

The startup of an AMK drive system is separated into different steps. The following flowchart shows the step-by-step process.



5 Preparation for startup



*1 for PLC programming acc. to. IEC 61131

5.1 Assembly and installation

Mounting KE/KW modules onto a liquid-cooled coldplate

See document 'Liquid-cooled cold plate KW-CP', Part no. 200043.

Mounting KE/KW modules onto an air-cooled coldplate

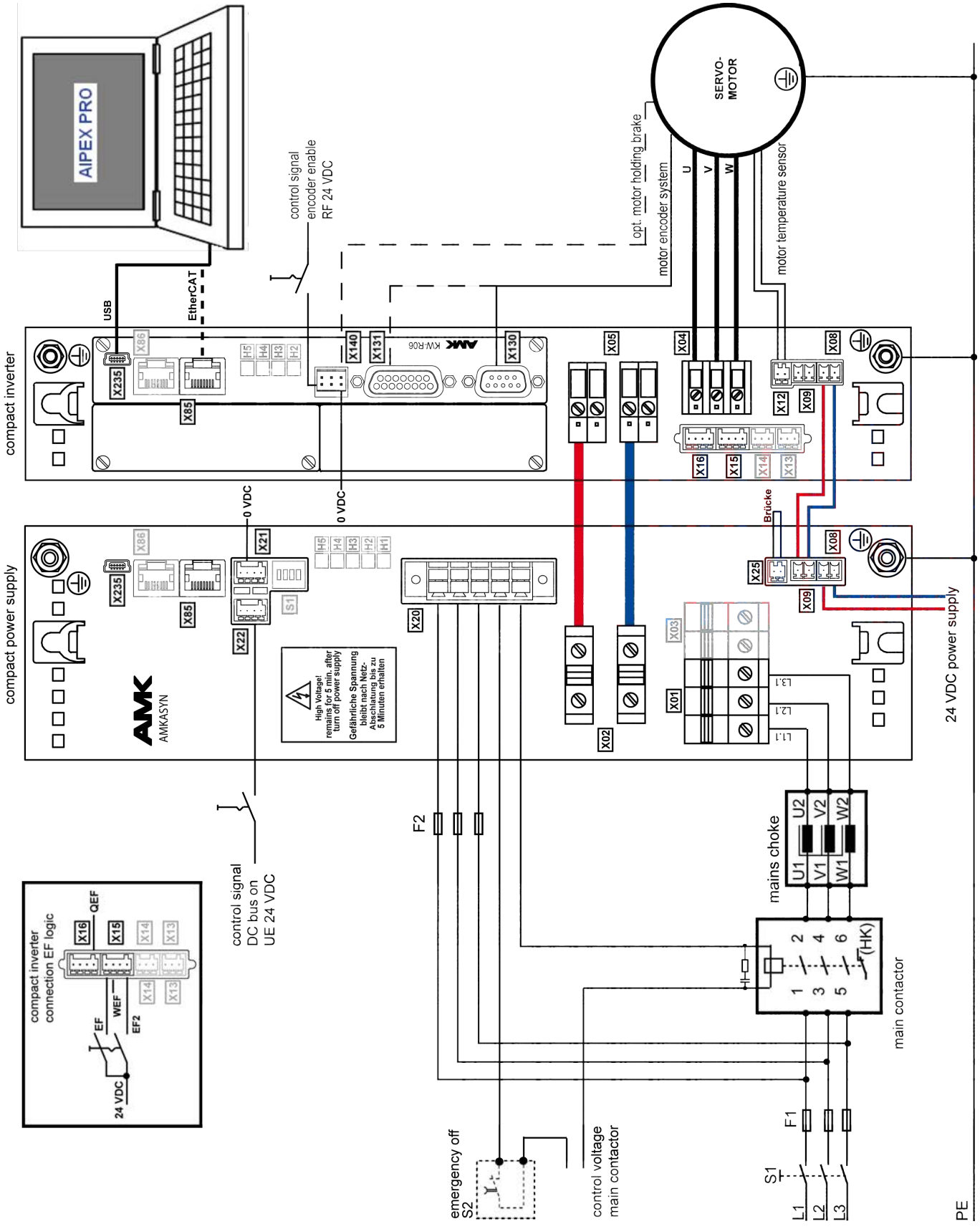
See document 'Fan-cooled cold plate KW-LK', Part no. 202393.

Mounting KE/KW modules with integrated air-cooling system

See document 'Servo drives KE/KW', Part no. 28932
chapter 'Installation of modules with integrated air cooling'.

5.2 Electrical connections (Overview)

For the initial startup of a drive, you need the following connections:
(Example KE 20 and KW 2 with KW-R06)



Connections compact power supply

Connection	Use
H1 - H5	LED status display
S1	Dip switch (device addressing)
X01	Mains connection (external main connector)
X02	DC bus
X03(.1)	External braking resistor
X03.2	External braking resistor
X06	DC bus
X08	Input 24 VDC external power supply
X09	Transmission 24 VDC (total of max. five modules per group)
X20	Power supply to charging circuit, control for main contactor
X21	2 binary outputs
X22	2 binary inputs, 2 binary outputs
X25	PTC thermistor for monitoring temperature of external components such as brake resistors and mains filters
X85	Real-time Ethernet IN
X86	Real-time Ethernet OUT
X235	Mini USB interface for firmware update and parametrisation

For detailed information about system configuration, switch-on components, charging circuit, and mains connection as well as terminal assignments, wire diameters, cable confection and tightening torques:
See document 'Device description Servo drives KE/KW' (Part no. 28932)

Connections compact inverter

Connection	Use
X04	Motor connection
X05	DC bus transmission (max. connected load 60 kVA)
X06	DC bus (max. connected load 100 kVA)
X08	Input 24 VDC external power supply
X09	Transmission 24 VDC (total of max. five modules per group)
X12	PTC thermistor for monitoring motor temperature
X13	Acknowledgement power output stage enable (transmission)
X14	Power output stage enable (transmission)
X15	Power output stage enable EF / EF2
X16	Acknowledgement of power output stage enable
X17	Power output stage enable EF EF2
X18	Power output stage enable transmission

The two axes of a compact double inverter KWD are distinguished by labelling A and B. e.g. X04A and X04B are the different motor connections

For detailed information about system configuration and switch-on components as well as terminal assignments, wire diameters, cable confection and tightening torques: See document 'Servo drives KE/KW' (Part no. 28932)

For more information about EF connection:
See document 'Device description Servo drives KE/KW' (Part no. 28932), chapter 'Function description KW'.

Connections controller card

Connection [1)]	Use
XS20	Functional Safety: Safety I/O (only KW-R07 / -R17)
X85 / X86	Real-time Ethernet IN/OUT
X130	Resolver
X131	Sinus encoder input
X132	Square-wave pulse interface
X137	ACC bus
X140	Binary inputs and outputs
X141	Binary i/O and analogue inputs
X235	USB

1) The availability of the interfaces depends on the type and the functionality of the used controller card

For detailed information about connection of the controller card, terminal assignments, wire diameters, cable confection and tightening torques:

See document 'Device description Controller cards KW-R06 / -R16 / -R07 / -R17' (Part no. 202744) and Controller cards KW-R24(-R) / -R25 / -R26 / -R27, chapter 'Electrical Connections'.

5.3 Installing AMK software products

5.3.1 AIPEX PRO

Install the AMK software AIPEX PRO (Part no. O811).
AIPEX PRO contains parametrisation and startup software, a IEC 61131-3 programming editor and a firmware flasher.

Required AIPEX PRO version:

KW-R06 / -R16 / -R07 / -R17≥ AIPEX PRO 1.09 SP2

KW-R24 / -R25 / -R26≥ AIPEX PRO 3.0

KW-R24-R / -R27 ≥ AIPEX PRO 3.03

The software must be installed to a PC with operating system Windows® 2000 / XP / Vista or 7. You need local administration rights for installation

For detailed information about AIPEX PRO:
See document 'Software description AIPEX PRO V3' (Part no. 204979).

5.3.2 AFL AMK function library

For PLC programming, you need the AFL AMK function library (Part no. O877) in addition. The AFL library contains standard function blocks to access easily to all standard functions of the controllers, power supplies, and drives.

For detailed information:
See document #Software description AFL - AMK function libraries' (Part no. 205795).

5.4 Communication connection

For initial startup, establish a direct connection between your PC with AIPEX PRO and the AMK device.

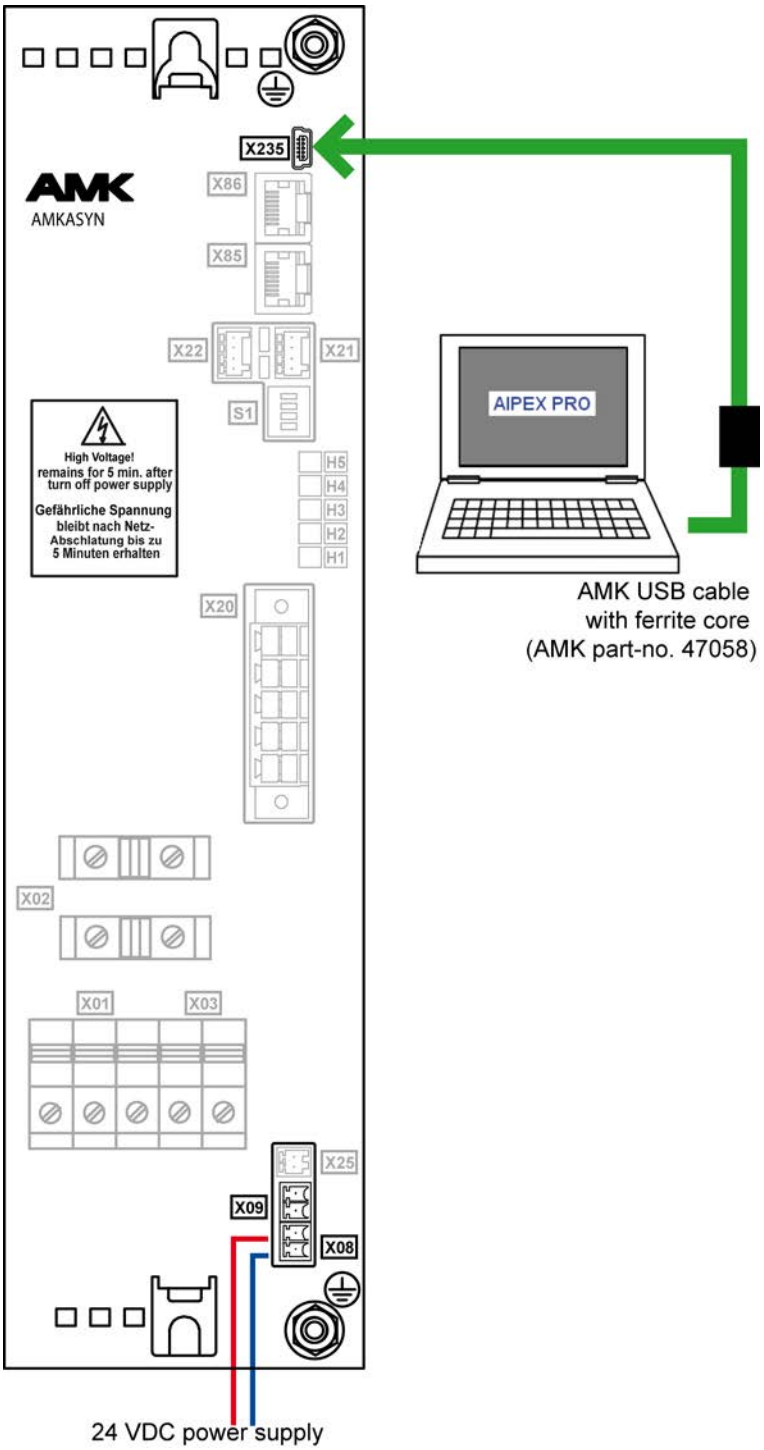
A direct connection is a point to point connection between PC and AMK controller.

Siehe 'Direct connection via USB' auf Seite 18.
Siehe 'Direct connection via EtherCAT' auf Seite 20.

5.4.1 Direct connection via USB

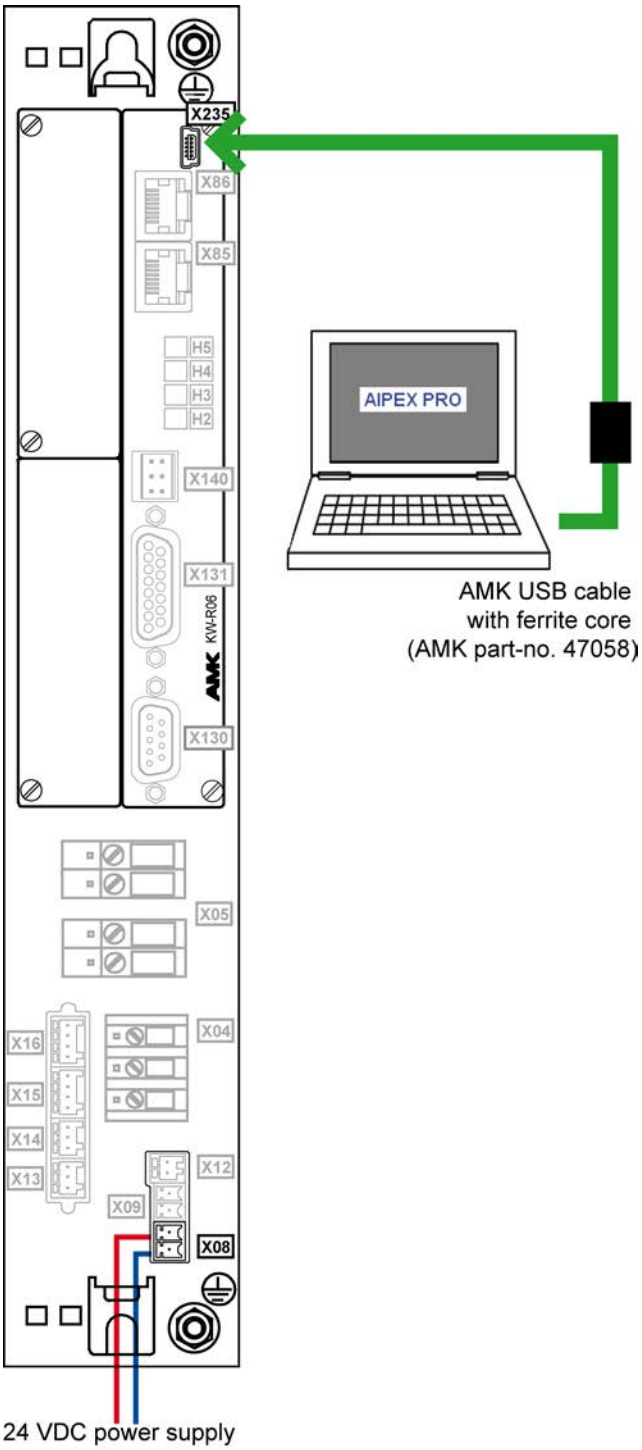
5.4.1.1 Compact power supply

For reading the device data with AIPEX PRO, you will need a 24 VDC power supply at the compact power supply.
Connect the PC with installed AIPEX PRO to the USB interface X235 of the compact power supply. Use an AMK USB cable with ferrite core (Part no. 47058).



5.4.1.2 Compact inverter

For reading the device data with AIPEX PRO, you will need a 24 VDC power supply at the compact inverter.
Connect the PC with installed AIPEX PRO to the USB interface X235 of the inverter. Use an AMK USB cable with ferrite core (Part no. 47058).



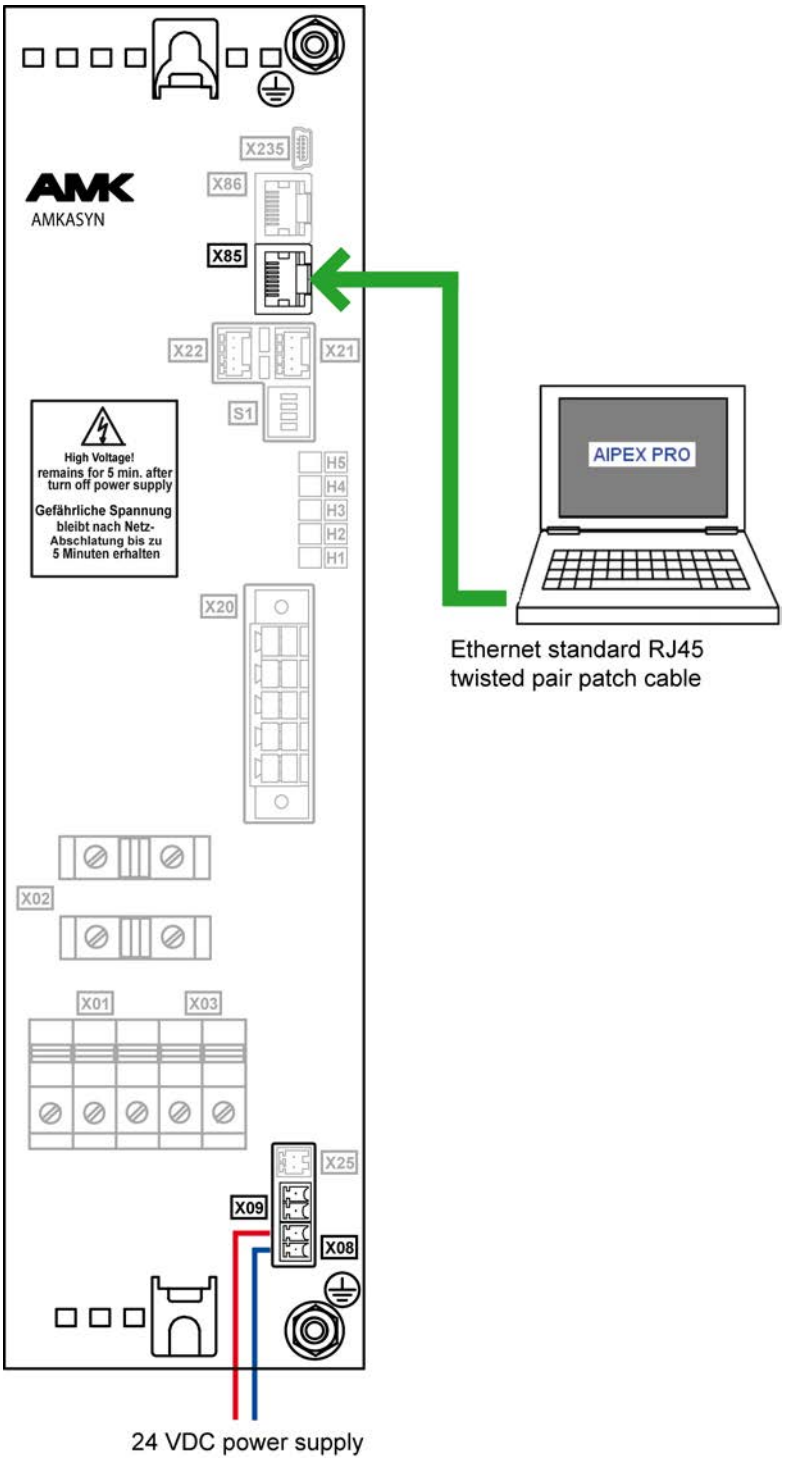
5.4.1.3 USB communication settings

If you use the USB connection, no communication settings must be done.

5.4.2 Direct connection via EtherCAT

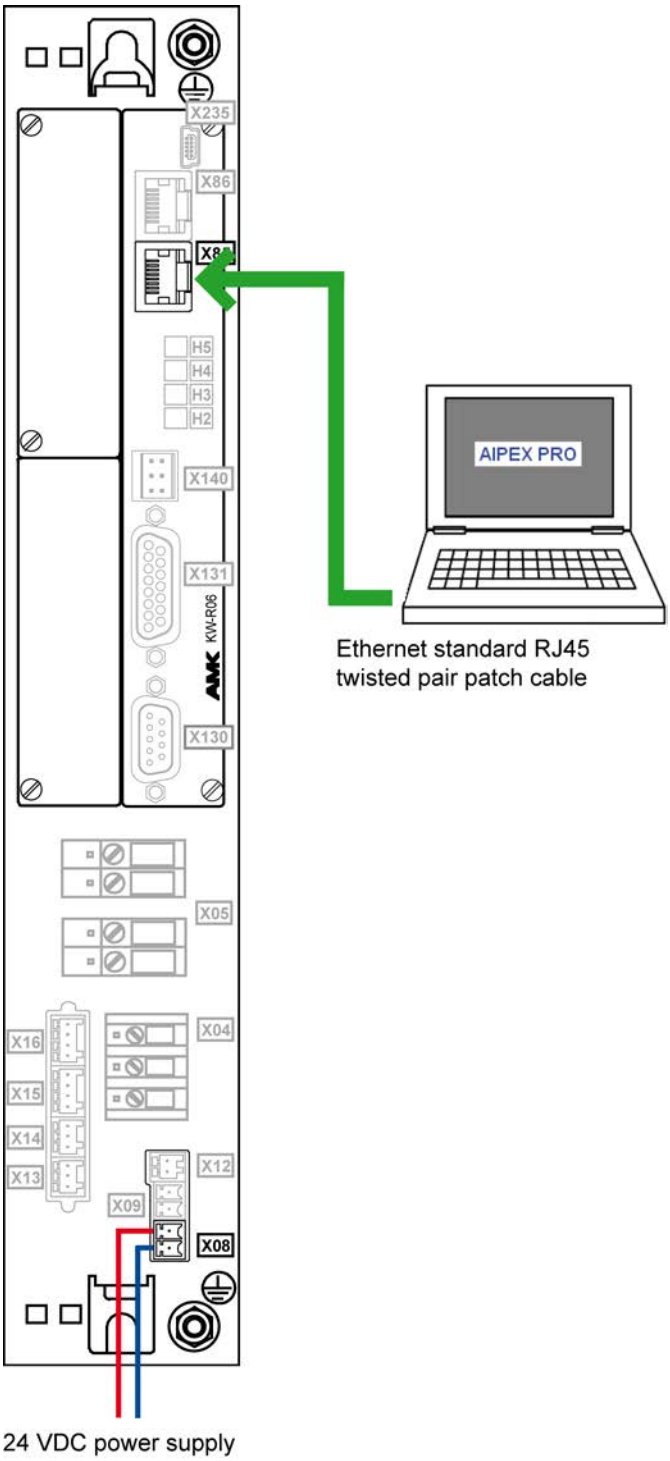
5.4.2.1 Compact power supply

For reading the device data with AIPEX PRO, you will need a 24 VDC supply voltage at the compact power supply.
Connect the PC with installed AIPEX PRO to the Ethernet IN interface X85 of the compact power supply. Use an Ethernet standard RJ45 twisted pair patch cable.



5.4.2.2 Compact inverter

For reading the device data with AIPEX PRO, you will need a 24 VDC supply voltage at the compact inverter.
Connect the PC with installed AIPEX PRO to the Ethernet IN interface X85 of the compact inverter. Use an Ethernet standard RJ45 twisted pair patch cable.



5.4.2.3 EtherCAT communication settings

EtherCAT master

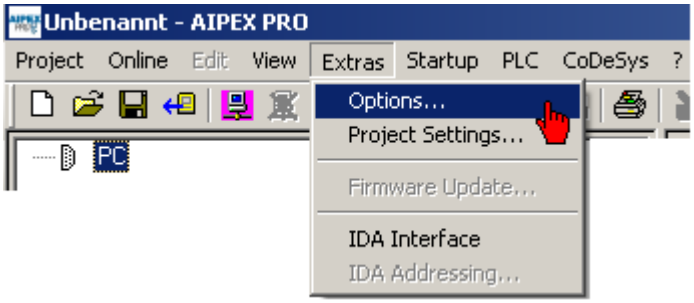
On a point to point connection via EtherCAT, the PC works as EtherCAT master.
The Ethernet network settings of the PC are not to be changed.

EtherCAT slave

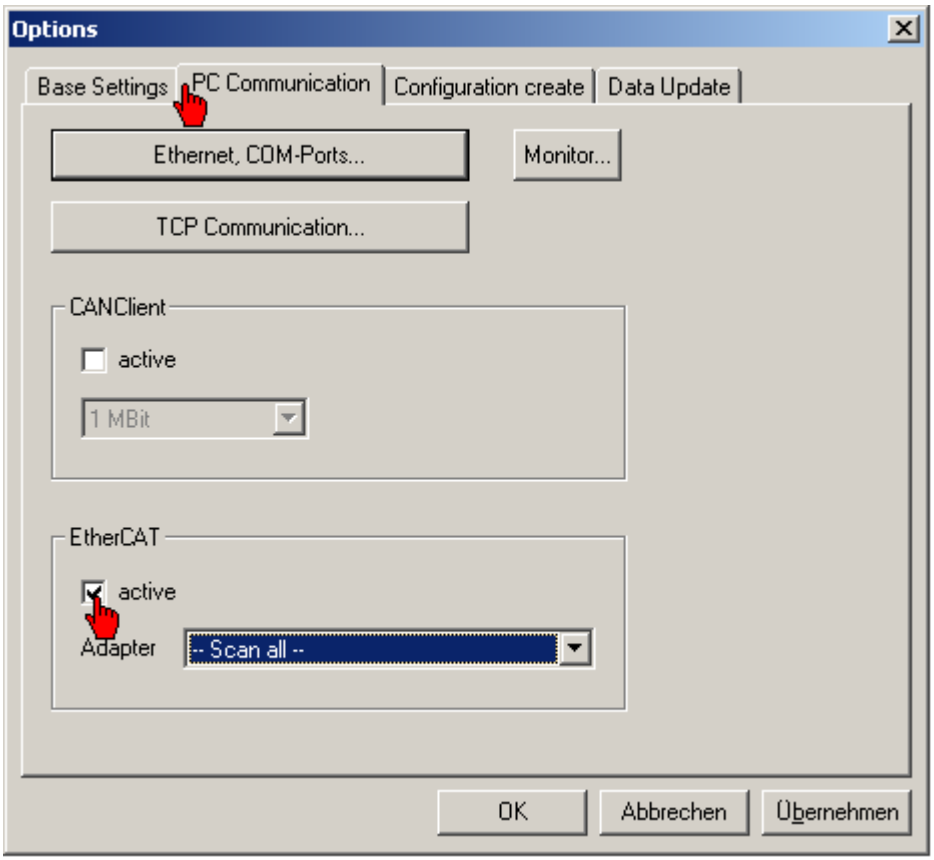
The connected drive (compact power supply or compact inverter) establishes the EtherCAT slave. Its network settings must be adapted:

Start AIPEX PRO

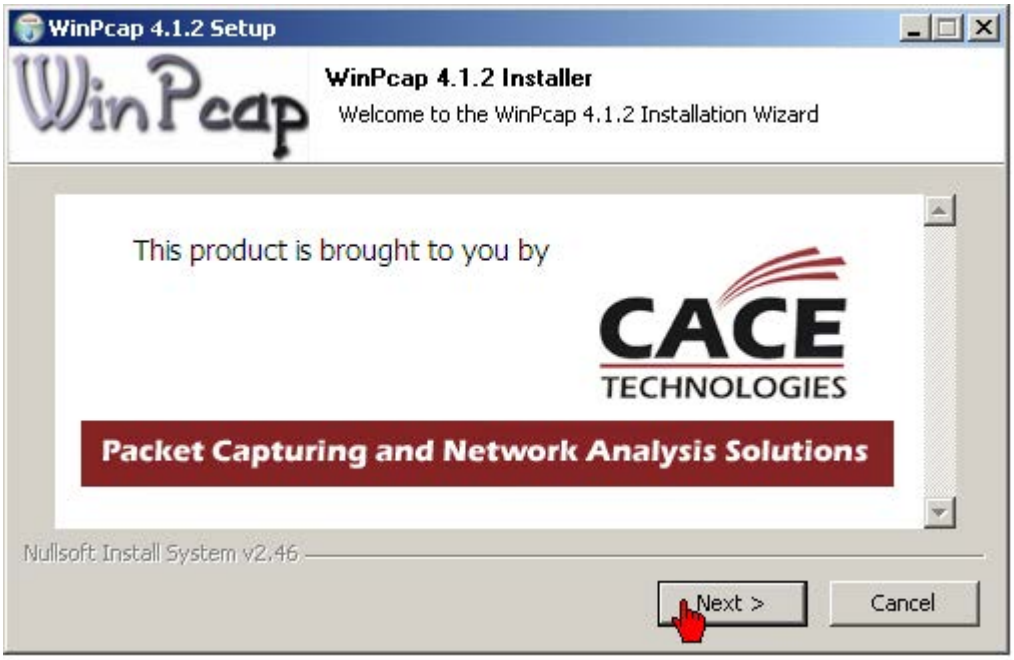
Start menu 'Extras' → 'Options'



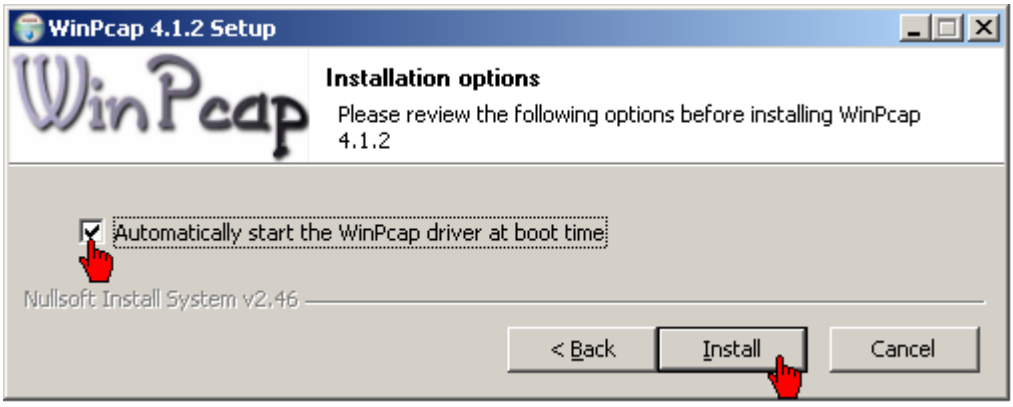
In register 'PC Communication', the EtherCAT communication can be activated and de-activated.
You can shorten the initialising phase by selecting the used Ethernet adapter of your interface.



Prerequisite WinPcap:
WinPcap will be automatically installed with AIPEX PRO



When installing WinPcap, the option 'Automatically start the WinPcap driver at boot time' must be activated mandatorily.
This option cannot be set later, a new installation will be necessary.



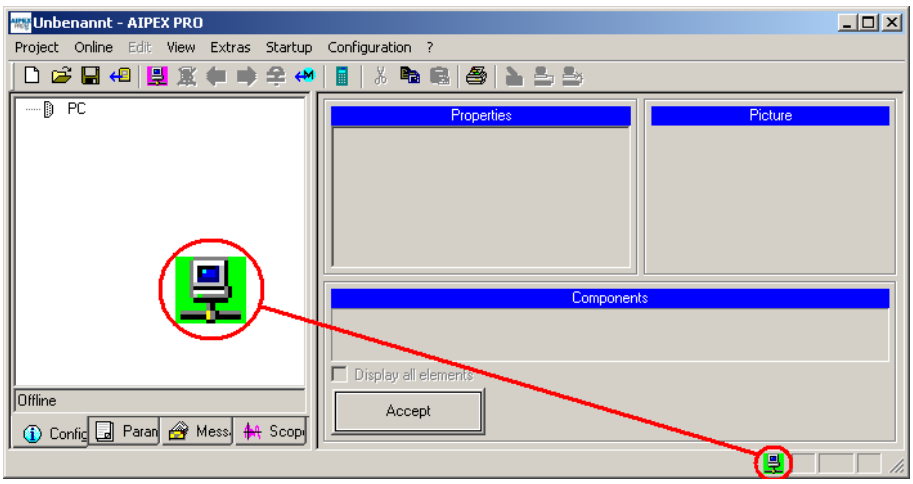
Modified communication setting require AIPEX PRO to be restarted.

5.4.3 Testing the communication

1. Connect the 24 VDC power supply to the device.
   Siehe 'Direct connection via USB' auf Seite 18.
   Siehe 'Direct connection via EtherCAT' auf Seite 20.
2. Start AIPEX PRO
3. After the initialisation is terminated, the green PC symbol in the status bar shows the activated connection between the AIPEX PRO PC and the AMK device.

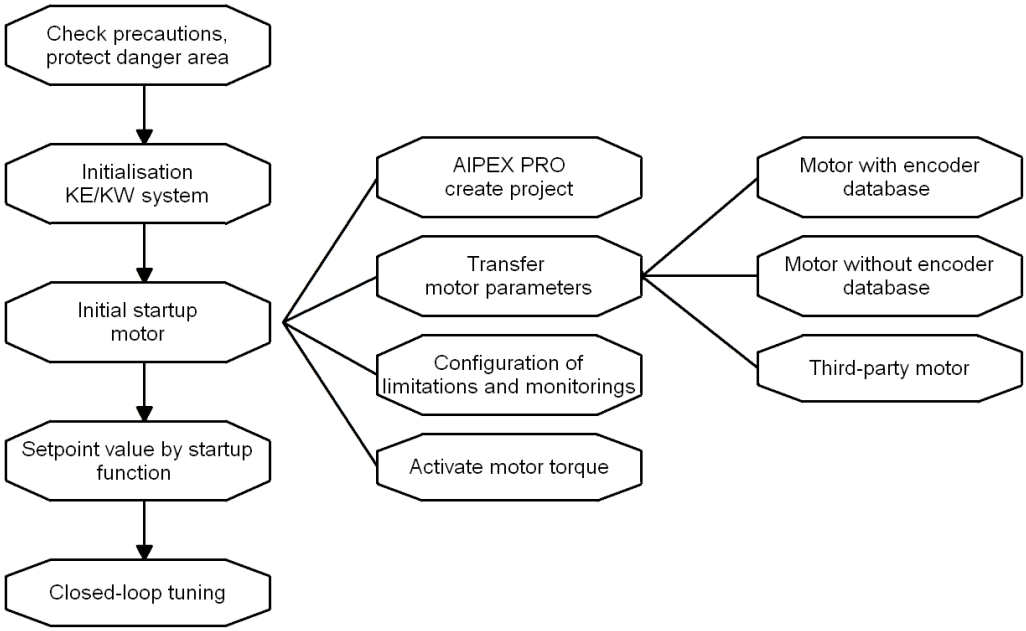
Prerequisites:

- communication is defined in AIPEX PRO
- connecting cable between PC and device
- AIPEX PRO window maximised (full screen)



green symbol	activated connection between the AIPEX PRO PC and the AMK device
no resp. red symbol	• no connection established • no interface defined • AIPEX PRO window not at full screen
two-coloured symbol (green / red)	multiple communication interfaces activated in AIPEX PRO

6 Electrical startup



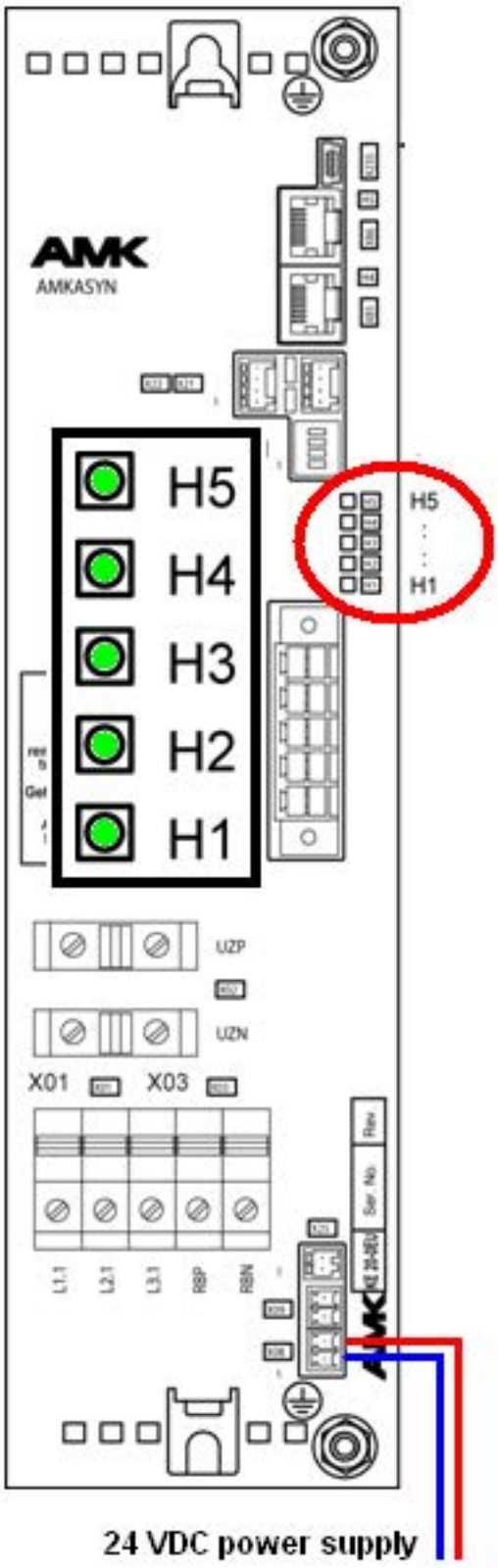
6.1 System run-up KE/KW

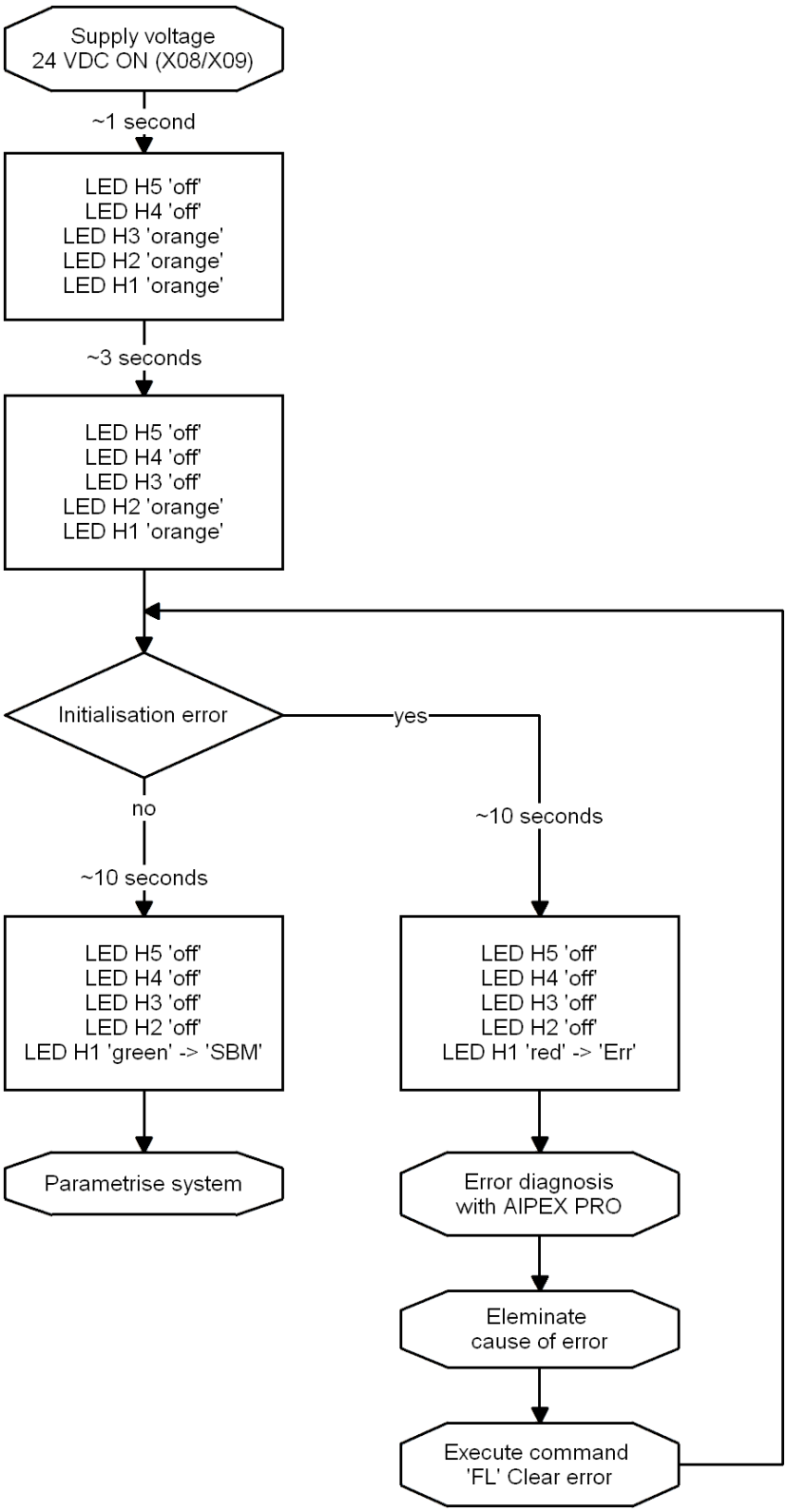
The SBM 'System ready message' acknowledges the error-free run-up of the devices and is prerequisite for activating the motor control.

If an error occurs during the system run-up, it is signalised by the LEDs of the compact power supply or the controller card of the compact inverter. By means of AIPEX PRO, details can be read.

Siehe 'Error diagnosis with AIPEX PRO' auf Seite 67.

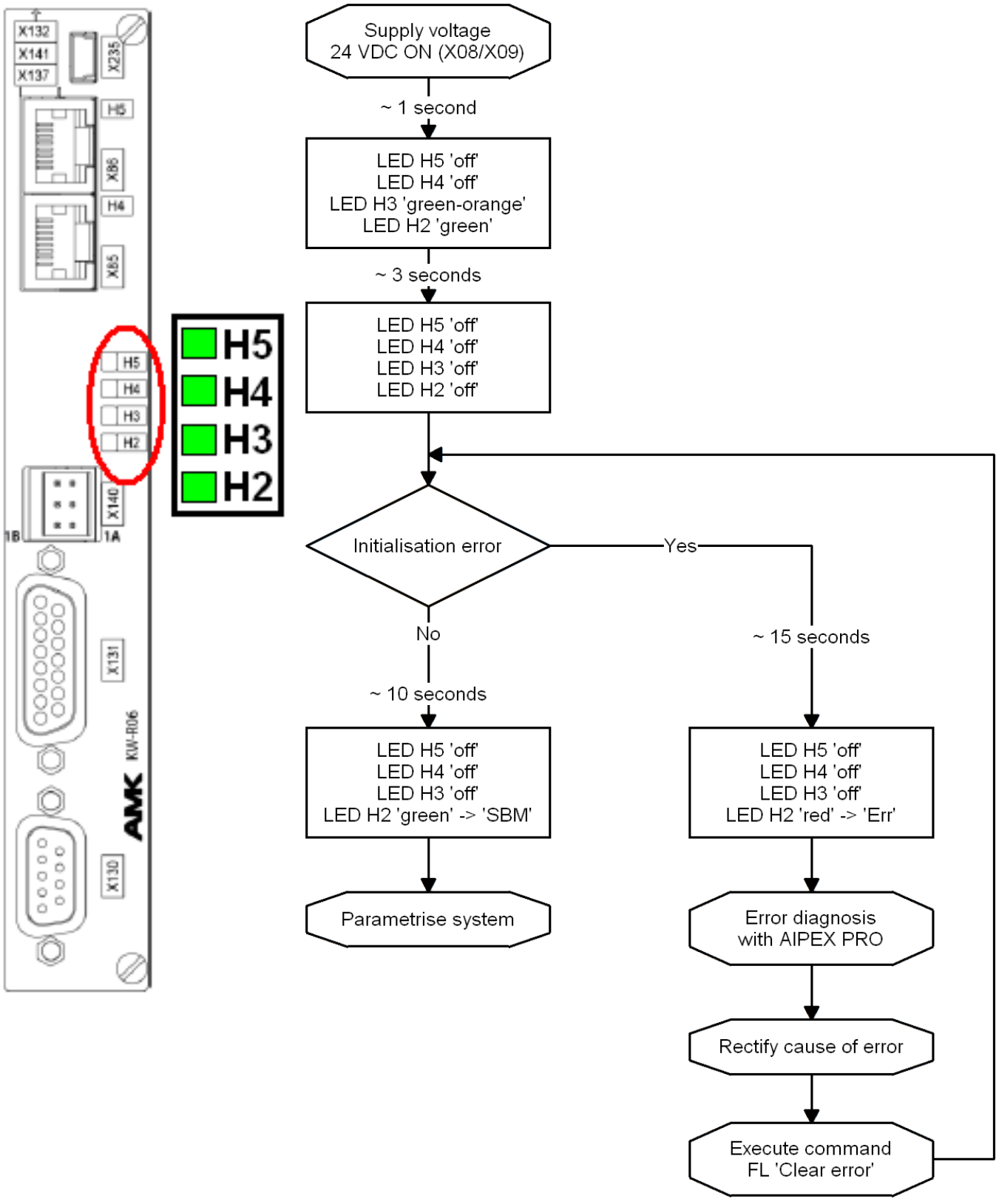
System run-up KE without fieldbus system



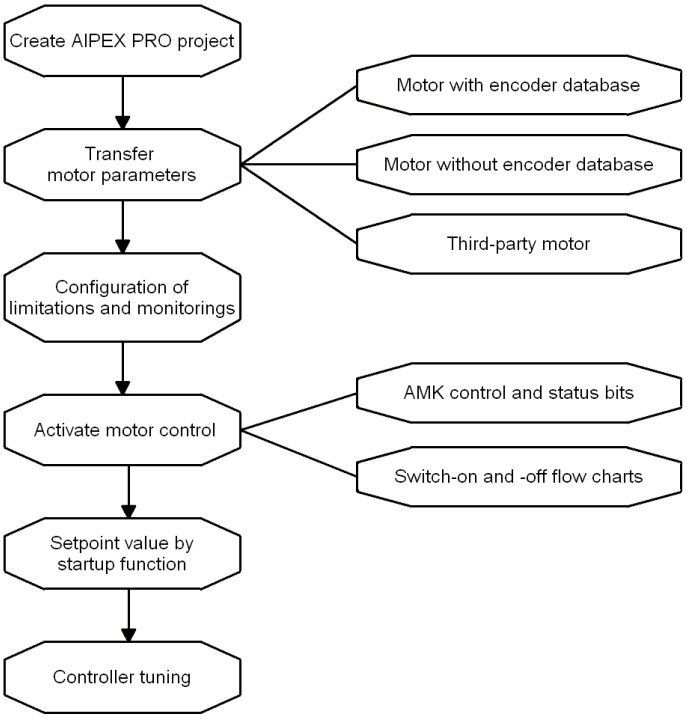


System run-up without fieldbus system

Example KW-R06



6.2 Initial startup motor

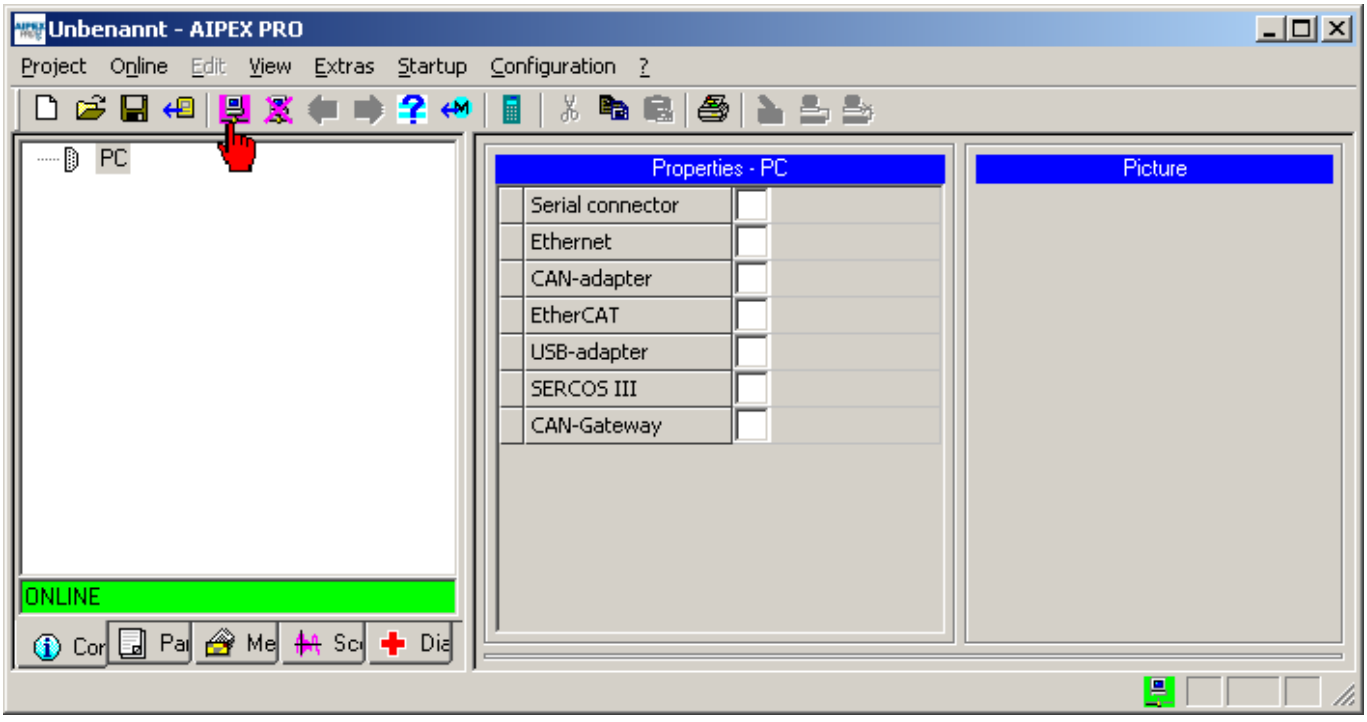


6.2.1 Creating an online project for initial motor startup

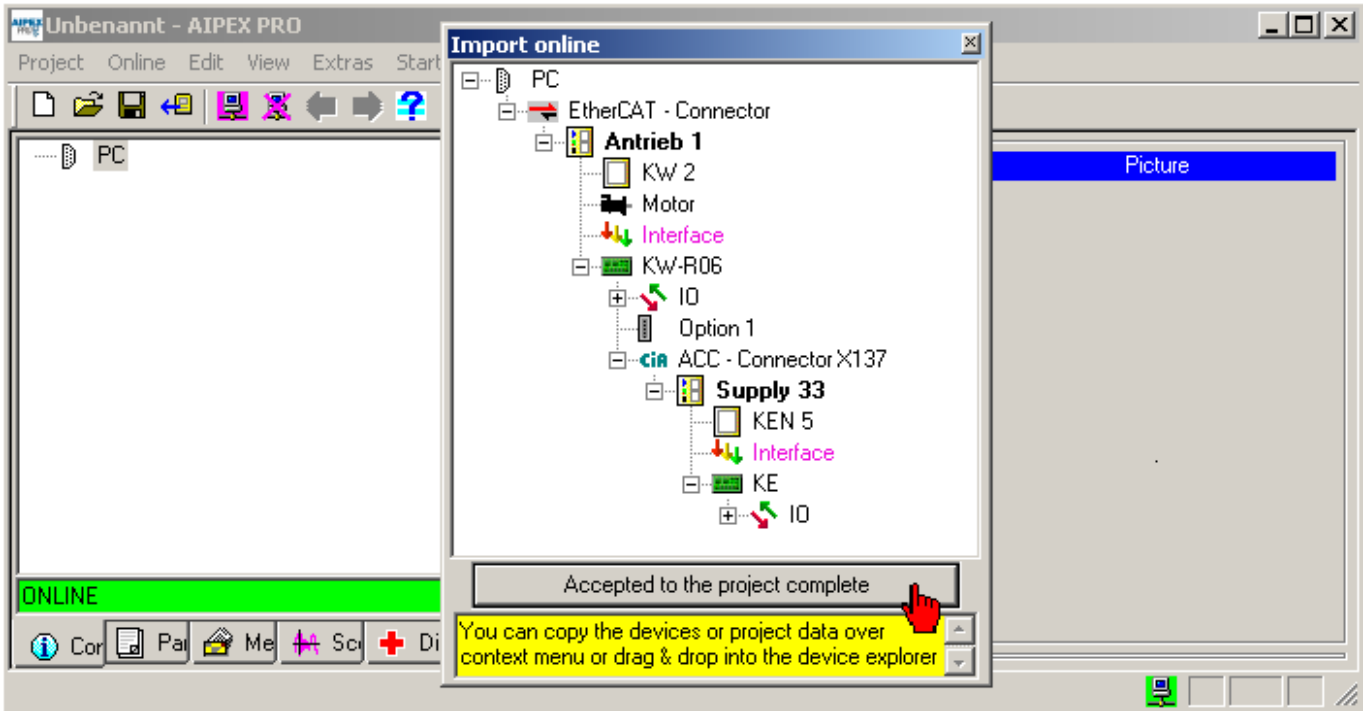
On an online project, the properties and parameter values of a physically existing drive system are transferred to the AIPEX PRO software.
Prerequisite: successful communication test. Siehe 'Testing the communication' auf Seite 23.

Transferring parameters online to the AIPEX PRO project

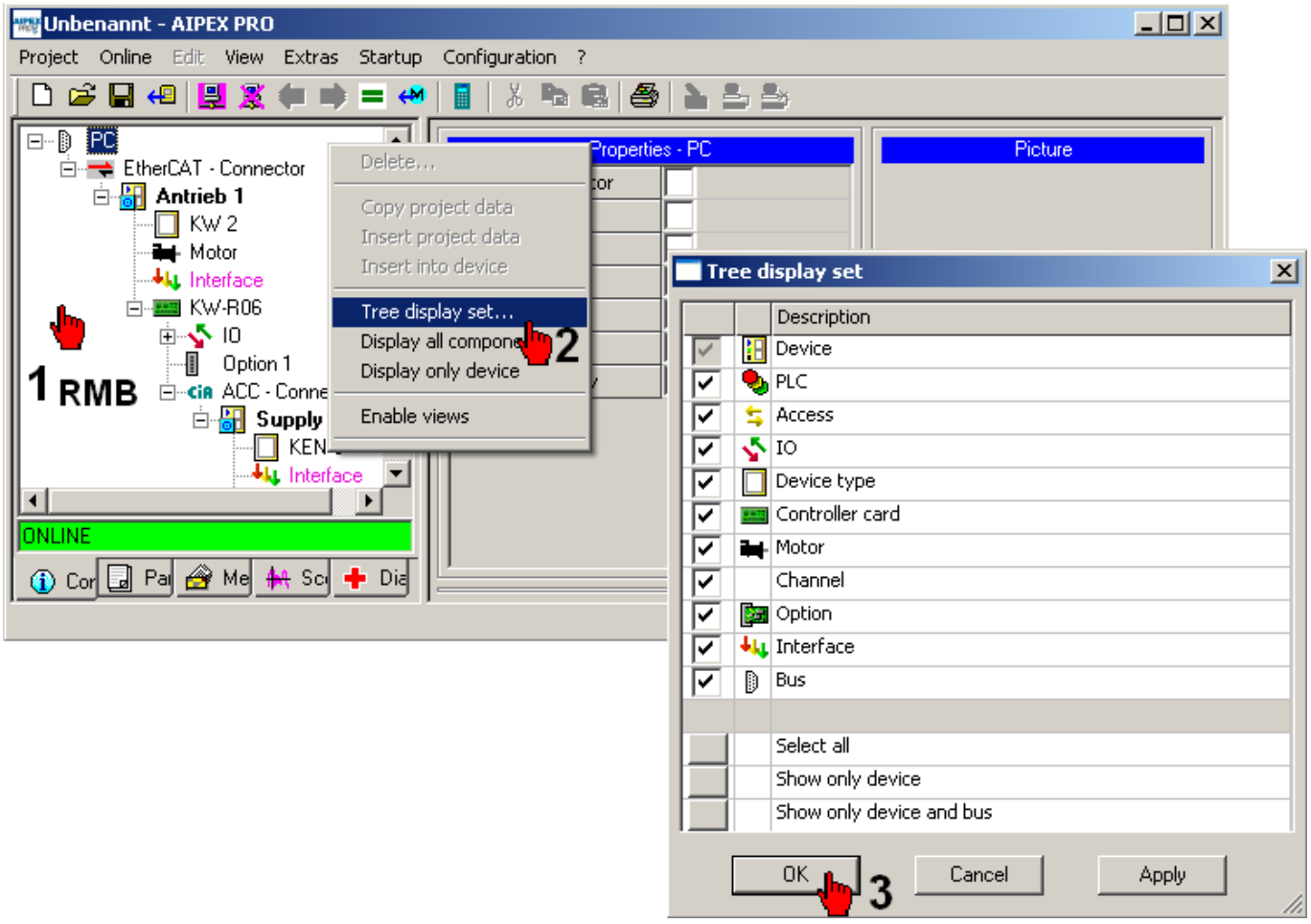
Click to the 'Logon' button to scan the connected drive system



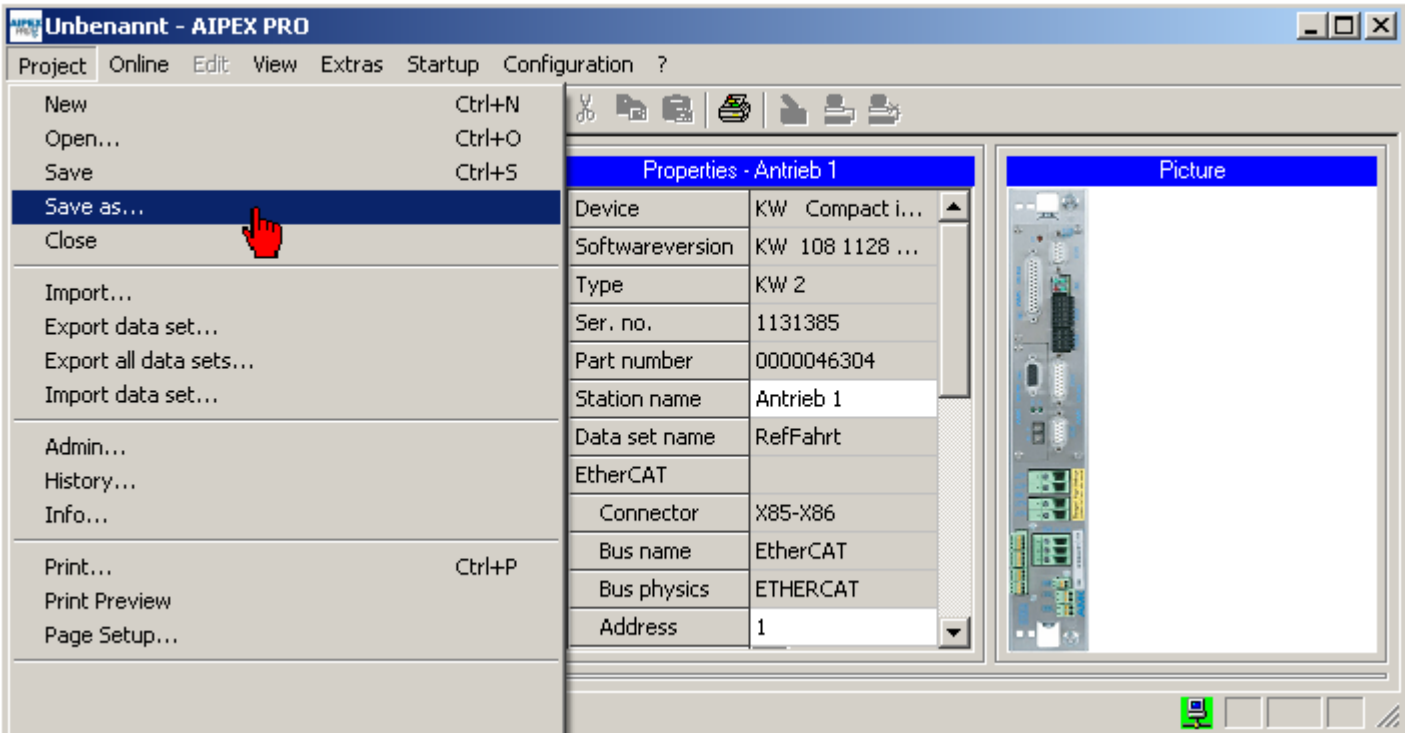
The 'Import online' window starts automatically and show all connected devices.
Click to 'Accepted to the project complete' to transfer the data to the project.



The connected devices are displayed in the device tree.
Click RMB in the device tree window and 'Tree display set...' to select the device types to be shown in the device tree window.



The transferred project data should be saved to a storage medium (e.g. hard disk).
'Project' → 'Save as...'



6.2.2 Entering motor parameters

DANGER	
⚠	**Danger from uncontrolled rotational movements of the motor shaft!** If the motor parameters are entered faultily, the motor cannot be controlled and it might move unexpectedly as soon as the controller enable signal (RF) is activated. **Steps to prevent:** • Recheck the entered motor parameters before setting the RF signal. • Make sure that no person stays within the vicinity of the machine when setting the RF signal after entering the motor parameters for the first time.

The process depends on the type of the implemented motor encoder system

AMK absolute encoder type E, F, P, Q, S, T, U, V and Y
Siehe 'Motors with encoder data base' auf Seite 30.

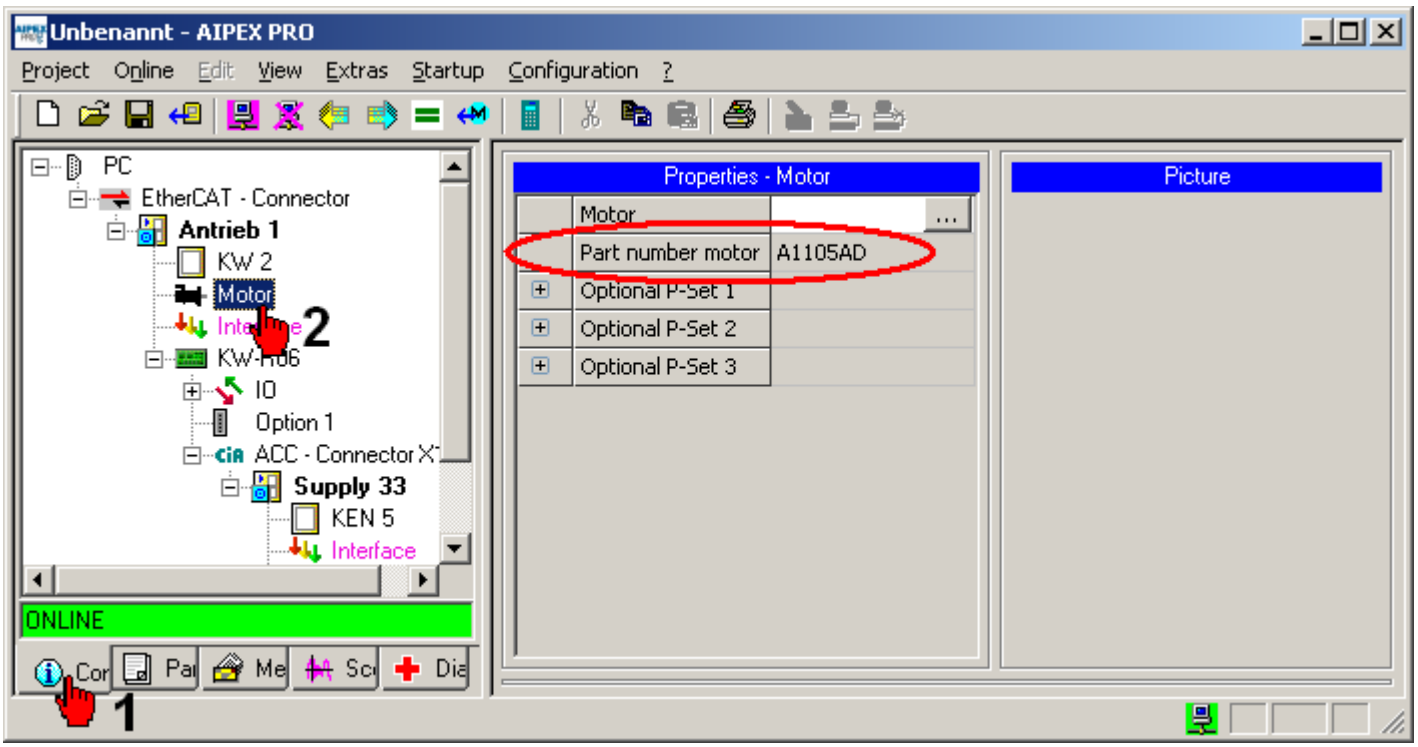
AMK I encoder or resolver
Siehe 'Motors without encoder data base' auf Seite 32.

Third-party motor
Siehe 'Third-party motors' auf Seite 33.

6.2.2.1 Motors with encoder data base

The encoder data base of AMK absolute encoder types E, F, P, Q, S, T, U, V and Y contains all relevant motor parameters needed for the initial startup.
In state of initial loading, the encoder data base is read automatically. As soon as the motor parameters were changed, this function is not active any more.

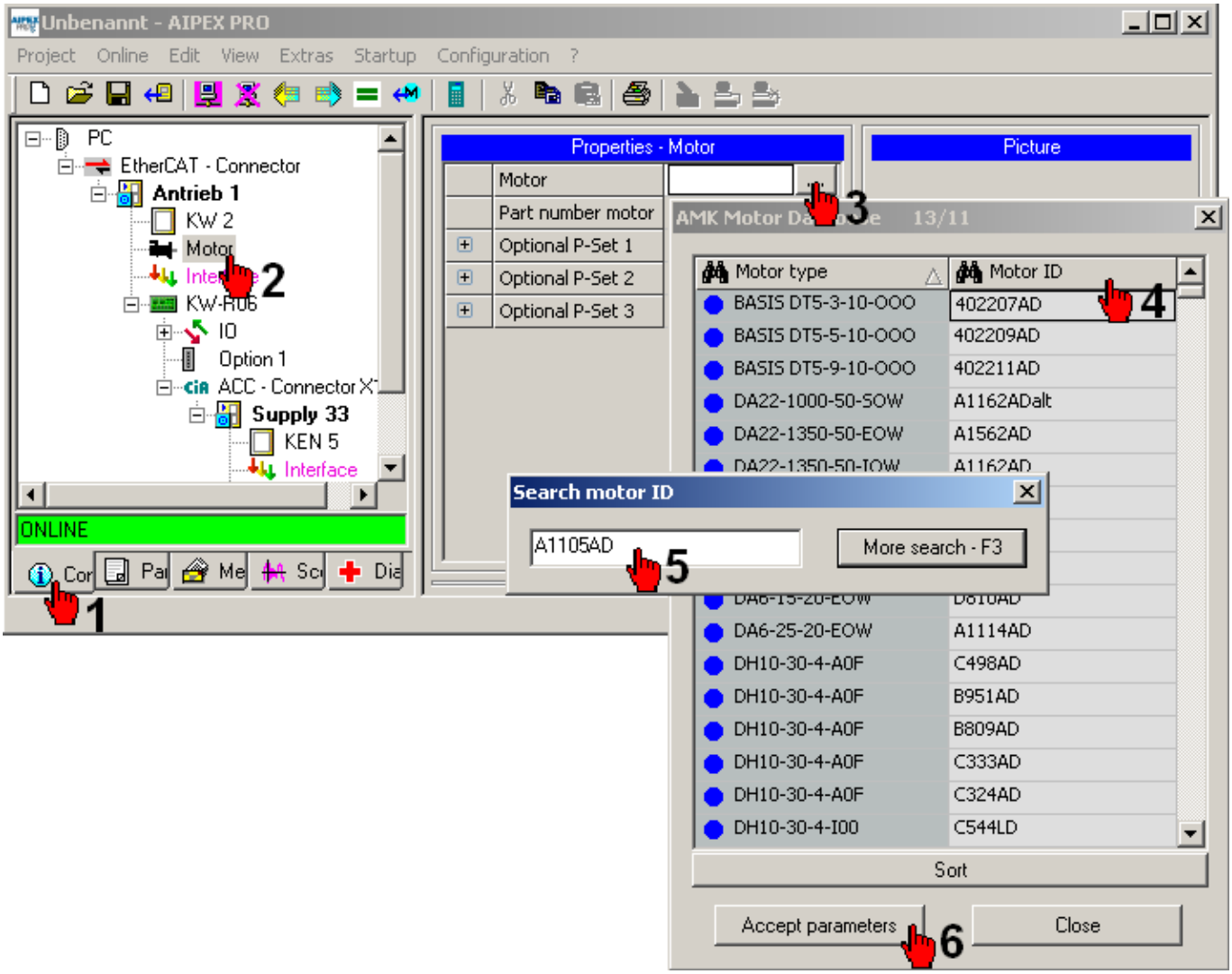
A motor part number displayed after system run-up shows that the motor parameters of the encoder system were transmitted to the controller. For checking purposes, you can compare the displayed part number with the data on the motor type plate.


Unbenannt - AIPEX PRO
Project Online Edit View Extras Startup Configuration ?
PC
EtherCAT - Connector
Antrieb 1
KW 2
Motor
Interface
KW-Hü6
IO
Option 1
ACC - Connector X7
Supply 33
KEN 5
Interface
ONLINE
Properties - Motor
Motor
Part number motor
A1105AD
Optional P-Set 1
Optional P-Set 2
Optional P-Set 3
Picture
1
2

6.2.2.2 Motors without encoder data base

For motors without encoder data base (type I or R encoder), the relevant motor parameters for initial startup can be imported from the motor data base integrated in AIPEX PRO.

Your will get the motor ID (part number) from the motor type plate.

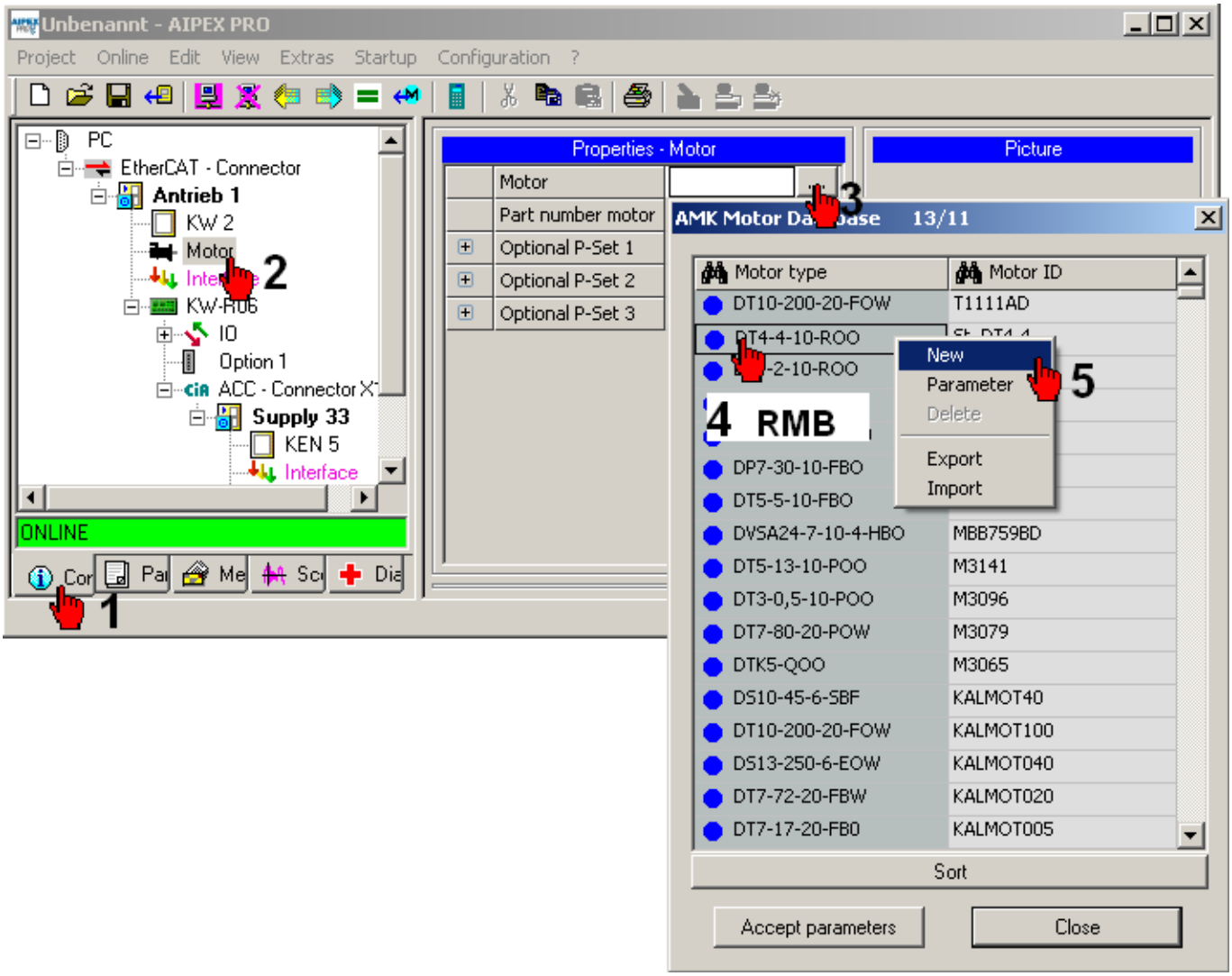


Motors not existing in the database can be added like third-party motors.

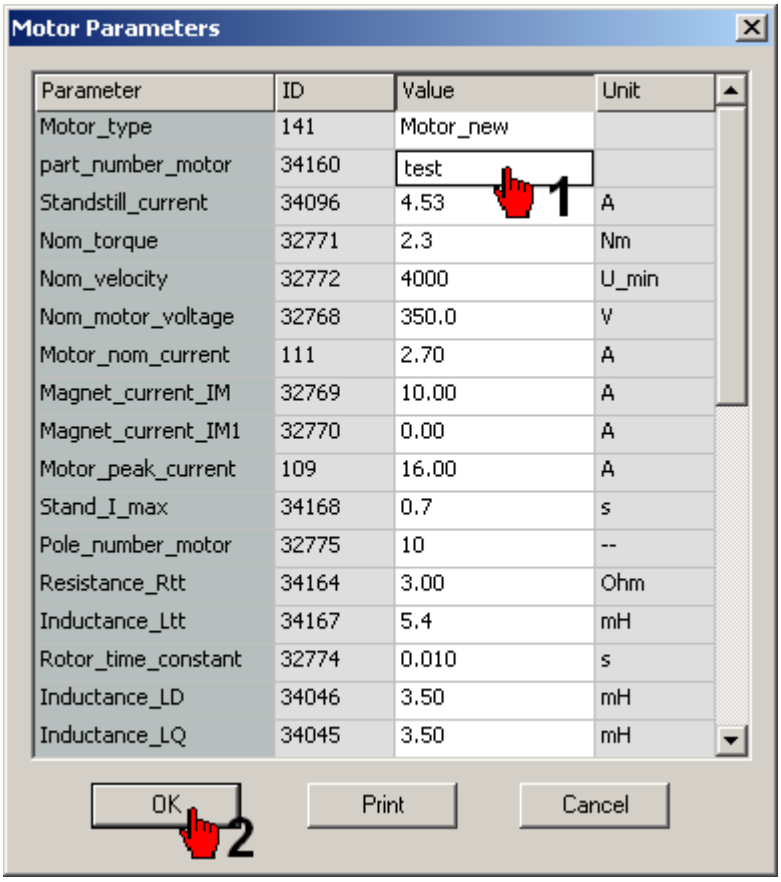
Siehe 'Third-party motors' auf Seite 33.

6.2.2.3 Third-party motors

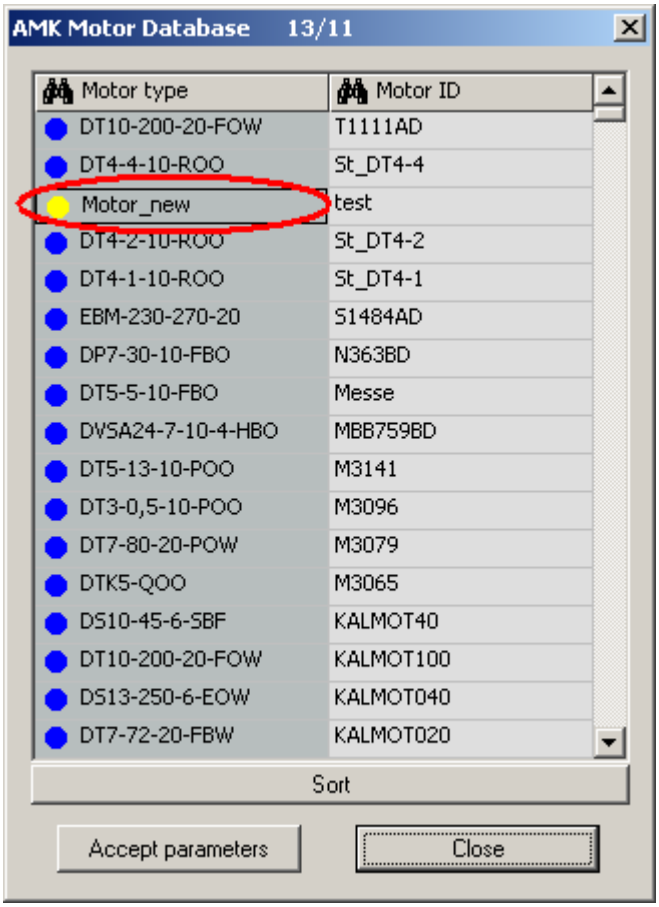
You can add any third-party motor to the AMK motor data base. Manually generated data sets will remain after an AIPEX PRO update.



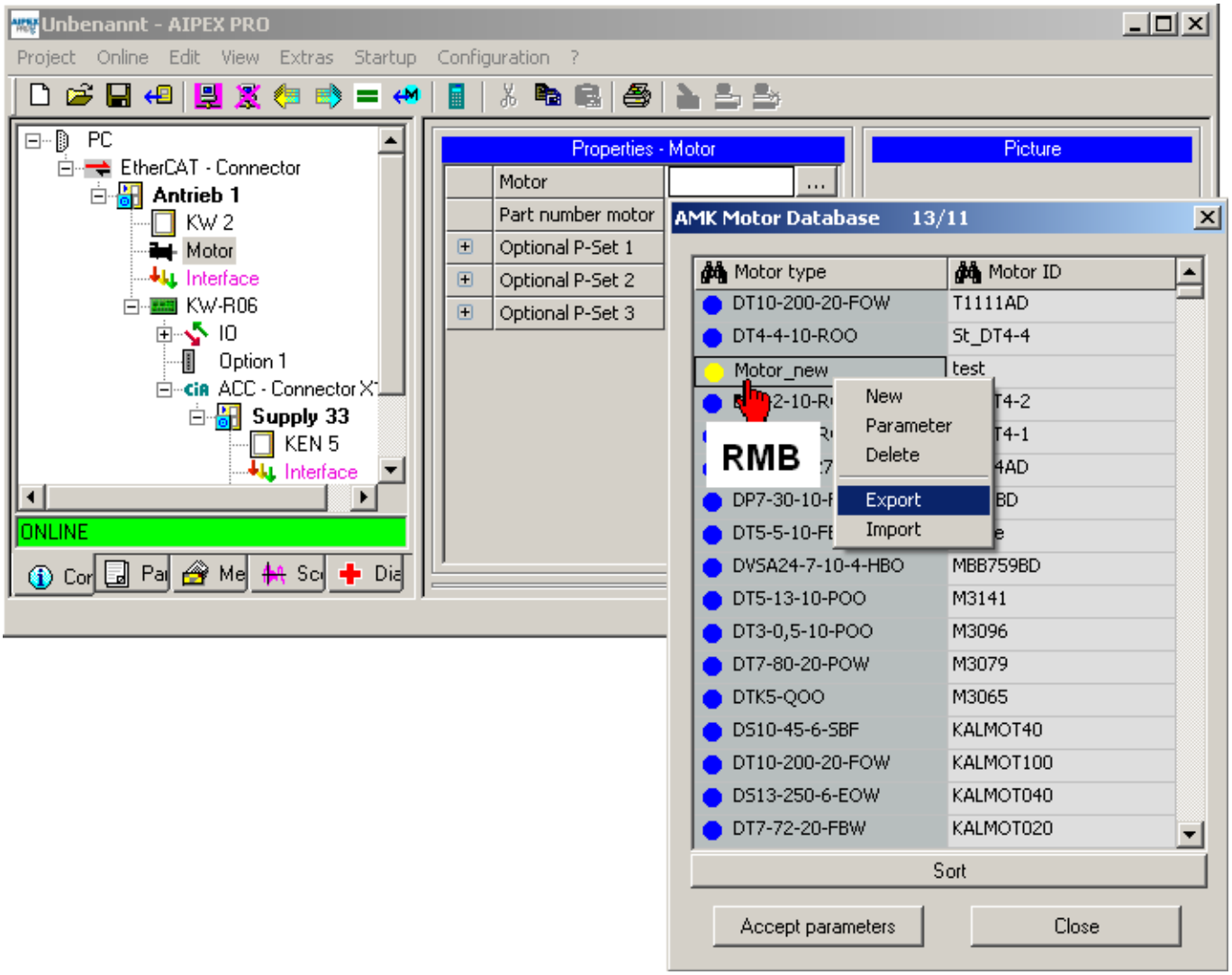
Enter all relevant motor parameters.



The third-party motor will be displayed with a yellow symbol.



By means of 'Export', the selected data set is saved to the hard disk as *.mdb file. This *.mdb file can be imported to another AIPEX PRO project ('Import')



6.2.3 Configuring limitations and monitorings

⚠ WARNING	
	**Hazard due to changing parameters!** The incorrect entering of parameters into the controller card significantly influences the drive system characteristics and creates an increased risk of accidents and damages! **Steps to prevent:** • Change parameters only if you are sure of the meanings and the consequences. If you are unsure, read the parameter documentation or ask the manufacturer or supplier.

Adapting the following parameters reduces the risk of personal injury or material damage during the initial startup.
ID113 'Maximum speed'

Adjust ID113 so that the entered speed plus 25 % does not cause any damage within the process.

ID82 'Positive torque limit'
ID83 'Negative torque limit'

Start with small limit values, e.g. of 5 % and increase in small steps. .
These parameters can be increased during operation by means of the menu 'Startup' → 'Temporary parameters'.
If the entered limit is too small, the motor can not start to rotate, because the breakaway torque is greater than the entered limit value.

ID38 'Positive velocity limit'
ID39 'Negative velocity limit'

Start at limits of ±50 1/min.
These parameters can be increased during operation by means of the menu 'Startup' → 'Temporary parameters'

ID32782 'Deceleration ramp RF inactive'

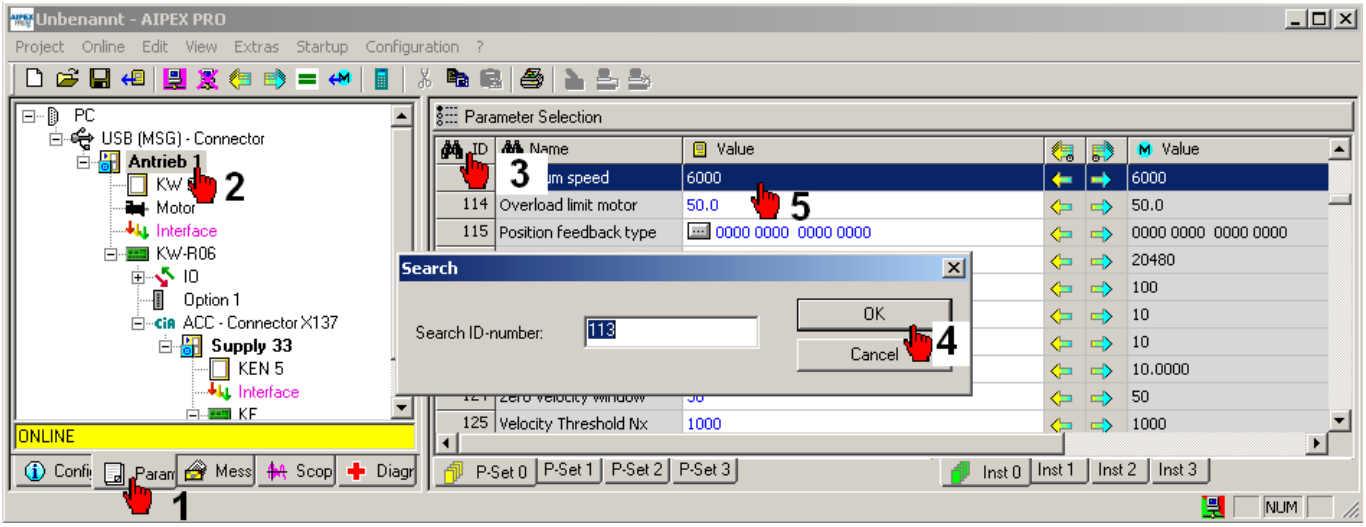
Adjust ID32782 so that the entered value does not cause any damage to the mechanical system during braking down.

ID159 'Excess error'
ID32922 'Residual distance erase window'
ID34182 'Limit position increment'

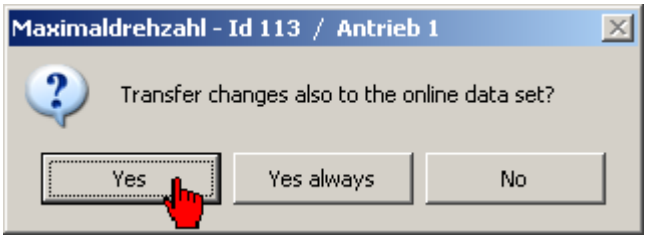
ID32773 'Service bits' Bit14 = 1 (i^2t monitoring of motor inactive)

The modifications of the above mentioned parameters become valid after setting the RF signal (controller enable) or the next system run-up.

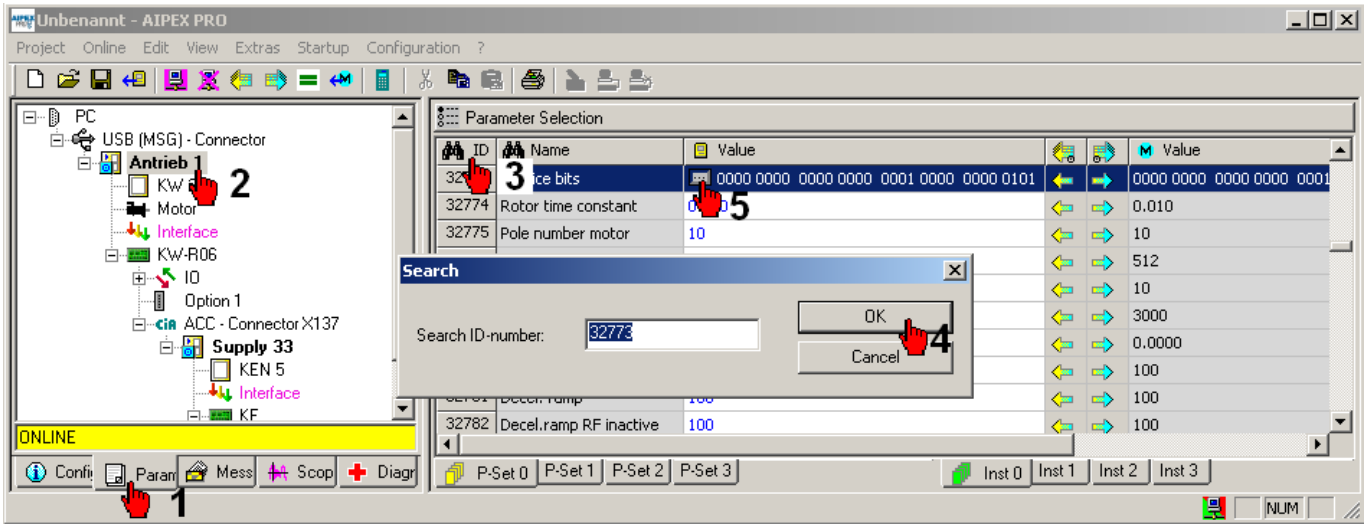
Example: parameter modification by entering a new value

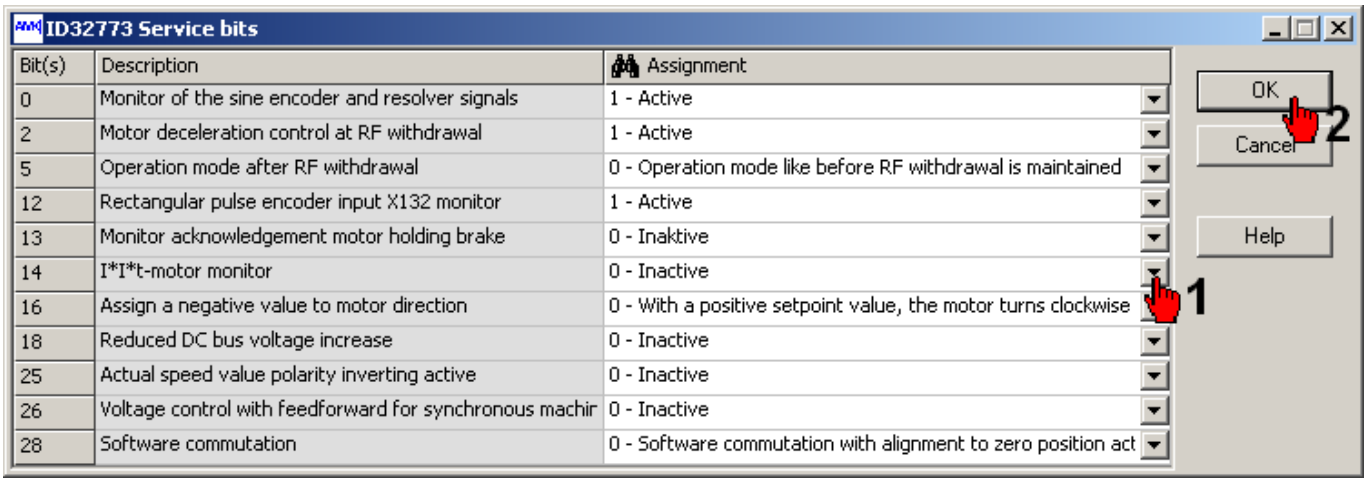


The value is modified within the AIPEX PRO offline data set on the PC. It must be transferred to the online data set on the device.

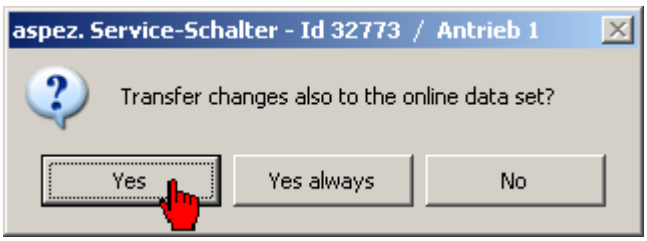


Example: parameter modification by means of an input window





The value is modified within the AIPEX PRO offline data set on the PC. It must be transferred to the online data set on the device.



6.2.4 Activating the motor controller

The motor controller is activated by the 'controller enable' signal (RF).
Prerequisite are the 'system ready message' (SBM; devices are run-up error-free) and the 'acknowledgement DC bus on' (QUE; DC bus is charged).
The parameters ID32795 'Source UE' and ID32796 'Source RF' define the sources of the control signals.
RF can be set by a binary input or a PLC command as well as an AND operation of both.
UE can also be commanded by binary inputs or PLC. Furthermore, it can be transferred automatically from the SBM signal.
Operations (PLC AND binary input) or (SBM AND binary input) are possible.
The default setting is activation by binary input.

6.2.4.1 Status and control signals

The operation state of the drive system will be commanded and acknowledged by means of control and status signal.

The optional EF logic (power output stage enable) has to be controlled by binary inputs and outputs. Any other signals and states can controlled and read by binary inputs and / or fieldbus.

6.2.4.1.1 Status signals

Signal	Name	Meaning
SBM	'System ready message'	After system booting without an error, SBM will be set and shows that the system is free of error. In case of an error SBM will be reset and a diagnosis message will be generated. The system reaction in case of an error (e.g. running out, brake down according ID32873 'Deceleration ramp RF inactive', system booting abort) depends on the kind of error. (See document Diagnostic messages (Part no. 25786), chapter Meaning of the diagnostic messages. The diagnosis messages can be read out with the software AIPEX PRO or read and evaluated by a controller. After the error cause is removed a system booting (ID33730 'System booting') has to be executed.
QUE	'Acknowledgement DC bus on'	QUE acknowledges that the DC bus voltage is inside the valid range.
QRF	'Acknowledgement controller enable'	QRF acknowledges the active control mode of the drive. Setpoints can be set depending on the configured operation mode (ID32800...). If QRF = 0 the drive is free of torque and no control mode is active.

Default adjustments

Signal	Hardware	LED	Terminal	Parameter	Code	Reflection	PLC access
SBM	Compact power supply	H1 'green'	X21 Pin 1 (BA1)	ID32865	33029	-	FB STANDARD_KE
QUE	Compact power supply	H1 'green flashing'	X21 Pin 2 (BA2)	ID32866	33030	-	FB STANDARD_KE
SBM	Controller card KW-R06 / -R16 / -R07 / -R17	H2 'green'	X141 Pin 2B (BA2)	ID32866	33029	ID34120 Bit1	FB STANDARD_ AXIS
	Controller card KW-R24(-R) / -R25 / -R26 *		X140 Pin 2B (BEA2)				
QRF	Controller card KW-R06 / -R16 / -R07 / -R17	H2 'green flashing'	X141 Pin 2A (BA1)	ID32865	33031	ID34120 Bit0	FB STANDARD_ AXIS
	Controller card KW-R24(-R) / -R25 / -R26 *		-	-	-	-	-

6.2.4.1.2 Control signals

Signal	Name	Meaning
FL	'Clear error'	FL causes a system booting after the reason for an error message is remedied and the drive is still in error state SBM = 0). The sucessfully finished system booting is acknowledged with the SBM = 1 signal. Clear error can only be executed if RF = QRF = 0 by a pulse signal ≥1 ms on the binary input or via fieldbus interface. Clear error can be executed as follow: • Configuration FL to an binary input • ID99 'Diagnosis reset status class 1' • ID32913 'Clear error'
UE	'DC bus on'	UE activates (signal-edge controlled) the loading procedure of the DC bus capacitors in the power supply device. UE can only be executed if SBM = 1. A successfully finish of the charging procedure is acknowledged by QUE = 1. If UE is reset, the capacitors will be discharged, QUE will be reset. Between 2 consecutive UE on signals, a device specific inhibit time has to be considered. See document Servo drives KE/KW (Part no. 28932), chapter Product planning, subtopic Inhibit Time for Control Signal UE.

Signal	Name	Meaning
RF	'Controller enable'	RF (signal-edge controlled) causes a system booting if at least one parameter has been changed before. RF activates the motor control in the current operation mode (e.g ID32800 'AMK main operating mode'. The motor is energized, setpoints are processed and the acknowledgement signal QRF will be set. RF can only be activated if SBM = QUE = 1. If RF is set, the power output stage are active. For devices with the option 'external power output stage enable' additionally EF/FE2 = 1 must be set. If the prerequisites are not fulfilled, the device generates an error message and resets SBM if someone try to set RF. IF RF is withdrawal during operation the motor is ramped down according ID32782 'Deceleration ramp RF inactive' until standstill (≤ 6 RPM) and unenergized. QRF will be reset. If a motor holding brake is active the signals RF and QRF on/off will be delayed device internal, depending on parameter ID206 'Drive on delay time' and ID207 'Drive off delay time'.
optional:		
EF/EF2	'Power output stage enable'	Interrupting the control inputs EF/EF2 will cause the trigger signals for control of the power output stages to be safely blocked in two channels. The motor is in a secure state torque off protected against restart. This safety function is certificated according to EN ISO 13849-1:2008 (Cat.4, PL e) and EN 954-1: 1996, cat. 4. See document Device description Servo drives KE/KW (Part no. 28932), chapter Function description KW, Function description - EF safety function.

Signal	Hardware	Terminal	Parameter	Code	Image	PLC access
UE	Compact power supply	X22 Pin 2 (BE2)	-	-	-	FB STANDARD_KE
FL	Compact power supply	X22 Pin 1 (BE1)	-	-	-	FB STANDARD_KE
RF	Controller card KW-R06 / -R16 / -R07 / -R17	X140 Pin 3B (BE1)	ID32978	32904	ID34100 Bit0	FB STANDARD_ AXIS
	Controller card KW-R24(-R) / -R25 / -R26 *					
FL	Controller card KW-R06 / -R16 / -R07 / -R17	X140 Pin 2B (BE2)	ID32979	33913	ID34100 Bit1	FB STANDARD_ AXIS
	Controller card KW-R24(-R) / -R25 / -R26 *	-	-	-	-	-
optional:						
EF	Compact inverter KW	X15 Pin 2,4	-	-	-	-
EF2	Compact inverter KW	X15 Pin 1	-	-	-	-
EF	Compact inverter KWD/KWZ	X17 Pin 3	-	-	-	-
EF2	Compact inverter KWD/KWZ	X17 Pin 1	-	-	-	-

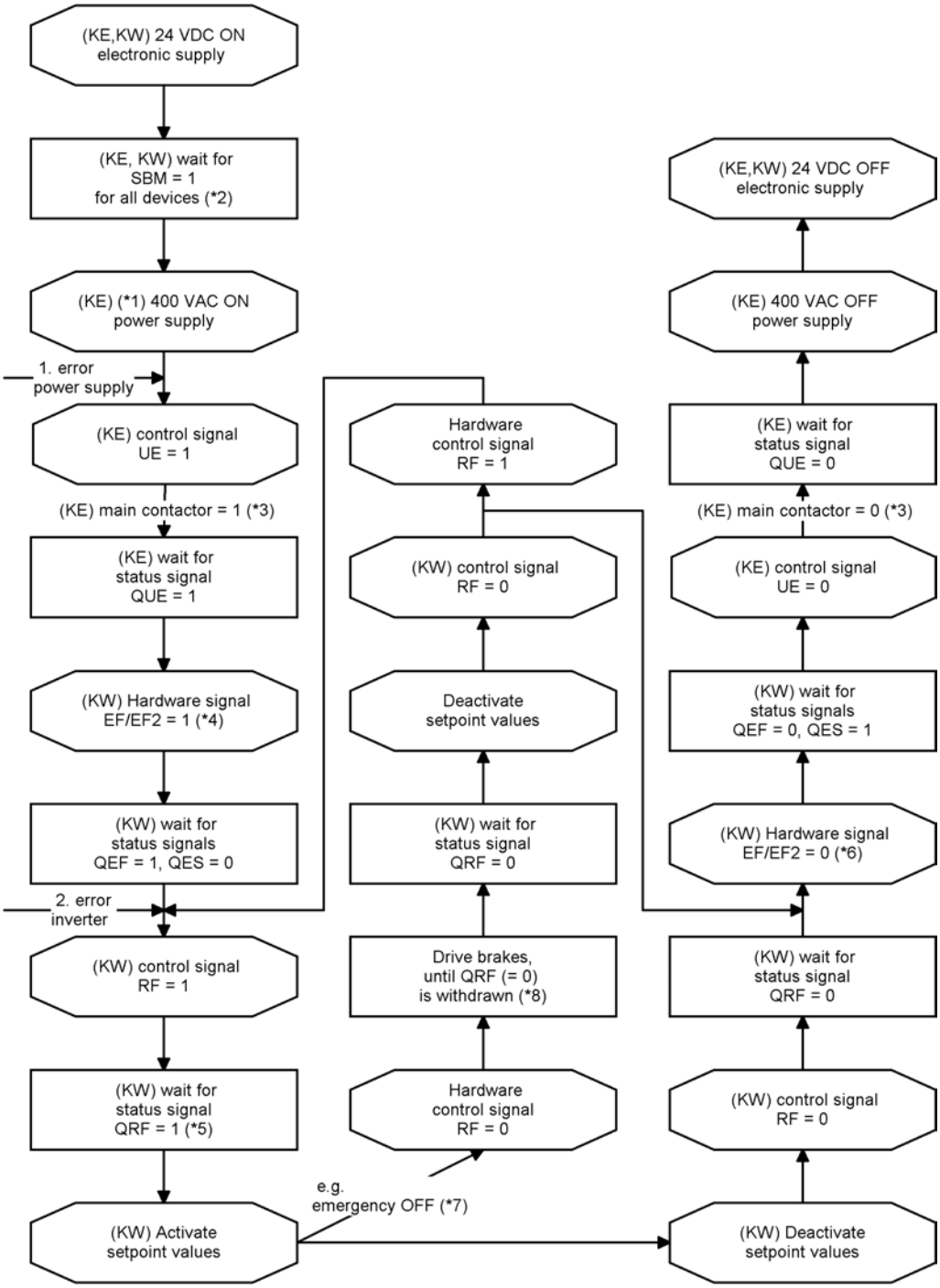
Control signal motor holding brake

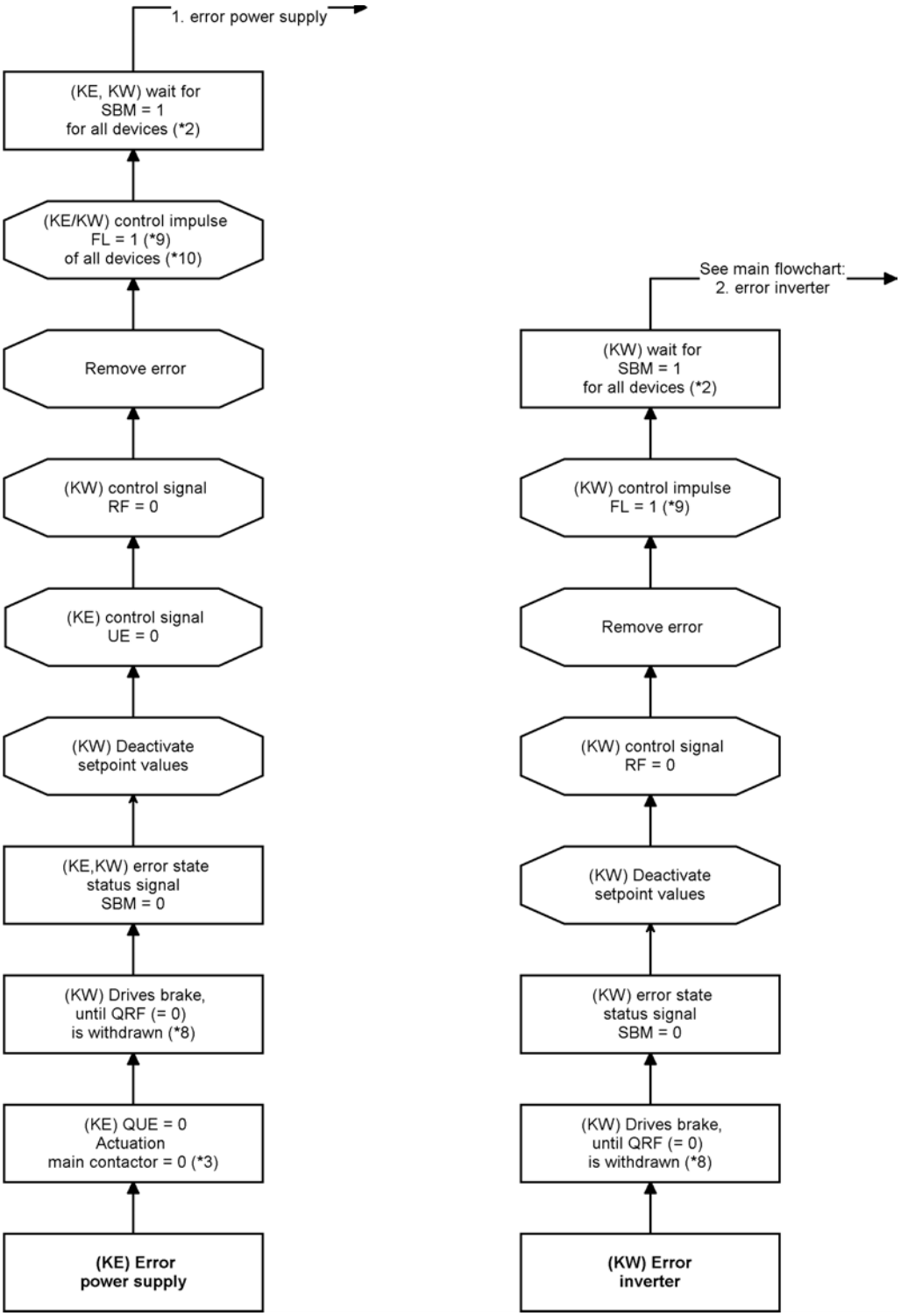
Signal	Hardware	Terminal	Parameter	Code	Reflection
Activating motor holding brake KW-R06 / -R16 / -R07 / -R17	controller card	X140 Pin 1A	ID32867	33052	ID34120 Bit3
Activating motor holding brake KW-R24(-R) / -R25 / -R26 *					

For detailed information: See document 'Function descriptions' (Part no. 203878), chapter 'Actuation of the motor holding brake'.

* The controller card has 3 multifunctional BEA (BEA 1-3). Each BEA can use as input or output. Inputs and outputs can be mixed. E. g. BEA1 and BEA2 are inputs, BEA3 is configured as output.

6.2.4.2 Switch-on and -off flow chart





*1	Close emergency OFF circuit (if existent).
*2	The module specific 'System ready' messages (SBM = 1) from the KE and KW modules signal the error-free states. The monitoring of these messages takes place in the higher-ranking controller. Time to SBM > 2 s.
*3	If present, the required external main contactor is actuated by the KE. The delay time until the contactor is actuated via terminal X20 (EH1/EH2) depends on the DC bus capacities connected to the KE.
*4	Only devices with EF logic: Hardware signal EF/EF2 must be applied at the latest at that time.
*5	Delay time until QRF is set depends on the connected motor resp. whether the data set must be newly calculated because of a modification of drive specific parameters.
*6	Only devices with EF logic: Reset hardware signal EF/EF2 if the motor has to be in a safe torque-free state afterwards.

*7	RF will be disabled via BE. BE is linked with PLC signal, see ID32796 'Source RF'.
*8	Motor is braked to a standstill after the ramp ID32782 'Deceleration ramp RF inactive'.
*9	Pulse ≥ 1 ms.
*10	Each inverter generated a DC bus error.

Explanation of the status and control signals: Siehe 'Status and control signals' auf Seite 37.

KW-R07 / -R17:

For the machine startup of a controller card with functional safety, the safety functions must be de-activated.

Therefore, the safe inputs must be connected stringently, and the SafePMT parameter set must be adapted. Without these adaptations, the startup of a servo motor is not possible.

See document 'Safety manual; functional safety' (Part no. 203446), chapter 'Running KW-R07 / -R17 without functional safety'.

6.3 Setpoint setting by startup function

DANGER

Motor shaft movement!

Hazardous motor movement occurs when the motor shaft moves in an uncontrolled or unintentional manner.

Steps to prevent:

- Decouple the motor from the load so that the shaft can rotate freely
- Specify the maximum permissible process speed and set ID113 accordingly. (ID113 = max. process speed/1,25)

The 'Startup' function of the AIPEX PRO software gives support to the initial startup and controller tuning.
The startup function contains a setpoint generator which can set several curve forms (trapezoidal, square wave, triangular, sinusoidal) for different operation modes (torque, speed, position control).

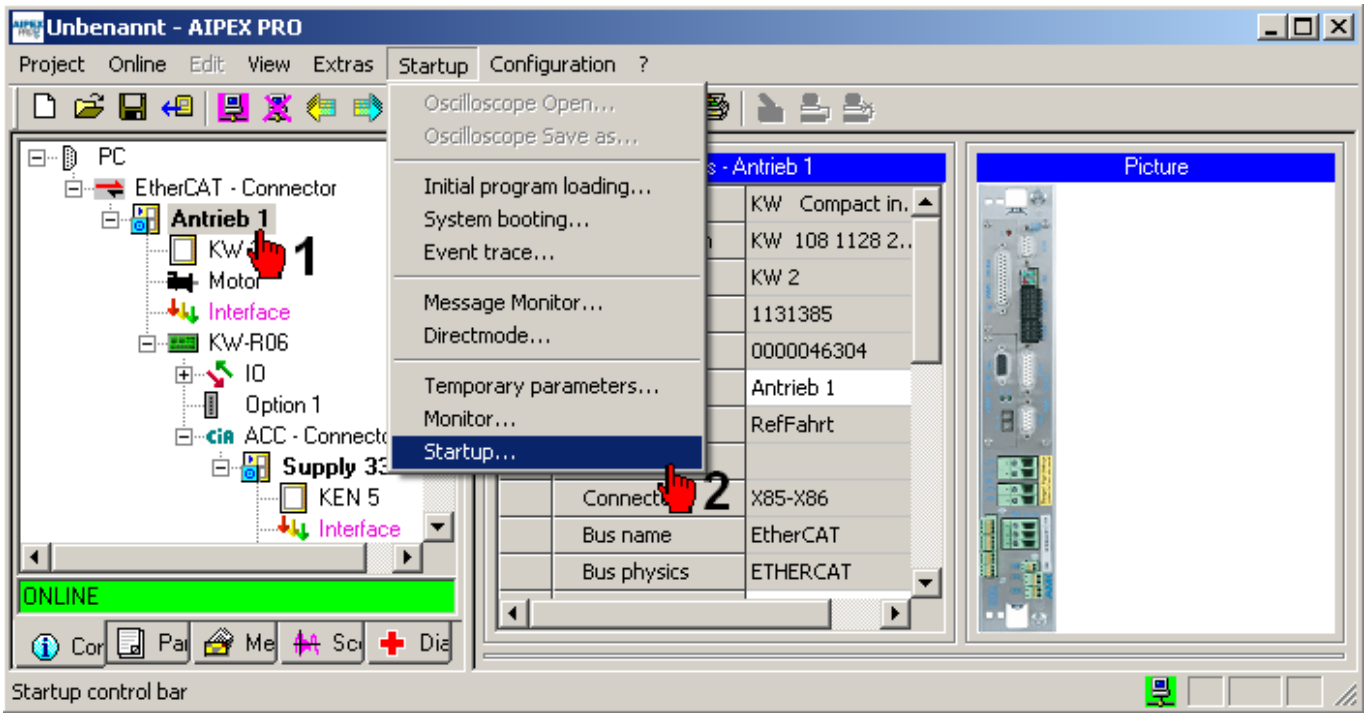
Before you first put the motor into operation, check the sense of rotation

The sense of rotation can be inverted by ID32773, bit16 = 1

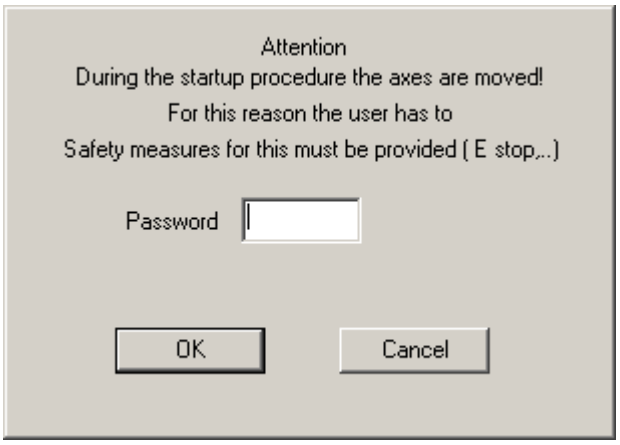
The following example shows how to set a positive speed setpoint with acceleration and deceleration ramp.
By means of the 'Scope' function of AIPEX PRO, you can display and store the actual motor values.

Starting the 'Startup' function

In the device tree click to that device you want to set a setpoint by the startup function. Click to the 'Startup' menu and subsequent to 'Startup...'.

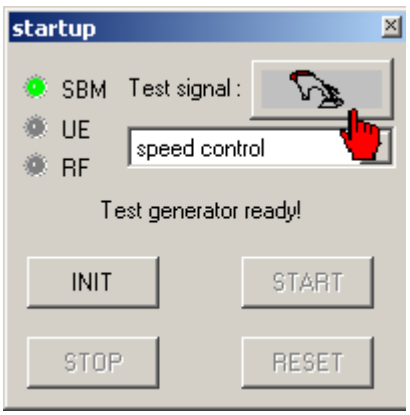


The startup function will be released by the AMK service password (500591).



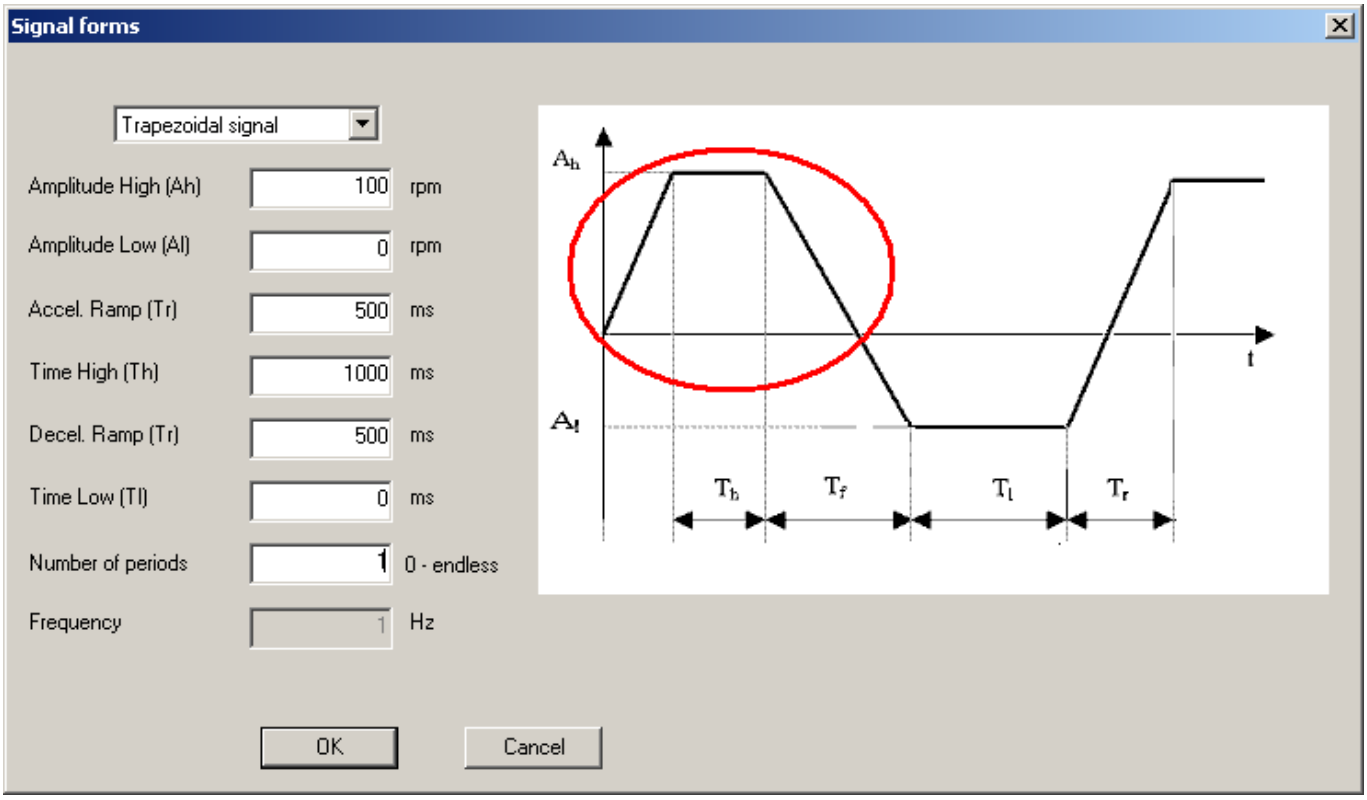
Open the configuration window 'Signal forms'

'Controller enable' RF must be withdrawn.

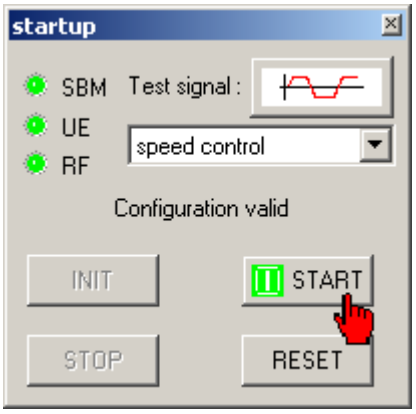


Example trapezoidal signal:

By means of the trapezoidal signal, you can set a positive and negative speed setpoint with acceleration and deceleration ramp.
The example configures just a positive movement.



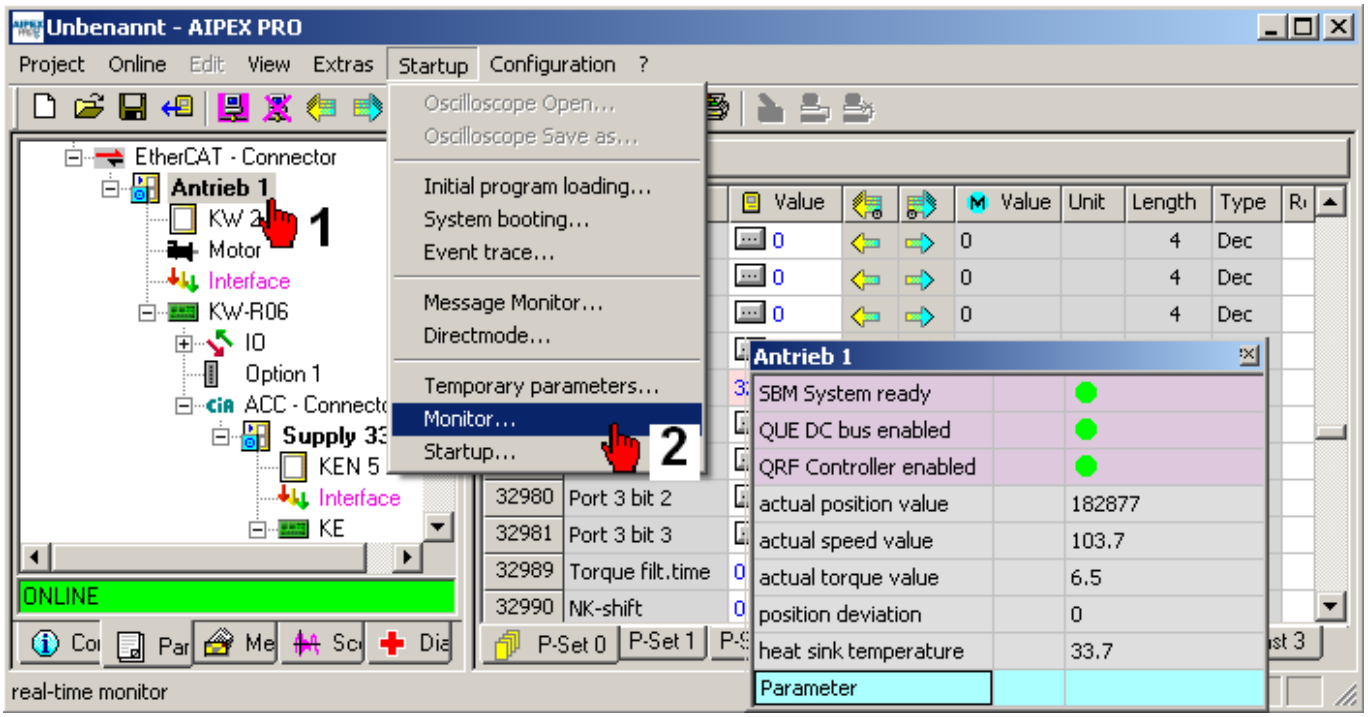
Now, activate the motor controller (siehe 'Switch-on and -off flow chart' auf Seite 40)
The LEDs show the states of SBM, UE and RF (green = active)
The configured movement sequence is started by 'START'.



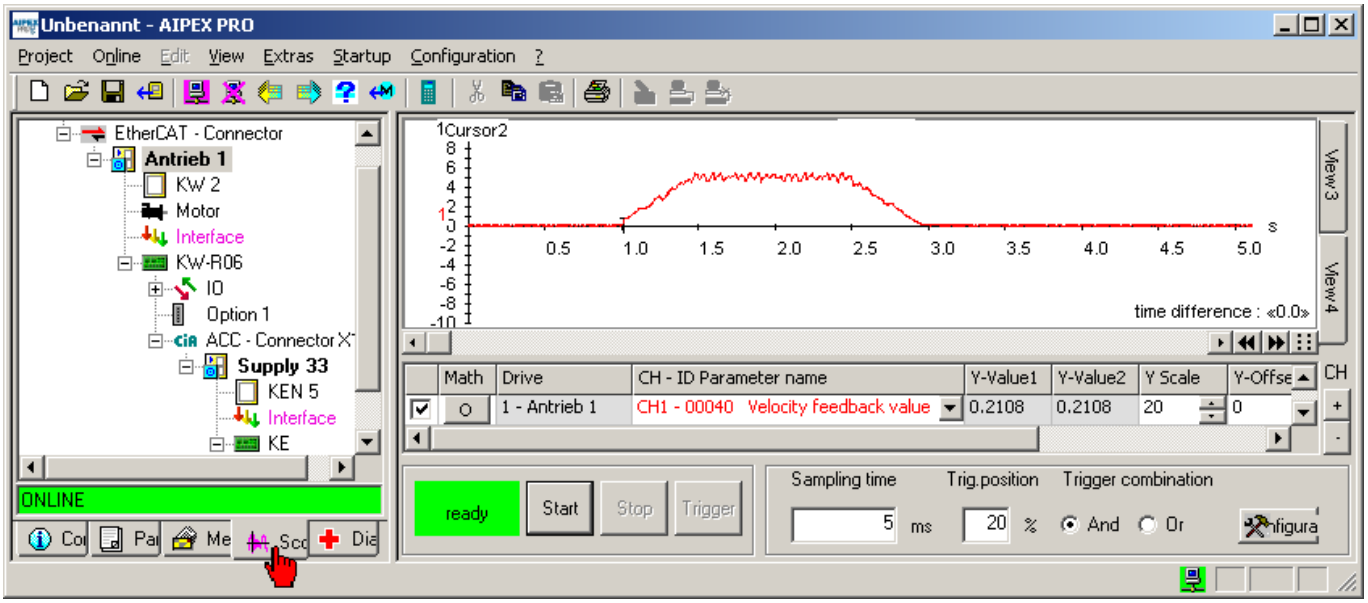
The movement can be interrupted by 'STOP' and continued by 'START'.
'STOP' and subsequent 'RESET' terminates the sequence.

Display actual values

By means of 'Monitor...', you can display the controller state and actual values.
Check whether a positive setpoint causes a positive speed and an increasing position value. A positive rotation direction means clockwise rotation with view to the motor shaft



By means of the AIPEX PRO oscilloscope, you can store and interpret the movement.



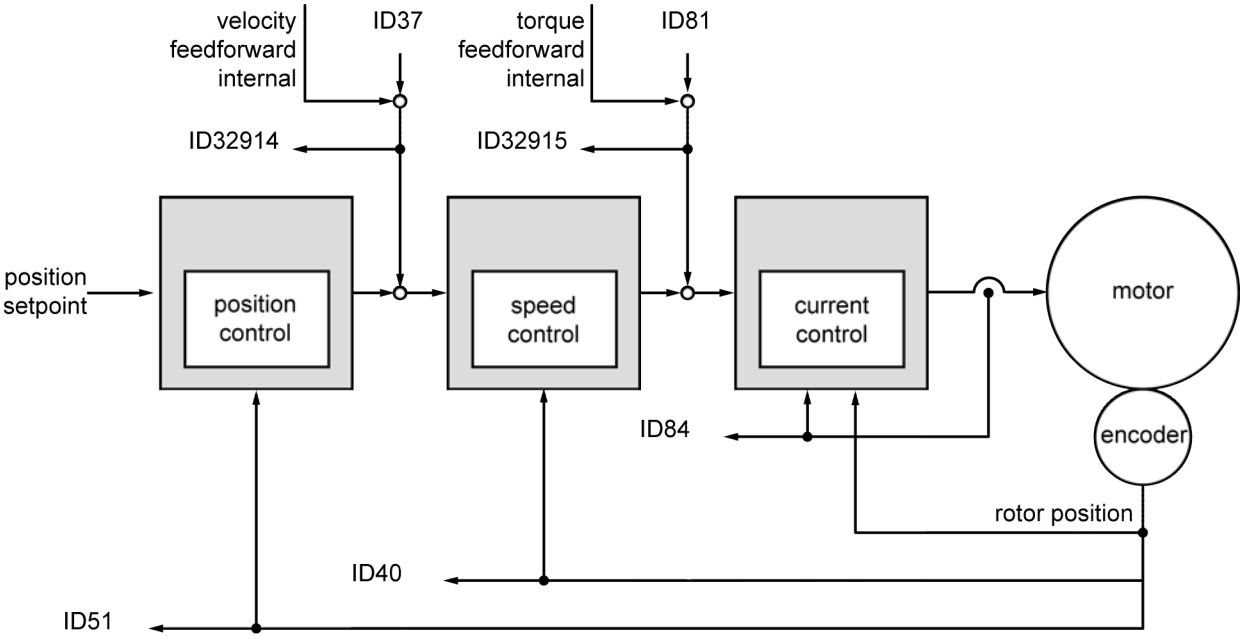
Configuring the oscilloscope: Siehe 'AIPEX PRO settings' auf Seite 51.

6.4 Setting the control loop

To set the control loop, the motor must be coupled to a load.

⚠ DANGER	
	**Motor shaft movement!** **Unintended motor shaft movement** is caused by errors in the motor control. Depending on the type of machine, this may have lethal consequences. Possible causes include the following: • Operator errors • Controller or application program faults • Faulty setpoint specification and scaling • Improper operating mode **Steps to prevent:** • Never allow personnel to remain in the vicinity of the machine while it is operating. • Always ensure that the machine is fully de-energised before commencing work on the machine or within the machine's vicinity. • Specify the maximum permissible process speed and set ID113 accordingly.

The control loop has a cascaded structure.
Only the control loops of those operation modes must be optimised which will be active in the process.



The parameters which were reduced during the initial startup, must be adapted to the application before the control loop is optimised.
ID38 'Positive velocity limit'
ID39 'Negative velocity limit'
ID82 'Positive torque limit'
ID83 'Negative torque limit'

6.4.1 Tuning the current controller

On asynchronous servo motors (AMK and third-party), an automatic current controller adjustment will be executed for the first RF 'Controller enable' on initial loaded inverters. The detected data are saved in the serial EEPROM (SEEP) of the inverter.

The automatic current controller adjustment will be repeated at any modification of ID111 'Motor nominal current IN' as soon as RF is set first after mains OFF / ON.

On AMK synchronous servo motors, the current controller parameters are transferred to the inverter from AIPEX PRO data base or from the encoder data base.

Siehe 'Motors with encoder data base' auf Seite 30.
Siehe 'Motors without encoder data base' auf Seite 32.

On synchronous third-party motors, the values of ID34050 'Current path Q integral-action time TN', ID34052 'Current path D integral-action time TN', ID34151 'Current path Q proportional gain KP', ID34152 'Current path D proportional gain KP' must be determined metrologically or mathematically and entered manually.

Entering the determined values:Siehe 'Third-party motors' auf Seite 33.

In general:

ID34050, ID34052, ID34151 and ID34152 = 0: (values of SEEP are valid)

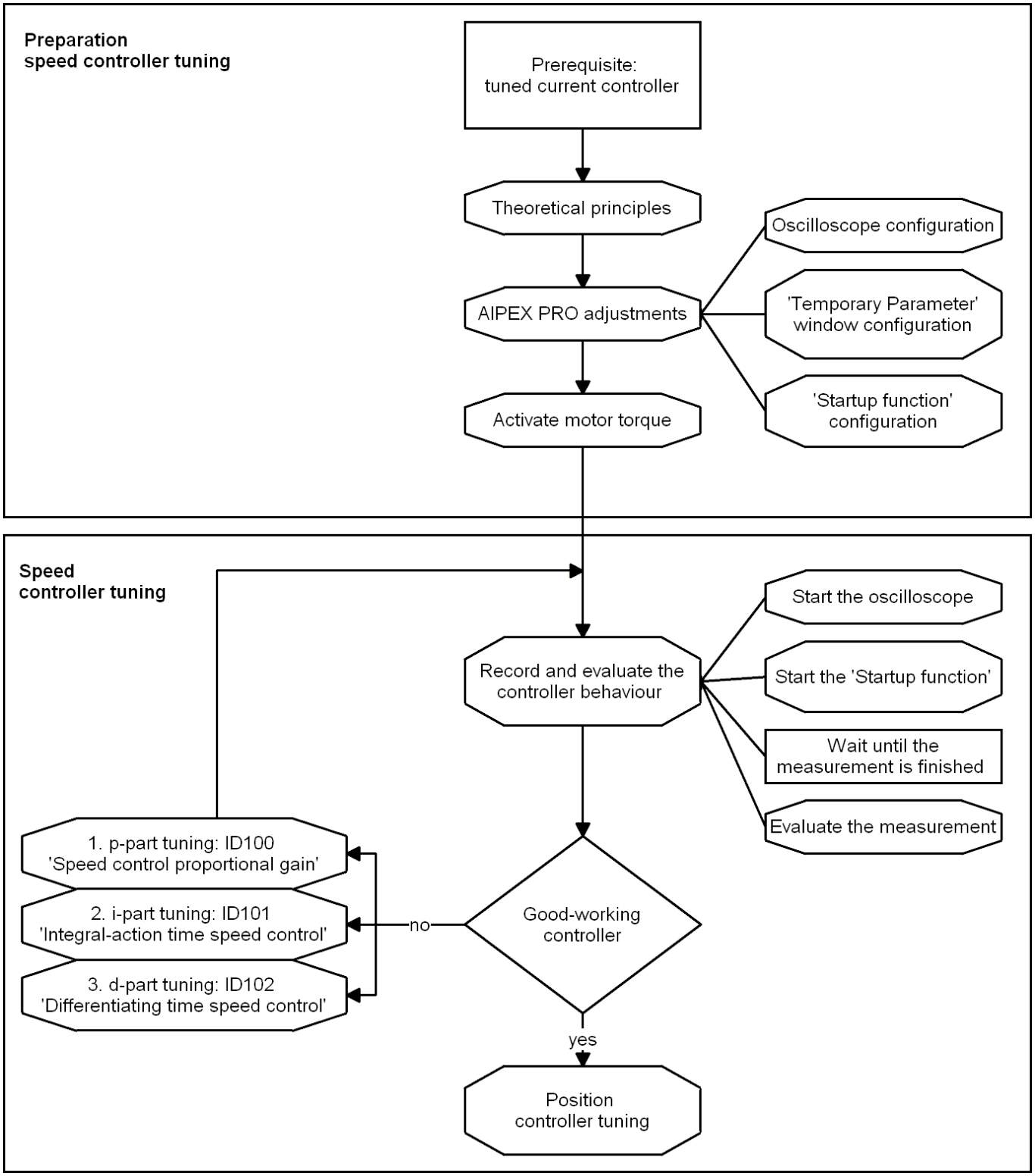
ID34050, ID34052, ID34151 and ID34152 ≠ 0 (parameter values are valid)

6.4.2 Tuning the speed controller

By means of the AIPEX PRO startup function, a square wave speed setpoint step-change is preset. The step response is recorded with the AIPEX PRO oscilloscope.

The controller parameters ID100 'Speed control proportional gain KP', ID101 'Integral-action time speed control TN' und ID102 'Differentiating time speed control TD' are displayed and tuned in the temporary parameter list and therefore are directly valid in the drive.

This chapter describes how to tune the speed controller by means of AIPEX PRO.
The Function descriptions (Part no. 203878), chapter 'Setting the control loop', describes the general procedure of tuning the speed controller.



6.4.2.1 Theoretical basis

The PID speed controller needs to be set and optimised depending on the application.

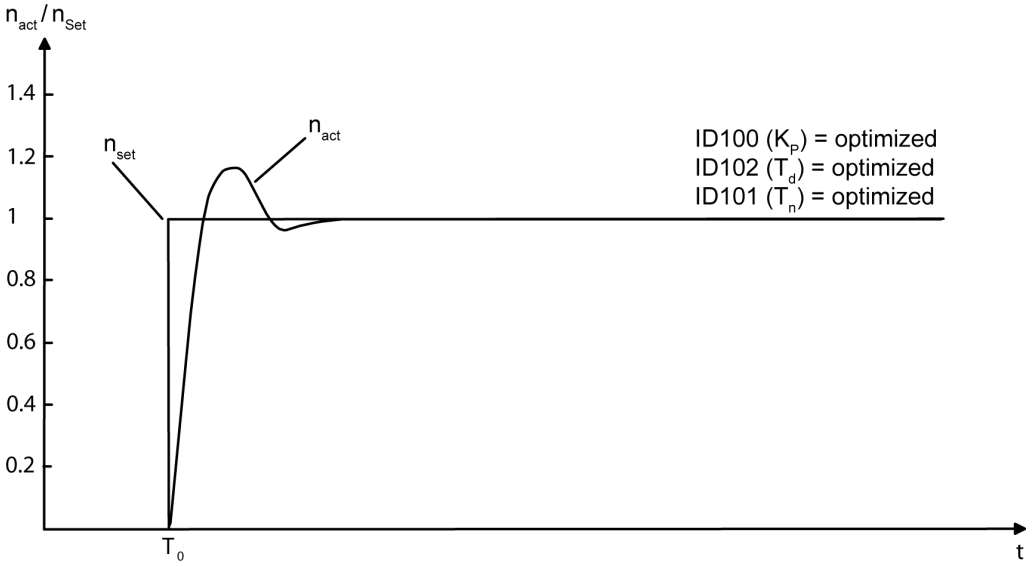
The precise mathematical description of all parameters of the control circuit has been shown often to be rather extensive and difficult in practical applications. Therefore, a simple procedure shall be presented here by which the controller can be set practically.

For that, a speed step-change (without ramp) needs to be given as a reference variable at the input of the controller. The step response (speed actual value) should be recorded for evaluating the controller setting. When specifying the speed step, make sure that the drive remains operating below the torque limit.

Set the controller as follows:

1. Setting ID100 'Speed control proportional gain KP' K_p, with ID101 = 0 (T_n), ID102 = 0 (T_d)
2. Setting ID101 'Integral-action time speed control TN' T_n, with ID100 = const. (K_p), ID102 = 0 (T_d)
3. Setting ID102 'Differentiating time speed control TD' T_d, with ID100 = const. (K_p), ID101 = const. (T_n)

Step response of the optimised speed control circuit



For an optimally set PID controller, the actual speed value may overshoot a setpoint step-change by no more than 20%.

Two PT1 filters can be configured at the output of the speed controller.
See ID32928 'Time filter 1' and ID32929 'Time filter 2'

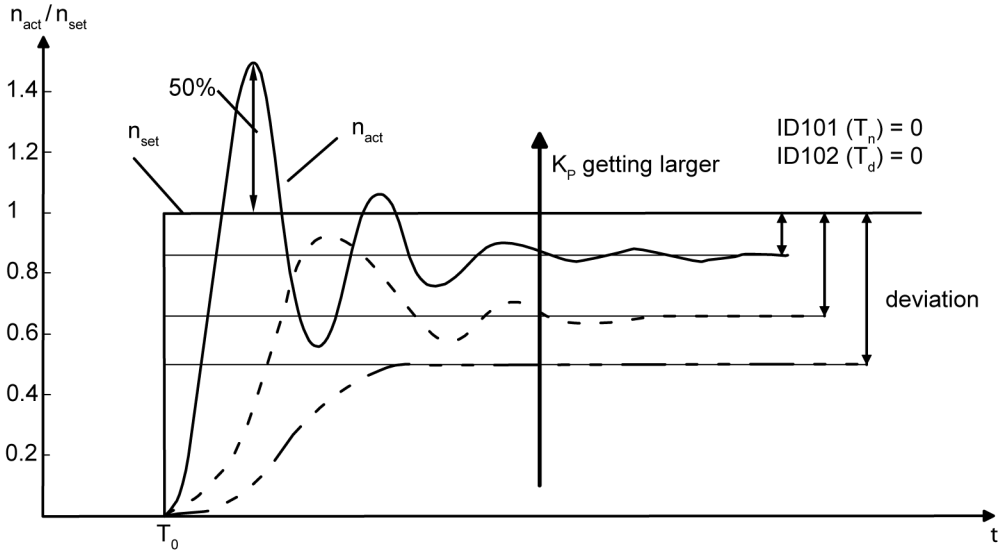
Relevant parameters:

Parameter	Name
ID100	'Speed control proportional gain KP'
ID101	'Integral-action time speed control TN'
ID102	'Differentiating time speed control TD'
ID32928	'Time filter 1'
ID32929	'Time filter 2'

Setting the proportional gain K_p

Set ID102 ('Differentiating time speed control TD', T_d) and ID101 ('Integral-action time speed control TN', T_n) to 0, the controller then works as proportional controller.

By increasing ID100 'Speed control proportional gain KP' K_P, the controller should be made to overshoot (50 % overshoots). The actual speed has a course then similar to the curve with the solid line:

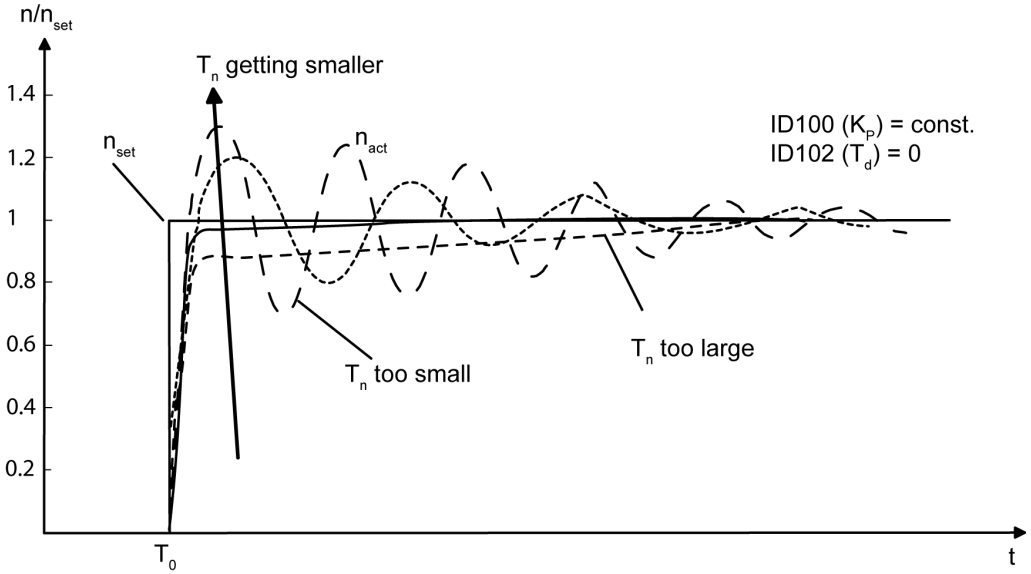


Halve the determined value for 'Speed control proportional gain KP' K_P and enter the halved value in ID100.

Setting the reset time T_n

Using the integral proportion (I-proportion) in the controller, the controller deviation resulting from the P controller is adjusted.

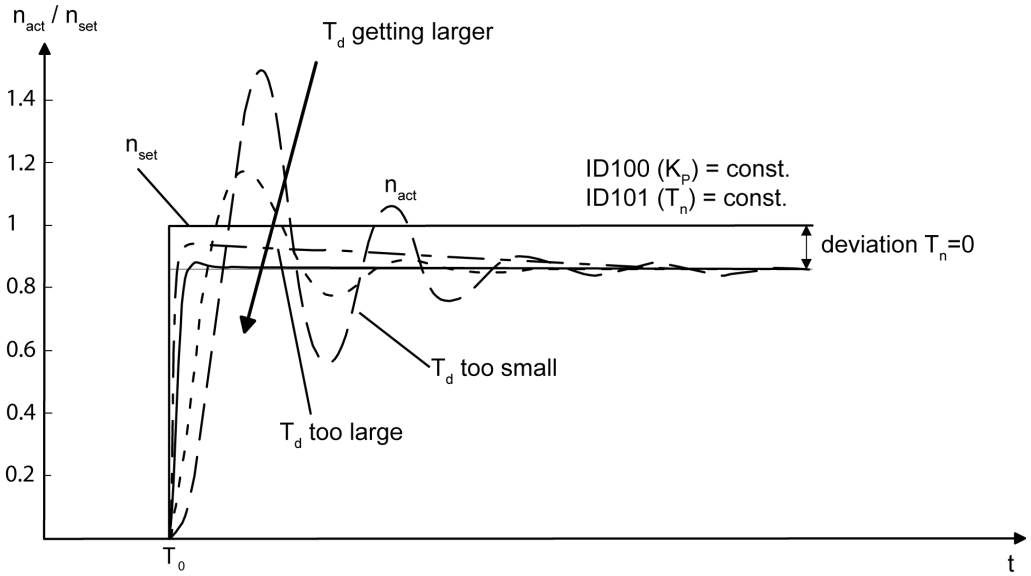
The integration time is reduced (starting at an initial value e.g. 100ms) until the settling time is minimal. If the reset time is set optimally, the actual speed value curve (jump answer) roughly follows the curve with the solid line:



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

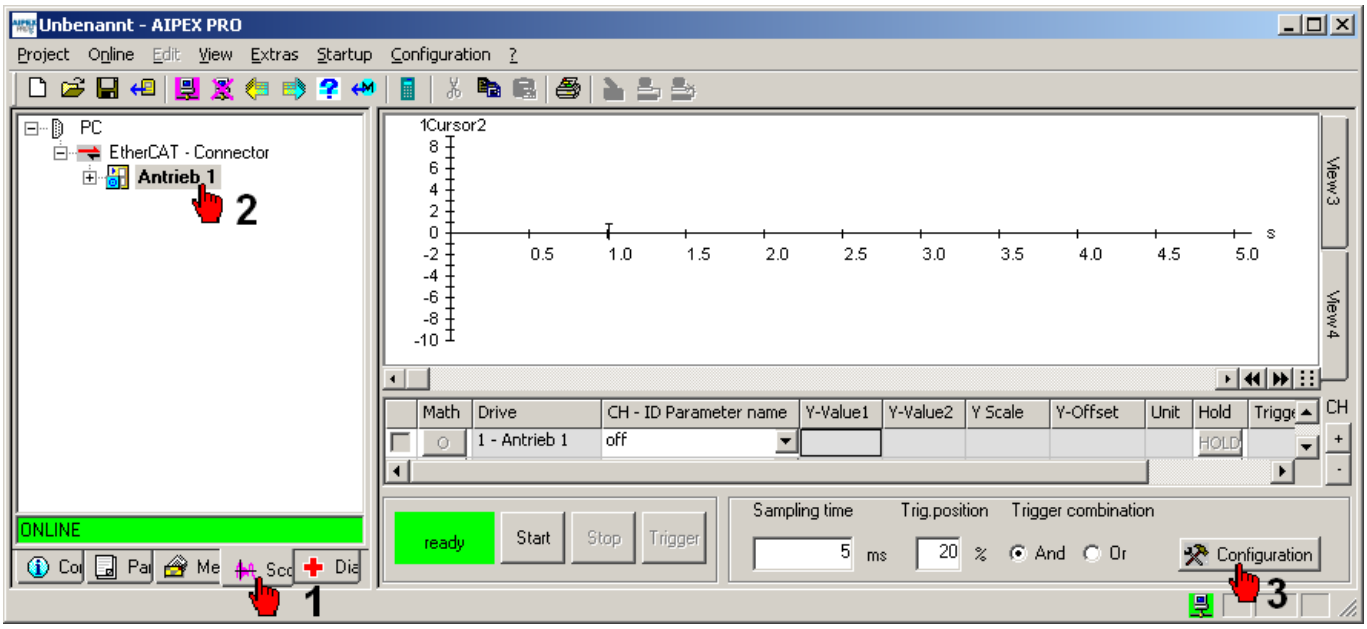
Setting the differential time T_d

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 D-share.

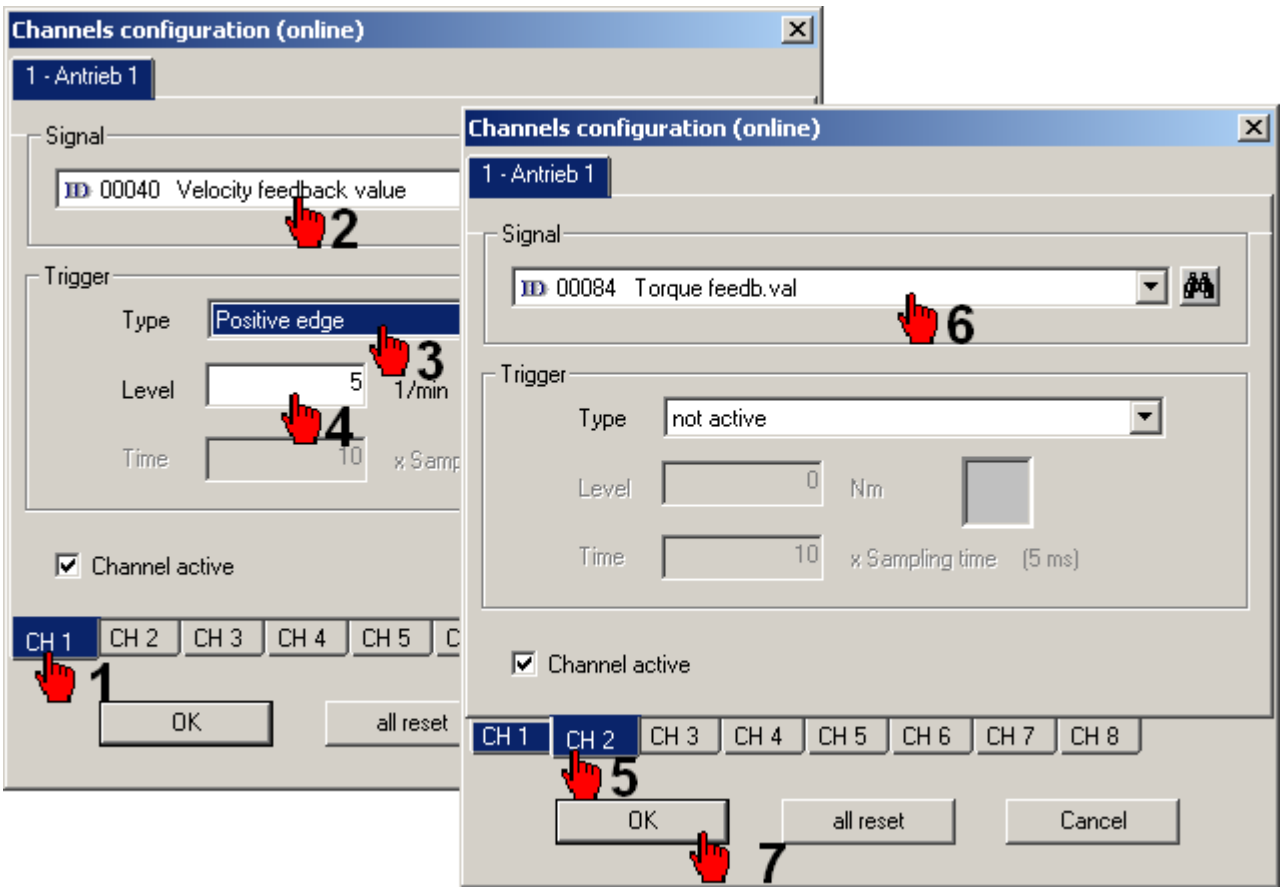


6.4.2.2 AIPEX PRO settings

Configuring the oscilloscope



Open the 'Channels configuration' window (3).



CH1:

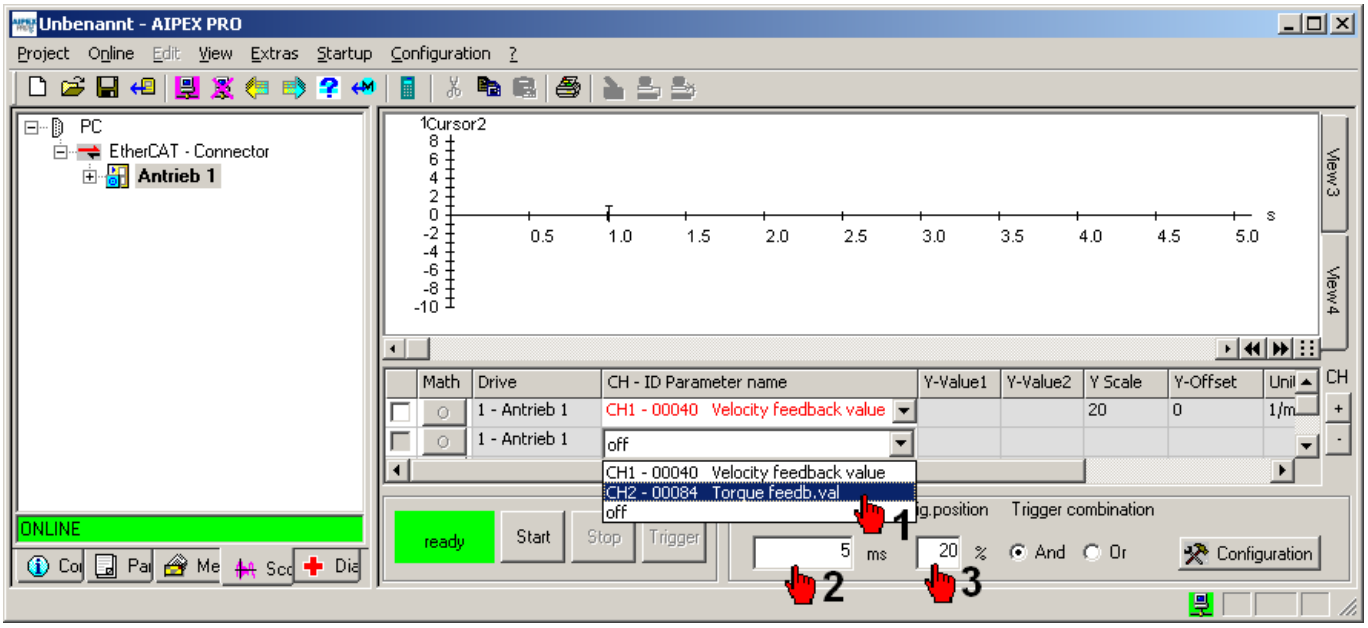
- Signal: ID40 'Velocity feedback value'
- Trigger:
  - Type: Positive edge
  - Level: 5 1/min (the recording is started when the actual speed value exceeds 5 rpm)

CH2:

- Signal: ID84 'Torque feedback value'
- Trigger: not active

CH3:

- Signal: ID34299 'Velocity setpoint in control'
- Trigger: not active



Activate the configured signals by the pull-down menu 'CH - ID Parameter name'

Maximum recording time

The maximum recording time is affected by the variable data memory size, as well as the configured measuring signals and the sampling time

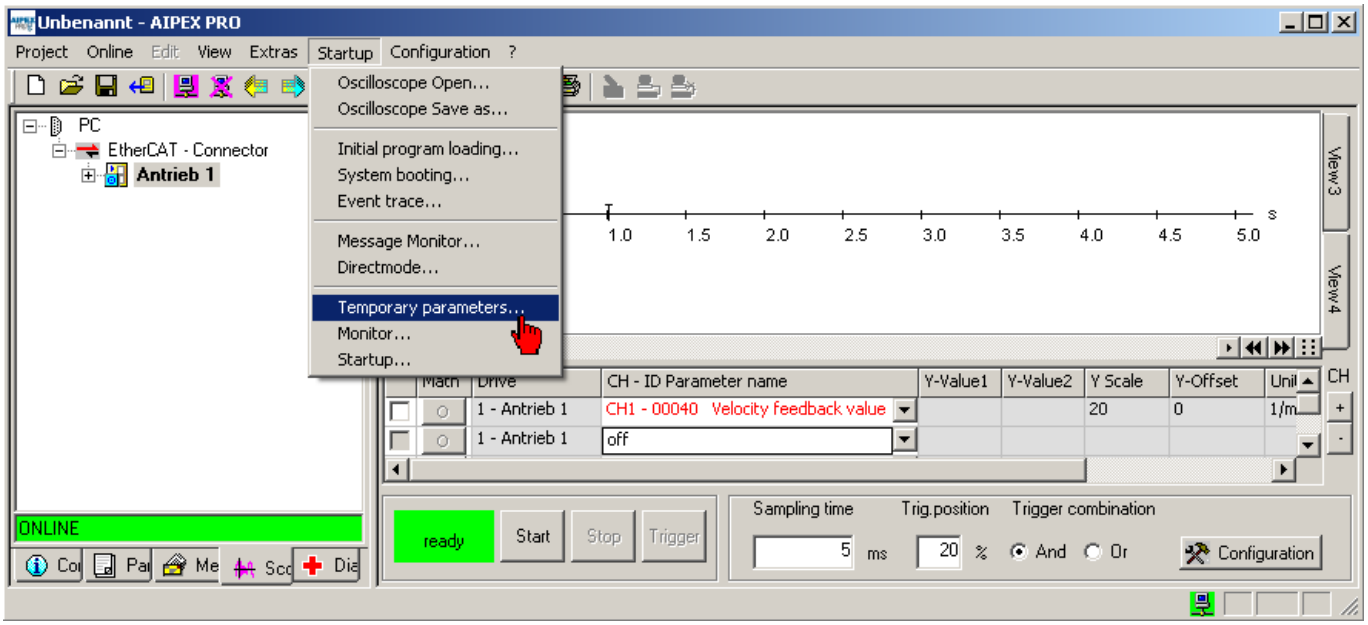
The data memory in the drive can be configured with ID34284 'OSC container length'.
The default value is 4096 bytes, the maximum value is 32600 bytes.

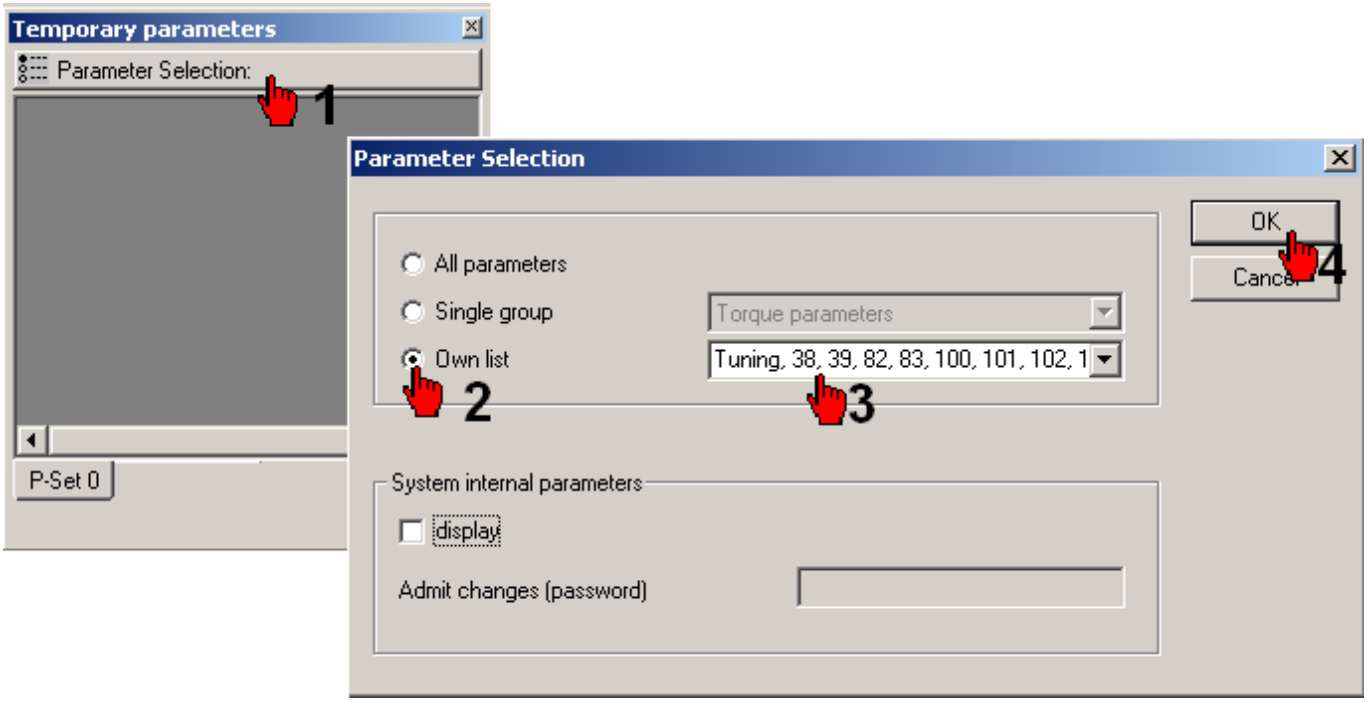
See: AIPEX PRO documentation

Topic: Scope - Maximum recording time

Configure 'Temporary parameters...'

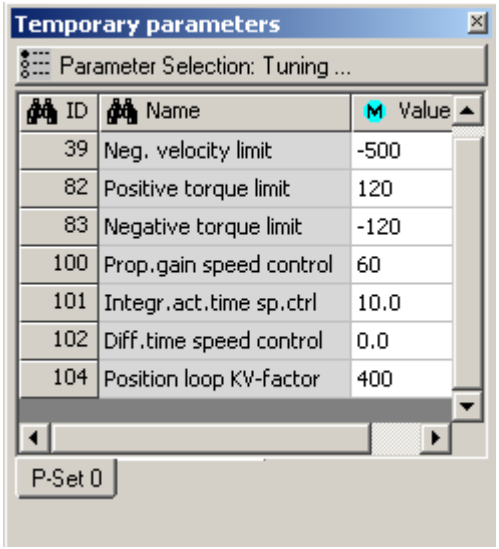
Open the 'Temporary parameters...' window in the 'Startup' menu.





Configure your 'Own list' by entering a name and the parameter IDs which are relevant for the controller settings.
We recommend the following input:
>own list name<,38,39,82,83,100,101,102

Display own list 'Tuning':



Configure 'Startup function' (Test generator)

Preparation (test generator without CAN control)
The inverter needs the signal RF controller enable to energize the motor. RF can be set for testing via a hardware switch.
For this, the following parameters must be adapted.
Additionally deactivate the special functionality FSE, so that you can use the 'Test generator'.

Hardware
Wire the required RF controller enable signal via a hardware switch to terminal X140 on the controller card.
X140 connection 3B: 24 VDC
X140 connection 1B: 0 VDC Reference potential

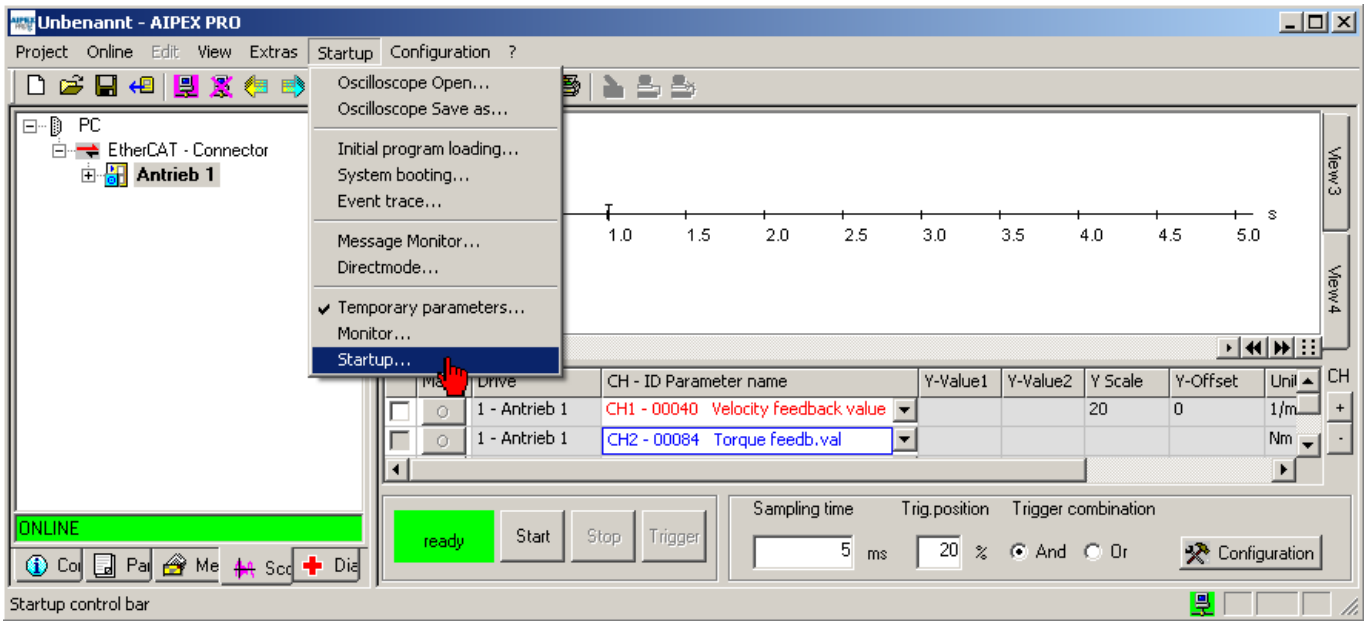
Parameterization

'Binary inputs assignment' is used to set the code RF controller enable to assigned to the binary input
ID32978 'Port 3 Bit 0'
Input value: 32904 (meaning: Code RF inverter enable)

The 'System parameters' group is used to set the controller enable RF source hardware.
ID32796 'Source RF'
Input value: 0 dec (meaning: RF via digital input)

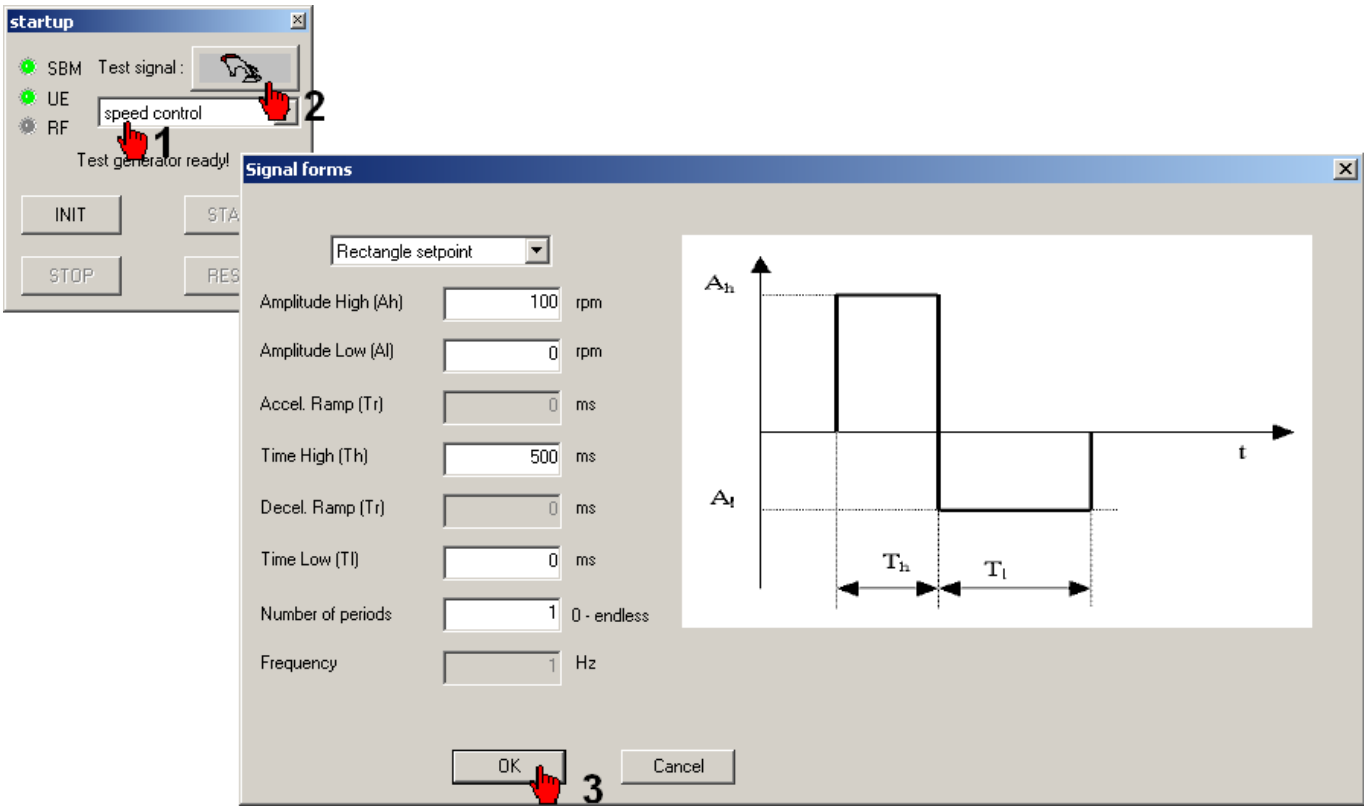
The 'System parameters' group is used to deactivate the FSE special function.
ID32901 'Global service bits'
Input value: 0x240 (meaning: FSE special function deactive)

Open 'Startup...' (Test generator...') in the 'Startup' menu (PW: 500591).



Select 'Rectangle setpoint' as speed setpoint step-change.

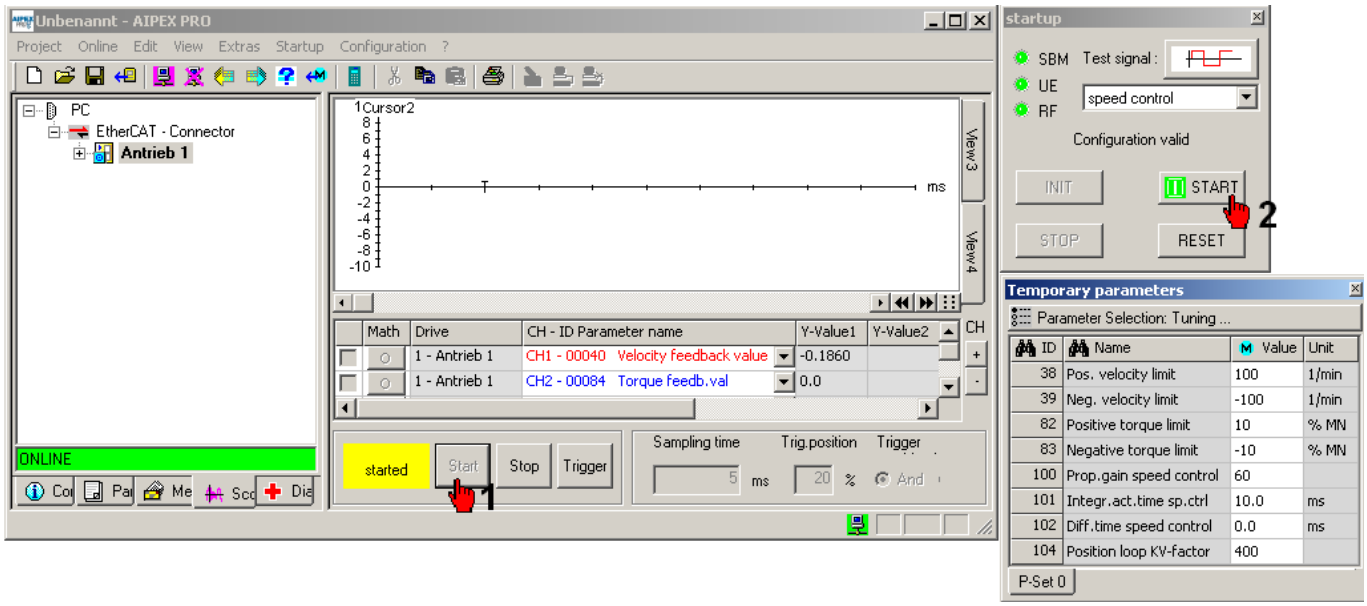
The following measured actual torque value has always to be less than the set torque limits.
If the torque limits are exceeded, the value of 'Amplitude High (Ah)' must be reduced.
Recommended start value: 100 1/min



6.4.2.3 Optimising the speed controller

Repeat the steps to optimize the speed controller until the controller behaviour meets your idea of dynamic and rigidity.

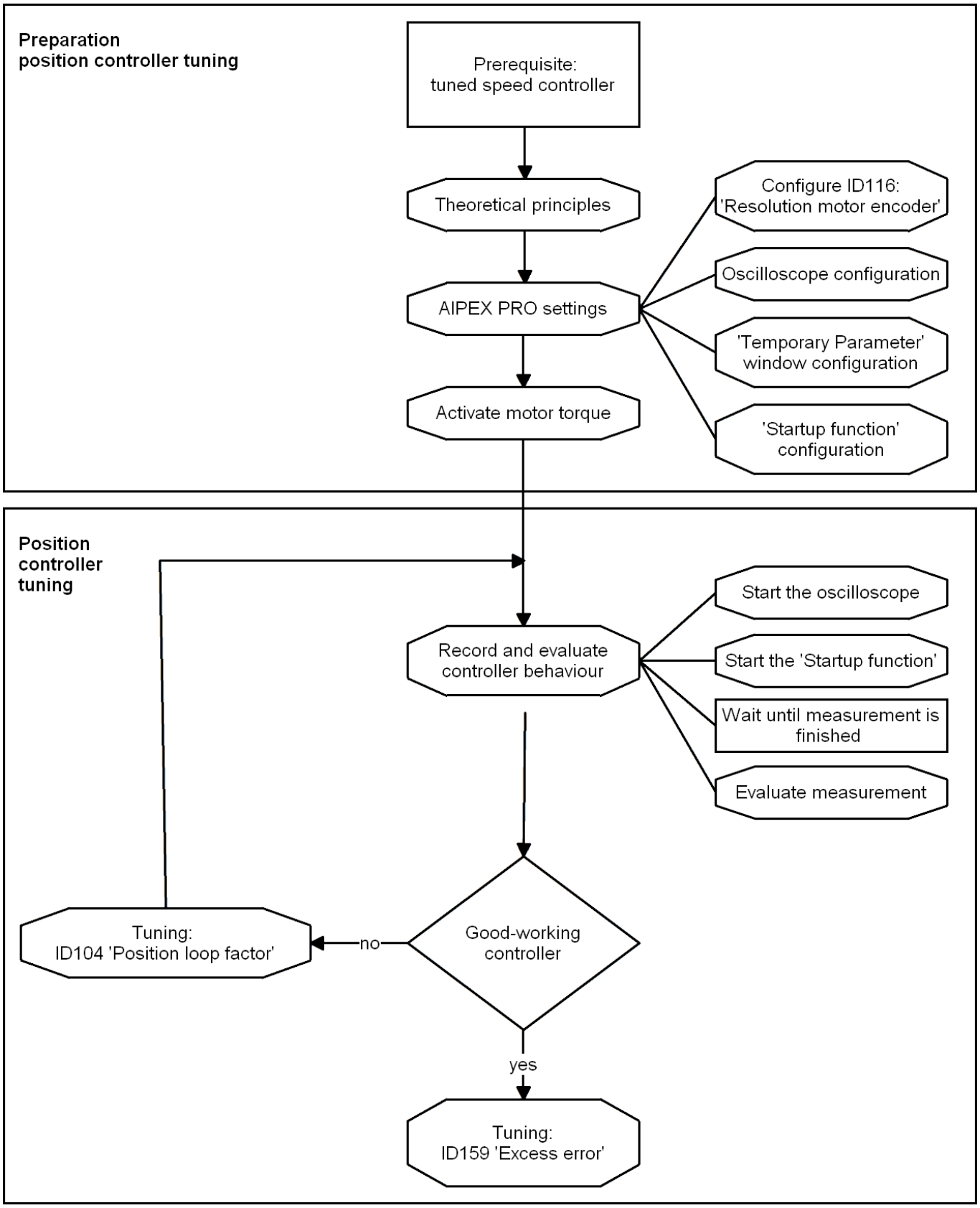
In the 'Temporary parameters' window, you can enter the parameter values before you take a new measurement. The input is directly valid.



After the measurement has finished, the results are transferred to the PC and displayed automatically.
Interpret the measurement.
By means of 'Temporary parameters', you can optimise the P part (ID100), I part (ID101), and D part (ID102).
The button 'HOLD' saves the selected value so that you can compare it to the next measurement.

6.4.3 Tuning the position controller

The dynamic of the position control loop depends on ID104 'Position loop factor KV'



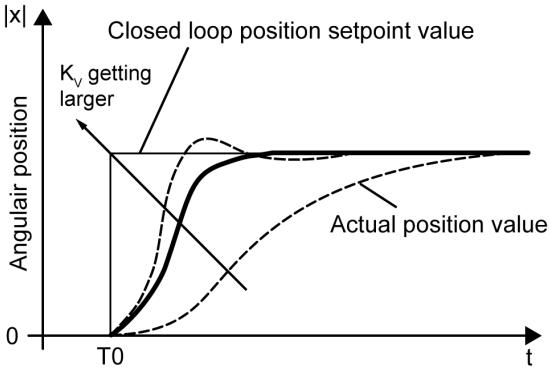
6.4.3.1 Theoretical basis

Setting the proportional gain K_V

The proportional gain of the position controller (P controller) is set in ID104 'Position loop factor KV'.

The following image shows the step response of the actual position value on a step-change position setpoint. In optimised state, the drive positions comparable to the solid line without overshoots:

Step response position controller, effect of ID104 'Position loop factor KV'



The following conditions have to be kept:

Formula: System internal limitation of K_V

LA = factor position resolution (depends on encoder type)

Motor encoder as position value encoder

LA = ID116 'Resolution motor encoder'

External encoder rotatory:

Formula: factor position resolution on external position value encoder

ID117 'Resolution external position feedback system' (Strichzahl pro Umdrehung)

ID122 'Load gear output revolution'

ID121 'Load gear input revolution'

6.4.3.2 AIPEX PRO settings

D116 'Resolution motor encoder'

Set ID116 'Resolution motor encoder' as high as possible.

Calculation of ID116: See Parameter description, Part no. 203704.

The maximum value depends on the motor encoder system. The calculated value of ID116 might not be used because it is limited by the higher-ranking controller. Enter a smaller value.

Configure the oscilloscope

Extend the oscilloscope configuration to record ID51 'Position feedback value' and ID32896 'Internal position command value'

Procedure: Siehe 'AIPEX PRO settings' auf Seite 51.

Configure 'Temporary parameters' window

Extend the temporary parameter list with ID104 'Position loop factor KV' and ID159 'Excess error'.

Procedure: Siehe 'AIPEX PRO settings' auf Seite 51.

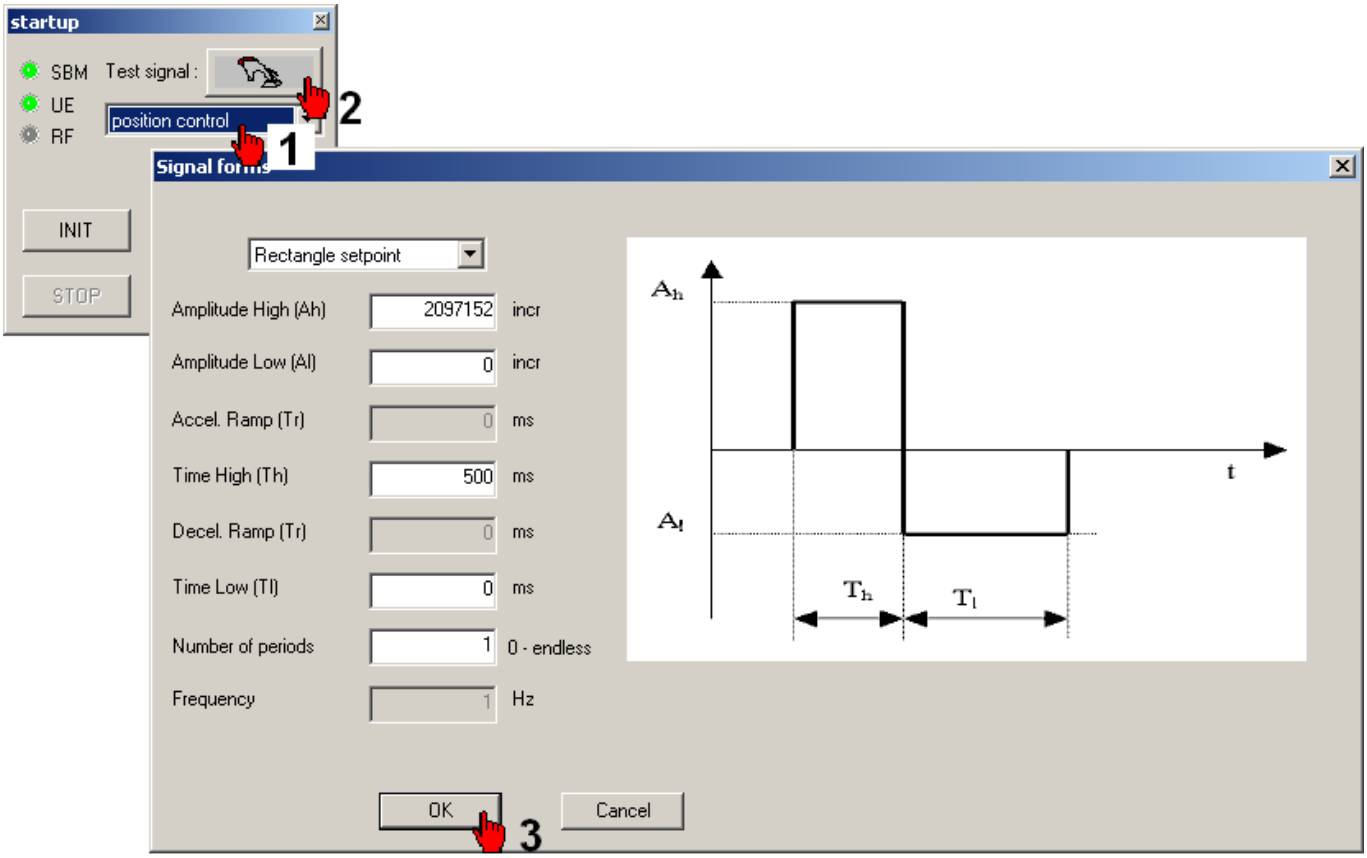
Configure startup function

The following measured actual torque value has always to be less than the set torque limits.
If the torque limits are exceeded, the value of 'Amplitude High (Ah)' must be reduced.
Recommended start value: ½ motor rotation (½ ID116)

Diagnostic message 2318 'Control deviation'
ID159 'Excess error' monitores the following error. Adjust the monitoring to your calculated value ID116

Configuration example (ID32776 = 512, PV = 2048)
ID116 'Resolution motor encoder' = 4 x ID32776 'Sine encoder period' x PV
ID116 = 4 x 512 x 2048 = 4194304 increments

½ motor rotation = 4194304 incr./ 2 = 2097152 incr.



Following error monitoring

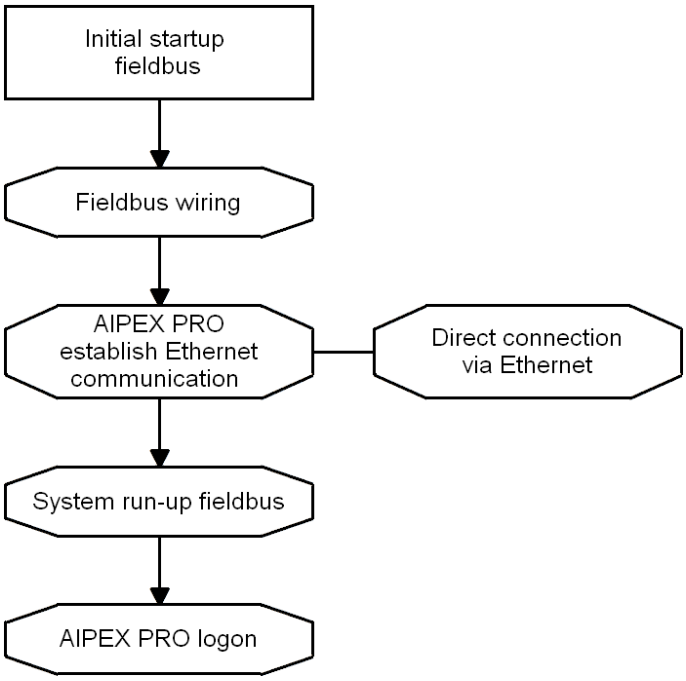
The proportional gain K_V directly influences the size of the following error. The higher K_V, the smaller the resulting following error.
The following error is calculated as follows:

If the difference between actual position value and position setpoint (= following error) exceeds ID159 'Excess error', RF (controller enable) is withdrawn, SBM reset and diagnostic message 2318 'Control deviation' is generated.
Adjust ID159 to the maximum permitted following error of your process.

6.4.3.3 Optimising the position controller

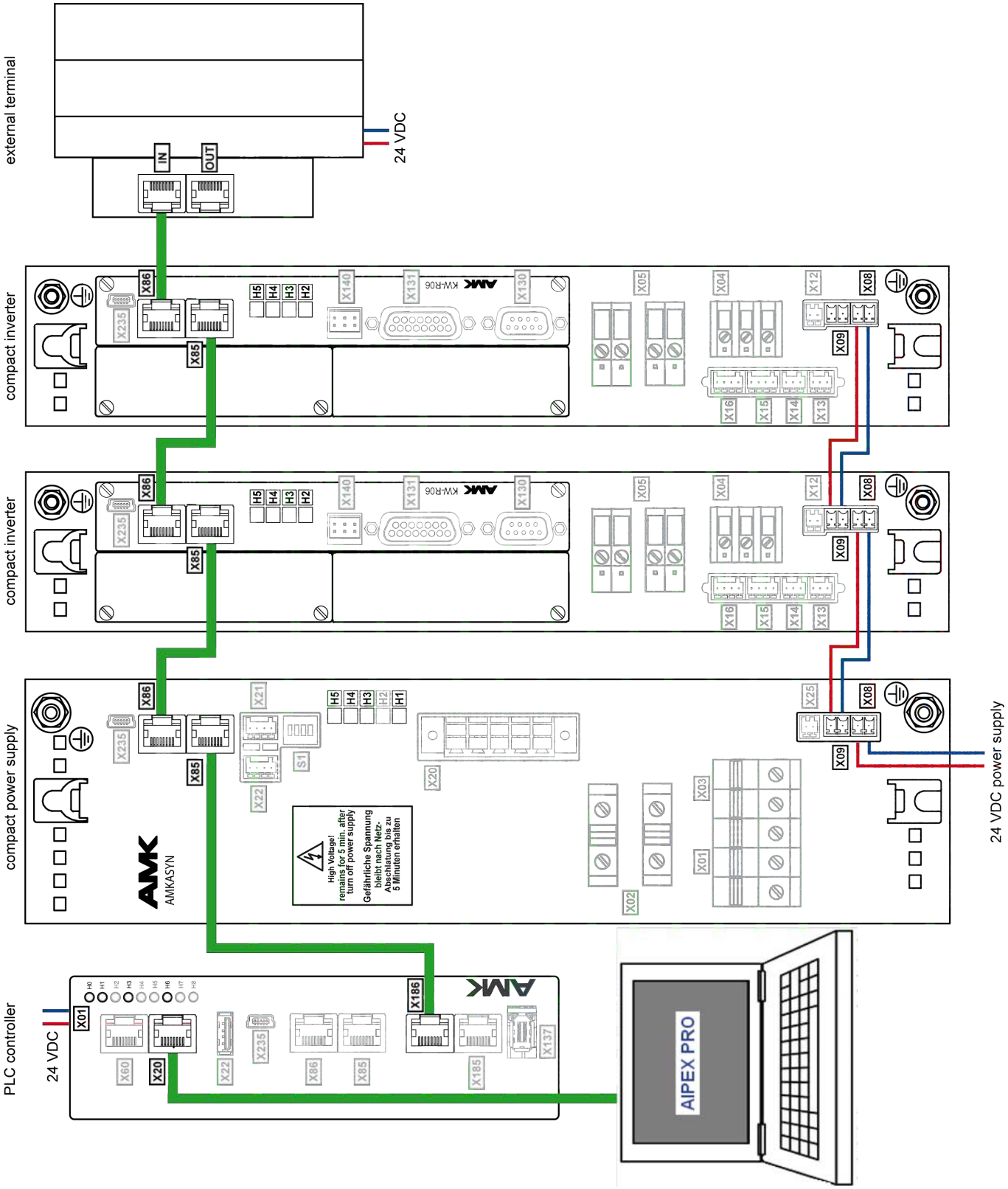
Execute the steps of 'Optimising the position controller' until the controller behaviour meets your idea of dynamic and rigidity.

7 Initial startup fieldbus



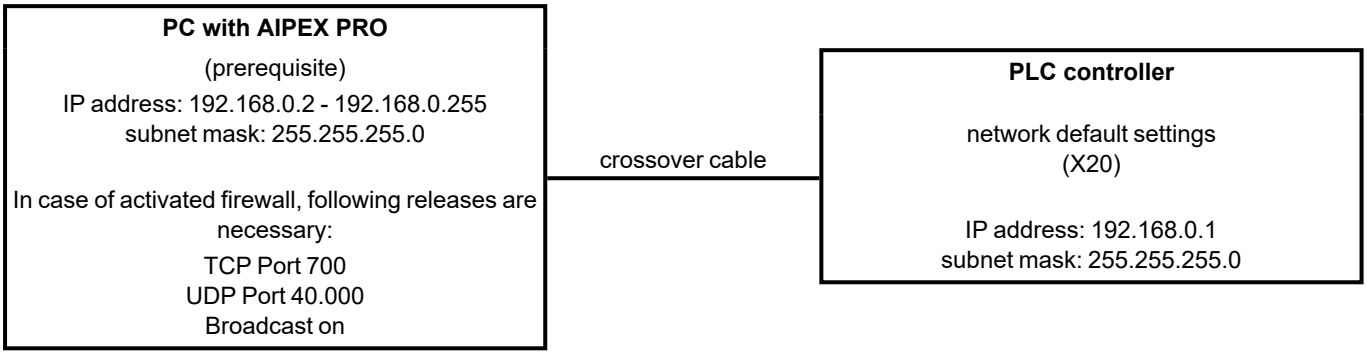
7.1 Overview fieldbus wiring

For fieldbus connection, use an Ethernet standard RJ45 twisted pair patch cable.



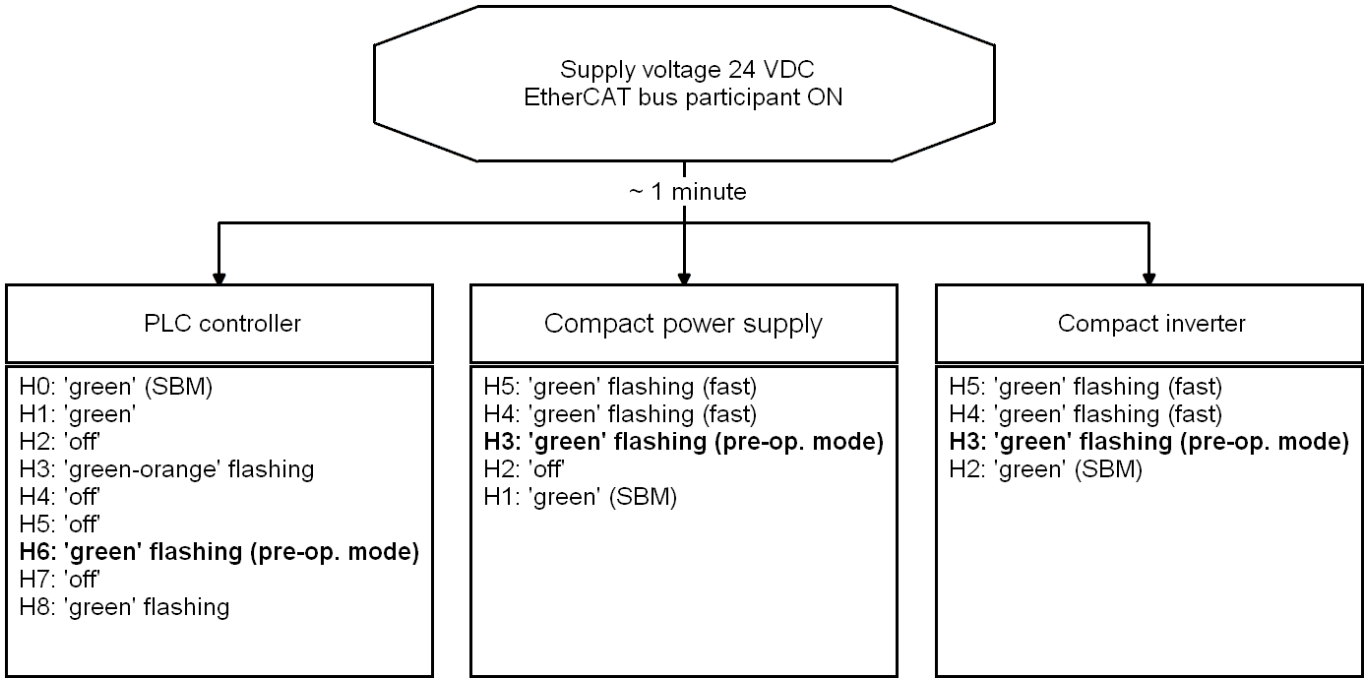
7.2 Direct connection via Ethernet

A direct connection is a point to point connection between PC and AMK controller.



See document Device descriptionControllers A4 / A5 / A6 (Part no. 202975), chapter 'Connection via Ethernet Interface X20'.

7.3 System run-up fieldbus



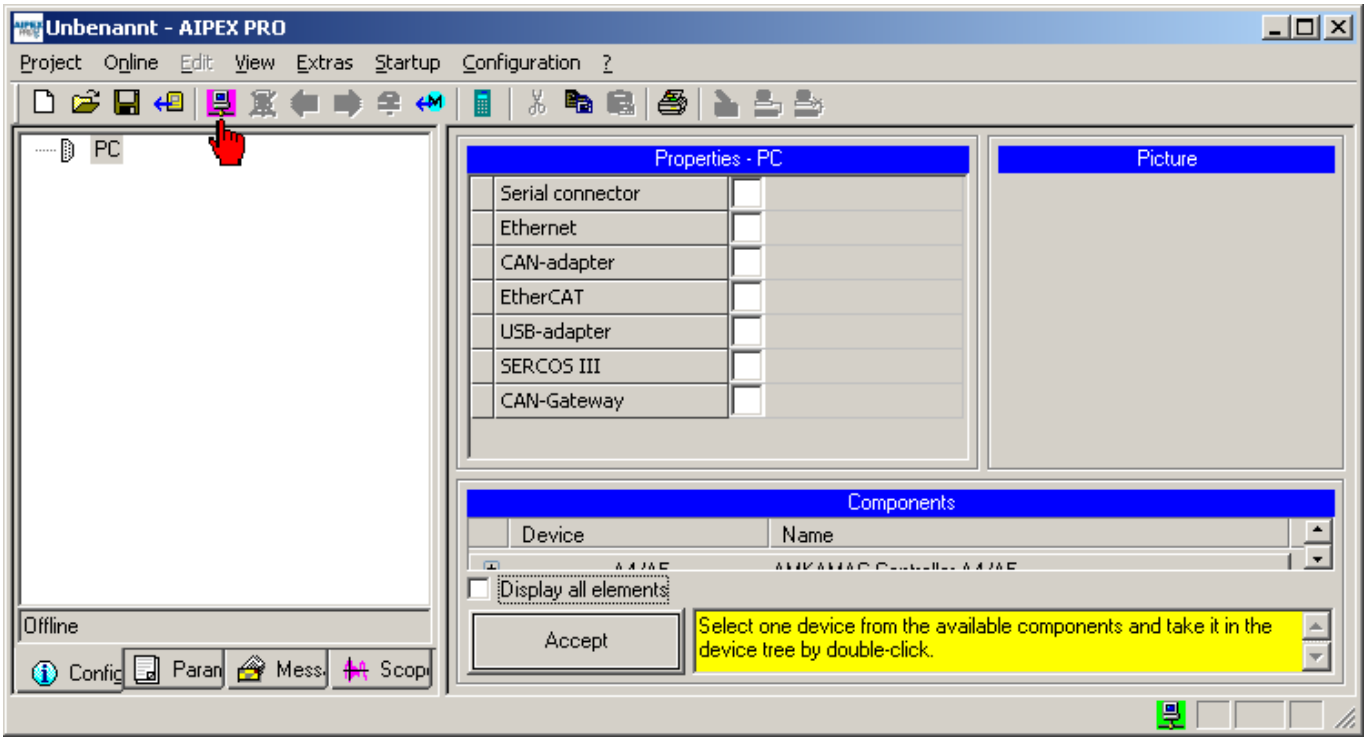
In case of a device error during the initialisation:

Status LED SBM = red (LED H0 (controller), H1 (compact power supply) or H2 (KW-R06 / -R16 / -R07 / -R17 / -R24(-R) / -R25 / -R26))

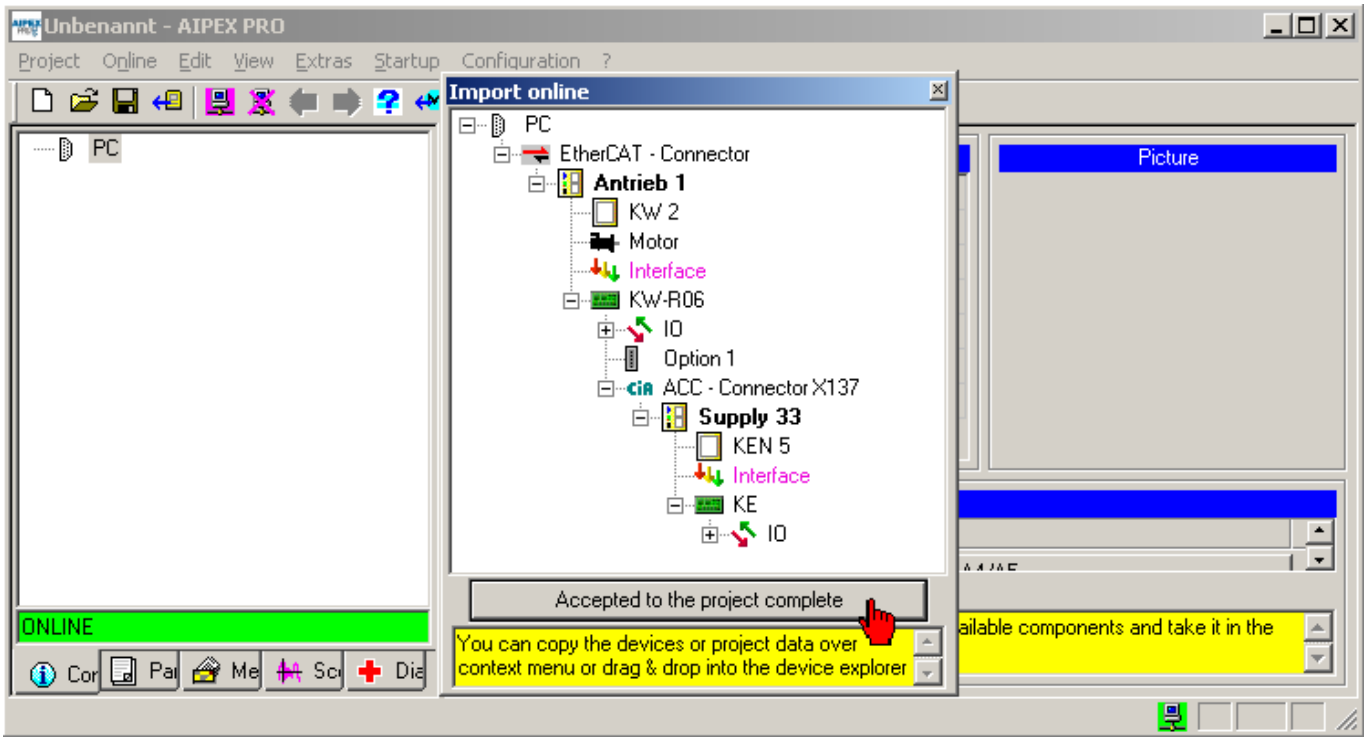
Siehe 'Error diagnosis with AIPEX PRO' auf Seite 67.

Only with an existing and valid xml configuration file, the fieldbus participants switch from pre-operational state to operational.

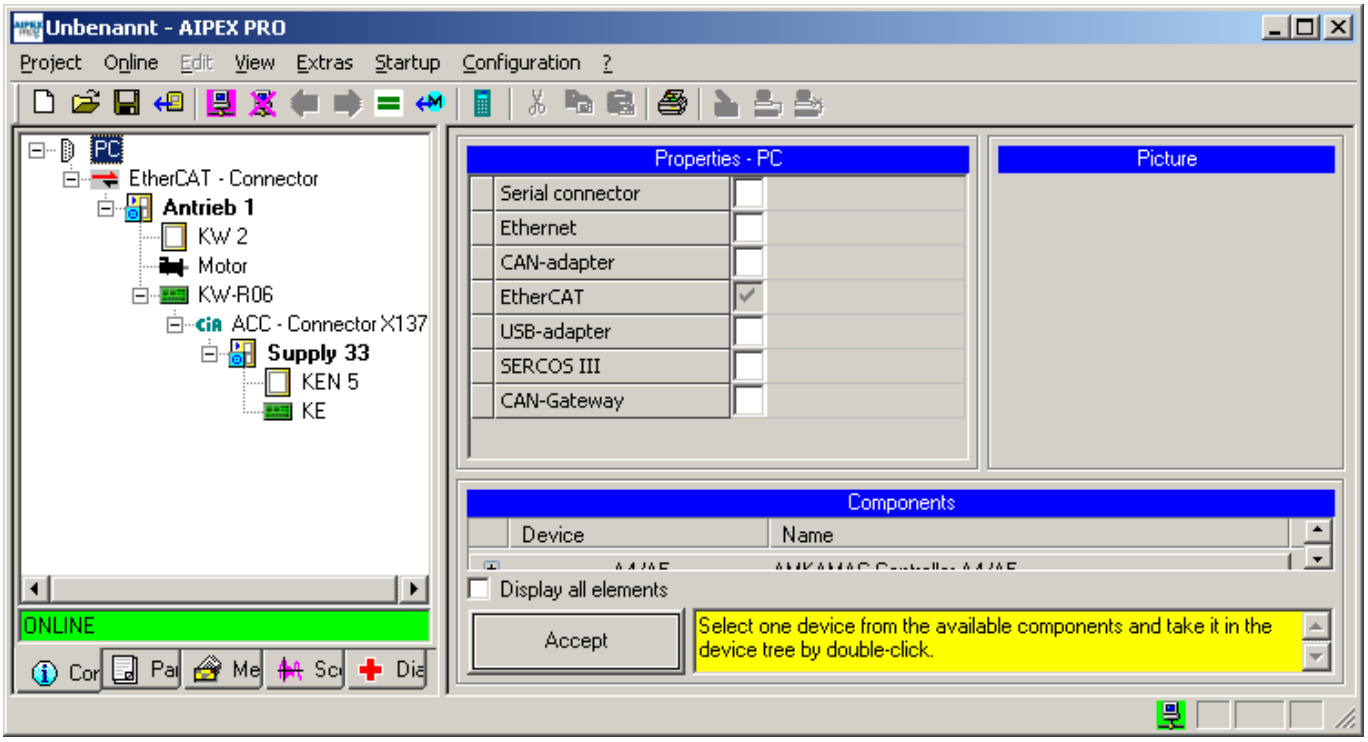
7.4 Logon fieldbus



Click 'Logon' to open the 'Import online' window



Click 'Accepted to the project complete' to import the detected devices.



End of initial startup

8 PLC programming

The startup of AMKAMAC A series PLC controllers is described in the device description 'Controllers A4 / A5 / A6' (Part no. 202975)

You will get guidance and hints for PLC programming in the following documents:

- **Basic knowledge AMK PLC programming in structured text (Part no. 204019)**

  This documentation describes the introduction in programming according to IEC 61131-3 with the programming software CoDeSys and the AMK function libraries. It explains the various modules, variables, data types and the instruction codes of the programming language Structured Text.
- **Software description AFL - AMK function libraries, (Part no.205795) includes AFL - AMK Function Library, part 1 standard function blocks and AFL - AMK Function Library, part 2 application blocks**

  The AMK Function Library contains standard function blocks which offer simple access to any standard functions of the controllers, power supplies and drives. The application blocks of the AMK Function Library offer further PLC functions for the drive control, e. g. print mark control or NC motion.

You can get the AMK Function Library with the AMK order no. O877.

9 Error diagnosis with AIPEX PRO

With 'Diagnostics', the diagnostic messages can be read out from the selected device.

Click on each message to receive an explanation for it. You get further information if you analyse Info (I), I2 and I3
The first message of the list is the main activator of the fault; further displayed numbers might be resulting errors which will not appear any longer after rectifying the cause of the first diagnostic message.

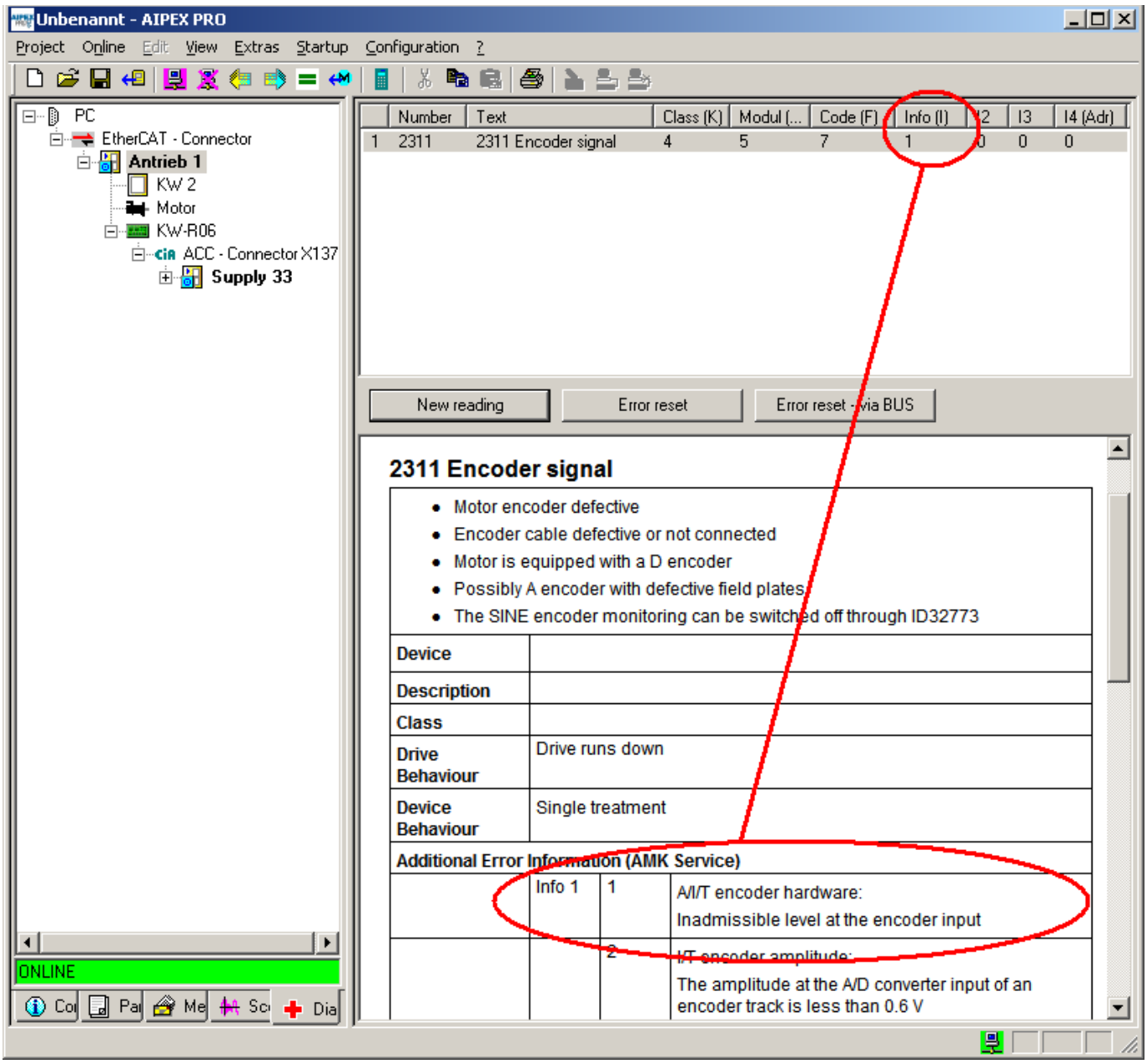
Button **'New reading'**
Diagnostic messages will be read out from the selected device.

Button **'Error reset'**
The errors will be deleted in the selected device .

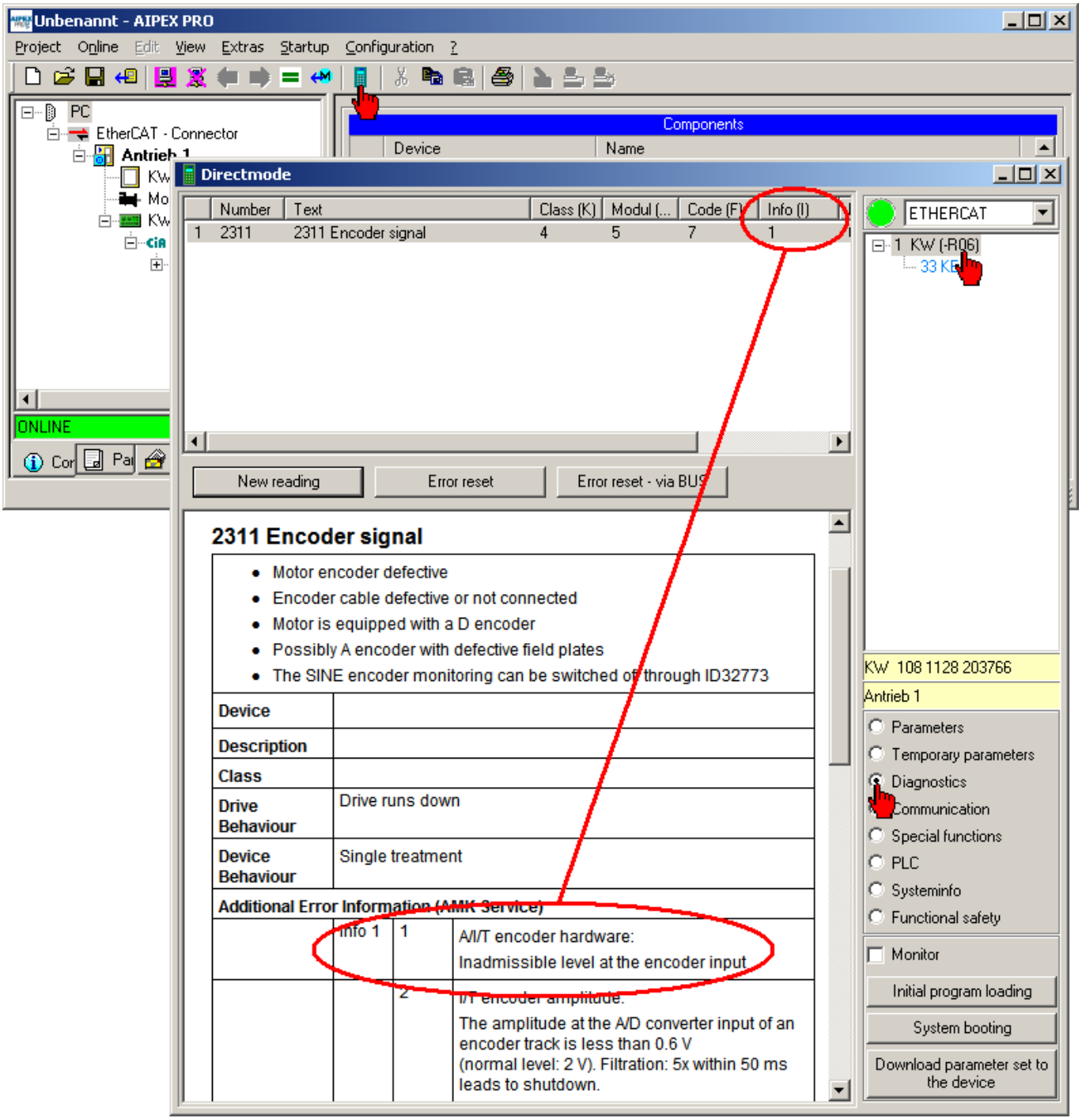
Button **'Error reset - via BUS'**
The errors of all devices of a bus line will be deleted. To do this, select the bus in the device tree.

After the causing error is rectified successfully, 'Error reset' activates a system restart and the system ready message SBM is set.

Diagnosis with AIPEX PRO (tab 'Diagnostics')



Diagnosis in direct mode



Glossary

A

A4 / A5 / A6
AMKAMAC controller A4 / A5 / A6

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

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

C

CAN
Controller Area Network

D

DC bus on
Converter on

Default
Factory setting

DZR
Speed control

E

EF
Power output stage enable

EF2
Power output stage enable

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

EtherCAT
Real-time Ethernet bus

F

FL
Command (Causes a new system run-up)

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

Firmware
System software, loaded by AMK

H

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

I

iC
AMKASMART decentralized inverter with power supply

ID
Parameter identification numbers acc. to SERCOS Standard

iDT
AMKASMART Servo motors with integrated inverter

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

iX
AMKASMART decentralized inverter

K

KW
AMKASYN compact inverter

KWD
AMKASYN compact double inverter to control two motors

KP
Proportional gain (speed control, PID controller)

KW-Rxx
AMKASYN controller card for installation into compact inverter

KEN
AMKASYN compact power supply without recovery

KES
AMKASYN compact power supply with sinusoidal voltage and current

Kv
Position loop factor

KE
AMKASYN compact power supply with recovery

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

L

LR
Position control

M

MDB
Motor database; it contains information about all AMK motor parameters

O

Operational
In state operational, data are transferred cyclically via fieldbus

P

Parameter
Identification number acc. to SERCOS standard

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

P-encoder
Absolute encoder singleturn, EnDAT 2.2 light

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

Q

Q-encoder
Absolute encoder multiturn, EnDAT 2.2 light

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

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

R

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

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

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

S

SafePMT
Safe parameter editor

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

SEEP
Device-internal memory, serial EEPROM

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

Sense of rotation
Clockwise rotation of motor with view to the motor shaft and positive setpoint

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

T

Td
Differentiating time in speed control (PID controller)

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

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

U

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

UE
Command 'DC bus on' control signal to load the DC bus e.g. in KE. DC bus on can only be set if the device is error-free (SBM = TRUE). After the DC bus is loaded, the acknowledgement message QUE is set.

UZ
DC bus (voltage)

V

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

Your opinion is important!

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

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Thank you for your assistance.
Your AMKmotion documentation team

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

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

2. Is the content structured well?

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

3. How easy is it to understand the documentation?

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

4. Did you miss any topics in the documentation?

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

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

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

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