Sensorless

Translation of the "Original Dokumentation"

Name: FKT_Sensorlos_en

Version:

Version: 2019/45	
Change	**Letter symbol**
• Controller card KW-R27 added	STL

Previous version: 2018/44

Product version:

Product (AMK part no.)	Firmware Version (AMK part no.)
KW-R24 (O901)	AE-R24 V2.11 2016/46 (206642)
KW-R24-R (O954)	AE-R24-R V2.11 2016/46 (206643)
KW-R25 (O902)	AE-R25 V2.11 2016/46 (206644)
KW-R26 (O903)	AE-R26 V2.11 2016/46 (206645)
KW-R27 (O957)	AE-R26 V2.12 2018/40 (207284)

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1 Description

Supported hardware: KW-R24 / KW-R24-R / KW-R25 / KW-R26 / KW-R27 /

The 'Sensorless' function is suitable for applications with three-phase asynchronous machines that do not need position control or permanent operation in the range of very low speeds or at standstill. Since the encoder is eliminated, the wiring complexity is reduced while the robustness of the drive system is simultaneously increased.

Compared to a controller with a voltage/frequency characteristic curve (U/f operation), 'Sensorless' has the advantage that the speed does not decline with increased load torque but is regulated to its setpoint. The information about the current rotor position needed for control is calculated from a measurement of current and voltage. This requires the motor parameters to be known exactly. In an automatic procedure, the AMK 'AIPEX PRO Startup' software determines the motor parameters and sets all relevant parameters in the controller.

2 Prerequisites and Conditions

The following points must be observed for use of the 'Sensorless' function:

- Controller card KW-R24(-R), KW-R25, KW-R26 , KW-R27 from firmware V2.02
- The function may be used only for three-phase asynchronous machines.
- No permanent speeds less than 5 %n_N
  The speed 0 r.p.m. can be run through. In permanent operation with speed setpoint 0 r.p.m., no encoder signal can be calculated, oscillations can occur around the point of rest and the actual value can drift. An external slow readjustment of the rotor position cannot be physically detected.
- No position control, no torque control
- Lower dynamics
  In the basic speed range of 0 r.p.m. to n_N, the setpoint generator must take into account at least one run-up time of 0.5 s. Load steps are allowed.
  In the range of the field weakening (to maximum 2 n_N), the setpoint generator must take into account at lease one run-up time of 2 s. Load steps are not allowed. The load torque must be changed slowly in the range of the field weakening so that the drive has enough time to set the new operating point with limited output voltage.
- No active loads (e.g. lifting devices, etc.)
- With regard to output voltage and output current, the inverter must be designed for the motor.
- For motors below 1 kW of shaft power, the inverter cannot differentiate between shaft power and the relatively high motor losses; this results in a worsening of speed accuracy in the lower speed range.
- For automatic determination of the motor parameters, the motor must be operated without load. The determined values can be transferred to inverters of the same type and output. For inverters of the same type but different output, the values must be newly determined.

3 Relevant parameters

Parameter	Parameter name	Meaning See document 'Parameter description' (AMK part no. 203704)
ID100 1)	'Speed control proportional gain KP'	The speed controller parameters must be determined and set in a manner that fits the mechanics.
ID101 1)	'Integral-action time speed control TN'	
ID102 1)	'Differentiating time speed control TD'	
ID109 1)	'Motor peak current'	The motor parameters from the identification plate or data sheet must be entered during initial startup.
ID111 1)	'Motor nominal current IN'	
ID32768 1)	'Nominal motor voltage'	
ID32769 5)	'Magnetising current'	
ID32772 1)	'Nominal velocity'	
ID32775 1)	'Pole number motor'	
ID32774 4)	'Rotor time constant'	The motor parameters can be measured by the startup software and entered into the parameters.
ID34185 4)	'Resistance rotor'	
ID34186 4)	'Inductance stator'	
ID34187 4)	'Inductance rotor'	
ID34188 4)	'Main inductance'	
ID34233 4)	'Phase resistance'	
ID34050 4)	'Current path Q integral-action time TN'	The current controller values are determined by the Sensorless startup function and automatically entered into the parameters.
ID34052 4)	'Current path D integral-action time TN'	
ID34151 4)	'Current path Q proportional gain KP'	
ID34152 4)	'Current path D proportional gain KP'	
ID34184 4)	'Compensation dead time PWM'	
ID34191 4)	'Velocity acquisition propotional gain'	
ID34192 4)	'Velocity acquisition integral-action time'	
ID32800 1)	'AMK main operating mode'	Only the speed control setting is allowed (ID32800 = 0x3C0043 default value).
ID32780 1)	'Acceleration ramp'	The acceleration time must be set sufficiently large.
ID32781 1)	'Deceleration ramp'	The deceleration time must be set sufficiently large.
ID32953 4)	'Encoder type'	ID32953 = 50 for sensorless operation of a synchronous motor
ID34189 1)	'Bit list sensorless'	See 'ID34189 'Bit list sensorless" on page 9.

1) The parameter value must be set specific to the application

4) Parameter value is determined by the startup software and automatically entered into the ID

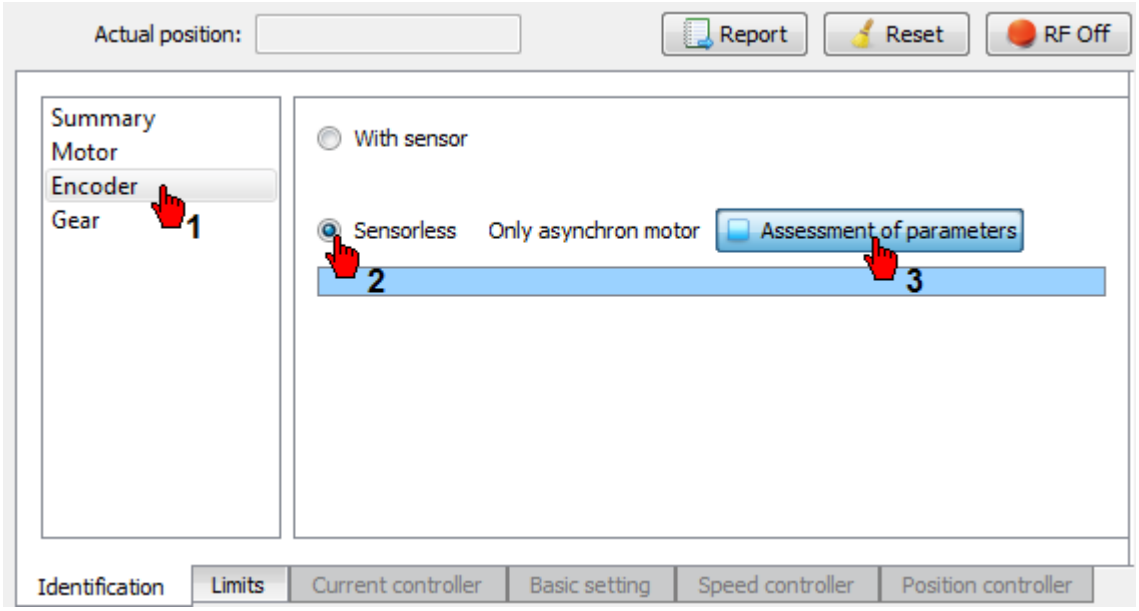
5) Alternatively, COS (Phi) can be entered during startup.

4 Startup

The motor must be connected on the power side to an inverter. No loads may be applied to the motor shaft; the motor must be able to turn freely. The DC bus voltage must be applied to the inverter.

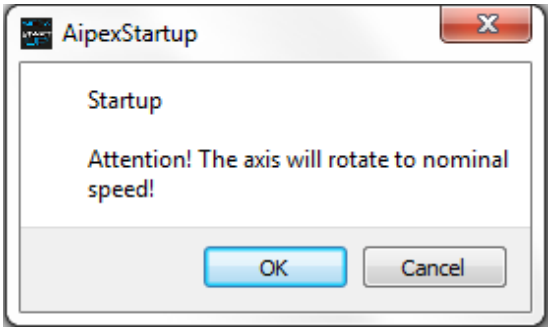
The function 'Sensorless' is called up as follows:

Select the drive under 'Device Selection'.



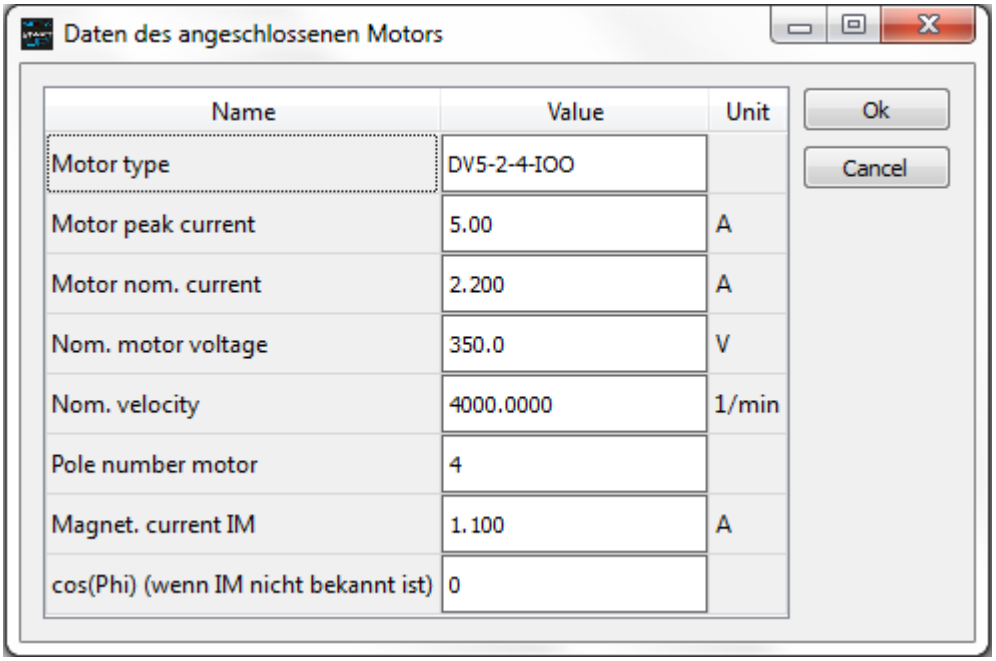
The 'Current Controller', 'Basic Settings', 'Speed Controller', and 'Position Controller' are not available when the 'Sensorless' function is selected.

After 'Determine Parameters', the following window opens:



First, the software displays the currently set motor data.

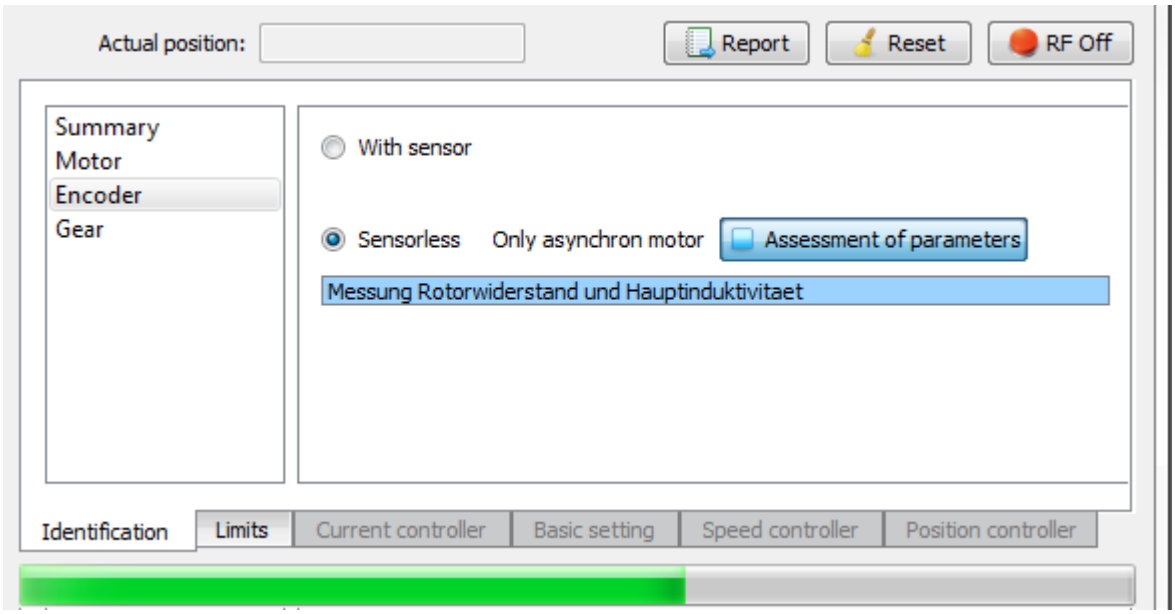
⚠DANGER	
⚠	**Danger to life due rotations of the motor shaft!** If the displayed data are confirmed with OK, the motor is energized and can accelerate up to the rated speed (nominal speed n_N). **Preventive measures:** • Ensure that no persons are in the range of movement of the machine.



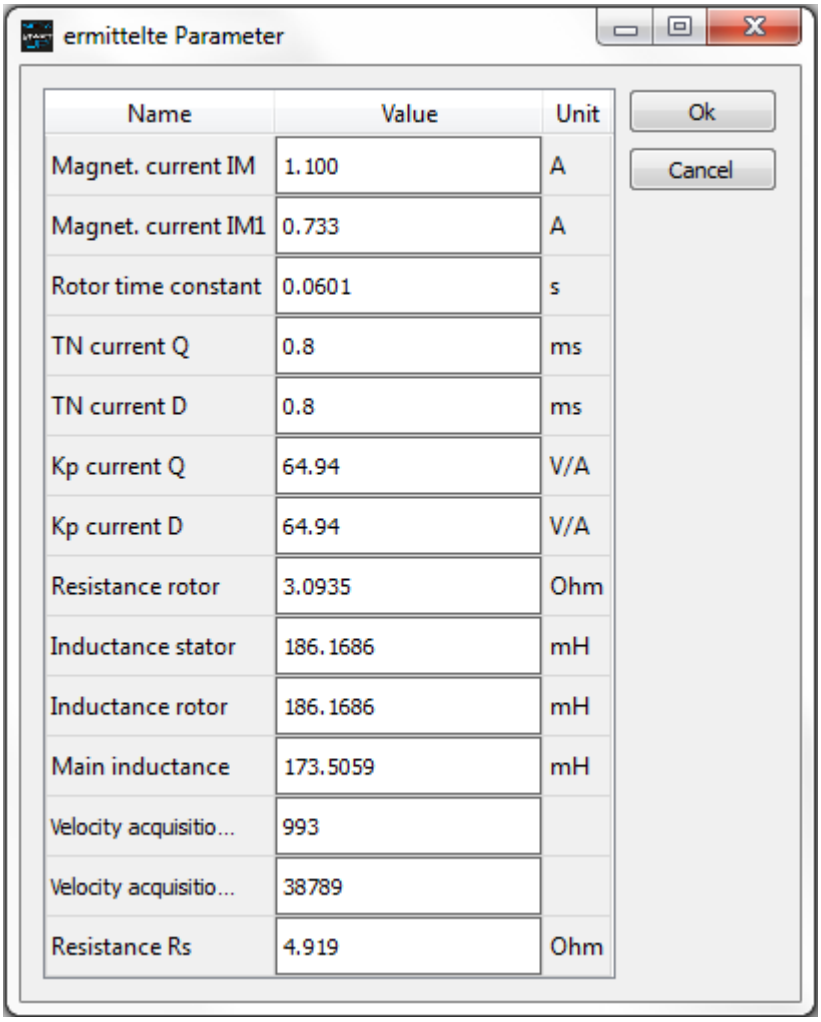
The displayed data must fit the connected motor and can be changed by the user. Motor data can be found on the identification plate and in the motor data sheet, for example.

If COS (Phi) <> 0, the magnetizing current is calculated from it. Enter COS Phi only if the magnetizing current is not available!

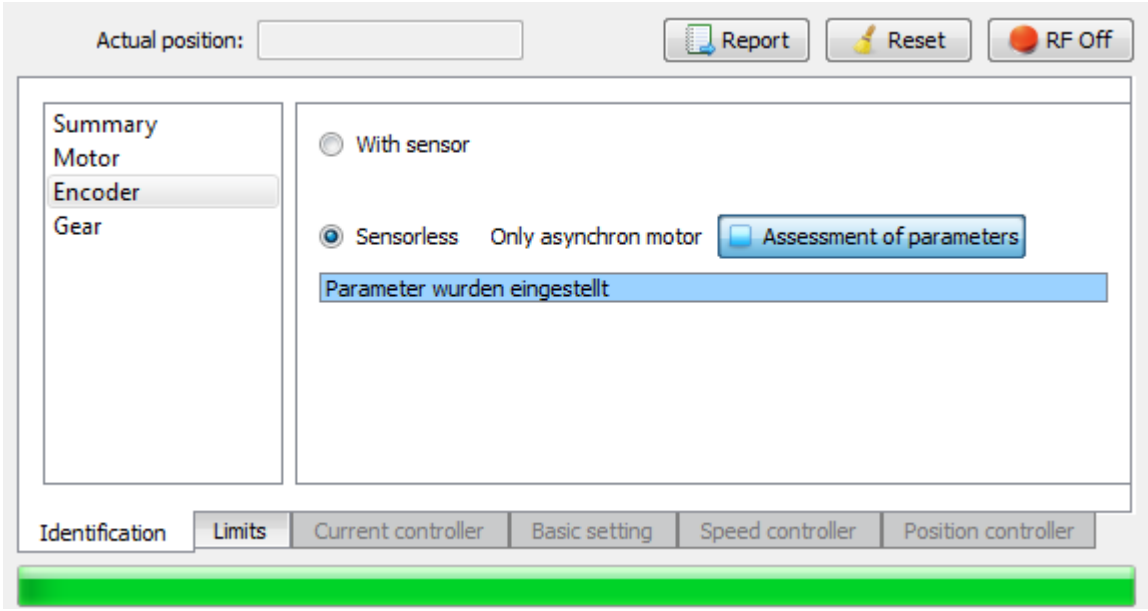
Start automatic measurement with 'Ok'.



The data necessary for sensorless control of the motor are determined in several successive measurements. At the end, the determined data are displayed and can be adapted by the user as needed.

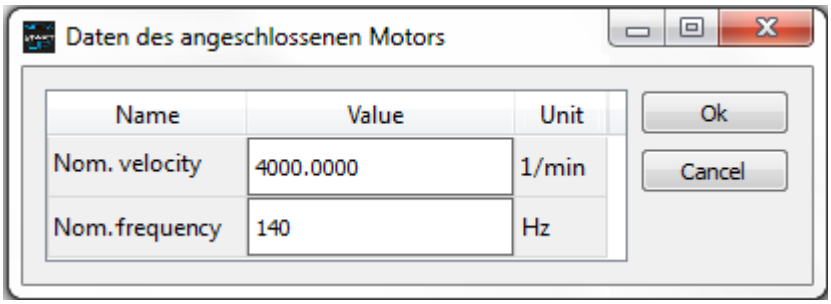


Confirm the determined parameters with 'Ok', which causes the values to be written to the corresponding parameters of the drive.



After the startup procedure has been successfully, completed, the value 0x0050 is automatically entered to ID32953 'Encoder type' and the asynchronous motor is ready to be operated sensorlessly.

If the measurement was not successful, this is displayed in the text window. Startup software tries to calculate suitable parameters from the data on the identification plate. You must enter the nominal frequency and nominal speed of the motor in the open window for the calculation.



From the nominal frequency and nominal speed, the software calculates the slippage in the nominal point with which additional characteristic values are calculated.

Appendix

ID34189 'Bit list sensorless'

Configuration ID34189 'Bit list sensorless'

Bit no.	Condition	Meaning
0 (LSB)	0	The sensorless operation mode starts at standstill of the motor.
	1	The sensorless operation mode starts at standstill or during the motor is turning (detected actual speed value)
1-15	0	Reserved
	1	Reserved