

How can the operator detect incorrect pole position identification on synchronous motors?

This FAQ affects all synchronous spindles on SIMODRIVE 611 the coarse position of which is detected through saturation-based pole position identification.

This FAQ describes how to further increase the probability to detect pole position identification faults during operation. This method checks the validity of the commutation angle offset determined in P1016 using the zero mark of the motor encoder used for pole position identification.

If the saturation-based pole position identification does not yield an exact result and the motor is therefore operated using a non-optimal commutation angle, a reduced torque and performance are output with identical current values. Increased current is required to generate performance values which are identical to those achieved when operating with correct commutation angle. This may lead to increased motor heating or even damage the motor.

In case of large deviations of the commutation angle, the motor may move in an uncontrolled manner.

Prerequisites for applying this procedure:

- ⇒ Installation of a motor measuring system with only one zero mark
- ⇒ Check existence and function of encoder zero mark;
- ⇒ Encoder increments must be modulo 16 resp. modulo 10;
other increments are not permissible

Parameters required – to be checked and, if necessary, set:

- ⇒ Zero mark monitoring must be activated
 - Detects zero mark failure due to, among others, broken cables, crimp faults, EMC
 - Factory setting in P1600 / Bit 8 (P1600.8)
 - Check assignment of P1600.8, correct, if necessary
 - P1600.8 = 0 => motor measuring system zero mark monitoring active
- ⇒ Synchronization monitoring must be active
 - Detects deviations from the commutation angle > 45°
 - Factory setting in P1600 / Bit 7 (P1600.7)
 - Check assignment of P1600.7, correct, if necessary
 - P1600.7 = 0 => synchronization fault, rotor position active
- ⇒ Pole position identification has to be performed **with fine synchronization**
 - To be set in P1011 / Bit 12 and Bit 13
 - ⇒ P1011.12 = 1 => detection of commutation angle offset;
in this status, the drive has been roughly synchronized;
Notice: Factory setting P1011.12 = 0
 - ⇒ P1011.13 = 0 => when the zero mark is passed for the first time, the commutation angle offset from P1016 is adopted for commutation;
in this status, the drive is precisely synchronized.

Only when commissioning for the first time – adopt commutation angle offset with commissioning tool for zero mark:

- ⇒ Procedure (for SIMODRIVE)
 - Select pole position identification, e.g. saturation-based procedure
 - P1017 => 1
 - Reset the NCK
 - P1017 has been reset to P1017 = 0 (contrary to the Installation Guide)
 - P1017 => 1 has to be set again, NCK need not be reset again
 - Servo enable
 - Zero mark passed through speed setpoint setting
 - The angle detected is adopted in P1016 for fine synchronization
 - Alarm 300799 (“Boot file must be saved“) is set -> can only be acknowledged by NCK Reset
 - Reset the NCK
 - Notice: Normally, Alarm 300799 is overlapped in the status line by Alarm 25201 (“Axis x Drive y Fault“). This is documented in the diagnostic buffer.

- ⇒ Check pole position identification via P1736 (“Rotor position identification test“)
 - It must be possible to freely revolve the motor (without load), e.g. the current can be neglected
 - The drive must be precisely synchronized when passing the zero mark for the first time
 - For test purposes, repeat P1736 pole position identification several times for different rotor positions
 - ⇒ Set P1736 = 1; automatically reset to 0 after pole position identification
 - ⇒ Read off the difference between the newly determined rotor position angle and the currently used rotor position angle in P1737; the difference must be smaller than 10°
 - ⇒ In the first test stage after moving the rotor to a new position, the deviation may be higher than 10°. However, it must be reduced to a value of less than 10° after the second test stage.

Further remarks:

- ⇒ When using the commissioning tool, the commutation angle offset determined reaches precise values (deviation of less than 2°). Another method to check the pole position identification and further increase the accuracy is described in a separate FAQ.

- ⇒ If the motor freely revolves, we recommend that you use the motion-based pole position identification to determine the commutation angle offset and takeover into P1016 using the commissioning tool.

In order to roughly synchronize the drive during the following operation, you can change over to saturation-based pole position identification.
The procedure to be applied to motion-based pole position identification is described in detail in the documentation, e.g. “SIMODRIVE 611 digital / SINUMERIK 840D/810D – Drive Functions – Function Manual“ / Chapter 2.5.