

AxN Automatic Encoder Phasing Procedure

SUMMARY

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Introduction

To correctly set up the AxN drive it is necessary to calculate the electrical angle offset between the rotor shaft and the motor encoder. AxN drive implements an automatic procedure that calculates the correct offset value.

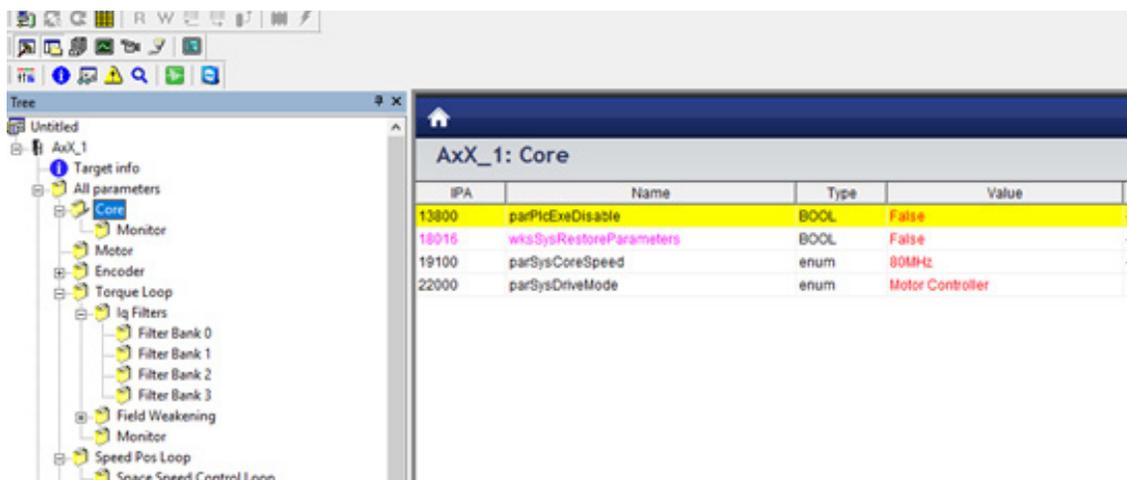
Prerequisites

To execute automatic phasing procedure, it is necessary to satisfy the following points:

1. The AxN drive must be correctly connected to the three phases AC power line, respecting the R, S, T phases notation.
2. The motor must be correctly connected to the AxN drive, also in this case, respecting the phases notation. On AxN drive phases output are identified with the A, B, C letters, to avoid confusion with input phases.
The correspondence with the motor phases are:
 - AxN line A → Motor phase U (Blue)
 - AxN line B → Motor phase V (Red)
 - AxN line C → Motor phase W (Yellow)
3. The motor encoder must be correctly mounted and fixed on the motor shaft and the AxN drive must be able to correctly read the encoder's position values.
4. The motor shaft must be free to turn. During the procedure the shaft can slowly rotate, it is recommended to run the procedure in a safe way when no person is working near to the shaft.
5. Cockpit3 project must contain correct parameters for the motor in use and Cockpit3 must be able to connect and to control AxN drive by using the serial line connection.
6. It is preferable, but non mandatory, to execute the phasing procedure with the lowest possible rotational inertia on the shaft. Phase Motion Control recommends performing the procedure when the motor shaft is detached from any load.

Phasing the encoder

1. The activity of a PLC program is not compatible with the phasing procedure so, as first thing, it is necessary to check out if a PLC program is running and, in this case, to disable the PLC execution. In Cockpit3 Tree menu select **All parameters** → **Core** and check the **parPlcExeDisable (IPA 13800)** parameter.
If it is set to FALSE, set it to TRUE, then save parameters on drive and perform a drive reset.



- Set the value of electrical angle offset to zero by changing the parameter **Encoder** → **Main** parMotor-Data.PhaseOffset (IPA27812).
- Set up procedure values from **Encoder Main** → **Electrical Field Orientation** menu. Parameters to set are:
 - IPA26302: parEncEFS.ProcedureType : IDRAMP option.
 - IPA26303: parEncEFS.Flags.Force : TRUE (Only for EnDAT absolute encoder).
 - IPA26305: IdRampTime: Total time of the phasing procedure.
 - IPA26306: IdRampCurrent: % of motor's peak current.
 - Default values for IdRampTime (0.5 sec) and IdRampCurrent (30%) are suitable for small motors with a low rotational inertia shaft.

In order to reduce the number of iterations to find the correct angle it is suggested to set up the IdRampTime to 2 seconds value.

The screenshot shows the Cockpit software interface with a tree view on the left and a parameter table on the right. The tree view shows the hierarchy: AxX_1 > Encoder > Main > Electrical Field Orientation. The parameter table is titled 'AxX_1: Electrical Field Orientation' and contains the following data:

IPA	Name	Type	Value	Um	Default
26302	parEncEFS.ProcedureType	enum	Id Ramp	--	Disabled
26303	parEncEFS.Flags.Force	BOOL	False	--	False
26304	parEncEFS.SpeedThreshold	REAL	5.24	rad/s	5.24
26305	parEncEFS.IdRampTime	REAL	0.500	sec	0.500
26306	parEncEFS.IdRampCurrent	REAL	30.0	%	30.0
26308	parEncEFS.ElecAngleFeed	REAL	0.015	%	0.015
26309	parEncEFS.IdSteadyTime	REAL	0.000	sec	0.000
26310	parEncEFS.PIK	INT	162	--	162
26311	parEncEFS.PIKp	INT	31103	--	31103
26312	parEncEFS.PIErMax	INT	4550	--	4550
26313	parEncEFS.PIGlobalShift	INT	13	--	13
26314	parEncEFS.PiOutValLimit	DINT	65535	--	65535

- Set up the AxN drive to operate in Torque Mode by changing the IPA29016 parDevCtrl.ModeOfOperation parameter under **Device Control** menu. If the current value for IPA29016 is not torque mode, annotate the value that must be restored at the end of the procedure.

IPA	Name	Type	Value
29000	wksControlWord	UINT	0000
29001	varStatusWord	UINT	0000
29016	parDevCtrl.ModeOfOperation	enum	Torque Mode
29017	varModeOfOperationDisplay	enum	Profile Velocity
29020	parDevCtrl.QuickStopOptCode	enum	QuickStop
29021	parDevCtrl.ShutdownOptCode	enum	Power Off
29022	parDevCtrl.DisableOperationOptCode	enum	SlowDown
29023	parDevCtrl.HaltOptCode	enum	SlowDown
29024	parDevCtrl.FaultReactionOptCode	enum	QuickStop
29044	parDevCtrl.RatedTorque	UDINT	0

- Set up the visualization of the IPA26307 varEncMainDeltaAngle parameter, by drag and drop the variable from **Encoder** → **Main** → **Monitor** menu to the Oscilloscope graph window.

IPA	Name	Type	Value	Um
26010	varEncMainMechHi	DINT	0	
26011	varEncMainMechLo	REAL	0.0000	*
26012	varEncMainMechAbsPosOffsetHi	DINT	0	
26013	varEncMainMechAbsPosOffsetLo	REAL	0.0000	*
26014	varEncMainMechSpeed	REAL	0.00	rad/s
26015	varEncMainMechAccel	REAL	0.0000	rad/s ²
26016	varEncMainElecAngle	REAL	0.0000	*
26307	varEncMainDeltaElecAngle	REAL	0.0000	*

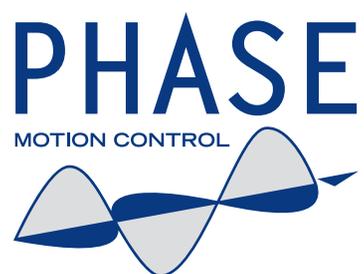
- Save parameters to drive and then perform a reset.
- Enable the drive by setting up IPA2900: wksControlWord, under **Device Control** menu to value 0x000F.
The motor shaft will rotate to a new position, when rotation ends, set up control word (IPA2900) to 0x0.

- a. If the shaft does not rotate, set up control word (IPA2900) to 0x0, increase the value IPA26306: IdRampCurrent adding a 10% to the current value and repeat the procedure by setting IPA2900 to 0x000F.
 - b. If the shaft rotates but visualized trajectory seems to be trunked or if it shows oscillations set up control word (IPA2900) to 0x0, increase IPA26305: IdRampTime by doubling its current value and repeat the procedure by setting IPA2900 to 0x000F.
8. When the procedure terminates with a smooth result get the value from IPA26307 varEncMainDelta-Angle and copy it in **Encoder** → **Main** parMotorData.PhaseOffset (IPA27812), then save parameters to drive.

Restore normal operativity

Once the new angle offset has been set up it is possible to restore AxN drive normal operation restoring the parameters modified during the procedure:

1. Set up IPA26302 parEncEFS.ProcedureType to Disable.
2. Set up IPA29016 parDevCtrl.ModeOfOperation to the original value before the change to Torque Mode.
3. Set up IPA26303 parEncEFS.Flags.Force to FALSE.
4. If it has been changed in the beginning of the phasing procedure, restore IPA 13800 parPlcExeDisable to FALSE.
5. Save all parameters and reset the drive.



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Iscritta al R.E.A. di Genova al N. 343807

Capitale Sociale Euro 5.000.000 Interamente versato

P.IVA 03425740101