User's manual
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Release A

Automated offset correction for absolute rotate movement over the feedback unwind

Programmed with TIA Portal V13

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Trademarks

AKD are registered trademarks of Kollmorgen Corporation
TIA Portal is a registered trademark of SIEMENS AG
Modbus is a registered trademark of Modicon, Incorporated

Notes

For better readability of the code all variables have a of lower case letter prefix, the definition is as following.

Prefix	Size	Description
i	Unknown	Input
o	Unknown	Output
b	1 Bit	Bool
by	8 Bit	Byte
w	16 Bit	Word
dw	32 Bit	Double Word
	Unknown	Variable struct

Contents

Introduction

An absolute feedback axis has a position value, which stays valid over power down. This Position has to be setup once with an offset, stored in the nonvolatile memory.

If the movement of the axis is bigger than the resolution of the feedback, this position may not be valid anymore after a power down. For the most absolute feedback devices this number is 4096 equals ±2048 revolutions. On rotary application, as long as the costumer revolutions are a multiple of the absolute revolution nothing changes. If the costumer application gear ratio isn't a common factor of the feedback unwind. The absolute position of the motor moves after power down, with every roll over.

To eliminate this effect a correction calculation in the PLC can be implemented. This document covers one possible solution to the situation for a AKD with Modbus connected to a Siemens S1200 PLC.

The absolute feedback position is set with the *AKD_MBComm_Param* data bloc. For calculating the offset correction position and velocity of the axis is needed which is taken form the *AKD_MBComm* data bloc.

Notes

To be capable of calculating the correction the data in the PLC have to be stored in the retain memory. The *AutoOffsetCalc* Funktions is not automatically called with every startup. This is to prevent error in connection with the other needed data blocs. The user has to make sure the communication to the AKD with the *AKD_MBComm* is running and the parameter control with the *AKD_MBComm_Param* is given before starting the correction.

To offset has to be set with the *AutoOffsetCalc* function. Otherwise the recalculation is not working with valid numbers. To be able of setting the offset the drive has to be disabled. If the drive has power on the new offset value is ignored and no fault is generated.

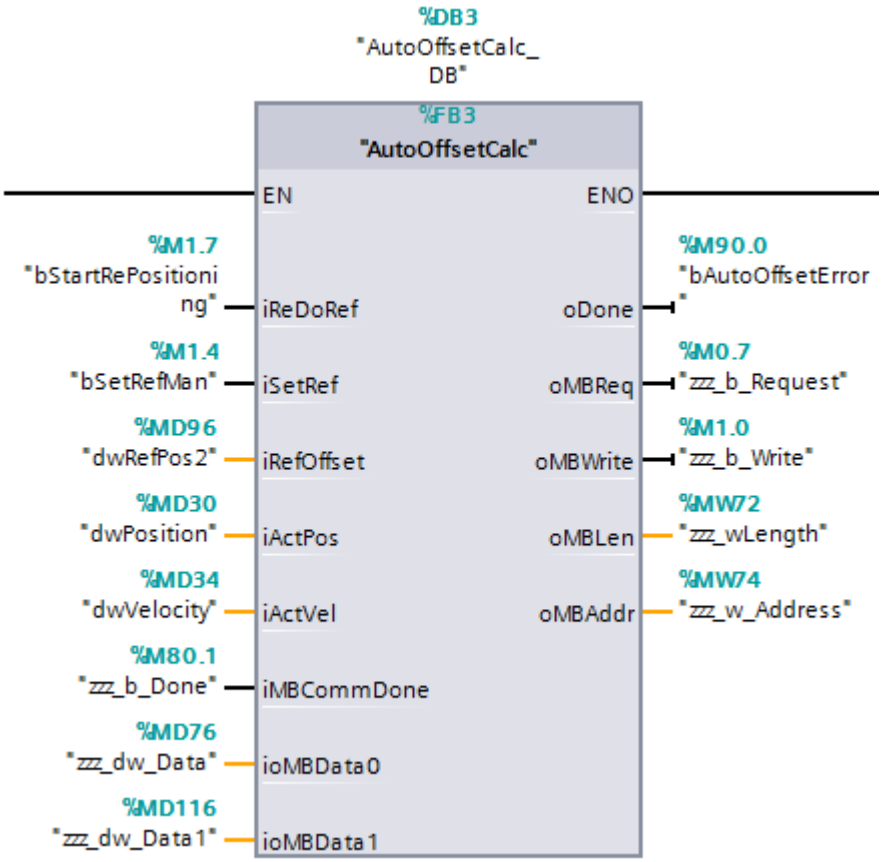
The function *iStart_Homing* or *iSet_RefPos* of the *AKD_MBComm* data bloc, as well as a direct offset setting with workbench has not to be used. If any of this function is executed the AKD needs to be powered down to reset all internal offsets. These values cannot be read with Modbus and therefor generated some not reproducible offset. To control the offset values all offset have to be set with the *AutoOffsetCalc* function.

As this calculation are done in the PLC and the position can change with no connectivity to the drive, there are situation where the auto offset calculation can fail. The user has to make sure the call of the recalculated offset can be used and the new position makes sense.
If the motor gets moved over the unwind in a power down state the new offset will be wrong

Automated offset correction

Configuration

The function **AutoOffsetCalc** is the interface for the user in the PLC. This function bloc is used to set and recalculated the offset an absolute axis for a rotated axis with a non-binary gear to the costumer application.



In the data bloc all variables have to be set as **retain**, to enable a recalculation of the position after a power down situation.

Name of the variable	Type	Direction	Description
EN	Bool	In	Call of the DB
iReDoSetRef	Bool	In	Automated recalculation of the offset position
iSetRef	Bool	In	Manual setting of an absolute position
iRefOffset	DInt	In	Manual reference position
iActPos	DInt	In	Actual axis position
iActVel	DInt	In	Actual axis velocity
iMBCommDone	Bool	In	Done bit of the direct parameter access
ioMBData0	DInt	In	First double word of the direct parameter access
ioMBData1	DInt	In	Second double word of the direct parameter access
ENO	Bool	Out	DB call done
oDone	Bool	Out	Offset setup done, supervision of revolutions active
oMBReq	Bool	Out	Request for direct parameter access
oMBWrite	Bool	Out	Defines the direct parameter access
oMBLen	UInt	Out	Length of the direct parameter access
oMBAddr	UInt	Out	Address of the direct parameter access

wAutoOffsetStatus	Int	Static	Internal status
dwFBUnwind	DInt	Static	Number of unwinds of the feedback device (can be adjusted)
dwGearRatio	DInt	Static	Gear ratio between feedback device and costumer application (can be adjusted)
dwStartNumRev	DInt	Static	Number of feedback revolution at the setting offset position
dwActNumRev	DInt	Static	Actual number of revolution in the drive
dwFaultPerUnw	DInt	Static	Offset fault correction value for every unwind count
dwNumberOfUnw	DInt	Static	Number of unwinds since last setup
dwActRev	DInt	Static	Number of revolution for the actual position
dwOldActRev	DInt	Static	Old number of revolution for the actual position
bManualHomingDone	Bool	Static	Rising edge of the manual set offset position
bMBCommStarted	Bool	Static	Rising edge of the direct parameter access done flag
bStartDone	Bool	Static	Rising edge of the automatic offset calculation
dwActPos	DInt	Static	Actual absolute position
bDoNewRefPos	Bool	Static	Initiate a new reference offset for the actual value
dwNewRefPos0	DInt	Static	High double word for the new offset value
dwNewRefPos1	DInt	Static	Low double word for the new offset value
dwPosResolution	DInt	Static	Position resolution MODBUS.PSCALE
bFBUnwind	Bool	Static	Defines the unwind of the feedback FALSE = ±fwFBUnwind/2; TRUE = 0 – dwFBUnwind
bDirveDir	Bool	Static	Positive direction of the actual position to the feedback (DRV.DIR)
dwActVel	DInt	Static	Local copie of the actual speed
dwOldActPos	DInt	Static	Last actual position value

Local Settings

Row 14 – 18 allows the user to setup the calculation behavior. These settings have to be done once for the application, according to the hardware.

dwFBUnwind
Number of revolution the feedback device can indicate, before there is a unwind. This value can be seen in the datasheet of the device. A typical values is 2^12 = 4096.

bFBUnwind
Defines how the feedback is indicating the revolution values
FALSE = the number of revolutions will always be between plus/minus half of the unwind
TRUE = the number of revolutions will always be a positive value between zero and unwind

bDriveDir
Interpretation of the actual position and speed value according to the feedback direction. This value has to be set as DRV.DIR.
FALSE = turning direction of the actual values and the feedback are the same
TRUE = turning direction of the actual values and the feedback are opposite

dwGearRatio
Gear ratio between one application revolution and one motor revolution. The modulo function of the drive has to be set to the same value, as the FB1.OFFSET is only set within in this window.

dwPosResolution
Position resolution per motor revolution. The standard value for Modbus is 2^20 = 1048576.

A change of the position resolution has to be done at multiple places in the software. The resolution is not only important for direct conversions, but also for shifts and variable length interpretation. If a change is needed handle with care and revalidate the functionality!

Detail Description of the input and output

iReDoRef
Activates the recalculation of the reference offset. This function has to be activated after a power up if the *iSetRef* has been done with this axis previously.

iSetRef
Sets the actual position to the designated value of *iRefOffset*.

iRefOffset
Offset for the *iSetRef.*

iActPos
Actual position of the axis

iActVel
Actual velocity of the axis.

iMBCommDone
Confirmation for a direct parameter access request.

ioMBData0
First double word of the direct parameter access.

ioMBData1
Second double word of the direct parameter access.

This data are used for read the absolute feedback position and to write the new offset. As both happens in coordination with the AKD_MBComm_Param the separation to when which data bloc is reading or writing has to be done carefully.

oDone
Confirmation that the offset setting has been done and the revolution supervision is actve.

oMBReq
Direct parameter request at the *AKD_MBComm_Paramd* data bloc.

oMBWrite
Direct parameter request read or write definition.

oMBLen
Length of the direct parameter access.

oMBAddr
Address of the direct parameter access.

Calculation example

The feedback device has a resolution between ±2048 revolutions in this example.

Überlauf Problem MRupf 06.05.2015

Einstellungen			**Resultat**		
Anwendungsverhältniss	10	:1	Offset Fehler per Überlauf		
Rückführungsauflösung	2048	u	in Umdrehungen	4	u
Einheit pro Motor Umdrehung	360	°	in Einheiten	1440	°

		Kontinuierlich			**Nachneustart**		
	Überlauf	**u**	**pos [°]**	**neu u**	**neue pos [°]**	**differenz [°]**
Vorwärts Bewegung	0	2047	2520	2047	2520	0
	1	3000	0	-1096	1440	1440
	1	5048	2880	952	720	1440
	2	7096	2160	-1096	1440	2880
	2	9144	1440	952	720	2880
	3	11192	720	-1096	1440	720
	3	13240	0	952	720	720
	4	15288	2880	-1096	1440	2160
	4	17336	2160	952	720	2160
	5	19384	1440	-1096	1440	0
	5	21432	720	952	720	0
	6	23480	0	-1096	1440	1440
	6	25528	2880	952	720	1440
	7	27576	2160	-1096	1440	2880
	7	29624	1440	952	720	2880
	8	31672	720	-1096	1440	720
	8	33720	0	952	720	720
	9	35768	2880	-1096	1440	2160
	9	37816	2160	952	720	2160
	10	39864	1440	-1096	1440	0
	10	41912	720	952	720	0
	11	43960	0	-1096	1440	1440
	11	46008	2880	952	720	1440
	12	48056	2160	-1096	1440	2880
Rückwärts Bewegung	0	-2047	1080	-2047	1080	0
	-1	-4095	1800	1	360	-1440
	-1	-6143	2520	-2047	1080	-1440
	-2	-8191	3240	1	360	-2880
	-2	-10239	360	-2047	1080	-2880
	-3	-12287	1080	1	360	-720
	-3	-14335	1800	-2047	1080	-720
	-4	-16383	2520	1	360	-2160
	-4	-18431	3240	-2047	1080	-2160
	-5	-20479	360	1	360	0
	-5	-22527	1080	-2047	1080	0
	-6	-24575	1800	1	360	-1440
	-6	-26623	2520	-2047	1080	-1440
	-7	-28671	3240	1	360	-2880
	-7	-30719	360	-2047	1080	-2880

About KOLLMORGEN

Kollmorgen is a leading provider of motion systems and components for machine builders. Through world-class knowledge in motion, industry-leading quality and deep expertise in linking and integrating standard and custom products, Kollmorgen delivers breakthrough solutions that are unmatched in performance, reliability and ease-of-use, giving machine builders an irrefutable marketplace advantage.

For assistance with your application needs, visit www.kollmorgen.com or contact us at:

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