AKD2G SYSTEM CONFIGURATION WITH KOLLMORGEN DDL LINEAR MOTORS

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This document shows the wiring requirements for connecting the DDL linear motors to the AKD2G servo drive. It also describes the setup procedure for configuring the AKD2G drive in the Workbench software.

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AKD2G System Configuration with Kollmorgen DDL linear motors with standard convention

Overview

This procedure covers the case where the feedback AXIS#.PL.FB counts up or positive when moving the coil in the same direction as the motor lead exit. In the case the feedback counts down or negative using this convention the standard procedure can still be followed assuming your feedback type is one where wiring changes can change the sign or direction of the feedback. If your feedback type does not allow the feedback count to be resolved by wiring, please follow the conventions in Appendix A.

Feedback Types that can be inverted by wiring:

Incremental Encoder with or without Halls Sine Encoder with or without Halls

Feedback Types that cannot be inverted:

BISS EnDAT Hiperface Hiperface DSL Renishaw BISS C

System Wiring Configuration

1. AKD2G System Cable Diagram



Figure 1

2. ACI-AKD-A (Heidenhain Sin/Cos) Cable Adapter



ACI-AKD-A (Heidenhain type)

Note this is compatible with either X23 (F3-Option) or X41 (SFA)

3. ACI-AKD-A (Renishaw Sin/Cos) Cable Adapter



ACI-AKD-B (Renishaw Sine/Cos type)

R = 120ohm 500 Milliwatt resistor

Note this is compatible with either X23 (F3-Option) or X41 (SFA)

4. AKD2G FEEDBACK X23

8.10.9 Feedback Connector X23



- Connectivity Option F3 or DX (→ #28)
- · Sub-D high density 15 pin, female
- Use Kollmorgen feedback cables
- Input for several feedback types
- Input for Electronic Gearing, (→ # 139)
- Output for encoder emulation (EEO1), (→ # 139)
- Digital input (→ # 154), Digital output (→ # 158)
- Mating connector data (→ # 54).

8.10.9.1 X23 Connector Pinout Summary



termination switch across pins 6 and 7. Please contact Kollmorgen Support for more information



Encoder power supply (X23 pins 10/11):

- Maximum voltage 9 V with shorted sense contacts (4/5), rated voltage 5 V +/-3.5%.
- Rated supply current is 350 mA.
 Voltage rise time ~4 ms with full load and 220 µF of capacitance.
- Encoder power lines capacitance 10 µF to 220 µF

-			Bi	ee	En	Dat		Sin/	Sin/	Incr	Incr.	Hall	991	Stop	CW/
Pin	SFD	Resolver	в	C	2.1	2.2	HIPERFACE	Cos	+Hall	Enc.	+Hall	rian	551	Dir	ccw
1	-	(*)	-			*	•	-	Hall U	-	Hall U	Hall U		-	
2	-		CL+	CL+	CL+	CL+	•	-	Hall V		Hall V	Hall V	CL+		
3	-	(*)	CL-	CL-	CL-	CL-		-	Hall W	-	Hall W	Hall W	CL-	-	
4	S+	223	S+	S+	S+	S+	S+	S+	S+	S+	S+	- 226	2	-	25
5	S-		S-	S-	S-	S-	S-	S-	S-	S-	S-	- 20			
6	COM+	R1 Ref+	D+	D+	D+	D+	D+	Z+	Z+	Z+	Z+	100	D+	2	1
7	COM-	R2 Ref-	D-	D-	D-	D-	D-	Z-	Z-	Z-	Z-		D-	•	
8	9	Th+	Th+	12	Th+	2	Th+	Th+	Th+	Th+	Th+	Th+	Th+	Th+	Th+
9		Th-	Th-	-	Th-		Th-	Th-	Th-	Th-	Th-	Th-	Th-	Th-	Th-
10	+5 V	(¥)	+5 V	+5 V	+5 V	+5 V	8 to 9 V	+5 V	+5 V	+5 V	+5 V	+5 V	+5 V	+5 V	+5 V
11	0 V		0 V	0 V	0V	٥v	0 V	0 V	0 V	0 V	ov	0 V	0 V	0 V	0V
12	-	S1 SIN+	A+	-	A+	*	SIN+	A+	SIN+	A+	A+	- 20		Step+	CW+
13	-	S3 SIN-	A-	-	A-	-	SIN-	A-	SIN-	A-	A-	•	-	Step-	CW-
14	-	S2 COS+	B+	-	B+	-	COS+	B+	COS+	B+	B+			Dir+	CCW+
15	2	S4 COS-	B-	- 21	B-	2	COS-	B-	COS-	B-	B-	1	2	Dir-	CCW-

CL = CLOCK, D = DATA, S = SENSE, Th = Thermal control, Z = Zero

= DC Terminated, can be overridden with DIO#.TERM

= Optional

5. X41 Feedback Connector

8.10.11 Feedback Connector X41 (SFA, accessory)

SFA (Smart Feedback Adapter) converts conventional feedback signals to a 2-wire serial signal. SFA can be laid into the cable duct or may be mounted to a DIN rail using a standard DIN rail clip.

SFA provides a 15 pole HD Sub-D female connector X41 to the system for connection of a Kollmorgen motor feedback cable (see *Kollmorgen 2G Cable Guide*). Dimensions (LxWxD): 88.6 x 55.6 x 21.2 (28.6 with rail clip). Order codes see regional Accessories Manual.



- · Sub-D high density 15 pin, female
- 1 m shielded cable with 3 flying leads for connection to X1 or X2 or X5
- The cable shield is connected by using shield wire to X5/1 or with cable ties to the X1/X2 shield plates.
- · Connected feedback must be set in WorkBench.
- Only use Kollmorgen feedback cables. The cable shield must be grounded on the end near the SFA.
- · SFA models with a metal DIN clip must be mounted inside a cabinet.
- Input for Electronic Gearing, (→ # 139)
- Output for encoder emulation (EXX3/EXX4), (→ # 139) Only available on "-EXX" (Encoder) models
- Master-Slave (→ # 141)

Connect the flying leads of the SFA cable to X1 (FB1, EXX3) or X2 (FB2, EXX4) or X5 (FB2, EXX4):







*The SFA does not include a DC termination switch across pins 6 and 7.



Operating Voltage: 7 to 12V, Maximum Load Current: 350mA

X41	SFD	Resolver	Bi	ss	En	Dat	UIDEELOE	Sin /	Sin /	Lun Part	Incr.	Hall	SSI
Pin		(1)	в	C	2.1	2.2	HIPEFAGE	Cos	+Hall	Incr. Enc.	+Hall		
1	3		1 10	100	1.25		1.50		Hall U	10	Hall U	Hall U	
2	~		CL+	CL+	CL+	CL+	1.00		Hall V	-0	HallV	Hall V	CL+
3			CL-	CL-	CL-	CL-	1.00		HallW	- 3	Hall W	Hall W	CL-
4	S+	÷	S+	S+	S+	S+	S+	S+	S+	S+	S+	200	
5	S-	5	S-	S-	S-	S-	S-	S-	S-	S-	S-	100	
6	COM+	R1 Ref+	D+	D+	D+	D+	D+	Z+	Z+	Z+	Z+		D+
7	COM-	R2 Ref-	D-	D-	D-	D-	D-	Z-	Z-	Z-	Z-		D-
8		Th+	Th+	-	Th+		Th+	Th+	Th+	Th+	Th+	Th+	Th+
9		Th-	Th-		Th-		Th-	Th-	Th-	Th-	Th-	Th-	Th-
10	+5 V		+5V	+5 V	+5 V	+5 V	8 to 9 V	+5 V	+5 V	+5 V	+5 V	+5 V	+5 V
11	0V	8	0 V	0 V	0 V	0V	0 V	0V	0 V	ov	0 V	0V	0V
12		S1 SIN+	A+		A+		SIN+	A+	SIN+	A+	A+		
13		S3 SIN-	A-		A-		SIN-	A-	SIN-	A-	A-		•
14		S2 COS+	B+	•	B+		COS+	B+	COS+	B+	B+		
15	•	S4 COS-	B-		B-	•	COS-	В-	COS-	B-	B-		

CL = CLOCK, D = DATA, S = SENSE, Th = Thermal control, Z = Zero

(1): Resolver with AKD2G-CON-SFA-R00 only, all other feedback devices with AKD2G-CON-SFA-E00 only

= DC Terminated, can be overridden with DIO#.TERM

= Optional

6. DDL Motor Hall Sensor Connections

DDL Motor Hall Sensor Connections



Motor Connector Pin Numbers	Motor Hall Effect Colors	AKD2G Drive Connection Connector X23 or X41 Pin No.
1	Yellow	1
2	Green	2
3	Black	3

7. DDL Motor Coil Connections



Motor Connector Pin Numbers	Motor Coil Wire Color	AKD2G Drive Connection Connector X1 or X2
1	Red	U
2	White	V
3	Black	W
Connector Shell	Grn/Yel	PE GND
Connector Shell	Violet	Shield

8. X1 and X2 Motor, Brake, Feedback Connection Pinout

8.5.5 Connector pinout

Information to wiring, mating connectors and cables (→ # 54).

8.5.5.1 X1 and X2: Motor, Brake, Feedback 1



- 4 pin, pitch 7.62 mm plus 2x2 pin pitch 3.81 mm
- Spring clamps
 - Locking screw, tightening torque 0.5 Nm (4.4 inlbs)
 - Motor power, Motor brake (X1: axis 1, X2: axis 2)
 - X1: Input for commutation feedback 1 (→ # 106)
 - X2: Input for commutation feedback 2 (→ # 106)
 - Wiring example:
 - DC Bus link (→ #92)

 - Motor single cable connection (→ # 97)
 - Motor dual cable connection (→ # 99)

Pin	Label Signal		Description			
1	U	U	Motor phase U			
2	v	v	Motor phase V			
3	w	w	Motor phase W			
			retention latch, shield screw			
5	PE	PE	Protective earth			
B+	B+	BR+	Motor holding brake +			
B-	B-	BR-	Motor holding brake -			
F+	F+	COM+	SFD3 + or HIPERFACE DSL +			
F-	F-	COM-	SFD3 - or HIPERFACE DSL -			

9. Minimum Wiring Requirement for the AKD2G Drive

Note: This wiring demonstrates the bench test conducted to test this procedure. Please reference all wiring and safety requirements as detailed in the AKD2G installation manual.



10. Configure the AKD2G Drive Using the Workbench Software

Install AKD2G Workbench. The software program can be found on the website (<u>http://www.kollmorgen.com/en-us/products/drives/servo/AKD2G/</u>), (<u>http://kdn.kollmorgen.com/</u>) and the Product Support Package (PSP) CD-ROM packaged with the drive. Follow the installation instructions. (If in doubt, install "Kollmorgen WorkBench GUI Full Version.")

1. Safety First

When first starting up the system, it is recommended to limit the peak current of the drive to a safe value and add wood blocks at each motor end stop to confirm it is operating correctly. If the motor was to run away at its full output force capability, it could cause serious injury or damage to the equipment.

Axis 1 Limits Screen is shown and Axis 2 Limits navigation shown.



2. Connect to the AKD2G Drive

Follow the instruction from the WorkBench help file.

Help pulldown menu→Documentation->AKD2G

🐕 Kollmorgen WorkBench		
File Edit View Tools	Help	
🔇 🔘 🕢 😡 Panic	Documentation +	AKD tis 1
Device Topology	Preferences	AKD2G
Motion	Kollmorgen Developer Network	MKD
A 🔩 Project	About	page shows all the drive limit:

Navigate to "Connecting to a Device" in the Table of Contents.

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We	come		~
AKI)2G User Manual		1
A	KD2G Models Descriptio	n	1
A	KD2G vs. AKD	•	1
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	Finding and Connectin to a Device	^g 🔺	
	Device Discovery		1
	Confirm Connection with the Device	1	
	TCP/IP View		1
	Modbus View		
	Disconnected		

3. Expand "Settings" and Select The Motor Setup Screen

🛠 Kollmorgen WorkBench					
File Edit View Tools Help					
🔇 🕥 🕢 🔴 Panic 🔢 Disable & Clear Faults 🛛 Sav	ve To Device Disconnect 🛛 💷 Ax	s 1 (1) Enable Stop 0 - Servio	ce 🔹 🛛 - Torque 🔹	Axis 2 (2) Enable Sto	p 0 - Service
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▲ ♥ no-name (Online)*	Field Weakening:	0 - Disabled 🗸 🗸	@ More Information		
Parameter Load/Save Settings	Motor Autoset:	1-0n 🗸	Commutation Source:	1 - Feedback 1	Configure
Terminal Under the Device Settings			Feedback Type:	0 - No Feedback Identified]
Device Diagnostics	Continuous Current:	1.000	Arms		
Axis I (1)	Peak Current:	2.000	Ams		
Feedback Click on Motor	Coil Thermal Constant:	10.000	mHz		
1 Inermal Protection	Inductance (quad, I-I):	4.000	mH		
Brake	Inductance (direct, H):	4.000	mH		
Limits	Inductance Saturation:	9,000.000	Ams		
Current Loop	Motor Poles:	6			
 Enable/Disable Tuning 	Motor Phase:	0	deg		
Performance Servo Tuner	Inertia:	0.000	kg*cm^2		
A H Motion	Torque Constant:	0.000	Nm/Ams		
Jog Motion	EMF Constant:	20.000	Vrms/k-rpm		
Motion Tasks	Motor Resistance (I-I):	10.000	Ohm		
A was 2 (2) A Restings	Maximum Voltage:	480	Vms		
Feedback Motor Thermal Protection	Maximum Speed:	3,000	īpm		

NOTE FOR THIS EXAMPLE AXIS 1 WILL BE SHOWN.

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Tuning	Motor Phase:	0	deg	
Performance Servo Tuner	Inertia:	0.000	kg*cm^2	
Motion	Torque Constant:	0.000	Nm/Ams	
Jog Motion	EMF Constant:	20.000	Vrms/k-rpm	
Motion Tasks	Motor Resistance (H):	10.000	Ohm	
A was 2 (2)	Maximum Voltage:	480	Vms	
Seedback	Maximum Speed:	3.000	rpm	
Thermal Protection				

Selecting the Motor.

STEP 1: SET MOTOR AUTOSET= "OFF".

Andrian 4 Mation 4 Maga Project 4	Motor These parameters describe the	ne motor attached to this drive.	
🕡 no-name (Online)*	Motor Properties		
	Motor Name:	empty	Select Motor
dd New Device Add New Group	Motor Type:	0 - Rotary, Permanent Ma 🗸	Create Motor
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🔤 Scope 🔚 Parameter Load/Save	Motor Autoset:	0 - Off 🗸 🗸	
E Terminal	Continuous Current:	1.000	Arms
at Hardware Configuration	Peak Current:	2.000	Arms
 We Communication Power 	Coil Thermal Constant:	10.000	mHz
Regen	Inductance (guad, H):	4.000	mH
 Encoder Emulation 	Inductance (direct. H):	4.000	mH
Analog Inputs	Inductance Saturation	9 000 000	Ame
V Analog Outputs	Mater Palas	6	V III 3
Actions	Motor Poles.	0	100
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SD Card	Inertia:	0.000	kg*cm [~] 2
Section	Torque Constant:	0.000	Nm/Arms
 Baults and Warnings 	EMF Constant:	20.000	Vms/k-rpm
Safe I/O	Motor Resistance (H):	10.000	Ohm
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STEP 2: Click on Select Motor

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SD Card Intelline 0.000 Ng / 4m² Image: SD Card Torque Constant: 0.000 Nm / 4m³ Image: SD Card Torque Constant: 0.000 Nm / 4m³ Image: SD Card EMF Constant: 20.000 Nm / 4m³ Image: SD Card Motor Resistance (4): 10.000 Ohm Image: Settings Maximum Votage: 480 Vms Image: I	Capture	legalini	0.000	ketem ^2
Image: Contractic 0.000 Vmm/mm Faults and Varnings EMF Constant: 20.000 Set IG IO Motor Restance (4): 10.000 Image: Contractic 10.000 Vmm/mm Image: Contractic Image: Contractic 10.000 Image: Contract	SD Card	Trans Constant	0.000	Kg Gli Z
■ Faulta and Varnings EMF-Constant: 20000 Vmms/k-rpm Set Be // Constant: 0.0000 Motor Resistance (4): 10.0000 Ohm ▲ ● Settings Maximum Voltage: 4000 Vims Vims ● ● Feedback Maximum Voltage: 4000 Vims ● ● Minimum Voltage: 3.000 rpm	Device Diagnostics	Torque Constant:	0.000	Nm/Ams
Axis 1 (1) Motor Resistance (4): 10.000 Ohm	Faults and Warnings Safe I/O	EMF Constant:	20.000	Vms/k-rpm
▲ C Settings Maximum Votage: 480 Vms (a) Feedback Maximum Speed: 3.000 rpm (a) Motir Maximum Speed: 3.000 rpm	∠ → Axis 1 (1)	Motor Resistance (H):	10.000	Ohm
© Peedosoc Maximum Speed: 3.000 pm	✓ Settings	Maximum Voltage:	480	Vms
	Feedback Motor When Protection	Maximum Speed:	3,000	фm
	imits			
China	A Home			
Initis Mone	Current Loop			

STEP 3: Change Motor Family to the correct motor type.

In this example the blah blah is used.

Select Motor		×
Motor Select the motor that is attached to the drive. To attach a motor, first select Motor family and then Motor series. Motor Family:	O Learn mo	re about this topic
AKM Series Connectors: Brake: Feedback: AKM Series AKM Series Image: Connectors: Brake: Feedback: AKM Series AKM Series Image: Connectors: Brake: Feedback: AKM Series Image: Connectors: Brake: Feedback: C and CH Series Cartridge DDR Image: Connectors: Brake: Image: Connectors: Brake: Image: C and ICD Series Ironcore DDL Image: Connectors: Brake: Image: Connectors: Brake: Image: Connectors: Brake: Image: C and ICD Series Ironcore DDL Image: Connectors: Brake: Image: Connectors: Brake: Image: Connectors: Brake: Image: Connectors: Brake: Image: C and ICD Series Ironcore DDL Image: Connectors: Brake: Image: Connectors: Brake: Image: Connectors: Brake: Image: Connectors: Brake: Image: C and ICD Series Ironcore DDL Image: Connectors: Brake: Image: C		
Feedback 1 v Select the feedback connector that your motor is	connected to.	
	ОК	Close

STEP 4: Select the Motor Part#.

Select Motor		×
Motor Select the motor that is att To attach a motor, first select Motor fa Motor Family:	ached to the drive. mily and then Motor series.	Learn more about this topic
IC and ICD Series Ironcore DDL	~	
Name:		
ICD05030A1	~	
ICD05030A1 ICD05030A5 ICD05050A1 ICD05050A5 ICD05075A1 ICD05075A5		
ICD05100A1 ICD05100A5 ICD10030A1 ICD10030A4 ICD10030A5	Select the feedback connector	that your motor is connected to.
ICD10030A8 ICD10050A1 - ICD10050A4		OK Close
ICD10050A5 ICD10050A8 ICD10075A1 ICD10075A4 ICD10075A5 ICD10075A8	*	

STEP 5: Select the Feedback # for the linear encoder used to commutate the motor. In this example the feedback is connected to X23 and Feedback 3 will be used.

Select Motor	×
Motor Select the motor that is attached to to To attach a motor, first select Motor family and t	Learn more about this topic he drive.
Motor Family:	
IC and ICD Series Ironcore DDL	~
Name:	
ICD05030A1	Y
To create new or edit existing custom motors: Custom Motors	
Target Feedback:	
Feedback 1	Select the feedback connector that your motor is connected to.
Feedback 1 Feedback 2 Feedback 3 Feedback 4 Feedback 5	OK Close

STEP 6: Click OK.

The Motor screen attributes should look similar to the following:



Motor

These parameters describe the motor attached to this drive.

Motor Properties

Motor Name:	ICD05030A1	Select Motor
Motor Type:	1 - Linear, Permanent Ma 😪	Create Motor
Motor Autoset:	0 - Off 🗸 🗸	
Continuous Current:	2.100	Arms
Peak Current:	7.900	Ams
Coil Thermal Constant:	2.180	mHz
Inductance (quad, H):	9.100	mH
Inductance (direct, H):	9.100	mH
Inductance Saturation:	9,000.000	Ams
Motor Poles:	2	
Motor Phase:	120	deg
Mass:	0.620	kg
Force Constant:	26.700	N/Ams
EMF Constant:	21.800	Vpeak/(m/s)
Motor Resistance (H):	3.200	Ohm
Maximum Voltage:	230	Vms
Maximum Speed:	8,000	mm/s
Pole Pitch:	32.000	mm

Note the Pole Pitch is 32.000 mm for Kollmorgen DDL motors. It can be changed in a custom motor file for non-Kollmorgen linear servo motors. This value also is shown/used in AXIS#.MOTOR.PITCH.

AXIS#.MOTOR.PITCH

Description

This parameter is used with linear encoders. It defines a distance in millimeters which is determined by how the linear encoder is used.

- When used with a linear motor, it defines the pole-to-pole pitch. The pitch is the distance between two similar poles. Kollmorgen linear
 motors have a pitch of 32mm.
- When using a linear encoder in a dual loop configuration in which the linear encoder is used as a secondary position feedback, the distance specified is equal to the distance the linear encoder travels given one rotation of the rotary motor.

NOTE

This parameter is required to be configured for AXIS#.MOTOR.TYPE = 1 or when using a linear encoder as the AXIS#.PL.FBSOURCE.

Context

For more information see Motor.

Versions

Action	Version	Notes
Implemented	02-00-00-	
Added dual loop behavior	02-09-03- 000	AXIS#.MOTOR.PITCH was not previously included in the resolution calculation when using a linear encoder only as a position source. In order to relate the rotary motor with the linear encoder for proper control, this parameter is now required to be set.

Note the default for AXIS#.MOTOR.PITCH is 32.000 mm

	Terminal
-	A command line interface to the device. Type a command and press return.
>AX	IS1.MOTOR.PITCH
32.00	D [mm]
>	
1	

5. Select Motor Temperature Sensor

STEP 1: Expand Motor in the tree and click on "Motor Temperature"



STEP 2: Select the "Thermal Resistor Type" from the listbox according to one of the following options depending on your motor model number's Thermal Protection Option.

1. Thermostat Option type "TR": PTC thermistor sensor

Kollmorgen DDL linear motors use a PTC thermistor sensor if the Thermostat Option selected is TR "Thermistor" (MOTOR.RTYPE = 0, "Single PTC Thermistor"). Set the value for the MOTOR.TEMPFAULT =1400.



2. Thermostat Option type "TS": Thermal switch

Kollmorgen DDL linear motors use a thermal switch if the Thermostat Option selected is TS Thermostat (MOTOR.RTYPE = 5, "Thermal Switch")

🛠 Kollmorgen WorkBench	
<u>File Edit View Tools H</u> elp	
3 💿 🕢 🧑 Panic 📋 Disable & Clear Faults 🛛 Save	To Device Disconnect 🖴 Axis 1 (1) Enable Stop 0 - Service 🕶 0 - Torque 🗸 📾 Axis 2 (2) Enable Stop 0 - Service 🔹 0 - Torque 🗸
Device Topology 7 Motion A Project Ton-name (Online)*	Montor Temperature Montor the motor temperature and configure faults/warnings. Thermal Resistor Type: 5 - Thermal Switch Thermal Sensor Source: 0 - Direct Wired
Add New Device Add New Group Conservice Add New Group Scope Parameter Load/Save Terminal Device Settings Power Communication Power Wegen Power Peredback Devices Encoder Emulation Analog Inputs Analog Inputs Analog Uputs Digital VO Actions So Card So Card So Card So Card So Settings Axis 1 (1) Settings Wake and Shake	Many motors have a themistor embedded in their windings.

3. No Thermal Sensor

In the case a thermal sensor is not used in the application, the thermal protection setting can be set to 127-No Thermal Sensor.

😵 Kollmorgen WorkBench	
File Edit View Tools Help	
Ca Ca Car Faults Save	e To Device Disconnect 🔲 Axis 1 (1) Enable Ston 0 - Service + 0 - Torque + 🔛 Axis 2 (2) Enable Ston 0 - Service + 0 - Torque +
Device Topology 7 Motion Project 7 no-name (Online)	Motor Temperature Monitor the motor temperature and configure faults/warnings. Thermal Resistor Type: 127 - No Thermal Sensor
Add New Device Add New Group	
 no-name (Online)* Scope Parameter Load/Save Terminal Device Settings Hardware Configuration Communication Power Regen Feedback Devices Encoder Emulation Analog Inputs Analog Outputs Digrameter Light I/O Actions Capture SD Card Device Disgnostics Axis I (1) Settings Wake and Shake Themal Protection 	

Note our demo setup used option 127-No Thermal Sensor

6. Select Feedback Type

Notes on the resolution setting are explained below.

Note from the Axis 1 Feedback screen the feedback source for commutation is Feedback 3 as well as the Velocity Loop and Position Loop feedback (same as commutation). This was selected during the motor configuration on the Motor screen.

Kolimorgen workbench					
Edit <u>View</u> <u>T</u> ools <u>H</u> elp					
🕥 🕢 🔴 Panic 🔢 Disable & Clear Fa	ults Save To Device Disconn	ect 🔰 💷 Axis 1 (1) Enable 🛛 🗄	itop 🛛 0 - Service 👻 🛛 0 - Torqu	e 🔹 📔 💷 Axis 2 (2) Enable 🛛 Sto	p 0 - Service • 0 - Torque •
ice Topology tion Project In no-name (Online)*	Feedb Configures th Control Loop Sources	Dack e connection of feedbacks and loop	o sources for this axis.		
		25 11 12			
	Commutation:	3-Feedback 3		I - No Encoder	Configure Feedback 3
New Device Add New Group	Velocity Loop:	0. Same as commutation	A Naturand	1 - No Encoder	Configure Fronthasts 2
🔰 no-name (Online)*	^	o oune do commutation	A NOLUSED	I - NO LINCOURI	Configure Feedback 3
Scope	Position Loop:	0 - Same as commutation	A Not used	1 - No Encoder	Configure Feedback 3
Terminal					Compare reconductor
4 🥡 Device Settings	Motion Sources				
Communication Power Regen Sectors Feedback Devices Feedback Devices Fonder Emulation Analog Inputs Analog Inputs Digital I/O Actions Compare Engines Compare Engines SO Card SO Card So Card So Card So Card So Settings So Settings	Electronic Gearing	0-None v	A Not used		
Feedback Motor Wotor Wotor Temperature Wotor Temperature					
Thermal Protection					

Next expand Feedback Devices under Device Settings->Feedback Devices



Click in the tree under Feedback Devices the Feedback number used (3 in this example).

Use the Feedback Selection listbox to select the encoder used in your application.



In this example our demo uses Incremental with Halls.

7. CONFIGURING ENCODER FEEDBACK RESOLUTION

Next the Encoder pitch must be entered. The following details and chart will assist in calculating and entering the correct value depending on your linear encoder specifications.

Project	Configuration settings for	a feedback device.	
no-name (Online)*			
	Position		
v Device Add New Group	If you move the motor you should see the gauge move.	O	
Add New Group		Halls	
no-name (Online)"	A	- + • • • • • • •	
Parameter Load/Save			
L Terminal	Drive Resolution:	134,217,728	Counts/mm
Bevice Settings			
Real Hardware Configuration	Position:	671,089	Counts
Description Sector S	Cartan		
> Power	Configuration		
W Regen	Feedback Selection:	10 - Incremental Encoder with Halls	
Eeedback Devices	reedback Selection.		
Feedback 2	Foodback Identified:	10- Incremental Encoder with Halls	
Feedback 3	reedback identified.	To indemendi Elected war helis	
Feedback 4	Mechanic Type:	1 - Linear v	
Feedback 5	Providine Type.		
Encoder Emulation	Encoder Pitch:	20 000 000	nm/line
Analog Inputs			
Digital I/O	Actual Encoder Resolution:	200	Enc Cnts/mm
Actions			
D State Compare Engines	Monitoring		ŭ.
🔞 Capture	EB Monitor PIN	360	
SD Card	TB Motilior Thy.	350	
Eustomization	EP Manitar POUT	4 204 007 200	
Avia 1 (1)	PB Monitor POOT.	4,234,307,230	
A Settings	lint i shal:	dea	
(a) Feedback	Unit Label.	Gey	
🔺 🔟 Motor	Direction	0 - Standard Direction of Motion	
Notor Temperature	Direction.		
Wake and Shake	Offeet	0.000	dea
Thermal Protection	Unser	0.000	ucy
U Brake	Control Devision	0.050	4.00

In this demo an incremental encoder was used.

To determine the Encoder pitch in nanometer/line use the following diagram and chart.



Encoder Resolution (R) = R um

Encoder Resolution per Period (P) um/line = Encoder Resolution (R)(um) * 4

$$Encoder pitch\left(\frac{nm}{line}\right) = Encoder Resolution Per Period (P)\left(\frac{um}{line}\right) * \frac{1000 nm}{1 um}$$
$$Actual Encoder Resolution \left(\frac{counts}{mm}\right)$$
$$= Encoder Resolution (R) (counts/um) * \frac{1000 um}{1 mm}$$

Example as in our case.

1 um readhead

1 count per 1 um

Encoder Resolution (R) = 1 um or 1 count per um

Encoder Resolution per Period (P) $\frac{um}{line} = 1(um) * 4 = 4 um/line$

Encoder pitch
$$\left(\frac{nm}{line}\right) = 4\left(\frac{um}{line}\right) * \frac{1000 nm}{1 um} = 4000 nm/line$$

Actual Encoder Resolution $\left(\frac{counts}{mm}\right) = 1 \left(\frac{counts}{um}\right) * \frac{1000 um}{1 mm} = 1000 counts/mm$

Encoder Equivalent Resolution μm (1 count)	Encoder Pitch nm/line (nm/period)	Actual Encoder Resolution Counts/mm (Read-only)
50	200000	20
40	160000	25
25	100000	40
20	80000	50
10	40000	100
5	20000	200
2.5	10000	400
2	8000	500
1	4000	1000
0.5	2000	2000
0.4	1600	2500
0.2	800	5000
0.1	400	10000
0.05	200	20000
0.02	80	50000
0.01	40	100000

FB#.LINEPITCH

Description

This parameter defines the line pitch for linear encoders in nm per line. This is only used when using linear motor types. For rotary motors, see <u>FB.ENCLINES</u>.

Context

See Feedback # View and FB#.MECHTYPE.

Versions

Action Version Notes
Implemented 02-00-00000

General Information

Read/Write
nm/line
0.001 to 2000000.000
20,000
Integer
Yes



8. Test Encoder Direction and Resolution

The direction of the encoder, the motor phase sequence, and hall sequence all need to match exactly. The hall phasing also needs to match the motor phasing exactly. This is very difficult to do by trial and error. **Axis Direction has to be set to zero** ("AXIS1.DIR=0" or "AXIS2.DIR=0")



IMPORTANT NOTE: On the Feedback screen there is a setting (FB#.SCALED.DIR) which is for monitoring and not related to Commutation Direction (i.e. AXIS#.DIR).

Edit View Tools Help			
🕘 🕢 🥌 Panic 🔢 Disable & Clear Fault:	s Save lo Device Disconnect	Axis 1 (1) Enable Stop 0 - Service + 0 - Iorque + 🛛 🏎 Axis 2 (2) Ena	ble Stop 0 - Service
ce Topology	P C Eeedback	3	
ion	I EEUDACK	J	
Project	Configuration settings for	r a feedback device.	
no-name (Online)			
· · · · · · · · · · · · · · · · · · ·	Position		
	If you move the motor you		
	should see the gauge move.		
New Device Add New Group			
an anna (Online)		Halls	
Sooo	~	- + • • •	
Parameter Load/Save			
Terminal	Drive Resolution:	134.217.728	Counts/mm
Device Settings			
Rendware Configuration	Position	402 653	Counts
Communication		100,000	o o o o o o o
Power	Configuration		
W Regen			
Feedback Devices	Feedback Selection:	10 - Incremental Encoder with Halls	
Feedback 1			
Feedback 2	Feedback Identified:	10- Incremental Encoder with Halls	
Feedback 3			
Feedback 4	Mechanic Type:	1 - Linear v	
Encoder Emulation			
Analog Inputs	Encoder Pitch:	4,000.000	nm/line
Analog Outputs			
Digital I/O	Actual Encoder Resolution:	1,000	Enc Cnts/mm
Actions	Marine		
🖻 🛐 Compare Engines	Monitoring		
Capture Capture	ER Monitor PIN	360	
SD Card	T B Monitor T IN.	330	
E ustomization	ED Marine DOUT	4 204 007 200	
Device Diagnostics	PB Monitor POUT:	4,234,367,236	
AXIS I (1)	IL NE LEL		
Gettings Gettings	Unit Label:	deg	NOT the
b Motor			same as
Thermal Protection	Direction:	V - Standard Direction of Motion Y	AVIS# DIPUU
 Brake 			- AAIS#.DIR!!!!
	Offset	0.000	deg
Units	. 100556.002		
Hinits			

From the commutation drawings in Figure 2 the motor "positive" direction is toward the end of the motor where the wires exit the motor.



The Feedback test available is the movement of the indicator on the Feedback screen for the given Feedback# of the motor (i.e. linear encoder).

🛠 Kollmorgen WorkBench			
File Edit View Tools Help			
🔇 🕥 🕢 🔴 Panic 🔢 Disable & Clear Faults 🛛 S	ave To Device Disconnect	Axis 1 (1) Enable Stop 0 - Service + 0 - Torque + 💷 Axis 2 (2) Ena	ble Stop 0 - Service - 0 - Torque -
Device Topology 7 Motion Project Not noname (Online) Add New Device Add New Group	Feedback Configuration settings for Position If you move the motor you should see the gauge move.	This indicator should move left to rig motor is moved in the direction of t	pht (positive) when the he motor output cable
To-name (Online) Scope Parameter Load/Save		+ • Halls	
Terminal Device Settings	Drive Resolution:	134,21/,/28	Counts/mm
Rardware Configuration	Position	-2,496,449,741	Counts
Communication	Configuration		5.
Regen Geedback Devices Feedback 1	Feedback Selection:	10 - Incremental Encoder with Halls v	
Feedback 2 Used.	Feedback Identified:	10 - Incremental Encoder with Halls	
Feedback 4 Feedback 5	Mechanic Type:	1 - Linear 🗸	
Encoder Emulation Analog Inputs	Encoder Pitch:	4,000.000	nm/line
Digital I/O	Actual Encoder Resolution:	1,000	Enc Cnts/mm
Actions	Monitoring	°	
Compare Engines	FB Monitor PIN:	360	
Customization Evice Diagnostics	FB Monitor POUT:	4.294,967,296	
Axis 1 (1) Settings () Feedback	Unit Label:	deg	
Motor W Thermal Protection	Direction:	0 - Standard Direction of Motion v	
Brake Marke Marke Marke Marke Marke	Offset:	0.000	deg
Home	Scaled Position:	-209.250	deg

If the encoder is counting in the wrong direction, swap the Sine+ and Sine- signal or the A and A\ signal. If this cannot be done if the Data channels of the encoder are being used. If changing the feedback direction is not possible, use Appendix A (Page 29) for the wiring configuration of the Hall sensors and the motor power connections.

9. Checking Motor Feedback Resolution

The feedback resolution can be tested by marking two lines on the magnet way 32mm apart. You can use whatever length you want, but longer is more accurate.

STEP 1: Click on Units for the given Axis used.

STEP 2: Change the User Units to "mm", "mm/s", and "mm/s^2"

STEP 3: Move the motor from one line to the other and see if the position counter changes the correct amount in the correct direction. HINT: You can use AXIS#.HOME.SET in Workbench Terminal to zero the position feedback where # is 1 or 2 for the axis number in the command.



If the position display does not match the distance the motor is moved, you may need to revisit the encoder scaling section of this manual or confirm the feedback device scale.

10. Check Motor Phasing of Any Servo Motor

This is useful for commissioning a third-party motor, as well as any frameless Kollmorgen motor, or any servo motor for which the phasing is unknown.

This part of the setup will require a two channel oscilloscope with isolated channels. Move the motor in the positive direction based on the motor manufactures specification. The AKD2G commutates a motor in the phase sequence of U V W in the positive direction.



When determining the motor phasing, the U phase (U phase with reference to V phase) will lead the back emf voltage waveform by 120° of the V phase (V phase with reference to W phase).



While moving the motor in a positive direction the motor V phase (V phase with reference to W phase) will lead the back emf voltage waveform by 120° of W phase (W phase with reference to U phase).



Use Figure 2 to determine the Hall Sensor alignment of the motor. Make sure the feedback position value (PL.FB) is counting in the positive direction.

11. Test Hall Sequence When Moving Motor in the Positive Direction

The hall phasing can be check with the parameter FB#..HALLSTATE in terminal. This is a binary value, where "001" is Hall U, "010" is Hall V, and "100" is Hall W.

FB#.HALLSTATE

Description

FB#.HALLSTATE reads the Hall switch values (encoder feedback only).

The value is the sum of the three hall bit states, where FB#.HALLSTATE = Hall U + Hall V + Hall W. If the hall is not active, it returns 0. When a hall is active, each hall contributes the following value to the sum:

•	Hall W = 1
•	Hall V = 2
	Hall II = 4

Value	Hall W	Hall V	Hall U
1	V		-2
2	-	V	-
3	V	N	-)
4	20	-31	N
5	V	-	V
6	27	V	V

The following sequences indicate the direction of rotation.

 Sequence
 Direction

 1,5,4,6,2,3,1
 Positive

 1,3,2,6,4,5,1
 Negative

These commands are not recordable on FB1 and FB2. For recording on FB1 and FB2, see <u>FB#.MONITOR#.SOURCE</u> and <u>FB#.MONITOR#.DATA</u>.

Versions

Action Version Notes Implemented 02-00-00000

General Information		What does this mean?
Туре	Read Only	
Units	Terminal: Binary Scope: N/A	
Range	Terminal: See description above Scope: 1 to 6	
Default Value	N/A	
Data Type	Terminal: String Scope: Integer	
Stored in Non Volatile Memory	No	

FB#.HALLMAP.U

Description

FB# HALLMAP. U reads and writes to a mapping register used to correct mis-wired motors without physically changing the wiring. This keyword only effects feedback devices that have halls (see FB#.SELECT for feedback types with halls).

0 The output is the U input value. (Default) 1 The output is the V input value. (Swap U with V) 2 The output is the W input value. (Swap U with W) 3 The output is fixed at 0.	
The output is the V input value. (Swap U with V) The output is the W input value. (Swap U with W) The output is fixed at 0. The output is fixed at 0.	
2 The output is the W input value. (Swap U with W) 3 The output is fixed at 0.	
3 The output is fixed at 0.	
4 The state of	
4 I ne output is U input inverted value. (When input U=0, U	output is 1)
5 The output is V input inverted value. (When input V=0, U	output is 1)
6 The output is W input inverted value. (When input W=0, U	J output is 1
7 The output is fixed at 1.	111

Implemented 02-10-00-000

General Information

Туре	Read/Write
Units	N/A
Range	0 to 7
Default Value	0
Data Type	Integer
Stored in Non Volatile Memory	Yes

Hall Sensor Sequence when FeedBack (PL.FB) Is Counting Positive

Using the Scope is easier to capture and analyze.

Hall Sensor Sequence when FeedBack (PL.FB) Is Counting Positive

Note with the AKD2G the FB#.HALLSTATE only reports the decimal value. I checked this with Terminal and the sequence reported was 1, 5, 4, 6, 2, 3, 1.

Step(CW)	FB#.HALLSTATE
1	1
2	5
3	4
4	6
5	2
6	3
1	1

Figure 2

When using a Kollmorgen DDL motor, **MOTOR.PHASE = 120** when the feedback direction is positive toward the "Lead Exit End" of motor (that is, the end of the motor where the leads come out), and when the hall alignmet and motor phasing match exactly as shown in Figure 2.

13. <u>How to Verify the Motor's Commutation Alignment Angle</u> (MOTOR.PHASE)

STEP 1: Set the Wake & Shake Current for the axis used (b7axis 1 or axis 2) equal to continuous of your linear motor in the Terminal Screen.

The keyword is AXIS#.WS.IMAX where # is 1 or 2 for the axis number.

The continuous current rating of the motor can be seen from the Motor screen.

tion	Motor These parameters describe the Motor Properties	ne motor attached to this drive.	
	Motor Name:	ICD05030A1	Select Motor
New Device Add New Group	Motor Type:	1 - Linear, Permanent Ma $ imes $	Create Motor
no-name (Online)*	Motor Autoset:	0 - Off 🛛 🗸	
Parameter Load/Save	Continuous Current:	2.100	Arms
Verminal Verminal Verminal Verminal	Peak Current:	7.900	Arms
Rendware Configuration	Coil Thermal Constant:	2.180	mHz
Power	Inductance (quad, I-l):	9.100	mH
W Regen	Inductance (direct, I-I):	9.100	mH
Feedback 1	Inductance Saturation:	9,000.000	Arms
Feedback 2	Motor Poles:	2	
Feedback 4	Motor Phase:	120	deg
Encoder Emulation	Mass:	0.620	kg"cm^2
Analog Inputs	Force Constant:	26.700	Nm/Ams
Digital I/O	EMF Constant:	21.800	Vpeak/(m/s)
Sompare Engines	Motor Resistance (H):	3.200	Ohm
Capture	Maximum Voltage:	230	Vms
Customization	Maximum Speed:	8,000	rpm
Device Diagnostics Axis 1 (1)	Pole Pitch:	32.000	mm

Returning to the Terminal set the AXIS#.WS.IMAX to the continuous current rating from the Motor screen.

	Terminal
-	A command line interface to the device. Type a command and press return.
>AX	IS1.WS.IMAX 2.1
2.100	[Arms]
>	

STEP 2:Setup the Wake and Shake Routine.

Navigate to the Wake and Shake screen under the Axis#->Settings->Motor->Wake and Shake.

🛠 Kollmorgen WorkBench	n she althanta the the she		
File Edit View Tools Help			
🔇 🗐 🕢 🔗 🔴 Panic 🔢 Disable & Clear Faults 🛛 Sa	ive To Device 🛛 Disconnect 👘 🖾 Axis 1 (1)	Enable Stop 0 - Service - 0 - Torque - 📟 Axis 2 (2) Enable Stop	0 - Service • 0 - Torque •
Device Topology 4 Motion Contract (Online)*	Wake and Shake will determine align Wake and Shake will determine align Mode Sets the method used for Wake and Shake 0 - Standard Wake and Shake	B ment offset between feedback and the electrical phases of the motor.	Arm Am Idle Motor Phase: 120 deg
Add New Device Add New Group	Complete de la		
no-name (Online)* Scope Parameter Load/Save Terminal	Mode:	1 - Active V	
Terminal Genico Sattings Hardware Configuration Foreir Hardware Configuration Foreir Communication Foreir Feedback Devices Feedback 2 Feedback 2 Feedback 4 Feedback 4 Feedback 4 Feedback 4 Feedback 4 Feedback 5 Concoder Emulation Analog Diputs Point 10 Compare Engines Costure SD Card SD Card SD Card SD Card So Feedback So Setback So Setba	Settings Number of Wake and Shake Loops: Time the current vector applied to motor: Maximum allowed velocity: More applied to motor: More >>	Courts 2 ma 53333 mm/s 2.100 Ams	

Change the Wake and Shake mode to 2-Auto Wake and Shake and click on the "Arm" button to arm the Wake and Shake routine. The status to the right of the Arm button should change from Idle to Armed. Note you cannot arm the W&S if the axis is already enabled (disable prior to arming). Also note a warning will issue to indicate the W&S is configured and active.

Stollmorgen WorkBench	
File Edit View Tools Help	
🔇 🕥 🕢 🔴 Panic 🔢 Disable & Clear Faults Save To De	vice Disconnect 🗰 Axis 1 (1) Enable Stop 0 - Service - 0 - Torque - 📾 Axis 2 (2) Enable Stop 0 - Service - 0 - Torque -
Device Topology	Wake and Shake
Motion	Wake and Shake
4 💑 Project	Wake and Shake will determine alignment offset between feedback and the electrical phases of the motor.
Diename (Online) Mode Sets t 2-Av	he method used for Wake and Shake Ltd Armed Udwake and Shake Motor Phase/ 120 deg
Add New Device Add New Group	
Les Porsierie Louis Jave Commin ↓ Terminal Ardvare Configuration ↓ © Communication ↓ Power Les	1 - Active v
Tuning	
Performance Servo Luner Slider Tuning	Axis Type Group Id Description Details
	1 \Lambda Wake and Shake 5500 Warning: Wake & Shake configured or active. Help
Watch	
Device Parameter	

Start the W&S Routing by enabling the Axis.

🛠 Kollmorgen WorkBench			
File Edit View Tools Help			
🕄 💿 🕢 🧀 Panic 🔢 Disable & Clear Faults 🛛 Si	iave To Device Disconnect 📟 Axis 1 (1	1) Enable Stop 0 - Service + 0 - Torque + 📟 Axis 2 (2) Enable Stop 0 - Service +	0 - Torque 👻
Device Topology 4 Motion 4 Project 9 Project 1 Online 1 Online 1 Calling Coup_	Wake and Shake Wake and Shake will determine all Mode Sets the method used for Wake and Shake 2 - Auto Wake and Shake	ke	Arm - Disam Armed Motor Phase: 120 deg
A animate Lossave A constrained Lossave Terminula Device Settings Device Settings Device Settings Power Power Power Power Power Peedback Divices Peedback 1 Peedback 2 Peedback 2 Peedback 3 Peedback 4 Peedback 4 Peedback 4 Peedback 5 Digital I/O Digital I/O Digital I/O Digital I/O Digital I/O Digital I/O Axis 1 (1) Peedback Peedback Wade and Shake Wade and Shake Wade and Shake	Mode: Less << Settings Sine Frequency Excitation:	1 - Active v	

The status to the right of the Arm button should change to "Running" while the W&S is executing. Monitor the Motor Phase read-only on the W&S screen while the W&S runs. This indicates the W&S algorithm is searching for the correct commutation angle in deg.

le		Arm	
ts the method used for Wake and	Shake	Am	Running
- Auto Wake and Shake	×	Motor Phase:	130 deg
nmutation Check			
de:	1 - Active 🗸		
ess <<			

The W&S will either finish and indicate "Successful" if it was able to determine the Motor Phase or "Error" if the W&S algorithm failed.

Project Ino-name (Online)*	Wake and Shake will determine alignment offset between feedback and the electrical phases of the motor Mode Sets the method used for Wake and Shake	Arm Successful
lew Device Add New Group	2 - Auto Wake and Shake V	Motor Phase: 125 deg
 Concerning Sectors Feedback 1 Feedback 2 Feedback 3 Feedback 4 Feedback 5 	Commutation Check Mode: Less <<	
Encoder Emulation Analog Inputs Analog Outputs Digital I/O Actions Compare Engines Capture SD Card	Settings	
Soutomization Device Diagnostics State IIO Axis 1 (1)		
 ✓ Settings (◎) Feedback ✓ Motor ♥ Motor Temperature ♥ Wake and Shake 		

Note for the standard convention the Motor Phase should be approximately 120 degrees.

When commissioning the linear motor system, the Wake and shake routine should be performed in several different positions of the motor's travel. The MOTOR.PHASE values should be no more than 5 degrees different in the different positions. This checks consistency.

The Motor Phase on the Motor Screen is automatically populated with the result of the W&S. It is important once you have the correct value to Save to Device to save the value to non-volatile memory.

le Edit View Tools Help				
a can view ioors ricip	alts Save To Device Disconnect AA	is 1 (1) Disable Stop 0 - Serv	ice + 0 - Torque	Axis 2 (2) Enable Stop 0 - Service • 0 - Torque •
			and the states	11 Contraction of the second second
Mation	* Motor			
A Broject	These parameters describe the	he motor attached to this drive.		
no-name (Online)*	Motor Properties			
	Motor Name:	ICD05030A1	Select Motor	 This is disabled because: The axis is active.
dd New Device Add New Group	Motor Type:	1 - Linear, Permanent Ma $ \smallsetminus $	Create Motor	
Feedback 1	Motor Autoset:	0 - Off ~		
Feedback 2	Continuous Current:	2.100	Ams	
Feedback 3	Peak Current:	7.900	Arms	
Feedback 5	Col Themal Constant:	2 180	mHz	
Analog Inputs	Industry Arrest 10	9.100	-	
Analog Outputs	inductance (quad, H):	3.100	me	
Digital I/O	Inductance (direct, I-I):	9.100	mH	
Compare Engines	Inductance Saturation:	9,000.000	Arms	
Capture	Motor Poles:	2		
SD Card	Motor Phase:	120	deg	
Device Diagnostics	Mass:	0.620	kg*cm^2	
Safe I/O	Force Constant:	26.700	Nm/Arms	
A 💷 Axis 1 (1)	EME Constant:	21,800	Vpeak /(m/s)	
Settings (o) Feedback	Mater Deviation of D	2 200	Ohm	
A Motor	Notor Pesistance (H):	3.200	Onm	
Motor Temperature	Maximum Voltage:	230	Vims	
Thermal Protection	Maximum Speed:	8,000	npm -	
i Brake	Pole Pitch:	32.000	mm	
Limits		7 0		
A Home				

14. Verify the Motor is Setup Correctly by Jogging it in Both Directions

Make sure the AKD2G drive's peak current is limited before doing this exercise. A linear motor runaway can result in damage to the system equipment or possible bodily injury.

STEP 1: Start with the Axis disabled.

Panic = Abort (F12) 🐼 (1) Inactive SW HW CS STO

STEP 2: Select the Service Mode and operation Mode. In this example we'll first use Service and Velocity.

STEP 3: Click on the Axis' Service Motion Screen.

📯 Kollmorgen WorkBench	
File Edit View Tools Help	
🌀 🕥 👩 🛑 Panic 🔢 Disable & Clear Faults	Save To Device Disconnect Axis 1 (1) Enable Stop 0 - Service • 1 - Velocity • Axis 2 (2) Enable Stop 0 - Service • 0 - Torque •
Device Topology Motion Project no-name (Online)*	Service Motion Service motion allows you to start and stop some test motions. Service Motion Mode: Pulse Revensing Group: Group: Group Group: Group
Add New Device Add New Group Feedback 3 Feedback 5 Feedback 5	Velocity 1: 10.000 mm/s
 ✓ Encoder Emulation ✓ Analog Inputs ✓ Analog Outputs ✓ Analog Outputs ✓ Digital I/O ✓ Actions ✓ Compare Engines 	0
Capture S Capture S Card S Customization Customization Foults and Warnings	Acceleration: 15.999.914 mm/s ² Deceleration: 15.999.914 mm/s ²
	Start Avis is inactive. Position Feedback: 150.384 mm Velocity Feedback: 0.000 mm/s
Wake and Shake	
Current Loop OV Velocity Loop Overation Enable/Disable Tuning Forferenzero Sano Tunar	
Slider Tuning Motion Motion My Service Motion H Motion Takes	

	Made: Duk		O Continuous
Service Motion	Mode. Puis	se O Reversing	O continuous
	Group: Group	1 ~	
Velocity 1:	1 20	/	
10.000 mn	n/s	/i	i\
			$ \rangle$
		/	$\langle \rangle$
		/	
		1V 503	
0		-	•
0		Time 1:	-
0		Time 1:	ms
0	15,999	Time 1: 500	ms
0	15,999	Time 1: 500 .914 mm/s^2 .914 mm/s^2	ms
0	15,999	.914 mm/s ² 914 mm/s ²	ms
0	15,999 15,999	.914 mm/s^2 .914 mm/s^2 .914 mm/s^2	ms
0	15.999 15.999 Start 150	.914 mm/s^2 .914 mm/s^2 .914 mm/s^2 .914 mm/s^2	ms

STEP 4: Select the Service Motion Mode. In this example we'll start by using Pulse

STEP 5: Input a slow jog velocity. In this example we've entered 10 mm/s.

STEP 6: Input the time (duration) of the pulse. Make sure the move time does not allow the motor to hit the hard stops (end of travels) with the given target velocity inputted in STEP 6. It is recommended to start this test at the mid-stroke of travel.

Service motion all	ows you to start and	stop some test motio	ms.
Service Motion M	ode: 💿 Pulse	Reversing	Continuous
Gn	oup: Group 1	~	
Velocity 1:	s /		
0	, _/	Time 1:	
0	15,999.914	Time 1: 1,000 ms mm/s^2	
0Acceleration:	15,999.914	Time 1: 1,000 ms mm/s^2 mm/s^2	
0 icceleration: Deceleration:	15,999.914 15,999.914 15,999.914	Time 1: 1,000 ms mm/s^2 mm/s^2 Axis is inactive.	
0	15,999.914 15,999.914 15,999.914 D Start A 150.384	Time 1: 1,000 ms mm/s^2 mm/s^2 Axis is inactive. mm	5

STEP 9: Adjust the Accel/Decel for Service Motion as desired.

STEP 10: Enable the Axis.

🛠 Kollmorgen WorkBench				
File Edit View Tools Image: State of the state of t	Help Disable & Clear Faults Save To Device Disconnect	Axis 1 (1) Enable Stop 0	- Service 🗸 1 - Velocity 🗸 💷 As	xis 2 (2) Enable Stop 0 - Service + 0 - Torque +

Axis 1 is shown in the status bar.

Panic = Abort (F12)	-33°	(1) Active	SW	HW	CS	STO	~

STEP 9: Click the Service Motion Start Button to pulse (move) the axis in the forward (positive) direction.

Service Motion Mod	le: 💿 Pulse 🛛 🔿	Reversing 🔿 Continuous
Grou	up: Group 1	~
Velocity 1: 10.000 mm/s	→ /	
0	/ 	
	Time	1: 1,000 ms
Acceleration:	Time	1: 1,000 ms s^2
Acceleration:	Time	1: 1,000 ms \$^2 \$^2
Acceleration:	Time 15,999,914 mm/s 15,999,914 mm/s > Start	1: 1,000 ms \$^2 \$^2
Acceleration:	Time 15,999.914 mm// 15,999.914 mm// Start 150.384 mm	1: 1,000 ms s^2 s^2

STEP 10: Set the slow jog velocity to a negative value. We used -10 mm/s in this example. Press the Start button in the Service Motion screen to pulse(move) the axis in the negative (reverse) direction.

Service Motion	Mode: 🔘 Pulse	O Reversing	🔿 Continuou
	Group: Group 1	~	
Velocity 1:	n/s ►	/	$\left \right\rangle$
	/		$ \rangle$
	/	1	1 1
0	/	Time 1:	
0		Time 1:	↓ \ s
0	15,999.914	Time 1: 1.000 ms mm/s^2	
0 Acceleration: Deceleration:	15,999.914	Time 1: 1.000 ms mm/s^2 mm/s^2	
0 Acceleration: Deceleration:	15,999.914 15,999.914 5,999.914	Time 1: 1,000 ms mm/s^2 mm/s^2	s
0	15,999.914 15,999.914 Start 159.720	Time 1: 1,000 ms mm/s^2 mm/s^2 mm	s

STEP 11: Set the Service Motion Mode to Continuous and Start/Stop using the Service Motion Control first with a positive Velocity setpoint and then a negative Velocity setpoint to jog the axis continuously in both directions.

Service Motion	Mode: 🔿 Pulse	Reversing	Continue
0	Group: Group 1	~	
Velocity 1:			
10.000 mr	n/s		
0			
0	.		
0			
0	15,999,914	mm/s^2	
0	15.999.914	mm∕s^2 mm∕s^2	
0 Acceleration: Deceleration:	15,999,914	mm/s^2 mm/s^2	
0	15,999,914 15,999,914 Start	mm/s^2 mm/s^2	
0Acceleration: Deceleration: Position Feedback:	15,999,914 15,999,914 Start 151.044	mm/s^2 mm/s^2 mm	

15. Home Axis and Use Motion Tasking to Extend and Retract

STEP 1: Disable the axis.

Kollmorgen WorkBench						
ile Edit View Tools Help						
🕥 🕢 😽 🔴 Panic 🔢 Disable & Clear Fault	s Save To Device Disconnect	💷 Axis 1 (1) Disable Stop	0 - Service + 1 - Velocity +	💷 Axis 2 (2) Enable	Stop 0 - Service - 0) - Torque 🔻
New York Charles Contract of C		ANY 14 04000 24 14	SS3			- 13 N
		100 million (100 m				
No. 1. 11 1. 1910.	(1) 1		2			

STEP 2: Safely move the motor to the desired home position.

STEP 3: Change the Axis' operation mode to Position.

🐕 Kollmorgen WorkBench											
File Edit View Tools	Help										
🔇 🗐 🕢 🔂 🔵 Panic 🗌	Disable & Clear Faults	Save To Device	Disconnect	💷 Axis 1 (1) Enable	Stop	0 - Service 👻	2 - Position +	📾 Axis 2 (2) Enable	Stop	0 - Service +	0 - Torque 🕶

STEP 4. Home the axis using Current Position and 0 for Dist. After homing and Position.

🛠 Kollmorgen WorkBench					
File Edit View Tools Help					
🔇 🐑 🕢 🔴 Panic 🔢 Disable & Clear Faults	Save To Device Disconnec	tt 📔 📟 Axis 1 (1) Enable 🛛	Stop 0 - Service - 2 - Position	• 🛛 📾 Axis 2 (2) En	able Stop 0 - Service - 0 -
Device Topology Motion Project no-name (Online)*	Home This page is us Select the type of hominar O - Current position	ed to issue a homing command. T motion you wish to use:	The home command is used to zero the	drives position.	
Add New Device Add New Group Feedback 4 Feedback 5 Encoder Emulation	•	Start Position	● Position	<u>Goto Axis Motion</u>	
Me Analog Outputs	Settings			Controls	
Actions Compare Engines Capture SDCard Customization	Acceleration: Deceleration: Direction:	5.333.424 mm/s ² 5.333.424 mm/s ² 1 - Postive		Found: Done: Active:	 Start
 Device Diagnostics Faults and Warnings Safe I/O Axis 1 (1) 	Dist. after homing: Position:	0.000 mm		Error: Position Feedback:	151.052 mm
✓ Settings	Position Error Thresh.:	4.000 mm		Auto Homing:	0 - Disabled 🛛 🗸
(i) Prectoack (ii) Motor (iii) Motor Temperature (iiii) Wake and Shake (iiii) Brake (iiiii) Brake (iiiii) Units (iiiii) Mone (iiii) Current Loop (iii) Velocity Loop (iii) Position Loop	Velocity: Max Distance:	32.000 mm/s	Disabled when value is 0.	Avis is inactive	

Enable the axis and press the Start button on the Home screen. Note the Position Feedback read-only on the Home screen should read 0.000 mm after homing.

😵 Kollmorgen WorkBench						
File Edit View Tools Help						
😋 💿 🕢 🔂 🛑 Panic 🔢 Disable & Clear Fau	Its Save To Device Disconnec	t 🖴 Axis 1 (1)	Disable S	top 0 - Service - 2 - Positi	on 👻 📔 🎟 Axis 2 (2) E	nable Stop 0 - Service - 0 -
Device Topology Motion Project no-name (Online)*	Home This page is use Select the type of homing r 0 - Current position	ed to issue a homing c notion you wish to use	ommand. Th	e home command is used to zero t	he drives position.	
Add New Device Add New Group Feedback 5 Feedback 5	Reference Point			→ Position		
 	Settings	Start Position			Goto Axis Motion Controls	
Actions	Acceleration:	5,333.424	mm/s^2		Found:	۲
Capture SD Card	Deceleration:	5,333.424	mm/s^2		Done:	
Customization	Direction:	1 - Positive V			Active:	Start
Eaults and Warnings	Dist. after homing:	0.000	mm		Error:	
Axis 1 (1)	Position:	0.000	mm		Position Feedback	0.000 mm
 Settings Feedback 	Position Error Thresh.;	4.000	mm		Auto Homing:	0 - Disabled V
Motor Q Motor Temperature	Velocity:	32.000	mm/s			
Wake and Shake Wake and Shake Brake Limits Moment b () Current Loop	Max Distance:	0.000	mm	Disabled when value is 0		
 Velocity Loop Position Loop Enable/Disable 						

STEP 5. Setup two motion task one to extend the motor/axis out to X mm and one for a return to home (both absolute motion tasks). Execute the extend (i.e. out to 100mm). Measure the physical location of your motor (i.e. carriage) and compare the position feedback shown in Workbench vs. your measurement. Retract by executing the return to home (i.e. Zero Position) and measure again.

	Save to t	Denice		111		111					
ce Topology on Project	ф	D D	Motion efine and conf	Tasks igure axis motion tas	iks in their respective sequ	iences.					
				Motion Ta	ask Running: Idle						
New Device Add New Group			ld Valid	Ту	pe	Position	Profile	Velocity	Acceleration	Deceleration	Next
Tecoper S	^	>	0 1	Absolute	1	0.000 [mm]	Trapezoidal	10.000 [mm/s]	5,333.424 [mm/s^2]	5,333.424 [mm/s^2]	None
Feedback 4		>	1			100.000 (mm)		10.000 (rim's)	5,333.424 [mm/s*2]*	5.333.424 (mm/s*2)	
Encoder Emulation		>	2	Absolute	4	0.000 [mm]	Trapezoidal	0.000 [mm/s]	5,333.424 [mm/s^2]	5,333.424 [mm/s*2]	None
M Analog Inputs		>	3	Absolute		0.000 [mm]	Trapezoidal	0.000 [mm/s]	5,333.424 [mm/s^2]	5,333.424 [mm/s^2]	None
Analog Outputs		>	4	Absolute		0.000 [mm]	Tranezoidal	0.000 Imm(=)	5 333 424 [mm/s^2]	5 333 424 [mm/s^2]	None
Actions			6	Absolute		0.000 [mm]	Trapezoidal	0.000 [mm/a]	E 222 424 [mm/s^2]	E 222 424 [mm/s ² 2]	Mana
Compare Engines			5	Absolute		0.000 [mm]	Tapezoidal	0.000 (minus)	5,353,424 [mmv5 2]	5,535.424 (mms z)	None
Capture		,	6	Absolute		0.000 [mm]	Trapezoidal	[a/mm] 000.0	5,333.424 [mm/s ⁻²]	5,333.424 [mm/s 2]	None
SD Card		>	7	Absolute		0.000 [mm]	Trapezoidal	0.000 [mm/s]	5,333.424 [mm/s^2]	5,333.424 [mm/s^2]	None
Eustomization		>	8	Absolute		0.000 [mm]	Trapezoidal	0.000 [mm/s]	5,333.424 [mm/s ²]	5,333.424 [mm/s~2]	None
Eaults and Warnings		>	9	Absolute	7	0.000 [mm]	Trapezoidal	0.000 [mm/s]	5,333.424 [mm/s^2]	5,333.424 [mm/s^2]	None
Safe I/O		>	10	Absolute	1	0.000 [mm]	Trapezoidal	0.000 [mm/s]	5,333.424 [mm/s^2]	5,333.424 [mm/s^2]	None
🛛 🚥 Axis 1 (1)		>	11	Absolute		0.000 [mm]	Trapezoidal	0.000 [mm/s]	5.333.424 [mm/s^2]	5.333.424 [mm/s~2]	None
A 😸 Settings		,	12	Absolute		0 000 [mm]	Tranezoidal	0.000 Imm/s1	5 333 424 [mm/s*2]	5 333 424 [mm/s*2]	None
Motor			12	Abashda		0.000 [mm]	Trapazoidal	0.000 [mm/s]	5 222 424 [mm/s^2]	5 222 424 [mm/s^2]	None
Q Motor Temperature			14	Absolute	1	0.000 (min)	Trapozoidal	0.000 [mm/-1 ³	E 222 424 [mm/s ^{A23}]	6,000.424 [mm/c*0]	Nees
Wake and Shake		·	14	Absolute		0.000 [mm]	rapezoidai	0.000 [mm/s]	0,000.424 [mm/s 2]	0,000.424 [mm/\$ 2]	None
Thermal Protection		,	15	Absolute		0.000 [mm]	Trapezoidal	0.000 [mm/s]	5,333.424 [mm/s"2]	5,333.424 [mm/s ²]	None
Hone		>	16	Absolute		0.000 [mm]	Trapezoidal	0.000 [mm/s]	5,333.424 [mm/s^2]	5,333.424 [mm/s^2]	None
Limits		>	17	Absolute		0.000 [mm]	Trapezoidal	0.000 [mm/s]	5,333.424 [mm/s^2]	5,333.424 [mm/s~2]	None
The Home		>	18	Absolute	4	0.000 [mm]	Trapezoidal	0.000 [mm/s]	5,333.424 [mm/s^2]	5,333.424 [mm/s*2]	None
Urrent Loop		>	19	Absolute	19.1	0.000 [mm]	Trapezoidal	[am] 000.0	5,333.424 [mm/s^2]	5,333.424 [mm/s^2]	None
(ii) Velocity Loop		>	20	Absolute		0.000 [mm]	Trapezoidal	0.000 [mm/s]	5.333.424 [mm/s^2]	5,333,424 [mm/s*2]	None
Enable/Disable		,	21	Absolute		0 000 (mm)	Tranezoidal	0.000 [mm/e]	5 333 424 Imm/s^21	5 333 424 [mm/e^2]	None
A Tuning				Aboute	1	0.000 [mm]	Tananaidal	0.000 [E 222 424 [miles 2]	E 222 424 [mm/s 2]	Massa
🏓 Performance Servo Tuner			22	Apsolute		0.000 (mm)	Tapezoida		0,000.404 [mm/s 2]	0,000.424 [mm/s 2]	NURE
P. Slider Tuning		,	23	Absolute		0.000 [mm]	Trapezoidal	0.000 [mm/s]	5,333.424 [mm/s 2]	5,333.424 [mm/s 2]	None
A T Motion		>	24	Absolute		0.000 [mm]	Trapezoidal	0.000 [mm/s]	5,333.424 [mm/s^2]	5,333.424 [mm/s^2]	None

The linear motor initial commissioning is now complete!

Appendix A

Configuring a DDL Liner Motor with Feedback Counting in the Opposite Direction

1. DDL Motor Coil Connections

Motor Connector Pin Numbers	Motor Coil Wire Color	AKD2G Drive Connection Connector X2
1	Red	W
2	White	V
3	Black	U
Connector Shell	Grn/Yel	PE GND
Connector Shell	Violet	Shield

2. DDL Motor Hall Sensor Connections

Motor Connector Pin Numbers	Motor Hall Effect Colors	AKD2G Drive Connection Connector X10 Pin No.
1	Yellow	2
2	Green	1
3	Black	3

3. Checking Motor Feedback Resolution

The feedback resolution can be tested by marking two lines on the magnet way 32mm apart. You can use whatever length you want, but longer is more accurate. Change the User Units to "mm".

If the position display does not match the distance the motor is moved, you may need to revisit the encoder scaling section of this manual or confirm the feedback device scale.

4. Check Motor Phasing of Any Servo Motor

This is useful for commissioning a third-party motor, as well as any frameless Kollmorgen motor, or any servo motor for which the phasing is unknown.

This part of the setup will require a two channel oscilloscope with isolated channels. Move the motor in the positive direction based on the motor manufactures specification. The AKD2G commutates a motor in the phase sequence of U V W in the positive direction.

When determining the motor phasing, the U phase (U phase with reference to V phase) will lead the back emf voltage waveform by 120° of the V phase (V phase with reference to W phase).

While moving the motor in a positive direction the motor V phase (V phase with reference to W phase) will lead the back emf voltage waveform by 120° of W phase (W phase with reference to U phase).

Use Figure 3 to determine the Hall Sensor alignment of the motor. Make sure the feedback position value (PL.FB) is counting in the positive direction.

5. Test Hall Sequence When Moving Motor in the Positive Direction

The hall phasing can be check with the parameter FB#..HALLSTATE in terminal. This is a binary value, where "001" is Hall U, "010" is Hall V, and "100" is Hall W.

FB#.HALLSTATE

 Description

 FBRHALLSTATE reads the Hall switch values (encoder feedback only).

 The value is the sum of the three hall bit states, where FB# HALLSTATE = Hall U + Hall V + Hall W. If the hall is not active, it returns 0. When a hall is active, each hall contributes the following value to the sum:

 Hall W = 1
 Hall V = 2
 Hall U = 1

 Value Hall W Hall V Hall U

 1

What does this mean?

. . .

Genera	Info	rma	tion
--------	------	-----	------

Туре	Read Only	
Units	Terminal: Binary Scope: N/A	
Range	Terminal: See description above Scope: 1 to 6	-
Default Value	N/A	1
Data Type	Terminal: String Scope: Integer	
Stored in Non Volatile Memory	No	1

FB#.HALLMAP.U

Description

FB#.HALLMAP.U reads and writes to a mapping register used to correct mis-wired motors without physically changing the wiring. This keyword only effects feedback devices that have halls (see FB# SELECT for feedback types with halls).

FB#. HALLMAP.U can be set to one of the following values:

Value	Description
0	The output is the U input value. (Default)
1	The output is the V input value. (Swap U with V)
2	The output is the W input value. (Swap U with W)
3	The output is fixed at 0.
4	The output is U input inverted value. (When input U=0, U output is 1)
5	The output is V input inverted value. (When input V=0, U output is 1)
6	The output is W input inverted value. (When input W=0, U output is 1
7	The output is fixed at 1.

Versions

Action Version Note Implemented 02-10-00-000

General Information

Туре	Read/Write
Units	N/A
Range	0 to 7
Default Value	0
Data Type	Integer
Stored in Non Volatile Memory	Yes

Hall Sensor Sequence when FeedBack (PL.FB) Is Counting Positive Using the Scope is easier to capture and analyze.

Hall Sensor Sequence when FeedBack (PL.FB) Is Counting Positive

Note with the AKD2G the FB#.HALLSTATE only reports the decimal value. I checked this with Terminal and the sequence reported was 1, 5, 4, 6, 2, 3, 1.

Step(CW)	FB#.HALLSTATE
1	1
2	5
3	4
4	6
5	2
6	3
1	1

The hall phasing can be check with the parameter FB1.HALLSTATE. This is a binary value, where "001" is Hall U, "010" is Hall V, and "100" is Hall W.

6. MOTOR BACK EMF AND HALL SENSOR SIGNAL ALIGNMENT

When using a Kollmorgen DDL motor, **MOTOR.PHASE = 120** when the feedback direction is positive toward the "Lead Exit End" of motor (that is, the end of the motor where the leads come out), and when the hall alignmet and motor phasing match exactly as shown in Figure 3.

Return to 13. Start the Wake and Shake Routine on "page 42"

Appendix B

1. Hall Effect Cable

2. Thermal Sensor Cable

3. Motor Power Cable

