

AKD SYSTEM CONFIGURATION WITH KOLLMORGEN DDL LINEAR MOTORS

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Rev. M

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

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System Wiring Configuration

1. AKD System Cable Diagram

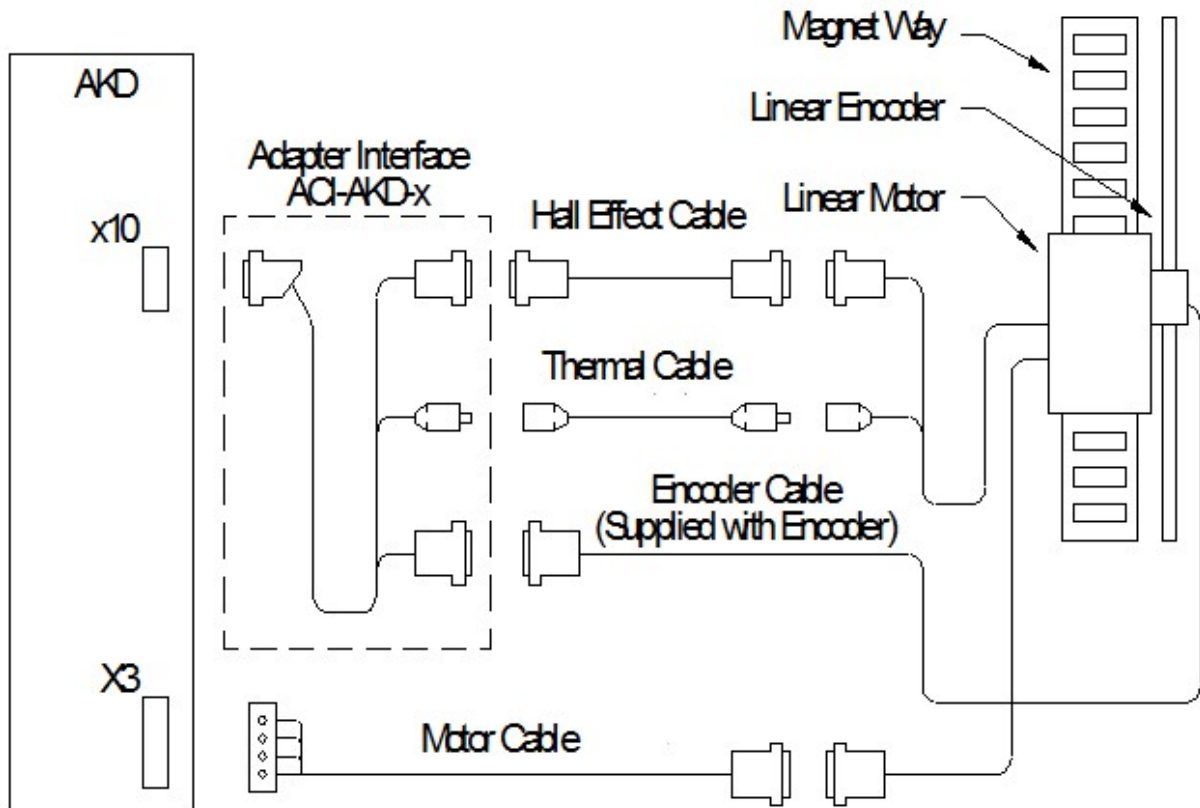
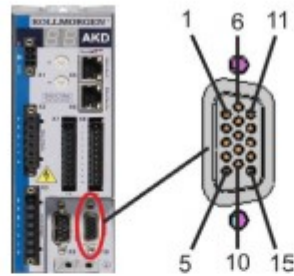


Figure 1

2. AKD FEEDBACK X10

Feedback connector (X10)

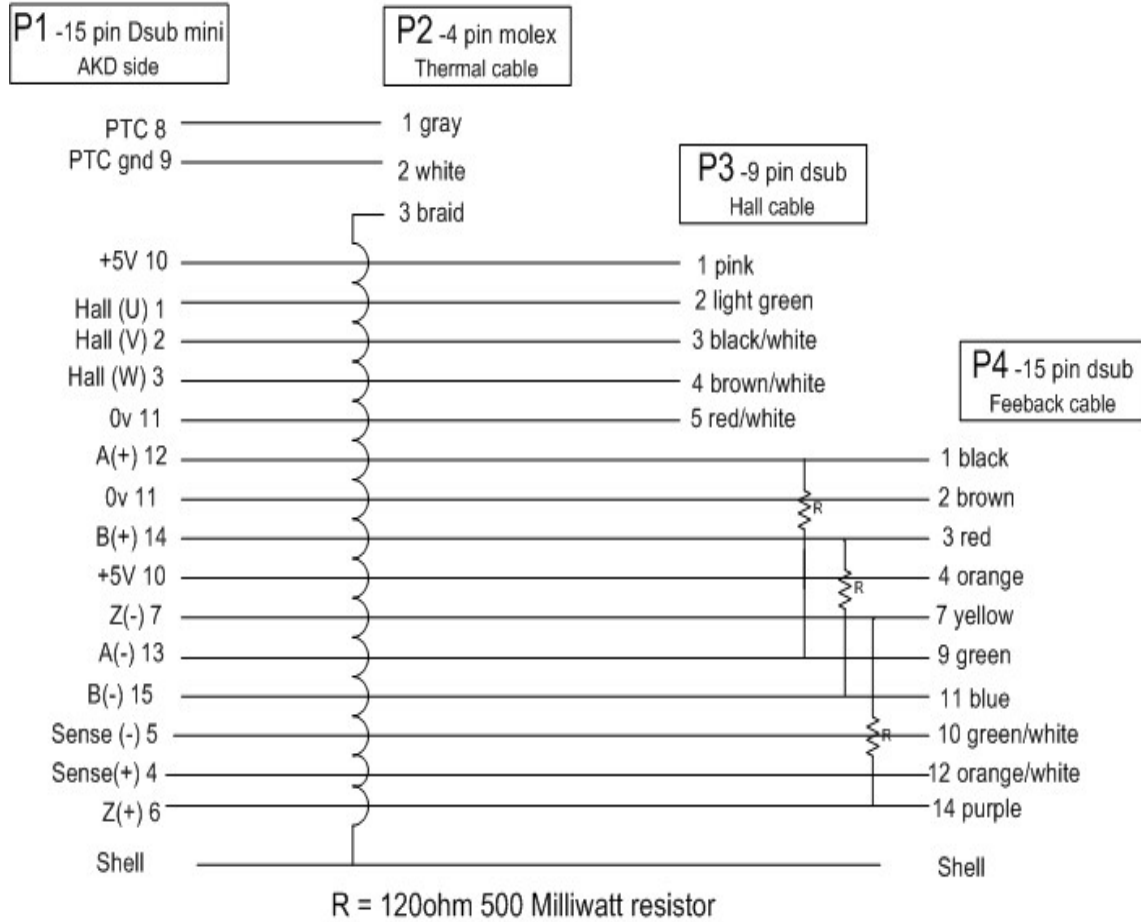


PIN	SFD	SFD3/DSL	Resolver	BiSS B (analog)	BiSS C (digital)	EnDAT 2.1	EnDAT 2.2	Hiperface	Sine Enc. +Hall	Tamagawa Smart Abs*	Incr. Enc. +Hall
1	-	-	-	-	-	-	-	-	Hall U	-	Hall U
2	-	-	-	CLK+	CLK+	CLK+	CLK+	-	Hall V	-	Hall V
3	-	-	-	CLK-	CLK-	CLK-	CLK-	-	Hall W	-	Hall W
4	SEN+	-	-	SEN+	SEN+	SEN+	SEN+	SEN+	SEN+	SEN+	SEN+
5	SEN-	-	-	SEN-	SEN-	SEN-	SEN-	SEN-	SEN-	SEN-	SEN-
6	COM+	COM+	R1 Ref+	DAT+	DAT+	DAT+	DAT+	DAT+	Zero+	SD+	Zero+
7	COM-	COM-	R2 Ref-	DAT-	DAT-	DAT-	DAT-	DAT-	Zero-	SD-	Zero-
8	-	-	Thermal control (+)								
9	-	-	Thermal control (-)								
10	+5V	+5V	-	+5V	+5V	+5V	+5V	+8 to +9 V	+5V	+5V	+5V
11	0V	0V	-	0V	0V	0V	0V	0V	0V	0V	0V
12	-	-	S1 SIN+	A+	-	A+	-	SIN+	A+	-	A+
13	-	-	S3 SIN-	A-	-	A-	-	SIN-	A-	-	A-
14	-	-	S2 COS+	B+	-	B+	-	COS+	B+	-	B+
15	-	-	S4 COS-	B-	-	B-	-	COS-	B-	-	B-

CLK = CLOCK, DAT = DATA, SEN = SENSE, * = for AKD with "NB" (rev 8+) only

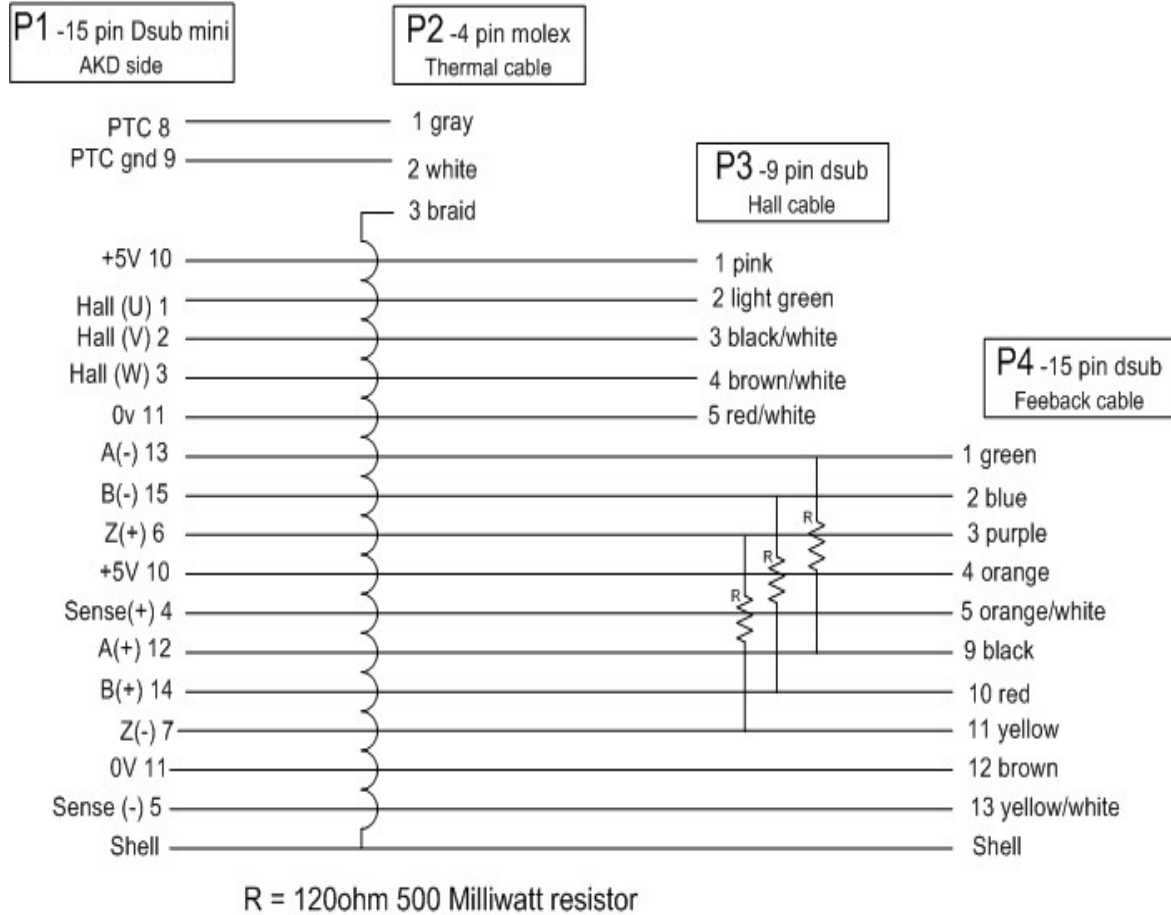
3. ACI-AKD-A (Heidenhain Sin/Cos)

ACI-AKD-A (Heidenhain type)

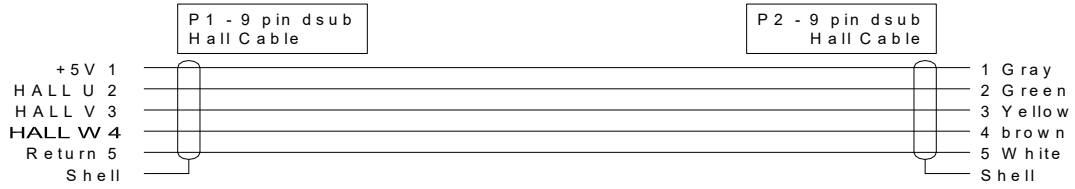


4. ACI-AKD-B (Renishaw Sin/Cos)

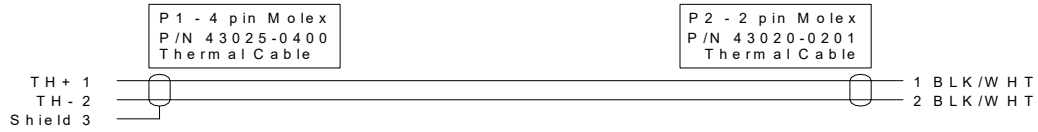
ACI-AKD-B (Renishaw Sine/Cos type)



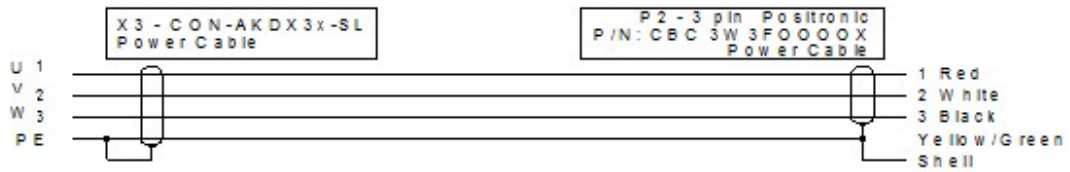
5. Hall Effect Cable



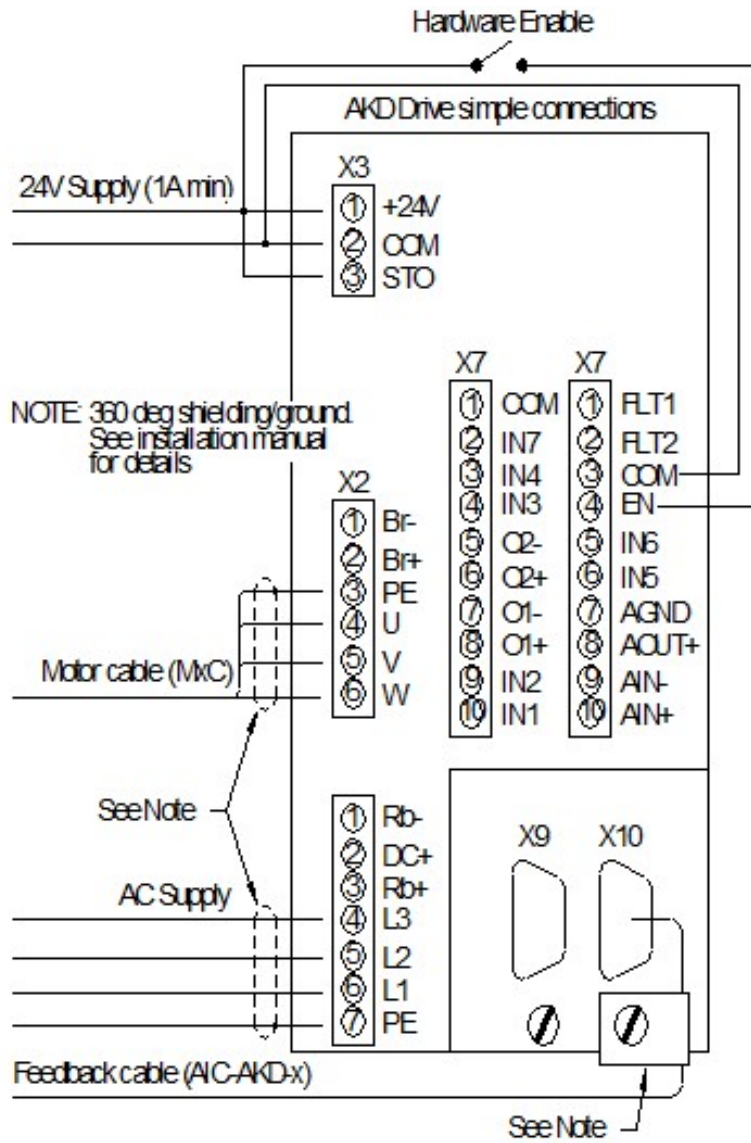
6. Thermal Sensor Cable



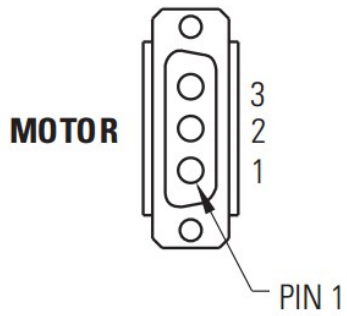
7. Motor Power Cable



8. Minimum Wiring Requirement for the AKD Drive



9. DDL Motor Coil Connections

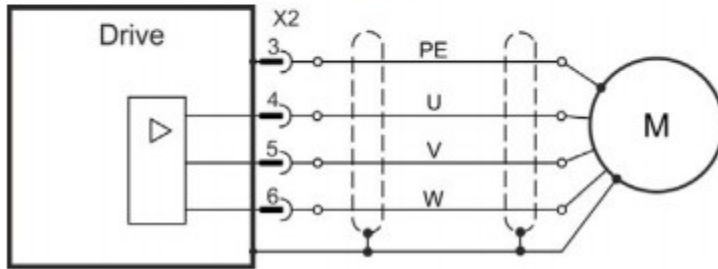


Motor Connector Pin Numbers	Motor Coil Wire Color	AKD Drive Connection Connector X2
1	Red	U
2	White	V
3	Black	W
Connector Shell	Grn/Yel	PE GND
Connector Shell	Violet	Shield

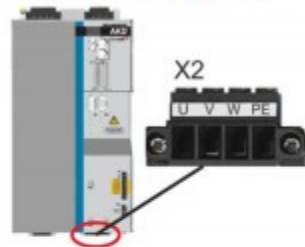
AKD-x003 to 024, power connector X2



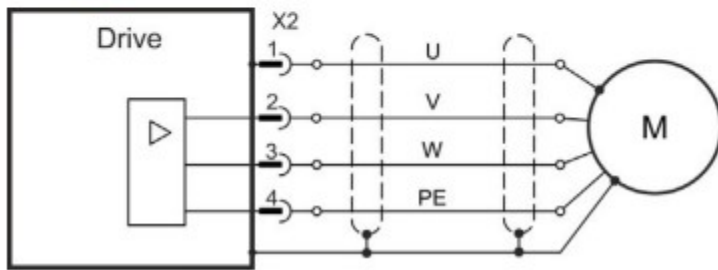
Pin	Signal	Description
1	-BR	Motor holding brake (→ p. 112)
2	+BR	Motor holding brake (→ p. 112)
3	PE	Protective earth (motor housing)
4	U	Motor phase U
5	V	Motor phase V
6	W	Motor phase W



AKD-x048, power connector X2



Pin	Signal	Description
1	U	Motor phase U
2	V	Motor phase V
3	W	Motor phase W
4	PE	Protective earth (motor housing)



Configure the AKD Drive Using the Workbench Software

Install AKD Workbench. The software program can be found on the website (<http://www.kollmorgen.com/en-us/products/drives/servo/akd/>), (<http://kdn.kollmorgen.com/>) 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.

1: Click on the "LIMITS"

2: Lower the Peak Current values to a safe level

Section	Parameter	Value	Unit
Current Limits	Positive Peak Current:	9.000	Ams
	Negative Peak Current:	-9.000	Ams
	Dynamic Break Peak Current:	1.000	Ams
Velocity Limits	Positive Speed Limit:	3,000.000	rpm
	Negative Speed Limit:	-3,000.000	rpm
	User Over-Speed Limit:	9,599.894	rpm
	Overall Over-Speed Limit:	9,599.894	rpm
Position Limits	Maximum Position Error:	655,360	Counts16Bit
	Position Limit 0	0	Counts16Bit
	Position Limit 1	1,048,576	Counts16Bit
Acceleration Limits	Acceleration:	59.903	rpm/s
	Deceleration:	59.903	rpm/s
Motor Limits	Motor limits are set through the Motor Foldback Screen: Goto Foldback		

2. Connect to the AKD Drive

Follow the instruction from the WorkBench help file.

The screenshot displays the Kollmorgen WorkBench software interface. The top menu bar includes 'File', 'Edit', 'View', 'Tools', and 'Help'. Below the menu bar, there are buttons for 'Connect' and 'Panic'. The 'Device Topology' panel on the left shows a 'Start Page' and a 'Kollmorgen Device (169.254.250.201)'. The main window displays the 'Kollmorgen WorkBench Help' content, with a 'Contents' list on the left and a 'Connecting the Drive' article on the right. The 'Contents' list includes 'Welcome Page', 'AKD Workbench User Manual', 'AKD Cover', 'AKD Models', 'Initial Drive Setup', 'Connecting the AKD', 'Connected and Disconnected States', 'Disconnected', 'Confirm Connection with the Device', 'Connect To Another Device', 'TwinCAT and Workbench Connection', 'Troubleshooting Connection and Communication Problems', 'Communicating with the AKD', 'Using WorkBench', 'Configuring Drive Power', 'Configuring Motor Settings', 'Using AKD in a Vertical Axis', 'Configuring with Linear Motors', 'Selecting Units for Your Application', 'Configuring General Drive Settings', 'Using Command Source and Operation', 'Creating Motion', 'Saving Your Drive Configuration', 'Tuning Your System', 'Using the Scope', 'Using Parameters and the Terminal Settings', and 'Faults and Warnings'. The 'Connecting the Drive' article lists 'Connected and Disconnected States', 'Disconnected', 'Confirm Connection with the Device', 'Connect To Another Device', 'TwinCAT and Workbench Connection', and 'Troubleshooting Connection and Communication Problems'. Two callout boxes provide instructions: '1: Click on the Help then on "Documentation -> AKD"' and '2: Expand "AKD User Manual" and then "connect to the AKD"'. The bottom of the interface shows a 'Watch' section with 'Enab...' and 'Device' labels, and a 'Parameter' label.

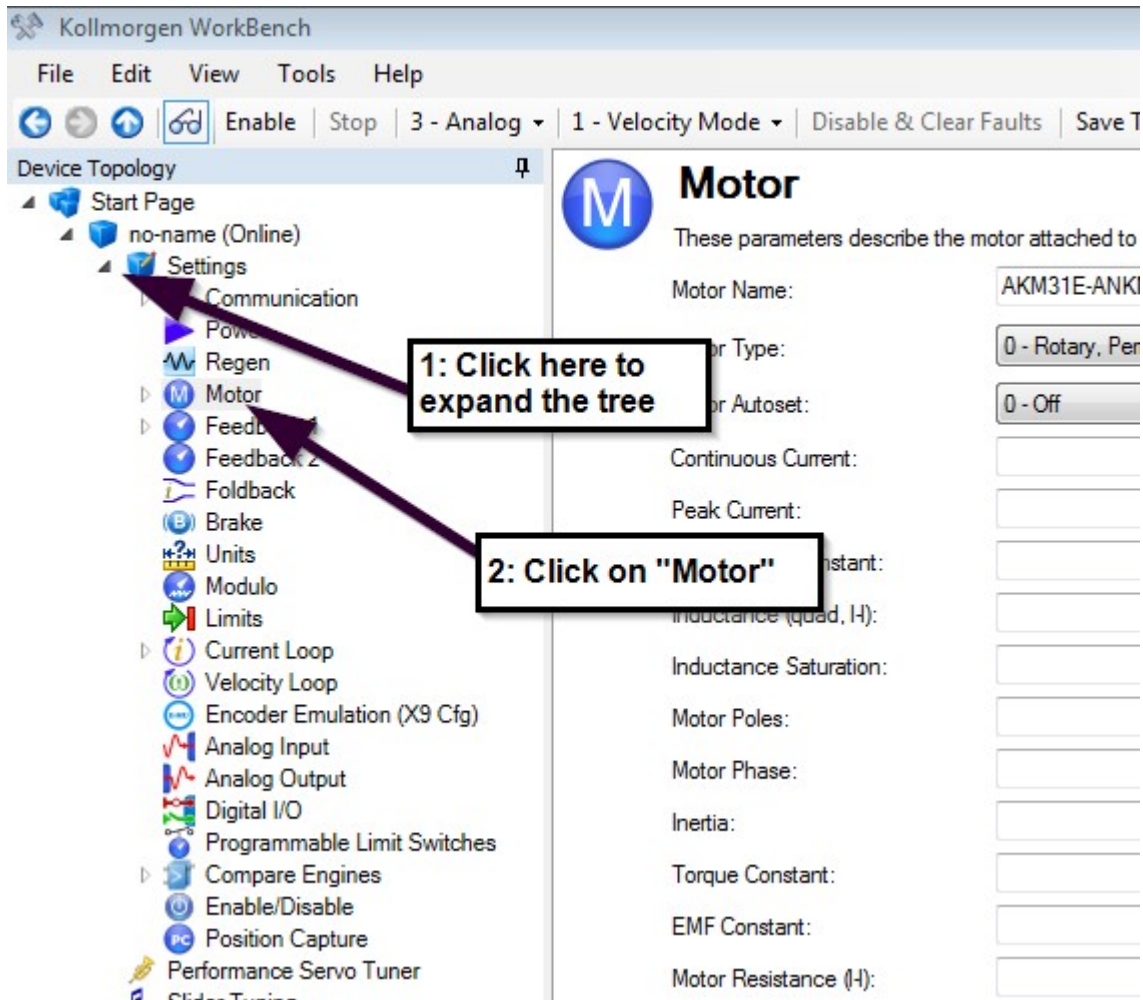
1: Click on the Help then on "Documentation -> AKD"

2: Expand "AKD User Manual" and then "connect to the AKD"

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KOLLMORGEN
Because Motion Matters

3. Expand “Settings” and Select the Motor Setup Screen



Kollmorgen WorkBench

File Edit View Tools Help

Enable Stop 3 - Analog 1 - Velocity Mode Disable & Clear Faults Save T

Device Topology

- Start Page
 - no-name (Online)
 - Settings
 - Communication
 - Power
 - Regen
 - Motor
 - Feed
 - Feedback 2
 - Foldback
 - Brake
 - Units
 - Modulo
 - Limits
 - Current Loop
 - Velocity Loop
 - Encoder Emulation (X9 Cfg)
 - Analog Input
 - Analog Output
 - Digital I/O
 - Programmable Limit Switches
 - Compare Engines
 - Enable/Disable
 - Position Capture
 - Performance Servo Tuner
 - Slide Tuning

1: Click here to expand the tree

2: Click on "Motor"

Motor

These parameters describe the motor attached to

Motor Name: AKM31E-ANKI

Motor Type: 0 - Rotary, Per

Motor Autoselect: 0 - Off

Continuous Current:

Peak Current:

Motor Start:

Inductance (quad, H):

Inductance Saturation:

Motor Poles:

Motor Phase:

Inertia:

Torque Constant:

EMF Constant:

Motor Resistance (H):

4. Select Motor from Pull Down List

The screenshot displays the Kollmorgen WorkBench interface. On the left is a 'Device Topology' tree with 'Motor' selected. The main window shows the 'Motor' configuration page with the following fields:

- Motor Name: AKM31E-ANKNC-00
- Motor Type: 0 - Rotary, Permanent Mi
- Motor Autoset: 0 - Off
- Continuous Current: 2.984 Arms
- Peak Current: 12.000 Arms

Annotations with arrows point to the 'Select Motor...' button (labeled '2: Click on "Select Motor"') and the 'Motor Autoset' dropdown (labeled '1: Turn off "Motor Autoset"').

A 'Select Motor' dialog box is overlaid, showing:

- Motor Family: IC and ICD Series Ironcore DDL
- Name: IC11030A1
- Buttons: Custom Motors..., OK, Close

Annotations with arrows point to the 'Motor Family' dropdown (labeled '3: Change Motor Family to correct motor type') and the 'Name' dropdown (labeled '4: Select motor part number. Then click OK.').



NOTE

If the motor cannot be found in the database, Custom motors can be setup using the “Edit Custom Motors” tools under “Edit” on the tool bar. Instructions for use can be found in the WorkBench help file.

5. Select Motor Temperature Sensor

The screenshot shows the Kollmorgen WorkBench software interface. The top menu bar includes File, Edit, View, Tools, and Help. The status bar shows 'Enable', 'Stop', '0 - Service', '0 - Torque Mode', 'Disable & Clear Faults', 'Save To Device', 'Connect', and a red 'Panic' button. The left sidebar displays the 'Device Topology' tree, with 'Motor Temperature' selected. The main panel is titled 'Motor Temperature' and contains a dropdown menu for 'Thermal Resistor Type'. The dropdown menu is open, showing the following options: '255 - No Thermal Sensor', '0 - Single PTC Thermistor', '1 - Single NTC Thermistor', '2 - KTY83-110 Thermistor', '3 - KTY84-130 Thermistor', '4 - PTC + KTY83-110 Thermistors', '5 - Thermal Switch', and '255 - No Thermal Sensor'. Two callout boxes with arrows point to the 'Motor Temperature' item in the tree and the dropdown menu.

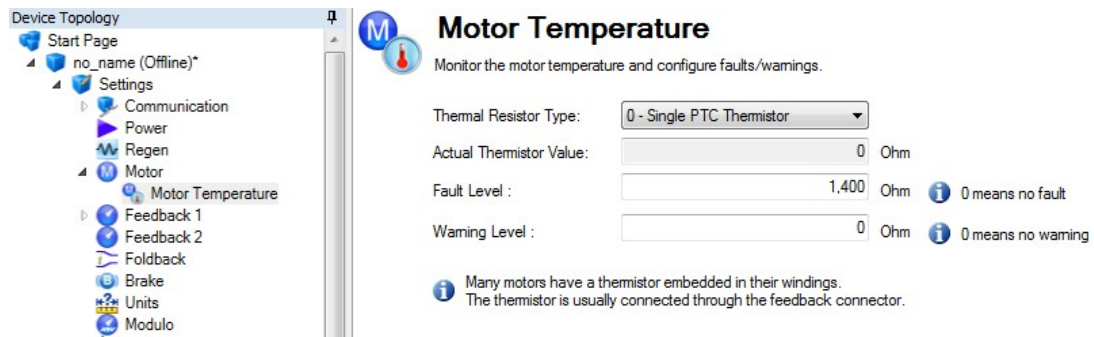
1: Click on the "Motor Temperature"

2: Select the Thermal Resistor Type for the motor

Note to double-click on "Motor" to expand the project tree if "Motor Temperature" is not visible.

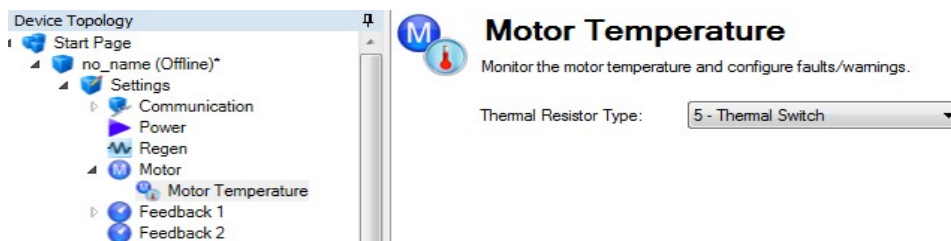
1. Thermostat Option type “TR”: PTC thermistor sensor

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.



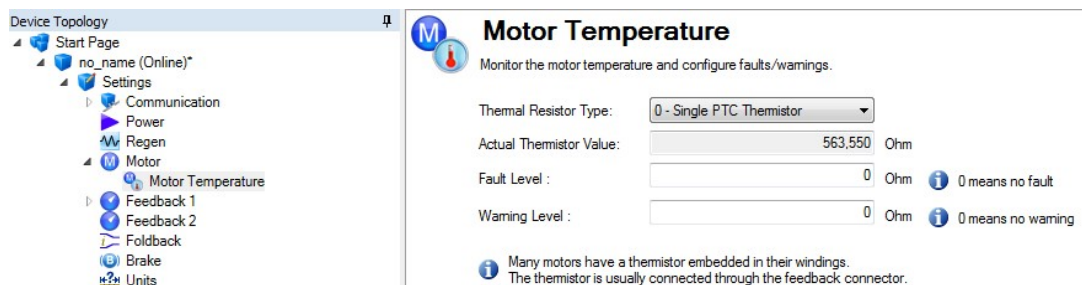
2. Thermostat Option type “TS”: Thermal switch

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



3. No Thermal Sensor

In the case a thermal sensor is not used in the application, the thermal protection feature can be defeated by setting the (MOTOR.TEMPFAULT = 0, the “Fault Level”)



7. Configuring Encoder Feedback Resolution

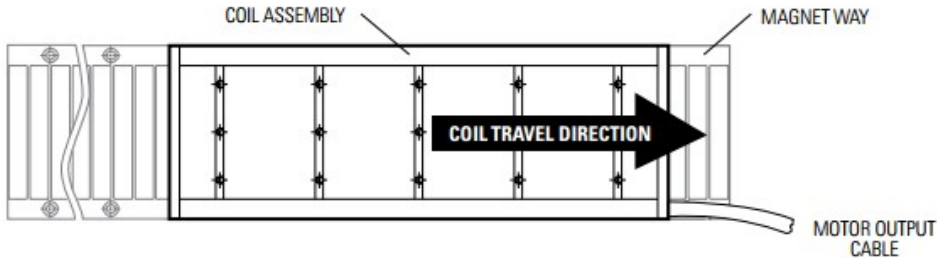
The encoder resolution is based on the magnet pitch of the motor divided by the encoder resolution. The units are lines/pitch. Kollmorgen DDL motors have a magnet pitch of 32 mm. For example, if the encoder has a 20 micron pitch, enter $(32\text{mm} / 20 \text{ micron pitch} * 1000) = 1600$ line count (lines per 32mm) as your encoder resolution. The following chart provides typical encoder resolution figures and their equivalent AKD value.

Encoder Equivalent Resolution µm Line Count	AKD Resolution lines/pitch	Encoder Equivalent Resolution µm Line Count	AKD Resolution lines/pitch
50	640	0.25	128000
40	800	0.2	160000
25	1280	0.1	320000
20	1600	0.08	400000
10	3200	0.05	640000
5	6400	0.04	800000
2.5	12800	0.02	1600000
2	16000	0.01	3200000
1	32000		
0.5	64000		
0.4	80000		

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. **Drive Direction has to be set to zero (“DRV.DIR =0”)**

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 motor feedback screen.

The screenshot shows the 'Kollmorgen WorkBench' software interface. The 'Device Topology' tree on the left has 'Feedback 1' selected. The main window displays the 'Feedback 1 (X10)' configuration screen. A callout box labeled '1: Select the "Feedback 1"' points to the 'Feedback 1' item in the tree. Another callout box labeled '2: This indicator should move left to right when the motor is moved forward' points to a horizontal bar with a small grey indicator block. Below the bar, there are control parameters: 'Motor Autoset' (set to 0 - Off), 'Position Feedback' (0.000 Counts), 'Drive Direction' (0), and 'Sine Cycles/Magnet Pitch' (1,600). A 'Goto Wake and Shake' link is also visible.

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. Change the User Units to “mm”.

The screenshot shows the Kollmorgen WorkBench interface. The left sidebar displays the Device Topology tree, with the 'Units' option highlighted. The main window shows the 'Units' configuration page. A dropdown menu for 'Select Type of Mechanics' is set to 'Motor Only'. The 'Pole-Pair Pitch' is set to 32.000 mm. The 'Position Unit' is set to '1 - mm', the 'Velocity Unit' is '1 - mm/s', and the 'Acceleration Unit' is '1 - mm/s^2'. The 'Position' display shows '0.000 mm'. A 'Less <<' button is visible. Annotations with arrows point to the 'Units' option in the sidebar, the unit dropdowns, and the 'More' button (represented by a double arrow icon) next to the 'Position' field. A 3D model of a motor assembly is shown in the background.

1: Click on "Units"

2: Setup all three Units as mm.

3: Click on the "More" button to show the position feedback counter

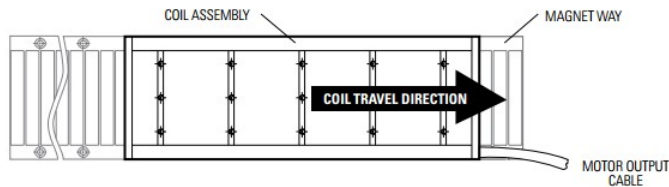
4: Move the motor from one line to the other and see if the position counter changes the correct amount in the correct direction

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.

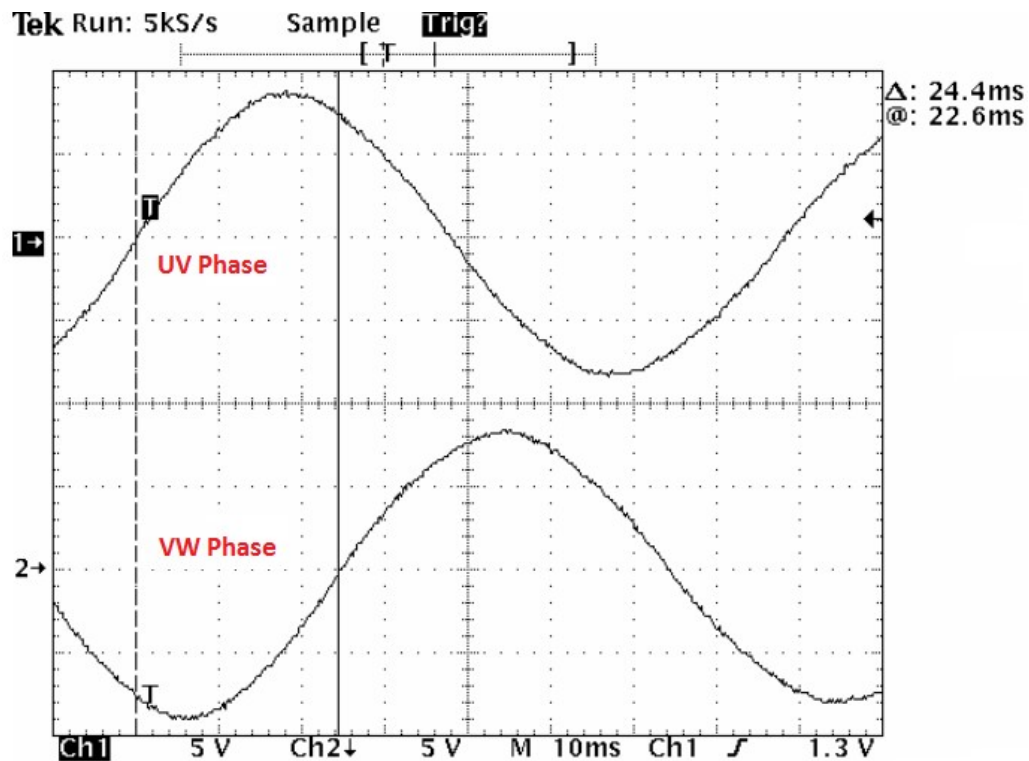
10. Check Motor Phasing of Any Servo Motor

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.

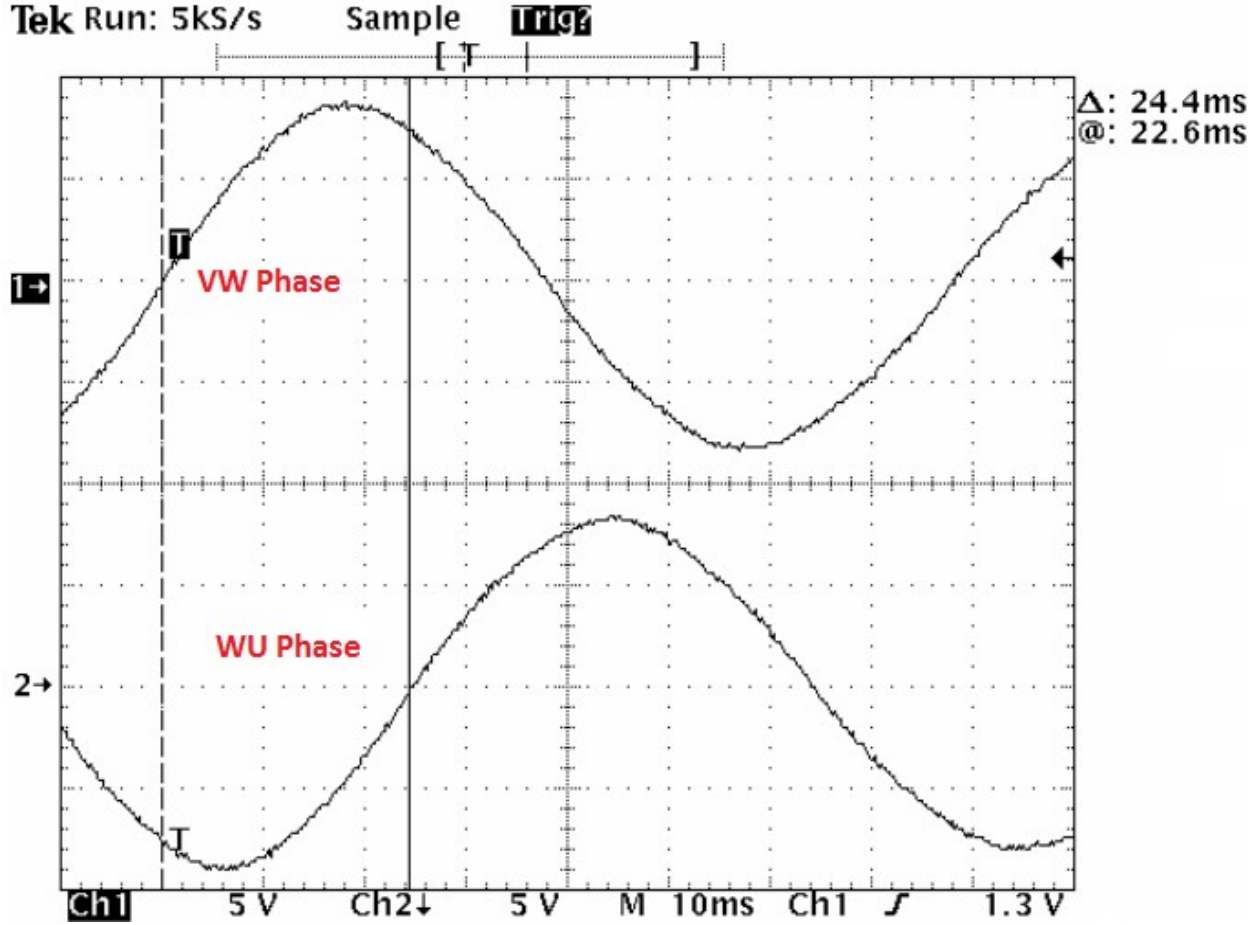
This part of the setup will require a two channel oscilloscope with isolated channels. Move the motor in the positive direction based on the motor manufactures specification. The AKD commutates a motor in the phase sequence of U V W in the positive direction.



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.

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

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.

The screenshot shows the Kollmorgen WorkBench interface. On the left is the 'Device Topology' tree, and on the right is the 'Terminal' window. The terminal displays the output of the command 'FB1.HALLSTATE'.

1: Click on Terminal (Arrow pointing to the Terminal icon in the Device Topology tree)

2: Type FB1.HALLSTATE and press Enter on the computer (Arrow pointing to the terminal input line)

```
-->FB1.HALLSTATE
1 0 0
-->FB1.HALLSTATE
1 0 1
-->FB1.HALLSTATE
0 0 1
-->
```

Macro 1 Macro 2 Macro 3 Macro 4 Macro 5 Edit Macros...

Hall Sensor Sequence when FeedBack (PL.FB) Is Counting Positive When Using AKD Firmware Version = or > 01-13-10-001. Do not use the parameter FB1.HALLSTATE in the oscilloscope feature to monitor Hall sensor state

Step(CW)	FB1.HALLSTATEW	FB1.HALLSTATEV	FB1.HALLSTATEU
1	0	0	1
2	0	1	1
3	0	1	0
4	1	1	0
5	1	0	0
6	1	0	1
7	0	0	1

Hall Sensor Sequence when FeedBack (PL.FB) Is Counting Positive When Using AKD Firmware Version < 01-13-10-001. Do not use the parameter FB1.HALLSTATE in the oscilloscope feature to monitor Hall sensor state.

Step(CW)	FB1.HALLSTATEW	FB1.HALLSTATEV	FB1.HALLSTATEU
1	0	0	1
2	1	0	1
3	1	0	0
4	1	1	0
5	0	1	0
6	0	1	1
7	0	0	1

11. Motor Back emf And Hall Sensor Signal Alignment

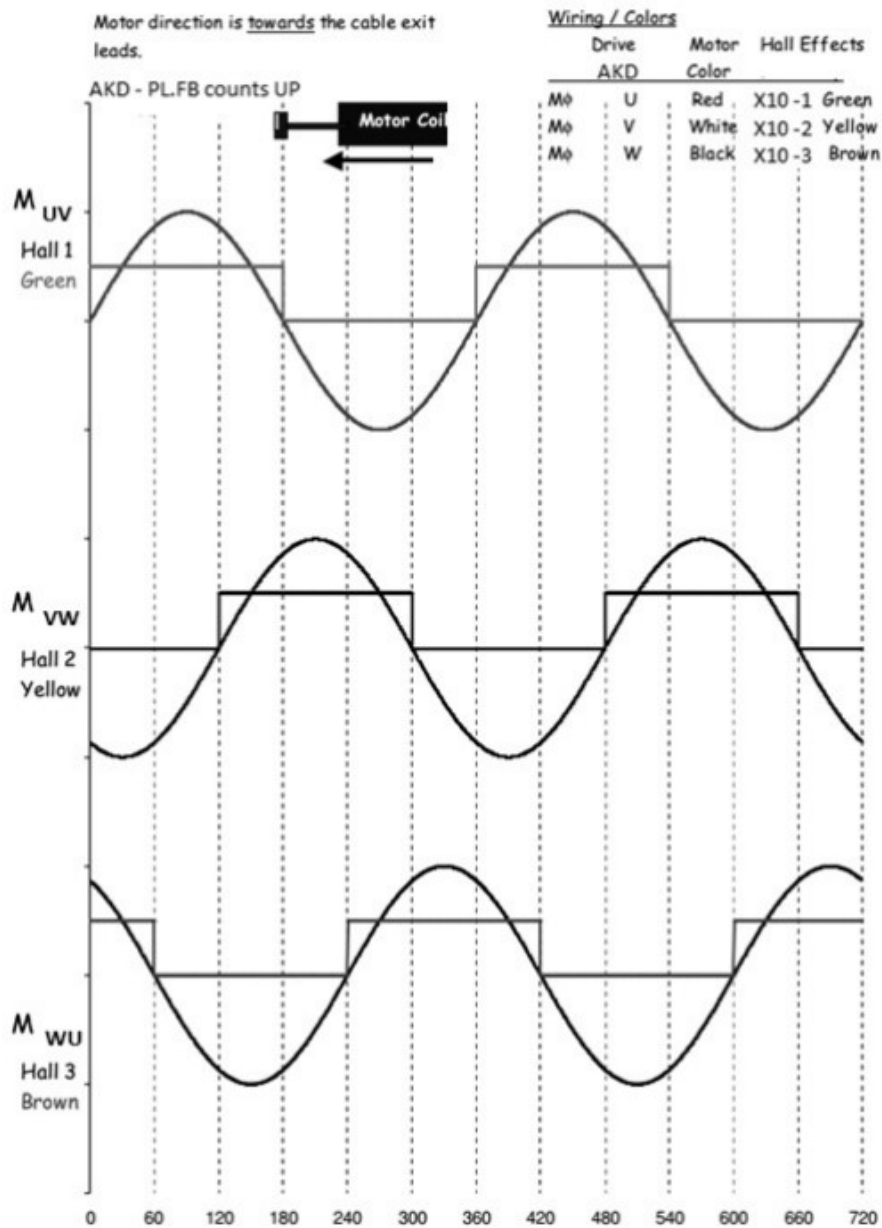
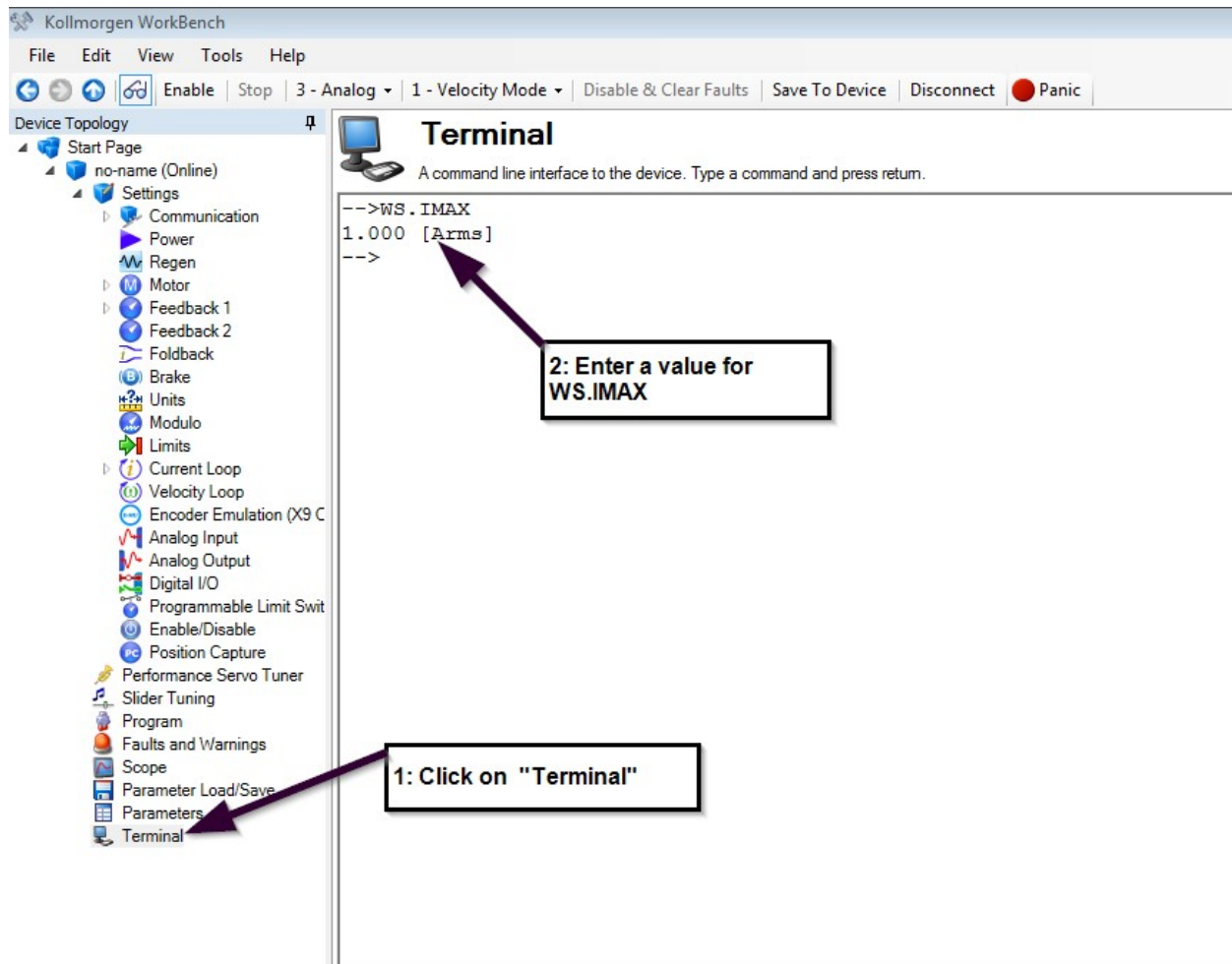


Figure 2

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 alignment and motor phasing match exactly as shown in Figure 2.

12. How to Verify the Motor's Commutation Alignment Angle (MOTOR.PHASE)

Set the Wake & Shake Current WS.IMAX equal to continuous of your linear motor in the Terminal Screen.



The screenshot displays the Kollmorgen WorkBench software interface. The top menu bar includes File, Edit, View, Tools, and Help. Below the menu bar, there are several status indicators: Enable, Stop, 3 - Analog, 1 - Velocity Mode, Disable & Clear Faults, Save To Device, Disconnect, and a red Panic button. The left sidebar shows the Device Topology tree, which is expanded to show the Terminal option at the bottom. The main window is titled "Terminal" and contains a command line interface. The terminal text shows the command `-->WS.IMAX` followed by the value `1.000 [Arms]` and a prompt `-->`. Two callout boxes with arrows provide instructions: "1: Click on 'Terminal'" points to the Terminal option in the Device Topology tree, and "2: Enter a value for WS.IMAX" points to the value `1.000` in the terminal.

13. Start the Wake and Shake Routine

Kollmorgen WorkBench

File Edit View Tools Help

Enable Stop 3 - Analog 1 - Velocity Mode Disable & Clear Faults Save To Device Disconnect Panic

Device Topology

- Start Page
- no-name (Online)
- Settings
 - Communication
 - Power
 - Regen
 - Motor
 - Feedback 1
 - Wake and Shake
 - Feedback 2
 - Foldback
 - Brake
 - Units
 - Modulo
 - Limits
 - Current Loop
 - Velocity Loop
 - Encoder Emulation (X9 C)
 - Analog Input
 - Analog Output
 - Digital I/O
 - Programmable Limit Swit
 - Enable/Disable
 - Position Capture
 - Performance Servo Tuner
 - Slider Tuning
 - Program
 - Faults and Warnings
 - Scope
 - Parameter Load/Save
 - Parameters
 - Terminal

Wake and Shake

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

2 - Auto Wake and Shake

Comutation Check

Mode: 1 - Active

Arm

Motor Phase: 4 deg

1: Click on the the "Wake and Shake"

2: Select 2 - Auto Wake and Shake

3: Click the Arm Button

4: Click on the Enable

Start the Wake and Shake routine to find the MOTOR.PHASE offset value. 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.

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

Kollmorgen WorkBench

File Edit View Tools Help

Enable Stop 0 - Service 1 - Velocity Mode Disable & Clear Faults Save To Device Disconnect Panic

Device Topology

- Start Page
- Kollmorgen Device (169.254.250.9)
- no_name (Online)*
- Settings
 - Commur...
 - Power
 - Regen
 - Motor
 - Feedback 1
 - Feedback 2
 - Foldback
 - Brake
 - Units
 - Modulo
 - Limits
 - Current Loop
 - Velocity Loop
 - Service Motion
 - Encoder Emulation (X9 Cfg)
 - Analog Input
 - Analog Output
 - Digital I/O
 - Programmable Limit Switches
 - Enable/Disable
 - Position Capture
 - Performance Servo Tuner
 - Slider Tuning
 - Program
 - Faults and Warnings
 - Scope
 - Parameter Load/Save
 - Parameters
 - Terminal

Service Motion

Service motion allows you to start and stop some test motions.

Service Motion Mode: Pulse Reversing Continuous

Group: Group 1

Velocity 1: 32,000 mm/s

Time 1: 2,000 ms

Acceleration: 3,584,000,000.000 Counts/s²

Deceleration: 715,839,984.631.808 Counts/s²

Position Feedback: 0 mm

Velocity Feedback: -0.757 mm/s

Start Drive is inactive.

1: Select Service Mode

2: Select Velocity Mode

3: Select Service Motion

4: Select Pulse

5: Input a slow Motor Velocity

6: Make sure the move time does not allow the motor to hit the hard stops

7: Select Start

7: Enable the AKD



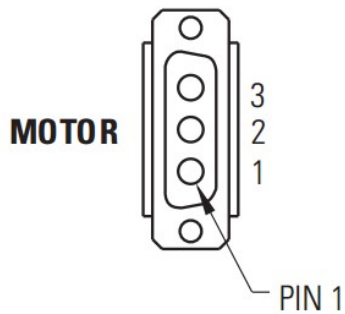
Make sure the AKD drive's peak current is limited before doing this exercise. A linear motor runaway can result in damage to the system equipment or possible bodily injury.

The linear motor initial commissioning is now complete!

Appendix A

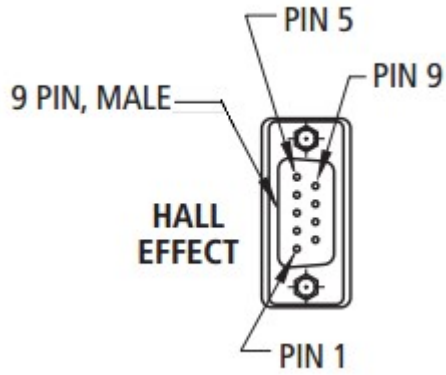
Configuring a DDL Liner Motor with Feedback Counting in the Opposite Direction

1. DDL Motor Coil Connections



Motor Connector Pin Numbers	Motor Coil Wire Color	AKD 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	AKD 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”.

Kollmorgen WorkBench

File Edit View Tools Help

Enable Stop 0 - Service 0 - Torque Mode Disable & Clear Faults Save To Device Connect Panic

Device Topology

- Start Page
- no_name (Offline)
 - Settings
 - Communication
 - Power
 - Regen
 - Motor
 - Motor Temperature
 - Feedback 1
 - Feedback 2
 - Foldback
 - Brake
 - Units
 - Modulo
 - Limits
 - Home
 - Current Loop
 - Service Motion
 - Encoder Emulation (X9 Cfg)
 - Analog Input
 - Analog Output
 - Position Capture
 - Motion Profile Table
 - Performance Servo Tuner
 - Slider Tuning
 - Motion Tasks
 - Drive Motion Status
 - Faults and Warnings
 - Scope
 - Parameter Load/Save
 - Parameters
 - Terminal

1: Click on "Units"

2: Setup all three Units as mm.

3: Click on the "More" button to show the position feedback counter

4: Move the motor from one line to the other and see if the position counter changes the correct amount in the correct direction

Pole-Pair Pitch: 32.000 mm

Select Type of Mechanics: Motor Only

Position Unit: 1 - mm

Velocity Unit: 1 - mm/s

Acceleration Unit: 1 - mm/s²

Modbus Unit: [Goto Modbus](#)

Less <<

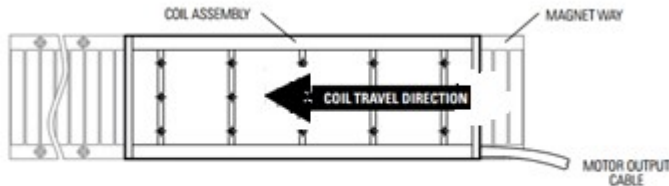
Position: 0.000 mm

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.

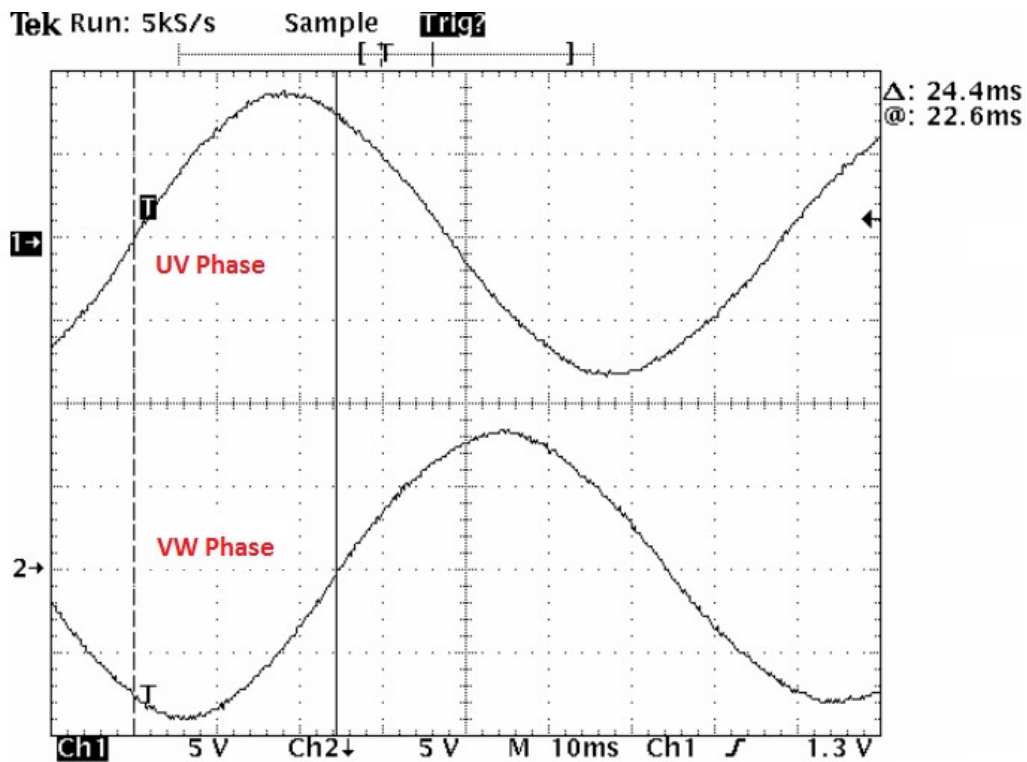
4. Check Motor Phasing of Any Servo Motor

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.

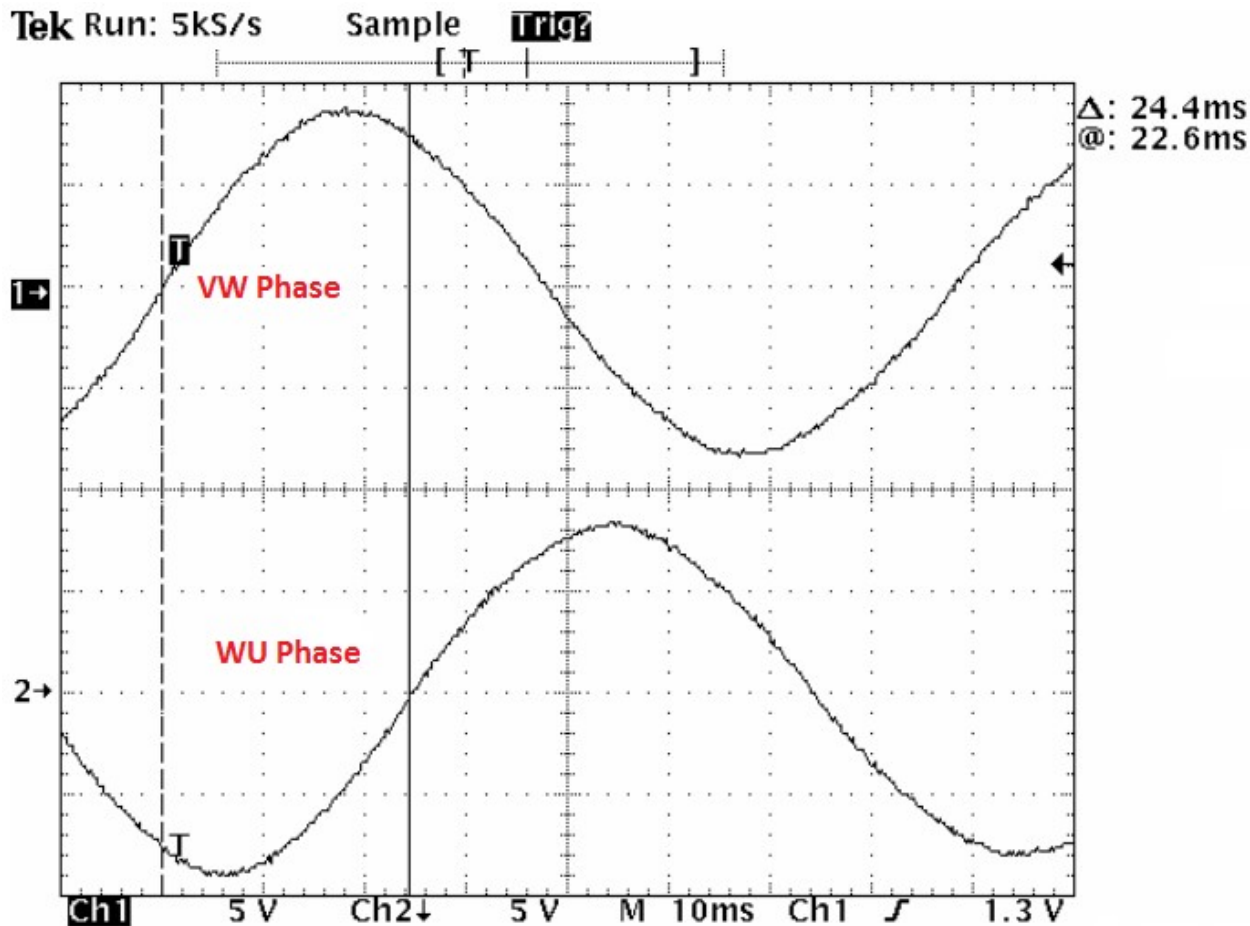
This part of the setup will require a two channel oscilloscope with isolated channels. Move the motor in the positive direction based on the motor manufactures specification. The AKD commutates a motor in the phase sequence of U V W in the positive direction.



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).

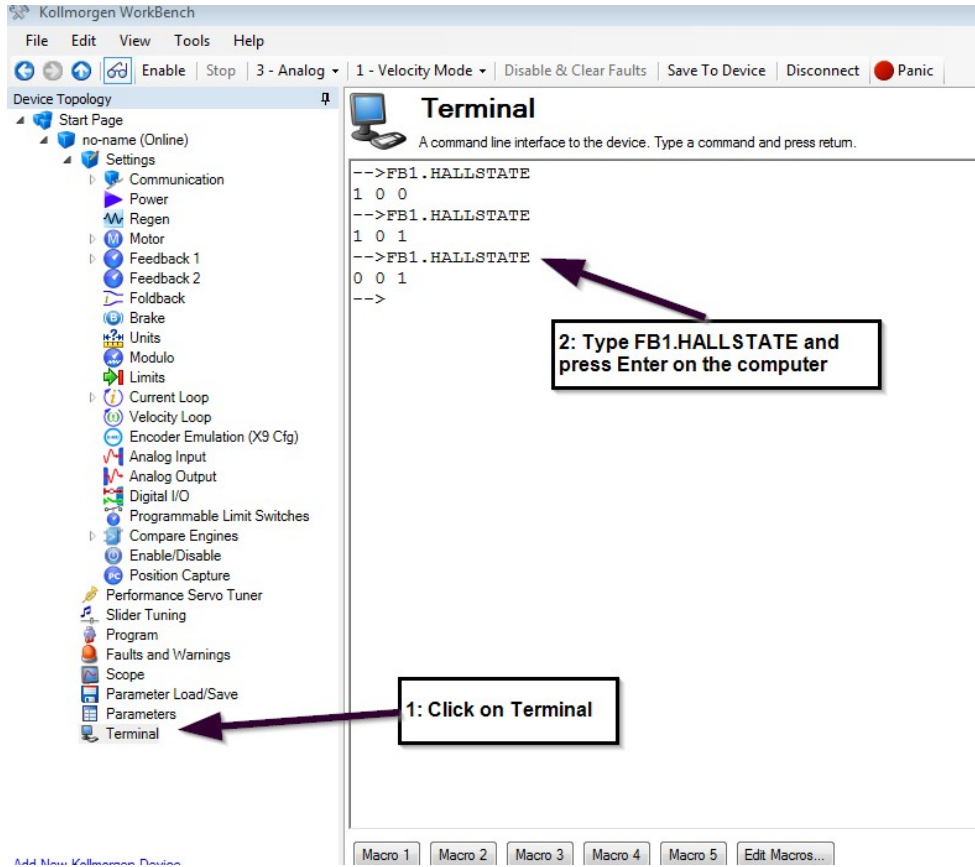


Use Figure 3 to determine the Hall Sensor alignment of the motor. Make sure the feedback position value (PL.FB) is counting in the positive direction.

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

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.



The screenshot shows the Kollmorgen WorkBench interface. On the left is the 'Device Topology' tree, and on the right is the 'Terminal' window. The terminal displays the output of the command 'FB1.HALLSTATE'.

1: Click on Terminal (Arrow pointing to the Terminal icon in the Device Topology tree)

2: Type FB1.HALLSTATE and press Enter on the computer (Arrow pointing to the terminal output)

```
--->FB1.HALLSTATE
1 0 0
--->FB1.HALLSTATE
1 0 1
--->FB1.HALLSTATE
0 0 1
--->
```

Macro 1 Macro 2 Macro 3 Macro 4 Macro 5 Edit Macros...

6. Monitoring the Hall Sensors States

Hall Sensor Sequence when FeedBack (PL.FB) Is Counting Positive When Using AKD Firmware Version = or > 01-13-10-001. Do not use the parameter FB1.HALLSTATE in the oscilloscope feature to monitor Hall sensor state

Step(CW)	FB1.HALLSTATEW	FB1.HALLSTATEV	FB1.HALLSTATEU
1	0	0	1
2	0	1	1
3	0	1	0
4	1	1	0
5	1	0	0
6	1	0	1
7	0	0	1

Hall Sensor Sequence when FeedBack (PL.FB) Is Counting Positive When Using AKD Firmware Version < 01-13-10-001. Do not use the parameter FB1.HALLSTATE in the oscilloscope feature to monitor Hall sensor state.

Step(CW)	FB1.HALLSTATEW	FB1.HALLSTATEV	FB1.HALLSTATEU
1	0	0	1
2	1	0	1
3	1	0	0
4	1	1	0
5	0	1	0
6	0	1	1
7	0	0	1

7. MOTOR BACK EMF AND HALL SENSOR SIGNAL ALIGNMENT

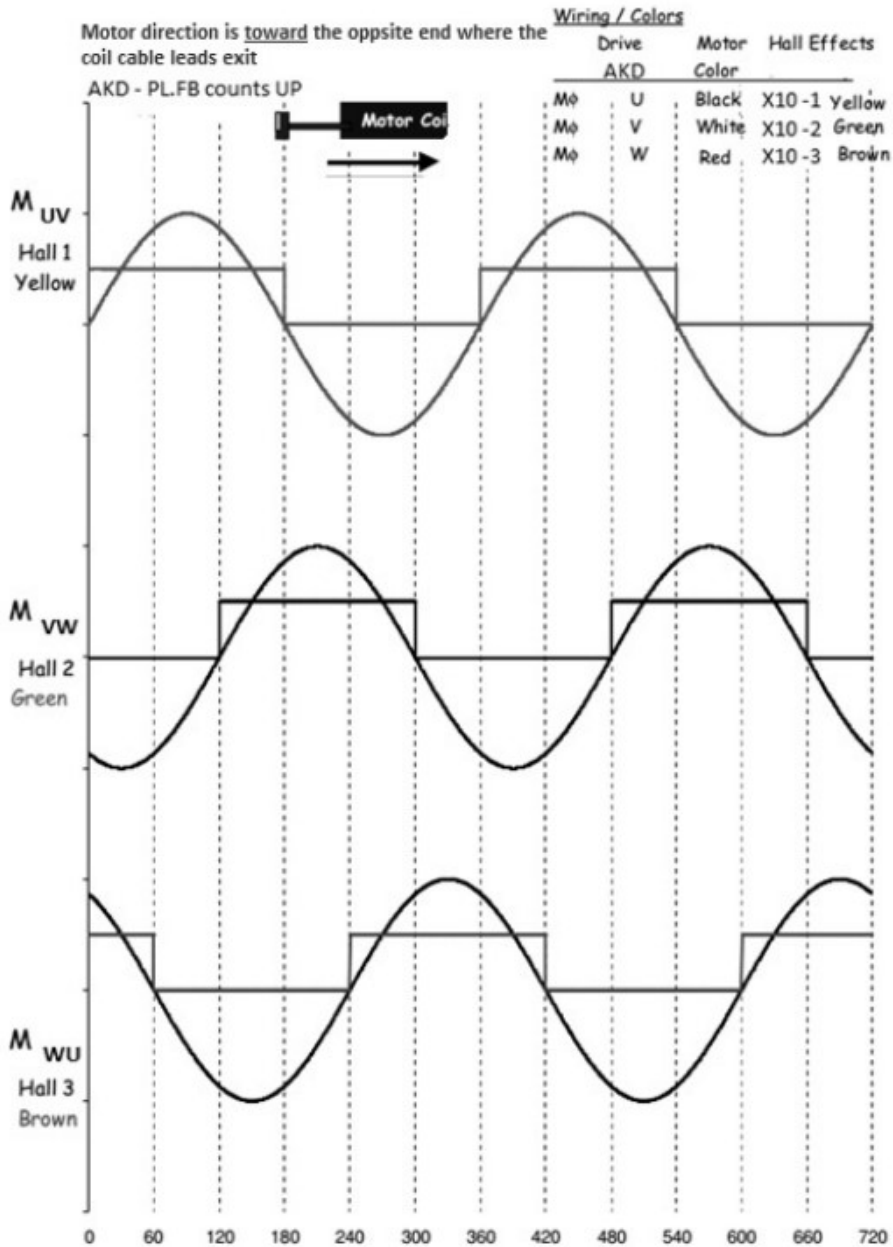


Figure 3

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 alignment and motor phasing match exactly as shown in Figure 3.

Return to **13. Start the Wake and Shake Routine** on “page 26”