KOLLMORGEN™

AKD System Configuration with Kollmorgen KBM Frameless Motors

By Kenny Hampton and Todd Evans

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This document shows the wiring requirements for connecting the KBM frameless motor and the feedback of your choice to the AKD servo drive. It also describes the setup procedure for configuring the AKD drive in the Workbench software and getting the motor to commutate correctly.

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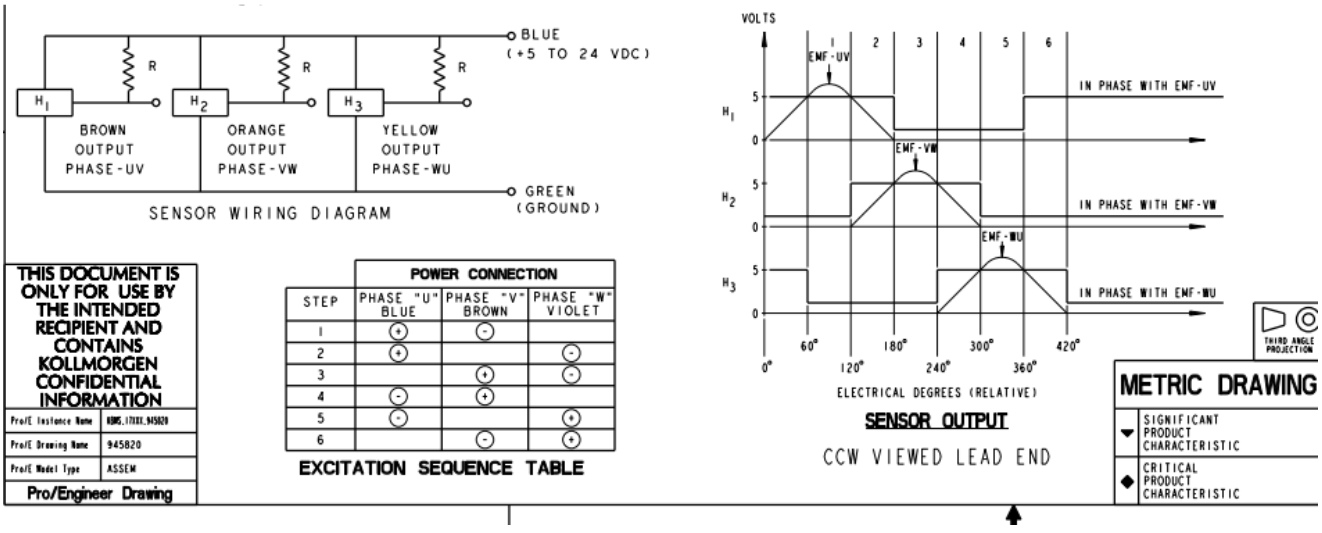
Conventions and Connections Overview

Conventions

The preferred standard electrical connections between the AKD-drive to KBM(s) - frameless motor, unless specifically stated otherwise, are based upon a C.C.W. rotation of the rotor as viewed from the lead-exit end of the motor, for a positive count direction of the position-loop. In addition, to help clarify one motor phase or Hall feedback signal, to another, an underlined last letter is utilized under the point of electrical reference; hence, phase-UV, reads: phase-U, with respect to phase-V, leads V, by 120-degrees with a C.C.W. rotation of the rotor; or where a positive Hall-1 (H1) signal, also defined as Huv (drive-Hu for the defined convention), reads: hall signal: H1 (Huv) is positive, and in phase with motor's Bemf, phase-U, with respect to motor phase-V, with a C.C.W. rotation of the rotor.

This document shows color codes that are typical for the KBM(S) motors. Always check the outline drawing of your specific KBM(S) motor to verify the color coding of the motor power (for both KBM and KBMS motors and halls (KBMS).

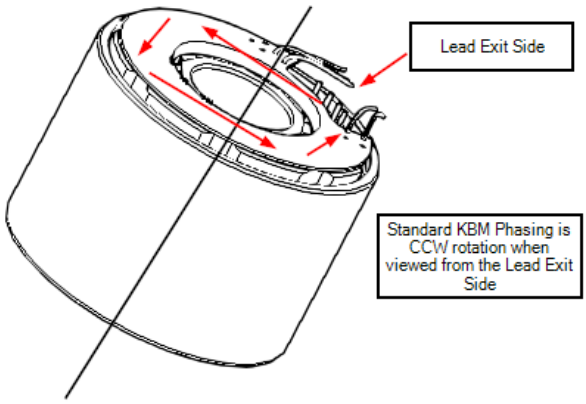
Here is an example of these details on a KBMS outline drawing.



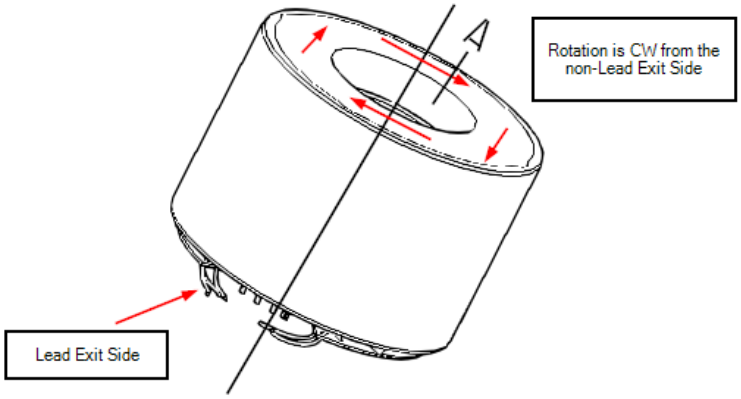
Orientation

As stated above the KBM motor uses the following convention.

If the motor is mounted upside down and you are viewing the lead exit side of the motor then the rotation for standard phasing will be CCW.



If the motor is mounted in an upright position and you are viewing the non-exit side of the motor then the rotation for standard phasing will be CW.



Feedback Wiring and Rotation Direction Conventions and Overview

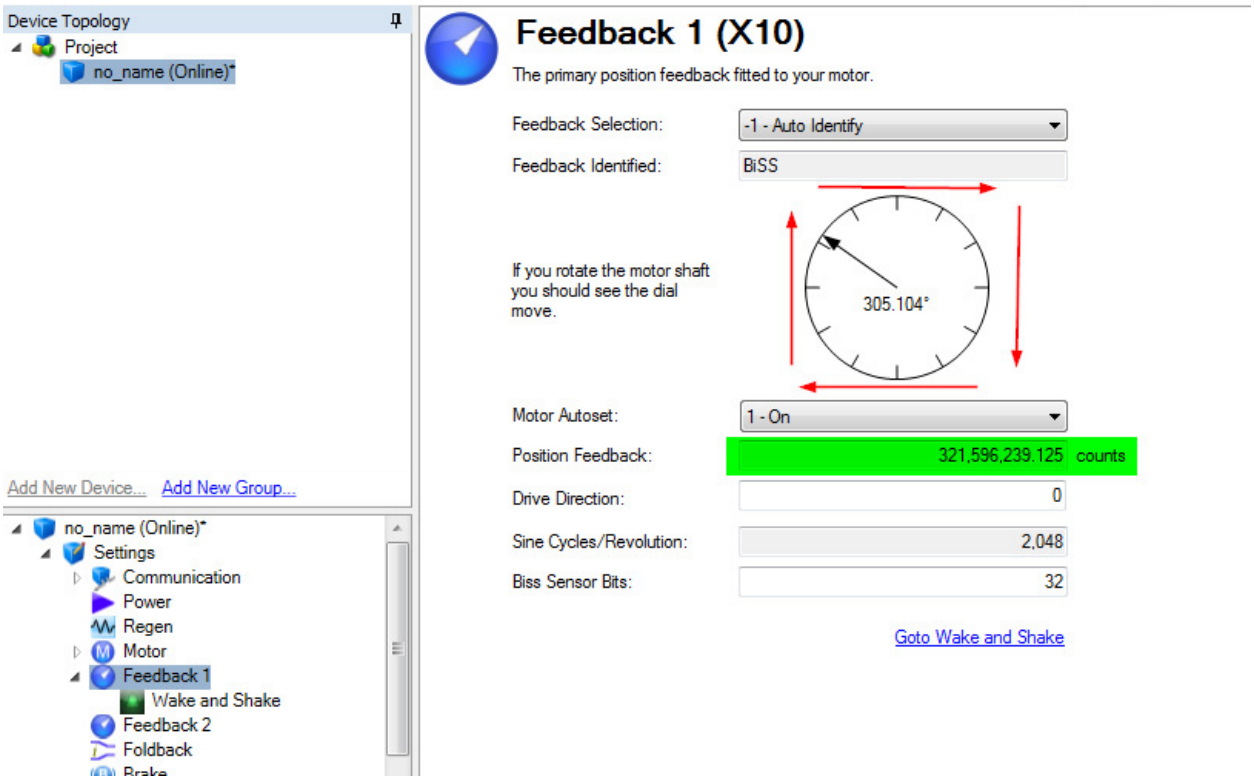
Before proceeding to check feedback wiring and direction online in Workbench it is important to understand the concept and importance of motor power phasing in agreement with feedback direction based on orientation and rotation direction conventions stated above.

Concept:

FB1 is expected to count up in the orientations and directions given above.
This can be checked with the drive disabled and the primary feedback wired to X10.

Make sure Drive Direction "DRV.DIR = 0" is set to zero. This should be added where you referencing how feedback is counting

In this example BISS is used.



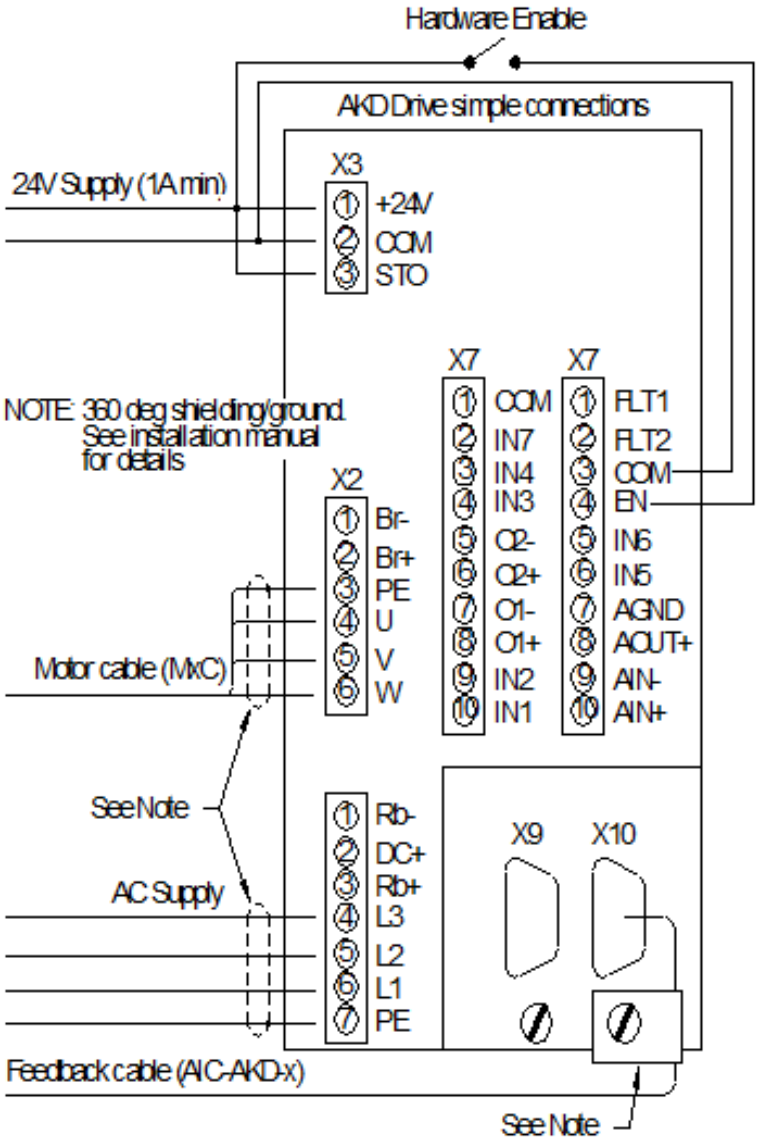
If the feedback counts DOWN when manually rotating the rotor in the orientations given above then the feedback type will determine how to remedy the conflict which may require either the motor and/or the feedback phasing to change. This will be covered in more detail later in this application guide.

Summary:

If feedback counts are negative in the direction of rotation for standard convention

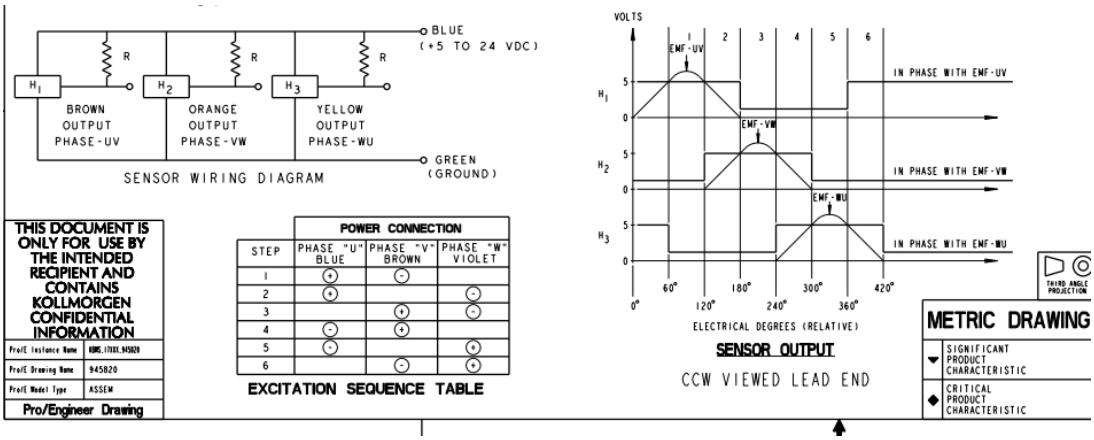
Feedback Type	Feedback Remedy	Motor Remedy	Wake and Shake Required?
Halls Only	This is beyond the scope of this application note; see the support documentation for AKD Halls Only operation.		
Resolver	Swap Sin + and Sin -	Not required	No
Incremental Encoder no halls	Swap A+ and A-	Not required	Yes
Incremental encoder with halls	Swap A+ and A- and Swap Halls U and V	Swap Motor U and W	No
Sine Encoder without Halls	Swap Sin+ and Sin-	Not required	Yes
Sine encoder with Halls	Swap A+ and A- and Swap Halls U and W	Swap Motor U and W	No
EnDat with analog	Feedback Direction cannot be inverted by wiring; motor phasing must change	Swap Motor U and W	No
EnDat digital only	Feedback Direction cannot be inverted by wiring; motor phasing must change	Swap Motor U and W	No
BISS with analog	Feedback Direction cannot be inverted by wiring; motor phasing must change	Swap Motor U and W	No
Renishaw BISS C (digital only)	Feedback Direction cannot be inverted by wiring; motor phasing must change	Swap Motor U and W	No
Hiperface with analog	Feedback Direction cannot be inverted by wiring; motor phasing must change	Swap Motor U and W	No
Hiperface DSL (digital only)	Feedback Direction cannot be inverted by wiring; motor phasing must change	Swap Motor U and W	No

MINIMUM WIRING REQUIREMENT FOR THE AKD DRIVE



Motor and Halls Overview

Example Wiring (see outline drawing for your specific model to verify color codes):



Motor Power Standard Convention

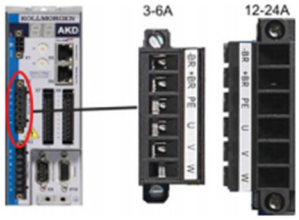
KBM Motor Connection	Typical KBM Motor Color	AKD Terminal X2
U	Blue	U
V	Brown	V
W	Violet	W
GND/PE (GND/PE)	Green/Yellow Stripe	GND/PE
Shield (to GND/PE)	Shield	GND/PE

Motor Power Non-Standard Convention (where motor phasing must change; note this is shown as a change on the drive end):

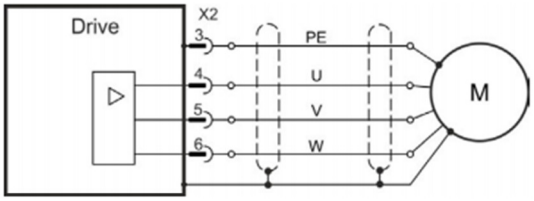
KBM Motor Connection	Typical KBM Motor Color	AKD Terminal X2
U	Blue	W
V	Brown	V
W	Violet	U
GND/PE (GND/PE)	Green/Yellow Stripe	GND/PE
Shield (to GND/PE)	Shield	GND/PE

Important! Often at the time of commissioning the KBM motor is already housed and wiring has been terminated to connectors or extended with a cable. In this case often the motor power lead color codes will change from the motor lead exit via the motor power extension cable or through-port connectorization, etc. It is extremely important to trace and label the wires at the drive end so the cable color code and phasing is known relative to the KBM's stator exit lead color code and phasing conventions.

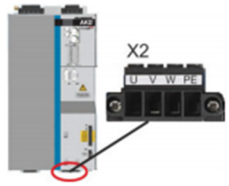
AKD-x003 to 024, power connector X2



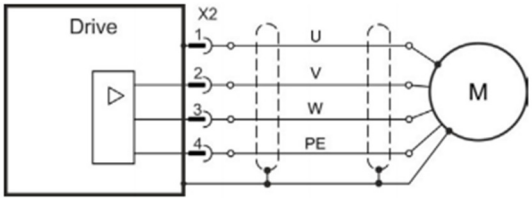
Pin	Signal	Description
1	-BR	Motor holding brake (➜ p. 112)
2	+BR	Motor holding brake (➜ p. 112)
3	PE	Protective earth (motor housing)
4	U	Motor phase U
5	V	Motor phase V
6	W	Motor phase W



AKD-x048, power connector X2

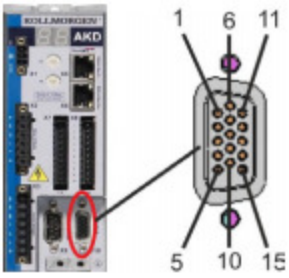


Pin	Signal	Description
1	U	Motor phase U
2	V	Motor phase V
3	W	Motor phase W
4	PE	Protective earth (motor housing)



AKD Feedback X10

Feedback connector (X10)



PIN	SFD	SFD3/ DSL	Resolver	BiSS B (analog)	BiSS C (digital)	EnDAT 2.1	EnDAT 2.2	Hiper-face	Sine Enc. +Hall	Tama-gawa 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	+5 V	+5 V	-	+5 V	+5 V	+5 V	+5 V	+8 to +9 V	+5 V	+5 V	+5 V
11	0 V	0 V	-	0 V	0 V	0 V	0 V	0 V	0 V	0 V	0 V
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

Halls

As previously stated, this application note covers halls when used with either incremental with halls or sine encoder with halls feedback device. Halls only commutation is beyond the scope of this guide and the user should refer to the AKD Halls Only application note on the KDN website.

The 2 feedback types covered in this application note where halls would be used (with the KBMS) is for either 1) Comcoder (incremental encoder with halls) or 2) Sine Encoder with Halls

Standard

KBM Hall Channel	KBM Color	AKD Motor Terminal Connection	AKM X10 Terminal
Hall U (H1)	Brown	Hall U (H1)	Pin 1
Hall V (H2)	Orange	Hall V (H2)	Pin 2
Hall W (H3)	Violet	Hall W (H3)	Pin 3
Common	Green/Common	Common (0 V)	Pin 11
Shield (GND/PE)	Shield	Shell	Shell

Non-Standard

In this case Halls U (H1) and V (H2) are swapped at the drive side X10 connection

KBM Hall Channel	KBM Color	AKD Motor Terminal Connection	AKM X10 Terminal Pin
Hall U (H1)	Brown	Hall V (H2)	Pin 2
Hall V (H2)	Orange	Hall U (H1)	Pin 1
Hall W (H3)	Violet	Hall W (H3)	Pin 3
Common	Green/Common	Common (0 V)	Pin 11
Shield (GND/PE)	Shield	Shell	Shell

MOTOR BACK EMF AND HALL SENSOR SIGNAL ALIGNMENT (STANDARD)

The following assumes the user has an oscilloscope where the inputs and/or probes are isolated from earth ground.

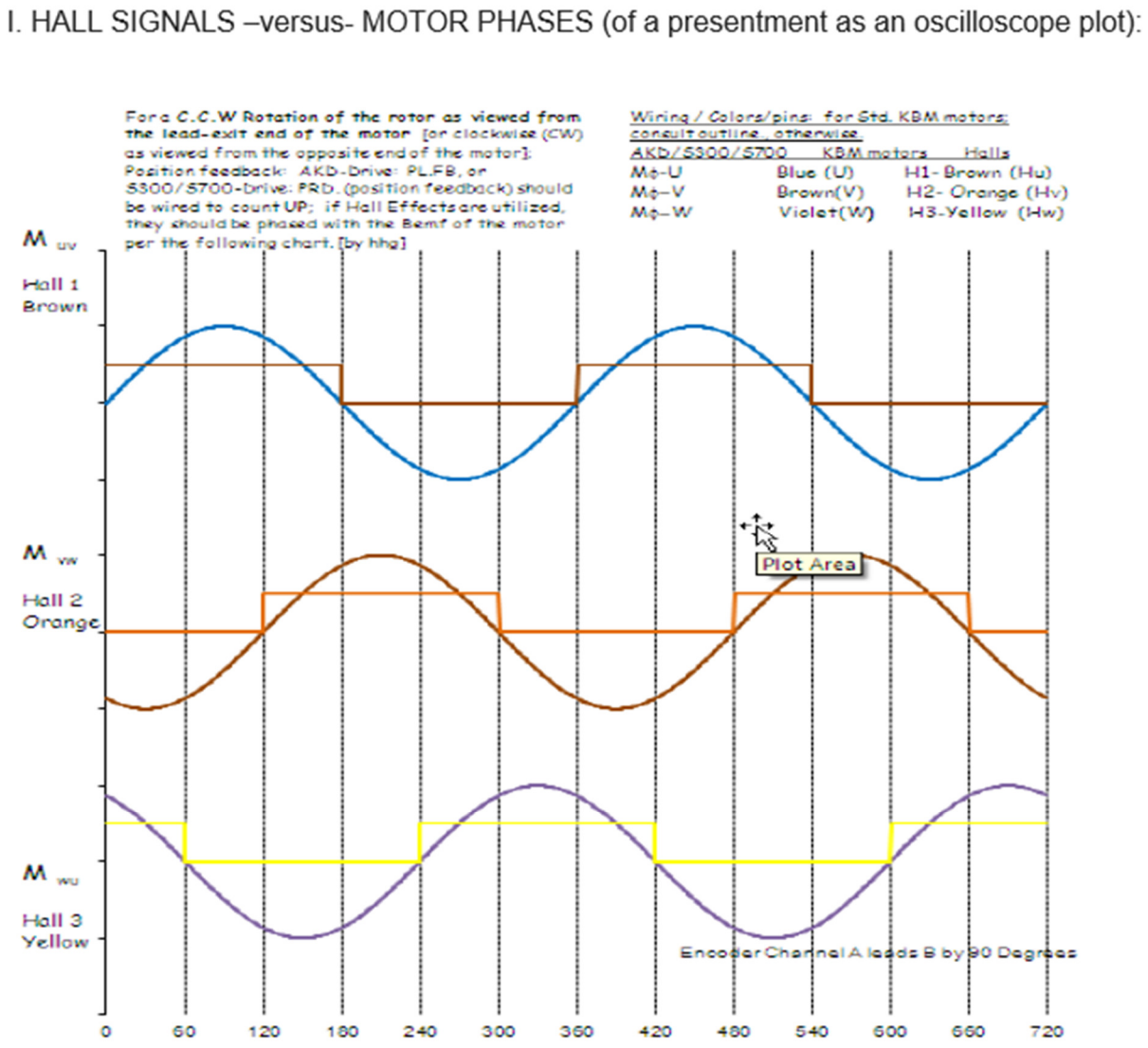
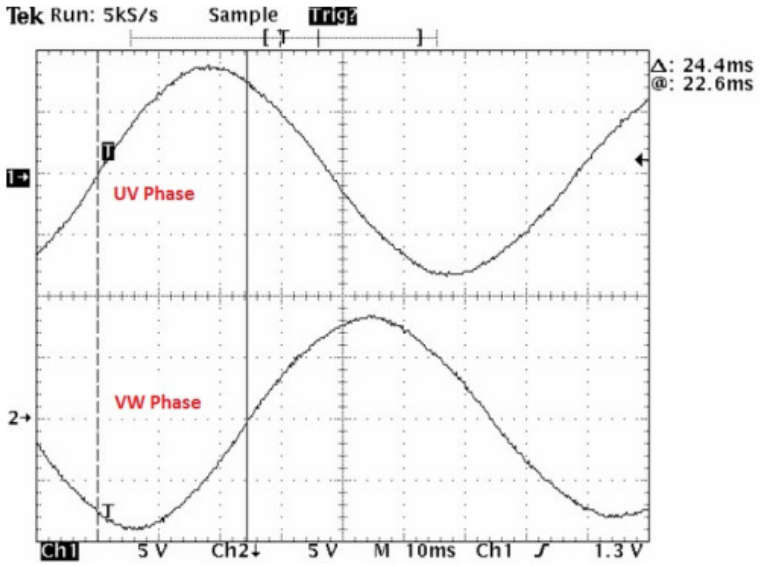


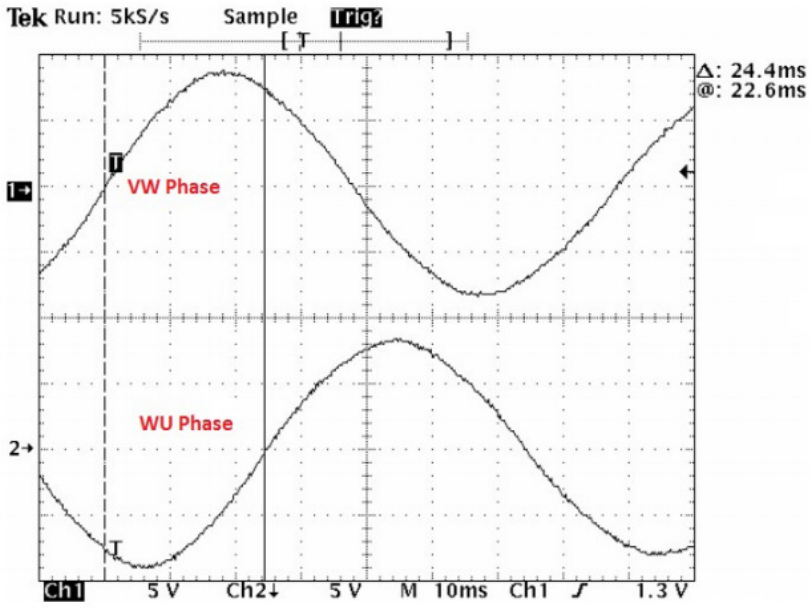
Figure 3

When using a Kollmorgen KBM motor and 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) rotated in a CCW direction when viewing from the lead exit end or CW from the opposite end of the motor then the hall alignment and motor phasing will match exactly as shown in Figure 3.

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) when the motor is manually turned using the directional convention of the KBM motor (CCW with respect to the lead exit of the stator).



The following shows with the same direction as above, 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).



FEEDBACK

Incremental Encoder With Halls

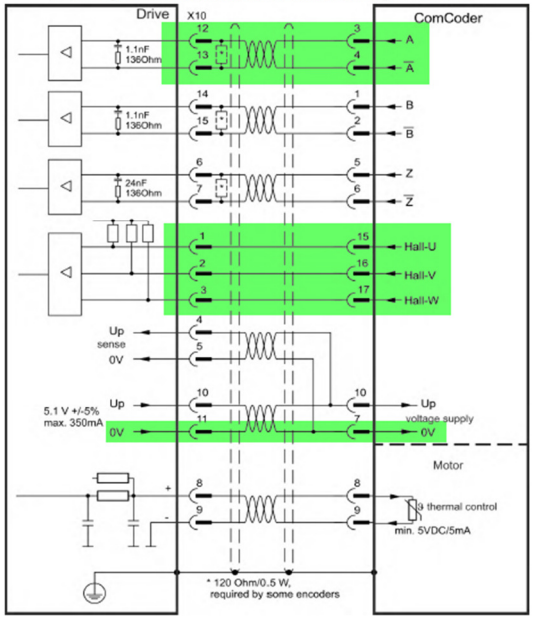
With the normal convention the wiring is shown. If the counts go DOWN with that convention then swap A+ and A- and swap halls U and V. The motor phasing must change where phases U and W must change at the drive end (Non-Standard Convention; see overview section).

9.12.13 Incremental Encoder

Feedback devices, which do not deliver absolute information for commutation, can either work with wake&shake commutation (see *WorkBench Online Help*) or can be used as a complete feedback system when combined with an additional Hall encoder. All signals are connected using a pre-assembled comcoder connection cable. The thermal control in the motor is connected via the encoder cable and evaluated in the drive.
If cable lengths of more than 25 m are planned, please consult customer support.

Type	FBTYPE	Frequency Limit
Incremental Encoder&Hall Switches (Comcoder)	10	2.5 MHz
Incremental Encoder (Wake&Shake)	11	2.5 MHz

The pin assignment shown on the encoder end relates to Kollmorgen AKM motors.



Non-Standard Convention: In this case Halls U (H1) and V (H2) are swapped at the drive side X10 connection

KBM Hall Channel	KBM Color	AKD Motor Terminal Connection	AKM X10 Terminal Pin
Hall U (H1)	Brown	Hall V (H2)	Pin 2
Hall V (H2)	Orange	Hall U (H1)	Pin 1
Hall W (H3)	Violet	Hall W (H3)	Pin 3
Common	Green/Common	Common (0 V)	Pin 11

Incremental Encoder without Halls

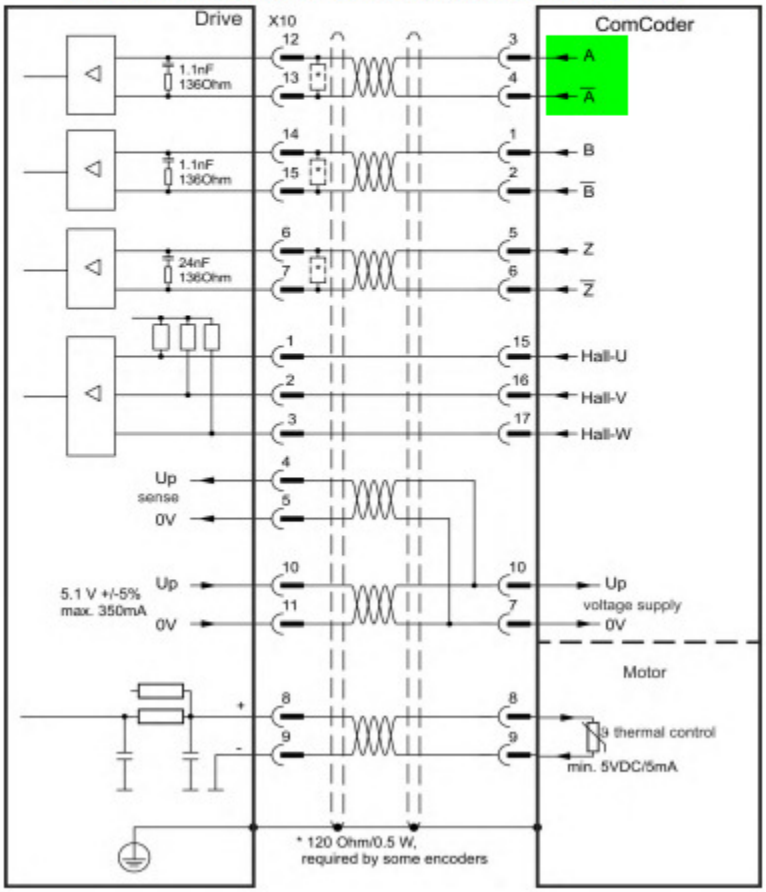
With the normal convention the wiring is shown. If the counts go DOWN with that convention then swap A+ and A-. Motor Phasing does not change from the Standard Convention.

9.12.13 Incremental Encoder

Feedback devices, which do not deliver absolute information for commutation, can either work with wake&shake commutation (see *WorkBench Online Help*) or can be used as a complete feedback system when combined with an additional Hall encoder. All signals are connected using a pre-assembled comcoder connection cable. The thermal control in the motor is connected via the encoder cable and evaluated in the drive.
If cable lengths of more than 25 m are planned, please consult customer support.

Type	FBTYPE	Frequency Limit
Incremental Encoder&Hall Switches (Comcoder)	10	2.5 MHz
Incremental Encoder (Wake&Shake)	11	2.5 MHz

The pin assignment shown on the encoder end relates to Kollmorgen AKM motors.



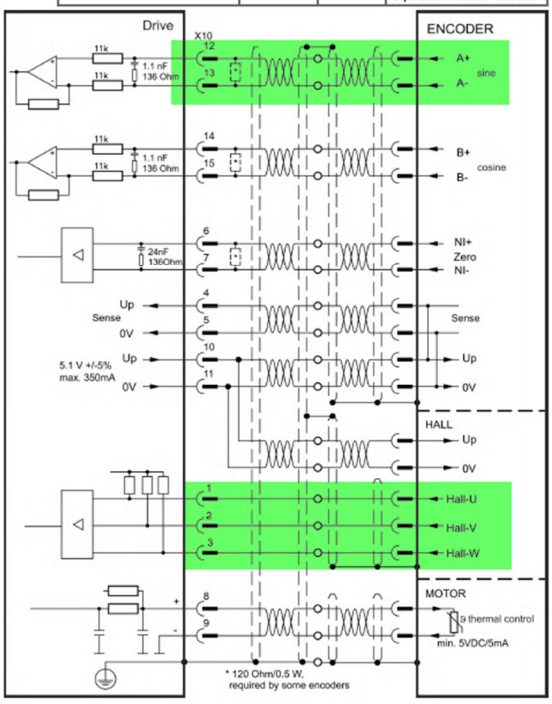
Sine Encoder with Halls

With the normal convention the wiring is shown. If the counts go DOWN with that convention then swap A+ and A- and swap halls U and V. The motor phasing must change where phases U and W must change at the drive end (Non-Standard Convention; see overview section).

9.12.12 Sine Encoder

Feedback devices, which do not deliver absolute information for commutation, can either work with wake&shake commutation (*WorkBench Online Help*) or can be used as a complete feedback system when combined with an additional Hall encoder. All signals are connected to X10 and evaluated there. If cable lengths of more than 25 m are planned, please consult customer support.

Type	FBTYPE	Up	Frequency Limit
SinCos 1 V p-p with Hall	20	5.1 V +/-5%	1 MHz, 250 kHz for encoders that require termination resistors
SinCos 1 V p-p (Wake&Shake)	21	5.1 V +/-5%	



Non-Standard Convention: In this case Halls U (H1) and V (H2) are swapped at the drive side X10 connection

KBM Hall Channel	KBM Color	AKD Motor Terminal Connection	AKM X10 Terminal Pin
Hall U (H1)	Brown	Hall V (H2)	Pin 2
Hall V (H2)	Orange	Hall U (H1)	Pin 1
Hall W (H3)	Violet	Hall W (H3)	Pin 3
Common	Green/Common	Common (0 V)	Pin 11

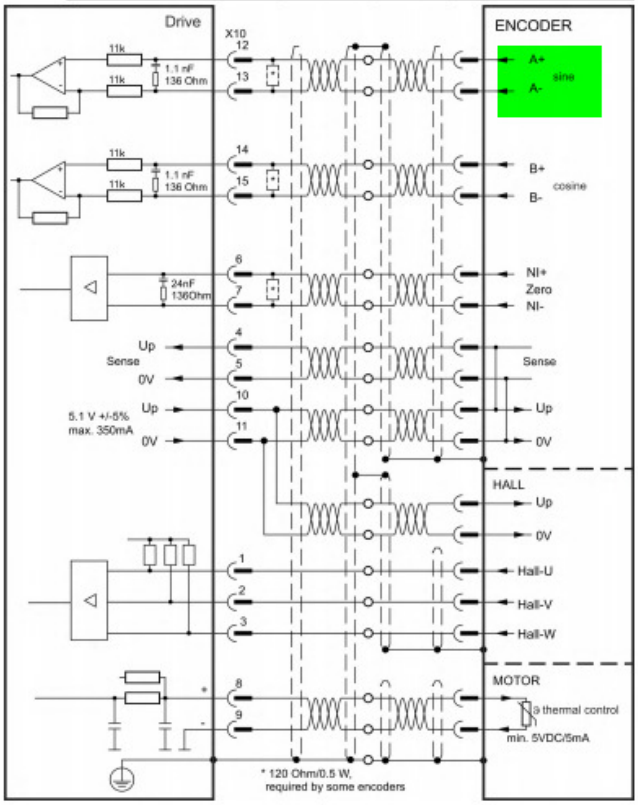
Sine Encoder Without Halls

With the normal convention the wiring is shown. If the counts go DOWN with that convention then swap A+ and A-. Motor Phasing does not change from the Standard Convention.

9.12.12 Sine Encoder

Feedback devices, which do not deliver absolute information for commutation, can either work with wake&shake commutation (*WorkBench Online Help*) or can be used as a complete feedback system when combined with an additional Hall encoder. All signals are connected to X10 and evaluated there. If cable lengths of more than 25 m are planned, please consult customer support.

Type	FBTYPE	Up	Frequency Limit
SinCos 1 V p-p with Hall	20	5.1 V +/-5%	1 MHz,
SinCos 1 V p-p (Wake&Shake)	21	5.1 V +/-5%	250 kHz for encoders that require termination resistors



Resolver

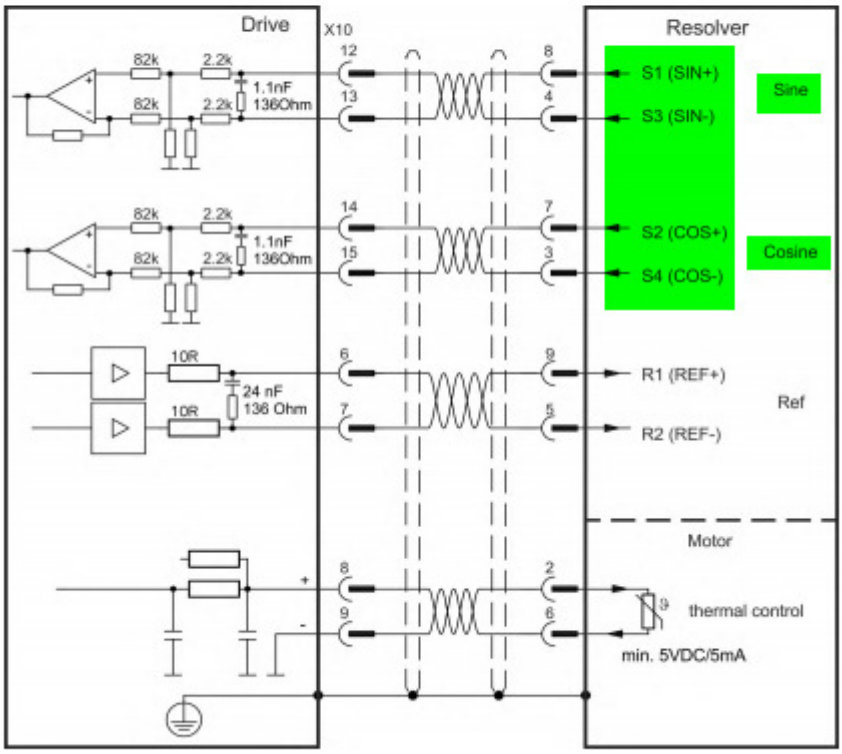
With the normal convention the wiring is shown. If feedback counts DOWN, swap SIN+ with COS+ and SIN- with COS-. Motor Phasing does not change from the Standard Convention.

9.12.4 Resolver

The diagram below shows the connection of a resolver (2 to 36-poles) as a feedback system. The thermal control in the motor is connected via the Resolver cable and evaluated in the drive. If no thermal control is in the motor, the cable must short pins 8 and 9.
If cable lengths of more than 100 m are planned, please contact customer support.

Type	FBTYPE	Description
Resolver	40	Accuracy: 14 bit (0.022°), resolution: 16 bit (0.006°)

The pin assignment shown on the Resolver end relates to Kollmorgen motors.



Feedback Devices with Serial Communications (without or without analog/all digital):

With the given convention, the following feedback types, if your counts go DOWN because of the mechanical orientation of the installed feedback device then the feedback direction for commutation cannot be changed by wiring. The motor phasing is the only wiring that can change to correct for this.

Feedback Devices this applies to:

EnDat 2.1 with analog

EnDat 2.2 all digital

BISS with analog

BISS (Renishaw BISS C all digital)

Hiperface with analog

Hiperface DSL (all digital)

See the AKD Installation manual for wiring connections. The KDN has application notes regarding Renishaw BISS C wiring conventions and setup of the feedback device in Workbench.

Thermal Device

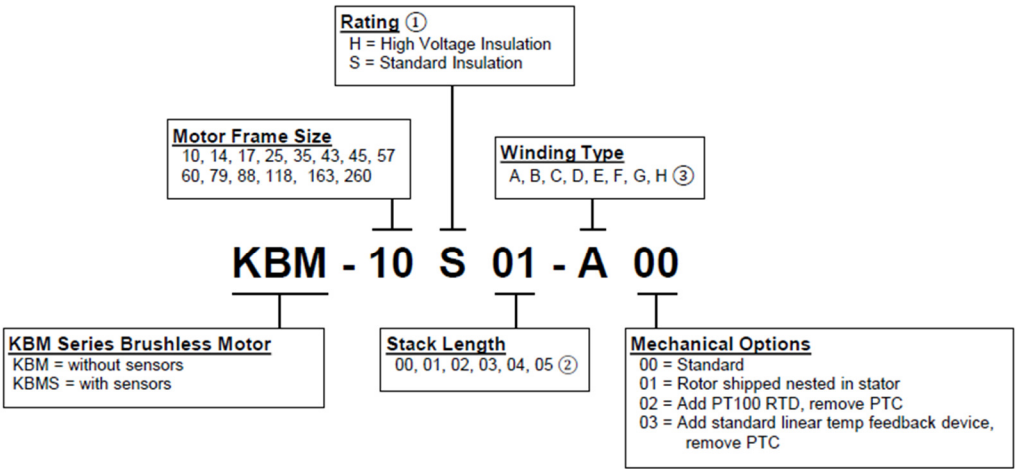
Per the following nomenclature, the 2 standard offerings for thermals on the KBM(S) motors are the PTC type thermistor and the KTY84-130.

Mechanical Options

00=PTC Single Thermistor

01=PTC Single Thermistor

03= KTY84/130



① S rating not available on frame sizes 10, 14, 17, 25, 35, and 45.

Before proceeding keep in mind the KBM frameless motor is available in high customized models and part numbers. The following is general information and to ensure the proper setup of the motor thermal settings and protection in the AKD drive it is important to acquire the datasheet for your exact model number which will include data such as thermal switching resistance, etc.

The KBM motor frame size 10,14,17,25,35, and 45 all use a single PTC thermistor for -X00 or X01 models. X03 models use a KTY84/130.

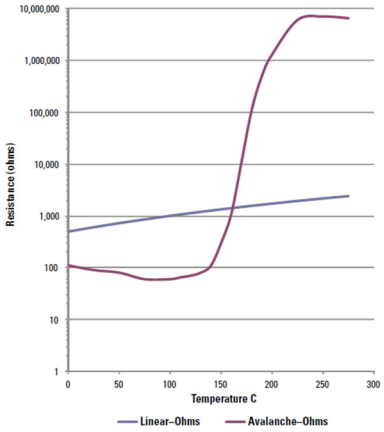
The KBM 43 has a Triplex configuration (three PTC's in series and all located in different sections of the stator)

The same trip point should be at or near the same resistance on this Triplex configuration as was on the single PTC device. The triplex configuration has the same resistance point on the upper end of the curve. The motor winding "critical temperature" is 155 deg C. The single PTC and the Triplex PTC show a resistance of 1330 ohms @ approx 155 degs C. Workbench defaults to 1300 ohms when a KBM motor is selected on the Motor screen which can be left as such.

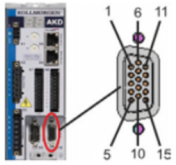
Here is a sample thermistor curve:

Thermistors

To provide for continuous safe operation of KBM(S) series motors in demanding applications, integral thermistors are mounted in the stator. These passive devices provide an output characteristic [Avalanche type] as shown in the side table for use in typical control safety circuits as the temperature goes beyond the rating of the motor windings [155C]. The KBM[S]-10XXX through KBM[S]-35XXX and KBM[S]-45XXX motors all have a single avalanche type thermistor while the balance of the KBM[S] family motors have two or three wired in series or independently depending on the model number. Linear thermistors are optionally available for use in winding temperature data acquisition and exhibit a basically linear resistance characteristic over the operating range of the motor.



Feedback connector (X10)



PIN	SFD	SFD3/ DSL	Resolver	BiSS B (analog)	BiSS C (digital)	EnDAT 2.1	EnDAT 2.2	Hiper-face	Sine Enc. +Hall	Tama-gawa 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	+5 V	+5 V	-	+5 V	+5 V	+5 V	+5 V	+8 to +9 V	+5 V	+5 V	+5 V
11	0 V	0 V	-	0 V	0 V	0 V	0 V	0 V	0 V	0 V	0 V
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

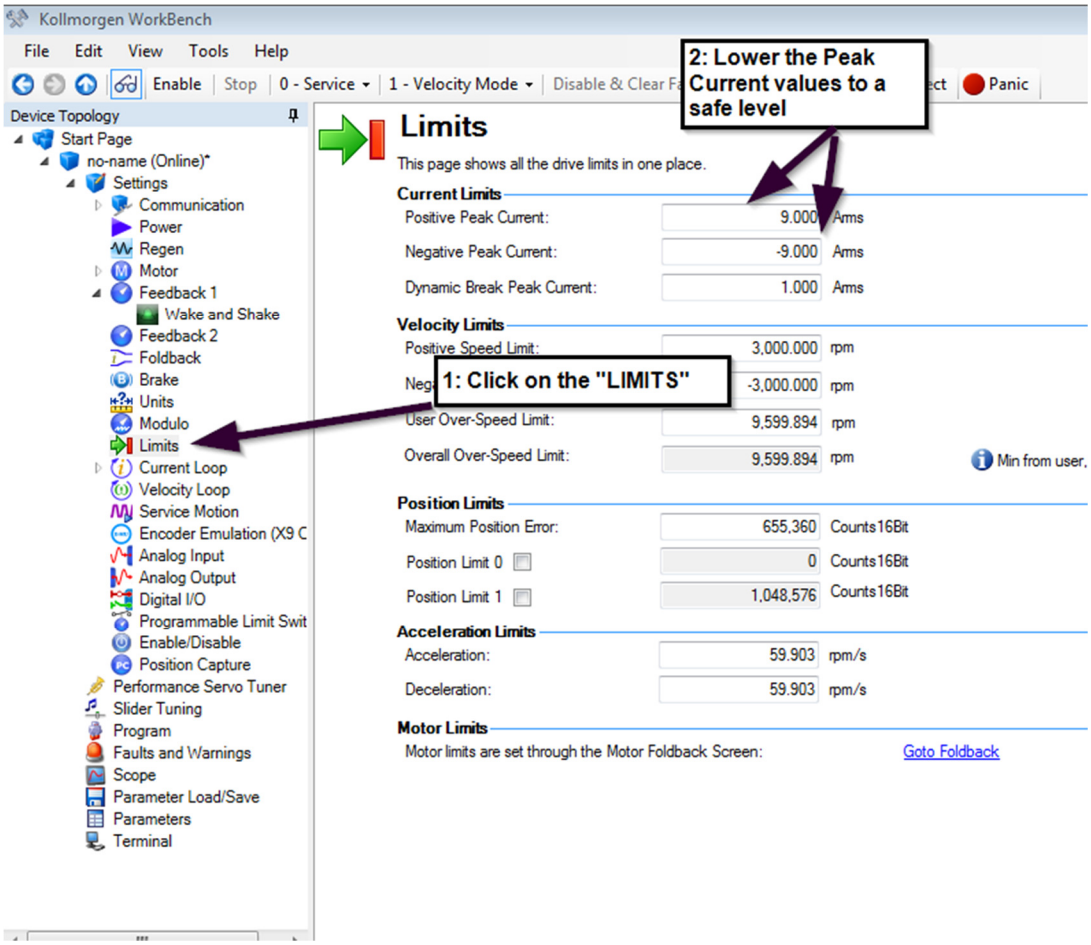
KBM Thermistor	KBM Color	AKD X10 Connection	AKM X10 Terminal Pin
+	Black	Thermal Control +	Pin 8
-	Blue	Thermal Control -	Pin 9
Shield (GND/PE)	Shield	Shield	Shell

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.")

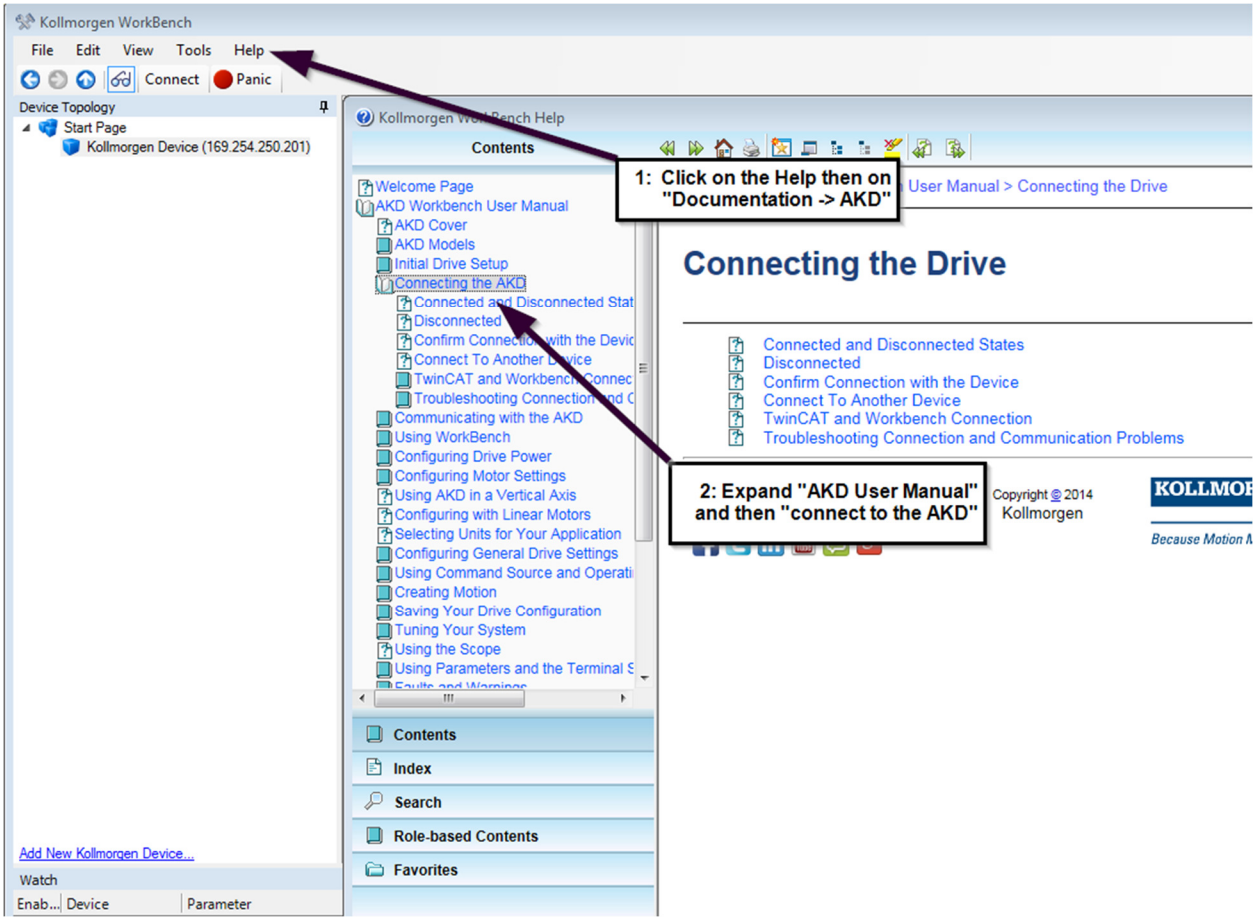
1. SAFETY FIRST

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.

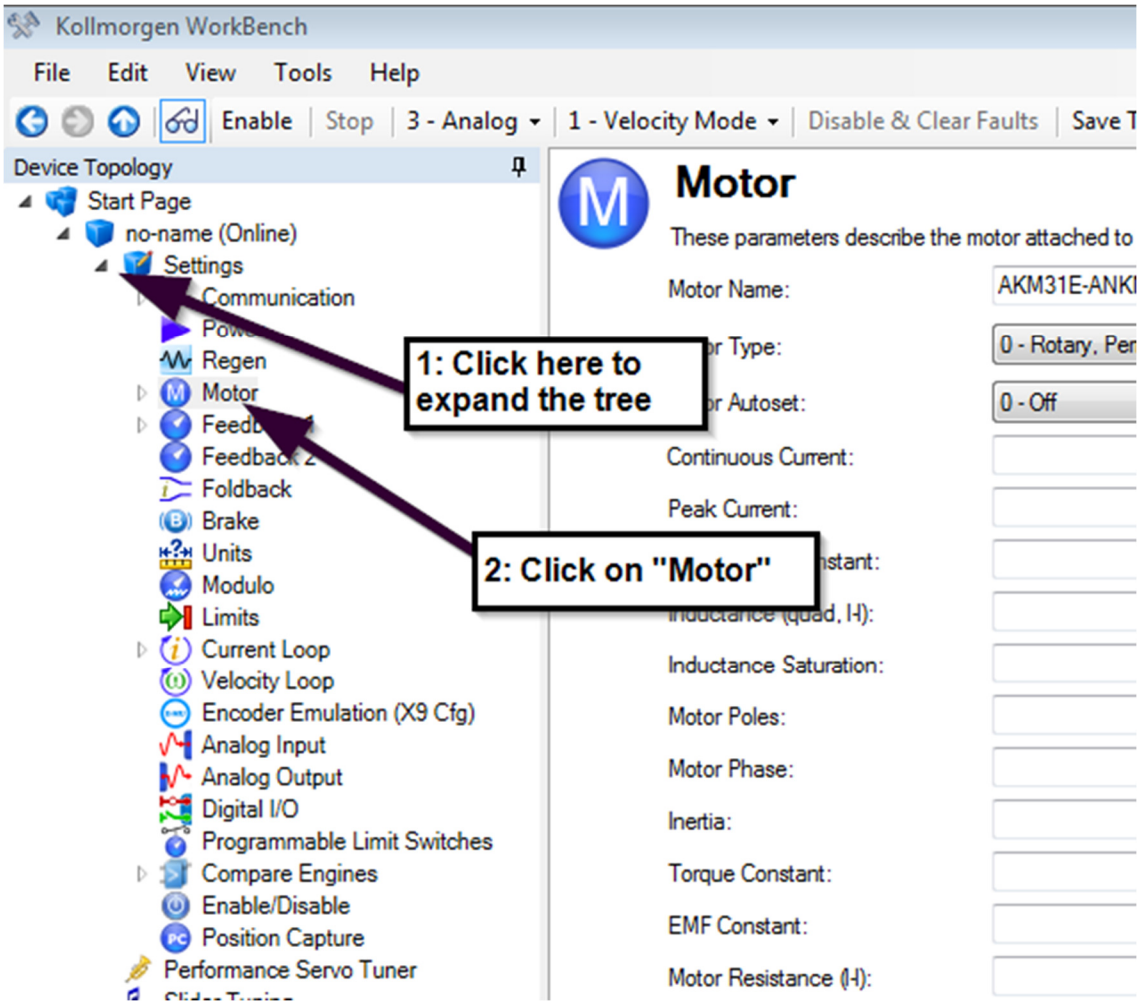


2. Connect to the AKD Drive

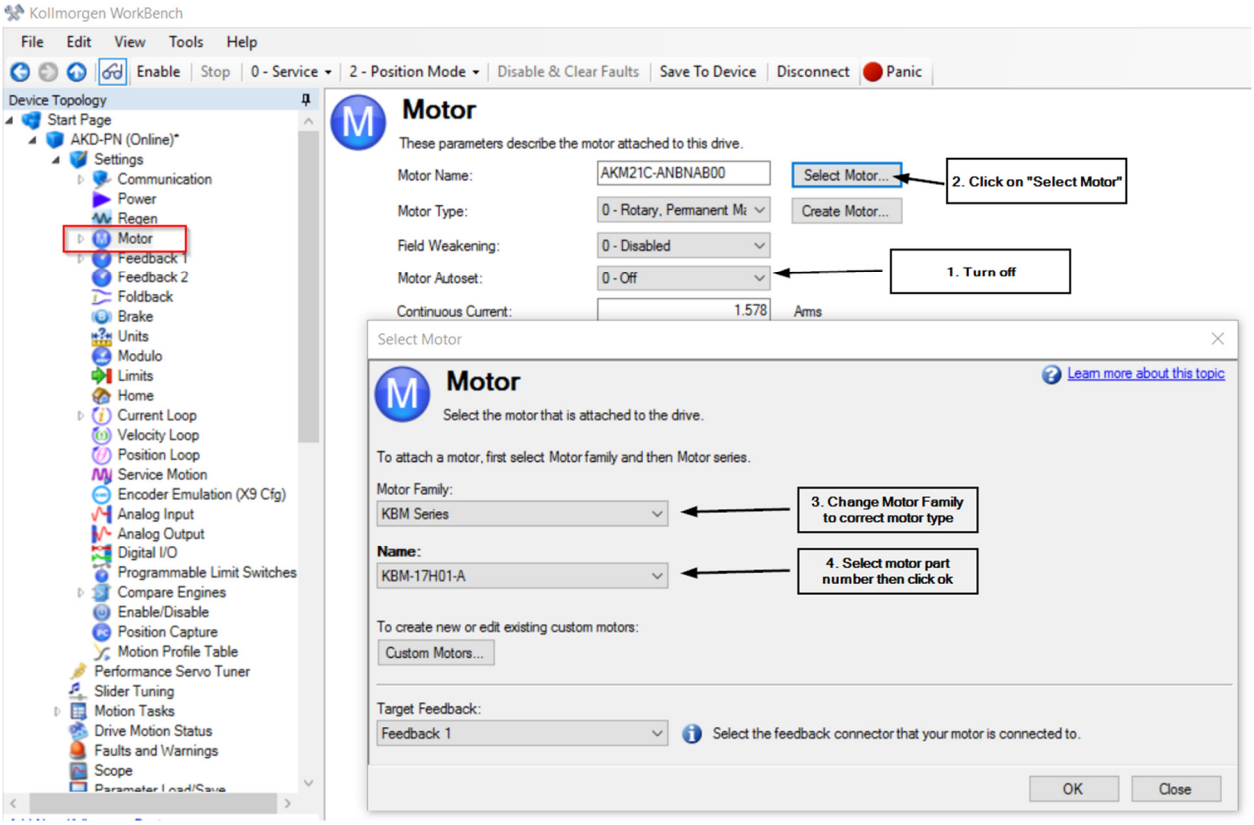
Follow the instruction from the WorkBench help file.



3. *Expand "Settings" and Select the Motor Setup Screen*



4. Select Motor from Pull Down List



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

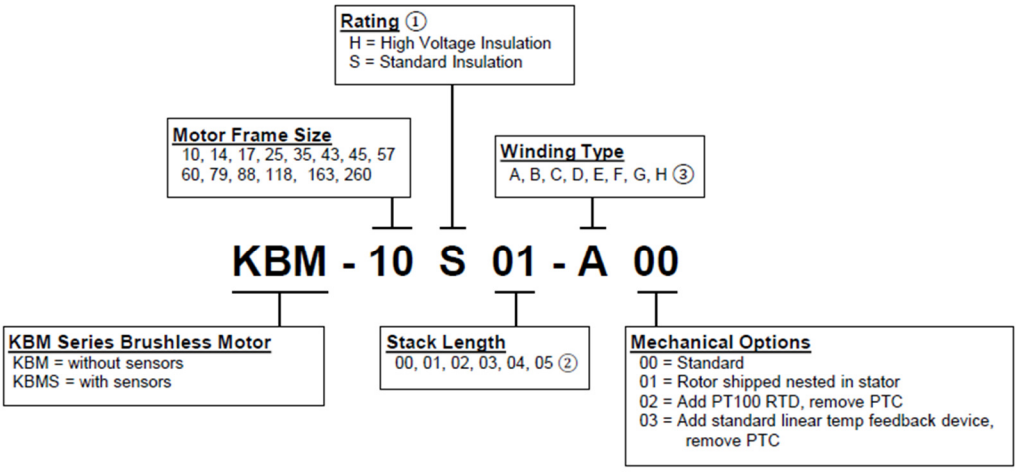
Per the following nomenclature, standard KBM(S) motors have PTC avalanche type thermistors embedded in the stator for motor thermal protection. Other sensors are available:

Mechanical Options

00=PTC Single Thermistor

01=PTC Single Thermistor

03= KTY84/130



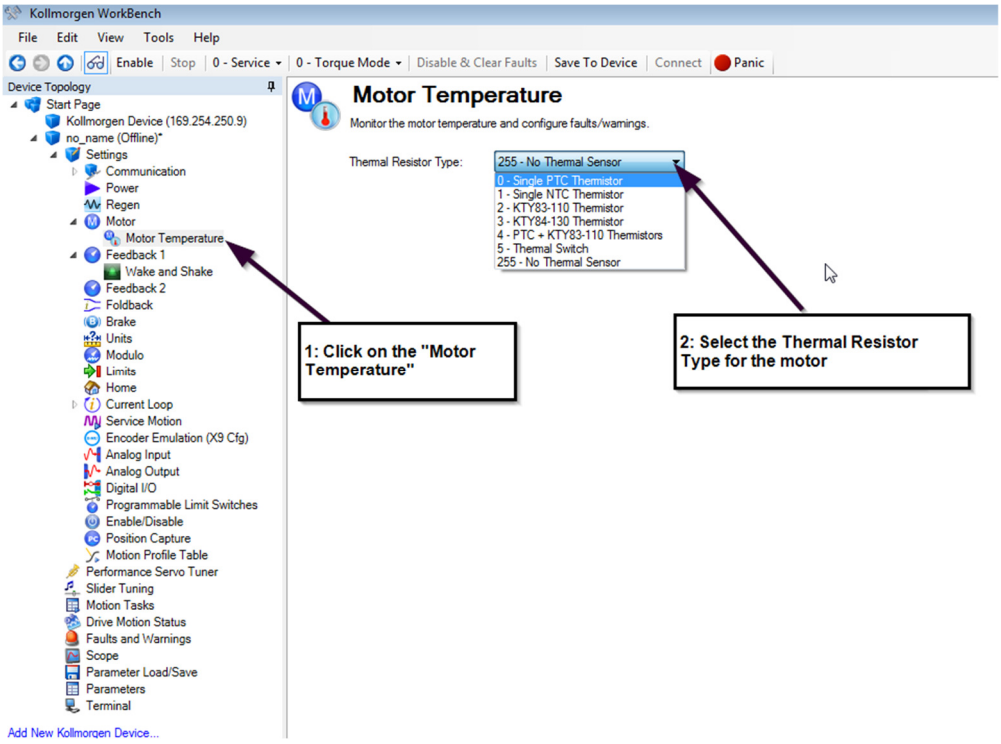
① S rating not available on frame sizes 10, 14, 17, 25, 35, and 45.

The 2 standard offerings we have are the PTC type thermistor and the KTY84-130. Trip point in the drive, from my understanding, would be set to 1330 Ohms, which equates to about 150 – 155°C winding temp.

The KBM has a 155°C motor winding temperature rating with integral thermistor

Before proceeding keep in mind the KBM frameless motor is available in high customized models and part numbers. The following is general information and to ensure the proper setup of the motor thermal settings and protection in the AKD drive it is important to acquire the data such as thermal switching resistance, etc. for your exact model number from Kollmorgen.

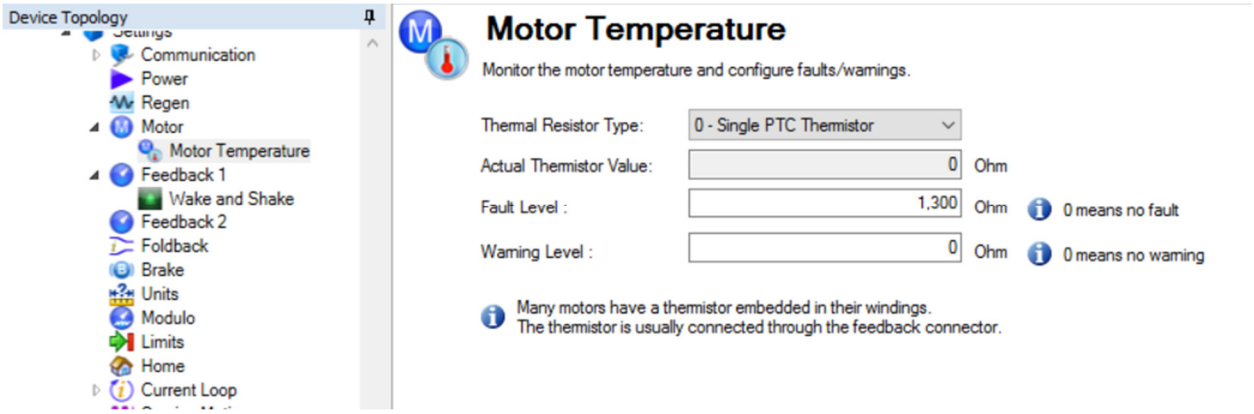
The KBM motor frame size 10,14,17,25,35, and 45 all use a single PTC thermistor for -X00 or X01 models. X03 models use a KTY



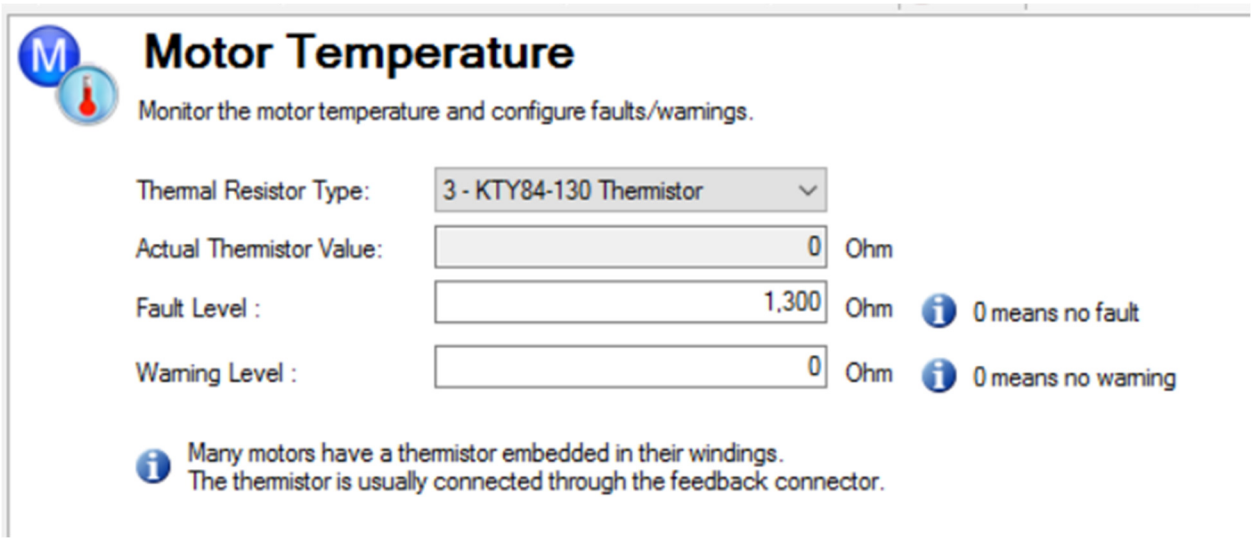
Note to double-click on “Motor” to expand the project tree if “Motor Temperature” is not visible.

1. <u>Thermistor Option type “00 or 01” Single PTC thermistor sensor</u>

   Kollmorgen DDL linear motors use a PTC thermistor sensor if the Thermostat Option selected is TR “Thermistor” (MOTOR.RTYPE = 0, “Single PTC Thermistor”). When the KBM motor is selected in Workbench on the Motor screen,



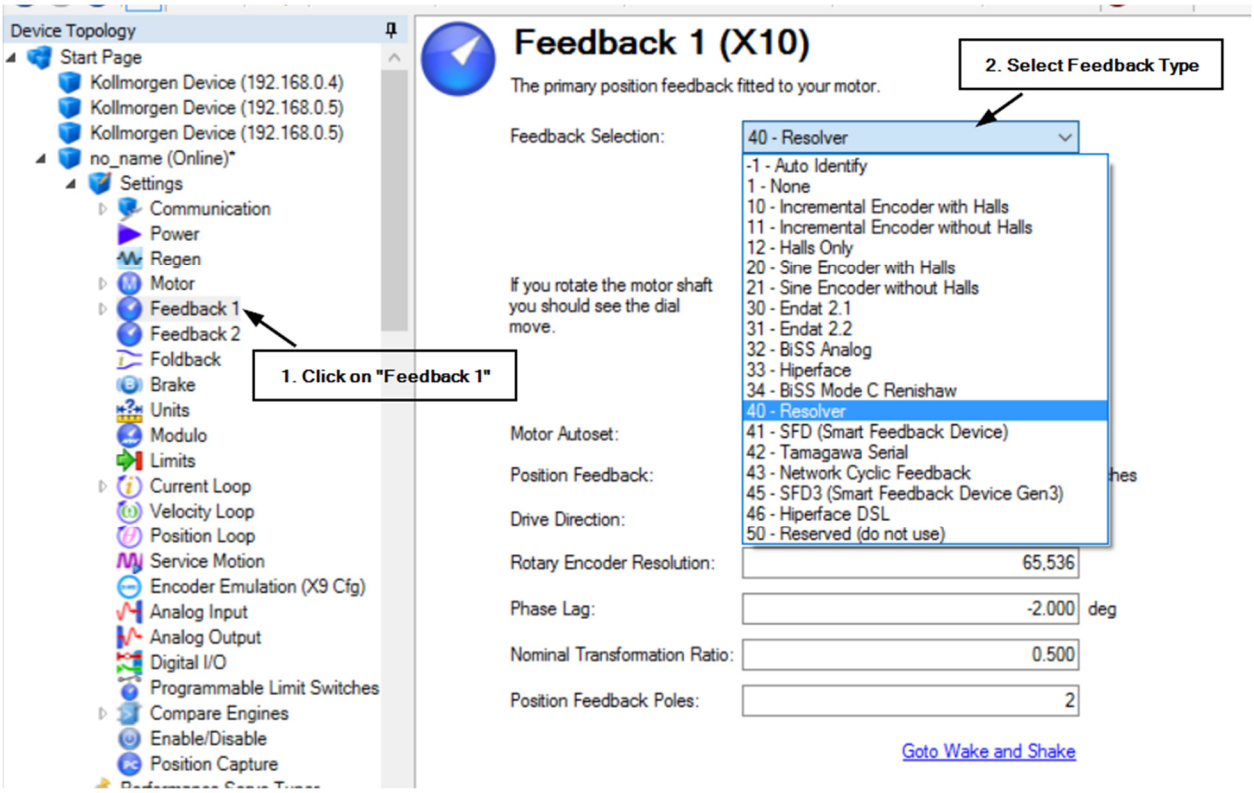
2. Thermostat Option type “03”: KTY84-130



For all other types refer to the thermistor datasheet for your specific model.

6. SELECT FEEDBACK TYPE

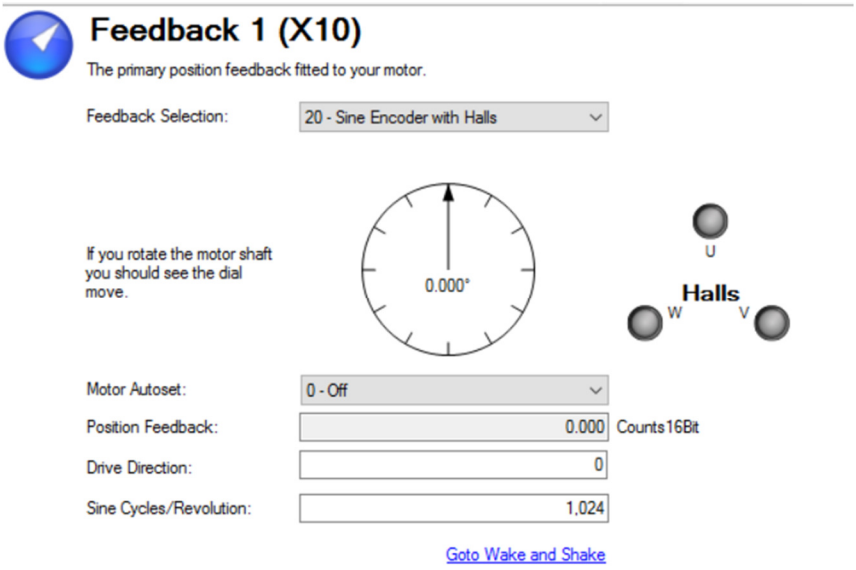
Notes on the resolution setting are explained below.



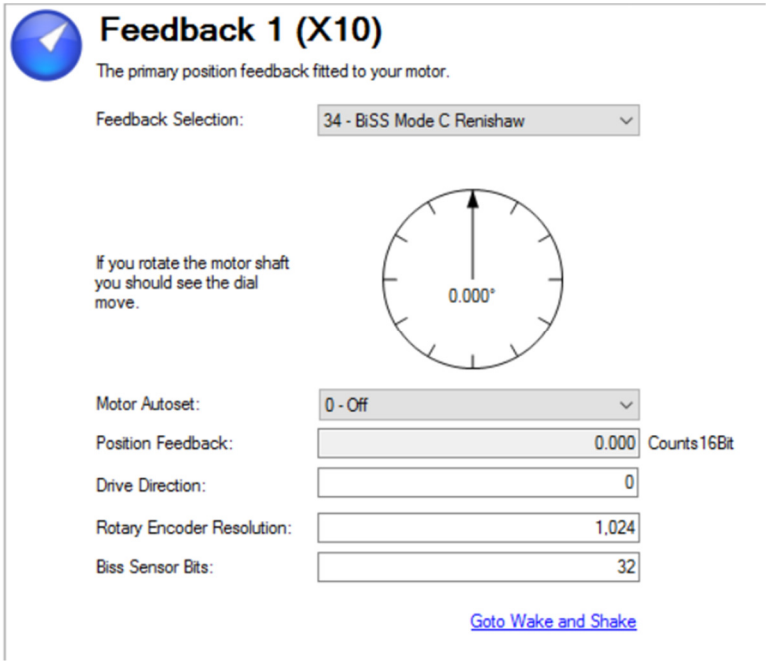
7. CONFIGURING ENCODER FEEDBACK RESOLUTION

Depending on your feedback selection the Feedback 1 screen will change graphically and also change in regards to feedback 1 related parameters.

For example a Sine Encoder with Halls show the Halls graphically and the configuration requires the sine cycles/revolution be entered that match the specifications of your feedback device.



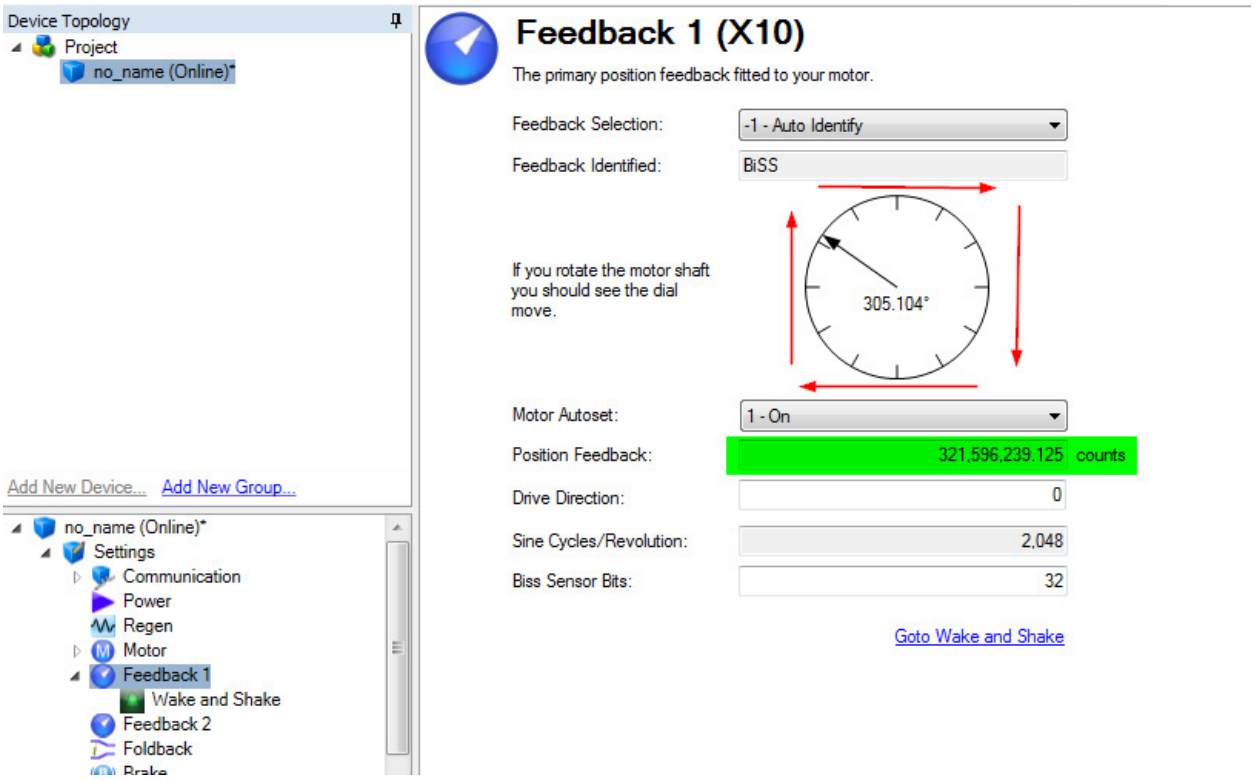
Compare with a Biss Mode C Renishaw where no halls are shown and there are 2 parameters that must be entered: 1) Rotary Encoder Resolution and Biss Sensor Bits. Please use the KDN articles for wiring conventions and also how to configure the BISS C Renishaw encoder for a rotary application.



8. TEST ENCODER DIRECTION AND RESOLUTION

Note: It is very important the Drive Direction parameter on the Feedback 1 screen is set to 0 until correct commutation is established. Once the motor is running with correct commutation, if the direction of rotation is reverse of what is required in the application then the Drive Direction can be changed at that point to a 1.

The Feedback test available is the movement of the indicator on the motor feedback screen.



The Summary is presented again here for convenience. Please refer back to the wiring section of this application guide for details and diagrams.

Summary:

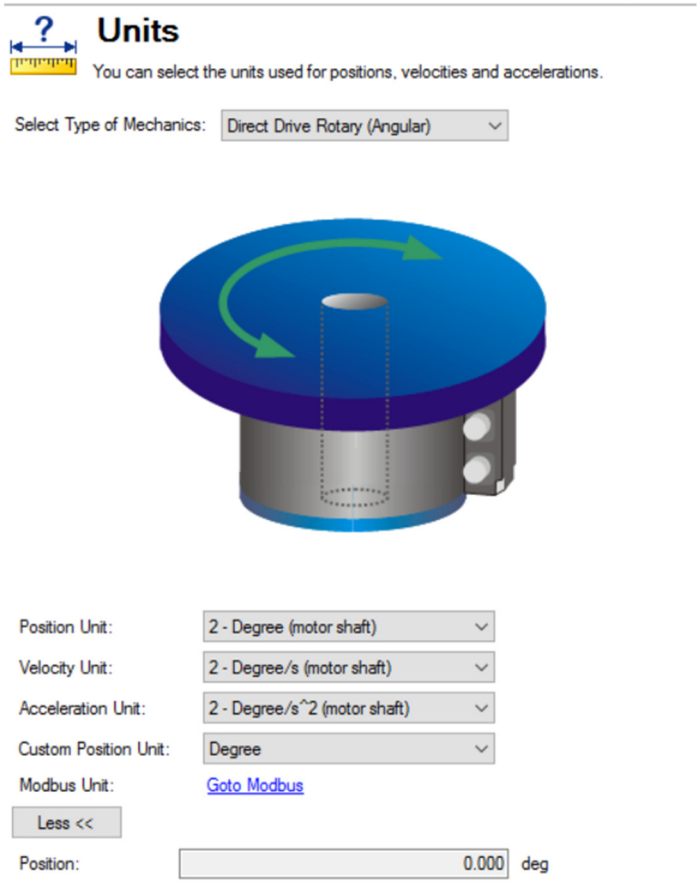
If feedback counts are opposite of convention

Feedback Type	Feedback Remedy	Motor Remedy	Wake and Shake Required?
Halls Only	This is beyond the scope of this application note; see the support documentation for AKD Halls Only operation.		
Resolver	Swap Sin + and Sin -	Not required	No
Incremental Encoder no halls	Swap A+ and A-	Not required	Yes
Incremental encoder with halls	Swap A+ and A- and Swap Halls U and V	Swap Motor U and W	No
Sine Encoder without Halls	Swap Sin+ and Sin-	Not required	Yes
Sine encoder with Halls	Swap A+ and A- and Swap Halls U and W	Swap Motor U and W	No
EnDat with analog	Feedback Direction cannot be inverted by wiring; motor phasing must change	Swap Motor U and W	No
EnDat digital only	Feedback Direction cannot be inverted by wiring; motor phasing must change	Swap Motor U and W	No
BISS with analog	Feedback Direction cannot be inverted by wiring; motor phasing must change	Swap Motor U and W	No
Renishaw BISS C (digital only)	Feedback Direction cannot be inverted by wiring; motor phasing must change	Swap Motor U and W	No
Hiperface with analog	Feedback Direction cannot be inverted by wiring; motor phasing must change	Swap Motor U and W	No
Hiperface DSL (digital only)	Feedback Direction cannot be inverted by wiring; motor phasing must change	Swap Motor U and W	No

Checking Motor Feedback Resolution

Workbench Units setup will depend on your application and if fieldbus communications (i.e. Ethernet IP, Profinet, Canopen, Ethercat, etc.) is used the scaling and setup may be different than what is shown.

In this example it is assumed the KBM(S) motor is direct drive and the desired units are degree, degree/s, and degree/s^2.



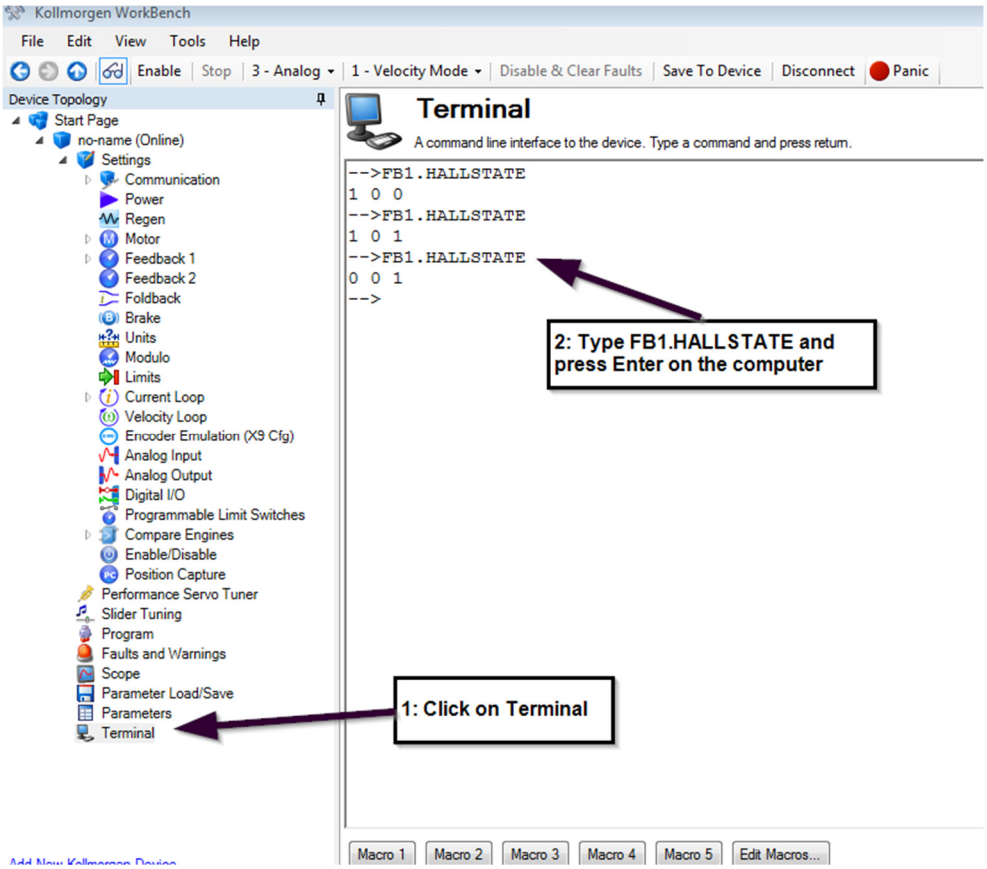
If possible, move the rotor manually with the drive disabled and monitor the change in Position on the readout of the Units screen above.

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.

9. IF THE MOTOR HAS HALLS THEN CHECK THE HALLSTATE SEQUENCE WHEN MOVING MOTOR USING THE CONVENTIONS IN THIS APP. NOTE.

Standard Convention (assuming the halls and motor phasing do not need to change from standard)

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.



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

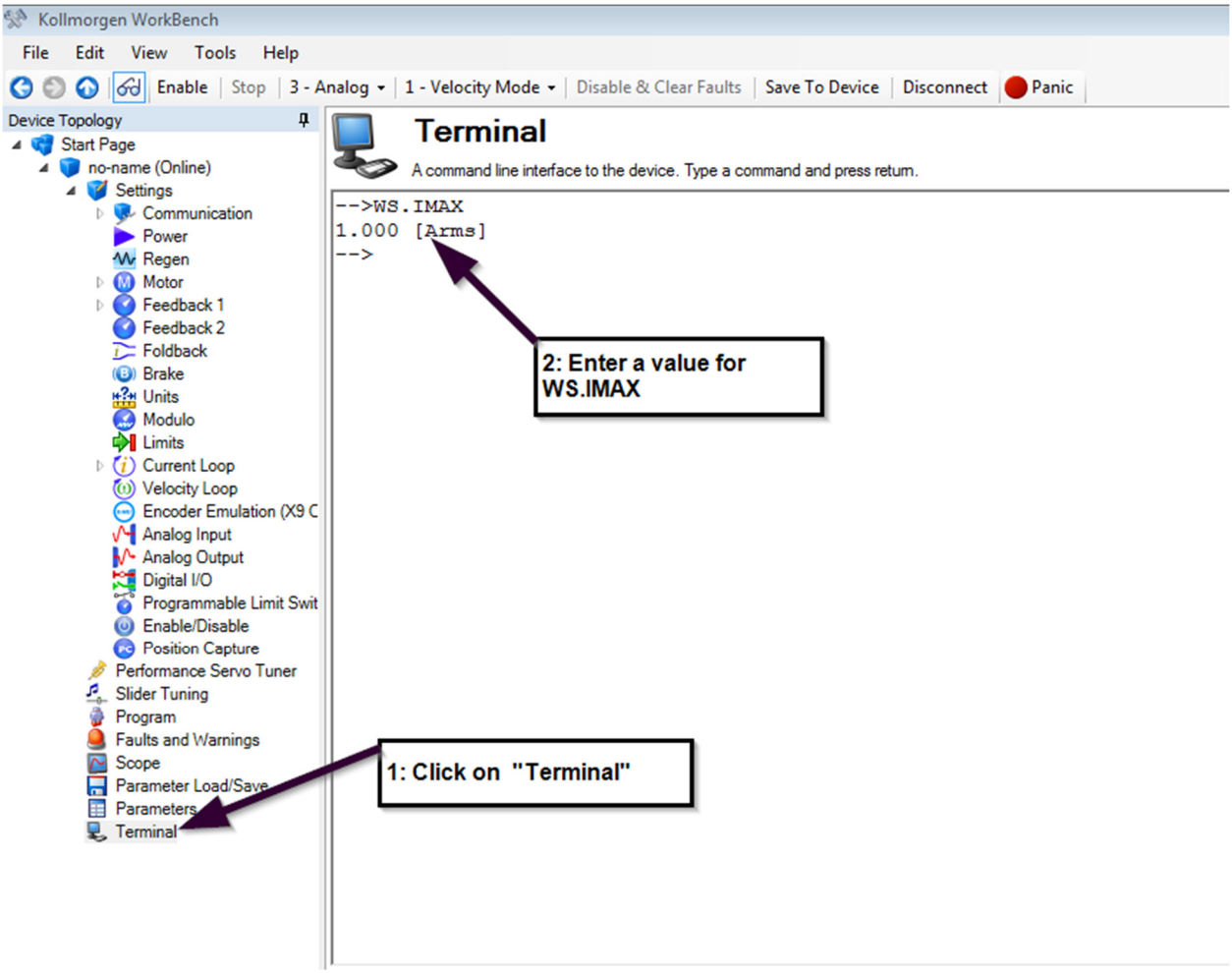
Step(CW)	FB1.HALLSTATEW	FB1.HALLSTATEV	FB1.HALLSTATEU
1	0	0	1
2	0	1	1
3	0	1	0
4	1	1	0
5	1	0	0
6	1	0	1
7	0	0	1

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.

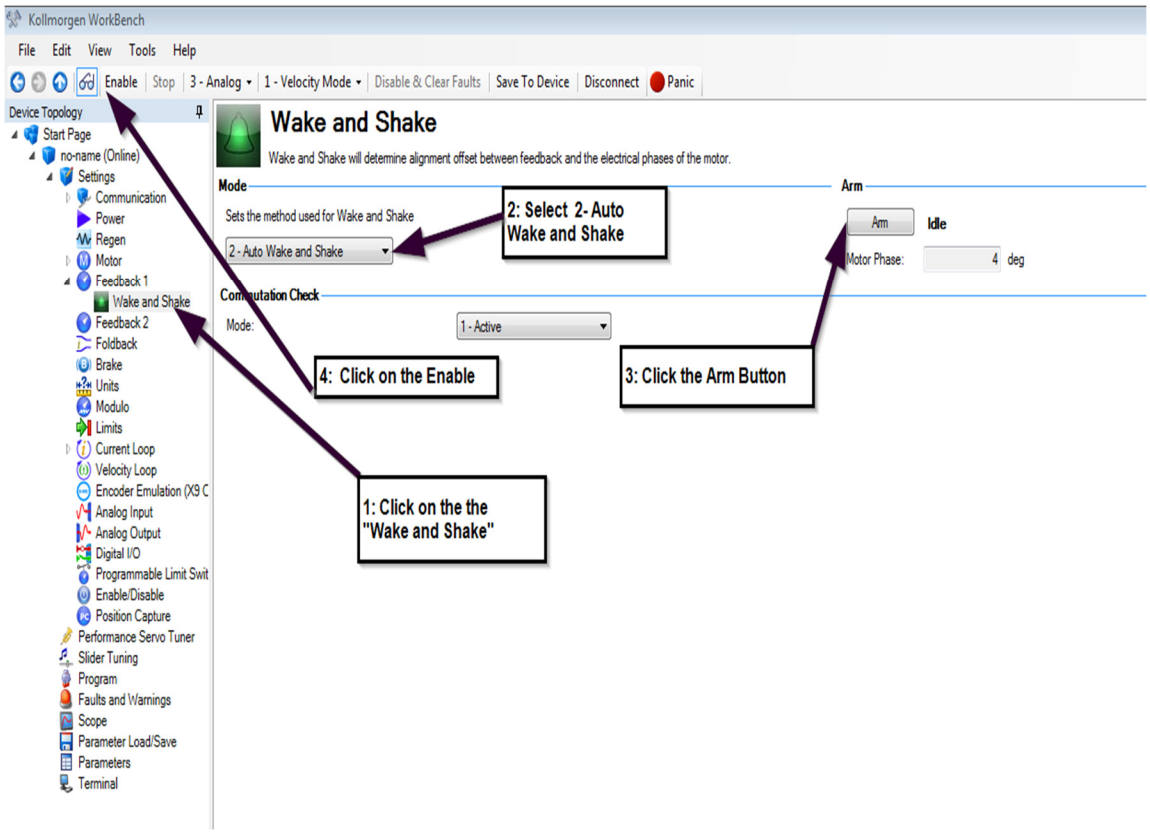
Step(CW)	FB1.HALLSTATEW	FB1.HALLSTATEV	FB1.HALLSTATEU
1	0	0	1
2	1	0	1
3	1	0	0
4	1	1	0
5	0	1	0
6	0	1	1
7	0	0	1

10. How To Verify The Motor's Commutation Alignment Angle MOTOR.PHASE for feedback that requires W&S on power up.

Set the Wake & Shake Current WS.IMAX equal to continuous of your KBM(S) motor in the Terminal Screen.

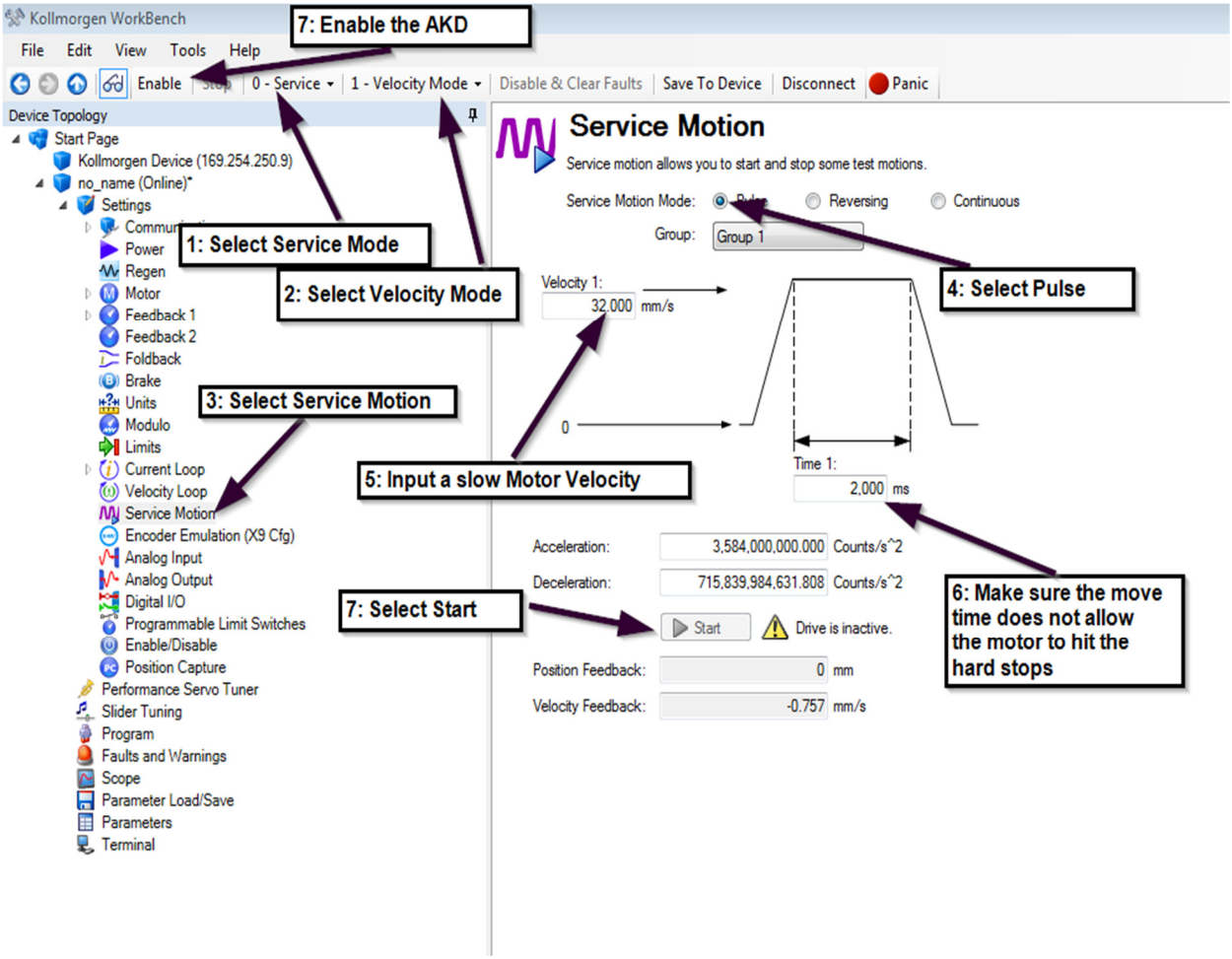


Start the Wake and Shake Routine



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.

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



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

The AKD to KBM(S) motor initial commissioning is now complete!

11. How To Verify The Motor's Commutation Alignment Angle MOTOR.PHASE for feedback that do not require W&S on power up.

For motors with feedback devices that do not require Wake and Shake on powerup, a commutation alignment test must be performed so the correct MOTOR.PHASE is set in the AKD drive.

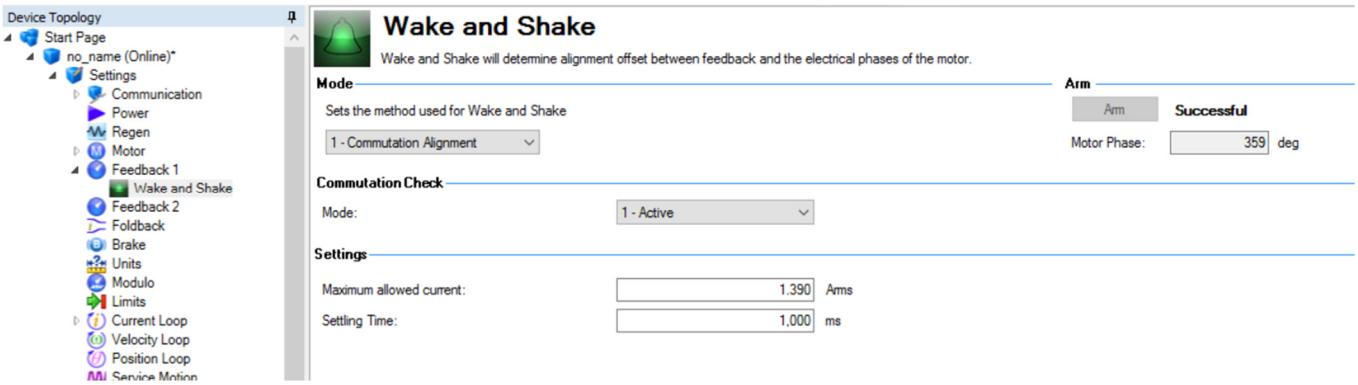
Make sure the AKD drive's peak current is limited before doing this exercise. A motor runaway can result in damage to the system equipment or possible bodily injury.

The AKD to KBM(S) motor initial commissioning is now complete!

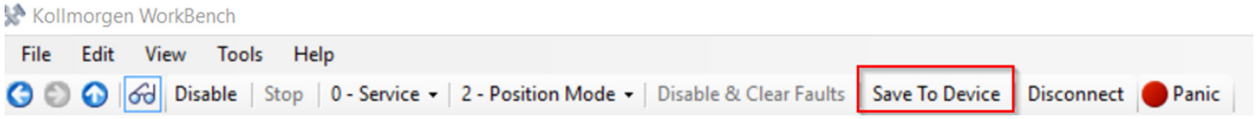
Commutation alignment check
From the Feedback 1->Wake and Shake screen:

- Set Mode to 1-Commutation Alignment Check.
- Set Commutation Check Mode to 1-Active
- Set the Maximum allowed current to the continuous rating of the motor. Keep in mind additional loading can affect the accuracy of the test. The motor should be free to turn and not connected to anything while you are attempting to setup and verify proper commutation.
- Before enabling the drive make sure you take precautions in the event the motor runs away. When ready click the "Arm" button and then enable the drive. The motor will move and the Motor Phase as a read-only will appear under the Arm button as shown in the screenshot below. The status will show "Running" and if successful when done will indicate "Successful and the Motor Phase angle will be reported in degrees.

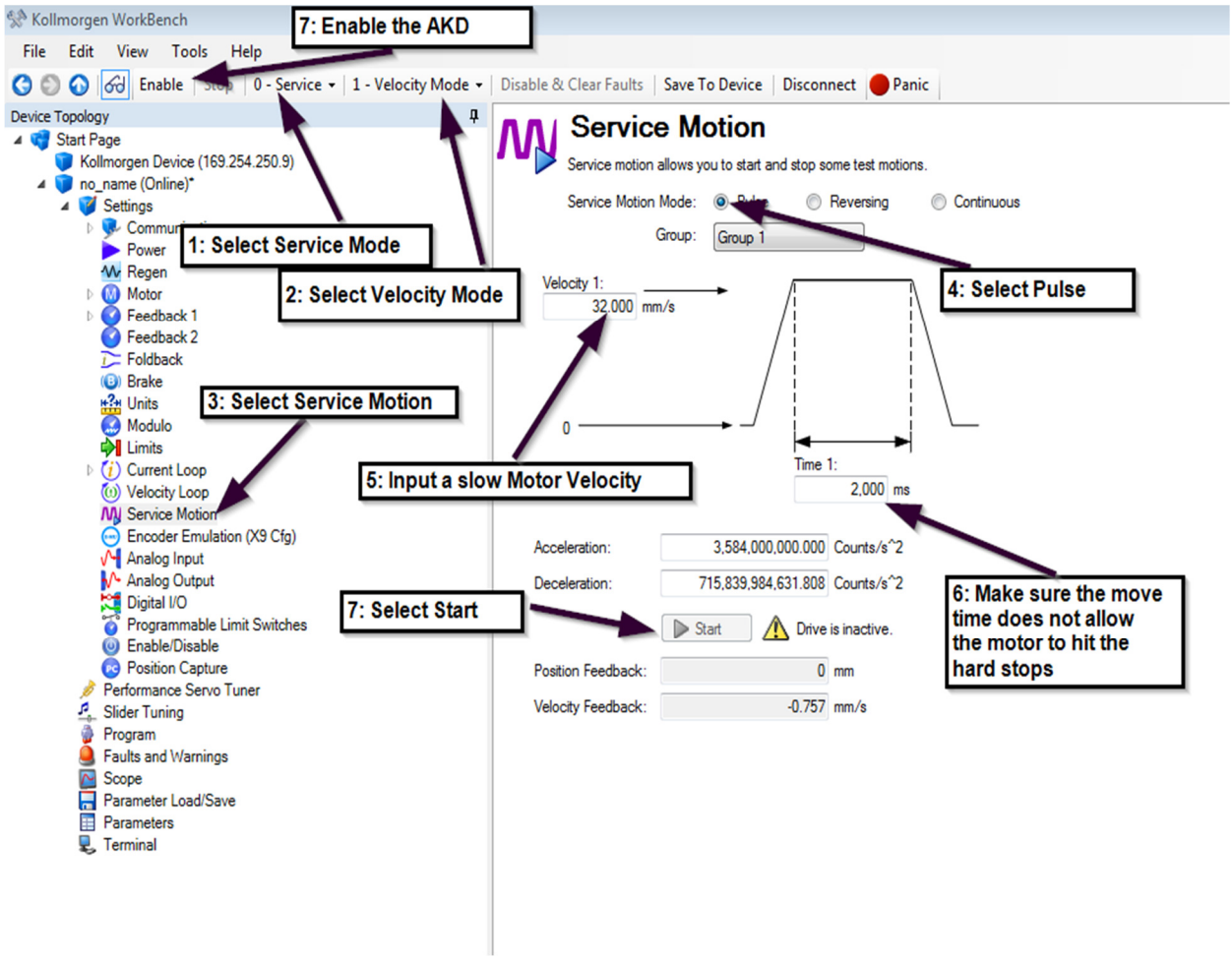
  It is generally a good idea to run the commutation alignment check several times to see the value is approximately the same angle.



At the top of the Workbench screen, click on “Save to Device”.



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



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

The AKD to KBM(S) motor initial commissioning is now complete!