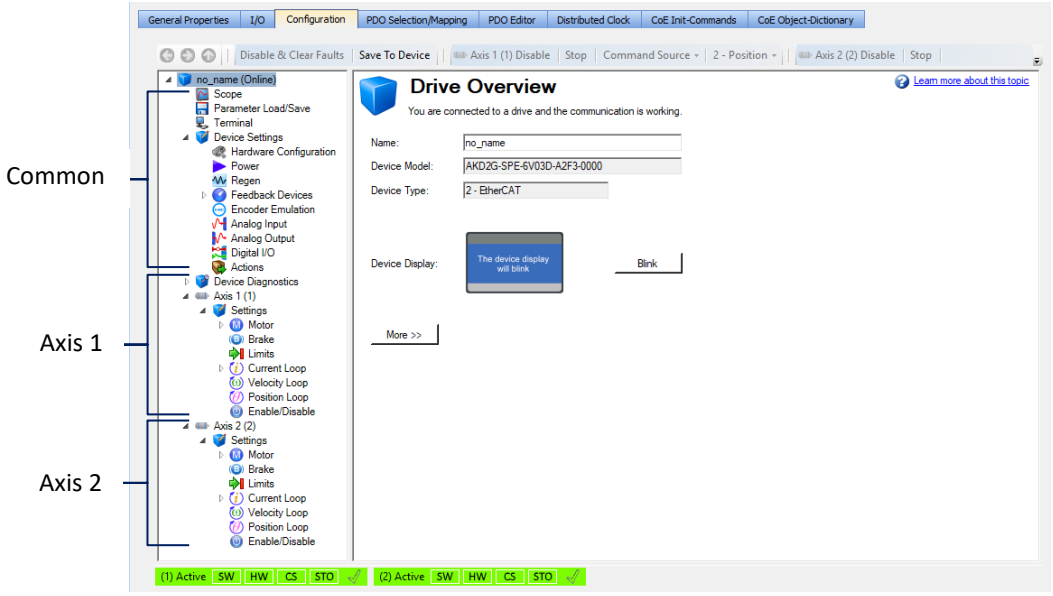
Using AKD2G in a KAS System

The AKD2G can be used in a KAS Motion/Machine control system. This application note outlines new/different features to be cognizant of when developing a KAS application that includes AKD2G drives. After reviewing this document, contact a KAS application engineer if you want more detail.

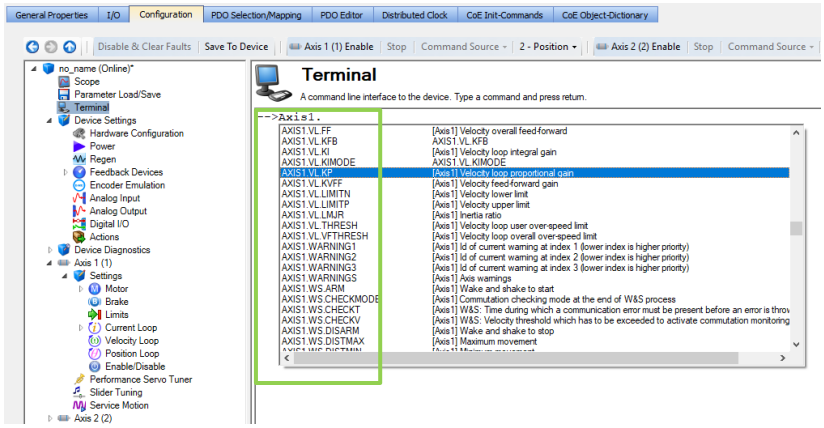
Workbench Architecture

In addition to the single axis version, the AKD2G is available in a 2 axis version. For the 2 axis version, Workbench integrated into the KAS IDE (Integrated Development Environment), has items that are common to both axes then followed by a section of Axis 1 specific items , then Axis 2 specific items:



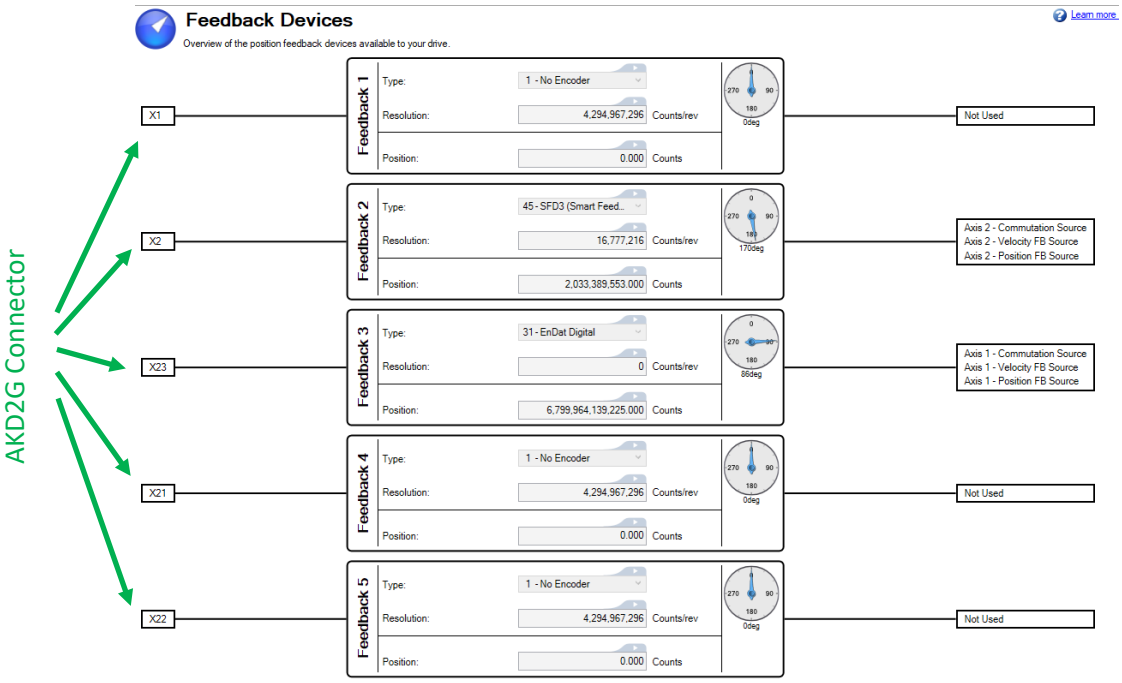
In the Workbench terminal window, which provides direct access to AKD2G parameter values in a concise format, note that many AKD2G parameter start out with an additional identifier to define the specific axis “Axis1” or “Axis2” before the *<parmeter group name>. <specific parameter>* it is assocated with.

Example The velocity loop proportional gain in the AKD is parameter VP.KP, in the AKD2G it is AXIS1. VP.KP or AXIS2.VP.KP



More Position Signals Available to the PxMM

AKD2G has up to 5 five independent feedbacks that can be assigned to the axis. Here is the WorkBench Screen:



The usage of the five channels may be freely configured in the Workbench software, subject only to a few restrictions that are not physically sensible.

- Exactly one feedback channel per axis can commutate the motor.
- At most, one feedback channel per axis can serve as the command source and the same feedback channel cannot also commutate the motor.
- A feedback channel can serve as the command source for more than one axis.
- FB1 cannot commutate axis 2. FB2 cannot commutate axis 1.

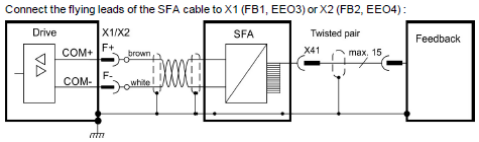
Feedback channel	Connector	Usable for
Feedback 1	X1	Axis 1: commutation feedback
	X41	Axis 1 via SFA on X1: commutation feedback
Feedback 2	X2	Axis 2: commutation feedback
Feedback 2	X41	Axis 2 via SFA on X2: commutation feedback
Feedback 3	X23	commutation feedback, velocity/position, command
Feedback 4	X21	commutation feedback, velocity/position, command
Feedback 5	X22	commutation feedback, velocity/position, command

Feedback Types	Connectors
SFD3	X1, X2
Encoder HIPERFACE DSL	X1, X2
Resolver	X23, X41
SFD	X23, X41
SinCos Encoder BiSS B (analog)	X23, X41
Encoder BiSS C (digital)	X23
SinCos Encoder EnDat 2.1	X23, X41
Encoder EnDat Digital 2.2	X23, X41
Encoder HIPERFACE	X23, X41
Sine Encoder	X23, X41
Sine Encoder + Hall	X23, X41
Incremental Encoder	X22, X23, X41
Incremental Encoder + Hall (Comcoder)	X23, X41
Hall Sensors	X23, X41
Tamagawa Smart Abs	X23, X41
Step/Direction	X21, X22, X23, X41
CW/CCW	X21, X22, X23, X41

Connector X1/ Connector X2

Feedback X1 and X2 only support 2 wire digital feedbacks types: SFD3 and HIPERFACE DSL. By default, each axis is assigned to feedback X1 or X2, for axis 1 and 2 respectively. To accommodate legacy feedbacks there is cable adapter SFA (P/N AKD2G-CON-SFA-000) that will plug into connector X1 or X2's 2 wire port. On the SFA's other side there is a 15 pole HD SubD female connector X41 that then will plug into Kollmorgen legacy feedback types (cables).

The 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 supported feedback types:

SFD	Resol-ver	BiSS B	EnDat 2.1	EnDat 2.2	HIPER-FACE	Sine/ Cos	Sine/ Cos +Hall	Incr. Enc.	Incr. Enc. +Hall	Hall	Smart Abs	Step/ Dir	CW/ CCW

Connector X23

Additionally, X23 connector is available for legacy feedbacks on feedback 3. The X23 connector provides the same d-sub 21 pin connector as AKD1 with support for the same feedbacks.

Connector X1/ Connector X2

There is also a limited support for feedbacks on the X21 and X22 connectors for feedbacks 4 and 5 that provide inputs for step and direction, A quad B incremental, and clockwise/counter-clockwise type feedback control.

Note that available connectors will depend on the drive model ordered.

Number Of Axes	Base Model	Additional Feedbacks w/Drive Options
Single Axis	(Conn X1) - SFA Adapter SFD3, DSL (Conn X21) - Step/Direction	Option F3 (Conn23) - Res, Enc, or Comcoder Option IO (Conn X22) – Step/Dir, CW/CCW or Inc Enc Option DX (Conn X22,X23)
Dual Axis	(Conn X1) - SFA Adapter SFD3, DSL (Conn X2) - SFA Adapter SFD3, DSL (Conn X21)- Step/Direction (Conn X22) - Step/Dir, CW/CCW or Inc Enc	Option F3 (Conn23) - Res, Enc, or Comcoder

Note: AKD2G options allow for 2 or 3 additional feedback devices for master encoder signals and other application needs to be incorporated into the AKD2G/ KAS system

AKD2G Position information through Ethercat

Scaling

Feedback 1 and 2 are scaled by the following COE Parameters: 0x6091h,0x6092h,0x6096h, and 0x6097h. Some are in the KAS COE Init parameters which sets these parameters when the Ethercat Network is Initialized:

0x6092 sub Index 1 = 1048576 feed constant (shaft resolution for the feed constant) COE Init
0x6092 sub Index 2 = 1 shaft revolutions for the Feed Constant COE Init
0x6096 sub Index 1 = 60 velocity scaling (numerator) COE Init
0x6096 sub Index 2 = 65536 velocity scaling (denominator) COE Init

```
position value = (position internal value*feed constant)/(position encoder
resolution * gear ratio)
```

Feedback 3,4, and 5 are scaled by the following COE Parameters: 0x60E8h, 0x60E9h, 0x60Edh and 60EEh. These can be added to the KAS COE Init parameters or using the ECATWriteSDO function blocks. Additional Feedback is possible through 60E4h.

Feedback Real Time Data - Through PDO channel

The feedback data is sent back to the control through the deterministic EtherCAT PDO channel, the objects used are:
Feedback 1- 0x6064 Sub Index 0 (standard mapping)
Feedback 2- 0x6864 Sub Index 0 (standard mapping)
Feedback 3 - 0x60E4 Sub Index 3 (optional mapping)
Feedback 4 - 0x60E4 Sub Index 4 (optional mapping)
Feedback 5 - 0x60E4 Sub Index 5 (optional mapping)

Standard mapping

Index	Subindex	Object Name	Size [bit]
0x3780	1	AIN1.VALUE	16
0x3781	1	AIN2.VALUE	16
0x6041	0	Statusword - Axis 1	16
0x6064	0	Position actual value - Axis 1	32
0x60FD	0	Digital inputs - Axis 1	32
0x6841	0	Statusword - Axis 2	16
0x6864	0	Position actual value - Axis 2	32

Optional Mapping

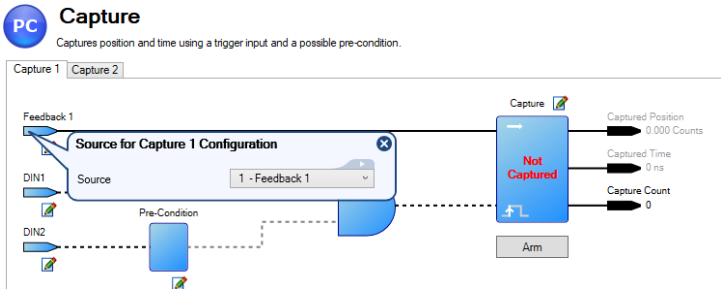
Index	Subindex	Object Name	Size [bit]
0x60E4	3	3rd additional position actual value - Axis 1	32
0x60E4	4	4th additional position actual value - Axis 1	32
0x60E4	5	5th additional position actual value - Axis 1	32

Using the AKD2G capture engine

Things worth noting about the high speed capture functionality in the AKD2G:

1. The AKD2G has a different set of Ethercat Objects than the AKD. These get used when the Capture engine functionality used in MC_TouchProbe, MLAxisCfgFastIn, MLTRigSetEdge, and other KAS function blocks. The AKD2G more closely uses DS-402 standard objects for this functionality

2. AKD2G has different capture engines for internal AKD2G capture setup and capture setup through Ethercat. This means the AKD2G Workbench screen below cannot setup the AKD capture engine for use through Ethercat

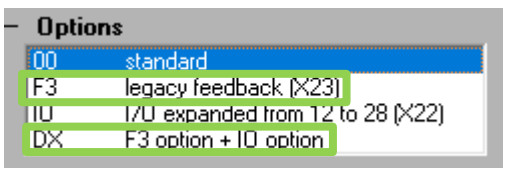


KAS accomplished AKD2G Capture engine setup through KAS function blocks and EtherCAT COE Init commands. See .kas manual for more detail.

3.For both the 1 and 2 axis configurations, the AKD2G has 2 high speed hardware inputs total on connector X21 rated for 1 usec activation/de activation delay. Note: The AKD Update rate is 2 µsec.

Some Motor Feedback options require an AKD2G option

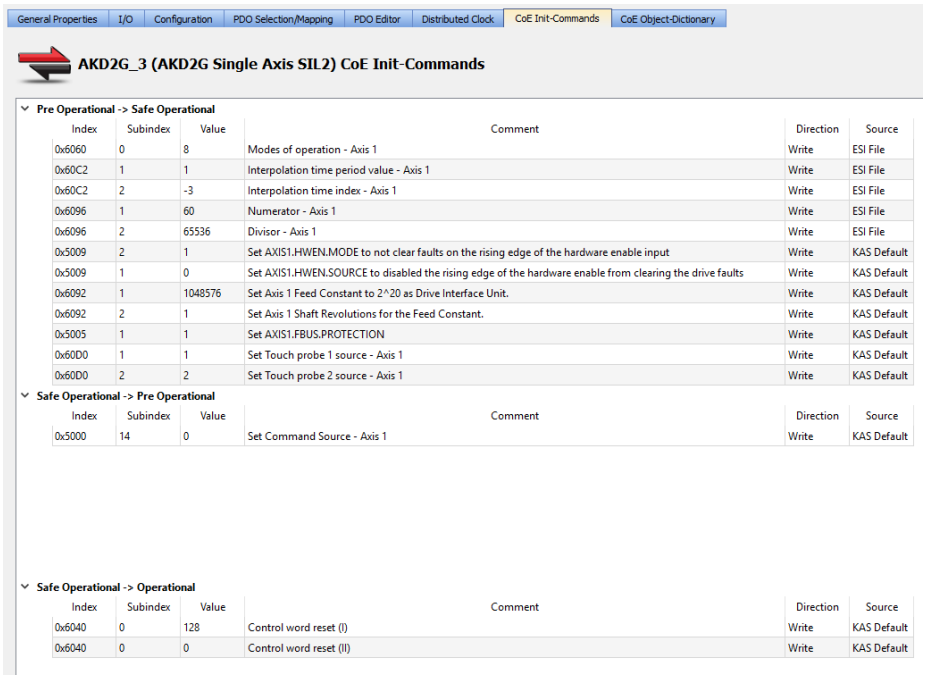
Only HIPERFACE DSL and SFD3 feedbacks support direct single cable connections into connectors X1 and X2. All other legacy feedbacks require connector X23 or the SFA (Smart Feedback Adapter). Connector X23 is available on AKD2G options F3 and DX.



Ethercat (COE Init) Run up parameters

For the AKD2G, the COE Init Parameters sent from the controller to the drive on Ethercat initialization have the following changes, some to line up with the DS402 standard:

For reference here is the AKD Parameters COE Init Parameters



General Properties | I/O | Configuration | PDO Selection/Mapping | PDO Editor | Distributed Clock | CoE Init-Commands | CoE Object-Dictionary

AKD2G_3 (AKD2G Single Axis SIL2) CoE Init-Commands

Pre Operational -> Safe Operational

Index	Subindex	Value	Comment	Direction	Source
0x6060	0	8	Modes of operation - Axis 1	Write	ESI File
0x60C2	1	1	Interpolation time period value - Axis 1	Write	ESI File
0x60C2	2	-3	Interpolation time index - Axis 1	Write	ESI File
0x6096	1	60	Numerator - Axis 1	Write	ESI File
0x6096	2	65536	Divisor - Axis 1	Write	ESI File
0x5009	2	1	Set AXIS1.HWEN.MODE to not clear faults on the rising edge of the hardware enable input	Write	KAS Default
0x5009	1	0	Set AXIS1.HWEN.SOURCE to disabled the rising edge of the hardware enable from clearing the drive faults	Write	KAS Default
0x6092	1	1048576	Set Axis 1 Feed Constant to 2^20 as Drive Interface Unit.	Write	KAS Default
0x6092	2	1	Set Axis 1 Shaft Revolutions for the Feed Constant.	Write	KAS Default
0x5005	1	1	Set AXIS1.FBUS.PROTECTION	Write	KAS Default
0x60D0	1	1	Set Touch probe 1 source - Axis 1	Write	KAS Default
0x60D0	2	2	Set Touch probe 2 source - Axis 1	Write	KAS Default

Safe Operational -> Pre Operational

Index	Subindex	Value	Comment	Direction	Source
0x5000	14	0	Set Command Source - Axis 1	Write	KAS Default

Safe Operational -> Operational

Index	Subindex	Value	Comment	Direction	Source
0x6040	0	128	Control word reset (I)	Write	KAS Default
0x6040	0	0	Control word reset (II)	Write	KAS Default

The new AKD2G COE Init Parameters are as follows (2 axis version shown):

Legend below:

Green bracket is related to Axis 1

Blue bracket is related to Axis 2

General Properties | I/O | Configuration | PDO Selection/Mapping | PDO Editor | Distributed Clock | CoE Init-Commands | CoE Object-Dictionary

AKD2G_1 (AKD2G Dual Axis SIL3 Basic Functions) CoE Init-Commands

Pre Operational -> Safe Operational

Index	Subindex	Value	Module	Comment	Direction	Source
0x6060	0	8	-	Modes of operation - Axis 1	Write	ESI File
0x60C2	1	1	-	Interpolation time period value - Axis 1	Write	ESI File
0x60C2	2	-3	-	Interpolation time index - Axis 1	Write	ESI File
0x6096	1	60	-	Numerator - Axis 1	Write	ESI File
0x6096	2	65536	-	Divisor - Axis 1	Write	ESI File
0x6860	0	8	-	Modes of operation - Axis 2	Write	ESI File
0x68C2	1	1	-	Interpolation time period value - Axis 2	Write	ESI File
0x68C2	2	-3	-	Interpolation time index - Axis 2	Write	ESI File
0x6896	1	60	-	Numerator - Axis 2	Write	ESI File
0x6896	2	65536	-	Divisor - Axis 2	Write	ESI File
0x5009	2	1	-	Set AXIS1.HWEN.MODE to not clear faults on the rising edge of the hardware enable input	Write	KAS Default
0x5009	1	0	-	Set AXIS1.HWEN.SOURCE to disabled the rising edge of the hardware enable from clearing the drive faults	Write	KAS Default
0x5109	2	1	-	Set AXIS2.HWEN.MODE to not clear faults on the rising edge of the hardware enable input	Write	KAS Default
0x5109	1	0	-	Set AXIS2.HWEN.SOURCE to disabled the rising edge of the hardware enable from clearing the drive faults	Write	KAS Default
0x6092	1	1048576	-	Set Axis 1 Feed Constant to 2^20 as Drive Interface Unit.	Write	KAS Default
0x6092	2	1	-	Set Axis 1 Shaft Revolutions for the Feed Constant.	Write	KAS Default
0x6892	1	1048576	-	Set Axis 2 Feed Constant to 2^20 as Drive Interface Unit.	Write	KAS Default
0x6892	2	1	-	Set Axis 2 Shaft Revolutions for the Feed Constant.	Write	KAS Default
0x5005	1	1	-	Set AXIS1.FBUS.PROTECTION	Write	KAS Default
0x5105	1	1	-	Set AXIS2.FBUS.PROTECTION	Write	KAS Default
0x60D0	1	1	-	Set Touch probe 1 source - Axis 1	Write	KAS Default
0x60D0	2	2	-	Set Touch probe 2 source - Axis 1	Write	KAS Default

COE Opmode Synchronous Position (Axis 1)

New Base Scaling (Axis 1)

COE Opmode Synchronous Position (Axis 2)

New Base Scaling (Axis 2)

New Base Scaling (Axis 1)

New Base Scaling (Axis 2)

Safe Operational -> Pre Operational

Index	Subindex	Value	Module	Comment	Direction	Source
0x5000	14	0	-	Set Command Source - Axis 1	Write	KAS Default
0x5100	14	0	-	Set Command Source - Axis 2	Write	KAS Default

Safe Operational -> Operational

Index	Subindex	Value	Module	Comment	Direction	Source
0x6040	0	128	-	Control word reset (I)	Write	KAS Default
0x6040	0	0	-	Control word reset (II)	Write	KAS Default
0x6840	0	128	-	Control word reset (I) (Axis 2)	Write	KAS Default
0x6840	0	0	-	Control word reset (II) (Axis 2)	Write	KAS Default

0x1A03 Contents:

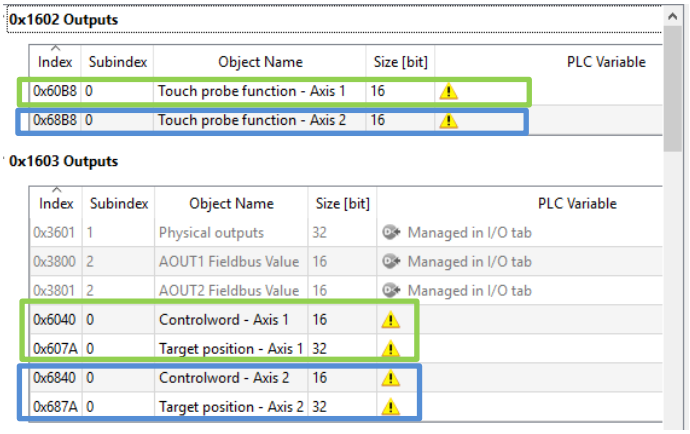
Index	Subindex	Object Name	Size [bit]
0x60E4	3	3rd additional position actual value - Ax...	32
0x60E4	4	4th additional position actual value - Ax...	32
0x60E4	5	5th additional position actual value - Ax...	32

EtherCAT PDO (Process Data Object) Differences in AKD2G

PDOs are the parameters(objects) that are passed cyclically between the Ethercat Master (PxMM) and Ethercat Drives (AKD2G). Changes to the standard objects (from AKD) are to line up with the CoE DS402 standard specification, to add objects for a second Axis (for AKD2G dual axis models only), and add safety related objects

Green bracket is related to Axis 1

Blue bracket is related to Axis 2

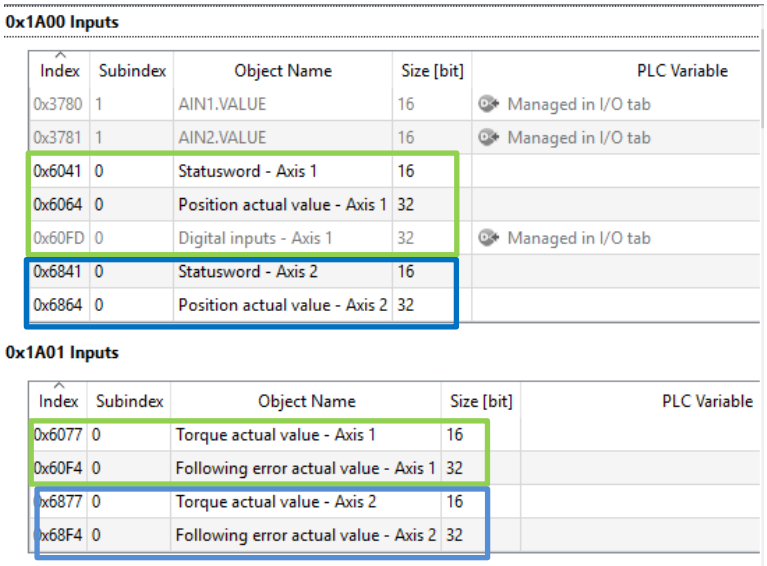


0x1602 Outputs

Index	Subindex	Object Name	Size [bit]	PLC Variable
0x60B8	0	Touch probe function - Axis 1	16	
0x68B8	0	Touch probe function - Axis 2	16	

0x1603 Outputs

Index	Subindex	Object Name	Size [bit]	PLC Variable
0x3601	1	Physical outputs	32	Managed in I/O tab
0x3800	2	AOUT1 Fieldbus Value	16	Managed in I/O tab
0x3801	2	AOUT2 Fieldbus Value	16	Managed in I/O tab
0x6040	0	Controlword - Axis 1	16	
0x607A	0	Target position - Axis 1	32	
0x6840	0	Controlword - Axis 2	16	
0x687A	0	Target position - Axis 2	32	



0x1A00 Inputs

Index	Subindex	Object Name	Size [bit]	PLC Variable
0x3780	1	AIN1.VALUE	16	Managed in I/O tab
0x3781	1	AIN2.VALUE	16	Managed in I/O tab
0x6041	0	Statusword - Axis 1	16	
0x6064	0	Position actual value - Axis 1	32	
0x60FD	0	Digital inputs - Axis 1	32	Managed in I/O tab
0x6841	0	Statusword - Axis 2	16	
0x6864	0	Position actual value - Axis 2	32	

0x1A01 Inputs

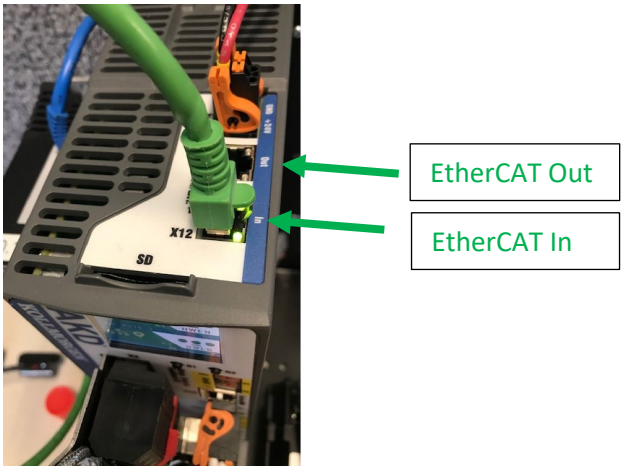
Index	Subindex	Object Name	Size [bit]	PLC Variable
0x6077	0	Torque actual value - Axis 1	16	
0x60F4	0	Following error actual value - Axis 1	32	
0x6877	0	Torque actual value - Axis 2	16	
0x68F4	0	Following error actual value - Axis 2	32	

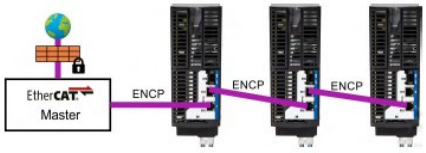
0x1A02 Inputs

Index	Subindex	Object Name	Size [bit]	PLC Va
0x60B9	0	Touch probe status - Axis 1	16	
0x60D1	0	Touch probe 1 time stamp positive value - Axis 1	32	
0x60D4	0	Touch probe 2 time stamp negative value - Axis 1	32	
0x68B9	0	Touch probe status - Axis 2	16	
0x68D1	0	Touch probe 1 time stamp positive value - Axis 2	32	
0x68D4	0	Touch probe 2 time stamp negative value - Axis 2	32	

EtherCAT Connector – on the Drive's Top face

As part of the AKD2Gs enhanced connector system the AKD2G Ethercat connection to the PxMM is on the top face. This facilitates more orderly wiring.

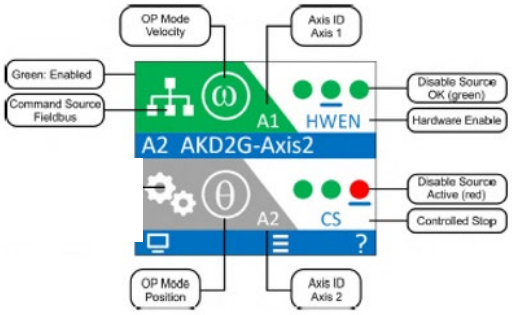


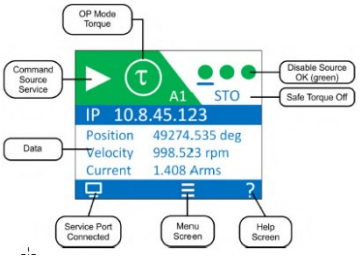


Front Display

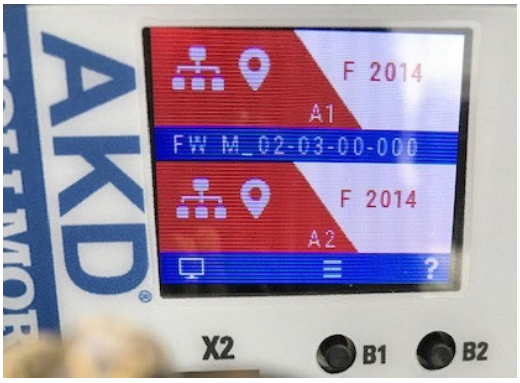
The AKD2G has more information available on the drive's front face display. This direct information from the drive is accessible without any other software program (Workbench or the IDE)

Status View – Displays enable status

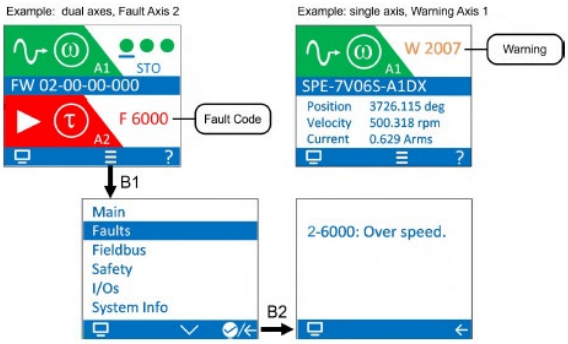




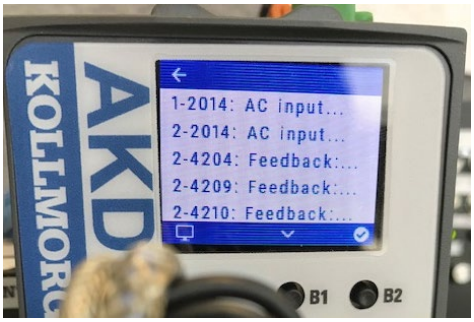
Status screen - when drive fault has occurred



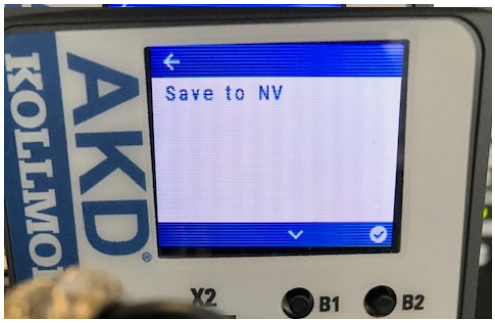
Display Screen Options – additional screens available through the B1/B2 buttons



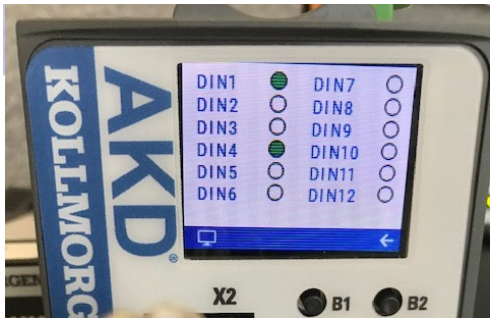
- Faults – Information on present AKD2G drive faults



- Parameters – Load or Save(Backup) to NV memory



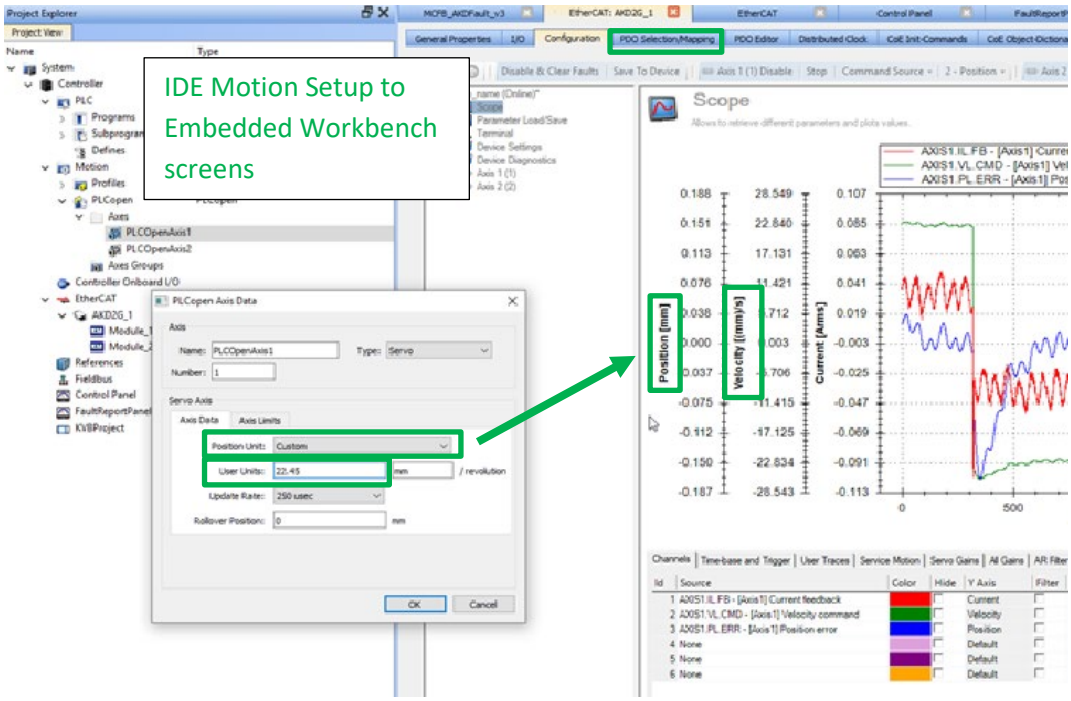
- Digital IO Status – Present Status

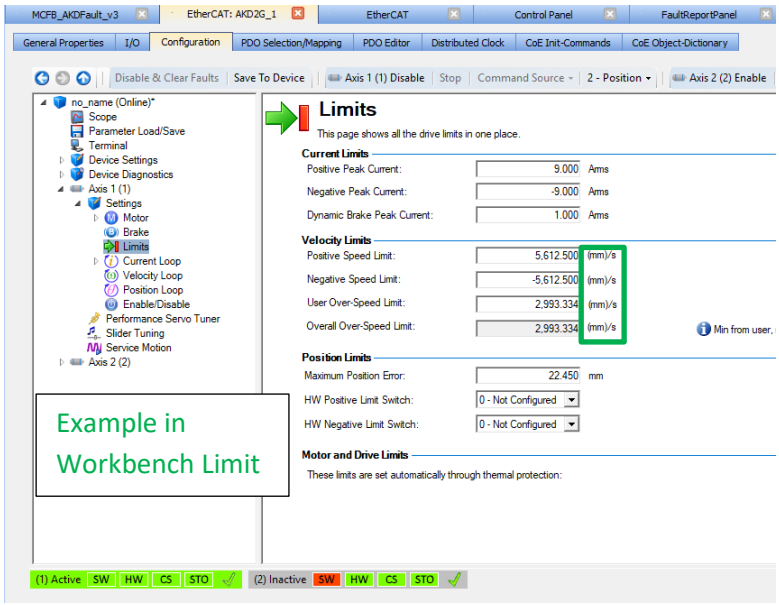


- TCP/IP – Connection details

User Units Consistency (between the IDE and Embedded Workbench)

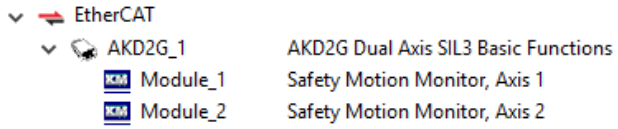
With the PxMM/AKD2G system, application units on the controller side defined in the PLCOpen Axis Data screen (with PLCopen motion)and PN Axis setup screen (with PipeNetwork motion) are now incorporated in the drive's WorkBench screens. When a project is started up, either through the IDE or PxMM powerup, the controller side setup units are automatically transferred to the drive side. Example below shows setting up units of mm in the IDE axis setup screen carries through to the embedded WorkBench screens such as Scope and Limits:


IDE Motion Setup to Embedded Workbench screens
Scope
Position [mm]
Velocity [(mm)/s]
Current [Arms]


Example in Workbench Limit
Limits
This page shows all the drive limits in one place.
Current Limits
Positive Peak Current: 9.000 Arms
Negative Peak Current: -9.000 Arms
Dynamic Brake Peak Current: 1.000 Arms
Velocity Limits
Positive Speed Limit: 5,612.500 (mm)/s
Negative Speed Limit: -5,612.500 (mm)/s
User Over-Speed Limit: 2,993.334 (mm)/s
Overall Over-Speed Limit: 2,993.334 (mm)/s
Position Limits
Maximum Position Error: 22.450 mm
HW Positive Limit Switch: 0 - Not Configured
HW Negative Limit Switch: 0 - Not Configured
Motor and Drive Limits
These limits are set automatically through thermal protection:

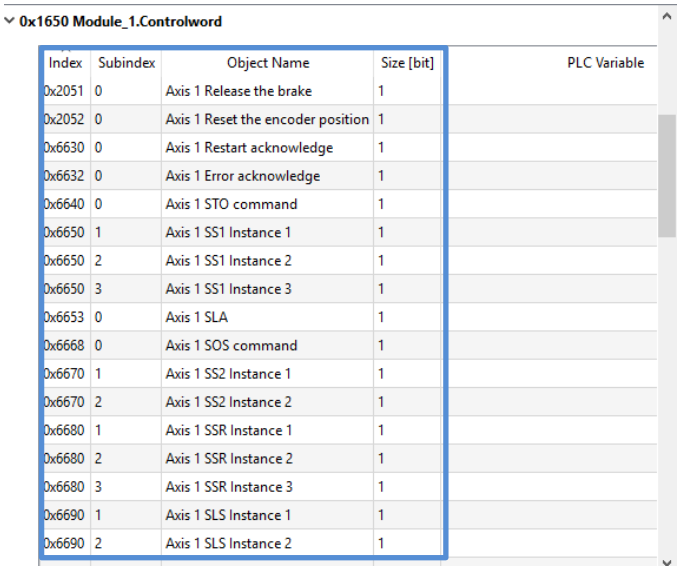
Safety SIL Level 3 (with AKD2G SMM option)

KAS version 3.03 will support the transfer of safety information from the AKD2G with SMM options #2 and #3 (available later this year) to and from a Master Safety Controller. In the PxMM, during Ethercat scan/discovery, the AKD2G default safety module profiles will be automatically added to the AKD2G device in the KAS IDE project tree.

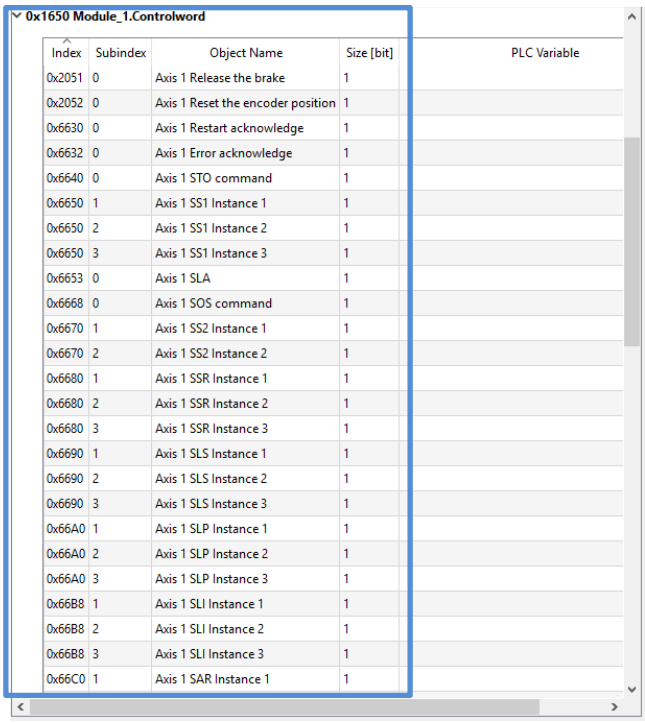


Available safety related default Ethercat PDOs are as follows:

0x1650 Basic Safety Functions (only Axis 1 shown)

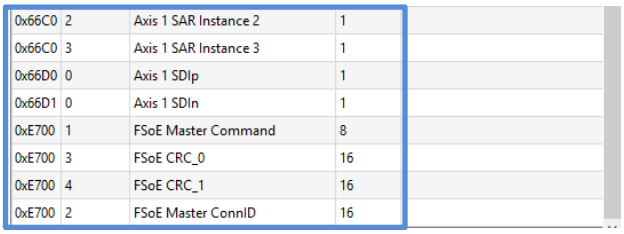


Index	Subindex	Object Name	Size [bit]	PLC Variable
0x2051	0	Axis 1 Release the brake	1	
0x2052	0	Axis 1 Reset the encoder position	1	
0x6630	0	Axis 1 Restart acknowledge	1	
0x6632	0	Axis 1 Error acknowledge	1	
0x6640	0	Axis 1 STO command	1	
0x6650	1	Axis 1 SS1 Instance 1	1	
0x6650	2	Axis 1 SS1 Instance 2	1	
0x6650	3	Axis 1 SS1 Instance 3	1	
0x6653	0	Axis 1 SLA	1	
0x6668	0	Axis 1 SOS command	1	
0x6670	1	Axis 1 SS2 Instance 1	1	
0x6670	2	Axis 1 SS2 Instance 2	1	
0x6680	1	Axis 1 SSR Instance 1	1	
0x6680	2	Axis 1 SSR Instance 2	1	
0x6680	3	Axis 1 SSR Instance 3	1	
0x6690	1	Axis 1 SLS Instance 1	1	
0x6690	2	Axis 1 SLS Instance 2	1	



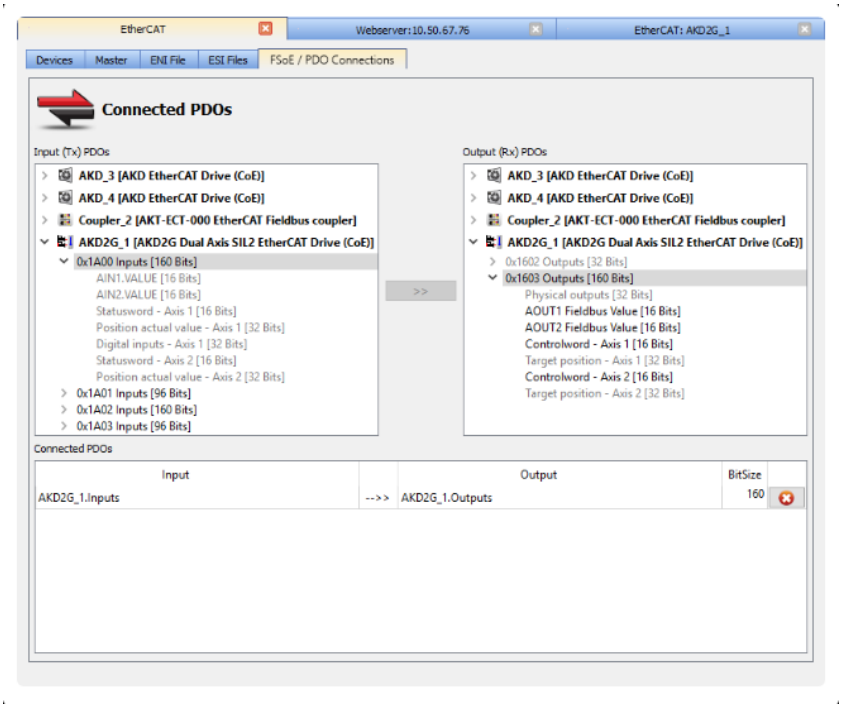
0x1650 Module_1.Controlword

Index	Subindex	Object Name	Size [bit]	PLC Variable
0x2051	0	Axis 1 Release the brake	1	
0x2052	0	Axis 1 Reset the encoder position	1	
0x6630	0	Axis 1 Restart acknowledge	1	
0x6632	0	Axis 1 Error acknowledge	1	
0x6640	0	Axis 1 STO command	1	
0x6650	1	Axis 1 SS1 Instance 1	1	
0x6650	2	Axis 1 SS1 Instance 2	1	
0x6650	3	Axis 1 SS1 Instance 3	1	
0x6653	0	Axis 1 SLA	1	
0x6668	0	Axis 1 SOS command	1	
0x6670	1	Axis 1 SS2 Instance 1	1	
0x6670	2	Axis 1 SS2 Instance 2	1	
0x6680	1	Axis 1 SSR Instance 1	1	
0x6680	2	Axis 1 SSR Instance 2	1	
0x6680	3	Axis 1 SSR Instance 3	1	
0x6690	1	Axis 1 SLS Instance 1	1	
0x6690	2	Axis 1 SLS Instance 2	1	
0x6690	3	Axis 1 SLS Instance 3	1	
0x66A0	1	Axis 1 SLP Instance 1	1	
0x66A0	2	Axis 1 SLP Instance 2	1	
0x66A0	3	Axis 1 SLP Instance 3	1	
0x66B8	1	Axis 1 SLI Instance 1	1	
0x66B8	2	Axis 1 SLI Instance 2	1	
0x66B8	3	Axis 1 SLI Instance 3	1	
0x66C0	1	Axis 1 SAR Instance 1	1	



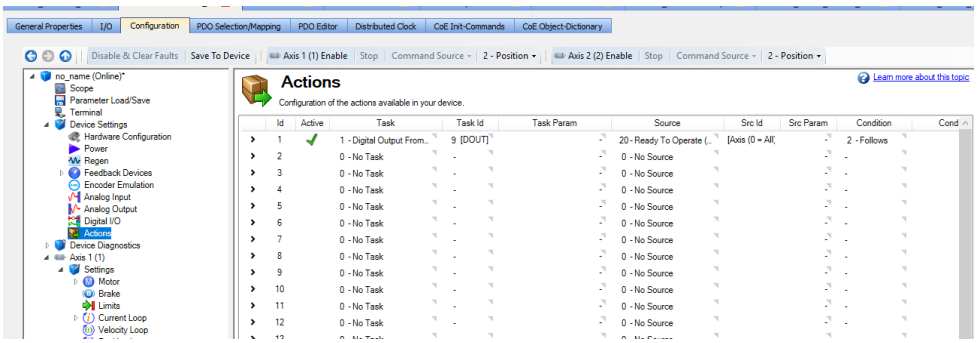
0x66C0	2	Axis 1 SAR Instance 2	1
0x66C0	3	Axis 1 SAR Instance 3	1
0x66D0	0	Axis 1 SDIp	1
0x66D1	0	Axis 1 SDIn	1
0xE700	1	FSoE Master Command	8
0xE700	3	FSoE CRC_0	16
0xE700	4	FSoE CRC_1	16
0xE700	2	FSoE Master ConnID	16

In the KAS IDE project tree a FSoE/PDO Selection tab has been added to the Ethercat section. FSoE stands for Fail Safe over EtherCAT. This facilitates using a separate Master Safety controller to then setup and incorporate the AKD2G's safety parameters or objects. The tab below displays: AKD2Gs safety Input (Tx) and Output (Rx) PDOs and associated safety functionality.



During machine operation, the PxMM runtime will copy the data between the connected PDOs. This makes it possible to transfer safety-critical process data via EtherCAT frames between the AKD2G and the Safety controller. The FSoE protocol, communication, and state machine are handled by the external EtherCAT Safety controller.

I/O Action Table



The AKD2G introduces an Action Table to configure certain tasks to run when certain events occur in the drive. Action Table replaces and extends the AKD1 digital input and output modes. This means the KAS program can

use the table to configure certain actions instead of programming in the controller side. Example tasks include setting a digital output and initiating a controlled stop. Example events include detecting a level transition on a digital input comparing velocity feedback to a threshold. The AKD2G drive may be configured for up to 32 actions. Each action is defined by a set of parameters whose names identify the action (ex: ACTION#.TASK). WorkBench provides a new Actions interface screen that can be used to configure all actions on the drive.

More I/O

The AKD2G contains more I/O. This could eliminate the need for AKI remote I/O is applications with limited IO needs

X21
- standard
- 2 x 11 pins, pitch 3.5 mm
- A: left connector
- B: right connector

X22
- standard for dual-axis drives
- optional for single axis drives
- 2 x 10 pins, pitch 3.5 mm
- A: left connector
- B: right connector

X23
- optional
- SubD 15 pins HD
- Mating connector: male

X21	Pin	Signal	Pin	Signal
	A1	Analog-In (AIN) 1 +	B1	Analog-Out (AOUT) 1
	A2	Analog-In (AIN) 1 -	B2	AGND
	A3*	Digital-In (DIN) 1	B3	+24 V
	A4*	Digital-In (DIN) 2	B4	DGND
	A5	Digital-In (DIN) 3 (HW-Enable Axis 1)	B5	Digital-Out (DOUT) 9 + (Relay)
	A6	Digital-In (DIN) 4 (HW-Enable Axis 2)	B6	Digital-Out (DOUT) 9 - (Relay)
	A7	Digital-In (DIN) 5	B7	Digital-Out (DOUT) 1
	A8	Digital-In (DIN) 6	B8	Digital-Out (DOUT) 2
	A9	Digital-In (DIN) 7	B9	Digital-Out (DOUT) 3
	A10	Digital-In (DIN) 8	B10	Digital-Out (DOUT) 4
	A11	STO-A-A1	B11	STO-B-A1

X22 (optional for single axis drives, standard for dual-axis drives)	Pin	Signal	Pin	Signal
	A12	STO-A-A2, dual-axis	B12	STO-B-A2, dual-axis
	A13	Digital-In (DIN) 9	B13	Digital-Out (DOUT) 5
	A14	Digital-In (DIN) 10	B14	Digital-Out (DOUT) 6
	A15	Digital-In (DIN) 11	B15	Digital-Out (DOUT) 7 +
	A16	Digital-In (DIN) 12	B16	Digital-Out (DOUT) 7 -
	A17	AGND	B17	Digital-Out (DOUT) 8 +
	A18	Analog-In (AIN) 2+	B18	Digital-Out (DOUT) 8 -
	A19	Analog-In (AIN) 2-	B19	Analog-Out (AOUT) 2
	A20*	Digital-In/Out (DIO) 1 +	B20*	Digital-In/Out (DIO) 2 +
	A21*	Digital-In/Out (DIO) 1 -	B21*	Digital-In/Out (DIO) 2 -

X23 (optional)	Pin	Signal
	2	Digital-In/Out (DIO) 6 +
	3	Digital-In/Out (DIO) 6 -
	6	Digital-In/Out (DIO) 5 +
	7	Digital-In/Out (DIO) 5 -
	10	+5 V
	11	0 V
	12	Digital-In/Out (DIO) 3 +
	13	Digital-In/Out (DIO) 3 -
	14	Digital-In/Out (DIO) 4 +
	15	Digital-In/Out (DIO) 4 -

Safe Motion IO – AKD2G with Safety Option 2 or 3

1) AKD2G Safe Motion Options #2 and #3 will be available later this year and include I/O point dedicated for safety connections.

X21	Pin	Signal	Pin	Signal
	A1	Analog-In (AIN) 1 +	B1	Analog-Out (AOUT) 1
	A2	Analog-In (AIN) 1 -	B2	AGND
	A3*	Digital-In (DIN) 1	B3	+24 V
	A4*	Digital-In (DIN) 2	B4	DGND
	A5	Digital-In (DIN) 3 (HW-Enable Axis 1)	B5	Digital-Out (DOUT) 9 + (Relay)
	A6	Digital-In (DIN) 4 (HW-Enable Axis 2)	B6	Digital-Out (DOUT) 9 - (Relay)
	A7	Digital-In (DIN) 5	B7	SOUT1
	A8	Digital-In (DIN) 6	B8	SOUT2
	A9	Digital-In (DIN) 7	B9	SOUT3
	A10	Digital-In (DIN) 8	B10	SOUT4
	A11	SIN1	B11	SIN2

Digital output Digital-Out (DOUT) 9	• max. 30 VDC, 1A • max. 42 VAC, 1 A • galvanic isolation for 24 VDC from PE • delay open/close: 10 ms / 10 ms
Safe digital inputs SIN1 to SIN4	• ON: > 15 VDC, > 2 mA, OFF: < 5 VDC, < 1 mA • galvanic isolation for 60 VDC • delay activation/de-activation about: 1.5 ms / 3.5 ms • test pulse are required
Safe digital outputs SOUT1 to SOUT4	• volt-free contacts, max 30 VDC, 172 mA • short circuit proof • galvanic isolation for 24 VDC from PE • activation delay (0->1) depends on the safety function • hardware de-activation delay (1>0) about 300 µs • emits test pulses

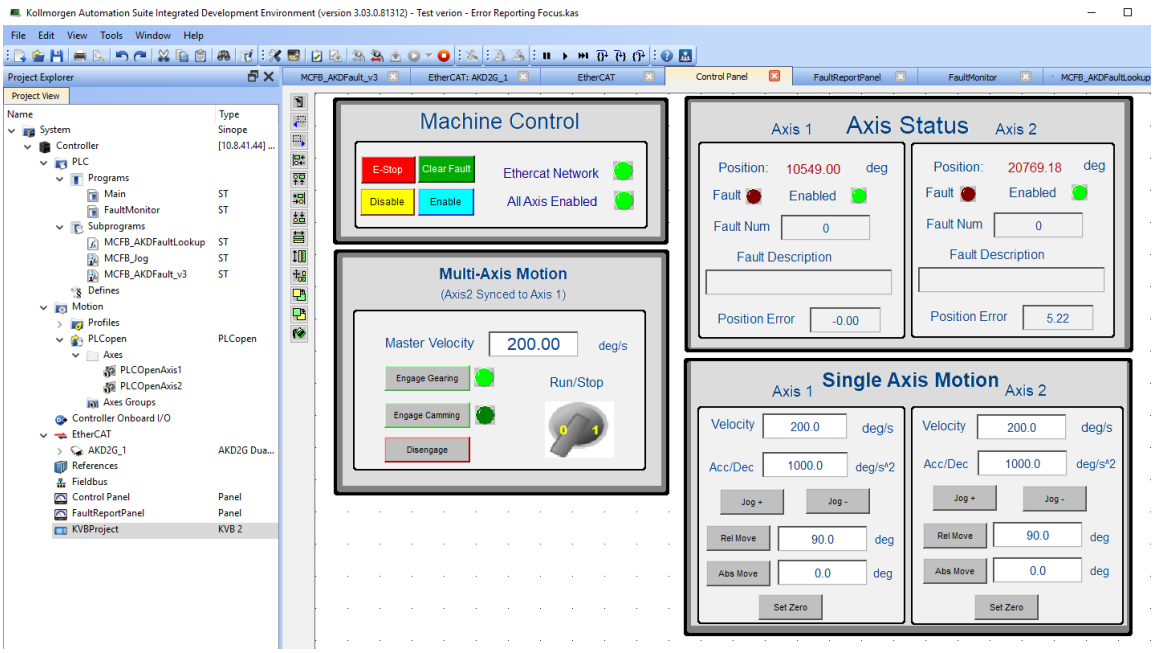
The Safe Inputs require a test pulse and the Safe Outputs generate a test pulse. Test pulses is what makes the difference between a safe I/O verses a non-safe version, gives that extra safety check to make sure the wire connection is still there.

I/O summary

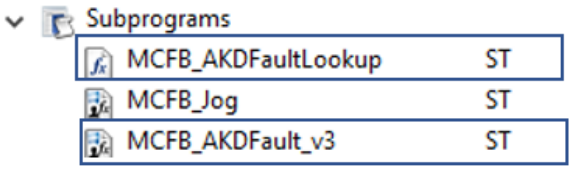
Interface	Electrical Data
Analog inputs Analog-In (AIN) 1 to 2	● ±10 VDC ● common mode rejection ratio: > 30 dB at 60 Hz ● resolution 16 bit and full monotonic ● update rate: 16 kHz ● non-linearity < 0.1% of full scale ● offset drift max. 250 µV/°C ● input impedance > 13 kΩ
Analog outputs Analog-Out (AOUT) 1 to 2	● 0 to +10 VDC, max 20 mA ● resolution 16 bit and full monotonic ● update rate: 4 kHz ● non-linearity < 0.1% of full scale ● offset drift max. 250 µV/°C ● short circuit protected to AGND ● output impedance 110 Ω
Digital inputs Digital-In (DIN) 1 to 2 IEC 61131-2 Type 1	● ON: 11 VDC to 30 VDC, 2 mA to 15 mA ● OFF: -5 VDC to 5 VDC, max.15 mA ● galvanic isolation for 60 VDC ● activation / de-activation delay: < 1 µs / < 1 µs
Digital inputs Digital-In (DIN) 3 to 12 IEC 61131-2 Type 1	● ON: 11 VDC to 30 VDC, 2 mA to 15 mA ● OFF: -5 VDC to 5 VDC, max.15 mA ● galvanic isolation for 60 VDC ● delay activation/de-activation: about 5 µs / 500 µs
Digital outputs Digital-Out (DOUT) 1 to 6	● max. 30 VDC, 100 mA ● short circuit proof ● galvanic isolation for 60 VDC ● delay activation/de-activation: about 5 µs / 300 µs
Digital outputs Digital-Out (DOUT) 7 to 8	● volt-free contacts, max 30 VDC, 100 mA ● sink or source ● galvanic isolation for 24 VDC from PE ● delay activation/de-activation: about 5 µs / 50 µs
Digital inputs/outputs Digital-In/Out (DIO) 1 to 6 RS485	● reference potential X22: AGND, X23: 0V ● input OFF: -0.3 V to +0.3 V ● selectable termination, difference/single ended ● delay activation/de-activation: about 50 ns
Digital output Digital-Out (DOUT) 9	● max. 30 VDC, 1A ● max. 42 VAC, 1 A ● galvanic isolation for 24 VDC from PE ● delay open/close: 10 ms / 10 ms
Safe digital inputs Axis 1: STO-A-A1, STO-B-A1 Axis 2: STO-A-A2, STO-B-A2	● ON: 17 VDC to 30 VDC, 5 mA to 6 mA ● OFF: 0 VDC to 5 VDC, max.1 mA ● galvanic isolation for 60 VDC ● delay activation/de-activation about: 1.5 ms / 3.5 ms

New project templates

The standard IDE new project templates can be used with the AKD2G drives can be used.



<u>The fault reporting code in subprograms MCFB_AKDFault_v3 and MCFB_AKDFaultLookup</u>



<u>will require new versions for the new fault reporting parameter structure in the AKD2G.</u>

Drive Warning and Fault Codes

The fault codes in the AKD are 4 digit long. Th fault codes on the AKD2G are 5 digit long and will be a different number. Example:

Bus Under Volts fault:

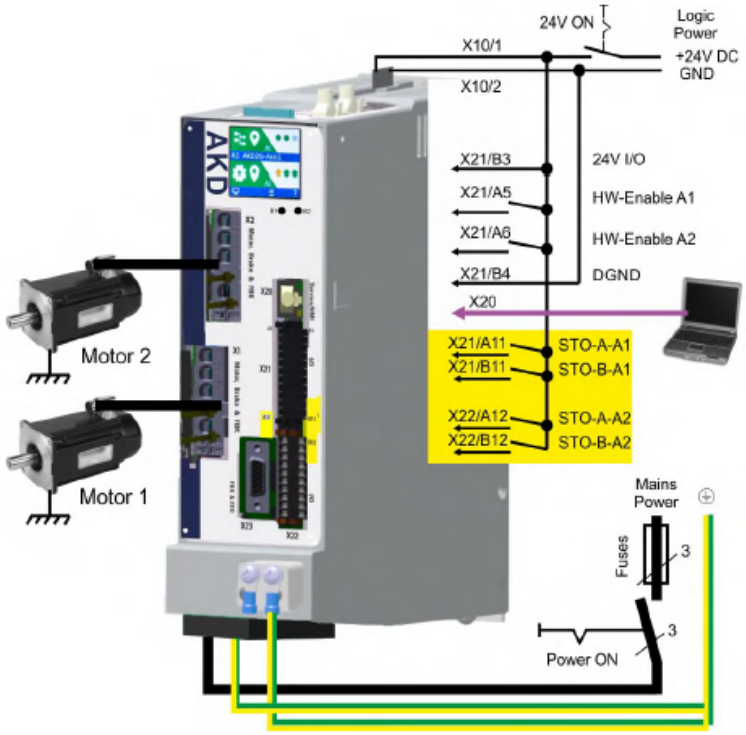
- In AKD it is F502
- IN AKD2G it is F2007

Also, with the AKD, warning numbers start with a **n**xxx. With AKD2G warning start with a **W**xxxx.

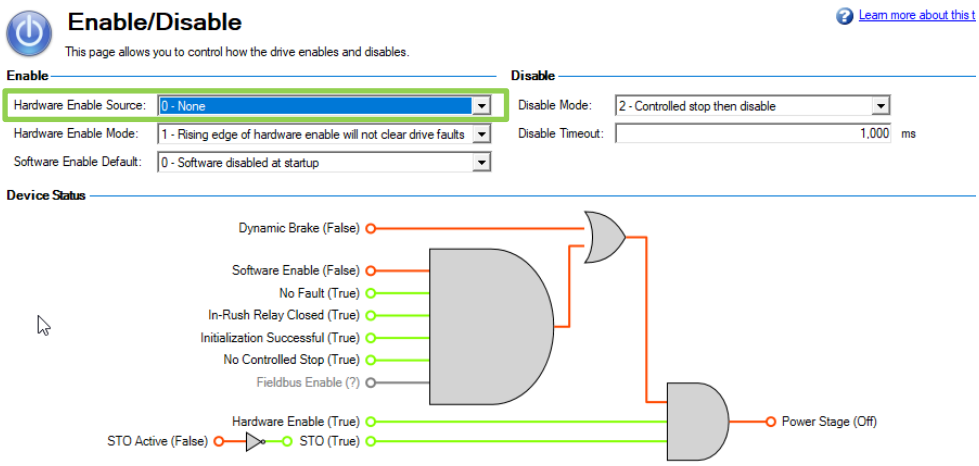
Minimum Wiring

9.2.1.2 Minimum wiring for drive test without load, example

NOTICE This wiring diagram based on default settings is for general illustration only and does not fulfill any requirements for EMC, functional safety, or functionality of your application.



Note: For the minimal wiring that does not necessarily meet any industry standards the HW-enable signal requirement can be reset by changing the HW enable source to none:



Stepper Motion command

Position Command from KAS through Ethercat to the AKD2G EEO is not yet available the AKD2G

More Detail

In the AKD2G Online documentation, there is a section on AKD2G vs AKD:

http://webhelp.kollmorgen.com/kas3.03/Content/AKD2G%20User%20Manual/WhatsNew/AKD1%20vs%20AKD2.htm