## AKD2G-xxx-xxxD-A1xx-0000 with KSM 12-2 Dual axis drive, dual axis KSM SiL2 sample configuration July 16, 2020

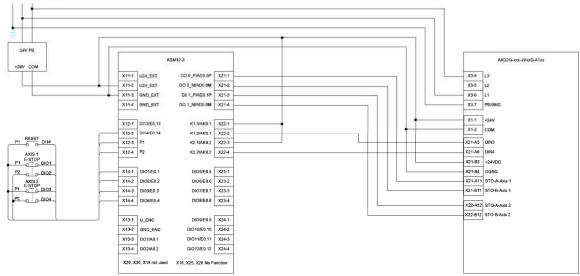
## 1. Disclaimer:

Safety Engineering is not so simple that one design will meet SIL2 for all applications. My intent in this document is to give a functional example of AKD2G drive and KSM Safety PLC. Without a risk assessment and risk reduction analysis, I can't say this example will meet any application's requirements.

2. Hardware

AKD2G-SPE-6V03D-A1F3-0000 AKM21C-xxxxAB-00, BiSS B feedback AKM21C-xxxxDB-00, EnDaT 2.1 feedback KSM 12-2 Safety PLC 2 Pieces KSM SINCOS feedback cable adapter

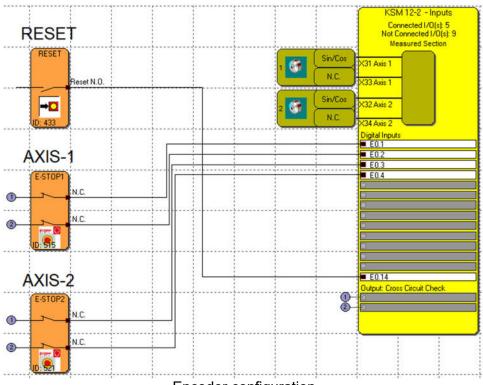
## 3. Connections for simple 120VAC demo (not including feedback connections)



- Critical drive parameters
   AXISx.DISTO (In my example, 2 seconds)
   AXISx.CS.DEC (in my example, 5000 RPM/s)
   AXISx.HWEN.SOURCE 3 or 4 (Axis1 = 3, Axis2 = 4)
   AXISx.DISMODE 2
   AXISx.ENDEFAULT 1 (if you want to drive to be SW enabled at power up)
- 5. Timing

E-STOP BUTTON	
HW ENABLE	
STO	
VELOCITY	

6. Input Program Configuration



Encoder configuration

Encoder configuration

6

×

C Linear Rotatory	Ring section Rotatory C Degr/s C RPS C RPM	Position P	nocessing Rev.	Maximal Speed Cutoff Threshold Incr. Cutoff Threshold Speed	4000 10 100	RPM Rev. RPM	Speed No	Filter
	Encoder A	С	Proc.Er	1C (•	Encod	er B		
5	inus Cosinus		Enco		Not Con	nected		
Parameter			Select	ion				
Direction	Up							
Supply Voltage Resolution (i)	5V 2048							

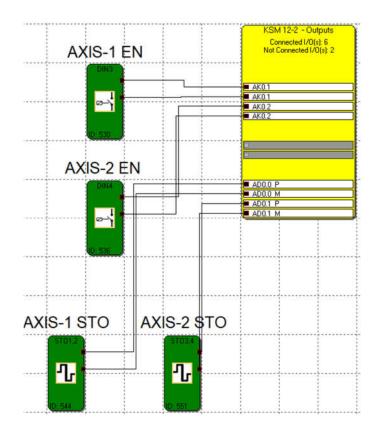
Estop Button configuration

Type.	2 N.C.	<u> </u>
		Cross Circuit Check
Signal # 1:	E0.1* -	with Pulse 1 💌
Signal # 2:	E0.2* •	with Pulse 2 +
tart behavior	ł	☐ Start test

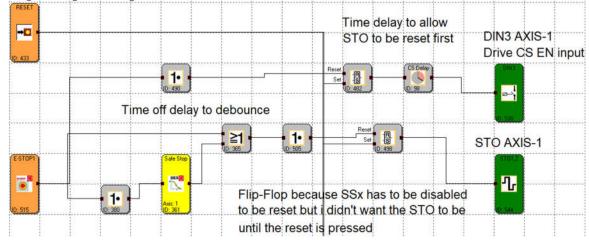
**Reset Button Configuration** 

·Inputs Signal # 1: E	E0.14* 💌	Cross Circuit with OFF	Check 👻	
🗸 use as Alarm Re	set (N.O.)			
✓ use as Logic-Re	comment:	RESET		

7. Output Program Configuration



8. Logic Programming for one of the two axis



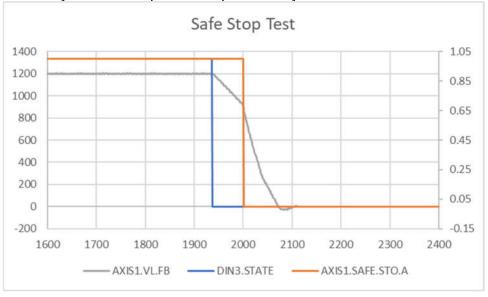
Timer configuration

	- Delay		
<u></u>	-		
Access_ID	200  n	ns 💌	
2 -	8 ms < Value < 3199	9992 ms	
	Behavior		
	<ul> <li>Switch ON Delay</li> <li>Switch OFF Delay</li> </ul>		
	C Impulse	,	
	C Intermittet		
	Comment:	elay	
OLLMORGEN	ОК	Cancel	Help
		onfigurat	tion
	Called and the second sec	onfigurat	tion
SX] Safe Stop 1/2	- Editor	Axis1	Ŧ
Stop Category according EN 602	- Editor Access_ID 01 204-1	Axis1	
SX] Safe Stop 1/2	- Editor	Avis1	
SX] Safe Stop 1/2	- Editor Access_ID 01 204-1 Ilowing expected standstill)	Avis1	
SX] Safe Stop 1/2	- Editor Access_ID 01 204-1 llowing expected standstill) wing expected standstill)	Avis1	
SX] Safe Stop 1/2	- Editor Access_ID 01 204-1 llowing expected standstill) wing expected standstill)	Axis1 Curve profile 1 Curve profile 1 C S-Shape/	
SX] Safe Stop 1/2 Stop Category — according EN 600 1 (Shut-off fo 2 (SOS follow	- Editor Access_ID OI Ve)	Axis1 Curve profile Curve profile C Linear C S-Shape/	
SX] Safe Stop 1/2 Stop Category — according EN 600 1 (Shut-off fo 2 (SOS follow	- Editor Access_ID OI Ve) Standard latency time	Curve profile 1 Curve profile 1 C Linear C S-Shape/	ype Jerk-Limited
SX] Safe Stop 1/2 Stop Category — according EN 600 1 (Shut-off fo 2 (SOS follow	- Editor Access_ID OI VIII Control Con	Axis1 Curve profile 1 Curve profile 1 C Linear C S-Shape/	ype Jerk-Limited

 Testing using Workbench Scope Normal Operation: Safe Stop Block's max ACC has been set to 5000 RPM/s. Axisx.CS.DEC is set to 10000 RPM/s. Notice the drive takes ½ as long to stop as the calculation in the Safety PLC.



Fault operation: Same setup as before but I set AXISx.CS.DEC to 4500 RPM/s. Because the Safe Stop block is set to 5000 RPM/s, the motor will not follow the minimal deceleration rate and the Safety PLC will drop the STO prematurely.



10. NOTES:

- Only EnDaT 2.1 and BiSS B Analog worked. Hiperface SIN/COS and Renishaw SIN/COS will not work (3.2VDC logic)
- Safe Stop Block "MAX ACC" is a bit misleading. In my case, the 5000 RPM/s is the minimal stopping rate of the motor for the Safety PLC to consider normal.
- I used the safe pulsing outputs of the Safety PLC to control the STO inputs. The AKD2G FS1 drive doesn't require the pulsing for correct STO operation. I used the dual safe outputs for the convenience of driving two STO inputs on the drive. The drive ignores the pulsing and operates the same as using a 24VDC signal.