

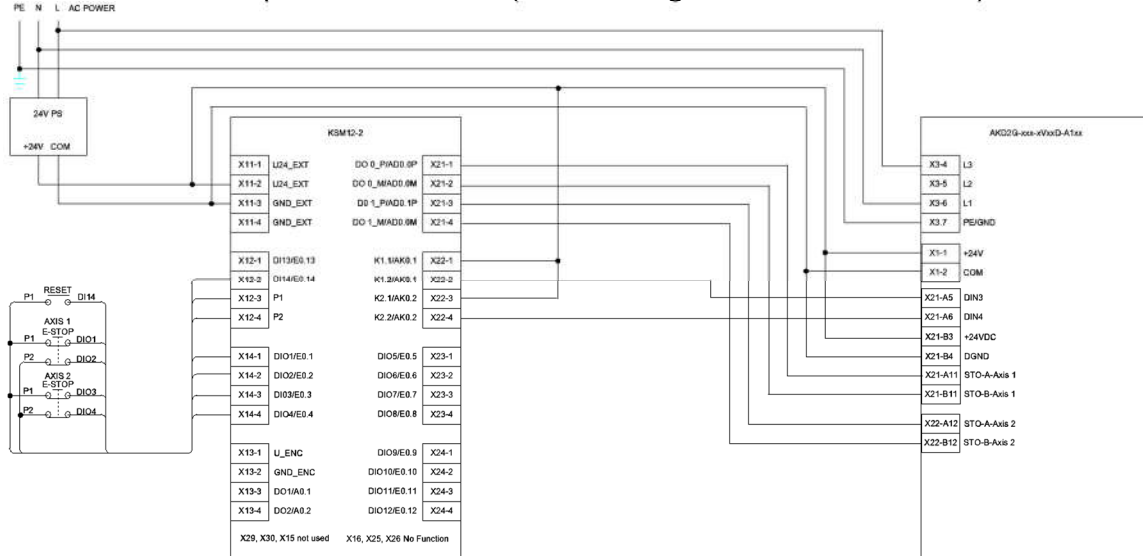
AKD2G-xxx-xxxD-A1xx-0000 with KSM 12-2

Dual axis drive, dual axis KSM

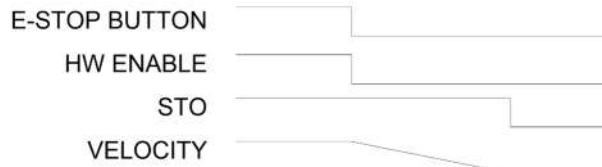
SiL2 sample configuration

July 16, 2020

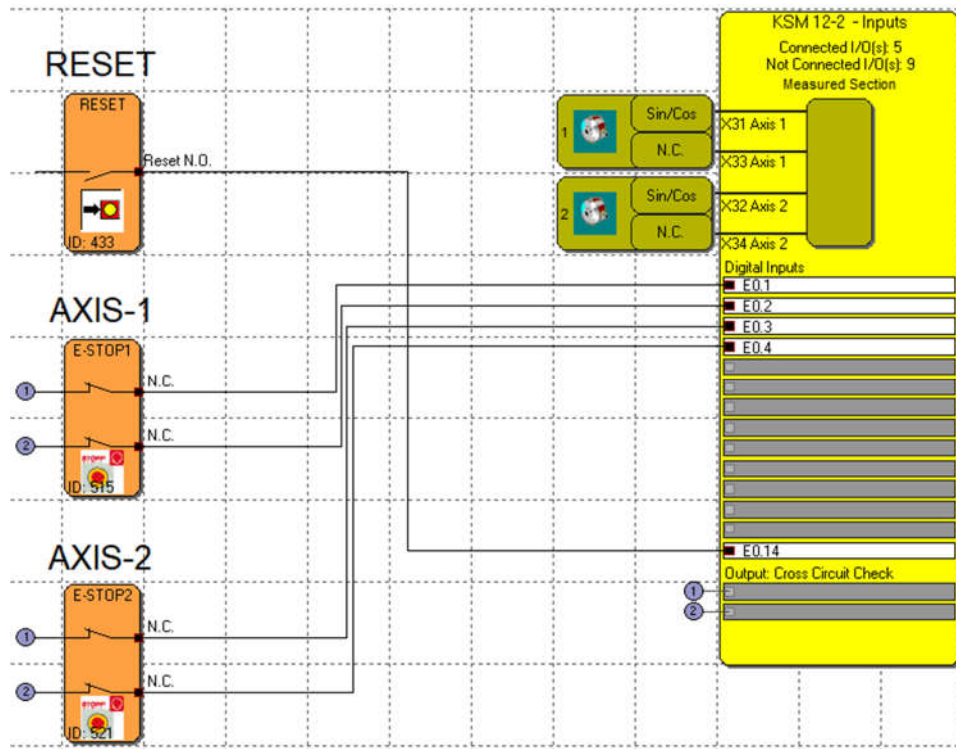
1. Disclaimer:
Safety Engineering is not so simple that one design will meet SIL2 for all applications. My intent in this document is to give a functional example of AKD2G drive and KSM Safety PLC. Without a risk assessment and risk reduction analysis, I can't say this example will meet any application's requirements.
2. Hardware
AKD2G-SPE-6V03D-A1F3-0000
AKM21C-xxxxxAB-00, BiSS B feedback
AKM21C-xxxxxDB-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)



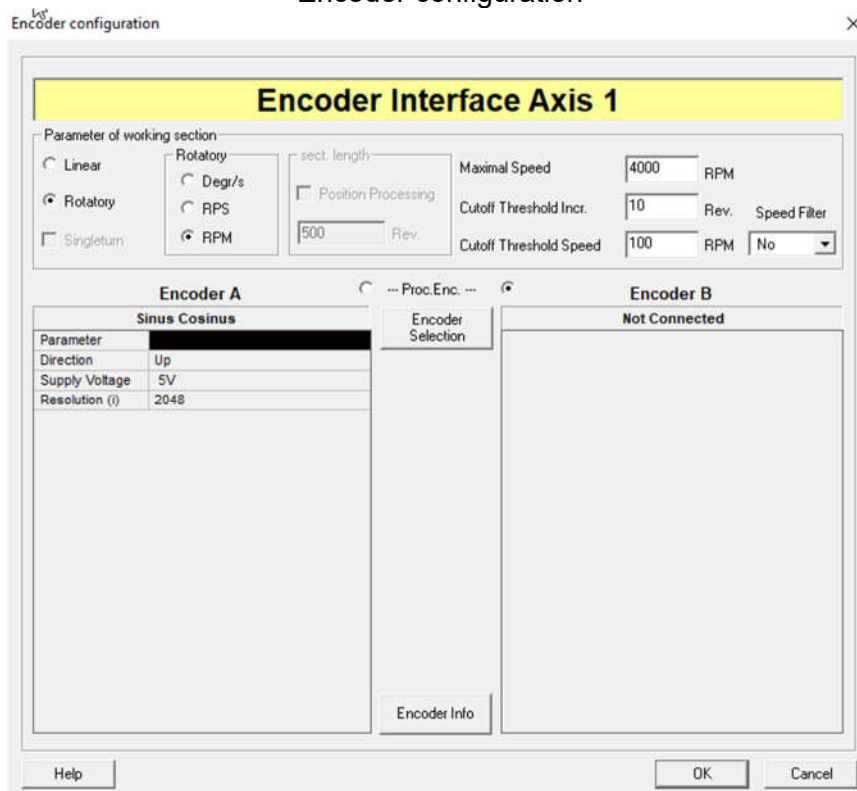
4. Critical drive parameters
 AXISx.DISTO (In my example, 2 seconds)
 AXISx.CS.DEC (in my example, 5000 RPM/s)
 AXISx.HWEN.SOURCE 3 or 4 (Axis1 = 3, Axis2 = 4)
 AXISx.DISMODE 2
 AXISx.ENDEFAULT 1 (if you want to drive to be SW enabled at power up)
5. Timing



6. Input Program Configuration



Encoder configuration



Estop Button configuration

Emergency Stop - Editor

Inputs

Type: 2 N.C.

Signal # 1: E0.1* with Pulse 1

Signal # 2: E0.2* with Pulse 2

Start behavior

Auto Start test

Monitored

Comment: E-STOP1

KOLLMORGEN

OK Cancel Help

Reset Button Configuration

Start- / Reset switch - Editor

Start behavior

use for monitored start up

Start Type: manually

Inputs

Signal # 1: E0.14* with OFF

Alarm Reset

use as Alarm Reset (N.O.)

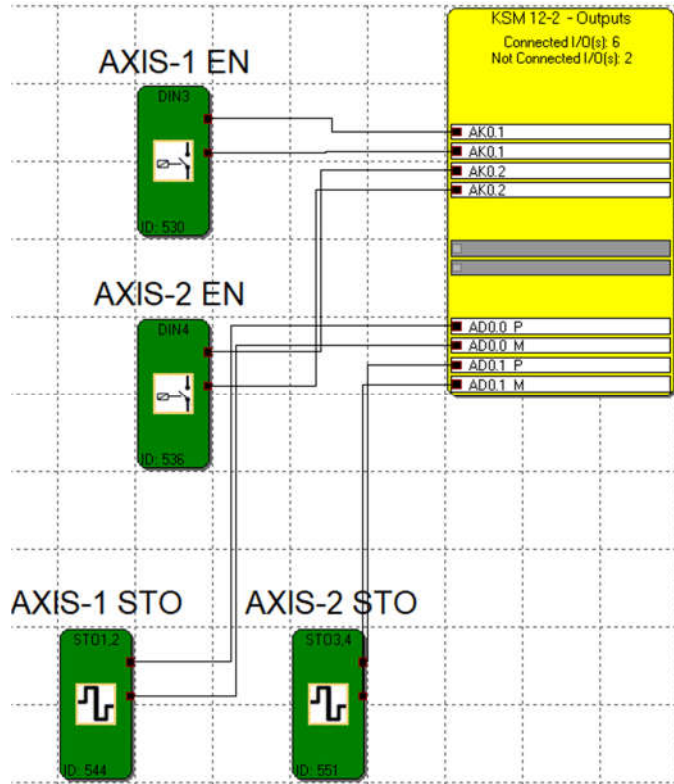
use as Logic-Reset (N.O.)

Comment: RESET

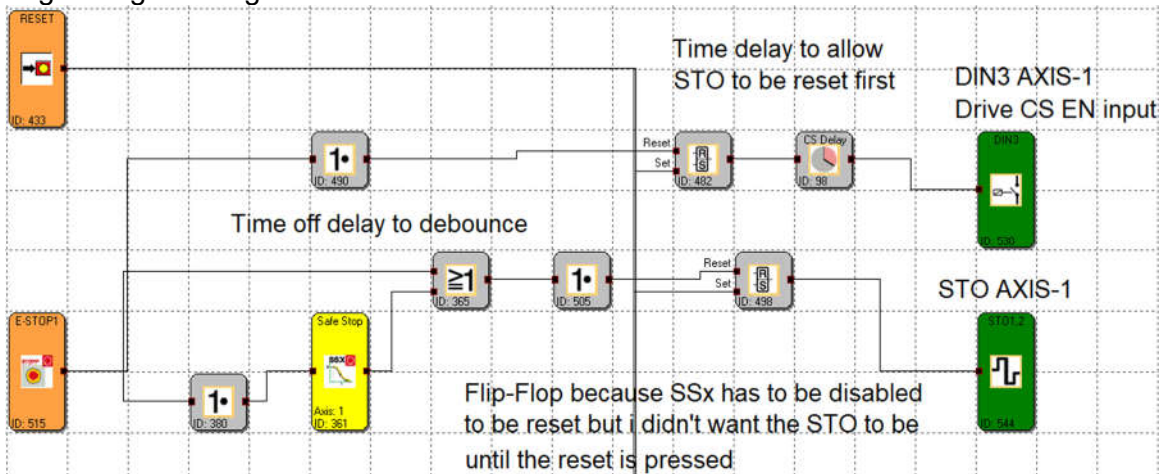
KOLLMORGEN

OK Cancel Help

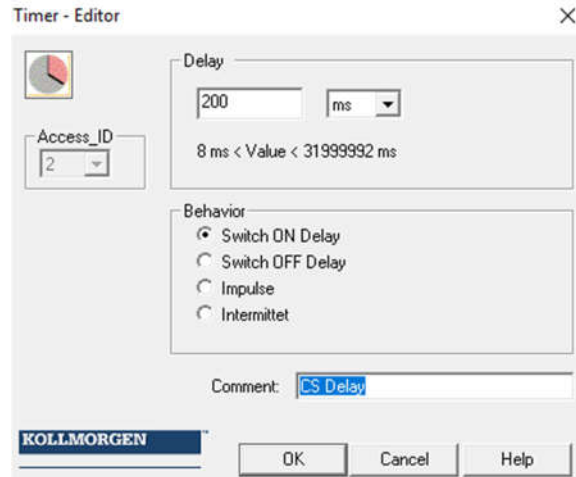
7. Output Program Configuration



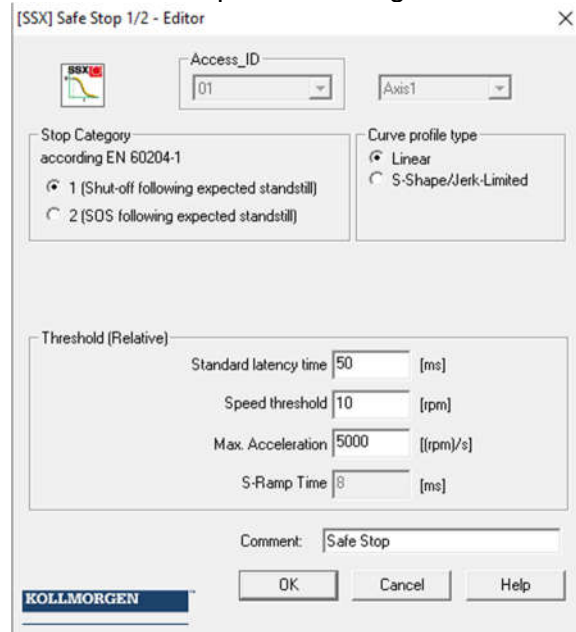
8. Logic Programming for one of the two axis



Timer configuration



Safe Stop Block Configuration

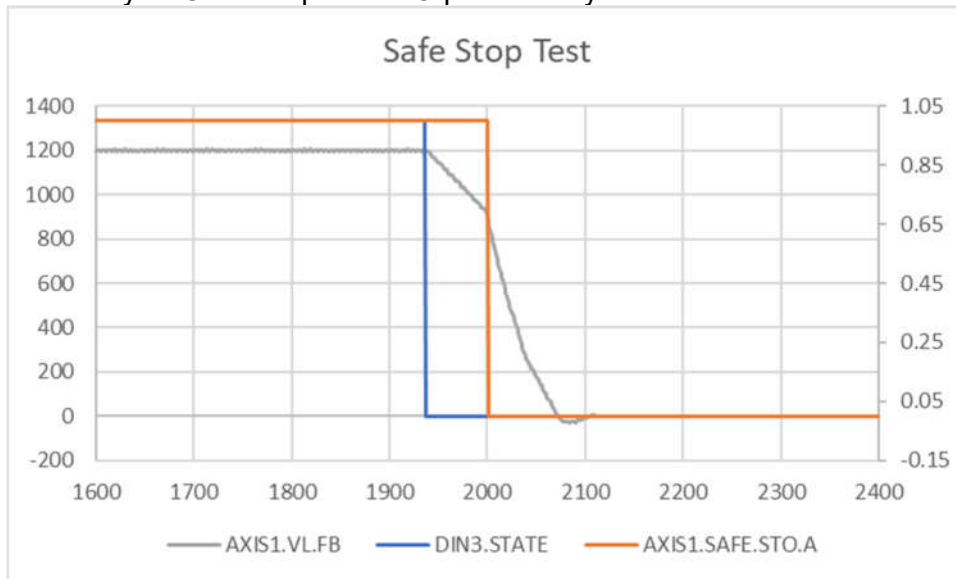


9. Testing using Workbench Scope

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 $\frac{1}{2}$ 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.