Setup IndraDrive SMO for Only STO with Safe Stop 1

Version 04

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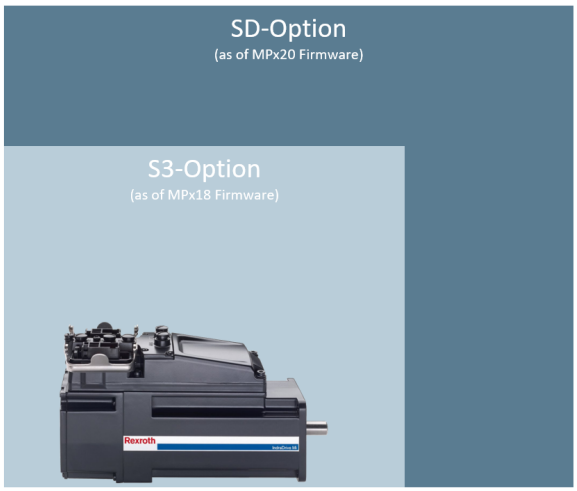
1 Introduction

The purpose of the document is to demonstrate how to configure an IndraDrive with the SafeMotion (SMO) option using only the Safe Torque Off (STO) function with Safe Stop 1 (SS1)/Category 1 Stop and no other SafeMotion functions.

2 Hardware, firmware, software, and documents

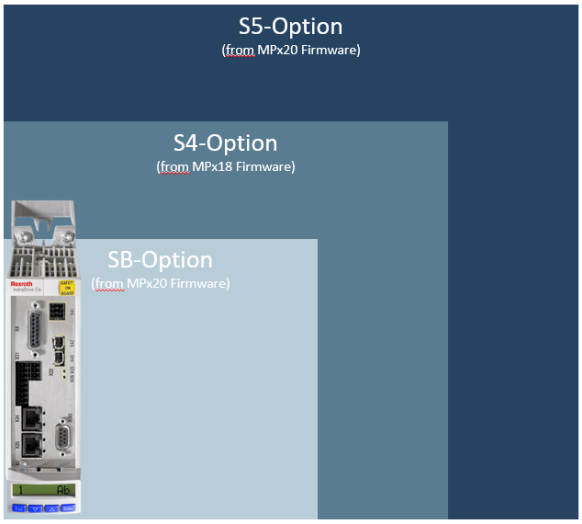
Description
IndraDrive Cs, C, M, Mi, or ML with control unit platform Cxx02 and safety technology S3, S4, S5, SB, or SD



S3/SD – Option (all variants)
- Selection via Safe Bus Communication
  - CIP Safety on Sercos (as of MPx20V02 Firmware)
  - FailSafe over EtherCAT (as of MPx20V04 Firmware)
  - PROFIsafe on PROFINET (as of MPx20V13 Firmware)
  - CIP Safety on Ethernet/IP (as of MPx21V04 Firmware)

SD-Option
- **Supports Safe Brake Control (SBC)**
- **No selection of safety functions via HSZ Safety Zone Module**

S3-Option
- **No Safe Brake Control (SBC) functionality**
- **No selection of safety functions via HSZ Safety Zone Module**



S4/S5/SB – Option (all variants)
- Selection via Safe Bus Communication
  - CIP Safety on Sercos (as of MPx20V02 Firmware)
  - FailSafe over EtherCAT (as of MPx20V04 Firmware)
  - PROFIsafe on PROFINET (as of MPx20V13 Firmware)
  - CIP Safety on Ethernet/IP (as of MPx21V04 Firmware)

S5-Option
- Selection via HSZ Safety Zone Module
- Local safety input/output
- **Supports Resolver Encoder**

S4-Option
- Selection via HSZ Safety Zone Module
- Local safety input/output
- **No Support for Resolver Encoder**

SB-Option
- **No selection of safety functions via HSZ Safety Zone Module**
- **No local safety input/output**
- **Supports Resolver Encoder**

2.1.1 Firmware

Description
FWA-INDRV*-**MPx-20VRS**-D5-1-xxx-xx or FWA-INDRV*-**MPx-21VRS**-D5-1-xxx-xx

2.1.2 Software

Description
SWA-IWORKS-DS*-15VRS-D0-DVD**-COPY

2.1.3 Applicable Documents

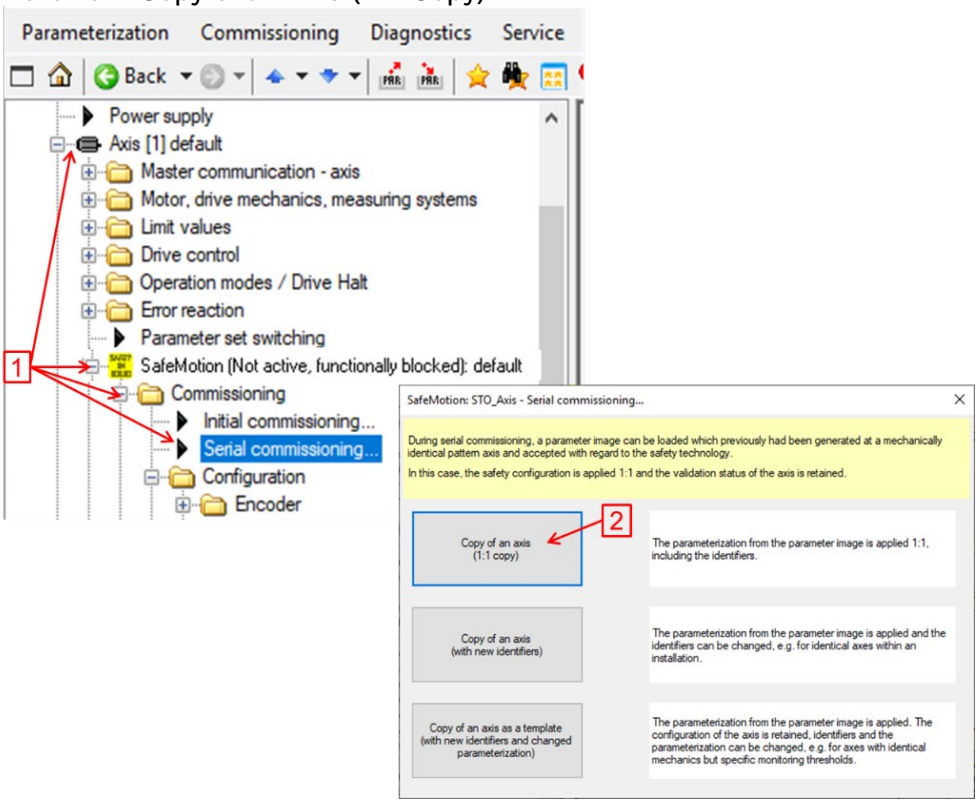
Manufacturer	Description	Material No.	Link
Bosch Rexroth	Rexroth IndraDrive Integrated Safety technology "Safe Motion" (as of MPx-18)	R911338920	
	MPx21 Functions	R911385758	
	MPx20 Functions	R911345608	
	Parameter Description	R911328651	
	Information on troubleshooting	R911326738	
	IndraDrive Ethernet/IP Communications with Allen-Bradley PLC AOIs Website		

3 Bosch Rexroth IndraDrive STO Commissioning

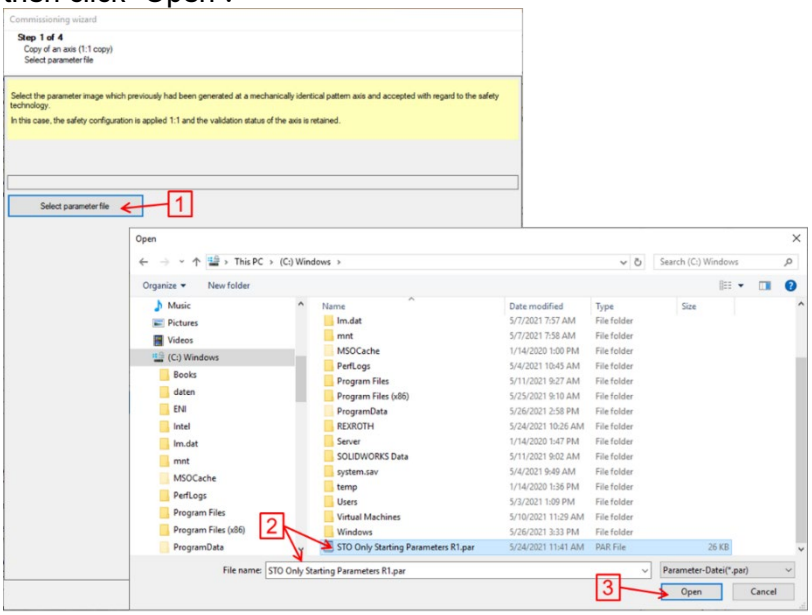
3.1.1 General IndraDrive STO configuration

- Connect to IndraDrive with IndraWorks.
- Save or drag and drop the parameter file (STO Only Starting Parameters R1.par) attached to this document to a known location on the PC (i.e. Desktop):

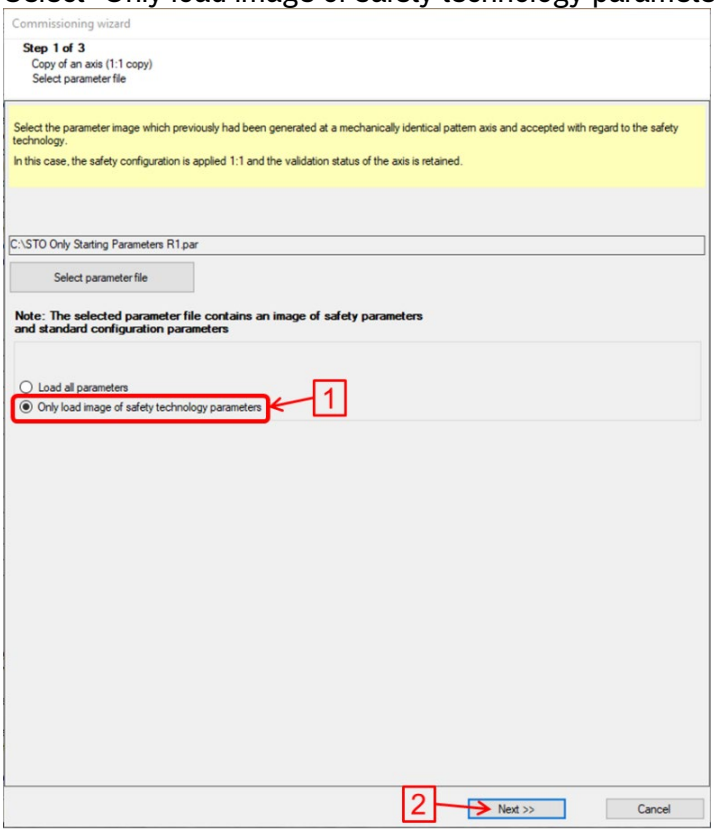
1. Expand Axis [1] default\SafeMotion [Not active, functionally blocked]: default\Commissioning then double click “Serial commissioning…”
2. Then click on “Copy of an Axis (1:1 Copy)”:



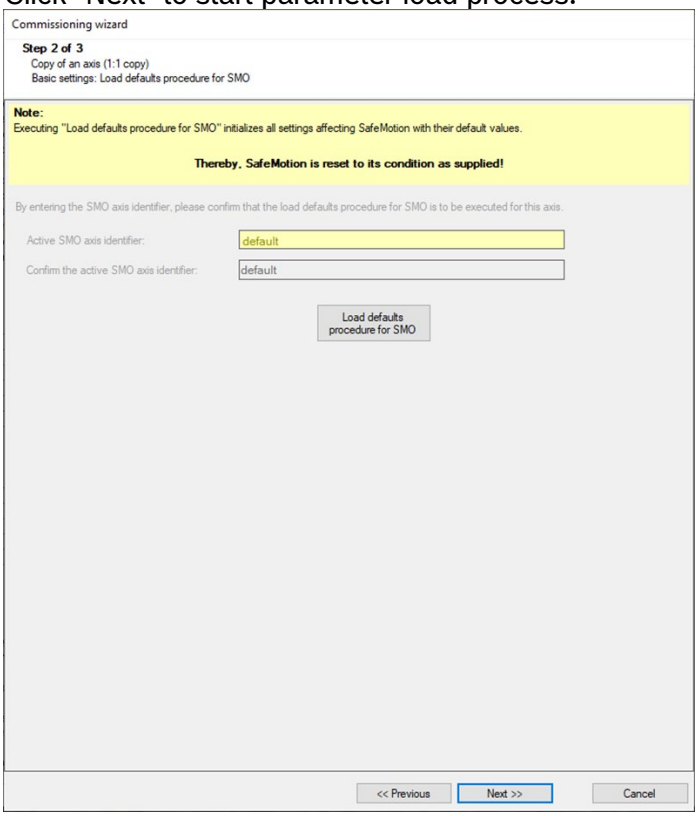
a. Click “Select parameter file”, select file “STO Only Starting Parameters R1.par” then click “Open”:



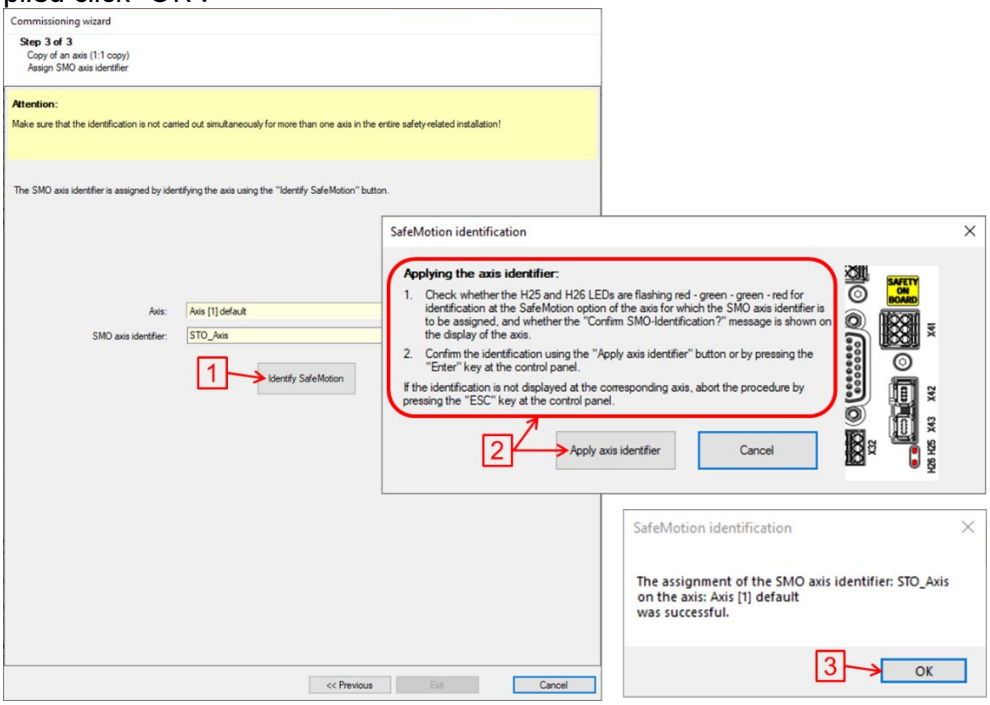
b. Select “Only load image of safety technology parameters” then click “Next”:



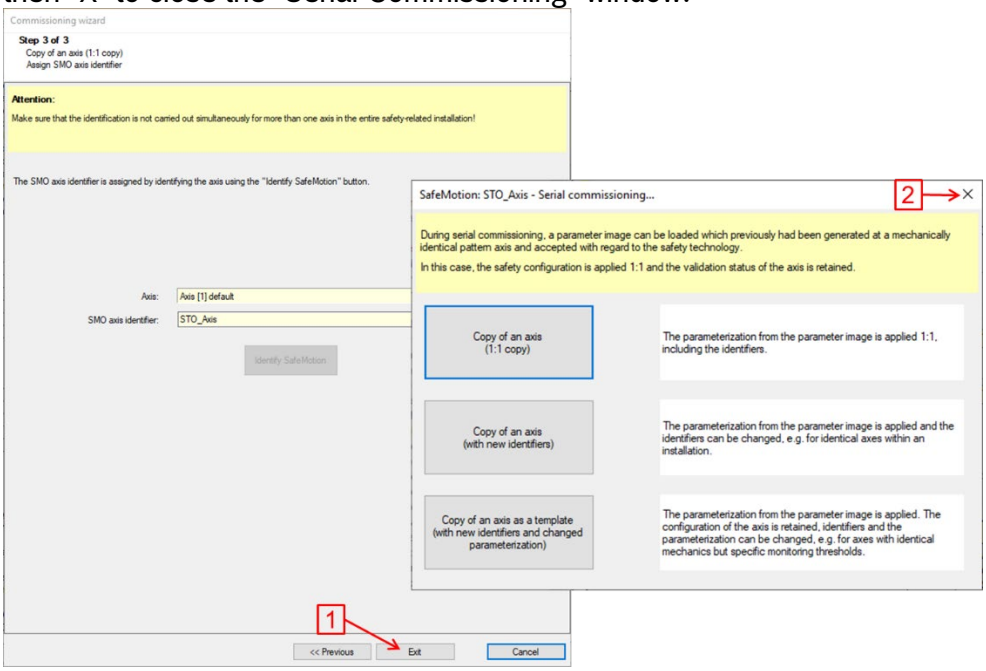
c. Click “Next” to start parameter load process:



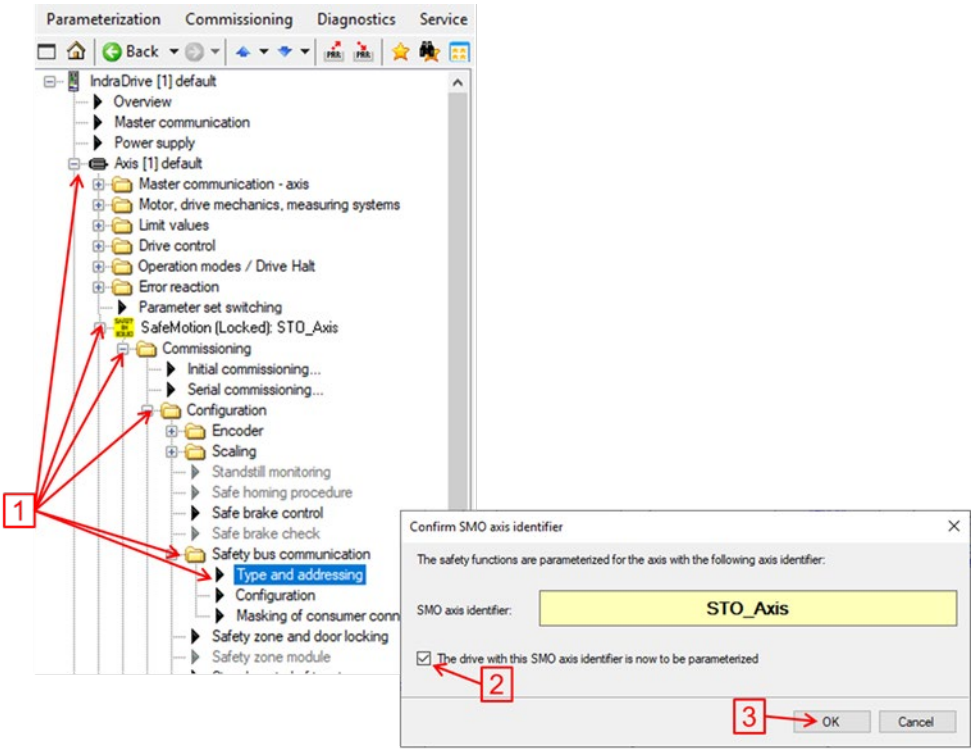
d. After the file (parameters) are done loading click the “Identify SafeMotion” button. Follow the instructions to ensure the parameters were loaded to the correct axis then click “Apply Axis Identifier”. After the SMO axis identifier is applied click “OK”:



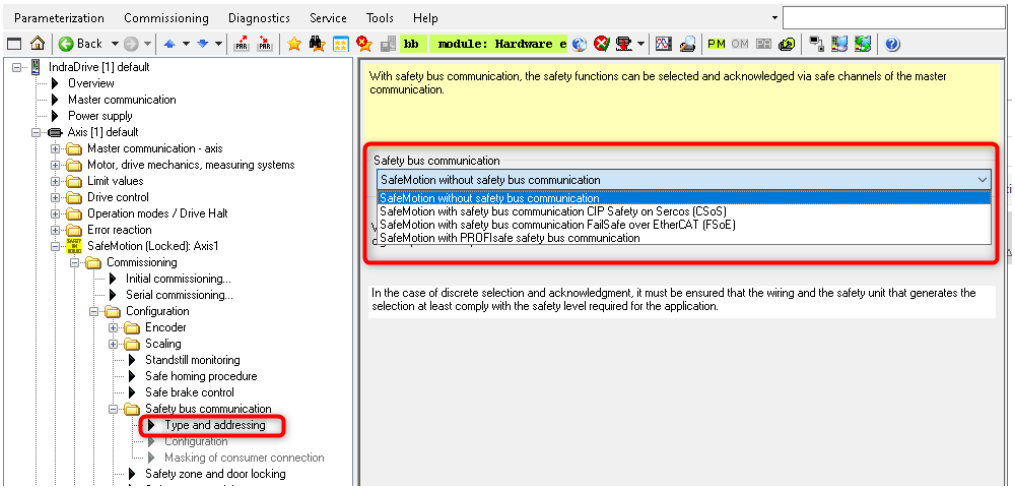
e. The serial commissioning load parameters process is completed, click “Exit” then “X” to close the “Serial Commissioning” window:



f. Expand Axis [1] default\SafeMotion (Locked): STO_Axis\Commissioning\Configuration\Safety bus communication then double click “Type and addressing”. Click the checkbox to confirm this is the axis to be parameterized then click “OK”:

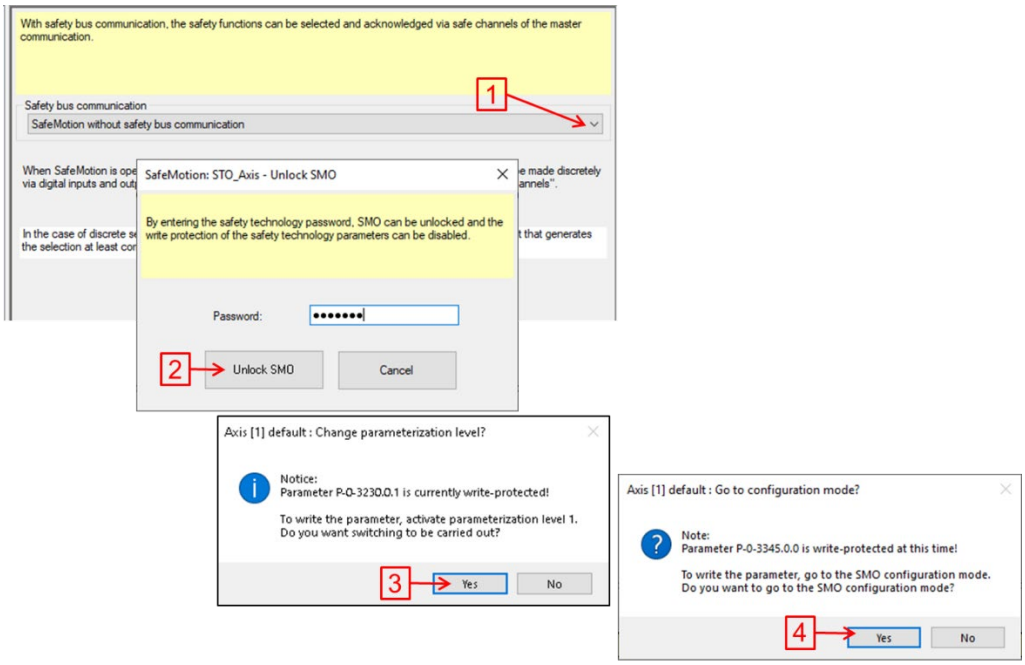


g. Use the pull-down menu to select the desired safety bus communication protocol:



When changing the safety bus communication protocol, you will be prompted for the SMO Password. Enter “Rexroth” then click on “Unlock SMO” then click “Yes” on the two popup windows to enter parameterization level 1 and SMO configuration mode (SCM).

The Target UNID or slave address for all safety bus communications are assigned in three steps:
1. Enter the Target UNID or address then click on “Write”
2. Verify the Target UNID or address then click on “Apply”
3. Click on “Confirm Target UNID\Address” button

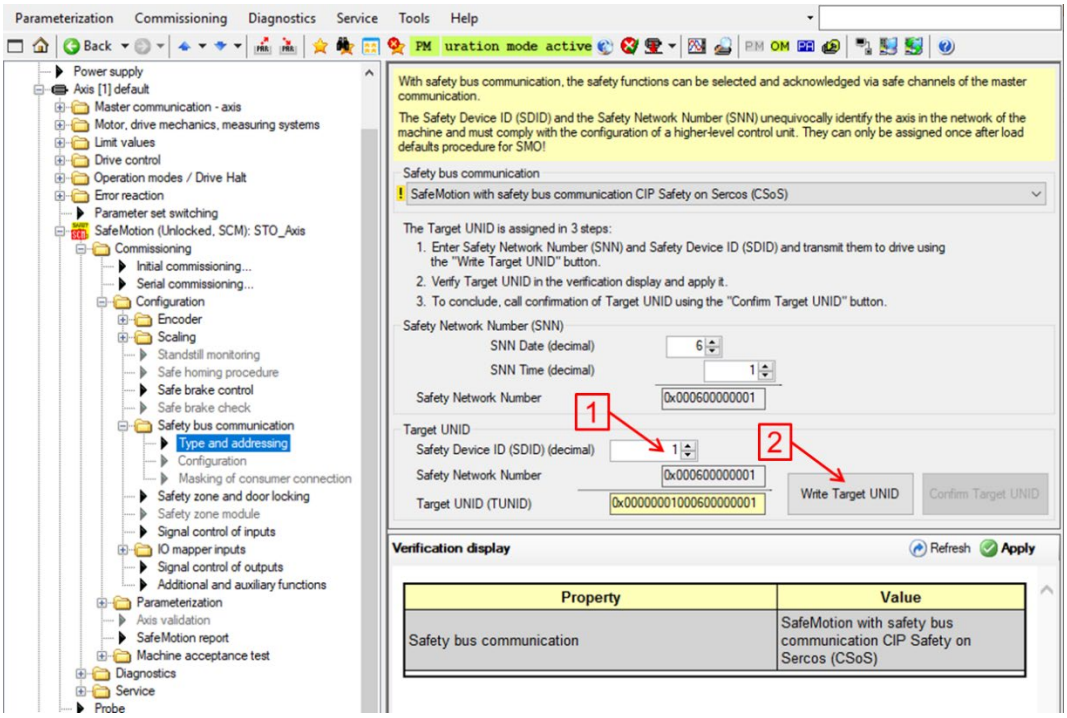


NOTE

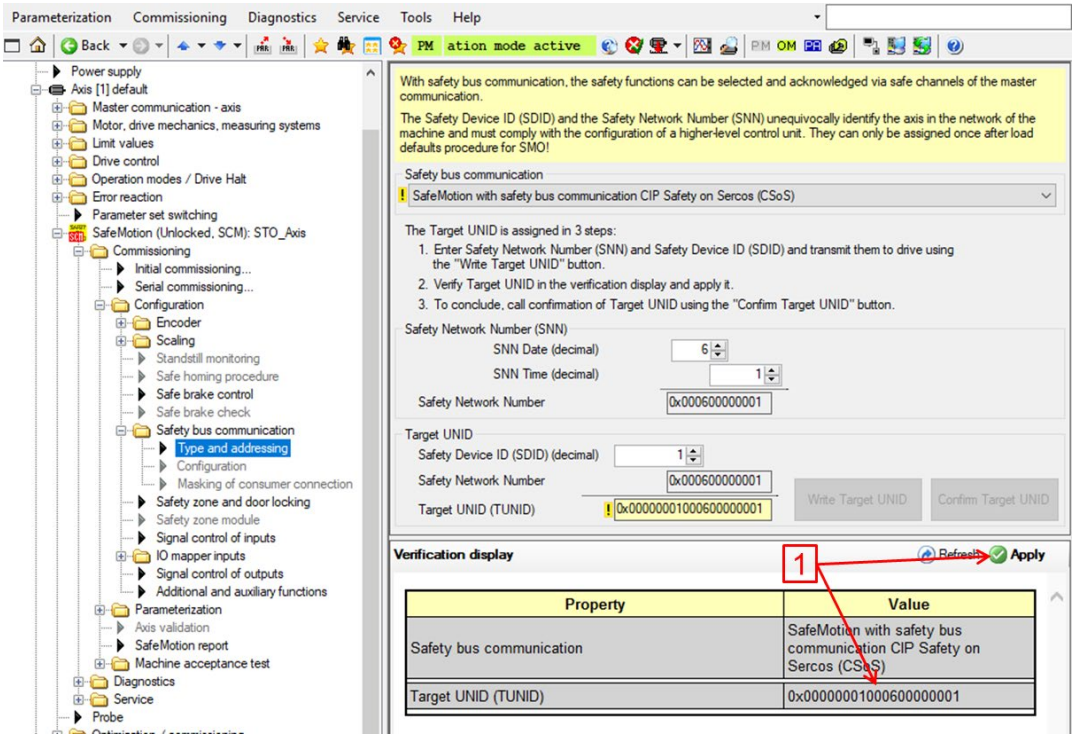
The following examples are shown for all the safety bus communication protocols, HSZ Zone Module, and Local I/O X41: CIP Safety on Sercos (CSoS), FailSafe over EtherCAT (FSoE), PROFIsafe, and CIP Safety on EtherNet/IP (CSoE). Please follow the setup for the safety bus communication protocol for your application. CSoE and Local I/O X41 are only available with firmware MPx21.

3.1.2 CIP Safety on Sercos (CSoS) Configuration

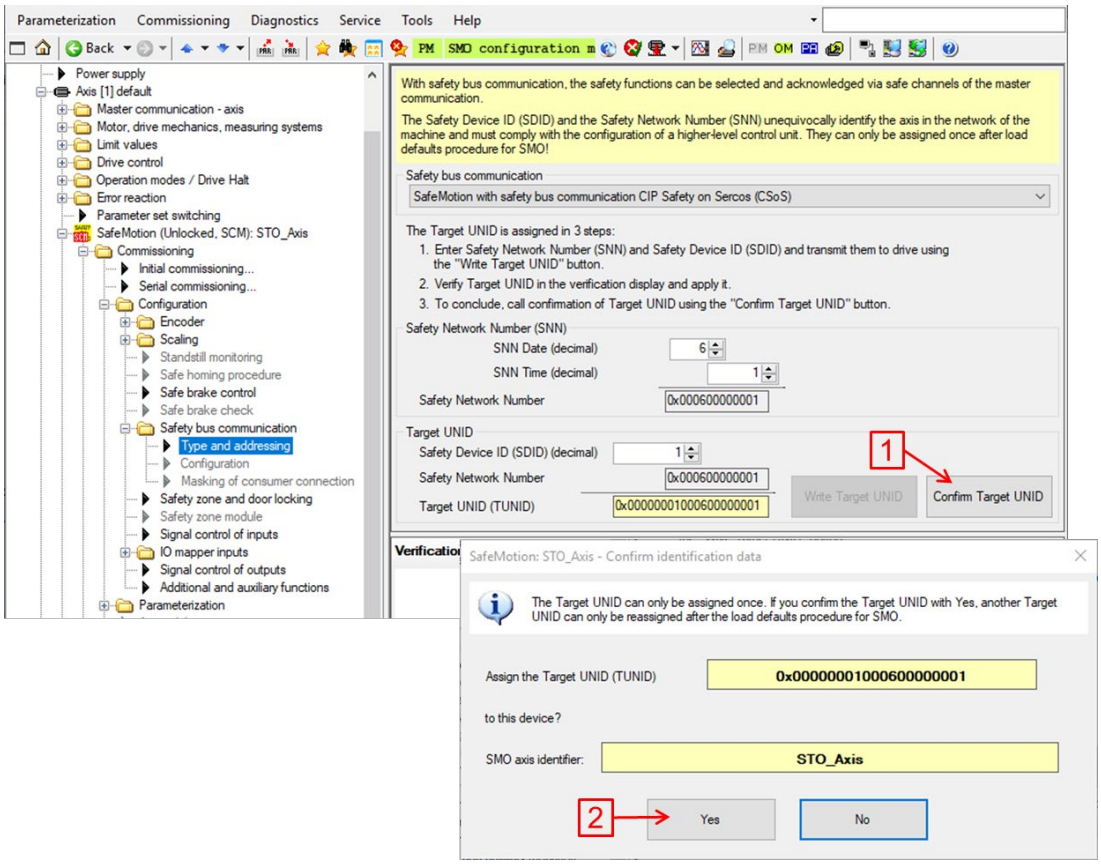
1. Enter the desired “Safety Device ID (SDID)” then click “Write Target UNID” button:



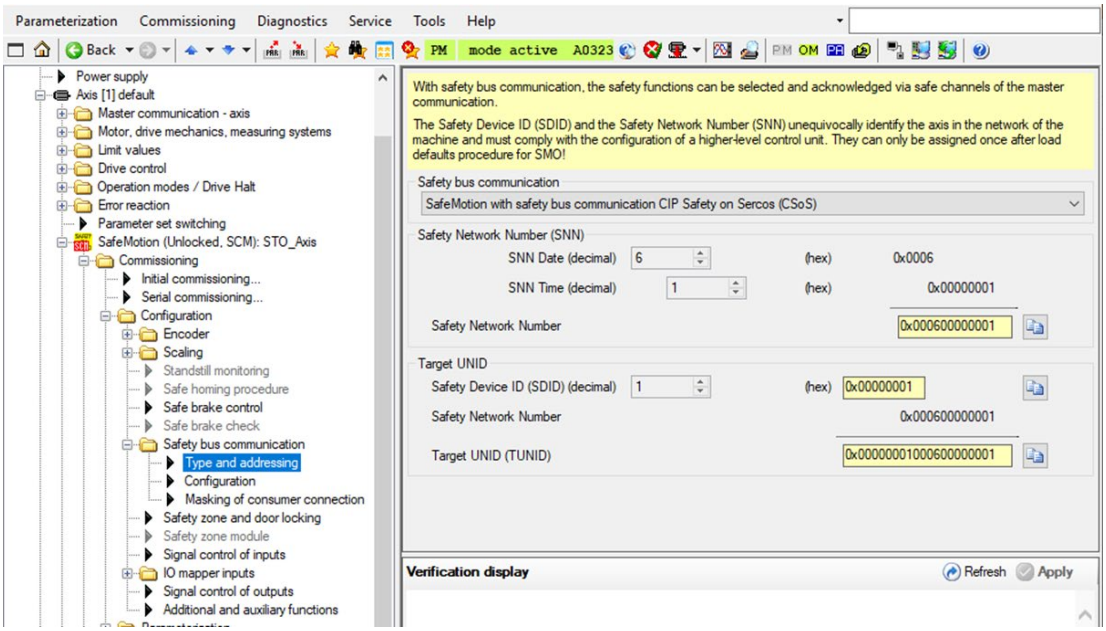
2. The “Write Target UNID” button is now greyed out. Confirm the “Target UNID (TUNID)” value is correct in the “Verification display” area then click “Apply”:



3. The “Confirm Target UNID” button is now active. Click the “Confirm Target UNID” button then click “Yes” to assign\confirm the Target UNID for this axis:

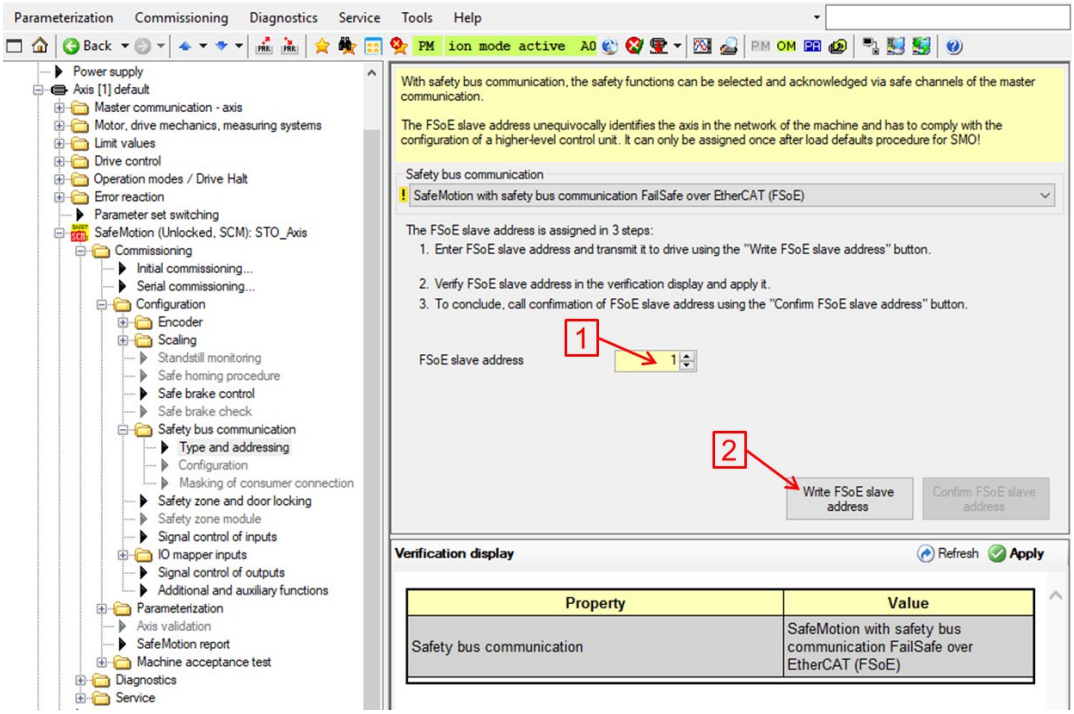


4. The CIP Safety on Sercos (CSoS) Target UNID is completed:

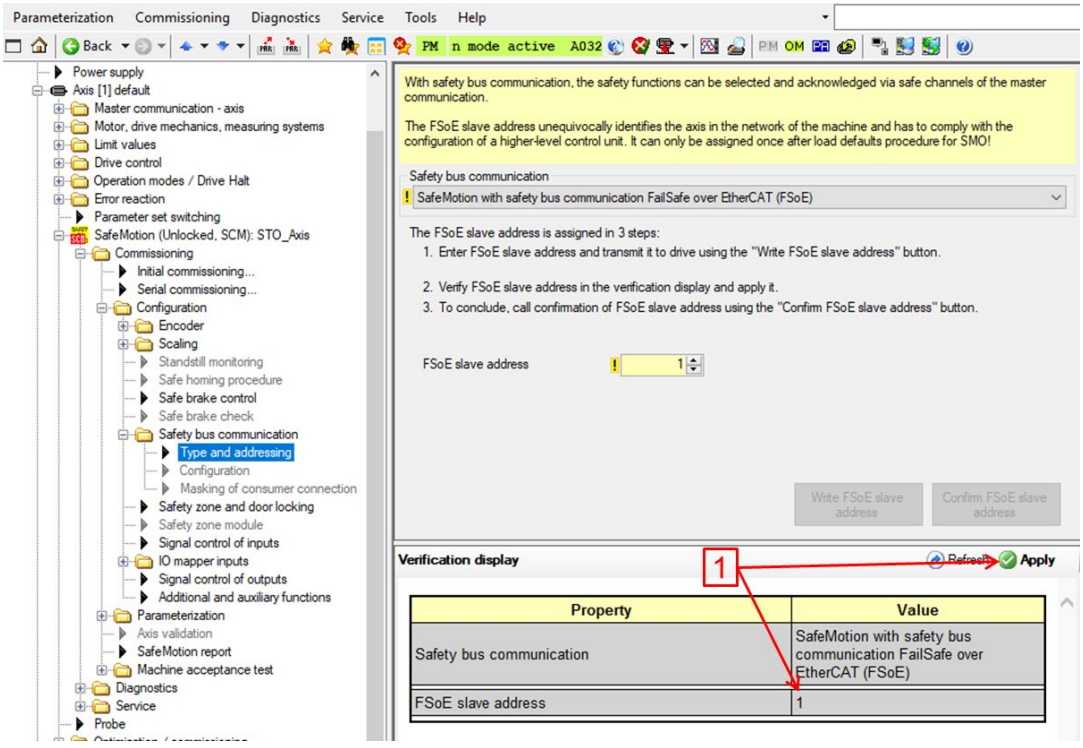


3.1.3 FailSafe over EtherCAT (FSoE) Configuration

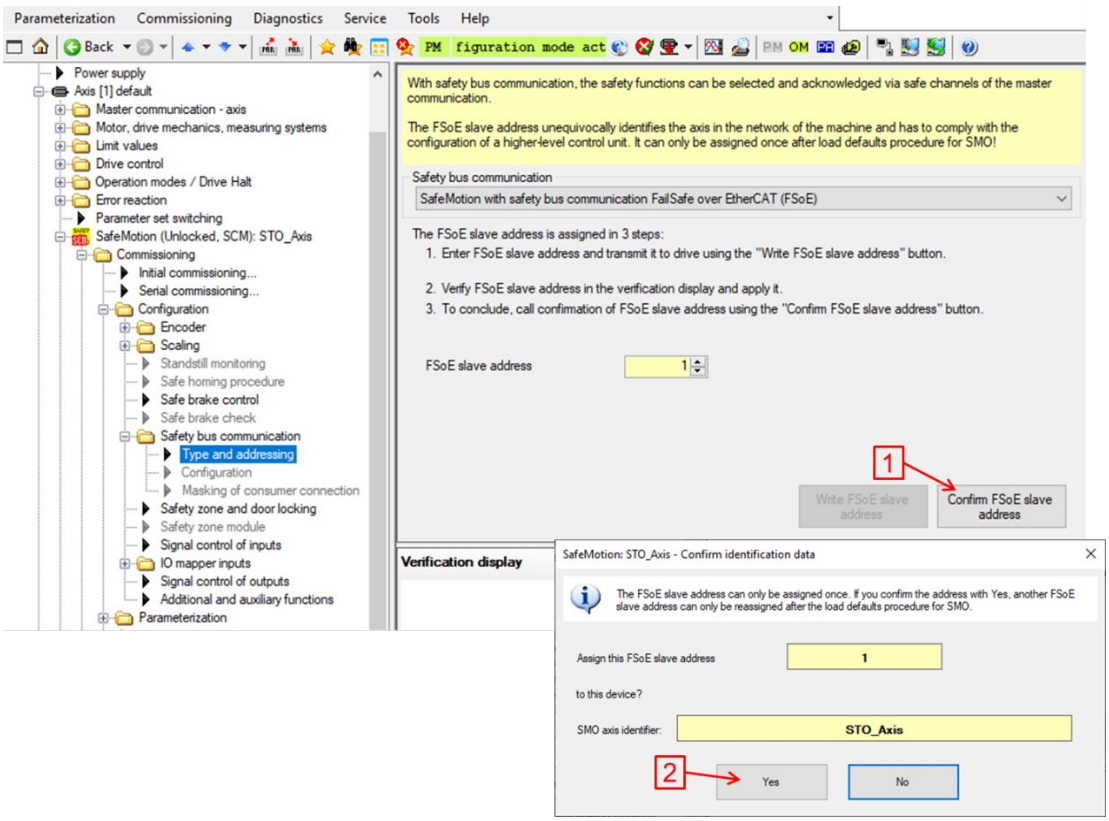
1. Enter the desired “FSoE slave address” then click “Write FSoE slave address” button:



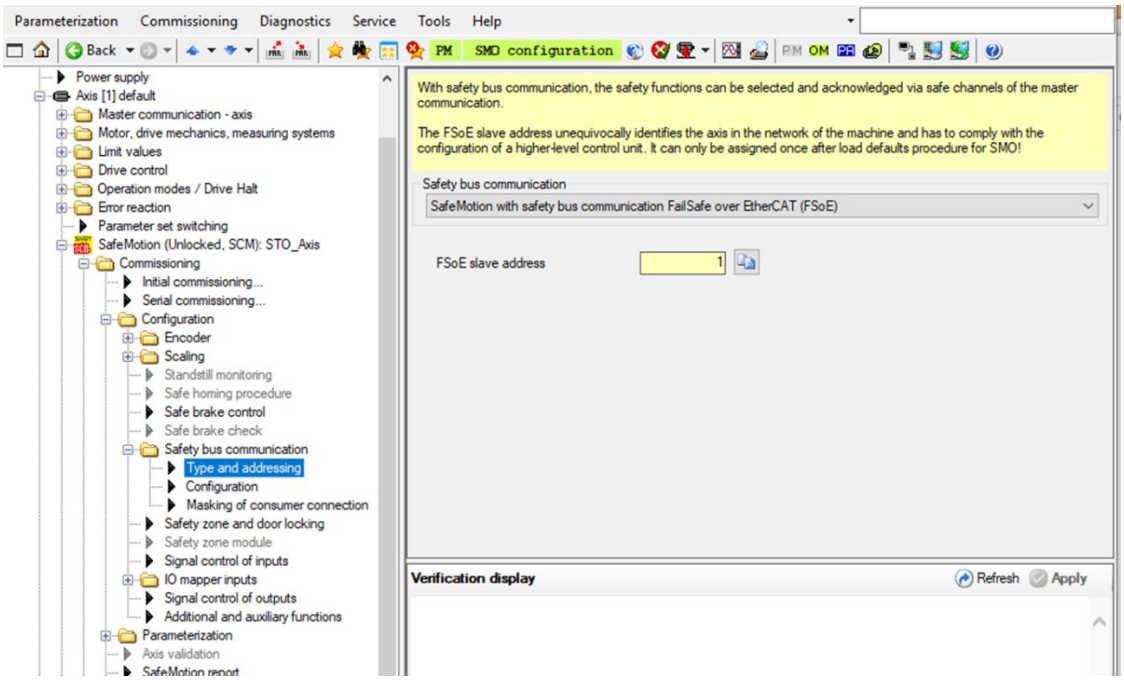
2. The “Write FSoE slave address” button is now greyed out. Confirm the “FSoE slave address” value is correct in the “Verification display” area then click “Apply”:



3. The “Confirm FSoE slave address” button is now active. Click the “Confirm FSoE slave address” button then click “Yes” to assign\confirm the FSoE slave address for this axis:

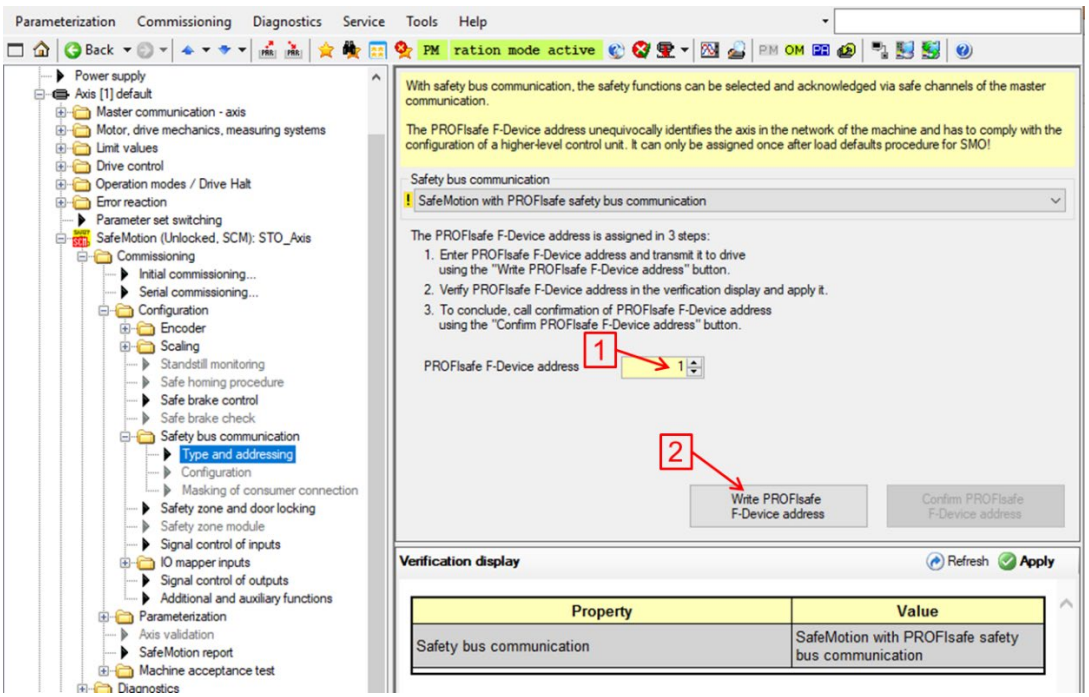


4. The FailSafe over EtherCAT (FSoE) slave address is completed:

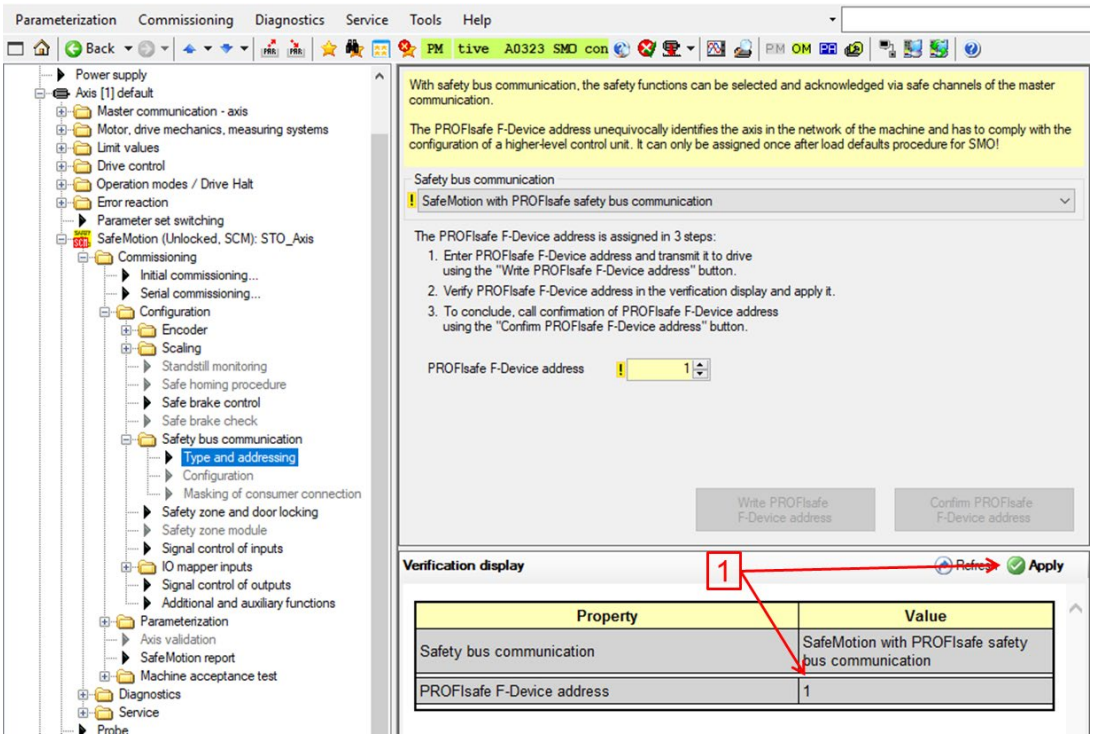


3.1.4 PROFIsafe over PROFINET Configuration

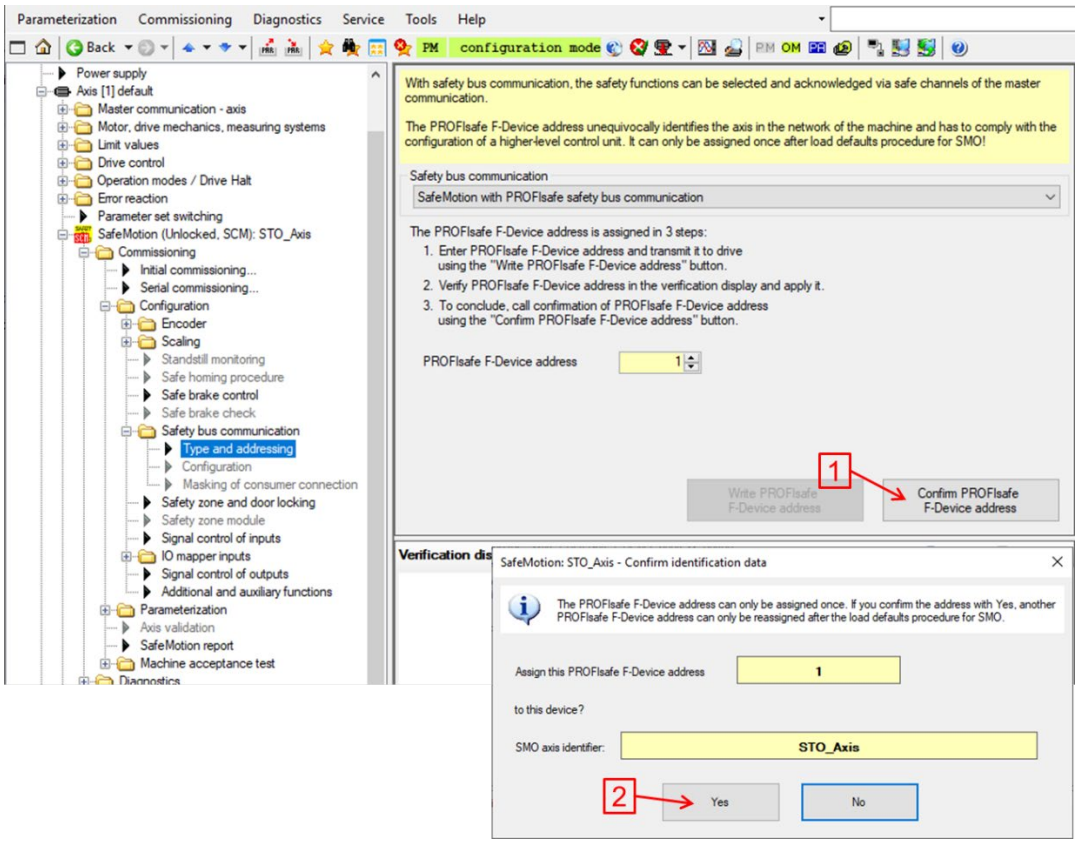
1. Enter the desired “PROFIsafe F-Device address” then click “Write PROFIsafe F-Device address” button:



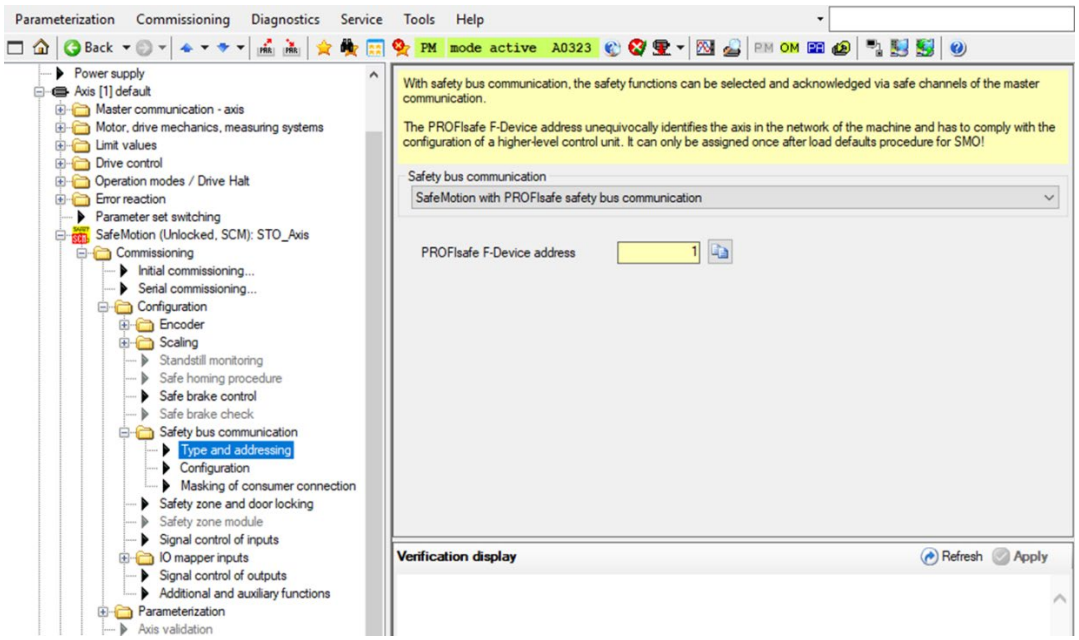
2. The “Write PROFIsafe F-Device address” button is now greyed out. Confirm the “PROFIsafe F-Device address” value is correct in the “Verification display” area then click “Apply”:



3. The “Confirm PROFIsafe F-Device address” button is now active. Click the “Confirm PROFIsafe F-Device address” button then click “Yes” to assign\confirm the PROFIsafe F-Device address for this axis:



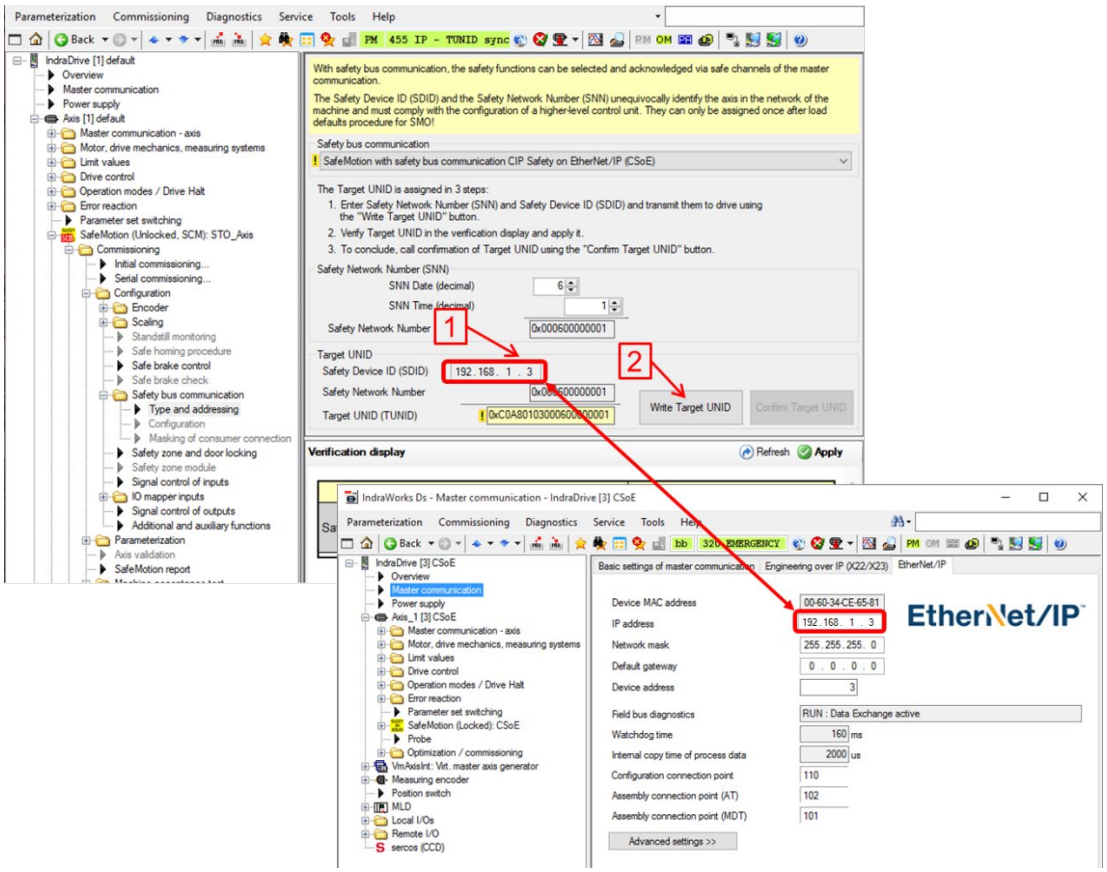
4. The PROFIsafe F-Device address is completed:



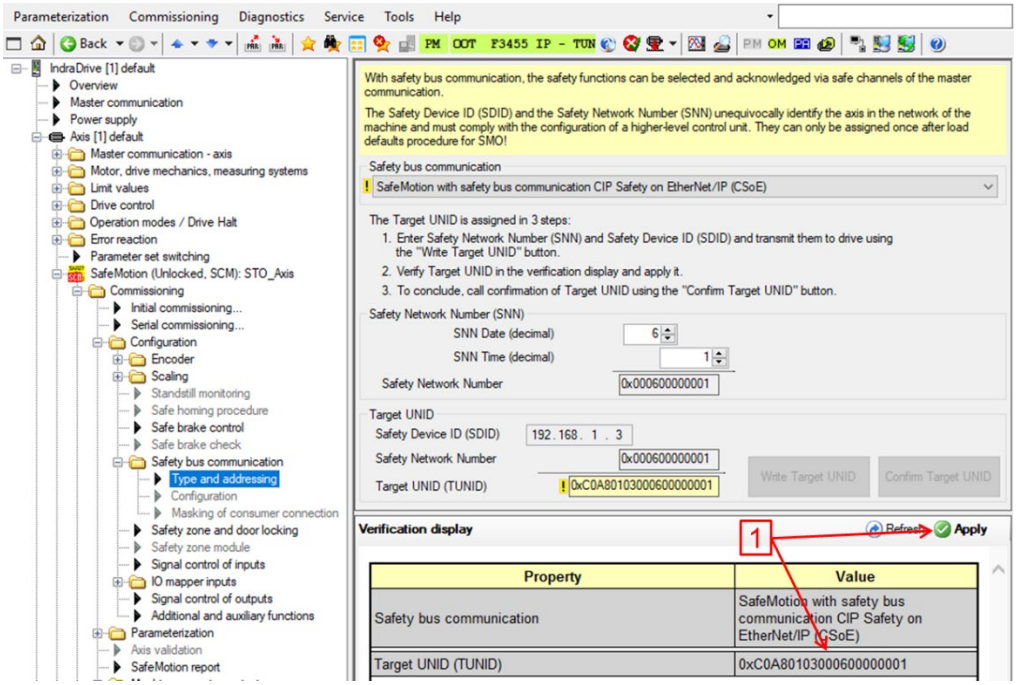
3.1.5 CIP Safety over EtherNet/IP (CSoE) Configuration

NOTE
MPx21 firmware must be used for CIP Safety on EtherNet/IP (CSoE) selection.

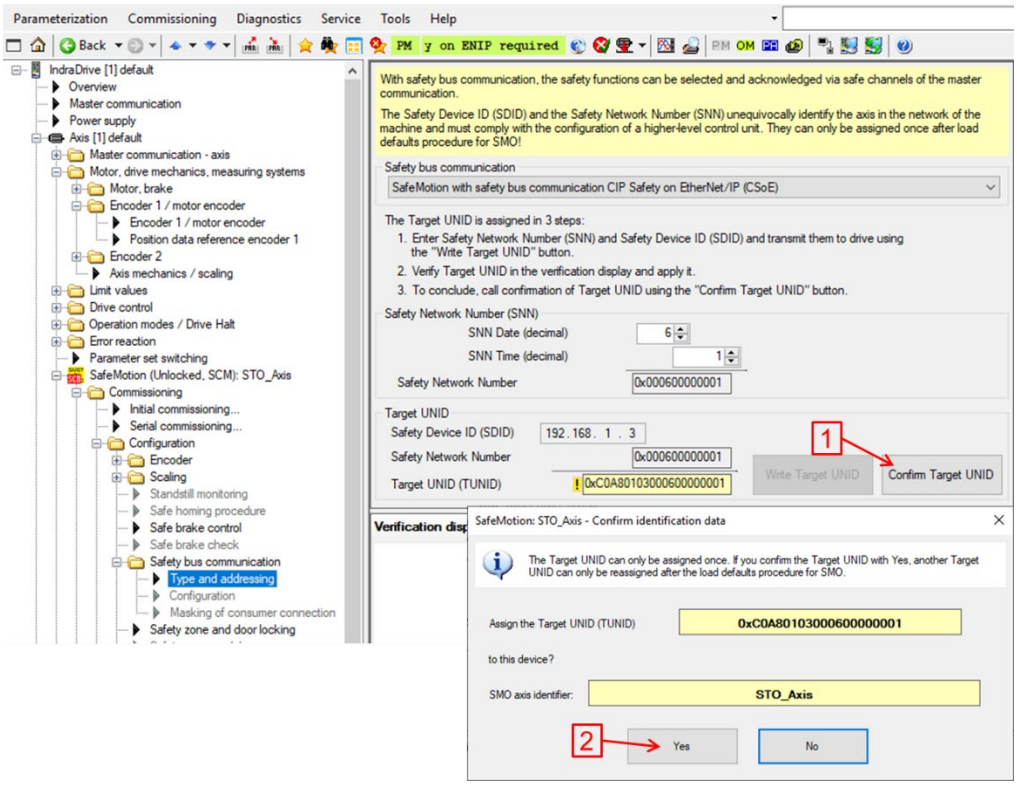
1. The “Safety Device ID (SDID)” should be automatically copied from the “Master communication” screen. These values must match, do not change the “Safety Device ID (SDID)” on this screen. Click the “Write Target UNID” button:



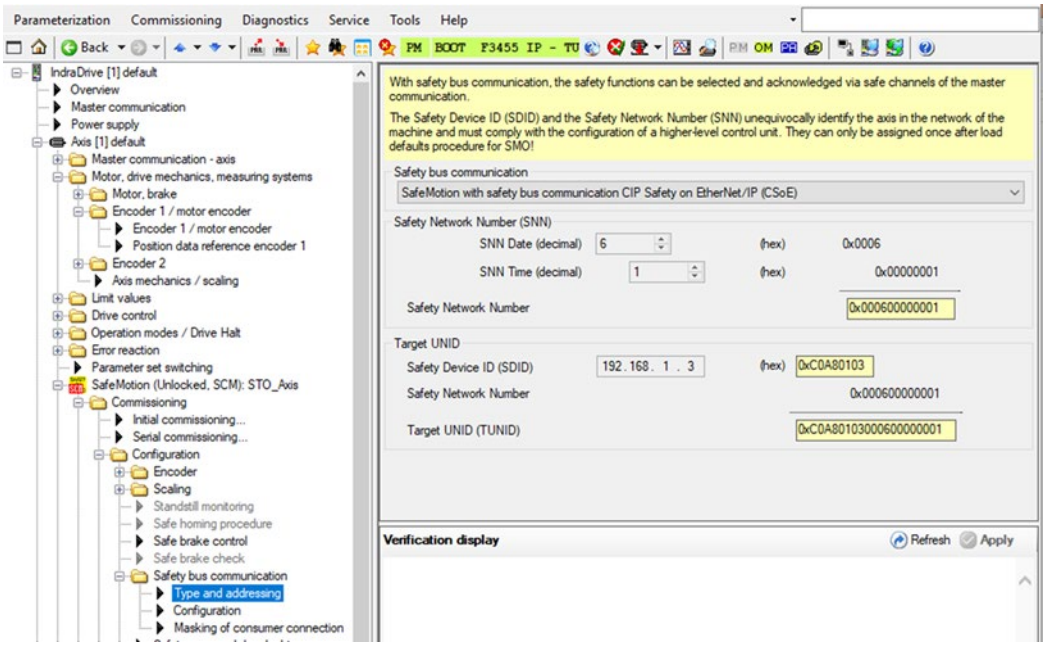
2. The “Write Target UNID” button is now greyed out. Confirm the “Target UNID (TUNID)” value is correct in the “Verification display” area then click “Apply”:



3. The “Confirm Target UNID” button is now active. Click the “Confirm Target UNID” button then click “Yes” to assign\confirm the Target UNID for this axis:



4. The CIP Safety on EtherNet/IP (CSoE) Target UNID is completed:



3.1.6 Safety PLC Programming Example

The IndraDrive requires two signals to be set high (1) in the SMO Control Word from the safety PLC for normal operation:

Bit 0 Mode selection signal (MS) and Bit 1 Emergency stop signal (SMES)

In this example the Emergency stop signal (SMES) bit will be used to transition in or out of STO:

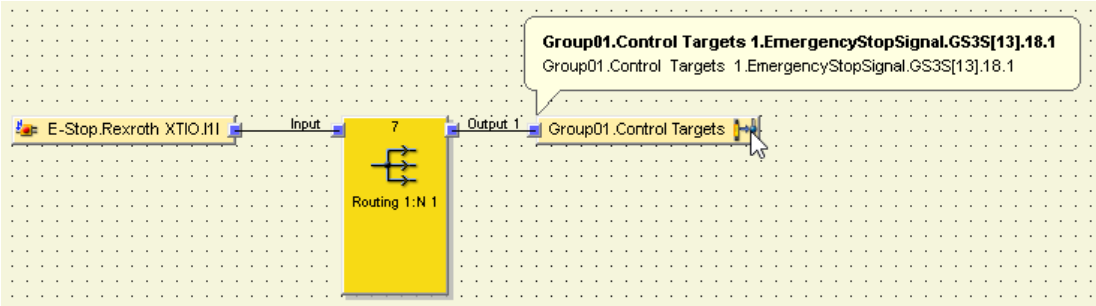
- Emergency stop signal (SMES) set to high (1) = normal operation
- Emergency stop signal (SMES) set to low (0) = STO
- The Mode selection signal (MS) will be set to high (1)

The SMO Status can be read in the safety PLC using the bits in the SMO Status Word:

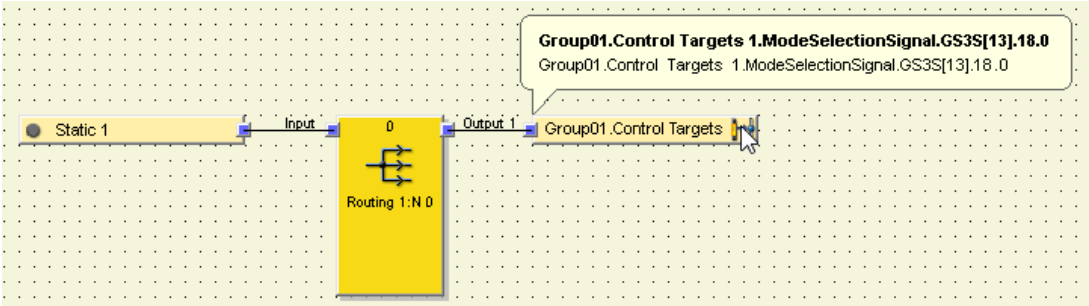
Type 3: "2-byte SMO control word, bit-coded SMM (780)"			
Configuration		Target assignment	
Bit	Name (SDDML)	IDN, bit number	Signal name
0	ModeSelectionSignal	P-0-3261, bit 0	Mode selection signal (MS)
1	EmergencyStopSignal	P-0-3261, bit 1	Emergency stop signal (SMES)
2	EnablingControl	P-0-3261, bit 2	Enabling control signal (EC)
3	SMM1Signal	P-0-3261, bit 3	SMM1 signal (A_SMM1)
4	SMM2Signal	P-0-3261, bit 4	SMM2 signal (A_SMM2)
5	SMM3Signal	P-0-3261, bit 5	SMM3 signal (A_SMM3)
6	SMM4Signal	P-0-3261, bit 6	SMM4 signal (A_SMM4)
7	SMM5Signal	P-0-3261, bit 7	SMM5 signal (A_SMM5)
8	SMM6Signal	P-0-3261, bit 8	SMM6 signal (A_SMM6)
9	SMM7Signal	P-0-3261, bit 9	SMM7 signal (A_SMM7)
10	SMM8Signal	P-0-3261, bit 10	SMM8 signal (A_SMM8)
11	SMM9Signal	P-0-3261, bit 11	SMM9 signal (A_SMM9)
12	SMM10Signal	P-0-3261, bit 12	SMM10 signal (A_SMM10)
13	SMM11Signal	P-0-3261, bit 13	SMM11 signal (A_SMM11)
14	SMM12Signal	P-0-3261, bit 14	SMM12 signal (A_SMM12)
15	SafeOutput_local	P-0-3323, bit 0	Safe output at local interface

Type 3: "2-byte SMO status word, bit-coded SMM (784)"			
Configuration		Source assignment	
Bit	Name (SDDML)	IDN, bit number	Signal name
0	SMESStatus	P-0-3231, bit 1	Emergency stop (SMES)
1	SMSTStatus	P-0-3231, bit 2	Special mode Safe standstill (SMST)
2	SMM1Status	P-0-3231, bit 3	Special mode Safe motion 1 (SMM1)
3	SMM2Status	P-0-3231, bit 4	Special mode Safe motion 2 (SMM2)
4	SMM3Status	P-0-3231, bit 5	Special mode Safe motion 3 (SMM3)
5	SMM4Status	P-0-3231, bit 6	Special mode Safe motion 4 (SMM4)
6	SMM5Status	P-0-3231, bit 7	Special mode Safe motion 5 (SMM5)
7	SMM6Status	P-0-3231, bit 8	Special mode Safe motion 6 (SMM6)
8	SMM7Status	P-0-3231, bit 9	Special mode Safe motion 7 (SMM7)
9	SMM8Status	P-0-3231, bit 10	Special mode Safe motion 8 (SMM8)
10	SMM9Status	P-0-3231, bit 11	Special mode Safe motion 9 (SMM9)
11	SMM10Status	P-0-3231, bit 12	Special mode Safe motion 10 (SMM10)
12	SMM11Status	P-0-3231, bit 13	Special mode Safe motion 11 (SMM11)
13	SMM12Status	P-0-3231, bit 14	Special mode Safe motion 12 (SMM12)
14	EncoderStandstill	P-0-3256, bit 6	Encoder standstill
15	SafetyStatus	P-0-3237, bit 0	Safety status

1. The “Emergency stop signal (ES)” is used as the safe out with the input pair wired input as the input selection:

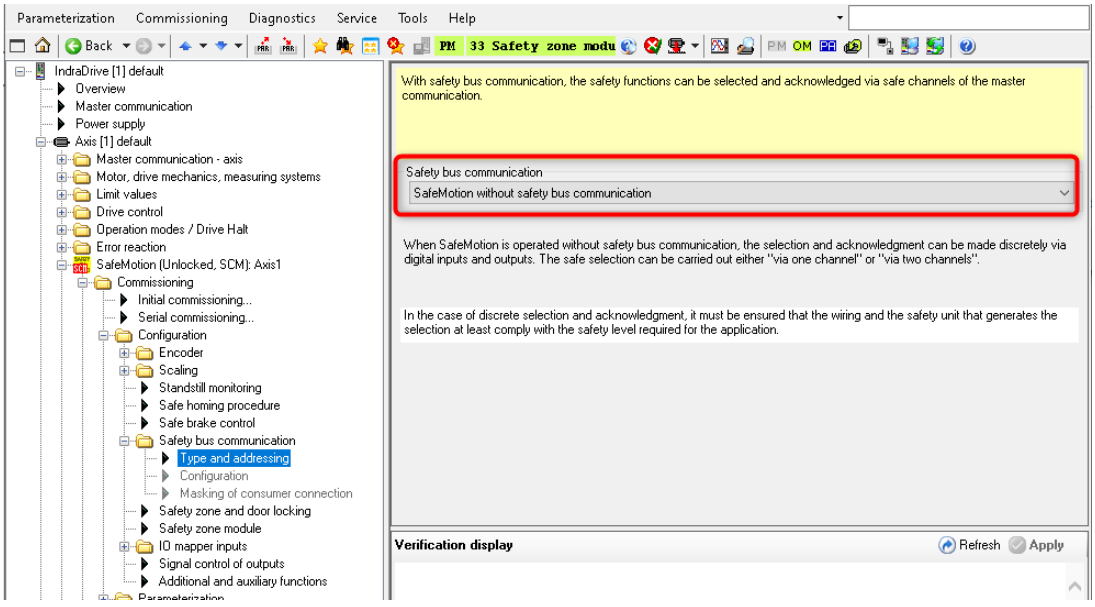


2. “Mode selection signal (MS)” is used as the safe out with a constant or static high (1) input signal:

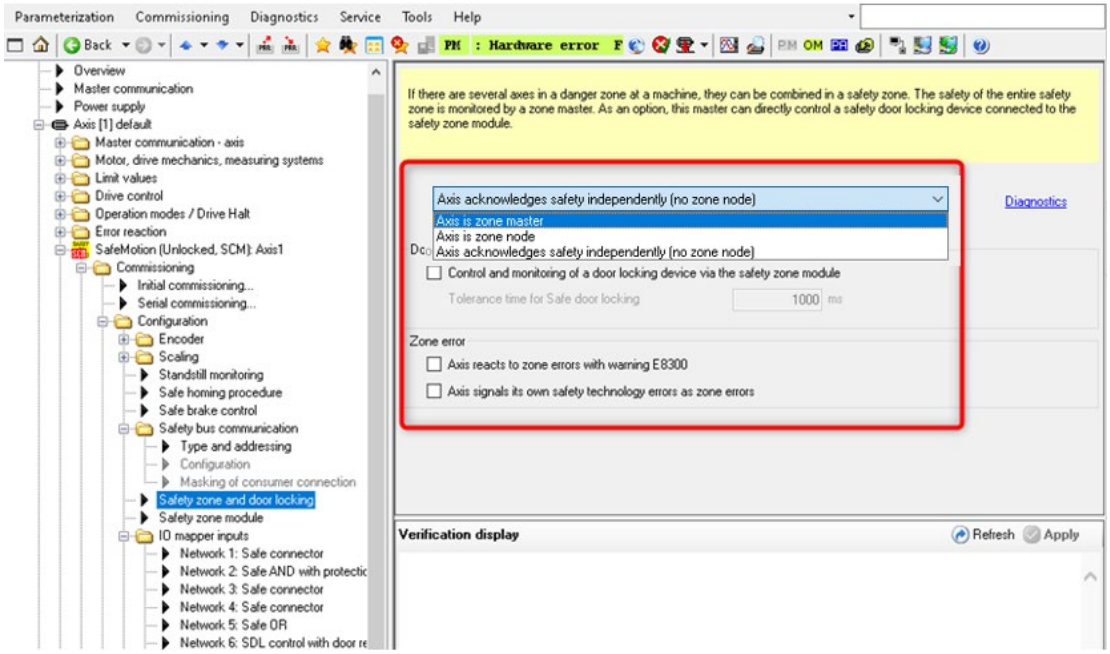


3.1.7 HSZ Zone Module

1. Select “SafeMotion without safety bus communication”:



2. Open “Safety zone and door locking” then select “Axis is zone master” or “Axis is zone node” depending on where the axis is in the zone network, configure other options for your application:



3.1.7.1 Programming Example Using I/O Mapper with HSZ Zone Module

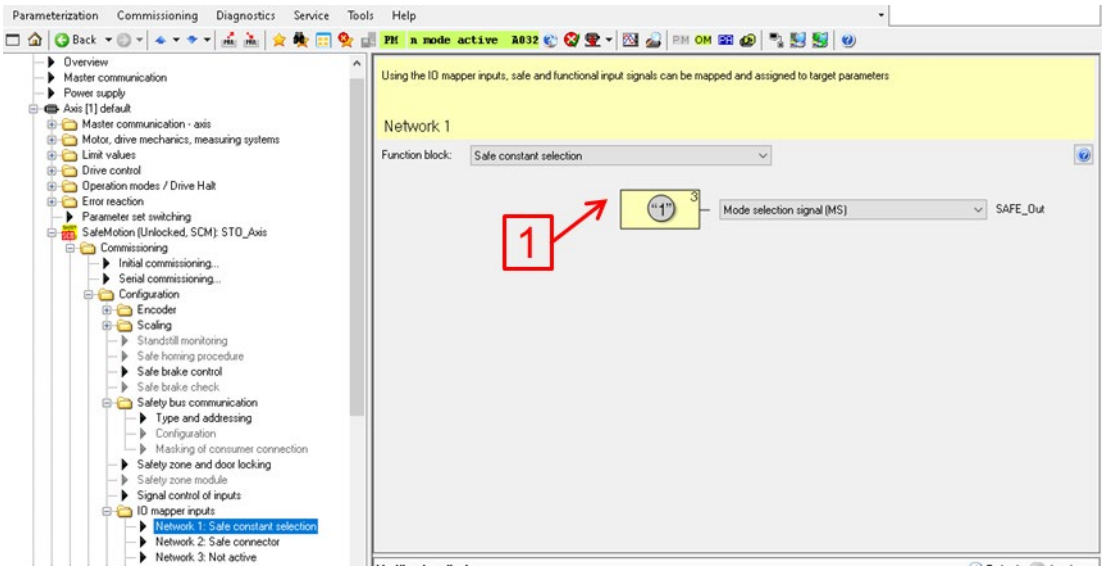
The IndraDrive requires two signals to be set high (1) in the SMO Control Word from I/O Mapper for normal operation:

Bit 0 Mode selection signal (MS) and Bit 1 Emergency stop signal (SMES)

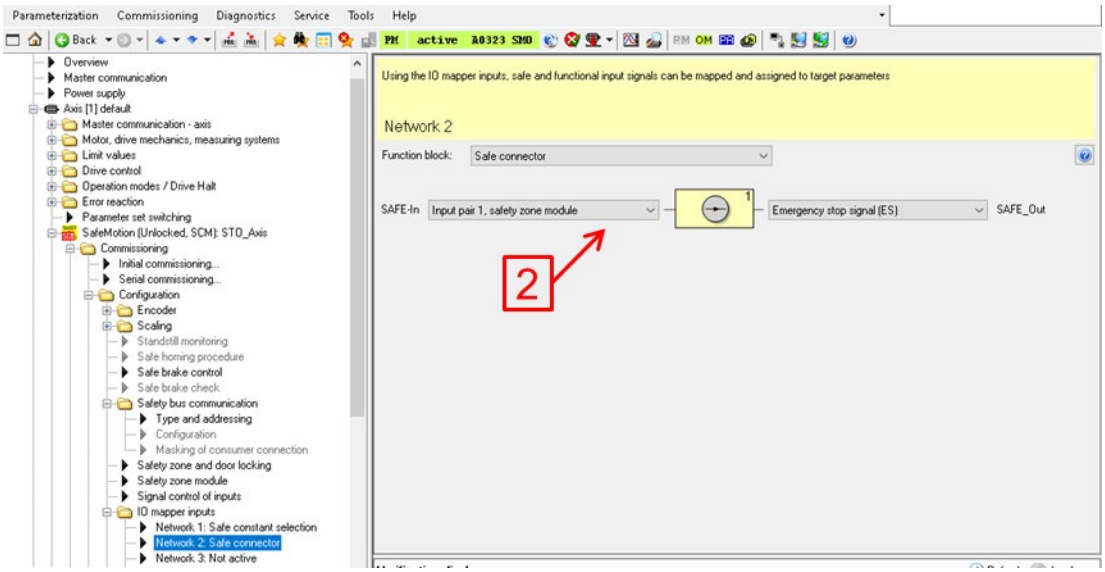
In this example the Emergency stop signal (SMES) bit will be used to transition in or out of STO:

- Emergency stop signal (SMES) set to high (1) = normal operation
- Emergency stop signal (SMES) set to low (0) = STO
- The Mode selection signal (MS) will be set to high (1)

1. Network 1 is used to select the Function Block “Safe constant selection” with “Mode selection signal (MS)” as the safe out:



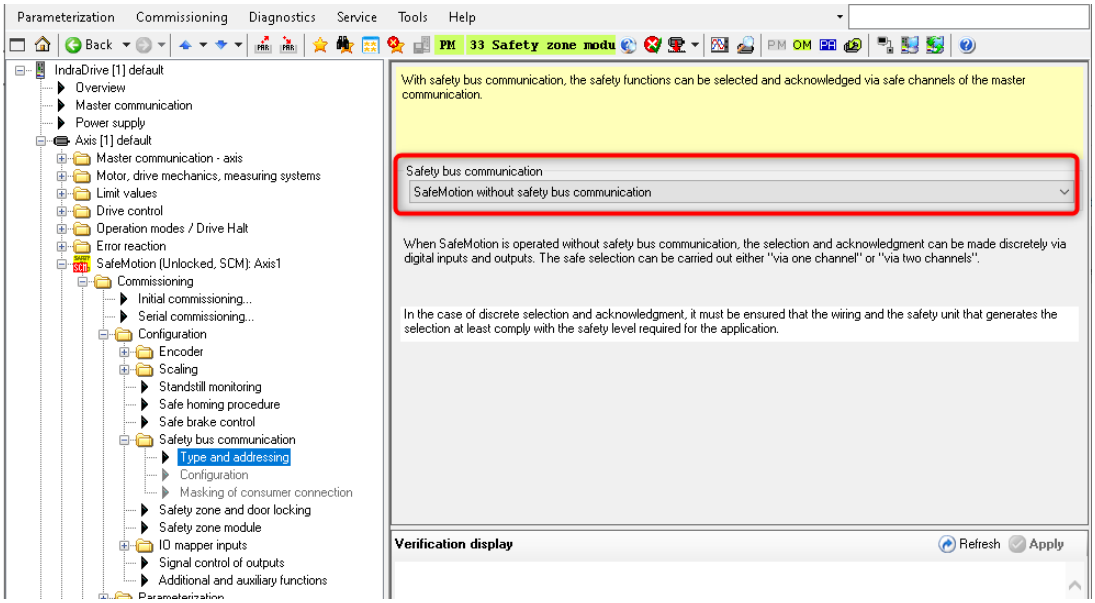
2. Network 2 is used to select the Function Block “Safe connector” with “Emergency stop signal (ES)” as the safe out. The input pair wired to the HSZ Zone Module is used for the safe in:



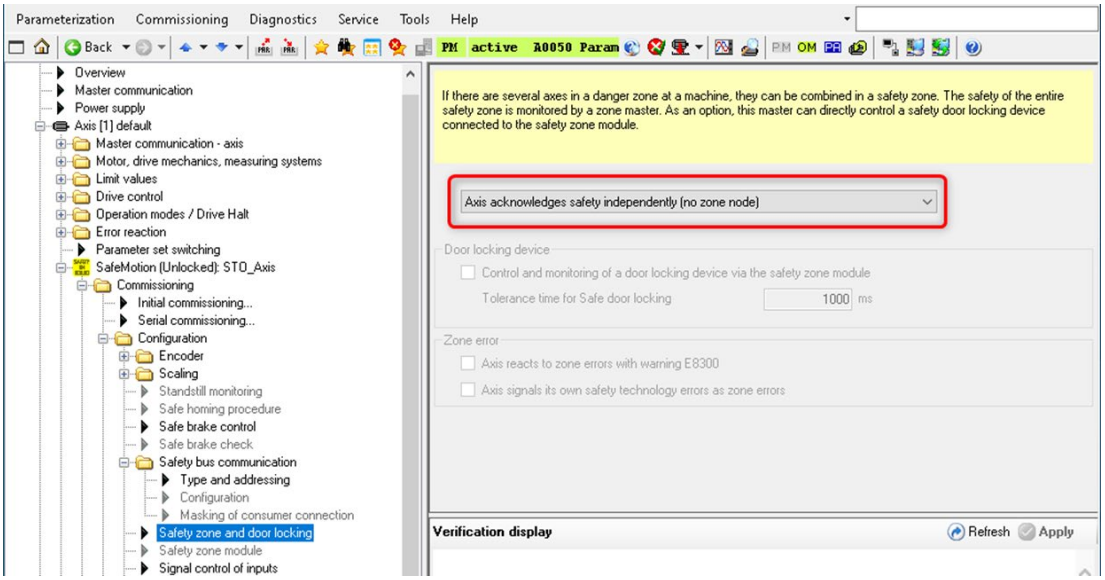
3.1.8 X41 Local I/O

NOTE
MPx21 firmware must be used for X41 local I/O selection.

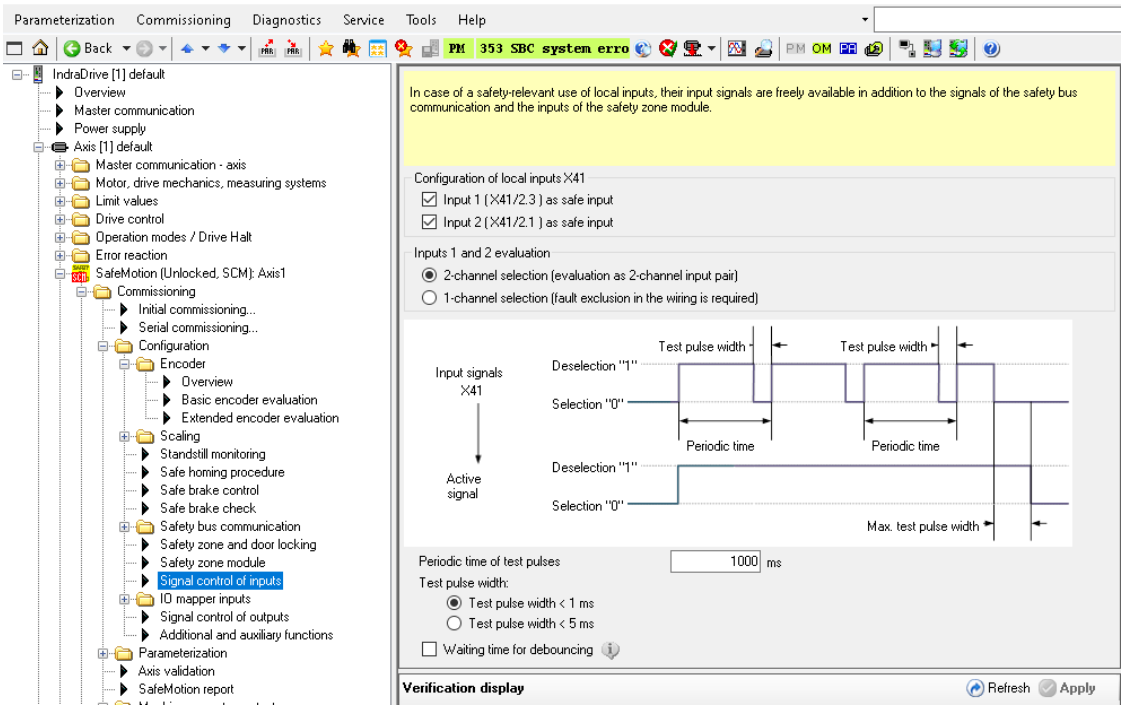
1. Select “SafeMotion without safety bus communication”:



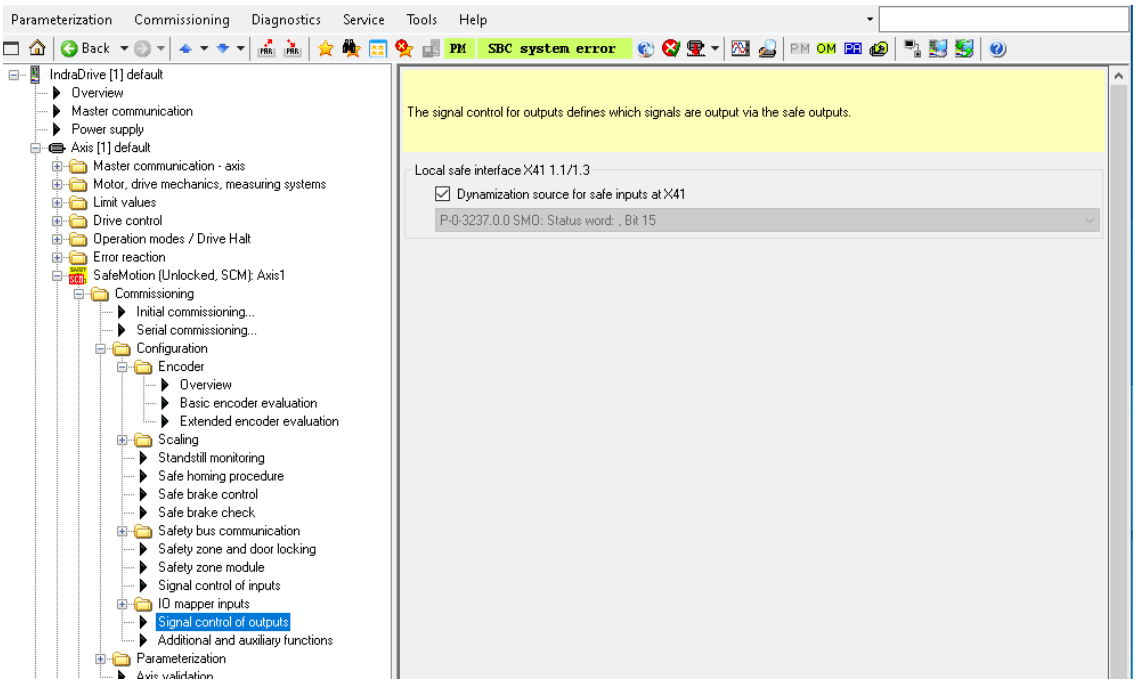
2. Open “Safety zone and door locking” then select “Axis acknowledges safety independently (no zone node)”:



3. If local I/O X41 is going to be used, then these inputs must be configured under “Signal control of inputs”:



4. If local I/O X41 will be used as the dynamization source, then this will need to be configured under “Signal control of outputs”:



3.1.8.1 Programming Example Using I/O Mapper with Local I/O X41

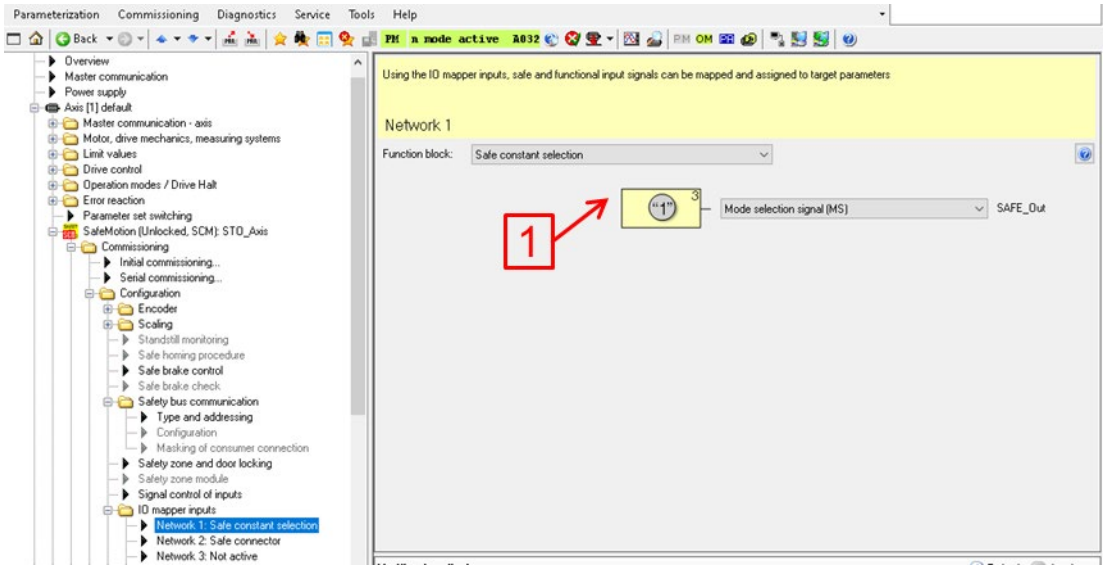
The IndraDrive requires two signals to be set high (1) in the SMO Control Word from I/O Mapper for normal operation:

Bit 0 Mode selection signal (MS) and Bit 1 Emergency stop signal (SMES)

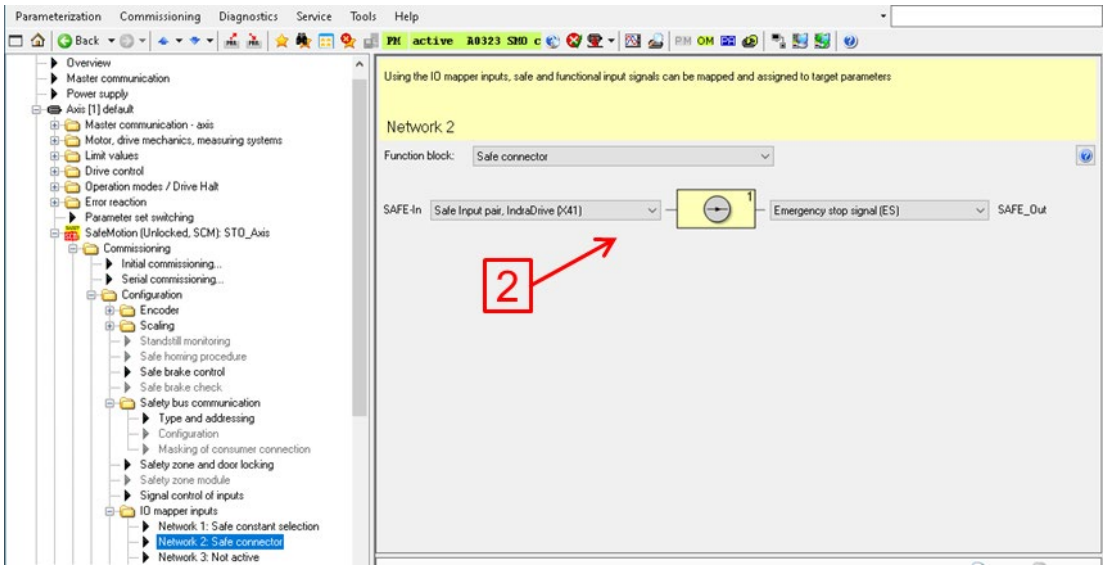
In this example the Emergency stop signal (SMES) bit will be used to transition in or out of STO:

- Emergency stop signal (SMES) set to high (1) = normal operation
- Emergency stop signal (SMES) set to low (0) = STO
- The Mode selection signal (MS) will be set to high (1)

1. Network 1 is used to select the Function Block “Safe constant selection” with “Mode selection signal (MS)” as the safe out:



2. Network 2 is used to select the Function Block “Safe connector” with “Emergency stop signal (ES)” as the safe out. The “Safe input pair, IndraDrive (x41)” is used for the safe in:



NOTE

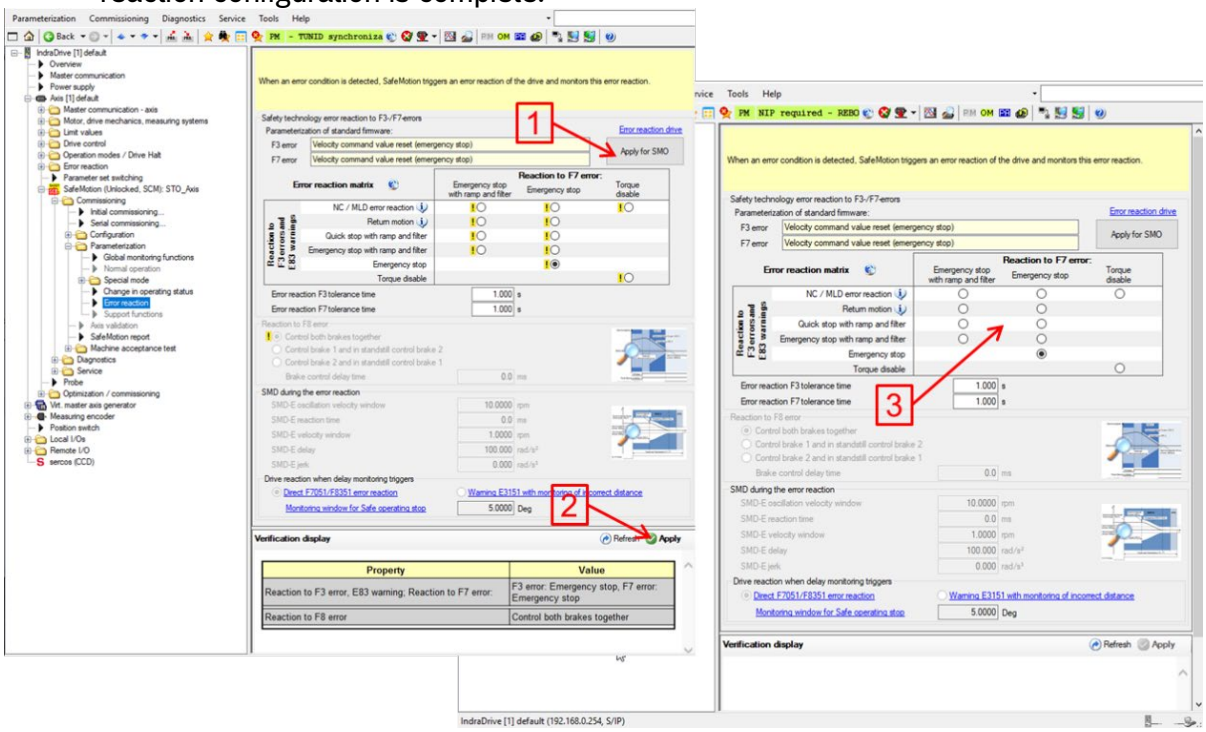
The following steps are only required if the error reaction on the standard firmware side have been modified from factory default.

If the error reaction on the standard firmware side has NOT been changed from factory default go to step 5 Exit SMO configuration\Parameter Mode

4 Error Reaction

The error reaction must be setup the same as the standard firmware. Expand “Axis [1] default\SafeMotion (Unlocked, SCM): STO_Axis\Commissioning\” then double click on “Error Reaction”.

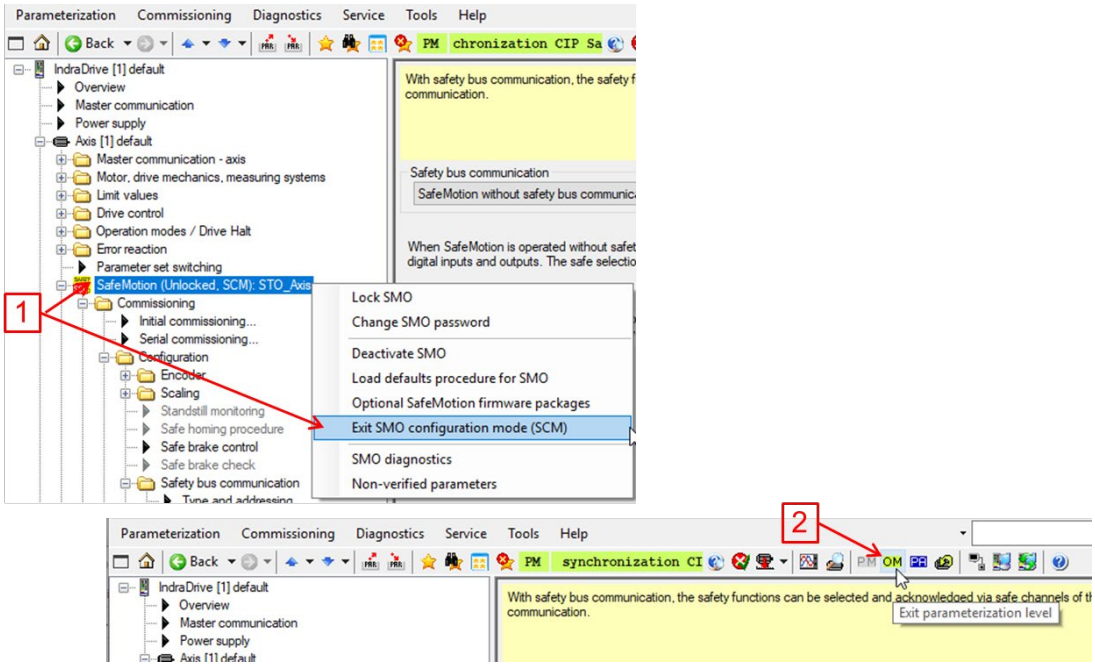
1. Click “Apply for SMO” to copy the error reaction from the standard firmware
2. Click “Apply” to confirm the values copied from the standard firmware side.
3. Once the changes are applied the window shows no more exclamation marks, error reaction configuration is complete:



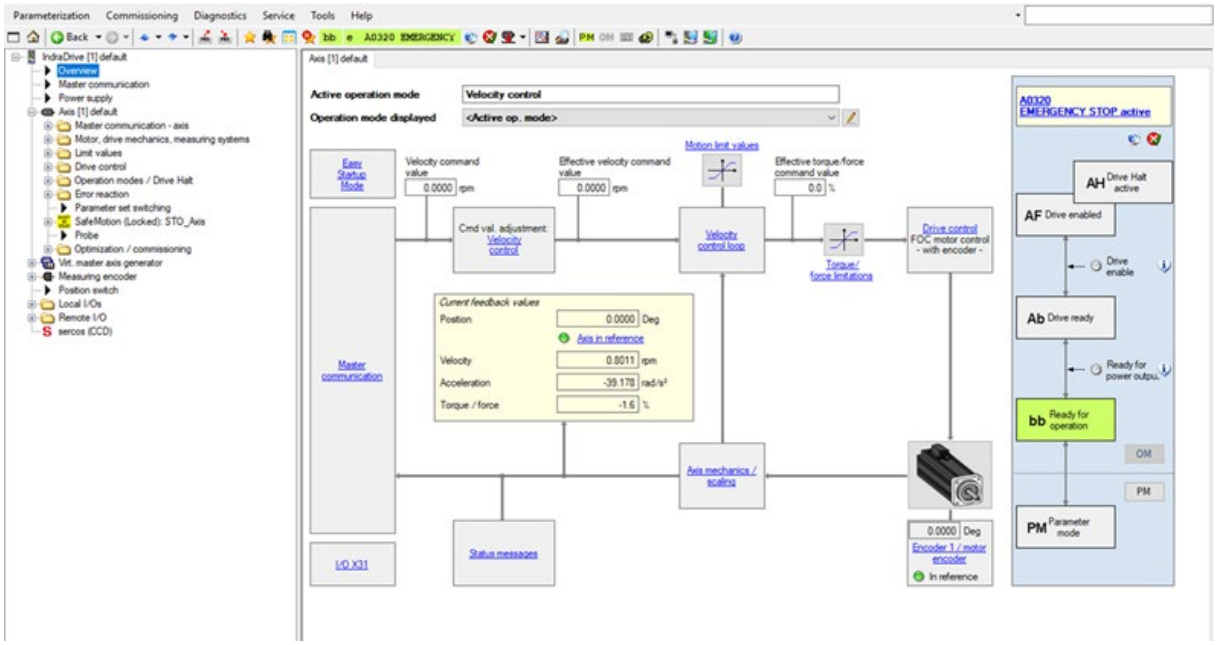
5 Exit SMO configuration\Parameter Mode

The axis configuration for STO is now complete.

1. Right click on SafeMotion (Unlocked, SCM): STO_Axis then select “Exit SMO configuration mode (SCM)”.
2. Once SMO configuration mode (SCM) has been exited click on “OM”:



The axis is now in operating mode:



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