



Getting Started Guide
MiS210 and MiS250

*Integrated safety functions with
safety IO and safety network
support*



This document is for illustrative purposes only. The safety system designer must refer to the “*Installation and Operating manual MiS210 and MiS250 Safety Modules*”.

Original Instructions

For the purposes of compliance with the EU Machinery Directive 2006/42/EC, the English version of this manual is the Original Instructions. Manuals in other languages are Translations of the Original Instructions.

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1 Information

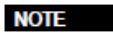
1.1 Warnings, Cautions and Notes



A **Warning** contains information which is essential for avoiding a safety hazard.



A **Caution** contains information which is necessary for avoiding risk of damage to the equipment and motor.



A **Note** contains information which helps to ensure correct operation of the product.

1.2 Safety related information



The user **must** refer to the document titled “*Installation and Operating manual MiS210 and MiS250 Safety Modules*” for safety related information.



The user **must** refer to the relevant drive manual for operating and safety instructions before proceeding.

2 Intended use for this document

This document “*MiS210 and MiS250 Safety Modules Getting Started Guide*”, is intended to help users **begin to evaluate** the MiS2x0 family of safety modules and the Connect PC tool with the Unidrive M and Digitax HD drive ranges. Users **must** refer to the “*Installation and Operating manual MiS210 and MiS250 Safety Modules*” document for full technical details.



The separate document “*Installation and Operating manual MiS210 and MiS250 Safety Modules*” contains important information that the machine/equipment designer **must** consider before designing a safety system or using the MiS210 or MiS250 module.



This document, the “*MiS210 and MiS250 Safety Modules Getting Started Guide*” is for illustrative purposes only. The safety system designer **must** refer to the “*Installation and Operating manual MiS210 and MiS250 Safety Modules*” when producing an actual configuration.



The design of safety-related systems requires specialist knowledge. To ensure that a complete control system is safe, it is necessary for the whole system to be designed according to recognized safety principles. The use of individual sub systems such as drives and option modules with safety functions, which are intended for safety-related applications, does not in itself ensure that the complete system is safe. It is the responsibility of the designer of the end product or application to ensure that it is safe and in compliance with the relevant regulations.



Any application examples given in “*MiS210 and MiS250 Safety Modules Getting Started Guide*”, are for illustration only and do not purport to represent complete solutions.

3 Product information

3.1 Products covered by this guide

This guide covers the MiS210 and MiS250 option modules. This document generically refers to the family of products as MiS2x0.

3.1.1 Supported drives

The MiS210 can be installed in slot 3 of the Unidrive M600, M700, M701, M702, HS70, HS71 and HS72 drives. The MiS250 can be installed in slot 2 of the Digitax HD M750, M751 or M753, the M754 is not supported.

3.2 What is the MiS2x0 family?

The MiS2x0 family consists of the MiS210 and the MiS250 safety option modules. Both these modules bring comprehensive safety control features and network safety to the Unidrive M and Digitax HD drive ranges.

3.3 Features

- Comprehensive set of configurable Machine Safety Functions (MSFs) including SES, STO, SS1, SS2, SOS, SBC, SDI, SLP, SLS, SLA, SSM and STHC3.
- Two safe hardware outputs.
- Pulsed outputs.
- Four safe hardware inputs.
- Inputs can support OSSD.
- Primary and secondary encoder channels.
- Ability for monitoring of a drive's EnDat 2.2 encoder up to 4 Mbaud.
- FSoE network safety (with M753 or SI-EtherCAT).
- CIP network safety (with factory fit on-board Ethernet V2).
- Safety MSFs and functions configurable in the PC tool Connect.
- Can realise a maximum of Ple in accordance with ISO 13849-1.
- Can realise a maximum of SIL 3 in accordance with IEC 61508 and IEC 62061.

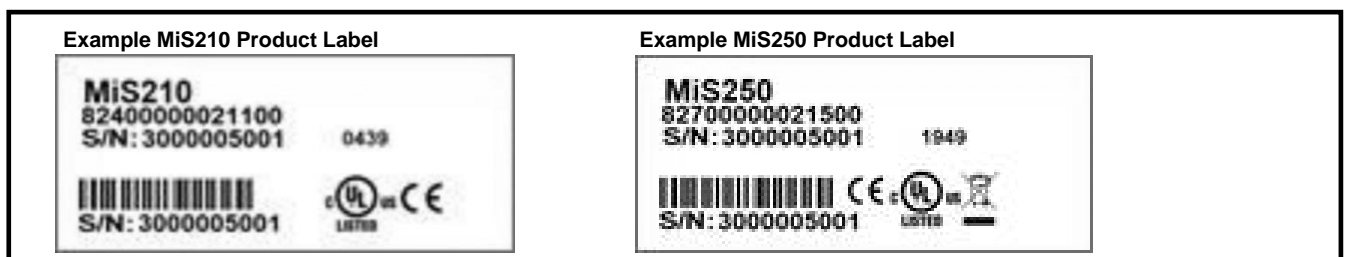
3.4 Option module identification

Figure 3-1 MiS210/MiS250 option module



The MiS210 and MiS250 can be identified by:

- The label located on the option module (MiS210 or MiS250).
- The MiS2x0 family can be identified by colour coding across the front of the MiS2x0 module (yellow).



3.5 Date codes

The date code is specified by four numbers. The first two numbers indicate the year, and the remaining numbers indicate the week of the year in which the option module or drive was built.

Example:

A date code of 2010 would correspond to week 10 of year 2020.

3.6 MiS210 & MiS250 firmware

It is not possible for the user to update or change the firmware in the MiS2x0 family of products. Hardware with the firmware version that is required should be ordered.

3.6.1 Identifying the firmware version

To ascertain the firmware version of the MiS210 module examine parameter 17.002, or for the MiS250 module examine parameter 16.002.

3.7 Drive, network module and Connect requirements

3.7.1 Drive date code requirements

Table 3-1

Drive model	Minimum date code
M600, M700, M701 & M702	1807
HS70, HS71 & HS72 up to frame size 9	2117
HS70, HS71 & HS72 up to frame sizes 11 & 12	2023
Digitax HD* M750, M751 & M753	2134

*Digitax HD M754 is not supported.

3.7.2 Drive firmware requirements

Table 3-2

Drive model	Minimum drive firmware
M600, M700, M701 & M702	V01.16.00*
HS70, HS71 & HS72 up to frame size 9	V02.16.00*
HS70, HS71 & HS72 up to frame sizes 11 & 12	V02.16.00*
Digitax HD M750, M751 & M753	V01.23.00

*If encoder snooping is required at 4M Baud in drive Open Loop mode then the drive firmware must be V01.23.00/V02.23.00 or greater, otherwise it is limited to 2M Baud.

3.7.3 Keypad language file requirements

The Keypad Language File should be "Language Files_V3_Keypad Language V3-English (4.4.5.99).keypadLang". Keypad language files are available from your supplier or to download from www.controltechniques.com.

3.7.4 Networked safety interface requirements

Table 3-3

Protocol	Interface	Minimum communications module firmware
FSoE	SI-EtherCAT or M753*	V01.07.04.02
CIP Safety	Factory fitted Ethernet V2	V02.11.00.16.

*FSoE is supported by the use of an M753, SI-EtherCAT does not support FSoE when used with an M750 or M751.

3.7.5 Connect requirements

Table 3-4

Tool	Minimum version
Connect	2.17.0.32

3.8 Conventions used in this guide

The configuration of the host drive and some option module functions is done using menus and parameters. A menu is a logical collection of parameters that have similar functionality.

In the case of an option module, the option module set-up parameters in menu 0 will appear in drive menu 15, 16 or 17 depending on which slot the module is installed in.

The setting of the Option Slot Identifiers (Pr 11.056) may change the slot numbering from those described above.

The method used to determine the menu or parameter is as follows:

- Pr S.mm.ppp - Where S signifies the option module slot number and mm.ppp signifies the menu and parameter number respectively.

If the option module slot number is not specified, then the parameter reference will be a drive parameter.

- Pr MM.ppp - Where MM signifies the menu allocated to the option module setup menu and ppp signifies the parameter number within the set-up menu.
- Pr mm.000 - Signifies parameter number 000 in any drive menu.

4 Mechanical installation

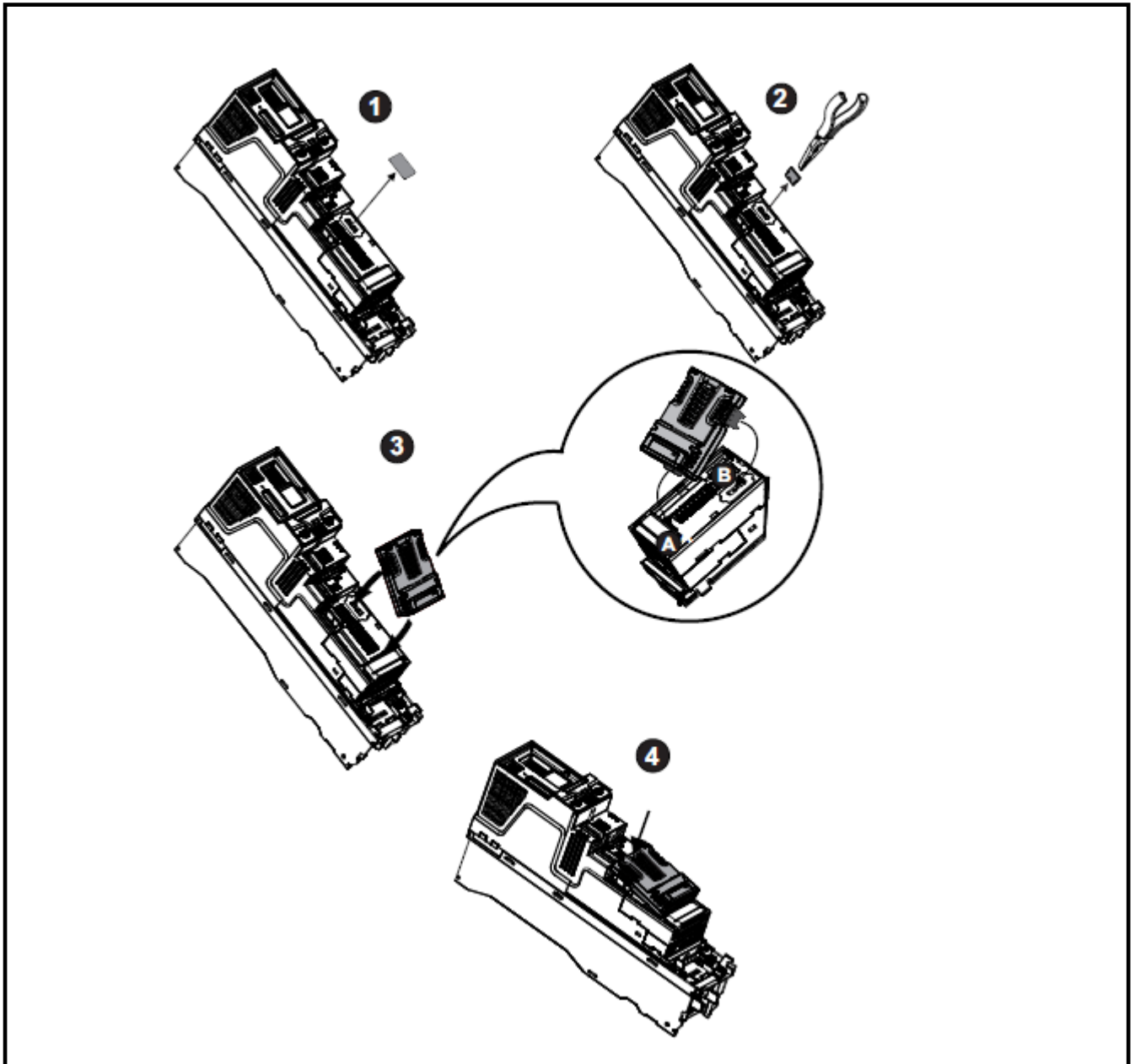


Before installing or removing an option module in any drive, ensure the AC supply has been disconnected for at least 10 minutes. If using a DC bus supply, ensure this is fully discharged before working on any drive or option module.

4.1 General installation

The installation of the MiS210 is shown in

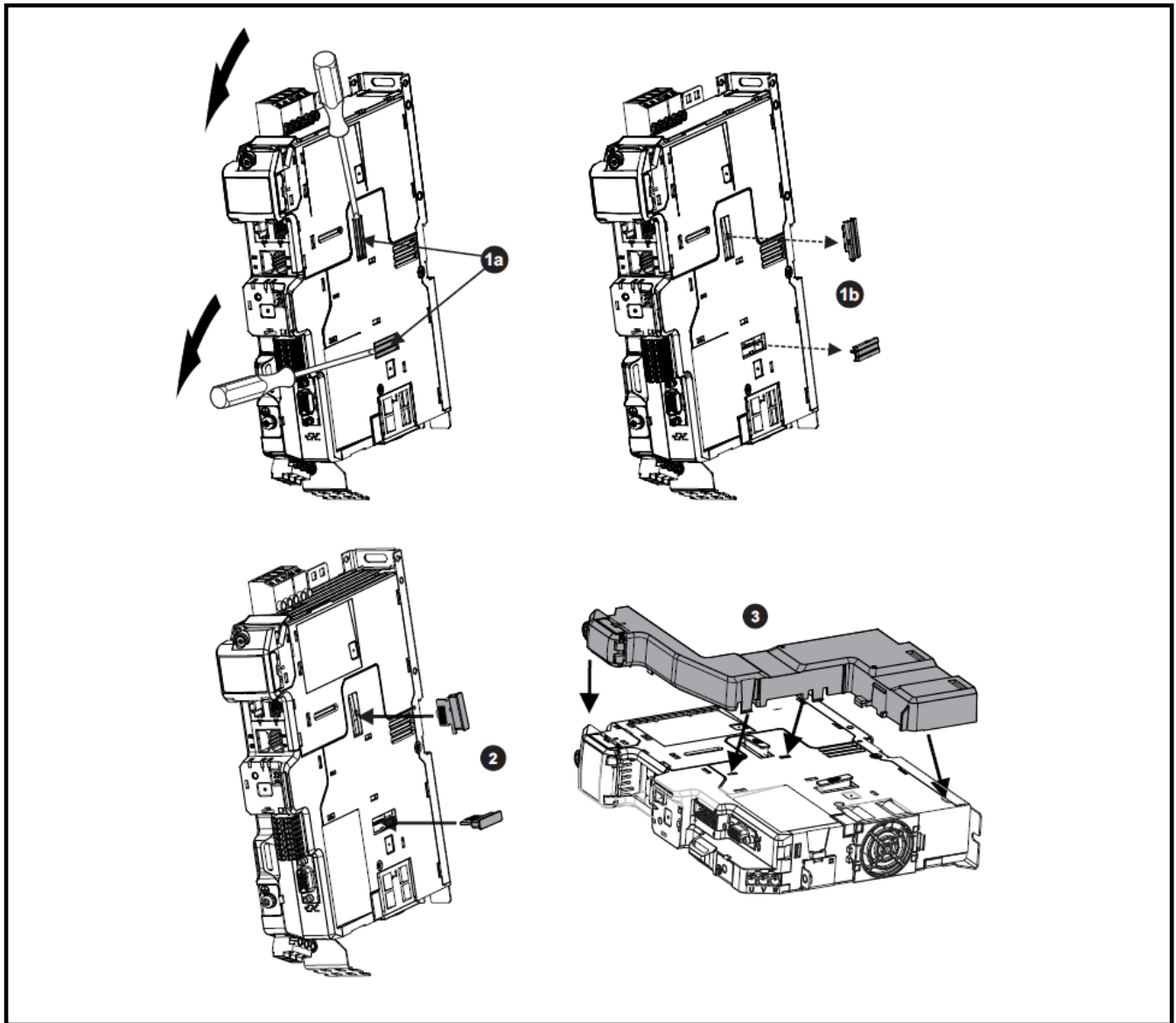
Figure 4-1 MiS210 option module installation



1. Remove the protective self-adhesive label from option slot 3.
2. Using a pair of needle nose pliers remove the STO PCB from the drive.
3. Move the option module in direction shown (A/B).
4. Align and insert the option module tab into the slot provided (A).
5. Press down on the option module until it clicks into place.

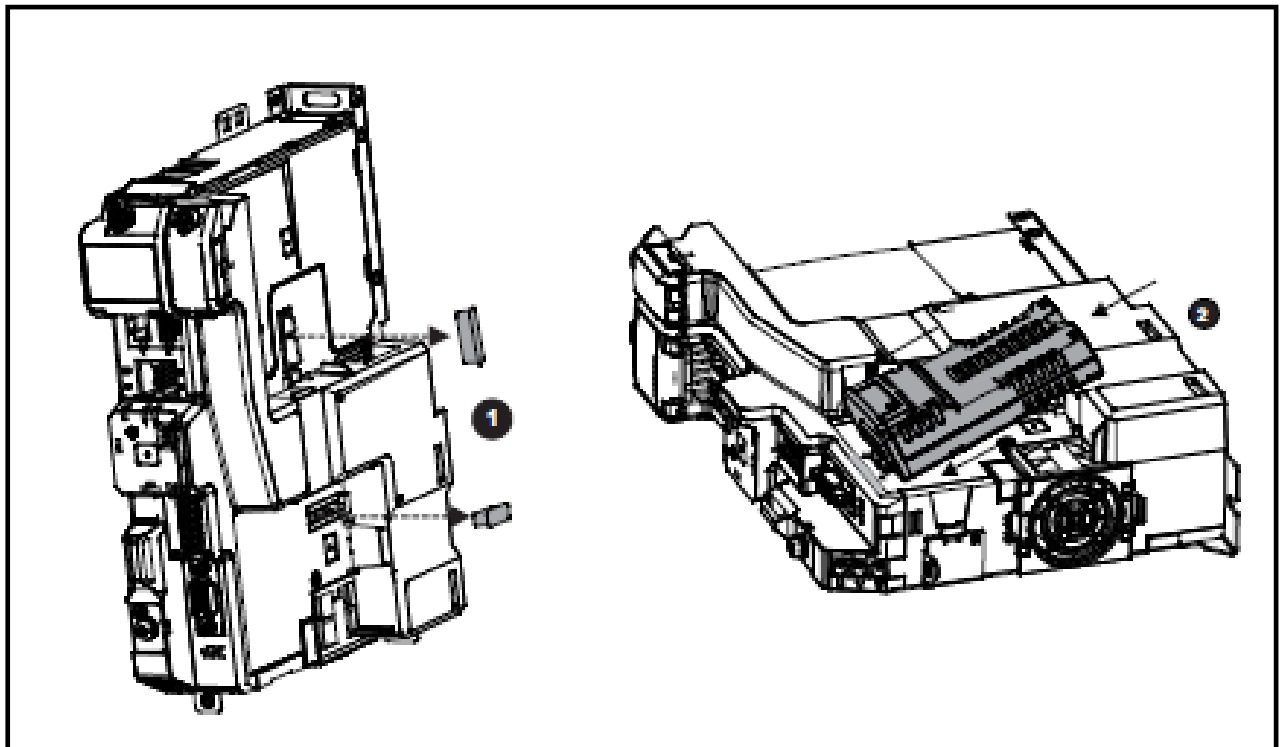
NOTE The MiS210 option module must only be fitted in slot 3 of a Unidrive M70x/HF7xx drive.

Figure 4-2 MiS250 option module installation – SI-Option mounting kit



- 1a.** Insert a flat head terminal screwdriver underneath the option module slot covers and prise both out in the direction shown as highlighted (**1b**).
- 2.** Install the interface card into the option module slot (do not remove the protective cover). The interface card will remain at an angle with respect to the plastic.
- 3.** Line up and clip the SI-option module support mounting frame to the drive in the direction shown.

Figure 4-3 MiS250 option module installation



1. Remove the protective interface card cover.
2. Align and insert the option module tab into the slot on the drive plastic.
3. Once the option module tab is located into the slot on the drive, push down at the rear of the option module until it clicks into place.

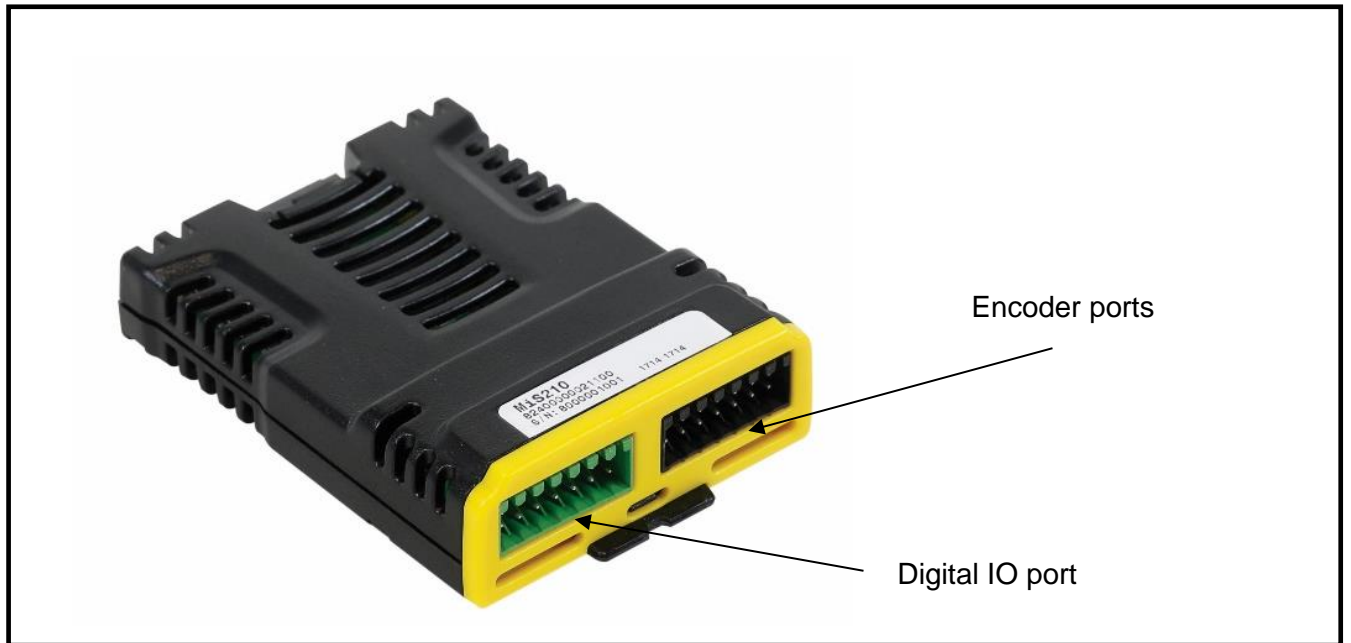
NOTE Once fitted, the SI-option module remains at an angle with respect to the drive.

NOTE The MiS250 option module must only be fitted in slot 2 of a Digitax HD drive.

5 Electrical installation

5.1 MiS210 & MiS250 terminal description

Figure 5-1 MiS210/MiS250 user terminals



The MiS210 and MiS250 are supplied with plug-in connectors for the IO and Encoder ports. There is no numbering on the connectors. The IO port connector is coloured green, and the Encoder port connector is black

5.1.1 Digital IO connections

Figure 5-2 Digital IO connector

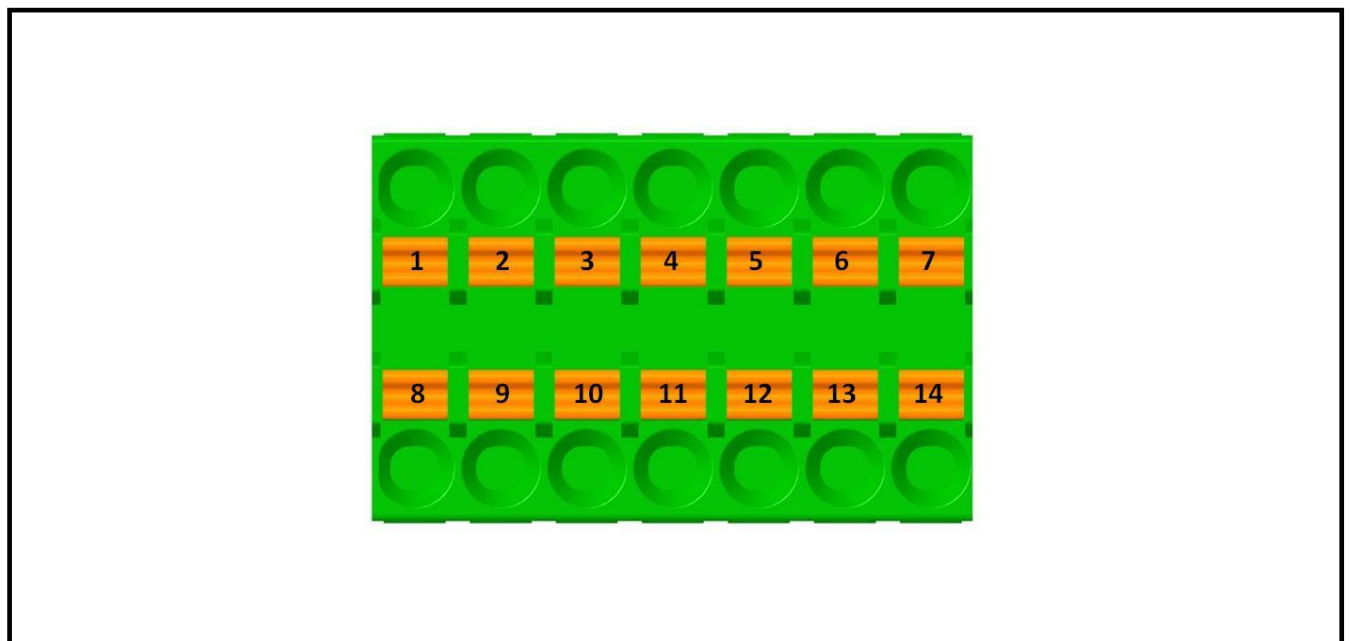
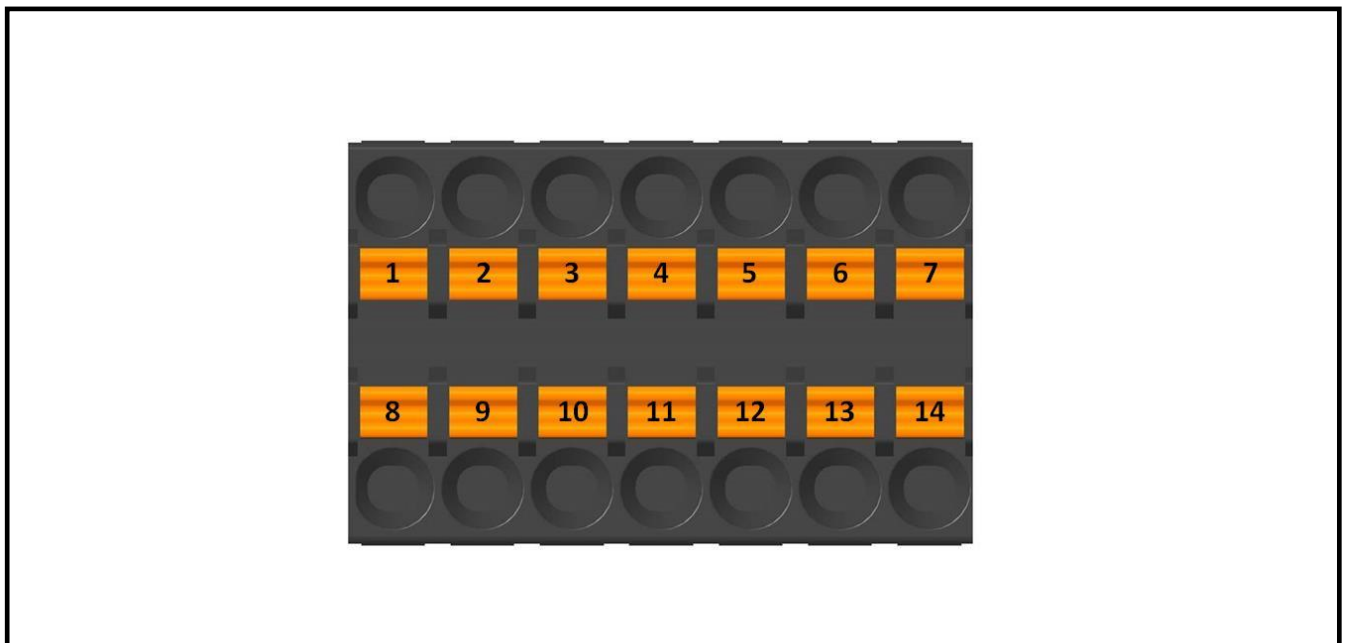


Table 5-1

Pin	Description	Pin	Description
1	Pulse Out 1	8	Output 1
2	IN1A	9	IN1B
3	IN2A	10	IN2B
4	0V	11	0V
5	IN3A	12	IN3B
6	IN4A	13	IN4B
7	Pulse Out 2	14	Output 2

5.1.2 Encoder connections

Figure 5-3 Encoder connector



In Table 5-2 the MiS2x0 encoder port connections are shown, (see section 5 Electrical installation for further details). For details of the drive's encoder connections please see the relevant drive documentation.

Table 5-2

Pin	Description	Pin	Description
1	0V	8	0V
2	Cos1, A1, Data1	9	Cos1/, A1/, Data1/
3	Sin1, B1, CLK1	10	Sin1/, B1/, CLK1/
4	Cos2, A2, Data2	11	Cos2/, A2/, Data2/
5	Sin2, B2, CLK2	12	Sin2/, B2/, CLK2/
6	Encoder PSU Output	13	0V
7	Encoder PSU Input	14	0V

Table 5-3 shows the combination of local encoders that can be directly connected to the MiS2x0 via Channel 1 and Channel 2 (local encoders).

Table 5-3 Local encoders only

Primary Encoder		Secondary Encoder	
Type	Location (MiS2x0)	Type	Location (MiS2x0)
Safe EnDat 2.2	Channel 1	-	-
EnDat 2.2	Channel 1	-	-
AB	Channel 1	-	-
Sin Cos	Channel 1	-	-
SSI	Channel 1	-	-
EnDat 2.2	Channel 1	AB	Channel 2
EnDat 2.2	Channel 1	SSI	Channel 2
EnDat 2.2	Channel 1	Sin Cos	Channel 2
AB	Channel 1	SSI	Channel 2
SSI	Channel 1	AB	Channel 2
Sin Cos	Channel 1	AB	Channel 2
AB	Channel 1	Sin Cos	Channel 2
Sin Cos	Channel 1	SSI	Channel 2
SSI	Channel 1	Sin Cos	Channel 2
Sin Cos	Channel 1	Sin Cos	Channel 2
AB	Channel 1	AB	Channel 2
SSI	Channel 1	SSI	Channel 2

In Table 5-4 the encoders that may be connected to the drive, and that the MiS2x0 is capable of monitoring (snooping) are detailed.

Table 5-4 Drive encoders only

Primary Encoder		Secondary Encoder	
Type	Location (drive)	Type	Location (drive)
Safe EnDat 2.2	Channel A*	-	-
EnDat 2.2	Channel A*	-	-
EnDat 2.2	Channel A*	EnDat 2.2	Channel B*

*For Unidrive M drives if encoder snooping is required at 4M Baud in drive Open Loop mode then the drive firmware must be V01.23.00 or greater, otherwise it is limited to 2M Baud. Digitax HD drives require a minimum firmware version of V01.23.00.

Channel A is termed "P1" and Channel B "P2" in the drive's documentation.

Table 5-5 shows the combinations of local and drive encoders possible.

Table 5-5 Drive and local encoder port combinations

Primary Encoder		Secondary Encoder	
Type	Location (drive)	Type	Location (MiS2x0)
EnDat 2.2	Channel A*	EnDat 2.2	Channel 2
EnDat 2.2	Channel A*	SSI	Channel 2
EnDat 2.2	Channel A*	Sin Cos	Channel 2
EnDat 2.2	Channel A*	AB	Channel 2

*For Unidrive M drives if encoder snooping is required at 4M Baud in drive Open Loop mode then the drive firmware must be V01.23.00 or greater, otherwise it is limited to 2M Baud. Digitax HD drives require a minimum firmware version of V01.23.00.

Channel A is termed "P1" in the drive's documentation.

5.2 MiS210 STO blade connector

The MiS210 has a blade type connector that interfaces to the drive's STO circuits (see section 4 Mechanical installation).

5.3 MiS250 STO connection

The MiS250 does not have a direct connection to the drive's STO circuits in the same way as the MiS210. Rather the user should select one of the safety digital outputs (pin 8 or pin 14) and wire this to the Digitax HD's STO circuit.

An STO cable is supplied with the MiS250 for this purpose.

The Digitax HD drive has two STO inputs, these are STO1 and STO2 and are on Pin 2 and Pin 6 of the drive respectively. The MiS250 is only required to control one STO to achieve a SIL of 3 as each STO independently achieves SIL3. The user may choose to connect the two STO channels together, the second STO to another safety device or to 24V. This is an application specific decision. See the relevant drive documentation for more details.

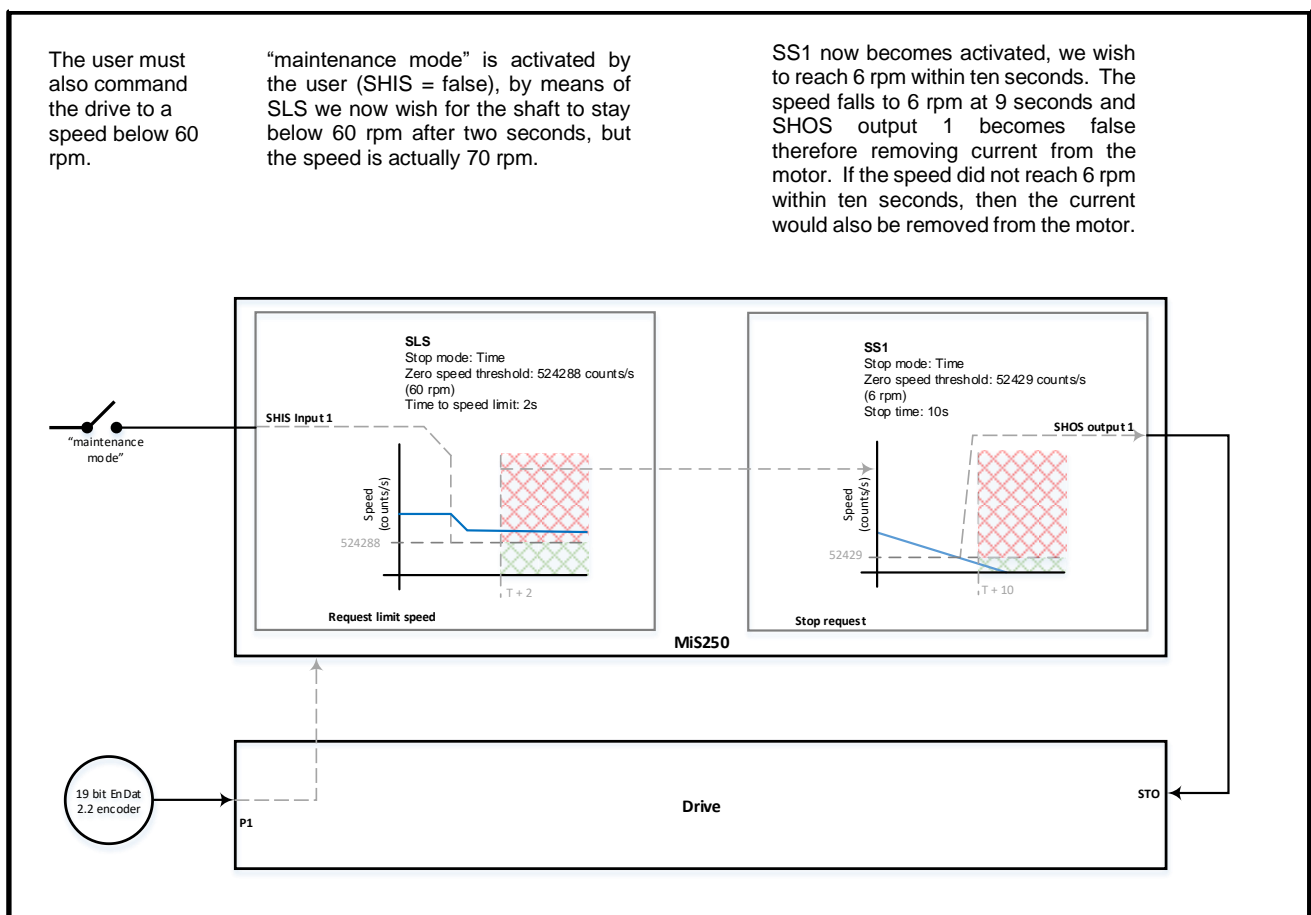
6 Quick start example

Here a quick start example is provided for illustrative purposes describing configuring Safely Limited Speed (SLS) and Safe Stop 1 (SS1) on a Digitax HD M75x drive with an MiS250 module fitted, although the user should find it simple to modify the example for use on a Unidrive M with MiS210.

NOTE Please see section 7 onward for more details of features and functionality shown in this example. Users must refer to the “*Installation and Operating manual MiS210 and MiS250 Safety Modules*” document for full technical details.

In the scenario described the “machine” has a “maintenance mode” whereby an operator can perform a specific task, but the shaft must not rotate faster than a certain speed. Within two seconds of the operator selecting this mode the motor shaft must rotate at no more than 60 rpm. If the desired safely limited speed is not reached for some reason, then the drive will be commanded to stop within a ten second window using an SS1 function. If this is realised, then the STO will be turned off at this point. If the zero speed is not attained within ten seconds the STO will also be turned off and in this case, it has been chosen for illustrative purposes not to raise an alarm in this example.

Figure 6-1 Example block diagram



6.1 Assemble the hardware

This example was prepared using the Control Techniques Digitax HD demo-case with an M753, however an M750 may be used and if so then the SI-Ethernet module shall not be fitted. A list of the hardware is given in Table 6-1 Hardware. Please see section 3.7 for firmware and hardware version requirements.

Table 6-1 Hardware

Item	Part number	Notes
Digitax HD M753	M753-012	Or M750-012
Unimotor HD	067EDA300DAFGC	EnDat 2.2 required
Encoder lead		Single cable solution
MiS250	82700000021500	
SI-Ethernet	82400000017900	For Connect (or use factory fitted Ethernet on M750), EoE* or EIA-485**
Switch and wiring		User assembly

*For EoE a suitable EtherCAT master is required. If EoE is required, then consult the third-party chosen EtherCAT master's documentation. The PC tool Connect receives and sends standard Ethernet frames and is unaware of the EoE protocol, the chosen EtherCAT master routes the Ethernet frames transparently from the perspective of the PC tool Connect.

** KI-485 Compat Adaptor is required for EIA-485.

In this example, the feedback for the drive and for the safety functions is derived from the EnDat 2.2 encoder connected to P1 of the drive, the encoder is single turn and 19-bits per revolution.

NOTE EnDat 2.1 encoders are not supported by the MiS2x0 family.

6.2 Option modules

Install the MiS250 module and the SI-Ethernet module (if required) into slots two and one respectively of the Digitax HD drive.

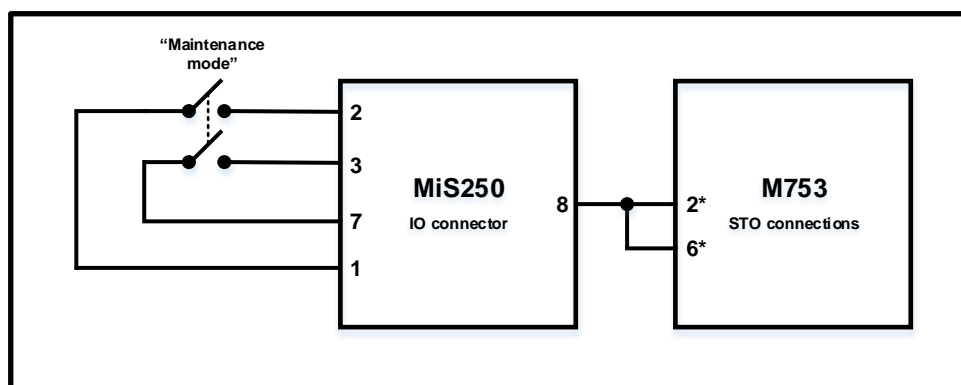
6.3 Interconnections

It is assumed a Digitax HD demo-case is used, and therefore the standard motor and control wiring is provided. See section 1 before proceeding.

Connect an Ethernet lead between the SI-Ethernet module and your laptop or PC.

Insert a double pole (DPST) toggle switch and connect the STO circuits of the drive as shown in Figure 6-2 Interconnections. *For convenience both STO channels of the drive are connected together. If an MiS210 and M70x drive are used, then the STO connection is provided directly between the module and drive.

Figure 6-2 Interconnections



6.4 Creating the safety application in Connect

If it is safe to do so apply power to the drive. Launch Connect and choose *Scan Ethernet network*. It is assumed suitable network parameters have not been previously entered.

6.4.1 Scan the Ethernet network

So that Connect may communicate with the Drive and MiS2x0 module a communications connection must be configured, here we are using an Ethernet connection.

Follow the steps shown in Figure 6-3 to Figure 6-6.

Figure 6-3 Scan Ethernet network

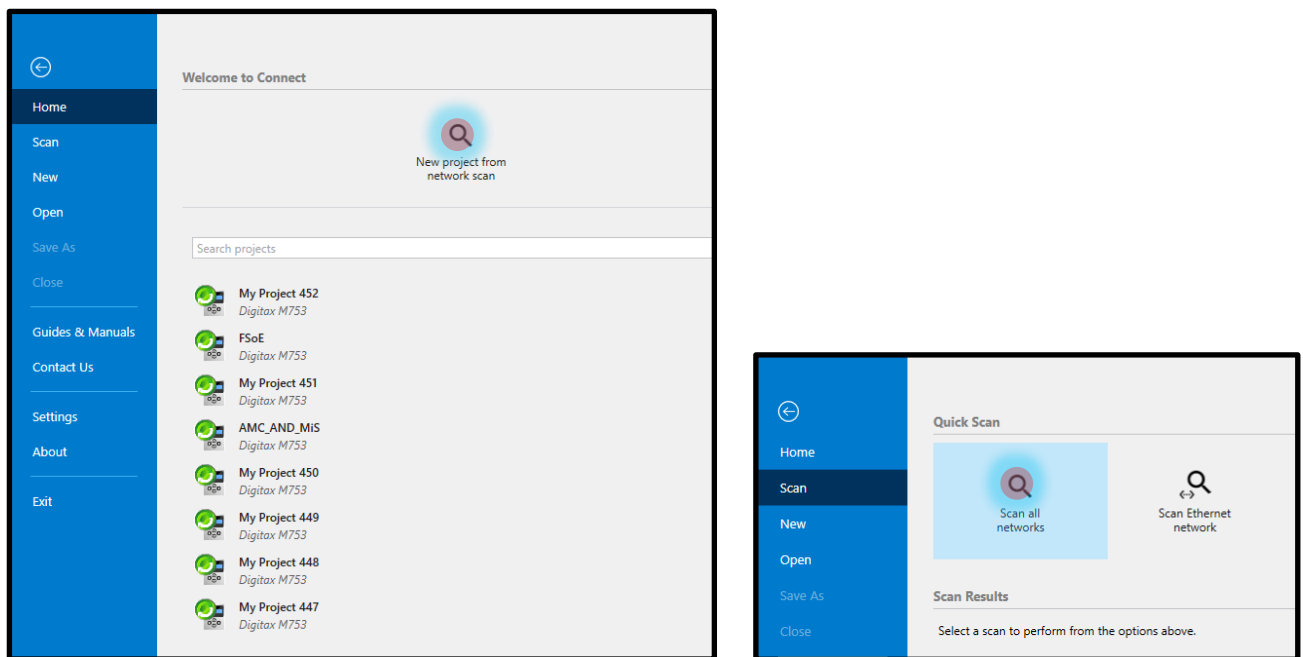


Figure 6-4 Configure IP details

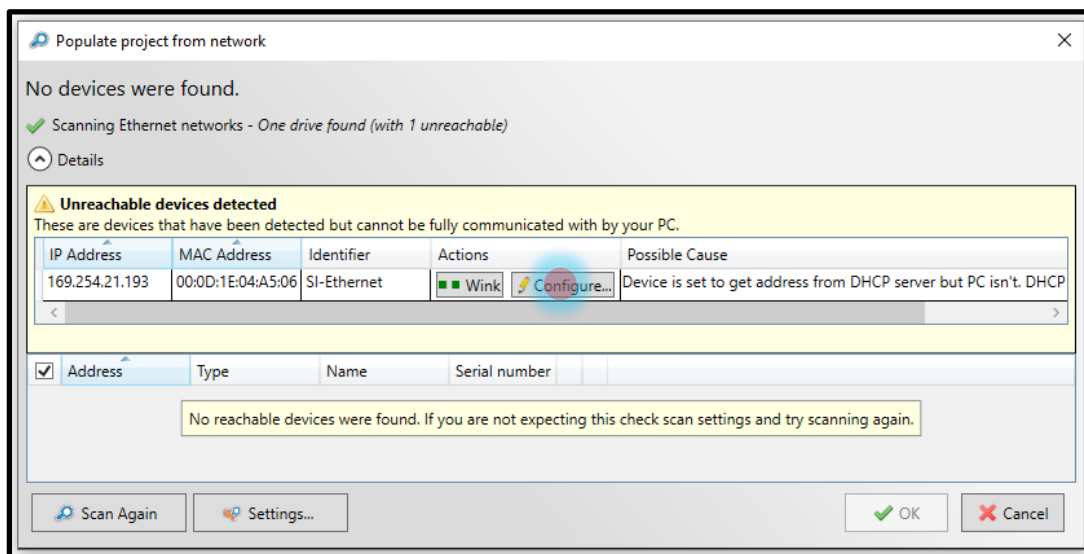


Figure 6-5 Assign address and Subnet mask

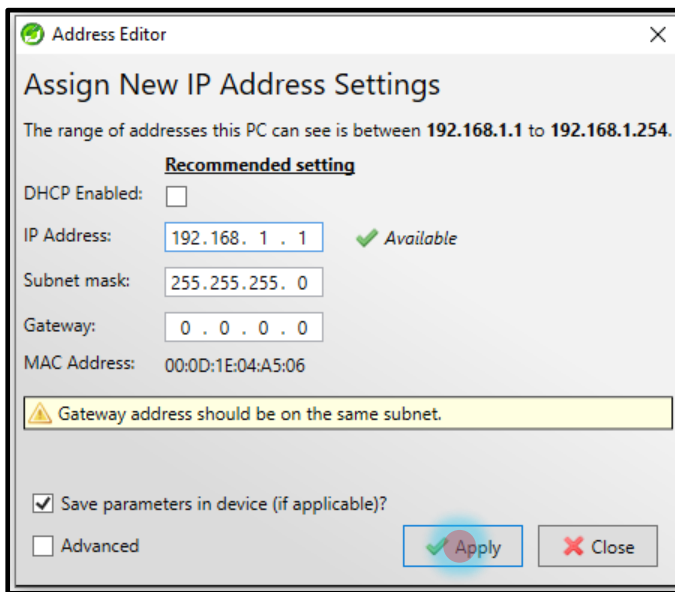
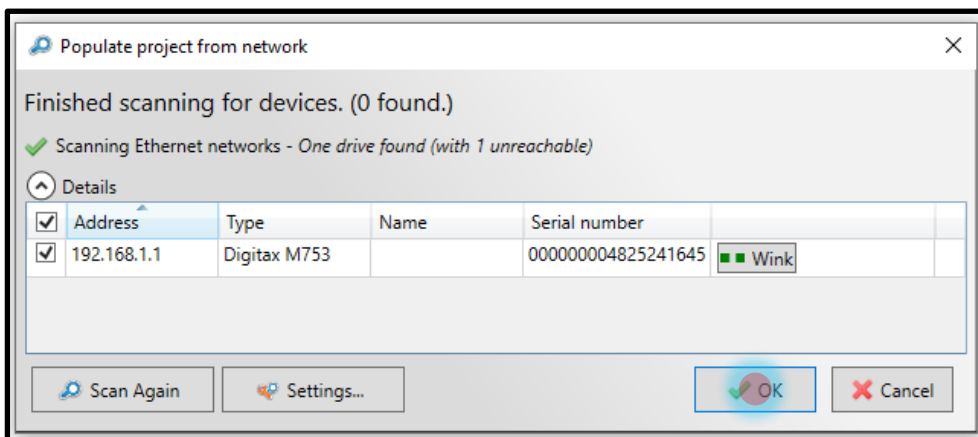
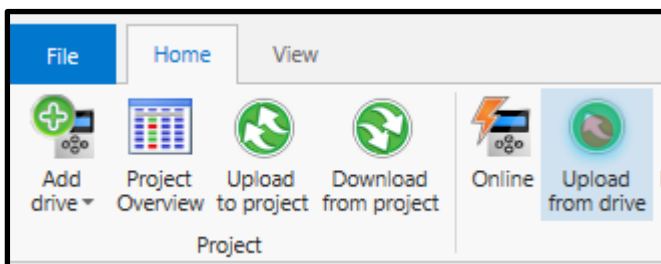


Figure 6-6 Complete IP address setup



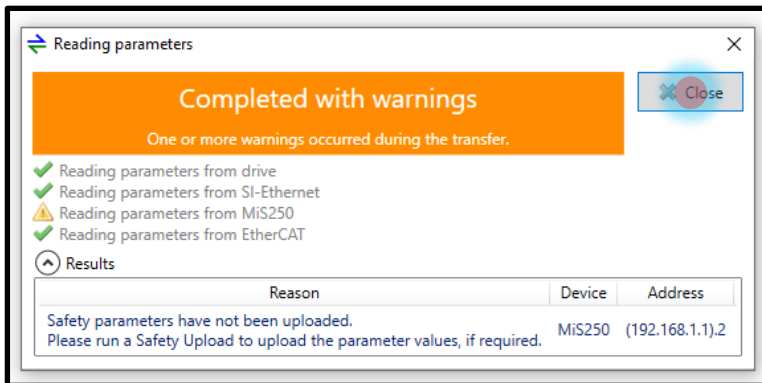
We now must upload parameters from the drive to the project so that the encoder information is available for the safety setup. (Because in this example we shall use the drive's Endat 2.2 encoder, and by default the drive interrogates the EnDat 2.2 encoder and automatically configures the relevant drive parameters).

Figure 6-7 Upload parameters from drive to project



The warning explains that the safety configuration has not been uploaded. This message may be ignored as we are creating a new configuration.

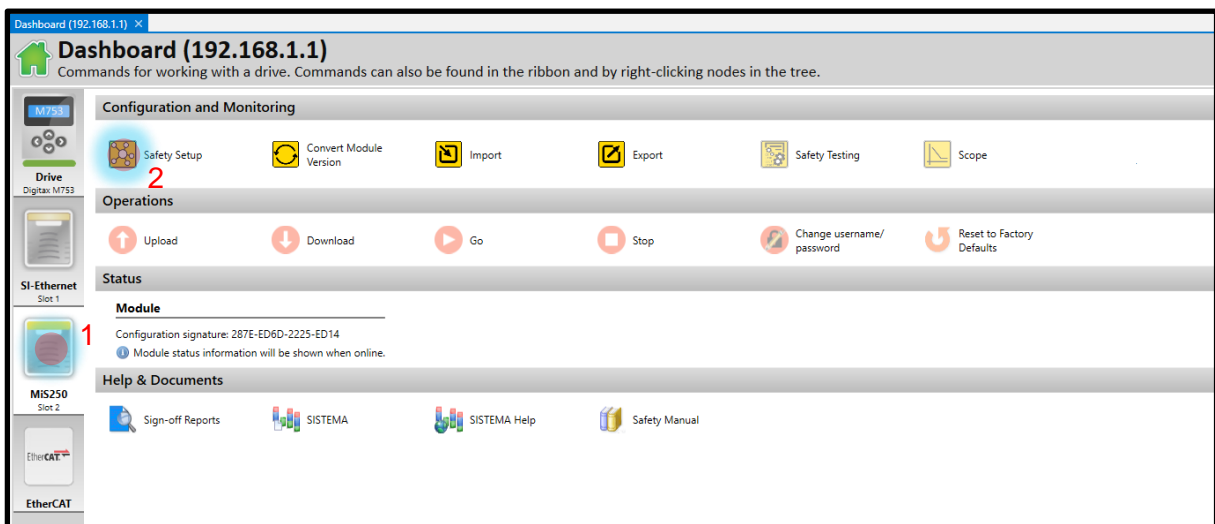
Figure 6-8



6.4.2 Create the safety application

Click on the *MiS250* option in the Dashboard (1) and select Safety Setup (2)

Figure 6-9 Select the MiS250 dashboard.



Follow the subsequent steps to configure the *Network*, *Encoders* and *System* tabs.

No safe network is required for this example.

Figure 6-10 Network tab

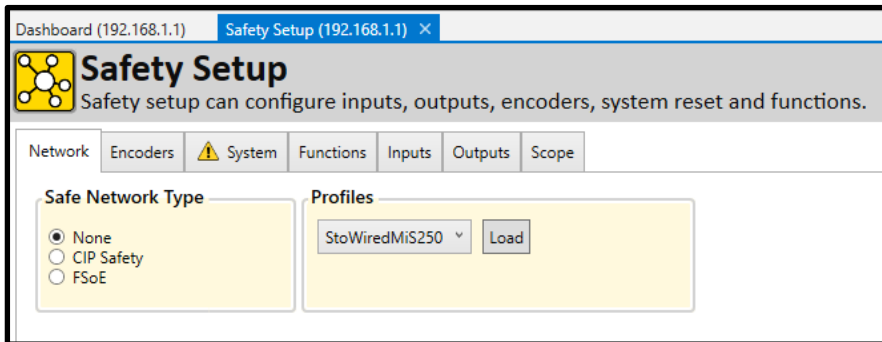
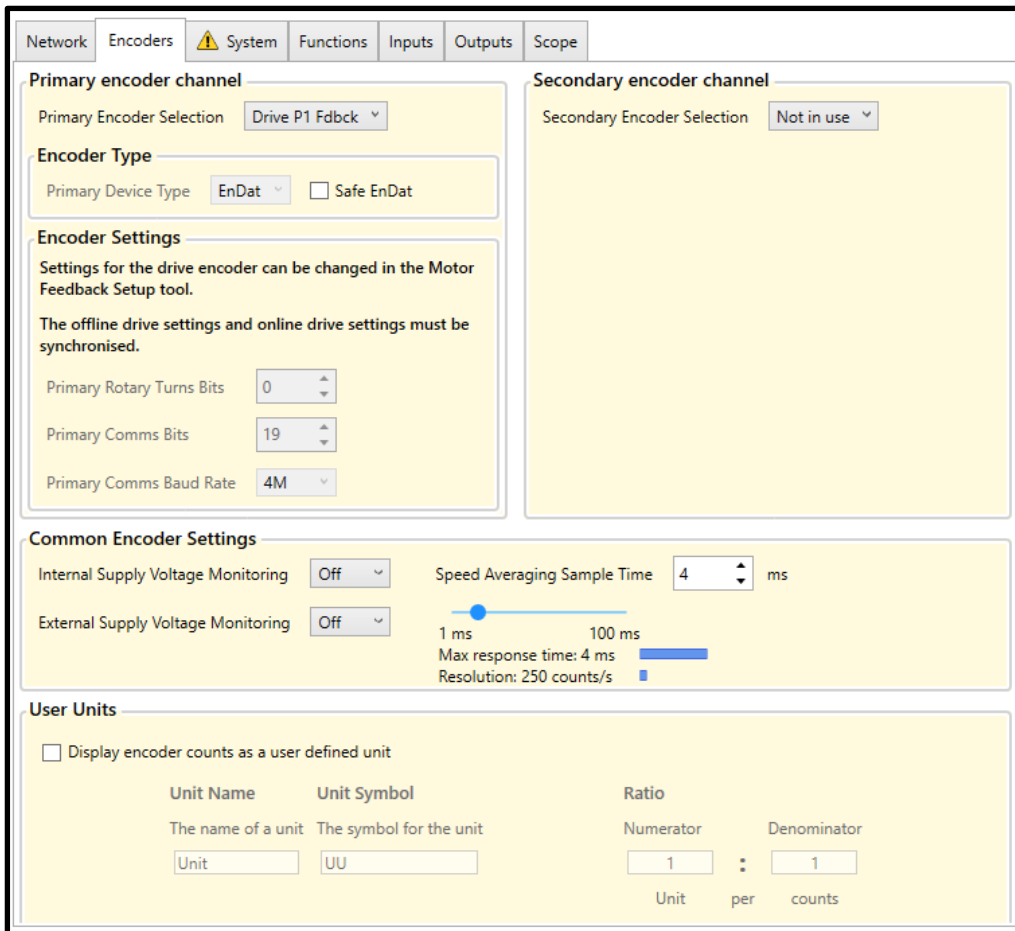


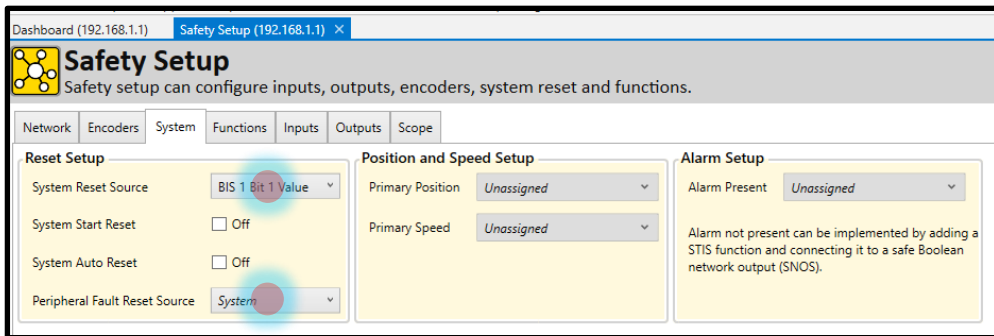
Figure 6-11 Encoders tab

As we have selected the EnDat 2.2 encoder on the drive's P1 port, the following *Encoder Settings* information is populated by Connect based on the drive's encoder configuration.



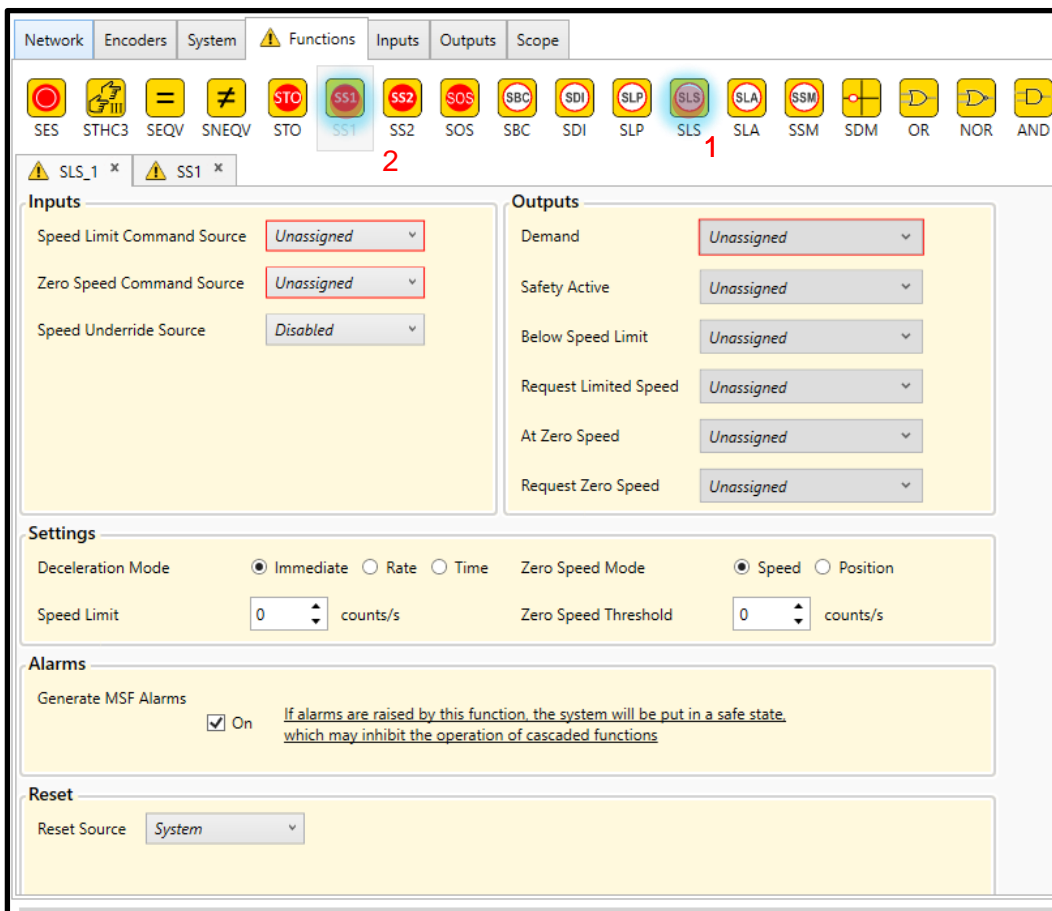
System reset will be via *BIS 1 Bit 1 Value* (Non-safe input 1, see section 7.3.1.7.2), and Peripheral faults will be reset by the same input.

Figure 6-12 System tab



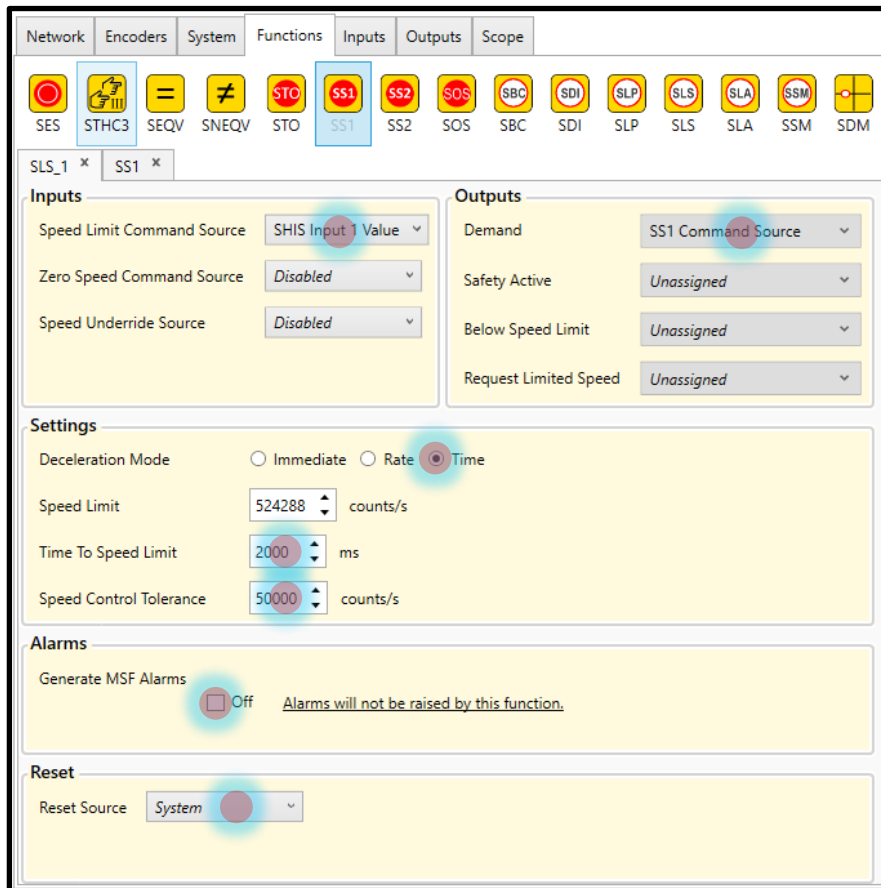
Add an instance of SLS and SS1 by selecting (1) then (2).

Figure 6-13 Functions tab - add SLS and SS1 Machine Safety Functions (MSFs)



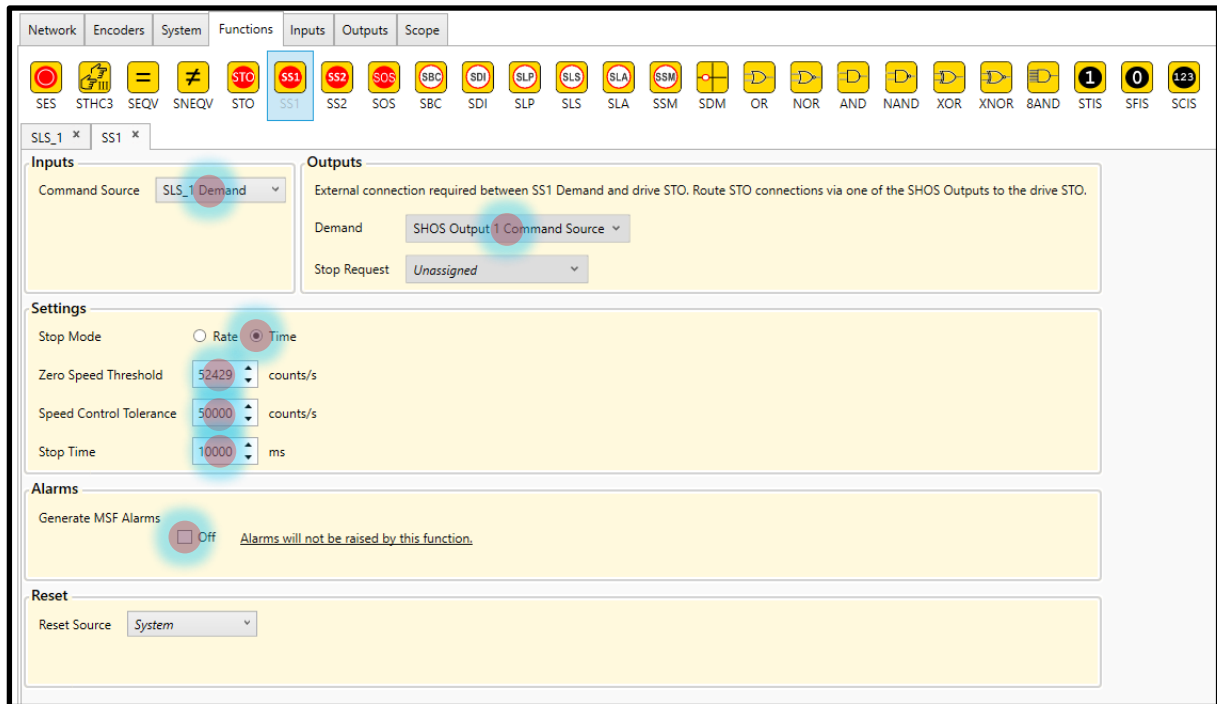
SLS will monitor for safe speed when safe hardware input (*SHIS Input 1 value*) is false. *Deceleration Mode* will be time based. The selected *Speed Limit* of 524288 counts/s equates to 60 rpm for this example. If the *Demand* output to SS1 is to remain true, then once SHIS1 becomes false the shaft's speed must fall below 60 rpm within 2 seconds. The MiS2x0 calculates a trajectory based on initial speed and the Speed Limit (figure 6.1 is simplified). The Speed Control Tolerance is added to this trajectory, this is an upper limit of the amount of dither on the speed feedback which the function allows during slowdown. The MSF is configured not to raise alarms if its speed envelope is breached, and the MSF is reset by the *System* input (Non-safe input 1 in this case).

Figure 6-14 Configure SLS



If *Command Source* becomes false (because SS1 *Demand* output becomes false), then SS1 will monitor the stopping of the shaft. In this example the shaft must be below 52429 counts/s or 6 rpm within ten seconds of *Command Source* becoming false. The *Speed Control Tolerance* is added to this trajectory, this is an upper limit of the amount of dither on the speed feedback which the function allows during slowdown. The MSF is configured not to raise alarms if its speed envelope is breached, and the MSF is reset by the *System* input (Non-safe input 1 in this case).

Figure 6-15 Configure SS1



Set the *Discrepancy Time* to 500 ms and *Mode* to use the pulsed outputs.

Figure 6-16 Configure Inputs tab

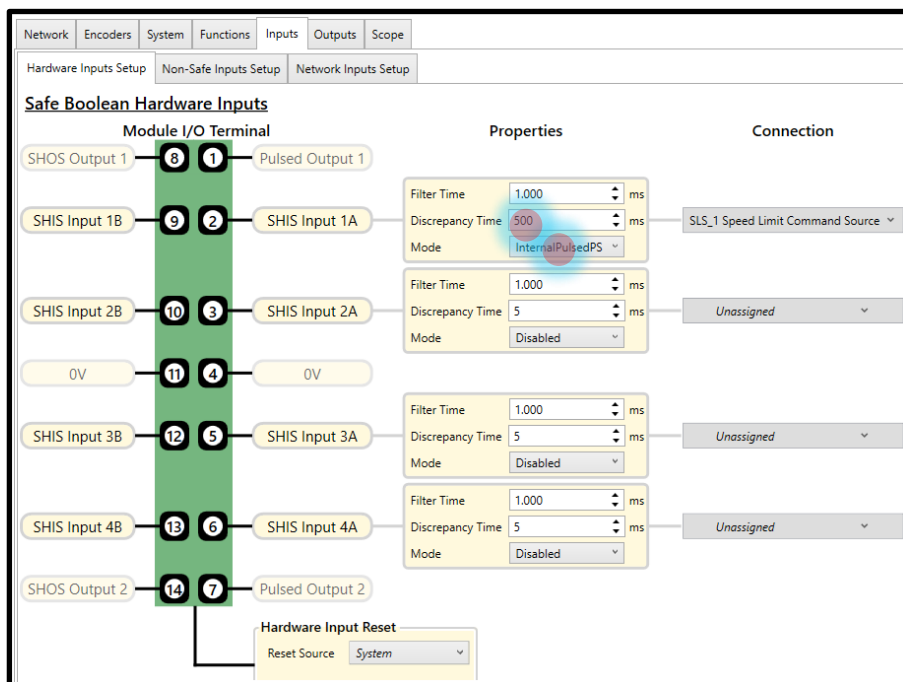
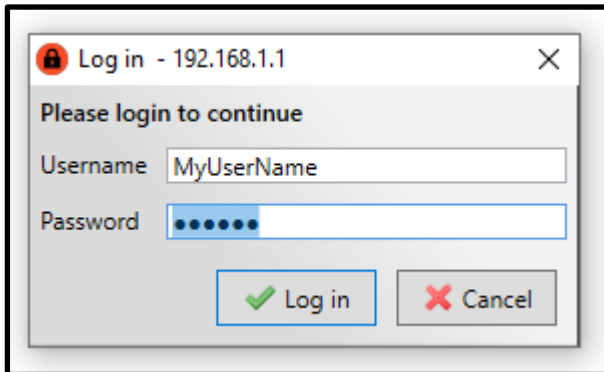


Figure 6-17 Save to project



Figure 6-18 Enter your new credentials



6.4.3 Download the safety configuration

Figure 6-19 Go on-line



Figure 6-20 Select Download from the dashboard

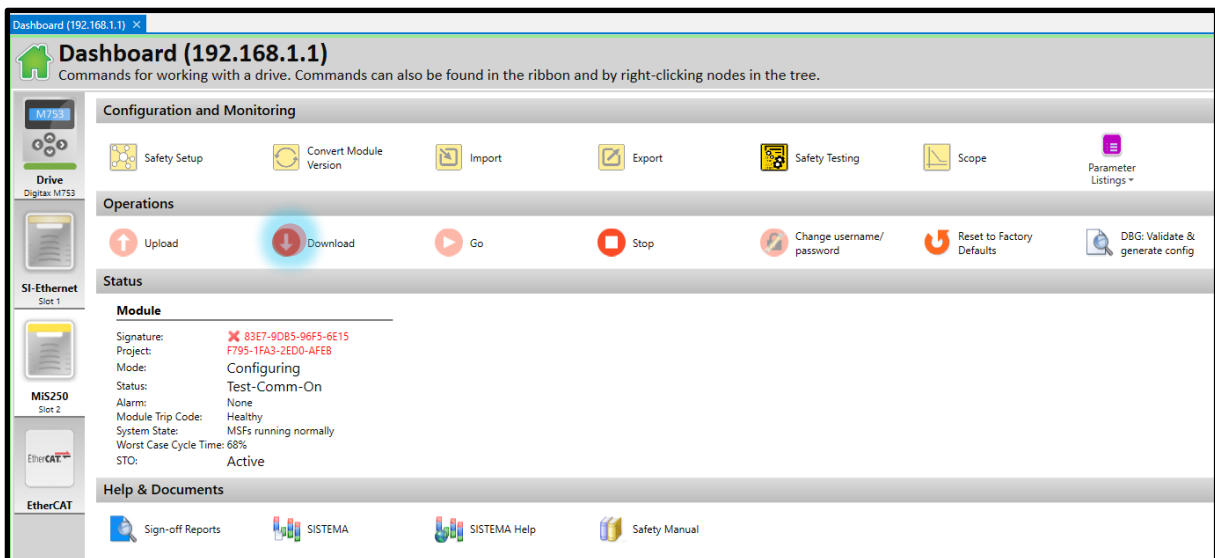


Figure 6-21 Replace configuration

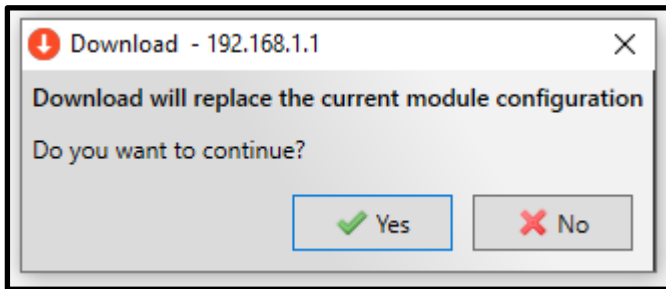


Figure 6-22 Enter credentials

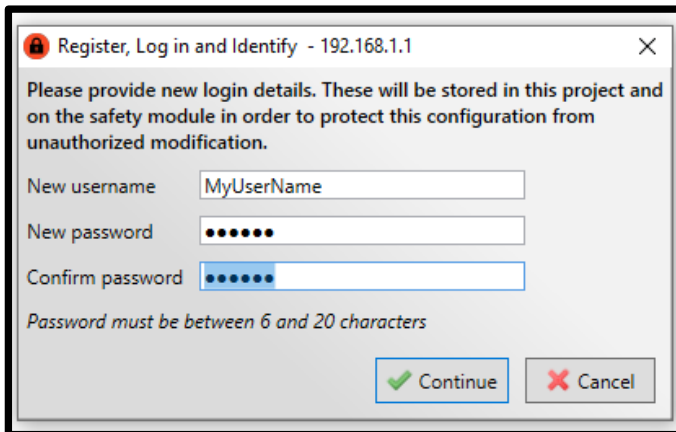


Figure 6-23 Enter round trip code

Enter the value of parameter 16.012 or the drive's serial number. (17.012 for MiS210).

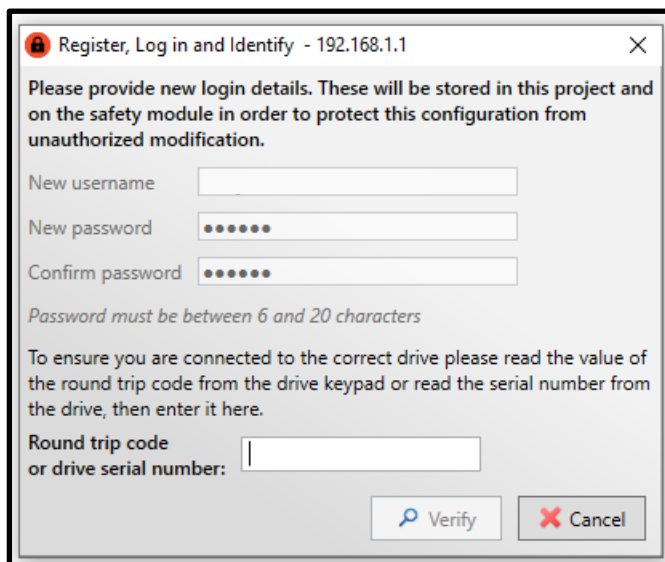
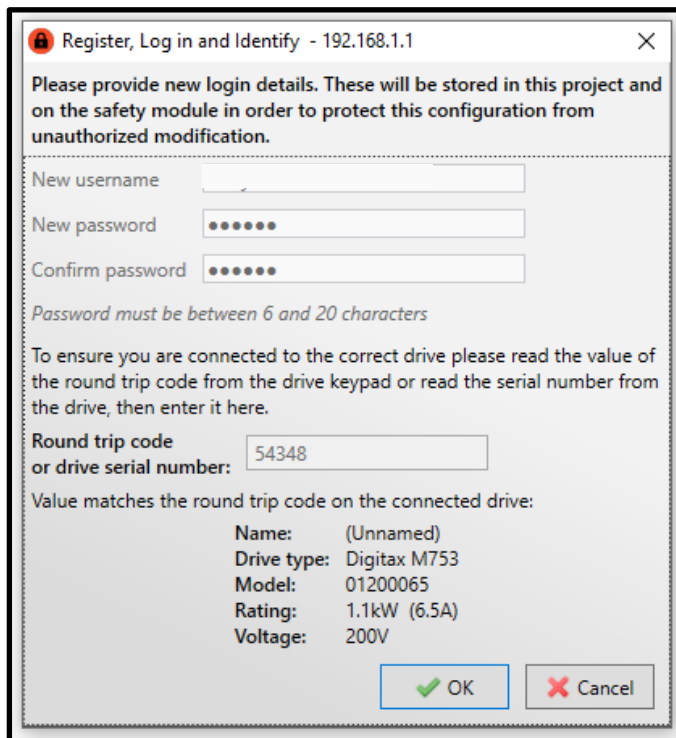


Figure 6-24



In the next step we will put the MiS2x0 into Test mode. The module will only remain in Test mode for a maximum of 24 days (this is configurable by the user). This allows the user to test the configuration. Once tested and development is completed typically the user would sign-off their safety application and then put the module into Operating mode see section 6.6.

Figure 6-25 Select Test

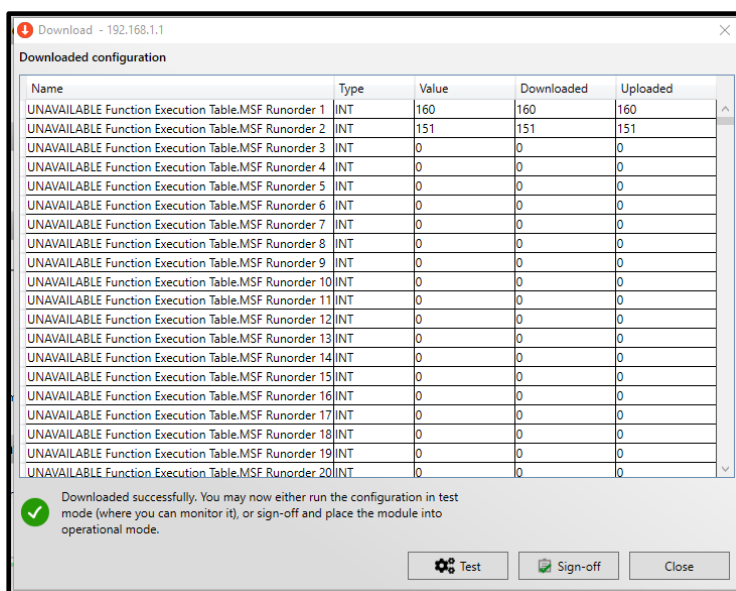
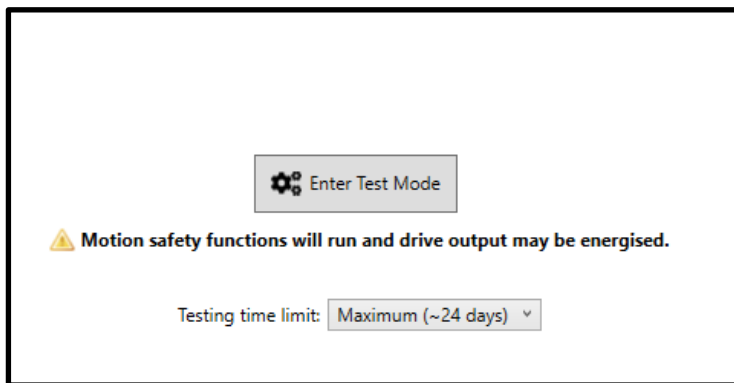


Figure 6-26 Enter Test Mode



6.5 Running the example in Test Mode

In the *Safety Testing* tab, you may view details of the encoder feedback, diagnostics for the MSFs and diagnostics for the inputs and outputs.

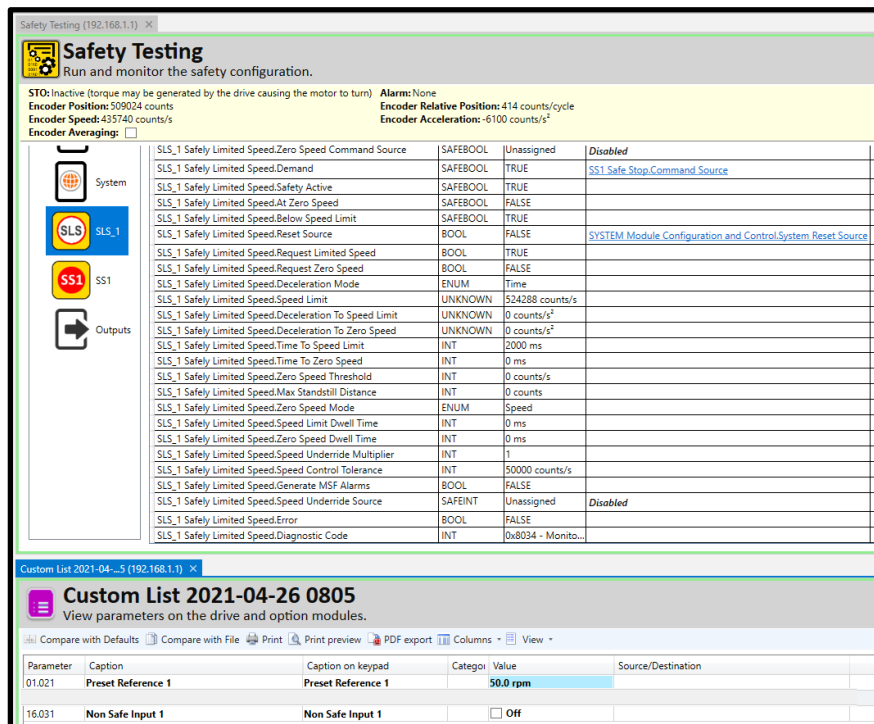
Only proceed if safe to do so.

Figure 6-27 Safety Testing

Parameter	Caption	Caption on keypad	Categoi	Value	Source/Destination
01.021	Preset Reference 1	Preset Reference 1		50.0 rpm	
16.031	Non Safe Input 1	Non Safe Input 1		<input type="checkbox"/> Off	

For this example, we will manually control the drive's speed by configuring the *Reference Selector* to *Preset* (parameter 01.014 = Preset, parameter 01.015 = 1) and varying *Preset Reference 1* (parameter 01.021). We will also control the MiS250's reset by manually writing to *Non Safe Input 1* (BIS 1, parameter 16.031).

Figure 6-28 SLS Diagnostic Code



Connect may be used to manually write the parameters, for convenience the user can choose to create a *Custom List* and add parameter 01.021 and parameter 16.031. (Open the required menu in the parameters folder of the project pane, right click on the desired parameter and select send to custom list).

Follow to steps in Table 6-2 to run the example.

Table 6-2 Steps to run the example

Step	Action	Comment
1	Apply the <i>Forward</i> run signal to the drive by closing the <i>FWD</i> switch on the demo case (Or apply 24V potential to <i>Digital Input 4</i>)	The STO MSF is <i>Active</i> (the 24V to the STO terminal is removed) and the drive will not allow current to flow in the motor
2	Set <i>Non Safe Input 1</i> (parameter 16.031) to true	<ul style="list-style-type: none"> On a rising edge the MiS250 will reset 24V is applied to the STO circuit of the drive The STO MSF is <i>Inactive</i>, and torque may be generated
3	Close the “maintenance switch” to turn off “maintenance mode” (<i>SLS Speed Limit Command Source</i> is active low)	SLS is not monitoring for overspeed
4	Increase the speed to 61 rpm or above (parameter 01.021)	The shaft should rotate at the selected speed.
5	Decrease the speed to 50 rpm (parameter 01.021)	Shaft should rotate at 50 rpm

6	Open the “maintenance switch”	SLS is now monitoring for overspeed
7	Increase the speed to 61 rpm (parameter 01.021)	<ul style="list-style-type: none"> The shaft should rotate at 61 rpm. We have commanded the shaft to go at a speed higher than the safely limited speed SLS <i>Safely Limited Speed Diagnostic code</i> will report <i>Safe Speed Threshold exceeded</i> SS1 <i>Safe Stop Diagnostic Code</i> will report <i>Stopping</i>
8	Decrease the speed to below 6 rpm (parameter 01.021) within 10 seconds of step 7	<ul style="list-style-type: none"> SS1 has detected a successful stop STO is <i>Active</i> and the drive will not turn the motor SS1 <i>Safe Stop Diagnostic Code</i> will report <i>Stopped</i>

The sample time of the MiS210 is fixed at 1 ms, thus the speed resolution is 1000 counts/s. This equates to a rotational speed resolution of 0.114 rpm for the 19-bit encoder in this example. The relationship between rotational speed in rpm and counts/s is given by:

$$\text{Rotational speed} = \frac{\text{counts/s}}{2^{19}} * 60$$

6.6 Running the example in Operating Mode

From the Safety Testing state, the user may exit Safety Testing and then begin to place the module in Operating mode. Operating mode requires the user to sign off their safety application.

Figure 6-29 Select Stop

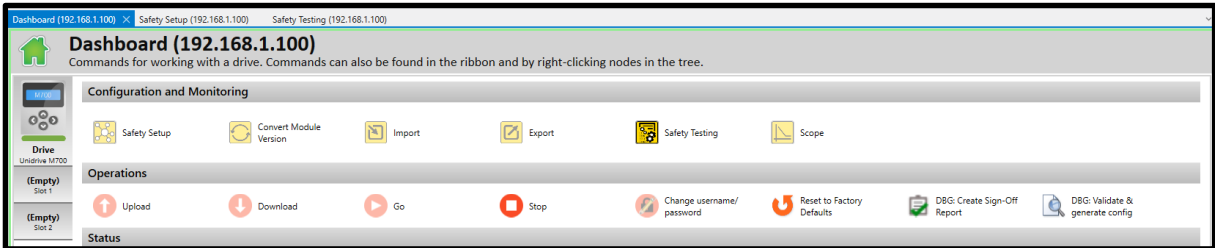


Figure 6-30 Request Stop

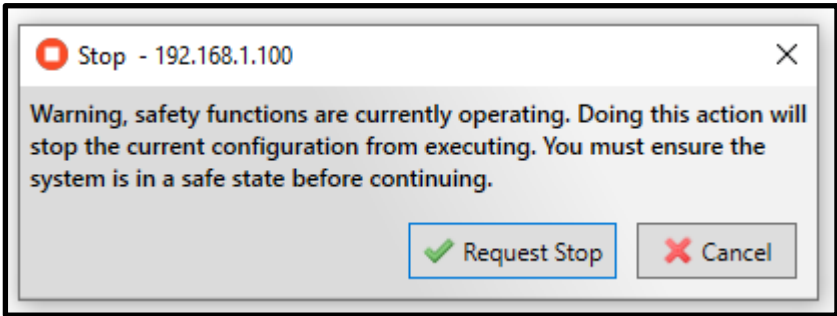


Figure 6-31 Enter the round trip code or drive's serial number

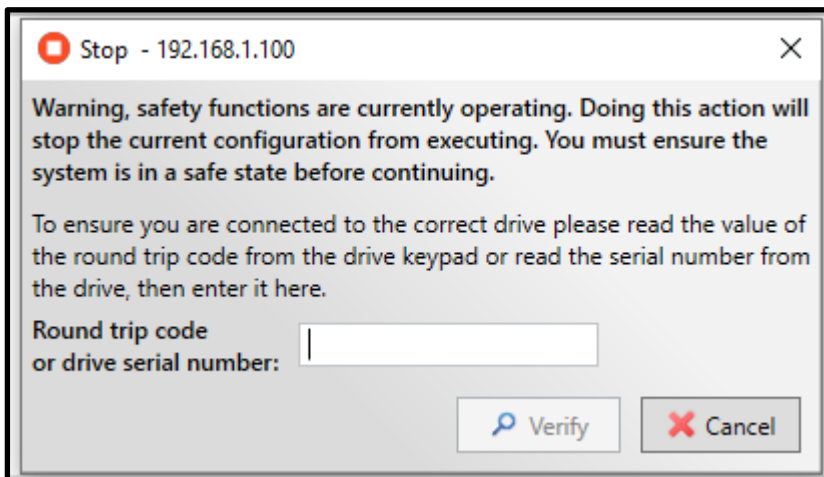
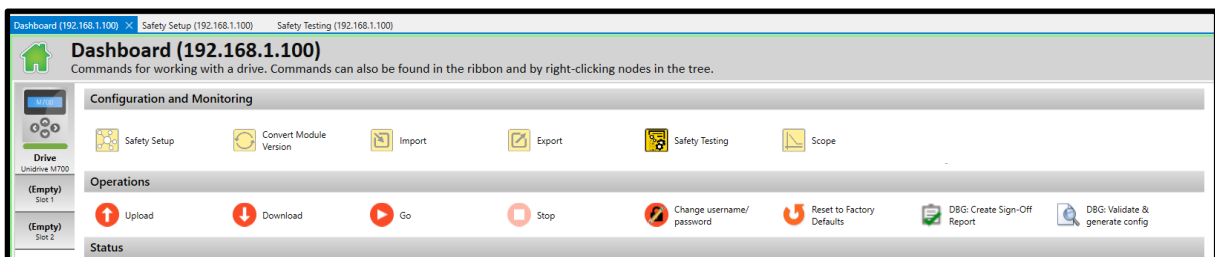
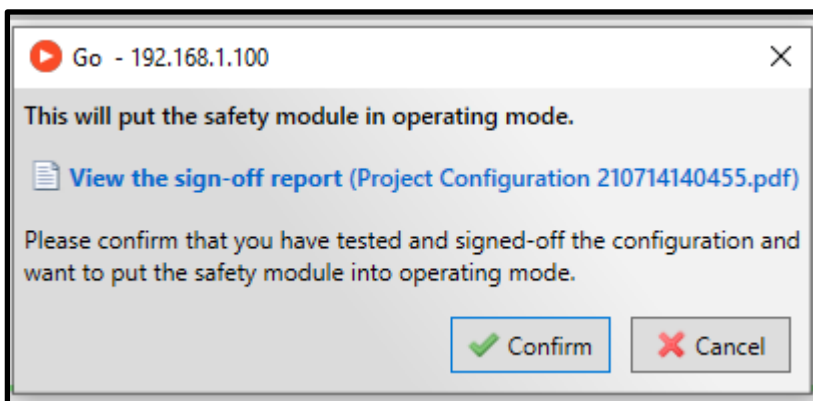


Figure 6-32 Select Go



You must only put the module into Operating mode if you have verified your system and signed off the report.

Figure 6-33 Select Confirm



The module should now be in operating mode.

7 Configuring the MiS210 & MiS250 modules

The PC tool Connect is required to configure the MiS210 and MiS250 safety modules, the modules safety configuration cannot be configured using parameters. From within Connect the user can configure, test and deploy their safety application along with creating a Sign-off report.

Connect is available from your supplier or to download from www.controltechniques.com. See section 3.7.5 Connect requirements for minimum version.

7.1 New project

Launch Connect. The user may *Scan* the network via the appropriate configuration network (Section 7.1.1) or create a new project manually by selecting *Empty Project*, then adding the required drive and safety module (Section 7.1.2).

7.1.1 Scan the network

It is assumed that a suitable drive with an applicable MiS2x0 module installed is connected to either an Ethernet or EIA-485 network (“Serial RTU network”). This example details the use of an Ethernet network with an M700 drive and MiS210 module. The commands available under *File* in the menu bar may be used or select the required network from the *Project Management* tab as shown in this example.

NOTE: Software such as VPNs may block the Scan function.

Figure 7-1 Project Management tab

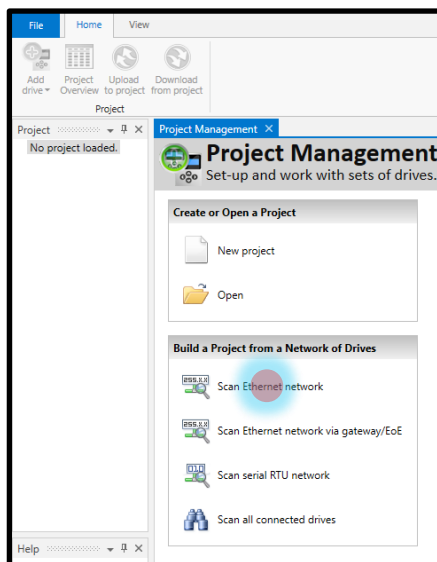
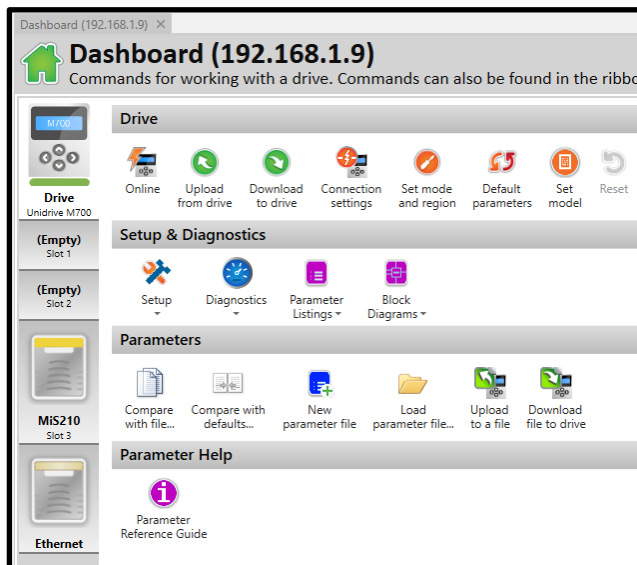


Figure 7-2 Drive's dashboard



Click on the *Scan Ethernet network button* (Figure 7-1). If the drive is successfully discovered, then the Drive's dashboard should load (Figure 7-2).

7.1.2 Add a drive and MiS2x0 module manually

This example details adding an M700 and MiS210 safety module.

Click on *New project* in the *Project management* tab (Figure 7-3). Select *Empty project* (Figure 7-4), add the drive (Figure 7-5) and select the drive type and configuration required (Figure 7-6). Click on Slot 3 in the Drive's dashboard (Figure 7-7) and then select the MiS2x0 module and firmware version (Figure 7-8).

Figure 7-3 New project

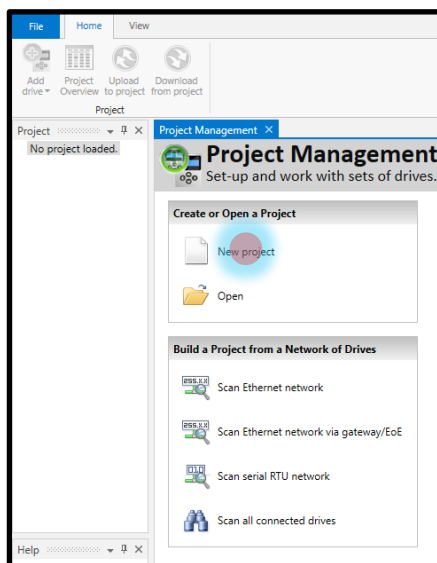


Figure 7-4 Empty project

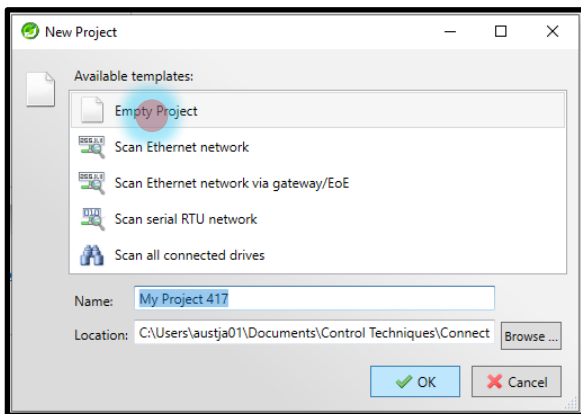


Figure 7-5 Add drive

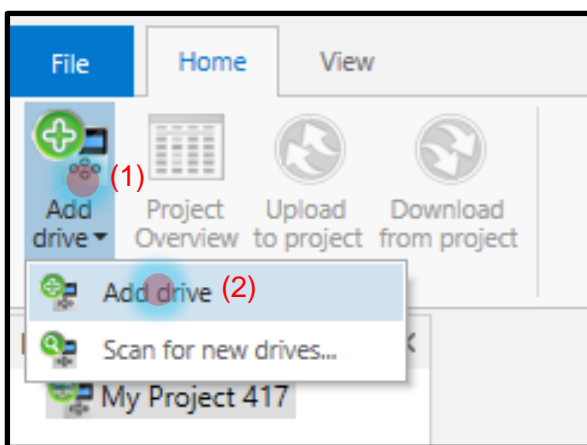


Figure 7-6 Select drive and settings

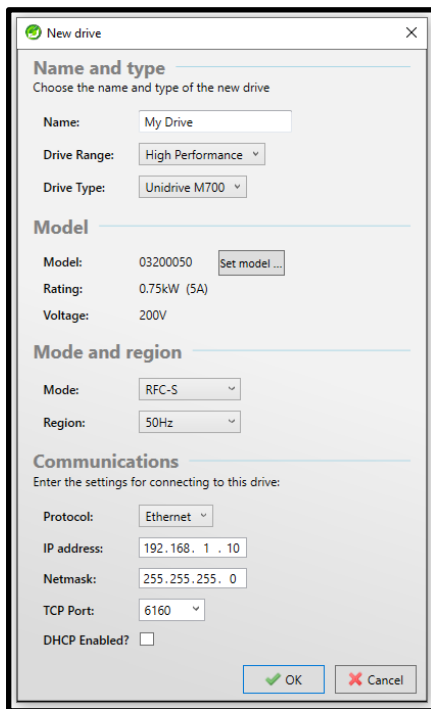


Figure 7-7 Select slot 3

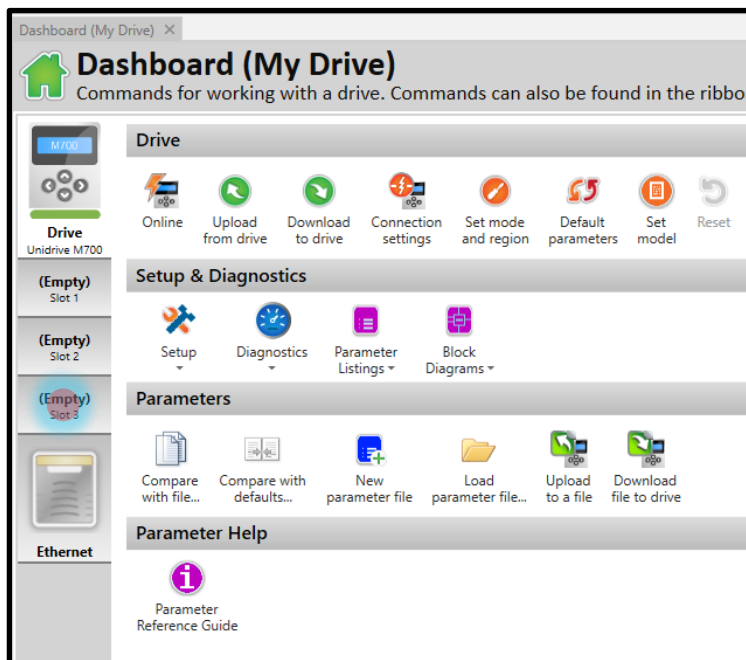
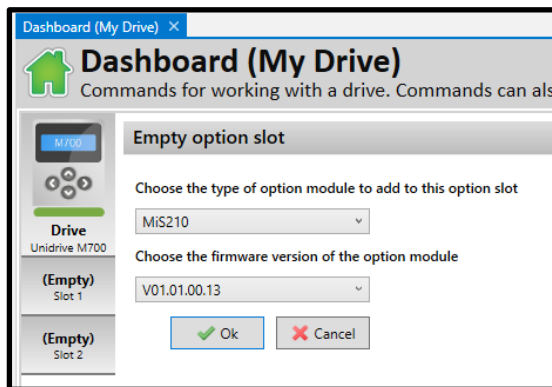


Figure 7-8 Select MiS210 and firmware version



NOTE The MiS2x0 module's firmware is fixed and cannot be changed. Select the required firmware version for your module.

7.2 Drive online and offline states

Safety Setup and import/export functions are undertaken in the drive's offline state, whereas *Downloading*, *Testing* etc are carried out in online state. This can be selected from the *Online* icon in the ribbon (Figure 7-9 Online button).

Figure 7-9 Online button (in offline state)



The icon text always shows Online; however, the icon has a blue background while online (see Figure 7-10) and no background when offline (Figure 7-9).

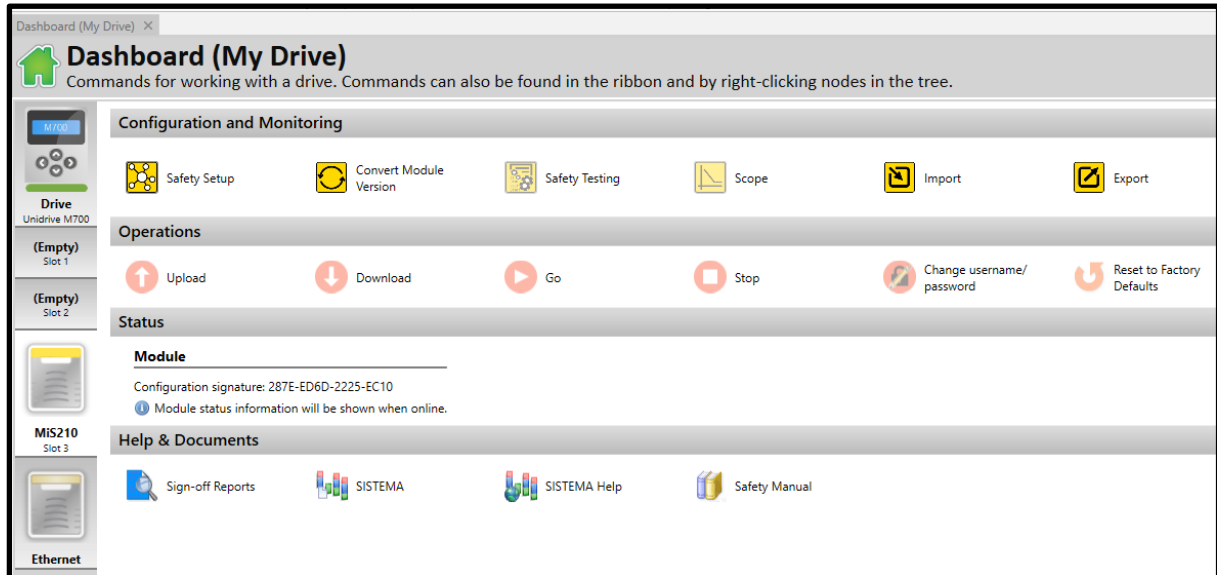
Figure 7-10 Online button (in online state)



7.3 Safety dashboard

Contained in the MiS2x0 module's Dashboard are all the tools for configuration testing and deployment.

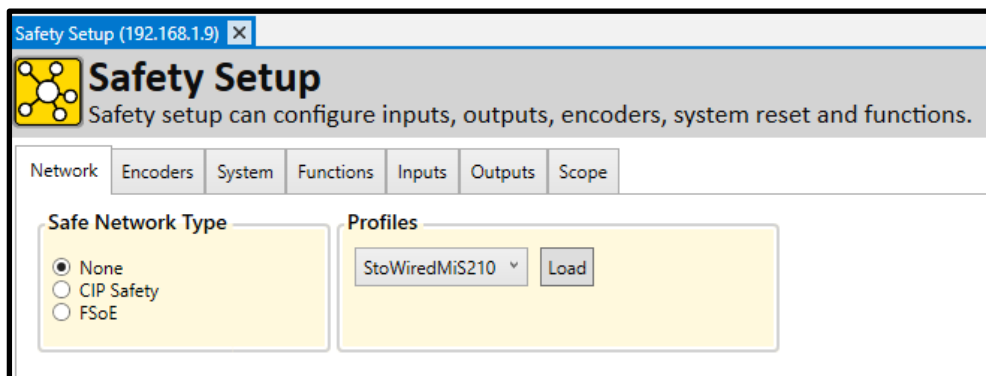
Figure 7-11 MiS2x0 module's Dashboard



7.3.1 Safety Setup

From within the MiS2x0 Dashboard click the *Safety Setup* button.

Figure 7-12 Safety Setup

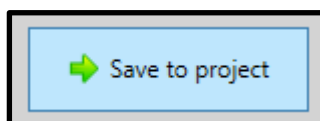


The Safety Setup window will open. From here the user can select the relevant tabs, these are detailed below.

7.3.1.1 Save to Project

To apply changes once a setup has been created click the *Save to Project* button.

Figure 7-13 Save to project

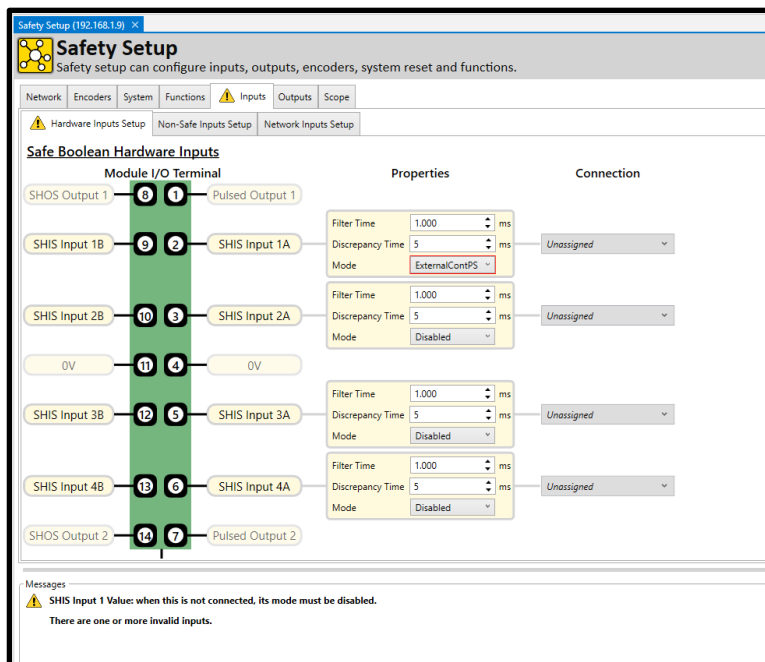


7.3.1.2 Messages

Connect will provide messages regarding the user's configuration issues at design time, these are shown in the Message frame located at the bottom of the Safety Setup page. Additionally,

the tabs where any issues are located will be indicated by triangular yellow exclamation symbols. See Figure 7-14 Messages.

Figure 7-14 Messages



7.3.1.3 Network

The MiS2x0 family is capable of supporting either CIP Safety or FSoE safe networks. In this tab either one safety network or no safety network can be selected. The user can manually select the input and output configurations that are specific to each protocol or select a pre-defined *Profile*. Currently the pre-defined *Profiles* supported are *StoWiredMiS210/MiS250* for no network and *StoFSoENetworkMiS210/MiS250* for FSoE. Selecting a profile will preconfigure some of the safety configuration.

See Section 10 Networked safety for information on configuring safe networks.

7.3.1.4 Encoders

In the Encoder tab the user may configure the primary and secondary encoders as required. The secondary encoder if necessary, is used to compare with the primary encoder in cases where this is a requirement. Note, the MiS2x0 family does not support multiple axes.

NOTE EnDat 2.1 encoders are not supported by the MiS2x0 family.

7.3.1.4.1 MiS2x0 speed resolution

The sample time of the MiS210 is fixed at 1 ms, thus the speed resolution is 1000 counts/s. For example, this equates to a rotational speed resolution of 14.6 rpm for a 1024 PPR AB rotary encoder (CPR = 4096). The relationship between rotational speed in rpm and counts/s for an incremental encoder is given by:

$$\text{Rotational speed (rpm)} = \frac{\text{counts/s}}{\text{PPR} * 4} * 60$$

And for a communications encoder where n is the number of bits per revolution.

$$\text{Rotational speed (rpm)} = \frac{\text{counts/s}}{2^n} * 60$$

7.3.1.4.2 MiS2x0 position and drive's encoder

For position functions, the position value if derived from the drive's encoder is the position as directly reported by the EnDat 2.2 encoder and is not the normalised position used by the drive.

Figure 7-15 Encoder tab

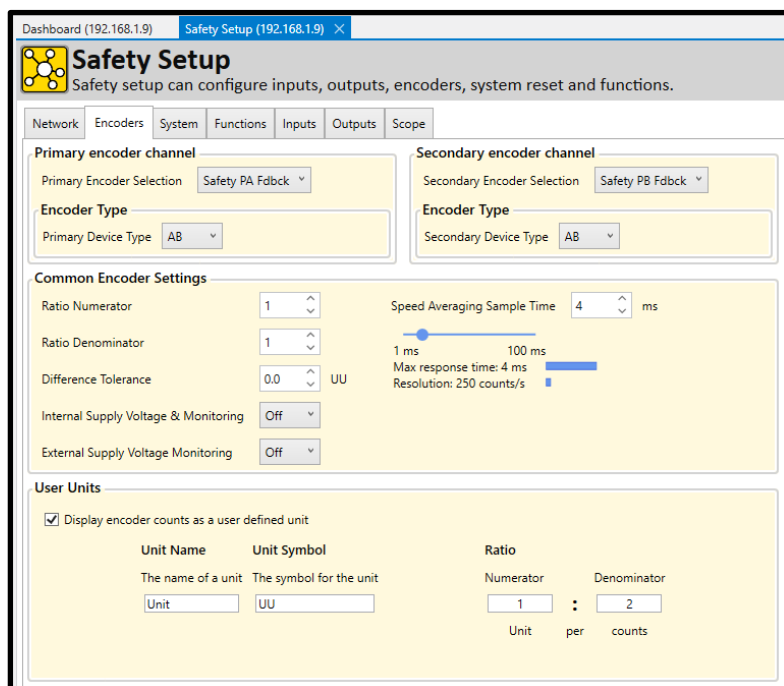


Figure 7-15 Encoder tab shows the Encoder tab in the Safety Setup view. Note, certain settings are only visible when specific features are activated. For example, if a secondary encoder is not in use, then the ratio and tolerance selections in the *Common Encoder Settings* frame will not be visible.

See section 5.1.2 Encoder connections for details of connecting encoders to the MiS2x0 module.

7.3.1.4.3 Encoder terminology

Table 7-1 Encoder terminology

AB	Incremental encoder with two complimentary square wave outputs that are 90° out of phase with each other.
SC	Sine/Cosine encoder with two analogue signals that offset by 90° to each other. The MiS2x0 does not interpolate the Sine/Cosine signals, the signals are counted in the same way as an AB encoder.
EnDat	Communications encoder based on proprietary communications. Only EnDat 2.2 (including Safe EnDat 2.2) encoders are supported by the MiS2x0 family.
SSI	Synchronous Serial Interface communications encoder
Rotary turns bits	With EnDat 2.2 encoders it is used to determine the number of bits within the communication messages from the position feedback device that represent turns. For AB and SC encoders the MiS2x0 requires the rotary turns bits to be set to 25.
Comms bits	Specifies the total number of bits of position information in the comms message from the EnDat 2.2 or SSI encoder.
Comms Baud rate	Defines the baud rate used for encoder communications.

Maximum Acceleration for Test	For Safe EnDat encoders.
Second Position bits	For Safe EnDat encoders. This is the position bits for the second feedback channel in the encoder, this value can be found in the encoder's datasheet.

7.3.1.4.4 Primary encoder channel

If an encoder is required in your application, then enter the configuration for the primary encoder. Select from either the drive's encoder (*Drive P1 Fdbck*) or the local channel A encoder (*Safety PA Fdbck*). See section 5.1.2 Encoder connections for details on the supported encoder types and possible combinations.

The settings for the drive's encoder (EnDat 2.2) are those configured in the drive, however if selecting Safe EnDat then the *Maximum Acceleration for Test* and *Second Position Bits* (refer to encoder manufacturer's datasheet) must be entered in the *Encoder Settings frame*.

7.3.1.4.5 Secondary encoder channel

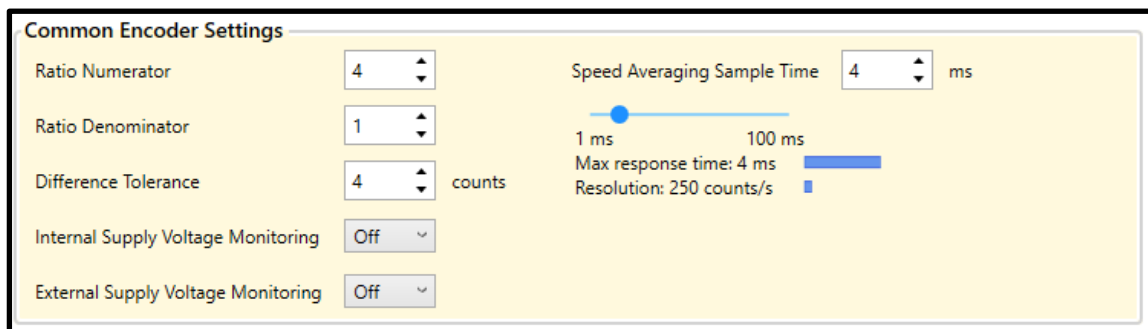
In the case where a secondary encoder is required, then enter the configuration for the encoder in the *Secondary encoder Selection* frame. See section 5.1.2 Encoder connections for details on the supported encoder types and possible combinations.

7.3.1.4.6 Common Encoder Settings

7.3.1.4.6.1 Encoder comparison settings (Ratio Numerator, Ratio Denominator & Difference Tolerance)

If a secondary encoder is used, then the primary encoders position is compared with the secondary encoder.

Figure 7-16 Ratio Numerator, Ratio Denominator & Difference Tolerance



$$\text{Scaled Encoder} = (\text{Secondary Encoder Reading} * \text{Encoder Ratio Numerator}) / \text{Encoder Ratio Denominator}$$

Consider the following example:

Primary Encoder = 4096 Pulses per Revolution, Secondary Encoder = 1024 Pulses per revolution.

To perform the scaling, the *Ratio Denominator* is set to 1 and the *Ratio Numerator* set to 4.

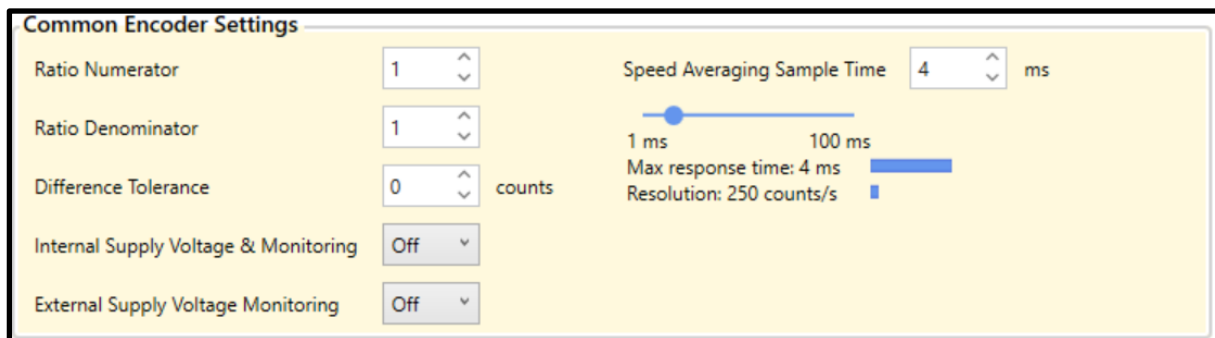
$$\text{Scaled Encoder} = \frac{(1024 * 4)}{1} = 4096$$

The *Difference Tolerance* is relative to the primary encoder and must take account of the difference in encoder resolutions. In the case above the primary encoder will count in units whereas the secondary encoder will increment in increments of 4 once every 4 counts of the primary encoder. Hence to avoid a trip due to a difference tolerance it will need to be set to a minimum of 4. Additionally, the Difference Tolerance must take account of encoder non-linearities, and if the encoders are attached by a mechanical gearbox, the gearbox backlash.

7.3.1.4.6.2 Supply Voltage Monitoring

Internal Supply Voltage & Monitoring if selected provides 5V, 8V or 15V from the encoder port of the MiS2x0 module and monitors the voltage. The *External Supply Voltage Monitoring* if selected monitors an external encoder supply via pin 7 of the encoder port. See section 5.1.2 Encoder Connections.

Figure 7-17 Supply monitoring

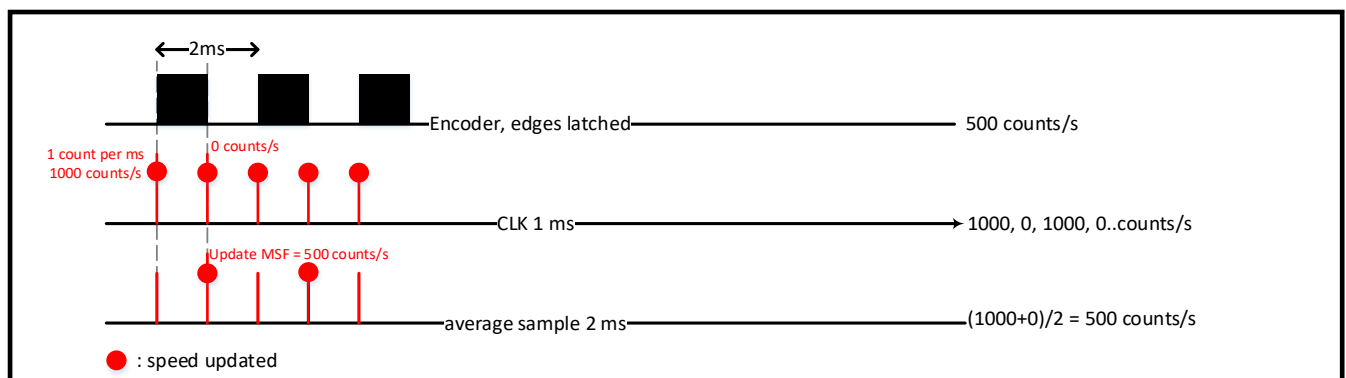


7.3.1.4.6.3 Speed Averaging Sample Time

This function acts on the calculated speed and not directly on the of the positional resolution of the encoder. It averages the counts/s (speed) per a sample time in milliseconds. This gives an apparent increase in speed resolution at the expense of a longer reaction time.

Speed averaging is useful to avoid fluctuations in the measured speed due to encoder resolution, this is shown in Figure 7-18. Speed here without averaging, each consecutive update of speed every millisecond would change, i.e. 1000, 0 and then 1000 etc. With speed averaging selected each consecutive reading is consistent.

Figure 7-18 Speed averaging



The resolution value of counts/s (speed) shown by the *Resolution* bar graph decreases as the sampling time increases, i.e. the counts/s resolution (smallest dividable part) becomes “better”. However, the response time increases. See Figure 7-19 Speed Averaging Sample Time.

Figure 7-19 Speed Averaging Sample Time

7.3.1.4.6.4 User Units

If selected the encoder counts may be displayed in Connect in terms of *User Units*. Enter the *Numerator* and *Denominator* required for your selected units, the *Unit Name* and *Unit Symbol* can also be entered.

Figure 7-20 User Units

7.3.1.5 System

7.3.1.5.1 Reset Setup

7.3.1.5.1.1 System Reset Source & Peripheral fault Reset

System Reset Source can be assigned to an input that typically, but not necessarily would be connected to a reset push button.

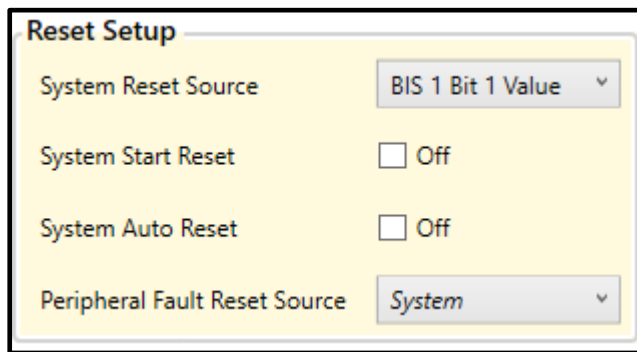
The *Start up* state refers to when the MiS2x0 module is powered up.

MSF alarms are raised when the system fails to operate within specified limits.

Peripheral Faults are alarms representing those faults that can be associated with the connected peripherals. For example, when an encoder cable has become disconnected and communications with the encoder is lost.

The *Peripheral Fault Reset Source* can either be a separate input in or it can use the *System Reset Source (System)*, or it can be disabled. If it is disabled, then Connect and the configuration credentials are required to reset a peripheral fault

Figure 7-21 Reset setup frame



7.3.1.5.1.2 Position and Speed Setup

If a safety network that supports integers is utilised, then network variables may be assigned to The *Primary Position* and *Primary Speed*. This allows the position and speed to be communicated to the safety PLC. For position functions, the position value if derived from the drive's encoder is the position as directly reported by the EnDat 2.2 encoder and is not the normalised position used by the drive.

7.3.1.5.1.3 Alarm Setup

It is possible to configure a safe output to indicate an *Alarm Present* condition.

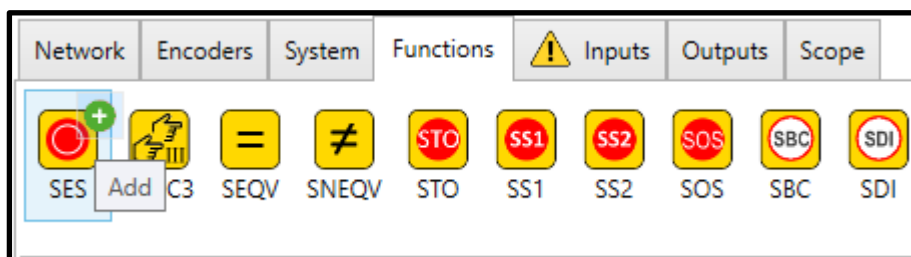
7.3.1.6 Functions

Contained in the *Functions* tab the user will find the main MSFs and associated MSFs such as logic. MSFs are outlined in section 8.

7.3.1.6.1 Add an MSF to the project

To add an MSF to your project simply double click on the required MSF icon, or click the green addition symbol when hovering over the icon. Some MSFs allow multiple instances of themselves; others only permit a single instance.

Figure 7-22 Adding an MSF



7.3.1.6.2 Removing an MSF from the project

To remove an MSF, click on the cross at the top of the tab. To remove all MSFs select the *Delete All* icon from the right of the *Functions* tab.

Figure 7-23 Deleting an MSF

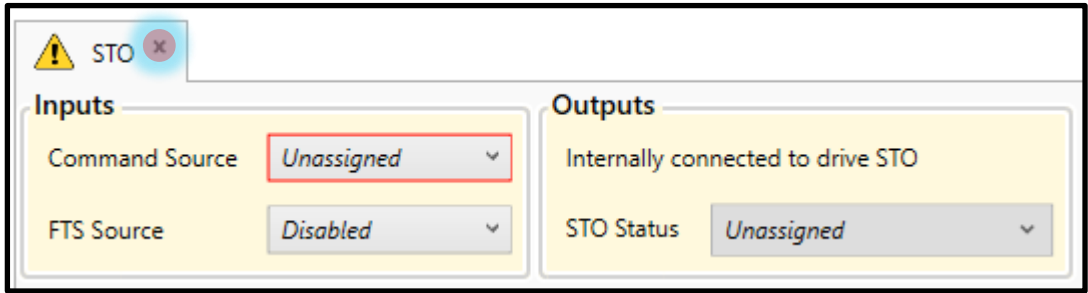


Figure 7-24 Deleting all MSFs



7.3.1.6.3 Connecting MSFs together

MSFs can be connected to each other where appropriate using the drop-down selections from *Inputs* and *Outputs* within an MSF. In Figure 7-25 Selecting an output and Figure 7-26 Connecting MSFs, an SES MSF and STO MSF have been added to the project, the *Demand* output of the SES has been connected to the *STO Command Source*. Note, the connection can be made from either the Output of SES or the Input of STO dropdown menus.

Figure 7-25 Selecting an output

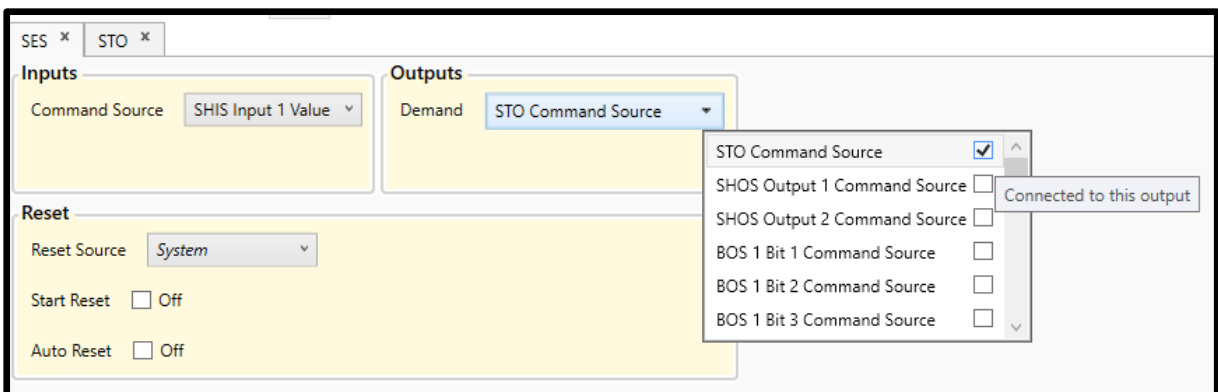


Figure 7-26 Connecting MSFs



7.3.1.7 Inputs

7.3.1.7.1 Hardware Inputs Setup (Safe Boolean Hardware Inputs)

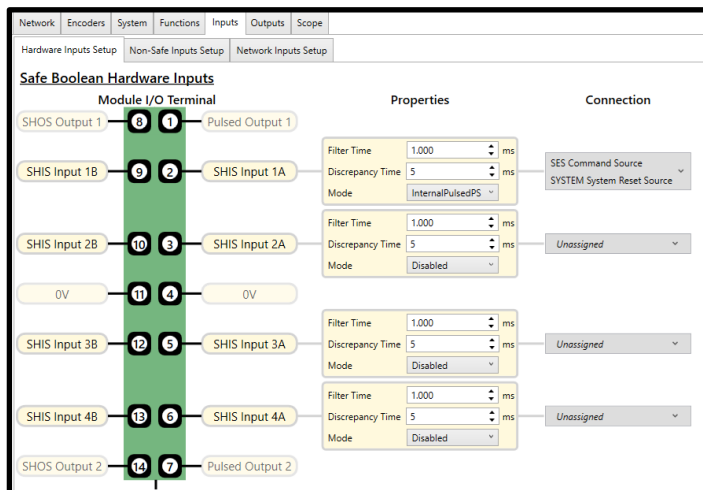
If safe hardware inputs are used in the MSFs' configurations, then the user must also configure the hardware inputs in the *Inputs* tab.

There are four two channel safe boolean hardware inputs available on the MiS2x0. Each channel can be configured with a filter time to aid with noise, a discrepancy time that allows a delay between each channel of the input becoming active, and a mode that allows configuration of the input type (see Table 7-2 Hardware input Mode).

Table 7-2 Hardware input Mode

Mode	Comment
ExternalContPS	An external 24V signal
InternalPulsedPS	The pulsed outputs of the MiS2x0 (terminals 1 & 7) are used to feed the switching device
OSSD	Approved OSSD (Output Signal Switching Device) outputs can be connected without restriction to the inputs

Table 7-3 Safe Boolean hardware inputs



7.3.1.7.2 Non-Safe Inputs Setup (Non-Safe Boolean Inputs)

If the configuration made by the user contains non-safe inputs (referred to as BIS inputs and Non Safe Inputs), then the relevant non-safe inputs assignments will be shown in the *Non-Safe Inputs Setup* tab. If required, the user can also modify the assignments from this tab.

Non Safe inputs may be written to via menu 17 or menu 16 for the MiS210 and MiS250 respectively. For example, the user may map a digital input of the drive to a *Non Safe Input*.

A single instance of the BIS MSF contains four inputs, Table 7-4 BIS MSF - Non Safe Inputs details how a total of four BIS MSFs (BIS 1 to BIS 4) provide the sixteen Non Safe inputs.

Figure 7-27 Non-Safe Inputs Setup

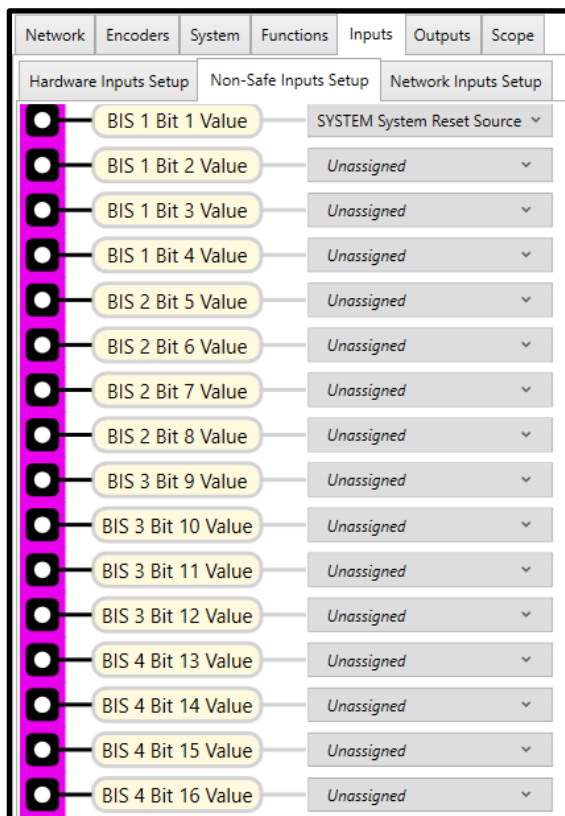


Table 7-4 BIS MSF - Non Safe Inputs

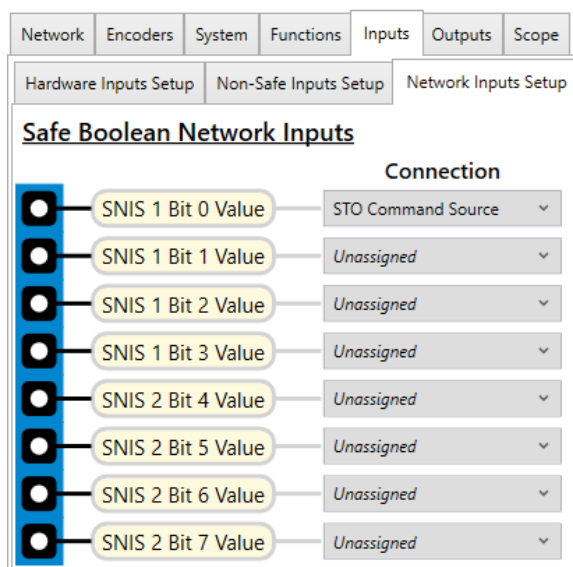
BIS MSF 1 to 4	Menu 16/17 caption	Menu 16/17 parameter
BIS 1 Bit 1 value	Non Safe Input 1	031
BIS 1 Bit 2 value	Non Safe Input 2	032
BIS 1 Bit 3 value	Non Safe Input 3	033
BIS 1 Bit 4 value	Non Safe Input 4	034
BIS 2 Bit 5 value	Non Safe Input 5	035
BIS 2 Bit 6 value	Non Safe Input 6	036
BIS 2 Bit 7 value	Non Safe Input 7	037
BIS 2 Bit 8 value	Non Safe Input 8	038
BIS 3 Bit 9 value	Non Safe Input 9	039
BIS 3 Bit 10 value	Non Safe Input 10	040
BIS 3 Bit 11 value	Non Safe Input 11	041
BIS 3 Bit 12 value	Non Safe Input 12	042
BIS 4 Bit 13 value	Non Safe Input 13	043
BIS 4 Bit 14 value	Non Safe Input 14	044
BIS 4 Bit 15 value	Non Safe Input 15	045
BIS 4 Bit 16 value	Non Safe Input 16	046

7.3.1.7.3 Network Inputs Setup

If network safety is used in the user’s configuration, then the Network Input assignments will be shown in the *Network Inputs Setup* tab. If required, the user can also modify the assignments from this tab.

A single instance of the SNIS MSF contains four inputs and they may be blocks of safe Booleans or safe integers. Depending on the *Network* setup the inputs shown will vary.

Figure 7-28 Network Inputs Setup



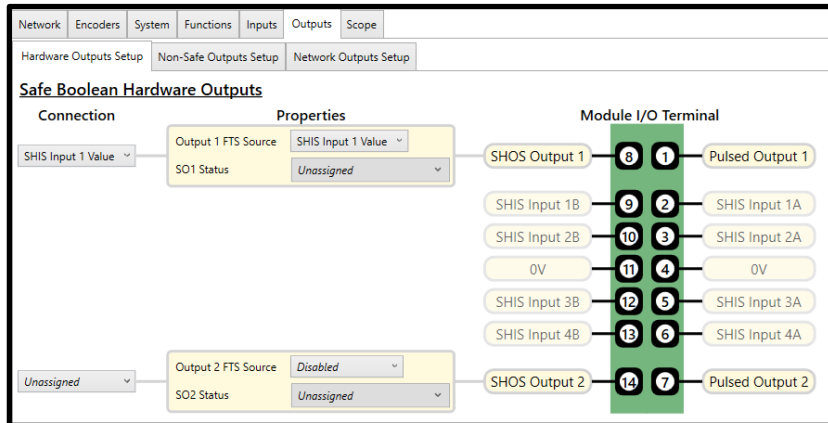
7.3.1.8 Outputs

7.3.1.8.1 Hardware Outputs Setup (Safe Boolean Hardware Outputs)

When safe outputs are used in the user's configuration there is no need for the user to enable the outputs in the *Hardware Outputs Setup* tab.

It is possible for the user to assign an input to the *FTS Source* (Force to safe). If this input is high, then the safe hardware output is forced safe. Additionally, the output *SO Status* (Safe Output) can be assigned to an output therefore providing the status of the output, for example to pass the value to the safety network if used.

Figure 7-29 Safe Boolean Hardware Outputs



7.3.1.8.2 Non-Safe Outputs (Non-Safe Boolean Outputs)

If the configuration made by the user contains non-safe outputs (referred to as BOS outputs and Non Safe Outputs), then the relevant non-safe output assignments will be shown in the *Non-Safe Outputs Setup* tab. If required, the user can also modify the assignments from this tab.

Non Safe outputs may be written to via menu 17 or menu 16 for the MiS210 and MiS250 respectively.

A single instance of the BOS MSF contains four outputs, Figure 7-30 Non Safe Outputs details how a total of four BOS MSFs (BOS 1 to BOS 4) provide the sixteen Non Safe outputs.

Figure 7-30 Non Safe Outputs

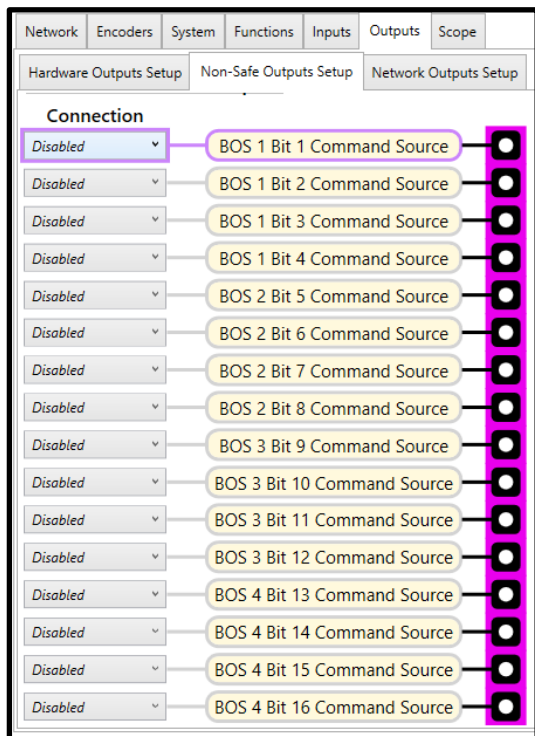


Table 7-5 BOS MSF - Non Safe Outputs

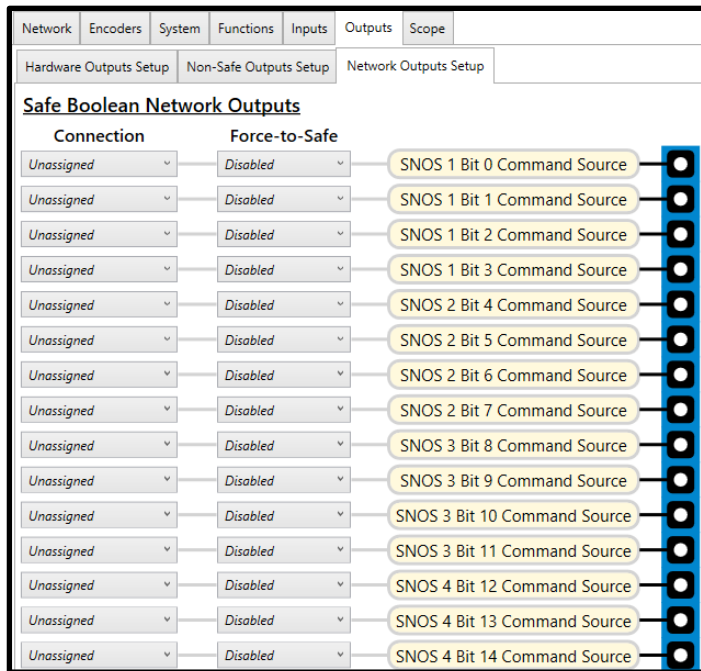
BOS MSF 1 to 4	Menu 16/17 caption	Menu 16/17 parameter
BOS 1 Bit 1 value	Non Safe Output 1	051
BOS 1 Bit 2 value	Non Safe Output 2	052
BOS 1 Bit 3 value	Non Safe Output 3	053
BOS 1 Bit 4 value	Non Safe Output 4	054
BOS 2 Bit 5 value	Non Safe Output 5	055
BOS 2 Bit 6 value	Non Safe Output 6	056
BOS 2 Bit 7 value	Non Safe Output 7	057
BOS 2 Bit 8 value	Non Safe Output 8	058
BOS 3 Bit 9 value	Non Safe Output 9	059
BOS 3 Bit 10 value	Non Safe Output 10	060
BOS 3 Bit 11 value	Non Safe Output 11	061
BOS 3 Bit 12 value	Non Safe Output 12	062
BOS 4 Bit 13 value	Non Safe Output 13	063
BOS 4 Bit 14 value	Non Safe Output 14	064
BOS 4 Bit 15 value	Non Safe Output 15	065
BOS 4 Bit 16 value	Non Safe Output 16	066

7.3.1.8.3 Network Outputs Setup

If network safety is used in the user's configuration, then the Network Output assignments will be shown in the *Network Outputs Setup* tab. If required, the user can also modify the assignments from this tab.

A single instance of the SNOS MSF contains four outputs and they may be blocks of safe Booleans or safe integers. Depending on the *Network* setup the outputs shown will vary.

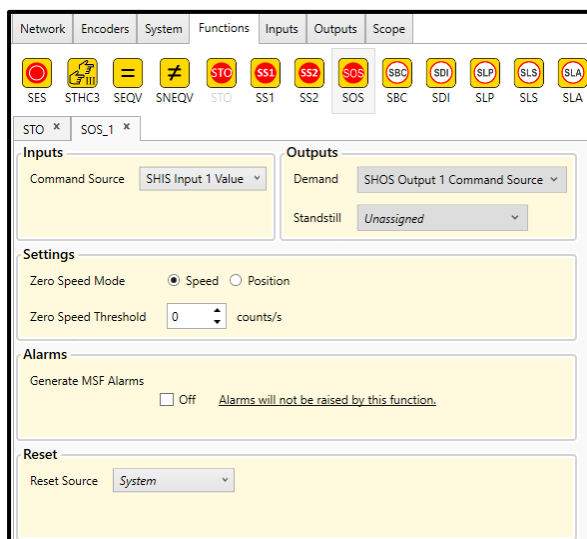
Figure 7-31 Network Outputs Setup



7.3.1.9 Generate MSF Alarms option

If certain MSFs monitored values go outside of their envelope, then by default an alarm is raised. This alarm can be deactivated at design time by deselecting the *Generate MSF Alarms* option where provided in a specific MSF setup tab. If it is required that the MSF demand forms an input to further MSFs, alarms would need to be disabled. For example, Figure 7-32 MSF Alarm deactivated, shows SOS with the MSF alarm deactivated.

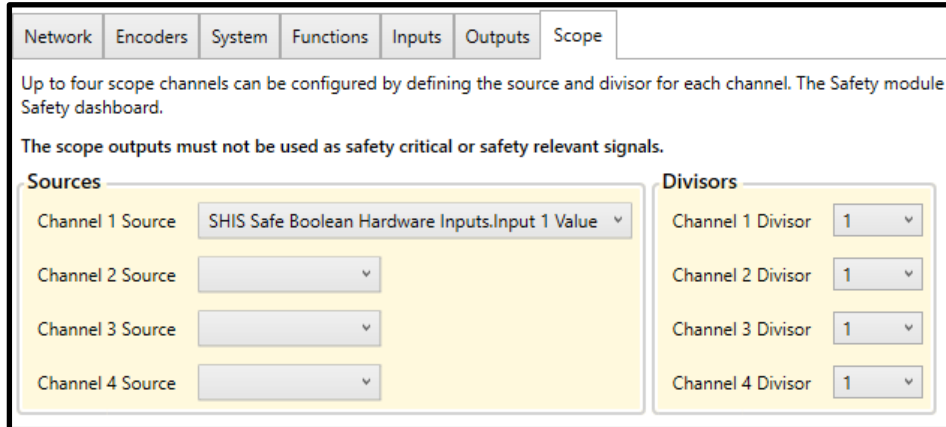
Figure 7-32 MSF Alarm deactivated



7.3.1.10 Scope

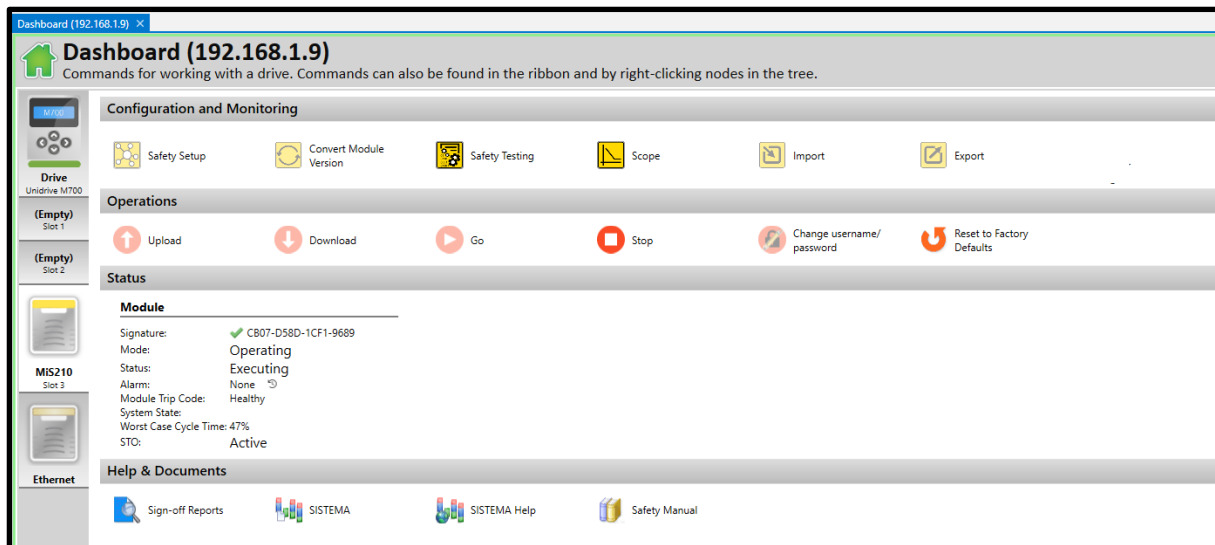
Up to four channels of data from the MiS2x0 module may be captured using the drive's onboard scope. The required channels are configured in the *Scope* tab along with an optional *Divisor*.

Figure 7-33 Scope



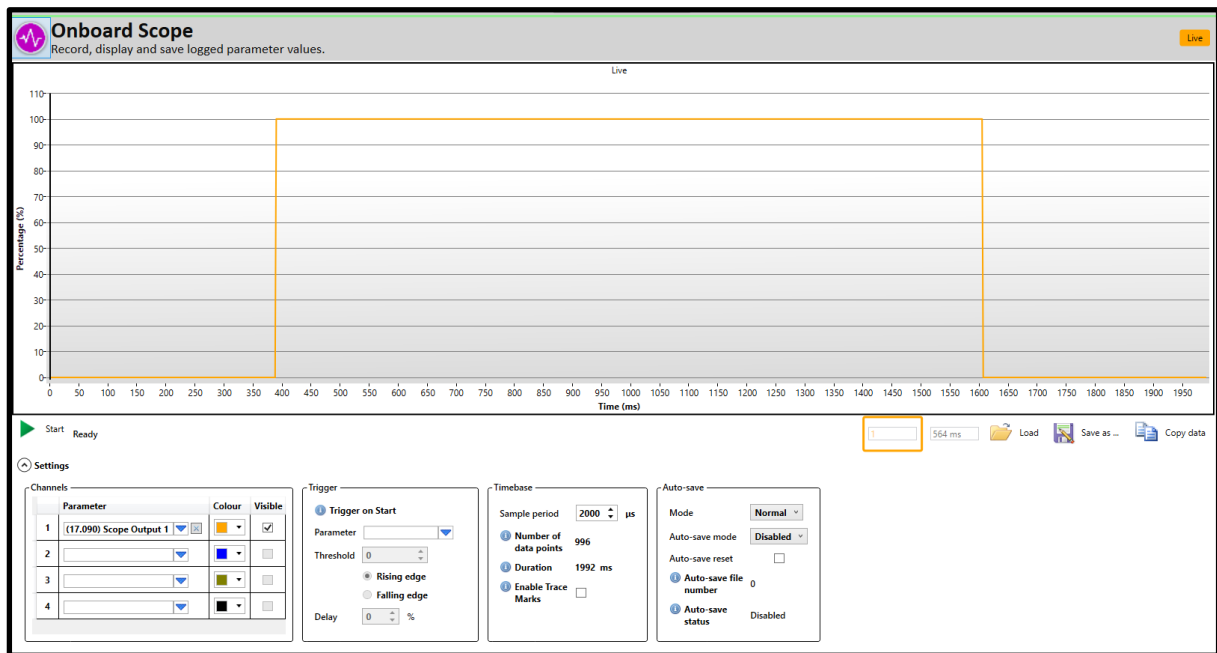
Once the configuration is downloaded to the MiS2x0 module, and the MiS2x0 is either placed in *Safety Testing* or *Operating mode* (by performing a Safety sign-off) then the user can select the *Scope* button from the MiS2x0 dashboard. This will launch the pre-configured drive's onboard scope.

Figure 7-34 Scope button on MiS2x0 Dashboard



The *Sample period* and trigger options can be set in the Onboard Scope, and then the *Start* button pressed to capture a recording of the relevant channels.

Figure 7-35 Onboard Scope



7.3.2 Safety testing

Once a valid configuration has been downloaded the user may place the MiS2x0 in Safety Testing mode. Here values of inputs, outputs, position, speed, and MSFs can be viewed.

Figure 7-36 Safety Testing button on MiS2x0 Dashboard

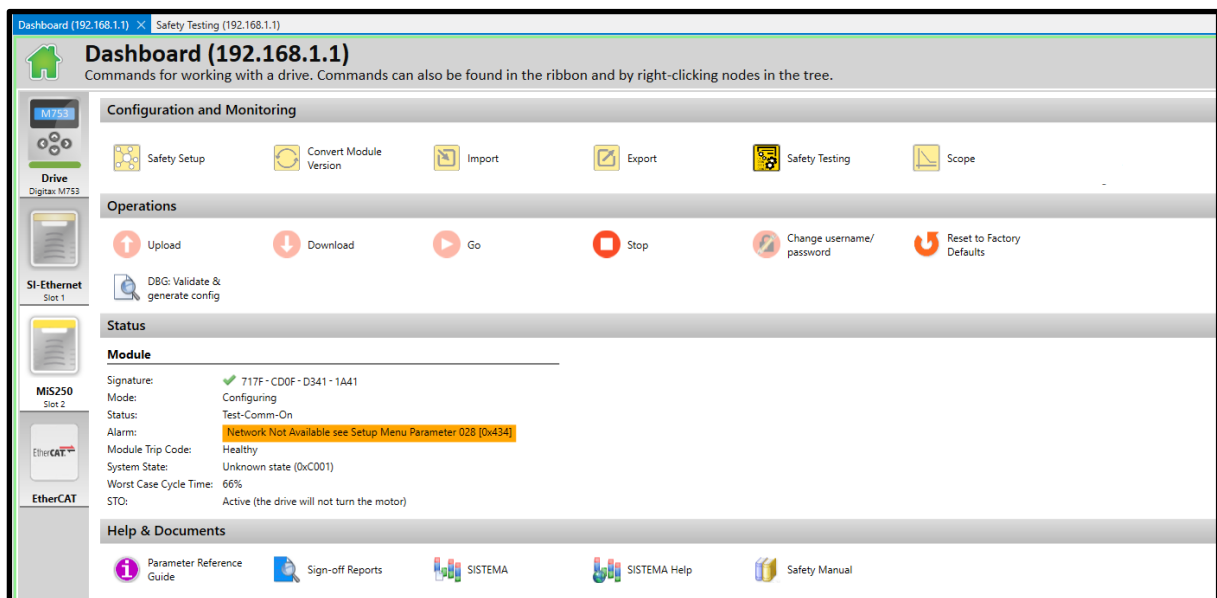


Figure 7-37 Safety Testing

Safety Testing
Run and monitor the safety configuration.

STO: Active (the drive will not turn the motor) Alarm: Network Not Available see Setup Menu Parameter 028 [0x434]
 Encoder Position: 100901 counts Encoder Relative Position: 0 counts/cycle
 Encoder Speed: -500 counts/s Encoder Acceleration: 62500 counts/s²
 Encoder Averaging:

Run Order	Name	Type	Value	Connection
	SLS_1 Safely Limited Speed.Speed Limit Command Source	SAFEBOOL	FALSE	SINIS_1 Safe Boolean Network Inputs.Bit 0 Value
	SLS_1 Safely Limited Speed.Zero Speed Command Source	SAFEBOOL	Unassigned	Disabled
	SLS_1 Safely Limited Speed.Demand	SAFEBOOL	FALSE	SHOS Safe Boolean Hardware Outputs.Output_1.Command Source
	SLS_1 Safely Limited Speed.Safety Active	SAFEBOOL	FALSE	
	SLS_1 Safely Limited Speed.At Zero Speed	SAFEBOOL	FALSE	
	SLS_1 Safely Limited Speed.Below Speed Limit	SAFEBOOL	FALSE	
	SLS_1 Safely Limited Speed.Reset Source	BOOL	FALSE	SYSTEM.Module Configuration and Control.System Reset Source
	SLS_1 Safely Limited Speed.Request Limited Speed	BOOL	FALSE	
	SLS_1 Safely Limited Speed.Request Zero Speed	BOOL	FALSE	
	SLS_1 Safely Limited Speed.Deceleration Mode	ENUM	Immediate	
	SLS_1 Safely Limited Speed.Speed Limit	UNKNOWN	52429 counts/s	
	SLS_1 Safely Limited Speed.Deceleration To Speed Limit	UNKNOWN	0 counts/s ²	
	SLS_1 Safely Limited Speed.Deceleration To Zero Speed	UNKNOWN	0 counts/s ²	
	SLS_1 Safely Limited Speed.Time To Speed Limit	INT	0 ms	
	SLS_1 Safely Limited Speed.Time To Zero Speed	INT	0 ms	
	SLS_1 Safely Limited Speed.Zero Speed Threshold	INT	0 counts/s	
	SLS_1 Safely Limited Speed.Max Standstill Distance	INT	0 counts	
	SLS_1 Safely Limited Speed.Zero Speed Mode	ENUM	Speed	
	SLS_1 Safely Limited Speed.Speed Limit Dwell Time	INT	0 ms	
	SLS_1 Safely Limited Speed.Zero Speed Dwell Time	INT	0 ms	
	SLS_1 Safely Limited Speed.Speed Underride Multiplier	INT	412	
	SLS_1 Safely Limited Speed.Speed Control Tolerance	INT	0 counts/s	
	SLS_1 Safely Limited Speed.Generate MSF Alarms	BOOL	FALSE	
	SLS_1 Safely Limited Speed.Speed Underride Source	SAFEINT	0	SINIS Safe Integer Network Inputs.Integer_1 Value
	SLS_1 Safely Limited Speed.Error	BOOL	FALSE	
	SLS_1 Safely Limited Speed.Diagnostic Code	INT	0x0-	

7.3.3 Convert module version

The module's firmware is fixed and cannot be changed, however configurations for deployment in modules with lower versions of firmware to that of the project can be created by using the *Convert Module Version* button on the *MiS2x0 Dashboard*.

For V01.01.00.34 firmware the Convert tool will be hidden, if your project is based on V01.00.00.17 firmware the Convert tool will be available.

Figure 7-38 Convert Module Version button on MiS2x0 Dashboard

Dashboard (192.168.1.9)
Commands for working with a drive. Commands can also be found in the ribbon and by right-clicking nodes in the tree.

Configuration and Monitoring

- Safety Setup
- Convert Module Version
- Safety Testing
- Scope
- Import
- Export

Operations

- Upload
- Download
- Go
- Stop
- Change username/password
- Reset to Factory Defaults

Status

Module

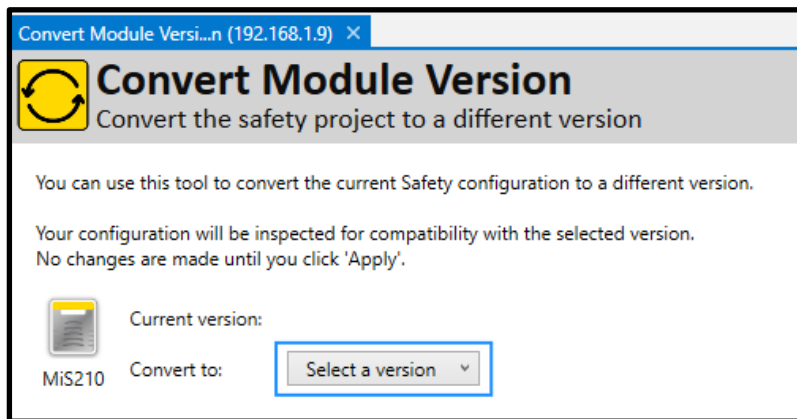
- Signature: ✓ CB07-D58D-1CF1-9689
- Mode: Operating
- Status: Executing
- Alarm: None
- Module Trip Code: Healthy
- System State: Healthy
- Worst Case Cycle Time: 47%
- STO: Active

Help & Documents

- Sign-off Reports
- SISTEMA
- SISTEMA Help
- Safety Manual

If newer features are used in your configuration that are not supported by previous versions of firmware, then it will not be possible for the conversion to take place.

Figure 7-39 Convert Module Version



7.3.4 Scope

See section 7.3.1.10 Scope.

7.3.5 Import

It is possible to import a suitable configuration from another Connect project, or another drive in the current project. The *Import* button is located on the MiS2x0 Dashboard. Each drive with a MiS2x0 module in a project has its own safety configuration.

Click the *Change* button in the *Current project* located in the *Source* frame and select the location of another project that you want to import the safety configuration from or select from another drive in the current project. Click *Import* to import the safety configuration into the current drive's MiS2x0 module. The compatibility of a source drive's MiS2x0 configuration will be checked when the *Import* button is pressed.

NOTE It is not possible to import an MiS210 configuration to an MiS250 or vice versa.

Figure 7-40 Import button on MiS2x0 Dashboard

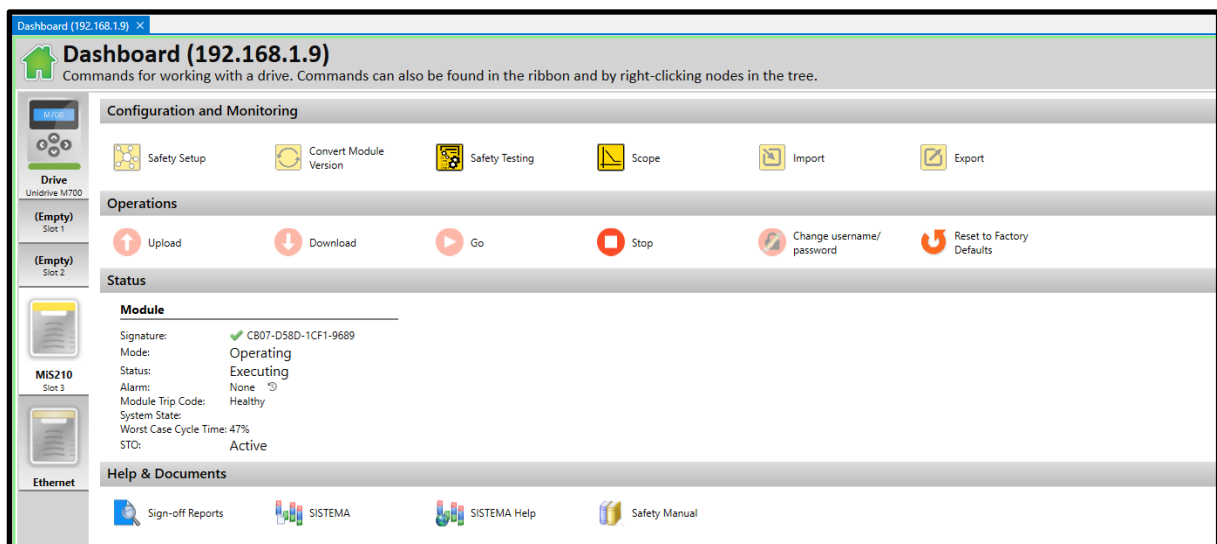
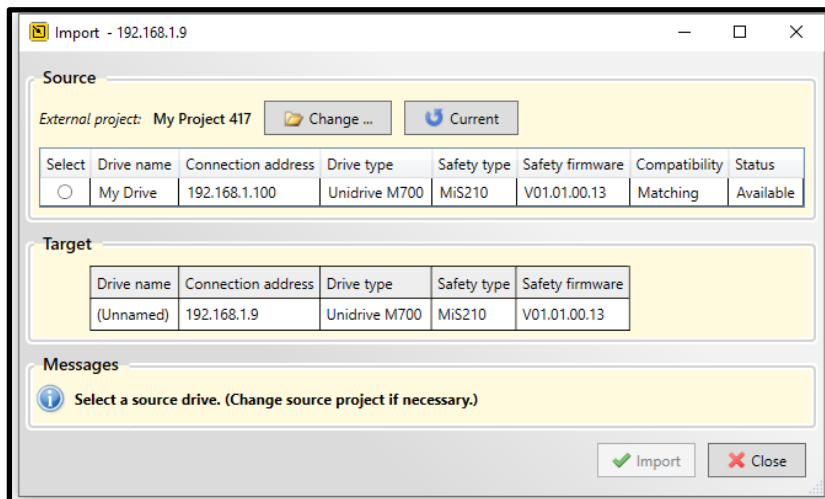


Figure 7-41 Import



7.3.6 Export

Safety configurations from the current project may be exported to other suitable existing projects, or other suitable drives within the current project. Each drive with a MiS2x0 module in a project has its own safety configuration.

Click the *Change* button in the *Current project* located in the *Source* frame and select the location of another project that you want to export the safety configuration to or select another drive in the current project to export to. If more than one drive with MiS2x0 modules are located in a target project, then the user may choose to export to multiple drives.

Click *Export* to export the safety configuration to the selected drives' MiS2x0 modules. The compatibility of a target drive's MiS2x0 configuration will be checked when the *Export* button is pressed.

NOTE It is not possible to export an MiS210 configuration to an MiS250 or vice versa.

Figure 7-42 Export button on MiS2x0 Dashboard

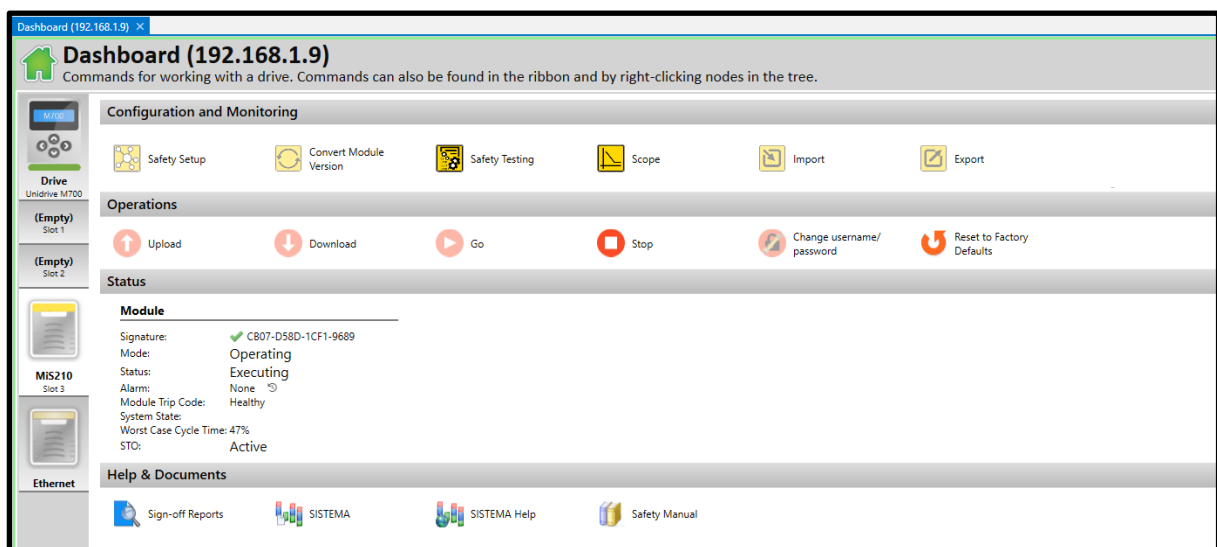
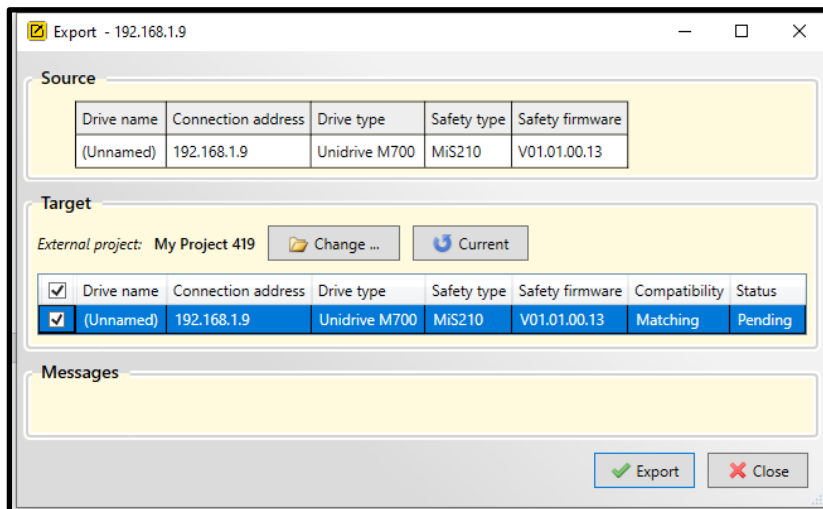


Figure 7-43 Export

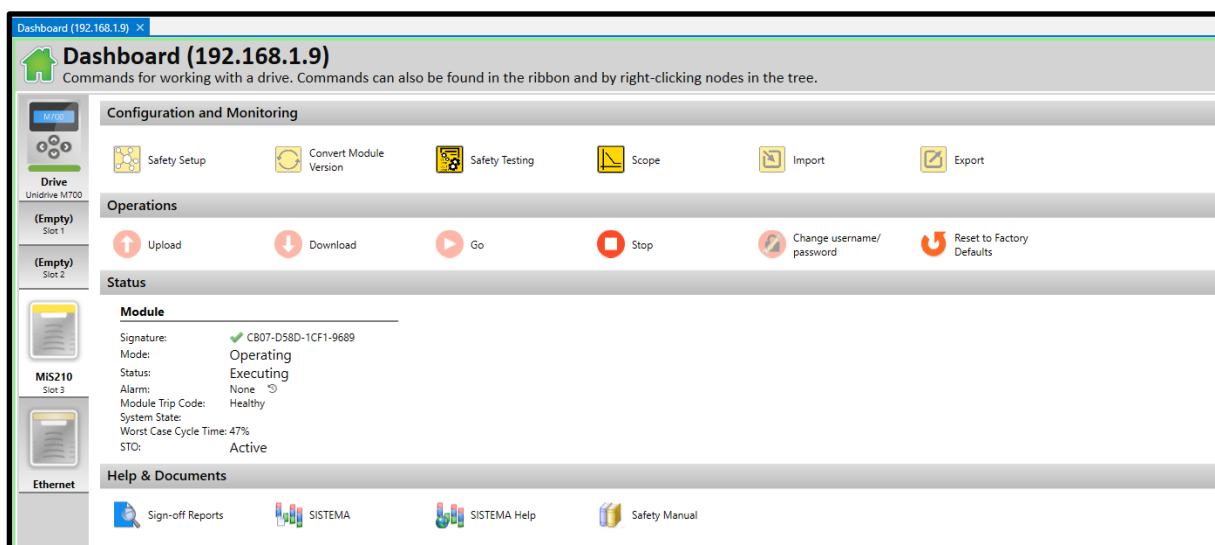


7.3.7 Upload

An existing configuration may be uploaded from an MiS2x0 module to replace the current project configuration. The current project configuration will be overwritten if an *Upload* is performed.

In drive *Online* state (see section 7.2) click the *Upload* button.

Figure 7-44 Upload button on MiS2x0 Dashboard

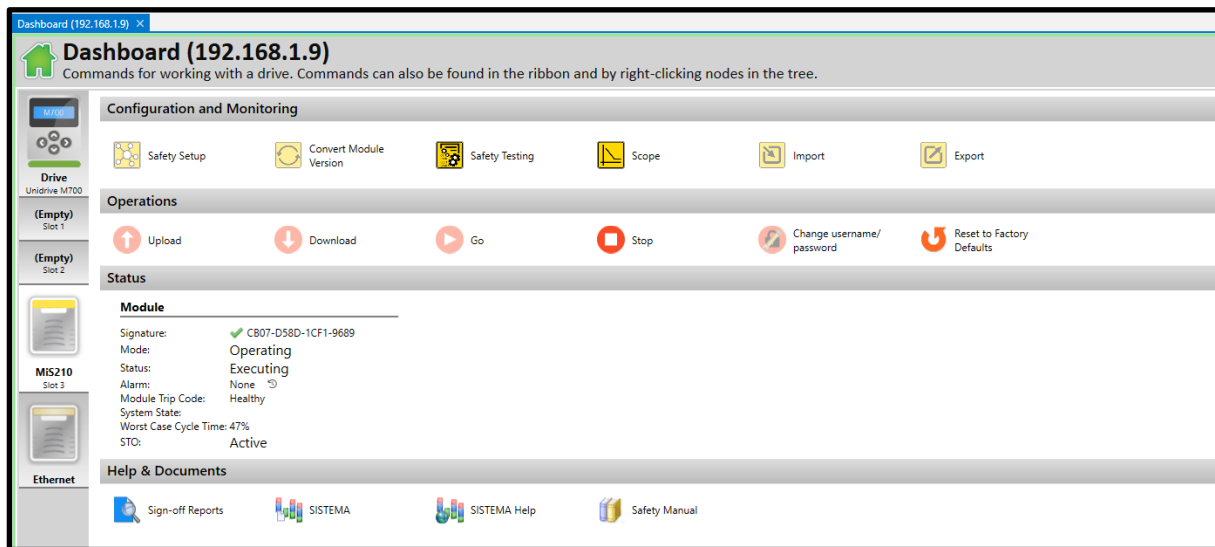


7.3.8 Download

The user may download the current project configuration to an MiS2x0 module using the *Download* button. If a configuration resides in the MiS2x0 module it will be overwritten.

In *Online* state (see section 7.2) click the *Download* button. The configuration will be downloaded, once the configuration is downloaded then the MiS2x0 module may be placed in *Test* mode or the configuration can be signed-off and the module placed in *Operational* mode.

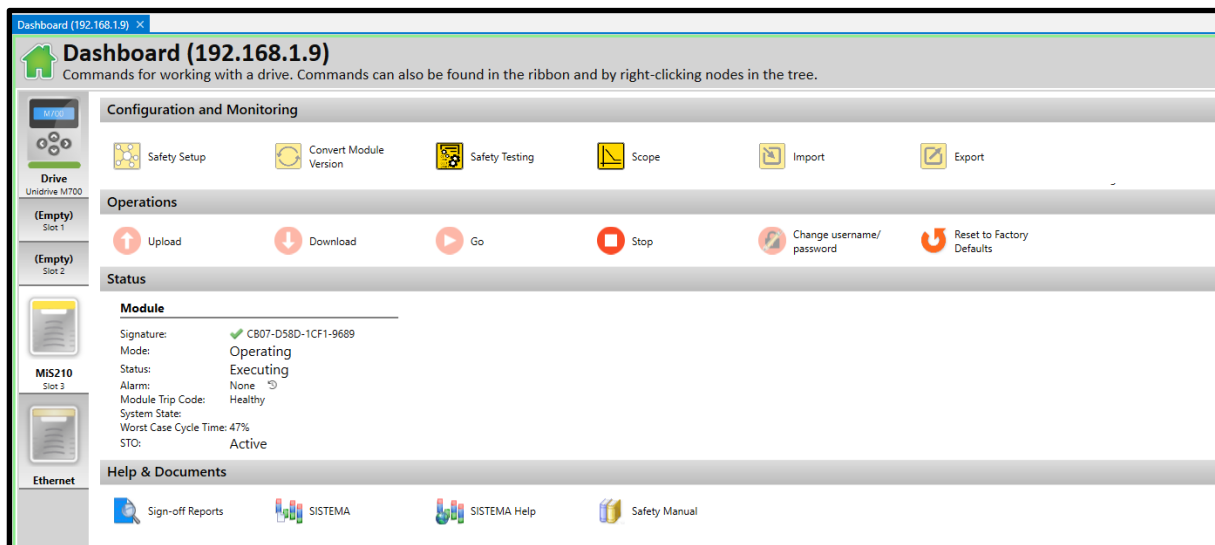
Figure 7-45 Download button on MiS2x0 Dashboard



7.3.9 Go

To place the MiS2x0 into operational mode the *Go* button may be pressed while in *Online* state (see section 7.2). This requires the user to sign-off their configuration. Operational mode can also be selected as part of the *Download* process.

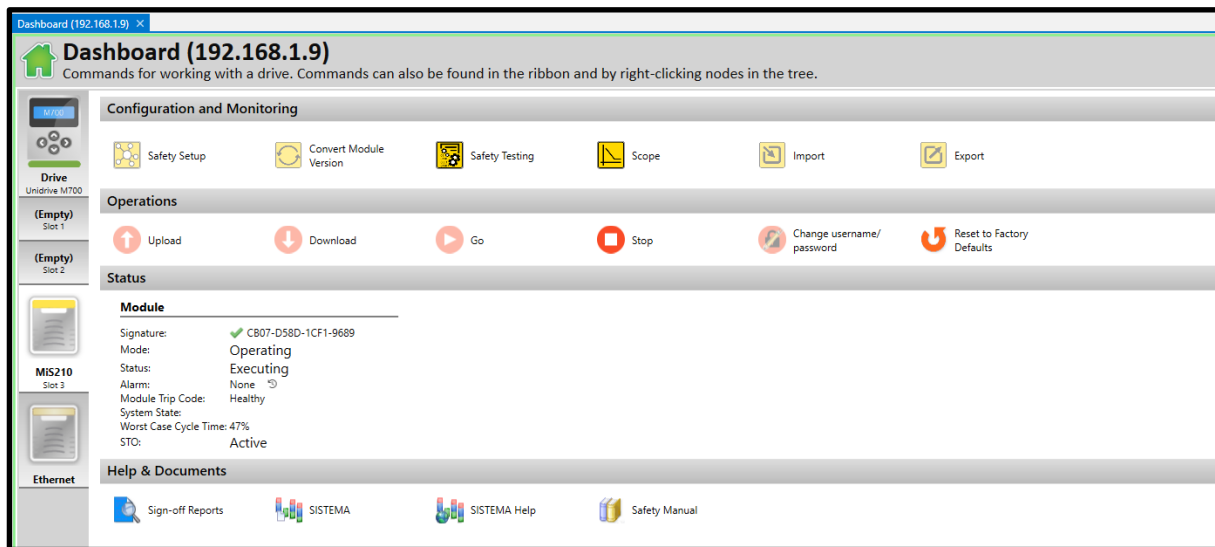
Figure 7-46 Go button on MiS2x0 Dashboard



7.3.10 Stop

If the MiS2x0 module is in *Operational* mode or *Test* mode, then the module may be placed into stop mode by pressing the *Stop* button while in *Online* state (see section 7.2).

Figure 7-47 Stop button on MiS2x0 Dashboard

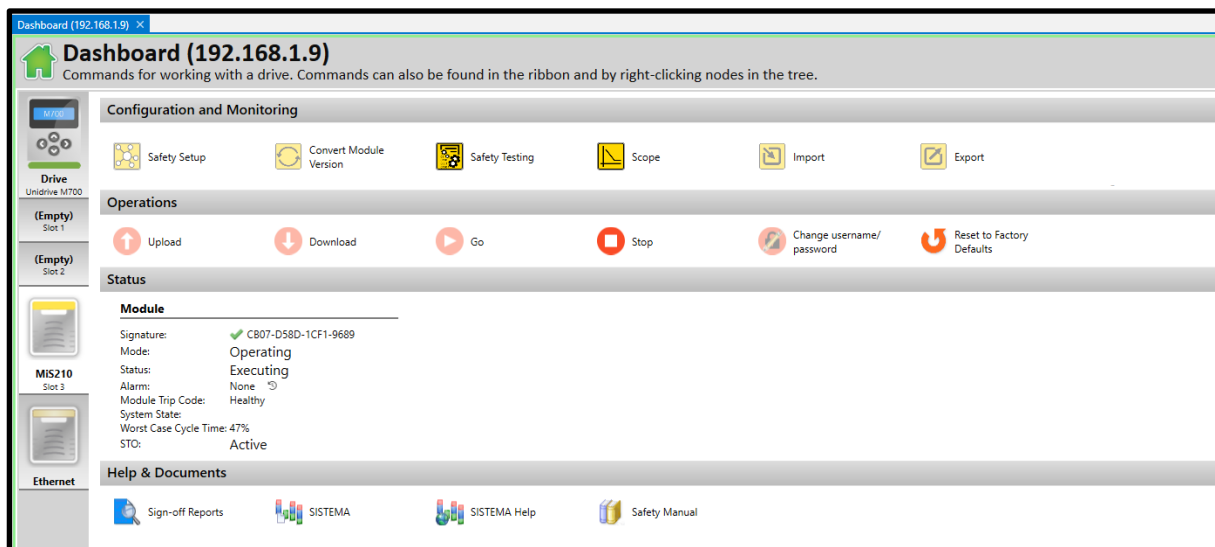


7.3.11 Change username/password

The user credentials may be changed on a MiS2x0 module while in *Online* state (see section 7.2) providing the original password is known. Click the *Change username/password* button, then enter the original credentials to be able to change the username or password.

The credentials can only be changed up to a maximum of seven times before the MiS2x0 requires to be reset to factory defaults.

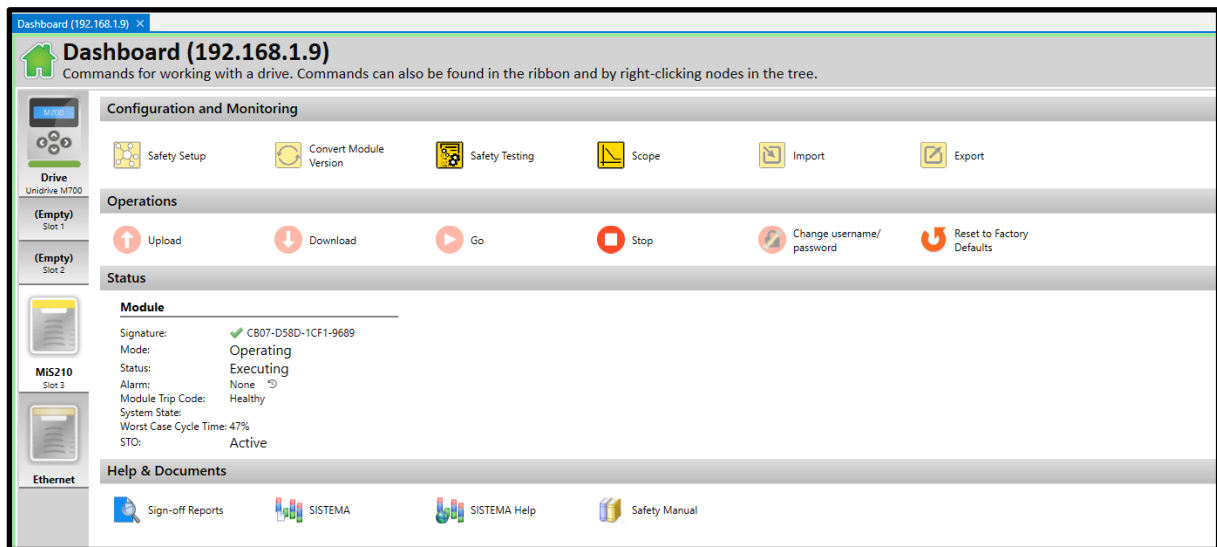
Figure 7-48 Change username/password button on MiS2x0 Dashboard



7.3.12 Reset to Factory Defaults

The MiS2x0 module can be factory defaulted by pressing the *Reset to Factory Defaults* button while in *online* state (see section 7.2). The user will be prompted to enter the round-trip code or drive's serial number.

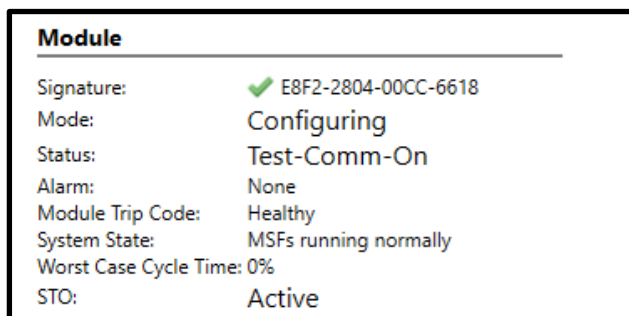
Figure 7-49 Reset to Factory Defaults button on MiS2x0 Dashboard



7.3.13 Status

In the *Status* view while the drive is in *Online* state (see section 7.2) the following information is shown.

Figure 7-50 Status display on the MiS2x0 Dashboard



7.3.13.1 Signature

Each configuration has a unique signature that is stored with the Connect project and on the MiS2x0 module when the configuration is downloaded. The signatures must match if the module is to move from the Configuring mode. The Signature field in *Status* will show a green tick if the signatures in the project and on the module match, if not a red cross will be shown along with the project's signature and the signature stored on the MiS2x0 module.

7.3.13.2 Mode and Status

The MiS2x0 module has three modes of operation and five states, these are shown in Table 7-6 Modes. See *Installation and Operating manual MiS210 and MiS250 Safety Modules* chapter 6 for further details.

Table 7-6 Modes

Mode	State	Description
IDLE	STANDBY	No configuration loaded, corrupt configuration, previously in Configuring before power cycle, previously state was failure before power cycle

IDLE	FAILURE	Fault factory reset, Power on failure.
OPERATING	EXECUTING	The module's configuration has been signed off and the module is performing safety functions.
OPERATING	FAILURE	Fault or factory reset
CONFIGURING	Test-Comm-Off	Ready for receiving download or to enter Testing
CONFIGURING	Test-Comm-On	In Testing performing safety functions
CONFIGURING	DOWNLOAD	Receiving a download
CONFIGURING	FAILURE	Fault or factory reset

7.3.13.3 Alarm

If there is an alarm it will be shown here.

There are two types of alarm that can be raised by the MiS2x0 Safety Module, System and MSF. System Alarms are raised when errors in the supporting equipment such as Encoders or Networks are detected during operation. MSF alarms are raised when the system fails to operate within specified limits. Not all Motion Safety Functions cause alarms to be raised for example Safe Direction. More complex Motion Safety Functions such as Safely Limited Speed by default raise an alarm, this can be changed by the safety system designer.

7.3.13.4 Fault

There are three types of Fault Diagnostic codes; Peripheral, Configuration and Internal. Peripheral Faults are associated with peripherals connected to the MiS2x0's encoder interfaces, network devices (via the Drive), host drive interface, and hardware outputs. Configuration Faults arise from exception with the configuration file downloaded and Internal Faults are those which are detected within the MiS2x0 Hardware or the operation of the MiS2x0 software. All faults will be written to the MiS2x0 internal EEPROM hence can be examined after a power cycle. In certain fault situations due to the potential severity of the fault detected it is possible it may not be stored. All faults result in an immediate halt of the processor.

See section 15 for further details.

7.3.13.5 Module Trip Code

The Module Trip Code is also displayed in parameter 17.005 on the MiS210 and parameter 16.005 on the MiS250, it contains a string that is displayed when the module initiates a drive trip.

0 – Healthy

1 – Module reset

7.3.13.6 System State

The System State is also displayed in parameter 17.097 on the MiS210 and parameter 16.097 on the MiS250, it contains a string that indicates the system state and if a reset is required.

8000 - MSFs Running Normally

8001 - System initialize

8002 - System Ready

8003 - System Wait for Reset

8004 - System Reset Error

C000 - System Alarm, Check Last Alarm Code

D000 - MSF Alarm, Check Last Alarm Code

7.3.13.7 Worst Case Cycle Time

Worst Case Cycle Time is measured and reported as the percentage of the 1 ms cycle time and is provided as a diagnostic tool.

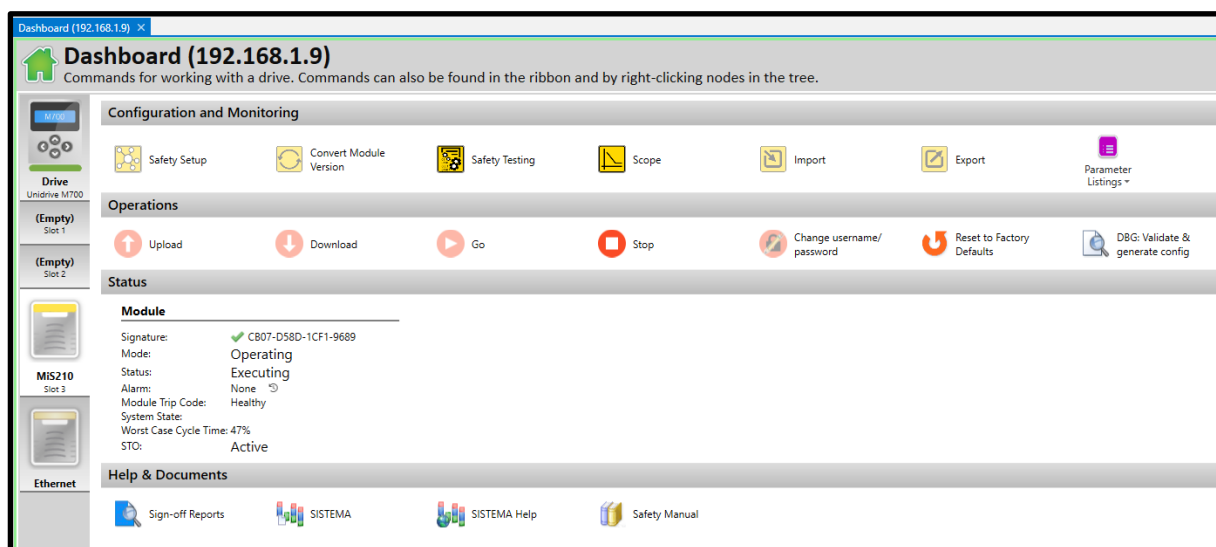
7.3.13.8 STO

When the STO is *Active* no torque can be produced in the motor (STO turned off), when the STO is *Inactive* torque may be generated in the motor (STO turned on). That is, a safe condition is *Active*, and the STO is turned off.

7.3.14 Sign-off Reports

Once a user has signed off the safety system the relevant reports will be available by clicking the *Sign-off Reports* button on the MiS2x0 Dashboard. When the report is clicked on a PDF report will be displayed.

Figure 7-51 Sign-off Reports on MiS2x0 Dashboard



7.3.15 SISTEMA

By clicking on the *SISTEMA* button on the MiS2x0 Dashboard, the user can launch the SISTEMA tool.

The SISTEMA software utility provides developers and testers of safety-related machine controls with comprehensive support in the evaluation of safety in the context of EN ISO 13849-1. SISTEMA stands for "Safety Integrity Software Tool for the Evaluation of Machine Applications". The tool enables you to model the structure of the safety-related control components based upon the designated architectures, thereby permitting automated calculation of the reliability values with various levels of detail, including that of the attained Performance Level (PL).

Please note Control Techniques cannot offer technical support for using the SISTEMA tool.

7.3.16 SISTEMA Help

By clicking on the *SISTEMA Help* button on the MiS2x0 Dashboard, the user can launch the SISTEMA a webpage that contains a link for the SISTEMA tool and also a link to the SISTEMA library for Control Techniques products with a MiS2x0 module.

8 Machine Safety Functions (MSF)

The MiS210 and MiS250 Safety Modules provide motion safety functionality for Control Techniques drives in accordance with the requirements of IEC 61800-5-2. PLCopen Safety part 1 has been used as a model for the Motion Safety Functions (MSFs) interfaces and behaviour.

NOTE: The following sections briefly outline each MSF and do not include all details and functions of each MSF. Refer to the “*Installation and Operating manual MiS210 and MiS250 Safety Modules*” for further detailed information.

8.1 Safe Torque Off (STO)

8.1.1 Drive's STO

The Safe Torque Off function within the drive provides a means for preventing the drive from generating torque in the motor, with a very high level of integrity. The drive's STO is the only function of the drive that is controlled from a safety perspective. It is suitable for incorporation into a safety system for a machine. It is also suitable for use as a conventional drive enable input. The safety function is active when the STO input is in the logic-low state as specified in the control terminal specification (see the relevant drive's user documentation). The function is defined according to EN 61800-5-2 and IEC 61800-5-2 as follows. (In these standards a drive offering safety-related functions is referred to as a PDS(SR)):

'Power that can cause rotation (or motion in the case of a linear motor) is not applied to the motor. The PDS(SR) will not provide energy to the motor which can generate torque (or force in the case of a linear motor)'

This safety function corresponds to an uncontrolled stop in accordance with stop category 0 of IEC 60204-1. The Safe Torque Off function makes use of the special property of an inverter drive with an induction motor, which is that torque cannot be generated without the continuous correct active behaviour of the inverter circuit. All credible faults in the inverter power circuit cause a loss of torque generation.

For further information regarding the drive's STO see the relevant drive's documentation.

The Unidrive M600, M700, M701, M702, HS70, HS71 and HS72 drives' STO circuits are connected to the MiS210 by means of the blade connector on the base of the module (see section 5.2 MiS210 STO blade connection). When the MiS210 module is inserted the drive's STO terminals are disconnected and have no use.

In the case of Digitax HD M750, M751 or M753 drives, then the user must select a safe output and wire this to the drive's STO terminal (see section 5.3 MiS250 STO connection).

8.1.2 Safe Torque Off (STO) MSF

The user may configure the STO output of the MiS210. Typically, this would be connected to the output of another MSF via the STO MSF's Command Source input. Some MSFs such as SS1 automatically connect to the STO MSF.

The MiS250 does not incorporate an internal STO connection, therefore the user should route STO connections via a safe output (SHOS) to the drive's STO see section 5.3. The STO MSF is unavailable when using an MiS250.

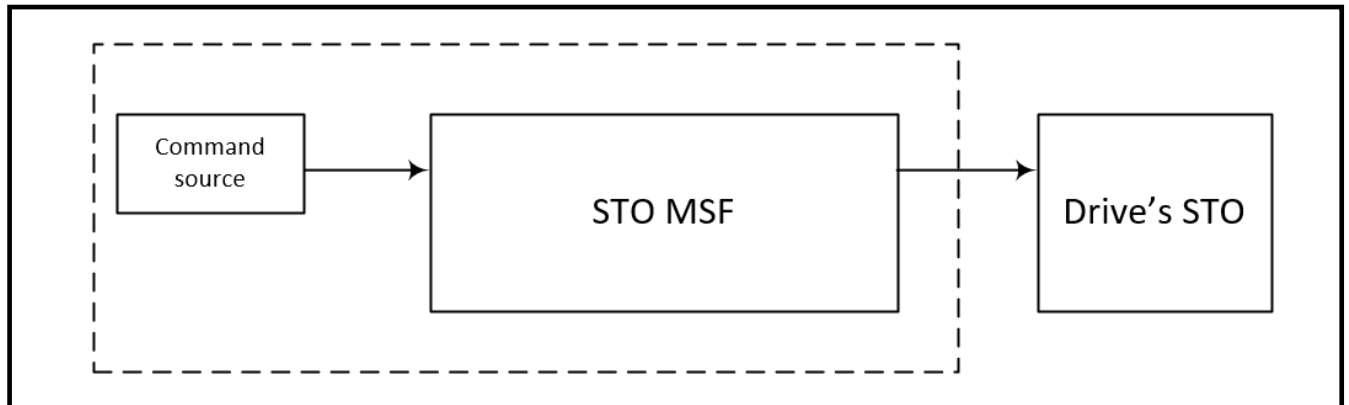


Figure 8-1 MiS210 STO

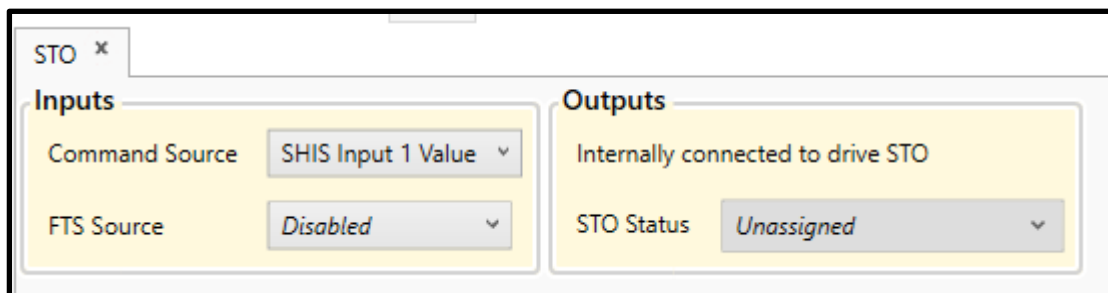
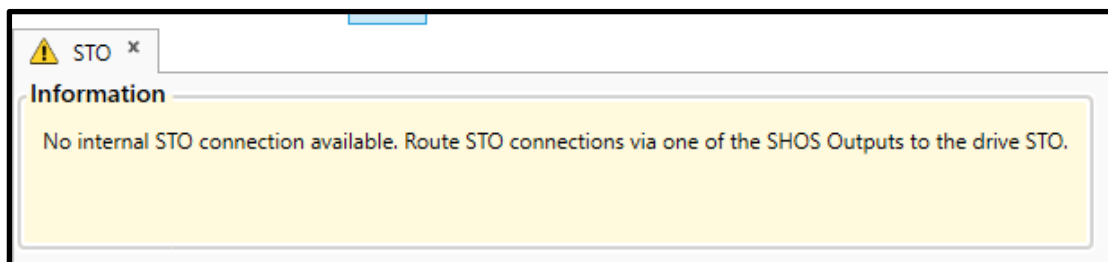


Figure 8-2 MiS250 no STO MSF



8.2 Safe Emergency Stop (SES) MSF

SES monitors a safe input and provides reset functionality. It supports a manual reset and can be used without other safety logic functions where the MiS210/MiS250 Safety Module is acting as safety controller. With the STO function it provides the functionality to support an emergency switch off by removing the torque immediately (Emergency Stop Category 0).

Figure 8-3 Typical SES configuration illustrates a typical example of SES, here a two channel Emergency stop actuator is monitored and the drive's STO controlled appropriately. Once a call for an Emergency stop is made the user must reset the system before torque can be produced by the motor again.

Figure 8-3 Typical SES configuration

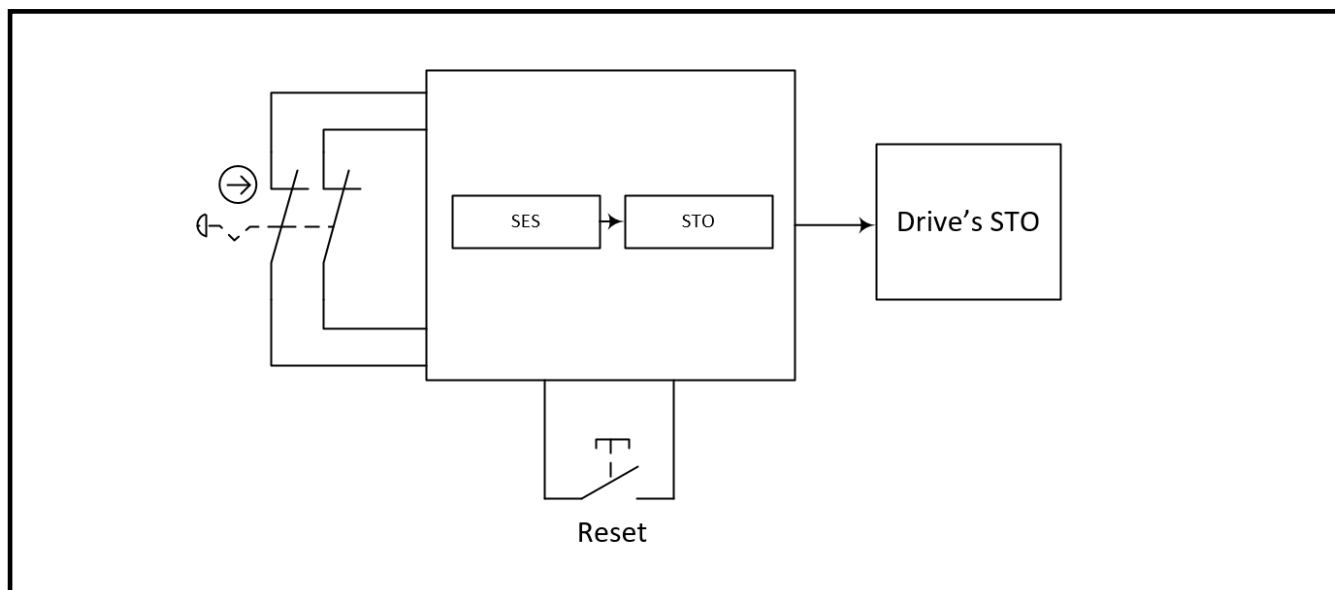


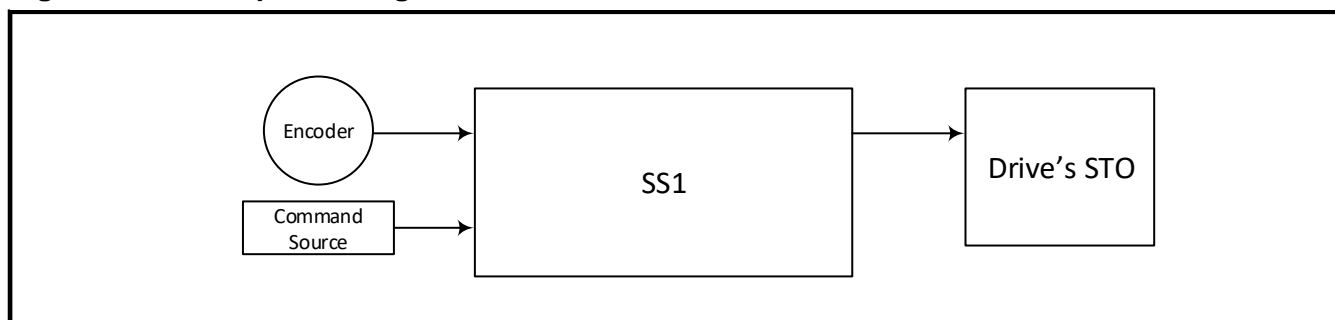
Figure 8-4 SES

SES x STO x	
Inputs	Outputs
Command Source: SHIS Input 1 Value	Demand: STO Command Source
Reset	
Reset Source: System	
Start Reset: <input type="checkbox"/> Off	
Auto Reset: <input type="checkbox"/> Off	

8.3 Safe Stop 1 (SES) MSF

The purpose of the SS1 MSF is to provide a controlled stop with power available to the axis to achieve the stop and then removal of power via the STO when the stop is achieved. The controlled stop period can be selected at design time as rate or time.

Figure 8-5 Simplified diagram of SS1



Considering the timed example in Figure 8-6 SS1 basic principle (time mode), once the *Command Source* input becomes active (low) then provided the axis decelerates within the *Stop Time* and does not exceed the *Speed Control Tolerance*, then the *STO* will remain true until the *Zero Speed Threshold* is reached, at this point the *STO* becomes false and hence active thus the axis will not produce torque.

Figure 8-6 SS1 basic principle (time mode)

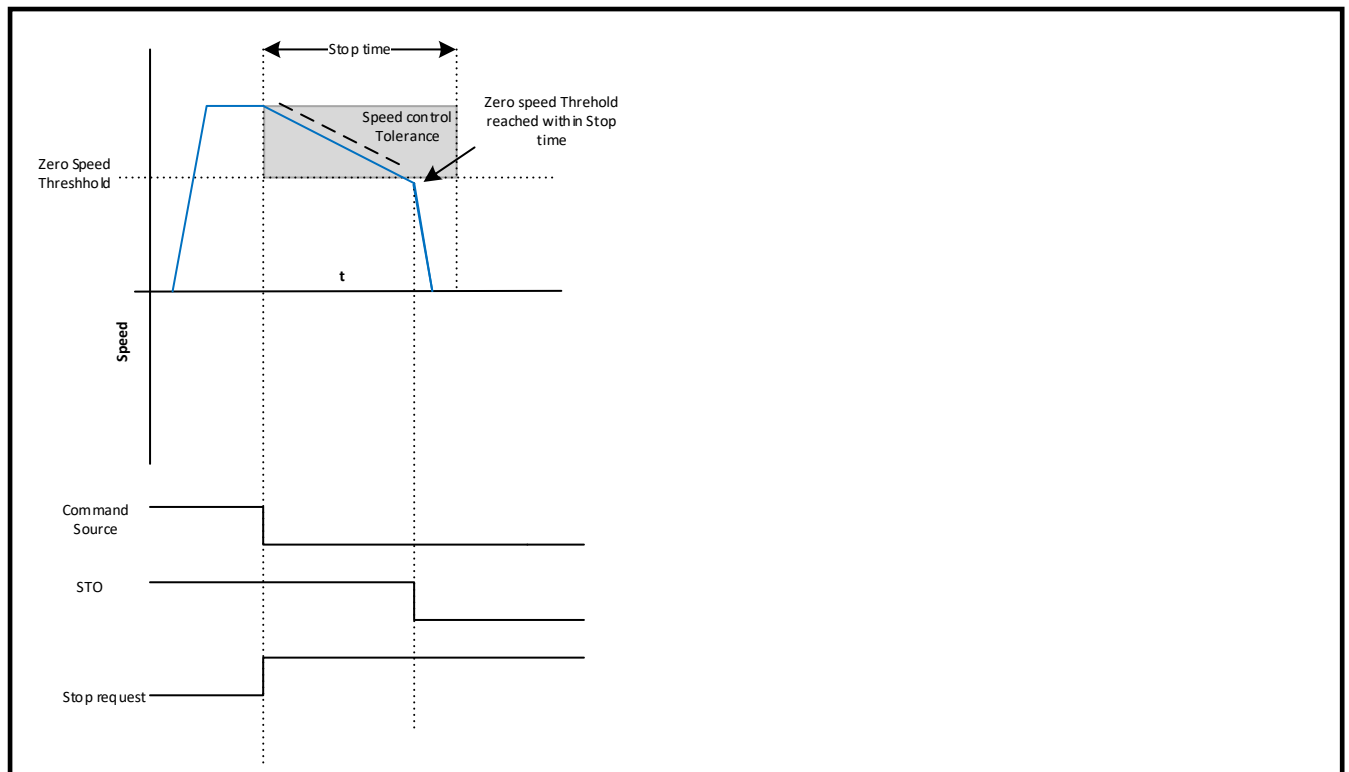
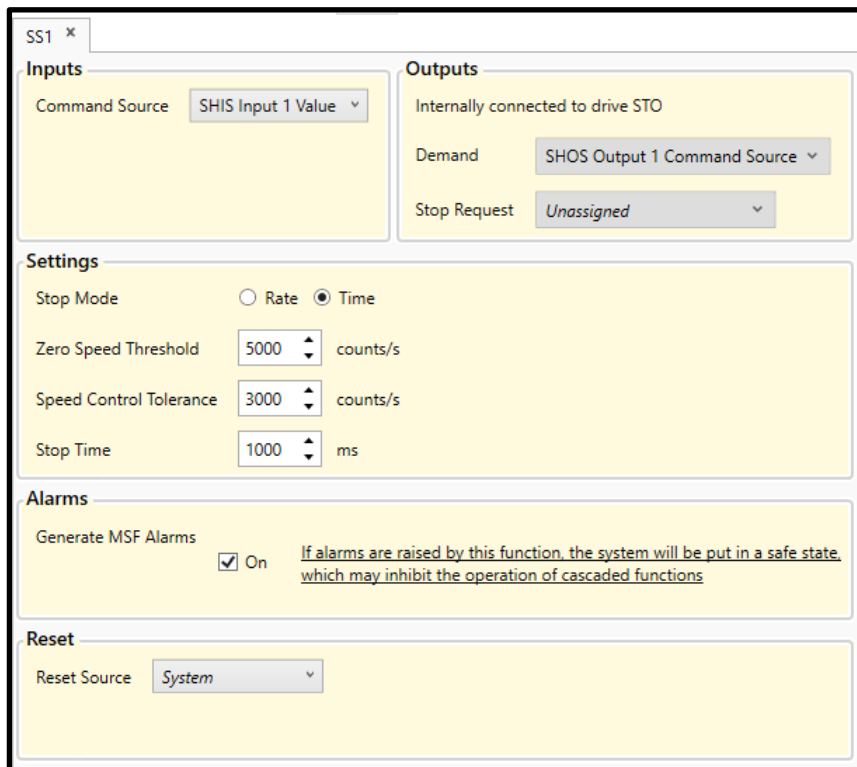


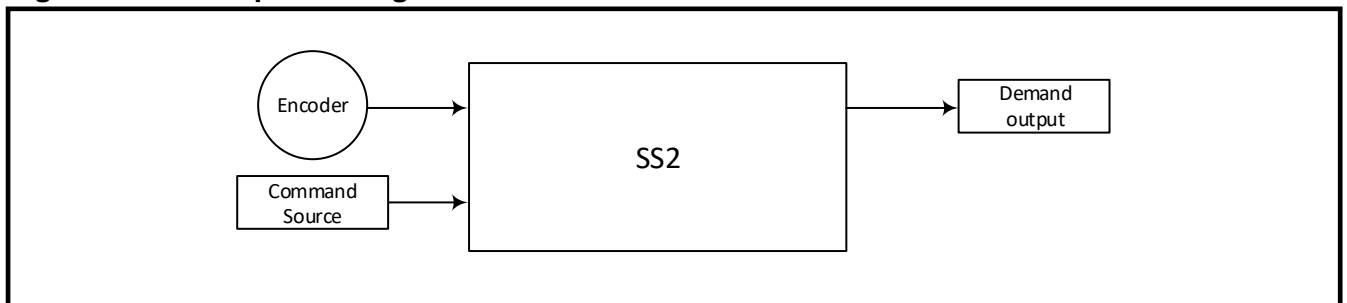
Figure 8-7 SS1



8.4 Safe Stop 2 (SS2) MSF

The purpose of the Safe Stop 2 (SS2) function is to provide a controlled stop with power available to the axis to achieve the stop and power remaining available to the axis after the stop has been achieved. For example, where the motor is required to remain energised holding zero speed, but if speed increases or position is compromised then a mitigation such as a brake must become active.

Figure 8-8 Simplified diagram of SS2



Considering Figure 8-9 SS2 basic principle (time mode), once the *Command Source* becomes active (low) then provided the axis decelerates within the *Stop Time* and does not exceed the expected speed plus the *Speed Control Tolerance*, then the *Demand Output* will remain true until the *Zero Speed Threshold* is reached, at this point the *Demand Output* will continue to remain true provided the axis speed remains below the *Zero Speed Tolerance*.

Figure 8-9 SS2 basic principle (time mode)

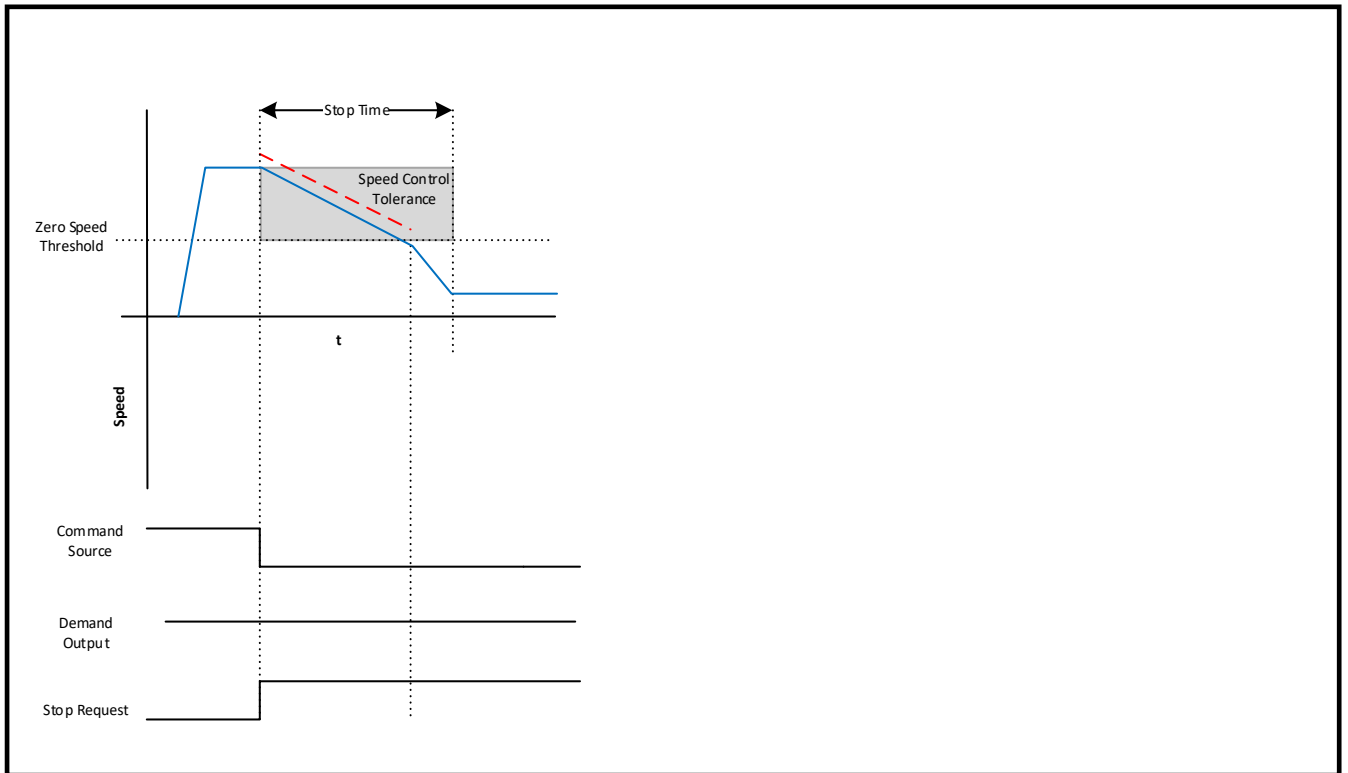


Figure 8-10 SS2

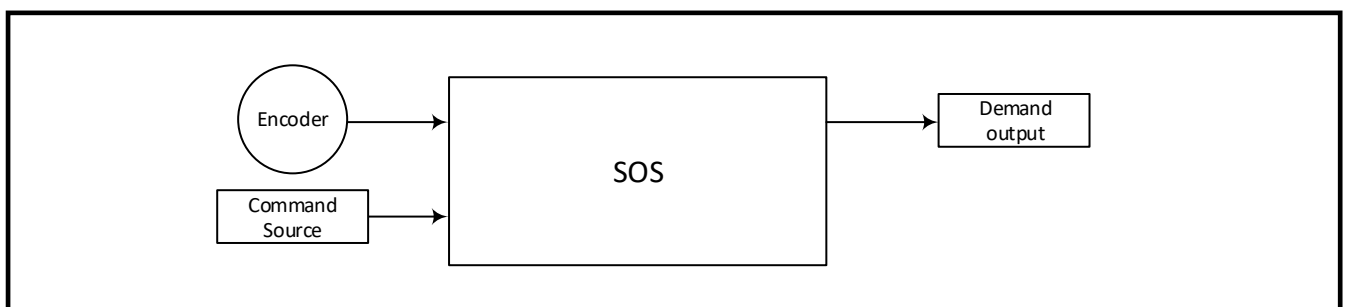
The screenshot shows the SS2 configuration interface with the following sections:

- Inputs:** Command Source is set to "SHIS Input 1 Value".
- Outputs:** Demand is set to "STO Command Source", Standstill is "Unassigned", and Stop Request is "Unassigned".
- Settings:** Stop Mode has "Rate" and "Time" radio buttons. Zero Speed Mode has "Speed" and "Position" radio buttons. Zero Speed Threshold is set to 5000 counts/s. Speed Control Tolerance is set to 40000 counts/s. Stop Time is set to 1000 ms.
- Alarms:** "Generate MSF Alarms" is checked (On). A note states: "If alarms are raised by this function, the system will be put in a safe state, which may inhibit the operation of cascaded functions".
- Reset:** Reset Source is set to "System".

8.5 Safe Operating Stop (SOS) MSF

The purpose of the Safe Operating Stop (SOS) function is to monitor the speed of an axis and set an output true if the speed of the axis is below the zero speed threshold or optionally if the axis does not move a distance greater than the maximum standstill distance.

Figure 8-11 Simplified diagram of SOS



With reference to Figure 8-12 SOS basic principle, it can be seen that once *Command Source* becomes active (low) then *Demand* output will remain true unless the speed of the axis is greater than the Zero speed threshold.

Figure 8-12 SOS basic principle

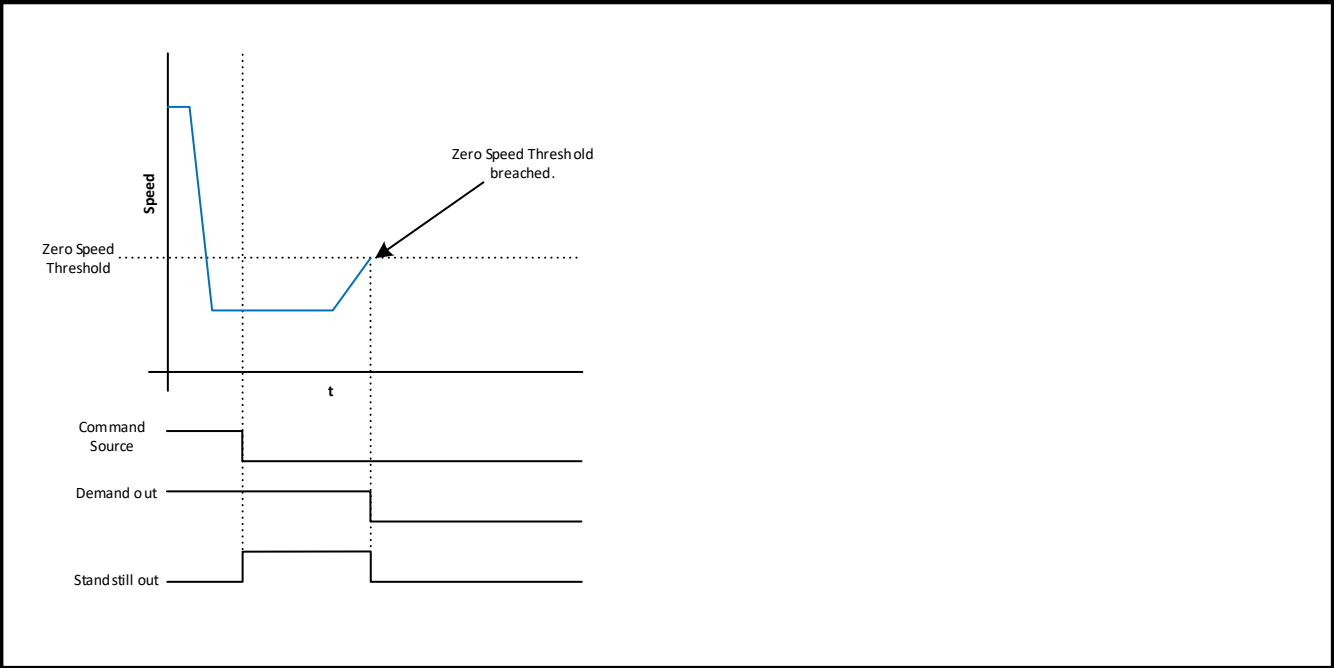


Figure 8-13 SOS

SOS_1 x

Inputs

Command Source SHIS Input 1 Value

Outputs

Demand SHOS Output 1 Command Source

Standstill Unassigned

Settings

Zero Speed Mode Speed Position

Zero Speed Threshold 4000 counts/s

Alarms

Generate MSF Alarms On If alarms are raised by this function, the system will be put in a safe state, which may inhibit the operation of cascaded functions

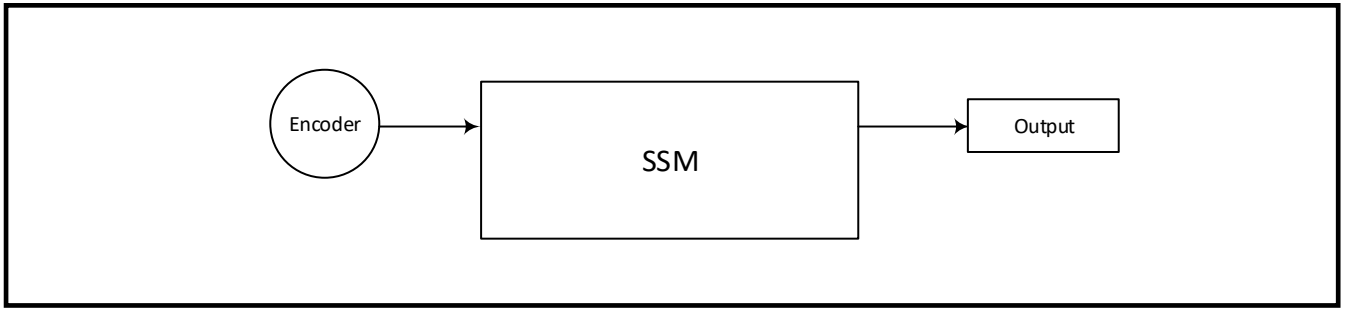
Reset

Reset Source System

8.6 Safe Speed Monitoring (SSM) MSF

The purpose of the Safe Speed Monitoring (SSM) function is to monitor the speed of an axis and set an output true if the axis speed is below the monitored speed setting.

Figure 8-14 Simplified diagram SSM



If the speed shown in the Figure 8-15 SSM basic principle exceeds the Safe Speed value indicated by the broken horizontal line, then Out will be false, if the speed is less than the Safe Speed limit then Out will be true. There is no latching behaviour associated with the SSM function.

Figure 8-15 SSM basic principle

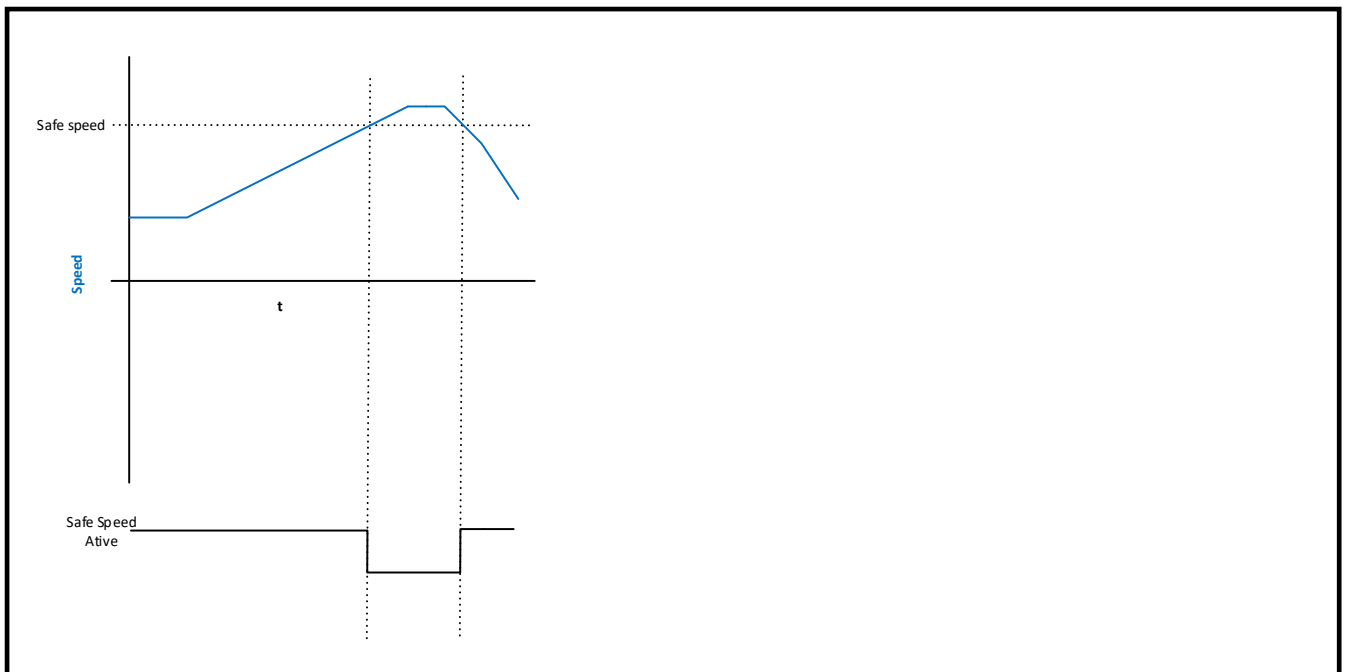
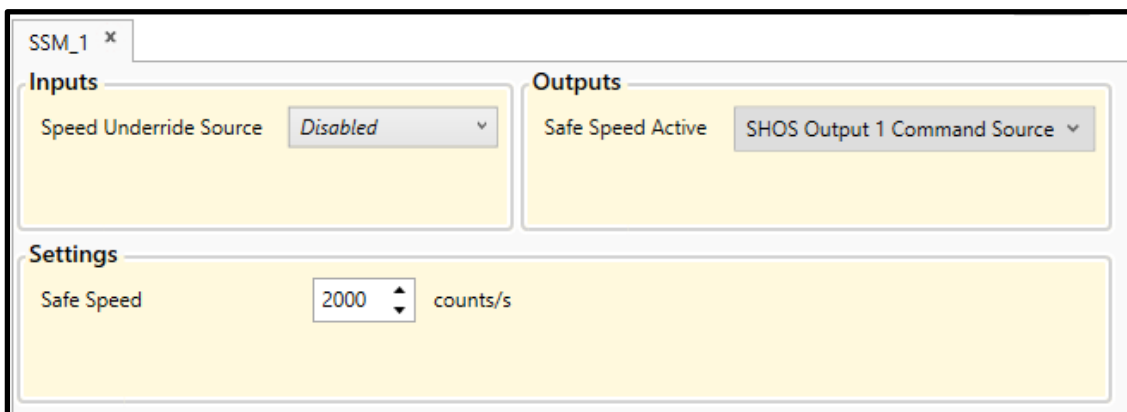


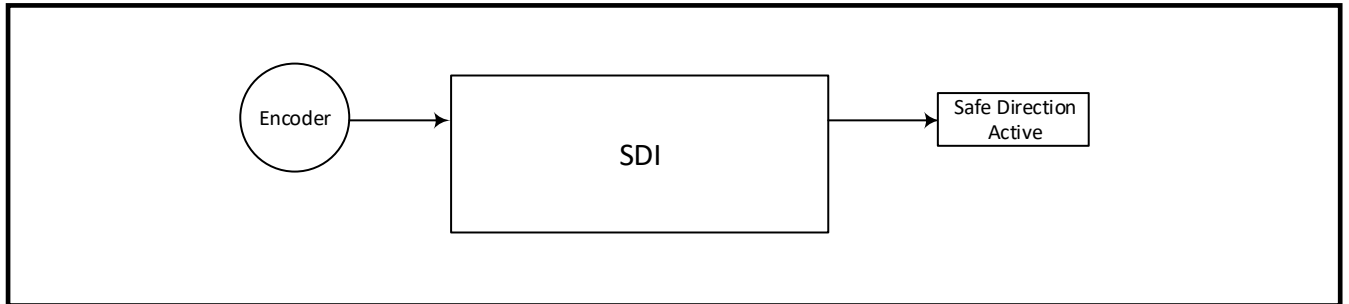
Figure 8-16 SSM



8.7 Safe Direction (SDI) MSF

The purpose of the Safe Direction (SDI) function is to monitor direction and set its output to true if the axis is moving in the selected direction, otherwise the output is set to false. An optional configuration allows for an amount of motion in the opposite direction if required.

Figure 8-17 Simplified diagram SDI



With reference to Figure 8-18 SDI basic principle, it can be seen that once the axis's direction becomes negative and the Opposite direction tolerance is exceeded then Out becomes false. When the axis changes direction and recovers a distance equal to the Opposite direction tolerance then Out becomes true.

Figure 8-18 SDI basic principle

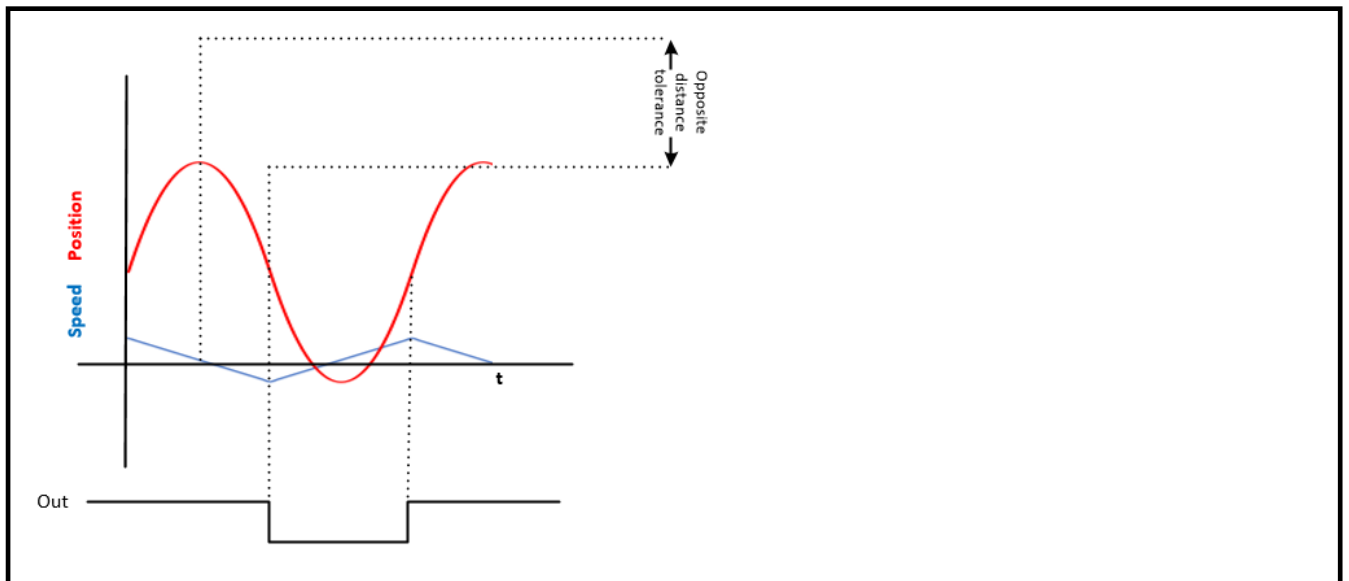
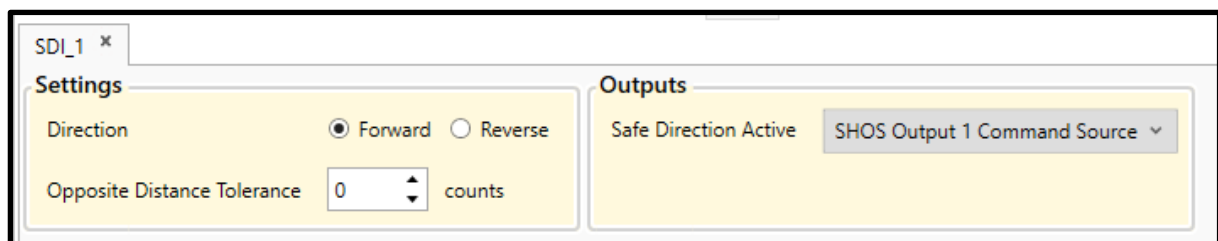


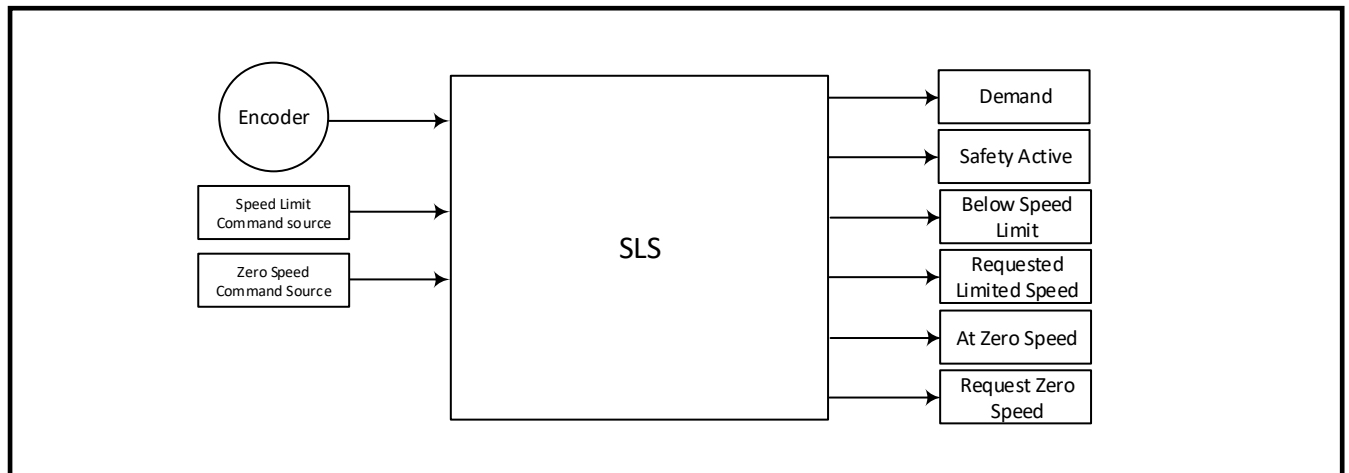
Figure 8-19 SDI



8.8 Safely Limited Speed (SLS) MSF

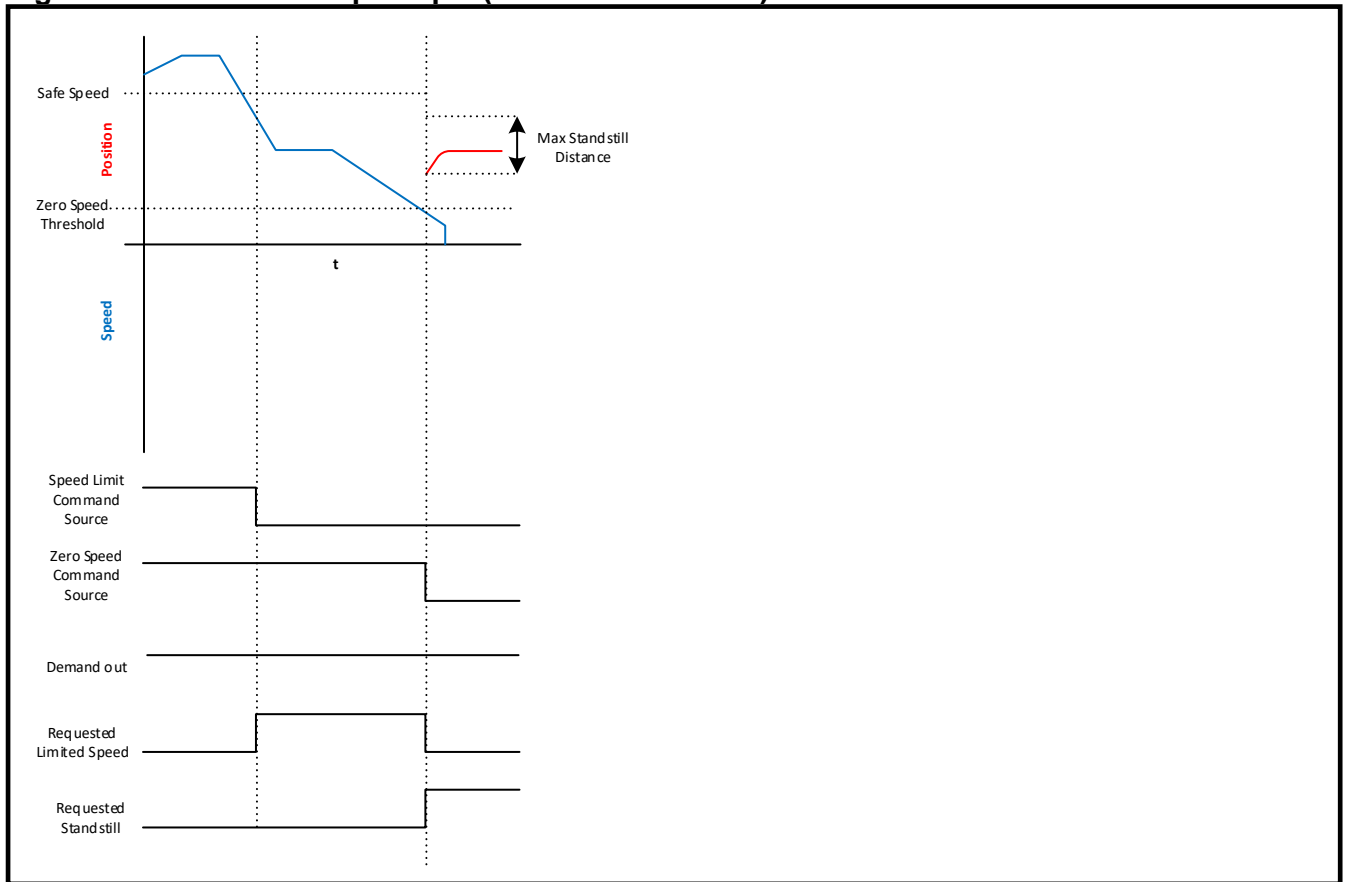
The purpose of the Safely Limited Speed (SLS) function is to monitor the speed of the axis and includes various additional checks on deceleration, time to reach the safe speed and zero speed. In Rate Mode, if the axis reaches a speed above that defined by the active envelope or in Time Mode if a significant speed increase is detected or the time is exceeded, the SLS Demand output will be set to false.

Figure 8-20 Simplified diagram SLS



In Figure 8-21 SLS Basic principle (immediate reaction) it can be seen that once a Reset has been initiated then the Demand out becomes true. Next the Speed Limit in Source is made active (low) by the user and provided the axis's speed is lower than the Safe Speed the Demand Out will remain true. If the user now makes Zero Speed Source active (low) and provided the axis's speed is below the Zero Speed Threshold then the Demand Out remains true, however the Demand Out will become false if the axis's position now exceeds the position limit Max Standstill Distance.

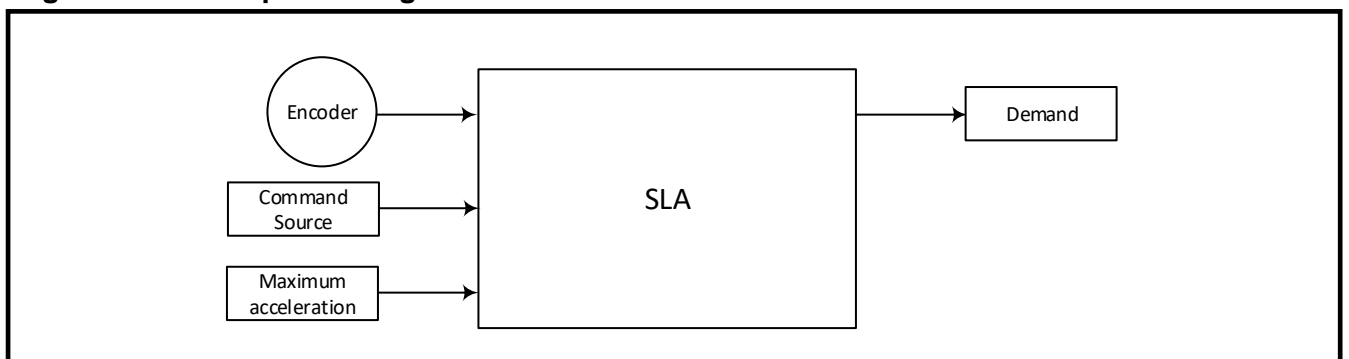
Figure 8-21 SLS Basic principle (immediate reaction)



8.9 Safely Limited Acceleration (SLA) MSF

This function is to monitor the acceleration and check that it is not exceeding a given rate limit. It can check the linear acceleration in all four quadrants and a limit value is given for each. If the acceleration is exceeded in a monitored quadrant the Demand is set false.

Figure 8-22 Simplified diagram of SLA



In Figure 8-23 SLA basic principle, once Command Source becomes active (low), then if the acceleration breaches the limit set for quadrant 1 in this example then Demand out will become low.

Figure 8-23 SLA basic principle

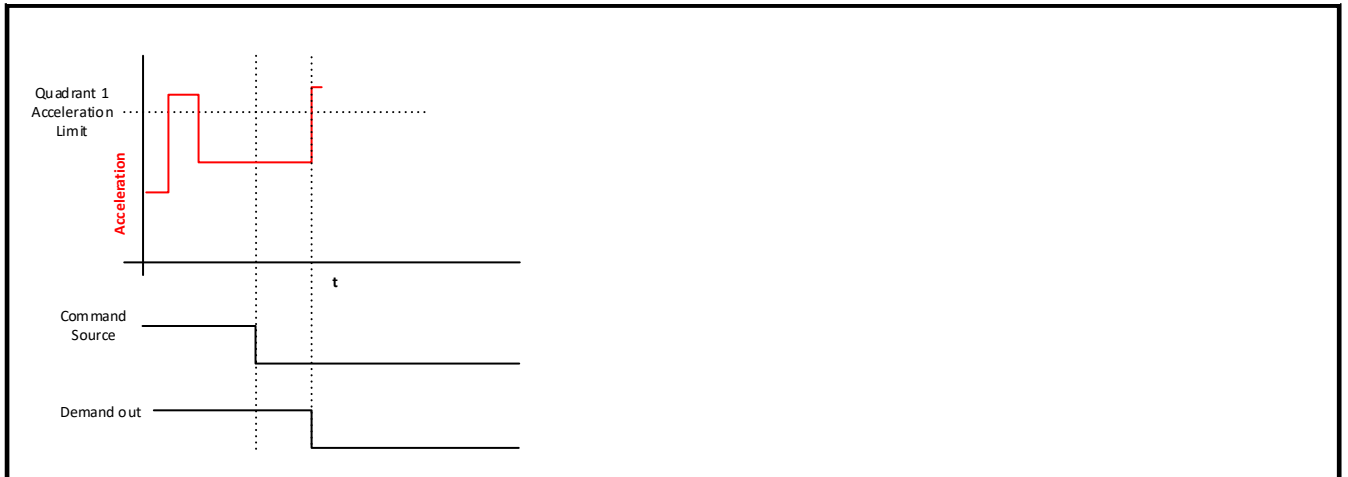


Figure 8-24 SLA

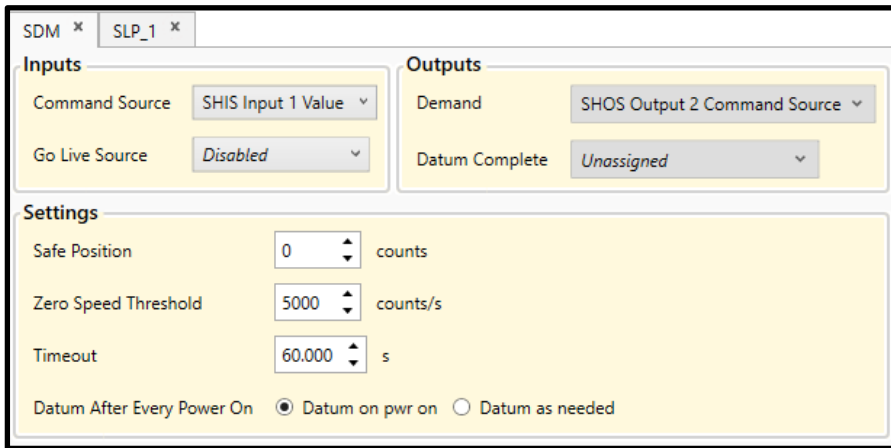
SLA_1 ×

<p>Inputs</p> <p>Command Source: SHIS Input 1 Value</p>	<p>Outputs</p> <p>Demand: SHOS Output 1 Command Source</p> <p>Safety Active: Unassigned</p>
<p>Settings</p> <p>Max Acceleration for Monitored Quadrant: 1000 counts/s²</p> <p>Quadrant Selection: Q1</p>	
<p>Alarms</p> <p>Generate MSF Alarms: <input type="checkbox"/> Off <small>Alarms will not be raised by this function.</small></p>	
<p>Reset</p> <p>Reset Source: System</p>	

8.10 Safe Datum (SDM) MSF

SDM provides a datum for position-based MSFs (SLP). This facilitates their operation relative to a known position of the axis.

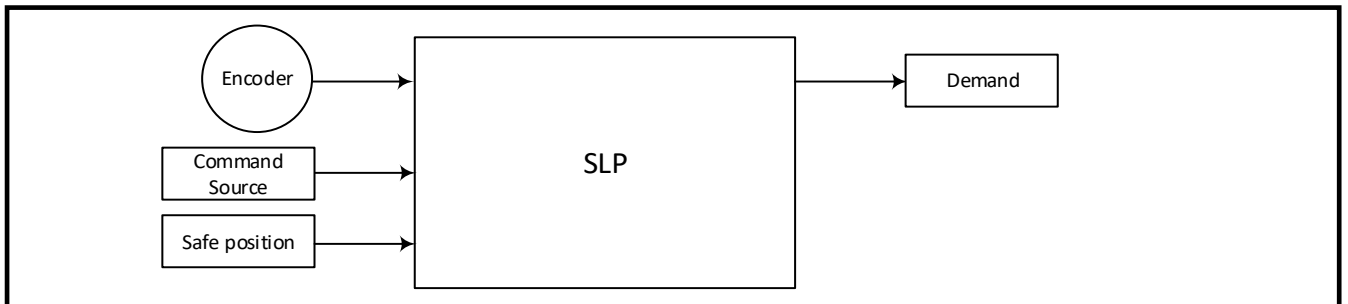
Figure 8-25 SDM



8.11 Safely Limited Position (SLP) MSF

The purpose of this function is to monitor the position of the axis and if it exceeds the defined envelope set the Demand to false. For position functions, the position value is derived from the drive's encoder is the position as directly reported by the EnDat 2.2 encoder and is not the normalised position used by the drive.

Figure 8-26 Simplified diagram of SLP



It can be seen in Figure 8-27 SLP basic principle (upper position limit, and stopping distances not calculated) that once Command Source becomes active (low), then if the position breaches the Upper position limit in this example then Demand will become low.

Figure 8-27 SLP basic principle (upper position limit, and stopping distances not calculated)

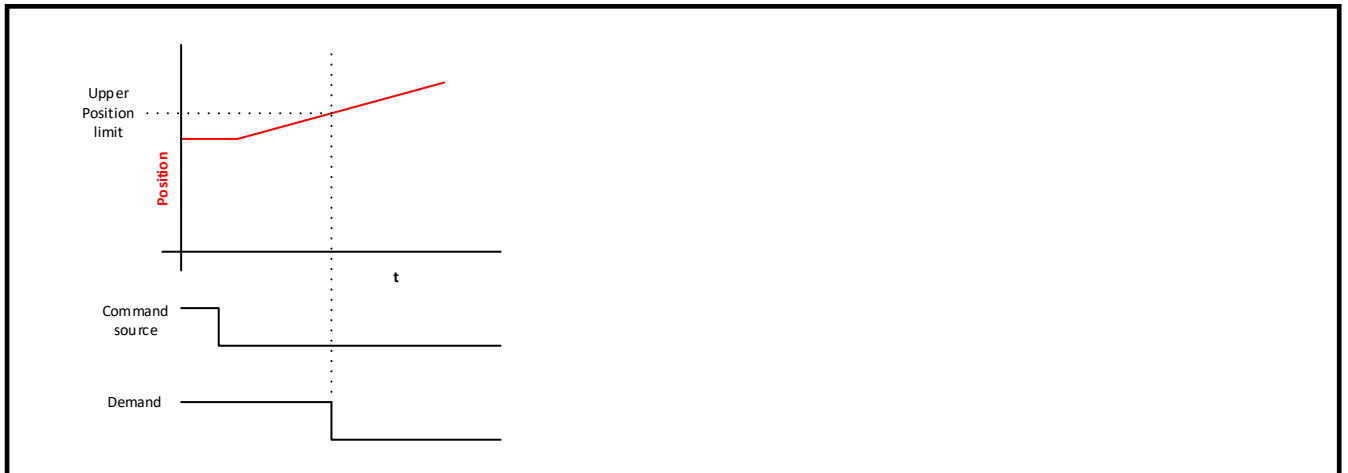
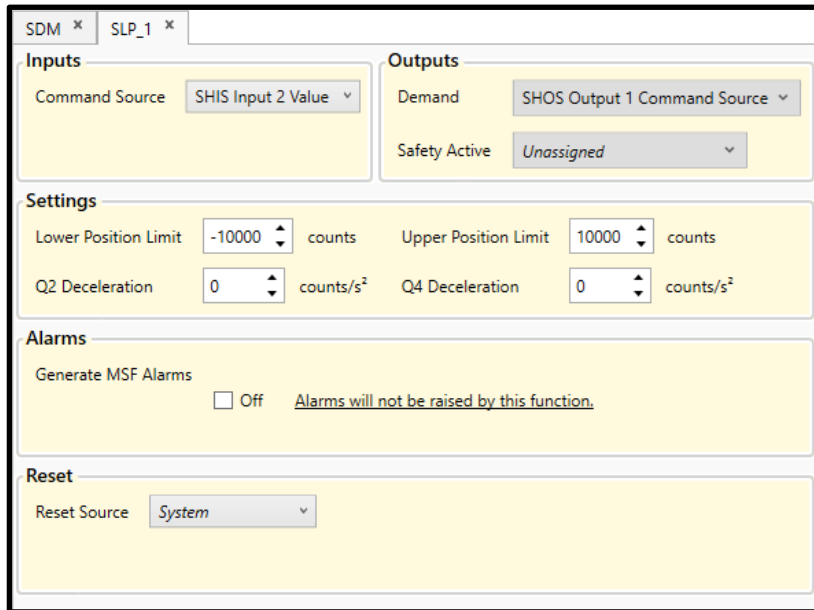


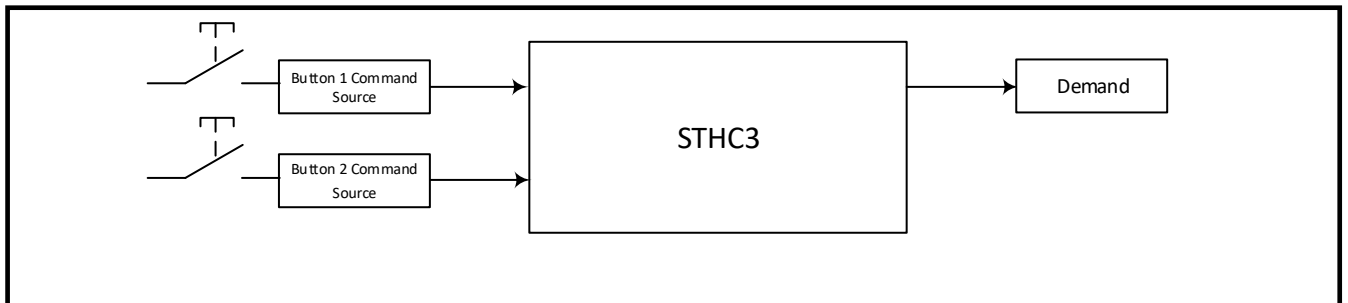
Figure 8-28 SLP



8.12 Safe Two-Handed Control 3 (STHC3) MSF

STHC3 requires both buttons to be activated within 500 ms of each other for the Demand output to become true. Additional options are provided to disable Auto Reset and set Delayed Restart.

Figure 8-29 Simplified diagram of STHC3



In Figure 8-30 STHC3 basic principle (no restart time) it can be seen that both Button 1 and Button 2 must both be activated within 500 ms of each other for the *Demand output* to become true.

Figure 8-30 STHC3 basic principle (no restart time)

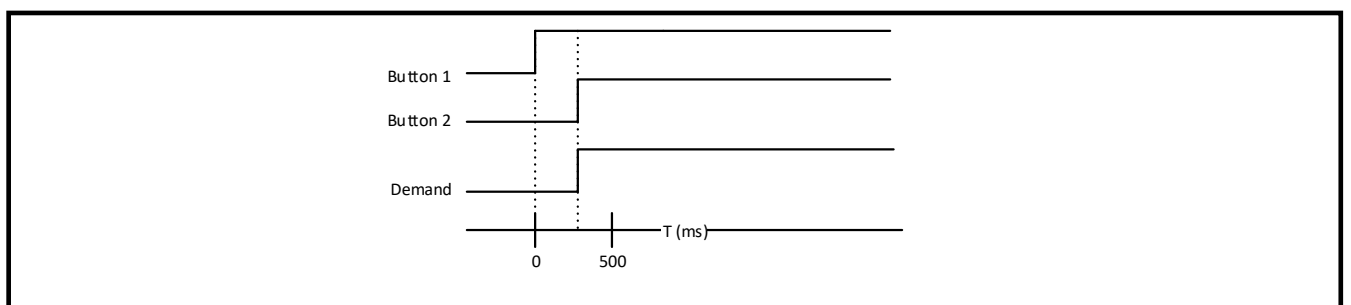
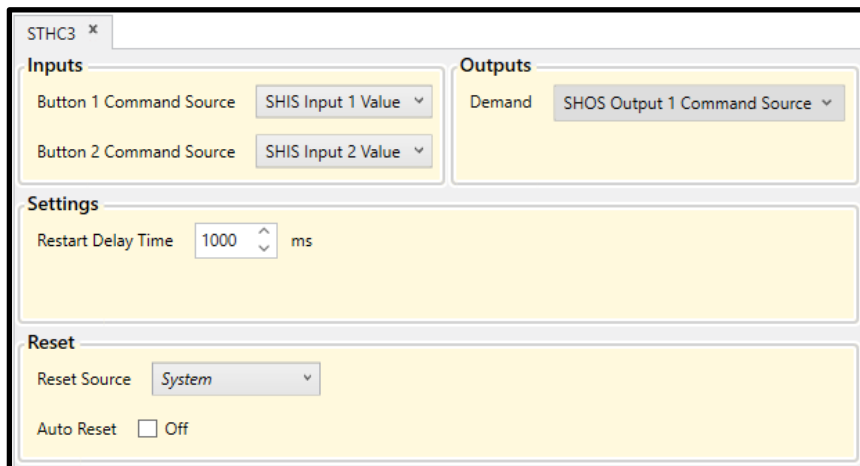


Figure 8-31 STHC3



8.13 Safe Brake Control (SBC) MSF

SBC provides functionality to control a brake. Four modes are supported being *Operational brake mode*, *Holding brake mode*, *Emergency stop brake mode* and *Emergency Brake Mode with Start-up Timer*.

Figure 8-32 Simplified diagram of SBC (contactor confirm shown)

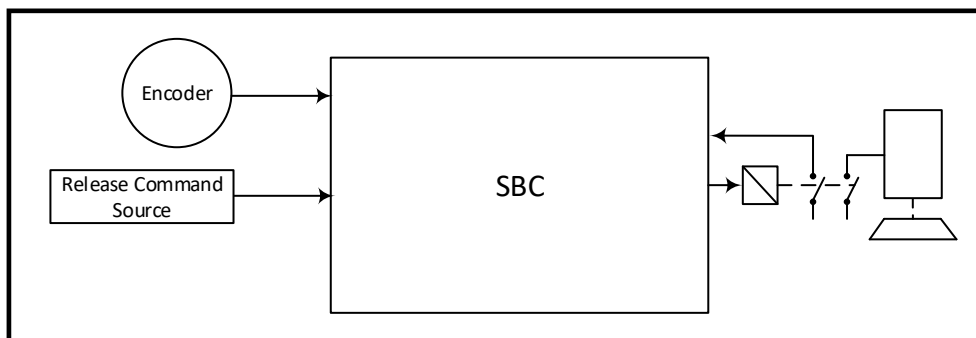
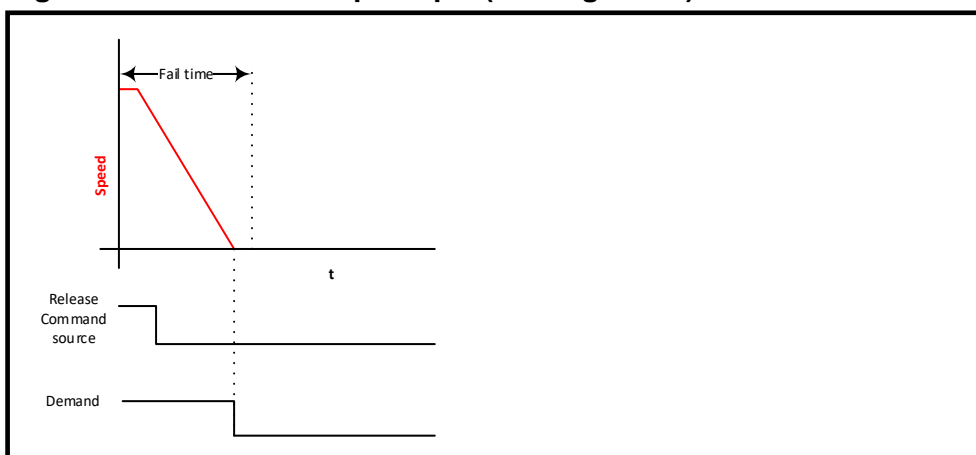
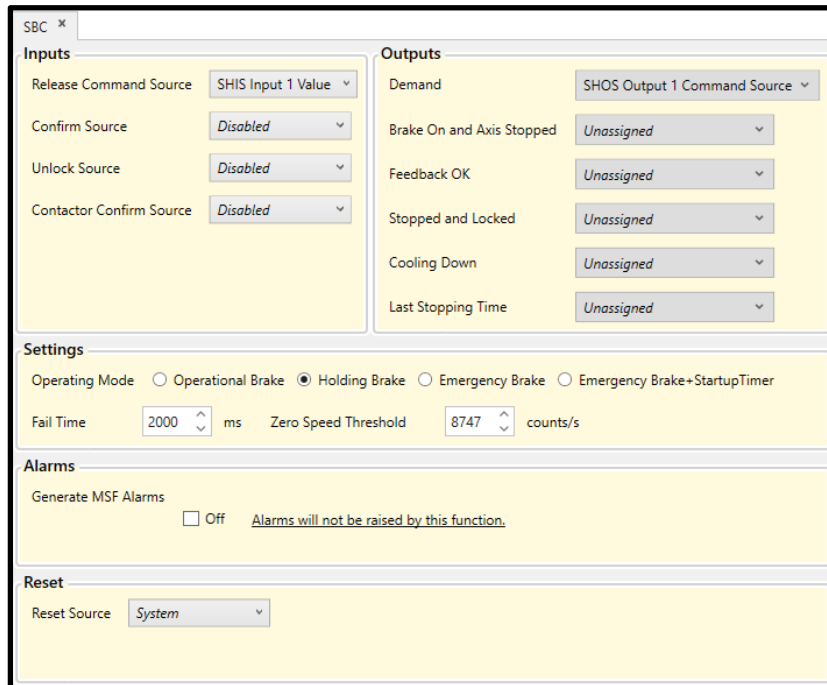


Figure 8-33 SBC basic principle (holding brake)



In Figure 8-33 SBC basic principle (holding brake) the brake is applied when *Release Command Source* becomes false, and the speed reaches the *Zero Speed Threshold* (zero in this case).

Figure 8-34 SBC



9 Wired safety

Please refer to section 6 for an example of configuring wired safety.

10 Networked safety

Users must refer to the "Installation and Operating manual MiS210 and MiS250 Safety Modules" document for full technical details.

10.1 Fail Safe over EtherCAT (FSoE) example

This example depicts the scenario of a Beckhoff PLC with a suitable safety module to control the SLS's speed override feature. It is suggested that the user completes the quick start example in section 6 before proceeding as this illustrates the full detailed steps for creating safety applications using Connect.

It is assumed the user has at least basic familiarity creating standard PLC programs, setting communication paths, and connecting to a PLC with TwinCAT3. If not, then refer to the relevant Beckhoff documentation.

Currently CODESYS SAFETY does not function with the MiS2x0 module.

The following example is provided in good faith however, Control Techniques cannot offer direct support for Beckhoff or other manufacturers' products, nor provide specific examples for differing hardware.

NOTE Users must refer to the "*Installation and Operating manual MiS210 and MiS250 Safety Modules*" document for full technical details.

Generic support for the MiS2x0 modules is available through your supplier or local Control Techniques Drive Centre. For support of other manufacturers' PLCs, software and products please contact the relevant third-party support channels.

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CODESYS® is a registered trademark of CODESYS GmbH.

10.1.1 Assemble the hardware

This example was prepared using a Control Techniques Digitax HD demo-case with an M753 drive installed. A list of the hardware is given in Table 10-1 Hardware. Please see section 3.7 for firmware and hardware version requirements.

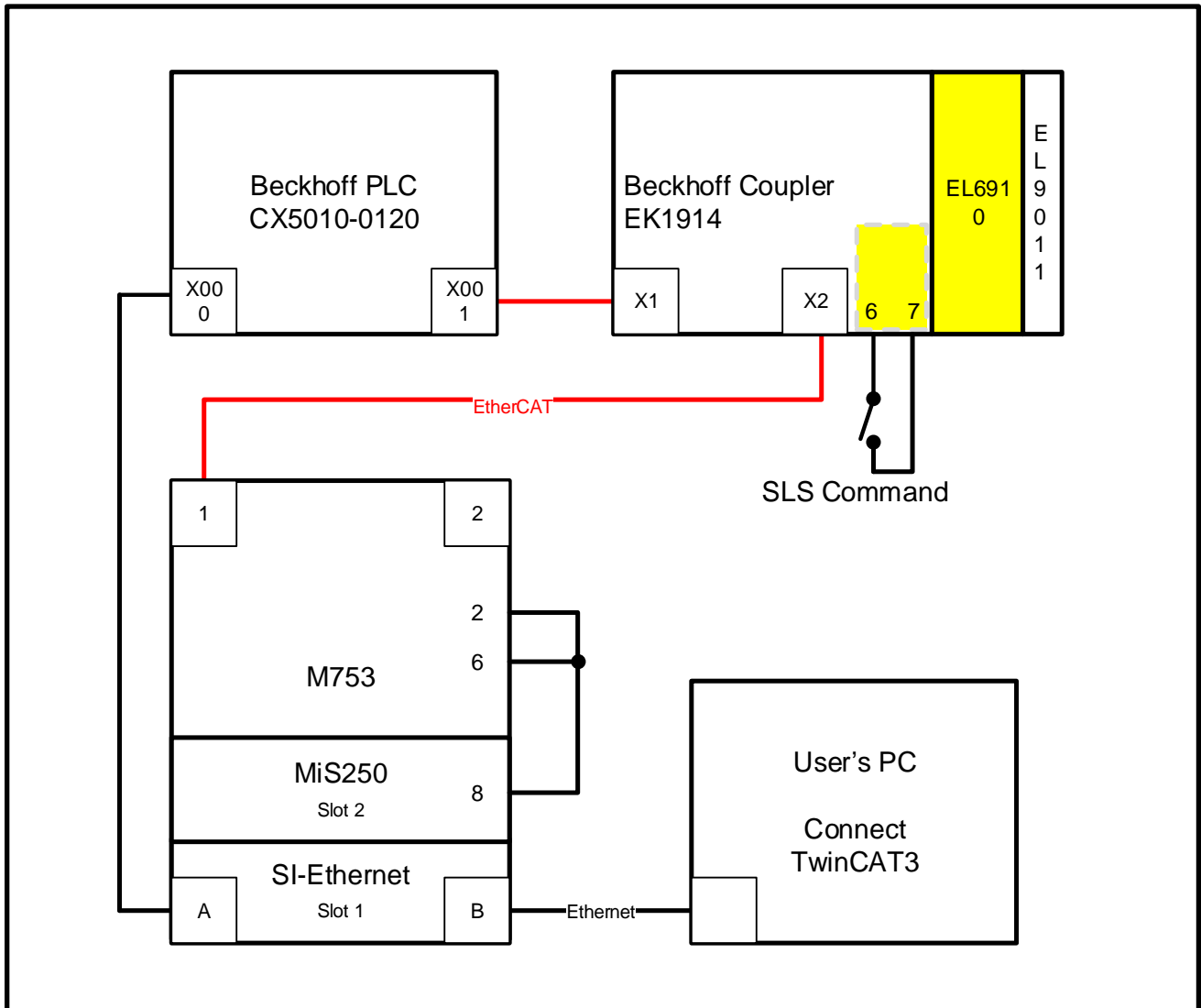
Table 10-1 Hardware

Item	Part number	Notes
Digitax M753	M753-012	
Unimotor HD	067EDA300DAFGC	EnDat 2.2 required
Encoder lead	SLBLAJ000-2	
MiS210	82400000016700	
SI-Ethernet	82400000017900	For Connect or use EoE* or EIA-485**
Beckhoff CX5010 PLC	CX5010-01 20	
Beckhoff Coupler	EK1914	
Beckhoff safety module	EL6910	
Beckhoff end cover	EL9011	

**For EoE support consult the relevant Beckhoff documentation. The PC tool Connect receives and sends standard Ethernet frames and is unaware of the EoE protocol, the EtherCAT master transparently routes the Ethernet frames from the perspective of the PC tool Connect.*

*** KI-485 Compat Adaptor is required for EIA-485.*

Figure 10-1 Interconnections



For this example, the feedback for the drive and for the safety functions both are derived from the EnDat 2.2 encoder connected to P1 of the drive, the encoder is single turn and 19-bits per revolution.

10.1.2 Option modules

Install the MiS250 module and the SI-Ethernet module (if required) into slots two and one respectively of the Digitax HD M753 drive.

10.1.3 Interconnections

It is assumed a Digitax HD demo-case is used, and therefore the standard motor and control wiring is provided. See section 1 before proceeding.

Refer to Figure 10-1 Interconnections.

10.1.4 Creating a safety application in Connect

If it is safe to do so apply power to the demo-case. Launch Connect and choose *Scan Ethernet network*. If you are not familiar with creating a new safety application in Connect, then please see section 6.4.

NOTE *FSoE Black Channel Enable* parameter 17.047 must be set to *On*.

In this example the IP addresses shown in Table 10-8 IP addresses are used and a subnet of 255.255.255.000.

Table 10-2 IP addresses

PC	192.168.1.51
Drive	192.168.1.1
PLC	192.168.1.150

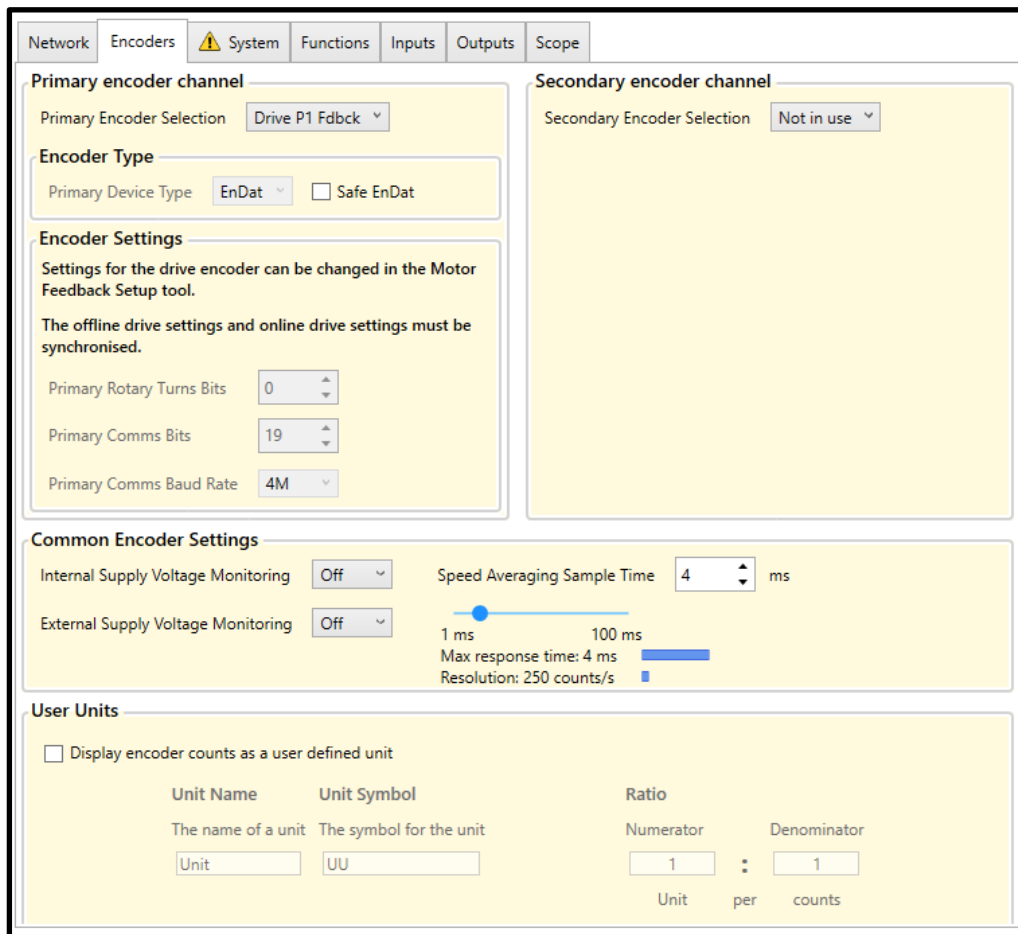
Configure the following tabs within Connect.

Figure 10-2 Network tab

The screenshot shows the 'Network' tab in the Connect software interface. It features several sections: 'Safe Network Type' with radio buttons for 'None', 'CIP Safety', and 'FSoE' (selected); 'Profiles' with a dropdown menu showing 'StoFSoENetworkMiS250' and a 'Load' button; and 'Network Settings' which includes a table for 'Network inputs and outputs for safety module'. The table has five columns: 'Selected', 'SAFEBOOL inputs', 'SAFEINT inputs', 'SAFEBOOL outputs', and 'SAFEINT outputs'. The 6th row is selected, indicating 32 SAFEBOOL inputs, 2 SAFEINT inputs, 32 SAFEBOOL outputs, and 2 SAFEINT outputs. Below the table is a 'Slave address' dropdown menu set to '1'.

Selected	SAFEBOOL inputs	SAFEINT inputs	SAFEBOOL outputs	SAFEINT outputs
<input type="radio"/>	0	0	0	0
<input type="radio"/>	8	0	8	0
<input type="radio"/>	16	0	16	0
<input type="radio"/>	32	0	32	0
<input type="radio"/>	32	1	32	1
<input checked="" type="radio"/>	32	2	32	2
<input type="radio"/>	32	3	32	3
<input type="radio"/>	32	4	32	4
<input type="radio"/>	16	0	16	2

Figure 10-3 Encoder tab



As we have selected the EnDat 2.2 encoder on the drive's P1 port, the *Encoder Settings* information is populated by Connect based on the drive's encoder configuration. (Upload from drive required).

Figure 10-4 System tab

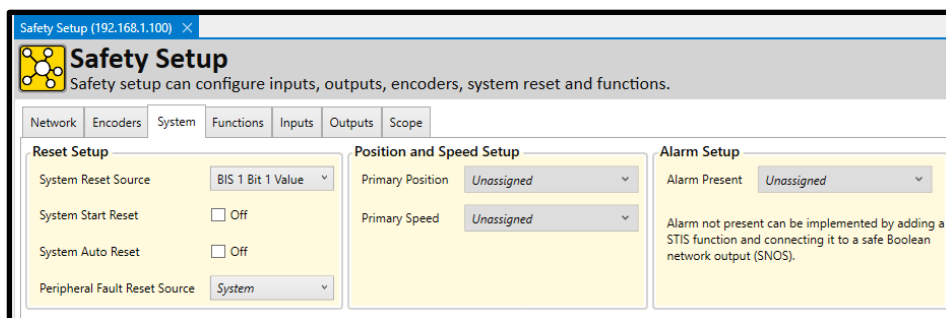


Figure 10-5 SLS tab

Inputs		Outputs	
Speed Limit Command Source	SNIS 1 Bit 0 Value	Demand	SHOS Output 1 Command Source
Zero Speed Command Source	Disabled	Safety Active	Unassigned
Speed Underride Source	SNIS Integer 1 Value	Below Speed Limit	Unassigned
		Request Limited Speed	Unassigned

Settings

Deceleration Mode: Immediate Rate Time

Speed Limit: 524287 counts/s

Speed Underride Multiplier: 1

Alarms

Generate MSF Alarms: Off Alarms will not be raised by this function.

Reset

Reset Source: System

We have set the *Speed Limit Command Source* to *SNIS Bit 0 value*, and *Speed Underride* to *SNIS Integer 1*. We can thus control when SLS monitors the speed and also control the speed underride over the network.

The *Speed Limit* is set to 524287 counts/s or 60 rpm (for the 19-bit per revolution single turn encoder used). The *Speed Underride Multiplier* is set to 1, the data type in the PLC will be DINT. Therefore, the underride value can be adjusted over the network between 524287 counts/s and 0 counts/s or 60 rpm to 0 rpm.

The *Demand* of SLS is assigned to *SHOS Output 1*.

Save the configuration, download and enter test mode in the normal way.

NOTE Check that *FSoE Black Channel State* parameter 3.01.006 is *Active*.

10.1.5 Creating a safety application in TwinCAT3

Copy the relevant ESI file into TwinCAT's configuration location (e.g. c:\TwinCAT\3.1\Config\Io\EtherCAT). The ESI file must match the SI-EtherCAT firmware. See section 3.7.2 for firmware requirements.

Create a new TwinCAT project and set the communications path. Add the EtherCAT network and scan for devices. Do not link an axis.

Figure 10-6 Set path

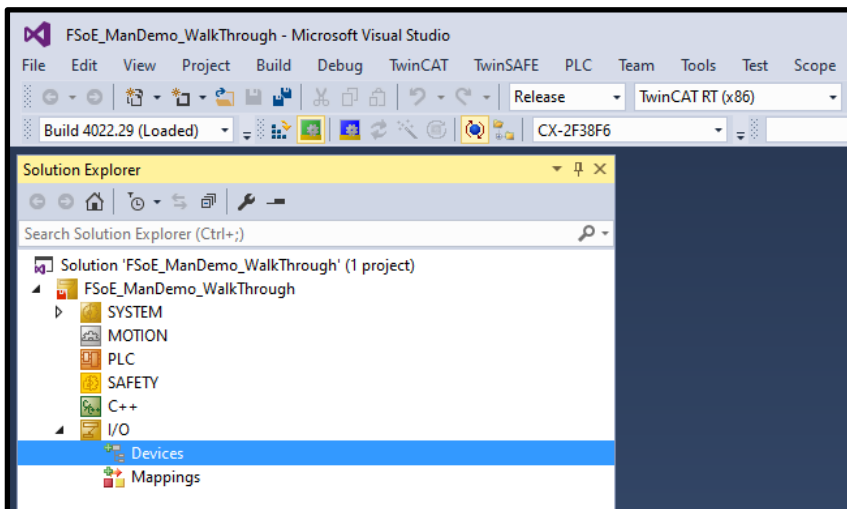


Figure 10-7 Scan for devices

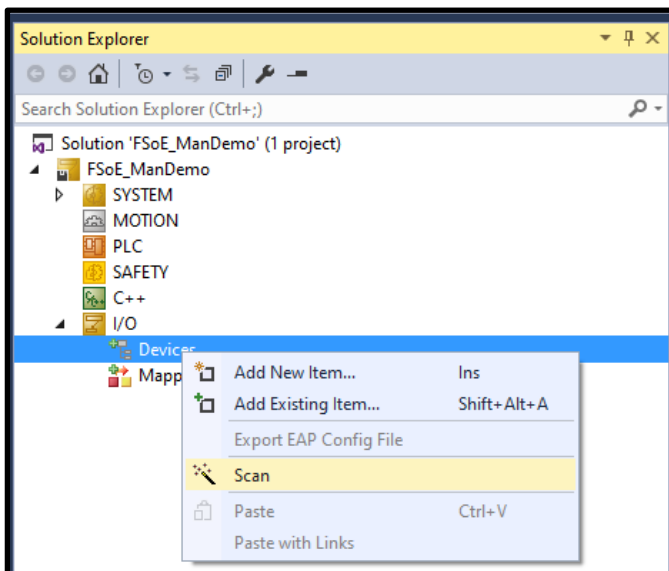


Figure 10-8 Select network

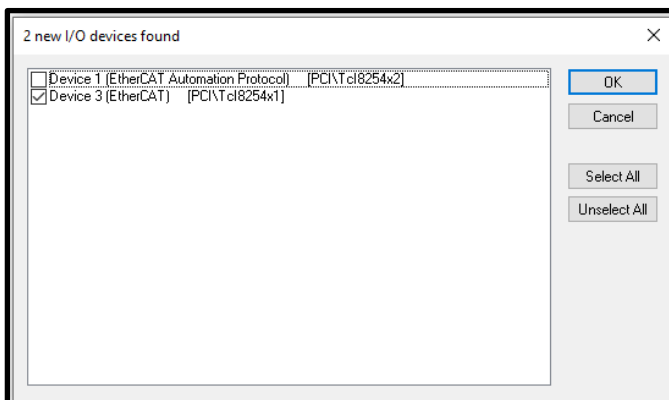


Figure 10-11 Add New Item to safety in solution tree

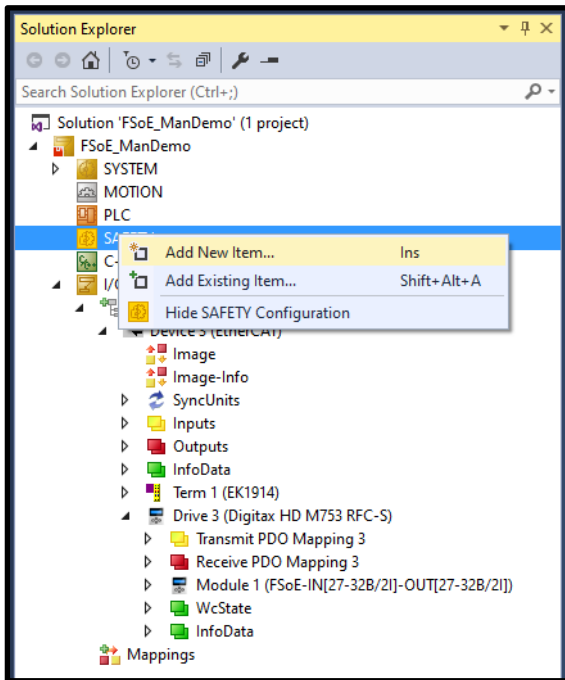
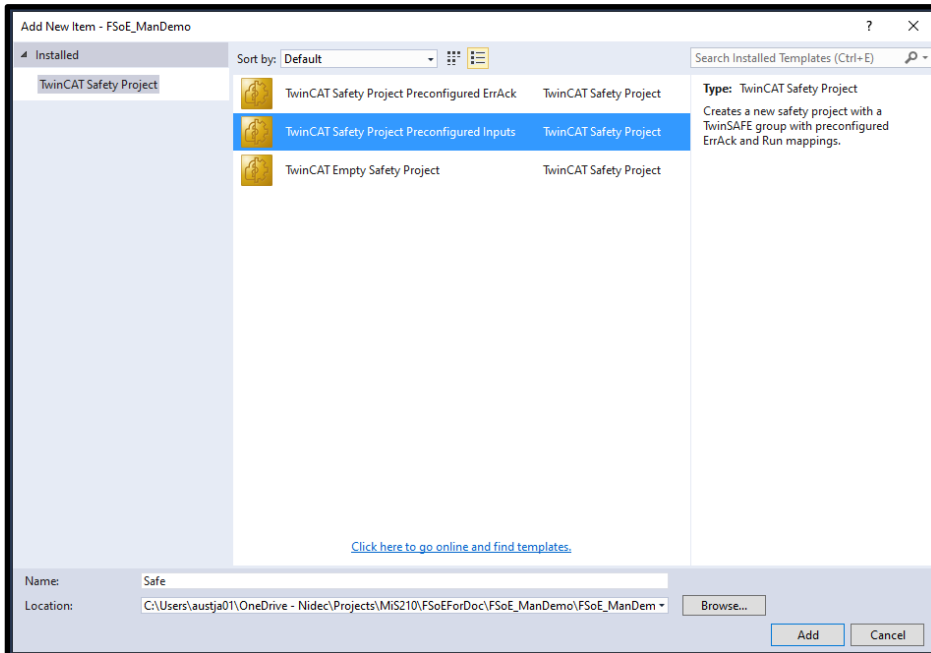


Figure 10-12 Select TwinCAT Safety Project Preconfigured Inputs



Double click on *Target System* under the Safety project in the solution tree. Select the Target System to be *EL6910*. Click the add button and select the physical device in the dialog (EL9690).

Figure 10-13 Target System

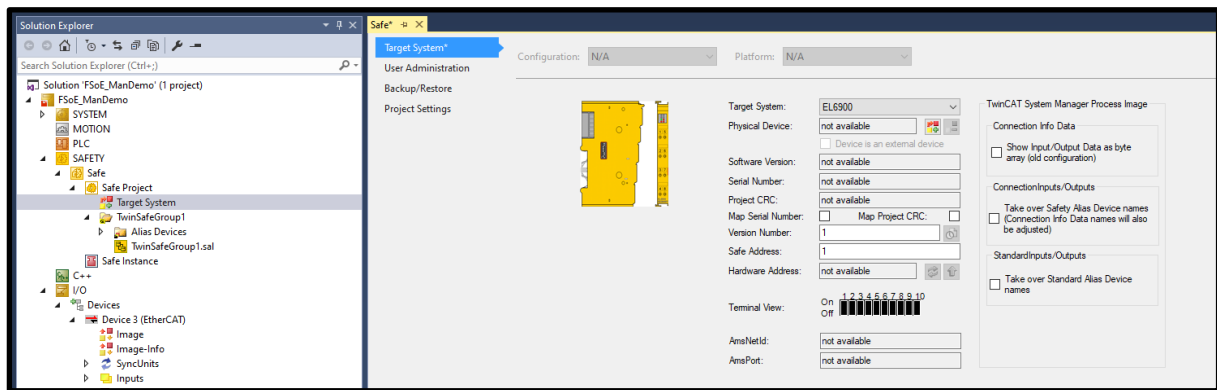
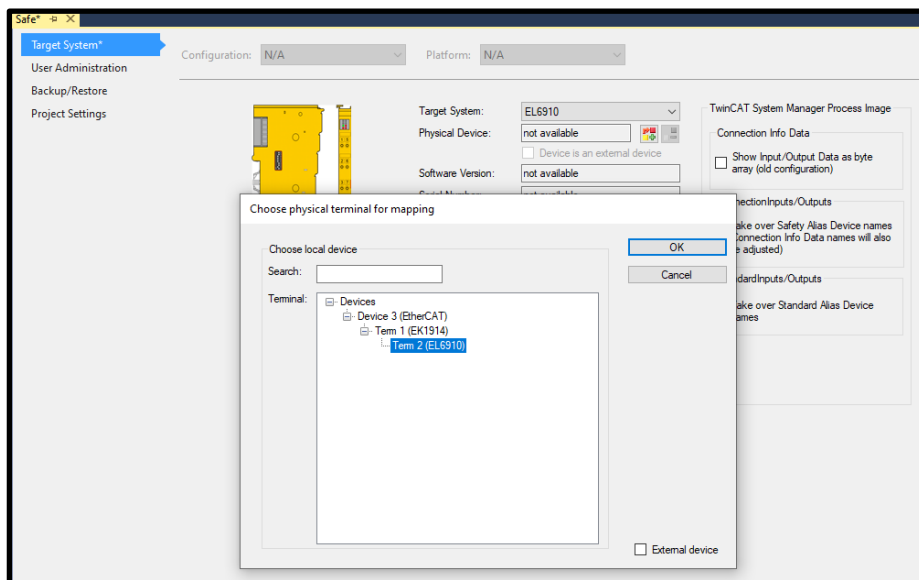


Figure 10-14 Select EL6900



Copy the *Hardware Address* value to the *Safe Address* field.

Make a note of the serial number, you will need to know this later.

Figure 10-15 Import Alias Device

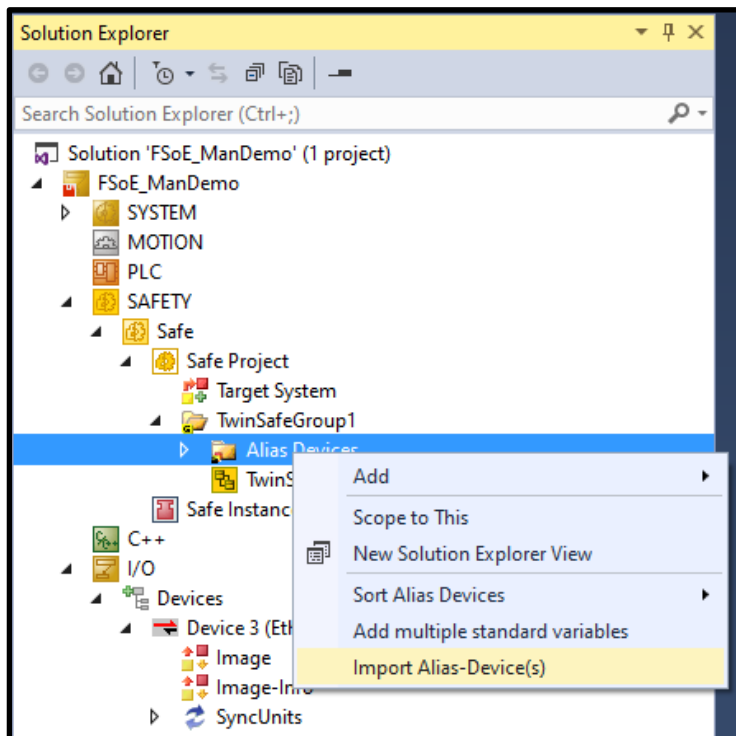


Figure 10-16 Add the safety devices

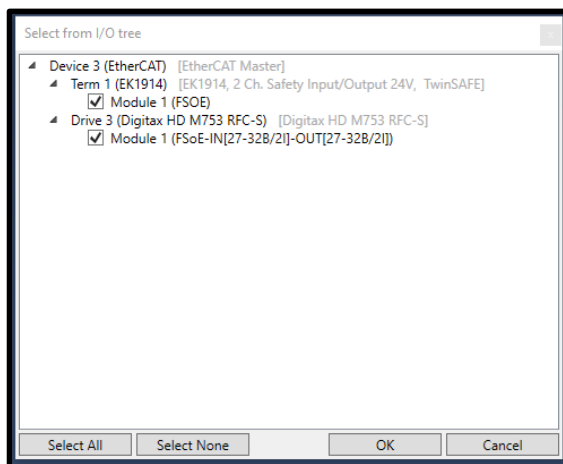


Figure 10-17 Double click Drive in Alias Devices

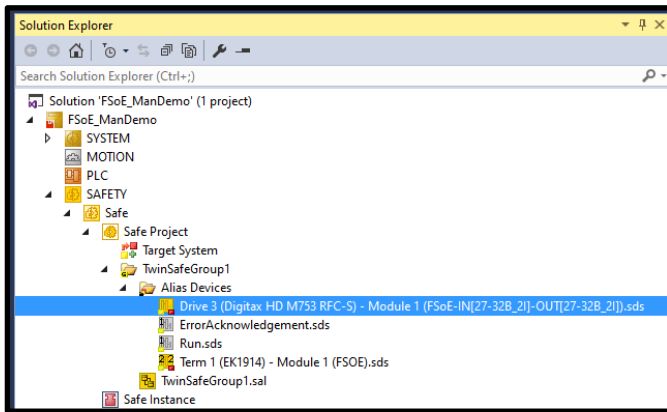


Figure 10-18 Copy the FSoE Network signature from your Connect project

Module	FSoE Network
Signature: A5FE - D486 - 2CCF - CEBE	Network signature: CEBE - 2CCF - D486 - A5FE
Mode: Configuring	
Status: Test-Comm-On	
Alarm: Network Not Available see Setup Menu Parameter 028 [0x434]	
Fault: None (Last fault: PSU 24V Self-Test Range Error, Can occur due to a Drive Brown Out [0x8E7])	
Module Trip Code: Healthy	
System State: Unknown state (0xC001)	
Worst Case Cycle Time: 66%	
STO: Active (the drive will not turn the motor)	

Figure 10-19 To TwinCAT

Index	Name	Value	Unit
E800:0	FSoE Application Parameters	>5<	
E800:01	Safety system signature wor...	0xCEBE (5292...)	
E800:02	Safety system signature wor...	0x2CCF (1147...)	
E800:03	Safety system signature wor...	0xD4B6 (5445...)	
E800:04	Safety system signature wor...	0xA5FE (42494)	

Figure 10-20 Add New Item to Alias Devices

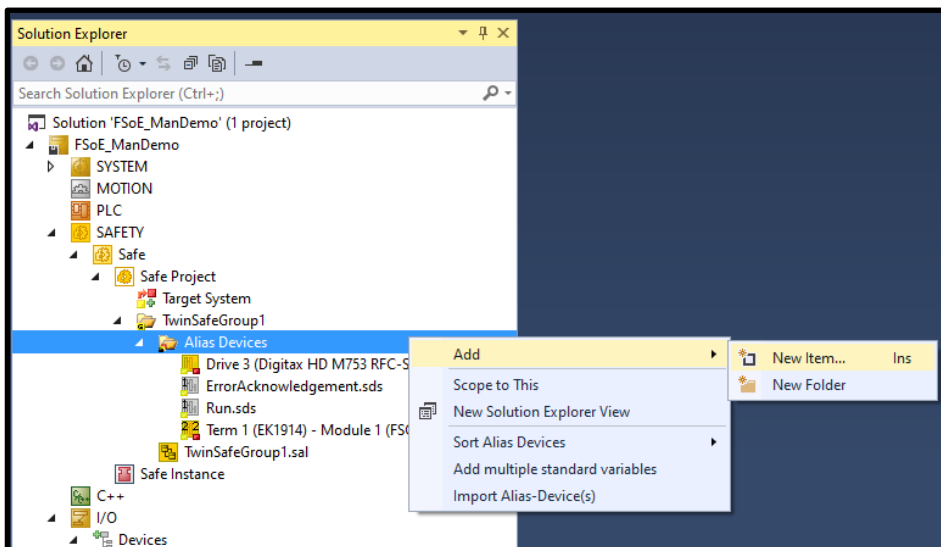


Figure 10-21 Add 1 Digital Output and name it CommErr.sds

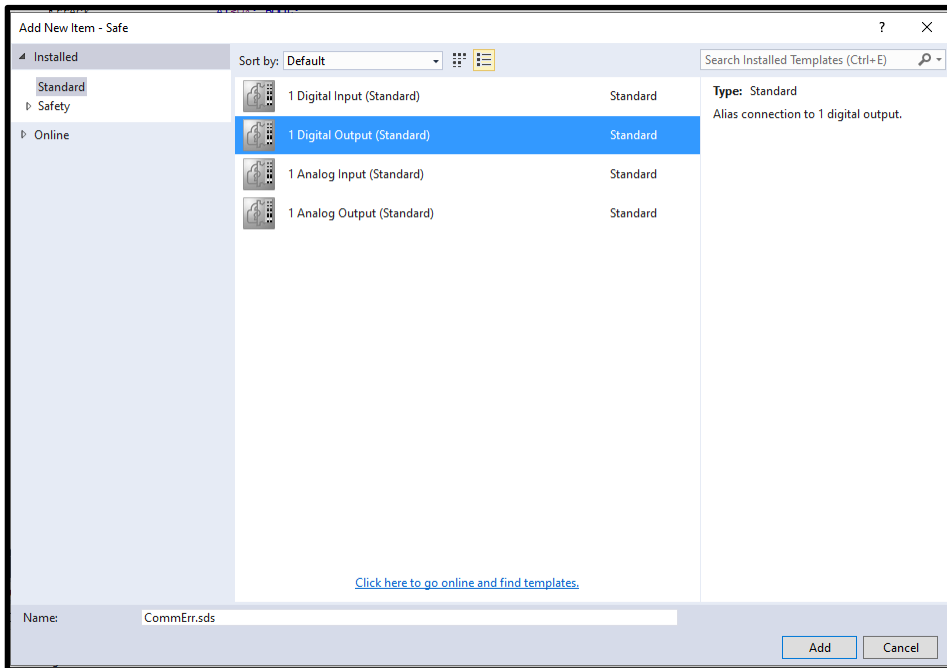


Figure 10-22 Add New Item to PLC

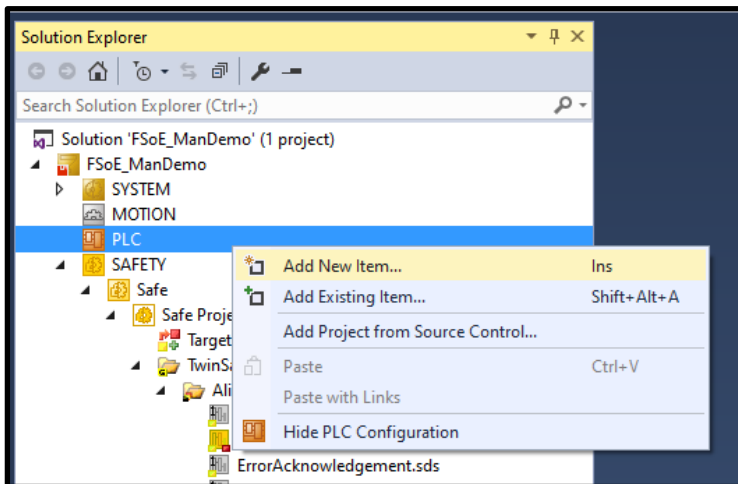


Figure 10-23 Select Standard PLC Project

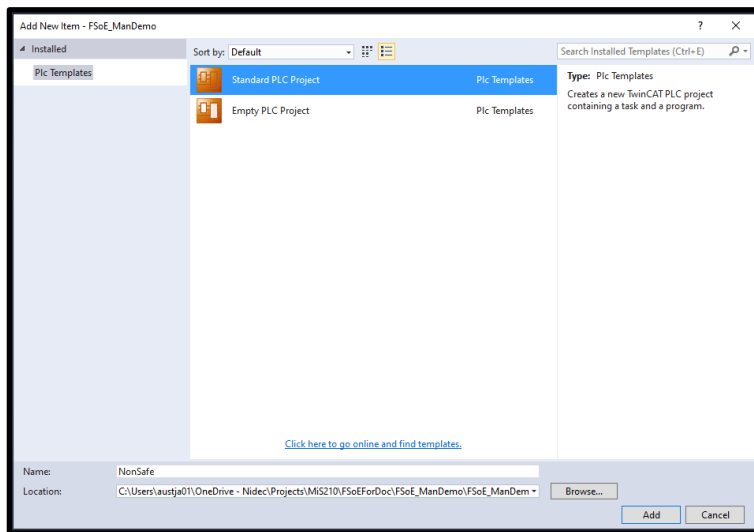


Figure 10-24 Add a Global Variable List and name it Mappings

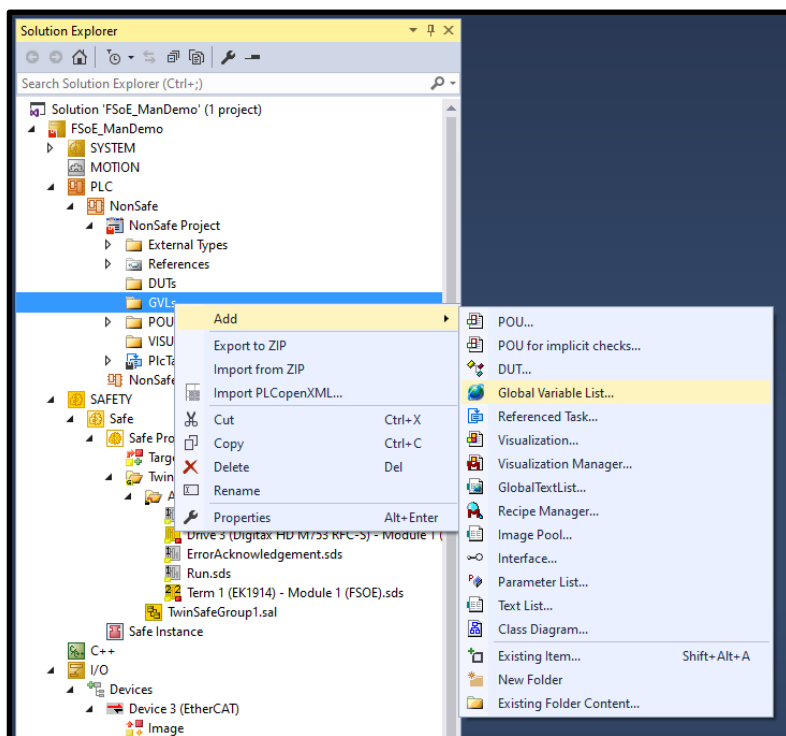


Figure 10-25 Declare the following variables

```

VAR_GLOBAL
    // Safety Run Control
    Run                                     AT%Q* : BOOL;
    ErrAck                                  AT%Q* : BOOL;
    // Safety Err Status
    CommErr                                  AT%I* : BOOL;
    SLS_SpeedOverride                       AT%Q* : DINT;
END_VAR

```

Figure 10-26 MAIN program

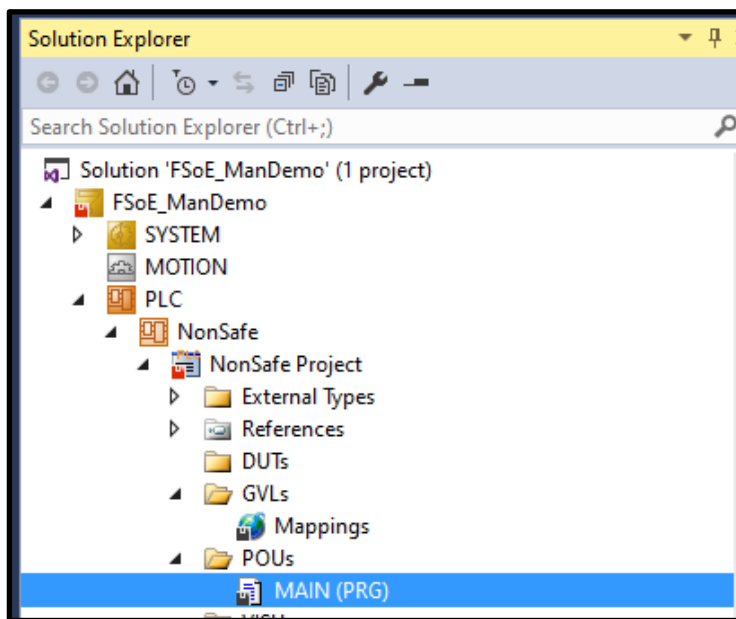


Figure 10-27 Add the following declaration and program

```
PROGRAM MAIN
VAR
    SafePartState: INT := 0;
    TestSpeed: DINT;
END_VAR

IF SafePartState = 0 THEN
    IF CommErr <> 0 THEN
        SafePartState := 1;
        Run := 0;
    ELSE
        Run := 1;
    END_IF
ELSIF SafePartState < 1000 THEN
    ErrAck := 1;
    SafePartState := SafePartState + 1;
ELSE
    ErrAck := 0;
    SafePartState := 0;
END_IF
SLS_SpeedOverride := TestSpeed;
```

Build the solution (Ctrl+Shift+B) errors will be generated at this stage and save.

Figure 10-28 ErrorAcknowledgment.sds

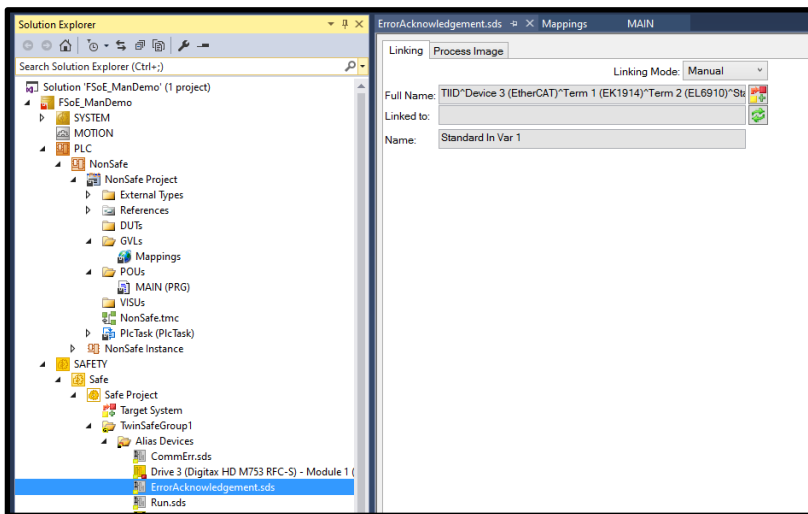
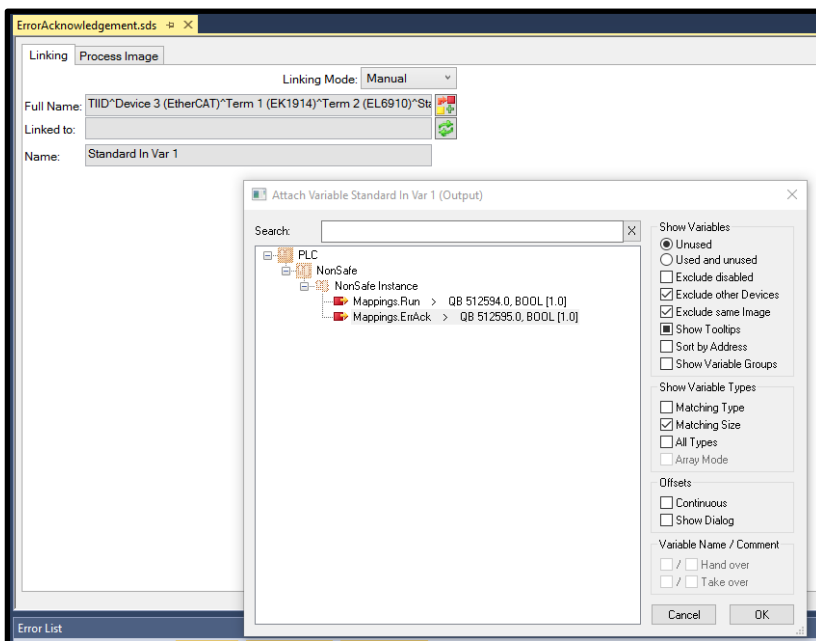


Figure 10-29 Map the ErrAck variable



Repeat for CommErr.sds and Run.sds.

Figure 10-30 Add New Item to Alias Devices

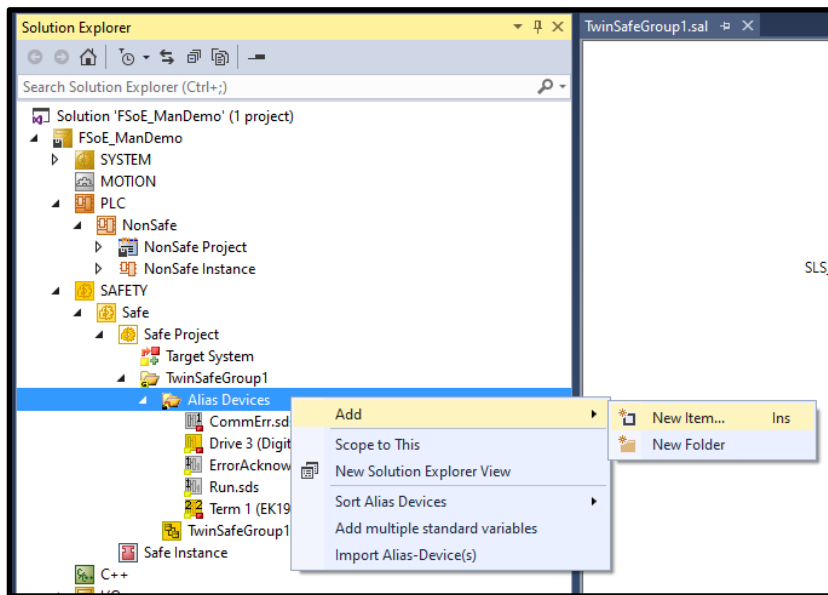


Figure 10-31 Add Analog Input

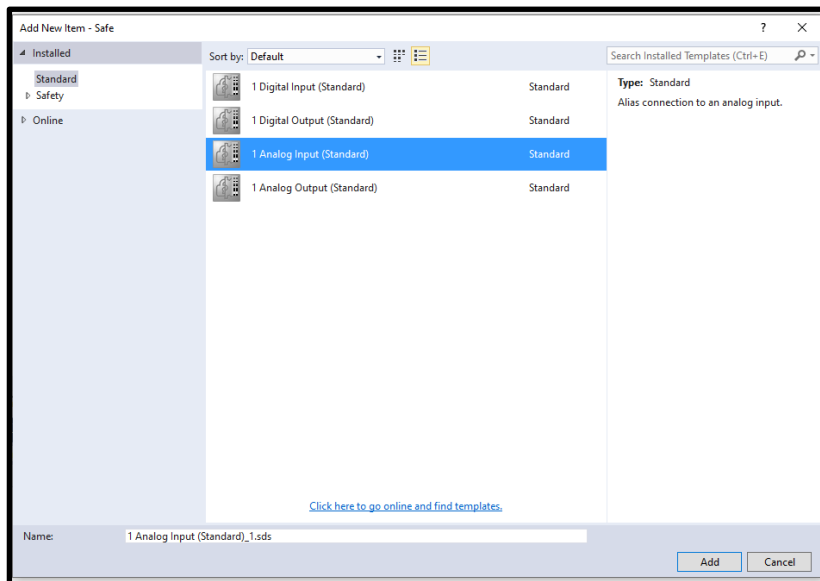


Figure 10-32 1 Analog Input

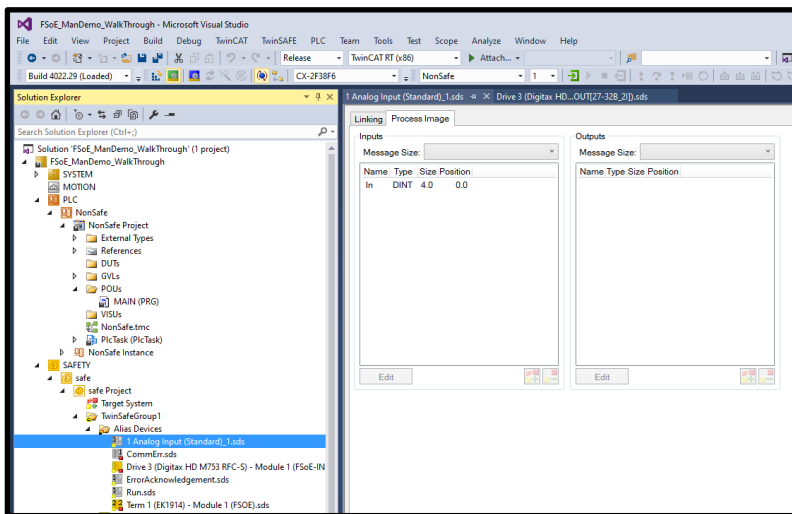


Figure 10-33 Change the data type of the added input to DINT

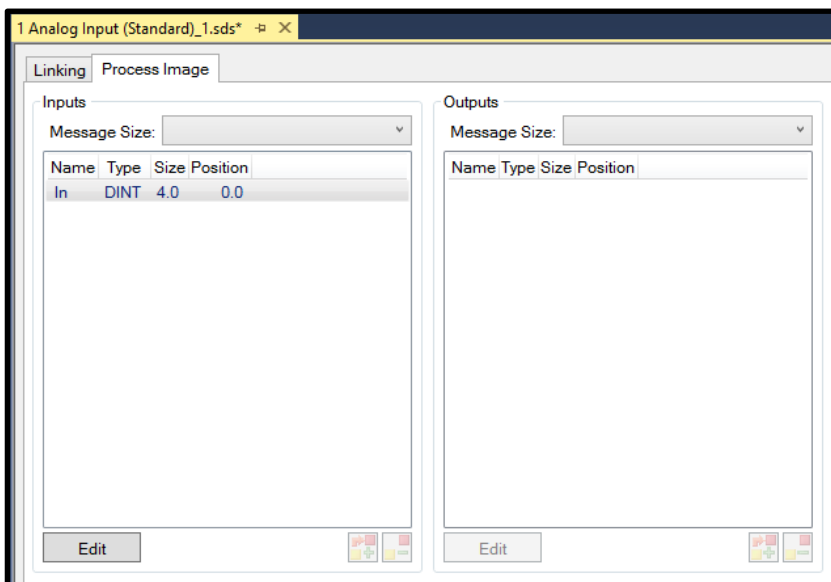
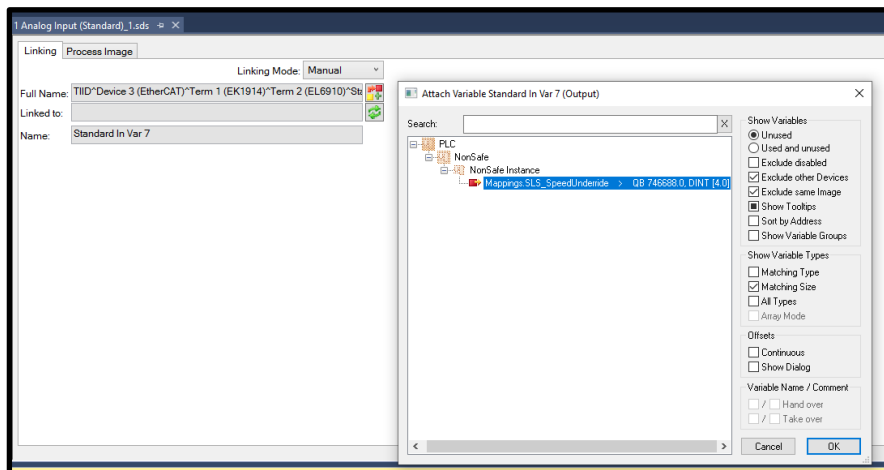


Figure 10-34 Add the mapping (build if required to see variables)



Activate the configuration.

Figure 10-35 TwinSafeGroup1.sal

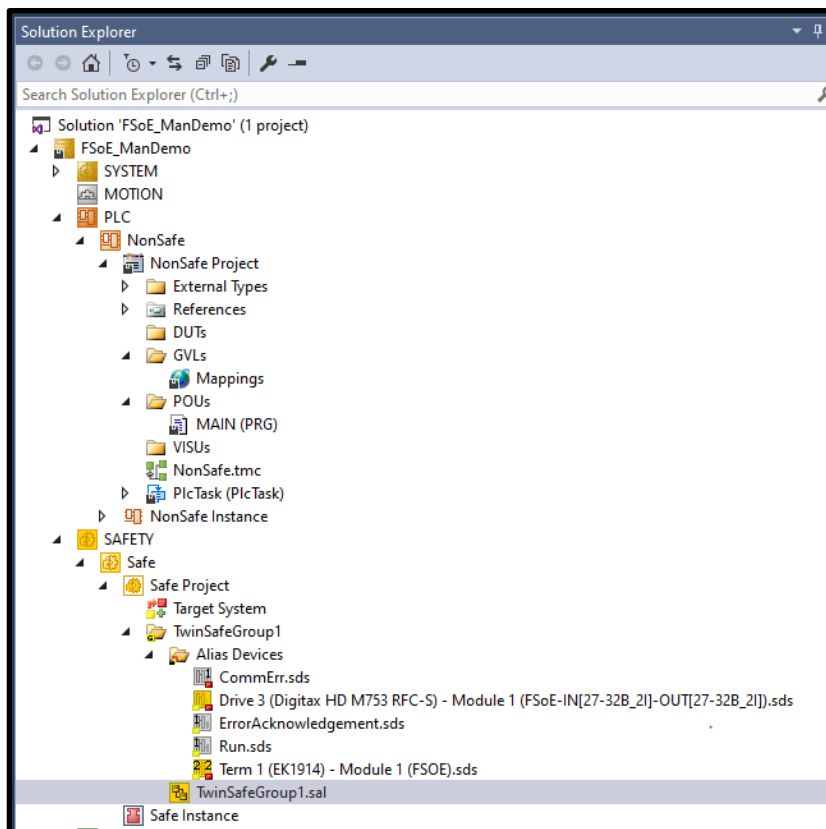
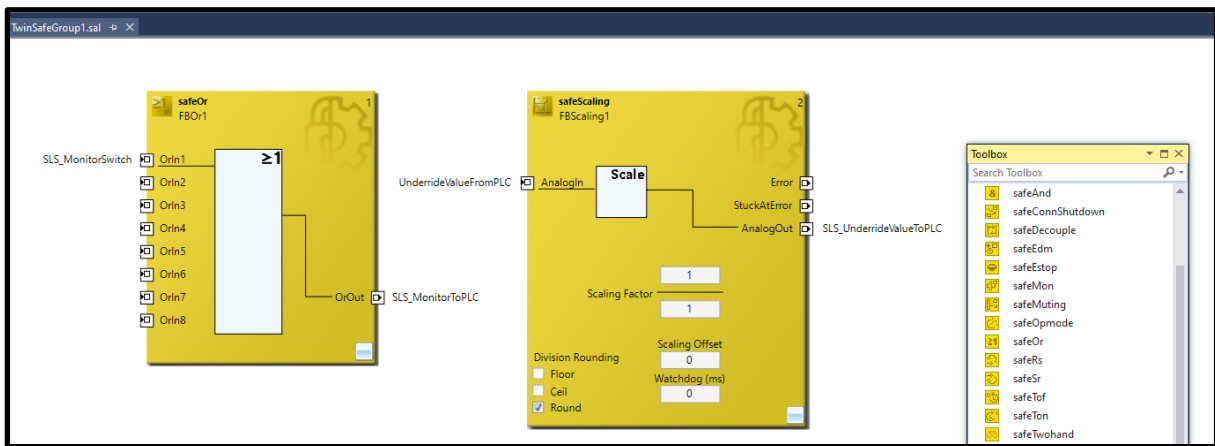


Figure 10-36 Add the following function blocks

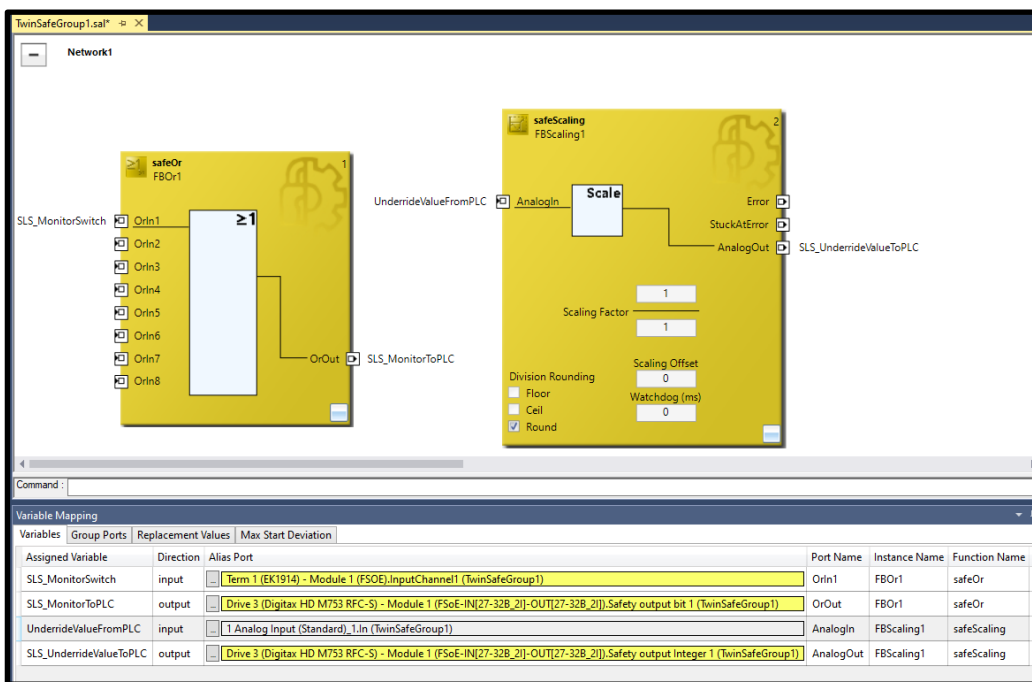


Add the function blocks and click next to the terminals, then add the variable names shown.

For the *safeScaling* function block, right click on *AnalogIn*, click *Properties* and change the *Data Type* to *DINT*. Repeat for *AnalogOut*.

Select *View>Other Windows>Variable Mapping* from the menu bar.

Figure 10-37 Assign the variables as shown



SLS_MonitorSwitch is assigned to the digital input 1 on the EK1914 bus coupler. Connect a switch between terminals 6 and 7 of the EK1914. This switch will

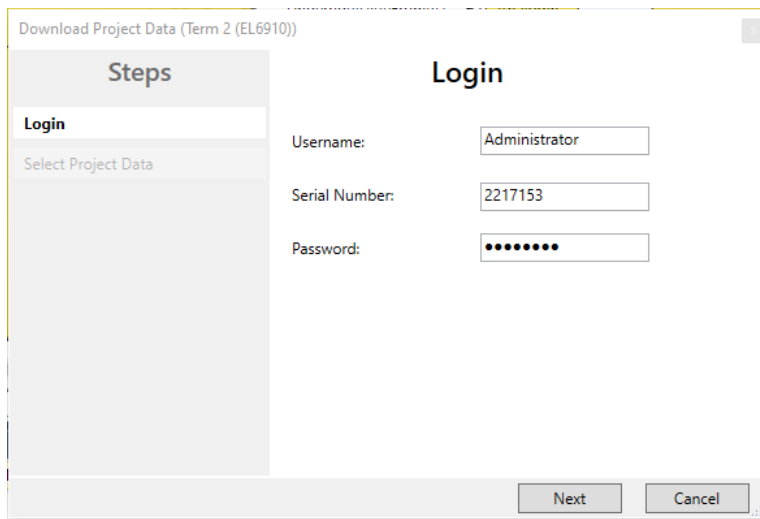
SLSMonitorToPLC is the output to instruct the MiS250's SLS over the network to monitor for overspeed.

UnderrideValueFromPLC is the alias device is linked to the global variable *SLS_SpeedUnderride* that is used within the MAIN PLC program.

SLS_UnderrideValueToPLC is the output over the network that is the Speed Underride value of SLS.

Select *TwinSAFE*>*Download Safety Project*.

Figure 10-38 Enter the credentials.



The default username is “Administrator”, and the default password is “TwinSAFE”. The serial number is that of the *Target System*.

10.1.6 Running the example

It is assumed that the MiS210 is in test mode and the PLC program is running.

In the *Safety Testing* tab within Connect you may view details of the encoder feedback, diagnostics for the MSFs and diagnostics for the inputs and outputs.

Within TwinCAT’s *TwinSafeGroup.sal* if *TwinSAFE*>*Show Online Data* is selected the user can view the values of the safety variables.

Only proceed if safe to do so.

For this example, we will manually control the drive’s speed by selecting the *Reference Selector* to *Preset* (parameter 01.014 = Preset, parameter 01.015 = 1) and varying *Preset Reference 1* (parameter 01.021). We will also control the MiS250’s reset by manually writing to *Non Safe Input 1* (parameter 16.031).

Connect may be used to manually write the parameters, for convenience the user can choose to create a *Custom List* and add parameter 01.021 and parameter 17.031. (Open the required menu in the parameters folder of the project pane, right click on the desired parameter and select send to custom list).

Follow to steps in Table 10-4 Hardware to run the example.

Table 10-3 Steps to run the example

Step	Action	Comment
1	Apply the <i>Forward</i> run signal to the drive by closing the <i>FWD</i> switch on the demo case (Or apply 24V potential to <i>Digital Input 3</i>)	SHOS 1 is false
2	Set <i>Non Safe Input 1</i> (parameter 16.031) to true	<ul style="list-style-type: none"> On a rising edge the MiS250 will reset SHOS 1 is true
3	Turn on the switch connected to terminals 6 & 7 of the EK1914	SLS speed monitoring is now deactivated <ul style="list-style-type: none"> SLS Safely Limited speed Diagnostic Code shows <i>Operational</i>
4	Apply any speed above 60 rpm (parameter 01.021)	<ul style="list-style-type: none"> The shaft should rotate at the selected speed. SHOS 1 should remain true.
5	Decrease the speed to 1 rpm (parameter 01.021)	Shaft should rotate at 1 rpm
	Within the TwinCAT MAIN program set a value of 262143 for <i>TestSpeed</i>	
6	Turn off the switch connected to terminals 6 & 7 of the EK1914.	SLS is now monitoring for overspeed <ul style="list-style-type: none"> SLS Safely Limited Speed Diagnostic shows <i>Monitoring safe speed</i> A value of 262143 (30rpm) is being sent to the MiS210
7	Increase the speed to 30 rpm (parameter 01.021)	SHOS 1 becomes false
8	Decrease the speed to 20 rpm	SHOS 1 remains false.
9	Set <i>Non Safe Input 1</i> (parameter 16.031) to true	<ul style="list-style-type: none"> On a rising edge the MiS210 will reset SHOS 1 becomes true

Figure 10-39 SLS view in Safety Testing

The screenshot shows the 'Safety Testing' window with the following status information:

- STO: Active (the drive will not turn the motor)
- Alarm: None
- Encoder Position: 408867 counts
- Encoder Relative Position: 0 counts/cycle
- Encoder Speed: -2000 counts/s
- Encoder Acceleration: -625000 counts/s²
- Encoder Averaging:

The 'Function Properties' table is as follows:

Name	Type	Value	Connection
SLS_1 Safely Limited Speed.Speed Limit Command Source	SAFEBOOL	TRUE	SNIS 1 Safe Boolean Network Inputs.Bit 0 Value
SLS_1 Safely Limited Speed.Zero Speed Command Source	SAFEBOOL	Unassigned	Disabled
SLS_1 Safely Limited Speed.Demand	SAFEBOOL	TRUE	SHOS Safe Boolean Hardware Outputs.Output 1 Command Source
SLS_1 Safely Limited Speed.Safety Active	SAFEBOOL	FALSE	
SLS_1 Safely Limited Speed.At Zero Speed	SAFEBOOL	FALSE	
SLS_1 Safely Limited Speed.Below Speed Limit	SAFEBOOL	FALSE	
SLS_1 Safely Limited Speed.Reset Source	BOOL	TRUE	SYSTEM.Module Configuration and Control.System Reset Source
SLS_1 Safely Limited Speed.Request Limited Speed	BOOL	FALSE	
SLS_1 Safely Limited Speed.Request Zero Speed	BOOL	FALSE	
SLS_1 Safely Limited Speed.Deceleration Mode	ENUM	Immediate	
SLS_1 Safely Limited Speed.Speed Limit	UNKNOWN	524287 counts/s	
SLS_1 Safely Limited Speed.Deceleration To Speed Limit	UNKNOWN	0 counts/s ²	
SLS_1 Safely Limited Speed.Deceleration To Zero Speed	UNKNOWN	0 counts/s ²	
SLS_1 Safely Limited Speed.Time To Speed Limit	INT	0 ms	
SLS_1 Safely Limited Speed.Time To Zero Speed	INT	0 ms	
SLS_1 Safely Limited Speed.Zero Speed Threshold	INT	0 counts/s	
SLS_1 Safely Limited Speed.Max Standstill Distance	INT	0 counts	
SLS_1 Safely Limited Speed.Zero Speed Mode	ENUM	Speed	
SLS_1 Safely Limited Speed.Speed Limit Dwell Time	INT	0 ms	
SLS_1 Safely Limited Speed.Zero Speed Dwell Time	INT	0 ms	
SLS_1 Safely Limited Speed.Speed Underride Multiplier	INT	1	
SLS_1 Safely Limited Speed.Speed Control Tolerance	INT	0 counts/s	
SLS_1 Safely Limited Speed.Generate MSF Alarms	BOOL	FALSE	
SLS_1 Safely Limited Speed.Speed Underride Source	SAFEINT	262143	SINIS Safe Integer Network Inputs.Integer 1 Value
SLS_1 Safely Limited Speed.Error	BOOL	FALSE	
SLS_1 Safely Limited Speed.Diagnostic Code	INT	0x8000 - Operat...	

In Figure 10-39 SLS view in Safety Testing the *Encoder Speed* is 0 counts/s, *Safely Limited Speed Underride* is 262143, and *Safely Limited Speed Diagnostic Code* reports *Operational*.

Figure 10-40 TwinSafeGroup Online values

The screenshot shows the 'TwinSafeGroup' interface with a 'Scale' block and a 'Variable Mapping' table.

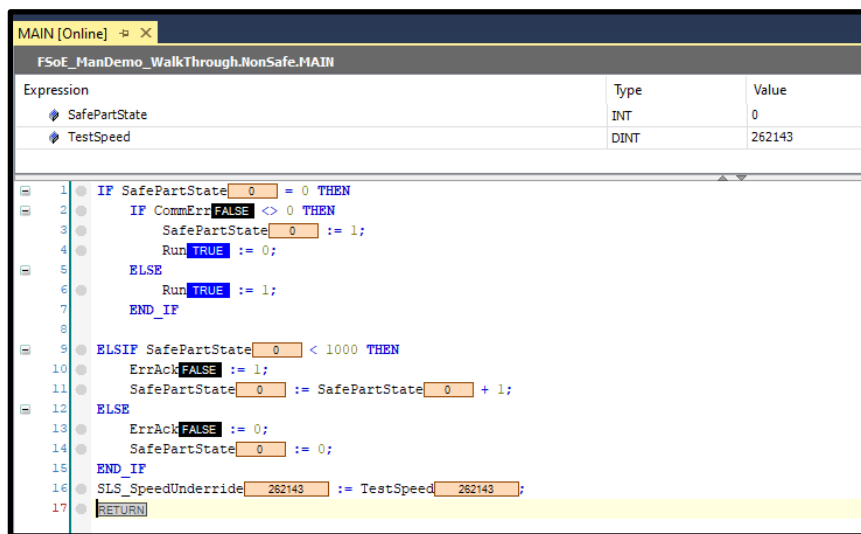
The 'Scale' block configuration is as follows:

- Input: UnderrideValueFromPLC
- Scaling Factor: 1
- Division Rounding: Floor, Ceiling, Round
- Scaling Offset: 0
- Watchdog (ms): 0
- Output: SLS_UnderrideValueToPLC

The 'Variable Mapping' table is as follows:

Assigned Variable	Online Value	Direction	Alias Port	Port Name	Instance Name	Function Name
SLS_MonitorSwitch	True	input	Term 1 (EX1914) - Module 1 (PSOE) InputChannel1 (TwinSafeGroup)	OrIn1	FBDr1	safeDr
SLS_MonitorToPLC	True	output	Drive 3 (Digital HD M79) BFC-S1 - Module 1 (PSOE-IR27-33B-2) Output27-33B-2) Safety output bit 1 (TwinSafeGroup)	OrOut	FBDr1	safeDr
UnderrideValueFromPLC	0	input	1 Analog Input (Standard) 13n (TwinSafeGroup)	AnalogIn	FBScaling1	safeScaling
SLS_UnderrideValueToPLC	0	output	Drive 3 (Digital HD M79) BFC-S1 - Module 1 (PSOE-IR27-33B-2) Output27-33B-2) Safety output integer 1 (TwinSafeGroup)	AnalogOut	FBScaling1	safeScaling

Figure 10-41 TestSpeed set to 262413 in MAIN



10.2 CIP Safety example

This example depicts the scenario of a Rockwell Allen Bradley ControlLogix PLC with suitable GuardLogix modules to control the SLS’s speed override feature. It is suggested that the user completes the quick start example in section 6 before proceeding as this illustrates the full detailed steps for creating applications using Connect.

It is assumed the user has at least basic familiarity creating standard PLC programs, setting communication paths, and connecting to a PLC with Studio 5000 Logix Designer. If not, then refer to the relevant Rockwell Allen Bradley documentation.

The following example is provided in good faith however, Control Techniques cannot offer direct support for Allen-Bradley or other manufacturers' products, nor provide specific examples for differing hardware.

NOTE Users must refer to the “*Installation and Operating manual MiS210 and MiS250 Safety Modules*” document for full technical details.

Generic support for the MiS2x0 modules is available through your supplier or local Control Techniques Drive Centre. For support of other manufacturers' PLCs, software and products please contact the relevant third-party support channels.

EtherNet/IP™ and CIP Safety™ are trademarks of ODVA, Inc.

10.2.1 Assemble the hardware

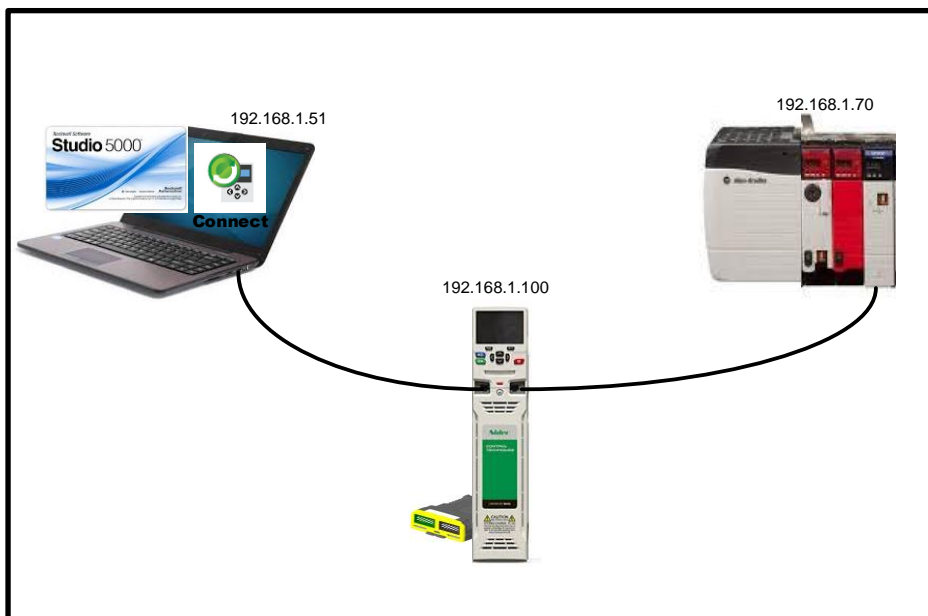
This example was prepared using an MiS210 and the official Control Techniques Unidrive M700 demo-case with an additional AB encoder mounted to the motor shaft. A list of the hardware is given in Table 10-4 Hardware. Please see section 3.7 for firmware and hardware version requirements. The drive’s Ethernet interface should be configured for CIP Safety (parameter S.02.018).

Table 10-4 Hardware

Item	Part number	Notes
Unidrive M700	M700-032 00050A	
Unimotor HD	067EDA399XAFM074140-SRBS	

Encoder lead	SLBLAJ000-2	
MiS210		
Hengstler AB encoder 1024 PPR	RI64/1024-BW4H9IB-BOX11	Additional encoder mounted to shaft. Or use motor's EnDat 2.2 if supported.
ControlLogix power supply	1756-PA72	
GuardLogix safety PAC (PLC)	1756-L72S	
GuardLogix safety partner module	1756-L7SP	
ControlLogix EtherNet/IP module	1756-ENBT	
ControlLogix 4 slot base	1756-A4	

Figure 10-42 Interconnections



10.2.1.1 Option modules

Install the MiS210 module into slot three of the Unidrive M700 drive.

10.2.1.2 Interconnections

It is assumed a Unidrive M demo-case is used, and therefore the standard motor and control wiring is provided. See section 1 before proceeding.

Fix an appropriate AB encoder to the shaft, suitable guarding must be provided to protect the user from the rotating shaft. Alternatively, if the motor's feedback is EnDat 2.2, then the user may wish to monitor the drive's encoder (see section 3.7 for hardware requirements), although the value of counts/s defined in the SLS tab will likely require modifying to represent the encoders resolution.

Connect an Ethernet lead between one port of the drive and the PLC, and a second between the drive and your laptop or PC.

10.2.2 Creating a safety application in Logix Designer

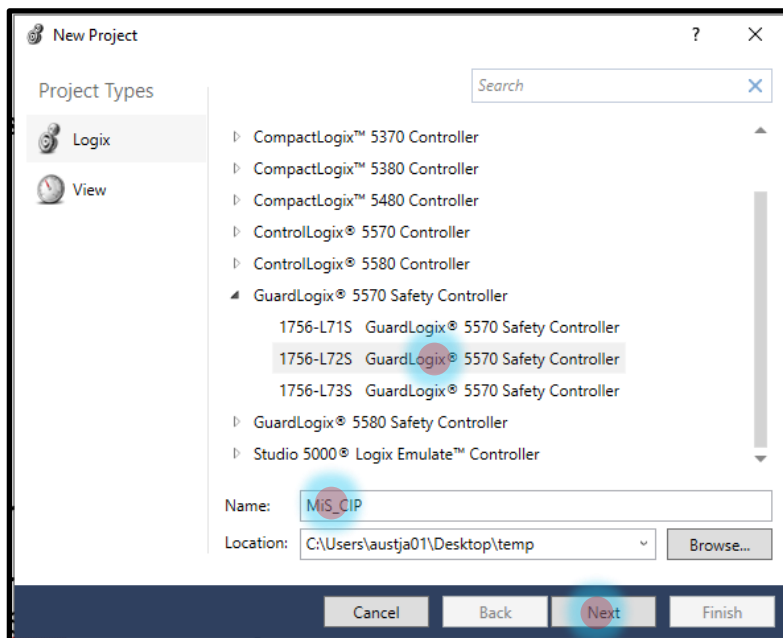
If it is safe to do so apply power to the PLC.

Launch Logix Designer, create a new project and set an appropriate communications path. In this example the IP addresses shown in Table 10-5 IP addresses were used and a subnet of 255.255.255.000.

Table 10-5 IP addresses

PC	192.168.1.51
Drive	192.168.1.100
PLC	192.168.1.70

Table 10-6 New project 1



2

Table 10-7 New project 2

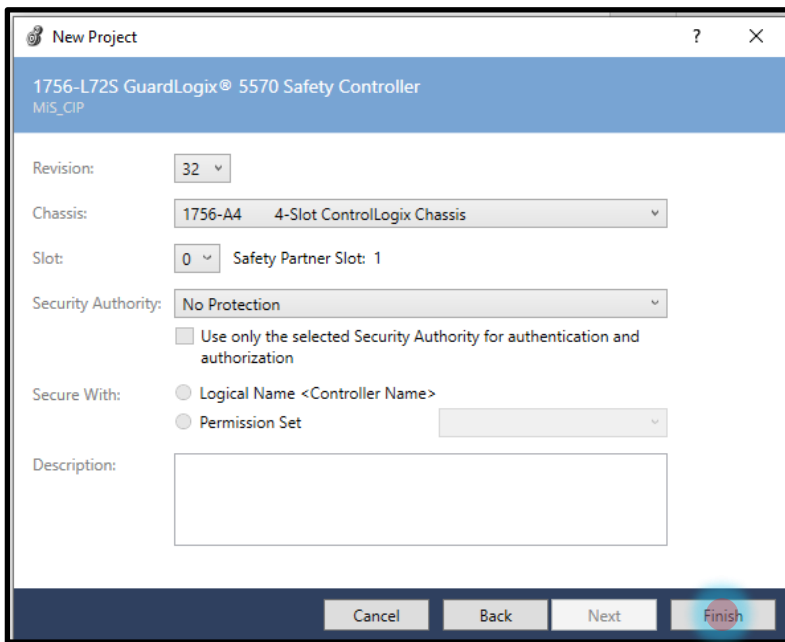


Figure 10-43 Add new module

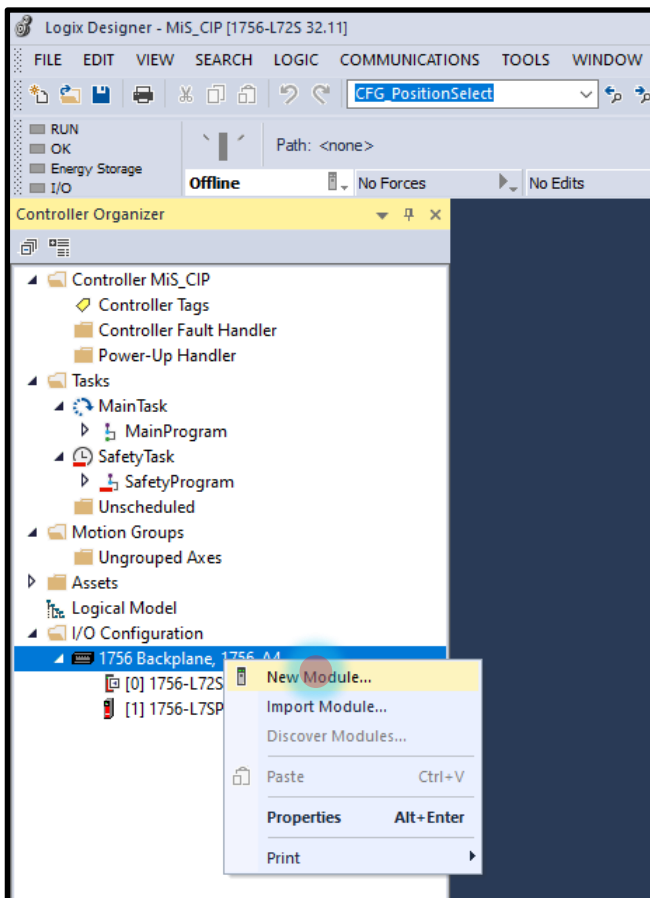


Figure 10-44 Add Ethernet bridge

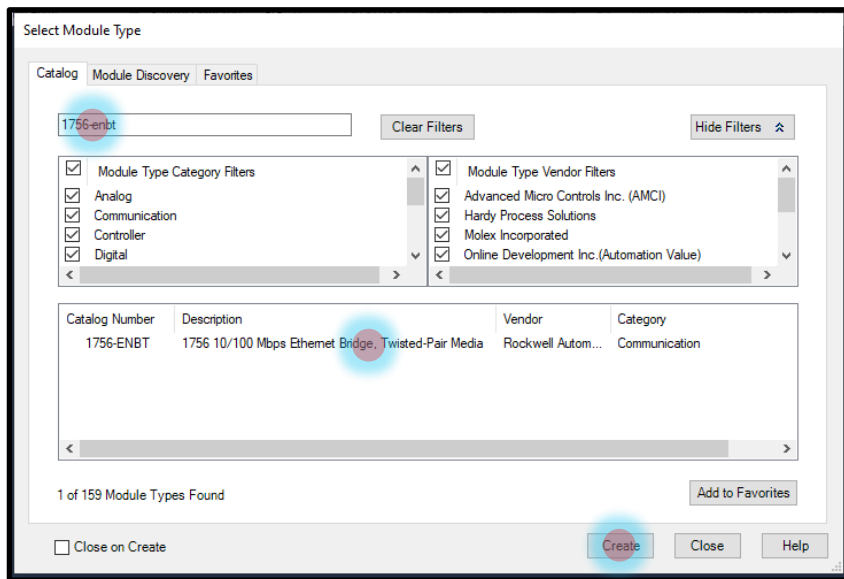


Figure 10-45 Configure the Ethernet adaptor on PLC

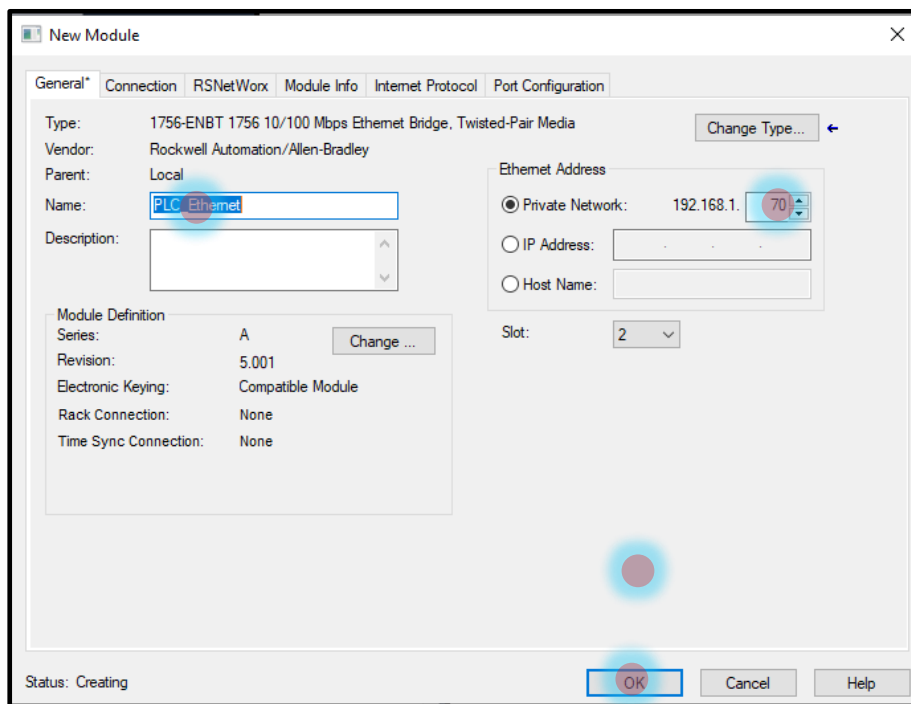


Figure 10-46 Add safety and standard module 1

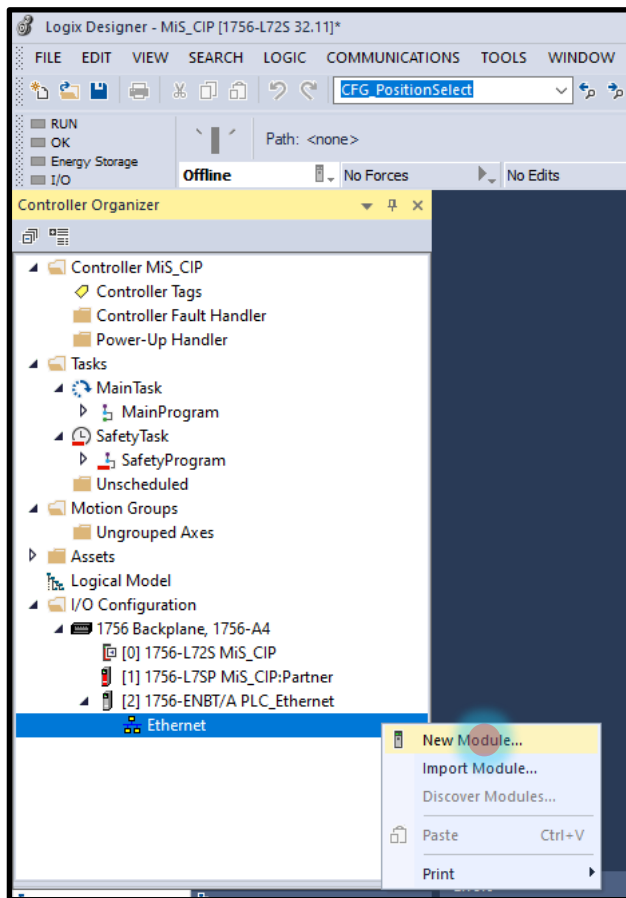


Figure 10-47 Add safety and standard module 2

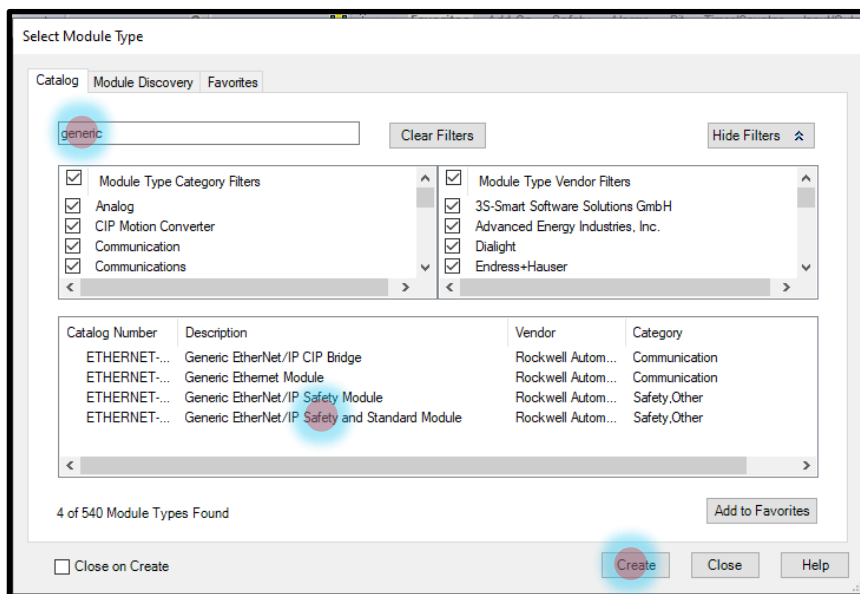


Figure 10-48 Configure safety and standard module 1

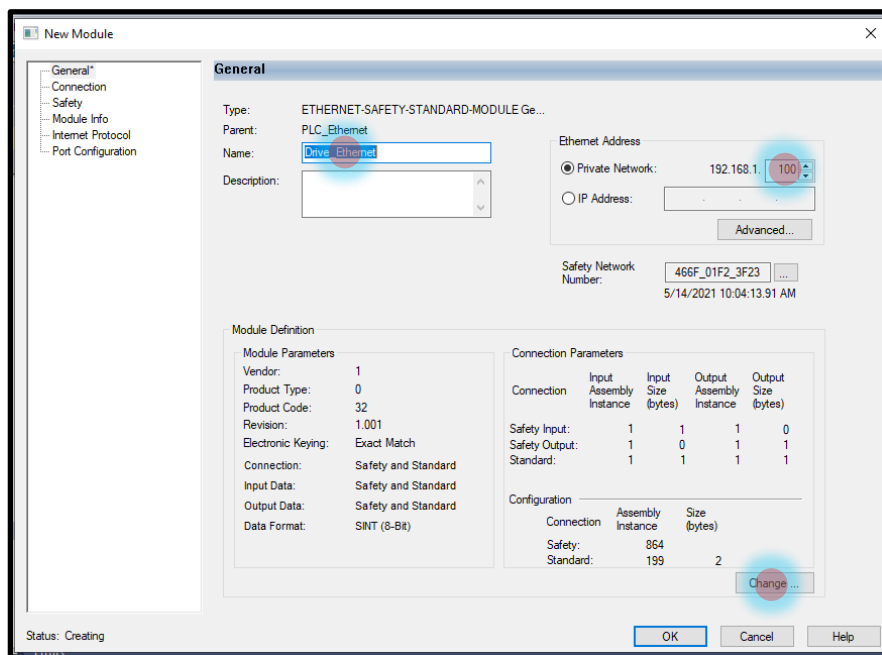
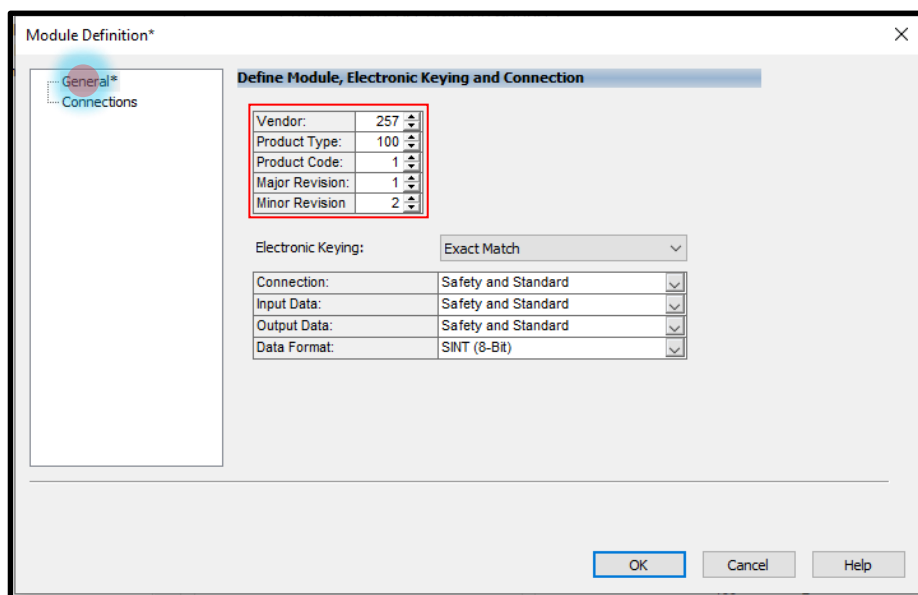


Figure 10-49 Configure safety and standard module 2



A product code of 1 is used here for an MiS210 fitted to an M700 drive, for other drive/module product codes see the Ethernet interface's parameter "Actual Product Code" (parameter S.20.033).

Figure 10-50 Configure safety and standard module 3

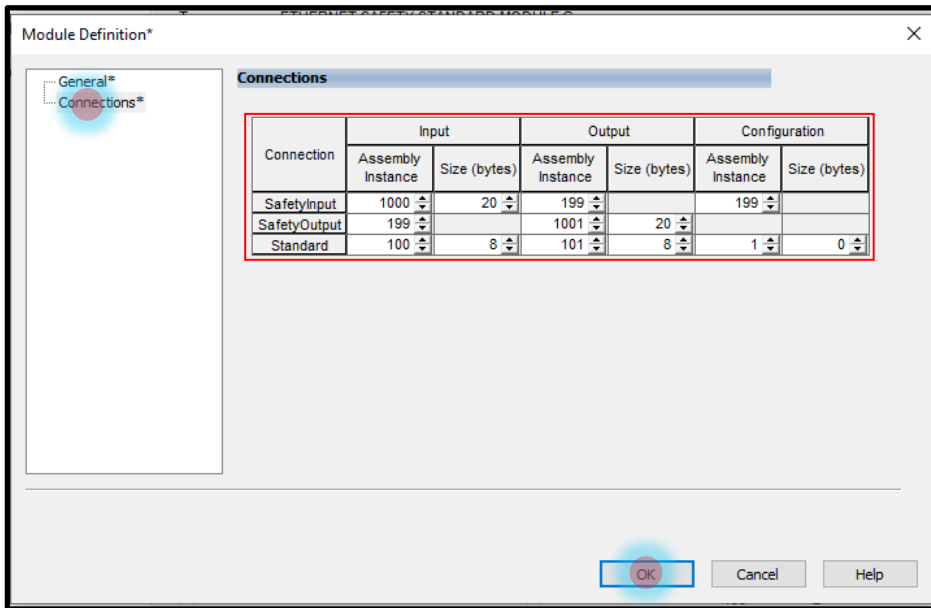


Figure 10-51 Change module definition

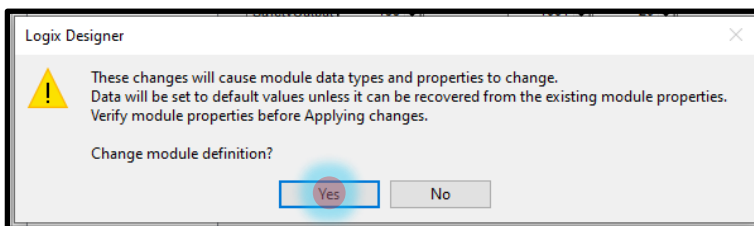


Figure 10-52 Go Online

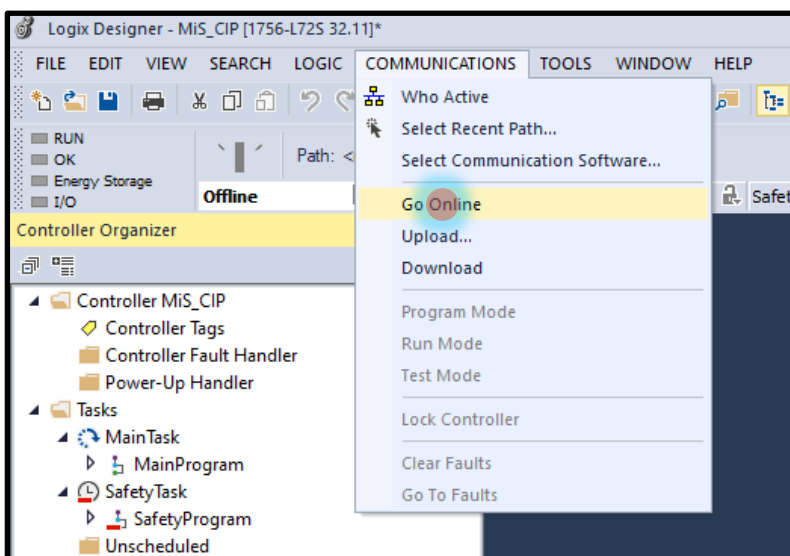


Figure 10-53 Download 1

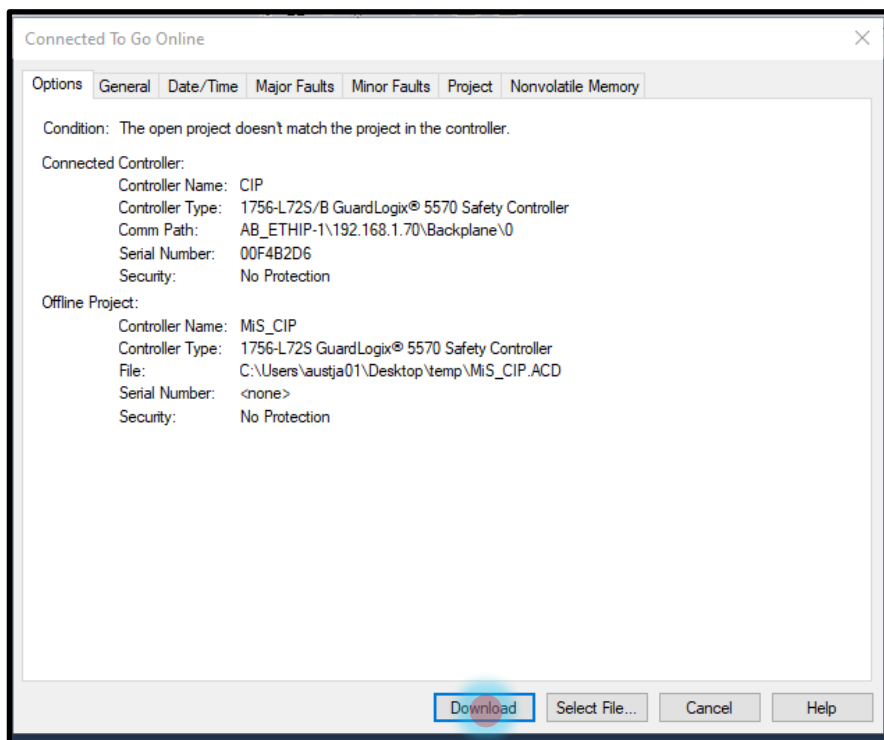


Figure 10-54 Download 2

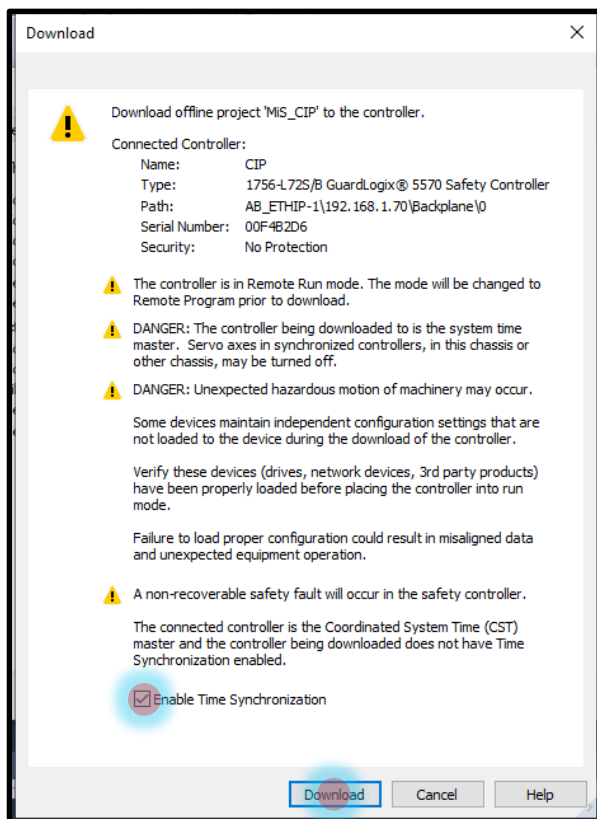
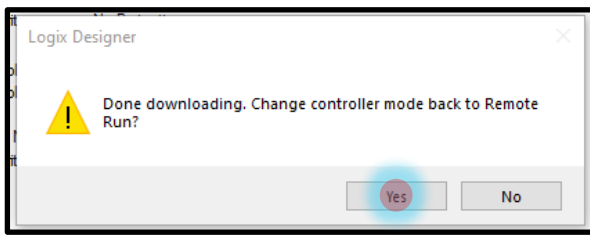


Figure 10-55 Remote run



10.2.3 Creating a safety application in Connect

If it is safe to do so apply power to the demo-case. Launch Connect and choose *Scan Ethernet network*. If you are not familiar with creating a new safety application in Connect, then please see section 6.4. Parameter 04.02.018 should be set to CIP Safety.

In this example the IP addresses shown in Table 10-8 IP addresses are used and a subnet of 255.255.255.000.

Table 10-8 IP addresses

PC	192.168.1.51
Drive	192.168.1.100
PLC	192.168.1.70

Figure 10-56 Network tab

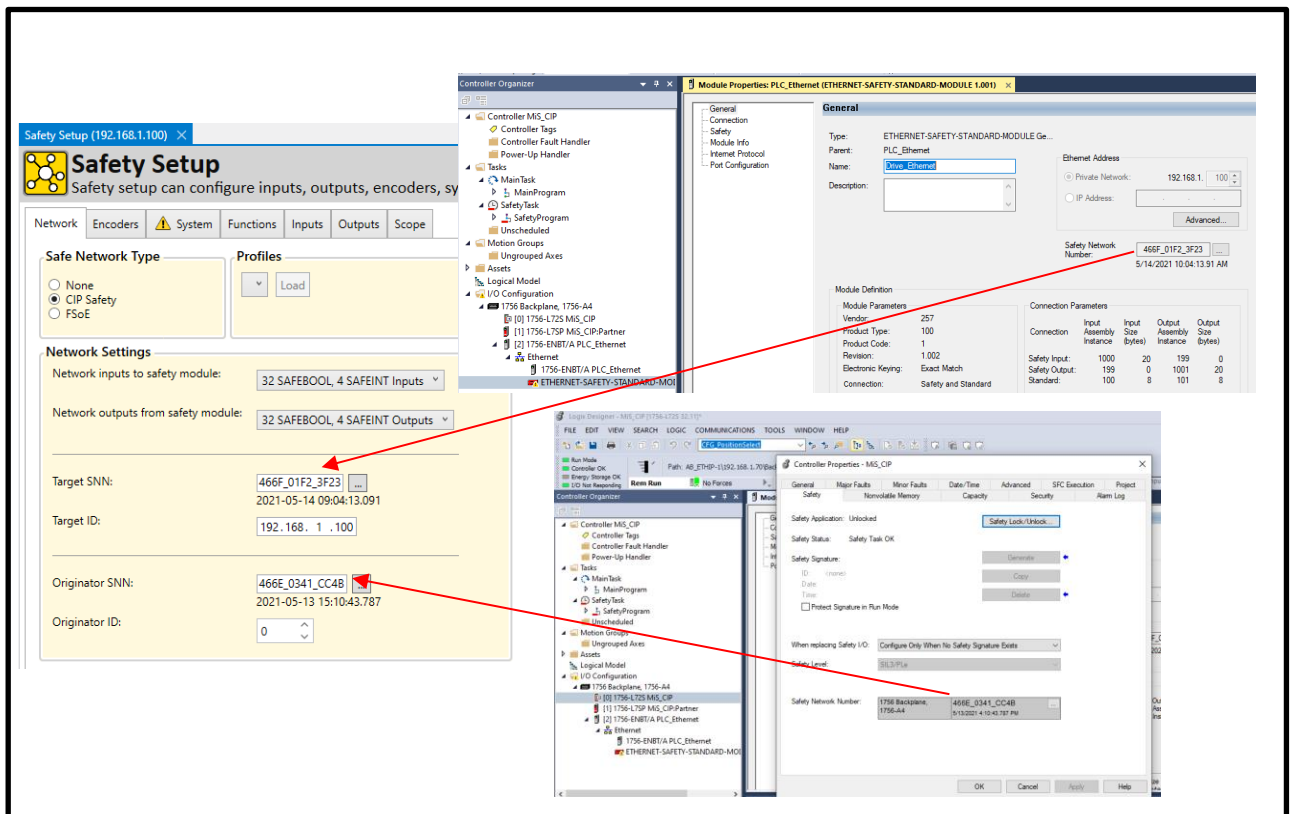
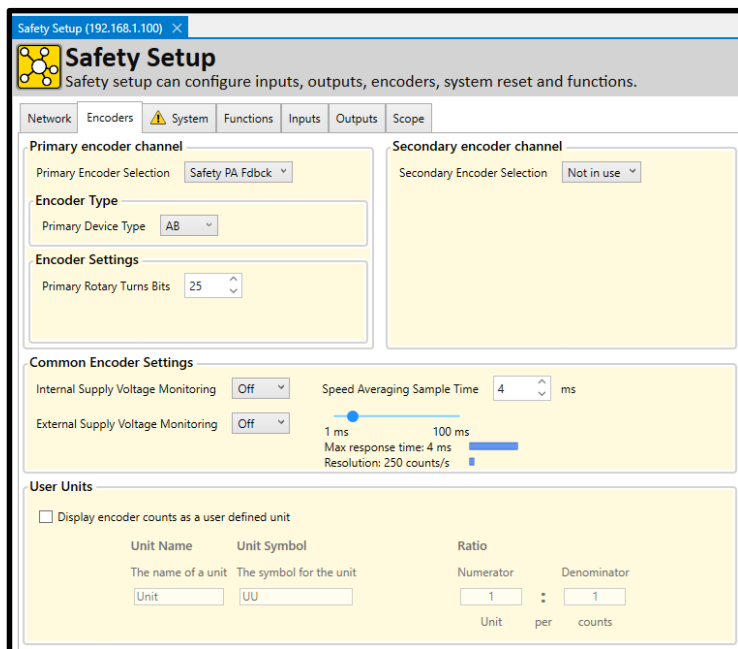


Figure 10-57 Encoder tab



Here a 1024 PPR AB encoder has been attached to the shaft and connected to the MiS210's encoder port. Alternatively if your demo-case supports EnDat 2.2 feedback then it is possible to use the drive encoder, see section Create the safety application 6.4.2.

Figure 10-58 System tab

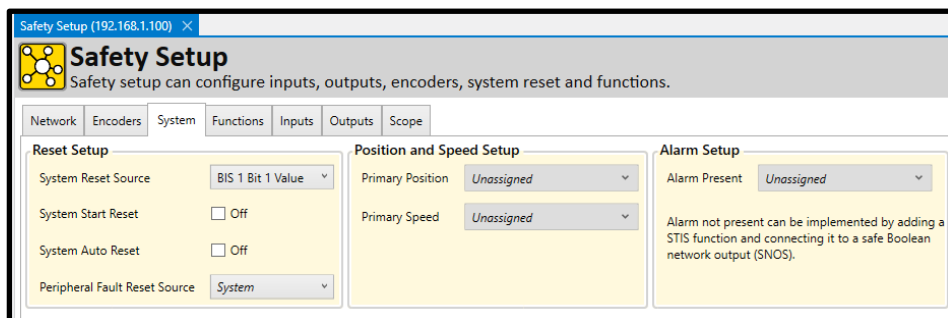
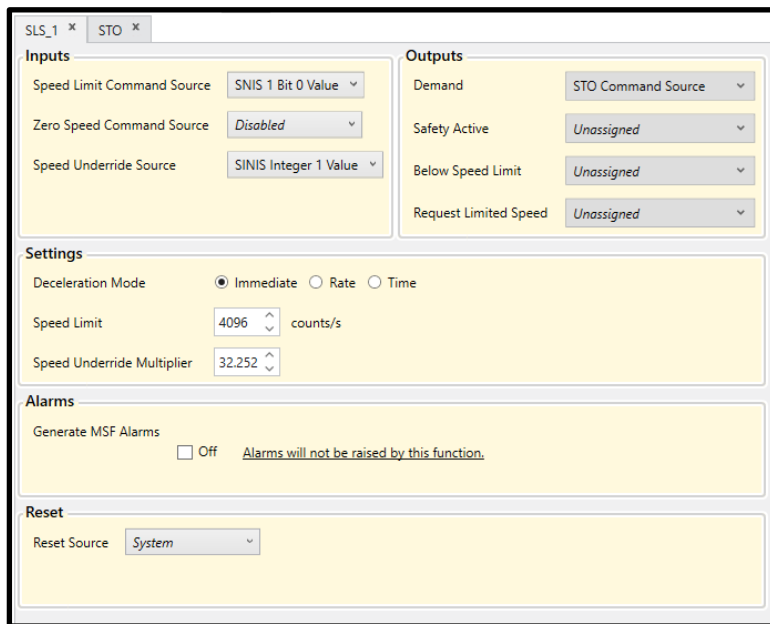


Figure 10-59 SLS tab



We have set the *Speed Limit Command Source* to *SNIS Bit 0 value*, and *Speed Underride* to *SNIS Integer 1*. We can thus control when SLS monitors the speed and also control the speed underride over the network.

The *Speed Limit* is set to 4096 counts/s or 60rpm (for the 1024 PPR AB encoder). The *Speed Underride Multiplier* is set to 32.252. For the full positive range of a SINT datatype in the PLC of 127, this will give $32.252 \times 127 = 4096$ counts/s. Therefore, the underride value can be adjusted over the network between 4096 counts/s and 0 counts/s or 60rpm to 0rpm.

The *Demand* of SLS is assigned to *STO Command Source*.

Save the configuration, download and enter test mode in the normal way.

10.2.4 Checking the network

Set parameter 17.031 true, therefore resetting the MiS210 on the rising edge of the input. If the configurations are correct you should see that within Logix Designer that the *I/O OK* indication is solid green, and no exclamation marks are shown in the *Controller Organizer* tree.

Figure 10-60 I/O OK in Logix Designer

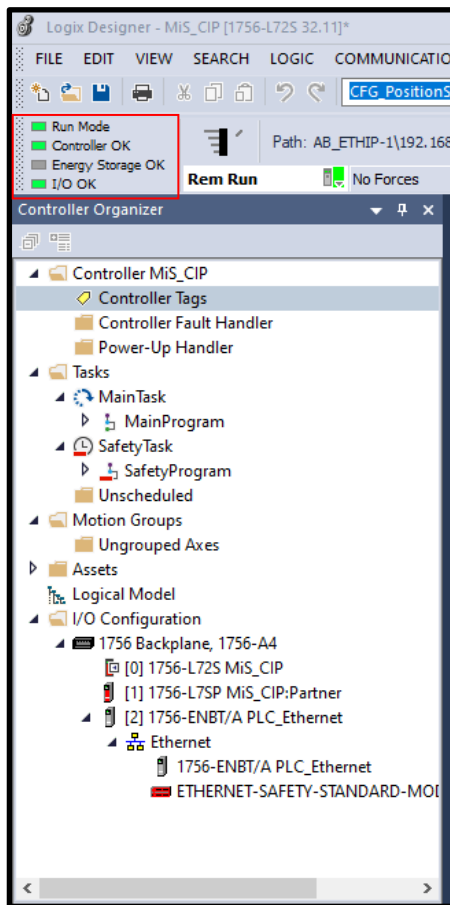


Figure 10-61 Status in MiS2x0 dashboard of Connect

Status	
Module	Network (CIP Safety)
Signature: ✓ 1C13 - 64A8 - D981 - FF86	Supervisor State: EXECUTE
Mode: Configuring	Network Status: LINK OK
Status: Test-Comm-On	Messages/second: 50
Alarm: None	Expectation margin: 35 ms
Module Trip Code: Healthy	Status Flags: 0
System State: MSFs running normally	Configuration signature
Worst Case Cycle Time: 64%	ID: 1C13_64A8
STO: Inactive (torque may be generated by the drive causing the motor to turn)	Timestamp (local): 07/01/2015 15:50:18.366

10.2.5 Adding a safety program to the Logix Designer configuration

Figure 10-62 Add variables to the Safety Program's Parameters and local Tags

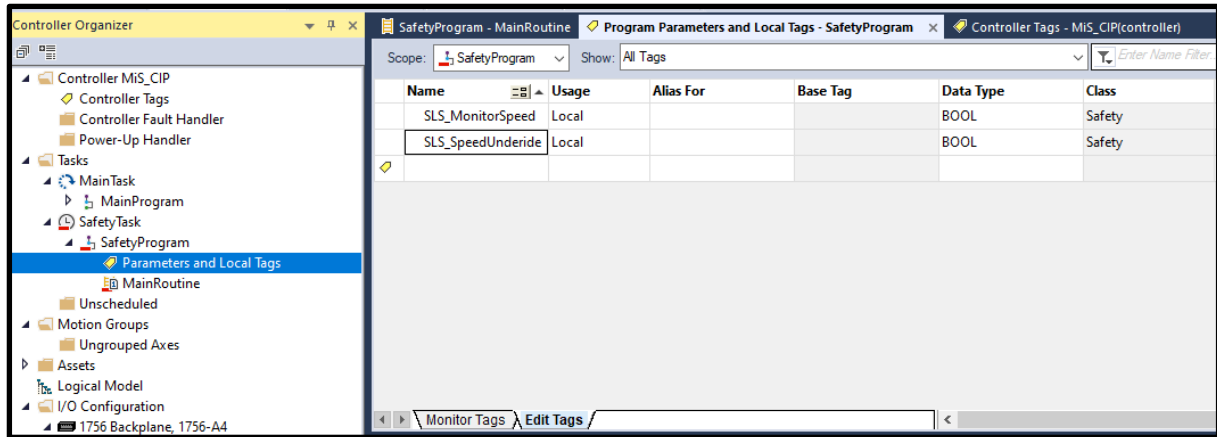
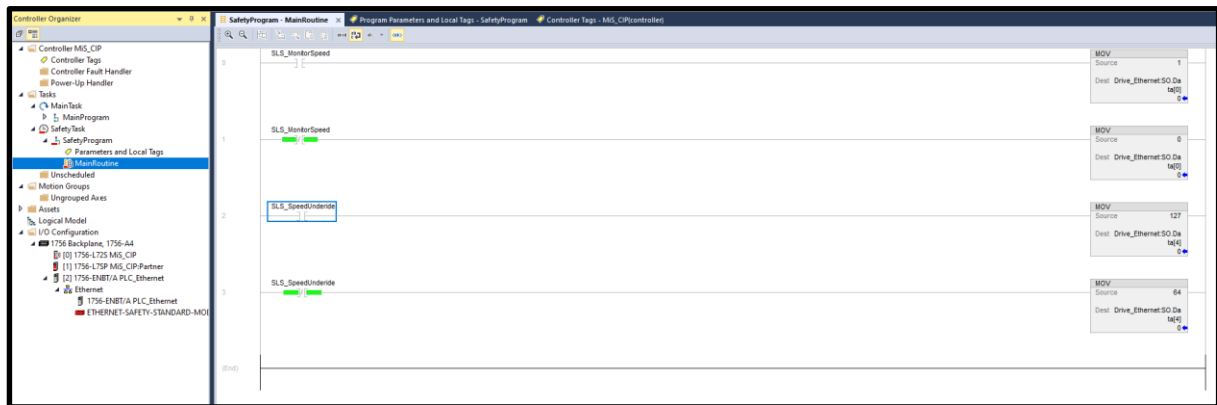


Figure 10-63 Add the following program to the safety program



10.2.6 Adding the Configuration signature to the Logix Designer configuration.

The configuration signature may be copied from Connect to the Logix Designer configuration.

Figure 10-64 Configuration signature information in Connect

Status	
Module	Network (CIP Safety)
Signature: ✓ 1C13 - 64A8 - D981 - FF86	Supervisor State: EXECUTE
Mode: Configuring	Network Status: LINK OK
Status: Test-Comm-On	Messages/second: 50
Alarm: None	Expectation margin: 35 ms
Module Trip Code: Healthy	Status Flags: 0
System State: MSFs running normally	Configuration signature
Worst Case Cycle Time: 64%	ID: 1C13_64A8
STO: Inactive (torque may be generated by the drive causing the motor to turn)	Timestamp (local): 07/01/2015 15:50:18.366

10.2.7 Running the example

It is assumed that the MiS210 is in testing mode and the PLC program is running.

In the *Safety Testing* tab you may view details of the encoder feedback, diagnostics for the MSFs and diagnostics for the inputs and outputs.

Only proceed if safe to do so.

For this example, we will manually control the drive's speed by selecting the *Reference Selector* to *Preset* (parameter 01.014 = Preset, parameter 01.015 = 1)) and varying *Preset Reference 1* (parameter 01.021). We will also control the MiS250's reset by manually writing to *Non Safe Input 1* (parameter 16.031).

Connect may be used to manually write the parameters, for convenience the user can choose to create a *Custom List* and add parameter 01.021 and parameter 17.031. (Open the required menu in the parameters folder of the project pane, right click on the desired parameter and select send to custom list).

Follow to steps in Table 10-9 Steps to run the example to run the example.

Table 10-9 Steps to run the example

Step	Action	Comment
1	Apply the <i>Forward</i> run signal to the drive by closing the <i>FWD</i> switch on the demo case (Or apply 24V potential to <i>Digital Input 3</i>)	The STO MSF is <i>Active</i> (the 24V to the STO terminal is removed) and the drive will not allow current to flow in the motor
2	Set <i>Non Safe Input 1</i> (parameter 16.031) to true	On a rising edge the MiS210 will reset STO is <i>Inactive</i> and torque may be generated
3	Within the Logix Designer's Safety program Toggle the <i>SLS_MonitorSpeed</i> variable so that it is true.	SLS speed monitoring is now deactivated <ul style="list-style-type: none"> SLS Safely Limited speed Diagnostic Code shows <i>Operational</i>
4	Apply any speed above 60 rpm (parameter 01.021)	The shaft should rotate at the selected speed.
5	Decrease the speed to 20 rpm (parameter 01.021)	Shaft should rotate at 20 rpm
6	Within the Logix Designer's Safety program Toggle the <i>SLS_MonitorSpeed</i> variable so that it is false	SLS is now monitoring for overspeed <ul style="list-style-type: none"> SLS Safely Limited Speed Diagnostic shows <i>Monitoring safe speed</i> A value of 64 is being sent to the MiS210 The value is subjected to the <i>Speed Underride Multiplier</i> and the result is 2048 counts/s, or 30 rpm
7	Increase the speed to 30 rpm (parameter 01.021)	STO becomes <i>Active</i> and the shaft will stop
	Decrease the speed to 20 rpm	Shaft will remain stopped
	Set <i>Non Safe Input 1</i> (parameter 16.031) to true	On a rising edge the MiS210 will reset STO is <i>Inactive</i> and torque may be generated <ul style="list-style-type: none"> Shaft should rotate at 20 rpm

8	Within the Logix Designer's Safety program Toggle the <i>SLS_SpeedUnderride</i> variable so that it is true	A value of 128 is sent to the MiS210 <ul style="list-style-type: none"> The value is subjected to the <i>Speed Underride Multiplier</i> and the result is 4064 counts/s, or 60 rpm
---	---	---

Figure 10-65 SLS view in Safety Testing

The screenshot shows the 'Safety Testing' window for a MiS210 controller. It displays real-time status for the SLS_1 configuration. Key parameters include:

- STO: Inactive (torque may be generated by the drive causing the motor to turn)
- Encoder Position: 800898 counts
- Encoder Speed: 1250 counts/s
- Encoder Relative Position: 1 counts/cycle
- Encoder Acceleration: 62500 counts/s²
- Alarm: None

A table below lists various SLS_1 parameters with their names, types, current values, and connections. The 'SLS_1 Safely Limited Speed.Speed Underride Multiplier' is highlighted with a value of 32, and 'SLS_1 Safely Limited Speed.Speed Underride Source' is set to 127. The 'SLS_1 Safely Limited Speed.Diagnostic Code' is 0x8034, indicating 'Monitoring safe speed. Segment=3'.

Name	Type	Value	Connection
SLS_1 Safely Limited Speed.Speed Limit Command Source	SAFEBOOL	FALSE	SNIS_1 Safe Boolean Network Inputs.Bit 0 Value
SLS_1 Safely Limited Speed.Zero Speed Command Source	SAFEBOOL	Unassigned	Disabled
SLS_1 Safely Limited Speed.Demand	SAFEBOOL	TRUE	STO.SafeTorque.Off.Command Source
SLS_1 Safely Limited Speed.Safety Active	SAFEBOOL	TRUE	
SLS_1 Safely Limited Speed.At Zero Speed	SAFEBOOL	FALSE	
SLS_1 Safely Limited Speed.Below Speed Limit	SAFEBOOL	TRUE	
SLS_1 Safely Limited Speed.Reset Source	BOOL	FALSE	SYSTEM Module Configuration and Control.System.Reset Source
SLS_1 Safely Limited Speed.Request Limited Speed	BOOL	TRUE	
SLS_1 Safely Limited Speed.Request Zero Speed	BOOL	FALSE	
SLS_1 Safely Limited Speed.Deceleration Mode	ENUM	Immediate	
SLS_1 Safely Limited Speed.Speed Limit	UNKNOWN	4096 counts/s	
SLS_1 Safely Limited Speed.Deceleration To Speed Limit	UNKNOWN	0 counts/s ²	
SLS_1 Safely Limited Speed.Deceleration To Zero Speed	UNKNOWN	0 counts/s ²	
SLS_1 Safely Limited Speed.Time To Speed Limit	INT	0 ms	
SLS_1 Safely Limited Speed.Time To Zero Speed	INT	0 ms	
SLS_1 Safely Limited Speed.Zero Speed Threshold	INT	0 counts/s	
SLS_1 Safely Limited Speed.Max Standstill Distance	INT	0 counts	
SLS_1 Safely Limited Speed.Zero Speed Mode	ENUM	Speed	
SLS_1 Safely Limited Speed.Speed Limit Dwell Time	INT	0 ms	
SLS_1 Safely Limited Speed.Zero Speed Dwell Time	INT	0 ms	
SLS_1 Safely Limited Speed.Speed Underride Multiplier	INT	32	
SLS_1 Safely Limited Speed.Speed Control Tolerance	INT	0 counts/s	
SLS_1 Safely Limited Speed.Generate MSF Alarms	BOOL	FALSE	
SLS_1 Safely Limited Speed.Speed Underride Source	SAFEINT	127	SNIS Safe Integer Network Inputs.Integer 1 Value
SLS_1 Safely Limited Speed.Error	BOOL	FALSE	
SLS_1 Safely Limited Speed.Diagnostic Code	INT	0x8034 - Monitoring safe speed. Segment=3	

In Figure 10-65 SLS view in Safety Testing the *Encoder Speed* is 1250 counts/s or 20 rpm, *Safely Limited Speed Underride* is 127, the *Safely Limited Speed Underride Multiplier* is 32 and *Safely Limited Speed Diagnostic Code* reports *Monitoring safe speed*.

Figure 10-66 Logix Designer

The screenshot shows a ladder logic network in Logix Designer. It features four MOV (Move) instructions that write values to the 'Drive_Ethernet-SO Da' register:

- MOV 1 to Drive_Ethernet-SO Da ta[0]
- MOV 0 to Drive_Ethernet-SO Da ta[0]
- MOV 127 to Drive_Ethernet-SO Da ta[4]
- MOV 64 to Drive_Ethernet-SO Da ta[4]

The network is labeled with SLS_1 variables: SLS_MonitorSpeed, SLS_SpeedUnderride, and SLS_SpeedUnderride. The 'SLS_SpeedUnderride' variable is highlighted in blue.

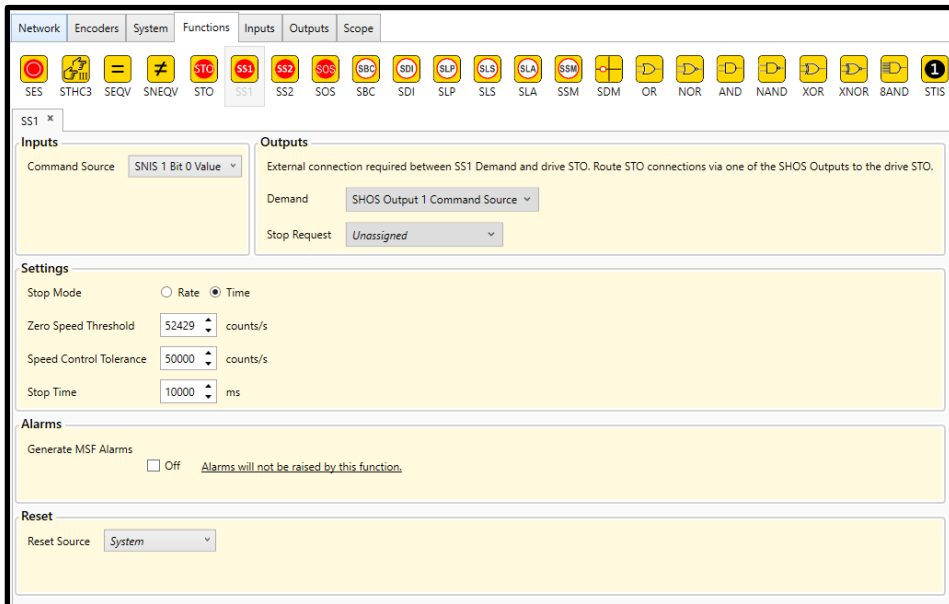
11 Controlling the drive

11.1 Controlling the drive over the network

In many cases where an FSoE or CIP Safety network is utilised then the user will wish to control the drive via the network, in this way the PLC (master) orchestrates non-safe control of all relevant axis as required. In the case of EtherCAT for instance, typically one would use the standard non-safe functionality such as the drive's CiA402 objects status word, control word, quick stop etc. It should be noted that the control of the drive does not constitute any part of a safety system other than the MiS2x0 controlling the drive's STO.

For example, in the case of SS1 the *Command Source Input* may be controlled via a safe network variable *SNIS 1* from the safety PLC program, and the drive would be commanded to stop at the same point by the user's non-safe standard PLC program.

Figure 11-1 Command Source



11.2 Local control

The MiS2x0 module provides non-safe inputs and outputs as a means for the user to control the drive and for the drive to control non-safe functions of the MiS2x0. See sections 7.3.1.7.2 and 7.3.1.8.2. Users can map these parameters in the normal way to control for example, speed or the AMC.

The following examples (sections 11.2.1 through to 11.2.4) suggest possible ways of controlling the drive however, users may wish to utilize other drive parameters to achieve their requirements.

It should be noted that the control of the drive does not constitute any part of a safety system other than the MiS2x0 controlling the drive's STO.

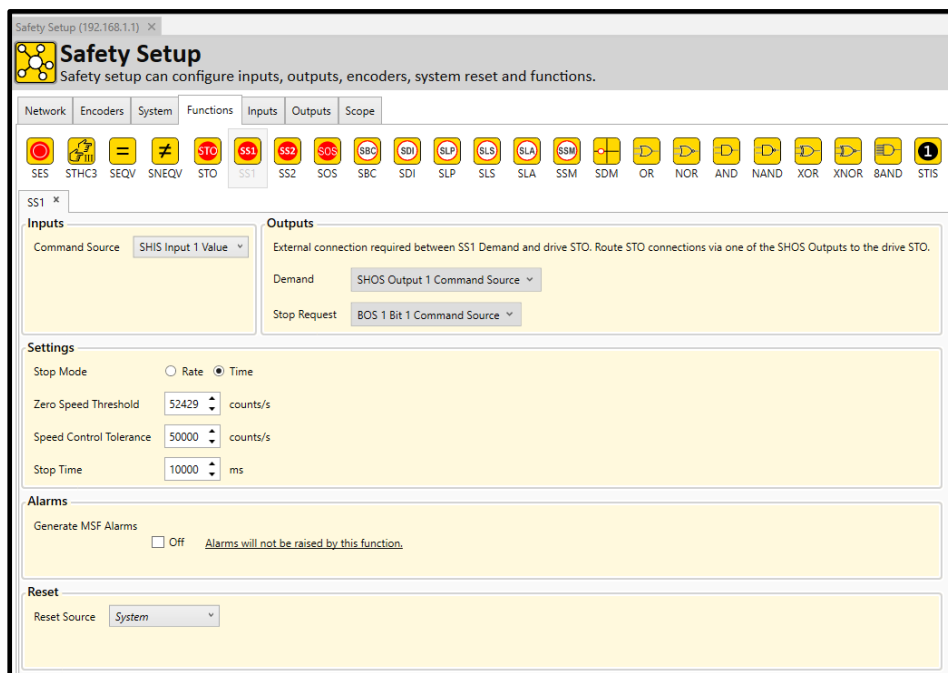
11.2.1 Control word override and on-board user program

Please note that Control word override is utilized by the PC tool Connect, for example to take control of the drive while performing an autotune. Users should consider this if using Control word override in their applications.

Parameter 06.085 and 06.086 allow the drive's control word to be overridden and users may wish to utilise the control word override and an on-board user program to influence the drive via the MiS2x0 module. Note, the on-board user program has a minimum cycle time of 4 ms.

In Figure 11-2 Stop Request it can be seen that *Stop Request* has been assigned as an output to *BOS*, this is *Non-safe output 1* parameter 16.051. When *Command Source* is active (false) and SS1 is monitoring speed then *BOS 1* and subsequently parameter 16.051 will be true.

Figure 11-2 Stop Request



Parameter 16.051 could be utilised by the user's on-board program. *Control word override* parameter 06.085 is required to reflect the desired condition for the drive. The individual bits in 06.085 operate in the same way as the bits in the standard drive's Control Word (06.042), therefore in this case it could be set to a value of 129, this equates to stop.

```
//SS1 Stop request mapped to BOS1/Non-safe output 1 parameter 16.051
IF ReadUserParameterInt(0,16,051) = 1 THEN
    M06.P086 := 1;           //Enable control override
    M06.P085 := 129;        //Set Control word override to stop
ELSE
    M06.P086 := 1;           //Disable control override
END_IF
```

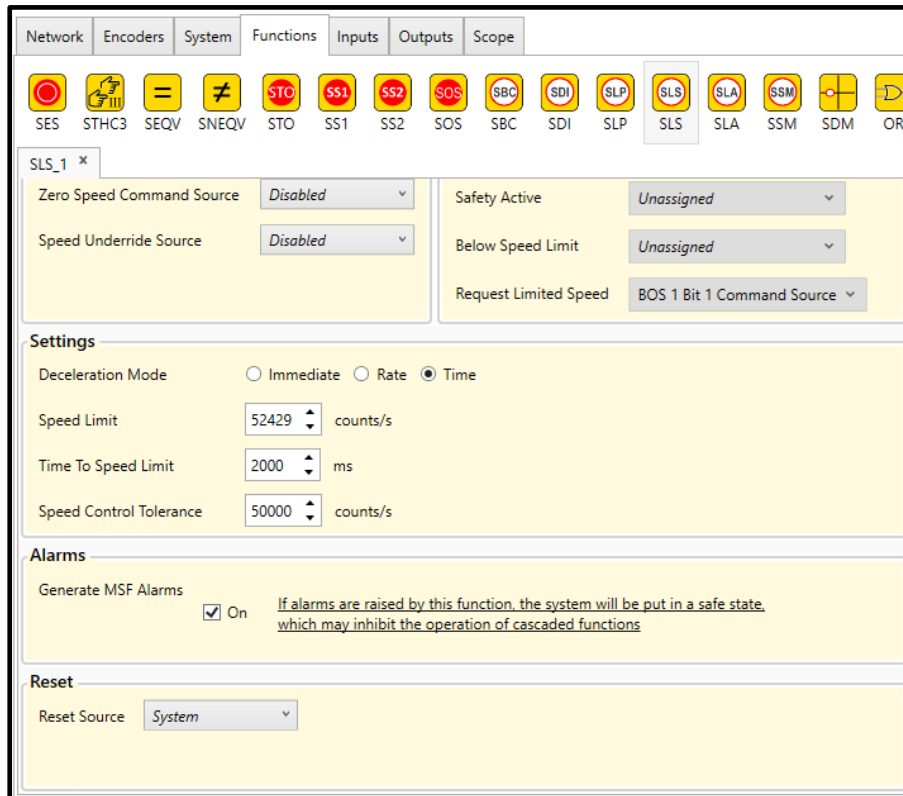
11.2.2 Controlling the speed with on-board user program

It is possible to use the preset speed selector to control the drive's speed. Parameter 01.014 Preset Selector should be set to Preset, and parameter 01.015 set to the required speed. The speed then can be adjusted in parameters 01.021 to 01.028 as appropriate.

In Figure 11-3 Requested Limited Speed it can be seen that *Requested Limited Speed* has been assigned as an output to *BOS*, this is *Non-safe output 1* parameter 16.051. When *Speed*

Limit Command Source is active (false) and SLS is monitoring speed then BOS 1 and subsequently parameter 16.051 will be true.

Figure 11-3 Requested Limited Speed



//Set up preset reference

IF NOT PresetConfigured THEN

M01.P014 := 3;

//Reference selector = Preset

M01.P021 := 100;

/"Normal" operating speed - Preset speed 1 = 100 rpm

M01.P022 := 2;

//Limited speed value - Preset speed 2 = 2 rpm

PresetConfigured := TRUE;

END_IF

//SS1 Requested Limited Speed mapped to BOS1/Non-safe output 1 parameter 16.051

IF ReadUserParameterInt(0,16,051) = 1 THEN

M01.P015 := 2;

//Select limited speed

ELSE

M01.P015 := 1;

//Select "normal" speed

END_IF

11.2.3 Interfacing to the AMC

In a similar way to how the drive's speed is controlled in section 11.2.2 the user may utilise an on-board user program or MCi program to interface to the drive's AMC and control the AMC's references as required.

A highly simplified example for illustrative purposes follows that forces a datum of SDM, datums the AMC and then drives the shaft outside the *Safe Position* of SLP.

For position functions, the position value if derived from the drive's encoder is the position as directly reported by the EnDat 2.2 encoder and is not the normalised position used by the drive and therefore the AMC.

Figure 11-4 SDM

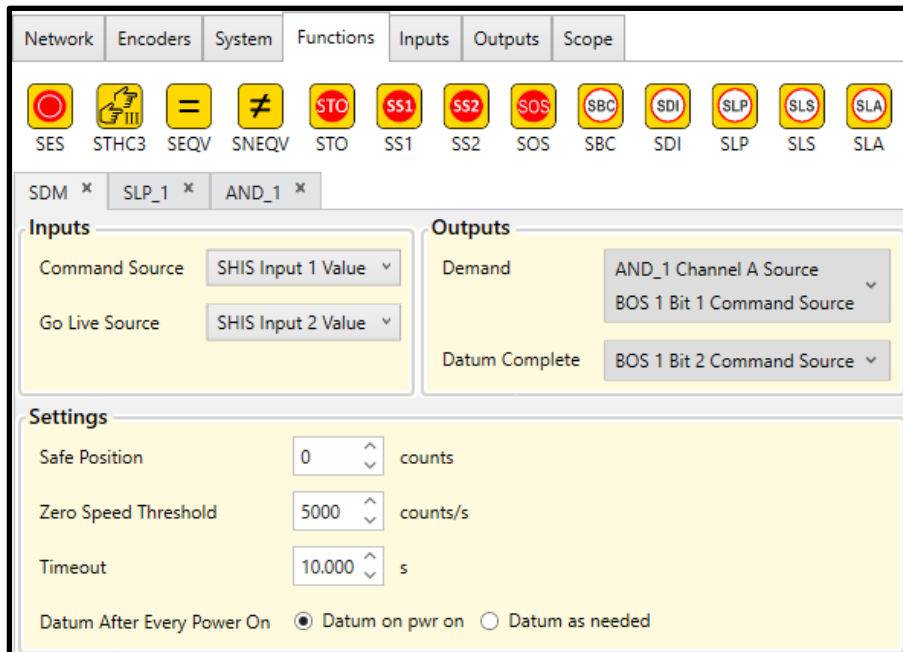


Figure 11-5 SLP

Figure 11-6 AND

CASE Step OF

- 20: (* Datum the MiS to a zero position. The Invalidate Datum parameter (16.089) will be set to clear an existing datum. OPEN SDM Command (SHIS 1) and CLOSE SDM Go Live (SHIS 2). Then set parameter 18.031.*)
IF M18.P031 **THEN**
 WriteUserParameterBOOL(0,16,089, TRUE); //Invalidate datum parameter on MiS
 M18.P031 := FALSE;
 Step := 30;
END_IF
- 30: //OPEN SDM Go Live (SHIS 2). Then set parameter 18.031.
IF M18.P031 **THEN**

```

        WriteUserParameterBOOL(0,16,089, FALSE);
        M18.P031 := FALSE;
        Step := 40;
    END_IF

40:    (*CLOSE SDM Go Live (SHIS 2) and Close SDM Command (SHIS 1). Then set parameter
    18.031.*)
    IF M18.P031 THEN
        M18.P031 := FALSE;
        Step := 50;
    END_IF

50:    IF ReadUserParameterBOOL(0,16,052) THEN //Non Safe Output 2
        //Datum of the safety system to a zero position is complete. Set 18.031 to continue.
        IF M18.P031 THEN
            M18.P031 := FALSE;
            Step := 60;
        END_IF
    ELSE
        //Datum of the safety system is NOT complete! Set 18.031 to start again.
        IF M18.P031 THEN
            M18.P031 := FALSE;
            Step := 0;
        END_IF
    END_IF

60:    (*We will now work out an AMC offset for the encoder to bring the AMC slave position to
    zero. Set parameter 18.031*)
    IF NOT Offset AND M18.P031 THEN
        OffsetAMC := 0 - M33.P004;
        Offset := TRUE;
        M33.P003 := OffsetAMC;
        M18.P031 := FALSE;
        Step := 70;
    END_IF

70:    (*Datum of the AMC to zero position complete. Set 18.031 to continue.*)
    IF M18.P031 THEN
        M18.P031 := FALSE;
        Step := 80;
    END_IF

80:    (* We will now attempt to move the shaft by one rotation using the AMC and go outside the
    safe position set in SDM. OPEN SHIS 3 to set SDM to monitor position. Then set 18.031 to
    continue.*)
    IF M18.P031 THEN
        M18.P031 := FALSE;
        M34.P003 := 524287; //AMC ref
        M41.P001 := TRUE; //AMC Enable
        M34.P007 := 1; //AMC Reference selector 1 = absolute
    END_IF

    IF NOT M41.P004 THEN //AMC movement complete flag
        Step := 90;
    END_IF

```

90: (*SHOS 1 should be off as we have breached the safe position. AMC slave position (33.004) and MiS position as shown in the Safety dashboard should both be at 524287 counts. Set 18.031 to start again.*)

```
IF M41.P004 THEN                                     //AMC movement complete flag
    M41.P001 := FALSE;                               //AMC Enable
    M34.P007 := 0;                                   //AMC Reference selector 0 = STOP
    IF M18.P031 THEN
        M18.P031 := FALSE;
        Step := 20;
    END_IF
END_IF
END_CASE
```

11.2.4 Enable sequencer latching

When using Control Word parameter 06.042 to control the drive, if bit 6 (Not Stop) of the drive's control word parameter 06.042 is false and Control Word Enable parameter 06.043 is true, then setting Enable Sequencer Latching parameter 06.040 to true will cause the drive to stop.

When using the Run Forward parameter 06.030 and Run Reverse parameter 06.032 to control the drive, If bit 6 (Not Stop) of the drive's control word parameter 06.042 is false and Control Word Enable parameter 06.043 is false, then setting Enable Sequencer Latching parameter 06.040 to true will cause the drive to stop.

Users can therefore use Enable Sequencer Latching parameter 06.040 to stop the drive (not a safety function) regardless of the control method and providing the *Not Stop* input is not required.

In Figure 11-7 Stop Request it can be seen that *Stop Request* has been assigned as an output to *BOS 1*, this is *Non-safe output 1* parameter 16.051. When *Command Source* is active (false) and SS1 is monitoring speed then *BOS 1* and subsequently parameter 16.051 will be true.

To route parameter 16.051 to Enable Sequencer Latching parameter 06.040 the user could choose to use a Logic Function block or an on-board user program. Note, the Logic Function block has a minimum update time of 4 ms.

To configure the drive's Logic Function 1 block set *Logic Function 1 Source 1* parameter 09.004 to a value of 16.051 and set *Logic Function 1 Source 2 Invert* parameter 09.007 to true. Set *Logic Function 1 Destination* parameter 09.010 to a value 6.040.

Figure 11-7 Stop Request

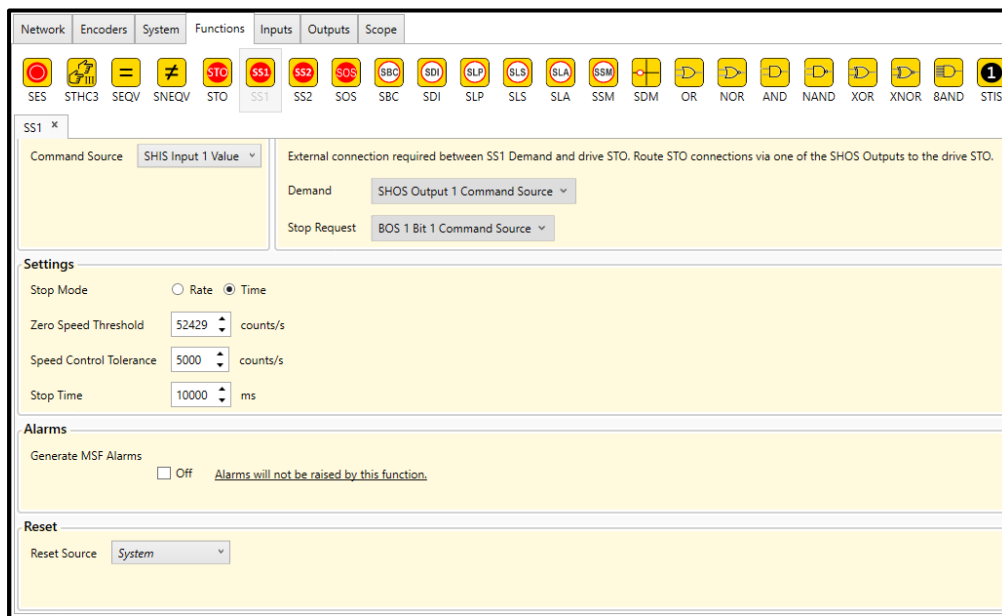


Figure 11-8 Logic Function 1 to route parameter 16.051 to 06.040

09.004	Logic Function 1 Source 1	Logic Function 1 Source 1	16.051	Non Safe Output 1
09.005	Logic Function 1 Source 1 Invert	Logic Function 1 Source 1 In...	<input type="checkbox"/> Off	
09.006	Logic Function 1 Source 2	Logic Function 1 Source 2	0.000	Unassigned
09.007	Logic Function 1 Source 2 Invert	Logic Function 1 Source 2 In...	<input checked="" type="checkbox"/> On	
09.008	Logic Function 1 Output Invert	Logic Function 1 Output Invert	<input type="checkbox"/> Off	
09.009	Logic Function 1 Delay	Logic Function 1 Delay	0.0 s	
09.010	Logic Function 1 Destination	Logic Function 1 Destination	6.040	Enable Sequencer Latching

12 Changing the drive's configuration

Do not change the configuration of the drive (this includes updating the Drive Firmware and downloading user programs to the drive or other option modules) or Reset the modules using Parameter 00.000 while the MiS2x0 is in Operating or Configuring Mode, as this may result in a failure which will require a power cycle.

13 Parameter descriptions

Parameter	Name	Description
001	Module ID	502 for MiS210 and 503 for MiS250
002	Software Version	The MiS2x0's software version
003	Hardware Version	The MiS2x0's hardware version

004	Module Alarm Code		Contain strings that can be displayed on the drive display in the event of certain module conditions: 0 – “Safety Failure” 1 – “Drive Firmware” 2 – “Safety Alarm” 3 – “Configuration” (Configuration not valid) 4 – “Module Healthy” 5 – “Read Par 15.012” 6 – “Read Par 17.012” 7 – “Read Par 24.012”
005	Module Trip Code		Contain strings that can be displayed when the module initiates a drive trip. 0 – “Healthy” 1 – “Module reset”
006	System Word 3	Signature	Bits 48 – 63 of signature displayed in HEX.
007	System Word 2	Signature	Bits 32 – 47 of signature displayed in HEX.
008	System Word 1	Signature	Bits 16 – 31 of signature displayed in HEX.
009	System Word 0	Signature	Bits 0 – 15 of signature displayed in HEX.
010	Safety Mode		0 – “Idle”: In a safe state and waiting for commands. 1 – “Operating”: monitoring the machine state. 2 – “Configuring”: can be configured and tested.
011	Safety State		0 – “Failure”: unrecoverable fault must be power cycled. 1 – “Standby”: starting up or waiting for user instructions. 2 – “Executing”: monitoring the machine. 3 – “Download”: waiting for or receiving a configuration. 4 – “Test-Comm-On”: config mode communications on. 5 – “Test-Comm-Off”: config mode communications off.
012	Round Trip Code		Generated by MiS210 during identification, stopping execution, and setting factory defaults. It must be read by the user and

		entered into Connect when it asks for a verification code to be entered.
013	Last Alarm Code	Contains the last alarm code generated by the MiS210. Alarms cause the MiS210 outputs to go to safe state, but they can be reset.
014	Last Fault Code	Contains the last fault code generated by the MiS210. Faults cause the MiS210 outputs to go to safe state and cannot be reset, a power cycle is required.
015	Log In Status	0 – “Logged Out” 1 – “Logged In”
016	Time Stamp Coarse	Time stamp parameter hrs:min:sec to be copied into PLC as the part of the Configuration signature.
017	Time Stamp Fine	Time stamp parameter (ms) to be copied into the PLC as part of the Configuration signature.
018	Date Stamp Day/Month	Date stamp Parameter dd.mm to be copied into the PLC as part of the Configuration signature.
019	Date Stamp Year	Date stamp Parameter YYYY to be copied into the PLC as part of the Configuration signature.
020	Safety Network Indication 1	State values of the Safety Supervisor object in CIP Safety: 0 – “NULL” – Never seen if network enabled. 1 – “SELF TEST” – Module self-test. 2 – “IDLE” – Device self-test passed and configured, but no valid data transfer from MiS210 to PLC. 3 – “SELF TEST FAULT” – Self test at power up failed. 4 – “EXECUTE” Data being transferred from device to PLC. 5 – “ABORT” The device has entered a recoverable fault state. 6 – “CRITICAL FAULT” The device has entered a non-recoverable fault state and must be power cycled.
021	Safety Network Indication 2	Network Status in CIP Safety 0 – “OFF LINE” – No Network communications

			<p>1 – “LINK OK” – Device online and connections validated</p> <p>2 – “ON LINE NO LINK” – Online but no connection yet validated</p> <p>3 – “Timeout” – One or more connection Timed out</p> <p>4 – “LINK FAULT” – Connection to Network not possible</p> <p>5 – “CFRICFR” – Critical Fault and received an Identify Comm Fault Request. Normally used to set a TUNID in a safety device and so should not be seen on the device as the TUNID is set in the configuration.</p>
022	Safety Network Indication 3		<p>Network Status in FSoE</p> <p>0 – “Not used” – FSoE Not Configured</p> <p>1 – “Reset” – Connection not initialized or faulted</p> <p>2 – “Session” – Interchanging of Session ID</p> <p>4 – “Connection” – Connection ID and Slave Address Transfer</p> <p>8 – “Parameter” – Transfer of Watchdog Time and Application Parameters</p> <p>16 – “Data” – Data transfer between Master and Slave</p>
023	Safety Network Indication 4		0 – “Not used”
024	Safety Network Indication 5		0 – “Not used”
025	EMPTY		
026	Safety Network Messages Per Second		The number of received data messages per second from the PLC.
027	Safety Network Expectation Margin		The margin between the latest message received and the set timeout in ms.
028	Safety Network Status Flags		<p>Device internal flags indicating network status:</p> <p>Bit 0 – Comms module safety buffer not yet set up.</p> <p>Bit 1 – A Fail-Safe error has been generated by the Safety Stack.</p> <p>Bit 2 – Connection for receiving data is not yet valid.</p> <p>Bit 3 – Connection for sending data is not yet valid.</p>

		<p>Bit 4 – Toggled every time a valid Input message is received.</p> <p>Bit 5 – A Reset has been received from the network to reset an Alarm condition.</p> <p>Bit 6 – A Remote Error generated by the master</p>
029- 030	EMPTY	
031 - 046	None Safe Inputs (BIS) 1 – 16	Bit Parameters that can be used as non-safe inputs to the motion safety functions. Users must route the required values to these parameters.
047 – 050	EMPTY	
051 - 066	None Safe Outputs (BOS) 1 - 16	Bit parameters that are written to by the motion safety functions as non safe outputs. Users must route these outputs to the required function.
067	EMPTY	
068	Percentage Cycle Time Used	Percentage used while running of the available 1ms cycle time
069	EMPTY	
070	Command Semaphore	These locations are used to transfer data between Connect and the device when in the executing state.
071	Message Bytes 0-3	
072	Message Bytes 4-7	
073	Message Bytes 8-11	
074	Message Bytes 12-15	
075	Message Bytes 16-19	
076	Message Bytes 20-23	
077	Message Bytes 24-27	
078	Message Bytes 28-31	
079	Encoder 1 Sign Bit	Encoder 1 Direction Sign
080	Encoder 1 Position 1	Encoder 1 Bits 63-48 (MS 16bits of 64-bit word)
081	Encoder 1 Position 2	Encoder 1 Bits 47-32
082	Encoder 1 Position 3	Encoder 1 Bits 31-16
083	Encoder 1 Position 4	Encoder 1 Bits 15-0 (LS 16bits of 64-bit word)
084	Encoder 2 Sign Bit	Encoder 2 Direction Sign
085	Encoder 2 Position 1	Encoder 2 Bits 63-48 (MS 16bits of 64-bit word)
086	Encoder 2 Position 2	Encoder 2 Bits 47-32
087	Encoder 2 Position 3	Encoder 2 Bits 31-16

088	Encoder 2 Position 4	Encoder 2 Bits 15-0 (LS 16bits of 64-bit word)
089	Invalidate Datum	If TRUE is a Request for the Datum function to be ran
090 - 093	Scope Parameters	4, 32-bit parameters that can be configured to follow any of the safety module's protected parameters
094 - 096	EMPTY	
097	System State	16-bit parameter indicating the system state and if a reset is required. 0x0000 - System Initialize 0x8000 - MSFs Running Normally 0x8001 - System Ready 0x8002 - System Wait for Reset 0x8003 - System Reset Error 0x8004 - System Wait for Reset (Peripheral Error) 0xC001 - System Alarm, Check Last Alarm Code 0xC002 - Peripheral Reset Error 0xD000 MSF Alarm, Check Last Alarm Code Reset errors 0x8003 and 0xC002, will be shown until their associated Reset signal be logic FALSE, allowing a rising edge to be detected as a request to reset.

14 Recovering and modifying configurations

14.1 Recover a configuration

If the user wishes to recover an original configuration from the MiS2x0, and the user login details are known but the original Connect project is unavailable.

Figure 14-1 Scan the Network

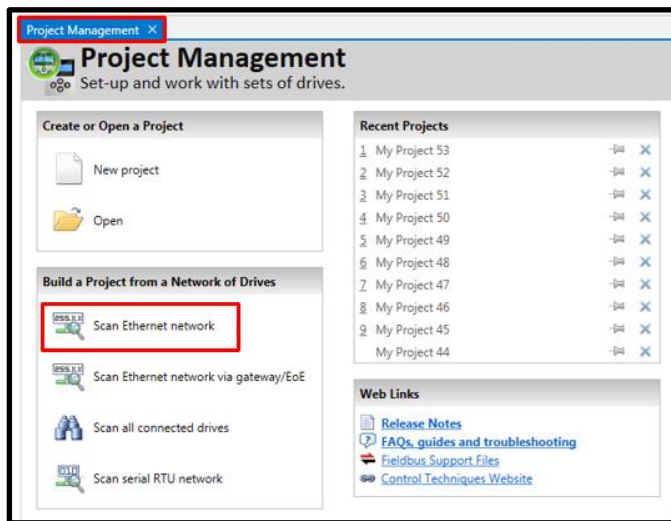


Figure 14-2 Select the MiS210

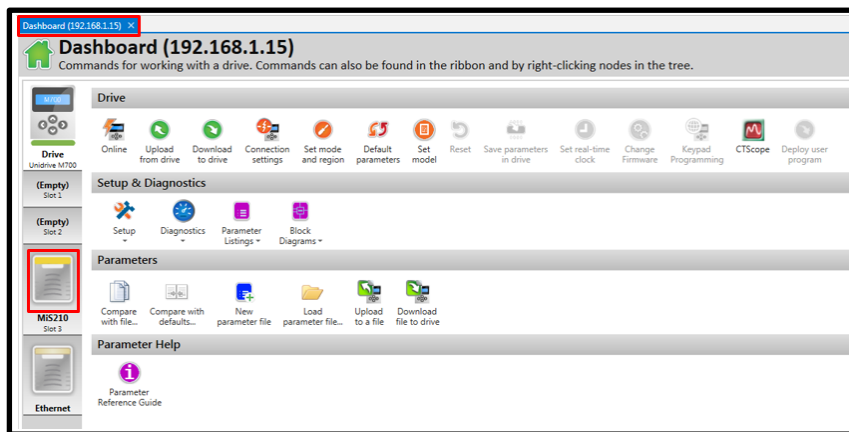


Figure 14-3 Go Online then Select “Stop”

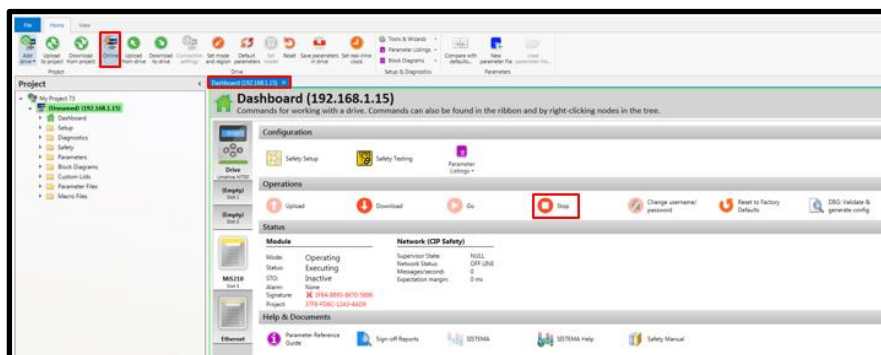
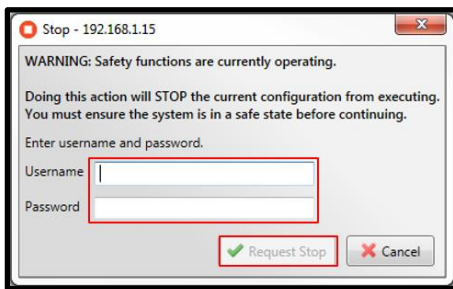


Figure 14-4 Enter existing Credentials and Select “Request Stop”



Read the value displayed in menu 17.012 on the drive's keypad and enter it as prompted, and then click Stop.

Figure 14-5 Enter Parameter Value and Select “Stop”

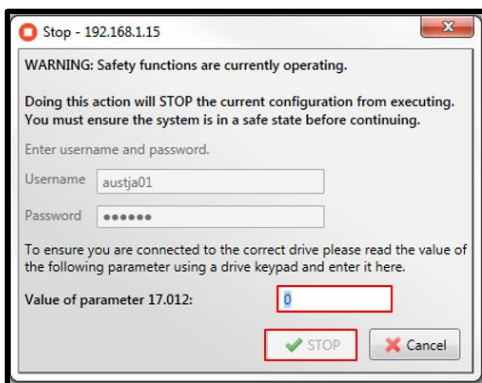


Figure 14-6 Select “Upload”

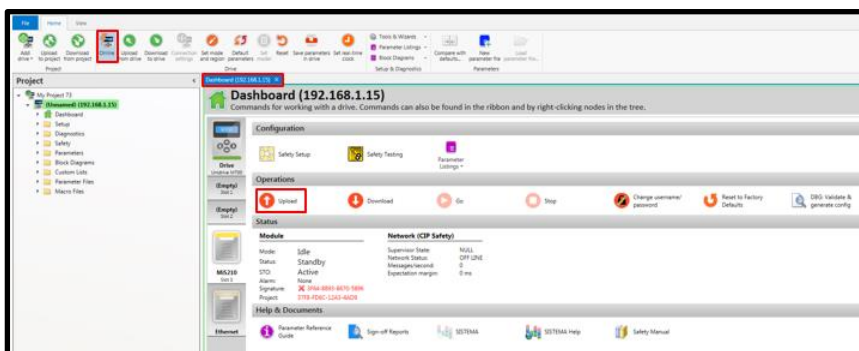


Figure 14-7 Select “Yes”

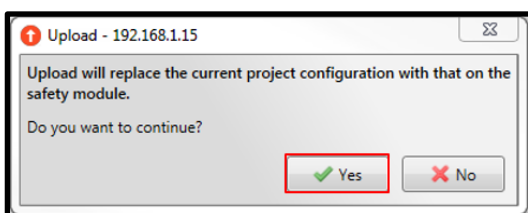


Figure 14-8 Enter New Login Details and then Click “Log In”

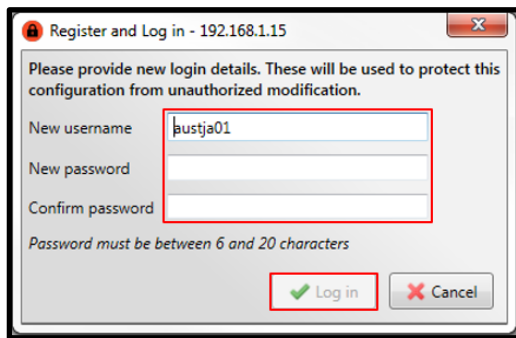
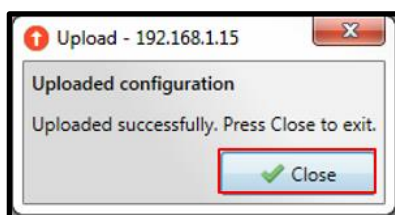


Figure 14-9 Configuration from MiS210 is now loaded into the current Connect project, Click “Close”



To begin the process of reloading the configuration to the MiS210 see the following steps.

Figure 14-10 Go Online, Select Reset to Factory Defaults

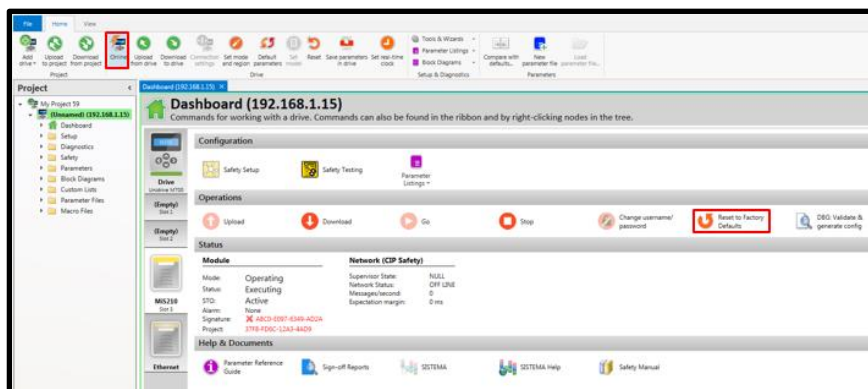
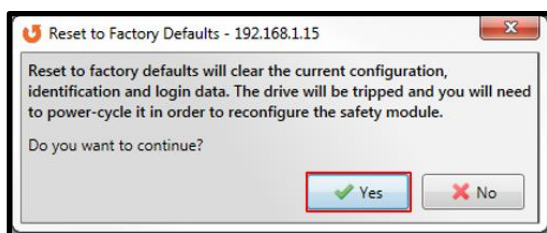
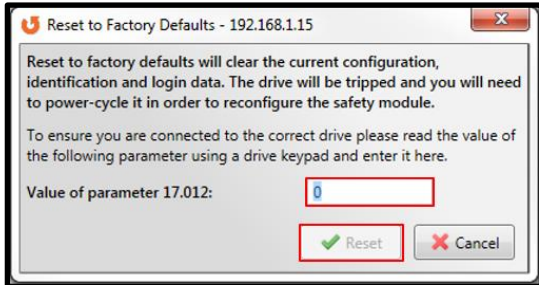


Figure 14-11 Select “Yes”



Read the value displayed in menu 17.012 on the drive's keypad and enter it as prompted, then click Reset.

Figure 14-12 Enter Parameter Value and Select “Reset”



Power cycle the drive, then once communications has been re-established, click “Yes”.

Figure 14-13 Select “Yes”

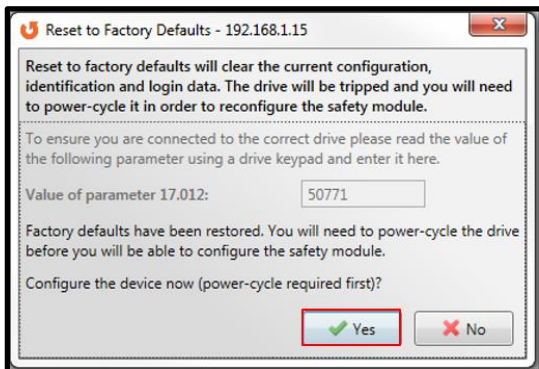
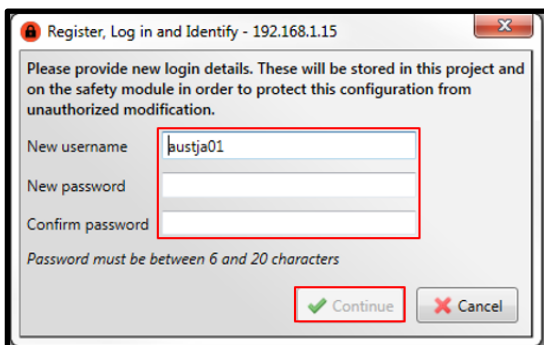


Figure 14-14 Enter New Log In Details and Select “Continue”



Read the value displayed in menu 17.012 on the drive's keypad and enter it as prompted, and then click OK.

Figure 14-15 Enter New Log In Details and Select “Continue”

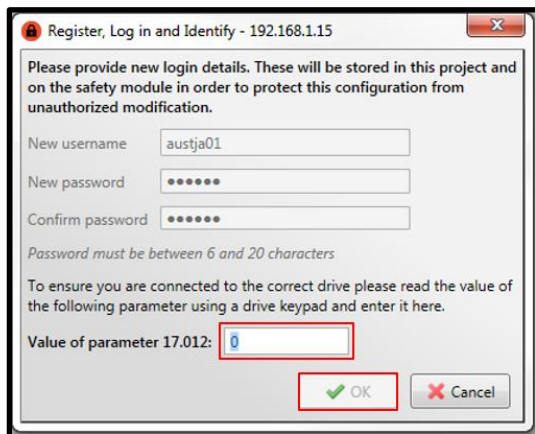


Figure 14-16 Select “Download”

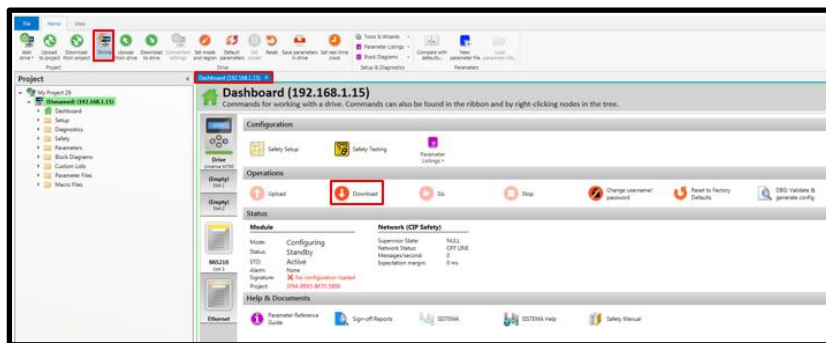


Figure 14-17 Select “Yes” to Confirm Download

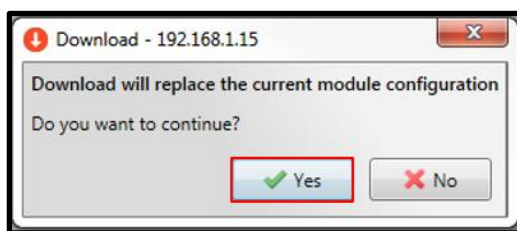


Figure 14-18 Check Details of Download and Select “Sign-off”

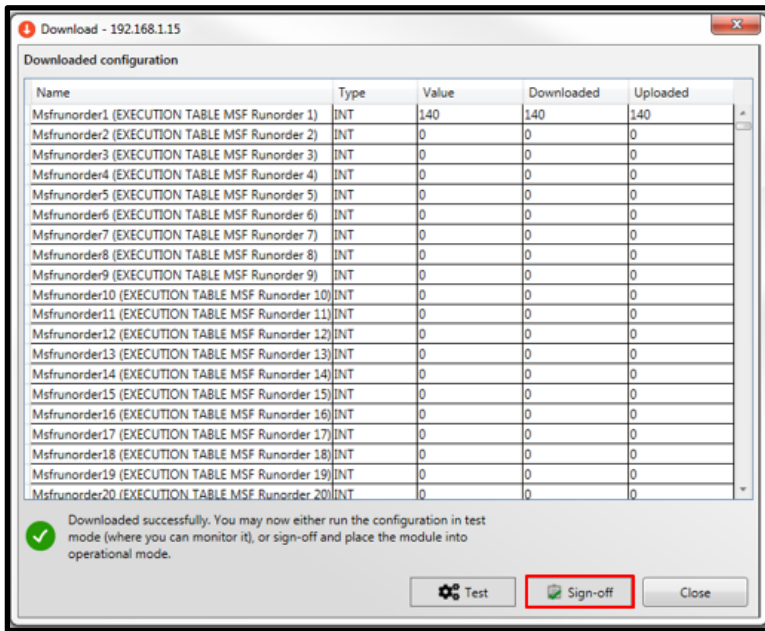


Figure 14-19 Select “Sign-off”

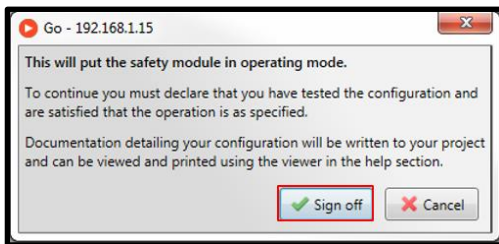


Figure 14-20 Select “Confirm”

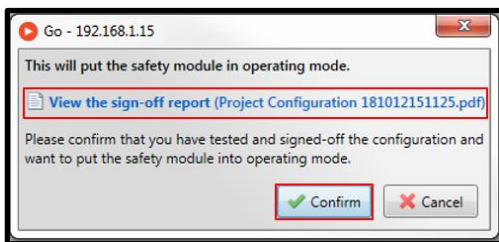
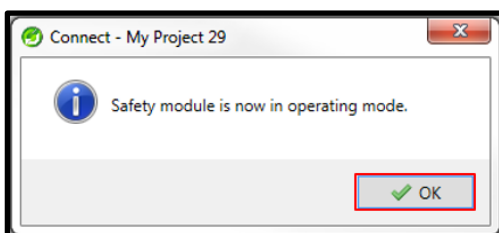


Figure 14-21 MiS210 is now in Operating Mode, Select “OK”



14.2 Modify a configuration

An existing Connect project may be opened and modified to allow re-configuration of an MiS210 that has an active safety configuration already installed. The original credentials are required.

In this workflow an existing Connect project is opened and modified to allow re-configuration of the MiS2x0.

Figure 14-22 Open an Existing Project

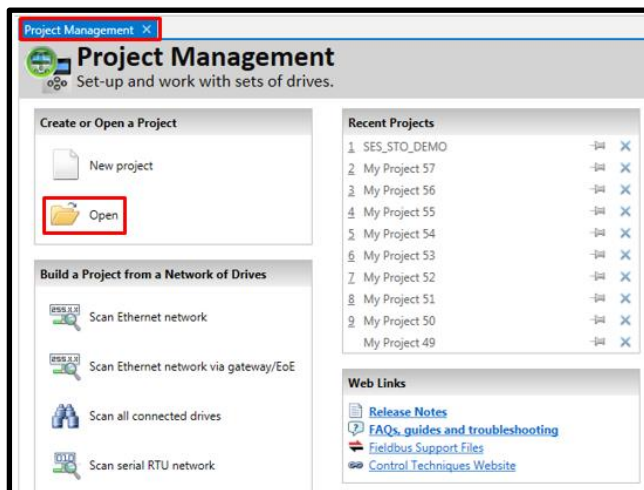


Figure 14-23 Select the MiS210

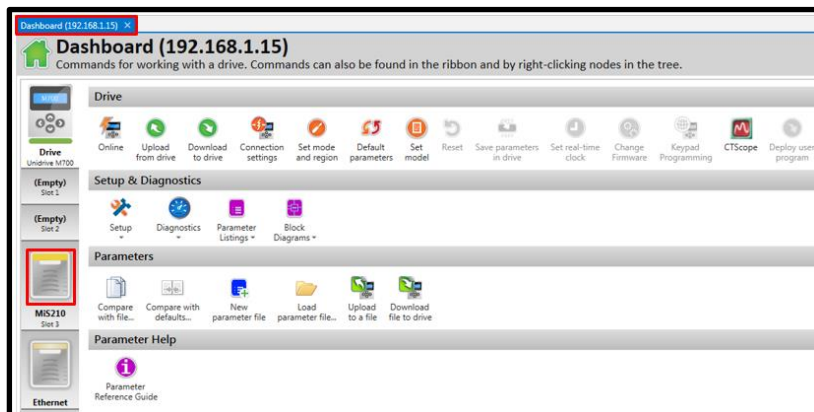


Figure 14-24 Go “Online” and Select “Stop”

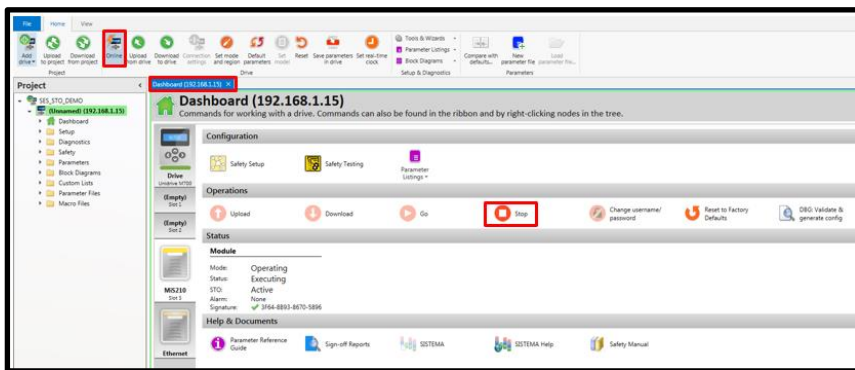
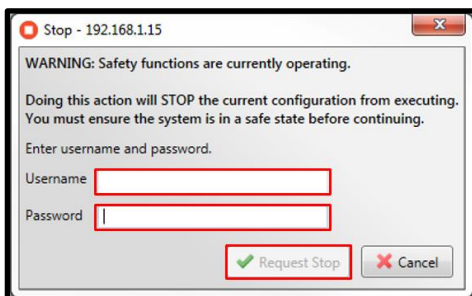


Figure 14-25 Enter Credentials associated with Configuration and Select “Request Stop”



Read the value displayed in menu 17.012 on the drive’s display and enter it as prompted, then click “STOP”.

Figure 14-26 Enter Parameter Value and Select “Stop”

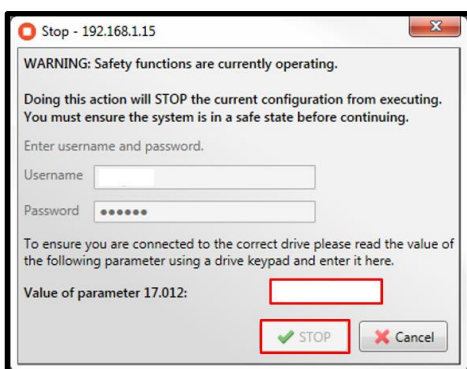


Figure 14-27 Go “Offline” and select “Safety Setup”

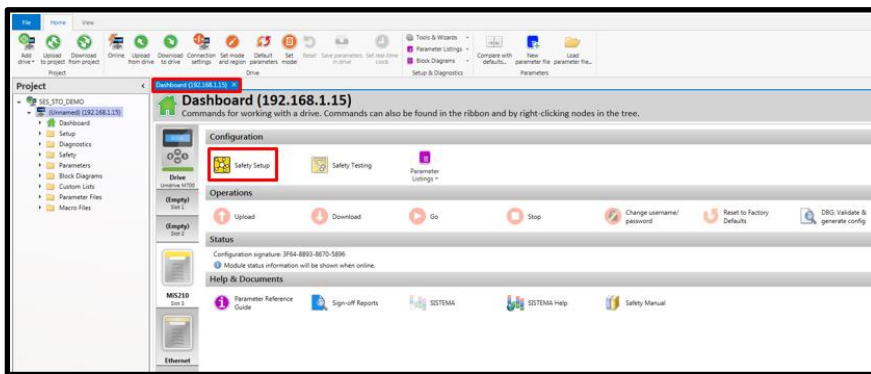


Figure 14-28 Modify the Existing Configuration as Required

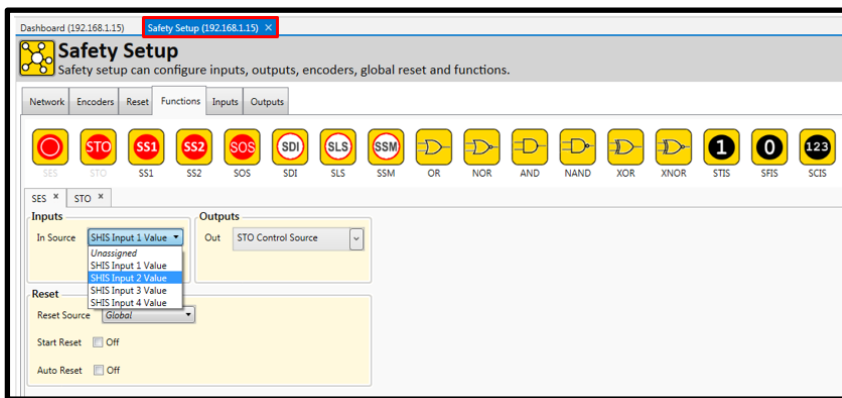


Figure 14-29 Select “Save to Project”

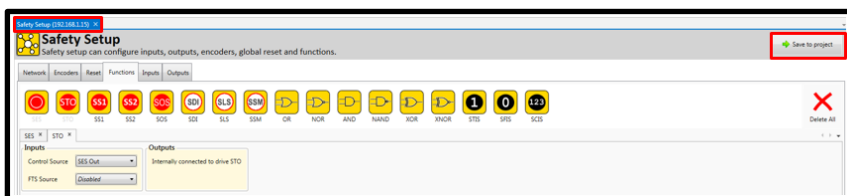


Figure 14-30 Enter Credentials and click “Log in”

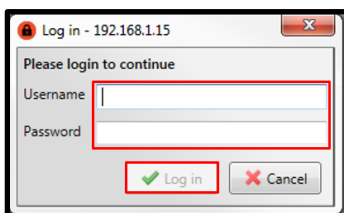


Figure 14-31 Go “Online” and select “Safety Testing”

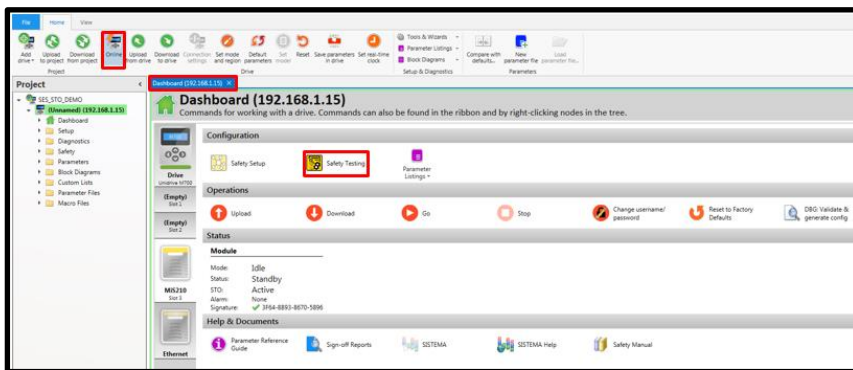


Figure 14-32 Select Download Configuration to Module

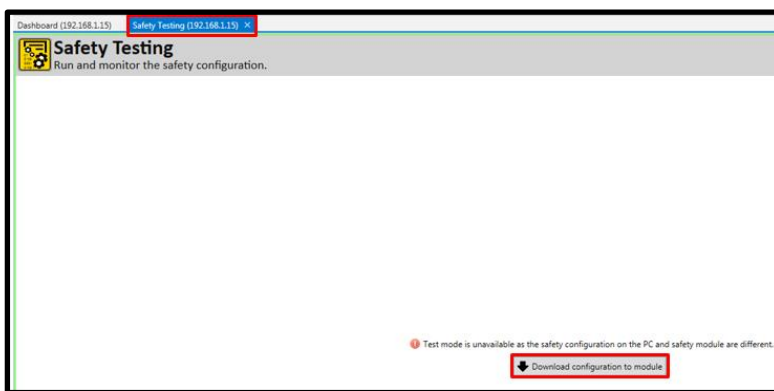


Figure 14-33 Select “Yes”

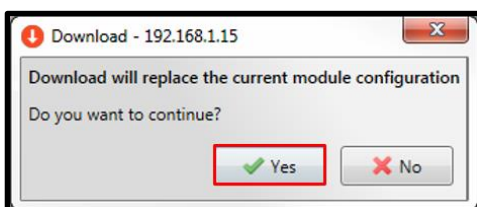


Figure 14-34 Select “Test”

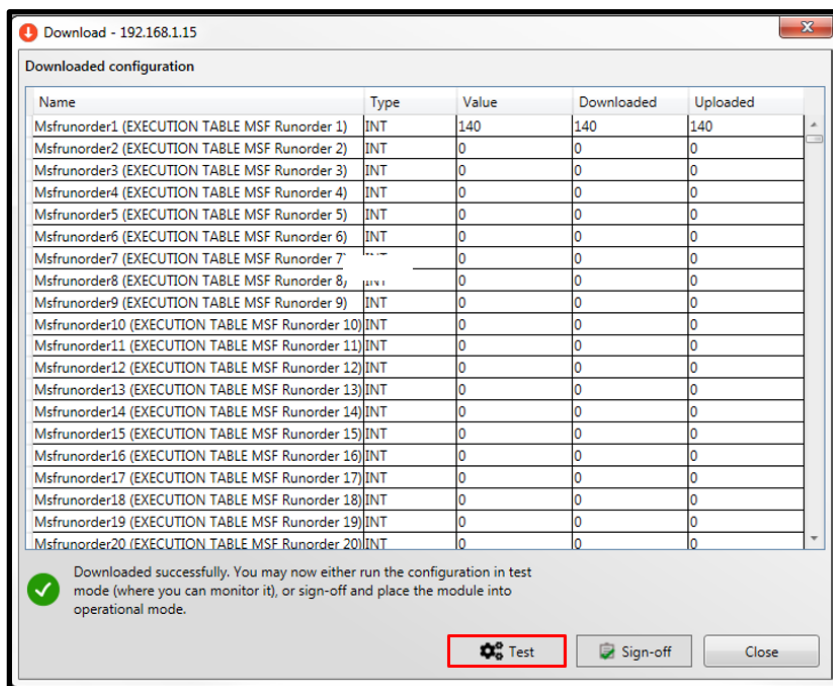
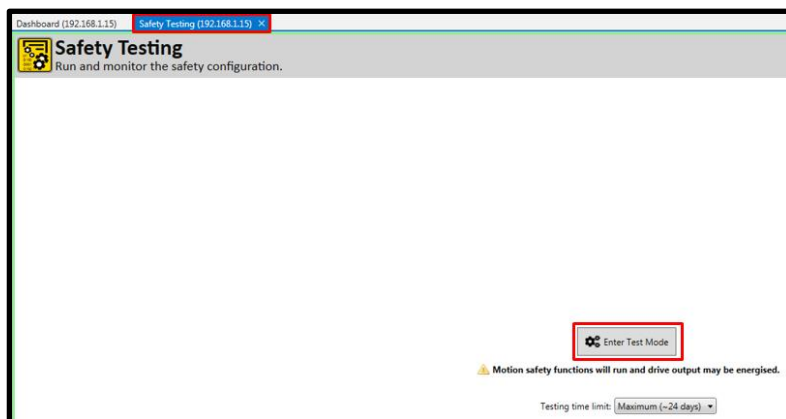


Figure 14-35 Select “Enter Test Mode”



In Test Mode the configuration is running and updating values can be viewed. In this workflow asserting an input on SHIS 2 and instigating a reset on BIS 1 causes the STO to become inactive and therefore allowing the drive to run.

Figure 14-36 In Test Mode

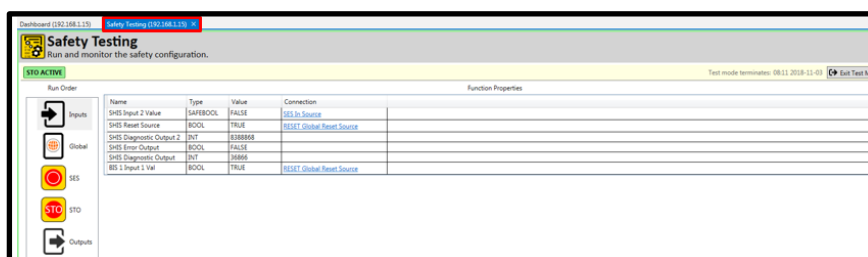
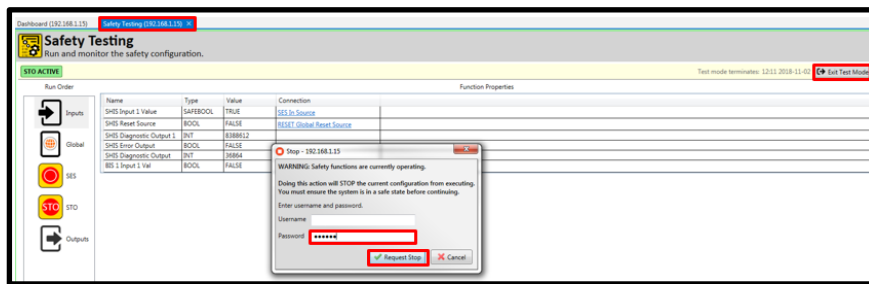


Figure 14-37 Select “Exit Test Mode” enter Credentials then click “Request Stop”



Read the value displayed in menu 17.012 on the drive’s display and enter it as prompted, then click “STOP”.

Figure 14-38 Enter Parameter Value

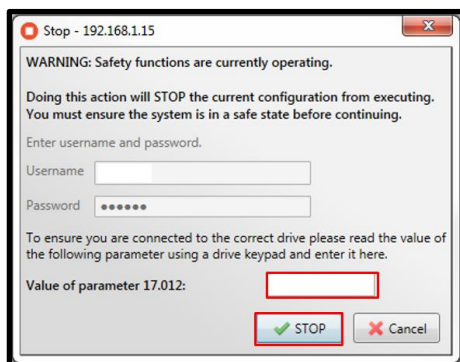


Figure 14-39 Select “Go”

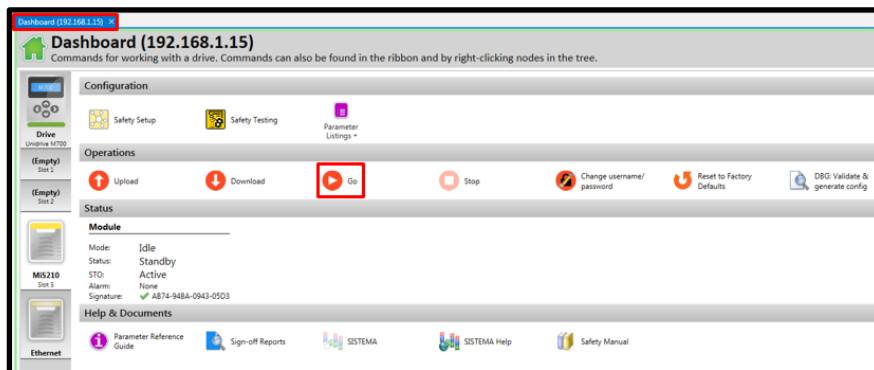
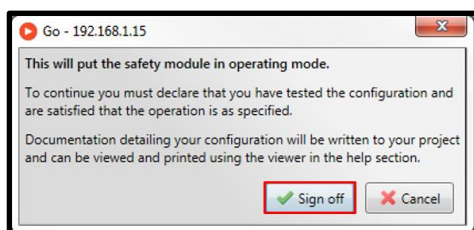


Figure 14-40 Select “Sign off”



Click on the link to view the sign-off report, then if you have tested and signed off the configuration select “Confirm” to enter operating mode.

Figure 14-41 Confirm the Configuration, select “Confirm”

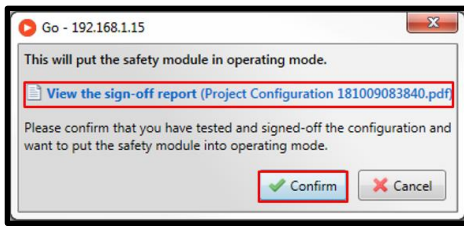
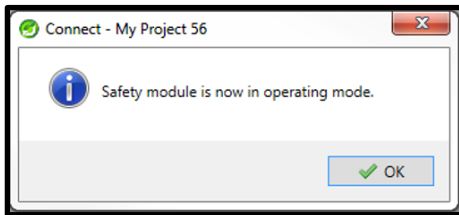


Figure 14-42 The MiS210 is now in Operating Mode, click “OK”

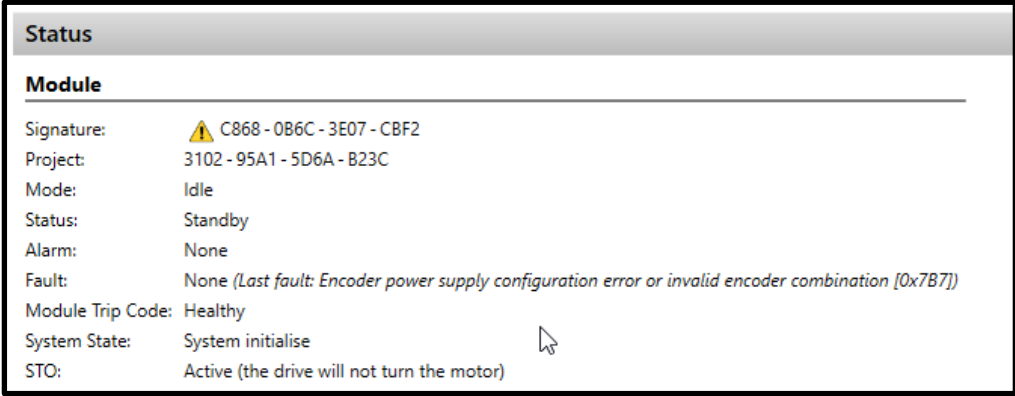


15 Diagnostics

Please refer to the document *Installation and Operating manual MiS210 and MiS250 Safety Modules* for detailed information regarding diagnostics.

Diagnostics are shown in the Status window within Connect, here any Alarms or Faults will be shown.

Figure 15-1 Status shown in Connect on the MiS2x0 dashboard while on-line



Status	
Module	
Signature:	⚠ C868 - 0B6C - 3E07 - CBF2
Project:	3102 - 95A1 - 5D6A - B23C
Mode:	Idle
Status:	Standby
Alarm:	None
Fault:	None (Last fault: Encoder power supply configuration error or invalid encoder combination [0x7B7])
Module Trip Code:	Healthy
System State:	System initialise
STO:	Active (the drive will not turn the motor)

15.1 Alarms

There are two types of alarm that can be raised by the MiS2x0 Safety Module, System Level and MSF Level. System Level Alarms are raised when errors in the supporting equipment such as Encoders or Networks are detected during operation. MSF alarms are raised when the system fails to operate within specified limits, for example a speed envelope is breached.

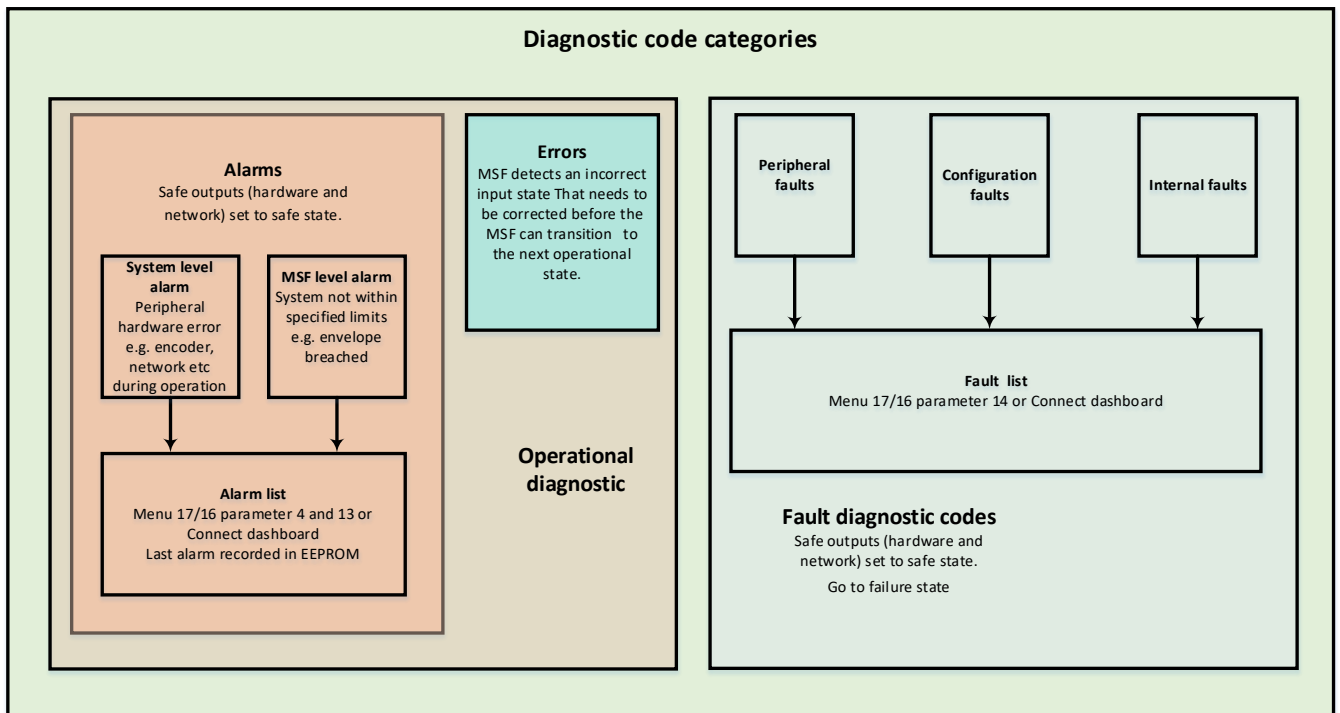
15.2 Faults

There are three types of Fault Diagnostic codes, Peripheral Faults, Configuration Faults, and Internal Faults. Peripheral Faults are associated with peripherals connected to the MiS2x0's encoder interfaces, network devices (via the Drive), host drive interface, and hardware outputs. Configuration Faults are to do with the configuration file downloaded and Internal Faults are those which are detected within the MiS2x0 Hardware or the operation of the MiS2x0 software. All faults will be written to the MiS2x0 internal EEPROM hence can be examined after a power cycle. In certain fault situations due to the potential severity of the fault detected it is possible it may not be stored. All faults result in an immediate halt of the processor.

15.3 Errors

Errors are raised when an MSF detects an incorrect input state which needs to be corrected before the MSF can transition from its current state to the next operational states. Errors would be detected and rectified as part of the user's testing process. Therefore, Errors are reported in the testing display while in Test Mode.

Figure 15-2 Diagnostic code categories



16 Glossary of terms

AB: A digital incremental encoder with two output channels.

Address: This is the unique network identification given to a networked device to allow communication on a network. When a device sends or receives data the address is used to determine the source and the destination of the message.

AMC: Advanced Motion Controller.

BIS: Boolean Inputs. A non-safe boolean input.

Bit: A binary digit, this may have the value of 1 or 0.

BOS: Boolean Outputs. A non-safe boolean output.

Byte: A collection of eight binary digits that collectively store a value.

CIP Safety: Common Industrial Protocol Safety. Safety application coverage for CIP networks such as EtherNet/IP.

Control word: A collection of binary digits that are used to control the drive.

counts/s: Counts per second. In the case of the MiS2x0 family counts/s refers to the number of encoder counts per second, i.e. a measure of rotational speed for a rotary encoder.

counts/s²: Counts per second squared. i.e. a measure of acceleration. (See counts/s).

CPR: Counts Per Revolution. The number of quadrature decoded states that exist between an encoder's two incremental outputs ($PPR * 4$). Alternatively referred to as lines per revolution. For communication encoders such as EnDat CPR equals the number (n) of bits per revolution 2^n the encoder supports.

DPST: Double Pole Single Throw.

EIA-485: Also known as TIA-485(-A) or RS-485. Specifies the electrical characteristics of a serial communication transceiver.

EoE: Ethernet over EtherCAT. An EtherCAT master tunnels standard Ethernet communication via EtherCAT. Control Techniques' PC tools including Connect receive and send standard Ethernet frames and are unaware of the EoE protocol.

EnDat 2.2: Proprietary communications serial encoder interface from HEIDENHAIN.

FSoE: Fail Safe Over EtherCAT. Safety application coverage for EtherCAT networks.

FTS: Force To Safe.

IEC 61508: An international standard published by the International Electrotechnical Commission titled Functional Safety of Electrical/Electronic/Programmable Electronic Safety-related Systems (E/E/PE, or E/E/PES).

IEC 62061: An international standard published by the International Electrotechnical Commission titled Safety of machinery: Functional safety of electrical, electronic and programmable electronic control systems.

ISO 13849-1: An international standard published by the International Organization for Standardization titled Safety of machinery – Safety-related parts of control systems.

MiS2x0: This guide covers the MiS210 and MiS250 option modules. This document generically refers to the family of products as MiS2x0.

MSF: Machine Safety Function.

OSSD: Output Signal Switching Device. Dual outputs of sensors are switched off momentarily while an integral self-test is performed.

PC: Personal computer.

PL: Performance Level.

PLC: Programmable logic controller.

PPR: Pulses Per Revolution. Represents the number of pulses an incremental rotary encoder will have on either of its outputs over a single revolution.

rpm: Revolutions per minute. Measure of rotational speed (min^{-1}).

RTU: Remote Terminal Unit. In the case of the PC tool Connect's terminology RTU refers to Modbus RTU. This is one of the serial protocols used by Connect (and other Control Techniques' PC tools) and is transmitted over EIA-485 hardware. Sometimes in the case of Control Technique's products referred to as "serial".

Safe EnDat: A safety rated encoder that uses the EnDat 2.2 protocol (see EnDat 2.2).

SBC: Safe Brake Control.

SDI: Safe Direction.

SES: Safe Emergency Stop.

SHIS: Safe Hardware Inputs. A safe boolean hardware input.

SHOS: Safe Hardware Outputs. A safe boolean hardware output.

SIL: Safety Integrity Level.

Sin Cos: An analogue incremental encoder with two output channels.

SISTEMA: Safety Integrity Software Tool for the Evaluation of Machine Applications.

SLA: Safely Limited Acceleration.

SLP: Safely Limited Position.

SLS: Safely Limited Speed.

SNIS: Safe Network Inputs. A safe boolean network input.

SNOS: Safe Network Outputs: A safe boolean network output.

SOS: Safe Operating Stop.

SS1: Safe Stop 1.

SS2: Safe Stop 2.

SSI: Synchronous Serial Interface.

SSM: Safe Speed Monitoring.

Status word: A value that denotes the status of the drive. Each bit within the word will have a specific meaning.

STHC3: Safe Two Handed Control 3.

STO: Safe Torque Off.

Word: A collection of sixteen binary digits.



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