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Application Note

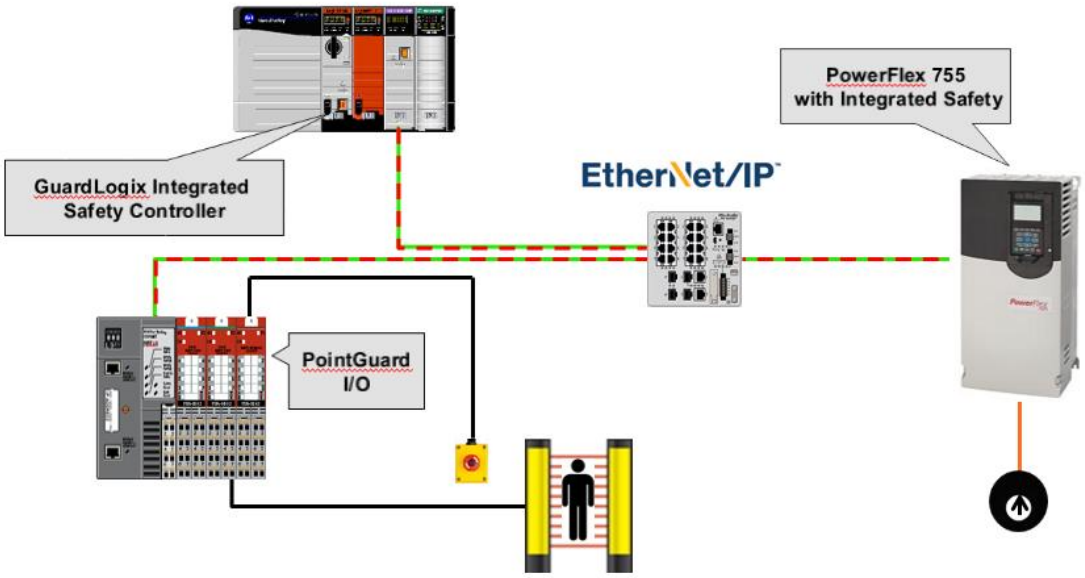
PowerFlex 755 – Integrated Safety with 20-750-S3 card

Objective

This document describes a sample setup of the PowerFlex 755 drive using the Embedded EtherNet port (EENET) with the 20-750-S3 Safety option card in Integrated Safety operation with a GuardLogix Safety Controller.

Description

The PowerFlex 755 drive with the 20-750-S3 safety card offers the option of Integrated Safety, a controller based safety function that is configured within Studio 5000 Logix Designer software to provide the Safe Torque-Off function. This method uses EtherNet/IP to communicate safety information (CIP Safety) and remove the need for discrete safety wiring to the drive. Rated Cat.3 and PLe per ISO 13849-1.



The following software, AOP and firmware versions are required:

- Studio 5000 Logix Designer V30 (and later)
- Drives AOP V4.09 (and later)
- GuardLogix safety controller L7S or L3S firmware V30 or higher
- PowerFlex 755 firmware V13 or higher

Installation

The 20-750-S3 can be connected in the slots 4, 5 and 6 of the PowerFlex 755 drive.

The main control board SAFETY jumper must be removed.

Setup in Studio5000

These is the hardware of our example setup:

GuardLogix L7S Safety Controller firmware V30.011
1756-EN2TR network card
PowerFlex 755 firmware V13.002
20-750-S3 card in Port 6

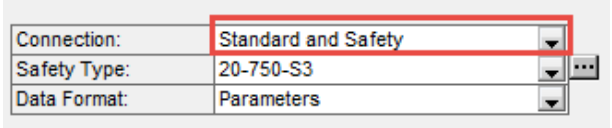
Setup Steps:

1. Open **Studio 5000 Logix Designer** and create a new project for the **L7S** controller.
2. Add the **EN2TR** network card to the IO Configuration.
3. Add the **PowerFlex 755 EENET** (via Embedded EtherNet port) drive to the EtherNet/IP network.

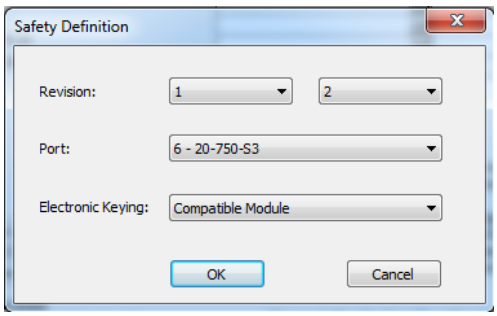
   We can also use the Dual port EtherNet card **20-750-ENETR** but only in **Tap** mode. Select also **PowerFlex 755 EENET** as drive profile type.

4. In the drive properties, select the **General** tab and open the **Module Definition** window.
   Click the **Match Drive** button to automatically load the drive information into the **Module Definition** screen, from the online network drive.

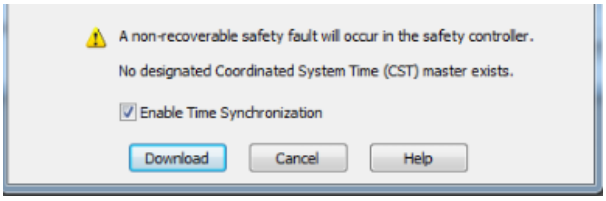
5. In the drop down menu for **Connection** select Standard **and Safety.**



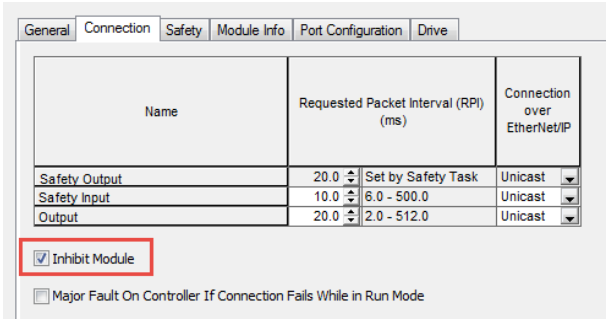
6. In **Safety Type** click the ... button to open the **Safety Definition** window. Select the **20-750-S3** card Revision, Port and Electronic Keying.



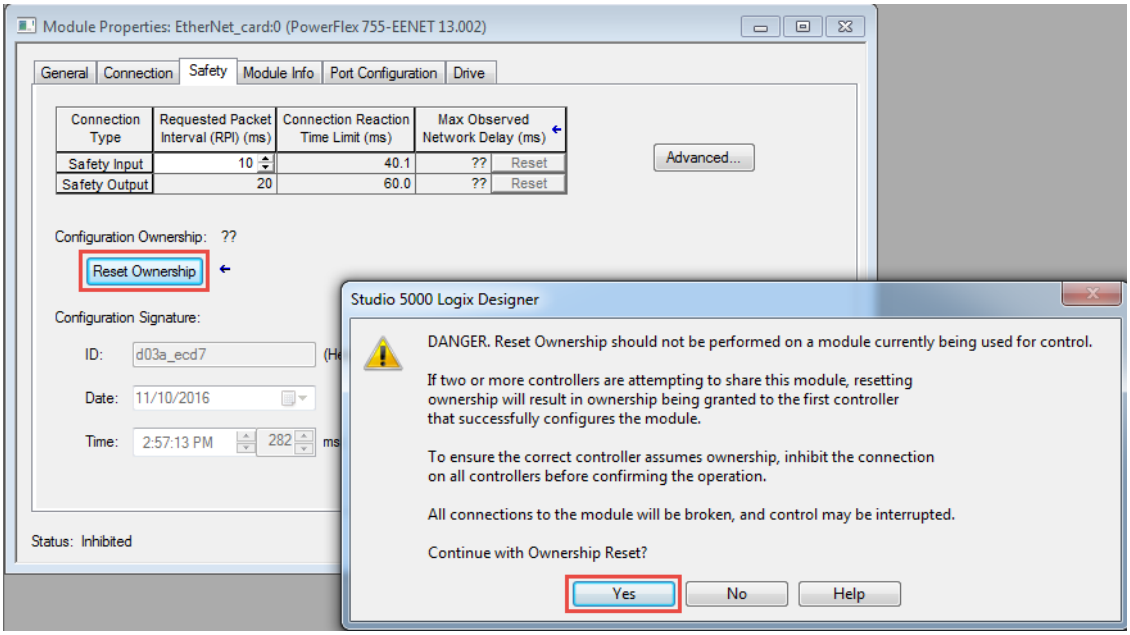
7. Save the project and download. When downloading completes, place the controller in **Run** mode.



8. In the drive properties, select the **Connection** tab and tick the box for **Inhibit Module**.



9. Select the **Safety** tab and click in the **Reset Ownership** button. Click **Yes** in the next window to confirm the reset.



10. Select the **Connection** tab and untick the box for **Inhibit Module**.
11. Verify that the yellow icon has disappeared and the drive is in the **Running** status.

Integrated Safe Torque-Off functionality

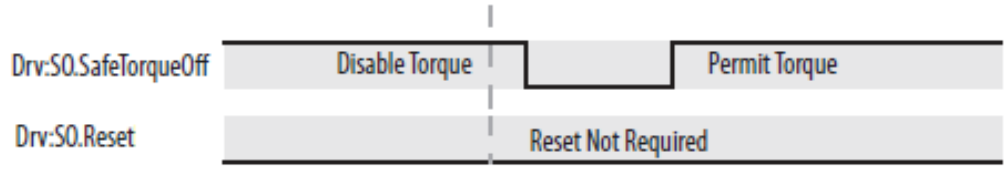
1. The PowerFlex 755 drive should display "**Not Enabled**".
2. Go to the Controller tags and locate the drive safety input and safety output tags. Notice that the **TorqueDisabled** and **ResetRequired** bits in the input are high **"1".**

Drive:SI	{...}	{...}	
Drive:SI.ConnectionFaulted	0		Decimal
Drive:SI.ConnectionStatus	2#0000_0000_0000_0000_...		Binary
Drive:SI.ResetRequired	1		Decimal
Drive:SI.RunMode	1		Decimal
Drive:SI.SafetyFault	0		Decimal
Drive:SI.Status	2#1000_0001		Binary
Drive:SI.TorqueDisabled	1		Decimal

3. Set the **SafeTorqueOff** bit in the output to 1. This bit needs to be energized in order to allow torque.

Drive:SO	{...}	{...}	
Drive:SO.Command	2#0000_0001		Binary
Drive:SO.Reset	0		Decimal
Drive:SO.SafeTorqueOff	1		Decimal

The Reset bit is not required. See below auto reset timing diagram using network Safe Torque-Off.



4. Notice that the **TorqueDisabled** and **ResetRequired** bits goes low **"0".**

Drive:SI	{...}	{...}	
Drive:SI.ConnectionFaulted	0		Decimal
Drive:SI.ConnectionStatus	2#0000_0000_0000_0000_...		Binary
Drive:SI.ResetRequired	0		Decimal
Drive:SI.RunMode	1		Decimal
Drive:SI.SafetyFault	0		Decimal
Drive:SI.Status	2#0000_0000		Binary
Drive:SI.TorqueDisabled	0		Decimal

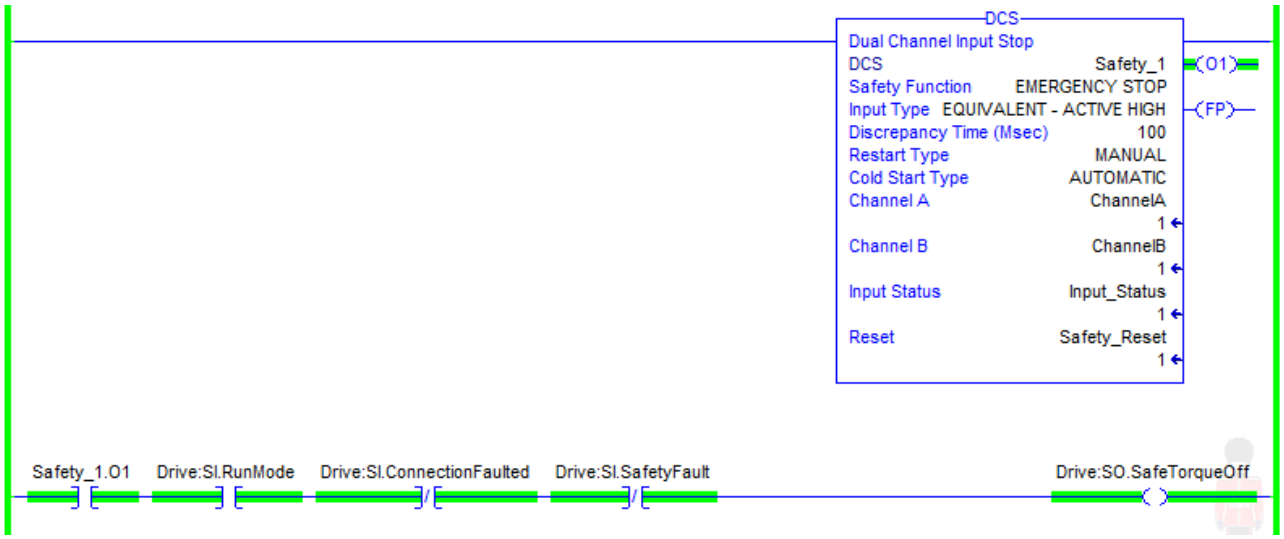
5. Now the PowerFlex 755 drive should display "**Stopped**".
6. Go to the Controller tags and locate the drive input and output tags. Notice that the **Ready** bit in the input is high **"1"**. You can now start and stop the drive.

Sample safety code

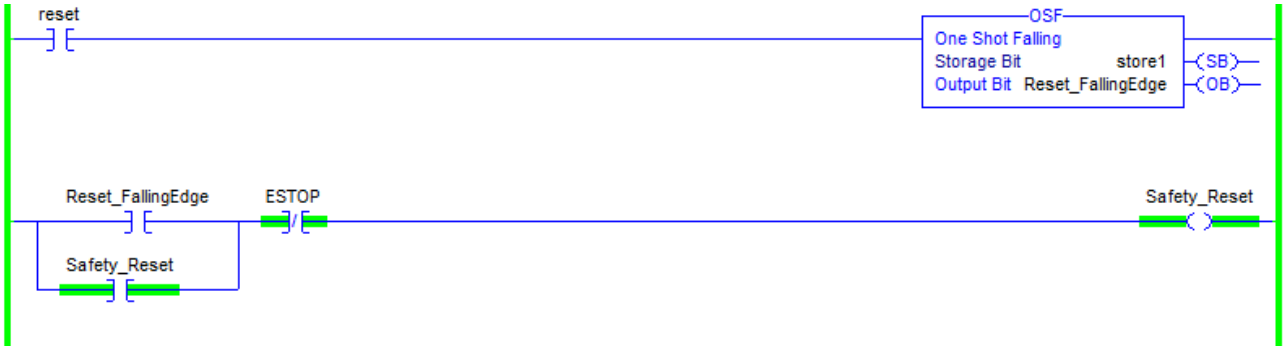
The following code is an example for a category 0 stop (coast). We use a **Dual Channel Input Stop (DCS)** instruction to monitor a dual-input safety device like an E-stop, light curtain or a safety gate.

The drive **STO** output is energized if both input channels are high (1), there are no faults, there is a valid connection, and there is a falling edge on the reset bit.

When the two inputs channels goes to low (0), the **DCS** instruction output bit (O1) goes to low (0) and drive **STO** output immediately goes to low (0) as well.



ISO 13849-1 stipulates that instruction reset functions must occur on falling edge signals. To comply with this requirement, a **One Shot Falling (OSF)** instruction is used on the reset rung. Then, the **OSF** instruction output bit is used as the reset bit for the **DCS** instruction.



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Resources

PowerFlex 755 Integrated Safety – Safe Torque Off Option Module User Manual

http://literature.rockwellautomation.com/idc/groups/literature/documents/um/750-um004_-en-p.pdf