**A yellow box with black text

Description automatically generatedStandard Ethernet/IP and CIP Safety setup between SICK FLEXI soft CPU, EFI-PRO module GEPR and the Yaskawa YRC1000 Robot Controller**

\*FX3-CPU0 with version 1.17.12339/4.xx, Part Number: 1043783

\*FX3-GEPR with version 1.17.12339/1.xx, Part Number: 1069070

\*Sick Safety Designer version 2024.02

\*Achieved on a YRC1000 with the following version information

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Michael Allen [Michael.allen@motoman.com](mailto:Michael.allen@motoman.com) 07/23/2024

**Overview**

This document shows how to configure a FlexiSoft Safety PLC with a GEPR EFI-Pro Module for EtherNet/IP Standard and CIP Safety Connections at the same time with a Yaskawa YRC1000 Robot Controller. There will be 4 bytes of standard EtherNet/IP data and 8 bytes of EtherNet/IP CIP Safety data between the PLC and the Robot Controller.

**PLC Setup**

1. Download Safety Designer version 2024.02. Create new project.
2. Add a FX3-CPU and a Generic EtherNet/IP Cip Safety Device to the device overview by dragging them over to the device overview.

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1. The overview should look like this once added.

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1. Double click the newly added generic device, under Configuration -> Common you will need to set the common settings of the Generic CIP Safety Device(YRC1000 in this case).

Device Name: Can put anything you want. YRC1000 was used for this document.

IP Address: IP Address of the robot, 192.168.1.31 was used for this document

Safety Network Number: Press Action-> Take over from project

Vendor: 44

Product Type: 140

Product Code: 1284

Major Version: 1

Minor Version: 1

Electronic Keying: Compatible Module

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1. Click Configuration -> Connections.

Paste “20 04 25 00 00 04 20 04 25 00 00 04 20 04 25 00 08 03“ into the connection path for safety inputs, set assembly size to 8. Do not include the quotation marks.

Paste “20 04 25 00 00 04 20 04 25 00 88 03 20 04 25 00 00 04” into the connection path for safety outputs, set assembly size to 8. Do not include the quotation marks.

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1. Click Configuration -> Default Settings. Make sure the safety packet format is set to Basic format and the RPI is set to 20 ms.

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1. You can close the window. Now double click the FX3 and go to Configuration -> Hardware Configuration. Then drag a GEPR from the Modules in the catalog over beside the FX3

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1. Should look like this once you have dragged it over.

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1. Now if you go back to the project configuration page and click the Connections tab you will be able to draw a connection between the FX3 FlexiSoft CPU and the generic CIP Safety Module. Should look like below once the connection is drawn.

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1. In the FX3 setup page in Safety Designer, click Configuration -> GEPR -> Device Identification. Make sure the SSN is set to the project SSN, if not, click take over physical SNN. The new SNN should populate.

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1. Under Configuration-> GEPR-> Network settings, ensure the projected device and physical device have the same IP’s if not read or transfer to the device to match the IP.

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1. In the dropdown menu click Ethernet/IP Access and select 4 bytes – Assembly 140 for CPU -> Network and 4 Bytes – Assembly 130 network -> CPU and For external communication for both, these will be used for the standard Ethernet IP Connection. Since we have set up the generic CIP Safety device on the configuration page, the CIP Safety connection you see on this page is not used. Set both of these to not used.

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1. Under Connection Creation your connection from the FX3 CPU and the Generic EtherNet/IP CIP Safety Module should already be connected because we dragged the connection together in step 8. It should look like below.

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1. Right click the connection wire between the Generic Device and the FX3 and press edit. Make sure you have the RPI set to 20 or whatever RPI is required for your application. Uncheck the “Use the SCID mechanism” button. The YRC1000 controller does not support this. Should look like below.

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1. Do the same thing for the output wire from the FX3 to the Generic Device. Right click the wire, press edit, change RPI and uncheck the SCID mechanism.

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1. Under Configuration -> GEPR -> Connection overview you should be able to see the input and output connection from the FX3 CPU to the Generic EtherNet/IP CIP Safety Module. Confirm the RPI is what you want, otherwise you can modify it here.

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1. Optional. Update the tags for the 4 bytes of standard EtherNet/IP data under the tag name editor if you would like to.

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1. Under the main project configuration, press connect if you are connected to the FX3 CPU then it will show up on the right side of the page under found devices.

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1. Drag the device over to the FX-CPU0 on the device overview which will assign the device to this configuration. It will automatically write the configuration to the CPU. It then should put you online with the CPU and it should look like below. If there is a mismatch it will ask you if you want to download or read the configuration. Make sure the hardware configuration is identical to what has been physically set up, then write/transfer the configuration.

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**Write TUNID to Robot Controller**

1. Perform this step after setting up EtherNet/IP Safe on the Robot Controller. Connect to the CPU. Double click FX3-CPU0, under the Configuration -> GEPR -> EtherNet/IP services -> Services for 3rd party devices. Put in the IP of the robot, 192.168.1.31 in our case, then press the read from device button. If the status is 0x04: Executing then there is nothing to do and the SNN is correct. If it is 0x08: Waiting for target unique node identifier(TUNID) then press take from project settings to get the SSN. Then click on write TUNID on 192.168.1.31 button. This will set the TUNID to match the project and you should see on the teach pendant under System Info -> Fieldbus Information that the SNN is no longer FFFF\_FFFF\_FFFF and should match the program SNN. As you can see from the images below the SNN on the robot matches the number in Safety Designer.

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\*Note if the TUNID was set before by some other safety device and is different than the one in the project, you will need to reset the safety configuration and the target ownership both of which can be done on the Services for 3rd party devices page.

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**Robot Setup**

1. Make sure to complete the EIP standard and safety setup for the YRC 1000 controller.
2. Go into Maintenance mode, Log into Safety User then go to System -> Setup -> Option Function -> Ethernet IP -> click Scanner.
3. Add new device, change the name, RPI, input size, output size. Take note the input size needs to be **8 bytes**, the SICK module has a 4 byte output header to the robot before the actual data is mapped. This is important! If you do not set this to 8 it will not connect.

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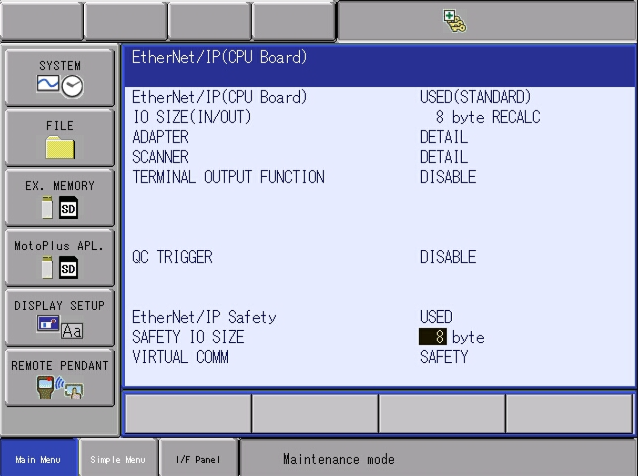
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1. Add the device under Scanner, make sure to set the IP address to the same as the one set in Safety Designer. The number of input bytes should say 8 and output should say 4.

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1. Ensure EtherNet/IP Safety is set to USED, Safety IO Size is set to 8 Bytes and Virtual Comm is set to SAFETY. If there is not EtherNet/IP Safety option here then EtherNet/IP Safety needs to be configured, follow the EtherNet/IP Safety setup documentation then proceed.



1. Press Enter on the EtherNet/IP setup to start allocating the standard Ethernet bits. Ensure Ethernet/IP CPU is on ST#15. Press enter again and modify.

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1. Set External IO Setup to Manual. Press enter, then Modify.

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1. Set the inputs from the Sick PLC to external IO #20070 with all 8 bytes as shown below. The first 4 bytes are header data and the second 4 bytes are the actual data bytes from the Sick PLC. Therefore the actual data we will be using starts at #20110 and goes to #20147. Press enter to go to the output allocation page.

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1. Under external IO Allocation Outputs, set the 4 bytes of outputs to the Sick PLC to #30110 so that both the inputs and outputs have data bits that start at the same IO group number. The additional 4 bytes are unallocated. Press Enter, Modify.

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1. Press File -> Initialize and then perform a safety board flash reset.

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1. Reboot the controller in online mode.
2. Check to see if the standard EtherNet/IP connection was setup correctly. Go to Communication Monitor under IN/OUT.

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1. Click Ethernet/IP CPU

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1. Verify that the connection has OK for the status. If it has NG, press enter and see what the connection issue is. Check for target -> originator size incorrect, IP address incorrect, In/Out instances backwards.

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**Communication Verification**

1. To verify the communication we are going to turn on some external outputs, you can do this using the Ladder Logic Editor. In the ladder editor turn on some outputs starting at 30110 which is where we set the standard outputs to the Sick PLC in the ethernet setup. In this example #30112, #30117 and #30127 were turned on as you can seen below.

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1. On the safety designer program, press connect to go online.

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1. Once online, under Configuration -> GEPR -> Data sets click on Network to Flexi Soft tab. As you can see from the screenshot there are 3 bits turned on. These correlate to the bits that were turned on in the robot controller.

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1. Now we will check standard outputs. Go to the Logic Editor tab, click Edit Mode, create a new page, drag a static 1 input to a Routing 1:n function block and then under outputs under CPU Logic on the right side of the screen you will see the GEPR with standard and Safety Outputs. Drag a standard output to the output of the Routing function block. In this case Byte 0 Bit 6 was used. Transfer the program to the PLC.

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1. Under Configuration -> GEPR -> Data sets, click Flexi Soft to network. You should see in the standard output that byte 0 bit 6 is on like the image below. On the teach pendant under IN/OUT -> External Inputs you will see external input #20116 is on.

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1. To verify the safety communication there are a couple of things we could check for. On the Safety Designer program under Configuration -> GEPR -> Connection overview you can see the connection status of the safety signals to the robot. If both the inputs and outputs have Established under the Connection status tab then they are configured correctly and are working as expected.

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1. Another way to confirm communication would be to modify the logic we previously made to include a safety signal. Go into Edit mode, double click the Routing 1:n block and add a second output. Under CPU logic -> GEPR -> To YRC1000. Byte 0 Bit 4 was used in this example. Transfer the new configuration to the controller.

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1. If you go back to the Configuration -> GEPR -> Data sets page under Flexi Soft to network tab you will see Byte 0 Bit 4 on.

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1. On the robot teach pendant under Safety Func -> Safety Signal Board Allocation. Ensure inputs are set to used and outputs are set to M-SAFE.

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1. Safety Func -> Safety Logic Circuit. Ensure the Pendant E-Stop is and input to SFBOUT01. Add SFBIN05 as an input and you can use any of the MS-OUTXX for the output. Write and then confirm the changes.

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1. SFBIN05 was used in this case, you can see that it is currently on because we turned it on from the Safety Designer Logic. You will also notice that the PPESP and EXDSW bits are turning on SFBOUT01 and SFBOUT03 in this example. If you go back to the Safety Designer, Configuration -> GEPR -> Data sets under the Network to Flexi Soft tab you will notice Byte 0 Bit 0,2,7 from the YRC1000 which correspond to SFBOUT01, SFBOUT03 and SFBOUT08 from the teach pendant.

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1. Congratulations you have successfully set up both Standard EtherNet/IP and CIP Safety connections with a YRC1000 Controller using a Flexisoft FX3-CPU0 and a GEPR EFI-PRO Module!