Application Note

2500 Series®
Programmable Automation Control System

Using Ethernet Port Isolation on the 2500P-ECC1 Ethernet Communications Coprocessor

Introduction

The CTI 2500P-ECC1 Ethernet Communication card provides 2 Ethernet communication ports. Recently a feature has been added called Ethernet Port Isolation. This allows for several possibilities to connect the module to one or two Ethernet networks. This paper aims to give an overview of the connection possibilities.

Connection to the Host Controller

The ECC1 module always requires an Ethernet connection to the CPU from which it will read/ write the memory locations. The CPU is called the Host Controller.

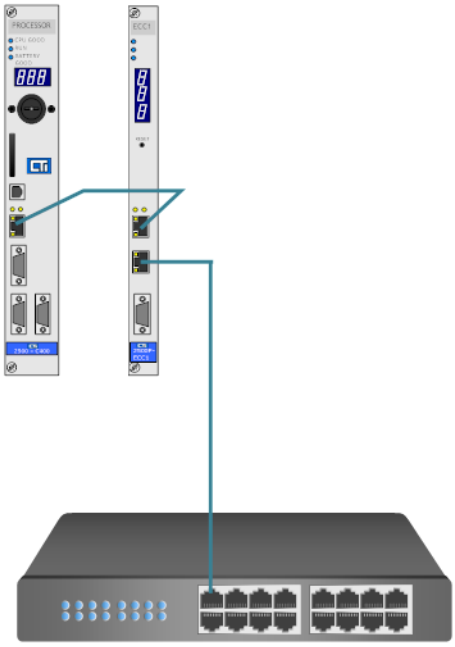
The ECC1 module and the CPU both have a unique IP address and their IP addresses must be in the same IP address range.

There are 2 methods to connect the ECC1 to the Host Controller:

1. Direct Connection to the Host Controller

   Port 1 of the ECC1 module will be connected directly by means of an RJ45 cable to the Ethernet port of the CPU.

   Port 2 of the ECC1 module will be connected to the network. Usually this is a connection to an Ethernet switch.



All communication devices will be connected to the Ethernet switch or to other switches in the network

This connection method provides one advantage:
If you are using an extensive network with many devices connected you may be affected by a phenomenon called broadcast storm.
https://en.wikipedia.org/wiki/Broadcast_radiation

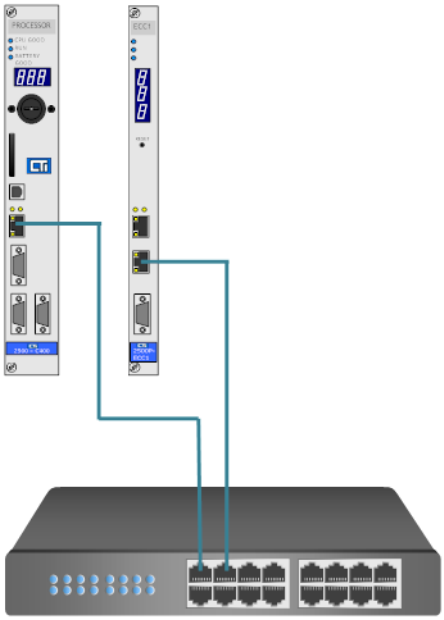
A broadcast storm can have negative effect on the performance of the connected devices. The embedded switch on the 2500P-ECC1 can provide broadcast storm protection for the 2500 Series® programmable controller.

When a PC with 505 Workshop programming software is used, it can be connected to the switch and the CPU will still be accessible for programming. Inside the 505 Workshop software the IP address of the CPU will be used to establish the connection. The ECC1 module will work in this case as a switch and simply forward the programming instructions from 505 workshop to the CPU.

2. Connection via a network switch

Port 1 or Port 2 of the ECC1 module will be connected to the Network switch.

The Ethernet port of the CPU will be connected to the Network switch.



Using this method, all communications between the HMI and the 2500P-ECC1 module and between the 2500P-ECC1 module and the 2500 Series® controller pass through the network switch. In addition, communications between the programming workstation and the 2500 Series® controller pass through the network switch.

CAUTION:

The second Ethernet port of the 2500P-ECC1 module SHOULD NOT be connected to the same network switch. Doing so could create a loop, which will disrupt network communications

The second Ethernet port of the 2500P-ECC1 module **can be connected to an alternative Network switch when Ethernet Port isolation is activated**. See next chapter for further details.

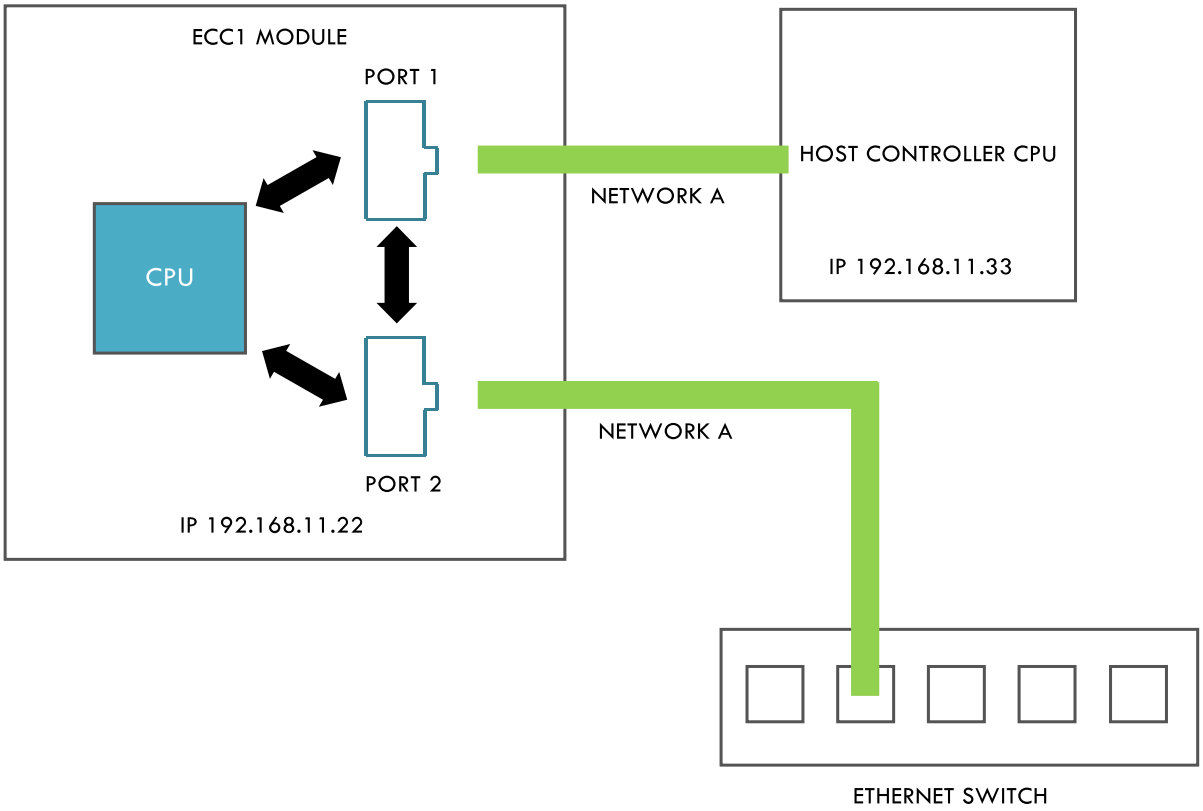
Using Ethernet Port Isolation on the ECC1 module

In Firmware Version 2.19 (available since 2016-11-08) a new feature has been added called Ethernet port Isolation. This feature is enabled by putting switch 4 on the switchblock on the ECC1 motherboard to the closed position.

To understand how Ethernet port isolation is working we need to take a look at the internal functioning of the ECC1 module.

1. Ethernet port isolation deactivated

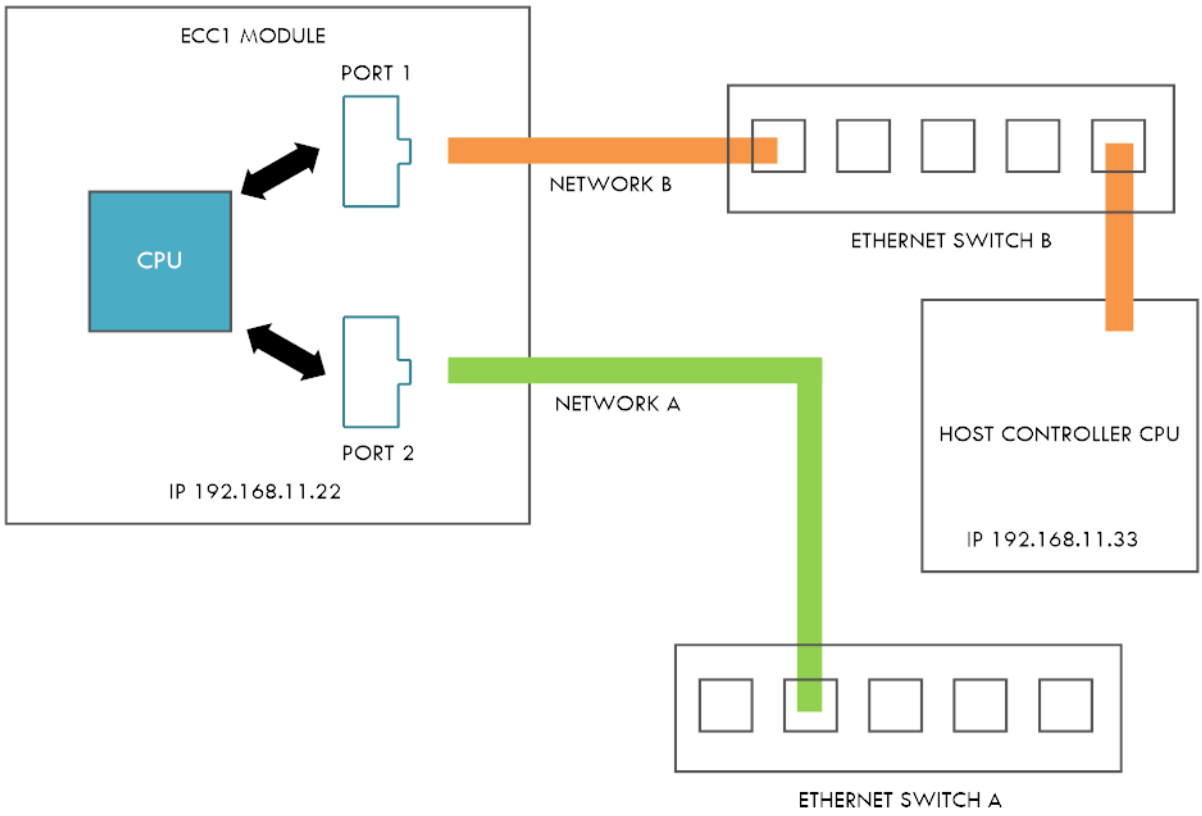
This is the default ECC1 configuration. In this case the 2 ports of the ECC1 module act like a regular Ethernet switch: the incoming ethernet frames are processed by the CPU but also forwarded to the other port. There is no separation between the networks connected to port 1 and port 2, they are part of the same network.



This is the configuration that will be used when the above described connection method *Direct connection to the Host Controller* is used. This method has the advantage that when, for example a PC with 505 Workshop or an HMI system is connected to the Ethernet switch, and these devices are configured to communicate with the CPU with IP address 192.168.11.33, the ECC1 module will forward the TCP/IP frames to the CPU and the devices connected to the ethernet switch can communicate directly with the CPU.

2. Ethernet port isolation activated

When Ethernet Port Isolation is activated, incoming Ethernet frames on port 1 and 2 are not directly forwarded to the other port. The Ethernet frames from both ports are forwarded to the CPU. The CPU processes the frames, but frames that are not designated to the IP address of the ECC1 will be dropped and NOT forwarded to the other port.



In this configuration the 2 networks connected to port 1 and port 2 are independent.

CAUTION:

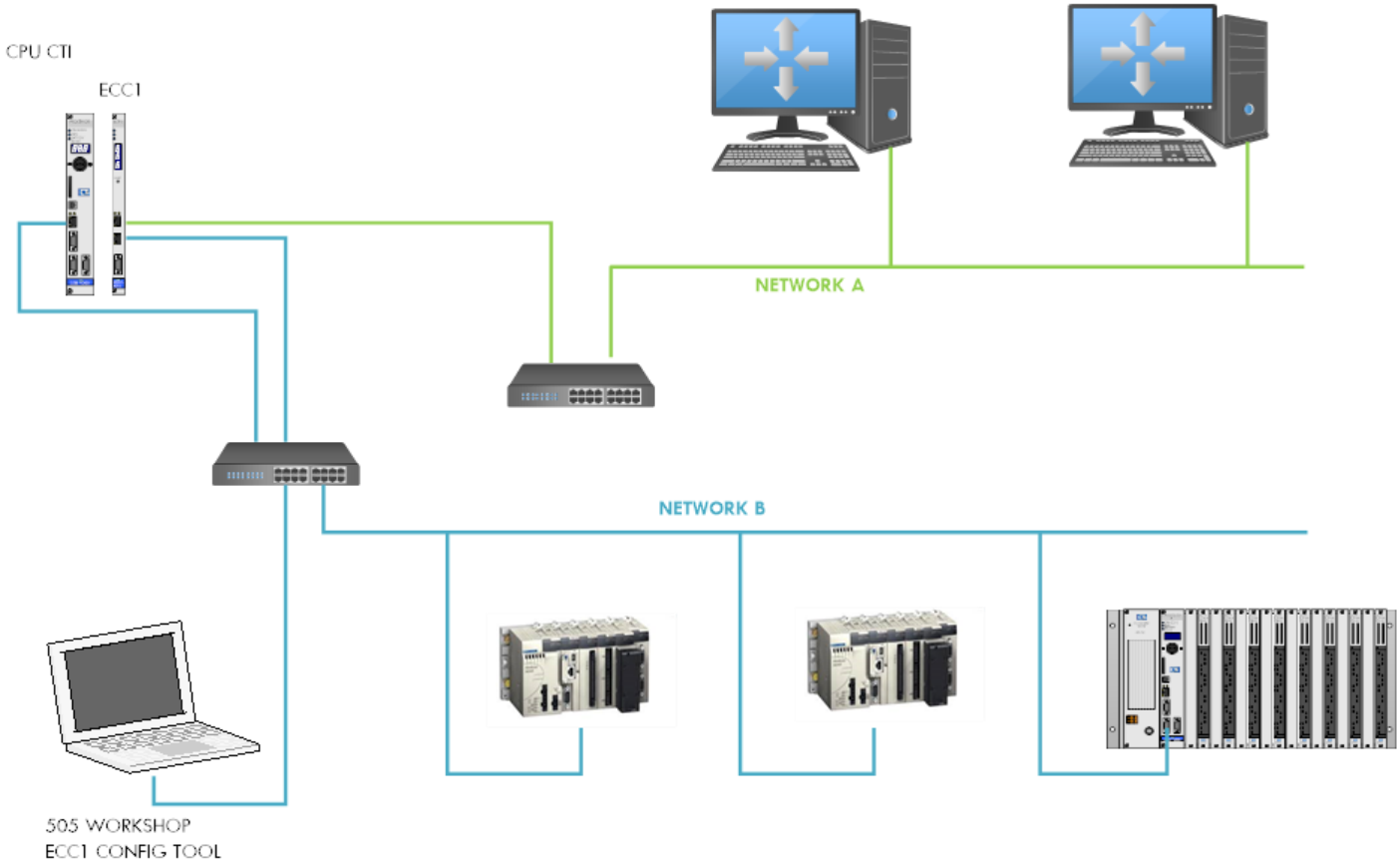
The ECC1 module can only be assigned one single IP address. This means that port1 on Network A and port2 on Network B will have the same IP address.

The IP address of the ECC1 has to be in the same IP Address range as the IP of the Host Controller.

If the ECC1 module needs to communicate with devices in another IP Address range, a layer 3 Network switch with address routing capabilities has to be used

3. A Practical Example of Ethernet Port Isolation

Below image shows a practical example of the use of Ethernet Port Isolation.



Network A is used to connect SCADA or HMI systems. Typically these systems would communicate to the ECC1 module. They would be configured to communicate to the IP address of the ECC1 module and would take benefit of the enhanced communication capabilities of the ECC1 module, which produces high update rates for the variables used on the SCADA system.

Network B is used to connect PLC's. In this example there are 2 PLC's from a third party supplier communicating in Modbus TCP and one CTI 2500 PLC. These 3 PLC's would be configured to communicate with the IP address of the ECC1 module. The ECC1 module will handle the Modbus TCP communication between the PLC's
Since the CPU is directly connected to this network, a PC with 505 Workshop that communicates directly to the CPU can also be connected to Network B.

Both Networks are independent one from another. Modbus TCP frames will not be mixed with Ethernet frames from the SCADA network and vice versa.

This approach has several advantages:

1. The network is divided into smaller segments.
2. Reduction of the overall network traffic.
3. An incident on one network does not have an impact on the other.
4. Easier to troubleshoot network and communication problems.

Related documents

CTI 2500P-ECC1 Communications Coprocessor User Manual V1.11
http://www.controltechnology.com/support/manuals

CTI Tech Tips:

Ethernet communications: What is the best solution for your needs ?
http://www.controltechnology.com/support/Tech-Tips

Several other application notes and technical information on:

http://www.controltechnology.com/products/2500-Series-Classic/Coprocessors/2500P-ECC1-Ethernet-Communications-Coprocessor-(1)

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