

# Lab 4: Commissioning SEL Real Time Automation Controller (RTAC) with SEL Protective Relays

## 1. Due Date for Lab Report

## 2. Background information:

The objective of lab 4 is to develop a basic understanding of several types of IEDs and learn how to communicate with them over a network. You will learn how to connect devices and how to use them. This lab will be using settings from Project from LAB 2 with a new IED added to it.

## 3. Learning outcomes

### ◆ Primary

1. Establish connection to downstream devices from an automation controller to a downstream device, SEL 451 using DNP communication (TCP,UDP Transfer Protocol)

## RTAC to Protective Relay Communication:

### Relay IP Table:

SEL 451	192.168.1.24
SEL 411L	192.168.1.25
SEL 311L	192.168.1.26
SEL 487E	192.168.1.28
SEL 421	192.168.1.29

1. You're a substation engineer tasked with commissioning a Relay and an RTAC and verify the communication between devices.
2. Choose a Relay for your protection needs, from the Relay IP Table please note down the IP Address of your Relay.
3. Navigate to RTAC AcSELERator software window. In AcSELERator Software find the Insert tab from the Ribbons, Click on SEL drop down tab and find the 400/300 Series side scroll tab and find the appropriate relay you've chosen and click on DNP Protocol.
4. On the screen popup to choose the type of connection RTAC will make, find Client - Ethernet and click Insert.
5. Find the Settings tab in the Relay Client - Ethernet sub window. Here leave the settings defaults at Server IP Port at 20000 or change it to a number between 0-65534. Server DNP Address at 1, Client DNP Address at 1. Enter the IP address of the Relay from your notes from the Relay IP table.

6. Click on Go Online and upload your settings.

Communications			
Transport Protocol	TCP	TCP,UDP	Use TCP or UDP as the ethernet transport protocol.
Client IP Port	20002	23,1024-65534	Local RTAC IP port for this DNP client session.
Client UDP Broadcast Port	20002	1-65534	Remote UDP port to which this DNP client transmits UDP broadcast messages.
Server IP Address	192.168.1.29	Valid IPv4 Addr...	IP address of the remote DNP server connection.
Server IP Port	20002	23,1024-65534	IP port of the remote DNP server connection.
Date-Time			
UTC Offset	0	-720 to 840 (mi...	Local Time offset from Universal Time
DST Enabled	False	True,False	Enable Daylight Savings Time
DNP			
Client DNP Address	1	0-65519	DNP source address. The local address of this RTAC client session. Addresses 65520-...
Server DNP Address	1	0-65519	DNP destination address. The address of the remote IED polled by this client session. ...
Integrity Poll Period	60000	0, 100-1000000...	Class 1,2,3,0 integrity poll period. Set to 0 to disable.
Class 1,2,3 Polling Period	5000	0, 100-1000000...	Class 1,2,3 Polling Period. Set to 0 to disable.
Poll Timeout	7000	100-65535 (milli...	Time allowed for attached DNP Server to respond to a poll. If time is exceeded, this D...
Number of Poll Retries	1	0-255	The number of poll retries before the connected DNP Server is considered offline.

7. On the Relay side of settings, Open SEL AcSELerator QuickSet software, and choose the relay from the Network Address book in Communications tab and Find the name and IP address of the relay you're connecting to.

8. Click on Parameters in the same Communications tab dropdown. In Connection Name, choose the Relay name from the Address book dropdown. The IP Address should automatically populate. Now click on OK. The software will automatically connect to the relay. Read the settings from the relay by clicking on File tab and Read button. After a few minutes your settings window will pop up.

9. Navigate to Port 5 Settings Tree > DNP Protocol Settings.

10. In this window, Enable DNP > Y, choose Yes in the tab to enable DNP3. Match the DNP Port Number from the RTAC port you've chosen. Enter the DNP Address as "1".

AcSELerator® QuickSet - [Settings Editor - 421DNP (SEL-421-1 007 v6.10.2.2)]

File Edit View Communications Tools Windows Help Language

Global  
Breaker Monitor  
Group 1  
Set 1  
Protection Logic 1  
Graphical Logic 1  
Group 2  
Group 3  
Group 4  
Group 5  
Group 6  
Automation Logic  
Outputs  
Front Panel  
Report  
Port F  
Port 1  
Port 2  
Port 3  
Port 5  
Host Names  
UCA  
DNP Protocol Settings  
DNP Custom Man...

### DNP Protocol Settings

ENDNP Enable DNP  
Y Select: Y, N

**DNP Protocol Settings**

DNPADDR DNP Address  
1 Range = 0 to 65519

DNPPNUM DNP Port Number for TCP and UDP  
20002 Range = 1 to 65534

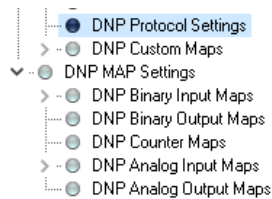
DNPMAP DNP Map Mode  
AUTO Select: AUTO, CUSTOM

ECLASSA Class for Analog Event Data  
2 Select: 0-3

ECLASSB Class for Binary Event Data  
1 Select: 0-3

ECLASSC Class for Counter Event Data

11. Now Navigate to DNP Master 1 section and enter the IP Address of the RTAC2 Port 1. Please make sure you match the port number in UDP Response Port Number for Master 1. Set the DNP Address for Master 1 to “1”.



A screenshot of the 'DNP Master 1' configuration window. It contains several fields for configuring Master 1:

- RPADR01 DNP Address for Master 1:** A text box containing '1' with a range of '0 to 65519'.
- DNP1P01 IP Address for Master 1 (www[h].xxx[h].yyy[h].zzz[h]):** A text box containing '192.168.1.14' with a range of 'ASCII string with a maximum length of 20'.
- DNPTR01 Transport Protocol for Master 1:** A dropdown menu set to 'TCP' with a note 'Select: TCP, UDP'.
- DNPUP01 UDP Response Port Number for Master 1:** A text box containing '20002' with a range of '1 to 65534, REQ'.
- UNSL01 Enable Unsolicited Reporting for Master 1:** A dropdown menu set to 'Y' with a note 'Select: Y, N'.

12. Click on File and click Send button to send your settings. Press OK and wait until the relay is online. This may disconnect the relay, but you can connect to it again.

13. Navigate to the Controller section of your RTAC Relay Client – Ethernet Window and verify the communication by checking Offline logic bit if it is FALSE and the data counters are incrementing.

14. Repeat step ‘11’, this time choose UDP for the Transport Protocol, send the configuration back to the relay and change transport protocol in the AcSELeRator RTAC software to UDP as well .

## Report

1. Write a brief description of the process of commissioning the new IED into the existing system.
2. You’ve successfully commissioned a relay and established communication. Please take a snip of the controller to submit your report.
3. Compare and analyze the observations made when using the two transport protocols, comment based on what you learnt in class and the observations you made when using the two transport protocols.

**Note:** The IP address of the specific RTAC you are using should be entered in DNP1P01 IP address for Master 1, in this case our RTAC(master 1) IP address is 192.168.1.2