

RTAC Steup at the Machine Learning for Power System Lab

Arizona State University

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1. Objective

The objective of this system is to learn real time operating system based deterministic and uninterrupted automation for all critical applications.

2. Introduction

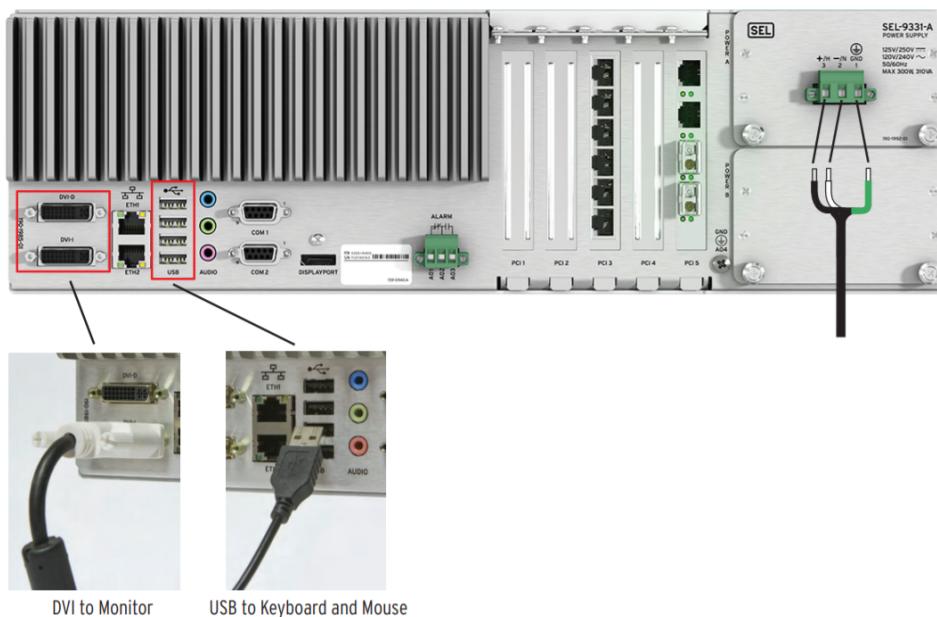
The RTAC features secure communication, advanced data concentration, high-speed logic processing, flexible engineering access, and protocol conversion capabilities between multiple built-in client/server protocols.

3. Software Required

SEL Acselerator Quickset, SEL Acselerator RTAC

4. Installation

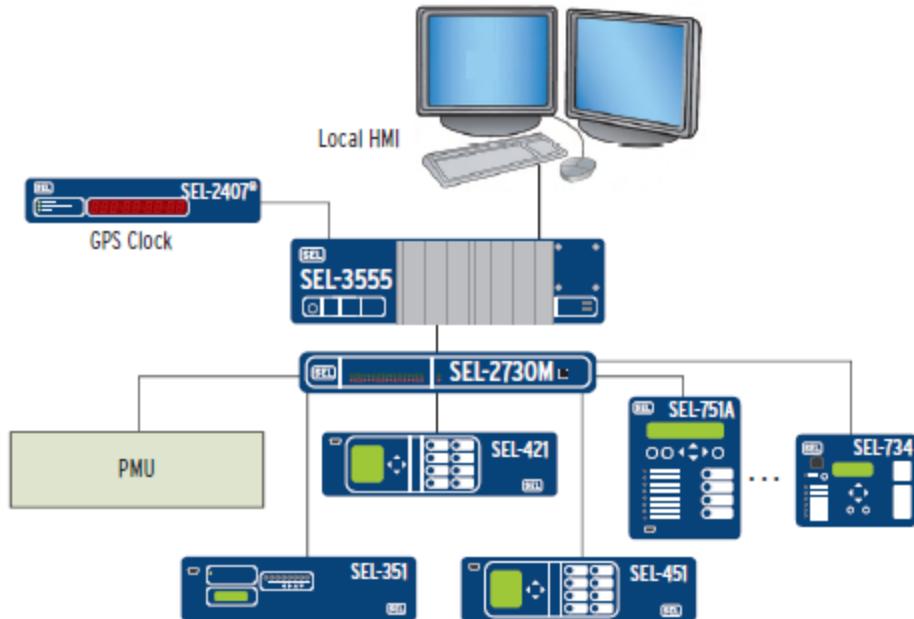
- The first steps in applying the SEL-3555 Real-Time Automation Controller (RTAC) are installing and connecting the device.



- Install the SEL Acselerator RTAC software.



- Establish ethernet connections



5. Ethernet Port Configuration

Use the Ethernet port on the SEL-3555 to connect to the RTAC web interface and to send project configurations to the unit by using ACSELERATOR RTAC software. Web configuration settings are covered in the SEL-5033 ACSELERATOR RTAC Instruction Manual.

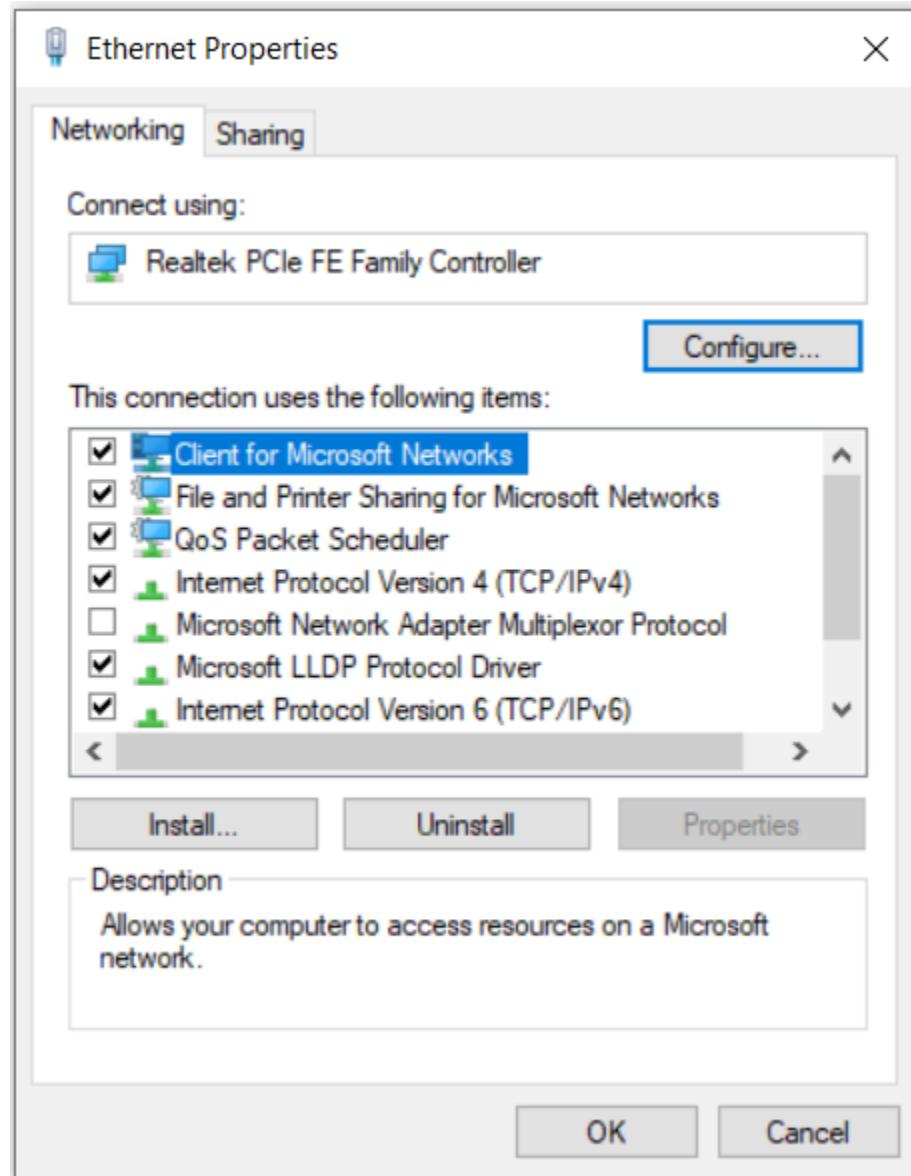
<https://selinc.com/products/3555/>

All Ethernet ports may be used at the same time and have unique SEL-programmed MAC addresses

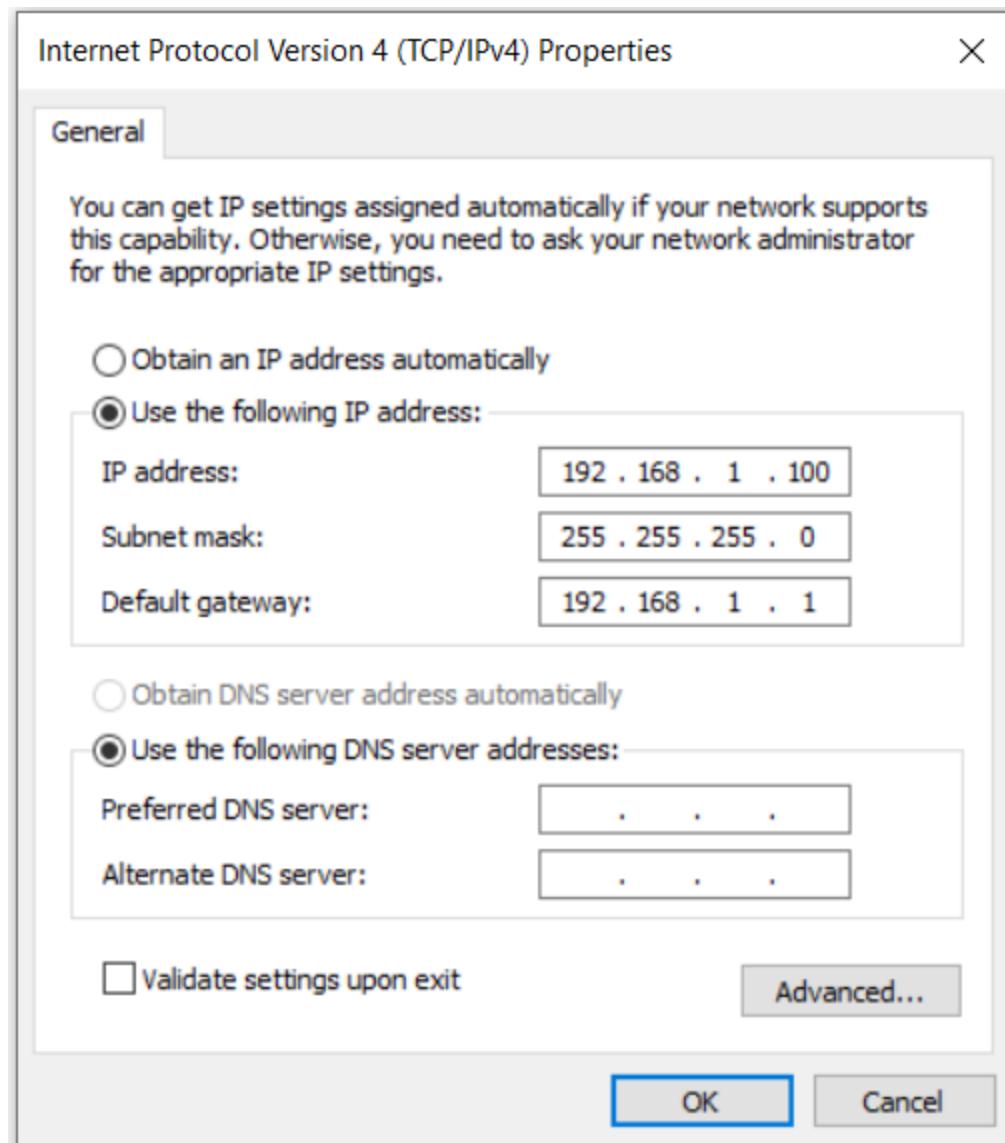
► ETH 1: 192.168.1.2

► ETH 2: 192.168.2.2

In order to configure the RTAC's ethernet settings the following changes need to be done to the user's laptop/desktop. Go to Control Panel > Network and Sharing > Change Adapter Settings > Ethernet Properties.

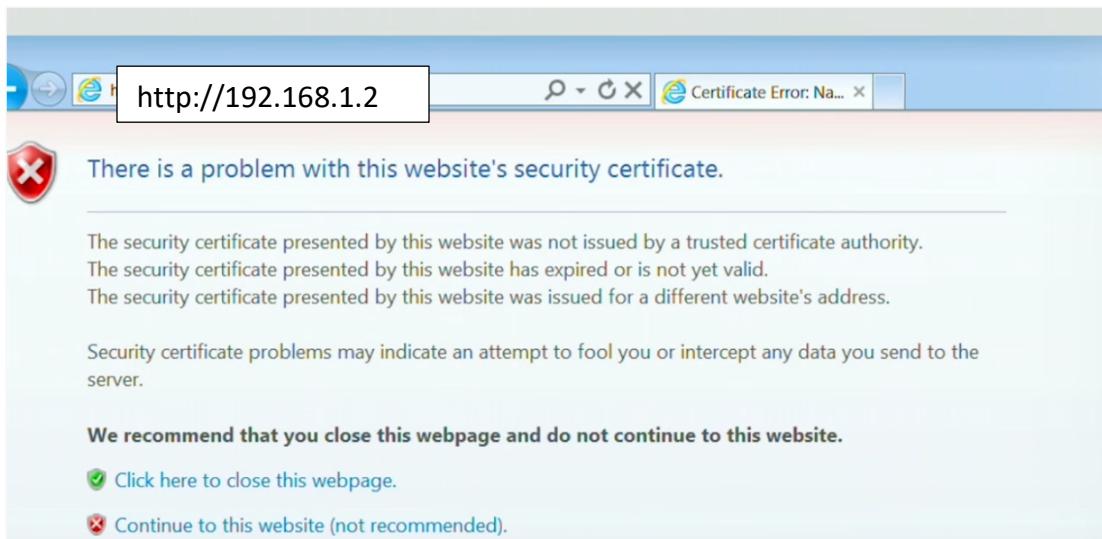


Then double click on Internet Protocol Version 4 (TCP/IPv4)

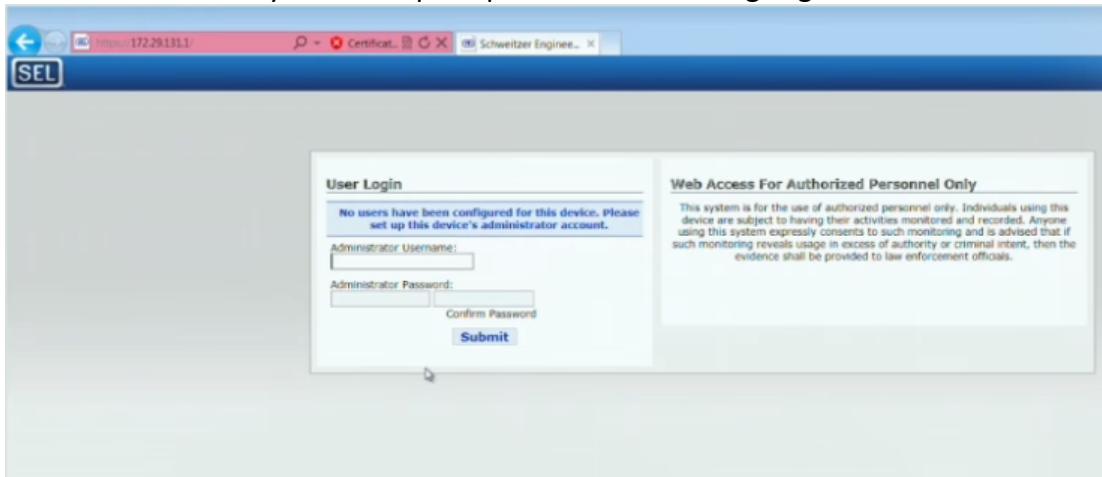


Make sure that the IP address, Subnet mask and Default gateway are set to the values shown above.

6. Web Interface



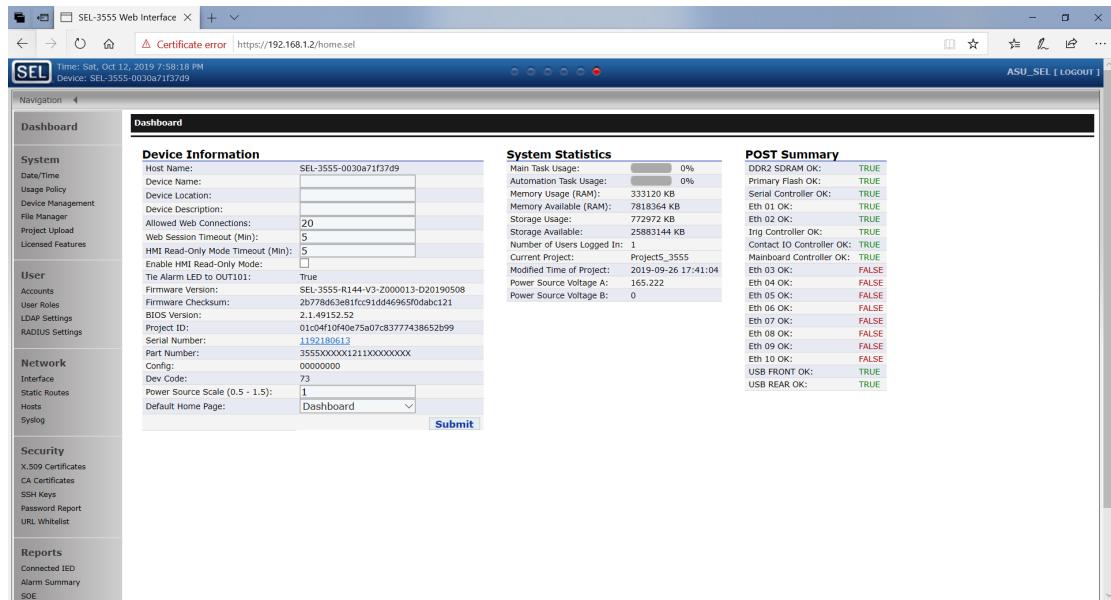
Select continue and you will be prompted to the following Login Screen.



Username: ASU_SEL

Password: Asu12345@

RTAC's web interface is where you configure usernames and passwords, you can configure the Ethernet addresses and a lot of other information



The screenshot shows the SEL-3555 Web Interface dashboard. On the left, a sidebar lists various system management options like Date/Time, Usage Policy, Device Management, File Manager, Project Upload, and Licensed Features. The main area is divided into three sections: Device Information, System Statistics, and POST Summary.

Device Information:

- Host IP: 192.168.1.2
- Device Name: SEL-3555-0030a71f37d9
- Device Location: (empty input field)
- Device Description: (empty input field)
- Allowed Web Connections: 20
- Web Session Timeout (Min): 5
- HMI Read-Only Mode Timeout (Min): 5
- Enable HMI Read-Only Mode:
- Tie Alarm LED to OUT101: True
- Firmware Version: SEL-3555-R144-V3-2000013-D20190508
- Firmware Checksum: 2b778d63ebffcc91dd44696f0dabcf121
- BIOS Version: 2.1.49152.2.52
- Project ID: 0104f10f40e75907c8377743d865b99
- Serial Number: 1192180613
- Power Source Scale (0.5 - 1.5): 1
- Default Home Page: Dashboard

System Statistics:

- Main Task Usage: 0%
- Automation Task Usage: 0%
- Memory Usage (RAM): 333120 KB
- Memory Available (RAM): 7818364 KB
- Storage Usage: 772972 KB
- Storage Available: 25883144 KB
- Number of Users Logged In: 1
- Current Project: Project5_3555
- Modified Time of Project: 2019-09-26 17:41:04
- Power Source Voltage A: 165.222
- Power Source Voltage B: 0

POST Summary:

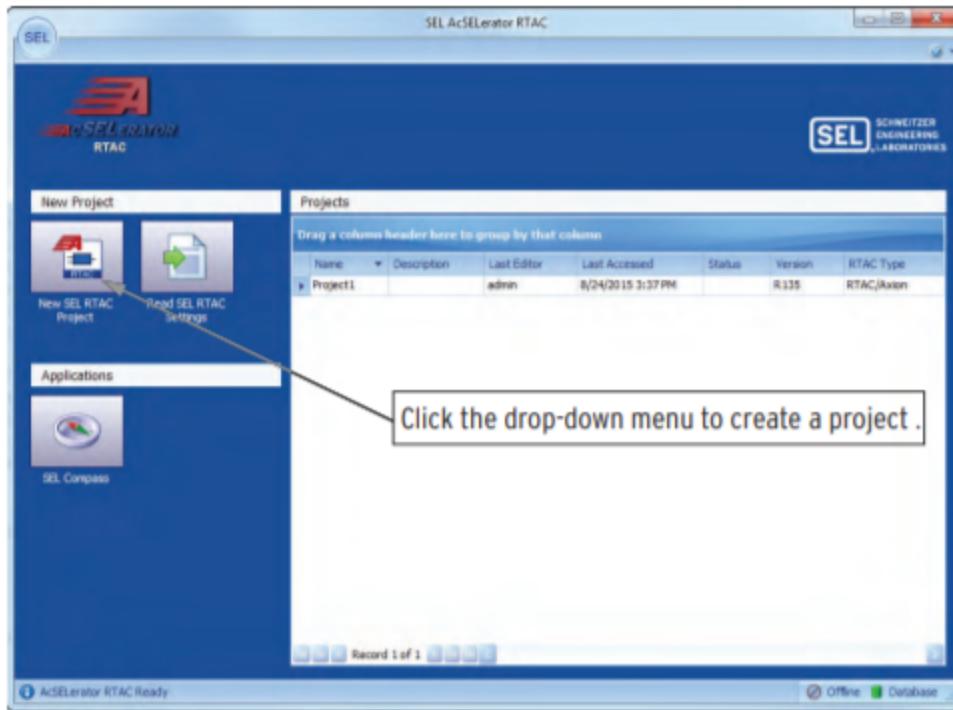
- D0R2-SDRAM OK: TRUE
- Primary Flash OK: TRUE
- Serial Controller OK: TRUE
- Eth 01 OK: TRUE
- Eth 02 OK: TRUE
- Irig Controller OK: TRUE
- Contact IO Controller OK: TRUE
- Mainboard Controller OK: TRUE
- Eth 03 OK: FALSE
- Eth 04 OK: FALSE
- Eth 05 OK: FALSE
- Eth 06 OK: FALSE
- Eth 07 OK: FALSE
- Eth 08 OK: FALSE
- Eth 09 OK: FALSE
- Eth 10 OK: FALSE
- USB FRONT OK: TRUE
- USB REAR OK: TRUE

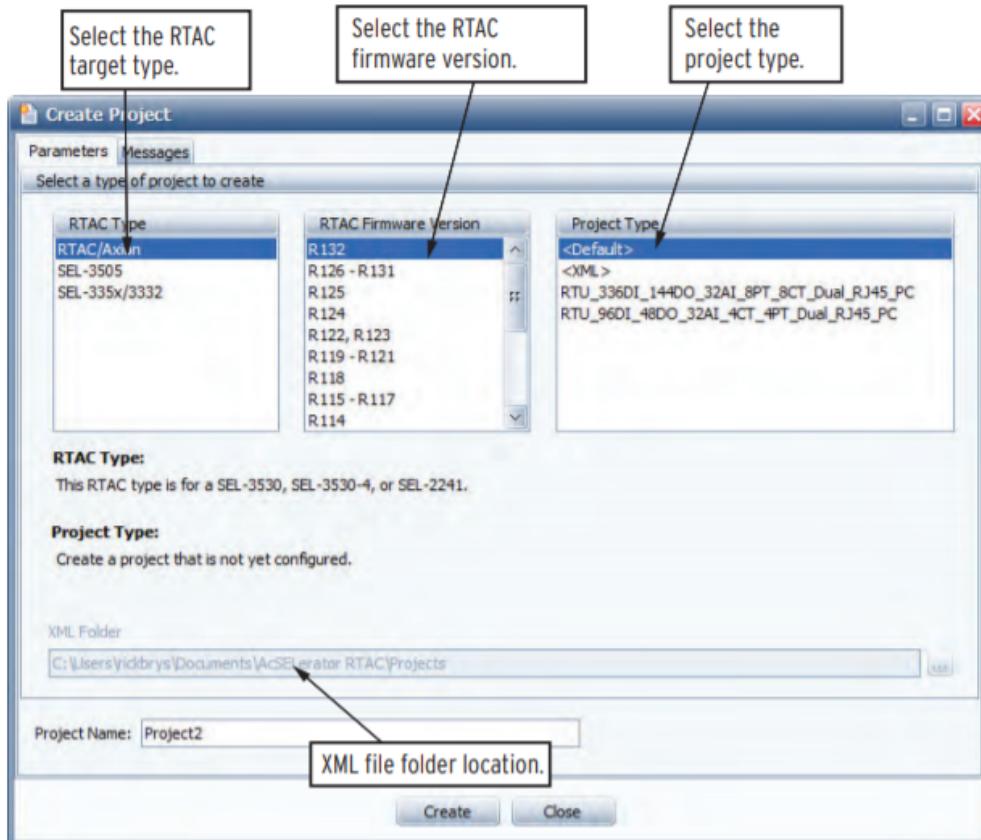
7. SEL Acselerator RTAC

- Open the SEL Acselerator RTAC software. Initially, two user accounts exist for the default database. One user account has a username of admin and a password of TAIL. The second user account has a username of engineer and a password of OTTER.



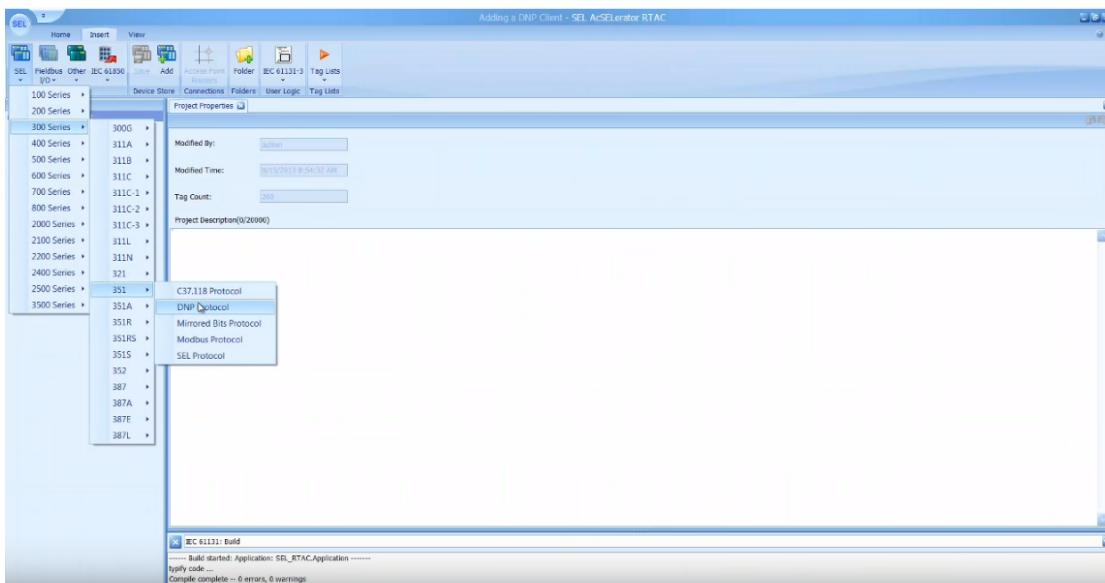
Use the start page that appears after you log in to the Acselerator RTAC database to view existing projects or create new ones.



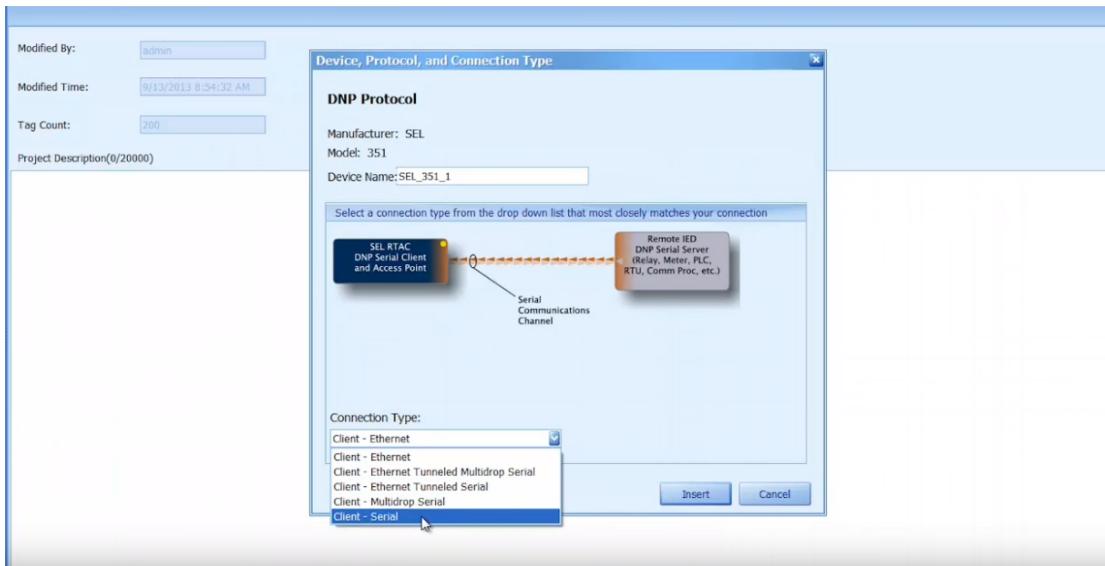


In our experiment the RTAC is SEL 3555. Choose the latest firmware version and let the project type be default.

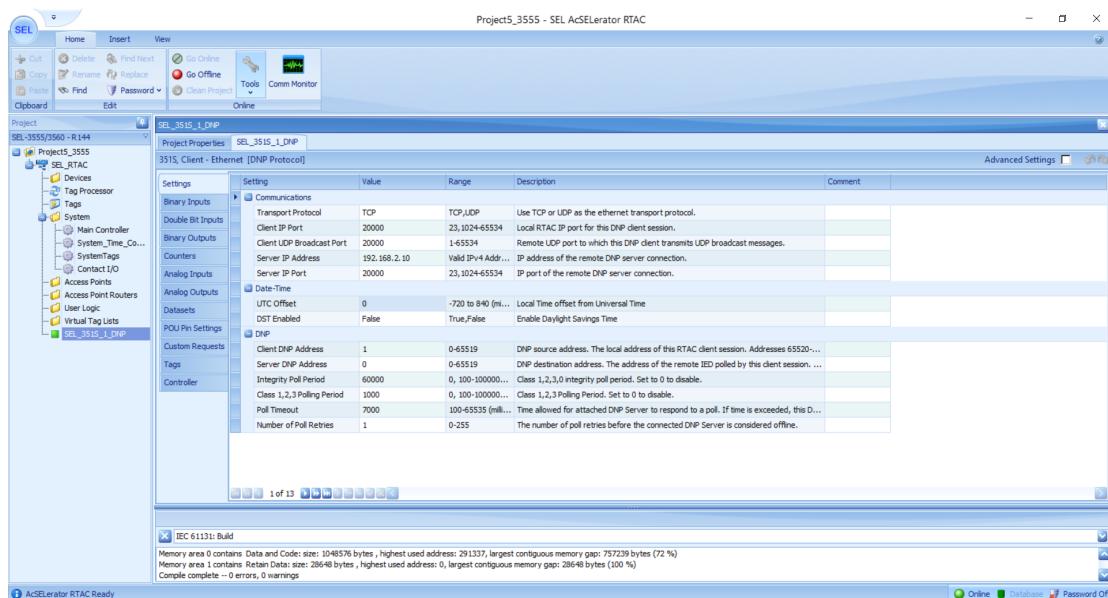
The first thing you do in the project is add SEL 351/ 351S relay under the SEL devices tab as shown below. There are a number of protocols available. We select the DNP protocol.



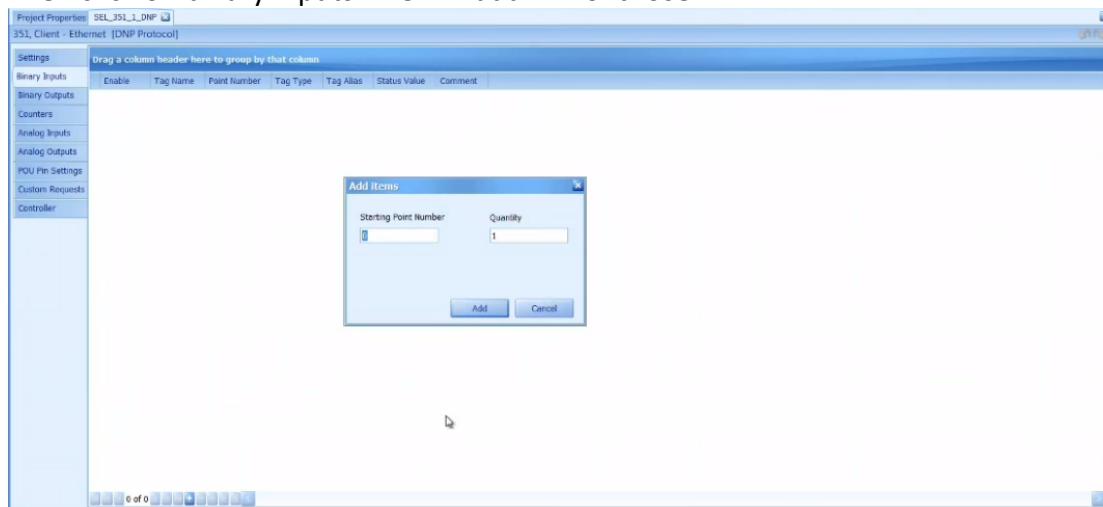
Select the client-server mode of connection as we have a connection via RS232 cable as shown below



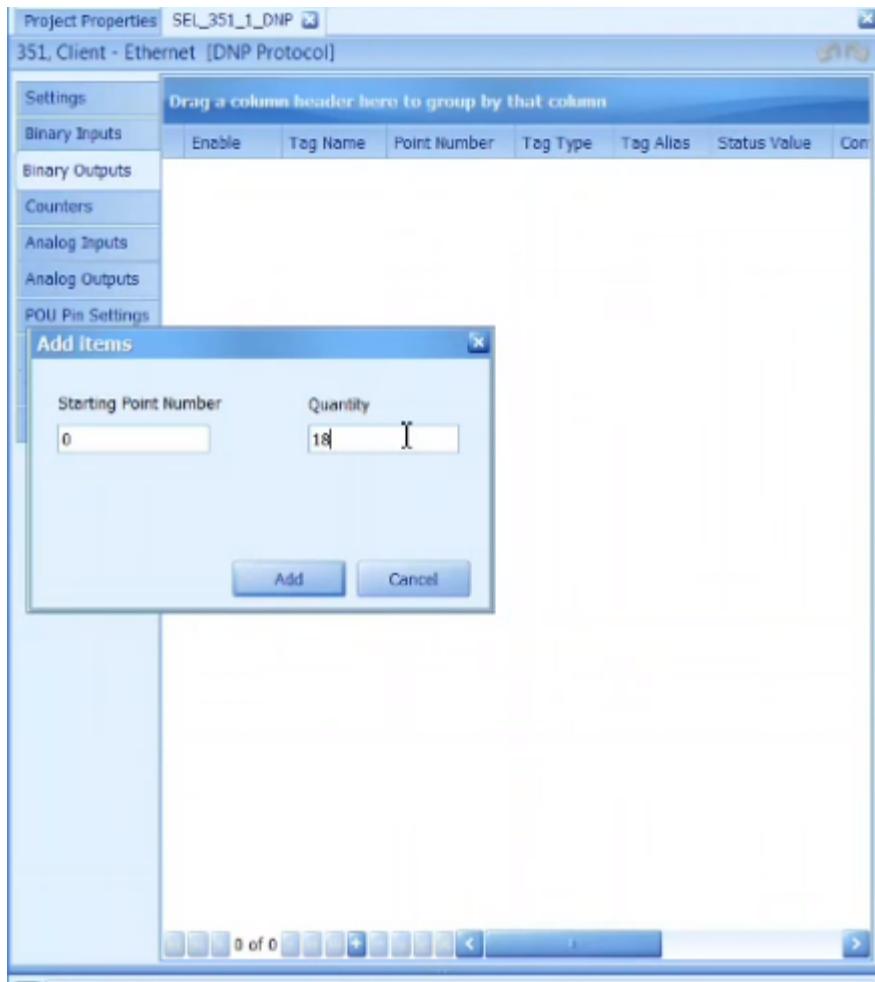
Once the 351S is added double click on the same and configure the IP address, transport method and polling period. Set the parameters to the values shown below.



Then click on binary inputs. We will add 24v of those.

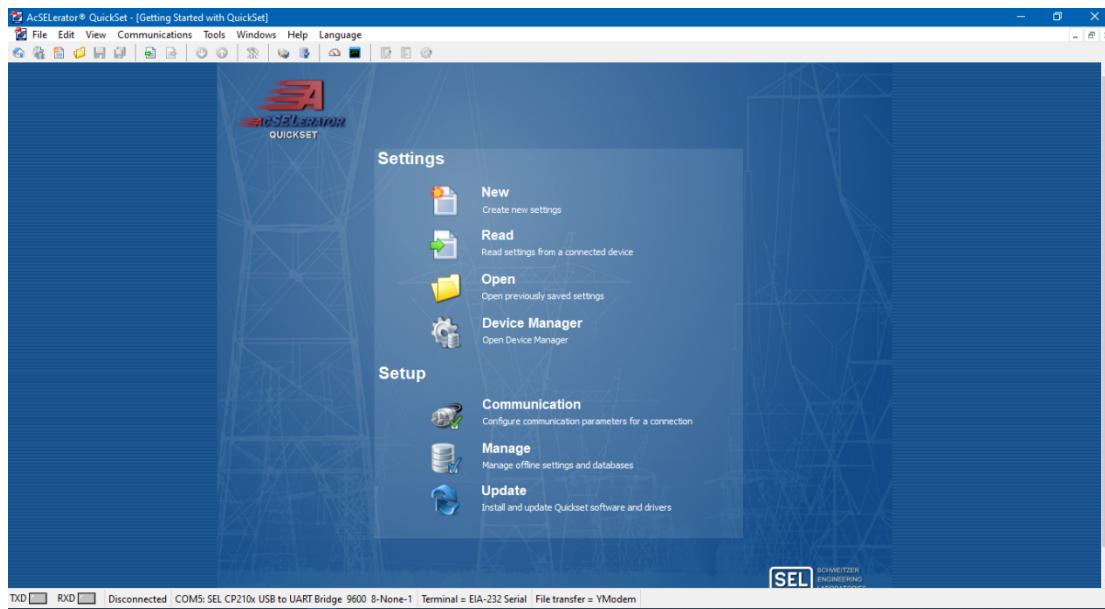


Similarly, we add 18 binary outputs.

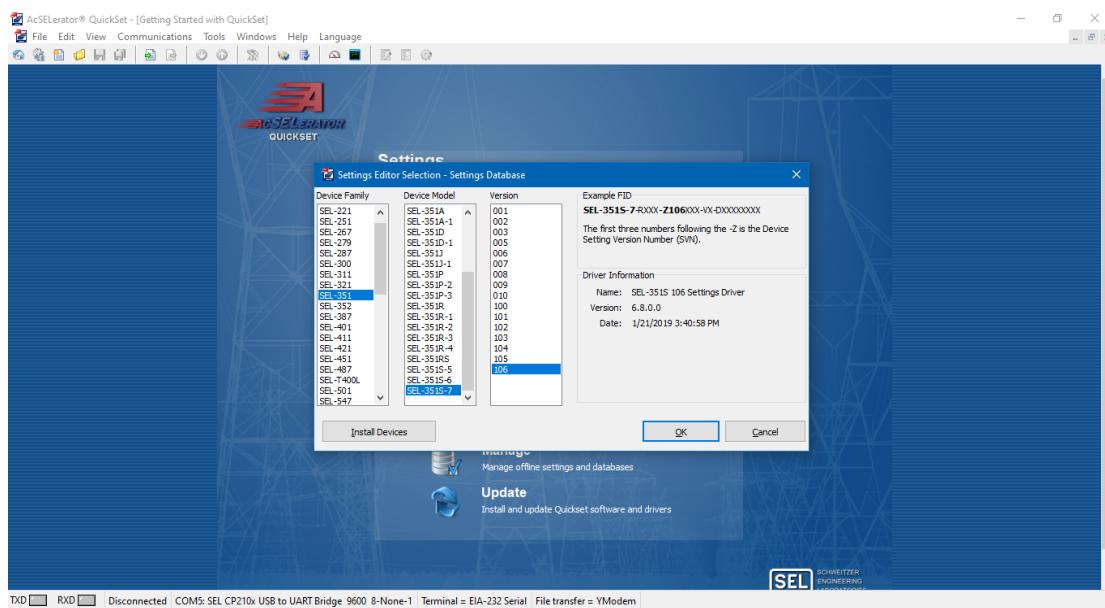


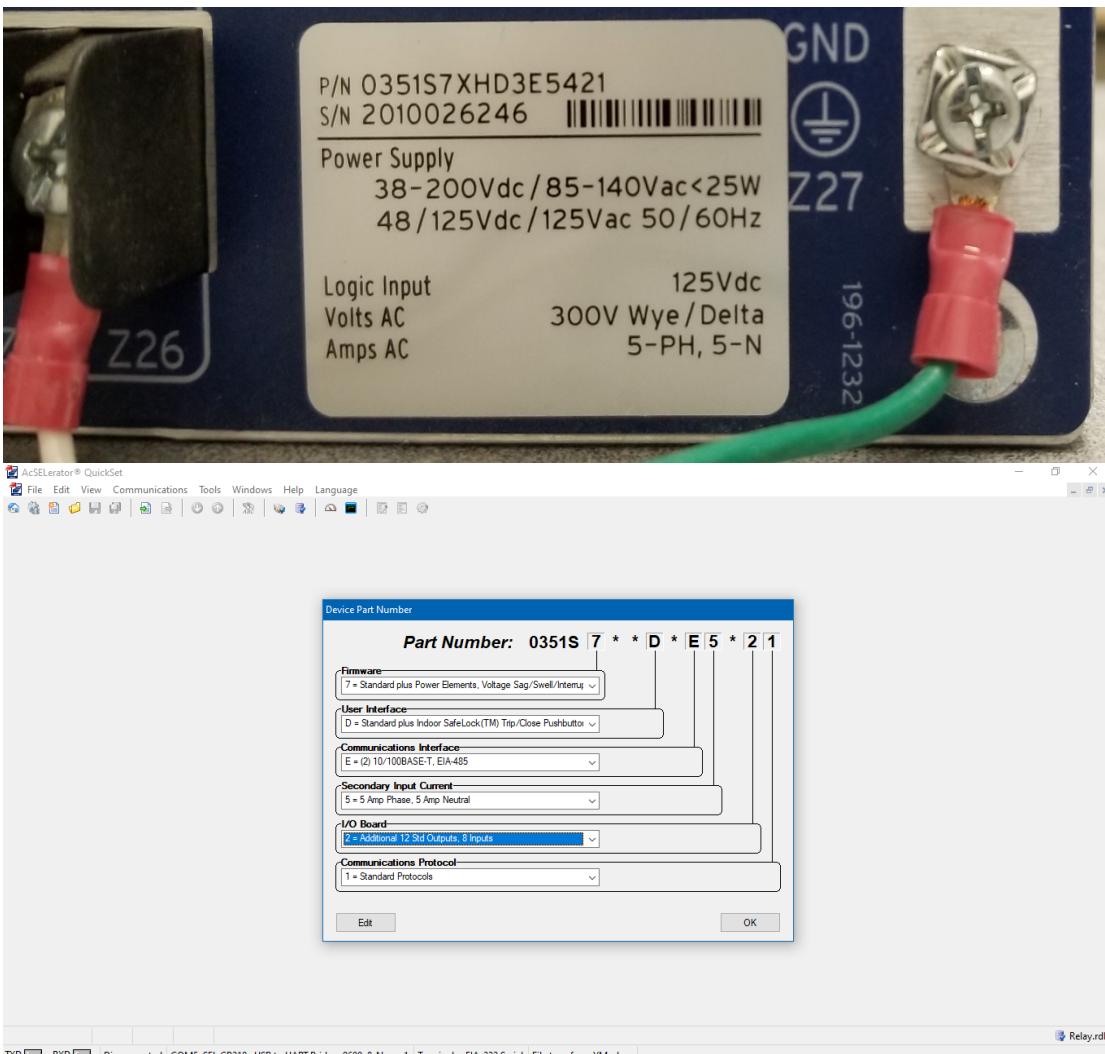
Likewise, add 40 analog inputs. This marks the end of configuration process for RTAC.

8. Configuration of 351S using Acselerator Quickset
 1. Install and Open SEL AcSElerator QuickSet.



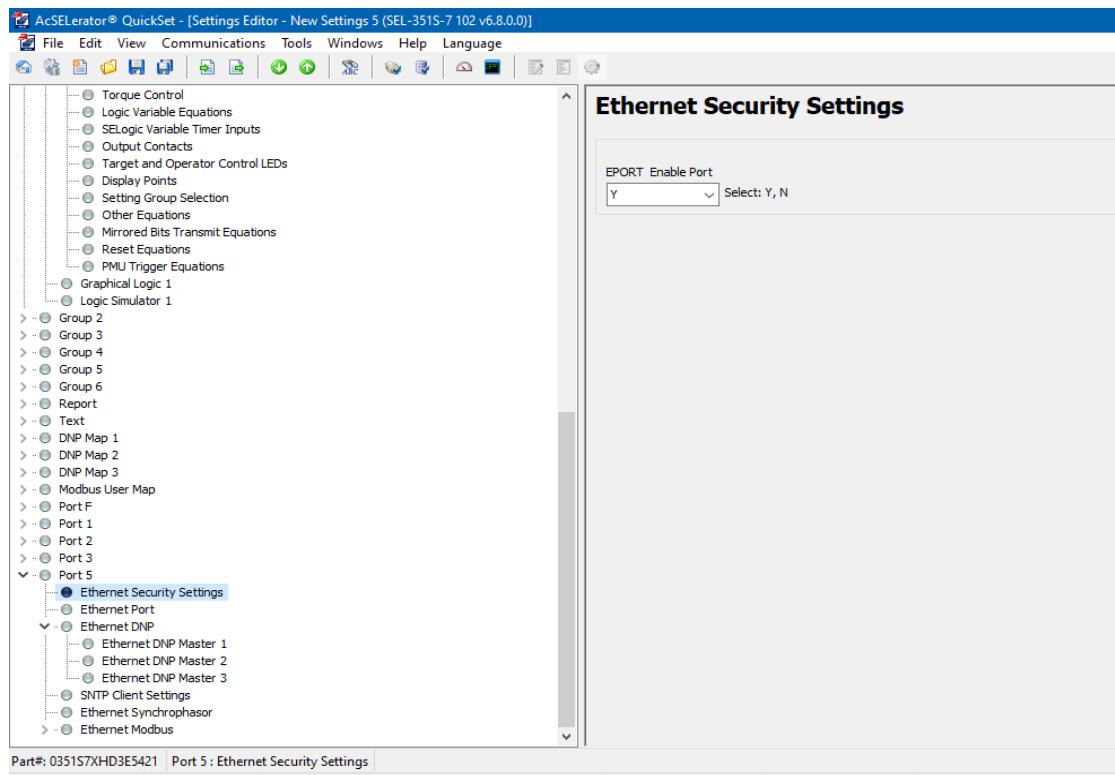
2. Create new Project and Select Device family, model, and version from device Part No (P/N).





4. Define varoius settings under Port 5 as per following.

- Ethernet Security Setting



- **Ethernet Port Settings**

Ethernet Port Settings

IPADDR IP Address (www[h].xxx[h].yyy[h].zzz[h]) 192.168.2.10	Range = ASCII string with a maximum length of 19.
SUBNETM Subnet Mask (www[h].xxx[h].yyy[h].zzz[h]) 255.255.255.0	Range = ASCII string with a maximum length of 19.
DEFRTR Default Router (www[h].xxx[h].yyy[h].zzz[h]) 192.168.2.1	Range = ASCII string with a maximum length of 19.
ETCPKA Enable TCP Keep-Alive Y	Select: Y, N
KAIDLE TCP Keep-Alive Idle Range (seconds) 10	Range = 1 to 20
KAINTRV TCP Keep-Alive Interval Range (seconds) 10	Range = 1 to 20
KACNT TCP Keep-Alive Count Range 5	Range = 1 to 20
NETMODE Operating Mode FAILOVER	Select: FIXED, FAILOVER, SWITCHED
FTIME Failover Time-out (seconds) 1.00	Range = 0.10 to 65.00
NETPORT Primary Net Port A	Select: A, B
NET5SPD Port 5 Speed (Mbps) Auto	Select: Auto, 10, 100

- **Ethernet Port Settings**



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NET5ASPd Port 5A Speed (Mbps)	<input type="text" value="Auto"/> Select: Auto, 10, 100
NET5BSPD Port 5B Speed (Mbps)	<input type="text" value="Auto"/> Select: Auto, 10, 100
ETELNET Enable Telnet	<input type="text" value="Y"/> Select: Y, N
MAXACC Maximum Access Level	<input type="text" value="2"/> Select: 1, B, 2
TPORT Telnet Port	<input type="text" value="23"/> Range = 1025 to 65534, 23
TIDLE Telnet Port Time-out (minutes)	<input type="text" value="15"/> Range = 1 to 30
AUTO Send Auto Messages to Port	<input type="text" value="N"/> Select: Y, N
FASTOP Fast Operate Enable	<input type="text" value="Y"/> Select: Y, N
EFTPSERV Enable FTP	<input type="text" value="N"/> Select: Y, N
FTPUSER FTP User Name (20 characters)	<input type="text" value="FTPUSER"/>
FTPCBAN FTP Connect Banner (64 characters)	<input type="text" value="FTP SERVER"/>
FTPIDLE Idle Timeout (minutes)	<input type="text" value="5"/> Range = 5 to 255
EHTTP Enable HTTP Server	<input type="text" value="N"/> Select: Y, N
HTTPPORT TCP/IP Port	<input type="text" value="80"/> Range = 1 to 65535
HTTPIDLE HTTP Web Server Timeout (minutes)	<input type="text" value="10"/> Range = 1 to 30
E61850 Enable IEC 61850 Protocol	<input type="text" value="N"/> Select: Y, N
EGSE Enable IEC 61850 GSE	<input type="text" value="N"/> Select: Y, N

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- Ethernet DNP Settings

Ethernet DNP Settings

EDNP Enable DNP Sessions	<input type="text" value="1"/> Select: 0-3
DNPNUM DNP TCP and UDP Port	<input type="text" value="20000"/> Range = 1 to 65534
DNPADDR DNP Address	<input type="text" value="0"/> Range = 0 to 65519

- Ethernet DNP Master 1

Ethernet DNP Master 1 Settings

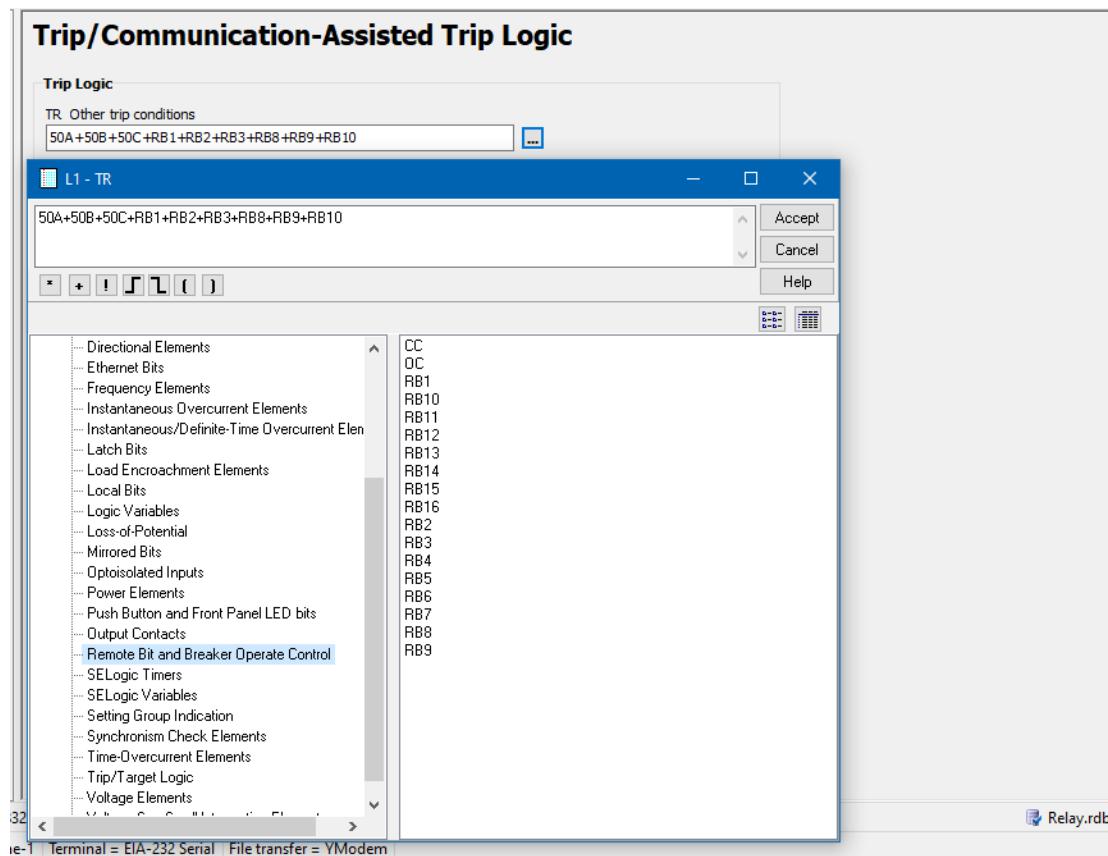
DNPIP1 IP Address (www[h].xxx[h].yyy[h].zzz[h])	<input type="text" value="192.168.2.2"/> Range = ASCII string with a maximum length of 19.
DNPTR1 Transport Protocol	<input type="text" value="TCP"/> Select: UDP, TCP
DNPUDP1 UDP Response Port	<input type="text" value="20000"/> Range = 1 to 65534, REQ
REPADDR1 DNP Address to Report to	<input type="text" value="1"/> Range = 0 to 65519
DNPMAP1 DNP Session Map	<input type="text" value="1"/> Select: 1-3
DVARAI1 Analog Input Default Variation	<input type="text" value="4"/> Select: 1-6
ECLASSB1 Class for Binary Event Data	<input type="text" value="1"/> Select: 0-3
ECLASSC1 Class for Counter Event Data	<input type="text" value="0"/> Select: 0-3
ECLASSA1 Class for Analog Event Data	<input type="text" value="2"/> Select: 0-3
DECPLA1 Currents Scaling Decimal Places	<input type="text" value="1"/> Select: 0-3
DECPLV1 Voltages Scaling Decimal Places	<input type="text" value="1"/> Select: 0-3

DECPLM1 Misc Data Scaling Decimal Places <input type="text" value="1"/> Select: 0-3
ANADBA1 Amps Reporting Deadband Counts <input type="text" value="100"/> Range = 0 to 32767
ANADBV1 Volts Reporting Deadband Counts <input type="text" value="100"/> Range = 0 to 32767
ANADBM1 Misc Data Reporting Deadband Counts <input type="text" value="100"/> Range = 0 to 32767
TIMERQ1 Minutes for Request Interval <input type="text" value="1"/> Range = 1 to 32767, I, M
STIMEO1 Seconds to Select/Operate Time-out <input type="text" value="5.0"/> Range = 0.0 to 30.0
DNPINA1 Seconds to Send Data Link Heartbeat <input type="text" value="120"/> Range = 0 to 7200
ETIMEO1 Event Message Confirm Time-out (seconds) <input type="text" value="5"/> Range = 1 to 50
UNSOL1 Enable Unsolicited Reporting <input type="text" value="N"/> Select: Y, N
PUNSOL1 Enable Unsolicited Reporting at Power-Up <input type="text" value="N"/> Select: Y, N
NUM1EVE1 Number of Class 1 Events to Transmit On <input type="text" value="10"/> Range = 1 to 200
AGE1EVE1 Oldest Class 1 Event to Tx On (seconds) <input type="text" value="2.0"/> Range = 0.0 to 99999.0
URETRY1 Unsolicited Message Max Retry Attempts <input type="text" value="3"/> Range = 2 to 10
UTIMEO1 Unsolicited Message Offline Time-out (seconds) <input type="text" value="60"/> Range = 1 to 5000

5. Set Trip/Communication-Assisted Trip logic. (Remote Bit from RTAC)

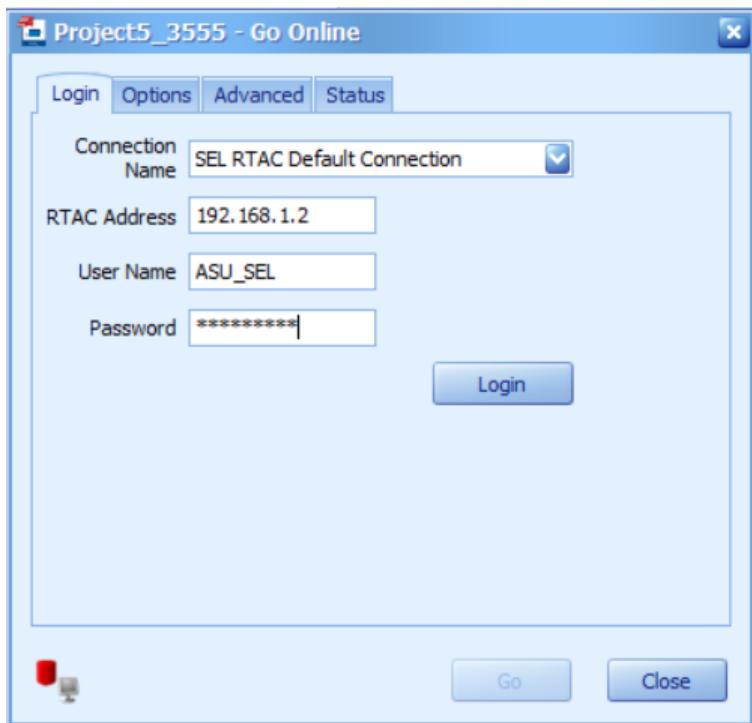
Grpup 1 > Logic 1> Trip/Communication-Assisted Trip Logic

Trip/Communication-Assisted Trip Logic	
Trip Logic	
TR_ Other trip conditions	<input type="text" value="50A+50B+50C+RB1+RB2+RB3+RB8+RB9+RB10"/>
TRCOMM Communications-assisted trip conditions	<input type="text" value="RB1+RB2+RB3+RB8+RB9+RB10"/>
TRSOTF Switch-onto-fault trip conditions	<input type="text" value="0"/>
DTT Direct transfer trip conditions	<input type="text" value="0"/>
ULTR Unlatch trip conditions	<input type="text" value="I(51P1+51G1)"/>

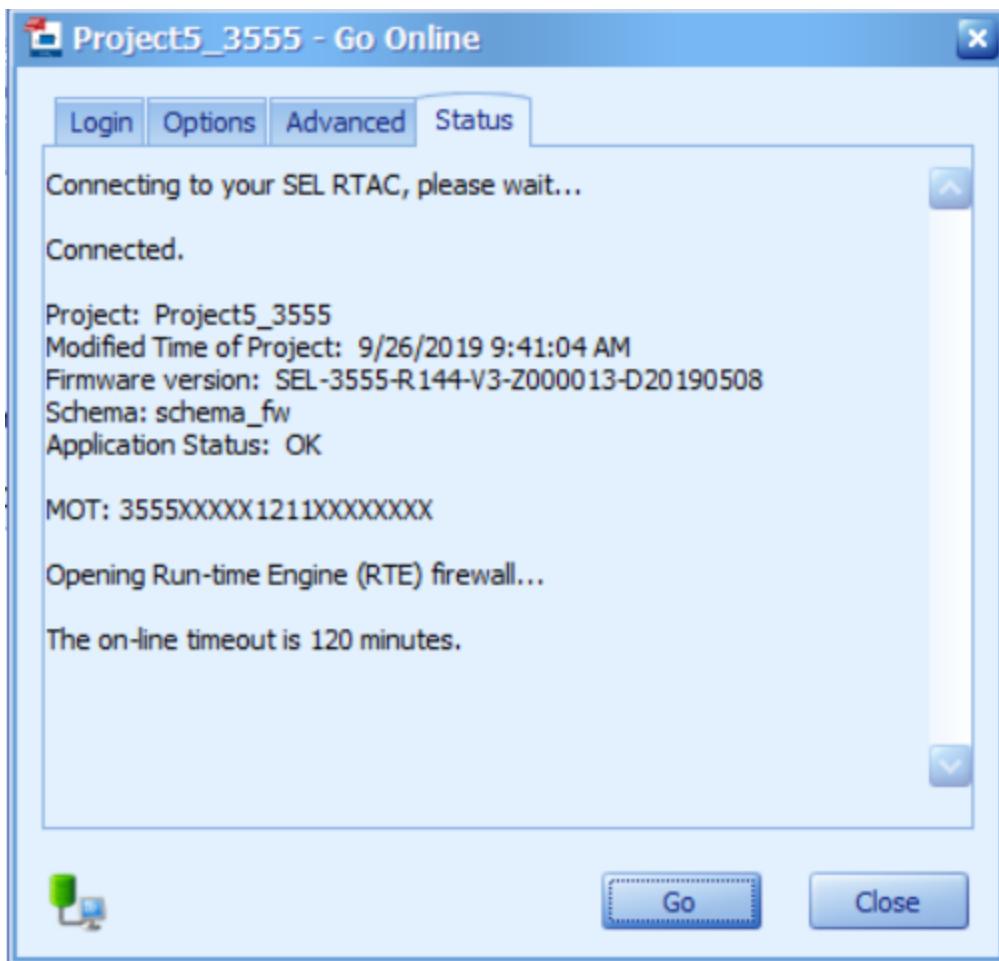


9. Open the Acselerator RTAC

1. Click the Go-online button and enter the ID and password



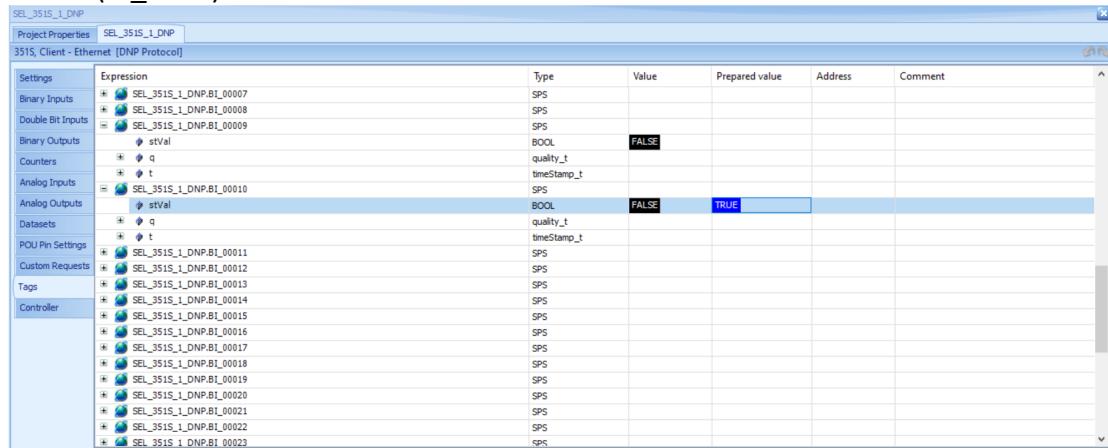
After this hit the Go button.



Click on the controller tab and expand the SEL_351S_1_DNP_POU. Make sure to verify that the offline button is 'FALSE' which implies that the RTAC is successfully communicating with SEL 351S as shown below



In order to issue a trip signal to the relay from the RTAC click on the Tags tab on the left. Ensure that the trip LED (BI_009) is false. The relay must be enabled to perform this action. So put the prepared value 'TRUE' by clicking on the prepared value column and pressing F6 in Enable(BI_0010).



We are going to send a trip signal. So, we need to put the prepared value True on the BO_000_RB1 as shown in the figure below.



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Expression	Type	Value	Prepared value	Address	Comment
SEL_351S_1_DNP.BI_00021	SPS				
SEL_351S_1_DNP.BI_00022	SPS				
SEL_351S_1_DNP.BI_00023	SPS				
SEL_351S_1_DNP.BO_00000	DNPc				
operPulse	operSPC				
cival	BOOL	FALSE	TRUE		
g	quality_t				
t	timeStamp_t				
pulseConfig	pulseConfig_t				
origin	originator_t				
operLatchOn	operSPC				
operLatchOff	operSPC				
operTrip	operSPC				
operClose	operSPC				
status	SPS				
SEL_351S_1_DNP.BO_00001	DNPc				
SEL_351S_1_DNP.BO_00002	DNPc				
SEL_351S_1_DNP.BO_00003	DNPc				
SEL_351S_1_DNP.BO_00004	DNPc				
SEL_351S_1_DNP.BO_00005	DNPc				
SEL_351S_1_DNP.BO_00006	DNPc				
SEL_351S_1_DNP.BO_00007	DNPc				
SEL_351S_1_DNP.BO_00008	DNPc				

After doing this the TRIP LED on the front panel of 351S should light up.

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