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Compiled by



**James Ranyane**

**Chief Technologist:  
Control and Automation  
Technology and Support**

Date: 11/05/2023

Approved by



**Mpumelelo Mathe**

**Manager:  
Control and Automation  
Technology & Support**

Date: 11/05/2023

Authorized by



**Nelson Luthuli**

**Senior Manager:  
PTM&C Engineering  
(Acting)**

Date: 15 May 2023

Supported by SCOT/SC



**Anita Oommen  
PASC Chairperson**

Date: 16 May 2023

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## 1. Introduction

The previous generation of EHV feeder schemes used Talus RTU's as a bay controller device. With the introduction of a newer generation of EHV feeder protection scheme (500 series and 670 series), it was necessary to change the old interface and use a different bay controller device, the ABB RTU560. There are two types of slightly different ABB RTU560 central processor units which are fully configurable as per user requirement, needs and application. They are the RTU560 CMU04 for the 500 series relay and the RTU560 CMU05 for the 670 series.

The two types of ABB RTU560 units allow for communication to the new generation of EHV scheme protection relays which offer two distinctive communication interface options, the serial interface (for the 500 series on RTU560 CMU04) and the Ethernet interface (for the 670 series on RTU560 CMU05).

The IST Talus RTU can only interface discretely to the protection device via hard wired contacts. The ABB RTU560 is however optimised for both the serial interface (CMU04) and the Ethernet interface (CMU05), as well as the ability to be interfaced via hard wired contacts (on both CMU04 and CMU05).

This standard is intended to outline the procedure to be followed when configuring and commissioning the ABB RTU560 (CMU04 and CMU05) for interfacing to the Eskom Transmission network.

This document is necessary for secondary plant when commissioning and configuring the ABB RTU560 (CMU04 and CMU05) Bay Processor.

## 2. Supporting clauses

### 2.1 Scope

RTU560 is a powerful device, and it is used in many different applications. The scope of this configuration and commissioning standard will be limited to the application of the ABB RTU560 as used in Eskom Transmission EHV protection schemes (500 and 670 series) and will cover both RTU560 CMU04 and RTU560 CMU05.

This standard covers all aspects of the ABB RTU560 Bay Processor in terms of specifying what checks/tests need to be carried out and what information is necessary when commissioning and configuring the ABB RTU560 (CMU04 and CMU05).

#### 2.1.1 Purpose

To ensure the correct configuring and commissioning of the ABB RTU560 (CMU04 and CMU05) bay processor in Transmission.

#### 2.1.2 Applicability

This standard applies to all personnel working on ABB RTU560 (CMU04 & CMU05) equipment in Transmission.

## 2.2 Normative/informative references

Parties using this document shall apply the most recent edition of the documents listed in the following paragraphs.

### 2.2.1 Normative

[1] ISO 9001, Quality Management Systems.

### 2.2.2 Informative

[2] ABB RTU560 connection and settings manual.

[3] ABB RTU560 data sheet.

[4] Any other relevant and available technology manuals

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## 2.3 Definitions

### 2.3.1 General

None

### 2.3.2 Disclosure classification

**Controlled disclosure:** controlled disclosure to external parties (either enforced by law, or discretionary).

## 2.4 Abbreviations

| Abbreviation | Description                              |
|--------------|--|
| BP           | Bay Processor                            |
| CMU          | Communication Unit                       |
| ABB          | ASEA Brown Boveri (Company name)         |
| RTU          | Remote Terminal Unit                     |
| CC           | Control Centre                           |
| RCC          | Regional Control Centre                  |
| NCC          | National Control Centre                  |
| OU           | Operational Unit                         |
| HMI          | Human Machine Interface                  |
| PC           | Personal Computer                        |
| BPIS         | Bay Processor Isolating Switch           |
| SIS          | Supervisory Isolating Switch             |
| SCADA        | Supervisory Control and Data Acquisition |
| WO           | Work Order(s)                            |
| IED          | Intelligent Electronic Device            |

## 2.5 Roles and responsibilities

All Transmission Secondary Plant Managers shall ensure that this standard is applied when configuring and commissioning the ABB RTU560 (CMU04 and CMU05) in Eskom Transmission.

## 2.6 Process for monitoring

Secondary plant managers and the grid supervisors shall monitor the compliance to this standard.

## 2.7 Related/supporting documents

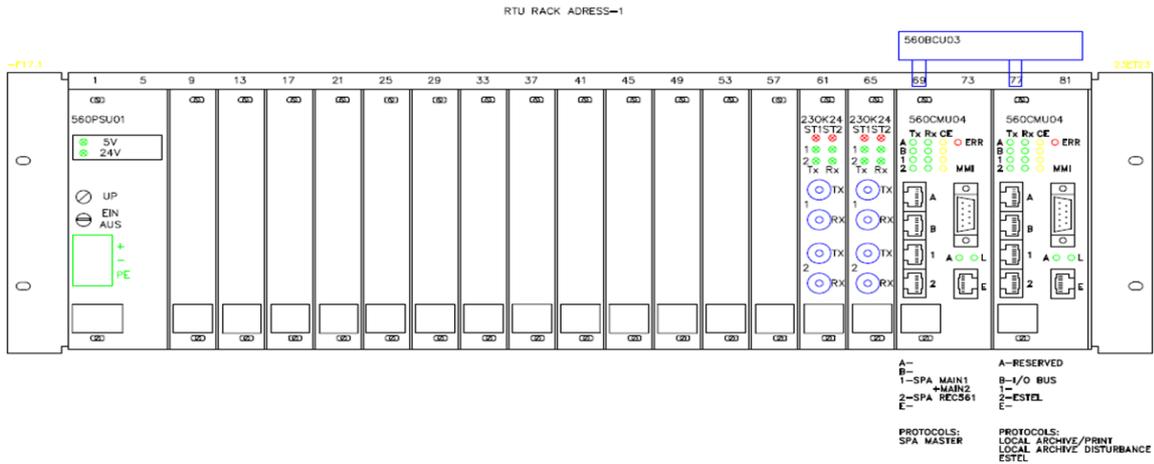
Not Applicable.

## 3. Identifying RTU560

### 3.1 Identifying CMU04 hardware

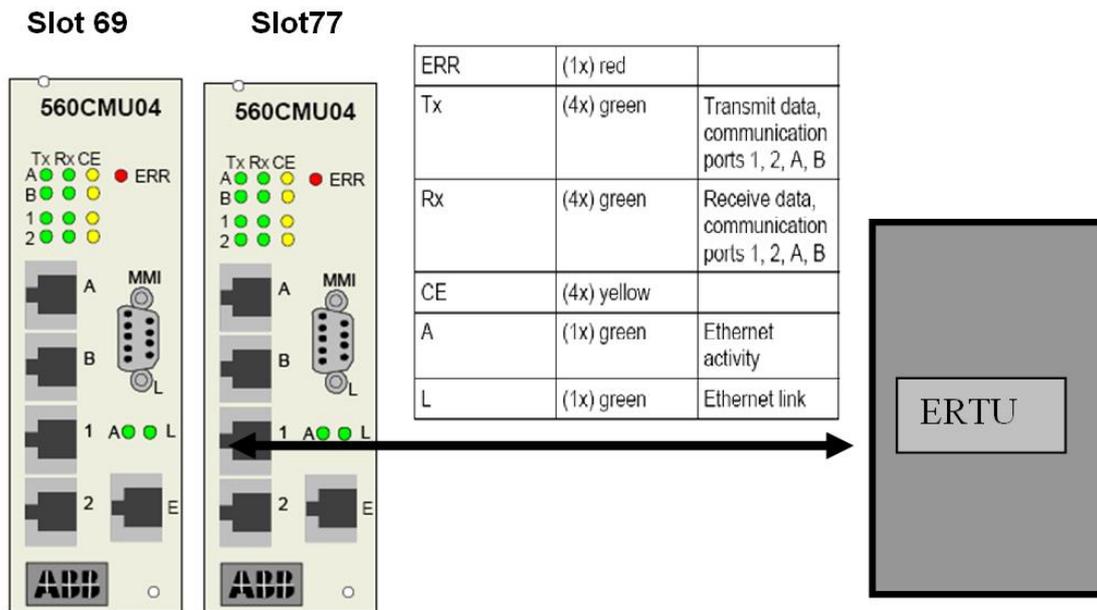
(Front view of the ABB560 CMU04)

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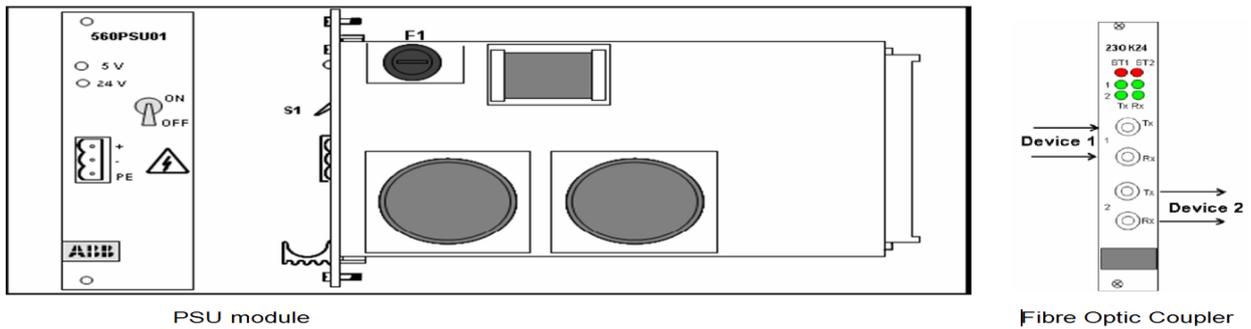


|         | MAIN1  | MAIN2  |
|---------|--------|--------|
| SFZ3100 | REL551 | REL531 |
| SFD3100 | REL551 | REL561 |
| SFC3100 | REL561 | REL561 |
| SFZ3200 | REL551 | REL531 |
| SFD3200 | REL551 | REL561 |
| SFC3200 | REL561 | REL561 |

(CMU arrangement and LED interpretation)

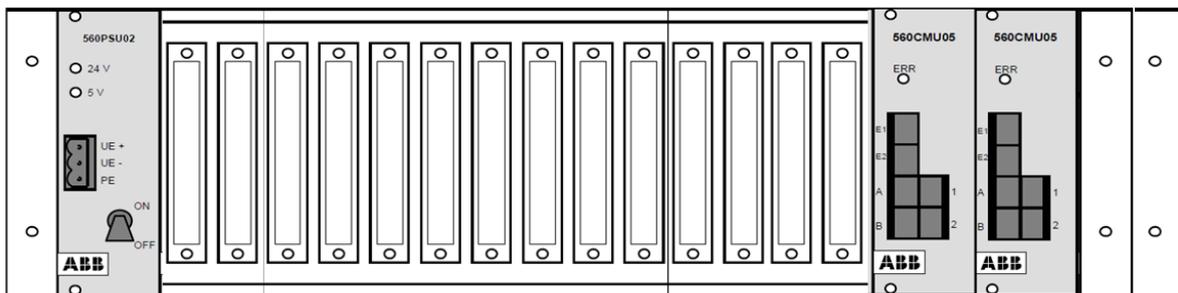


(PSU module and Fibre Optic Coupler)



### 3.2 Identifying CMU05 hardware

(Front view of the ABB RTU560 CMU05)



(CMU05 Specifications)



- 560CMU05 R0001 and R0002
  - Interfaces
    - 4 serial interfaces (RS232C or RS485)
    - 2 Ethernet ports (10/100BaseT) for communication to
      - Host systems and/or
      - Subordinated devices and/or
      - RTU I/O
  - CPU
    - AMD ELAN520 CPU @133MHz
    - 128 MB flash memory
    - 64 MB RAM
  - Web server for diagnosis and maintenance via Ethernet ports
  - PLC capable
  - Bit protocols (Hitachi, Conitel) are supported only by 560CMU05 R0002

## 4. About the ABB RTU560

### 4.1 About the ABB RTU560 CMU04

- The ABB RTU560 (CMU04) is used in the ABB EHV Phase-5 protection schemes. ABB RTU560 CMU04 uses RTUtil560\_7110.exe software as the configurator. The configuration template used in the ABB RTU560 CMU04 is selected based on the applicable standard Option(s). SVC and series capacitor bank are once off applications and will not be covered in this document, however, the general basic functionality is common to all RTU560 CMU04 setups.

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There are three standard EHV scheme configuration options, namely:

- Option-1
- Option-3
- Option-4

Option-1 is the one that is mostly used.

#### 4.1.1 Applicability of the three CMU04 standard options

##### Option-1: Standard scheme

There are six variations of Option-1 EHV Phase-5 protection schemes. All six variations use the same standard RTU560 configuration and database option; however, all the points that are not applicable to a particular scheme are indicated as not use in the database for the control centres. There are many alarms in the standard configuration (template) although each scheme only use alarms that are applicable to the particular scheme. The applicable alarms are indicated with an “x” on the Option-1 standard excel database spread sheet.

| Scheme Type | Protection Type   | Main1 Relay  | Main2 Relay  |
|-------------|---|--------------|--------------|
| 5FZ3100     | Impedance scheme with Transfer function                   | Impedance    | Impedance    |
| 5FD3100     | Current Diff & Impedance scheme with Transfer function    | Current Diff | Impedance    |
| 5FC3100     | Current Diff scheme with Transfer function                | Current Diff | Current Diff |
| 5FZ3200     | Impedance scheme with no Transfer function                | Impedance    | Impedance    |
| 5FD3200     | Current Diff & Impedance scheme with no Transfer function | Current Diff | Impedance    |
| 5FC3200     | Current Diff scheme with no Transfer function             | Current Diff | Current Diff |

##### Option-3: Power station scheme

Option 3 is similar to option 1 from the scheme and database perspective. The main difference between option 3 and option 1 is that; option 3 has additional I/O modules/cards for interfacing to the power station control desk/mimic board. Option 3 has a different RTU560 standard configuration but has the same database for control centres and same Unicon for ERTU or D400 Client Map template.

| Scheme Type | Protection Type   | Main1 Relay  | Main2 Relay  | I/O Module/Scheme       |
|-------------|---|--------------|--------------|-------------------------|
| 5FZ3100     | Impedance scheme with Transfer function                   | Impedance    | Impedance    | 2xBinary Input cards    |
| 5FD3100     | Current Diff & Impedance scheme with Transfer function    | Current Diff | Impedance    |                         |
| 5FC3100     | Current Diff scheme with Transfer function                | Current Diff | Current Diff | 2xBinary Output cards   |
| 5FZ3200     | Impedance scheme with no Transfer function                | Impedance    | Impedance    |                         |
| 5FD3200     | Current Diff & Impedance scheme with no Transfer function | Current Diff | Impedance    | 2xAnalogue Output cards |
| 5FC3200     | Current Diff scheme with no Transfer function             | Current Diff | Current Diff |                         |

**Option-4: Power station scheme**

This scheme is used at the power stations for generator interface protection. It protects the power station power line between the generator and the substation busbar on the transformer primary side.

| Scheme Type | Protection Type                            | Main1 Relay | Main2 Relay | I/O Module          |
|-------------|--|-------------|-------------|---------------------|
| 5FZ3900     | Impedance scheme with no Transfer function | Impedance   | Impedance   | Digital Transducer. |

**4.2 About the ABB RTU560 CMU05**

The ABB RTU560 (CMU05) is used in the ABB EHV Phase-5 670 series relays protection schemes. ABB RTU560 CMU05 uses RTUtil560\_9920.exe software as the configurator. The type of the configuration used on CMU05 is based on the applicable scheme. Configuration on CMU05 come pre-loaded with the scheme.

**4.2.1 Applicability of the different CMU05 configuration(s)**

Option-1: Standard Scheme.

Standard scheme variations are similar to that of CMU04 option-1 except that the configuration in CMU05 come pre-loaded from the supplier, requiring only scheme/bay parameter adjustments (e.g. analogues, sync settings, communication addresses, etc). The other difference between the two CMUs is that interfacing with the RTU is only via the Ethernet connection, it has no serial interface.

Option-3: Power-Station module (with power-station control device)

Option-3 is also similar to Option-1 with the main difference being that it has the power-station control device which does not form part of the RTU560 configuration. The power-station control device is configured by the protection department.

**5. Requirements for communicating with the ABB RTU560**

**5.1 Hardware Requirements**

There are different communication options that may be used to communicate with the RTU560 BP. The LAN interface (For normal operation) and the Serial interface (for abnormal operation/system recovery on CMU04 units).

**5.1.1 CMU04 Hardware Requirements**

- Standard Eskom Issued Lap-top
- Standard ethernet cable
- Operating system: MS Windows XP or Windows 7 32-bit Professional
- Memory: 64 BM RAM
- Processor: Pentium class
- Hard disc: >200MB free disc space
- The dial-up modem interface cable is required for abnormal mode of operation

**5.1.2 CMU05 Hardware Requirements**

- Standard Eskom Issued Lap-top.
- Standard LAN cable.
- Operating system: MS Windows 7/10 64 bit

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- Memory: 64 BM RAM
- Processor: Pentium class
- Hard disc: >200MB free disc space

## **5.2 Software Requirements**

### **5.2.1 CMU04 Software Requirements**

- Standard Internet Explorer/Mozilla Firefox/Chrome web browser application(s).
- RTUtil560\_7110.exe

### **5.2.2 CMU05 Software Requirements**

- Standard Internet Explorer/Mozilla Firefox/Chrome web browsing application(s).
- RTUtil560\_9920.exe

## **6. Connecting to the ABB RTU560 Web browser via Ethernet**

Connection to the RTU560 is achieved via normal Web browser application such as Internet Explorer/ Chrome or Mozilla Firefox. (Firefox is recommended).

Communication to the ABB RTU560 Web browser for testing and/or configuration is accomplished via PPP Dial up connection (only for CMU04) or via Ethernet connection (this is a fast data rate transfer connection which is the recommended one). It must be noted that the Ethernet connection settings noted in this section of the document is common for both CMU04 and CMU05. Slot 66 will differ on the IP address one dials once connected.

Setting up the network connection to the ABB RTU560 for the Eskom Issued Laptop is common for both ABB RTU560 CMU04 and ABB RTU560 CMU05.

The default IP address on slot-77 is 192.168.1.77 and the default IP address on slot-69 is 192.168.1.69 on the default subnet mask of 255.255.255.0.

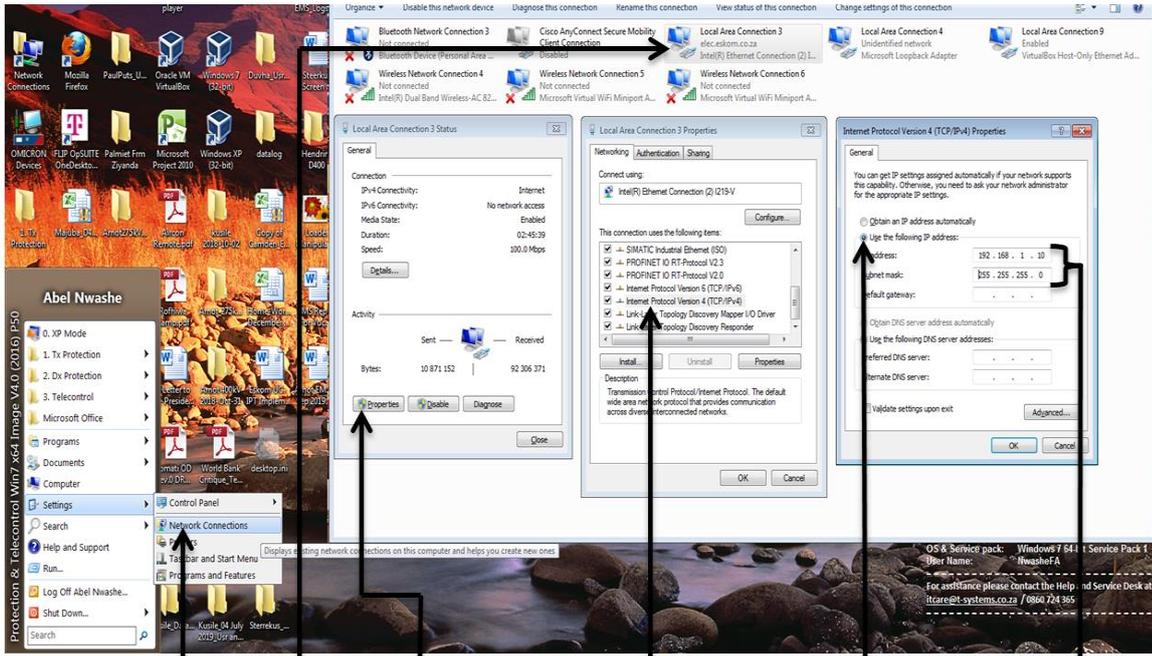
It is therefore imperative that you configure network connection the laptop is configured to be in the same IP range (e.g., 192.168.1.10 and the default mask of 255.255.255.0).

The Dial up connection is only available in CMU04, the default address for this is "10.0.10.50". It is therefore important to always have the dial up set up available as it is the only way you can access the RTU560 CMU04 if the Ethernet connection cannot achieve a connection.

Web browser is used for:

- Downloading the configuration
- Uploading the configuration
- Diagnostics
- Commissioning
- Uploading of archive data

(See pictures below for setting-up your PC for connecting to RTU560)



- |  |  |                      |   |  |   |
|--|--|----------------------|---|--|---|
| 1. Click: the start window> Settings> Network Settings | 2. Double click: Local Area Connection 3 | 3. Click: Properties | 4. Double click: Internet Protocol Version 4 (TCP/IPv4) | 5. Click: Use the following IP address | 6. IP: 192.168.1.10<br>Mask: 255.255.255.0<br>and click Ok>Ok>close |
|--|--|----------------------|---|--|---|

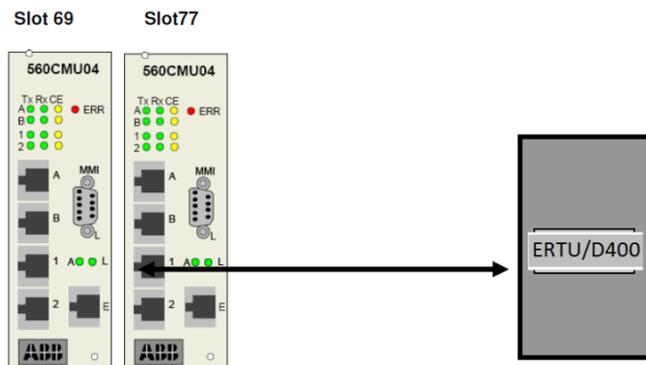
## 7. Commissioning the ABB RTU560 Hardware

### 7.1 Commissioning CMU04 Hardware

The ABB RTU560 (CMU04) uses a standard configuration template that is only updated for station specific parameters. RTU560 (CMU04) for Phase-5 EHV scheme is made up of three types of main modules, namely:

- Main Processing Unit, 560CMU04, two off
- Fibre Optic interface module, two off
- Power Supply Unit, one off

**560CMU04 in slot 77 is the master module.**



The master 560CMU04 board (CMU = communication unit) controls process events and communications with the ERTU/D400. Each module is mounted in defined position for communication in sub-rack 560CSR01.

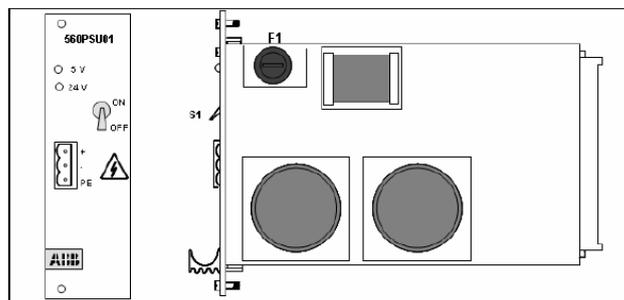
The main functions of the 560CMU04 are:

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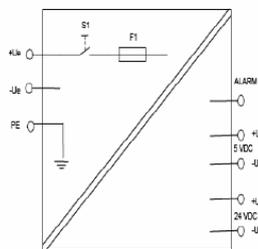
- Storage of configuration files.
- Managing and controlling of the I/O boards on the RTU peripheral bus.
- Reading Process events from the input boards.
- Writing commands to the output boards.
- Communications with ERTU and IEDs via the four integrated serial line interfaces.
- Managing the time base for the RTU560 station and synchronizing the I/O boards.
- Handling the dialogue with RTU560 and Web-Browser (PPP-Protocol) via MMI interface.

**560PSU01 Power Supply Unit:**

The board occupies two slots within the RTU560 sub-rack. It connects via a DIN F socket connector to the sub-rack.



Board Layout and Fuse Position



Block diagram of power supply module

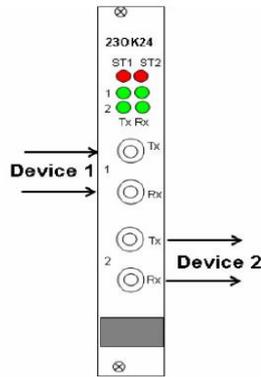
The 560PSU01 board has a fixed location in the RTU560 communication unit, this is slot 1. The primary fuse is placed on the right-hand side of the power supply. If the output voltage fails, the green LED will turn off. Replace only the same type of fuse to prevent power supply failures. The power supply unit 560PSU01 generates the two supply voltages (5V DC and 24V DC) for the RTU560 communication units within the communication sub-rack 560CSR01. The output power is sufficient to supply the communication sub-rack 560CSR01 with typical configurations.

- The Power supply unit has the input range of 110...220VDC
- It generates the 5VDC and 24VDC supply voltages for the RTU560 communication units and other boards
- It has two LED's for displaying output voltages
- It has an alarm indication in case of failure

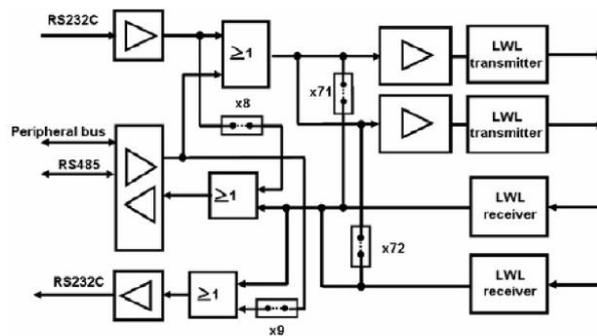
The input power supply to the ABB RTU560 is dictated by the protection scheme hosting the RTU560 bay processor. It is therefore important to check the polarity of the input supply on the protection scheme before connecting the input source to the RTU560 BP.

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Fibre optic coupler 230K24.



Front plate view of 230K24 Fibre Optic module



Block diagram of Fibre Optic module

- The board has two Tx/Rx channels available per module
- It is used for interfacing of IEDs (Relays) to the 560CMU04 module
- It converts optic signal to RS232C electrical interface
- Can be used to connect to remote RS485 devices via embedded fibre converter modules
- Electrical isolation between the protection relays and the RTU560

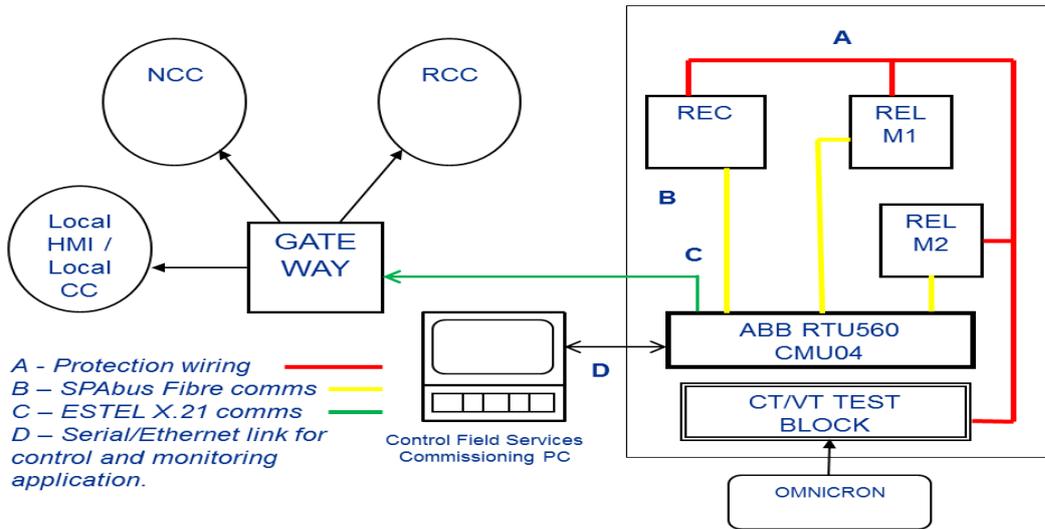
### 7.1.1 Setting-up CMU04 communications to Protection IED's

RTU560 CMU04 is furnished with two fibre optic coupler module 230K24 to allow for fibre communication to protection IED's. All three protection IED's directly connect to the RTU560 CMU04 via this module.

Correct device addresses must be configured on both the RTU560 CMU04 and each protection IED respectively to allow for data communication between the respective devices.

RTU560 interfaces serially with the protection scheme IED's by fibre, no hard wire interface. Communication to the IED's is via SPAbus protocol on RS232 at 9600 bit/sec.

It is important to ensure that correct fibre connections are made.



7.1.2 Setting-up CMU04 comms to ERTU/D400

Communication to the ERTU/D400 is via ESTEL protocol. RTU560 CMU04 uses RS422 interface for communication with the gateway on port-1 of 560CMU04 in slot 77.

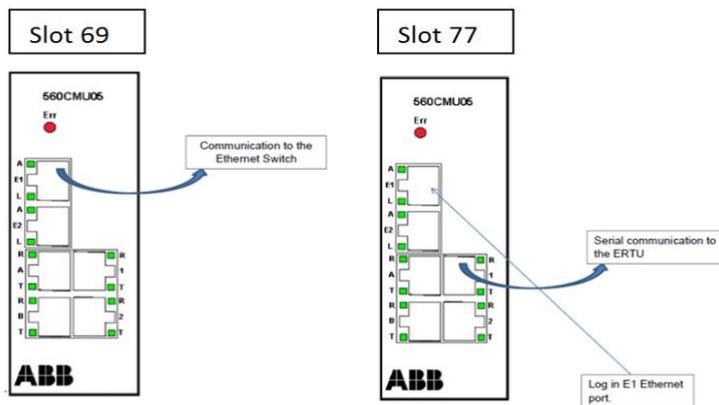
(See Annex A for check sheet)

7.2 Commissioning CMU05 Hardware

The standard RTU560 CMU05 is normally delivered as part of the applicable Phase-5 (670) protection scheme. The basic RTU560 (CMU05) for Phase-5 EHV (670) scheme is made up of two types of boards namely:

- Main Processing Unit, 560CMU05, two off
- Power Supply Unit, one off

Slot "69" and Slot "77".



RTU560 CMU05 can only be accessed via Ethernet interface; there is no serial communication for navigating the RTU560 CMU05.

The communication between the RTU560 and the PC is always via an Ethernet connection. There are two Ethernet ports on 560CMU05, namely E1 and E2. **E1** is used for establishing PC connection with the bay processor.

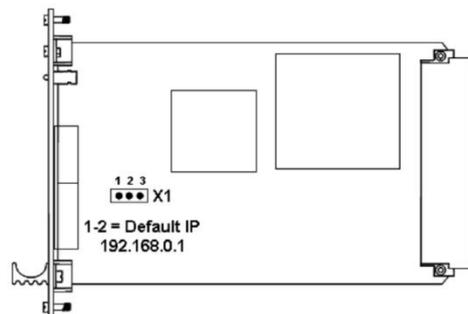
RTU560 CMU05 comes pre-configured with the bay specific configuration from the factory, there is no template configuration. The configuration in each bay processor is unique and may only be downloaded into that specific bay processor. It is therefore imperative to keep a good record of the bay specific configurations by naming them correctly to avoid downloading the wrong one.

CMU05 has a default IP address which enables logging into the CMU even if the configuration IP address is not known. The default IP address is **192.168.0.1**. To use this address, the jumper position on the card must be changed.

Jumper **X1** is connected on position **2-3** during normal operation. Jumper **X1** must thus be moved to position **1-2** for the default IP to be activated. The default address is only used when the test/commissioning PC is connected to Ethernet port **E1**. It is also only used when it is not possible to connect with the configuration IP address.

Ensure that the test/Commissioning PC Ethernet settings are adjusted to be on the same Ethernet range as the default IP address range on the RTU560. To ensure uniformity, use **192.168.0.10** for the test/commissioning PC IP address, and **255.255.255.0** for the subnet mask.

**NB:** The jumper setting must always be restored to the original position (**2-3**) once the configuration or firmware download is complete.

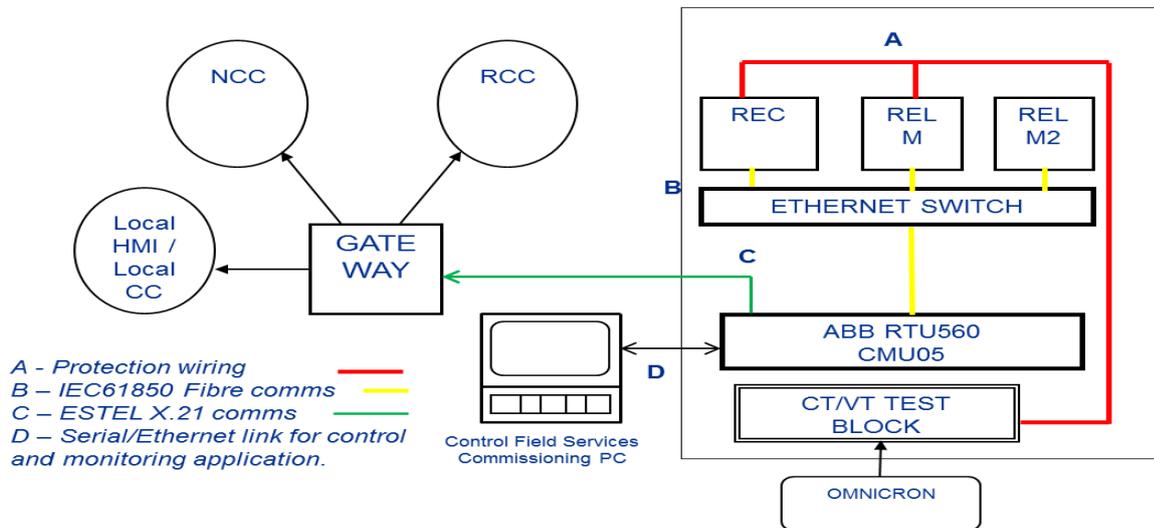


560CMU05 Board

### 7.2.1 Setting-up CMU05 comms to Protection IED's

RTU560 CMU05 communicates with the protection IED's via the bay switch using a LAN based protocol. All devices connect directly to the bay switch to enable communication. It is important to ensure that the hardware switch to device communication is established by physically noting bay switch comms activity indicated by the LED's.

The network settings for the CMU05 in "slot 69" must be in the same Ethernet range as the protection IED's to enable LAN connection (this setting is usually pre-loaded from the factory).



### 7.2.2 Setting-up CMU05 comms to ERTU/D400

Communication to the ERTU/D400 is via Estel protocol. RTU560 CMU05 has six RJ45 ports on the front plate namely:

- E1 and E1 (Ethernet ports) (E1 is the one used – slot 69 uses E1 to connect to the Ethernet switch, slot 77 uses E1 to connect to the test/commissioning PC)
- CPA and CPB Interface
- CP1 and CP2 Interface (CP1 is the one used for interfacing with the ERTU/D400)

CP1 is the one used for interfacing with the ERTU/D400 via a RS232 to RS422 Moxa converter.

(See Annex B for check sheet)

## 8. Configuring the ABB RTU560

Standard configurations templates are available for all CMU04 configuration options. It is however necessary to rename the configuration running on the RTU560 CMU04 BP and store it on Transmission configuration central repository as new version after commissioning or updating it for any other reason. This enables Transmission configuration controllers to maintain the integrity of the device history for future reference.

- The configuration engineering tool for RTU560 is RTUtil560
- RTUtil560 CMU04 runs on standard windows Operating system (Windows XP, Windows 7 32-Bit)

CMU05 configurations are normally recovered or restored from the RTU560 CMU05 BP; the configuration file is then adjusted as per scheme/bay requirements and then downloaded back to the RTU560 CMU05. It is however a good practice to archive the original RTU560 CMU05 BP configuration and store it in Transmission configuration central repository as version zero before modifying anything on it. This enables Transmission configuration controllers to have a fallback should the updated configuration get corrupted.

RTUtil560.

- The configuration engineering tool for RTU560 is RTUtil560
- RTUtil560 CMU05 runs on standard windows Operating system (Windows 7 64-Bit, Windows 10 64-Bit)

The general view of the user to the engineering data is implemented based on international Standard IEC 1346-1. This Standard describes the structuring principles and reference designations for industrial systems installations and equipment.

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This standard is presented in trees showing the RTU from different points of view on the user interface. The user interface structure offers three trees to describe the system structure usually used for an RTU.

**Network Tree.**

The Network Tree shows the lines and protocols for routing the data points through the network.

**Signal Tree.**

In the Signal Tree the location and designation of signals is shown. The signal location describes the place of the data points in the primary process.

**Hardware Tree.**

The Hardware Tree present the structure of an RTU with the level's cabinet, rack, board and the reference to the data points defined in signal Tree. The structuring in trees allows a common presentation format and a general user interface of the RTU data and the environment.

### 8.1 Configuring ABB RTU560 CMU04

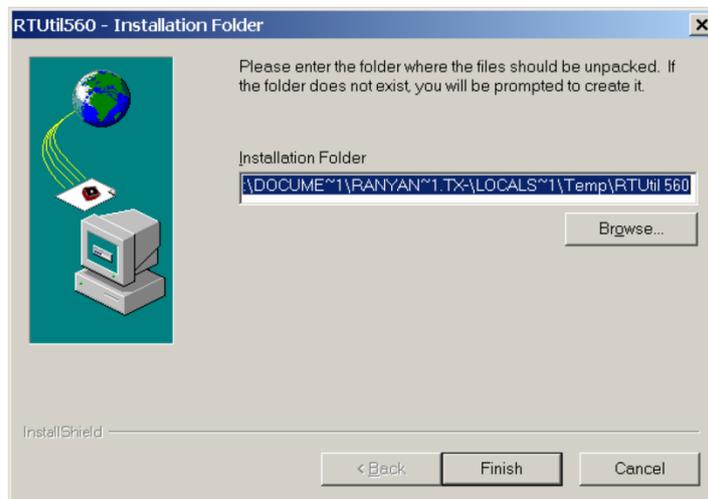
#### 8.1.1 Installing RTUtil560 (For CMU04)

The installation steps covered below may not be necessary if your machine was preloaded with the standard authorised Eskom windows engineering image. This installation is covered on this document for consideration only when necessary.

Call the setup program “*RTUtil\_560\_07\_01\_001\_00.exe*” from its location and follow the installation dialog.

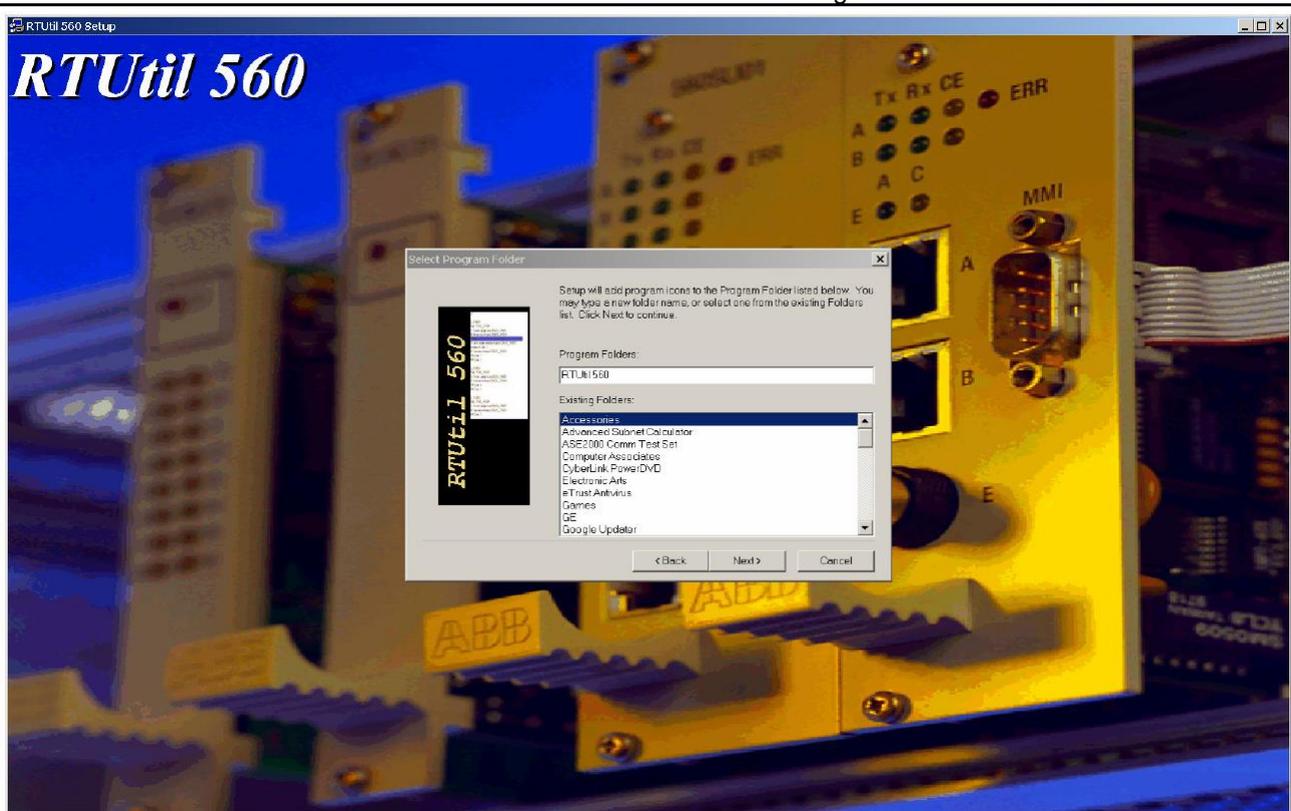
Double click on the “*RTUtil\_560\_07\_01\_001\_00.exe*” application program

Click the “Finish” button on the window below

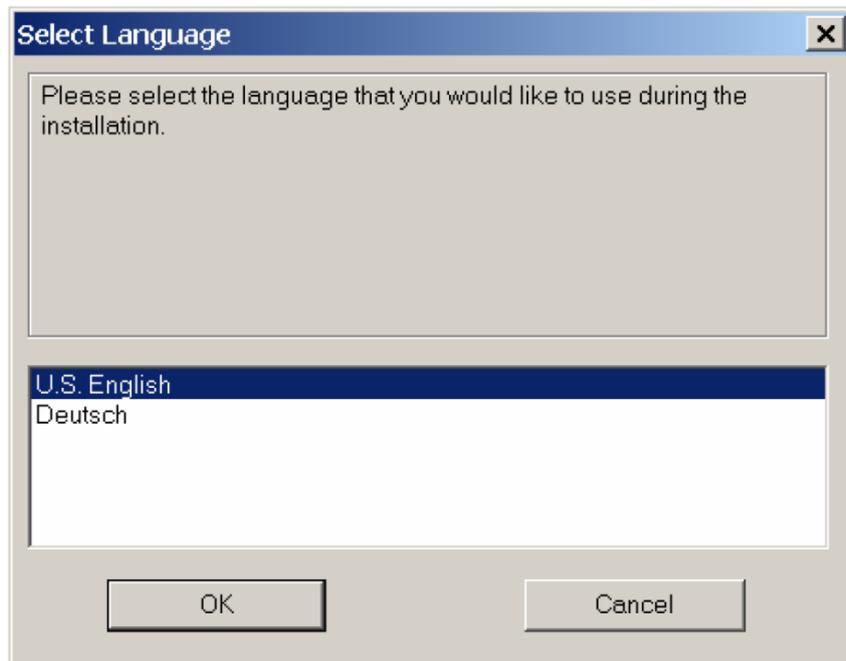


Click OK on “*Choose Setup Language*” window

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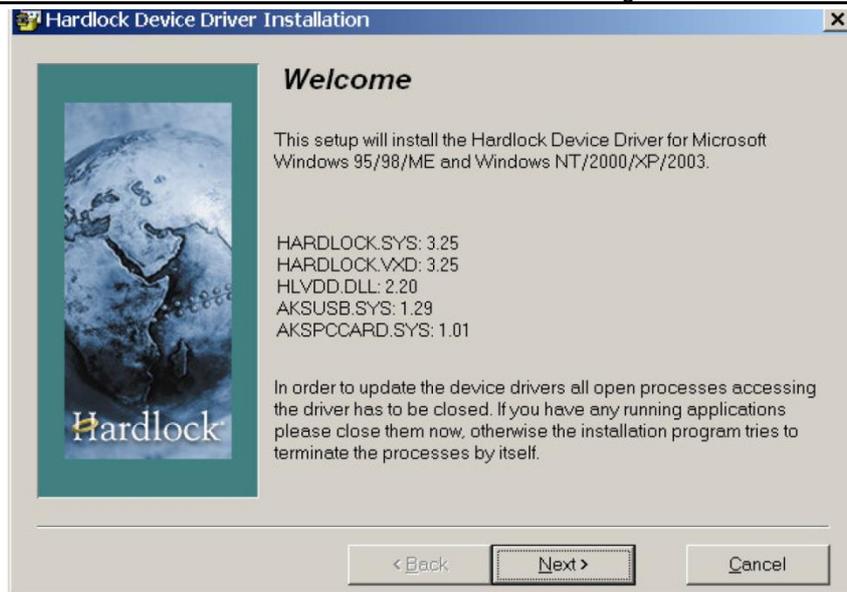
Click next on the window above, do not change any selection. The installation process will start



Select English and click OK

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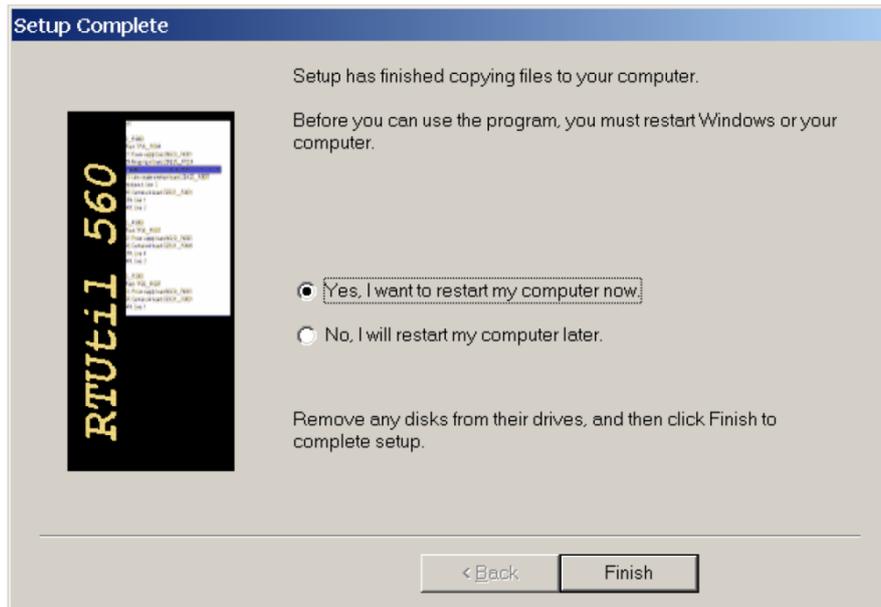


Click next on the window above



Click finish on the window above

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Click finish to restart the PC to complete the installation process.

### 8.1.2 Activating Estel Protocol (For CMU04)

RTU560 communicates with the ERTU/D400 via Estel protocol in Transmission application. RTUtil560 was however not built with Estel protocol as one of the native protocols in its database applications. What this means is that you cannot run any Estel applications straight away after installing RTUtil560 utility on your computer. Estel has to be incorporated separately after installation of RTUtil560 to enable configuration and running of Estel based applications.

When the RTUtil560 is installed, the following directory and sub-directories will be created in your Program Files on your C:\ local drive:

C:\ Program Files

- ABB
- RTUtil560\_7\_1\_1\_0
  - -batch
  - -bin
  - -csv export
  - -csv import
  - -db
  - -hlp
  - -pattern
  - -patterns\_Mwt
- proj
- rtufile
- tutorials
- -xls\_Export
- xls\_import

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- From the “ABB RTU560 data” information provided, open “Estel protocol data” then “Estel Type Database\_7\_1\_1\_0”
- From “Estel Type Database\_7\_1\_1\_0” copy “RTUtil560\_DB\_Type.mdb” file
- Go to your “program files” folder on your C: drive as depicted above.
- Open the “-db” subdirectory and past the “RTUtil560\_DB\_Type.mdb”, replace the one already in there

### 8.1.3 Opening CMU04 configuration(s)

The configuration is not built from the scratch; we use the template and only edit it for station specific application.

- Open the RTUtil560 short cut from the Start menu Program
- The screen shown below will open, click cancel

Initialize Project

Project name: Project1

Engineer name:

Company:

Department:

Project number:

Build date: 2008/10/27 01:16:54 PM

Comment:

Max. number of character for ObjectID string 32

Take the 32 character string for object ID within the configuration file from object ID string beginning at character 1

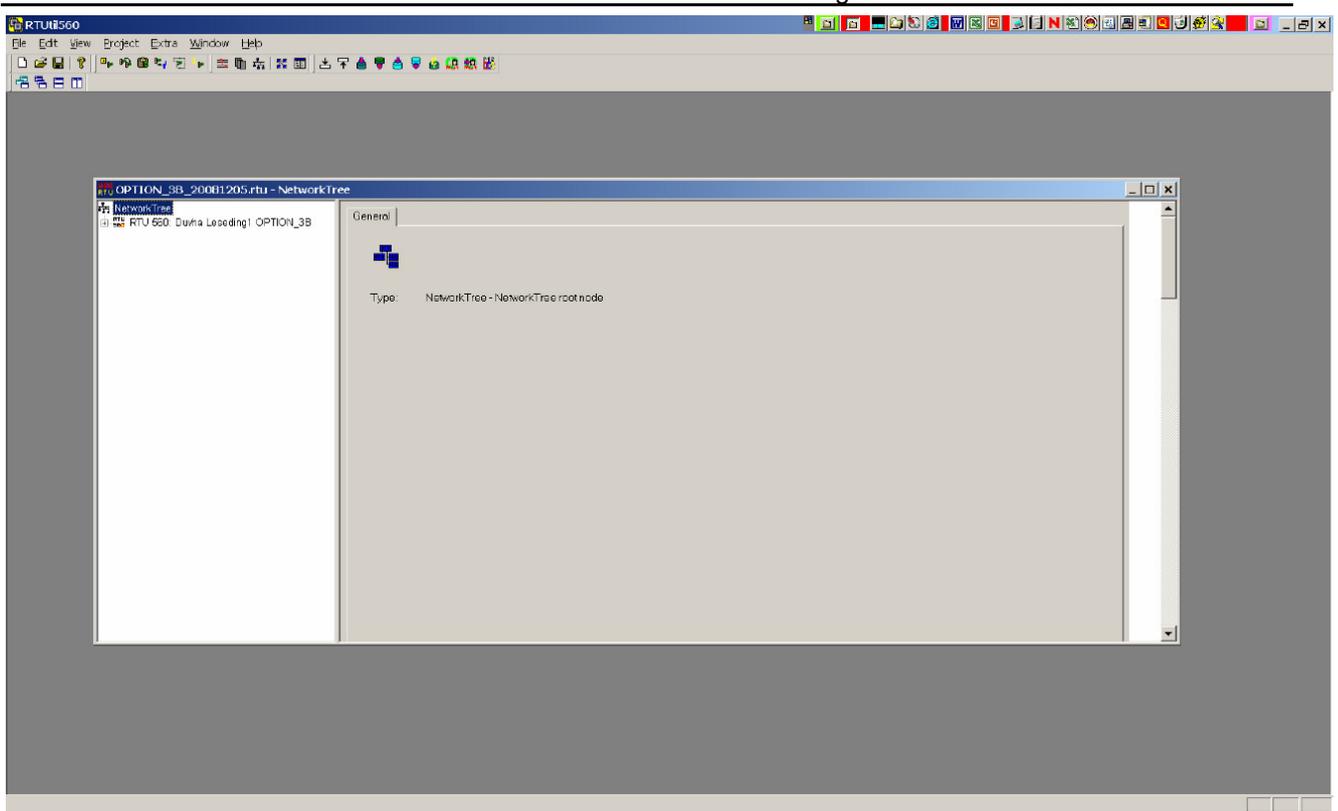
The string for the object ID within the configuration file may not be unambiguous, if you take it as a part from the object ID within the project.

Make the string within the configuration file unambiguous, if a string already exist.

Back Next Cancel

Editing the project.

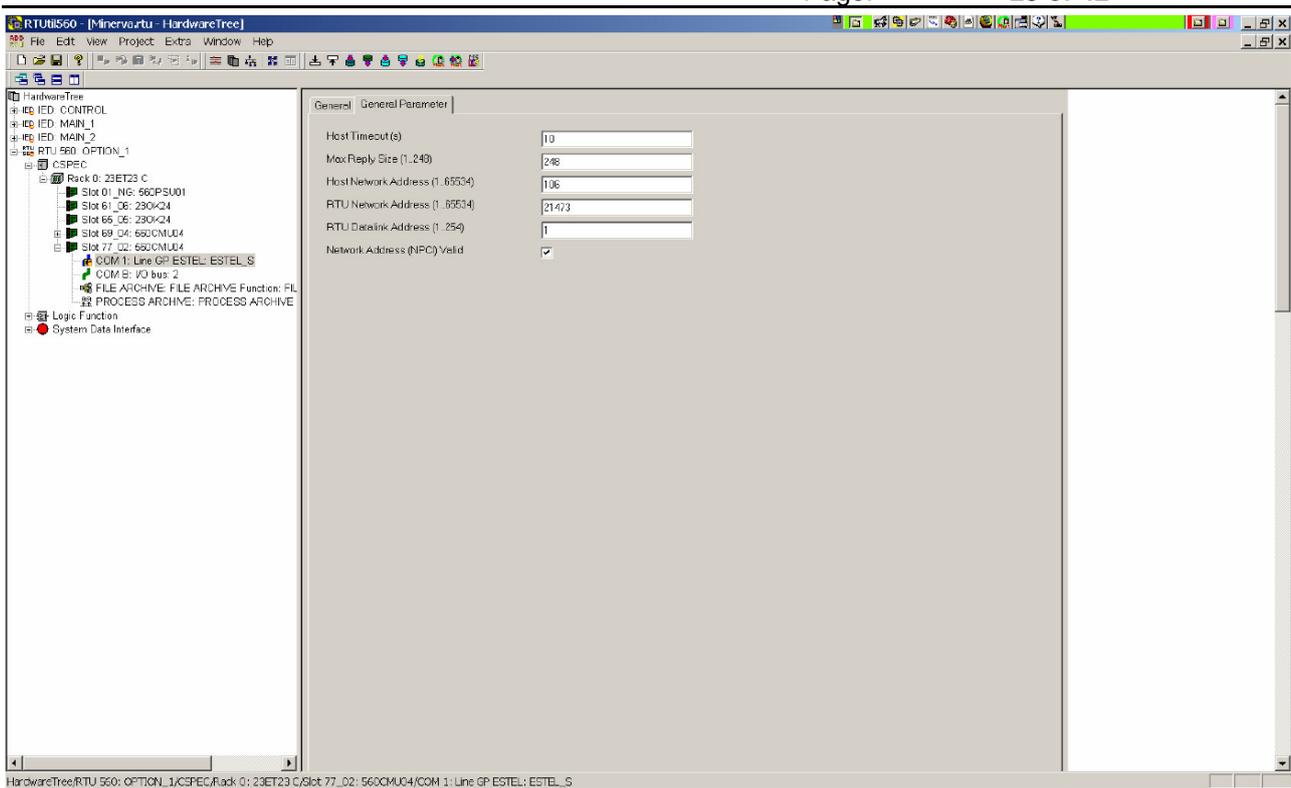
- Go to the File drop down menu and open the project from the directory on your hard drive.
- Edit the project according to the station configuration.



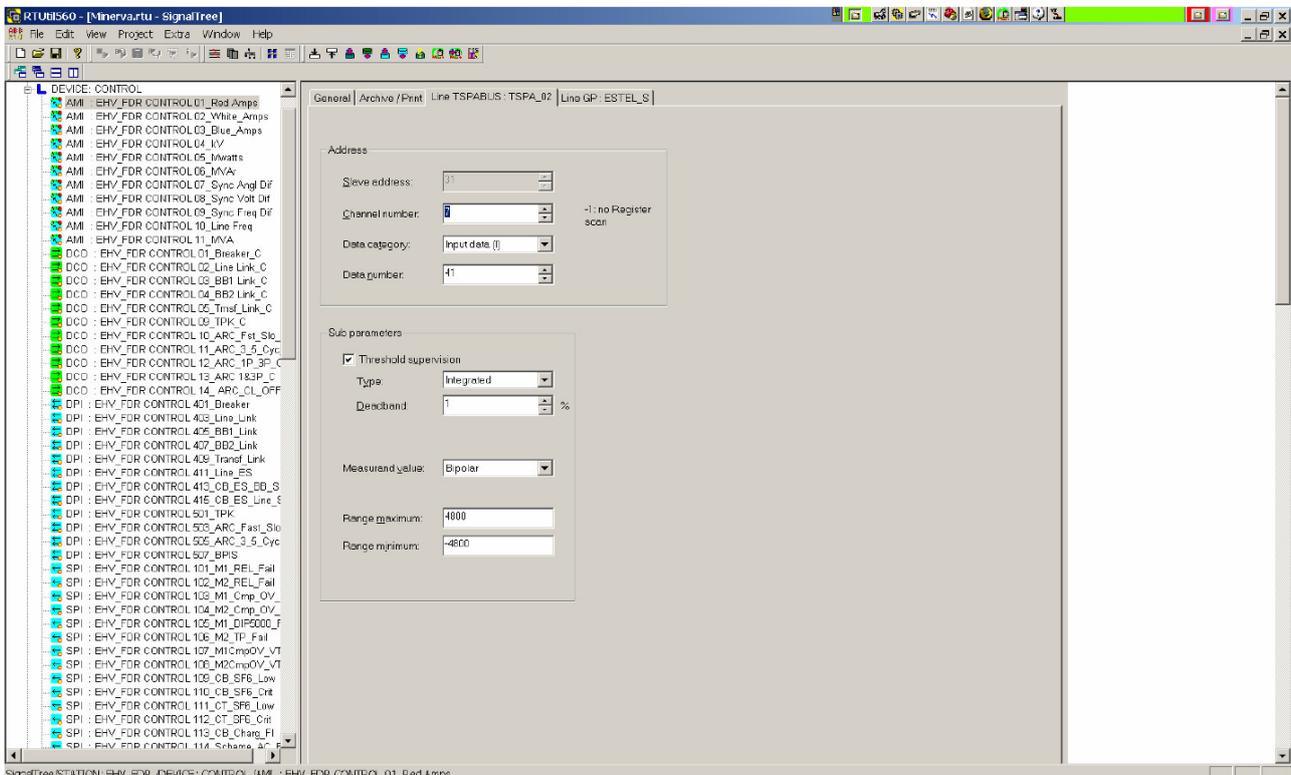
The standard configuration will need to be edited for:

- RTU Network address (Bay processor NW address)
- RTU Data link address (Bay processor DL address)
- Host Network address (ERTU address)
- Analogues scaling values (Protection CT ratio)
- Open the standard configuration from your hard drive
- Click on “View” drop down menu from the tool bar
- Select Hardware Tree menu

The addresses are edited from the Hardware Tree as shown below on Hardware Tree View.



Signal tree view for editing analogues.

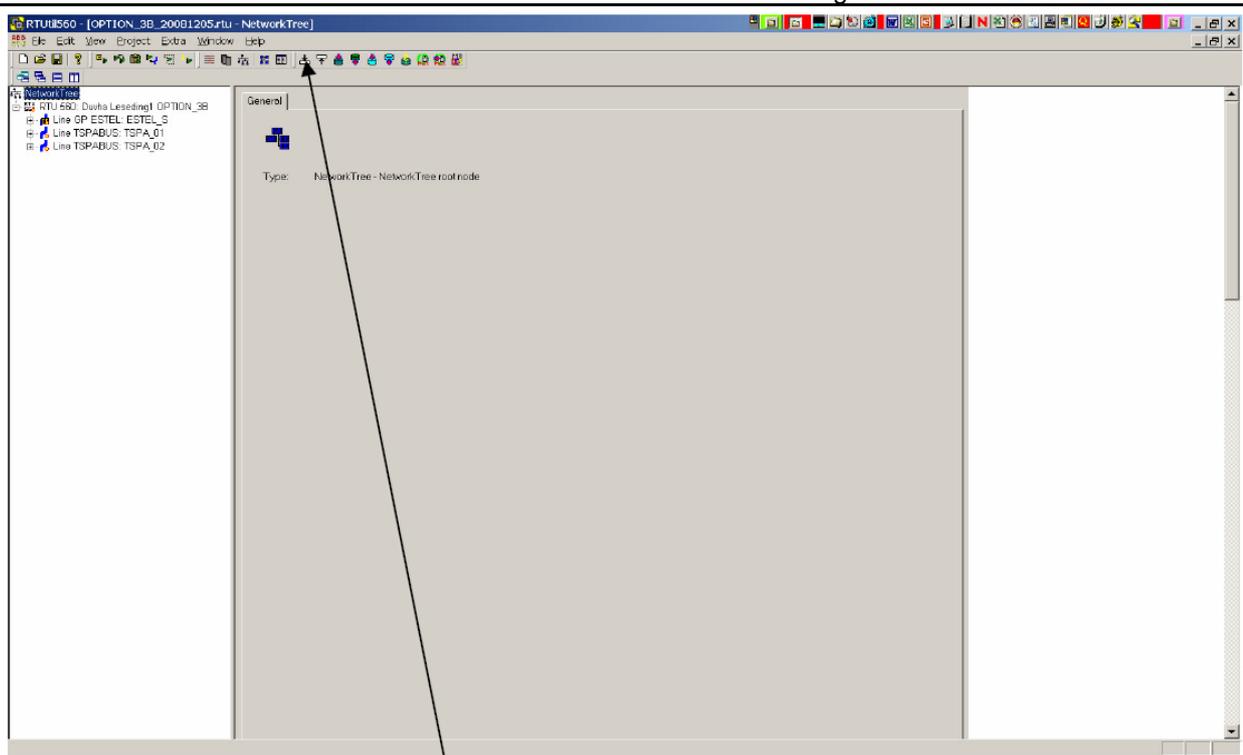


Generating RTU configuration files.

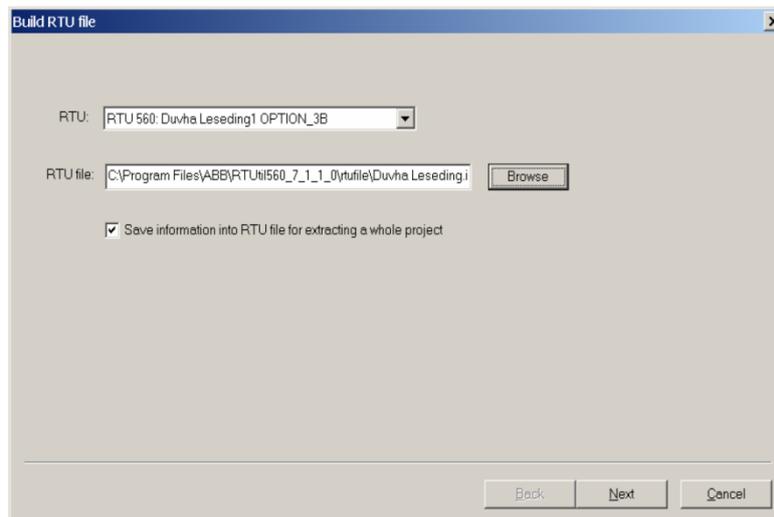
After making the updates on the template, the configuration must be compiled and be generated for downloading to the RTU560.

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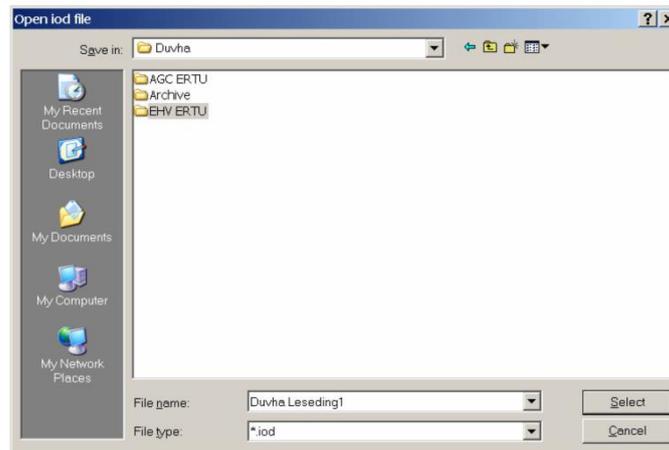
When downloaded from the WEB, this document is uncontrolled and the responsibility rests with the user to ensure it is in line with the authorized version on the WEB.



- Click on “Build RTU files” icon, arrow pointing down
- The window below will pop up, go to the “Browse” tab and select the folder where you saved your substation configuration



NB: Make sure that the “save information into RTU file for extracting a whole project” box is ticked above;



- Click next after selecting the folder
- Name file as the name of the bay, substation followed by the feeder's name
- Click "Select, and Next , then Plausibility and Generate from the windows that will appear

Three types of files are generated from the configuration when you build RTU560 configuration. These are the files that must be downloaded into the RTU.

They are the:

- xx xxx xx.iod
- xx xxx xx.gcd
- xx xxx xx.ptx

The xx xxx xx.iod file is the Input/Output data information

The xx xxx xx.gcd is the General Configuration data information

The xx xxx xx.ptx is for archive information

*"See Annex C for check sheet"*

## 8.2 Configuring ABB RTU560 CMU05

### 8.2.1 Establishing communication with CMU05

The communication between the RTU560 and the PC is always Ethernet. There are two Ethernet ports on 560CMU05, namely E1 and E2. Always use E1 for establishing connection with the RTU.

Connect to 560CMU05 in slot 77 **E1** Ethernet port using your standard LAN cable.

Open the Internet Browser and type the IP-address: **192.168.1.77**

CMU05 Default IP Address:

CMU05 has a default IP address. This enables logging into the CMU even if the configuration IP address is not known. The default IP address is 192.168.0.1. To use this address, the jumper setting on the card must be changed.

The X1 jumper must be moved to position 1-2 for this to work. Make sure that you connect to Ethernet port **E1**; the default address works only in this port. You must also change your PC IP address. For uniformity, use 192.168.0.10 for PC IP address, and 255.255.255.0 for subnet mask. This will enable restoration and downloading of firmware/configuration files. The jumper setting must always be restored to the original position once the configuration or firmware download is complete.

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### 8.2.2 Firmware verification

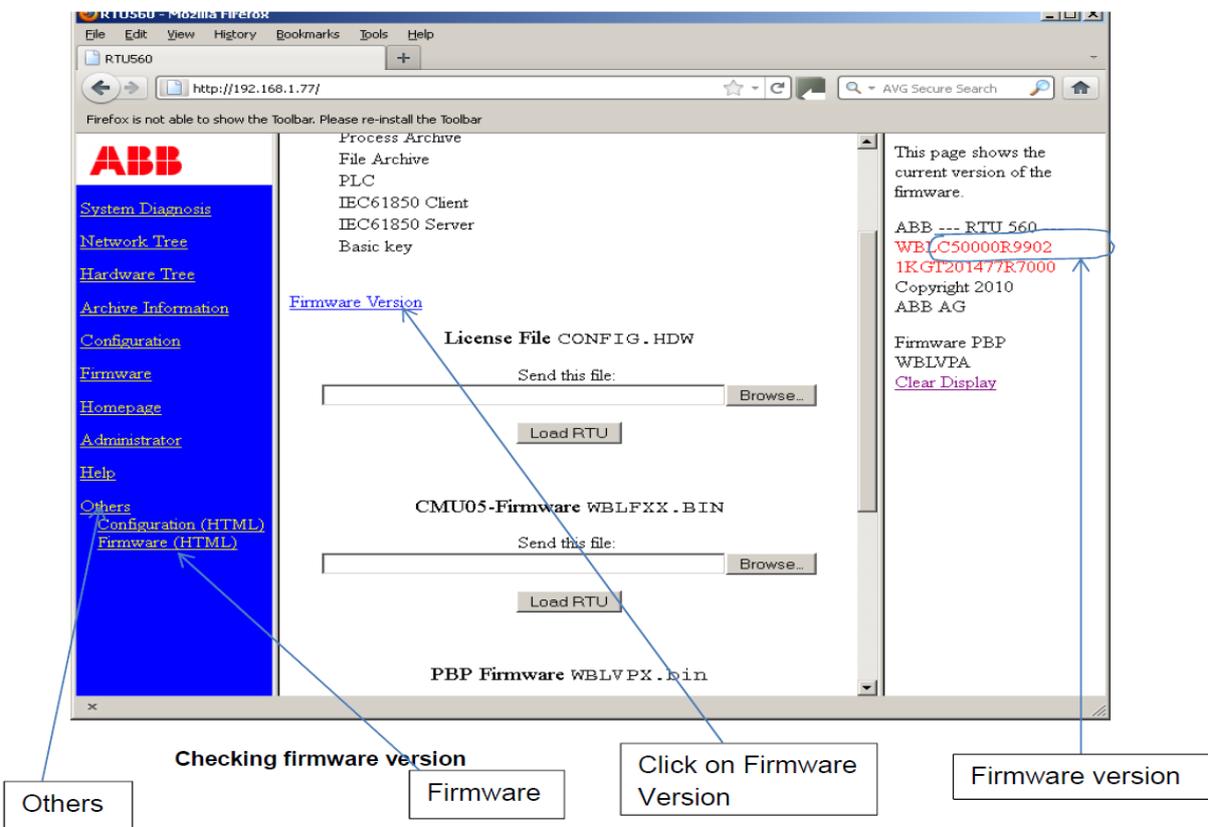
Once connection with the RTU has been successfully established, we need to check the Estel protocol firmware version loaded on the RTU. The firmware version must be upgraded if it is not the latest as stipulated below.

The approved Estel protocol firmware running on RTU560 CMU05 is version WBLC50000R9902.

To check the firmware version,

On the browser display in the figure below select:

- “Others”
- Then “Firmware”
- Click on “Firmware Version”, the firmware version will be displayed in red texts.



### 8.2.3 Downloading Firmware

If the firmware checked above is not the latest version, the latest version must be downloaded. The firmware must be downloaded in both CMU05 in slot 77 and slot 69.

- CMU05 slot 77 Ethernet port E1. IP: 192.168.1.77  
PC Setting. IP Address: 192.168.1.10  
Subnet mask: 255.255.255.0
- CMU05 slot 69 Ethernet port E1, use the default IP: 192.168.0.1  
PC Setting. IP Address: 192.168.0.10  
Subnet mask: 255.255.255.0

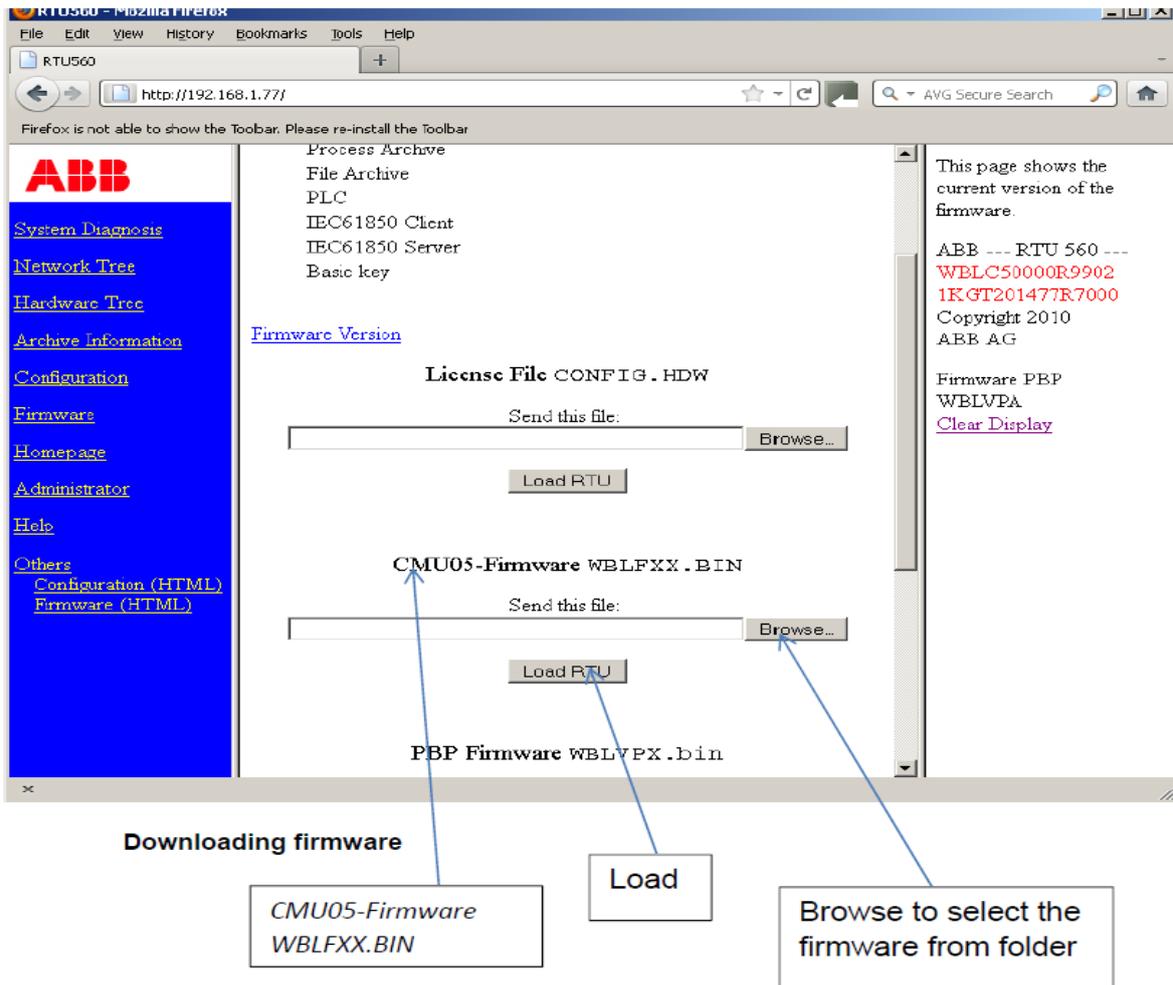
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When downloaded from the WEB, this document is uncontrolled and the responsibility rests with the user to ensure it is in line with the authorized version on the WEB.

On the browser display in the figure below select:

- “Others”
- Then “Firmware”
- Go to “**CMU05-Firmware WBLFXX.BIN**” pick up box, Refer to the figure below:
- Click on Browse to navigate to where the firmware was saved
- Select the firmware (**WBLC50000R9902**) from the location it was saved.
- Click on “Load” to download the firmware

Repeat the process to download the firmware into the CMU in slot 69. Change PC settings as explained above.



### 8.2.4 Updating the configuration

Each RTU560 comes with its bay specific configuration pre-loaded from the factory. To update this configuration, an “.iod” file must be uploaded from the RTU. It is this file that will be converted to RTU560.rtu file, which will then be updated for station/bay specific parameters. There are few steps that must be followed in order to successfully restore and update CMU05 configuration file namely:

- Saving file: Upload “.iod” file from the RTU
- Extract: Rebuilding RTU configuration from the “.iod” file
- Updated: Updating station/ bay parameters, e.g. BP address, ERTU address, analogues scaling

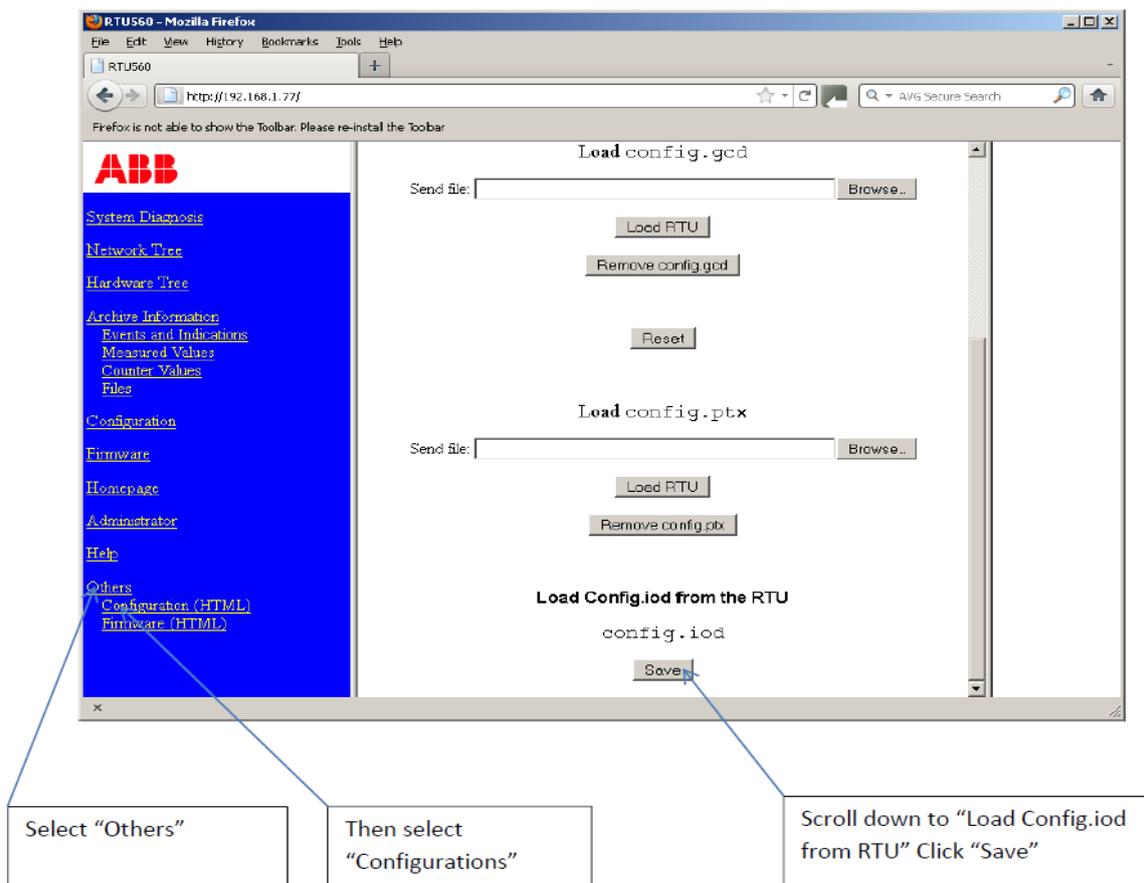
**ESKOM COPYRIGHT PROTECTED**

- Build: Building and generating downloadable configuration files, i.e., iod, gcd and ptx files.

### 8.2.5 Saving the “.iod” file

On the browser, select:

- “Others”
- Then “Configuration”
- At the bottom of the screen select “Save” config.iod, the configuration .iod file will be saved on the desktop.
- Rename the file to the bay name, e.g., “Esselen\_TRFR12.iod”. Save the file in the station directory on your PC local drive.



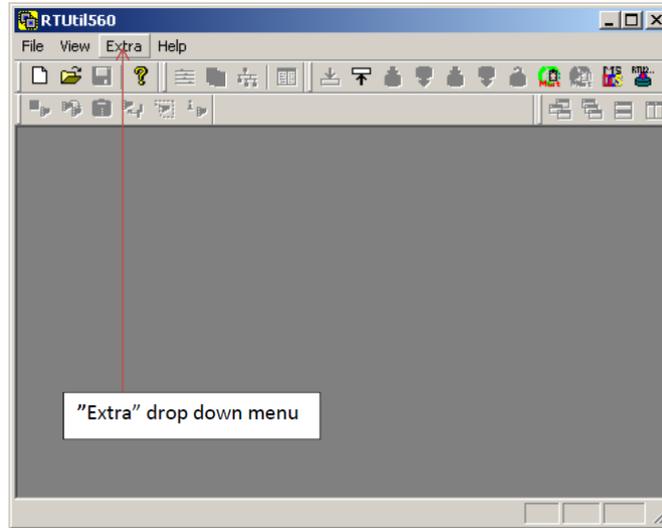
### 8.2.6 Extracting RTU configuration

The “.iod” file saved from the RTU needs to be converted to “.rtu” file in order to update it as per station specific parameters. The process of this conversion is called extraction.

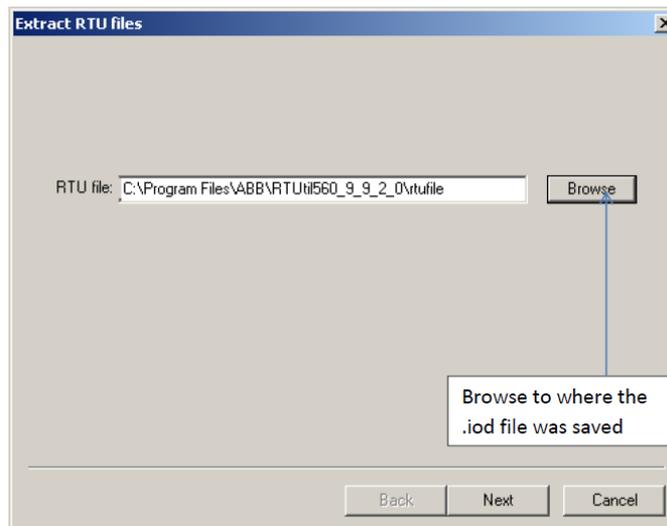
- Open RTUtil560 application utility (RTUtil560\_9920.exe)
- Click on “Extra” drop down menu
- Then select “Extract RTU Files” from the drop down menu
- Browse to the location where the “.iod” file was saved, select it and then click on the “Next” button on the dialogue box that appears. This is where you select the folder where you will save the extracted file.

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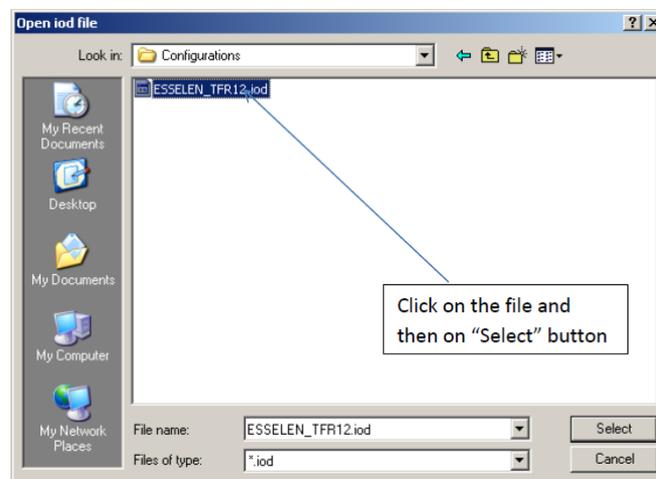
“extra” menu.



Locating the saved “.iod” file through the browse menu.

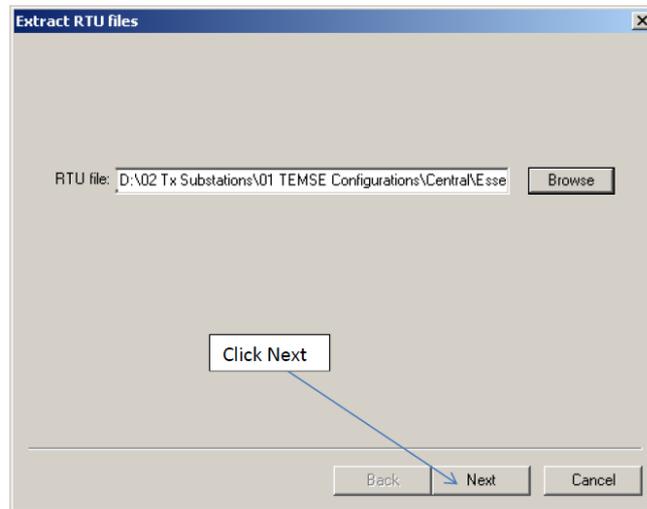


Selecting the “.iod” file on the browse menu;

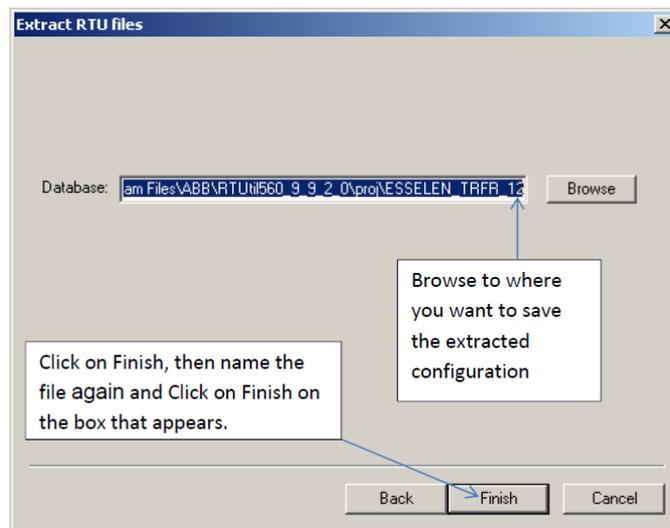


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Extracting “.rtu” files.



Choosing a different folder for saving the “.rtu” files OR using the default folder.



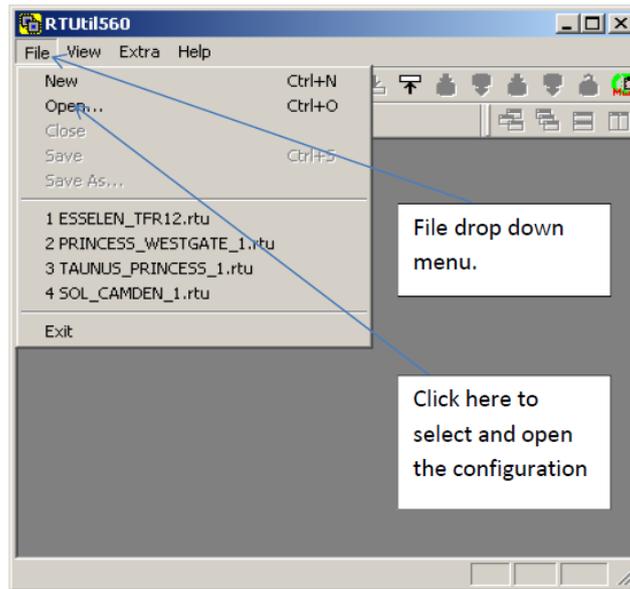
The configuration has now been extracted and can be edited as per bay specific settings.

### 8.2.7 Opening the extracted “.rtu” configuration file

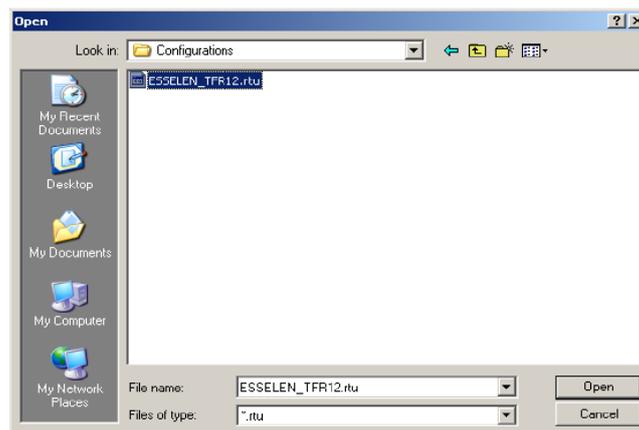
Once the configuration has been extracted, it is now in the format that it can be opened with RTUtil560 engineering utility tool.

- Open RTUtil560 engineering utility if not already opened.
- Click on “File” drop down menu
- Then click on “Open” to navigate to the folder where the extracted “.rtu” configuration file is stored.

The file menu;

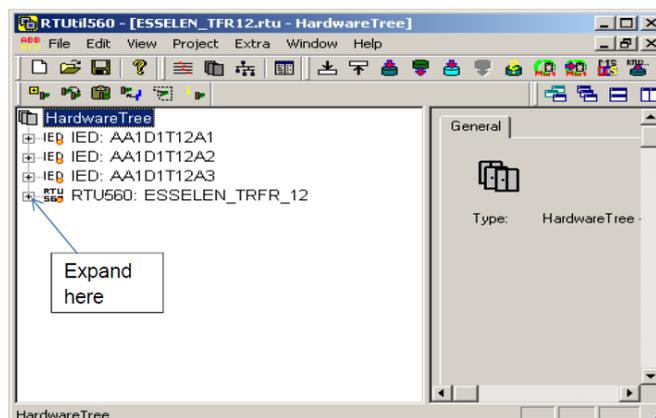


The file “open” menu.



### 8.2.8 Adjusting configuration parameters

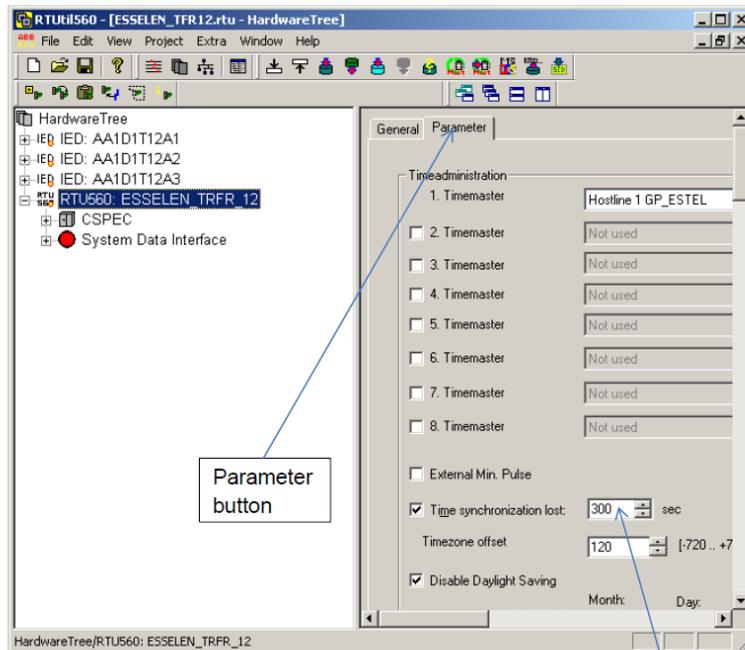
Expand the ‘bay’ name by clicking the “+” sign (as shown below).



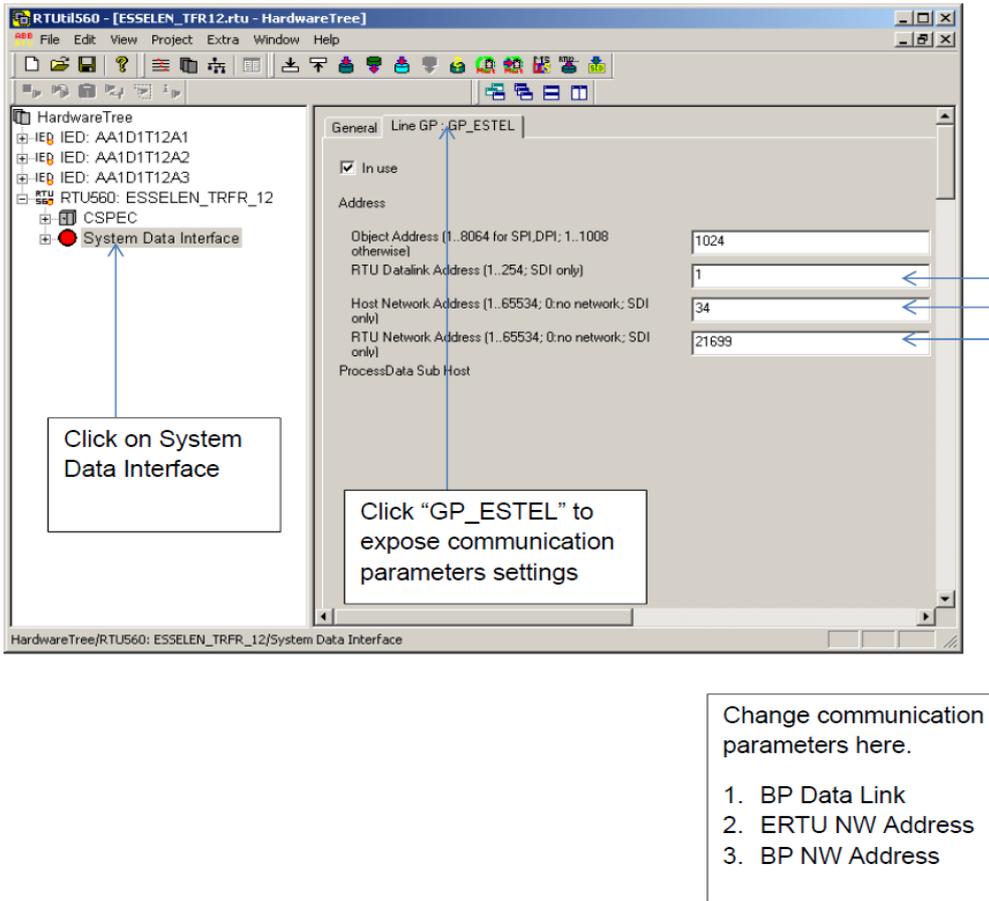
Click on the ‘bay’ name and select the “parameter tab” as shown below.

- Ensure that time “synchronisation lost” value is set to 600 as shown below.

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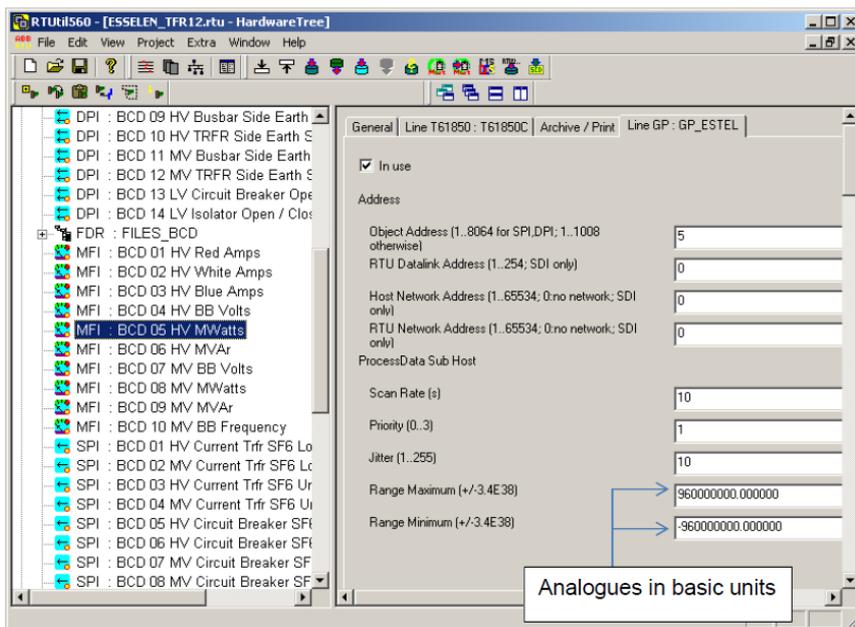
- Click on “System Data Interface” text, do not expand it. (as shown below)
- Then Click “Line GP:GP\_ESTEL” button to expose communication parameters settings
- Change communication parameters to the correct values for the bay



The analogues in 560CMU05 are set up in their basic units, e.g., kV is configured as volts, MW in watts etc. As an example, 275kV is set up as 275000.000000V,

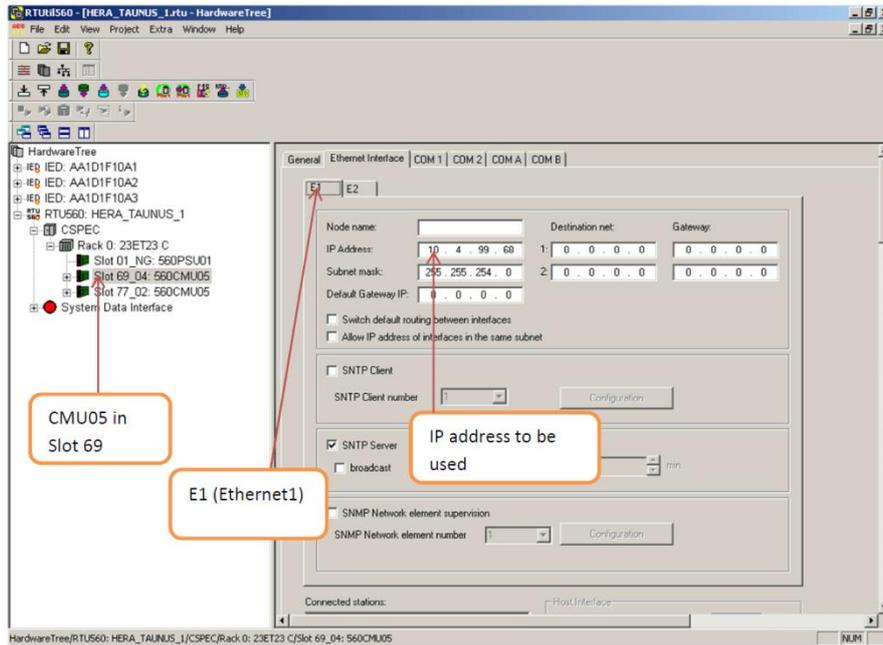
960MW would be configured as 960000000.000000W.

Update all analogues as per CT and VT ratios using RTU560 scaling spread sheet.



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Noting "slot 69" IP address for protection IED time synchronisation (see below);



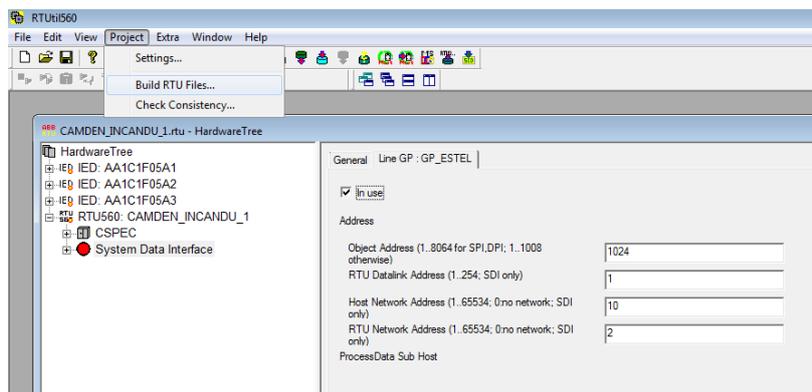
The configuration must be saved once all parameters have been set as per scheme/bay requirement(s).

### 8.2.9 Generating Downloadable Files

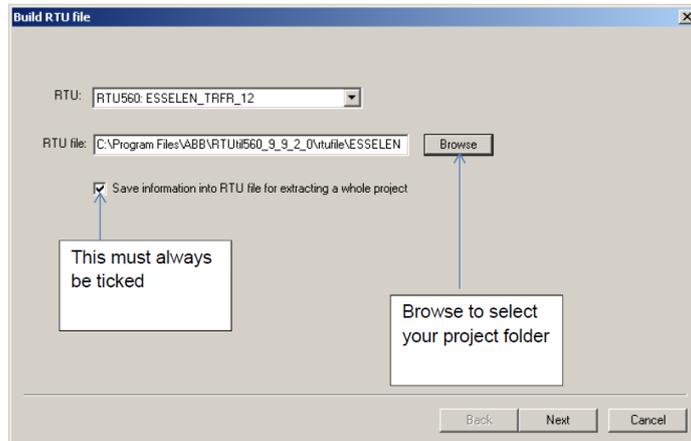
Once the configuration has been updated, it must now be downloaded into the BP.

- When generating the downloadable files, namely .iod, .gcd and .ptx, always make sure that the **“Save information into RTU file for extracting a whole project”** box is ticked
- Brows to the folder you want to save the files in, otherwise they will be saved in a default folder in C:\ drive.
- Name the files according to the bay name and save.

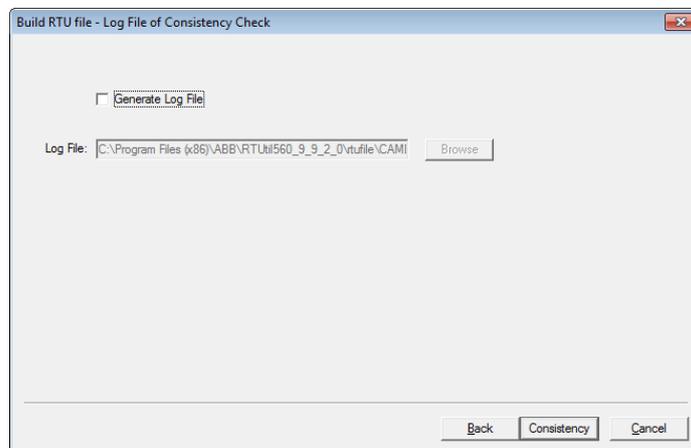
Build Downloadable files by clicking “project” then “build rtu files”.



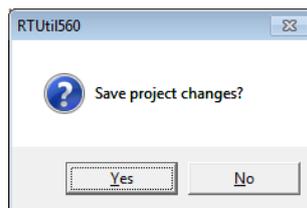
Ensure that you browse to the folder where your project is located and then click “next”;



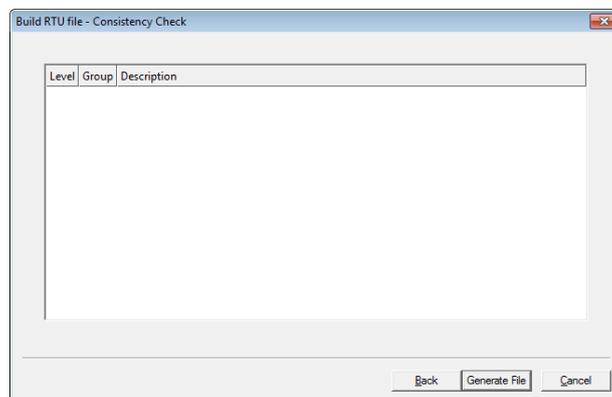
Click “consistency” below to build RTU files.



Click “yes” on the tab below to ensure that all “new” configuration parameters are adjusted accordingly.



Click “generate files” below to generate the three files with scheme/bay parameters adjusted accordingly.



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Three types of files will be generated from the configuration when you build RTU560 configuration. These are the files that must be downloaded into the RTU.

They are the:

- xx.iod
- xx.gcd
- xx.ptx

The xx.iod file is the Input/Output data information

The xx.gcd is the General Configuration data information

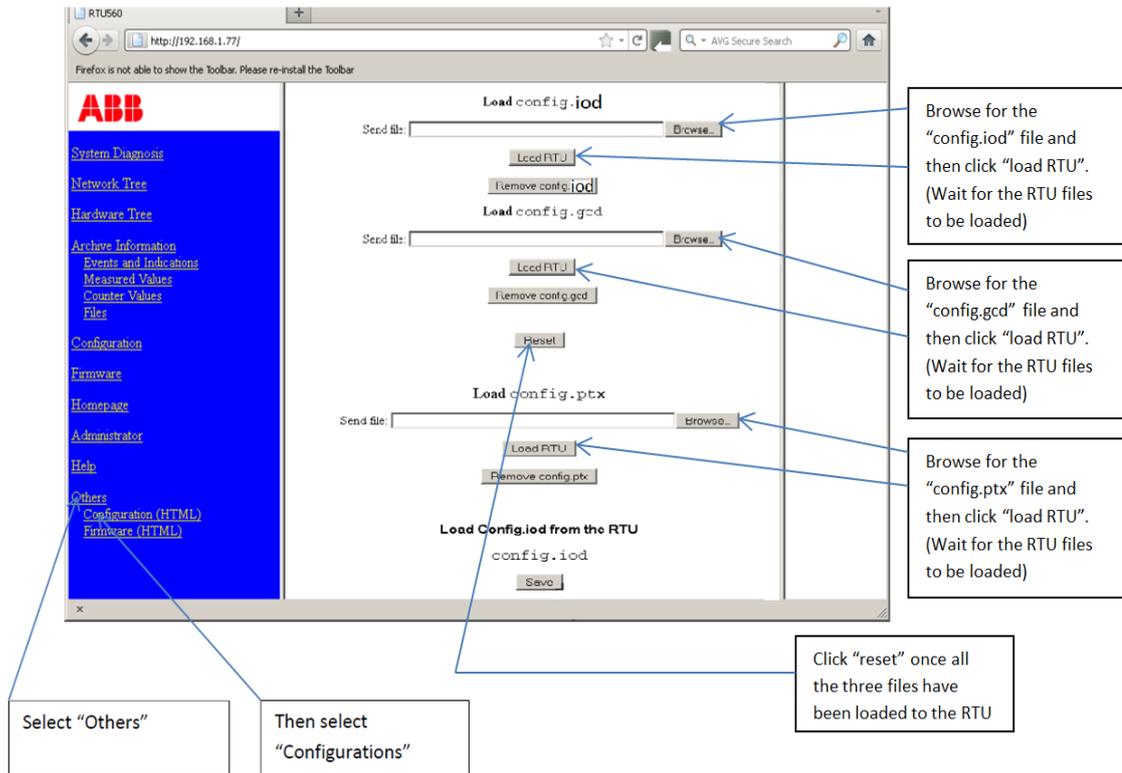
The xx.ptx is for archive information

Restore all the connections to their original setting. Make sure that the CMUs are not left on default IP address; otherwise, there will be no communication between the RTU and the relays or ERTU.

(See Annex D for check sheet)

### 8.3 Downloading the three files on both the CMU04 and CMU05 RTU's

The three files (.iod, .gcd and .ptx) are downloaded the same way on both the CMU04 version and the CMU05 version of the ABB560 RTU. (See below)



## 9. Configuration naming and archive

It is imperative that a common configuration management approach for all substation control system equipment is adopted. The revision number must only be updated once the device has been fully commissioned and the configuration file is ready for archive. This can be at the end of each commission stage during the life of the project or when the configuration is updated for any other reason after commissioning.

All interim changes during commissioning may be indicated by the date appended at the end of the file name, and proper revision naming convention must be used once fully commissioned. The baseline revision number shall be "001" for any file and will increment from here. The revision number must be incremented for any change in the configuration. Please note: any configuration with rev "000" refers to the configuration that was restored from the RTU560 when it was powered up for the first time.

All changes must that are done after commissioning will automatically trigger a revision update and subsequent archive.

The naming convention shall be as follows: Station name\_Bay name\_RTU560\_CMU type\_Revision number.

See below:

StationName\_BayName\_RTU560\_RevNo

e.g. Camden\_Sol1\_RTU560\_CMU04\_001 (for CMU04)

Camden\_Sol1\_RTU560\_CMU05\_001 (for CMU05)

Vulcan\_Trfr1\_RTU560\_CMU04\_001 (for CMU04)

Vulcan\_Trfr1\_RTU560\_CMU05\_001 (for CMU05)

The configuration must be sent for archive as soon as it has been named appropriately and downloaded successfully.

## **10. Browsing and navigating the ABB RTU560 (CMU04 and CMU05)**

### **10.1 Logging into the ABB560 RTU for general viewing and configuring**

Username: Load

Password: Load

All relevant data is available on the Hardware Tree.

### **10.2 Logging into the ABB560 RTU for sending control signals**

Username: Control

Password: Control

All relevant data is available on the Hardware Tree.

## **11. Authorization**

This document has been seen and accepted by:

| <b>Name and surname</b> | <b>Designation</b>                                  |
|-------------------------|---|
| Anita Oommen            | PASC Chairperson                                    |
| Nelson Luthuli          | PTM &C Senior Manager                               |
| Mpumelelo Mathe         | Control & Automation Technology and Support Manager |
| Quinton Labuschagne     | Control Application Senior Consultant               |
| Johan Pieterse          | Transmission Special Projects                       |

## 12. Revisions

| Date     | Rev. | Compiler      | Remarks  |
|----------|------|---------------|--|
| May 2023 | 1    | James Ranyane | Formalising the configuration and commissioning standard |

## 13. Development team

The following people were involved in the development of this document:

- James Ranyane
- Abel Nwashe

## 14. Acknowledgements

- Gilbert Valentyn
- Ian Naicker
- Steven Matlhogela

**Annex A – Hardware Commission Check Sheet for CMU04**

|                         |  |
|-------------------------|--|
| Substation And Bay Name |  |
|-------------------------|--|

Commissioned By: \_\_\_\_\_ Unique No: \_\_\_\_\_

Date of SCADA commissioning: \_\_\_\_\_

| <b>ABB RTU560 CMU04</b> |   |
|-------------------------|---|
| <b>Power Supply</b>     | Serial Number <span style="float: right;">SN:</span>  |
|                         | Input: 110V to 220V dc  |
|                         | Input Polarity Checked? <span style="float: right;">Yes <input type="checkbox"/> No <input type="checkbox"/></span> |
|                         | +5V   |
|                         | +24V  |

|                               |                                 |  |
|-------------------------------|---------------------------------|--|
| <b>Communication hardware</b> | Fibre comms to protection IED's |  |
|                               | Serial comms to ERTU/D400       |  |

**Other general checks**

|   |  |
|---|--|
| 1 | All cable entry points vermin/rodent proofed? <span style="float: right;">Yes <input type="checkbox"/> No <input type="checkbox"/></span>            |
| 2 | Are air conditioners operational? <span style="float: right;">Yes <input type="checkbox"/> No <input type="checkbox"/></span>                        |
| 3 | Confirm that cables and panels are labelled at both ends <span style="float: right;">Yes <input type="checkbox"/> No <input type="checkbox"/></span> |
| 4 | Are the records and drawings correct and updated? <span style="float: right;">Yes <input type="checkbox"/> No <input type="checkbox"/></span>        |
| 5 | Is the bay-processor adequately labelled? <span style="float: right;">Yes <input type="checkbox"/> No <input type="checkbox"/></span>                |
| 6 | Confirm earthing of the RTU560 BP <span style="float: right;">Yes <input type="checkbox"/> No <input type="checkbox"/></span>                        |
| 7 | Latest Configuration and Database archived? <span style="float: right;">Yes <input type="checkbox"/> No <input type="checkbox"/></span>              |

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**Annex B – Hardware Commission Check Sheet for CMU05**

|                         |  |
|-------------------------|--|
| Substation And Bay Name |  |
|-------------------------|--|

Commissioned By: \_\_\_\_\_ Unique No: \_\_\_\_\_

Date of SCADA commissioning: \_\_\_\_\_

| <b>ABB RTU560 CMU05</b> |   |
|-------------------------|---|
| <b>Power Supply</b>     | Serial Number <span style="float: right;">SN:</span>  |
|                         | Input: 110V to 220V dc  |
|                         | Input polarity checked? <span style="float: right;">Yes <input type="checkbox"/> No <input type="checkbox"/></span> |
|                         | +5V   |
|                         | +24V  |

|                               |  |
|-------------------------------|--|
| <b>Bay Switch Information</b> | Serial Number <span style="float: right;">SN:</span> |
|                               | Manufacture Date                                     |

|                               |                               |
|-------------------------------|-------------------------------|
| <b>Communication hardware</b> | Ethernet comms to Bay Switch? |
|                               | Serial comms to ERTU/D400     |

| <b>Other general checks</b> |  |
|-----------------------------|--|
| 1                           | All cable entry points vermin/rodent proofed? <span style="float: right;">Yes <input type="checkbox"/> No <input type="checkbox"/></span>            |
| 2                           | Are air conditioners operational? <span style="float: right;">Yes <input type="checkbox"/> No <input type="checkbox"/></span>                        |
| 3                           | Confirm that cables and panels are labelled at both ends <span style="float: right;">Yes <input type="checkbox"/> No <input type="checkbox"/></span> |
| 4                           | Are the records and drawings correct and updated? <span style="float: right;">Yes <input type="checkbox"/> No <input type="checkbox"/></span>        |
| 5                           | Is the bay-processor adequately labelled? <span style="float: right;">Yes <input type="checkbox"/> No <input type="checkbox"/></span>                |
| 6                           | Confirm earthing of the RTU560 BP <span style="float: right;">Yes <input type="checkbox"/> No <input type="checkbox"/></span>                        |
| 7                           | Latest Configuration and Database archived? <span style="float: right;">Yes <input type="checkbox"/> No <input type="checkbox"/></span>              |

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### Annex C – Configuration Check Sheet for CMU04

|                         |  |
|-------------------------|--|
| Substation And Bay Name |  |
|-------------------------|--|

Configured By: \_\_\_\_\_ Unique No: \_\_\_\_\_

Date of Configuration and Archive: \_\_\_\_\_

|                      |      | ABB RTU560 CMU04 |                          |    |                          |
|----------------------|------|------------------|--------------------------|----|--------------------------|
| <b>Configuration</b> | .iod | Yes              | <input type="checkbox"/> | No | <input type="checkbox"/> |
|                      | .gcd | Yes              | <input type="checkbox"/> | No | <input type="checkbox"/> |
|                      | .ptx | Yes              | <input type="checkbox"/> | No | <input type="checkbox"/> |
|                      | .rtu | Yes              | <input type="checkbox"/> | No | <input type="checkbox"/> |

|                      |                          |              |
|----------------------|--------------------------|--------------|
| <b>Communication</b> | Comms to Control device? | IED Address: |
|                      | Comms to Main-1          | IED Address: |
|                      | Comms to Main-2          | IED Address: |

#### Other general checks

|   |   |     |                          |    |                          |
|---|---|-----|--------------------------|----|--------------------------|
| 1 | Correct configuration Option Used?  | Yes | <input type="checkbox"/> | No | <input type="checkbox"/> |
| 2 | Was the “ <i>save information into RTU file for extracting a whole project</i> ” box ticked when downloadable files were generated? | Yes | <input type="checkbox"/> | No | <input type="checkbox"/> |
| 3 | Are the time sync parameters adjusted accordingly?  | Yes | <input type="checkbox"/> | No | <input type="checkbox"/> |
| 4 | Are all analogues adjusted correctly as per calculator?   | Yes | <input type="checkbox"/> | No | <input type="checkbox"/> |
| 5 | Is comms to IED’s and to ERTU/D400 established?   | Yes | <input type="checkbox"/> | No | <input type="checkbox"/> |
| 6 | Has the configuration files been named correctly as per approved naming convention?   | Yes | <input type="checkbox"/> | No | <input type="checkbox"/> |
| 7 | Latest Configuration and Database archived?   | Yes | <input type="checkbox"/> | No | <input type="checkbox"/> |

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### Annex D– Configuration Check Sheet for CMU05

|                         |  |
|-------------------------|--|
| Substation And Bay Name |  |
|-------------------------|--|

Configured By: \_\_\_\_\_ Unique No: \_\_\_\_\_

Date of Configuration and Archive: \_\_\_\_\_

|                      |      | ABB RTU560 CMU05 |                          |    |                          |
|----------------------|------|------------------|--------------------------|----|--------------------------|
| <b>Configuration</b> | .iod | Yes              | <input type="checkbox"/> | No | <input type="checkbox"/> |
|                      | .gcd | Yes              | <input type="checkbox"/> | No | <input type="checkbox"/> |
|                      | .ptx | Yes              | <input type="checkbox"/> | No | <input type="checkbox"/> |
|                      | .rtu | Yes              | <input type="checkbox"/> | No | <input type="checkbox"/> |

|                      |                         |         |                          |    |                          |
|----------------------|-------------------------|---------|--------------------------|----|--------------------------|
| <b>Communication</b> | Bay Switch Configured?  | Yes     | <input type="checkbox"/> | No | <input type="checkbox"/> |
|                      | Comms to Control device | IED IP: |                          |    |                          |
|                      | Comms to Main-1         | IED IP: |                          |    |                          |
|                      | Comms to Main-2         | IED IP: |                          |    |                          |

#### Other general checks

|   |   |     |                          |    |                          |
|---|---|-----|--------------------------|----|--------------------------|
| 1 | Correct configuration Option Used?  | Yes | <input type="checkbox"/> | No | <input type="checkbox"/> |
| 2 | Was the “ <i>save information into RTU file for extracting a whole project</i> ” box ticked when downloadable files were generated? | Yes | <input type="checkbox"/> | No | <input type="checkbox"/> |
| 3 | Are the time sync parameters adjusted accordingly?  | Yes | <input type="checkbox"/> | No | <input type="checkbox"/> |
| 4 | Are all analogues adjusted correctly as per spreadsheet?  | Yes | <input type="checkbox"/> | No | <input type="checkbox"/> |
| 5 | Is comms to IED’s and to ERTU/D400 established?   | Yes | <input type="checkbox"/> | No | <input type="checkbox"/> |
| 6 | Has the configuration files been named correctly as per approved naming convention?   | Yes | <input type="checkbox"/> | No | <input type="checkbox"/> |
| 7 | Latest Configuration and Database archived?   | Yes | <input type="checkbox"/> | No | <input type="checkbox"/> |

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