Eskom	Standard	Technology

Title: **NETWORKING DEVICES COMMISSIONING GUIDE FOR THE TRANSMISSION SUBSTATION**

Unique Identifier:	**240-170000044**
Alternative Reference Number:	**<n/a>**
Area of Applicability:	**Engineering**
Documentation Type:	**Standard**
Revision:	**1**
Total Pages:	**27**
Next Review Date:	**October 2025**
Disclosure Classification:	**Controlled Disclosure**

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PCM Reference: **240-44509543 – PCM Design Systems**

SCOT Study Committee Number/Name: **Telecontrol & SCADA Study Committee**

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1. Introduction

This document outlines the commissioning check procedure for the Siemens RUGGEDCOM networking hardware for Transmission substations.

2. Supporting clauses

2.1 Scope

2.1.1 Purpose

The purpose of this document is to detail the procedure that must be followed after installing the cabinets housing the network equipment in the substation and powering the equipment on, in order to confirm that the network hardware was installed and configured correctly and is operating as expected.

2.1.2 Applicability

This document shall apply throughout Eskom Holdings SOC Limited's Transmission Division sites.

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] 240-68111223 Technical Specification for Standard Networking Devices for the

[2] Transmission Substation Environment

[3] 240-46264031 Fibre-optic Design Standard – Part 2: Substations

2.2.2 Informative

None

2.3 Definitions

2.3.1 General

Definition	Description
Console Interface	A console interface provides serial access to a networking device for configuration and troubleshooting. It is helpful when troubleshooting as it bypasses the IP interface, and thus incorrect configurations mostly will not affect it.
DHCP	The Dynamic Host Control Protocol is used to automatically assign IP addresses, gateways and other relevant networking configurations with end devices, allowing them to connect to the network without any specific knowledge of the network itself or Ethernet technology principles.
Engineering Port	An engineering port in this system is considered one that belongs to the Engineering VLAN and allows temporary engineering connections for troubleshooting or configuration of the network and attached devices. The last two (2) copper RJ45 Ethernet ports on any device will be designated as engineering ports.

Definition	Description
LLDP	The Logical Link Discovery Protocol is used by networking devices to discover the identity of neighbouring devices that are also running LLDP. This will mainly be used for checking connections between networking devices, although some end devices may provide LLDP support natively.
MS-DOS Prompt	MS-DOS provided a selection of features that are useful for networking troubleshooting, including PING and TRACERT commands for testing communication paths. While MS-DOS is obsolete, the MS-DOS prompt included with all copies of Windows provides access to these tools.
SSH	The Secure Shell protocol is used for communicating with devices across a TCP/IP network. Unlike other commonly used communication options such as Telnet or HTTP, SSH provides secure communications including encrypted authentication data and thus is the option that will be used for ROS devices.
STP	The Spanning Tree Protocol comes in a variety of options, but all the options provide the same basic functionality, which is link redundancy on Ethernet based networks. STP will keep unused links in a standby mode but will bring them to an active state rapidly in the event an active link is broken.
VLAN	Virtual Local Area Networks are used to logically segregate traffic on a TCP/IP network, which allows control of traffic and prevents end devices from having to deal with traffic that is not relevant to them. VLANs are also essential in GOOSE communications for IEC61850.
VRRP	The Virtual Router Redundancy Protocol provides redundancy at a router level, without the need for changing configurations of end devices. Effectively two or more routers are associated with a single virtual router for the network. Only one physical router will be active at any time, however if this router goes down for any reason one of the redundant routers will take over the routing responsibilities for the network in a manner that is completely transparent to end devices.

2.3.2 Disclosure classification

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

2.4 Abbreviations

Abbreviation	Description
DB9	D-Sub miniature 9 connector
DHCP	Dynamic Host Control Protocol
DNS	Domain Name System
GOOSE	Generic Object-Oriented Substation Event
GPS	Global Positioning Satellites
IP	Internet Protocol
LC	Lucent Connector
LCD	Liquid Crystal Display
LLDP	Logical Link Discovery Protocol
MM	Multimode
MS-DOS	Microsoft Disk Operating System

Abbreviation	Description
MSTI	Multiple Spanning Tree Instance
MSTP	Multiple Spanning Tree Protocol
NTP	Network Time Protocol
RJ45	Registered Jack 45
ROS	Rugged Operating System
ROX 2	Rugged Operating System on Linux version 2
RS232	Recommended Standard 232
RSTP	Rapid Spanning Tree Protocol
SNTP	Simple Network Time Protocol
SSH	Secure Shell
STP	Spanning Tree Protocol
TCP	Transmission Control Protocol
UDP	User Datagram Protocol
VLAN	Virtual Local Area Network
VRRP	Virtual Router Redundancy Protocol

2.5 Roles and responsibilities

Work roles and responsibilities are allocated according to the requirements and individual competencies. All Eskom Holdings SOC Limited Transmission Division managers will ensure that this document is complied to.

2.6 Process for monitoring

Not applicable.

2.7 Related/supporting documents

Not applicable.

3. Required Tools for Commissioning

3.1 Hardware

- Console Cable:
  - For RX1500 and RSG2488, use standard straight RS232 DB9-DB9 console cable.
  - For RSG2100 and RS416, use DB9-RJ45 console cable provided with the units. A DB9-DB9 straight-through RS232 console cable can be used to extend the provided cable if required.
- 10-20m Ethernet cable (Cat5e or Cat6 can be used for commissioning purposes).
- Laptop with the minimum installed software (listed below).

3.2 Software

- PuTTY
- Web Browser (Recommended Internet Explorer for Windows or Mozilla Firefox for Linux).
- MS-DOS Prompt (for Windows) or Terminal (for Linux).

4. Prerequisites

1) Only personnel who are deemed to be competent to work of substation networking equipment are permitted to commission the substation network. In this regard the decision on competence is to be made by the relevant Secondary Plant Manager.

2) The commissioning engineer/technician shall ensure that he/she has the latest versions of the substation networking equipment configuration and drawings.

5. General

This section details how a commissioning engineer/technician connects to a ROS device, a ROX 2 device, as well as how to open an MS-DOS prompt window in Windows.

5.1 Commissioning notes

Screenshots are provided throughout this document as examples and in order to check the correct configuration menu is being accessed. However, in some cases the actual setting shown on these screenshots will be different from what must actually be configured on the unit. Substation specific documentation always takes precedence over this document in terms of actual configuration settings.

5.2 Connecting to a RUGGEDCOM ROS device (RSG2100, RSG2488, RS416) using PuTTY

1) Open PuTTY.exe.

2) Connect to the device using SSH on PuTTY. The example below shows the connection to a device with IP address 10.4.0.10:

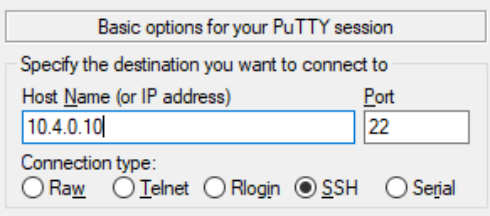


Figure 1: PuTTY Connection to ROS Device Example

3) Log into the device with the username **admin** and the required password.

5.3 Connecting to a RUGGEDCOM ROX2 device (RX1500)

1) Open your preferred web browser (Internet Explorer/Mozilla Firefox are recommended).

2) In the address bar type the IP address of the device you wish to connect to.

3) You may be presented with an unsecure connection warning, this can be ignored as shown below:

Internet Explorer:

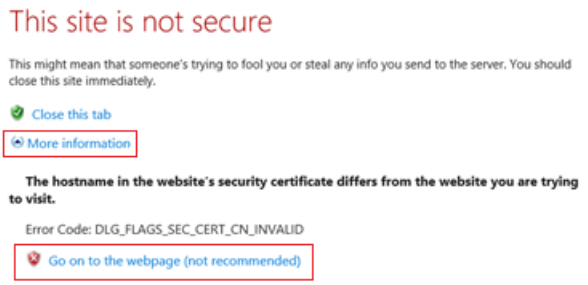
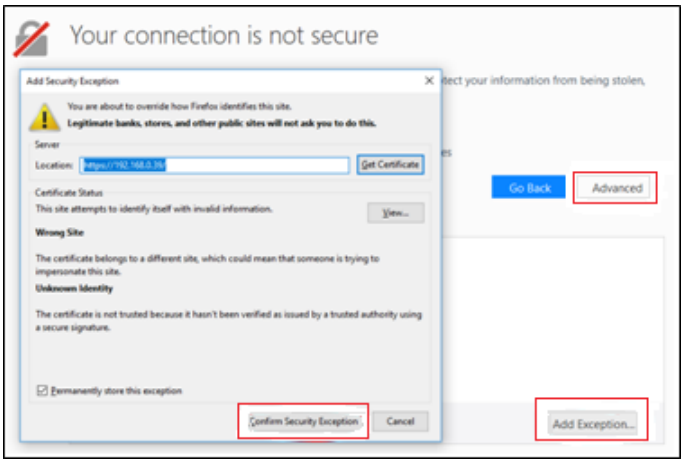


Figure 2: Internet Explorer Connection Warning

a) Click More Information.

b) Click Go on to the webpage (not recommended).

Mozilla Firefox:



a) Figure 3: Firefox Connection Warning

b) Click **Advanced**.

c) Click **Add Exception**.

d) Click **Confirm Security Exception**.

Once you have successfully processed past the warning window, you will be presented with a login page. Use username **admin** and the specific password as defined for the unit (if not yet configured the default password for all RUGGEDCOM devices is **admin** with username **admin**).

5.4 Opening MS-DOS Prompt

1) Press <**Windows Key + R**>.

2) Type **cmd** into the run prompt and press **Enter**.

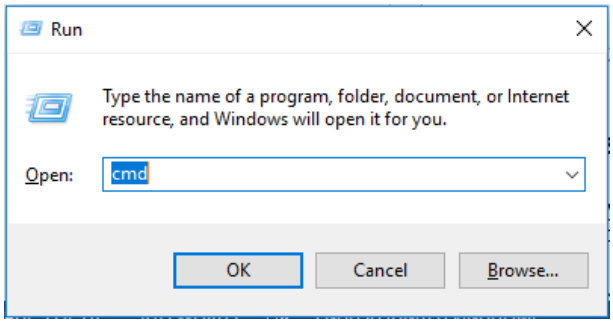


Figure 4: Windows Run Prompt

3) This will open the MS-DOS Prompt as pictured below.

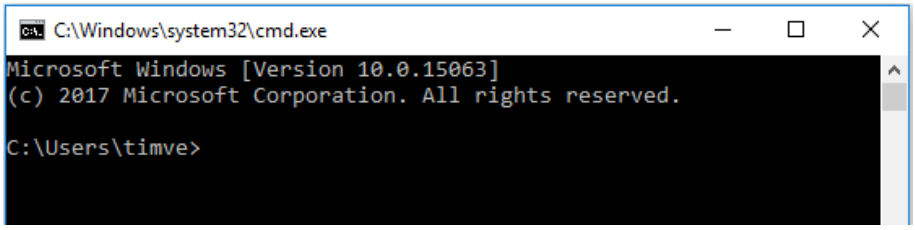


Figure 5: Windows MS-DOS Prompt

6. Commissioning Procedure

Appendix A contains a commissioning checklist, a copy of which should be printed and completed for each networking device commissioned. This checklist must be signed by the commissioning engineer/technician and the senior supervisor, and then passed on to the secondary plant manager for signing and archiving.

6.1 Check Hardware Build

1) Check that each installed unit has the correct build and port interfaces, as per the details below.

6.1.1 RSG2488

The RSG2488 units supplied fulfil the role of backbone switches. They have the following build code:

6GK6024-8GS23-3DA0-Z A00+B05+C05+D05+E05+F00+G60+H61:

- 2 x Power Supplies (88-300VDC/85-264VAC voltage range)
- 19” Rack Mount Kit
- 16 x 1000Sx MM via LC Connectors
- 2 x 10/100/1000Tx via RJ45 Connectors

Figure 6: RSG2488 – Front View

6.1.2 RSG2100

Two builds of RSG2100 are provided for the standard systems to fulfil the role of station switches, gateway switches and bay switches, i.e. a larger option (higher port count) and a smaller option (lower port count):

6.1.2.1 Large RSG2100

6GK6021-0AS23-3DB0-Z A05+B05+C05+D05+E02+F00+G05+H00+J00+K01:

- 2 x Power Supplies (88-300VDC/85-264VAC voltage range)
- 19” Rack Mount Kit
- 10 x 100Fx MM via LC Connectors
- 2 x 1000Sx MM via LC Connectors
- 2 x 10/100Tx Ports via RJ45 Connectors

Figure 7: RSG2100 (Large) – Front View

6.1.2.2 Small RSG2100

6GK6021-0AS23-3DB0-Z A05+B05+C00+D00+E02+F00+G00+H00+J00+K01:

- 2 x Power Supplies (88-300VDC/85-264VAC voltage range)
- 19” Rack Mount Kit
- 4 x 100Fx MM via LC Connectors
- 2 x 1000Sx MM via LC Connectors
- 2 x 10/100Tx via RJ45 Connectors

Figure 8: RSG2100 (Small) – Front View

6.1.3 RX1500

The RX1500 units supplied fulfil the role of routers on the network. They have the following build codes:

6GK6015-0AM23-3DC0-Z A03+B16+C00+D00+E01:

- 2 x Power Supplies (88-300VDC/85-264VAC voltage range)
- 19” Rack Mount Kit
- Layer 3 hardware with full layer 3 software (this means the unit can handle both switching and routing)
- 4 x 100Fx MM via LC connectors
- 6 x 10/100Tx via RJ45 Connectors

Figure 9: RX1500 – Front View

6.1.4 RS416

The RS416 unit supplied fulfils the role of a serial port server to extend serial connectivity over the TCP/IP network. They have the build code as listed below:

6GK6041-6AT23-3DB0-Z A02+B00+C00+D00+E05+F01:

- 2 x Power Supplies (88-300VDC/85-264VAC voltage range)
- 19” Rack Mount Kit
- 4 x RS232/422/485 via RJ45 Connectors
- 2 x 100Fx MM via LC Connectors
- 2 x 10/100Tx via RJ45 Connectors

Figure 10: RS416 – Front View

6.2 Check Physical Interfaces and Cable Connectors

1) Check that the physical interfaces on all units are not damaged/obstructed in any way.
2) Ensure that unused fibre optic interfaces have their dust covers in place.
3) Check all connectors are securely connected to the cables.
4) Check that all cables are firmly fitted to their correct interface on the networking hardware.
5) Ensure that the fibre cable has been installed according to the DST_240-43264031: Fibre-optic Design Standard – Part 2: Substations:
   a) Ensure that the fibre patch leads are adequately secured to the cabinet trunking.
   b) Ensure that the fibre cable has been glanded properly to the cabinet and that there is sufficient slack in the cabinet.
6) Ensure that all the networking equipment is properly earthed.

6.3 Check Terminal Blocks and Power Connections

1) **CAUTION:** If the unit has already been powered up, be sure not to touch any live cables or terminal blocks during this inspection step!
2) Check that the terminal blocks are tightly fitted to the unit, and that the securing screws for the terminal block are tightened.
3) Check that the power supply cables are correctly connected to the correct terminals.
4) Check that the terminal block protective covers are installed.

5) Where applicable, check that both power supply 1 and power supply 2 are connected.

6) For each networking equipment cabinet where there are dual power supplies:

a) Switch off MCB Main 1 and ensure that the networking equipment remains powered up.

b) Switch back on MCB Main 1.

c) Switch off MCB Main 2 and ensure that the networking equipment remains powered up.

d) Switch back on MCB Main 2.

6.4 Check Failsafe Alarm Connections

1) Check that the failsafe alarm is correctly connected to the NC (normally closed) and Common terminals on the failsafe relay terminal block.

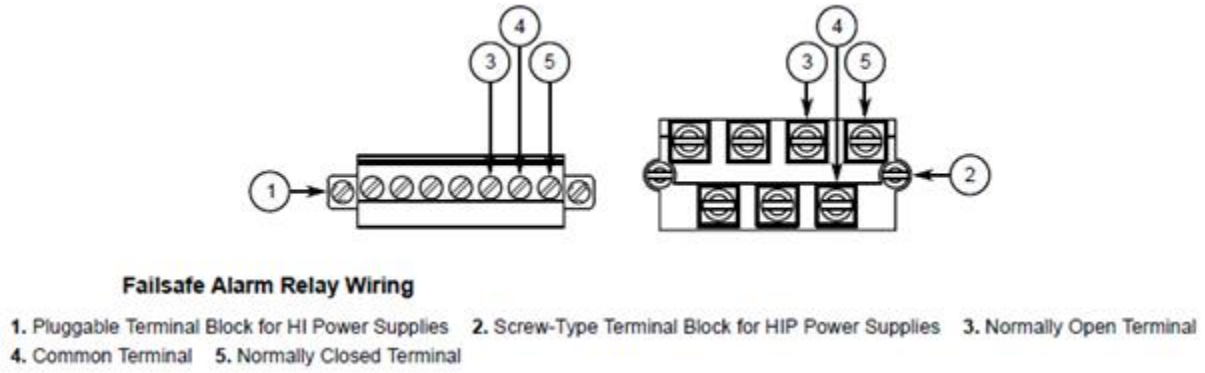


Figure 11: RSG2488 – Failsafe Relay Wiring

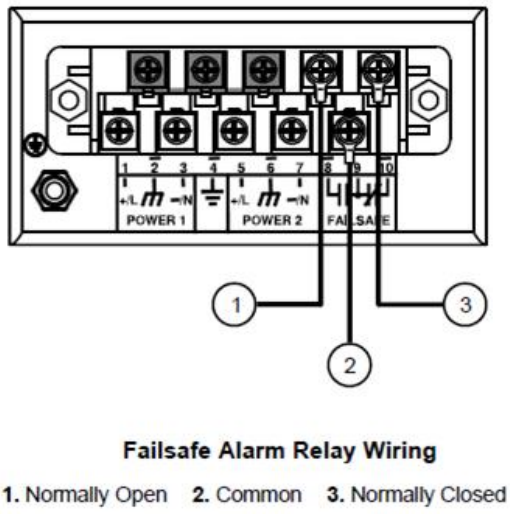
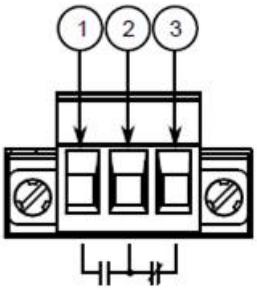


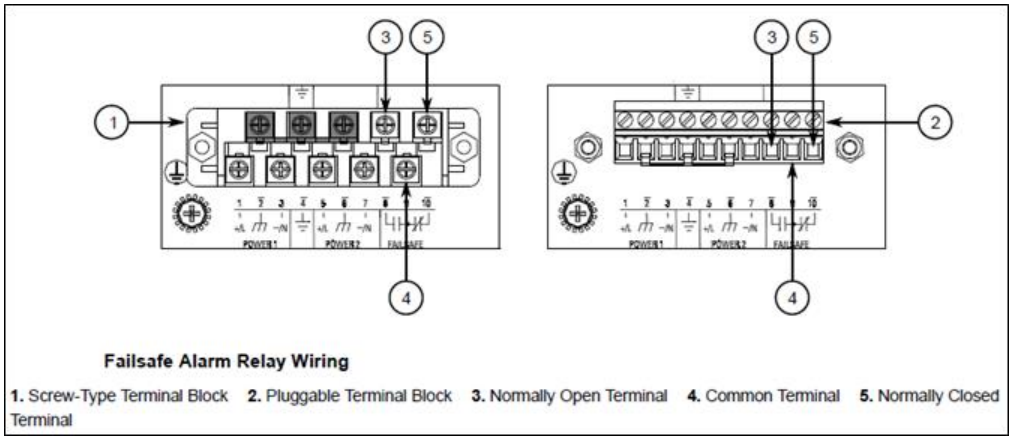
Figure 12: RSG2100 – Failsafe Relay Wiring



Failsafe Alarm Relay Wiring

1. Normally Open **2.** Common **3.** Normally Closed

Figure 13: RX1500 – Failsafe Relay Wiring



Failsafe Alarm Relay Wiring

1. Screw-Type Terminal Block **2.** Pluggable Terminal Block **3.** Normally Open Terminal **4.** Common Terminal **5.** Normally Closed Terminal

Figure 14: RS416 – Failsafe Relay Wiring

6.5 Check Mounting

1) Check that the rack mount (or DIN rail if applicable) brackets are correctly installed on the units.

2) Check that the units are correctly and firmly mounted to the panel rack mount.

6.6 Check Panel Labels

1) Ensure that all networking hardware is correctly labelled in the panel.

6.7 Check Console Interfaces

1) Ensure console interfaces on devices are not physically damaged (RJ45 console interface on RSG2488 and RX1500, DB9 console interface on RSG2100 and RS416).

Figure 15: RSG2488 – Console Interface

Figure 16: RSG2100 – Console Interface

Figure 17: RX1500 – Console Interface

Figure 18: RS416 – Console Interface

2) Ensure that each device can be communicated with via the console interface. For each device:

a) Connect the relevant console cable from the testing laptop to the console interface of the device under test:

- For RX1500 and RSG2488, use standard straight RS232 DB9-DB9 console cable.
- For RSG2100 and RS416, use DB9-RJ45 console cable provided with the units. A DB9-DB9 straight through RS232 console cable can be used to extend the provided cable if required.

b) Using PuTTY, open a serial connection to the device using the settings below, ensuring that you select the correct COM port on the laptop:

- Baud: 57600
- Data Bits: 8
- Parity: None
- Stop Bits: 1
- Flow Control: None

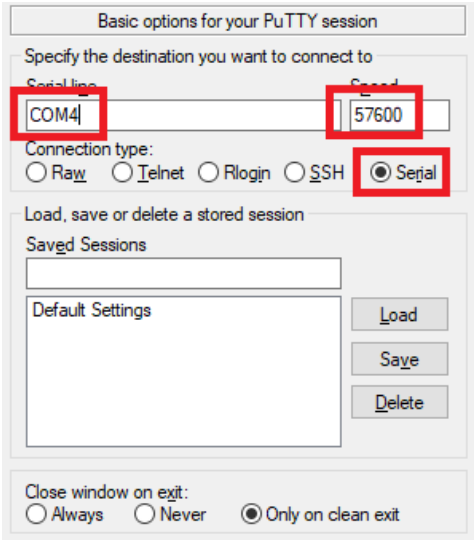


Figure 19: PuTTY Serial Connection Example

3) Click **Open** and then press **Enter** once the new console window appears, you should be presented with the login prompt for the device.

4) The appearance of a login prompt indicates a successful connection.

6.8 Check that the DHCP is working

1) Set the laptop to obtain an IP address automatically rather than a static address (refer to Figure 20 below):

2) On Windows 7/8:

   a) Click on Start icon on laptop and in the **"Search programs and files"** area enter **"Network and Sharing Centre"**, opening the link with the same name.

3) On Windows 10:

   a) Press the Windows key and then type in **"Network Status"**, selecting the link with the same name.

   b) Select the **"Network and Sharing Centre"** link from the panel on the right.

4) Select "**Change adapter settings**" from the left panel.

5) Right click your Ethernet interface and select **Properties.**

6) Double click "**Internet Protocol Version** 4" in the list.

7) Select "**Obtain an IP address automatically**" and "**Obtain DNS server address automatically**" checkboxes, then click **OK** in both windows.

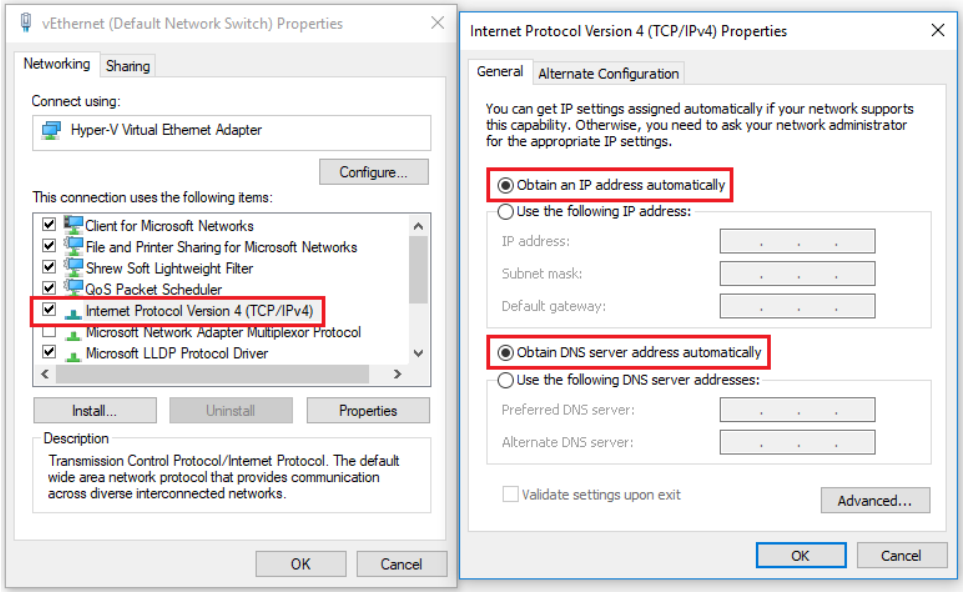


Figure 20: Windows IP Address Configuration

8) Connect the laptop to one of the engineering ports on any of the switches (One of the last two copper ports on any of the units). Wait a minute or two for the device to be assigned a DHCP address.

9) Open MS-DOS prompt (**Start > "cmd**") and type in **ipconfig** and press **Enter**.

10) Check that an IP address in the correct DHCP range has been assigned to your machine, as well as the correct default gateway.

Figure 21: MS-DOS IPConfig Command Example

6.9 Check Networking Devices' IP Address Assignments

1) While connected to an engineering port, open MS-DOS command prompt.

2) For each networking device on the network:

   a) Open up pings to the device (**ping xxx.xxx.xxx.xxx** where xxx.xxx.xxx.xxx is the IP address of the device under test).

   b) Ensure that pings go through correctly and do not time out.

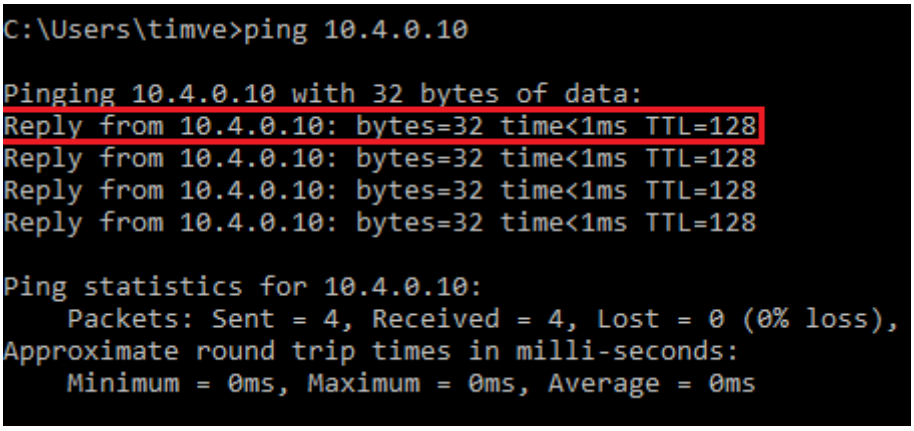


Figure 22: PING Command Example

6.10 Check VLAN Logical Setup and VRRP setup

1) On the laptop, open 7 MS-DOS command prompts, each of which must be set to have continuous pings to the VRRP router address for each VLAN (this should be the first IP address in each subnet). To open up continuous pings use the –t switch on the ping command. E.g. **ping xxx.xxx.xxx.xxx –t** with xxx.xxx.xxx.xxx being the IP address to ping.

2) For each networking device under test:

   a) Connect the laptop to an engineering copper port on the unit.

   b) Wait for the laptop to receive a DHCP address, then ensure the pings go through to all 7 VRRP addresses.

3) Finally, when connected to the last device to test and the pings have all resumed:

   a) Power down the Main 1 RX1500 router and ensure pings do not stop (1 or 2 ping replies may be lost, but they should resume after this).

   b) Power up the Main 1 RX1500 router and wait for it to reboot (about 5-10 minutes).

   c) Power down the Main 2 RX1500 router and once again ensure pings do not stop.

   d) Power up the Main 2 RX1500 router.

6.11 Check Time Synchronisation

- For each RSG2100 and RS416:

  1) Navigate to Administration > System Time Manager > Configure NTP > Configure NTP Servers and ensure that both servers are reported as Reachable.

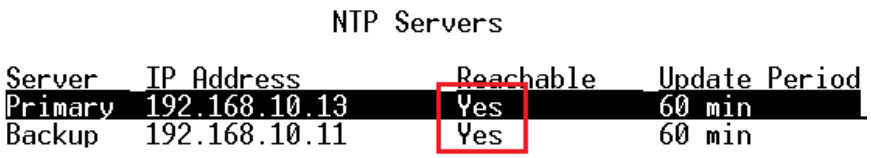


Figure 23: NTP Server Reachable Example

  2) Navigate to Administration > System Time Manager > Configure Time and Date.

  3) Visually ensure the time and date are correct on the unit. The correct time can be checked on the GPS clock LCD panel.

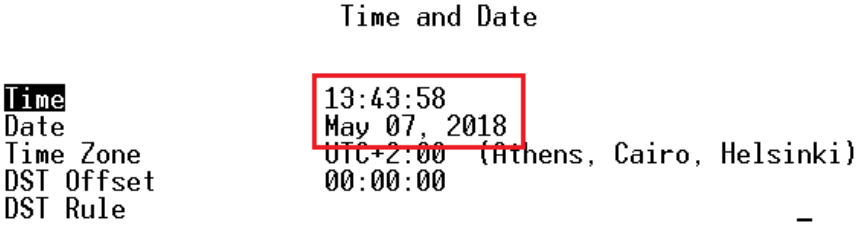


Figure 24: Time and Date on ROS Unit

- For each RSG2488:
  1) Navigate to Administration > System Time Manager > View Time Sync Status.
  2) Check that **SNTP offset** is showing a number, rather than Acquiring or Holdover.

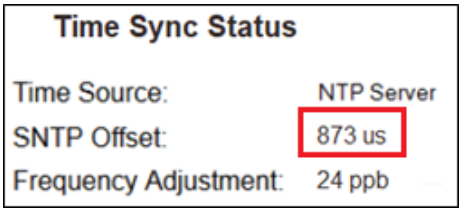


Figure 25: RSG2488 – Time Sync Status

- For each RX1500:
  1) Navigate to services > time > ntp > status > reference-clock.
  2) Ensure that the **State** for the primary NTP server is reporting **System Peer**.

Figure 26: RX1500 - NTP Status

6.12 Check Physical Topology

- For each ROS networking device under test:
  1) Log into the unit.
  2) Navigate to Network Discovery > Link Layer Discovery Protocol> View LLDP Neighbour Information.
  3) For each LLDP entry:
     a) Select the entry and press **Enter.**
     b) Cross reference with the topology diagram for this network to check that the **Port** (physical interface on this unit) connects to the correct **PortId** (physical interface on the neighbouring device identified by **SysName**).
     c) For example, the entry below shows that port 3/2 on the device we are logged into connects to port fe-3-6 (port 3/6) on RX1501 named DemoRX1500.

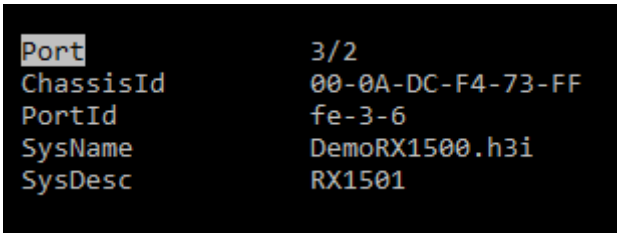


Figure 27: ROS LLDP Entry Example

Note: Tthat if the neighbouring devices have not been configured correctly with a System Name, then the ChassisID MAC address must be compared with the neighbours MAC address to ensure the port is connected to the correct neighbour as per the topology diagram for this network.

- For each ROX2 device under test:
  1) Log into the unit.
  2) Navigate to switch > net-discovery > lldp > port-lldp-neighbours.
  3) For each LLDP entry that is shown:
     a) Cross reference with the topology diagram for this network to check that the **Slot+ Port** (physical interface on this unit) connects to the correct **PortId** (physical interface on the neighbouring device identified by **System Name**).
     b) For example, the entry below is the reverse of the one shown above, showing that port 3/6 (fe-3-6) connects to port 3/2 on RSG2488.

Slot	Port	Chassis ID	Port ID	System Name	System Description	Port Description	Management Address
lm3	6	94:b8:c5:22:05:40	3/2		RSG2488		192.168.0.35

Figure 28: ROX II LLDP Entry Example

Note: That if the neighbouring devices have not been configured correctly with a System Name, then the Chassis ID MAC address entry must be compared with the neighbours MAC address to ensure the port is connected to the correct neighbour as per the topology diagram for this network.

6.13 Check Ethernet Stats

- For each ROS networking device under test:
  1) Log into the unit.
  2) Navigate to Ethernet Stats > View Ethernet Statistics.
  3) Check the ErrorPkts column for any reports that are reporting packet errors (i.e. number is over 0).
     a) If a port is reporting error packets observe for a minute or so, if constant error packets are reported this port and the connected cable must be investigated.
        - In the event errors are discovered, navigate to **Ethernet Stats > View Ethernet Port Statistics** and select the port that was showing the errors to find out more details of what the exact error types are.
          - For instance, if the errors are **CRCAlignErrors** then this could indicate a faulty cable/port or interference on the cable.
          - If the errors are **Collisions** this could indicate a speed/duplex configuration mismatch on this port.

```
BBSW-M1                    Ethernet Statistics

OutPkts              ErrorPkts
3949                 0
3957                 0
3939                 0
3879                 0
3991                 0
3999                 0
3864                 0
513                  0
0                    0
0                    0
0                    0
0                    0
0                    0
0                    0
0                    0
0                    0
0                    0
0                    0
More left ..._
```

Figure 29: Ethernet Statistics (RSG2488, RSG2100, RS416) Example

- For each ROX 2 networking device under test:

  1) Log into the unit.

  2) Navigate to interfaces > switch.

  3) For each connected interface on the unit, select that interface from the list of switch interfaces.

  4) Check the ErrorPkts statistic under Port Statistics to ensure it is not reporting any packet errors (i.e. number is over 0).

     a) If a port is reporting error packets observe for a minute or so, if constant error packets are reported this port and the connected cable must be investigated.

        - In the event errors are discovered, scroll down to the **RMON Port Statistics** information block to find out more details of what the exact error types are.

          - For instance, if the errors are CRCAlignErrors then this could indicate a faulty cable/port or interference on the cable.

          - If the errors are Collisions this could indicate a speed/duplex configuration mismatch on this port.

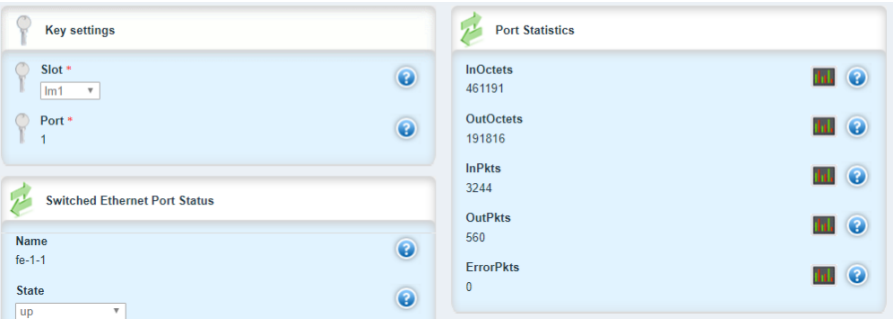


Figure 30: Ethernet Statistics (RX1500) Example

6.14 Check Spanning Tree Operation

1) Open 6 PuTTY sessions, with 2 logging into each of BBSWM1, BBSWM2 and SSW (i.e. have two active connections to each of the two backbone switches and the common station switch for the substation).

2) On each pair of PuTTY connections:

   a) Navigate one to **Spanning Tree > View Bridge RSTP Statistics**.

   b) Navigate the other to **Spanning Tree > View Port RSTP Statistics**.

3) Ensure that BBSWM1 is marked as the Root Bridge under **Bridge Status**, and that the other two are reporting Designated Bridge.

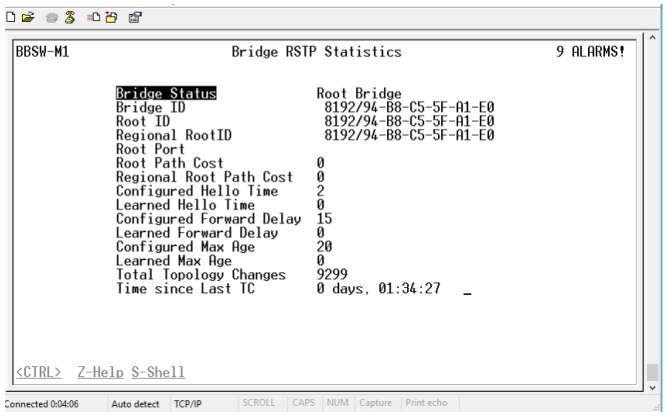


Figure 31: RSTP Stats (RSG2488, RSG2100, RS416) Example

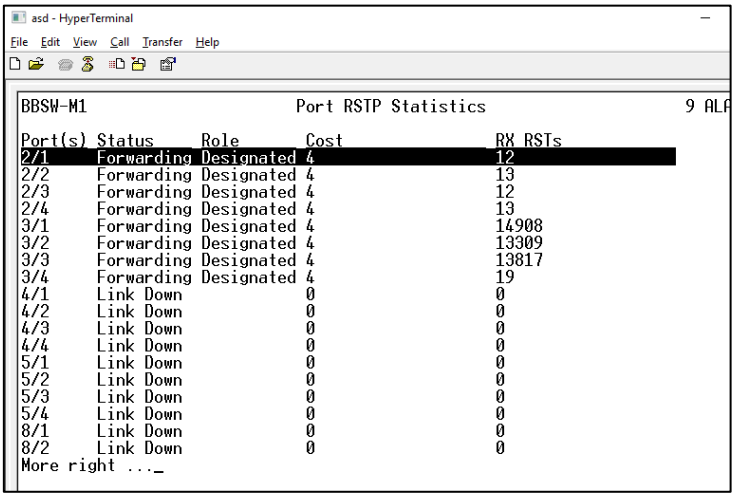


Figure 32: RSTP Port Stats (RSG2488, RSG2100, RS416) Example

4) For each pair of PuTTY connections:

   a) Navigate one to **Spanning Tree > View Bridge MSTI Statistics**.

   b) Navigate the other to **Spanning Tree > View Port MSTI Statistics**.

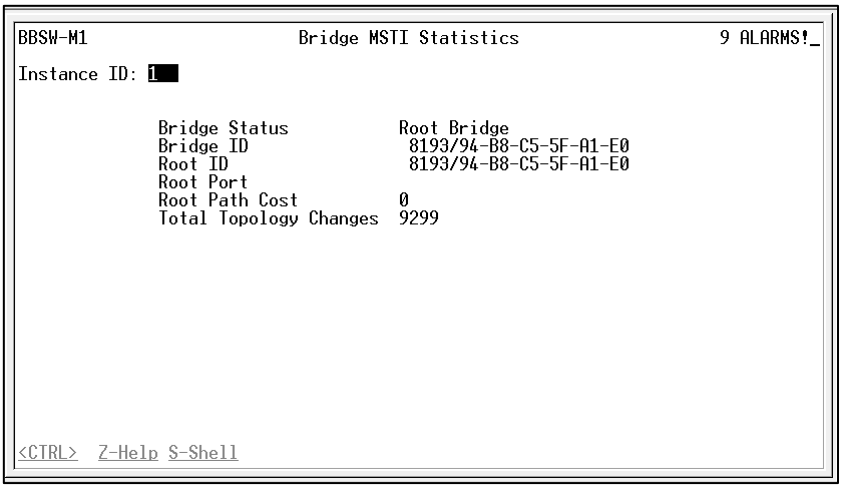


Figure 33: MSTP Stats (RSG2488, RSG2100, RS416) Example

5) Sequentially change the **Instance ID** for each connection up from 1 to 6, checking that the correct switch is marked as Root Bridge in each case:

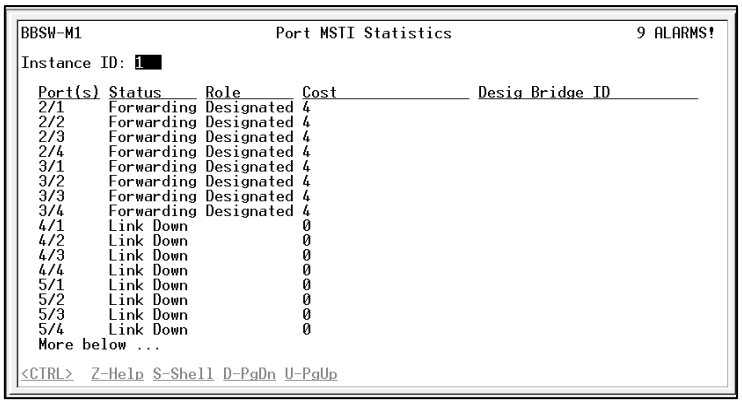


Figure 34: MSTP Port Configuration Example

Table 1: Root Bridges for each MSTI

MST Instance	Root Bridge
1	BBSWM1
2	BBSWM2
3	SSW
4	BBSWM1
5	BBSWM2
6	SSW

6) While still checking MSTI 6, disconnect the link between BBSWM1 and SSW, and check that one of the links between BBSWM1 and BBSWM2 should change from Discarding Status to Forwarding Status.

7) Reconnect the link between BBSWM1 and SSW.

8) Check that your laptop is not physically connected to the SSW, if it is swap the connection over to one of the backbone switches.

9) Power down the SSW and ensure that BBSWM1 becomes the Root Bridge. Power up SSW.

6.15 Check Latched Alarms

- For each ROS device under test:
  1) Log into the unit.
  2) Navigate to **Diagnostics > View Latched Alarms**.
  3) Ensure that no critical alarms are latched. Note that any Port Down alarms may have been caused by other commissioning checks. If any port down alarms exist, navigate to **Diagnostics > Clear Latched Alarms** and press "Y" to clear all the alarms. Wait a couple of minutes and then recheck to ensure no devices are "flopping" (links going up and down repeatedly).
- For each ROX 2 device under test:
  1) Log into the unit.
  2) Navigate to admin > alarms.
  3) Ensure that no critical alarms are latched. Note that any Port Down alarms may have been caused by other commissioning checks. If any port down alarms exist, navigate to **admin > clear-all-alarms** and click **Perform** to clear all the alarms. Wait a couple of minutes and then recheck to ensure no devices are "flopping" (links going up and down repeatedly).

7. Authoriation

This document has been seen and accepted by:

Name and surname	Designation
Avhapfani Luvhengo	Secondary Plant Manager – Central Grid
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8. Revisions

Date	Rev	Compiler	Remarks
Oct 2020	1	D Gojela	First Draft

9. Development team

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

- Ian Naicker
- James Ranyane
- Dumisani Gojela

10. Acknowledgements

- Siemens
- CONCO Energy Solutions (PTY) Ltd

Annex A – Commissioning Checklist

Device Name		**Device IP**	
Section	**Description**	**Pass (✓)/ Fail (✗)**	**Notes**
6.1	Builds of all networking hardware matches expected build codes		
6.2	Physical interfaces are not damaged/obstructed		
	Unused fibre optic interfaces have dust covers in place		
	Cable connectors are all securely crimped/spliced to their cable		
	Cable are firmly connected to networking hardware		
	Fibre cable installed according to DST_240-46264031		
	Networking equipment correctly earthed		
6.3	Terminal blocks are properly secured to the units		
	Power supply cables correctly connected to terminals		
	Terminal block protective covers in place		
	Power supply 1 and 2 are connected (where applicable)		
	Dual powered units **only**: Unit remains powered up when MCB Main 1 is turned off		
	Dual powered units **only**: Unit remains powered up when MCB Main 2 is turned off		
6.4	Failsafe relay is connected correctly		
6.5	Mounting brackets are correctly installed on hardware		
	Hardware is correctly and firmly mounted in the panels		
6.6	Networking hardware is labelled correctly		
6.7	Console ports physically undamaged		
	Unit can be reached via console port		
6.8	DHCP assigns correct address to engineering laptop		
6.9	IP addresses of networking devices are assigned and reachable		
6.10	VLANs are setup correctly		

	VRRP is working as expected		
6.11	Time correctly synchronised on all devices		
6.12	Physical topology is correct		
6.13	No ports reporting error packets		
6.14	Spanning Tree Protocol is operating correctly		
6.15	No alarms are latched following commissioning checks		

Field Engineer/Technician	**Senior Supervisor**	**Secondary Plant Manager**
Name:	Name:	Name:
Date:	Date:	Date:
Signature:	Signature:	Signature: