

Reyrolle Protection Devices



Energy Management



Contents

Technical Manual Chapters

- 1. Installation
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Installation Guide

Document Release History

This document is issue 2019/02. The list of revisions up to and including this issue is:

2019/02	Addition of Disposal information & update of photographs and drawings
2014/09	First issue

Software Revision History

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Section 1: Introduction

This manual is applicable to the following protection device:

7XG3124 Arc Fault Detection Module

The 'Ordering Option' Tables summarise the features available in each model



Figure 1: 7XG3124 Ordering Options

Section 2: Hardware Description

2.1 Sensor Installation

2.1.1 Sensor Spacing

The RA30 sensor is available as a single detector or dual detector package.

The RA30A single detector version is depicted in figure 1 showing the location of the detection window and the approximate coverage zone:



Figure 2: RA30A single detector & Coverage Zone

The recommended spacing for the RA30A single detectors is approximately 5 - 6 m to ensure adequate detection overlap.



5 - 6 m Figure 3: RA30 Spacing

The RA30B Dual detector version provides an additional detection window for dual zones of coverage as depicted below :



Figure 4: RA30B Dual Detector

The recommended spacing for the RA30B single detectors is approximately 5 - 6 m to ensure adequate detection overlap, this combination provides an overall coverage zone of approximately 10 - 12 m.



10 - 12m

Figure 5: RA30B Dual Detector Spacing

The RA30A and RA30B sensors may also be mixed to provide various coverage combinations, again spacings of approximately 5 - 6 m should be observed to ensure adequate detection overlap.



10 - 12m

Figure 6: RA30 & RA30B Spacing

2.1.2 Sensor Placement

Sensors need to be mounted to provide full coverage of the switchgear cubicles to be protected. Where the protected zone is larger than the sensor coverage then the use of multiple sensors is required.

Precise positioning of the sensors is generally not required as the light caused by the arc is reflected from the walls.

2.1.3 Sensor Mounting

The RA30 is suitable for flush panel mounting in a number of configurations, for further information on mounting arrangements and mounting hardware refer to the RA30 Catalogue Sheet.

2.1.4 Example Sensor Placement

The following are some typical examples of sensor placement.



Figure 7: Sensor placement inside CB racking chamber



Figure 8: Sensor placement inside busbar chamber



Figure 9: Sensor placement inside cable termination chamber



Figure 10: Sensor placement for switchgear Busbar coverage (External through Hole Detector)



Figure 11: Sensor placement near Low Voltage Contactor for a Variable Speed Drive



Figure 12: Sensor placement for Switchgear cable termination chamber (External through Hole Detector)



Figure 13: Sensor placement for end of Bus chamber (External through Hole Detector)



Figure 14: Sensor placement for Switchgear cable termination chamber (External through Hole Detector)

2.2 Scheme Wiring

2.2.1 RA24 Connection Diagram



Figure 15: RA24 Connection Diagram

The above diagram shows the RA24 connections.

The connected sensor inputs need to be enabled and unused inputs disabled via the Web browser configuration tool. This is essential to :

- Allow connected sensor inputs to operate for an ARC Fault
- Allow connected sensor inputs to be supervised
- Ensure unconnected sensor inputs do not indicate an Arc sensor Alarm condition



2.3 Terminal Layout and Module Dimensions



Figure 16: Terminal Layout and Module Dimensions

The module may be surface mounted or alternatively mounted on a din rail by using 2 optional din rail mounting kits (See Catalogue Sheet for Ordering Options)

2.4 Custom Labels

The RA24 front panel makes provision for two (2) custom labels, one label identifies the sensor location and the remaining label provides IED identification and IP address details.

The default labels supplied with the relay may be marked up by hand or alternatively custom labels may be produced using the template provided on the Reyrolle website, printed and slipped behind the clear windows on the front panel as depicted below.



Figure 17: RA24 Custom Label

Section 2: Communication

2.1 Physical Connections

The RA24 is ordered with either of the following Ethernet connection options :



The RA24 IED employs IEC61850 Goose messaging to convey the operation of ARC Fault Sensors and may be used with one or many subscribing IEDs to deploy ARC Fault protection schemes.

The simplest application topology is to connect a single RA24 directly with a single IED using a suitable crossover connection :



Figure 20: RA24 Direct Connection

Alternatively the RA24 or many RA24 Arc Fault Monitors may be connected to a Station Bus Lan as shown below :



Figure 21: RA24 IEC61850 Station LAN

2.2 IP Addressing

The RA24 IED will come preconfigured from the factory with the IP address 192.168.0.220. The default IP address may be used in a web browser session to undertake relay configuration. Full details of relay configuration are described in subsequent sections of the user guide.

Reconfiguration of the RA24 IP address may be required according to the IP addressing defined in the IEC61850 substation configuration, any subsequent web browser sessions will need to utilise the reconfigured IP address.

Section 3: RA24 File Glossary & Firmware Upgrade

3.1 RA24 File Glossary

3.1.1 1S24.cid

This XML file is interpreted by the RA24 every time it powers up to determine all nodes the RA24 will support, the explicit Goose and Report datasets *this* RA24 will output, and optionally set initial values of some configuration items. It also contains some private SystemCorp extensions. The IP address quoted in this file *must* match an IP address already configured on the RA24. It is used to select whether the RJ45 *or* Fibre ports are used for IEC61850. It is loaded onto A:\ drive using FTP. There are two .icd files that can be downloaded from Reyrolle website. Descriptions of both files are provided below:

3.1.1.1 1S24.ICD

The <u>**1S24.cid**</u> can be used as-is on the RA24 and has a default set of 16 separate Goose messages, one for each FADet point with stVal and Quality included in the Goose. However, The IP address within this file, must match the IP Address configured on the RA24

3.1.1.2 1S24-bare.icd

The <u>**1S24-bare.icd</u>** has an ICD extension as it is intended for importing into site configuration tools which can add specific Goose to it (with whatever VLAN, Versioning etc. required). The Tool can then export a CID file for use on the RA24. **Please Note:** On the RA24 itself, it must be called 1S24.cid.</u>

3.1.2 sarc.exe

This file contains the runtime application code for the RA24 arc sensor. This executable includes the SystemCorp IEC6180 stack and all the RMS firmware. It is usually run at start-up by autoexec.bat. It is loaded onto A:\ drive using FTP.

3.1.3 test.exe

This file contains the test code for the RA24 hardware. It includes RMS test firmware. It is run manually on the command line, usually by the test-jig. 1S24.exe must not be running already, so an autoexec.bat that doesn't include 1S24.exe is required. Test.exe does not have to be removed after testing, it can remain on the A:\ drive. It is loaded onto A:\ drive using FTP.

3.1.4 PIS10.key

This is the special license key file required by the SystemCorp stack (see 1S24.exe) to allow it to run. A different key file is required for each BECK chip and is keyed to the Serial Number on the BECK chip.

Note that RMS production versions of the stack will not require a PIS10.key, but only BECK-IEC chips bought direct from BECK by RMS will allow this configuration. Others will require a specific key file. Some key files are located in:

L:\ENG\Projects\1s024\Firmware\release\A-drive\key

3.1.5 Autoexec.bat

Applications to run on start-up on the RA24 are listed in this file. Typically this includes sarc.exe and ETH1.exe on a runtime system.

For testing hardware it should not include sarc.exe.

For firmware debugging it should also include Probe.exe.

3.1.6 CHIP.INI

This is the BECK system configuration file.

When @CHIPTOOL or RA24 web app is used to configure IP addresses, or select DHCP, this file is modified automatically.

Other configuration items are included that are desirable for the proper operation of the RA24, so a default CHIP.INI file is included with the project. Ability to upgrade the operating system or not can be controlled using this file. Configuration of FTP, or enabling/disabling Telnet or SSH can be controlled using this file. It is loaded onto A:\ drive using FTP.

3.1.7 HTTP directory

This entire folder and sub-folders is required by the RA24 to support the web browser. If not present the web browser will give a default BECK screen or be unbrowsable. This folder and contents needs to be copied from the RA24 release project verbatim. The default web admin password is "RMS". It is loaded onto A:\ drive using FTP.

3.1.8 ETH1.exe

An application supplied to support the 2nd Ethernet channel. On the RA24 this is used for the optic fibre port. It is loaded onto A:\ drive using FTP.

3.1.9 ARC_IO.hex

This Intel hex file is used to program the Arc IO expander peripheral on the relay/psu board. Programming of this file is done using Atmel JTAG or ISP dongles plugged onto the Jtag or ISP headers on the Relay PCB. It is not possible to upgrade this processor remotely via the BECK chip (yet).

3.1.10 SC1x3V0xyy_FULL.hex

This hex file contains version *x.y* of the BECK operating system. As of writing, the latest version is *1.51*. At least this version must be present on the BECK board to properly support RA24 operation. The upgrade procedure is detailed below. Chips supplied from BECK may not have necessarily have the most recent operating system version installed. Version *1.20* was seen on BECK chips supplied by SystemCorp.

3.2 Upgrading the RA24

3.2.1 Upgrading the Operating System

- Connect Ethernet cable to RJ45
- Run @CHIPTOOL on PC
- If necessary configure target RA24 to be on same IP network as your PC or configure DHCP
- Ensure there is a CHIP.INI installed that allows upgrades. TFTP must be enabled, which is disabled by default for security.
- Right click on target RA24 and select Program Flash image
- IP address of target device should appear in UDP/IP subsection
- Browse for "Load File" to select the new SC1x3V0*xyy*_FULL.hex file
- Click "Start" in the UDP/IP subsection
- Do not power off RA24 until upgrade has completed

3.2.2 Upgrading the RA24 firmware

- Connect Ethernet cable to RJ45
- Run @CHIPTOOL on PC
- If necessary configure RA24 to be on same network as PC or configure DHCP
- Right click on target RA24 and select FTP
- FTP username=ftp, password=ftp are the factory defaults
- Copy new sarc.exe from PC to A: on RA24
- Reboot RA24.
- Default Autoexec.bat starts sarc.exe on startup.

3.3 Loading a new sub-station configuration

As an IEC61850 device, the RA24 needs to be configured so it can communicate appropriately in a particular sub-station. How and which GOOSE messages are sent between IED devices is setup in a system configurator. Information the RA24 requires as a result of this configuration of the site are the GOOSE datasets that must be sent by this RA24, and the Report datasets that must be sent, and where to.

The exact procedure may differ based on which system configurator is used, so here is the procedure that works for communication with a Reyrolle relay using the Siemens DIGSI system Configurator

3.4 Setting up a new RA24

These are the steps that are used to convert a bare board into a RA24. These steps will normally be done automatically by the production test jig, but it is worth documenting them here. In this case I'm using Ethernet whereas the test-jig will use a serial port, but they are doing the same thing.

- Connect an Ethernet cable to the RJ45 connector
- Run @CHIPTOOL on PC
- If necessary configure RA24 to be on same network as PC or configure DHCP
- Right click on target RA24 and select FTP
- Copy entire http folder to the RA24 A:\
- Edit CHIP.INI on PC to set the IP addresses
- Copy ETH1.exe, test.exe, CHIP.INI, Autoexec.bat, 1S24.cid, sarc.exe to the RA24 A:\
- Connect ISP dongle to relay card
- Use RA24 ArcIO upgrade tool or AVR Studio to load ATmega64 chip with IO firmware
- Reboot
- NB: IP address will change to that in copied CHIP.INI
- Browse the IP address on the web and configure RA24 as required.

3.5 Configuring a RA24

- RA24 configuration can be achieved in 3 ways with the same result: Use a web browser set to the RA24 IP address to configure individual ARC sensors on or off, and whether it is included in the overall alarm output. You can also change the default admin password from "RMS" and configure the IP and SNTP parameters.
- Use a terminal (either telnet from @CHIPTOOL, or a serial port terminal) to bring up the command line interface. Use CLI commands to configure parameters as required. Ctrl-F may be required to switch context.
- Edit the 1S24.cid file to contain initial values for some nodes. The IP address does not change the RA24 IP address, but must match either the RJ45 or Fibre IP address. FTP (from @CHIPTOOL) the new file onto the RA24. Reboot. These parameters will be loaded as the file is read on startup. Configuring an Arc sensor on/off or included is also possible this way. This is a convenient way to setup a number of RA24's with the same configuration.

Section 4: Environmental Protection Hints

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The disposal of our products and possible recycling of their components after decommissioning has to be carried out by an accredited recycling company, or the products/components must be taken to applicable collection points. Such disposal activities must comply with all local laws, guidelines and environmental specifications of the country in which the disposal is done. For the European Union the sustainable disposal of electronic scrap is defined in the respective regulation for "waste electrical and electronic equipment" (WEEE).



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By disposing of these products correctly you will help to save valuable resources and prevent any potential negative effects on human health and the environment.

NOTE: Our products and batteries must not be disposed of as household waste. For disposing batteries it is necessary to observe the local national/international directives.

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NOTE: You can find more information about activities and programs to protect the climate at the EcoTransparency website:

https://www.siemens.com/global/en/home/products/energy/ecotransparency.html

7XG3124

Application Guide

Document Release History

This document is issue 2019/02. The list of revisions up to and including this issue is:

2019/02	Updates Figure 47 photograph
2014/09	First Issue

Software Revision History

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Section 1: RA24 Arc Fault Monitor Configuration

1.1 Web Browser Session

Configuration of a RA24 can be undertaken either via direct connection to a PC or via a Lan.

If a direct connection to a PC is utilitised a crossover patch lead will be required to enable communication with the RA24.

Whether the communication is direct or via a LAN, both the PC and the RA24 need to have IP addressing within the same network.

With a subnet mask of 255.255.255.0 the first 3 octets of the IP address need to be the same for the PC and the RA24 and the last octet needs to be unique, for example:

RA24 IP Address: 192.168.0.220 PC IP Address: 192.168.0.238

In the above example entering the RA24 IP Address (192.168.0.220) into the PC web browser address field will establish a web browser session displaying the Relay Build Information and a menu tree to navigate to the other configuration screens.

Arc Fault Relay - Windows Internet Explorer	
C ⊂	Siemens Search
🙀 Favorites 🙀 🖉 Web Slice Gallery 👻	
Cault Relay] ▼ 🖃 🖶 ▼ Page ▼ Safety ▼ Tools ▼ 🕢 ▼
Relay Build Information	qk
Serial Number: 616524_4 Package Release: 2.99 Firmware: V2.99 PCB Revision: 1 Relay: 1 ICD File Base: 1.05 Last PCB test: 21MAR1 Last Relay test: None Last Config Change: 01Jan06 Password: Change @ 2013 RMS Pty Ltd	REYROLLE RA24 Arc Faul • Relay Build • IP Configuration • Arc Status • Help
Done SInternet Protec	ted Mode: On 🆓 👻 🍕 100% 👻



To make any changes you will be prompted for a User name and Password

Connect to 192.1	68.0.221	? 🛛
The server 192.168.0 password. Warning: This server password be sent in a without a secure conr).221 at Retry require is requesting that you in insecure manner (b hection).	is a username and ur username and asic authentication
<u>U</u> ser name:	1	*
Password:		
	Remember my pa	ssword
	ОК	Cancel

Figure 2: RA24 Login window

The factory default username and password is:

Username: admin Password: RMS

The username and password need only be entered once for each web server session and allows for multiple setting changes with access automatically timing out after 2 minutes of inactivity.

1.2 Relay Build

The Relay Build screen provides device details such as the of the Serial Number and Firmware version.

The Password may be changed at this point by entering your new password and pressing the *Change* button, enter the user name and previous password if prompted.

Arc Fault Relay - Windows Internet Explorer	and the second s	
	👻 🔄 🗙 🔎 Siemens Sear	ch 🔎 🔻
🖕 Favorites 🛛 🍰 🙋 Web Slice Gallery 🔻		
Arc Fault Relay	🖄 🕶 🗟 👻 🚍 🖝	Page ▼ Safety ▼ Tools ▼ 🔞 ▼ ≫
Relay Build Information	Help	
Serial Number: 616524_4 Package Release: 2.99 Firmware: V2.99 PCB Revision: 1 Relay: 1 ICD File Base: 1.05 Last PCB test: 21MAR1 Last Relay test: None Last Config Change: 01Jan06 Password: Change		REYROLLE RA24 Arc Fault - Relay Build - IP Configuration - Arc Configuration - Arc Status - Help
		Web application
Done	Internet Protected Mode: On	🖓 🔻 🍕 100% 🔻

Figure 3: RA24 Homepage

1.3 IP Configuration

The IP Configuration screen displays and allows editing of the IP address parameters for the RJ45 port, Fibre port, Gateway and the SNTP Server.

To change the IP address edit the IP address field and then click the Change button and enter the user name and password if prompted.

Note that the Fibre port must be on a different IP network to the RJ45 port.

For time stamping in accordance to the IEC61850 standard an SNTP server is required. The SNTP server IP address can be set in the IP Configuration screen but if left blank the RA24 will attempt to find a default SNTP server if available.

Arc Fault Relay IP Configuration - Windows Internet Explorer	-	
😋 🔵 🗢 🙋 http://192.168.0.220/ipc.htm	✓ ✓ X ✓ Starting stength results	+ م
🚖 Favorites 🛛 🚖 🔊 Web Slice Gallery 🔻		
Arc Fault Relay IP Configuration	🟠 🔻 🗟 👻 🖃 🖶 👻 Page 👻 Safety	/▼ Tools▼ 🕢 ▼
IP Configuration	Help	
RJ45 IP Address: 192.168.0.220 Mask: 255.255.255.0 Fibre IP Address: 192.168.1.220 Mask: 255.255.255.0 IP Gateway: 192.168.0.254 Change IP	REYR RA	OLLE
SNTP Server: Resync: 600 seconds Change Seconds	SNTP Arc Fault - Relay Bi - IP Confi - Arc Cor	uild iguration nfiguration tus
		plication
	Local intranet Protected Mode: Off	a → ⊕ 100% →

Figure 4: RA24 IP Configuration

1.4 Arc Configuration

The Ass Configuration concerns	and detailed a second second second second	a still a set fair a set of t	
I DE ALC L'ODTIQUITATION SCIEEN	provides contiduiration	Settings for each of	Ind the Sensor Innuite
0			

🖉 Arc Configuration - Windows Internet Explorer									
S → P http://192.168.0.220/conf.htm					+ م				
🔶 Favo	orites 🛛 👍 🙋 We	b Slice Gallery 👻							
🔏 Arc Ce	onfiguration			ł	- 🛛 -	- 🖶 -	Page 🕶 Safety 👻 Tools 👻	@ • "	
		Arc Configura	tion		Help		REYROLLE		
	Sensor	State	Trip1	Trip2	Zone				
	1	Disabled	Yes	Yes	1				
	2	Disabled	Yes	Yes	2		D • O •	- 64	
	3	Disabled	Yes	Yes	3		RA/4	- 64	
	4	Disabled	Yes	Yes	4			- 64	
	5	Disabled	Yes	Yes	5		Arc Fault	- 64	
	6	Disabled	Yes	Yes	6		Relay Build		
	7	Disabled	Yes	Yes	7		- IP Configuration		
	8	Disabled	Yes	Yes	<u>8</u>	E	- Arc Configuration		
	9	Disabled	Yes	Yes	9		Fibre Loop Sensor	- 64	
	10	Disabled	Yes	Yes	10		Holp	- 64	
	11	Disabled	Yes	Yes	11		meip	- 64	
	12	Disabled	Yes	Yes	12			- 64	
	13	Disabled	Yes	Yes	13			- 64	
	14	Disabled	Yes	Yes	14			- 64	
	15	Disabled	Yes	Yes	<u>15</u>			- 64	
	16	Disabled	Yes	Yes	<u>16</u>			- 11	
ł		@ 2013 F I	IIIS Phy I fel II			•	Web application		
				📢 Local	intranet Protec	cted Mode: Of	ff 🥠 👻 🔍 100	% 👻	

Figure 5: RA24 Arc Configuration

There are 4 settable parameters for each sensor input:

State

Armed or disabled, defines if the Sensor input is enabled or disabled, click on the field to change the state and enter the user name and password if prompted.

Trip 1 & 2 Output Contacts

The RA24 provides two high speed tripping output contacts (Trip 1&2). These may be employed for local tripping functions and for system testing purposes. Each sensor input may be set to trip either of the output contacts. The arc trip contacts will self-reset after a 2s delay. The trip indication LED is reset either by pressing the front panel reset button, via the remote reset status input or via IEC61850 control.

Trip 1

Yes or No, determines if the Sensor input operates the Trip 1 output, click on the field to change the state and enter the user name and password if prompted

Trip 2

Yes or No, determines if the Sensor input operates the Trip 2 output, click on the field to change the state and enter the user name and password if prompted.

Zone

The Zone Setting provides a means of improving Goose response time for simultaneous trips in a single Arc Fault tripping zone. The Zone setting ensures that a Goose is immediately broadcast without having to wait for the updating of all arc detectors in the same corresponding zone. Allowable Zone values are from 1 to 16. Set the Zone value the same for sensors located in the same zone. Click on the field to alter the Zone value

1.5 Arc Status

The Arc Status screen provides status information on each of the of the 16 Sensor inputs.

Arc Status - Windows Intern	et Explorer					_ D X
🕒 🕞 🗢 🙋 http://192.10	58.0.220/arc.htm		- 47 × 8	starting sten	gth results	• م
🚖 Favorites 🛛 🛔 🖉 W	eb Slice Gallery 👻					
Arc Status			🐴 - 🔊 -	- 🚔 -	Page 🕶 Safety 🕶	Tools 🔻 🔞 👻
Arc Status	Automatic refresh	Refresh	H	lelp		
				- N - 1	DEVDC	
Sensor	State	Flag	Zone Count	-ń I	KEIKC	
1	Disabled	No	<u>0</u>			
2	Disabled	No	0			
3	Disabled	No	0		RAZ	Λ
4	Disabled	No	0			
5	Disabled	No	0		Arc Fault	
6	Disabled	No	<u>0</u>		··· Relay Build	ld
7	Disabled	No	<u>0</u>		- IP Configuration	ation
8	Disabled	No	<u>0</u>	E	- Arc Config	uration
9	Disabled	No	<u>0</u>		Arc Status	
10	Disabled	No	<u>0</u>		- Fibre Loo	p sensor
11	Disabled	No	<u>0</u>		Incip	
12	Disabled	No	<u>0</u>			
13	Disabled	No	<u>0</u>			
14	Disabled	No	<u>0</u>			
15	Disabled	No	<u>0</u>			
16	Disabled	No	<u>0</u>			_
	© 2013 I	MS Phy I tel		-		
					Web appli	cation
			👊 Local intranet Prote	ected Mode: Of	ff 💮 🖷	• 🔍 100% 👻

Figure 6: RA24 Arc Status

State

The State column determines the state of each sensor input. The following states are reported : Disabled ARC Sensor is disabled

Dioubiou	
Armed	ARC Sensor is armed
Tripped	ARC detected (changes for the period of the trip) Failed ARC sensor supervision failure

Initializing ARC sensor initializing (transitory) Stuck ARC sensor stuck on

Flag

The Flag column will indicate and latch for an Arc Sensor operation, individual Flags may be reset by clicking on the sensor flag status and entering the user name and password if prompted.

Count

The Count field provides a log of ARC sensor operations since power on or the last counter reset, the individual sensor counters may be reset to 0 by clicking on the count field and entering the user name and password if prompted.

1.6 Summary of RA24 SARC Configuration

The following steps outline the RA24 SARC Configuration :

- Establish a Web Browser session using the default IP address
- ✓ Set up the IP addressing for the SNTP server
- ✓ Arm the ARC Sensor inputs to be utilized in the application
- ✓ Set which outputs are to be operated by the respective ARC sensors

Section 2: IEC61850 Substation Configuration

2.1 Application Example

The following example will demonstrate the process of implementing an ARC Fault Protection scheme using IEC61850 Goose messaging in conjunction with other IEC61850 equipped IEDs.

The example will comprise of a RA24 Arc Fault Monitor used in conjunction with Reyrolle 7SR22 Argus relays with IEC61850 communications and implemented with the Reydisp Manager Productivity tool embedded with the optional Digsi System configurator.

A similar process is equally applicable to IEC61850 equipped IEDs from alternative vendors and alternative System Configuration tools.

The steps to implement our Application Example are :

- ✓ Create an IEC61850 project in a System configurator
- ✓ Populate the project with the Application IEDs
- ✓ Populate the project with the RA24 IEDs using the default RA24 icd file
- ✓ Populate the project with the IEC61850 Substation
- Using the System Configurator configure the desired IP addressing of the subnet containing all of the application IEDs
- ✓ With the System Configurator create the GOOSE applications with the associated GOOSE linkages between the source IED logical nodes (in the case of the RA24 : SARCs) and the subscribing IED (in our example we use GGIO)
- ✓ With all GOOSE mapping complete create a .cid file for the RA24 using the export facility in the System Configurator
- ✓ FTP the 1S24 .cid file into the RA24
- ✓ Reboot the RA24 to invoke the GOOSE mapping
- Create the subscribing relay application logic that will make use of the status changes in the subscribed GOOSE messages from the RA24
- ✓ Send the relay configurations as well as IEC 61850 to the respective subscribing IEDs in the application

2.2 Arc Fault Scheme

The single line schematic arrangement of the application example is shown in the diagram below:



Figure 7: Single Line Arc Fault Scheme

Arc Fault coverage is to be provided to the bus, circuit breaker chambers and cable termination chambers and shall be current checked with an overcurrent relay. Tripping shall be zoned to provide sectionalizing and minimize affected plant.


Figure 8: RA24 Sample Protection Scheme

The scheme comprises of RA30 sensors connected to a RA24 Arc Fault Monitor, providing ARC Fault coverage of the colored protection zones.

The RA24 provides the SARC Logical Node for the operation of Arc Fault Sensors.

The 7SR22 Overcurrent relay subscribes to SARC Goose messages and initiates the required protection tripping via an Overcurrent Check.

Tripping in this case will be carried out by hardwiring to respective circuit breakers and using binary outputs from the 7SR22 IED but could also be implemented via Goose by another subscribing IED.

Flexible tripping logic may be implemented in the 7SR22 according to specific application requirements and may also accommodate different operating arrangements in more complex applications.

2.3 RA24 SARC Allocation

In the proposed scheme we have 6 Arc Fault Sensors installed providing coverage for 5 distinct protection zones. The individual SARCs are allocated as follows :

Zone Coverage	Colour	Number of Sensors	SARC Allocation
Feeder Exit Termination Chamber		1	SARC 1
Feeder CB Chamber		1	SARC 2
Bus		2	SARC 3 SARC 4
Incomer CB Chamber		1	SARC 5
Incomer Termination Chamber		1	SARC 6

Table 1: RA24 SARC Allocation Protection Zone Tripping

The required circuit breaker tripping is defined by the following tripping table :

SARC Operation	Zone Coverage	Colour	Trip
SARC 1	Feeder Exit Termination Chamber		1A CB
SARC 2	Feeder CB Chamber		TR1 LT CB
SARC 3 or SARC 4	Bus		TR1 LT CB
SARC 5	Incomer CB Chamber		Upstream
SARC 6	Incomer Termination Chamber	n Upstream	

Table 2: RA24 Protection Zone Tripping

2.4 RA24 Source Arc Fault Detector Points

The RA24 will broadcast the following Arc Fault Detector Points to subscribing IEDs :

O Goose ARC Fault Detector points	
SARC	Description
RMS RA24/DEV RA24/RMS SARC1/FADET	RA24 Arc Fault Detector 1
RMS_RA24/DEV_RA24/RMS_SARC2/FADET	RA24 Arc Fault Detector 2
RMS_RA24/DEV_RA24/RMS_SARC3/FADET	RA24 Arc Fault Detector 3
RMS_RA24/DEV_RA24/RMS_SARC4/FADET	RA24 Arc Fault Detector 4
RMS_RA24/DEV_RA24/RMS_SARC5/FADET	RA24 Arc Fault Detector 5
RMS_RA24/DEV_RA24/RMS_SARC6/FADET	RA24 Arc Fault Detector 6
	O Goose ARC Fault Detector points SARC RMS_RA24/DEV_RA24/RMS_SARC1/FADET RMS_RA24/DEV_RA24/RMS_SARC2/FADET RMS_RA24/DEV_RA24/RMS_SARC3/FADET RMS_RA24/DEV_RA24/RMS_SARC4/FADET RMS_RA24/DEV_RA24/RMS_SARC5/FADET RMS_RA24/DEV_RA24/RMS_SARC6/FADET

Table 3: RA24 Source Arc Fault Detector Points

2.5 7SR22 Single Point Input GGIO Allocation

The 7SR22 relay will subscribe to SARC Goose messages broadcast by the RA24 IED and shall assign subscribed SARCs to Single Point Input GGIO as follows :

Destination 7SF	22 Relay Goose Single Point Inputs	
ARC Fault Dete	ctors	
Function	Single Point Input	Description
SARC1	CBn/CTRL/SPi64GGIO1/SPCSO1	CBn Single Point Input 1
SARC2	CBn/CTRL/SPi64GGIO1/SPCSO2	CBn Single Point Input 2
SARC3	CBn/CTRL/SPi64GGIO1/SPCSO3	CBn Single Point Input 3
SARC4	CBn/CTRL/SPi64GGIO1/SPCSO4	CBn Single Point Input 4
SARC5	CBn/CTRL/SPi64GGIO1/SPCSO5	CBn Single Point Input 5
SARC6	CBn/CTRL/SPi64GGIO1/SPCSO6	CBn Single Point Input 6

Table 4: 7SR22 Single Point Input GGIO Allocation

2.6 Creating an IEC61850 Station

To create and configure an IEC61850 project requires an IEC61850 system configurator.

In our example Reydisp Manager with the optional embedded Digsi system configurator will be used to establish the Goose message linkages between the RA24 and the 7SR22 Overcurrent relay.

Reydisp Manager is used as the productivity tool to manage the IEC61850 configuration process for Reyrolle relays and may also be utilized to create any required logic in Reyrolle devices.

A screenshot of Reydisp Manager is shown below :

🏫 Reydisp Manager		
File Edit View Insert Tools	Window Help	

Figure 9: Reydisp Manager Configuration - 1

To create a new project choose File and New.

🏫 New Proje	ect	
Name: Location: Directory:	Create directory for project	Browse
Project File:	 ОК	Cancel

Figure 10: Reydisp Manager – New Project

🏫 New Proje	ct	- 0 X
Name:	RevArc Arc Fault Protection	
Nume.		
Location:	C:\Users\Desktop	Browse
Directory:	ReyArc Arc Fault Protection	
Project File:	C:\Users\Desktop\ReyArc Arc Fault Protection\ReyArc Arc Fault Protection.r	
	ОК	Cancel

Fill in the details including where you want the project file to be stored and hit OK.

Figure 11: Reydisp Manager – New Project 2

The new project has been created.



Figure 12: Reydisp Manager – New Project 3

2.7 Populating IEDs In the IEC 61850 Project

We now need to populate the project with our IEDs, firstly the Reyrolle 7SR22. Choose Insert and Device and you will be presented with the following screen.

🖬 Select Device	
1. Select Product Family and Software Version	2. Select Device by MLFB
1. Select Product Family and Software Version ▼ TSR210 ♥ TSR210 ♥ TSR220 ♥ TSR220	2. Select Device by MLFB
Connected Device	
	Select Cancel

Figure 13: Reydisp Manager – Add Device

Select the required relay, for this example we will choose a 7SR2202-2AA77-0CA0 ensure that the MLFB code is correctly filled.

🔚 Select Device	
Select Device 1. Select Product Family and Software Version Devices R7a-7a <	Select Device by MLFB S R 2 2 0 2 · 2 A A 7 7 · 0 C A 0 Reset S
75R2204-2 (AB) A [1-4] ⊥-00A0 75R2204-2 (AB) A [1-4] 2-00A0 75R2204-2 (AB) A [1-4] 2-00A0 75R2204-2 (AB) A [78] 7-0CA0 75R2204-2 (AB) A [78] 7-0CA0 75R2204-2 (AB) A [78] 7-0DA0	7 5 R 2 2 0
Connected Device	Select Cancel

Figure 14: Reydisp Manager – Add Device 2

Once the MLFB code is correctly selected, you can then select the device.

The 7SR22 IED has been added to your project.

Reydisp Manager - [RMS	Arc Fault Prote	ction - E:\M	y Documen	ts\RMS Arc Fa	ult Protecti	ion\RMS Arc F	ault Protec	tion\RMS Arc	Fa	
💼 File Edit View Inser	t Tools Wind	ow Help	-						- 1	∍ ×
🗅 🐸 🔁 🗖 🚍 💿										
😰 Add 🝷 🙀 🚋 🥅 Icons 🔋	📰 List 🔝 Details	Project S	ync							
	Item Name 🗠	IED Nam	e Τγ	/pe	Author	Last Modif	ied	Comment	Status	
	75R2202-2AA	7 TEMPLAT	E Re	vrolle Device		24/10/201	2 2:20:1		Device Syn	c Re
	<									>
	RMS Arc Fau	lt Protecti	on / 75R2	2202-2AA77	7-0CA0					
	Device coning	juracion				_				-
	2	<i>~</i>	Ð		3	\odot				
	Sync Device	Configure	Logic	Settings	Configure	Configure				
		communica			Threndre	Time 2016				
	Utilities									
	_					*				
	Export Denico	Peload Device	Migrate Douid	e Undate Device	Evport ICP	Compile EN100	Import	Import		
	Export Device	Firmware	ringrate Devic	from Template	export rep	Binary	CID/SCD	Settings		
<u><</u>										<u>~</u>

Figure 15: Reydisp Manager – Add Device 3

Continue adding Reyrolle IEDs as required using the same process.

Nominate a meaningful IED name for each IED by right clicking on the IED and choosing properties.

G	75R2202-2A	A77-OCAO - Properties 🛛 🗙
	General IEC 61	850
	Name:	7SR2202-2AA77-0CA0
	Path:	E:\My Documents\RMS Arc Fault Protection\RMS Arc Fault Pr
	File Name:	E:\My Documents\RMS Arc Fault Protection\RMS Arc Fault Pr
	Hierarchy:	RMS Arc Fault Protection/7SR2202-2AA77-0CA0
	Model:	7SR220\R7a-7a\7SR2202-2[AB]A[78]7-0CA0 Template R3
	MLFB:	7SR2202-2AA77-0CA0
	Author:	
	Created: Last Modified:	24/10/2012 2:20:17 PM 24/10/2012 2:20:17 PM
	Comment:	
		OK Cancel

Figure 16: Reydisp Manager – Rename Device

General IEC 61850	
IED Name:	0C_7SR22
ICD File:	E:\My Documents\RMS Arc Fault Protection\RMS Arc F
ICD Size:	440.96 KB
Extended Device Ir Manufacturer:	nformation SIEMENS
Device Type:	7SR220
Description:	
Config Version:	1.0
C Station Configuratio	n
Station:	N/A
IP Address:	172.16.0.1
Subnet Address:	255.255.255.0
Gateway Address	: 172.16.0.254
UDP Port:	50,000

Choose the IEC 61850 tab and enter a name in the IED Name field.

Figure 17: Reydisp Manager – Rename Device 2

Next we will add the ReyArc RA24 IED which is added as a Third Party ICD File. You will need to have the RA24 ICD file (Note: This file is called 1S24.icd) which is available through the Reyrolle website.

Choose Insert and Third Party ICD File and you will be presented with the following file selection, choose the RA24 ICD file

Select ICD File						? 🗙
Look in:	CD ICD	~	6	🗊 E		
My Recent Documents Desktop My Documents	Svn ABB DK61 GEC Reyrolle SEL SystemCorp Thytronic IS24-bare					
My Computer						
	File name:	1S24-bare		1	~	Open
My Network	Files of type:	ICD File (*.icd)		•	~	Cancel

Figure 18: Reydisp Manager – Insert 3rd Party ICD

The RA24 IED has now been added to your project.

	Ann Fault Destantio	- F.M. D					
Reydisp Manager - [KMS	Arc Fault Protectio	m - c: wy bocu	ments was are r	ault Protection	KMS ATC FAULT PTOLE	CHONNEMS ATC Pa	
Hie Edit view Inser	t loois window	нер					
දුට Add 🝷 👷 🕼 🛄 Icons [📰 List 🛄 Details 🔂	Project Sync					
	Item Name 🧠	IED Name	Туре	Author	Last Modified	Comment	Status
	75R2202-2AA7	OC_75R22	Reyrolle Device		24/10/2012 3:33:5		Device Sync Re
	RP/5_1524	RM5_1524	Device		24/10/2012 3:44:5		
	<						>
	RMS Arc Fault F	Protection / R	MS_1S24				
	Utilities						
		<u> </u>					
	<u> </u>						
	Export ICD Op	en Device Folder					
	1						

Figure 19: Reydisp Manager – Insert 3rd Party ICD 2

You can nominate a meaningful IED name for the RA24 IED by right clicking on the IED and choosing properties.

Now we will add a IEC61850 Station, choose Insert and Station.

🏫 Reydisp Manager - [RMS	Arc Fault Prote	ction - E:\My	Documents\RMS A	rc Fault Protecti	ion\RMS Arc Fault Prot	ection\RMS Ar	c Fa 🔳 🗖 🔀
💼 File Edit View Inser	rt Tools Wind	ow Help					_ 8 ×
L) 📁 🗟 🗆 🗖 🔍							
🙀 Add 👻 🙀 👘 🔝 Icons [📰 List 🔟 Details	Project Syr	nc				
	Item Name 🗠	IED Name	Туре	Author	Last Modified	Comment	Status
	75R2202-2AA	7 OC_75R22	Reyrolle Devic	te	24/10/2012 3:33:5		Device Sync Re
	New Station		61850 Station	1	24/10/2012 3:59:2		
	RM5_1524	RM5_1524	Device		24/10/2012 3:44:5		
	<						>
	RMS Arc Fau	lt Protectio	n / New Station				
	Station Confi	nuration	in , new station				
			-				
		- HO	- 				
	System	Update	Open SCD in				
	Configurator	Station	Netview				
	Utilities						
	Export SCD	Import SCD	Open Station Folder				
< >							

Figure 20: Reydisp Manager – Add IEC61850 Station

We can give the Station a meaningful name by editing the Item Name. We then nominate the Station Devices to be included in the Station by right clicking on the Station and choosing properties.

Thew Station - I	Properties
General Station	Devices
Name:	New Station
Path:	C:\Users\z0036kcv\Desktop\ReyArc Arc Fault Protection\Static
File Name:	C:\Users\z0036kcv\Desktop\ReyArc Arc Fault Protection\Static
Hierarchy:	ReyArc Arc Fault Protection/New Station
Model:	
MLFB:	
Author:	
Created:	28/08/2014 10:21:41
Last Modified:	28/08/2014 10:21:56
Comment.	
	-
	OK Cancel

Figure 21: Reydisp Manager – Rename IEC61850 Station

Select Station Devices and you will see a selection of available unassigned IEDs

Device Name	IED Name	Location
7SR2202-2AA77-0CA0	OC_7SR22	ReyArc Arc Fault Pro
ReyArc_1524	RA24	ReyArc Arc Fault Pro
•		
		Add to Station
Assianed Devices		Add to Station
Assigned Devices	IED Name	Add to Station
Assigned Devices	IED Name	Add to Station
Assigned Devices Device Name	IED Name	Add to Station
Assigned Devices	IED Name	Add to Station

Figure 22: Add Device to IEC61850 Station

Select the IEDs

Station Devices		
assigned Devices		
vice Name	IED Name	Location
R2202-2AA77-0CA0	OC_7SR22	ReyArc Arc Fault Protec
yArc_1S24	RA24	ReyArc Arc Fault Protec
		4
		Add to Station
igned Devices		
· · · · · · · · · · · · · · · · · · ·	IED Name	Location
vice Name		
vice Name		Þ
III		•
vice Name III devices assigned		Remove Device
vice Name		

Figure 23: Add Device to IEC61850 Station 2

Press Add to Station.

U	New Station - Properties			x
G	eneral Station Devices			_
	Unassigned Devices			
	Device Name	IED Name	Location	
	•		4	
	L		Add to Station	
	Assigned Devices			
	Assigned Devices	IED Name	Location	
	Assigned Devices Device Name 75R2202-2AA77-0CA0 Revice 1524	IED Name OC_7SR22	Location ReyArc Arc Fault Protect	
	Assigned Devices Device Name 7SR2202-2AA77-0CA0 ReyArc_1S24	IED Name OC_7SR22 RA24	Location ReyArc Arc Fault Protec ReyArc Arc Fault Protec	
	Assigned Devices Device Name 7SR2202-2AA77-0CA0 ReyArc_1S24	IED Name OC_7SR22 RA24	Location ReyArc Arc Fault Protec ReyArc Arc Fault Protec	
	Assigned Devices Device Name 7SR2202-2AA77-0CA0 ReyArc_1S24	IED Name OC_7SR22 RA24	Location ReyArc Arc Fault Protect ReyArc Arc Fault Protect	
	Assigned Devices Device Name 7SR2202-2AA77-0CA0 ReyArc_1S24 2 devices assigned	IED Name OC_7SR22 RA24	Location ReyArc Arc Fault Protect ReyArc Arc Fault Protect ReyArc Arc Fault Protect	
	Assigned Devices Device Name 7SR2202-2AA77-0CA0 ReyArc_1S24 2 devices assigned	IED Name OC_7SR22 RA24	Location ReyArc Arc Fault Protect ReyArc Arc Fault Protect ReyArc Arc Fault Protect	
	Assigned Devices Device Name 7SR2202-2AA77-0CA0 ReyArc_1S24 2 devices assigned	IED Name OC_7SR22 RA24	Location ReyArc Arc Fault Protect ReyArc Arc Fault Protect Nemove Device	

Figure 24: Add Device to IEC61850 Station 3

Press OK to Assign the Devices to the Station

2.8 IEC61850 Station - System Configuration

We now need to configure the IP Addressing for our Station LAN and the Goose Linkages for our Goose messages.

With the Station highlighted Double Click the System Configurator Button, this will start the Digsi System Configurator in the Network view.



Figure 25: System Configurator

Expanding the Station will present the Subnets associated with the Station.

KIN IEC61850 System Configurator -New St	ation - [C:\Users\z0036kcv\Deskt	p\ReyArc Arc Fault Protection\Station1\Station	1.sc 🗆 🔍 🗙
Station Edit Insert View Help			
Network + GOOSE	ports and logs		
■ ■ ∾ ~ X □ ■ x ₩			
Subnets		Properties	
Name	 Name in manager 	Identification	
▼ ↑ New Station		Name Subnet1	
New devices		Description	
III NONE		Comment	
▼ 👪 Subnet1		Type Subnet	
0C_75R22	75R2202-2AA77-0CA0	Detected dates 172 16 0 1	
RA24	ReyArc_1524	IP start address I/2.16.0.1	5.0
		Standard Gateway Chevice-de	enendent>
		Baud rate <not set=""></not>	cpendence
		Type 8-MMS	
		Name	
		Name of subnet	
		Nume of Sublice	
•		•	

Figure 26: System Configurator - Devices

IEC61850 System Configurator -New Static	on - [C:\Users\z0036kcv\Deskt	top\ReyArc Arc Fault Protection\Station1\Station.s			
Station Edit Insert View Help					
Network	s and logs				
IIII → ♀ X ↓ E × 100					
Subnets		Properties	д		
Name 🔺	Name in manager	Identification			
▼ ↑ New Station		Name Subnet1			
New devices		Description			
 NONE		Comment			
▼ 👪 Subnet1	1	Type Subnet			
. OC 75R22	75R2202-2AA77-0CA0	Parameter			
RA24	RevArc 1S24	IP start address 172.16.0.1			
		Subnet mask 255.255.255.	0		
		Standard Gateway <device-dep< th=""><th>endent></th></device-dep<>	endent>		
		Baud rate <not set=""></not>			
		Type 8-MMS			
		Name			
		Name of subnet			
		P .			
l			//		

Clicking on the Subnet will reveal the IP Start address, Subnet mask and standard gateway settings.

Figure 27: System Configurator - IP Address

We can set the IP start address for our network for convenience, in this case 192.168.0.1. The Standard Gateway may also be set at this point if one exists.

🔏 IEC61850 System Configurator - New Station - [C:\Users\z0036kcv\Desktop\ReyArc Arc Fault Protection\Station1\Station.sc 📼 🖻 🗾 🖉					
Station Edit Insert View Help					
Network + GOOSE	orts and logs				
📔 🖬 🚢 🗠 🗠 🗶 💵 🖦 📰	<u></u>				
Subnets			Properties	4	
Name	 Name in manager 	E	Identification		
▼ ↑ New Station			Name	Subnet1	
New devices			Description		
i NONE			Comment		
▼ 👪 Subnet1		_	Туре	Subnet	
GC_75R22	75R2202-2AA77-0CA0	E	Parameter		
RA24	ReyArc_1S24		IP start address	192.168.0.1	
			Subnet mask Standard Cateway	<pre>200.200.200.000</pre>	
			Baud rate	<pre><pre>coot set></pre></pre>	
			Type	8-MMS	
			1765	0.1.1.2	
		I	P start address		
		2	atart address for automa	ticaddressing	
< <u> </u>		F.			
				///	

Figure 28: System Configurator - IP Address 1

Expanding Subnet1 will reveal the IEDs that we previously assigned to the Station.

K IEC61850 System Configurator -New	Station - [C:\Users\z0036	kcv\Desktop\RevArc Arc Fault	Protection\Station1\Sta	tion.sc 🗆 😐 🐹
Station Edit Insert View Help		and a conception of the rate i duit		
Network A GOOSE	Reports and logs			
🖬 🕹 🗠 🍳 🐰 💷 🋍 🗙	auto IP			
Subnets			Propertie	s ₽
Name 🔺	Name in manager	IP address	🗆 Identificat	tion
★ New Station			Name	Subnet1
New devices			Description	L .
 INONE			Comment	
▼			Туре	Subnet
B. OC 75R22	75R2202-2AA77-0CA0	192,168.0.1	🗆 Paramete	r
B RA24	RevArc 1524	192.168.0.2	IP start add	tres 192.168.0.1
40 10 12 1		17211001012	Subnet mas	sk 255.255.255.0
			Standard G	atev <device-dependent></device-dependent>
			Baud rate	<not set=""></not>
			Type	8-MMS
			Name Name of subr	iet
			, , , , , , , , , , , , , , , , , , ,	

Figure 29: System Configurator - IP Address 2

The individual devices may be selected to set their IP addresses.

K IEC61850 System Configurator - New S	Station - [C:\Users\z0036kcv\D	esktop\ReyArc Arc Fault F	rotection	\Station1\Station	n.sc 🗆 🔍 📈 🔨
Station Edit Insert View Help					
	eports and logs				
Subnets				Properties	
Name 🔺 N	ame in manager	IP address	[Identification	
▼ ↑ New Station				Name	OC_7SR22
New devices				Name in manag	7SR2202-2AA77-0CA0
. NONE				Туре	Connected access point
▼ III Subnet1				Comment	
0C 75R22 75	SR2202-2AA77-0CA0	192.168.0.1		Device type	7SR220
Ba RA24 Re	evArc 1524	192,168,0,2		Device version	1.0
				Manufacturer	SIEMENS
			[Parameter	
				IP address	192.168.0.1
				Subnet mask	255.255.255.0
				Standard Gatev	
				Device-device (Both
				Vertical commu	Server
				Timer function	False
				Router function	False
			[Parameter for	r SIPROTEC
				Use as a timer	No
				Messagebuffer	Dynamic and static re
				IP address IP address of devi	ice (access point)
4					

Figure 30: System Configurator - IP Address 3

Alternatively at the Subnet level the IP addressing may be automatically allocated starting at the IP start address previously set for the Subnet by pressing the auto IP button.

We'll choose to auto allocate the IP addressing, the result is shown below with the the IP address of each device being incremented and unique.

IEC61850 System Configurator -New	w Station - [C:\Users\z0036k	cv\Desktop\ReyArc Arc Fault Pro	tection\Station1\Stat	ion.sc 🗆 🔲 📈
Station Edit Insert View Help				
Network + GOOSE	Reports and logs			
	auto IP			
Subnets		the second second second	ertie	s – Ф
Name	Name in manager	a subnet, starting with the subne	t start address.	ion
▼ ♠ New Station	·····,		Name	Subnet1
New devices			Description	
			Comment	
▼ m Subnet1	1		Туре	Subnet
L. OC 75822	75R2202-2AA77-0CA0	192,168.0.1	Parameter	
B. RA24	RevArc 1524	192.168.0.2	IP start add	res 192.168.0.1
			Subnet mas	255.255.255.0
			Standard Ga	tev <device-dependent></device-dependent>
			Baud rate	<not set=""></not>
			Туре	8-MMS
			Name Name of subn	et
Addresses all devices in a subnet, starting	with the subnet start address.			//.

Figure 31: System Configurator - IP Address 4

2.8.1 System Configuration – GOOSE View

With the network addressing having been completed we'll now create our GOOSE applications and associated GOOSE linkages.

The screenshot below shows the GOOSE view within the ReyArc System configurator Station :

📓 IEC61850 System Configurator - New Station - [C:\Users\z0036kcv\Desktop\ReyArc Arc Fault Protection\Station\Station.scd]										
Station Edit Insert View	Help									
Network GOOSE	AT Report	s and logs								
🗌 🚽 🗠 🖓 💷 🗎	1 × 🖾	auto MAC	e							
GOOSE messages									Properties	무
Source		CDC E	Description		NONE	Subn	Destination			
n New Station										
•		III						Þ		
Source catalogue				- Destination of	atalogue	9		4		
				면						
Name	▲ CDC	Description	on	Name			Description			
▶		75R2202-2	AA77-0CA0	▶			75R2202-2AA77-0CA	.0		
<			•		m			4		

Figure 32: System Configurator - GOOSE

A GOOSE application needs to be added to you station. Select New Station & "Add New Goose Application"

KIEC61850 System Configurate	or -New Station - [[C:\Users\z0036kcv\De	ktop\ReyArc Arc Fault Protectio	on\Statio	n1\Station.scd]		
Station Edit Insert View	Help						
	AT Departs and	d loop					
	A. Reports and	nogs					
📕 🖶 🗠 🗠 🗶 🖬 🖷							
GOOSE messages	Adds a r	new GOOSE application	•				Properties 4
Source	▲ CD	C Description	NONE 5	5ubn	Destination	E	Identification
A New Station							Name New Station
							Type Station
							Edition Edition1
						ľ	First time No timer ava
							Second ti No second tir
						E	Parameter for SIPROT
							First MAC 01-0C-CD-01
							Last MAC 01-0C-CD-01
							Last MAC 01-0C-CD-01 First app 1
							Last MAC 01-0C-CD-01 First app 1 Last app 16383
۷ [m)			F	Last MAC 01-0C-CD-01 First app 1 Last app 16383
۲ آپان Source catalogue			→]Destination catalogue			۰ ₽	Last MAC 01-0C-CD-01 First app 1 Last app 16383
< J <mark>} Source catalogue</mark> 한 호텔			-•]Destination catalogue			۰ ب	Last MAC 01-0C-CD-01 First app 1 Last app 16383
< Je Source catalogue প্রা ্রন্দ Name	▲ CDC De	ा। म् scription	JDestination catalogue 과 한 Name	•	Description	۰ ₽	Last MAC 01-0C-CD-01 First app 1 Last app 16383
≮ Jy Source catalogue ेल Source catalogue Name ► ■ 0C_75R22	▲ CDC De 759	። 4 Scription R2202-2AA77-0CA0	→JDestination catalogue 과 호 Name ▶ 급) OC_7SR22	•	Description 75R2202-2AA77-0CA0	۲ ب	Last MAC 01-0C-CD-01 First app 1 Last app 16383
< <p>✓ Source catalogue ③ ● Name > ■ 0C_7SR22 > ■ RA24</p>	▲ CDC De 758 16	**************************************	-↓]Destination catalogue → 04 Name > 0.0 . 75822 > 0 75822 > 0 75822 > 0	-	Description 75R2202-2AA77-0CA0 16 ARC Sensor Relay	, 4	Last MAC 01-0C-CD-01 First app 1 Last app 16383
	▲ CDC De 758 16	III scription R2202-2AA77-0CA0 ARC Sensor Relay	→JDestination catalogue → 0 Mame > 0 0C_7SR22 > 0 RA24	•	Description 75R2202-2AA77-0CA0 16 ARC Sensor Relay	۲ ب	LastMAC 01-0C-CD-01 First app 1 Last app 16383
< Source catalogue Mame Barrow	▲ CDC De 756 16	III scription R2202-2A77-0CA0 ARC Sensor Relay	→ Destination catalogue ↓ ↓ Name → ▶ ■ OC_7SR22 ▶ ■ RA24		Description 75R2202-2AA77-0CA0 16 ARC Sensor Relay	• ₽	Last MAC 01-01-CD-01 First app 1 Last app 16383
< Source catalogue Source catalogue Mame Name > □ 0 0,75R22 > □ RA24	▲ CDC De 754 16	III scription R2202-2AA77-0CA0 ARC Sensor Relay	-J]Destination catalogue 전체 전체 Name > 및 OC_75R22 > 및 RA24	•	Description 75R2202-2AA77-0CA0 16 ARC Sensor Relay	۲ ب	Last MAC 01-01-CD-01 First app 1 Last app 16383
< Source catalogue Source c	▲ CDC De 756 16	III scription R2202-2AA77-0CA0 ARC Sensor Relay	→JDestination catalogue → → → → → → → → → → → → → → <td>•</td> <td>Description 75R2202-2AA77-0CA0 16 ARC Sensor Relay</td> <td>• #</td> <td>LastMAC 01-0C-CD-01 First app 1 Last app 16383</td>	•	Description 75R2202-2AA77-0CA0 16 ARC Sensor Relay	• #	LastMAC 01-0C-CD-01 First app 1 Last app 16383
< Source catalogue Mame Mame Mame RA24 Max	▲ CDC De 755 16	III scription R2202-2AA77-0CA0 ARC Sensor Relay	→JDestination catalogue	•	Description 75R2202-2AA77-0CA0 16 ARC Sensor Relay	<u>،</u>	Last MAC 01-01-CD-01 First app 1 Last app 16383
< Source catalogue → Source catalogue → Set Name → C_75R22 → RA24	▲ CDC De 759 16	III scription R2202-2AA77-0CA0 ARC Sensor Relay	→ Destination catalogue > Name > > > RA24	•	Description 75R2202-2AA77-0CA0 16 ARC Sensor Relay	► ₽	Last MAC 01-01-01- First app 16383
< Source catalogue Source catalogue Mame Name P ■ 0 c_75R22 P ■ RA24	▲ CDC De 754 16	III Excription R2202-2AA77-0CA0 ARC Sensor Relay	-↓]Destination catalogue → Rame > ■ 0C_75822 > ■ RA24	•	Description 75R2202-2AA77-0CA0 16 ARC Sensor Relay	•	Last MAC 01-01-CD-01 First app 1 Last app 16383
< Source catalogue Source catalogue Mane P ■ 0C_7SR22 P ■ RA24	▲ CDC De 759 16	III scription R2202-2AA77-0CA0 ARC Sensor Relay	→JDestination catalogue	•	Description 75R2202-2AA77-0CA0 16 ARC Sensor Relay	• •	Last MAC 01-02-01 First app 16383 Last app 16383
< Source catalogue	▲ CDC De 755 16	III scription R2202-2AA77-0CA0 ARC Sensor Relay	→] Destination catalogue Mame > □ 0C_7SR22 > □ RA24		Description 75R2202-2AA77-0CA0 16 ARC Sensor Relay	• •	Last MAC 01-0-CD-01 First app 1 Last app 16383 Name Name of station
 ✓ Source catalogue ✓ ✓ ✓ ✓ ✓ OC_75R22 ✓ RA24 	▲ CDC De 755 16	III scription R2202-2AA77-0CA0 ARC Sensor Relay	→ Destination catalogue ○ ○ Name > > □ 0.C_75R22 > □ RA24		Description 75R2202-2AA77-0CA0 16 ARC Sensor Relay	4	Last MAC 01-0CD-01 First app 1 Last app 16383 Name Name of station

Figure 33: System Configurator - GOOSE 2

Once our Goose application is added, selecting this application reveals the associated IEDs as sources and destinations.

	on - [C:\Users\z0036kcv\D	esktop\ReyArc Arc Fault Prote	ction\Stat	on1\Station.scd]	
Station Edit Insert View Help					
Network + GOOSE	s and logs				
	And He Sea				
GOOSE messages					Properties #
Source	CDC Description	NONE	Subn	Destination	Identification
★ A New Station					Name GOOSE applica
GOOSE application	1				Descripti
]				Comment
					Type Siemens GOOSE
					🗆 Parameter
					Applicati 1
					GOOSE parameters
					Communi PriorityLow
					Minimum 10 ms
					Maximum 2000 ms
					VLAN ID 0
•				,	VLAN Pric 4
Source catalogue		Destination catalog	ie	д	
groon country ac	+	- Bestination catalogi			
화 화	+				
Mame ▲ CDC	+ Description	화 한 Name	•	Description	
Image: Second and log de Image: Second	Description 7SR2202-2AA77-0CA0	→ → Name ▶ ■ 0C 75R22	•	Description 75R2202-2AA77-0CA0	
Image: Second state CDC Name ▲ CDC > □ 0C_75822 > □ RA24	Description 75R2202-2AA77-0CA0 16 ARC Sensor Relay	→ → Name → ○ → □ 0C_7SR22 → ■ RA24	•	Description 7SR2202-2AA77-0CA0 16 ARC Sensor Relay	
Image: Second constraints Image: Second constraints CDC > ■ 0C_7SR22 > ■ RA24 Image: Second constraints Image: Second constraints	Pescription 75R2202-2AA77-0CA0 16 ARC Sensor Relay	/ 에 에 에 Name > 월 0C_7SR22 > 월 RA24		Description 75R2202-2AA7-0CA0 16 ARC Sensor Relay	Name

Figure 34: System Configurator - GOOSE 3

Expanding the respective IEDs in the Sources and Destinations windows will show the Logical Nodes and their associated Data Objects.

Firstly we'll select the RA24 IED and expand RMS_SARC1 and choose FADet to Add as a Source.

Station Edit Insert View	Help								
Network GOOSE	AT Report	s and logs							
🗐 🚽 🗠 🗠 🗶 🖵 🗑	L 🗙 🔯	auto							
00SE messages									Pr
ource		▲ CDC Des	cription		NONE	Subn	Destination	Descript	🗆 Identif
1 New Station									Na FAD
🔻 🔛 GOOSE application									Ty GOO
RA24/DEV_1524/LLN	10/DataSet (2/	60)				~			Hit RA2
RA24/DEV_1524/	RMS_SARC1/F	ADet SPS Log	ical Device for ARC s	ensor relay/Arc Det					Param
🔟 Status value		SPC							FC ST
								•	
Source catalogue			4	- Destination ca	atalogue				
*				İ⇒ İ+					
ame	▲ CDC	Description	*	Name		A	Description		
OC_75R22		75R2202-2AA77-0CA	0	OC_75R22			75R2202-2AA77-0CA0		
RA24		16 ARC Sensor Relay	/	RA24			16 ARC Sensor Relay		
 DEV_1524 		Logical Device for Al	RC sensor relay						
LLN0		General	E						
LPHD1		Physical device state	IS						
RMS_SARC1		Arc Detector 1							
🔟 Beh	INS	Behaviour of ARC de	tector						
FACntRs	INC	Resettable Detect co	ounter						
M FADet	SPS	ARC fault detected							
🔟 Health	INS	Health of ARC detec	ARC fault detected	1					
Mod 🗹	INC	Mode of ARC detect	or (can enable)						
RMS_SARC10		Arc Detector 10							
RMS_SARC11		Arc Detector 11							Name
RM5_SARC12		Arc Detector 12	-						source of

Figure 35: System Configurator - GOOSE 4

Once Added as a source it will appear in the interconnections. In turn add all of the required source SARCs.

S IEC61850 S	System Configurator -	New Statio	on - [C:\Users\z00	36kcv\D	esktop\ReyA	rc An	c Fault Protection\Station1\	Station.sc	4]			
Station Edit	t Insert View He	elp										
Networ	k 🕂 GOOSE	Report	s and logs									
🖬 🚽 🗠) 🗠 🛄 🛍 🤉	× 🔯	auto									
GOOSE messa	ages											🚰 Рг म
Source			•	CDC	Descriptio	n		NONE	Subn	Destination		□ Identifica
▼ 🔒 New Sta	ation											Na DataS
🔻 🞲 GOO	SE application											Ty Datase
🔻 🎁 R	A24/DEV_1524/LLN0/D)ataSet (2/	60)						~			Hi RA24/D
÷ +	RA24/DEV_1524/RM	S_SARC1/F	ADet	SPS	Logical De	vicefo	or ARC sensor relay/Arc Det					Paramete
🔻 🎁 R	A24/DEV_1524/LLN0/D	ataSet_1	2/60)						~			Co <stand< td=""></stand<>
) 🕨 🛨	RA24/DEV_1524/RM	S_SARC2/F	ADet	SPS	Logical Dev	vicefo	or ARC sensor relay/Arc Det					Inc No
🔻 🎁 R	A24/DEV_1524/LLN0/D)ataSet_2 (2/60)						~			
► <u>+</u>	RA24/DEV_1S24/RM	S_SARC3/F	ADet	SPS	Logical Dev	vicefo	or ARC sensor relay/Arc Det					
			RA24/DEV	1S24/RN	IS_SARC3/FA	ADet						
•				III							۲.	
Source ca	talogue				4	-	Destination catalogue					
фн фн							· · · · · · · · · · · · · · · · · · ·					
Name			Description			N	ame	A D	escriptio	n		
▶ 10111C	RMS SARC13		Arc Detector 13				0C 75822		SR7202-24	A77-0CA0		
• • •	RMS_SARC14		Arc Detector 14			, i	RA24	1	6 ARC Sen	sor Relay		
• • •	RMS_SARC15		Arc Detector 15							,		
• • •	RMS_SARC16		Arc Detector 16									
🕨 🕨 F	RMS_SARC2		Arc Detector 2									
🔻 🖣 F	RMS_SARC3		Arc Detector 3		E							
2	🔟 Beh	INS	Behaviour of AR	C detecto	or							
	FACntRs	INC	Resettable Dete	ct counte	r							
	FADet	SPS	ARC fault detect	ed								
2	✓ Health	INS										Name
<u> </u>	⊿ Mod	INC	Mode of ARC de	tector (ca	an enable) 🔻							the dataset
•	1	1			F.	1					•	

Figure 36: System Configurator - GOOSE 5

The SARCs are linked to the respective 7SR22 IED Single Point Input GGIO chosen from the Destinations window .

K IEC61850 System Configura	tor -New Stati	on - [C:\Users\z00	/36kcv\D	esktop\ReyArc A	rc Fault Pr	rotection	Station1\Station.scd]			
Station Edit Insert View	Help									
Network GOOSE	AT Repor	ts and logs								
🛯 🖬 🛏 🗠 🗶 💷 I	il 🗙 🔯	auto 💀 💽								
GOOSE messages										🖌 🚰 Pr 🕈
Source		-	CDC	Description	NONE	Subn	Destination	Description		🗆 Identifica
▼ ↑ New Station							*			Na DataS
▼ 1 GOOSE application							*			Ty Datase
RA24/DEV_1524/LI	N0/DataSet (2	/60)				-	*			Hi RA24/D
RA24/DEV_152	4/RMS_SARC1/	FADet	SPS	Logical Devic					-	Paramete
RA24/DEV_1524	4/RMS_SARC1/	FADet/Status val	SPC	Logical Devic			OC_7SR22/CTRL/SPI64GG	Control/User SP Inputs Block 1/Single Point Data	ā 🗇	Co <stand< td=""></stand<>
 RA24/DEV_1524/LI 	N0/DataSet_1	(2/60)				v	*			Inc No
RA24/DEV_1524	4/RMS_SARC2/	FADet	SPS	Logical Devic				Control/User SP Inputs Block 1/Single Point D	ata 01	
RA24/DEV_1524	4/RMS_SARC2/	FADet/Status val	SPC	Logical Devic			OC_7SR22/CTRL/SPi64GG	Control/User SP Inputs Block 1/Single Point Data		A
RA24/DEV_1524/LI	N0/DataSet_2	(2/60)	1			~	*			4
▶ → RA24/DEV_1524	4/RMS_SARC3/	FADet	SPS	Logical Devic					-	
Source catalogue					4	∔ -∰D(estination catalogue			4
en en en en en en en en en en en en en e							₽			4
Name	▲ CDC	Description			·	Nam	e	Description		4
RMS_SARC13		Arc Detector 13					▼ 📑 SPi64GGI01	User SP Inputs Block 1		4
RMS_SARC14		Arc Detector 14					SPC501	Single Point Data 01		A
RMS_SARC15		Arc Detector 15					SPCS010	Single Point Data 10		4
RMS_SARC16		Arc Detector 16				4	SPCS011	Single Point Data 11		4
RMS_SARC2		Arc Detector 2					SPC5012	Single Point Data 12		4
RMS_SARC3		Arc Detector 3				4	SPC5013	Single Point Data 13		4
Beh	INS	Behaviour of AR	C detectr	or	7		SPCS014	Single Point Data 14		4
FACntRs	INC	Resettable Dete	ect counte	er			SPCS015	Single Point Data 15		4
FADet	SPS	ARC fault detect	ted			4	SPCS016	Single Point Data 16		
Health	INS						SPCS017	Single Point Data 17		Name
Mod	INC	Mode of ARC de	atector (c	an enable)			SPCS018	Single Point Data 18		The name o
DMS SADCA		Arc Detector 4				+	SPC5019	Single Point Data 19	-	Life docused

Figure 37: System Configurator - GOOSE 6

With the links complete save and exit the Digsi System Configurator.

2.9 Creating the RA24 .cid File

We know need to create a .cid file which we will use at a later stage of the IED Configuration process. (Note: Please close and re-open Digsi System configurator before proceeding with the next step)

1. Open the Station in Reydisp Manager, go to the Network screen, select the RA24 IED, right click and select Export IEC61850 device configuration.

IEC61850 System Configurator -New Station - [C:\Use	ers\z0036kcv\Desktop\ReyArc Arc Fault Pro	ection\Station1\Station.scd]
Station Edit Insert View Help		
Network GOOSE AT Reports and logs		
▋ ➡ ♥ ♀ 🗶 및 🛍 🖌 🔟 🕮		
Subnets		Properties 7
Name 🔺 Name in manag	er IP address	Identification
★ ↑ New Station		Name RA24
New devices		Name in manag ReyArc_1S24
i NONE		Type Connected access point
▼ III Subnet1		Comment
. OC 75R22 75R2202-2AA77-0	CA0 192.168.0.1	Device type RTUType
RA24 Davides 1534	102.100.0.2	Device version 1.0
χ Cut	Ctrl+X	Manufacturer RMS Pty Ltd
Export IEC61850 device confid	uration Ctrl+G	🗆 Parameter
		IP address 192.168.0.2
		Subnet mask 255.255.255.0
		Standard Gatev 192.168.0.1
		Device-device (Both
		Vertical commu Server
		Timer function False
		Router function False
		E Parameter for SIPROTEC
		Use as a timer No
4		
		Name
		Name of device (access point)

Figure 38:System Configurator - .CID File

Save the file for later RA24 configuration. System configuration is now complete. Save the file as 1S24.cid

Section 3: RA24 IEC61850 Configuration

3.1 The .CID File

The RA24 requires a .cid file that incorporates the IEC61850 Substation Project Configuration including the Report datasets that must be sent and where they are sent to.

The Project Configuration is contained in the .cid file for the RA24 created earlier from our Substation configuration process example and needs to be loaded into the RA24 IED.

FTP 1S24.cid File

We will be using the Beck's @CHIPTOOL software utility to establish a terminal session with the RA24 and to FTP the .cid file.

Download @CHIPTOOL for free from :

http://www.beck-ipc.com/en/download/licence.asp?id=chiptool install&l=1

Run @CHIPTOOL on the PC.

The Tool will detect any RA24 devices on the network as seen by the screen shot below :

📌 @CHIP	TOOL									_ 🗆 🗙	
File Flash	CHIP Tools	Info									
	Scan for IPC@CHIPs at the network										
! Snr	Name	DHCP	IP	Netmask	Gateway	Target	ID	lfldx	RTOS	lfType	
016C1C	RMS 1S24	No	192.168.0.221	255.255.255.0	192.168.0.1	SC143	003056A16C1C	2:0	V1.51	ETH	
Collect M	lode							<u>?</u> <u>H</u> e	lp	<u>§</u> top	
Scanning		Sorted by Snr	Ope	en popup menu with	right mouseclick	at table rov	vs			1.	

Figure 39: @CHIPTOOL

With the RA24 selected in the @CHIPTOOL screen we will establish an FTP session by choosing Tools and FTP-Client.

Connect								
Target- <u>I</u> P:								
192.168.0.221								
<u>U</u> ser:								
Pass <u>w</u> ord								
✓ Save User and Password								
Representation-Type:								
 Binary (Image) ASCII 								
Use passive mode								
<u>C</u> onnect Cancel								

Figure 40: @CHIPTOOL - Connect

Enter the following Username and Password for the FTP session:

User :	ftp
Password :	ftp

Sechiptool FTP-	Client				
File View Connection					
B' 🖹 🔁 🖄 🛙	b 🖸 💉				
4 7 m		Drive: C 💌	4 7		Drive: A
C:A			/A:/		
 Filename 	Size	Time 🔥	 Filename 	Size	Time 🔨
🗅 Config.Msi	DIRECTORY	22/10/2012 8:46:36	ā	DIRECTORY	30/12/1899 12:00:00
🛅 d8094b917198aa0	DIRECTORY	7/12/2010 3:16:38 P	🗅 HTTP	DIRECTORY	1/01/2006 12:00:00
🗅 Documents and Set	DIRECTORY	16/06/2012 1:56:46	1S24.cid	254261	30/10/2012 1:03:00
🛅 GE Power Manage	DIRECTORY	22/03/2011 3:41:14	1S24.cid.eth1	242655	9/10/2012 1:17:00 A
🗂 ICD Files	DIRECTORY	16/04/2012 1:57:16	1S24.cid.ok	248701	17/10/2012 1:03:00
🗅 Intel	DIRECTORY	7/12/2010 12:56:40	1S24.cid.org	226715	5/06/2012 2:39:00 A
🗅 MSOCache	DIRECTORY	8/12/2010 8:27:24 A	1524.cid.sip	247378	30/10/2012 4:27:00
🗅 Program Files	DIRECTORY	27/09/2012 12:24:04	AUTOEXEC.BAT	29	30/10/2012 1:05:00
🗅 QUARANTINE	DIRECTORY	25/10/2012 12:38:12	BECK.GIF	3211	1/01/2006 12:00:00
C RECYCLER	DIRECTORY	10/09/2012 11:57:46	CHIP.GIF	9505	1/01/2006 12:00:00 📄
🗅 S	DIRECTORY	14/08/2012 4:40:20	CHIP.INI	564	24/10/2012 1:42:00
🗅 SEL	DIRECTORY	20/01/2011 11:35:12	CHIP.SAV	564	24/10/2012 1:24:00
🗅 Siemens	DIRECTORY	12/09/2011 5:47:02	🗎 dk3.cid	9329	11/10/2012 12:26:00
🗅 SiLabs	DIRECTORY	22/03/2011 3:42:36	ETH1.EXE	23744	17/10/2012 1:03:00
🗅 Software Downloads	DIRECTORY	8/06/2011 3:01:34 P	🖹 LOG.TXT	89822	1/11/2012 5:16:00 A
🗂 នា	DIRECTORY	12/07/2011 11:38:18	LOG_PREV.TXT	219205	9/10/2012 11:13:00
🗅 System Volume Info	DIRECTORY	7/02/2012 4:52:54 P	🖹 openssh.key	883	1/01/2006 12:00:00
🗅 TEMP	DIRECTORY	12/07/2011 11:38:16	PIS10.KEY	21	1/01/2006 12:00:00
🗅 WINDOWS	DIRECTORY	1/11/2012 2:42:36 P	PROBE.EXE	11088	1/01/2006 12:00:00
🖹 .md	1024	20/12/2010 8:36:20	public.key	225	1/01/2006 12:00:00
AUTOEXEC.BAT	0	7/12/2010 12:45:44	sarc.exe	613344	1/11/2012 5:15:00 A
🖹 boot.ini	211	7/02/2012 4:43:38 P 🗸	🖹 send.exe	17264	1/01/2006 12:00:00 🗸
<		>	<		>
Connected to 192.168.0.2	221.				

Figure 41: @CHIPTOOL - FTP

You will be presented with 2 file directories, the left side is the source directory and the right side A:/ is the RA24.

Locate and select the saved 1S24.cid file created earlier, right click on the file and copy it to the A:/ drive.

Once copied, ensure that any existing 1S24.cid file in the A:/ drive is renamed or deleted (right click on the file for renaming deletion options).

Then select the copied file in the A:/ drive, right click and ensure it is renamed as 1S24.cid. (Note: The new .cid file must be renamed "1S24.cid")

Renaming RMS_1S24.cid 🛛 🔀		Renaming RMS_1S24.cid 🛛 🔀
Please enter the new filename. RMS_1S24.cid OK	\$	Please enter the new filename. 1S24.cid OK Cancel
Figure 42	: @CHIPTOC	OL - FTP 2

Rebooting The RA24 With The New 1S24.cid File

A reboot of the RA24 is required once the new 1S24.cid file has been loaded.

The reboot can be done either via powering down and repowering the device or by pressing and holding the Flag Reset button for about 5 sec until all the LEDs start flashing, refer to Reboot under Monitor Indications.

Section 4: 7SR22 Configuration

4.1 Logic Configuration

Our application is to employ a current check using the pickup of an Instantaneous Overcurrent Element (50-1) to qualify an Arc Sensor operation. The following sections outline the logic implemented.

4.2 User output Allocation

Using the previously defined ARC Fault Sensor Zones we will nominate the User Outputs that will capture the resultant SARC operation and current check logic.

Zone Coverage	Colour	SARC Allocation	User Output
Feeder Exit Termination Chamber		SARC 1	User Output 1
Feeder CB Chamber		SARC 2	User Output 2
Bus		SARC 3 SARC 4	User Output 2
Incomer CB Chamber		SARC 5	User Output 3
Incomer Termination Chamber		SARC 6	User Output 3

Table 5: RA24 User Output Allocation

4.3 Current Check Logic

The SARC GOOSE Trips are qualified by the SARC quality and a current check in our current check logic. The quality bit can be used for blocking purposes such as testing or isolations.



Figure 45: Relay Logic - SARC 5 & 6

4.4 Binary Output Allocation for Circuit Breaker Tripping

SARC Operation	Zone Coverage	User Output	Binary Output	Trip
SARC 1	Feeder Exit Termination Chamber	User Output 1	BO2	1A CB
SARC 2	Feeder CB Chamber	User Output 2	BO3	TR1 LT CB
SARC 3 or SARC 4	Bus	User Output 2	BO3	TR1 LT CB
SARC 5	Incomer CB Chamber	User Output 3	BO4	Upstream
SARC 6	Incomer Termination Chamber	User Output 3	BO4	Upstream

The following User Output to Binary Output allocations complete our ARC Fault Trip with Current Check.

Table 6: Binary Output Allocation

The screenshot shows the User Output to Binary Output allocation in the setting editor of Reydisp Manager.

Setting Editor - RMS Arc Fault	Protection/7SR220	2-24477-	OCAO		
System Notes Settings					
☐ 75R220x-2xAx7-0CA0	Setting	Common	G1		G2 G3 G4 G5 G6 G 🔨
SYSTEM CONFIG CT/VT CONFIG	En100 Error	$\overline{\checkmark}$	NONE		
FUNCTION CONFIG	IEC61850 Configured	\checkmark	NONE		
VOLTAGE PROT'N	User Output 1	$\overline{\checkmark}$	BO2	•	
CONTROL & LOGIC	User Output 2	v	BO3	-	
OUTPUT CONFIG	User Output 3	$\overline{\checkmark}$	BO4		
OUTPUT MATRIX BINARY OUTPUT CONFIG	User Output 4	\checkmark	NONE		
LED CONFIG PICKUP CONFIG	User Output 5	$\overline{\mathbf{v}}$	NONE		
MAINTENANCE DATA STORAGE	User Output 6	\checkmark	NONE		
COMMUNICATIONS	User Output 7	\checkmark	NONE		~
	<		1.00		>

Figure 46: Reydisp Relay Settings

Complete any other Protection settings otherwise required and save your setting.

4.5 Device Sync

With all IED settings, IED Logic and IEC61850 configuration complete we now need to Synchronize the device.

Reydisp Manager will manage the file transfer process to the 7SR22 IED and upon completion the 7SR22 will be able subscribe to SARC Goose messages from the RA24 IED.

Section 5: Monitor Indications

5.1 Front Layout

The picture below depicts the indications provided on the front of the Arc Fault Monitor.



Figure 47: RA24 Front Layout View

5.2 Power Up

When powering up, all the Leds will flash once and then extinguish and then in turn sequentially illuminate 1 led at a time until all Leds are illuminated – the sequence takes about 14 secs during the boot cycle.

When the boot cycle is complete the RA24 will indicate the current state.

5.3 System Status

	Auxiliary Supply or	Relay Healthy Indication	
	LED State	Meaning	
	On Solid	Healthy	
	Fast Flashing (approx three times every sec)	CID loading error	
×× + ~ -	Slow Flashing (approx once every sec)	SNTP sync fail	
	Off	Internal Communications failure	
	Refer to the Comm Interpreting Vx Aux Indications for furth	issioning section : kiliary Supply or Relay Healthy her details	
Activity		Ethernet Activity	
Figure 49, DA24 System Status			

Figure 48: RA24 System Status

5.4 Service Alarm

The module self supervision checks the following : Auxiliary supply failure Internal supply rail is outside acceptable limits CPU Hardware watchdog failure

Figure 49: RA24 Service Alarm

5.5 Arc Sensor Indicators

Indicate solid when an Arc Sensor has detected an Arc, the LEDs are reset after pressing the Flag Reset.

16 x Arc Sensors	16 Arc Sensor Indicators
1 2	

Figure 50: RA24 Arc Sensor Indications

A flashing Arc Sensor LED indicates a failure of the sensor, refer to the Sensor Alarm indicator description.

5.6 Arc Sensor Circuit Supervision

Indicates solid when an Arc Sensor has faulted either due to an open circuit, sustained short circuit

(>10 sec) or high ambient lighting.

Sensor Alarm

Figure 51: RA24 Arc Sensor Cicuit Supervision

reset upon the fault conditions being corrected.

5.7 Arc Trip

Indicates solid when the respective assigned self reset Arc Trip contacts operate. The LEDs reset when the Arc Trip contacts self reset.



Figure 52: RA24 Arc Trip Indication

5.8 Global Arc Block

Indicates solid when the Global Arc Block input is energised, all Arc Trips are blocked (61850 and Arc Trip outputs).

Global Arc Block	
	Global Arc Block

Figure 53: RA24 Global Arc Block

5.9 Flag Reset	
FLAG RESET	To reset the ARC Sensor LEDs
Reset	The ARC sensor LEDs may also be reset by energising the binary input

Figure 54: RA24 Flag Reset

5.10 Reboot

FLAG RESET	A reboot is achieved by applying power to the relay, all the Leds will flash once and then extinguish and then in turn sequentially illuminate 1 led at a time until all Leds are illuminated – the sequence takes about 14 secs. Alternatively if the relay is powered, hold down the Flag Reset button for about 5 sec until all of the Leds (except Service) start flashing, then release the Flag Reset button. The LEDs will continue to flash for approx 9 secs and then extinguish and then in turn sequentially illuminate 1 led at a time until all Leds are illuminated – the sequence takes another 14 secs approx. The reboot must be used after loading in new .icd files into the IED and restarting the
	software process with the new 61850 configurations.
	The reboot may also be required if for some reason the RA24 does not respond to web server commands or becomes unresponsive to ftp or terminal sessions.
	Figure 55: RA24 Reboot

5.11 Reset To Factory Default

FLAG

RESET

With the relay unpowered, hold down the Flag Reset button and power up the relay. After releasing the reset button all of the Leds (except Service) will flash once and then extinguish and then in turn sequentially illuminate 1 led at a time until all Leds are illuminated – the sequence takes another 14 secs approx.

The Cold Boot is used for reverting the IED back to factory default settings including default passwords.

Figure 56: RA24 Reset to Factory Default

7XG3124

Commissioning Guide

Document Release History

This document is issue 2014/09. The list of revisions up to and including this issue is:

2014/09	First Issue
2011/00	

Software Revision History

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Section 1: Commissioning Preliminaries

Overview

Commissioning tests are carried out to prove:

- a) Equipment has not been damaged in transit.
- b) Equipment has been correctly connected and installed.
- c) Confirm that settings have been correctly applied.
- d) To obtain a set of test results for future reference.

1.1 Before Testing

Carefully examine the module to ensure that no damage has occurred during transit. Check that the model number and rating information are correct.

1.2 Insulation

The relay, and its associated wiring, may be insulation tested between:

- all electrically isolated circuits
- all circuits and earth

An electronic or brushless insulation tester should be used, having a dc voltage not exceeding 1000V. Accessible terminals of the same circuit should first be strapped together. Deliberate circuit earthing links, removed for the tests, subsequently must be replaced.

1.3 ARC Trip Verification

ARC Trip Verification will require a flash source to initiate sensor operation.

A high powered photographic flash is the most convenient means of initiating positive sensor operation.

Note that mobile phone or small compact camera flashes may not have sufficient power to cause sensor operation.

Section 2: Commissioning Checklists

2.1 Site Commissioning Verification Checklist

Observe all site specific standard safety procedures.

The following tests are undertaken following the completion of all RA24 ARC Monitor and Overcurrent Relay IEC61850 Substation Configuration and associated IED configurations, scheme wiring and the wiring of all RA30 sensors.

System Power Up

ltem	Description	Complete
1	Confirm all necessary primary equipment isolations	
2	Confirm all necessary secondary equipment isolations (including trip outputs)	
3	Check fitment of RA30 optical sensors and cable condition	
4	Check panel installation of the RA24 monitor	
5	Check for correct case earthing	
6	Check the RA24 is wired to the protection design schematic, connected to a Substation LAN and confirm all IEC61850 configurations	
7	Confirm Fail alarm relay is closed (Terminals 25 and 26)	
8	Apply correct Auxiliary voltage to power up the RA24	
9	Upon power up the relay enters a relay boot cycle, all the Leds will flash once and then extinguish and then in turn sequentially illuminate 1 led at a time until all Leds are illuminated – the sequence takes about 14 secs.	
	Observe that the green power LED remains illuminated solid after the relay boot cycle.	
10	Confirm Fail alarm relay is open (Terminals 25 and 26) and the associated LED is extinguished	
11	Using a web browser check RA24 configuration settings match protection setting specifications	
12	Confirm that the Arc Sensor fail alarm LED remains off and none of the sensor LEDs are flashing (Refer Sensor Failure Trouble shooting if a sensor fail is indicated)	
13	Confirm all Sensor LED's remain OFF	
14	Confirm the Ethernet LED is showing activity	

Table 1: System Power Up

2.2 Sensor Failure Alarm Verification

ltem	Description	Complete
1	Disconnect each sensor from the associated RA24 sensor input	
2	Confirm the associated sensor LED flashes, the Sensor Alarm LED illuminates and operation of the Relay Fail Alarm output contact	
3	Reconnect each sensor back to the associated RA24 sensor input	
4	Confirm the associated sensor Fail indications clear and the Relay Fail Alarm output contact opens	
5	In turn short across each RA24 sensor input	
6	Confirm the associated sensor LED flashes, the Sensor Alarm LED illuminates and operation of the Relay Fail Alarm output contact	
7	Remove the short on each RA24 sensor input	
8	Confirm the associated sensor Fail indications clear and the Relay Fail Alarm output contact opens	

Table 2: Sensor Failure Alarm Verification

2.3 Arc Trip Testing

Item	Description	Complete
1	Initiate the operation of each sensor by the use of a suitably powered camera flash	
	* If a current check interlock is employed in your ARC Fault protection scheme ensure that current is injected into the associated Overcurrent relay to cause operation of the current check element at the same time the sensor is flashed	
2	Check operation of the corresponding sensor LED and the arc fault trip output contacts	
3	Confirm that the subscribing IED has received the GOOSE SARC from the RA24	
4	View the web browser settings of the RA24 to explain any unexpected behavior	
5	Confirm operation of Flag Reset after each tripping operation. Repeat ARC trips and confirm correct operation of remote reset using the web browser	

Table 3: Arc Trip Testing

2.4 Apply a Global ARC Fault block.

ltem	Description	Complete
1	Initiate the operation of each sensor by the use of a suitably powered camera flash	
2	Confirm blocking of the arc fault trip output contacts	
3	Confirm blocking of the SARC GOOSE messages from the RA24	

Table 4: Global Arc Fault Block

2.5 Sensor Failure Alarm Trouble Shooting

ltem	Description	Complete
1	If any arc sensor LED's are flashing re-check the RA30 wiring integrity	
2	Check that the sensors are wired to the correct sensor inputs	
3	Using a web browser session check that the correct sensor inputs are enabled and any unused sensor inputs are disabled	
4	If the Sensor Alarm persists disable all of the sensor inputs and check that all Sensor Alarm indications are extinguished	

Table 5: Sensor Failure Alarm

2.6 ARC Sensor Supervision Trouble Shooting

ltem	Description	Complete
1	If there is a Sensor Alarm indication re-check the RA30 wiring integrity	
2	Check that the sensors are connected to the correct arc sensor inputs and check that the correct sensor inputs are enabled and unused inputs are disabled	
3	Check for high ambient lighting conditions for all the sensors	

Table 6: Arc Sensor Supervision

2.7 ARC Trip Trouble Shooting

If an arc trip occurs without an ARC being present this indicates either:

- a very high ambient light condition is triggering a sensor

or

- short circuit wiring of a RA30 sensor

In both cases if the condition persists the Supervision output will operate after a 10 sec delay.

ltem	Description	Complete
1	Check the RA30 wiring integrity of the sensors	
2	Check for high ambient lighting conditions for all the sensors	

Table 7: Arc Trip Trouble Shooting
Section 3: Commissioning Ethernet Communications'

3.1 General Ethernet Communications Trouble Shooting

If you are having trouble communicating with the RA24 IED or other subscribing IEDs check the following:

ltem	Description	Complete
1	Check that the Station Bus Lan is active and functioning	
2	Check that the RA24 IED and the subscribing IED Ethernet ports are active and communicating by checking the port activity LEDs	
3	Undertake a ping test on the RA24 IED and the subscribing IEDs	
4	Confirm the IP addressing for each of the devices is correct as determined by the Substation topology (check the devices are on the same Subnet) and that devices connected on the same Subnet have unique addresses	

Table 8: Ethernet Comms Trouble Shooting

3.2 IEC61850 GOOSE Message Trouble Shooting

If a SARC GOOSE is not being received by a subscribing IED check the following:

ltem	Description	Complete
1	Check that the required SARC is enabled in the RA24	
2	For a current check scheme is the current check element enabled and being picked up?	
3	Check the GOOSE linkages in the Substation Project and ensure that the correct sources and subscriptions have been established	
4	Check that the Subscribing IED logic is consistent with the Subscribed SARC. If required troubleshoot the logic by observing the individual incoming signals are consistent with your test conditions for example Is the correct GGIO being received? Is the quality bit being correctly treated? Is the current check qualification being asserted	
5	Using the RA24 Web Browser check for any error messages on the Status screen when you FTP the .cid file into the device	
6	In the Web Browser observe the trip status when a Sensor is triggered	
7	Using and IEC61850 browser such as IED Scout observe the trip status changes in the RA24 ICD	

Table 9: GOOSE Trouble Shooting

Section 4: RA24 Power Supply Indications

4.1 Interpreting Vx Auxiliary Supply or Relay Healthy Indications

The Healthy LED will be illuminated solid to indicate normal operation of the RA24.

The Healthy LED is also utilised to indicate error conditions to assist in troubleshooting. The following table summarises all Healthy LED indication

LED State	Meaning
On Solid	Healthy
Fast Flashing (approx three times every sec)	CID loading error (61850 stack problem)
	The .cid file is in error or possibly corrupted, open a web server session where further information is reported on the Relay Build page
Slow Flashing	SNTP sync fail
(approx once every sec)	Check SNTP server is functioning or check that the SNTP Server address on the IP config screen is correct
Off	Internal RA24 Communications failure
	A permanent Internal RA24 Communications failure will assert the Service Alarm

Table 10: Relay Healthy Indications

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EMEA-T10041-00-76GB

February 2019