



OPENING UP THE SMART GRID

Method Statement

Decommissioning of Alvin Reclose™ Devices in an LV Substation



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Glossary

Term	Definition
ALVIN	Automated Low Voltage Intelligent Network
HV	High Voltage
ISD	Intelligent Substation Device – The enclosure comprising the LV-CAP™ platform, a 4G router/modem, power connectivity and LV network monitoring hardware.
LV	Low Voltage
LV-CAP™	Low Voltage Common Application Platform
NOP	Normally Open Point

1 Introduction

This method statement forms part of a suite of documentation which has been created specifically for the OpenLV project that is being conducted by WPD in conjunction with EA Technology Ltd. The Open LV project is a proof of concept study to determine the viability and functionality of a form of distributed intelligence being applied to an electrical distribution system. Method 1 of OpenLV is concerned with the temporary “meshing” of two secondary distribution substations as a means of relieving load and /or thermal constraints.

2 Document Scope

In accordance with the requirements stipulated by WPD, this document will form the basis of a WPD approved procedure for the decommissioning of the Alvin Reclose™ devices installed at 10 LV substations by the OpenLV Project.

This document assumes that each substation pair is in the physical state defined by completion of the commissioning process. Consequently:

- The substations in question are ‘meshed’ at the start of the decommissioning process, with links inserted in the normally open point link box between the connected feeders; and
- the ALVIN Reclose™ units are under the control of the LV-CAP™ platform, installed in the ISD.

Where the links have been removed for operational reasons, it will be necessary to re-insert these in order to replace the ALVIN Reclose™ units with standard fuse links.

3 Alvin Reclose™ Description

ALVIN Reclose is an intelligent distribution fuse replacement device, comprising of a BS-88 fuse in series with a controllable current switching device providing an impressive arc free 1000+ operations. ALVIN Reclose fits into most BS-88 fuse boards without the use of any additional tooling. It is powered from the Busbar or Circuit and constantly monitors voltage and current waveforms for any faults. Once a fault has been detected the circuit breaker (ordinarily) trips before the fuse ruptures, protecting the network and enabling further safe reclose options without the need to replace a fuse.

It is also possible to directly control the circuit breaker in the Alvin Reclose™ unit, taking advantage of the embedded SafeOn and arc-free breaker technology to make and break connections in LV circuits independent of the fault protection operation.

In the OpenLV project, the Alvin Reclose™ units are being used in this manner to provide network meshing capability under the control of the LV-CAP™ platform and will not automatically reclose after a fault has been detected.

3.1 ALVIN Reclose unit

EA Technology's Alvin Reclose™ offers Distribution Network Operators a uniquely sophisticated but low-cost supply restoration solution, providing DNO's the ability for quick, restoration of supply post-fault whilst reducing risk to onsite staff and customers. The units also introduce capability for network automation and future LV network control schemes, as the OpenLV Project is demonstrating.

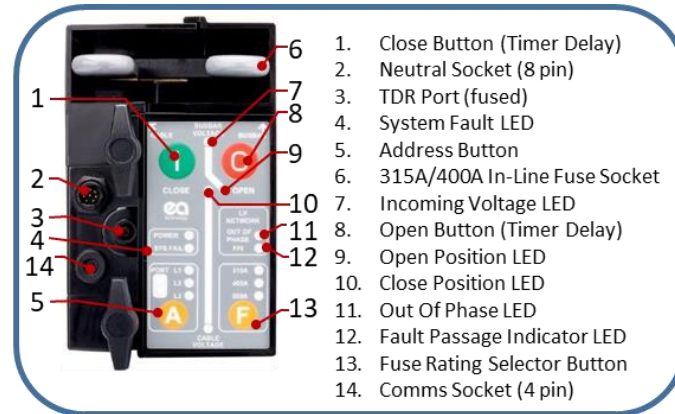


Figure 1 - Standard Alvin Reclose™ device

The ALVIN devices used for the project (non-reclose after first fault detection configuration) are readily identifiable by labels affixed to the front and sides of the Alvin Reclose™ units provided for the project, clearly stating "FOR OPENLV PROJECT USE ONLY".



Figure 2 – OpenLV Modified Alvin Reclose™ device

It is therefore essential that the ALVIN Reclose™ units removed as part of this process **are returned to EA Technology** for reactivation of the auto-reclose functionality, before they are deployed as part of business-as-usual practices.

3.2 Neutral Cable and G-Clamp

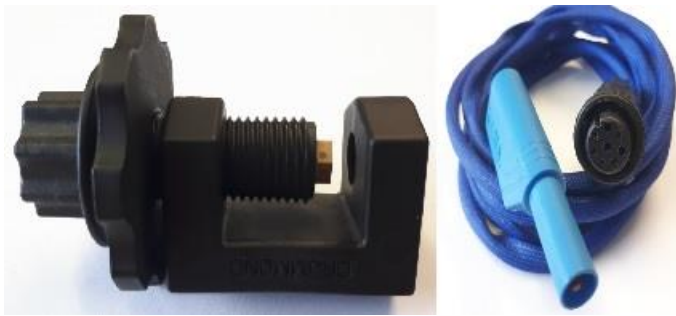


Figure 3 - Neutral Clamp & Cable

3.3 Daisy Chain Cable

The Daisy Chain cable is a communications link between Alvin Reclose™ Devices.



Figure 4 - Daisy Chain Cable

3.4 In-Line Fuse Carrier

In-line fuse carriers and appropriately rated fuses will be provided for each Alvin Reclose™ device at each site.



Figure 5 - LV in-line fuse carrier

3.5 Removal procedures

A procedure for the 'quick removal' of Alvin Reclose™ devices is provided for reference in Appendix 2. Due to site specific arrangements at different OpenLV locations resulting from the interconnected network requirements, this Method Statement details the specific process to be followed when decommissioning Alvin Reclose™ devices **as part of the OpenLV Project**.

4 Approved Procedure

4.1 Introduction

4.1.1 Overview of trial and associated equipment

The OpenLV innovation project has trialed smart LV closing devices (EA Technology ALVIN devices) with an associated multifunctional monitoring and control hardware and software platform (EA Technology's LV-CAP™ platform) to assess potential future benefits. Whilst the LV-CAP™ platform is capable of a wide range of functions, this specific trial demonstrated the system's potential to monitor and control a small interconnected LV system – see overview diagram below.

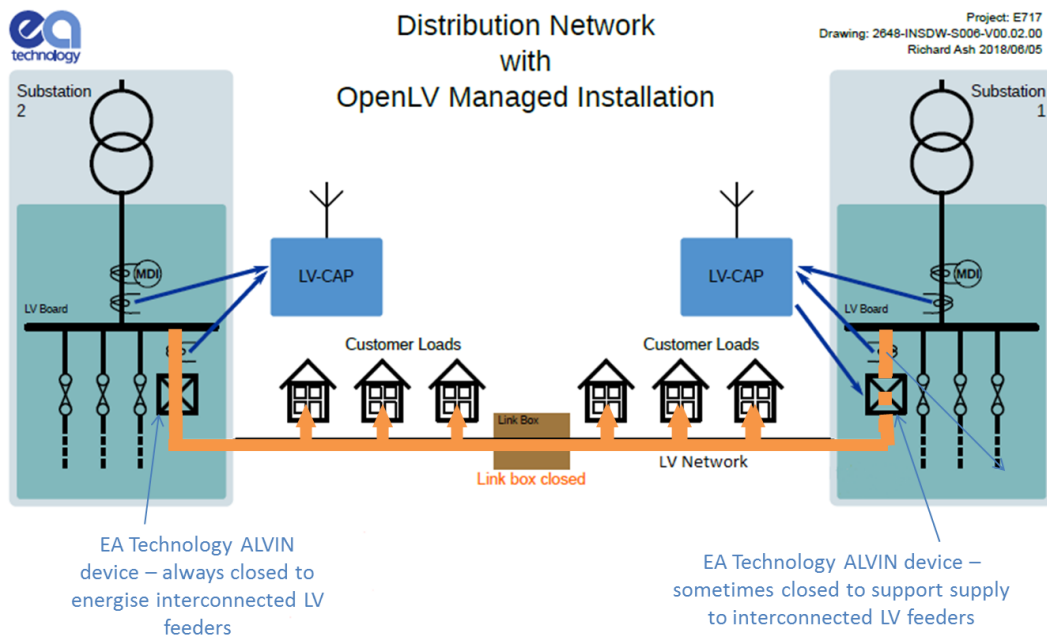


Figure 6: OpenLV Trial System

The system implemented controlled switching of ALVIN devices at only one of the substations to provide a second source of supply to the two link-box-connected LV feeders. This switching was based on the predicted temperature of the transformers at both substations. The predicted transformer temperatures were based on forecast substation loads, with both predictions calculated within the LV-CAP™ platform based on measurements received by LV-CAP™ platform from sensors fitted at the substations.

4.1.2 Overview of work

Decommissioning of the LV-CAP™ platform, including all monitoring sensors and ancillary equipment is detailed in the Method Statement to which this document is a supporting appendix. The process below is limited to just the removal of ALVIN Reclose™ devices installed as part of the OpenLV Project.

A multi-stage process is required that can be summarised as:

- Stage 1 – Disabling the ability of the LV-CAP™ platform to autonomously control the ALVIN Reclose™ devices at both substations
 - Isolate ALVIN Reclose™ units from the ISD communications.
 - Physically disconnect communication links
 - Manually close ALVIN circuit breakers
- Stage 2 – Verification of LV Network State
 - Verify that links are inserted at the link box / normally open point
- Stage 3 – Removal of trial hardware from Site 1
 - Removal of ALVIN Reclose™ devices
 - Installation of standard fuse carriers
- Stage 4 – Removal of trial hardware from Site 2
 - Removal of ALVIN Reclose™ devices
 - Installation of standard fuse carriers
- Stage 5 – Reversion of LV network arrangement to regular operation
 - Removal of the links from the link box.

4.2 General Safety Considerations

Before any work is carried out a site-specific safety risk assessment shall be carried out in accordance with WPD document ST:HS20A.

4.2.1 The electrical risks associated with this work are:

- Contact with live electricity resulting in burns and electric shock;
- Flashover causing fire and explosion resulting in burns and eye injuries.

4.2.2 These electrical risks are controlled by:

- All work being carried out in accordance with the Distribution Safety Rules;
- The use of trained and authorised personnel, this work shall only be undertaken by personnel with the following authorisations: LV Switching (LVSW) and LV Control Person (LVLK);
- The following of approved procedures, in particular:
 - ST:OS2E/4 - Relating to Low Voltage System Operation;
 - ST:CA7A/6 - Relating to the Inspection and Maintenance of LV Mains Link Disconnecting Boxes;
- Confirmation of the operational state of the network prior to work commencing, and inspection of the condition of assets prior to operation/use
- The effective use of shrouding;
- The correct use of approved PPE;
- The correct use of approved insulated tools.

4.2.3 Personal Protective Equipment

Whilst undertaking the work described in this procedure the following PPE shall be worn:

- AFR clothing in accordance with WPD document ST:HS8H;
- Class 0 rubber gloves in accordance with WPD document ST:HS8B;
- A full-face visor in accordance with WPD document ST:HS8D.

4.3 Decommissioning process

The two substations in the pair to be decommissioned are defined as Site 1 and Site 2 respectively.

The LV-CAP™ platform at Site 1 substations has full control over the ALVIN Reclose™ devices, being able to open and close the circuit breaker as necessary to demonstrate the control system capabilities.

The circuit breakers at the Site 2 substation, however, are permanent closed, except in the event of an LV network fault.

It is therefore recommended that the following order of works is followed, to minimise travel requirements and time on-site.

There is no specific requirement as to which substation is visited first, however for simplicity, the order of the instructions below assumes that Site 1 will be first substation entered.

4.3.1 Interconnecting linkbox: Verify interconnection

It is necessary for the links to be inserted at the link box as installation or removal of ALVIN Reclose™ devices will de-energise the feeder in question if it is not being back-fed from an alternative substation.

1. Ensure the links are inserted in the link box connecting the feeders from each substation.

If the links have been removed for any operational reason they must be reinserted for the duration of this decommissioning process.

It is essential to ensure that customer supplies will not be interrupted during this process and this order of works has been written with this in mind, however, **prior to commencing any stage, verify that your actions will not result in customer disconnections.**

4.3.2 Site 1 substation: ALVIN control isolation

At the substation defined as Site 1, in the pair:

2. Ensure the isolation switch on the 'front' of the ISD (LV-CAP™) enclosure is set to prevent communications.
3. Remove the blue communication cable connecting the ISD to the L1 ALVIN Reclose™ unit, from the ALVIN device.

If EA Technology staff are not present on-site to provide access to the ISD enclosure and enable full removal of the cable, it can be coiled up and placed on top of the enclosure without risk.

4. If the ALVIN Reclose™ circuit breakers are currently 'open', manually set them to 'closed' ensuring the interconnected feeder is energised from this substation.
5. Relocate to the other (Site 2) substation.

4.3.3 Site 2 substation: ALVIN control isolation

At the substation defined as Site 2, in the pair:

6. Ensure the isolation switch on the 'front' of the ISD enclosure is set to prevent communications.
7. Remove the blue communication cable connecting the ISD to the L1 ALVIN Reclose™ unit, from the ALVIN device.
8. If the ALVIN Reclose™ circuit breakers are currently 'open', manually set them to 'closed' ensuring the interconnected feeder is energised from this substation.

4.3.4 Site 2 substation: Removal of ALVIN Reclose™ devices

9. Ensure standard, appropriately rated fuses are fitted to fuse carriers and ready to be fitted in place of the ALVIN devices, prior to removal of the ALVIN devices or disconnection of any cables.
10. Remove the neutral cable connecting the bottom (usually L3) ALVIN device to the G-Clamp fitted to the neutral bar.
11. Remove the G-Clamp from the neutral bar.
12. Remove the two (2) daisy chain cables connecting the three ALVIN devices to each other.
13. Verify the fuses are not 'blown'.
14. Remove the ALVIN devices in sequence, replacing each unit in turn with standard fuse carriers prepared earlier.
15. Box all ALVIN Reclose™ devices, G-Clamp and associated neutral and daisy cables for shipment to EA Technology.
16. Verify the feeder is energised from this substation.
17. Relocate to the other (Site 1) substation.

4.3.5 Site 1 substation: Removal of ALVIN Reclose™ devices

18. Ensure standard, appropriately rated fuses are fitted to fuse carriers and ready to be fitted in place of the ALVIN devices, prior to removal of the ALVIN devices or disconnection of any cables.
19. Remove the neutral cable connecting the bottom (usually L3) ALVIN device to the G-Clamp fitted to the neutral bar.
20. Remove the G-Clamp from the neutral bar.
21. Remove the daisy chain cables between the three ALVIN devices.
22. Verify the fuses are not 'blown'.
23. Remove the ALVIN devices in sequence, replacing each unit in turn with standard fuse carriers prepared earlier
24. Box all ALVIN Reclose™ devices, G-Clamp and associated neutral and daisy cables for shipment to EA Technology.
25. Verify the feeder is energised from this substation.
26. Relocate to the link box.

4.3.6 Interconnecting link box: Remove links

27. Remove interconnecting links from the link box.
28. Verify voltage is present on either side of the normally open point.
29. Complete normal procedures for a change of operating state on the network.
30. Ensure that
 - the control room are informed that ALVIN Reclose™ units and the LV-CAP™ automated LV Control system have been removed from site 1 and 2 substations; and
 - any operational network drawings are updated.

Appendix 1. Decommissioning Record Sheets

Decommissioning Record – decommissioning of Alvin Reclose™ devices.

Substation Ref		Substation Name	
-----------------------	--	------------------------	--

LV Fuse Board Manufacturer & Type		LV Fuse Board Serial Number	
----------------------------------------------	--	------------------------------------	--

Date of Decommissioning	
--------------------------------	--

Note: this is a record of decommissioning, the method is described in the accompanying method statement.

Ref	Commissioning step		Tick when completed
1.	Site 1 Confirm L1, L2 & L3 Alvin Reclose™ devices have been isolated	L1	
		L2	
		L3	
2.	Site 2 Confirm L1, L2 & L3 Alvin Reclose™ devices have been isolated	L1	
		L2	
		L3	
3.	Confirm links installed at link box to ensure LV feeder back feed prior to Alvin Reclose™ device decommissioning		
4.	Site 1: Confirm L1, L2 & L3 Alvin Reclose™ devices have been removed	L1	
		L2	
		L3	
5.	Site 1 Confirm L1, L2 & L3 are energised via standard fuses	L1	
		L2	
		L3	
6.	Site 2 Confirm L1, L2 & L3 Alvin Reclose™ devices have been removed	L1	
		L2	
		L3	

Ref	Commissioning step		Tick when completed
7.	Site 2	L1	
	Confirm L1, L2 & L3 are energised via standard fuses	L2	
		L3	
8.	Confirm links removed at link box.		

Decommissioning completed by:

WPD Authorised Person (LVSW & LVLK)

Name:

Date:

EA Technology Ltd

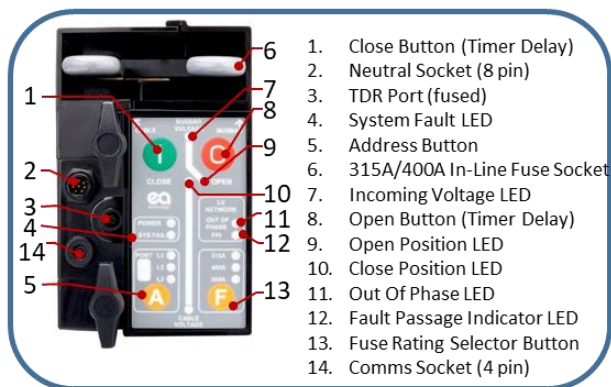
Name:

Date:



Quick Removal Guide

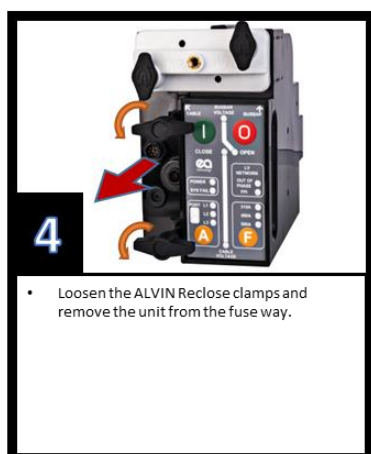
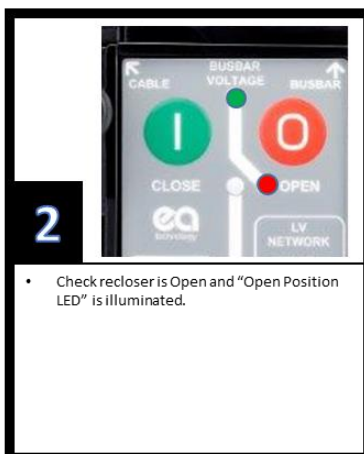
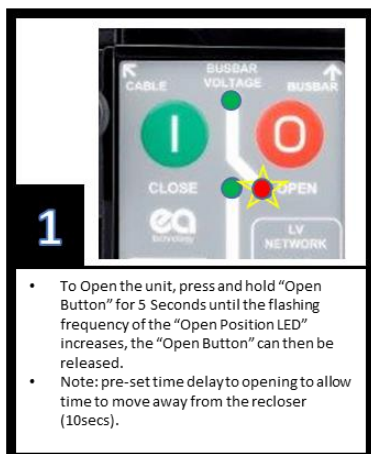
Version 0.1



This guide applies to all configurations of ALVIN Reclose and covers the manual operation only

Please make sure at all times you adhere to your Distribution Safety Rules. WHERE A POINT OF ISOLATION IS REQUIRED THE ALVIN RECLOSE UNIT SHALL BE REMOVED COMPLETELY

This is an electronic auto recloser, therefore care must be taken as the operator may not be aware of any preprogramed operating protocols



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