



OPENING UP THE SMART GRID

Method Statement

Installation 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 installation of Alvin Reclose™ devices. On ten LV circuits (installed in five connected pairs) these devices will replace the WPD standard LV fuses for one feeder found within secondary substation distribution fuse boards. This document assumes the following:

- the selected circuits have passed all the technical criteria to allow them to be ‘meshed’;
- selected secondary substation sites already have Lucy Electric Gridkey (MCU520) monitoring installed;
- existing monitoring is fitted such that the load of the feeder with Alvin Reclose™ units is determined through sensors on the cables **rather than** sensors through the fuse carrier.

3 Alvin Reclose™ Description

The 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. The 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.

4 Alvin Reclose™ operational requirements specifically for OpenLV

The Alvin Reclose™ devices which will be employed for the duration of this OpenLV project are a conduit to provide the automated LV switching function in order to “mesh” two LV feeders between pairs of secondary substations. WPD have placed the following specific requirements/restrictions upon the Alvin Reclose™ devices to be used for this purpose:

- Alvin Reclose™ devices used within OpenLV schemes are to act as “dumb switches”, and in the event of abnormal network conditions will behave like a standard BS88 LV distribution fuse.
- Alvin Reclose™ devices must not auto-reclose or “peck” in an attempt to restore supplies in the event of a power outage.
- The Alvin Reclose™ unit’s default purpose, to open in the event of a fault, will remain, although the units deployed under the OpenLV Project will be configured such that they **will not automatically reclose after a fault** in an attempt to restore supply to customers.
- In the event of a fault, the units will require manual intervention to restore customer supplies, as would be the case in the event of a fuse replacement being required under a BAU fault scenario.
- Alvin Reclose™ devices must not attempt to auto sectionalise

These requirements mean that standard “off the shelf” Alvin Reclose™ devices cannot be used within OpenLV network meshing schemes. To ensure that these specific requirements are adhered to, EA Technology will modify the firmware within each of the Alvin Reclose™ devices that are intended to be used within the confines of the OpenLV project.

EA Technology will demonstrate the changes to firmware during Factory Acceptance Testing, (FAT), and will provide a visible means of modified Alvin Reclose™ unit identification before deployment by the project.

5 Supplied Equipment

Table 1 details the list of components that will be provided by EA Technology for use when undertaking equipment installation at each substation for the OpenLV project.

Table 1 - Component list provided by EA Technology

Item	Quantity
ALVIN Reclose unit <i>(Individually packaged with neutral cable)</i>	3
Fuse Stalk Covers	6
Neutral Cable and G-Clamp	1
Daisy Chain Cable	2
LV-CAP™ Comms link Cable	1
In-Line Fuse Carrier (& fuses)	3
Installation Kit	1

NOTE: Alvin Reclose™ units are normally supplied without the in-line fuse carrier or fuse.

However, for the OpenLV project an exception will be made and an LV fuse carrier will be supplied with each Alvin Reclose™ unit, with 315A and or 400A fuses available at each site (as appropriate for each point of installation).

The fuse to be installed will be confirmed by the LV network studies undertaken as part of the site verification checks and hence are specific to each substation.

5.1 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.

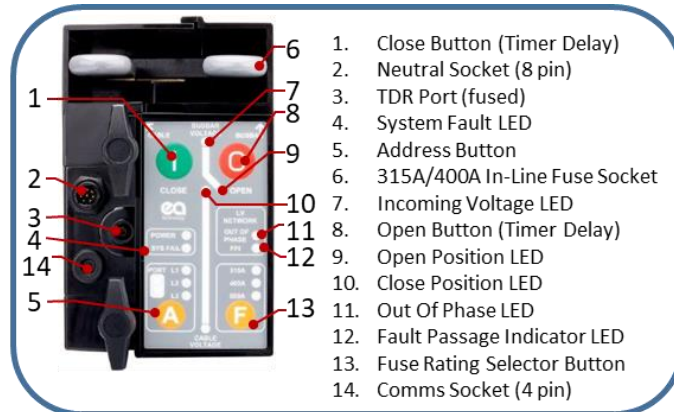


Figure 1 - Standard Alvin Reclose™ device

The ALVIN devices for use on 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

5.2 Fuse Stalk Covers

Each Alvin Reclose™ unit is supplied with 2 Fuse Stalk Covers. When not in use these should be stored within the Substation for use in the future if required. Inspect the covers for any sign of damage prior to installation.



Figure 3 - Fuse Stalk Covers

5.3 Neutral Cable and G-Clamp



Figure 4 - Neutral Clamp & Cable

5.4 Daisy Chain Cable

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



Figure 5 - Daisy Chain Cable

5.5 In-Line Fuse Carrier

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



Figure 6 - LV in-line fuse carrier

5.6 Installation Kit

An installation kit will be supplied with each set of ALVIN Reclose units. The kit comprises of various sizes of cable ties, sticky back cable tie pads, magnetic mounts, 3m spiral wrap, quick installation guide and various other components that can be used to dress trailing cables to facilitate a neat and safe installation of the equipment within the substation.

5.7 Installation and removal procedures

Procedures for the 'quick installation and removal' of Alvin Reclose™ devices are provided for reference in Appendix 2 and Appendix 3, although due to the site specific differences in the OpenLV locations resulting from the interconnected network requirements, this document outlines the specific process to be followed when installing Alvin Reclose™ devices **as part of the OpenLV Project.**

6 Approved Procedure

6.1 Introduction

6.1.1 Overview of trial and associated equipment

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

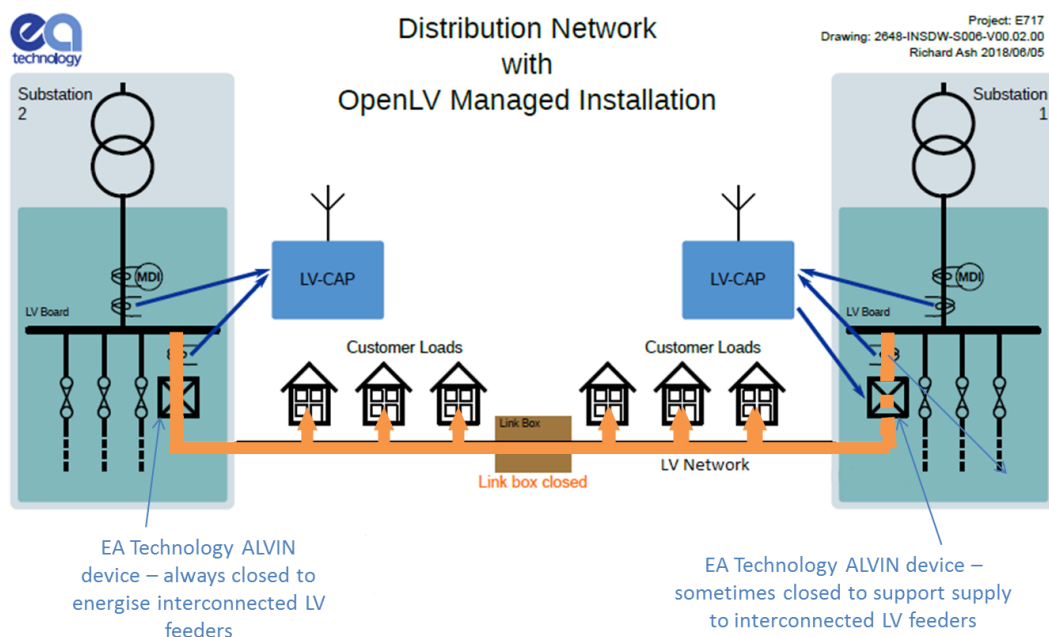


Figure 7: OpenLV Trial System

The system will control 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 will be based on the predicted temperature of the transformers at both substations. The predicted transformer temperatures will be based on forecast substation loads, and both predictions will be calculated within the LV-CAP™ platform based on measurements received by LV-CAP™ platform from sensors fitted at the substations.

6.1.2 Overview of work

Installation, commissioning and setting to work of the Alvin Reclose™ and the LV-CAP™ platform, for use in this trial, is a three-stage process that can be summarised as:

- Stage 1 – Equipment installation, commissioning and initial data capture with normal network configuration
 - Installation of the Alvin Reclose™ devices.
 - Commissioning and functional testing of LV-CAP platform with ALVIN devices.
 - Disabling of system control of ALVIN devices.
 - Operation of the system in a 'data capture only' mode.
- Stage 2 (duration approximately 2 weeks) – Control simulation
 - Closing of the link box links to interconnect two LV feeders.
 - Operation of ALVIN devices to supply the interconnect LV feeders from one substation only.
 - Enablement the Loadsense software without ALVIN control capability, to simulate trial system operation, without any ALVIN switching being undertaken.
- Stage 3 – Control implementation
 - Install links at the link box and enable full trial system functionality.

It should be noted that the work will be undertaken as a short programme:

- Stage 1 - will be implemented within one day, and will remain in 'data capture only' mode for approximately two weeks;
- Stage 2 – will be implemented within a day and will monitor the interconnected feeders for approximately two weeks;
- Stage 3 – will be implemented within a day and will remain in active control mode for a period of approximately 12 months.

6.2 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.

6.2.1 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.

6.2.2 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.

6.2.3 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.

6.3 Stage 1 Commissioning – Equipment installation and initial data capture

Confirmation of successful completion of each commissioning step should be recorded in record sheets shown in Appendix 1.

A Stage 1 commissioning record sheet should be completed for each substation.

A copy of the commissioning sheets should be returned to the OpenLV project team.

6.3.1 Confirm that work is taking place at the intended substation pair.

6.3.2 Installation of equipment at the first substation of the nominated pair¹

6.3.2.1 Ensure all items are available, complete and undamaged.

The required equipment is listed in Table 2.

Table 2 – Component list provided by EA Technology

Item	Quantity
ALVIN Reclose unit (<i>Individually packaged with neutral cable</i>)	3
Fuse Stalk Covers	6
Neutral Cable and G-Clamp	1
Daisy Chain Cable	2
LV-CAP™ Comms link Cable	1
In-Line Fuse Carrier (& fuses)	3
Installation Kit	1

This includes:

- On the neutral “G-Clamp” confirm there is continuity between the square brass clamping plate and the 4mm shrouded socket on the fluted screw head of the G-Clamp.

¹ For the purpose of Alvin Reclose™ device commissioning, it does not matter which substation of the pair is commissioned first.

Installation of Alvin Reclose™ Devices in an LV Substation

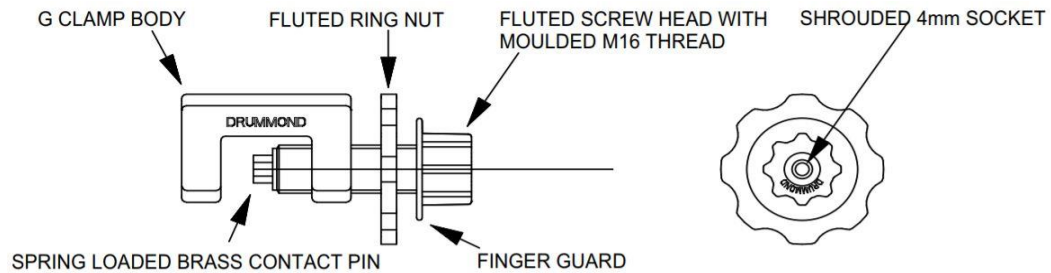


Figure 8 - Neutral G-Clamp Schematic

- Confirm the availability of 83mm 3 x JSU appropriately rated fuses, and their integrity in preparation for service. Securely fit each of the fuses into the Alvin fuse holders but do not install the fuse holders into the Alvin Reclose™ units at this stage.
- Ensure there is no JSU fuse fitted to the Alvin Reclose™ device and confirm there is NO continuity between the top and bottom unit clamps on the rear of the Alvin Reclose™ unit.

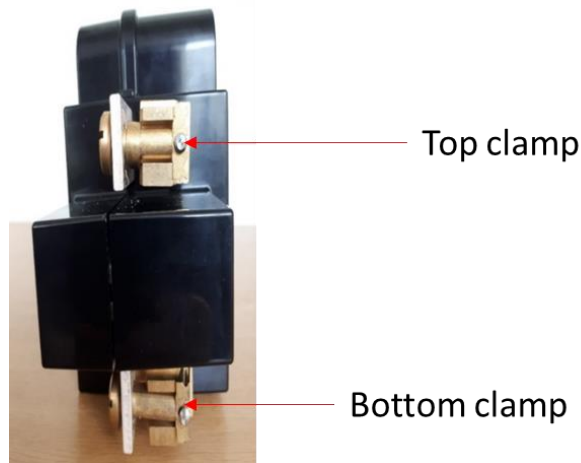


Figure 9 - Rear view of an Alvin device

- NOTE: In the event that continuity is found between the clamps on the rear of the Alvin Reclose™ device, the unit should be immediately withdrawn from service and returned to EA Technology for investigation.

6.3.2.2 Check and confirm the labels within the LV cabinet in order to identify the LV fuse way / circuit which will form part of the OpenLV trial.

Installation of Alvin Reclose™ Devices in an LV Substation

6.3.2.3 Complete Substation information and LV Fuse board information on the Commissioning record. Record (Appendix 1) the Alvin Reclose™ serial number and revision.

The serial number and revision of the Alvin Reclose™ unit can be found on the left-side of each device.



Figure 10 - Alvin Reclose™ Nameplate

6.3.2.4 Install neutral busbar “G-Clamp” to provide permanent neutral connection to Alvin Reclose™ devices

- In order to provide the Alvin Reclose™ unit with a permanent neutral connection, the “G-Clamp” must be fitted to the neutral busbar. Identify a suitable location for securely mounting the “G-Clamp” provided, which considers the cable routing to ensure that the connecting cable will not be unintentionally dislodged. Using the correct PPE and approved procedures, Install the neutral “G-Clamp”.

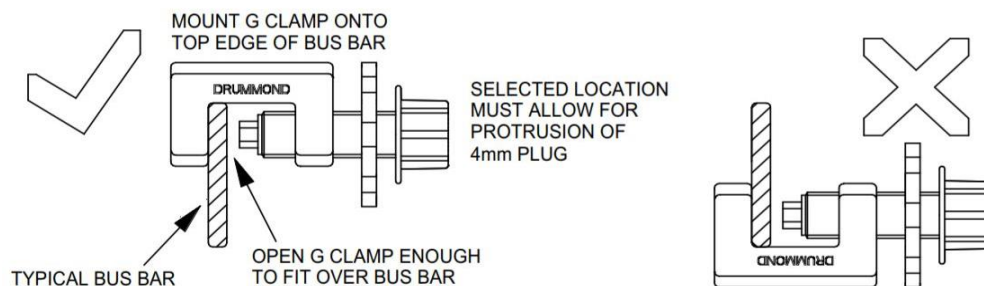


Figure 11 - G-Clamp installation

Installation of Alvin Reclose™ Devices in an LV Substation

1. Where possible fit the G-Clamp to the top edge of the busbar as shown in Figure 11 above.
2. Ensure the clamp is positioned in such a way the 4mm socket on the fluted head is easily accessible and there is enough room to stack multiple 4mm plugs if required.
3. Open the G-clamp far enough to fit over the busbar and place in position.
4. Hand-tighten the screw head until the brass contact pin contacts the busbar.
5. Continue to hand tighten the G-clamp for a further complete turn past the point of initial contact.
6. Tighten by hand the fluted lock ring nut against the G-clamp body, to prevent the G-clamp from loosening.

6.3.2.5 Install links at link box to connect the trial LV feeders.

1. Using standard procedures, install links at specified link box location to interconnect trial LV feeders.

6.3.2.6 Install, power up and configure the Alvin Reclose™ into the L3 fuse way of the LV feeder being worked on.

1. Ensure the JSU fuse is withdrawn from the Alvin Reclose™ device and that the fuse stem covers are in place.
2. Withdraw the operational fuse and confirm the status of the back-feed as per WPD standard procedure.
3. Install the Alvin Reclose™ into the fuse way.
4. Connect the neutral cable to the socket on the G-Clamp and connect to the Alvin Reclose™ unit. This will cause the Alvin Reclose™ device to “wake up”.
5. Set up the Alvin Reclose™ address. The individual address of each of the installed Alvin Reclose™ units needs to be configured within 30 seconds of the device being energised. The address is changed by pressing the address “A” button which cycles through all the available address options (Port 1, L1 ---→ Port 5, L3). It is important that no two units installed on the same LV fuse board have the same phase designation and port number. The following serves as an example of a typical LV fuse board Port and Phase arrangement.

For the OpenLV Project, the control software has been programmed to expect the Alvin Reclose™ units to be configured for Port 1, L1 – L3.

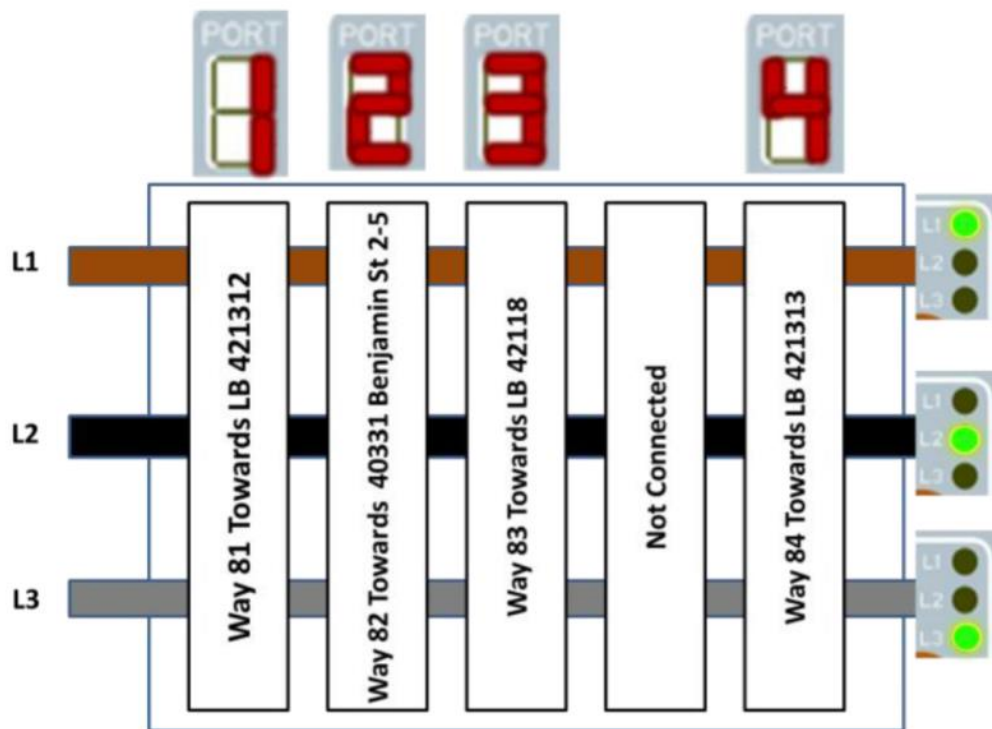


Figure 12 – Example LV fuse board arrangement

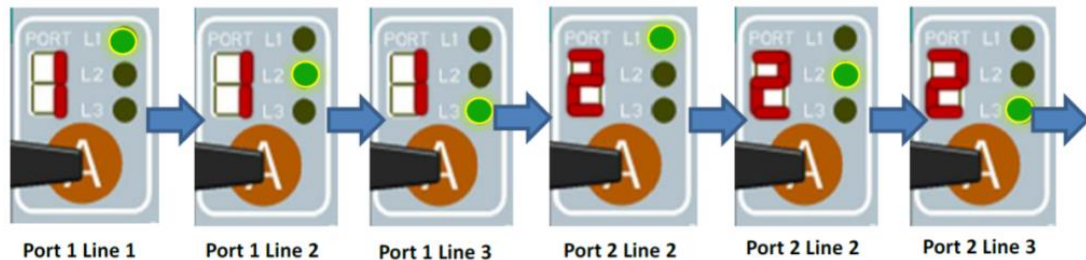


Figure 13 – Port and Phase designation

6. Enter the correct “fuse” rating to the Alvin Reclose™ device. There are two options available, 315A and 400A. Press the “F” button repeatedly to scroll through and select the desired fuse rating.

The correct fuse rating will be confirmed on-site by EA Technology following LV network studies undertaken to verify the suitability of the network for use in the trials.

Installation of Alvin Reclose™ Devices in an LV Substation

7. Ensure that the ALVIN device is in the OPEN position.
 - On first installation, the unit should be in the Open Position and the RED LED should be illuminated as shown in Figure 14



Figure 14 – Alvin Reclose™ Circuit Breaker position indicators

- If the RED Open LED is not illuminated, press and hold the OPEN Button for 5 seconds until the RED LED starts to flash at an increased frequency. Release the button. Within the unit there is a pre-set time delay feature to enable the operator to move away from the unit while it operates. After 10 seconds, the Alvin Reclose™ unit should open, and the RED LED be illuminated.

6.3.2.7 Install, power up and configure the Alvin Reclose™ into the L2 fuse way of the LV feeder being worked on

1. See details in 6.3.2.6.
2. Note: no neutral connection is required; instead, connect the daisy chain cable between the “L3” and “L2” Alvin Reclose™ devices.

6.3.2.8 Install, power up and configure the Alvin Reclose™ into the L1 fuse way of the LV feeder being worked on

1. See details in 6.3.2.6.
2. Note: no neutral connection is required; instead, connect the daisy chain cable between the “L2” and “L1” Alvin Reclose™ devices.

6.3.2.9 Connect ALVIN devices to LV-CAP™ monitoring and control cabinet

1. Ensure all 3 Alvin Reclose™ devices are in the “Open” position.
2. On the LV-CAP™ cabinet, ensure the communications isolator switch is set to the ‘OFF’ position.
3. Insert the LV-CAP™ Comms link cable to the LV-CAP™ cabinet, and then connect to the L1 Alvin Reclose™.
4. On the LV-CAP™ cabinet, set the communications isolator switch to the ‘ON’ position.

6.3.2.10 Confirm with EA Technology representative that the LV-CAP™ communications are being received from the L1, L2 and L3 Alvin Reclose™ devices.

1. Check busbar voltage is reported for L1, L2 and L3 Alvin Reclose™ devices
2. Check feeder cable voltage is reported for L1, L2 and L3 Alvin Reclose™ devices.
3. Check circuit breaker position is reported for L1, L2 and L3 Alvin Reclose™ devices.

6.3.2.11 Confirm that Alvin Reclose™ devices can be opened and closed using the Alvin device control buttons

1. Confirm that the 83mm JSU fuses are NOT fitted into any of the Alvin Reclose™ devices, and that all fuse stem covers are in place.
2. Confirm that the L1 Alvin Reclose™ device can be both closed and opened using the Alvin Reclose™ device local control buttons; and that local position indications are shown accordingly, and that the position indications in the LV-CAP™ platform are shown accordingly.
3. Confirm that the L2 Alvin Reclose™ device can be both closed and opened using the Alvin Reclose™ device local control buttons; and that local position indications are shown accordingly, and that the position indications in the LV-CAP platform are shown accordingly.
4. Confirm that the L3 Alvin Reclose™ device can be both closed and opened using the Alvin Reclose™ device local control buttons; and that local position indications are shown accordingly, and that the position indications in the LV-CAP™ platform are shown accordingly.

6.3.2.12 Confirm with EA Technology representative that the LV-CAP™ platform can OPEN and CLOSE the L1, L2 and L3 Alvin Reclose™ devices.

1. Confirm with the EA Technology representative that the L1 Alvin Reclose™ device can be closed and then opened, with switch positions clearly seen on the Alvin Reclose™ device panel and registered by the LV-CAP™ platform.
2. Confirm with the EA Technology representative that the L2 Alvin Reclose™ device can be closed and then opened, with switch positions clearly seen on the Alvin Reclose™ device panel and registered by the LV-CAP™ platform.
3. Confirm with the EA Technology representative that the L3 Alvin Reclose™ device can be closed and then opened, with switch positions clearly seen on the Alvin Reclose™ device panel and registered by the LV-CAP™ platform.
4. Confirm with the EA Technology representative that the L1, L2 and L3 Alvin Reclose™ device can be simultaneously closed and then opened, with switch positions clearly seen on the Alvin Reclose™ device panels and registered by the LV-CAP™ platform.
5. Confirm all three Alvin Reclose™ devices are left in the OPEN position.

6.3.2.13 Disable and prove that the LV-CAP™ platform capability to send OPEN and CLOSE commands to the L1, L2 and L3 Alvin Reclose™ devices has been disabled.

1. Instruct the EA Technology representative to disable the Alvin Reclose™ control capability on the LV-CAP™ platform.
2. Confirm that L1, L2 and L3 Alvin Reclose™ devices are in the OPEN position.
3. Instruct the EA Technology representative to attempt to send CLOSE commands to the L1, L2 and L3 Alvin Reclose™ devices and confirm that these are unsuccessful.
4. Manually CLOSE L1, L2 and L3 Alvin Reclose™ devices using ALVIN device front panels, and confirm L1, L2 and L3 Alvin Reclose™ devices are in the closed position.
5. Instruct the EA Technology representative to attempt to send OPEN commands to the L1, L2 and L3 Alvin Reclose™ devices and confirm that these are unsuccessful.
6. Manually OPEN L1, L2 and L3 Alvin Reclose™ devices using ALVIN Reclose™ device front panels, and confirm L1, L2 and L3 Alvin Reclose™ devices are in the OPEN position.

Note: Once the configuration has been updated on the iHost server, it can take up to 10 minutes to filter down to the relevant LV-CAP™ platform.

6.3.2.14 Confirm phasing across the L1, L2 and L3 ALVIN Reclose™ device fuse stems.

1. NOTE:
 - Right-hand ALVIN Reclose™ fuse stem connects to the LV cabinet busbar.
 - Left-hand ALVIN Reclose™ fuse stem connects to the ALVIN Reclose™ switch device (and then onwards to the LV feeder cable).
2. Check for voltage on ALVIN Reclose™ devices fuse stems, with ALVIN Reclose™ devices in both OPEN and CLOSED positions.
 - Remove the LV stem covers from the 3 Alvin Reclose™ devices.
 - With an approved LV voltage detection device check to ensure phase voltage is present on the right-hand Alvin Reclose™ fuse stems of L1, L2 and L3 devices.
 - With an approved LV voltage detection device check to ensure that there is no phase voltage present on the left-hand Alvin Reclose™ fuse stems of the L1, L2 and L3 devices.
 - Manually close the L1 Alvin Reclose™ then check for the presence of phase voltage on the left-hand Alvin Reclose™ fuse stem for the L1, L2 and L3 devices.
3. Carry out an LV phase checks.
 - Using standard procedures, confirm the phases match across left hand and right-hand Alvin Reclose™ fuse stems for each Alvin Reclose™ device (L1, L2 and L3).

6.3.2.15 Insert ALVIN Reclose™ 83mm JSU fuses, close ALVIN Reclose™ devices, and confirm load is being supplied through each ALVIN Reclose™ device.

1. Manually open L1, L2 and L3 Alvin Reclose™ devices.
2. Confirm all ALVIN Reclose™ are OPEN.
3. Insert a fuse holder into each ALVIN Reclose™ device.
4. Manually close L1, L2 and L3 Alvin Reclose™ devices.
5. Confirm all ALVIN Reclose™ are CLOSED.
6. Confirm with EA Technology representative that L1, L2 and L3 Alvin Reclose™ devices are carrying current (i.e. check current readings for all three Alvin Reclose™ units).

6.3.2.16 Substation installation and commissioning completion

1. Complete the remaining boxes on the Commissioning Record (Appendix 1).
2. Confirm all ALVIN Reclose™ devices are the closed position.
3. Remove all tools and equipment from the installation location.
4. Secure the installation site.

6.3.3 Second installation of the substation pair

6.3.3.1 Installation and commissioning of the equipment at the second substation of the pair is identical to the first substation, follow steps 6.3.2.1 to 0.

6.3.4 Completion of Stage 1 commissioning

6.3.4.1 Confirm via EA Technology representatives that all ALVIN Reclose™ devices (L1, L2 and L3) at both substations are supplying power to the interconnected LV feeders.

6.3.4.2 Following standard procedures, remove links at link box that are interconnecting the LV feeders. Confirm voltage present at all link box links.

6.3.4.3 Re-confirm via EA Technology representatives that all ALVIN Reclose™ devices (L1, L2 and L3) at both substations are still supplying power to the interconnected LV feeders.

6.3.4.4 Deploy Commissioning Stage 1 fault restoration instructions at both substations

Refer to Appendix 4 for examples.

6.4 Stage 2 Commissioning – Control simulation

6.4.1 Establish Stage 2 system operating state

6.4.1.1 WPD local team to confirm that there is no ongoing restoration of fault repair activity associated with the substation pair.

6.4.1.2 WPD local team to confirm with project team representatives which substation is nominally “Substation 1” within the control scheme.

1. Establish contact with remote EA Technology team.
2. Confirm which substation is nominally “Substation 1” within the control scheme.

6.4.1.3 Install links at link box to connect the trial LV feeders

1. Confirm with remote EA Technology project team that ALVIN Reclose™ devices are supplying power to respective LV feeders.
2. Install links in the link box.
3. Place signage inside the link box confirming the links should normally be in place as part of equipment trial network operation (excluding the need to find faults and restore customers).
4. Complete normal procedures for a change of operating state on the network.

6.4.1.4 Open ALVIN Reclose™ devices at “Substation 1”

1. Proceed to “Substation 1”.
2. Establish contact with remote EA Technology team.
3. Manually OPEN ALVIN Reclose™ devices on L1, L2 and L3.
4. Confirm with remote EA Technology team that:
 - load at “Substation 2” has picked up load previously supplied from “Substation 1”; and
 - Cable voltage is still present for all ALVIN Reclose™ devices at “Substation 1”, and that both reported busbar and cable voltages (at “Substation 1”) are within supply limits, and that cable voltage is less than busbar voltage.

6.4.2 Completion of Commissioning Stage 2 implementation steps

1. Establish contact with remote EA Technology team and confirm they have recorded steps taken.
2. Deploy fault restoration instructions at “Substation 1” and “Substation 2” sites.
Refer to Appendix 5 for examples.

6.4.3 Control system parameter tuning

During the anticipated 2-week period of control system simulation the LV-CAP™ platform control system is inhibited from changing the position of ALVIN Reclose™ devices at “Substation 1”. This was demonstrated in Commissioning Stage 1.

Also during the anticipated 2-week period of control system simulation, EA Technology will tune control system parameters by remotely accessing the LV-CAP™ platforms at “Substation 1” and at “Substation 2”. This is intended to ensure and demonstrate that the control system is operating as expected. Nominally this will be to seek to close the ALVIN Reclose™ devices at “Substation 1” during periods of higher load at “Substation 2”.

During this period, the EA Technology team shall do nothing that alters the capability of the LV-CAP™ platforms (at either “Substation 1” or “Substation 2”) to alter the position of the installed and live ALVIN Reclose™ devices.

6.5 Stage 3 Commissioning– Activate automatic control of “Substation 1” Alvin Reclose™ devices

6.5.1 Enable and test control of ALVIN Reclose™ devices at “Substation 1”

1. WPD local team attends “Substation 1” site and establishes contact with EA Technology remote team.
2. WPD local team confirms local indication of “Substation 1” ALVIN Reclose™ devices with EA Technology remote team (i.e. all devices are in OPEN position)
3. EA Technology remote team confirms remote indications of “Substation 2” ALVIN Reclose™ devices (i.e. closed and supplying load)
4. EA Technology remote team completes update of configuration of the LV-CAP™ devices at “Substation 1” only, to enable LV-CAP™ platform control of the Alvin Reclose™ devices.
5. EA Technology remote team confirms OK to proceed with testing of LV-CAP™ platform capability to operate ALVIN Reclose™ devices at “Substation 1”.
6. EA Technology remote team tests LV-CAP™ platform capability to CLOSE L1, L2 and L3 ALVIN Reclose™ devices at “Substation 1”.
7. EA Technology remote team tests LV-CAP™ platform capability to OPEN L1, L2 and L3 ALVIN Reclose™ devices.
8. EA Technology remote team establishes control systems preferred ALVIN Reclose™ device position (i.e. OPEN or CLOSED).
9. EA Technology remote team sets ALVIN Reclose™ devices to position opposite to control systems preferred position (e.g. if control systems preferred is CLOSED, ALVIN Reclose™ devices are set to OPEN position by EA Technology remote team.
10. WPD local team and EA Technology remote team observe control system change position of the ALVIN Reclose™ devices in expected time period (i.e. at start of next half hour period).

6.5.2 Completion of Commissioning Stage 3 implementation steps

1. Establish contact with remote EA Technology team and confirm they have recorded steps taken.
2. Deploy fault restoration instructions at “Substation 1” and “Substation 2” sites.

Refer to Appendix 6 for examples.

Appendix 1. Commissioning Record Sheets

- Stage 1 Commissioning Record – installation and functional testing of Alvin Reclose™ devices
- Stage 2 Commissioning Record – system configuration for control simulation period
- Stage 3 Commissioning Record – activate automatic control of “Substation 1” Alvin Reclose™ devices

Stage 1 Commissioning Record – installation and functional testing of Alvin Reclose™ devices

Substation Ref		Substation Name	
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LV Fuse Board Manufacturer & Type		LV Fuse Board Serial Number	
---	--	--------------------------------	--

Phase	Alvin Reclose™ Model	Alvin Reclose™ Revision	Alvin Reclose™ Serial No.	Alvin Reclose™ Date of Manufacture
L1				
L2				
L3				

Date of installation	
-------------------------	--

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

Ref	Commissioning step	Commissioned item/settings	Tick when completed
1.	Confirm L1, L2 & L3 Alvin Reclose™ devices have in-line fuses removed, and that there is no continuity between rear clamps	L1	
		L2	
		L3	
2.	Neutral busbar "G-Clamp" installed		
3.	Confirm links installed at link box to provide LV feeder back feed prior to Alvin Reclose™ devices installation		
4.	Confirm Alvin Reclose™ devices installed powered up and configured.	L3 Alvin current setting A	
		L2 Alvin current setting A	
		L1 Alvin current setting A	
5.	Confirm communications between Alvin Reclose™ devices and the LV-CAP platform.	L1 busbar voltsV	
		L2 busbar voltsV	
		L3 busbar voltsV	
		L1 cable voltsV	
		L2 cable voltsV	
		L3 cable voltsV	
		L1 position indication	
		L2 position indication	
		L3 position indication	

Installation of Alvin Reclose™ Devices in an LV Substation

Ref	Commissioning step	Commissioned item/settings	Tick when completed
6.	<p>Confirm L1, L2 and L3 Alvin Reclose™ devices can individually be both opened and closed using ALVIN local control panel.</p> <p>This includes confirmation that local and LV-CAP platform position indications are shown correctly.</p>	L1 CLOSE	
		L1 OPEN	
		L2 CLOSE	
		L2 OPEN	
		L3 CLOSE	
		L3 OPEN	
7.	<p>Confirm L1, L2 and L3 Alvin Reclose™ devices can individually be both opened and closed using LV-CAP platform.</p> <p>Confirm that L1 and L2 and L3 Alvin Reclose™ devices can be simultaneously both opened and closed from the LV-CAP platform.</p> <p>This includes confirmation that local and LV-CAP platform position indications are shown correctly.</p>	L1 CLOSE	
		L1 OPEN	
		L2 CLOSE	
		L2 OPEN	
		L3 CLOSE	
		L3 OPEN	
		L1, L2 & L3 CLOSE	
		L1, L2 & L3 OPEN	
8.	Confirm that the OPEN/CLOSE capability of the LV-CAP platform has been disabled	L1, L2 & L3 do not CLOSE	
		L1, L2 & L3 do not OPEN	
9.	Confirm phasing across L1, L2 and L3 Alvin Reclose™ device fuse stems with Alvin Reclose™ devices in CLOSED position		
10.	Confirm 83mm JSU fuses in-line fuses have been installed to L1, L2 and L3 Alvin Reclose™ devices, and that current and busbar voltage readings are being received by the LV-CAP platform	L1 Alvin currentA	
		L2 Alvin currentA	
		L3 Alvin currentA	
		L1 Alvin busbar voltsV	
		L2 Alvin busbar voltsV	
		L3 Alvin busbar voltsV	

Ref	Commissioning step	Commissioned item/settings	Tick when completed
11.	Confirm Commissioning Stage 1 fault restoration instructions have been deployed at both substations		

Stage 1 commissioning completed by:

WPD Authorised Person (LVSW & LVLK)

Name:

Date:

EA Technology Ltd

Name:

Date:

Stage 2 Commissioning Record – system configuration for control simulation period

“Substation 1”

Substation Ref		Substation Name	
Feeder name:			

“Substation 2”

Substation Ref		Substation Name	
Feeder Name			

“LV Link box”

Name of LV link box interconnecting the above two LV feeders	
--	--

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

Ref	Commissioning step	Commissioned item/settings	Tick when completed
1.	Contact established with remote EA Technology team.		
2.	Confirm links installed at link box to interconnect above LV feeders.		
3.	Confirm L1, L2 and L3 Alvin Reclose™ devices at “ Substation 1 ” above have been opened.		
4.	Confirm change in measured current through L1, L2 and L3 Alvin Reclose™ devices at “ Substation 2 ” with remote EA Technology team.	L1 Alvin current A	
		L2 Alvin current A	
		L3 Alvin current A	
5.	Confirm cable voltage measures for L1, L2 and L3 Alvin Reclose™ devices at “ Substation 1 ” with remote EA Technology team.	L1 Alvin busbar voltage V cable voltage V	
		L1 Alvin busbar voltage V cable voltage V	
		L1 Alvin busbar voltage V cable voltage V	
6.	Confirm Commissioning Stage 2 fault restoration instructions have been deployed at both substations.		

Stage 2 commissioning completed by:

WPD Authorised Person (LVSW & LVLK)

Name:

Date:

**Stage 3 Commissioning Record – activate automatic control of
Substation 1 Alvin devices**

“Substation 1”

Substation Ref		Substation Name	
Feeder name:			

“Substation 2”

Substation Ref		Substation Name	
Feeder Name			

“LV Link box”

Name of LV link box interconnecting the above two LV feeders	
--	--

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

Ref	Commissioning step	Commissioned item/settings	Tick when completed
1.	Contact established with remote EA Technology team.		
2.	Instruct software to be enabled at “Substation 1” only, to allow LV-CAP platform at “ Substation 1 ” to switch Alvin Reclose™ devices at “ <u>Substation 1</u> ”.		
3.	Confirm LV-CAP platform at “Substation 1” can CLOSE and OPEN L1, L2 and L3 Alvin Reclose™ devices at “Substation 1”.		
4.	Confirm LV-CAP platform at “Substation 1” has been observed to change “Substation 1” L1, L2 and L3 switch positions at beginning of a half hour period.		
5.	Confirm Commissioning Stage 3 fault restoration instructions have been deployed at both substations.		

Stage 3 commissioning completed by:

WPD Authorised Person (LVSW & LVLK)

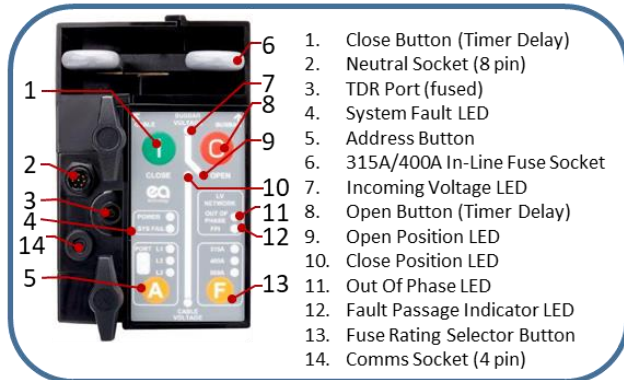
Name:

Date:

Appendix 2. Alvin Reclose™ - Quick Installation Guide



Quick Installation 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 preprogrammed operating protocols

1

- Secure neutral "G" Clamp to the neutral busbar and connect the neutral reference cable to the "G" Clamp.
- Remove the In-Line fuse from the ALVIN Reclose, confirm rating and continuity.
- Check there is no continuity between top and bottom unit clamps on the rear of the ALVIN Reclose (if any continuity is present the unit **SHALL** be withdrawn from service).

2

- Record the ALVIN Reclose serial number and revision from the name plate before installation.
- Remove the LV fuse from the LV Board and install the ALVIN Reclose unit in its place.
- Secure in place by tightening the clamps.
- Connect the neutral cable to the neutral socket (2).
- ALVIN Reclose status LED's should now illuminate.

3

- Within 30 seconds of power up set the address of the unit by repeatedly pressing to the 'A' button.
- Set Fuse Characteristic to 315A or 400A by pressing the "Fuse Rating Selector Button" 'F'.
- Check unit is in the Open Position and "Open Position LED" is illuminated as shown in stage 4.

4

- If not, Press and hold the "Open Button" for 5 seconds until the flashing frequency of the "Open Position LED" increases, the "Open Button" can then be released.
- Note: There is a pre-set time delay to opening to allow time to move away from the ALVIN Reclose (10secs).
- Insert the In-Line Fuse onto recloser fuse way stalks and tighten clamps.

5

- To Close the unit, press and hold the "Close Button" for 5 Seconds until the flashing Frequency of the "Close Position LED" increases, the "Close Button" can then be released.
- Note: There is a pre-set time delay to closing to allow time to move away from the ALVIN Reclose (10secs).

6

- Check "Close Position LED" is illuminated.
- Confirm that supplies are restored.
- If successful, then the ALVIN Reclose can be left to undertake its duty.
- Install additional units using the daisy chain cable from the previously installed unit to the new unit as the neutral reference.
- Fit the WIFI dongle into socket (14) on the last unit.

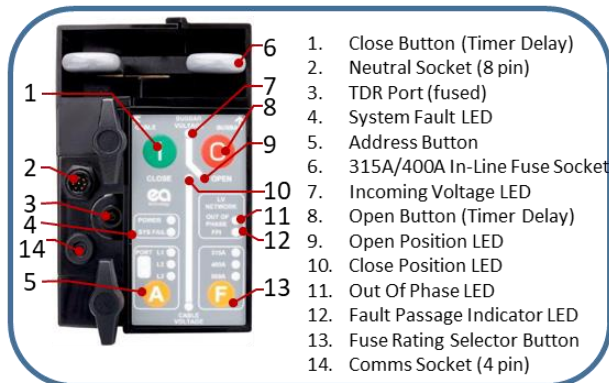
Safer, Stronger, Smarter Networks

Appendix 3. Alvin Reclose™ - Quick Removal Guide



Quick Removal Guide

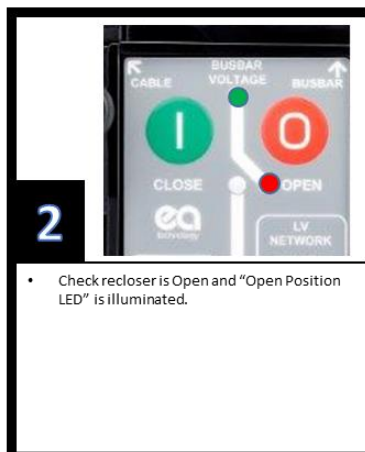
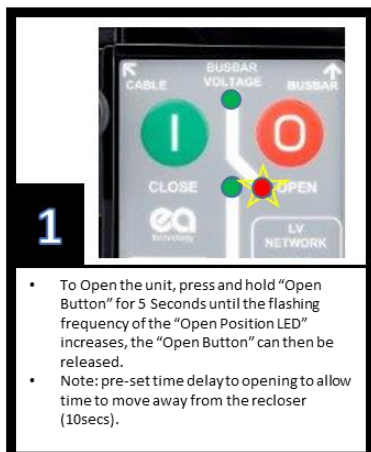
Version 0.1



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



Safer, Stronger, Smarter Networks

Initial supply restoration steps

(OpenLV Substation XXXXXX – in commissioning stage 1 with LV NOP OPEN)

NOTE: the ALVIN devices fitted at this substation are inhibited from automatically reclosing after a fault.

1. Confirm if any of the individual phase supplies to this feeder have tripped:



On any of the three single phase ALVIN units:

- ALVIN circuit breaker is OPEN, and
- No voltage detected on feeder cable; and
- Fault passage indicator is lit.

2. Attempt to reclose the ALVIN circuit breaker on each phase that is tripped – see quick start guide:
 - a) If all phases successfully close AND cable voltages are indicated, follow standard procedures to confirm successful restoration.
 - b) If any phase/ALVIN device closes, but no cable voltage is indicated, re-open the Alvin device, check the ALVIN in-line fuse and replace if necessary.
 - c) If any phase/ALVIN device does not successfully reclose after fuse-check/replacement, this indicates an active fault remains on this feeder:
 - i. Open ALVIN Control Isolation Switch; and
 - ii. Commence standard fault finding procedures (including removal of the ALVIN units).



ALVIN Reclose™ Isolation Switch

3. Once all repairs have been completed and all supplies restored, please contact the OpenLV project team to arrange return to project operating state.

If you are in any doubt, contact local contact name & telephone number

Installation of Alvin Reclose™ Devices in an LV Substation

Initial supply restoration steps

(OpenLV Substation YYYYYY – in commissioning stage 1 with LV NOP OPEN)

NOTE: the ALVIN devices fitted at this substation are inhibited from automatically reclosing after a fault.

1. Confirm if any of the individual phase supplies to this feeder have tripped:



On any of the three single phase ALVIN units:

- ALVIN circuit breaker is OPEN, and
- No voltage detected on feeder cable; and
- Fault passage indicator is lit.

2. Attempt to reclose the ALVIN circuit breaker on each phase that is tripped – see quick start guide:
 - a) If all phases successfully close AND cable voltages are indicated, follow standard procedures to confirm successful restoration.
 - b) If any phase/ALVIN device closes, but no cable voltage is indicated, re-open the Alvin device, check the ALVIN in-line fuse and replace if necessary.
 - c) If any phase/ALVIN device does not successfully reclose after fuse-check/replacement, this indicates an active fault remains on this feeder:
 - i. Open ALVIN Control Isolation Switch; and
 - ii. Commence standard fault finding procedures (including removal of the ALVIN units).



ALVIN Reclose™ Isolation Switch

3. Once all repairs have been completed and all supplies restored, please contact the OpenLV project team to arrange return to project operating state.

If you are in any doubt, contact local **contact name & telephone number**

Initial supply restoration steps at XXXXXX

(OpenLV Substation XXXXXX – in commissioning stage 2 with LV NOP CLOSED and LV Feeder A from this substation and LV Feeder B at substation YYYYYY both supplied from substation XXXXXX.)

NOTE: the ALVIN devices fitted at this substation are inhibited from automatically reclosing after a fault.

1. If no-supplies are reported associated with this feeder, confirm if any of the individual phase supplies to this feeder have tripped:



On any of the three single-phase ALVIN units:

- ALVIN circuit breaker is OPEN, and
- No voltage detected on feeder cable; and
- Fault passage indicator is lit.

2. Attempt to reclose the ALVIN circuit breaker on each phase that is tripped – see quick start guide:
 - a) If all phases successfully close AND cable voltages are indicated, follow standard procedures to confirm successful restoration.
 - b) If any phase/ALVIN device closes, but no cable voltage is indicated, re-open the Alvin device, check the ALVIN in-line fuse and replace if necessary.
 - c) If any phase/ALVIN device does not successfully reclose after fuse-check/replacement, this indicates an active fault remains on this interconnected LV feeder:
 - i. Follow standard procedures to open links at NOP ([link box location](#))
 - ii. Return to this substation (XXXXXX) and attempt to close ALVIN devices to restore supplies:
 - If all phases successfully close AND cable voltages are indicated, follow standard procedures to confirm successful restoration.
 - If any phase/ALVIN device does not successfully reclose after fuse-check/replacement, this indicates an active fault remains on this feeder:
 - Switch ALVIN Control Isolation Switch to OFF position;
 - Commence standard fault finding procedures (including removal of the ALVIN units).
 - iii. Proceed to link box (location) and verify status, then go to substation YYYYYY and attempt to close ALVIN devices to restore supplies to YYYYYY Feeder B, following the instructions at that site.



ALVIN Reclose™ Isolation Switch

3. Once all repairs have been completed and all supplies restored, please contact [local team representative](#) to confirm the state equipment should be felt in.

If you are in any doubt, contact local [contact name & telephone number](#)

Installation of Alvin Reclose™ Devices in an LV Substation

Initial supply restoration steps at YYYYYY

(OpenLV Substation YYYYYY – in commissioning stage 2 with LV NOP CLOSED and LV Feeder A from this substation and LV Feeder B at substation XXXXXX both supplied from XXXXXX.)

NOTE: the ALVIN devices fitted at this substation are inhibited from automatically reclosing after a fault.

1. This feeder is connected to XXXXXX Feeder A via closed LV NOP (link box location). The ALVIN devices here (YYYYYY) are expected to be OPEN. If the NOP (link box location) is open, the jump to step 4.
2. If no-supplies are reported associated with this feeder, one or more ALVIN devices may show no cable voltage detected.



On any of the three single-phase ALVIN units:

- ALVIN circuit breaker is OPEN, and
- Red LED indicating No voltage detected on feeder cable

3. Go to substation XXXXXX and follow initial restoration steps at that site.
4. If restoration has been attempted at XXXXXX, AND links are removed at NOP (link box location) then attempt to close ALVIN devices at this substation (YYYYYY) to restore supplies.
 - i. If all phases successfully close AND cable voltages are indicated, follow standard procedures to confirm successful restoration.
 - ii. If any phase/ALVIN device closes, but no cable voltage is indicated, re-open the Alvin device, check the ALVIN in-line fuse and replace if necessary.
 - iii. If any phase/ALVIN device does not successfully reclose after fuse-check/replacement, this indicates an active fault remains on this feeder:

- Switch ALVIN Control Isolation Switch to OFF position;
- Commence standard fault finding procedures (including removal of the ALVIN units).



ALVIN Reclose™ Isolation Switch

5. Once all repairs have been completed and all supplies restored, please contact local team representative to confirm the state equipment should be felt in.

If you are in any doubt, contact local contact name & telephone number

Initial supply restoration steps at XXXXXX

(OpenLV Substation XXXXXX – in Automatic Operation State with LV NOP CLOSED. The interconnected LV feeders may be supplied from XXXXXX only, or from XXXXXX AND YYYYYY)

NOTE: the ALVIN devices fitted at this substation are inhibited from automatically reclosing after a fault.

1. If no-supplies are reported associated with this feeder, confirm if any of the individual phase supplies to this feeder have tripped:



On any of the three single-phase ALVIN units:

- ALVIN circuit breaker is OPEN, and
- No voltage detected on feeder cable; and
- Fault passage indicator is lit.

2. Attempt to reclose the ALVIN circuit breaker on each phase that is tripped – see quick start guide:
 - a) If all phases successfully close AND cable voltages are indicated, follow standard procedures to confirm successful restoration.
 - b) If any phase/ALVIN device closes, but no cable voltage is indicated, re-open the Alvin device, check the ALVIN in-line fuse and replace if necessary.
 - c) If any phase/ALVIN device does not successfully reclose after fuse-check/replacement, this indicates an active fault remains on this interconnected LV feeder:
 - i. Open ALVIN Control Isolation Switch
 - ii. Follow standard procedures to open links at NOP ([link box location](#))
 - iii. Return to this substation (XXXXXX) and attempt to close ALVIN devices to restore supplies:
 - If all phases successfully close AND cable voltages are indicated, follow standard procedures to confirm successful restoration.
 - If any phase/ALVIN device does not successfully reclose after fuse-check/replacement, this indicates an active fault remains on this feeder:
 - Switch ALVIN Control Isolation Switch to OFF position;
 - Commence standard fault finding procedures (including removal of the ALVIN units).
 - iv. Proceed to link box ([link box location](#)) and verify status, then go to substation YYYYYY and attempt to close ALVIN devices to restore supplies to YYYYYY Feeder B, following the instructions at that site.
3. Once all repairs have been completed and all supplies restored, please contact [local team representative](#) to confirm the state equipment should be felt in. NOTE: the ALVIN Control must remain isolated while the NOP is in an OPEN state.



ALVIN Reclose™ Isolation Switch

If you are in any doubt, contact local [contact name & telephone number](#)

Installation of Alvin Reclose™ Devices in an LV Substation

Initial supply restoration steps at YYYYYYY

(OpenLV Substation YYYYYY – in Automatic Operation State with LV NOP CLOSED. The interconnected LV feeders may be supplied from XXXXXX only ,
or from XXXXXX AND YYYYYY)

NOTE: the ALVIN devices fitted at this substation are inhibited from automatically reclosing after a fault.

1. This feeder is connected to **XXXXXX Feeder A** via closed LV NOP (**link box location**). The ALVIN devices here (**YYYYYY**) may be either OPEN or CLOSED in automated operation. If the NOP (**link box location**) is open, then jump to step 5.
2. If no-supplies are reported associated with this feeder, one or more ALVIN devices may show no cable voltage detected OR may show cable no-voltage indication AND fault passage indicator.



On any of the three single-phase ALVIN units:

- ALVIN circuit breaker is OPEN, and
- Red LED indicating No voltage detected on feeder cable
- Fault passage indicator is lit.



3. Go to substation XXXXXX and follow initial restoration steps at that site.
4. If restoration has been successfully attempted at XXXXXX with LV NOP CLOSED (link box location), follow standard procedures to confirm successful restoration has occurred.
5. If restoration has been attempted at XXXXXX, AND links have been removed at NOP (link box location) then:
 - i. Switch ALVIN Control Isolation Switch to OFF position
 - ii. Attempt to close ALVIN devices at this substation (YYYYYY) to restore supplies
 - iii. If all phases successfully close AND cable voltages are indicated, follow standard procedures to confirm successful restoration.
 - iv. If any phase/ALVIN device closes, but no cable voltage is indicated, re-open the Alvin device, check the ALVIN in-line fuse and replace if necessary.
 - iv. If any phase/ALVIN device does not successfully reclose after fuse-check/replacement, this indicates an active fault remains on this feeder:
 - Confirm ALVIN Control Isolation Switch is in the OFF position;
 - Commence standard fault finding procedures (including removal of the ALVIN units).
6. Once all repairs have been completed and all supplies restored, please contact **local team representative** to confirm the state equipment should be felt in. NOTE: the ALVIN Control must remain isolated while the NOP is in an OPEN state.



ALVIN Reclose™ Isolation Switch

If you are in any doubt, contact local contact name & telephone number

