



Safer, Stronger, Smarter Networks

# Automated Low Voltage Intelligent Networks

Chris Lowsley



[www.eatechnology.com](http://www.eatechnology.com)

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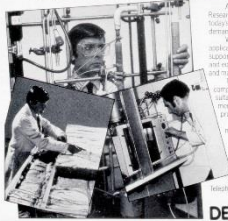
# About EA Technology

# Our heritage

Delivering innovation for

50 years

You don't have to put technologists on your payroll  
to get them working for you.



DEVELOPELECTRIC

1990

- Electricity privatisation
- Transition to commercial provider of technology services

1966

- Electricity Council Research Centre

1994

- Reformed as EA Technology

2004

- Employee-owned

2016

- 200 employees
- c£18m (c€24m) turnover

Design and  
build  
Instruments

Consulting  
Services

Technical Site  
Services

Training &  
Power Skills



Safer, Stronger, Smarter Networks

# Our Products

## Medium and High Voltage Electrical Partial Discharge Solutions

### Detection



UltraTEV  
Detector™



UltraTEV Plus<sup>2</sup>



CableData  
Collector™



UltraTEV  
Locator™



PD Hawk™

### Location



UltraTEV  
Monitor™



UltraTEV Alarm™

### Monitoring



# Our Products

Intelligent fault location and restoration solutions for Low Voltage networks



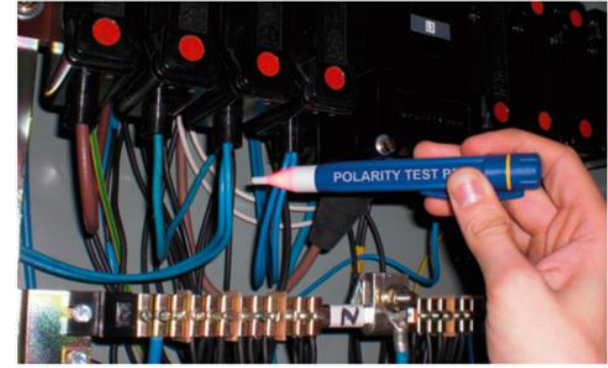
## Low Voltage (ALVIN range)

Creating Safer, Stronger, Smarter networks with next generation LV network management equipment.



## Cable Fault Location (CableSniffer)

Locate underground cable faults - Fast.



## Polarity Test Pens

Safely check which low voltage conductors are live

# Our Technical Services

A range of services to help our clients understand the condition of their substations, cables, transformers and overhead lines



Oil diagnostics



Transformer condition assessment



Switchgear condition assessment



Substation earthing



Cable condition assessment



Overhead line services



Failure investigations



Lightning protection and location

# Our Consultancy and Software

Activity that helps inform strategic choices, driving cost-efficiencies for those who own and operate energy networks



## Asset Investment Management

World leading software to underpin investment planning decisions for electrical power assets.



## Asset Management and Policy

Comprehensive technical support to ensure policy alignment and safe systems of work.

A focus on the electrical assets from the component through to investment planning..



## Network Innovation

End-to-end support in embedding new solutions into today's power systems.



## Network Studies

Modelling and analysis to extend and adapt power networks, ensuring compliance and fitness for purpose.

..and how to extend, manage and integrate solutions into the electrical system



# A company with a global reach

Regional offices: USA, UAE, SEA, China, Australia





A blue wavy banner that starts wide on the left and tapers towards the right, containing the text 'LV Solutions Business' in white.

# **LV Solutions Business**

# LV Solutions

## Key Focus:

- automated self healing LV distribution networks
- maximising network uptime
- minimising downtime



Cable Sniffer 2



ALVIN Reclose

# **ALVIN Reclose Equipment**



**ALVIN**  
Reclose

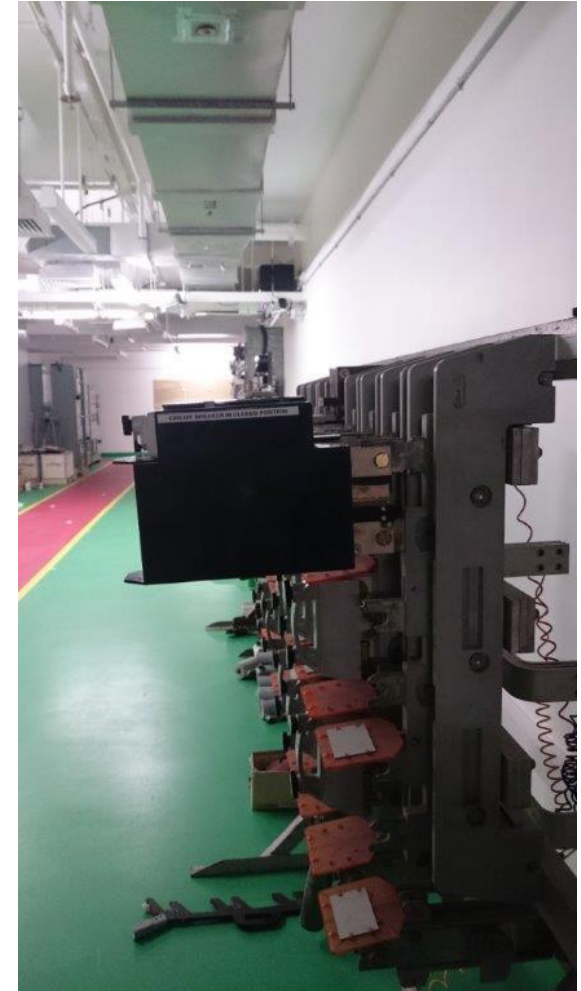
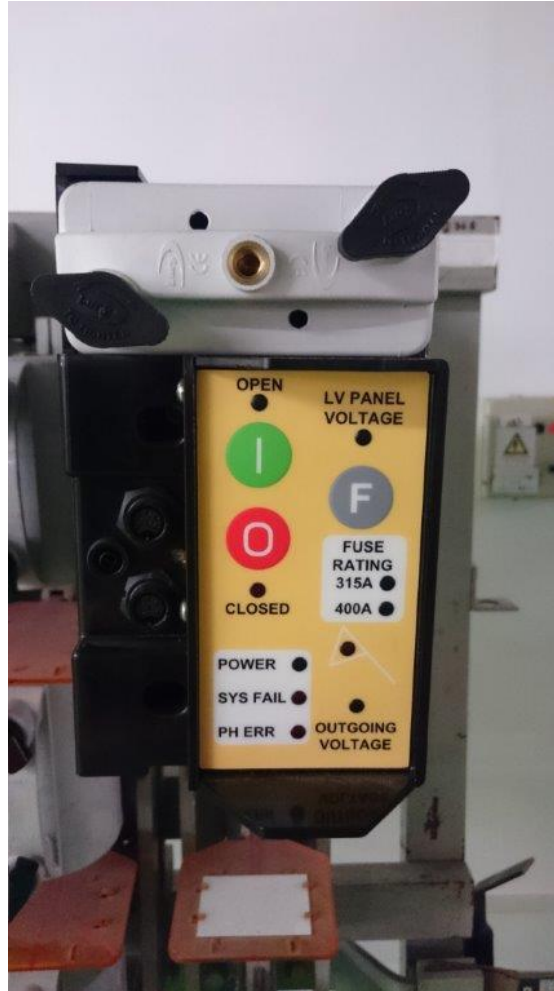
Intro Video



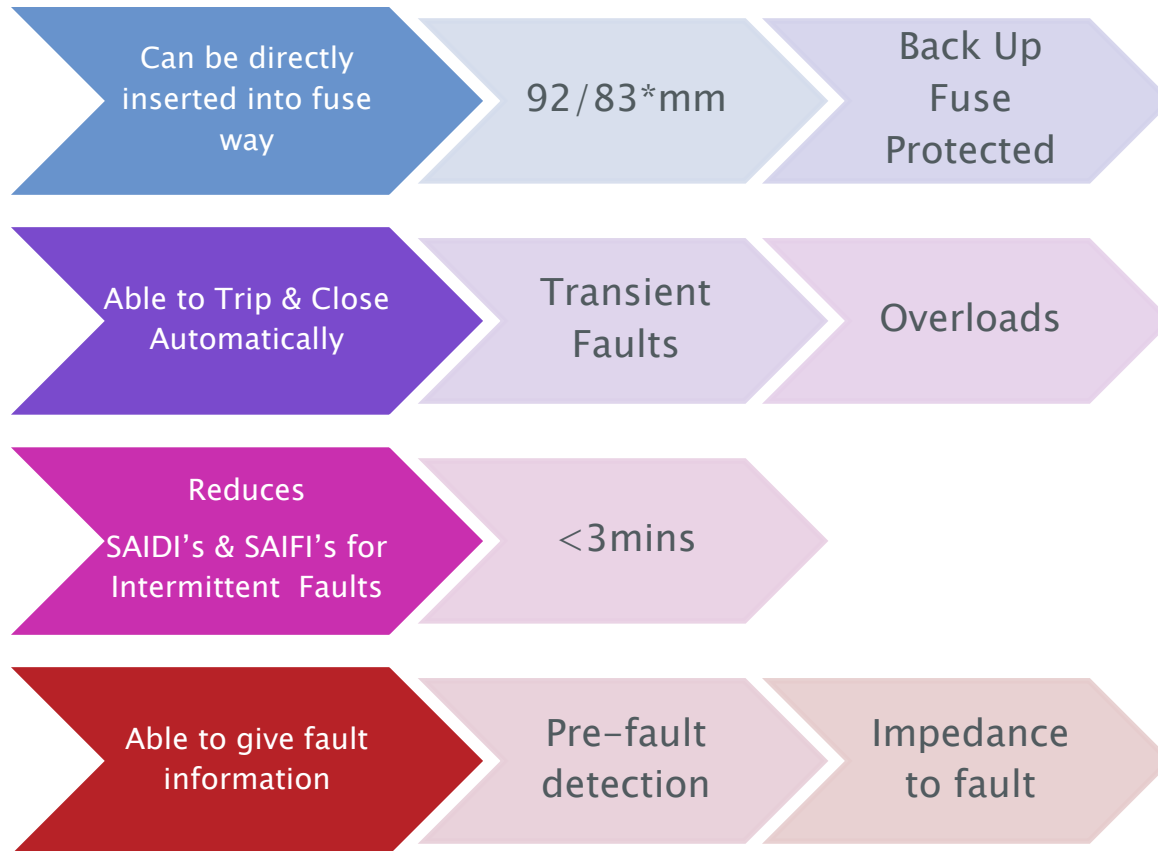
A solid blue shape that starts as a wide, curved band on the left and tapers into a horizontal bar on the right.

**Background**

# Early Prototype



# Replacement for an LV Fuse



# Guide to Fuse Replacement

100 amp



250 amp



350 amp  
(Audiovisual  
Auto-Alert)



600 amp



1500 amp  
(Slow-Blow)



2000 amp  
(Slow-Blow)



16 amp



130 amp





ALVIN Reclose is not a...

~~Fault Conditioning Tool~~

ALVIN Reclose is not a...

**Or is it??**

**It has a limited conditioning capability up to 2000A  
during the SafeOn process**

# So what is ALVIN Reclose?

1. ALVIN is a cost effective replacement for a fuse that will try to safely restore customer supplies in less than 3 mins
2. It should be installed after 1<sup>st</sup> fuse operation in case of a transient fault or overload
3. It is a capital investment to be left on the network indefinitely or until the circuit is proved to be healthy
4. If one ALVIN Reclose unit prevents 75 customers being off supply for more than 1 hour, it will have paid for itself\*

A blue wavy banner that starts wide on the left and tapers to the right, containing the text 'Basic Design'.

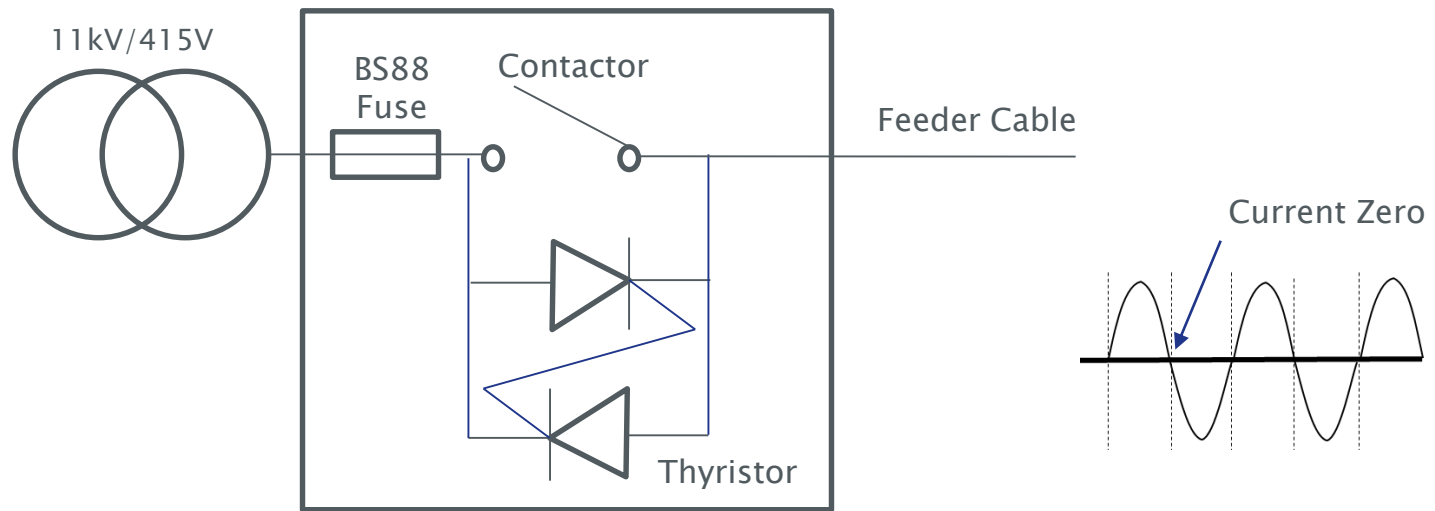
# Basic Design



# Operating Principles

## ALVIN Reclose has an Innovative Design

- Thyristor provides arc free switching

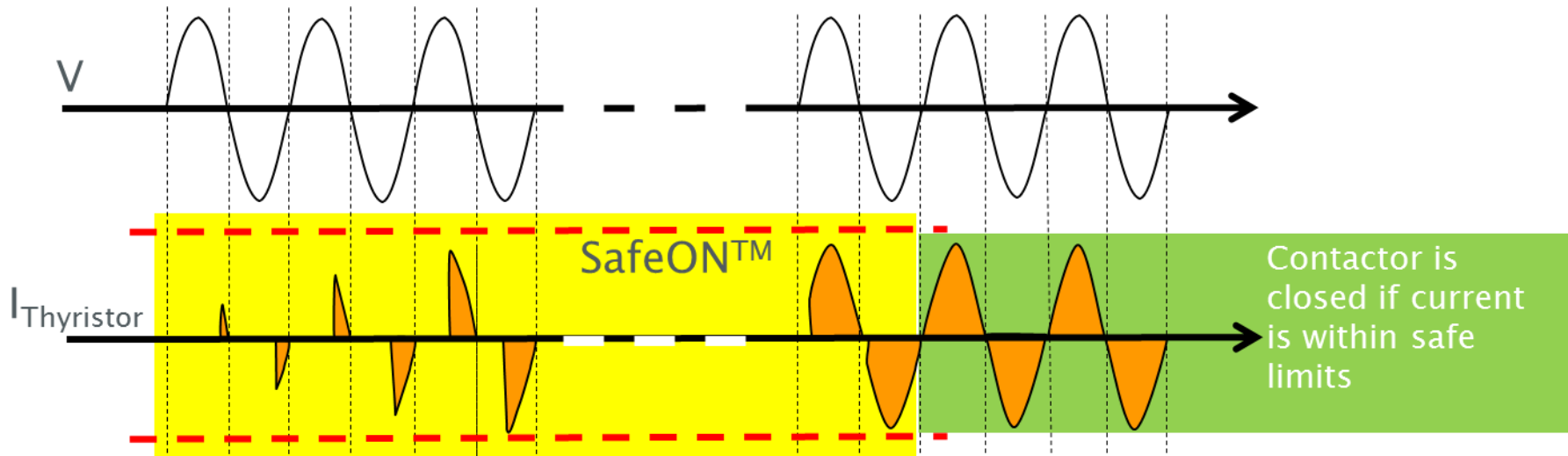


- Thyristor takes all the duty of making and breaking
- Contactor provides low losses when switched
- Thyristor operates at current zero crossing on the sine wave

A blue wavy graphic that starts as a thin line on the left and expands into a wide, horizontal band across the bottom of the slide.

SafeON

# SafeON™ Making

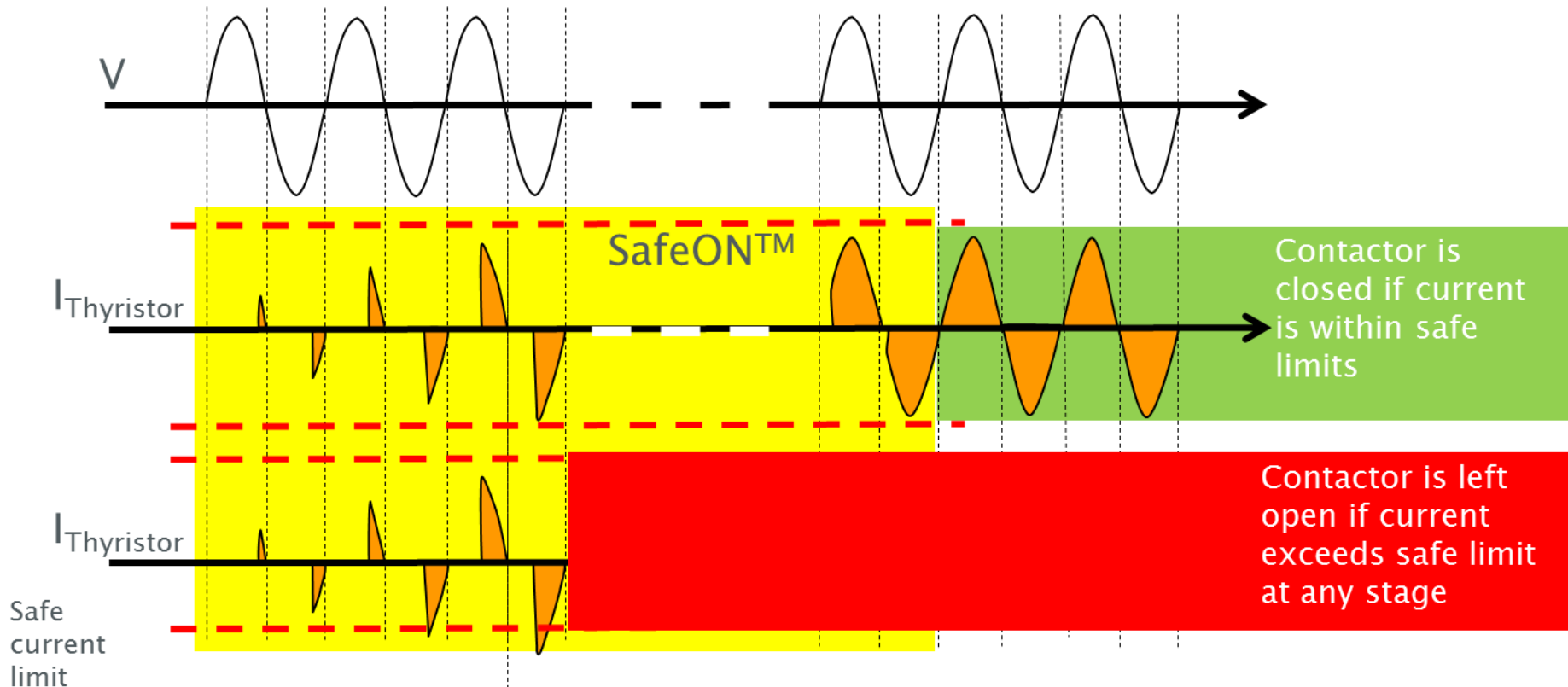


Fault detection and current limiting technology

--- . Inrush Current Limits (configurable)

# Why it Helps Us....

## SafeON™ Making



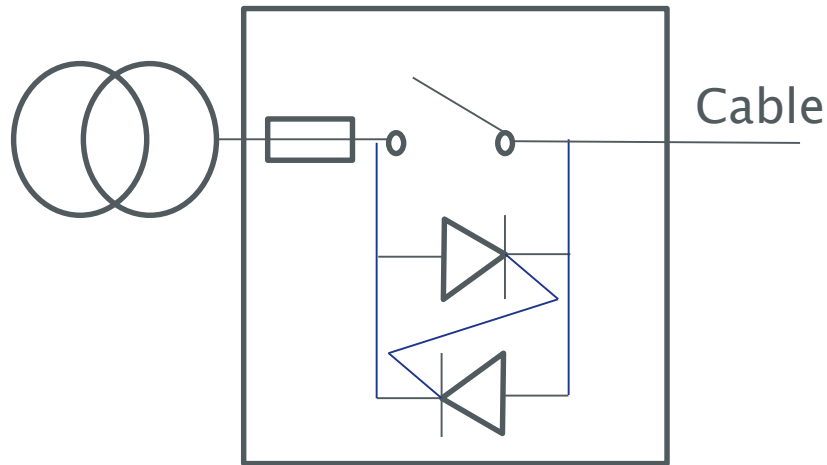
Fault detection and current limiting technology

# Arc Free Switching

# Arc-free switching

SafeON™ Principles

**Close Operation**

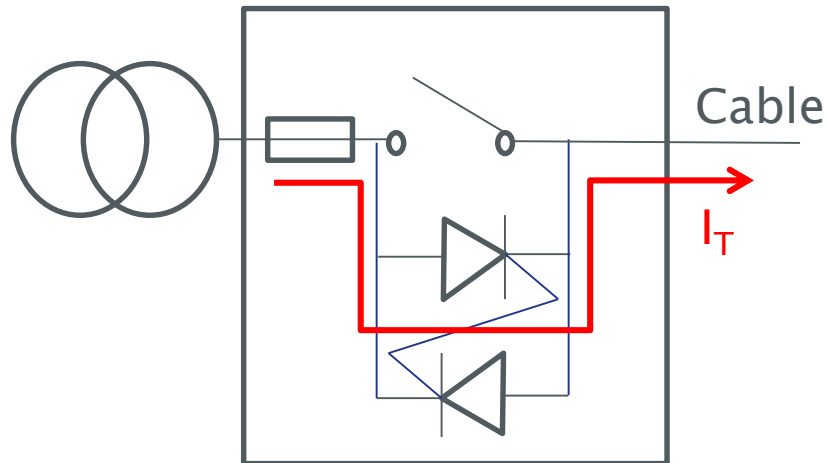


ALVIN Reclose device is open, no conduction.

# Arc-free switching

SafeON™ Principles

Close Operation



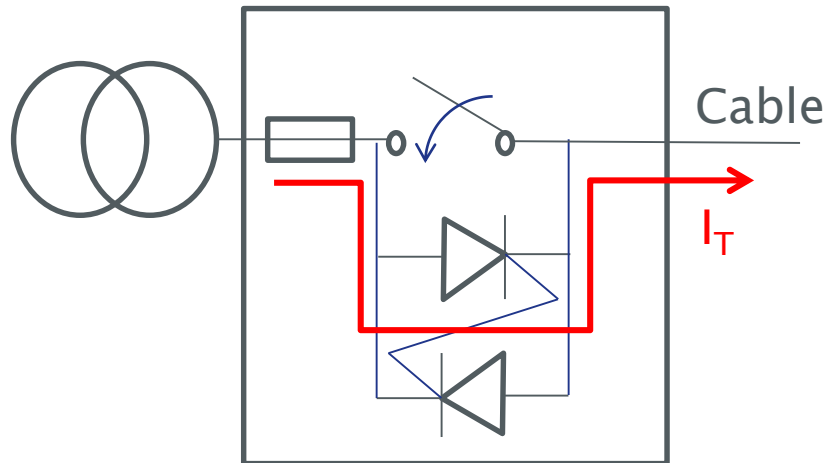
ALVIN Reclose device intends to close. SafeON™ controls current via thyristor



# Arc-free switching

SafeON™ Principles

Close Operation

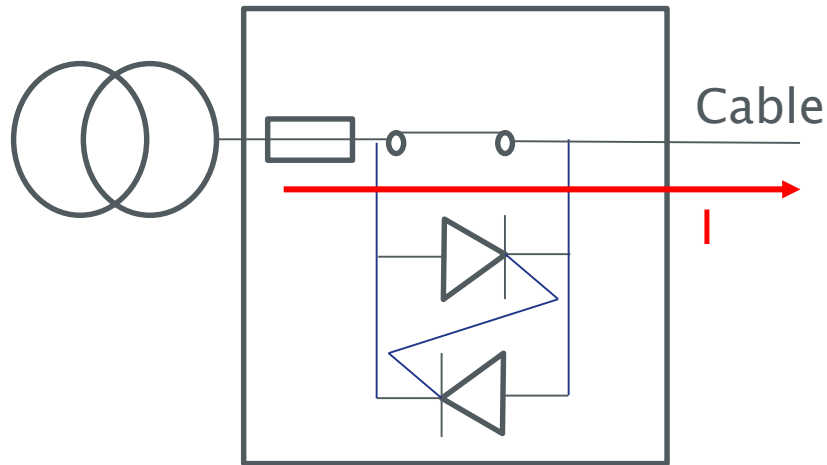


No fault found, contactor is closed while thyristor is conducting

# Arc-free switching

SafeON™ Principles

Close Operation

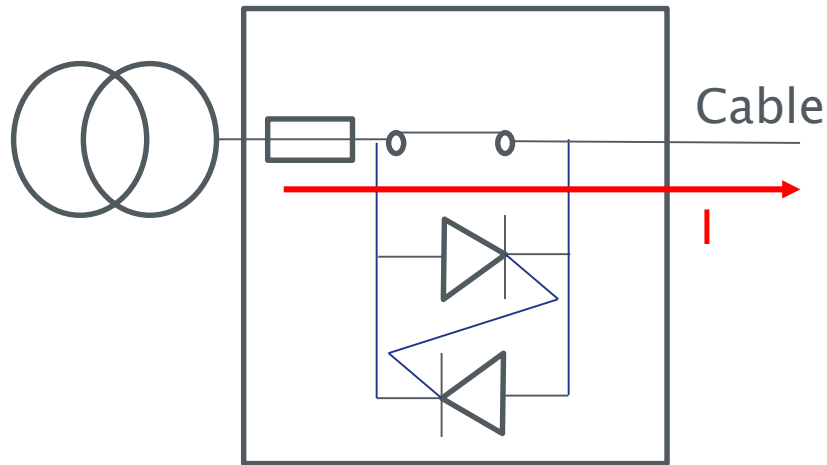


Once switch is closed, thyristor switches off, current flows through switch

# Arc-free switching

SafeON™ Principles

**Open Operation**

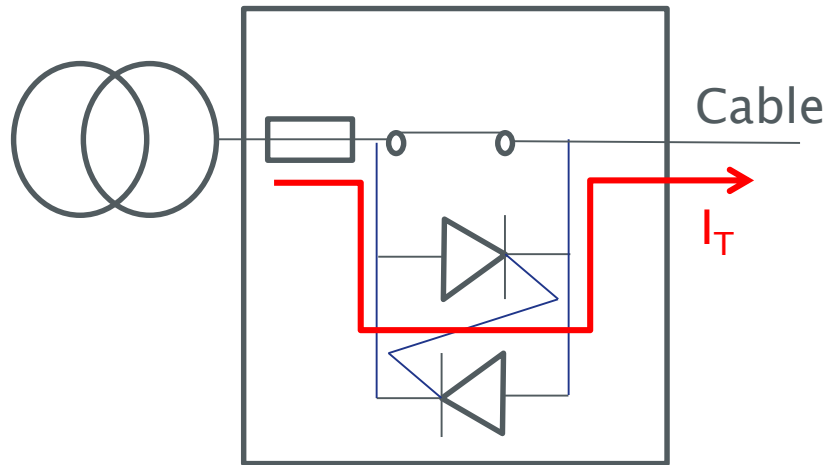


Current flowing through switch under normal conditions

# Arc-free switching

SafeON™ Principles

Open Operation

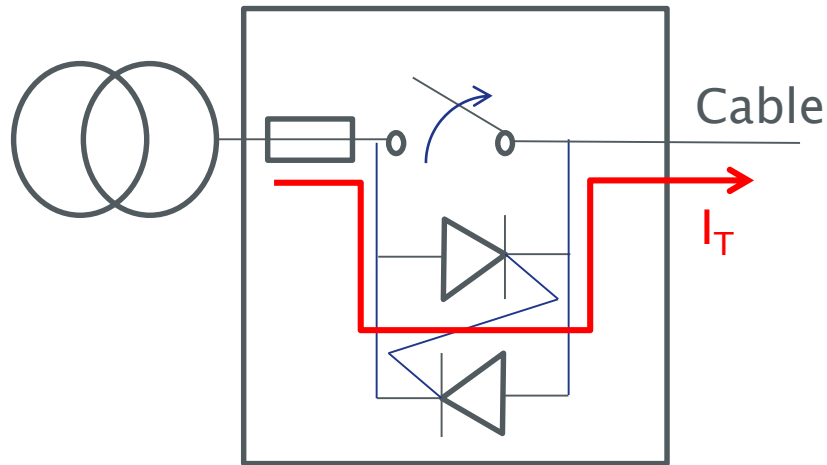


ALVIN Reclose device intends to open so thyristor switched on

# Arc-free switching

SafeON™ Principles

Open Operation

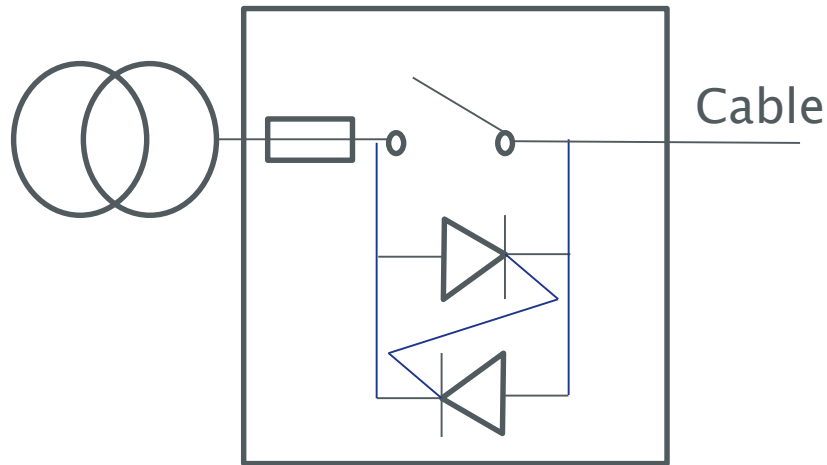


Contactor is opened while thyristor is conducting

# Arc-free switching

SafeON™ Principles

Open Operation



Thyristor switches off at zero crossing; ALVIN Reclose device is open, no conduction.

# Benefits of Arc-Free Switching

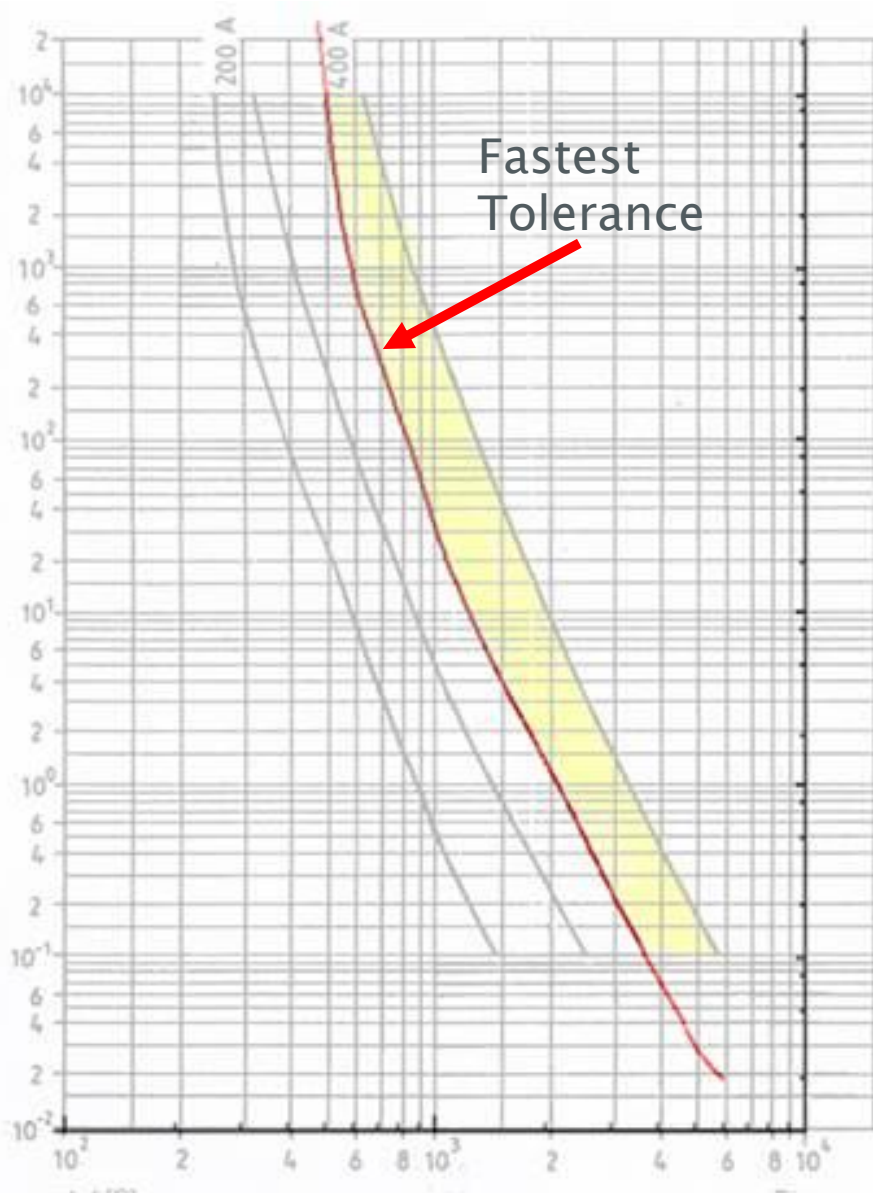
1. Multi-shot Capability (1 000 ops)
2. No closing onto a permanent fault
3. No Arcing during switching = Safer
4. No Arcing = No contact wear
5. No contact wear = No Maintenance
6. No Maintenance = No return to Supplier
7. No Return to supplier = Less Cost



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# Protection Characteristics

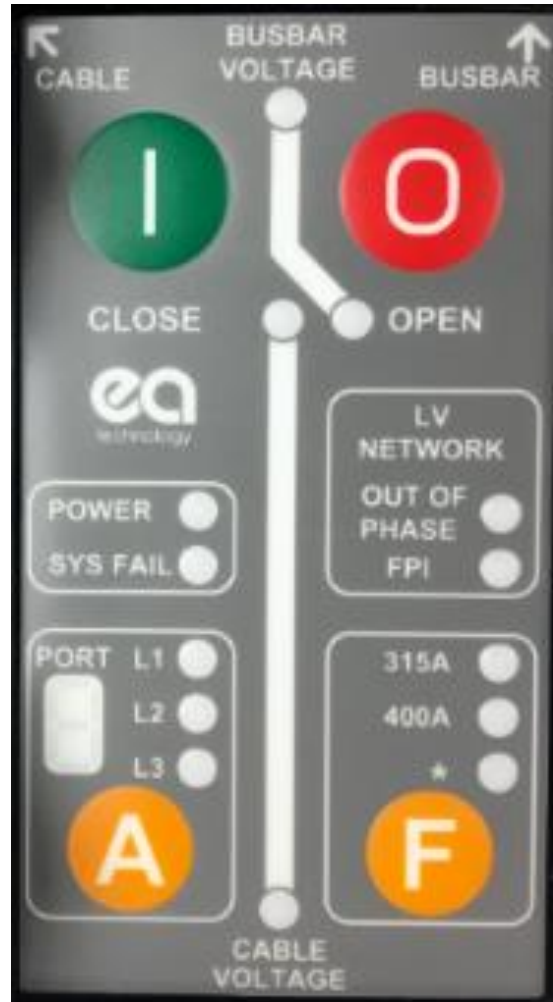
# ALVIN Acting as a Fuse



## BS88 Fuse Curve:

- Batches of fuses have tolerance band
- ALVIN is programmed to beat fastest part of tolerance band
- ALVIN has an accumulator to mimic heating of fuse

# Fuse Settings



## Settings:

- 315A
- 400A
- \* Single Trip Mode for
  - Live Working
  - Single shot

# Benefits of ALVIN Protection

## Settings:

- Programmable protection settings
- Can model any LV fuse characteristic
- Can provide hybrid models
  - Fuse curve with instantaneous trip
- Number of reclose attempts can be changed before lockout

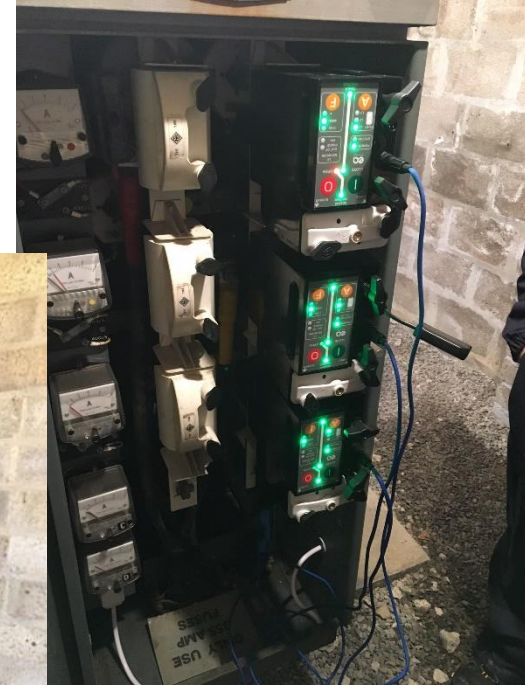
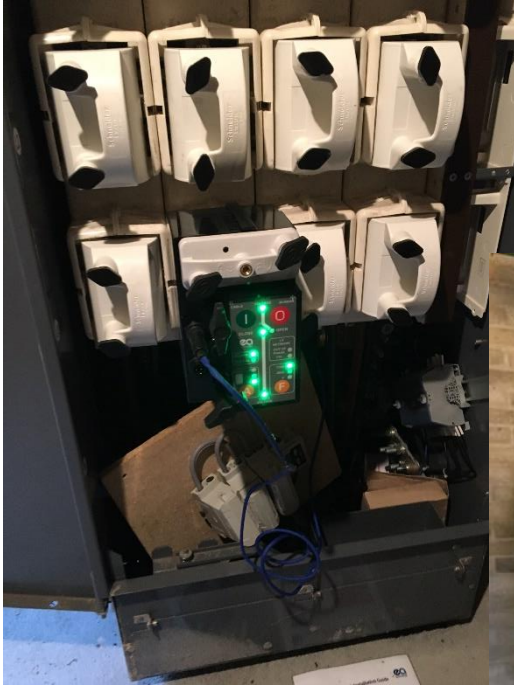
# ALVIN Reclose Ratings

ITEM	RATING
Rated Operating Voltage	275V phase to neutral on either pole 440V across poles
Rated Insulation Voltage	690V
Rated Operating Current	400A
Operating frequency	50Hz
Rated making capacity	80kA
Rated breaking capacity	80kA
Overcurrent trip characteristic	Inverse time-based on 315A & 400A BS88-2 It zones
Ambient air temperature	-25°C to +45°C
Operating cycles	1000
Voltage measurement	±1.5% 50V to 253V AC RMS
Current measurement	±1% >200A, ±2A ≤200A
Harmonic monitoring	Yes
Directional Fault Indicators	Yes
Fault location ready	Yes
Making on faulty cable	SafeON™ with current limiting to 2.4kA
Standards applied	IEC 60947-2, IEC 61000, IEC60255



# Typical Installations

# Installations





# Installations



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**Stand Alone Mode**

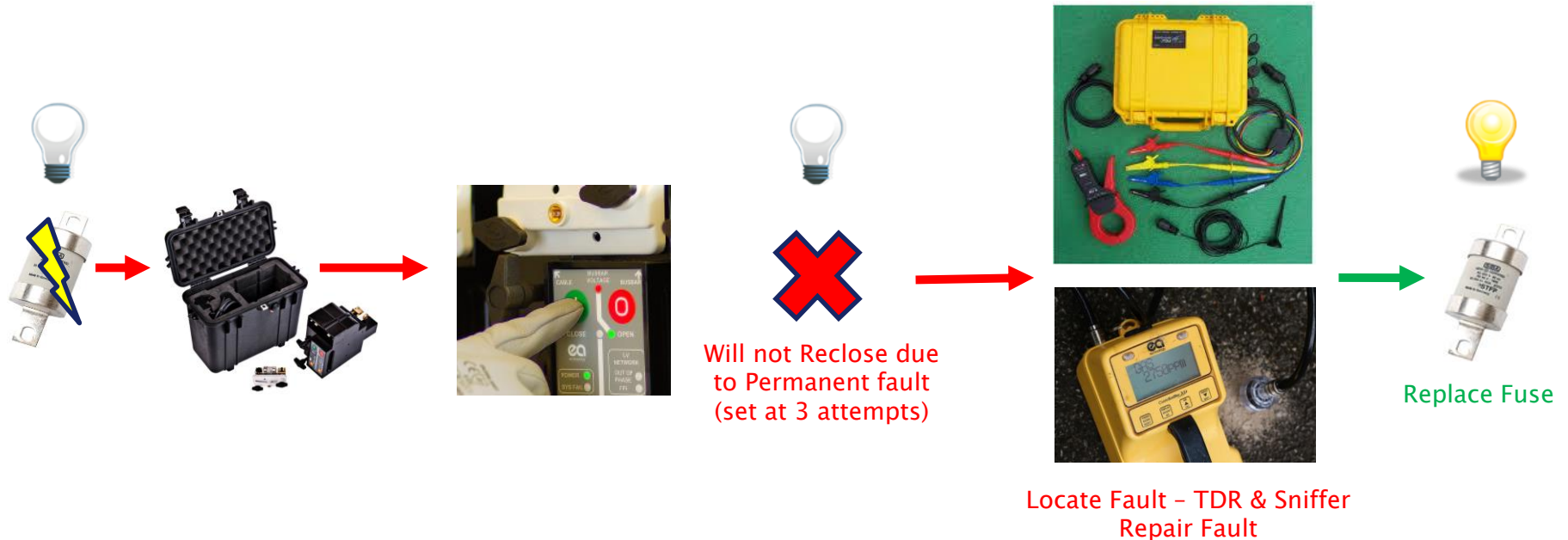
# How to use ALVIN Reclose

## Stand Alone Mode – Transient Fault or Overload



Once in place the ALVIN Reclose can be commissioned onto Network Asset Register

# How to use ALVIN Reclose Stand Alone Mode – Permanent Fault



If Fuse holds, ALVIN Reclose should be reused for the next fuse replacement

# **ALVIN Reclose with Communications**

# Advanced Mini Portal 2 (AMP2)



## AMP2

- GSM Comms
- WiFi Linked
- 24V Power Supply



## Wireless Link

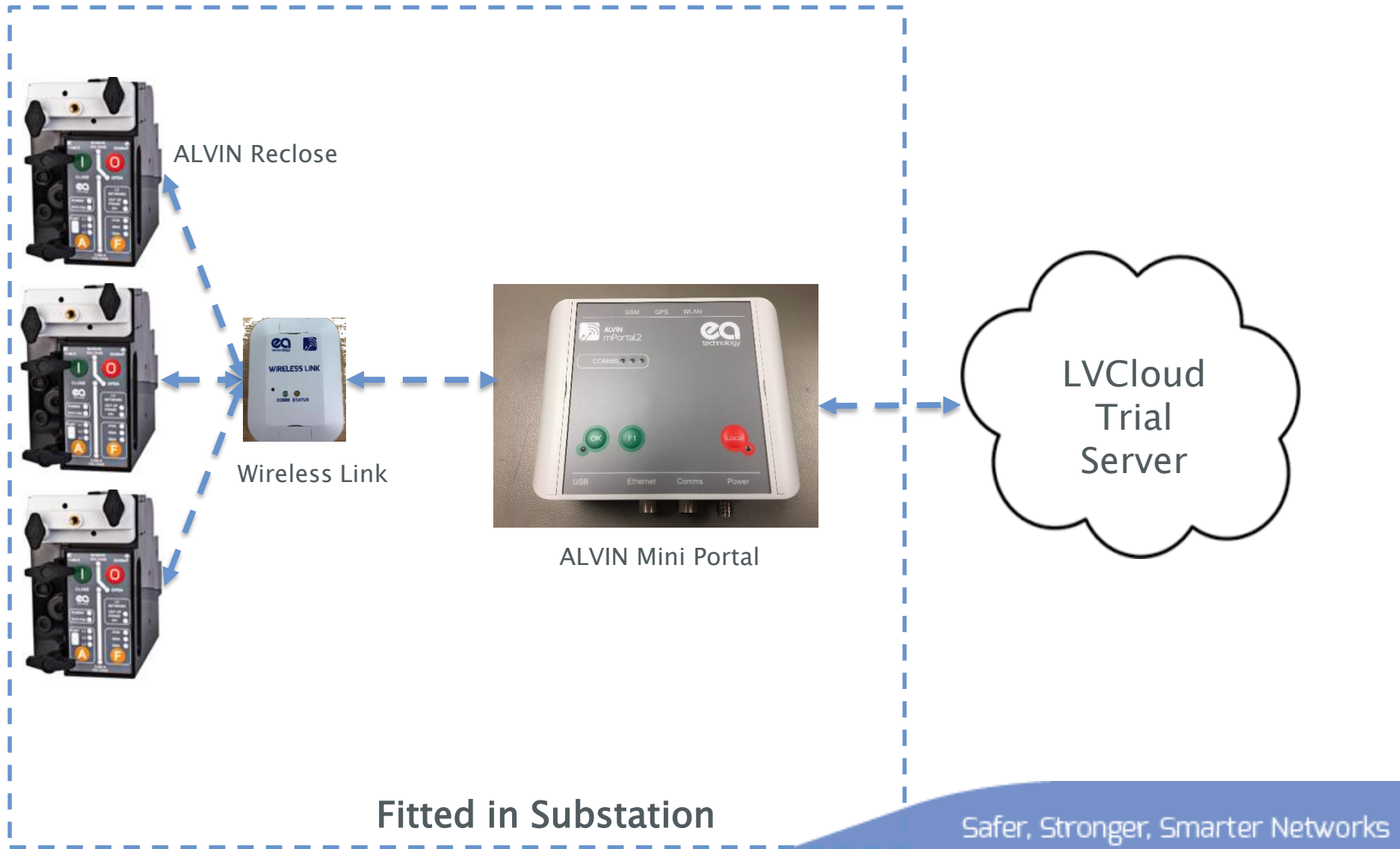
- Links ALVIN to AMP2

# Advanced Mini Portal 2 (AMP2)

- Provides conduit between connected equipment and Cloud Database
- Sim card inserted into AMP2
- Wirelessly linked to ALVIN Reclosers



# How does it link together?





**Cloud Server**

# LVCloud Server

[Download Devices CSV](#) 

**Camberwell Grovelands Close (176)**

90502

Has offline devices



**V5 Belmont Road (162) (71109)**

ViaNet5

Has offline devices



**Darlaston Road (163)**

06680

Everything is ok



**Camberwell New Road (135)**

90066

Everything is ok



**Rowan Road (50)**

06574

Everything is ok



**NEVER CONNECTED (FL) Stratford Grove (36)**

08486

Everything is ok



**Beechcroft Rd SCH NO 2 (12)**

07587

Everything is ok



**Drewstead Road (65)**

92505

Has offline devices



**Buckfast Road (159)**

06638

Everything is ok



**Stonehouse Street (130)**

93935

Everything is ok



**Plough Road (113)**

07278

Everything is ok



**Cole Street (70)**

90542

Everything is ok



**Drummond Road (1)**

93377

Everything is ok



**Devon Street (2)**

90533

Everything is ok



**Rowcross Street (48)**

90758

Has offline devices



**Fernlea Road (140)**

07435

Everything is ok



**Fairmile Avenue (100)**

92542

Everything is ok



**The Broadway (66)**

08246

Everything is ok



**Brixton Water Lane Allied Carpets (114)**

90852

Everything is ok



**Glencairn Road (48)**

92672

Everything is ok



**Elm Grove M&S**

90551

Everything is ok



**Havelock Walk (100)**

80287

Has offline devices



**Colliers Wood H ST GT Mills (233)**

08332

Everything is ok



**Herne Hill (16)**

91111

Everything is ok



**UNDERGROUND SUB - NO CONNECTION (FL)  
Birdhurst Road (120)**

06810

Everything is ok



**Fairfield Court (83)**

07252

Everything is ok



**Church Lane (36)**

08278

Everything is ok




**Elliott Road (115)**

90128

Everything is ok






# LVCloud Server – ALVIN Reclose

 UK Power Networks | Buckfast Road (159)


**Substation: Buckfast Road (159) (06638)**

**Reclosers (3)**

Asset: dev1 ...

L1	<div><b>Recloser 1.1</b> LV feeder: [A] LAST SEEN: 07.09.2018 15:40:10 BST</div>	<div>CLOSED  ...</div>
L2	<div><b>Recloser 1.2</b> LV feeder: [A] LAST SEEN: 07.09.2018 15:40:10 BST</div>	<div>CLOSED  ...</div>
L3	<div><b>Recloser 1.3</b> LV feeder: [A] LAST SEEN: 07.09.2018 15:40:10 BST</div>	<div>CLOSED  ...</div>

# LVCloud Server – ALVIN Reclose



UK Power Networks

Buckfast Road (159)

dev1 > Recloser 1.1, LV feeder: [1]

device

Recloser 1.1, LV feeder: [1]

last seen

07.09.2018 15:40:10 BST

modbus address

1

firmware

v6.9.2


serial number

CP00032F

uptime

3mo, 3w, 22h, 32m, 26s

CLOSED



Events

All Events (except AG)

<

1

2

3


4

–

>

22.07.2018 05:53:28 BST

RC.WAVE

Show Waveform 

message

New waveform is available

22.07.2018 05:53:07 BST


RC.FCC

message

Fault current when closed. An excessive current was detected when the contactor was closed. Current value:

09.07.2018 19:10:08 BST

RC.WAVE

Show Waveform 

message

New waveform is available

09.07.2018 19:10:08 BST


RC.FCC

message

Fault current when closed. An excessive current was detected when the contactor was closed. Current value:

02.07.2018 01:51:02 BST

RC.WAVE

Show Waveform 

message

New waveform is available

<

1

2

3

4

–

>

Data

switchState

CLOSED

fuseRating

400

totalOpenOperations

2

fpiStatus

0

switchTemperature

42

busbarVoltage

247

cableVoltage

247

currentRms

81

# LVCloud Waveform Capture (pre-fault)

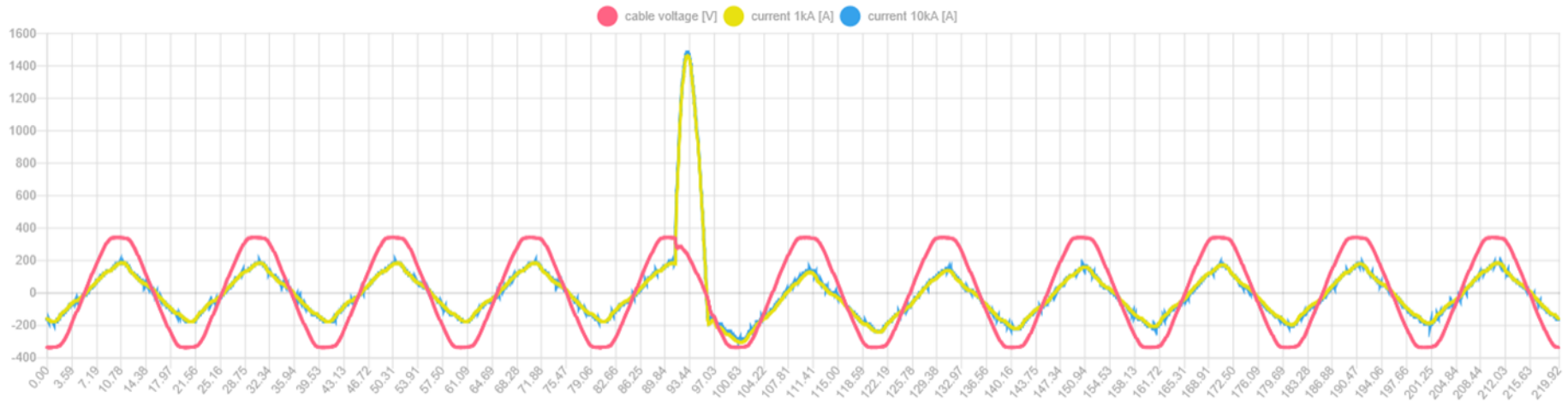
2018-07-09 19.09.48 BST

Show Details

Download binary file

Download CSV

Trigger: current



# LVCloud Waveform Capture (pre-fault)

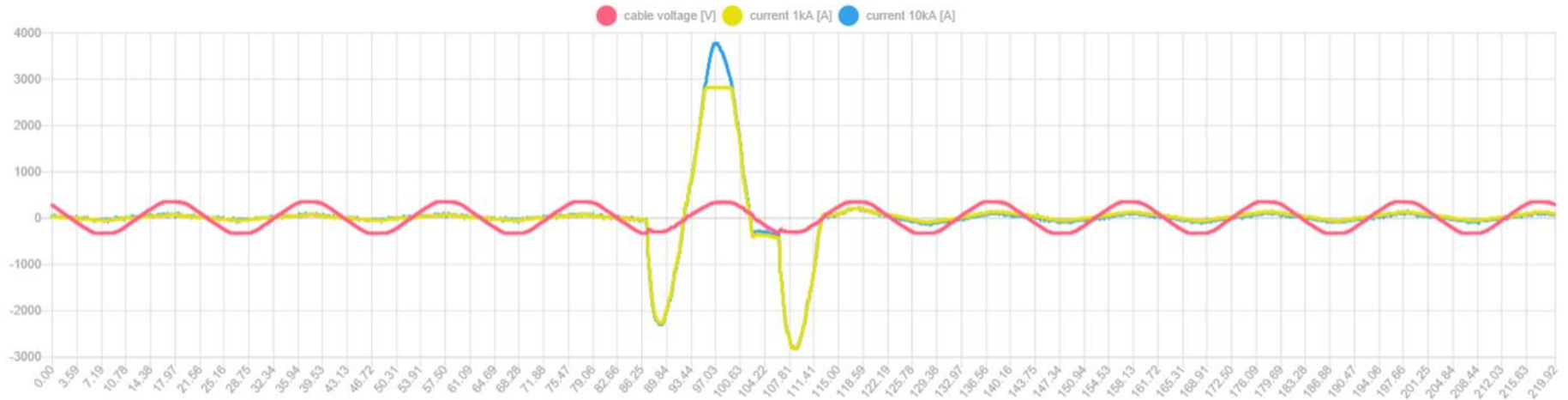
2018-05-30 06.43.32 BST

Show Details

Download binary file

Download CSV

Trigger: current



# LVCloud Server - TDR

Substation: Boone Street (85999)

Reclosers (3)

**TDR (1)**

Asset: dev1 ...

**TDR**

LAST SEEN: 07.09.2018 16:09:23 BST





# LVCloud - TDR



UK Power Networks | Boone Street | dev1 > TDR

device  
TDR

last seen  
07.09.2018 16:09:23 BST

uptime  
0s

Grab waveform

Grab index file

## Events

All Events (except AG)

1 2

23.08.2018 12:52:39 BST

TDR.WAVE

Show Waveform

message

New waveform is available at index No. 9.

23.08.2018 12:20:58 BST

TDR.WAVE

Show Waveform

message

New waveform is available at index No. 8.

23.08.2018 10:23:39 BST

TDR.WAVE

Show Waveform

message

New waveform is available at index No. 7.

23.08.2018 07:53:48 BST

TDR.WAVE

Show Waveform

message

New waveform is available at index No. 6.

19.08.2018 12:46:53 BST

TDR.WAVE

Show Waveform

message

New waveform is available at index No. 5.

1 2

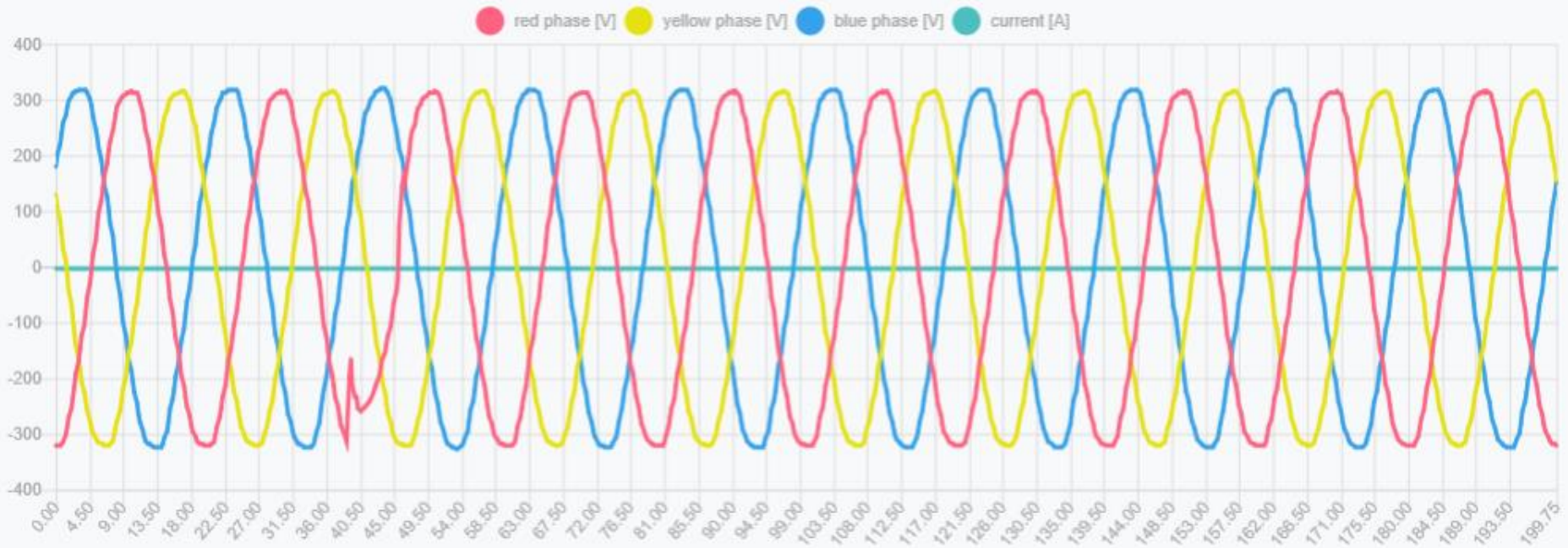
# LVCloud TDR Waveform Capture

Waveform

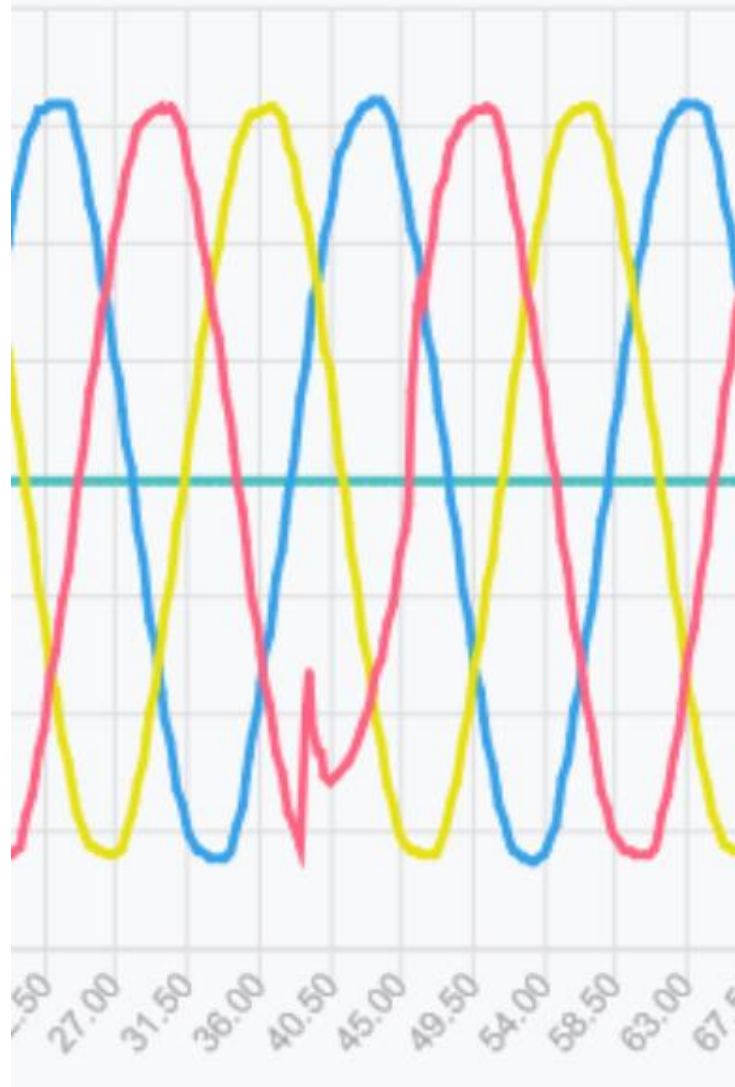
X

Chart

Details



# LVCloud TDR Waveform Capture

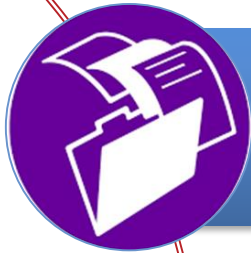


A blue wavy banner that starts wide on the left and tapers towards the right, containing the text 'Health and Safety' in white.

# Health and Safety

# Health & Safety

## Installation/Removal of ALVIN Reclose



Distribution Safety Rules to be adhered to



Wear the Correct PPE

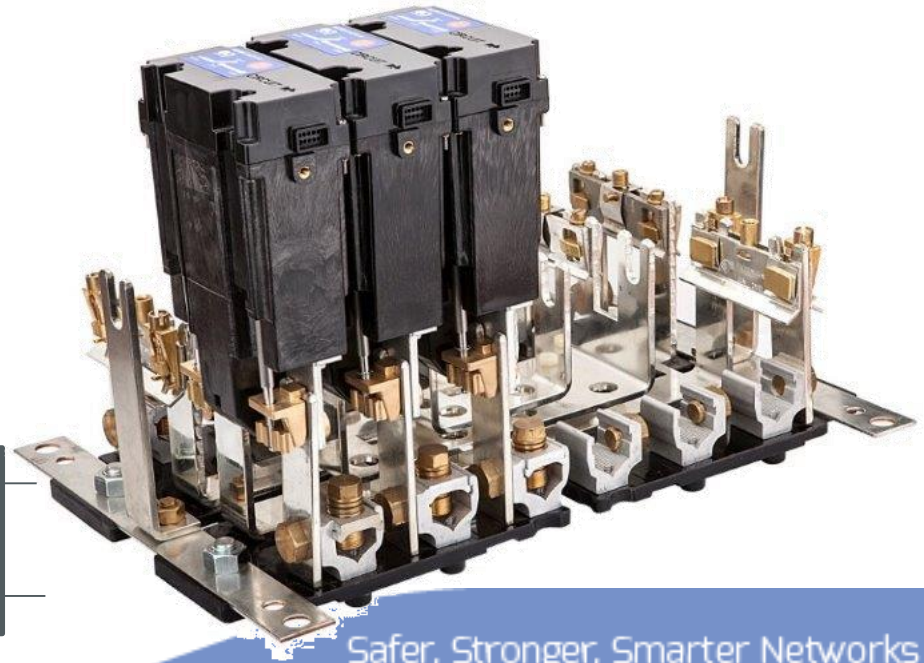
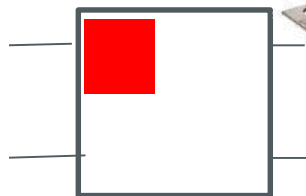
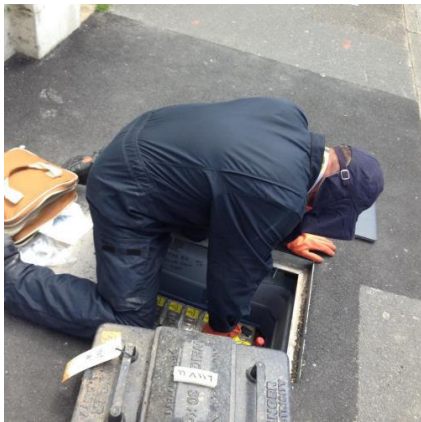


The ALVIN Reclose unit must be withdrawn from fuse way to establish a Point of Isolation

## Other Equipment in ALVIN Range

# ALVIN LinkSense

- Self contained fully automated LinkBox switching device
- Low Cost Solution (OPEX and CAPEX)
- Automated operation depending on network conditions



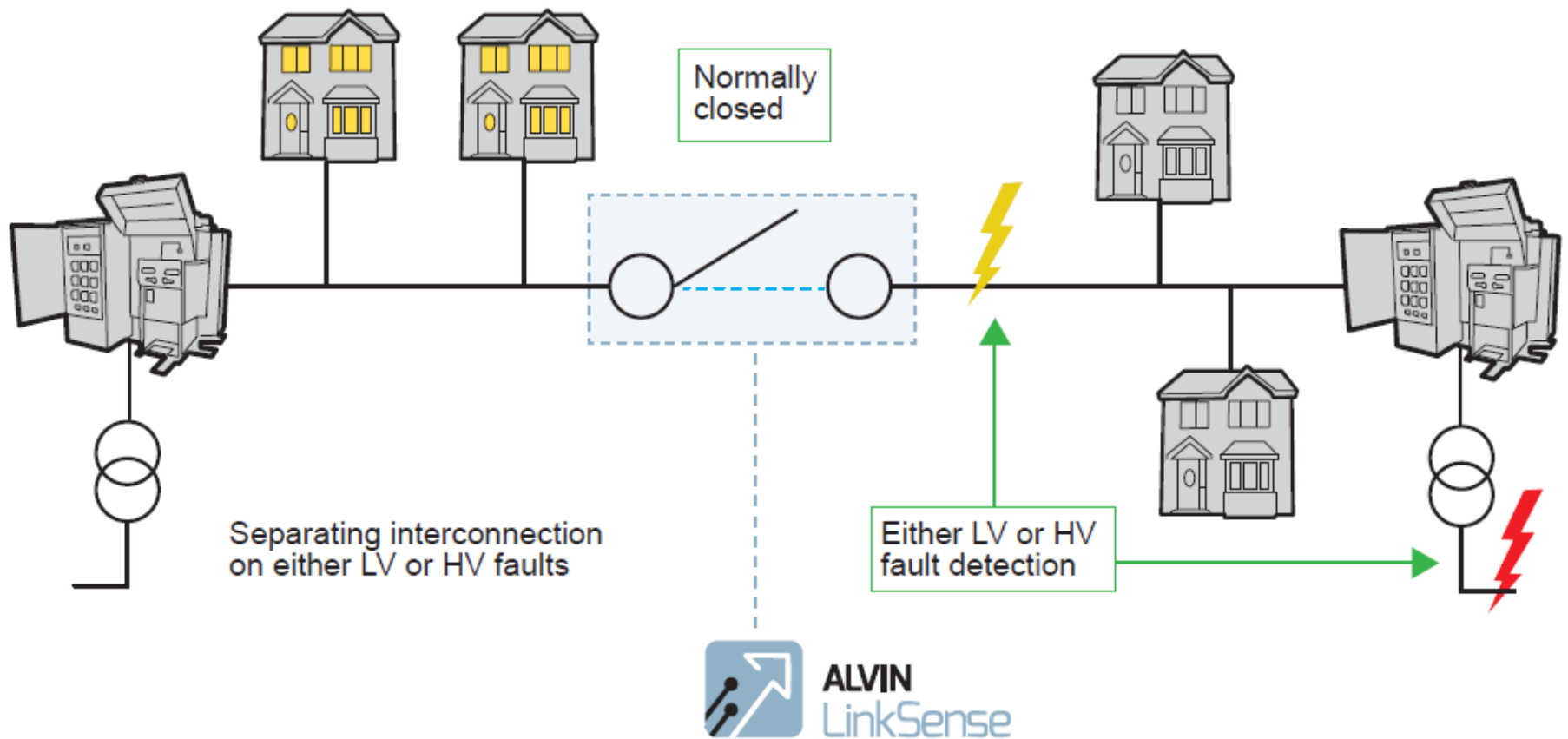
# Link Box Automation



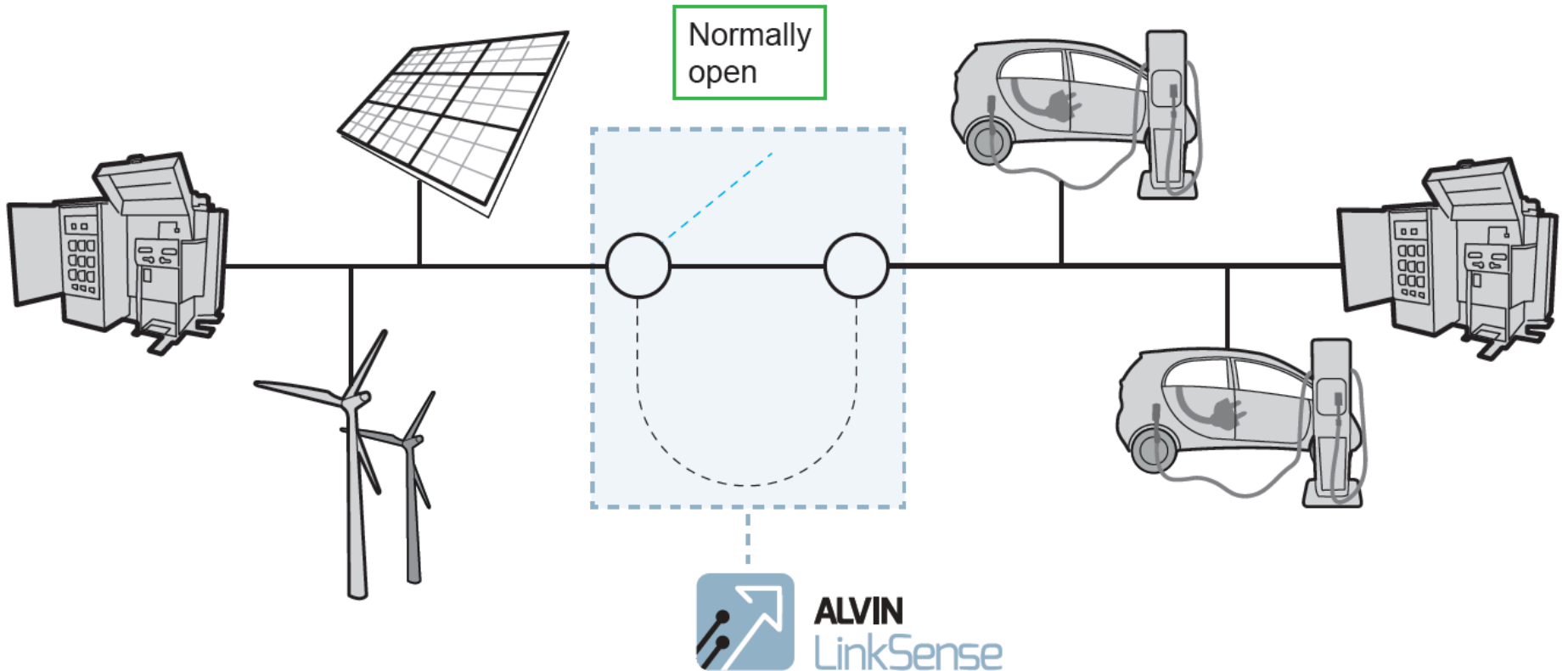
# Link Box automation

The following applications may be done by remote control from the control centre or automatically by LinkSense device

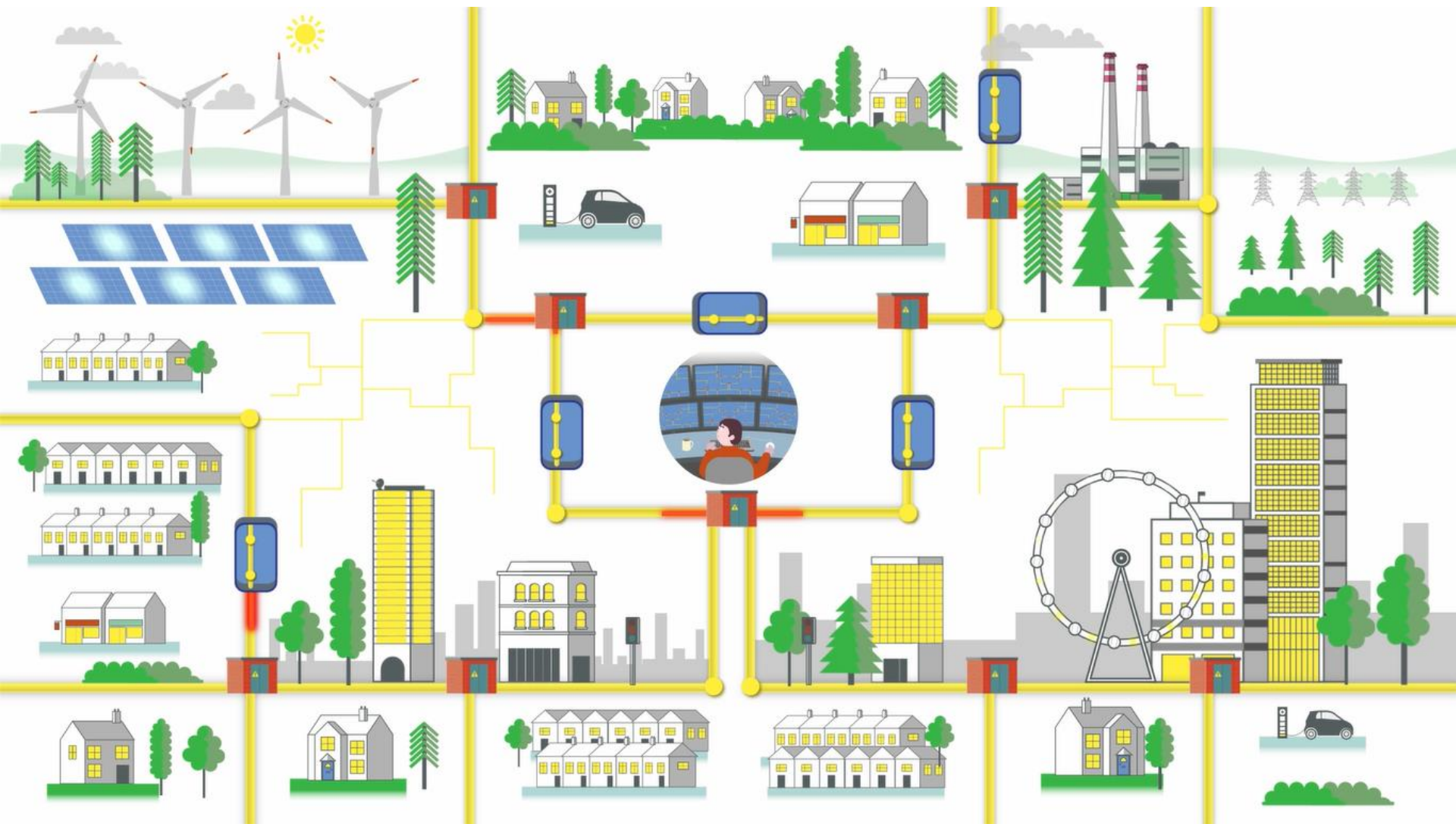
# LinkSense ICT



# LinkSense BAL



# Fully Automated LV network

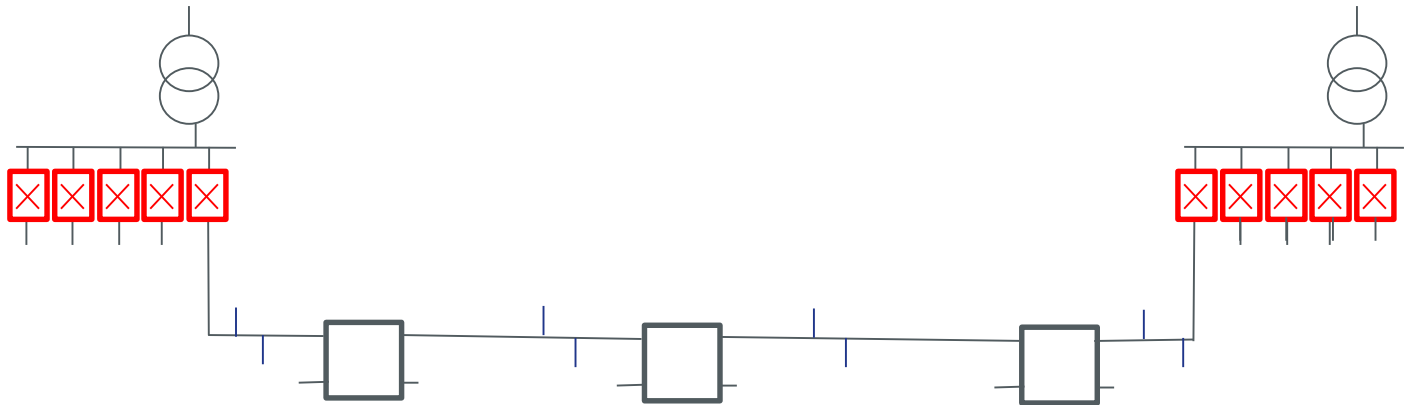


# SMART Grid Video

# Low Voltage Network

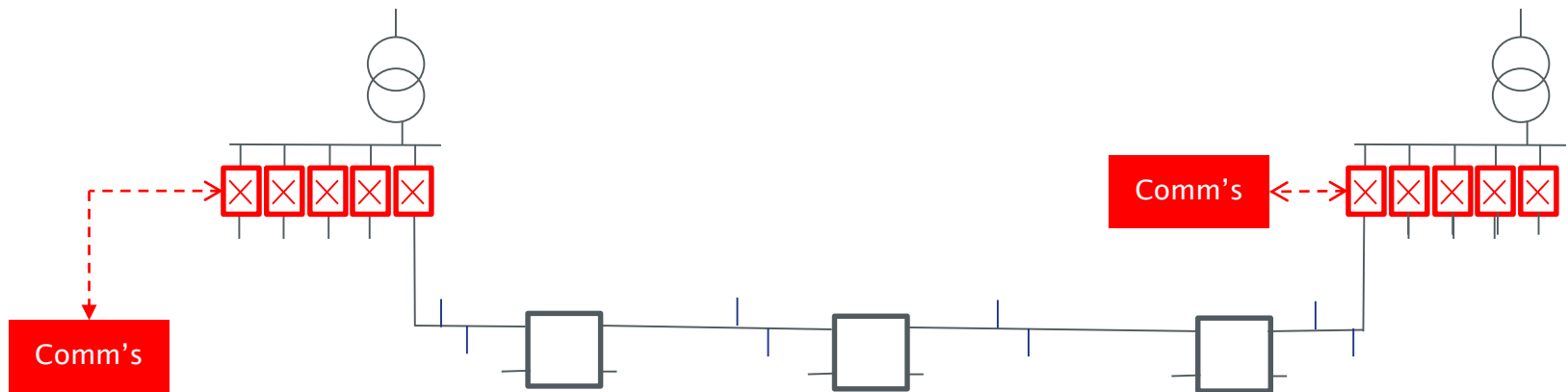
Network, equipment,

## Interconnected Network with Link Boxes



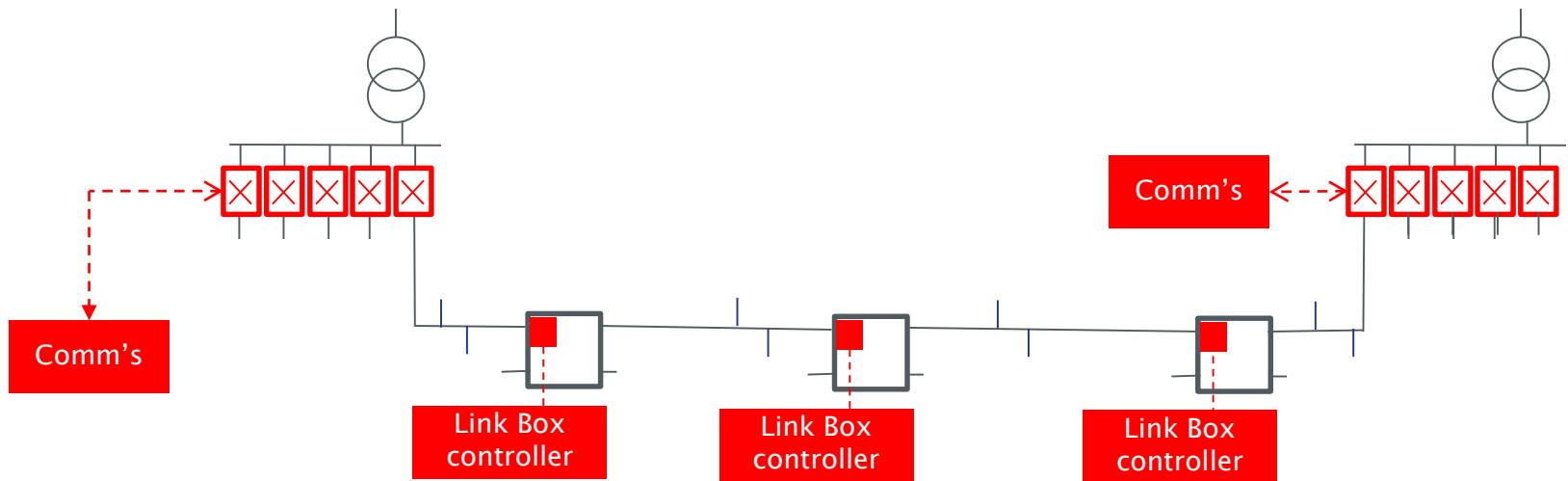
# Low Voltage Network

Network, **equipment**, external comms



# Low Voltage Network

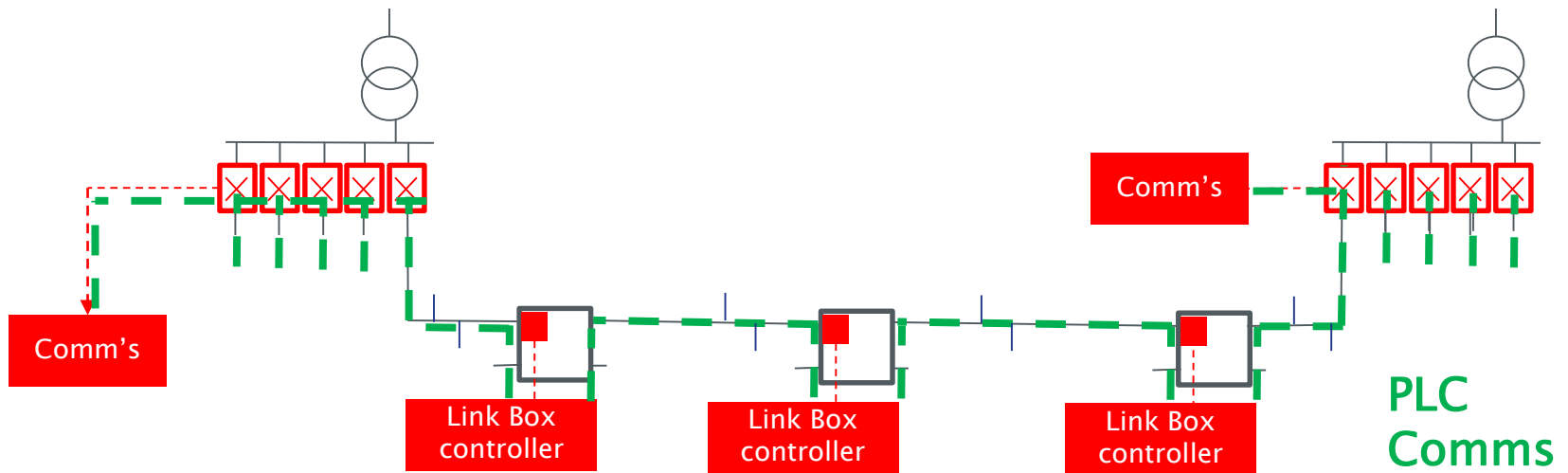
Network, **equipment**, external comms





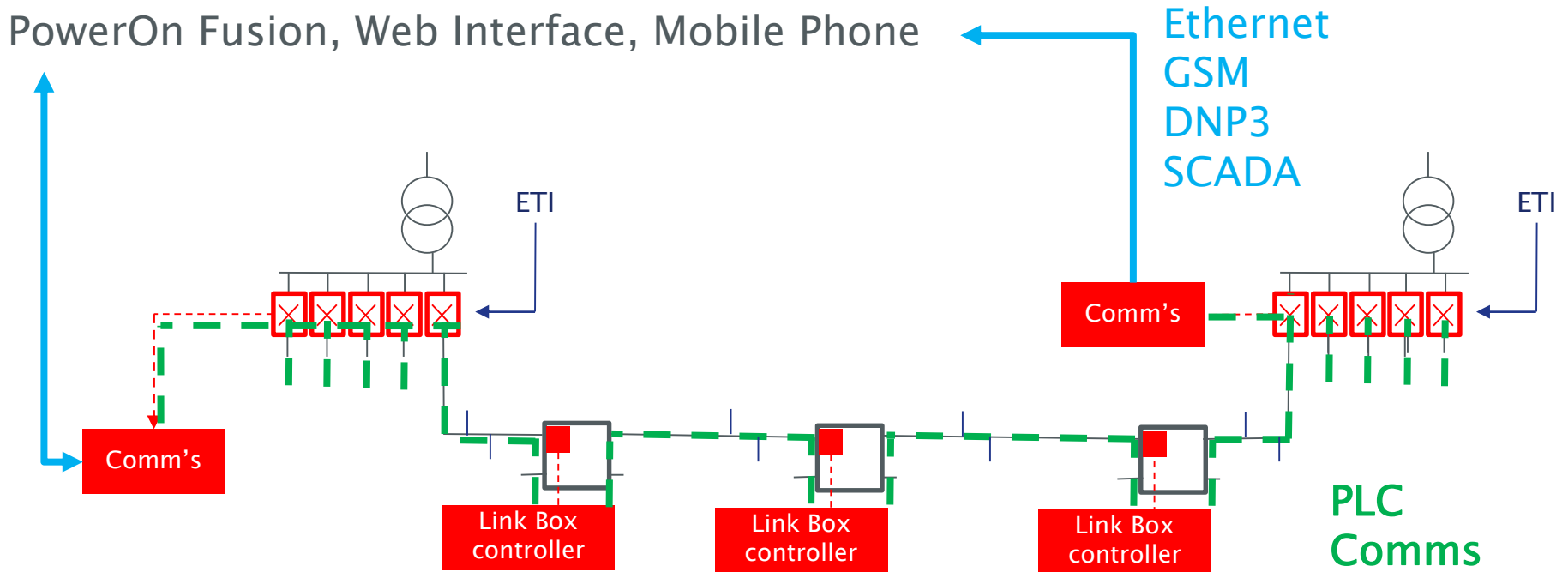
# Low Voltage Network

Network, equipment, external comms, **internal comms**



# Automated Low Voltage Network

Network, equipment, external comms internal comms, **control+automation**



# Thank You

For further information

Email [chris.lowsley@eatechnology.com](mailto:chris.lowsley@eatechnology.com)

[www.eatechnology.com](http://www.eatechnology.com)

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