

theLIA



Emergency Lighting And Controls

January 2022

THE LIGHTING INDUSTRY ASSOCIATION
www.thelia.org.uk

Foreword

This guide is intended for designers, specifiers, installers, users and those responsible for the maintenance of lighting controls when used in conjunction with emergency lighting systems

It is an overview, intended to help you benefit from efficient lighting controls and emergency lighting, safely specifying systems and properly testing them so they operate as intended

It will help ensure your design provides the safe and compliant system that you may have intended - for the lifecycle of your building, estate, or project

Further guidance about Emergency Lighting and Lighting Controls are available through the LIA & ICEL websites. Links to these, Legislation and SLL guides are listed at the end of this document

Opportunities

Reduce Risk

- Helping designers & operators improve safety by specifying compatible systems.

Improve Safety

- By automation and record keeping.

Reduce Cost

- Minimise whole life cost by adoption of test systems, reducing operator errors and detecting faults by automation.

Avoid Waste

- Reduce waste caused by incorrect specification of equipment for your building (Circular Economy).

Better Management and Integration

- Data can help identify issues, and minimise maintenance costs.
- Integration, Smart and IOT features within systems can bring further benefits when applied correctly.

How does this guide help?

Correct Functionality

- This guide will help you understand and correctly specify Control and Emergency Systems in order to ensure functions will operate as intended.
- Listed below are some commonly requested functionalities which can be assured by applying information from this guide, avoiding many of the possible issues.

<i>Failure Mode</i>	Power Failure (Whole Building)	Power Failure (Local Area)	Control System Failure	Control System Driven Dali Test	Full Load CPS Test	Brightness Compensation	Control System Load Shed
<i>System Type</i>							
CPS Central Power System and Lighting Control System - <i>Using This Guide</i>	✓	✓	✓	✓	✓	Possible	Possible

Common Issues

It is often reported that in many buildings emergency lighting fail-safe operation is inadvertently compromised by incorrect understanding, design or specification. Such errors can also occur during installation, commissioning, test or maintenance. These are some common issues often caused by assumption and misunderstanding:-

Assumption

One cannot assume that a luminaire or control gear intended for mains operation can function correctly when used as an emergency device ie. by alternative power supply

Design

Designers must be sure of current requirements and ensure that both Life Safety and Lighting Control systems are compatible, operating in harmony at installation and through life

Defaults & Settings

Many lighting, control and emergency components have default settings, these are based on their market brief, experience & technical know-how, but may not be based on the specific design and operation you envisage or desire in your specific application or region.



Common Issues

Incompatibilities

- System: Choice of system should be appropriate to building constraints, wiring considerations, protocols and topology of localised devices, networks, central or monitoring systems and links to overview systems such as Building Management Systems (BMS).
- Equipment: Making sure emergency equipment recognises when it must function for safety (ie. Emergency Conditions) and when under normal operation for energy efficiency. Your systems should identify what lumen output is required under what circumstances as a primary consideration. We must also understand how systems will safely re-set to normal operation, monitoring and re-charging. This should also consider interruption, damage and brown out of power supplies. For central systems, consider ability to meet inrush current demands of luminaires and control gear.

Maintenance & Testing

- Systems must be fully tested under all envisaged operational modes during handover, properly maintained, and testing should be repeated as detailed in BS EN1838 & BS5266. Maintenance includes training both responsible persons and FM team, software updates, resilience reviews & support contracts.



Safety

To avoid exposure to safety risks we suggest the following simple considerations

Testing

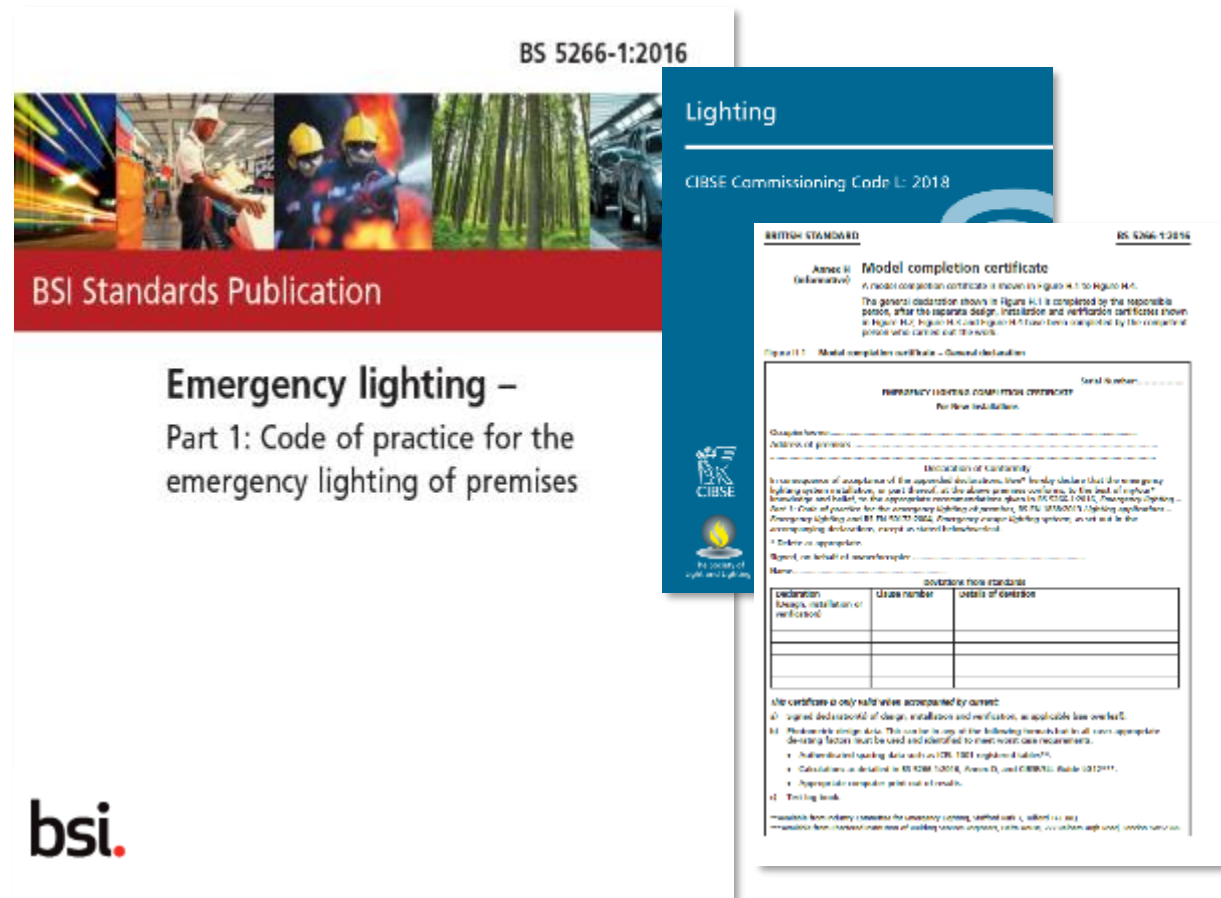
- Manual - using BS 5266.
- Automated - BS EN 62034 is written for building owners and persons responsible for fire safety within the building. Employers are required to ensure that appropriate emergency lighting is installed, and also that regular automated tests are carried out to ensure the equipment functions correctly and will not fail in an emergency.

'One System' Assumptions

- Ensure that if one overall system is used, that it fully meets your needs. Unless it meets the appropriate standards and suits both your application and needs the suitability of a system may be a false assumption.

Test & Handover

- Both control and emergency life safety systems must be fully tested in all failure modes possible for your application. It should be fully documented, records and O&M information provided, and handed over with training to the user's FM provider or maintenance team. BS5266 specifies a testing procedure and checklist for such records, CIBSE/SLL Commissioning Code L details how to commission and test both systems. A periodic visual inspection should also be carried out to check for changes of use, obstructions and layout.



Safety Considerations

Am I Up To Date? / What's Changed in my building?

- I.e. use/risk/Building Layout etc.
- Buildings such as offices typically have a churn rate of 2 years, where partitions and layout might change affecting the Fire Risk Assessment, which in turn will affect what emergency lighting and controls provisions might need to change.

Software & Support

- 'In-Use' - this could be an additional cost and a liability to the potential end user and may not be envisaged or communicated by the specifier or during construction process. Without it the safety and security of your staff, building, and company cannot be assured.



Safety Considerations

System Defaults & Resets?

- Are they adequate & automatic for your project?.
- Follow Secure By Design Guidance.

Future proof?

- Manufacturer Support vs Individual Integrator.
- A series of components and systems bound together by an individual integrator might miss some interoperation features and functionality that may be included as defaults by a responsible manufacturer (ie an LIA or ICEL approved company). Also, it may be harder to maintain in the long term due to availability of records, software & personnel.
- Software / Licensing - Without a supply chain in place the safety and security of your staff, building, and company cannot be assured.
- Allow Future Flexibility & Additions.

System?

- System level integration (e.g. between lighting and BMS).
- Component level integration open protocols (i.e. DALI-2, D4i).
- Only link at high level (i.e. inter-system for monitoring/report).



Safety Considerations

Does it do what it should?

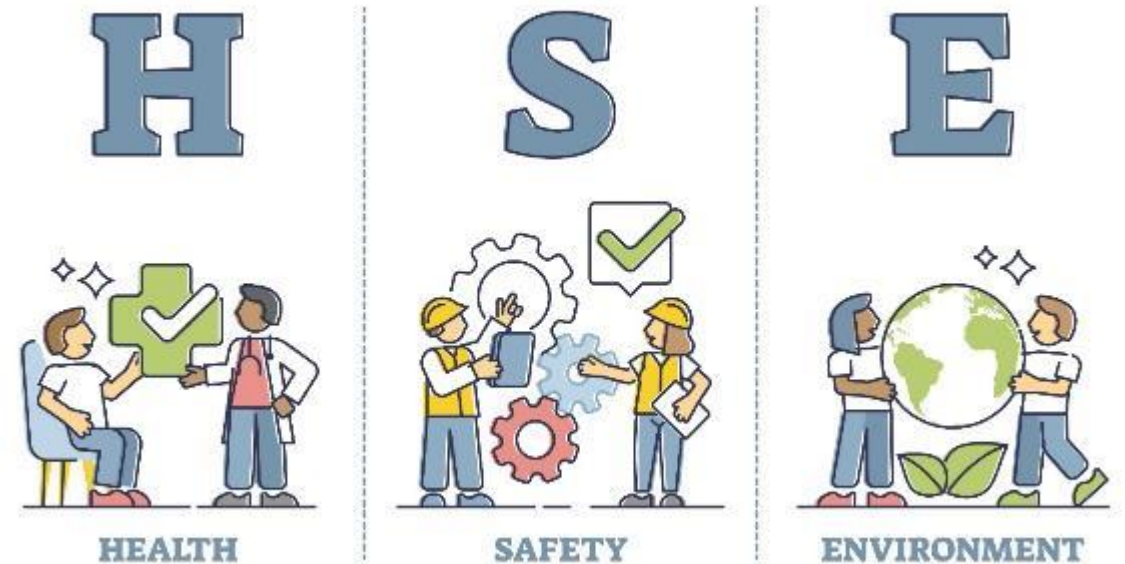
- Will it be reliable through life?
 - Is it 'maintenance proof'?
(ie. Self-healing such as 1 luminaire per port)
- Does it comply?.
- Central System load – Inrush current, Full system duration tests, power settings and end of life conditions.
- What if there is an emergency during testing?
 - Automatic defaults must ensure life safety operation mode (i.e. emergency lighting condition). Testing will be suspended and should be rescheduled.
- Tell you when things need fixing?



Safety Considerations

Responsibility, Regulation & Guidance, Further Learning?

- Do you know your responsibilities?
 - Responsible Person(s), professional competence of everybody involved, legislation changes, testing & record keeping, Fire Risk Assessment.
- Golden Thread
 - The term 'Golden Thread of information' is now used in construction to describe an accurate and up-to-date record of the building data that is needed to properly maintain and operate an asset. It also tracks legal responsibilities of businesses and individuals in the event of legal investigation or enforcement actions.
 - In the past this would have been via Operation & Maintenance Manuals.
 - Records must now also include full details of commissioning, testing, changes to structure, systems and equipment, Service Level Agreements.



Conclusion

- It is your responsibility to ensure the system works and meet your Fire Safety Risk Assessment criteria.
- All systems must always fail safe and emergency lighting default on when intended.
- Seek professional advice and guidance from knowledgeable organisation such as the LIA or an LIA/ICEL member.
- In the event of an emergency - features such as brightness compensation, load shed, presence detection,... etc.... should never interfere with the provision of emergency lighting.

EMERGENCY LIGHTING MUST ALWAYS WORK WHEN IT IS REQUIRED!!!



Useful Links (Standards and Guidance documents)

- Lighting applications. Emergency lighting
 - [BS EN 1838:2013](#)
- Emergency escape lighting systems
 - [BS EN 50172:2004](#)
- Central Safety Power Supply Systems
 - [BS EN 50171:2001](#)
- Automatic test systems for battery powered emergency escape lighting
 - [BS EN 62034:2012](#)
- Code of practice for the emergency lighting of premises
 - [BS5266-1 2016](#)
- A guide to Emergency Lighting
 - [BIP 2081:2020](#)

HSE

- [Fire safety in the workplace](#) – Who's responsible
- [Fire safety in the workplace](#) – Fire risk assessment

LIA/ICEL

- LIA Guides - [Member](#) / [Non-member](#)
- ICEL Technical Statements – [Member](#) / [Non-member](#)

CIBSE/SLL

- [Guide E: Fire safety engineering](#)
- [SLL Publications](#)

[Fire Industry Association](#)

Glossary

- **Non-Maintained:** luminaire in which the emergency lighting lamps are in operation only when the supply to the normal lighting fails.
- **Maintained:** luminaire in which emergency lighting lamps are energized at all times when normal or emergency lighting is required.
- **Switched maintained** is a further definition in the DALI specification (IEC 62386-202).
- **Self Contained:** a luminaire with its own power source, light source and control gear to provide light in an emergency. (*or Power source and gear within 1m*).
- **Central Power Systems (CPS):** a power source that can provide power for multiple luminaires in a whole building, a localised floor, area, or room.
- **Schematic Wiring Diagrams** of common Emergency Lighting and Control Systems are available in the annex.



theLIA



This guide was produced by members of the Connected Lighting Technical Committee (CLTC) and the Emergency Lighting Technical Committee (EML TC) of the Lighting Industry Association.
© Lighting Industry Association 2022 - All Rights Reserved

This document contains general information about emergency lighting and controls.









In assessing the suitability of any specific product or installation the user must make their own judgement and/or take appropriate advice. Neither the Lighting Industry Association Ltd, nor any person acting on its behalf, makes any warranty of representation, expressed or implied with respect to the information contained in this document, or assumes any liability with respect to the use of, or damages resulting from, the use of this information for a specific application, project or installation.

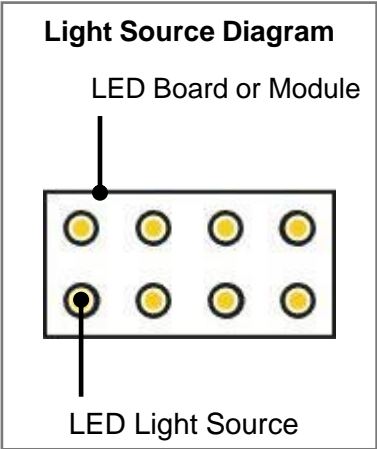
THE LIGHTING INDUSTRY ASSOCIATION

LIA Emergency and Controls Guide - Annex

Wiring Diagrams - Emergency & Control Systems

KEY For clarity - connections are shown schematically
(ie Mains 230v would actually be L,N,E; DALI would be Da1, Da2 etc)

Unswitched Live (230v) (Permanent Live)		Brown
Switched Live (230v)		Black/Red
Emergency Live (230v) (ie C.P.S backed, Fire Protected Cabling)		RED
DALI Pair		Light Blue
Lighting Control Bus (or Signal)		Yellow
Control Gear / EM Gear to Light Source (LED)		Purple
Other		Black
Test Connection (link)		Blue Dotted



DALI is used throughout this guide as it has become the industry standard local control protocol.
This guide and diagrams can still help if applied with care to other systems including wireless and wired systems

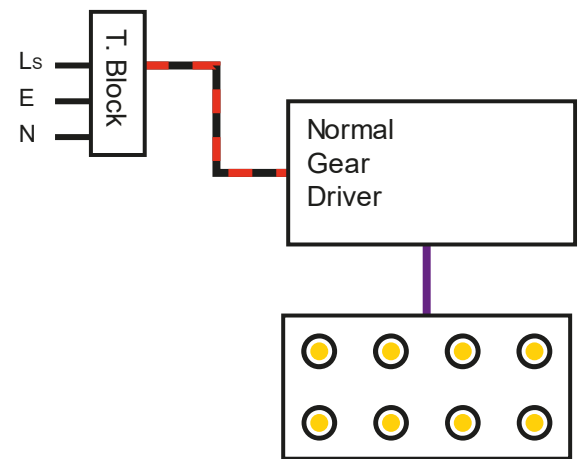


Luminaire Diagrams – Self Contained

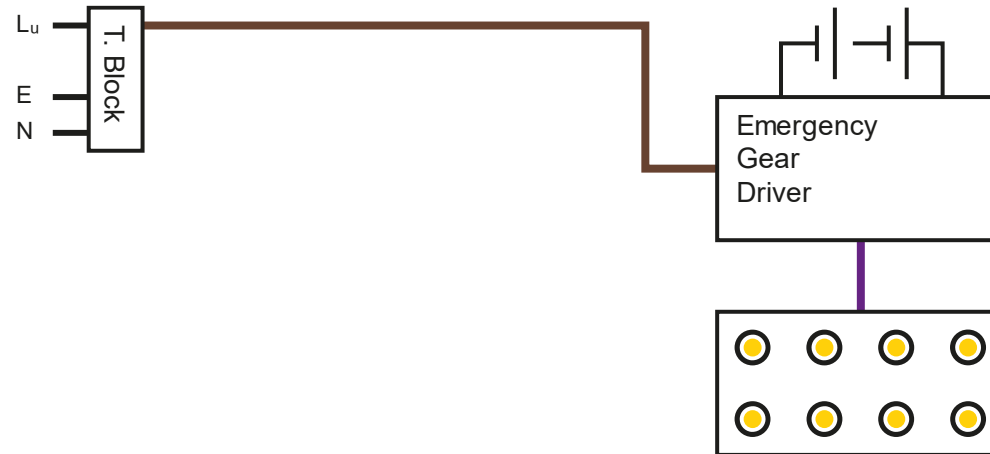
(Emergency Batteries and Gear integral *or adjacent to* Luminaire)

- **Self Contained:** a luminaire with its own power source, light source and control gear to provide light in an emergency. (*or Power source and gear within 1m*)

Conventional - Mains Only



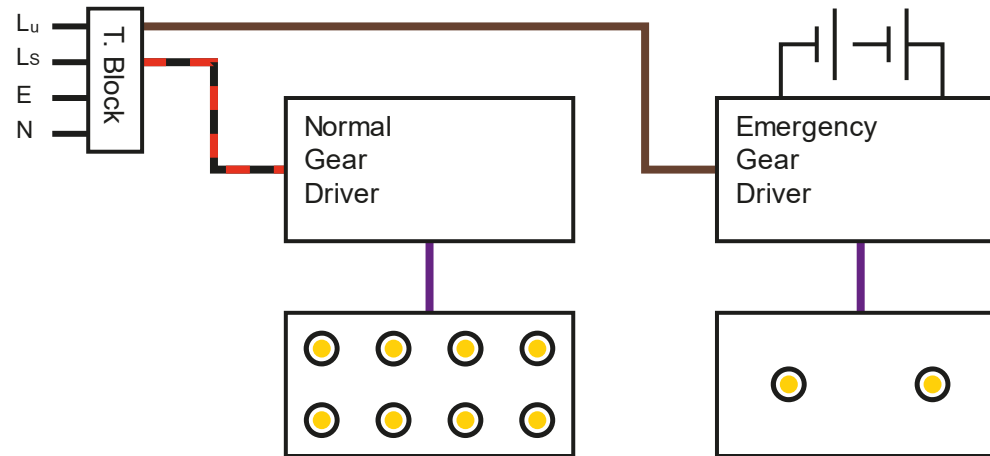
Non Maintained



- **Non-Maintained** : luminaire in which the emergency lighting lamps are in operation only when the supply to the normal lighting fails

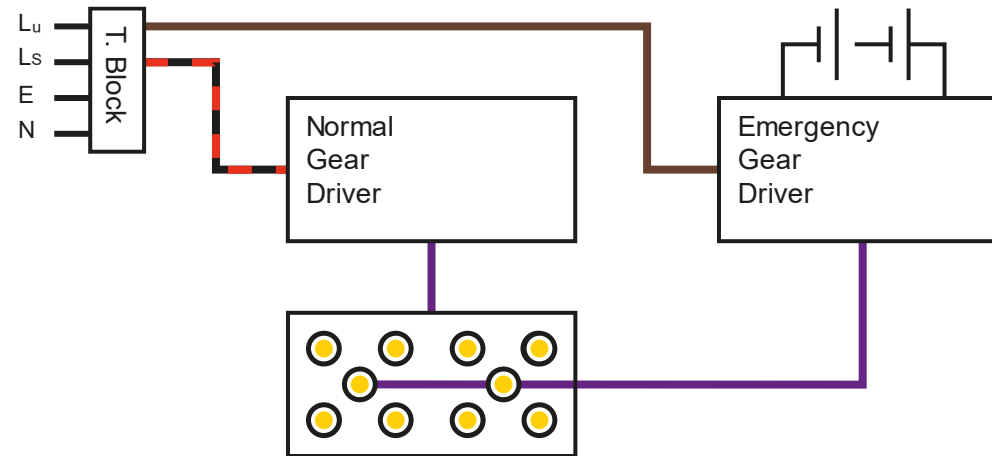
Self-Contained Maintained

(Separate emergency light source sustained)



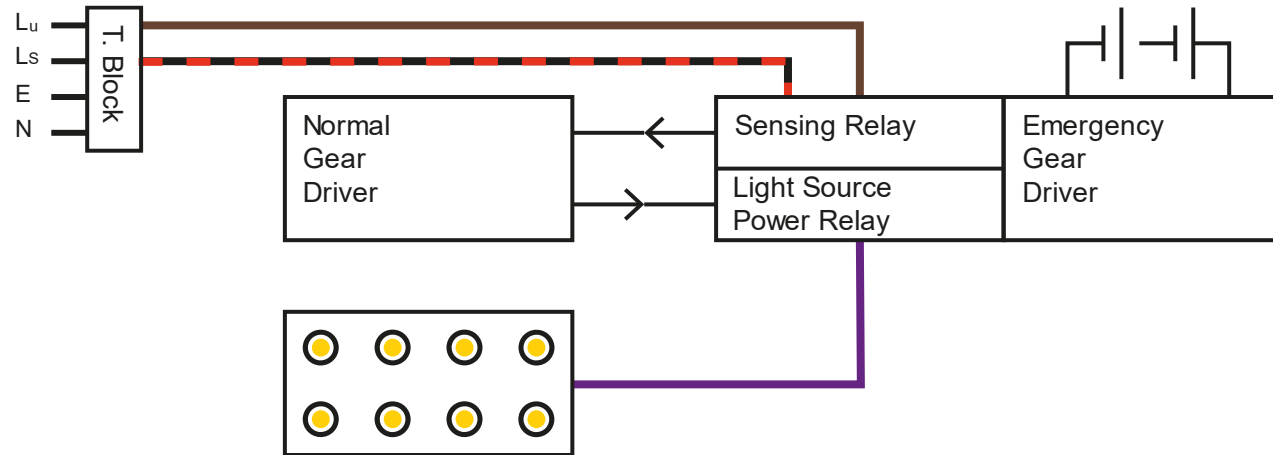
- **Maintained:** a luminaire that also lights at other times (ie is used for both normal lighting and emergency lighting conditions)
- **Note:** BS EN 60598-2-22:2014 defines this as a **Combined Emergency Luminaire** – a luminaire containing two or more lamps (*now Light Sources*) at least one of which is energized from the emergency lighting supply and the others from the normal lighting supply.

Self-Contained Maintained (Dual light source LED board)



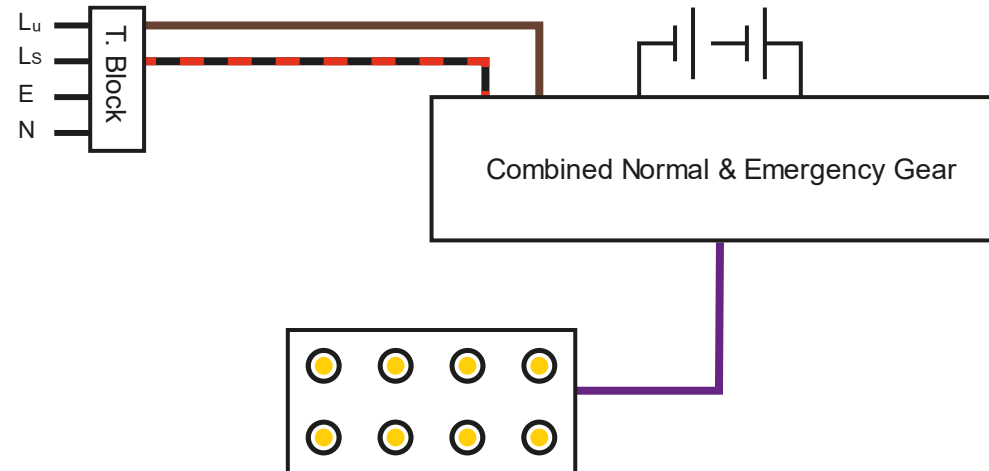
- **Maintained:** luminaire in which emergency lighting lamps are energized at all times when normal or emergency lighting is required
- **Note:** BS EN 60598-2-22:2014 defines this as a **Combined Emergency Luminaire** – a luminaire containing two or more lamps (*now Light Sources*) at least one of which is energized from the emergency lighting supply and the others from the normal lighting supply.

Self Contained - Maintained



- **Maintained:** luminaire in which emergency lighting lamps are energized at all times when normal or emergency lighting is required

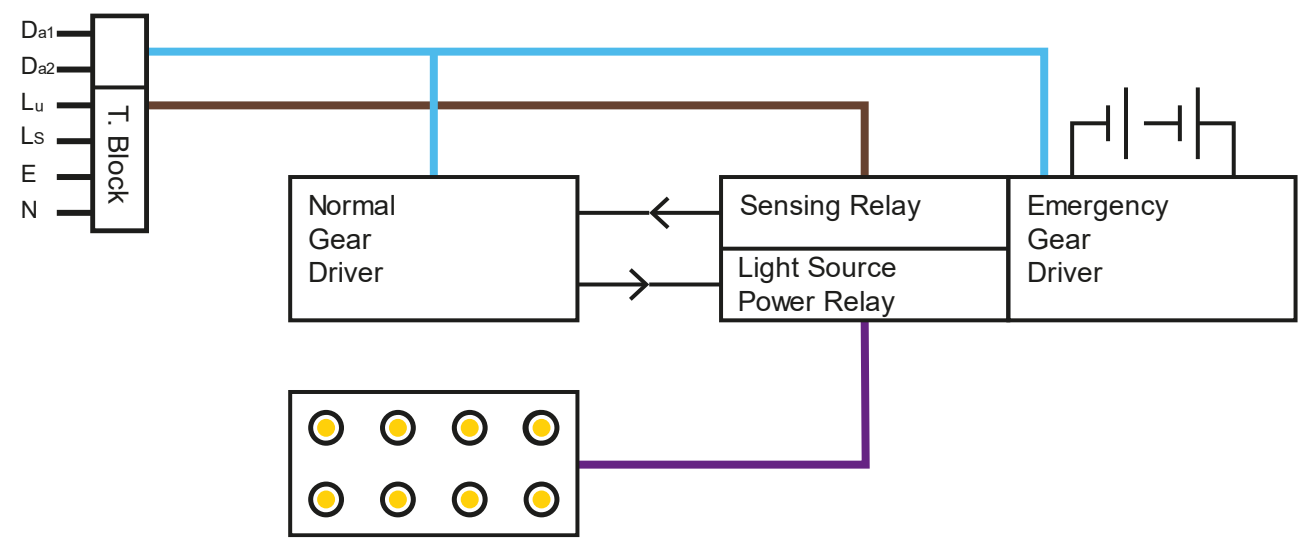
Combined Control Gear (Maintained)



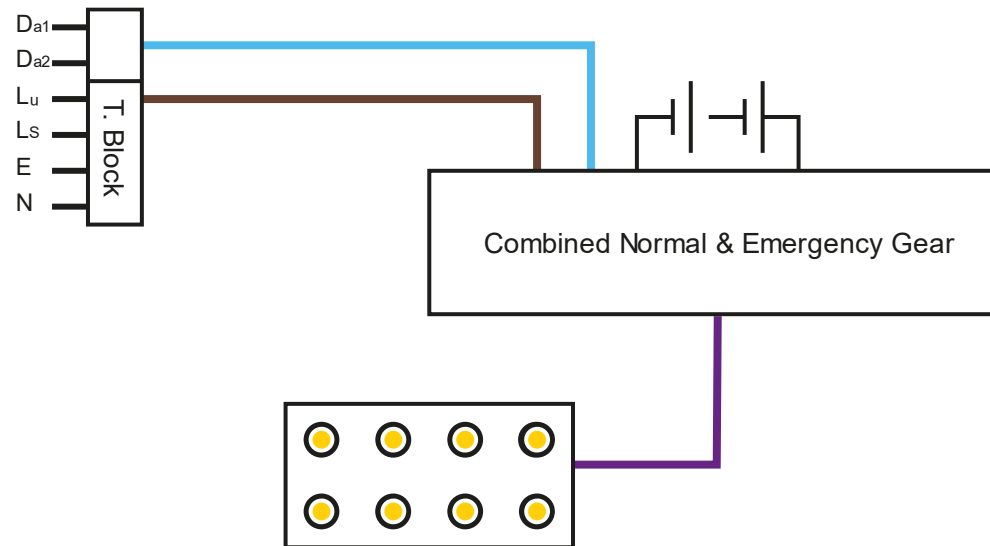
In this instance a single unit of control gear houses components for both normal (mains lighting) functionality and Emergency functionality

Luminaire Diagrams – Self Contained + DALI Control

DALI Self Contained - Maintained



DALI Combined Control Gear (Maintained)

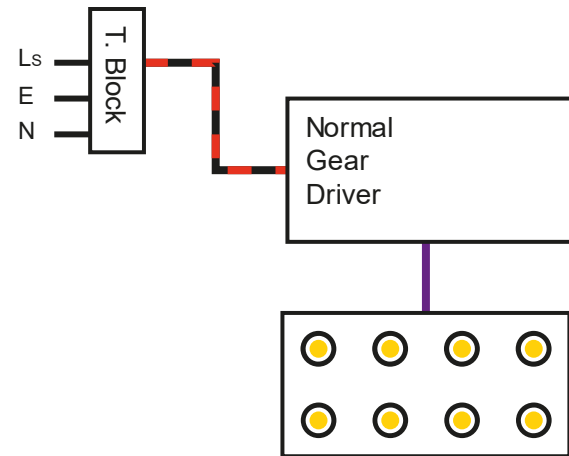


In this instance a single unit of control gear houses components for both normal (mains lighting) functionality and Emergency functionality. In DALI terms it has only one address and is known as DALI Combined Control Gear (*which differs from the BS EN 60598 description stated on pages 20 & 21*)

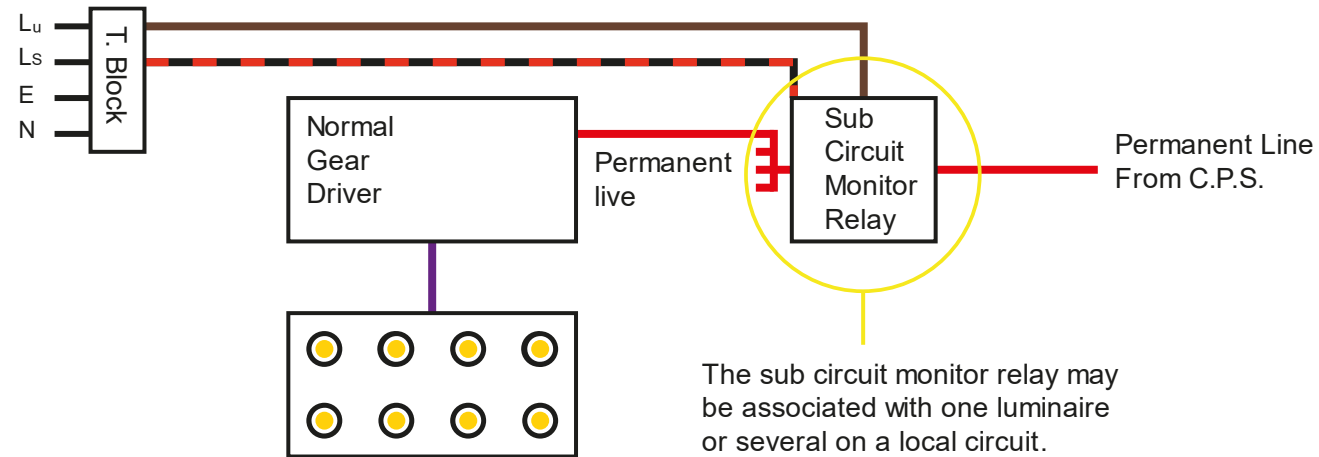
Luminaire Diagrams

CPS (Central Power Supplies)

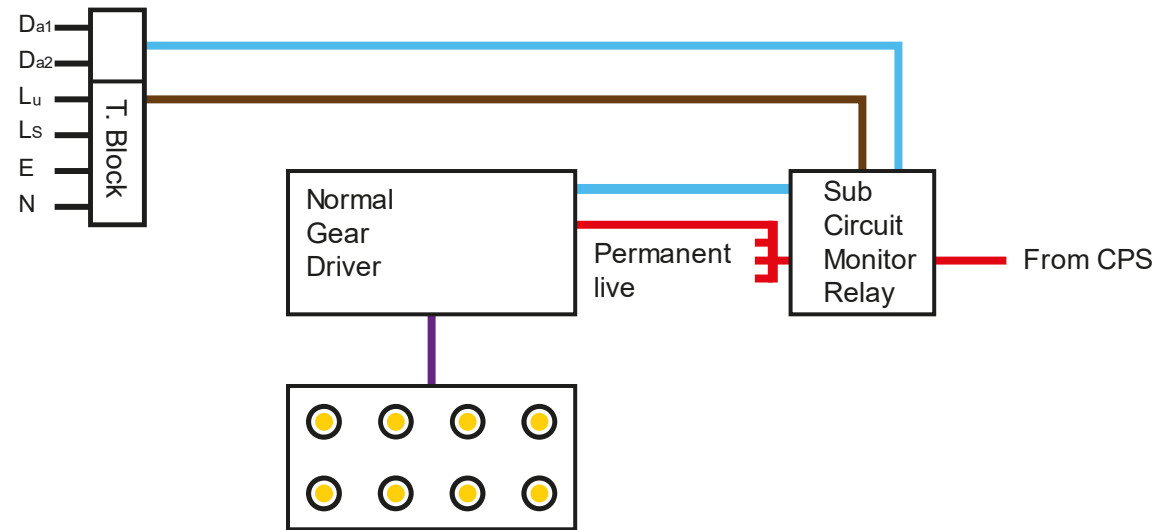
Conventional - Mains Only



Central Supplied Power System (C.P.S.) Maintained Operation



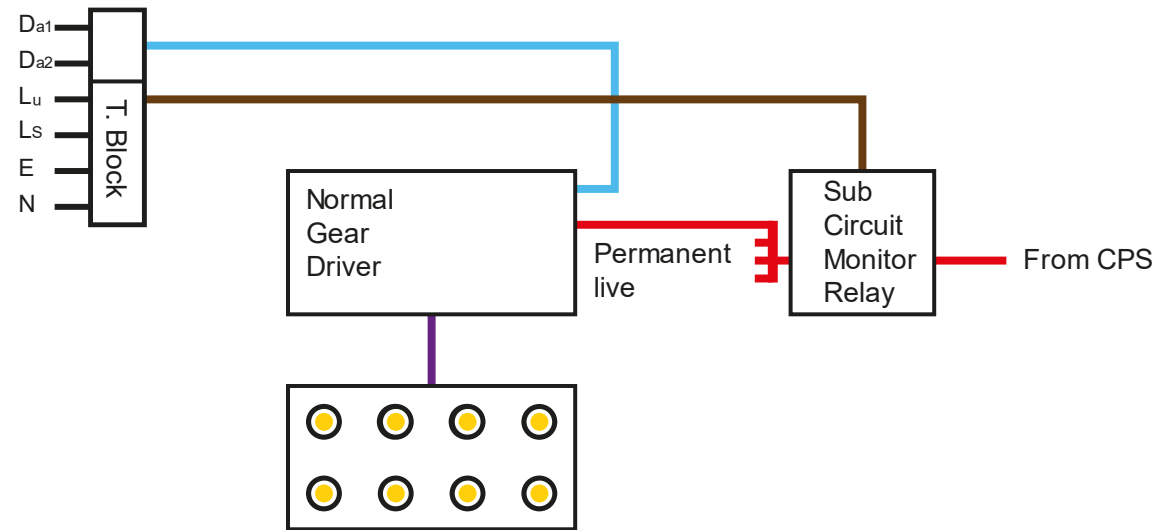
DALI Controlled Central Supplied Power System CPS Maintained - *DALI wired through Sub Circuit Monitor Relay*



DALI control system will be disconnected from luminaire by Sub Circuit Monitor Relay during power failure conditions

- Driver will operate light source at default output*
- Control System cannot control or monitor*

DALI Controlled Central Supplied Power System CPS Maintained - *DALI wired directly to Luminaire/Driver*



DALI control system will be connected to luminaire during all conditions

- Control System can control and monitor via DALI
- **Control signal must be interrupted elsewhere to allow Driver to operate at default emergency output** (otherwise the control system may have set luminaire to Dim or 0% output, interfering with emergency operation)

CPS Diagrams

Centralised Power Supplies

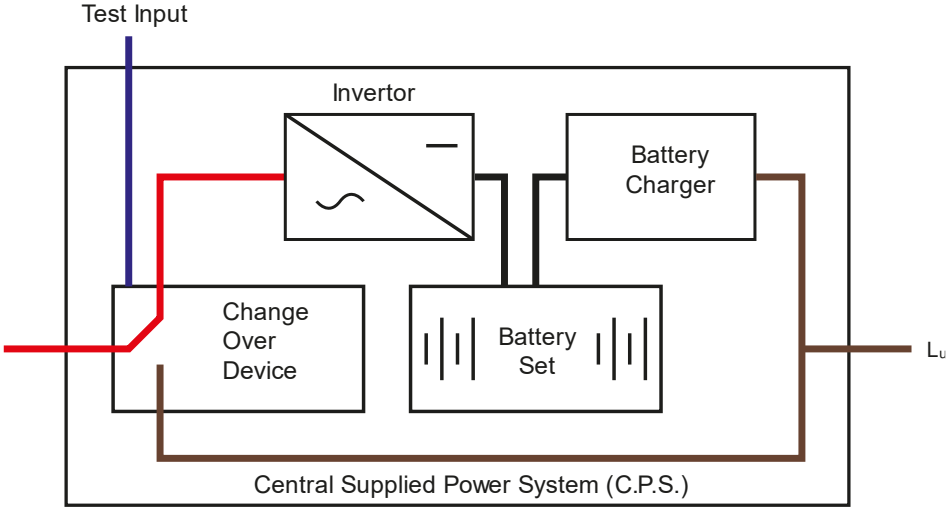
CBU - Central Battery Unit

UPS – Uninterruptible Power Supply *

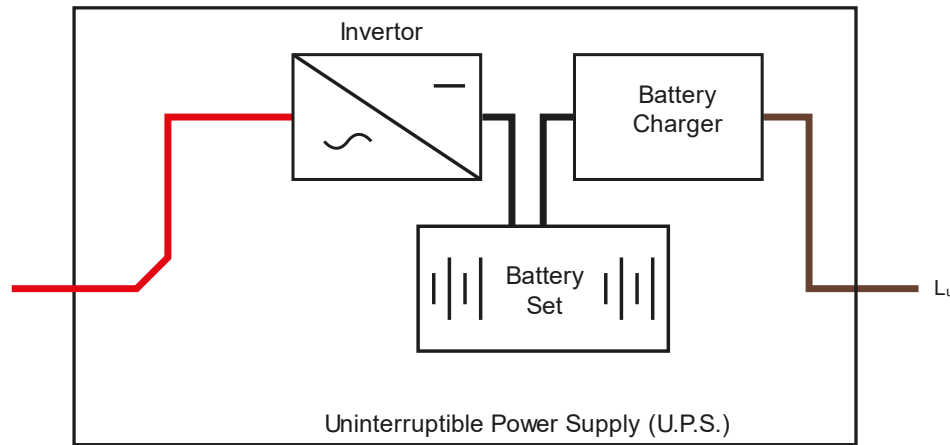
- **Central Power Systems (CPS):** a power source that can provide power for multiple luminaires in a whole building, a localised floor, area, or room.

Central Supplied Power System (CPS)

Central Battery System

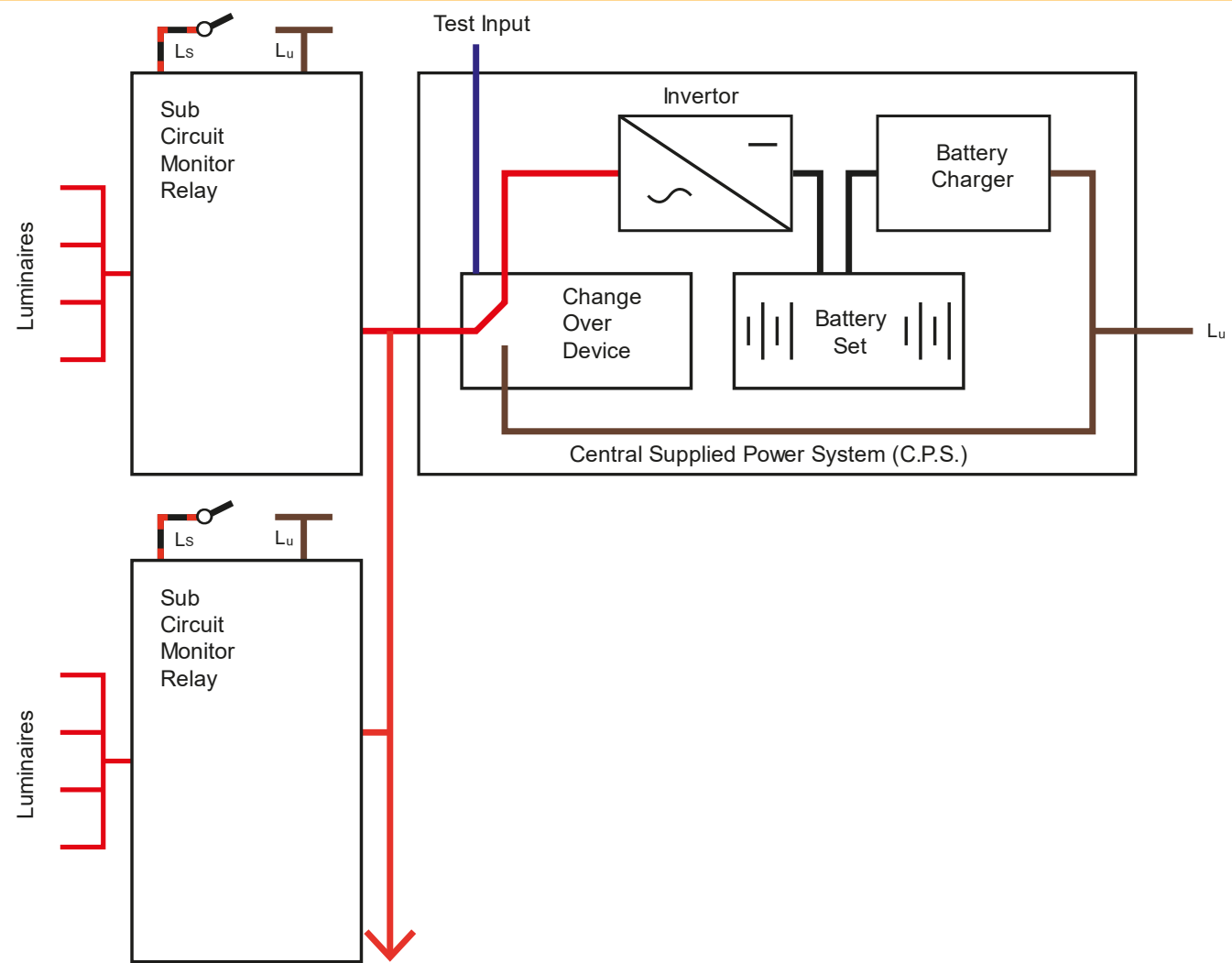


Central Supplied Power System (CPS) Uninterruptible Power Supply (U.P.S.)

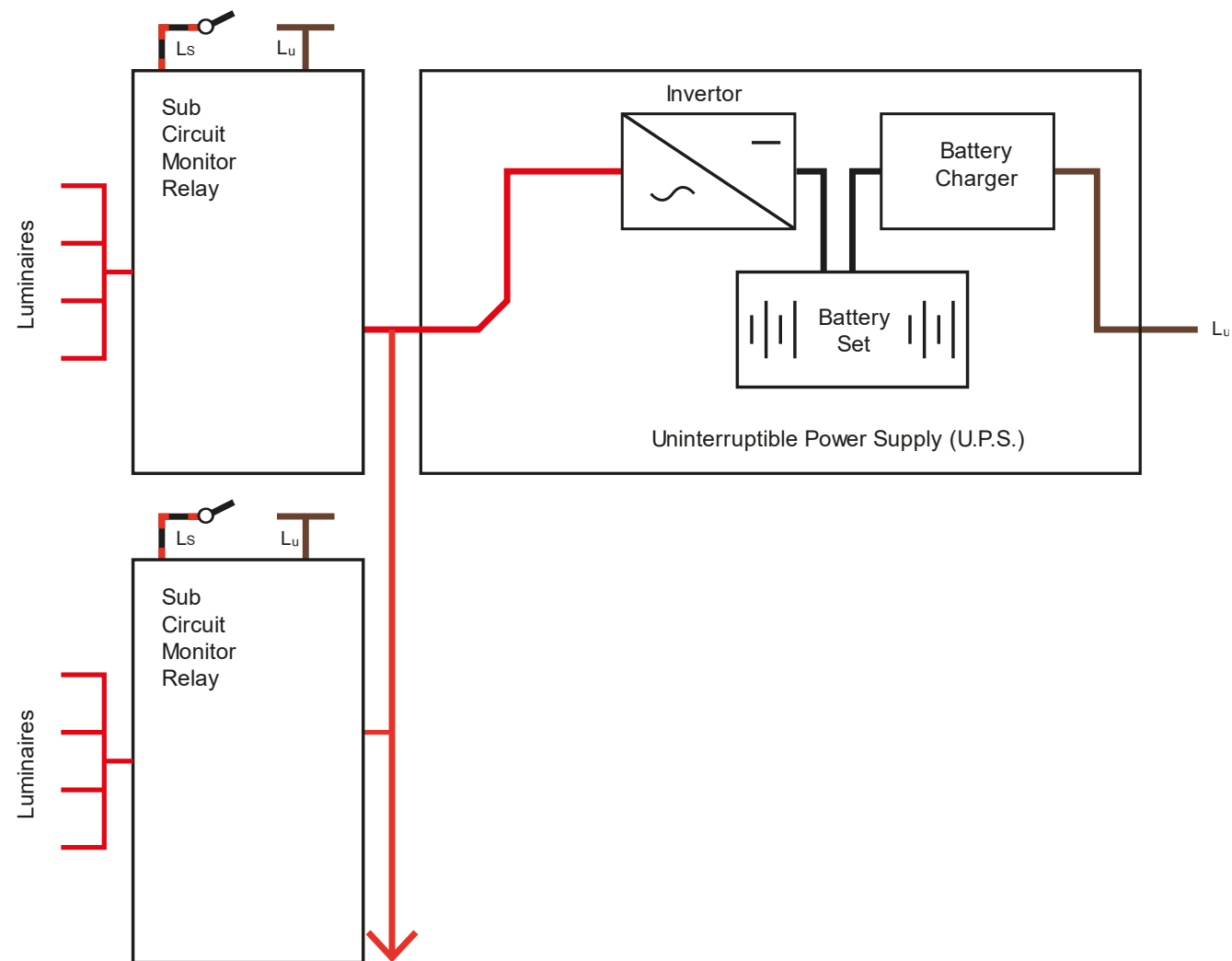


* Note - UPS Systems are not usually rated correctly or suited to the needs Emergency Lighting.
Check for compliance to BS EN 50171:2001 Central Safety Power Supply Systems

Central Supplied Power System (CPS) Sub-Circuit Monitored



Uninterruptible Power Supply (U.P.S.)



Combined Lighting & Emergency Dali Control & CPS

Centralised Power Supplies

CBU - Central Battery Unit

UPS – Uninterruptible Power Supply

- **Note: Functionality of emergency and control systems under normal, emergency and test operations can be significantly affected if the DALI control signal is present or disconnected (by intention or mistake). See notes in red**

Control System with DALI Local Control Only

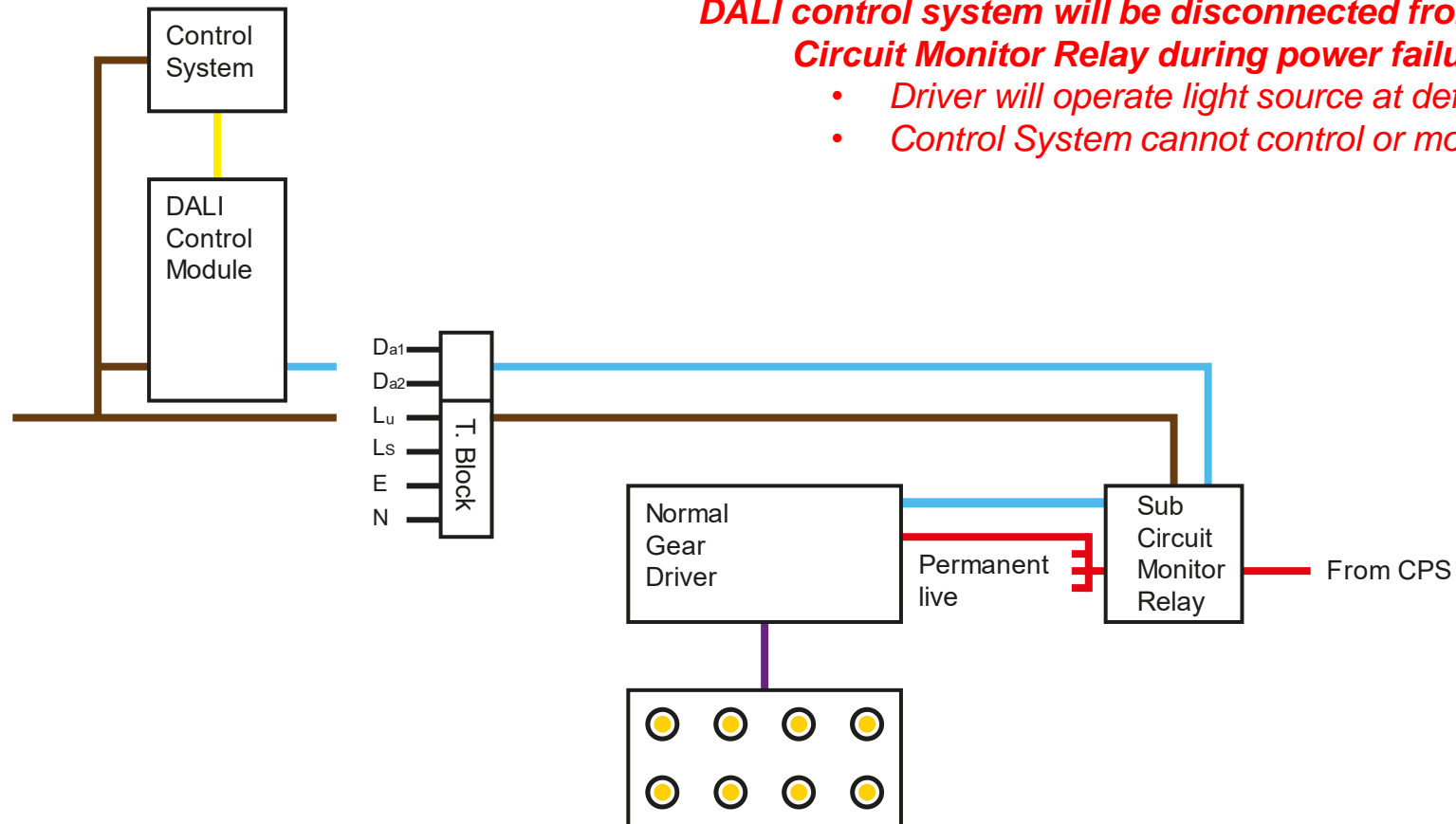
Controls & Luminaire Wiring

DALI Controlled Central Supplied Power System CPS - Maintained

DALI wired through Sub Circuit Monitor Relay

DALI control system will be disconnected from luminaire by Sub Circuit Monitor Relay during power failure conditions

- Driver will operate light source at default output*
- Control System cannot control or monitor*



Control System with DALI and Relay Local Control

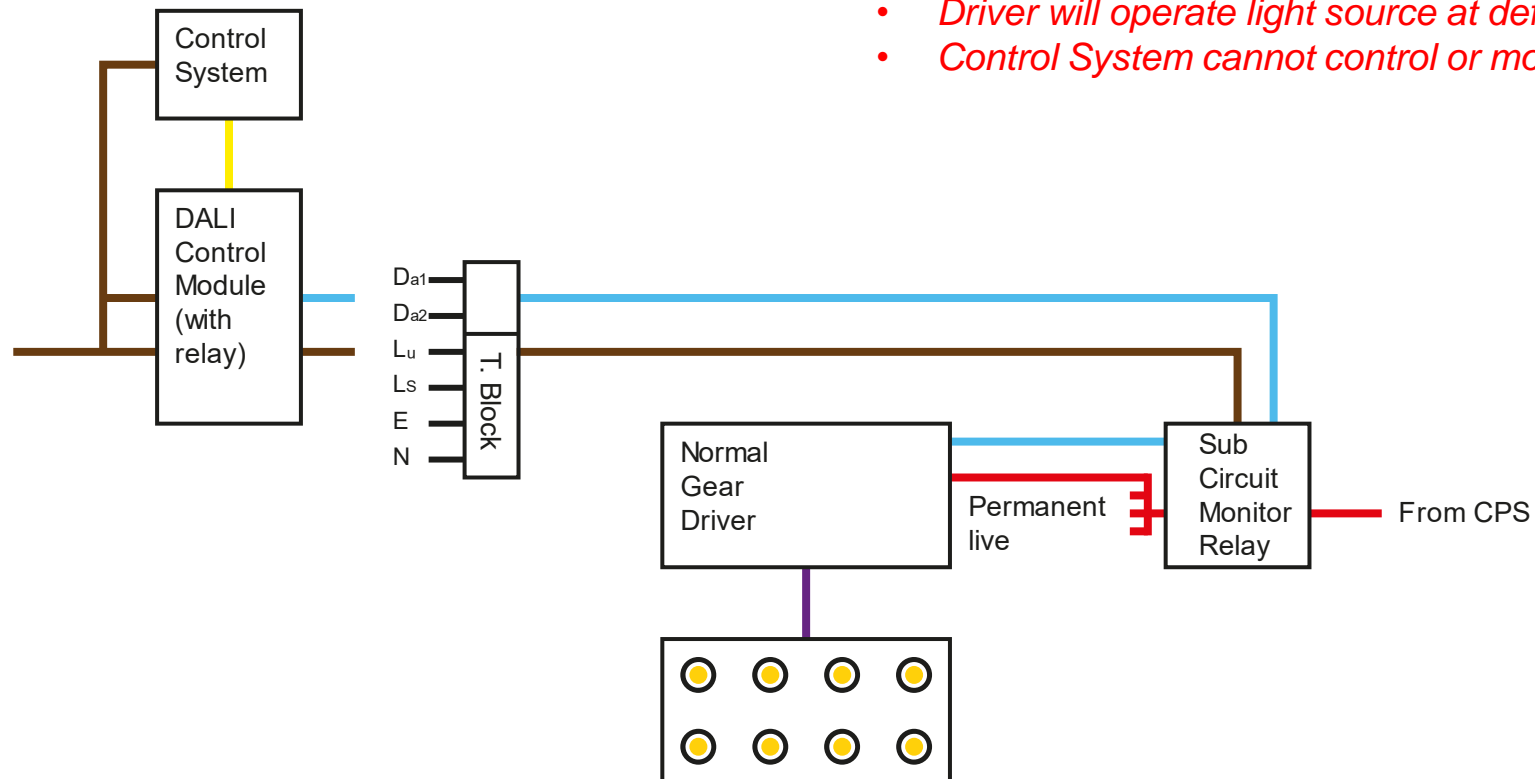
Controls & Luminaire Wiring

DALI Controlled Central Supplied Power System CPS - Maintained

DALI wired through Sub Circuit Monitor Relay

DALI control system will be disconnected from luminaire by Sub Circuit Monitor Relay during power failure conditions

- Driver will operate light source at default output*
- Control System cannot control or monitor*



Control System with DALI Local Control only

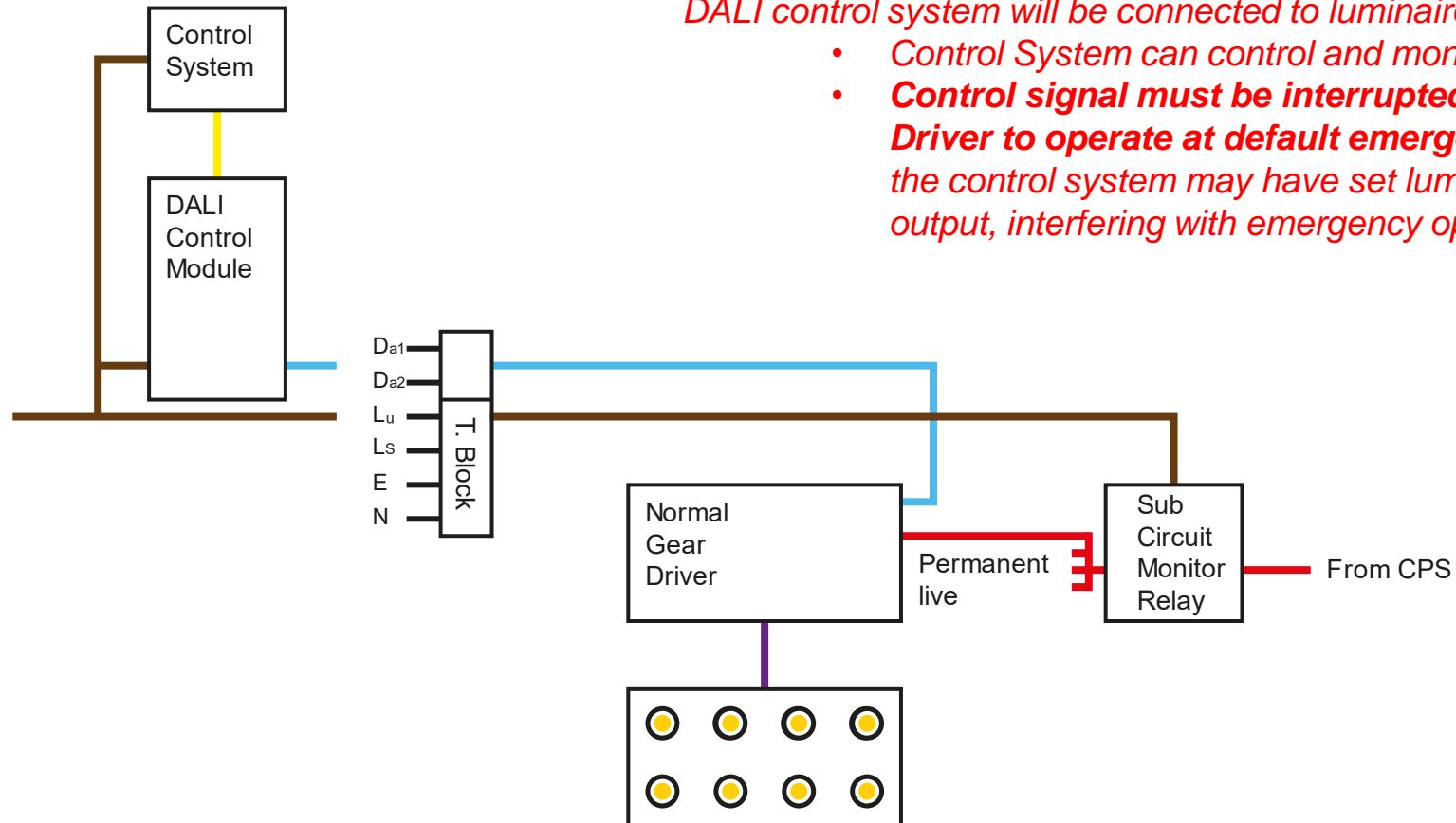
Controls & Luminaire Wiring

DALI Controlled Central Supplied Power System CPS - Maintained

DALI wired directly to Luminaire/Driver

DALI control system will be connected to luminaire during all conditions

- Control System can control and monitor via DALI*
- Control signal must be interrupted elsewhere to allow Driver to operate at default emergency output** (otherwise the control system may have set luminaire to Dim or 0% output, interfering with emergency operation)*



Control System With DALI and Relay Local Control

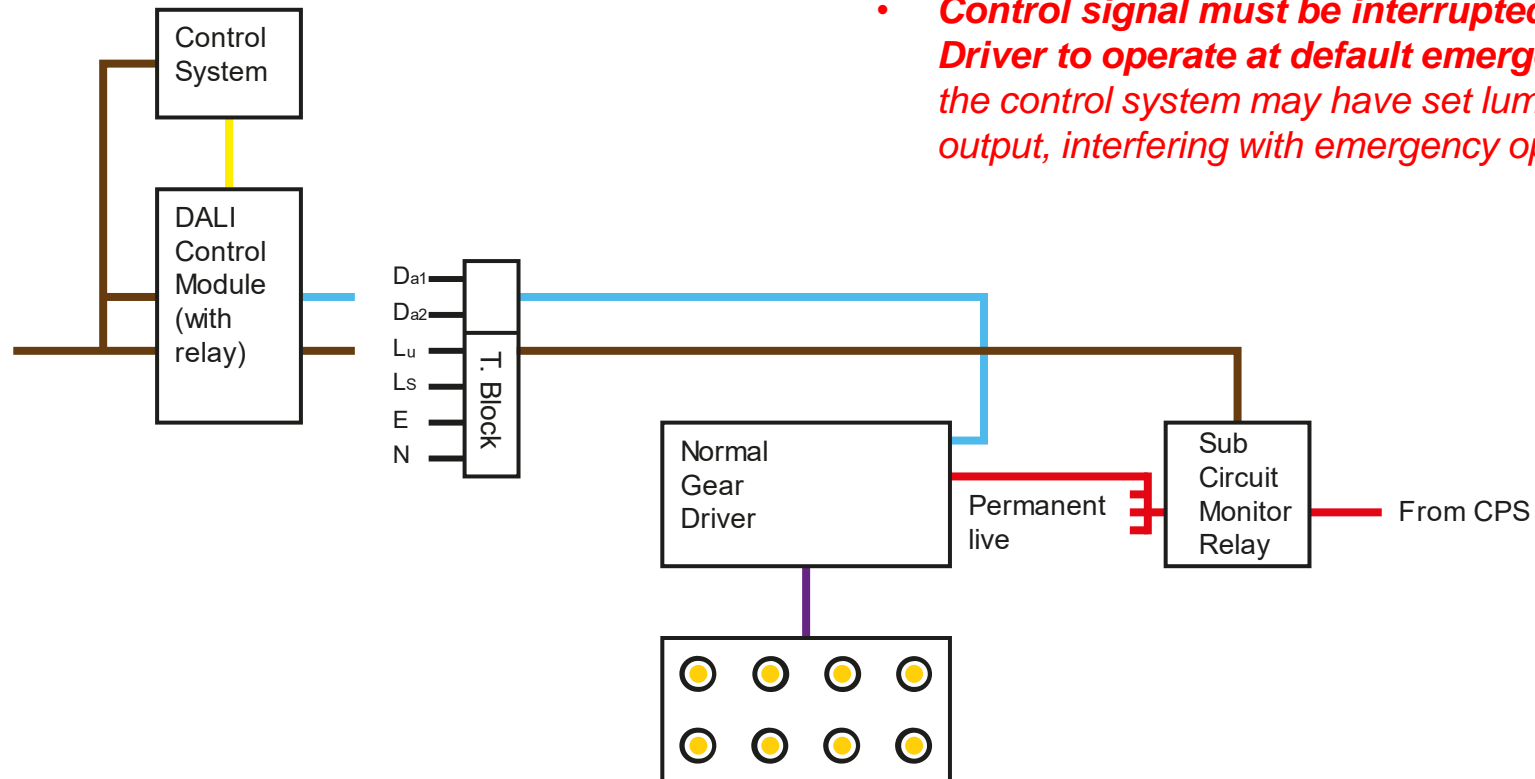
Controls & Luminaire Wiring

DALI Controlled Central Supplied Power System CPS - Maintained

DALI wired directly to Luminaire/Driver

DALI control system will be connected to luminaire during all conditions

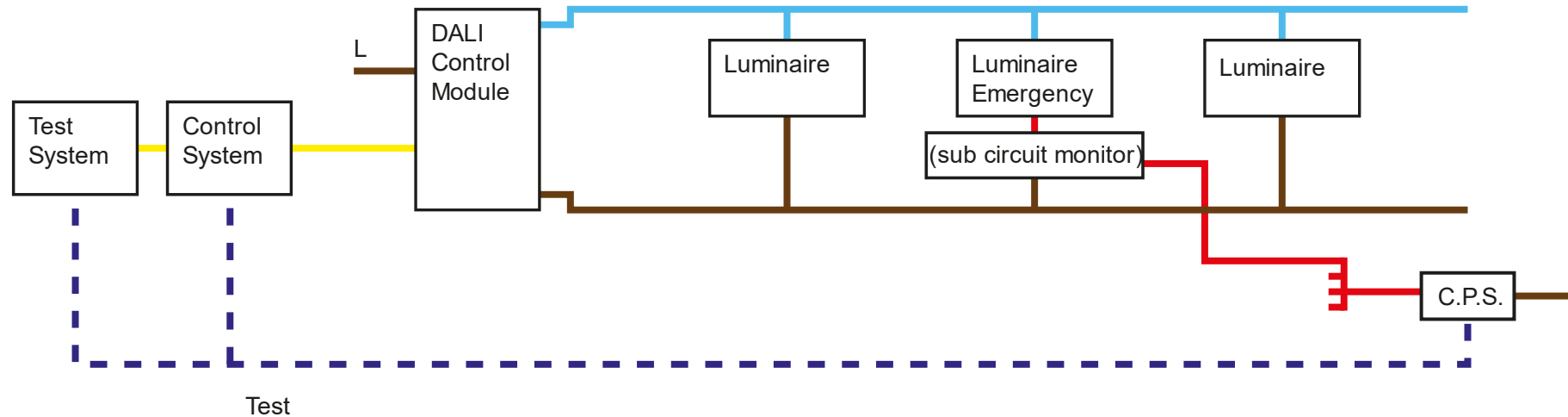
- Control System can control and monitor via DALI*
- Control signal must be interrupted elsewhere to allow Driver to operate at default emergency output** (otherwise the control system may have set luminaire to Dim or 0% output, interfering with emergency operation)*



Control System With DALI and Relay Local Control

System Wiring – Single Supply or Circuit

DALI Controlled EM Test Central Supplied Power System CPS - Maintained



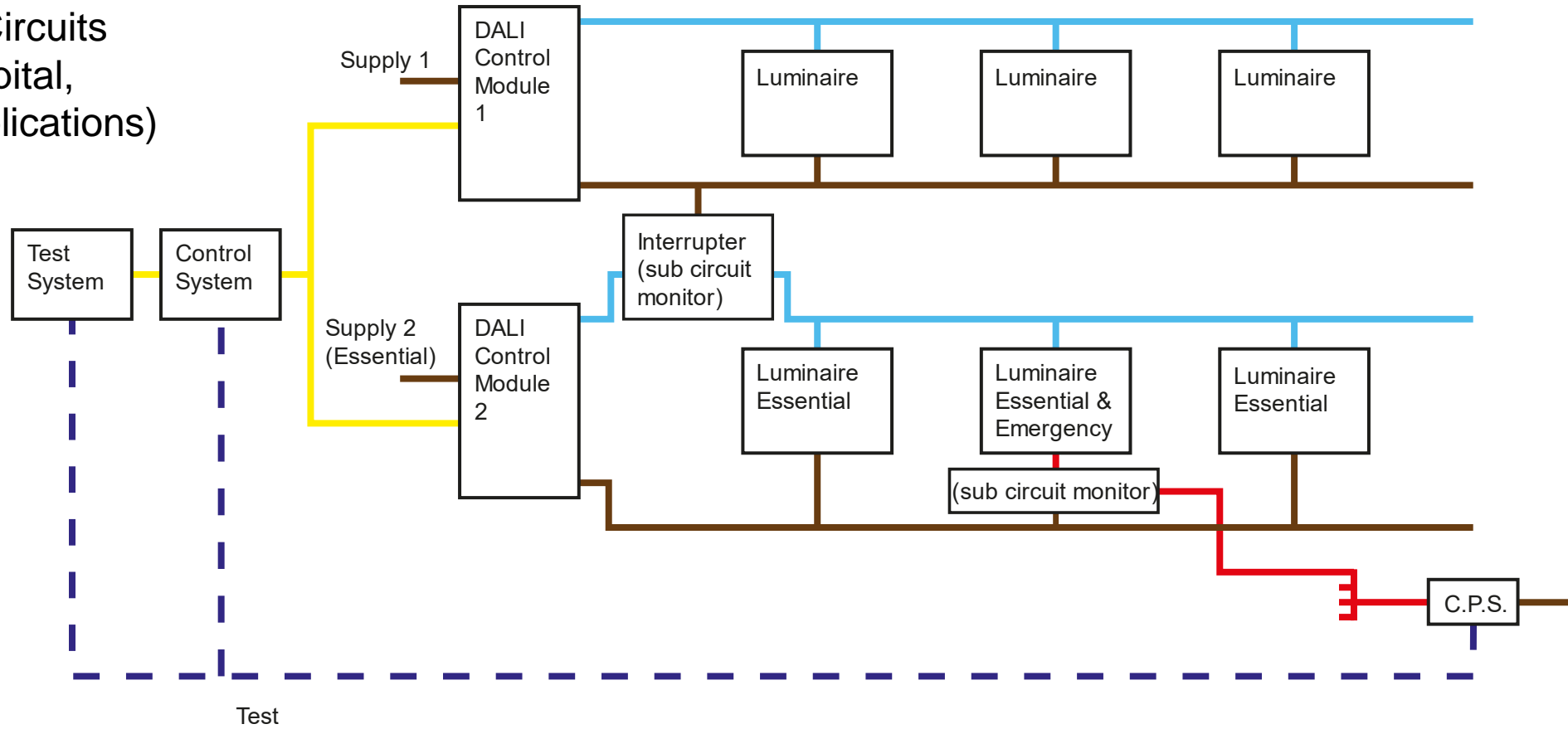
The use of a 'Test' link ensures status sharing between Control, Emergency Test, and Central Power Systems allowing full load testing

Control System With DALI and Relay Local Control

System Wiring – Multiple Supplies or Circuits

DALI Controlled EM Test Central Supplied Power System CPS - Maintained

i.e. Essential / Non-essential Circuits
(e.g – Hospital,
Airport applications)



The use of a 'Test' link ensures status sharing between Control, Emergency Test, and Central Power Systems allowing full load testing