DALI and DALI-2 Emergency Lighting
- Seminar for ZVEI

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18th March 2021

DALI® Alliance

DALI®2 D4™

Agenda

- Introduction to DALI and DiiA
  - Trademarks, Registration & Certification
- IEC 62386-202: Control gear for self-contained emergency lighting, edition 1
  - Details of the current standard
  - Testing, registration and Trademark
- IEC 62386-202: Edition 2
  - Changes
- IEC 62386-220: Control gear for centrally-supplied emergency operation

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DALI – The basics

Digital **A**ddressable **L**ighting **I**nterface

- DALI® is the industry-standard protocol (language) for bi-directional, digital communication between lighting-control devices.
  - Dedicated to lighting, with a rich feature set
- DALI is technically managed in the open, global standard IEC 62386.
- DALI-2™ is the latest version of the DALI protocol.
- DALI-2 and D4i certification is driven by DiiA, the global DALI alliance.
  - Ensures interoperability through testing and certification with trademark use
- DALI, DALI-2 and D4i trademarks are controlled by DiiA.

The DALI Alliance

- The DALI Alliance (DiiA) is an open, global consortium of lighting companies that aims to grow the market for lighting-control solutions based on DALI.
- Also known as Digital Illumination Interface Alliance
- More than **260 members** worldwide.
  - Industry leaders in lighting and control
- Membership allows certification or registration of products:
  - Over **1,600 DALI-2 certified products (including D4i)**
  - Over 1,350 DALI version-1 registered products
- Membership allows DALI, DALI-2 and D4i **trademark use**.

Trademarks, Registration and Certification

The Trademarks are used by DiiA members:

- The original **DALI** logo is used on **registered** control gear (drivers). These have passed the DALI version-1 tests and are listed on the DALI website.
  - Use for marketing/promotion of DALI technology is also permitted.
- **DALI-2** is used on **certified** products. These have passed the DALI-2 tests, with **verification by DiiA** before certification is granted. All certified products are listed on the website.
- **D4i** is also used on **certified** products. These have passed the DALI-2 tests, with verification by DiiA. D4i products also include some specific features that are optional for DALI-2.
- Luminaires using **DALI**, **DALI-2** or **D4i** components are also able to use these Trademarks.
- Detailed requirements are given in the *Trademark Guidelines* document.

Part 202: Self-contained emergency

(Device type 1)

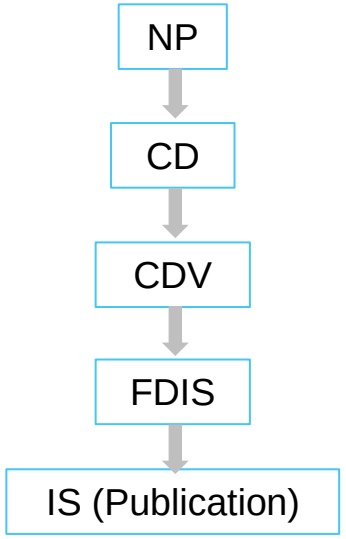
Overview:

- Describes the requirements for **control gear** for self-contained emergency lighting
- ***Self-contained*** means that the luminaire contains the control gear and battery (or they are placed next to the luminaire)
- The four **types** of self-contained emergency lighting are explained (types A-D)
- The control gear includes **self-testing** of the lamp, battery, drive circuit and charging circuit
- **Optional features** include automatic periodic self-testing
- The main principle is to turn **on the lamp when the mains is off!**

Part 202: Standards and certification

Standards:

- IEC 62386-202 edition 1 published in 2009
- Edition 2 (at final technical stage in IEC)
  - CDV will be submitted this month (March 2021)



Testing, registration and certification:

- DALI version-1 testing has been available for several years
  - Tested products must be registered to use the DALI Trademark logo
- DALI-2 tests are in the final phase of testing
  - Release date expected to be around June 2021, enabling DALI-2 certification
  - Test results and product information is verified by DiiA
  - Certified products can then use the DALI-2 Trademark logo

Part 202: Self-contained emergency – Types (1)

- Four types of self-contained emergency devices: type A, B, C or D
  - The control gear can be only one of these types (Table 3)

  - **Type D: Non-maintained**: the lamp is only on when the mains is not present (or in test mode)
  - **Type C: Maintained**: the lamp is always on, whether the mains is present or not
  - **Type B: Switched-maintained non-dimmable**: the lamp can be switched on or off when mains is present, but is on when the mains is not present
  - **Type A: Switched-maintained dimmable**: the lamp can be dimmed or switched off when mains is present, but is on when the mains is not present

- The type can be determined by:
  - `251: QUERY FEATURES`
    - Bit 1: maintained
    - Bit 2: switched maintained
  - `154: QUERY PHYSICAL MINIMUM LEVEL`
    - Indicates whether switched-maintained gear is switching only (PHM=254) or dimmable (PHM<254)

Part 202: Self-contained emergency – Types (2)

- Switched-maintained dimmable and non-dimmable (Type A & Type B):

  – Must support arc power level commands, for example: (see Table 4)
    - DIRECT ARC POWER CONTROL
    - OFF
    - STORE ACTUAL LEVEL IN THE DTR
    - STORE THE DTR AS SYSTEM FAILURE LEVEL
    - STORE THE DTR AS SCENE’ / 'GO TO SCENE
    - STORE THE DTR AS MAX LEVEL (type A only)
    - STORE THE DTR AS MIN LEVEL (type A only)

  – An optional hardwired switch may be used to enable/disable the execution of the arc power control commands.

Part 202: Specific features

- EMERGENCY LEVEL, EMERGENCY MIN LEVEL, EMERGENCY MAX LEVEL
  - EMERGENCY LEVEL provides the arc power level to be used during emergency operation.
  - The range is limited by EMERGENCY MIN LEVEL and EMERGENCY MAX LEVEL. These are manufacturer fixed values.
  - If the EMERGENCY LEVEL is not adjustable, these three values are identical.

- LAMP TOTAL OPERATION TIME
  - The total time the lamp has operated, in 4h resolution
- LAMP EMERGENCY TIME
  - The time the emergency lamp has operated from the battery, in 1h resolution
- Counters can be reset using `RESET LAMP TIME`
- `QUERY BATTERY CHARGE` (reply ‘MASK’ 255 if unknown)
- `START IDENTIFICATION` starts a 10s identification procedure

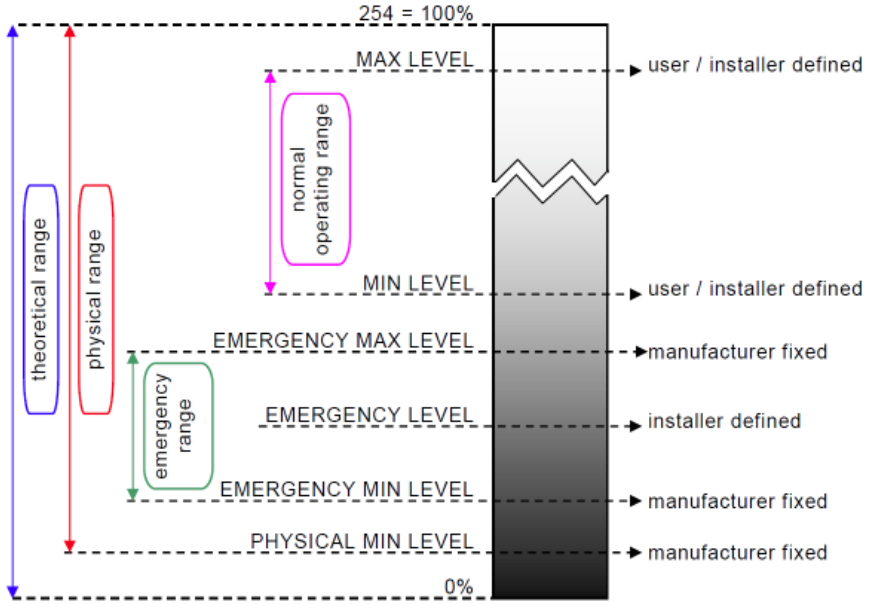


Figure 1 – Example of light level definitions

Figure ©Tridonic/IEC

Part 202: Modes (1)

Seven operating modes are defined: (see figure 2)

- normal mode
  - Mains is present
- emergency mode
  - Mains is off, the lamp is running from the battery
- function test in progress
- duration test in progress
- inhibit mode
  - Mains is present, inhibit input or `INHIBIT` command has been received
- rest mode
  - Mains is off, and the lamp is kept off (as a result of a discharged battery, `REST` command, or mains fail whilst in inhibit mode).
- extended emergency mode
  - Mains is present but was recently off, so the lamp continues to be operated in the same way as in emergency mode for a period of time, or until the battery is discharged

Figure ©Tridonic/IEC

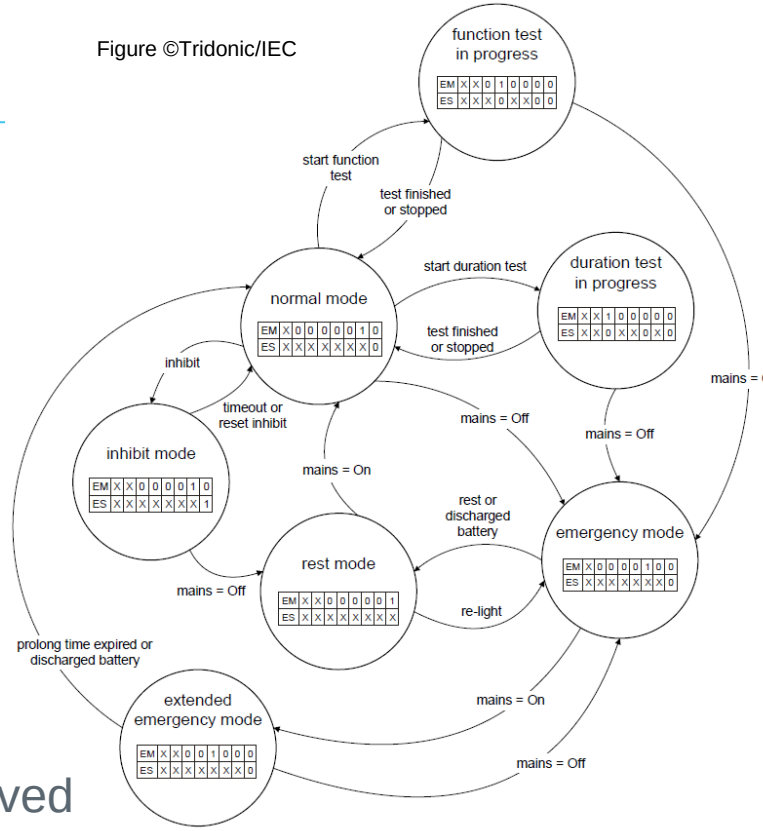


Figure 2 – Modes of operation

Part 202: Modes (2)

Determining the mode:

- QUERY EMERGENCY MODE
  - Bits 0-5 indicate which mode is active.

- REST
  - This command is used when in emergency mode, and causes the lamp to be turned off by entering rest mode. If the feature *Re-light in rest mode* is supported, then the command RE-LIGHT/RESET INHIBIT will cause the lamp to be turned back on by entering *emergency mode* whilst the mains is off. This will not override a hardwired inhibit switch.
- INHIBIT
  - This command is used when in normal mode, and (re-)starts a 15 minute timer during which the control gear is placed in *inhibit mode*. Activation of a hardwired inhibit switch can also cause this change of mode.

- PROLONG TIME
  - This is the time the control gear continues to operate the lamp after the mains supply has been restored. During this time, the control gear is in *extended emergency mode* and operates the lamp in the same way as when in *emergency mode* [0, 127.5 min]. If the battery discharges whilst in *extended emergency mode*, the control gear returns to *normal mode*.

Part 202: Function and duration tests

There are two types of tests that emergency control gear must implement:

- Function test
  - A quick test, usually between a few seconds and 1 min
  - Might be carried out monthly (depending on the region)
  - Checks the operation of the lamp, battery, circuit and changeover relay/drive circuit

- Duration test
  - A longer test for the rated duration, usually 1h to 3h
  - Might be carried out annually (depending on the region)
  - Ensures that the battery will be able to operate the lamp for the full rated duration
  - The battery must still be capable of operating the lamp at the end of the rated duration. The test fails if the battery discharges before the rated duration has been reached.

Part 202: Triggering tests

- `START FUNCTION TEST` and `START DURATION TEST` commands.
  - These commands will normally start the function/duration test immediately.
  - If the control gear is not in normal mode, or the battery level is insufficient, then the test is marked as pending.

- **Periodic automatic testing** is an **optional** feature that allows the two types of tests to be automatically scheduled after a delay, repeating periodically.
  - TEST DELAY TIME: used to determine the starting time for automatic function and duration tests
    1. A 16-bit RAM variable is set with the required delay (15 min resolution).
    2. This is transferred to the appropriate function or duration test delay variable when either of the test intervals are stored.
  - FUNCTION/DURATION TEST INTERVAL
    - Function tests can be repeated with an interval of 1 to 255 days.
    - Duration tests can be repeated with an interval of 1 to 97 weeks.

Part 202: Test timeout

- Both types of tests can be delayed if the battery is too low, or the control gear is not in *normal mode*.
- If the start is delayed, the flag *function test request pending* or *duration test request pending* (bits 4 or 5 of EMERGENCY STATUS byte) is set.
- A variable, TEST EXECUTION TIMEOUT specifies the number of days allowed before the test should be completed.
- If the test does not complete by this time, the test fails with bit 4 or 5 of FAILURE STATUS set.

Part 202: Test results

- `QUERY EMERGENCY STATUS` is used to determine when the tests are completed
  - The tests are self-timed, but can end early if a failure is detected or a `STOP TEST` command is received, or mains is turned off.
  - On test completion, bit 1 or 2 of the emergency status byte is set.
  - `QUERY FAILURE STATUS` can then be used to determine whether the tests passed (bit 6 or 7), or the reason for test failure (bit 0-5).

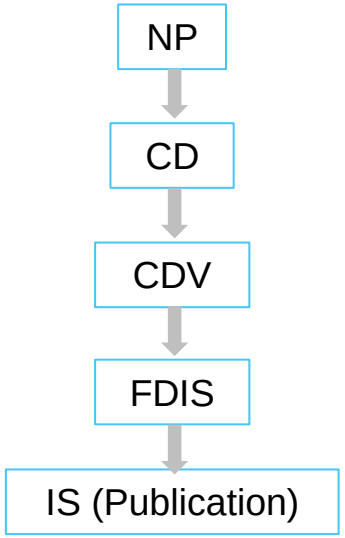
Part 202, edition 2 – Work in progress

- An update is in progress to the standard for control gear for self-contained emergency lighting (**IEC 62386-202**).

- It has just been agreed (16th March 2021) to submit the current draft at the "CDV" stage in IEC.
  - This means technical changes are no longer expected.

- Publication is not expected until the end of 2021 or into 2022, and depends on IEC voting.
  - Testing and certification is unlikely to start until the end of 2022.

- Some of the **main technical changes** are described on the following pages.



Part 202, edition 2 – Changes from ed.1

- **New memory bank** added
  - Control gear **temperatures**, including min/max
  - **Average power** during charging, or charge maintenance
  - Duration and function **test times**
  - **Battery**: recharge time, failure and discharge counters, connected time
  - **Duration & function tests**: Start counters, failure counters
  - Rest & Emergency mode: **Counters**
  - **Emergency lamp**: operating times, failure counters
  - Much of the above information is recorded for both the current battery, and total (all batteries)

- **Installation inhibit** feature added
  - For new installations, this prevents (inhibits) emergency mode upon normal supply failure. This feature is disabled after the pre-configured time of uninterrupted normal supply.
  - The purpose is to avoid battery wear-out during installation.
  - **Example**: If the installation inhibit timer starts at 75 hours, for newly installed emergency luminaires, and the normal supply is turned off every evening and weekend until the installation has completed, then emergency mode will be prevented each time. Once the installation has completed, and the normal supply is no longer turned off, the installation inhibit feature automatically disables after 75 hours, or it can be disabled by a bus command.

Part 202, edition 2 – Changes from ed.1

- **Testing of *emergencyLevel*** can be triggered by sending a command (max. 4.5 minutes).
- **Battery cut-off mode** is added.
- **Deep-discharge prevention**: Emergency mode will terminate to Rest mode if the battery voltage reaches lamp cut-off, saving the battery from deep discharge.
- **Extended duration tests** are now allowed – used for initial testing in some regions.
  - Executes for the configurable extended time, or until lamp cut-off.
- **Hardwired switch** operation can be disabled.
- **Auto-test** is now a necessary feature
- Clarification of **command execution in each mode** (for example Emergency mode and Rest mode)

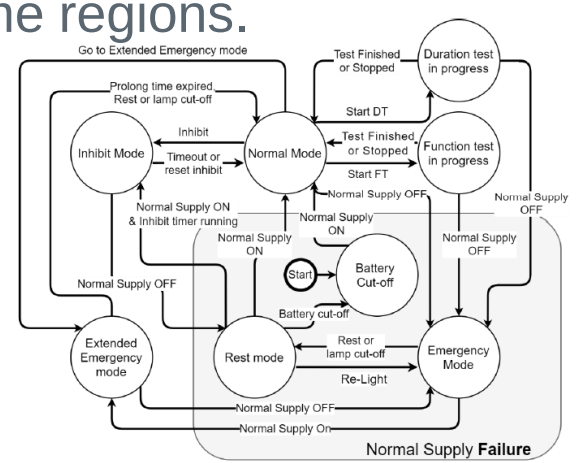


Figure ©Tridonic/IEC

Part 220: Centrally supplied emergency

- Emergency operation can be triggered in either of two ways:
  - Failure of the normal supply and establishment of the emergency supply
  - Collapse of the bus voltage (for example by short-circuiting the bus)

- Adjustable emergency level is supported
- Locking mechanism to prevent accidental or unauthorized modification of configuration

- Standard published in 2019
- Tests not yet developed.
- Recently, interest from DiiA members has increased.
- Possibility to develop tests later in 2021
- Once tests are released, DALI-2 certification starts

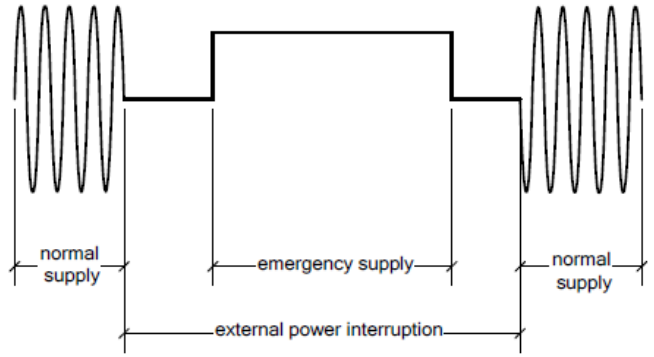


Figure ©Tridonic/IEC

Summary

- **Specifications & tests:**
  - IEC 62386-202 edition 1: 2009
    - Edition 2: in final stages within IEC
  - IEC 62386-220 (central emergency): 2019

- **Tests:**
  - Part 202: Available for DALI version-1. Update in progress for DALI-2
  - Part 220: DALI-2 tests not yet in development

- **Certification and Trademarks:**
  - DALI-2 certification for part 202 will start later this year.

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- **Q&A**