Managing lights with DALI

TN-012, rev 2

cybroTech

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What is DALI?

DALI is an acronym and stands for “Digital Addressable Lighting Interface“. It is an international standard that guarantees the exchangeability of dimmable ballasts from different manufacturers. This gives planners, luminaries manufacturers, building owners, installers and end-users the security of supply from many sources.

The analog 1 – 10V control interface has been most common industry standard for the dimming of electronic ballasts in the past. DALI has been designed to become a new standard in the market. With its greater flexibility and simplicity of installation in a great variety of applications is replacing the analog interface.

Communication and installation have been simplified as much as possible. All intelligent components communicate in a local system in a way that is both simple and free of interference. There are no special requirements for the wiring of data cables, and there is no need to install termination resistors on the cables to protect them against reflections.

DALI advantages

Options for lighting system when using DALI:

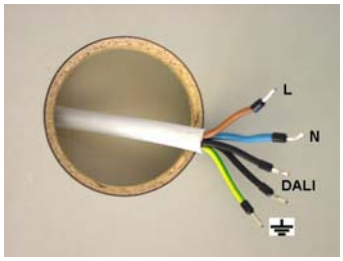
- Simple wiring of control lines (no group formation, no polarity),
- Control of individual units (individual addressing) or groups (group addressing) is possible,
- A simultaneous control of all units is possible at any time through broadcast addressing,
- No interference of data communication is to be expected due to the simple data structure,
- Control device status messages (lamp fault, ...),
- Automatic search of control devices,
- Simple formation of groups through “flashing“ lamps,
- Automatic and simultaneous dimming of all units when selecting a scene,
- Logarithmic dimming behavior – matching the eye’s sensitivity,
- System with assigned intelligence (every unit contains: individual address, group assignment, lighting scene values, fading time, ...),
- Fading: adjustment of dimming speed,
- Options for emergency lighting can be chosen (selection of specific ballasts, dimming level),
- No need to switch on/off the external relay for the mains voltage (this is done by internal electronic components),
- Lower system cost and more functions compared to 1–10V-systems.

DALI technical specifications

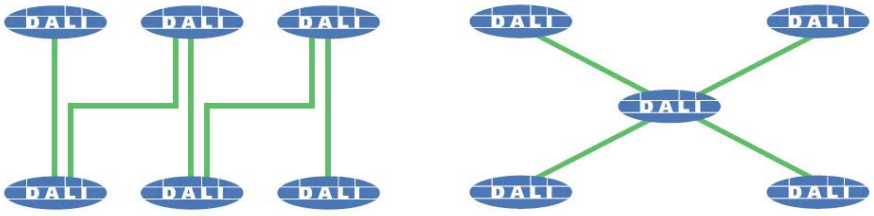
DALI line:

- DALI voltage 9.5–22.4 V
- DALI system current, max. 250 mA
- Effective data transfer rate 1.200bits/s
- Maximum cable length of DALI control wires 300 m (for 1.5 mm2 wire)

- Supply and control wires can be laid together in one cable or duct

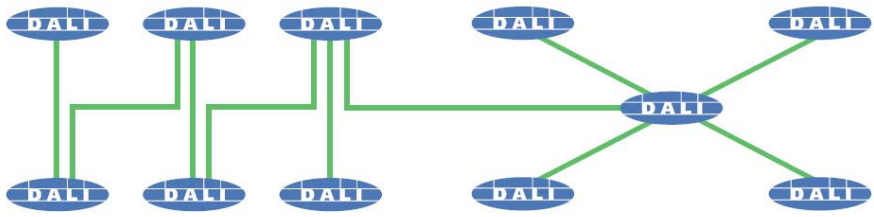


- No special wiring required with regard to wiring topology (star, series and mixed networking allowed).



Serial connections

Star connections



Combined installation

DALI ballasts

Ballasts should be configured (programmed) before use in DALI lighting system.
Programmed parameters are held in the memory of the ballast itself.
These parameters are:

- Light levels
  - Power on
  - Maximum
  - System failure
- Fade time and rate
- Individual address
- Groups assigned to the ballast
- Light scene values assigned to the ballast

Individual addresses:
Ballast has its own address. DALI system includes as many as 64 addresses and each one of the addresses individually communicates with the control device. All units, however, can be contacted at the same time by way of a broadcast.

Group addresses:
Up to 16 groups can be configured to meet the varying lighting requirements of occupants, workspace needs, room functionality, time of day or ambient light levels.

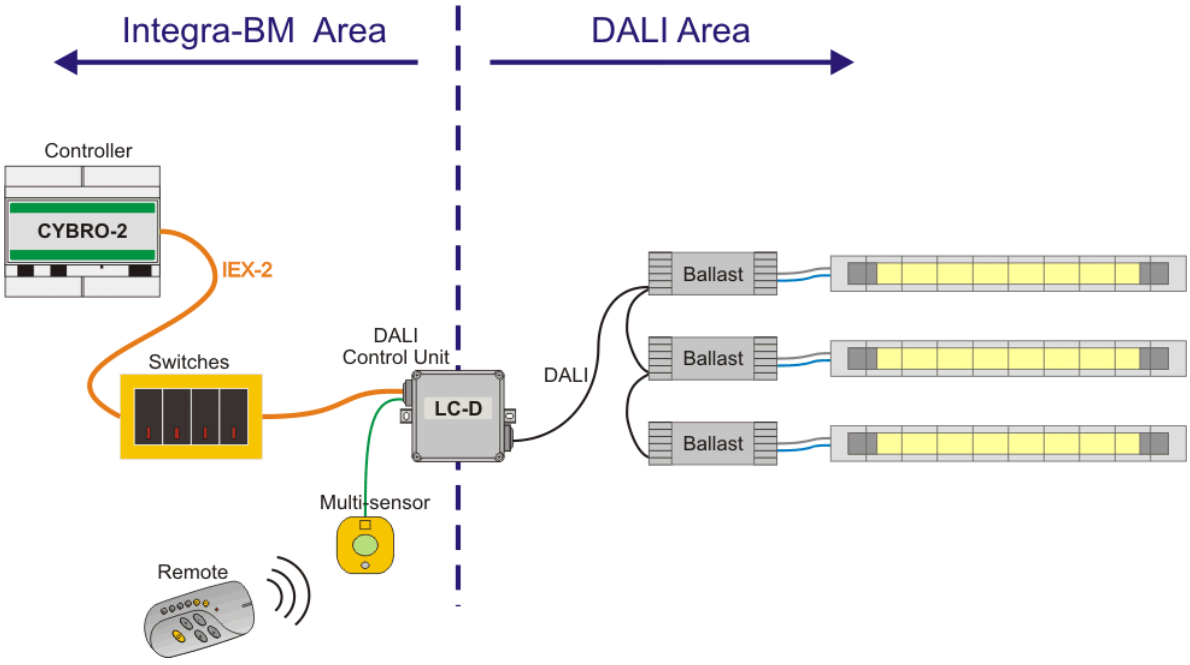
Scene assignment:
Up to 16 scenes can be configured in a DALI system. Light values for scenes are assigned to ballasts.

Two-way communication enables bi-directional information flow, enabling the ballasts to provide feedback to the network on information such as:

- Luminary state (on/off)
- Lamp energy level
- Lamp and ballast condition

DALI and Building Management

Lighting control systems based on DALI can be used as subsystems for lighting control within Building Management Systems (Integra-BM).
A translator (gateway) is planned for connecting DALI subsystem and Integra-BM. All automating components installed in a room or building is part of Building Management.
LC-D expansion unit in Integra-BM automation works as getaway with translating from the Integra-BM to DALI and in reverse order to establish the communication between Integra-BM and DALI-units.

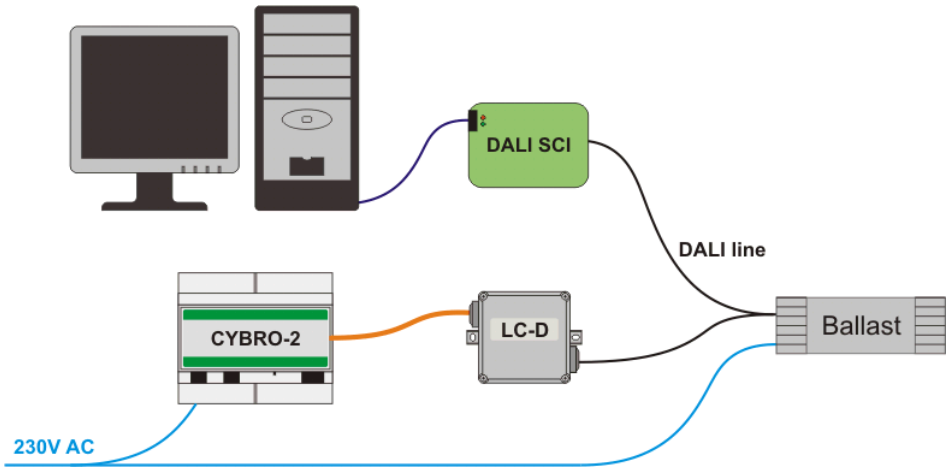


Programming DALI ballasts

DALI ballasts configuration requires the interface module DALI SCI and configuration software on Personal Computer. For configuration software Cybrotech recommends use of ConfigTOOL software program for configuration DALI ballasts.

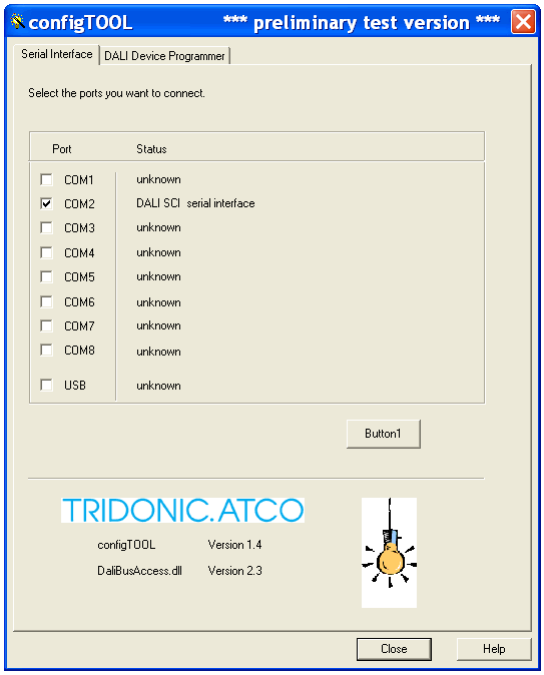
HW Configuration

The DALI SCI is connected to the RS 232 serial interface of a Personal Computer and interfaces via an opto isolated connection on to the DALI signal line. DALI signals are not SELV. Therefore DALI power supply is needed and is provided with LC-D expansion module.



Programming

Open program and select the serial port. Software will find connected DALI SCI device.

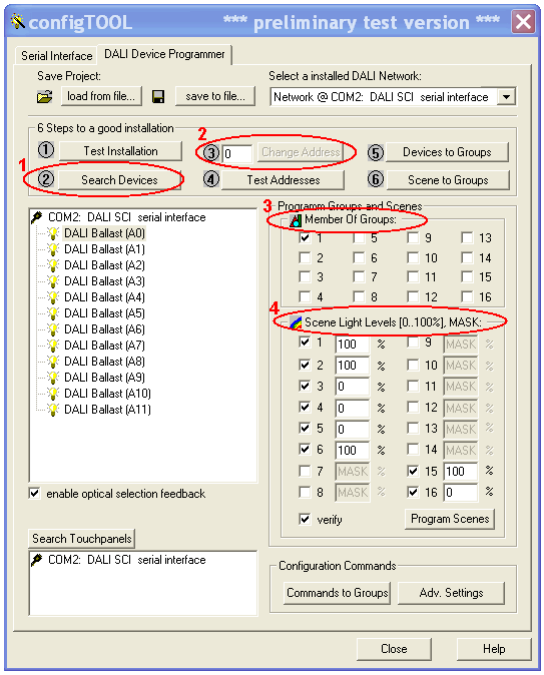


Configure DALI ballasts:

1. Locating DALI ballasts
   Click *Search Devices* and follow the procedure
2. Individual Addressing

Select the ballast you want to configured (if you have connected a light to it, light will switch on). Write the number of individual address in text box and click *Change Address*.

3. Group Addressing
   Mark groups in which selected ballast should be included.
4. Set up Scenes
   Mark the Scene in which selected ballast should be included and enter dimming level. Save the scene with *Program Scenes*.



CyPro commands for DALI lights

CyPro program managing lights in DALI network has program lines that generate or read messages on DALI network. That part of code contains:

- DALI address: Individual, group or broadcast
- DALI command: for switching on/off, dimming, sting fade time,…
- DALI request: set to send DALI command to specified DALI address

When sending command after command on DALI network be aware of data transfer rate 1.200bits/s.

Examples of program code:
Switching light to 100% using individual address 0

```
lcd00_dali_adr:=0;
lcd00_dali_cmd:=254;
lcd00_dali_req:=1;
```

Switching light off using individual address 1

```
lcd00_dali_adr:=2;
lcd00_dali_cmd:=0;
lcd00_dali_req:=1;
```

Switching light to maximum using direct individual address 2

```
lcd00_dali_adr:=5;
lcd00_dali_cmd:=5;
lcd00_dali_req:=1;
```

Switching lights to 20% using group 1

```
lcd00_dali_adr:=128;
lcd00_dali_cmd:=195;
lcd00_dali_req:=1;
```

Switching lights to 2. scene

```
lcd00_dali_adr:=255;
lcd00_dali_cmd:=17;
lcd00_dali_req:=1;
```

Setting fade time to 8s:

```
if fp(clock_100ms) then
  lcd00_dali_adr:=163;
  lcd00_dali_cmd:=8;    //set value to DTR memory
  lcd00_dali_req:=1;
elsif fn(clock_100ms) then
  lcd00_dali_adr:=255;
  lcd00_dali_cmd:=46;    //store value from DTR as Fade Time
  lcd00_dali_req:=1;
end_if;
```

Checking lamp failure on direct individual address 0:

```
lcd00_dali_adr:=1;
lcd00_dali_cmd:=146;
lcd00_dali_req:=1;
if lcd00_dali_ans=255 then
  lamp_error=1;            // Lamp error
  lcd00_dali_ans:=0;       // Reset error message
end_if;
```

Appendix

DALI Addresses:

Address	Description
0	Individual 0 (ordinary address)
1	Individual 0 (direct address)
2	Individual 1 (ordinary address)
3	Individual 1 (direct address)
…	…
126	Individual 63 (ordinary address)
127	Individual 63 (direct address)
128	Group 1 (ordinary address)
129	Group 1 (direct address)
130	Group 2 (ordinary address)
131	Group 2 (direct address)
…	…
158	Group 16 (ordinary address)
159	Group 16 (direct address)
254	Broadcast (ordinary address)
255	Broadcast (direct address)

- Use ordinary address for setting brightness 0..100% (0..254). Changes are made smoothly with fade time.
- Use direct address for direct commands: step up, step down, recall max, recall min… Changes are made momentarily.

DALI Commands:

Command	Description	Type
0 .. 254	Set light intensity	Ordinary
0	Off	Direct
1	Up	Direct
2	Down	Direct
3	Step up	Direct
4	Step down	Direct
5	Recall max level	Direct
6	Recall min level	Direct
7	Step down and off	Direct
8	On and step up	Direct
16	Go to scene 1	Direct
17	Go to scene 2	Direct
…	…	…
31	Go to scene 16	Direct

32	Reset	Direct
33	Store actual level in the DTR	Direct
42	Store DTR as max level	Direct
43	Store DTR as min level	Direct
44	Store DTR as system fail level	Direct
45	Store DTR as power on level	Direct
46	Store DTR as fade time	Direct
47	Store DRT as fade rate	Direct
64	Store the DTR as scene 1	Direct
65	Store the DTR as scene 2	Direct
…	…	…
79	Store the DTR as scene 16	Direct
80	Remove from scene 1	Direct
81	Remove from scene 2	Direct
…	…	…
95	Remove from scene 16	Direct
96	Add to group 1	Direct
97	Add to group 2	Direct
…	…	…
111	Add to group 16	Direct
112	Remove from group 1	Direct
113	Remove from group 2	Direct
…	…	…
127	Remove from group 16	Direct
128	Store DTR as short address	Direct
144	Query status	Direct
145	Query ballast	Direct
146	Query lamp failure	Direct
147	Query lamp power on	Direct
148	Query limit error	Direct
149	Query reset state	Direct
150	Query missing short address	Direct
151	Query version number	Direct
152	Query content DTR	Direct
153	Query device type	Direct
154	Query physical minimum level	Direct
155	Query power failure	Direct
160	Query actual level	Direct
161	Query max level	Direct
162	Query min level	Direct
163	Query power on level	Direct

164	Query status failure level	Direct
165	Query fade time/data rate	Direct
176	Query scene 1 level 1	Direct
177	Query scene 2 level 2	Direct
…	…	…
191	Query scene 16 level 16	Direct
192	Query groups 1-8	Direct
193	Query groups 7-16	Direct
194	Query random address (H)	Direct
195	Query random address (M)	Direct
196	Query random address (L)	Direct
224	Query app ext cmd 224	Direct
225	Query app ext cmd 225	Direct
…	…	…
285	Query app ext cmd 285	Direct
256	Terminate	Direct
257	Data transfer register (DTR)	Direct
258	Initialize	Direct
259	Randomize	Direct
260	Compare	Direct
261	Withdraw	Direct
264	Search address (H)	Direct
265	Search address (M)	Direct
266	Search address (L)	Direct
267	Program short address	Direct
268	Verify short address	Direct
269	Query short address	Direct
270	Physical selection	Direct
272	Enable device type	Direct

Fade time:

Command	**Time**
0	0s
2	1s
4	2s
6	4s
8	8s
10	16s
12	32s
14	64s
15	90,5s