HEIDELBERG, DECEMBER 2021

KNX DALI Gateways – Practical knowledge about DALI – Part 2

Online Learning Session – Competence Center Europe – Smart Buildings

Juergen Schilder, Thorsten Reibel, Marc-Andre Hahn, Michael Rall, Stefan Grosse & Olaf Stutzenberger
KNX DALI Gateways – Practical knowledge about DALI – Part 2
Online Learning Session

Why going in more Details with DALI?

- DALI as a worldwide standard with a huge number of existing installations and even more light circuits has proven its value in commercial projects, a real success story together with KNX.
- In most of the cases DALI installation and commissioning with ABB i-bus® KNX DALI Gateways works well thanks to long term experiences, standardization and also adaptions in the last years.
- At the beginning only DALI-1 standard was existing, causing in some cases challenges to deliver a proper solution.
- DALI-2 with a test procedure for the products helps in this regard.
- With ABB i-bus® KNX Gateways, the powerful ETS application and support with ABB i-bus® Tool a smooth implementation is feasible.
- Nevertheless there are still some challenges in projects, caused by demanding installations or DALI-1 devices.
- With these learning sessions we want to provide additional content, partly more complex than normal, but very helpful if required.
- Few customers need this support, ABB can deliver in such a case.
Diagnostic with “DALI Monitor“ and DALI USB Interface

- Next Thursday: Practical demonstration – Part 2
KNX DALI Gateways – Practical knowledge about DALI – Part 2

Part 2: Today (Online Learning Session)
DALI diagnostic with
  Software “DALI Monitor” and DALI USB interface
  ETS Group Monitor
  Oscilloscope

... and with live demonstration on Thursday (Practical Learning Session)
### KNX DALI Gateways – Practical knowledge about DALI – Part 2

Overview of all ABB i-bus® KNX DALI Gateways and DALI Light Controller

<table>
<thead>
<tr>
<th>Gateway</th>
<th>Gateway</th>
<th>Gateway</th>
<th>Gateway</th>
<th>Gateway</th>
<th>Light Controller</th>
<th>Light Controller</th>
</tr>
</thead>
<tbody>
<tr>
<td>DG/S 1.64.1.1</td>
<td>DG/S 2.64.1.1</td>
<td>DG/S 1.64.5.1</td>
<td>DG/S 2.64.5.1</td>
<td>DG/S 8.1</td>
<td>DLR/S 8.16.1M</td>
<td>DLR/A 4.8.1.1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Controlled</th>
<th>Single/Group</th>
<th>Single/Group</th>
<th>Single/Group</th>
<th>Broadcast</th>
<th>Group control</th>
<th>Group control</th>
</tr>
</thead>
<tbody>
<tr>
<td>DALI outputs</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>8 (A…H)</td>
<td>1</td>
</tr>
<tr>
<td>DALI devices</td>
<td>64 (ballasts and</td>
<td>2 x 64 (ballasts</td>
<td>64 (ballasts and</td>
<td>2 x 64 (ballasts and</td>
<td>128 (max. 16 per</td>
<td>64</td>
</tr>
<tr>
<td></td>
<td>Em.Conv.)</td>
<td>and Em.Conv.)</td>
<td>Em.Conv.)</td>
<td>and Em.Conv.)</td>
<td>output)</td>
<td>64</td>
</tr>
<tr>
<td>DALI addressing</td>
<td>64 individual</td>
<td>A: 64 individual</td>
<td>64 individual</td>
<td>A: 64 individual</td>
<td>not necessary</td>
<td>64 individual</td>
</tr>
<tr>
<td></td>
<td></td>
<td>B: 64 individual</td>
<td></td>
<td>B: 64 individual</td>
<td></td>
<td>64 individual</td>
</tr>
<tr>
<td>Lighting groups</td>
<td>16 DALI</td>
<td>2 x 16 DALI</td>
<td>16 DALI</td>
<td>2 x 16 DALI</td>
<td>cable installation</td>
<td>16 DALI</td>
</tr>
<tr>
<td>Emerg. Light. con.</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>-</td>
<td>8 DALI</td>
</tr>
<tr>
<td>DT8 Color temp.</td>
<td>-</td>
<td>-</td>
<td>Yes</td>
<td>Yes</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Tunable White T&lt;sub&gt;c&lt;/sub&gt;</td>
<td>-</td>
<td>-</td>
<td>Yes</td>
<td>Yes</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Application V2.0, e.g. DT8 RGB(W), HSV(W), load shedding, sequencer, ...</td>
<td>-</td>
<td>-</td>
<td>Yes</td>
<td>Yes</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>
DALI technology and KNX DALI Gateways

The DALI Gateway as the Master
- Transfers commands from KNX to DALI and sends back status messages to KNX
- Sends cyclical queries to all DALI devices (slaves)
  - Status
  - Actual level
    - Only the addressed device replies with information
    - This is a continuous process (24/7)
    - The time between each query can be set in the ETS parameters (default 2 sec.)

DALI device:
Ballast (DT0, DT6, DT8,...) or emergency lighting converter (DT1)
DALI commands and cyclical queries

- The DALI commands are specified in the International Standard IEC 62386 Part 102 “General requirements – Control gear”
- The DALI Gateway as the Master sends commands
  - Level instructions (direct arc power, go to scene, …)
  - Special commands (program short address, write memory location, initialize, ping, …)
  - Configuration instructions (set min/max level, set fade time, store actual level, add to group, …)
- and cyclical queries to all DALI devices (slaves)
  - Status
  - Actual level
Diagnostic with “DALI Monitor“ and DALI USB Interface

- IP Router IPR/S or IP Interface IPS/S (5 tunneling connections)
- ETS with Group-/Bus Monitor
  - Recording and analysis of KNX telegrams
- DALI USB Interface with DALI Monitor
  - Recording and analysis of DALI telegrams
Diagnostic with “DALI Monitor“ and DALI USB Interface

- Manufacturers offer interfaces between USB and DALI, e.g. Tridonic, Lunatone
- Together with software, the telegrams can be recorded and analyzed on the DALI line
  - Commands and queries sent by the DALI Gateway
  - Answers from the devices
- It can also be used to address, program DALI devices and set parameters (e.g. Tridonic “masterCONFIGURATOR” software)
  → With the KNX DALI Gateway DG/S, however, this is done via the i-bus® Tool and the ETS
- The DALI USB interface has no DALI address
Diagnostic with “DALI Monitor“ and DALI USB Interface

The program "DALI Monitor" is also installed with the “masterCONFIGURATOR” software.

~ 200 €
Diagnostic with “DALI Monitor“ and DALI USB Interface

Example: Switch ON output A
- Control element sends group address 3/4/101 with value “1”
- ETS group monitor records telegram with group address 3/4/101 with value “1”
- DALI Gateway converts KNX group address 3/4/101 with value “1” into DALI command “Bcast – direct arc power level 254 (100% light output)”
- All ballasts switch on
- DALI Gateway simulates the switch on behavior of all ballasts and sends KNX group addresses with corresponding values (depends on fade time and parameter “Behavior Switch On Value”)
Diagnostic with “DALI Monitor“ and DALI USB Interface – Example: Switch ON output

- Control element sends group address 3/4/101 with value “1”
- DALI Gateway converts KNX group address 3/4/101 with value “1” into DALI command “Bcast – direct arc power 254 level (100% light output)"
- All ballasts switch on
- DALI Gateway simulates the switch on behavior of all ballasts and sends KNX group addresses with corresponding values (depends on fade time and parameter “Behavior Switch On Value“)
Diagnostic with “DALI Monitor“ and DALI USB Interface

Example: Switch ON ballast 2
- Control element sends group address 3/4/61 with value “1”
- ETS group monitor records telegram with group address 3/4/61 with value “1”
- DALI Gateway converts KNX group address 3/4/61 with value “1” into DALI command “A1 – direct arc power level 254 (100% light output)”
- Ballast no. 2 (= DALI address 1) switches on
- DALI Gateway simulates the switch on behavior of ballast no. 2 and sends KNX group address 3/4/62 with value “ON” and 3/4/65 with value “100%” (depends on fade time and parameter “Behavior Switch On Value”)

Cyclical queries “Status” and “Actual level” Command “A1 – direct arc power 254 (100%)”

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Diagnostic with “DALI Monitor“ and DALI USB Interface – Example: Switch ON ballast 2

- Control element sends group address 3/4/61 with value “1”
- DALI Gateway converts KNX group address 3/4/61 with value “1” into DALI command “A1 – direct arc power 254 level (100% light output)"
- Ballast no. 2 (= DALI address 1) switches on
- DALI Gateway simulates the switch on behavior of ballast no. 2 and sends KNX group address 3/4/62 with value “ON” and 3/4/65 with value “100%” (depends on fade time and parameter “Behavior Switch On Value”)

<table>
<thead>
<tr>
<th>Time</th>
<th>Source Source Name</th>
<th>Destination Destination Name</th>
<th>Info</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Time</th>
<th>Source Source Name</th>
<th>Destination Destination Name</th>
<th>Info</th>
</tr>
</thead>
<tbody>
<tr>
<td>02.11.2021 16:11:18:797</td>
<td>3.7.131</td>
<td>DALI DAO/5 3/4/65</td>
<td>Bal. 2: White LED strip mid. Status Bright. value</td>
</tr>
</tbody>
</table>
Diagnostic with “DALI Monitor“ and DALI USB Interface

Example: Switch OFF group 3
- The group membership is already saved in the ballasts
- Control element sends group address 3/4/21 with value “0”
- ETS group monitor records telegram with group address 3/4/21 with value “0”
- DALI Gateway converts KNX group address 3/4/21 with value “0” into DALI command “G2 – direct arc power level 0 (OFF light output)”
- Group no. 3 (= DALI group 2) switches off
- DALI Gateway simulates the switch off behavior of the group and sends KNX group address 3/4/22 with value “OFF” and 3/4/25 with value “0%” (both depends on fade time and parameter “Behavior Switch Off Value”)

Online Learning Session
Diagnostic with “DALI Monitor” and DALI USB Interface – Example: Switch OFF group 3

- Control element sends group address 3/4/21 with value “0”

<table>
<thead>
<tr>
<th>Time</th>
<th>Source</th>
<th>Source Name</th>
<th>Destination</th>
<th>Destination Name</th>
<th>Info</th>
</tr>
</thead>
</table>

- DALI Gateway converts KNX group address 3/4/21 with value “0” into DALI command “G2 – direct arc power 0 level (OFF light output)”

<table>
<thead>
<tr>
<th>Line</th>
<th>Type</th>
<th>Hex Data</th>
<th>Address</th>
<th>Command</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>DAP</td>
<td>8400</td>
<td>G2</td>
<td>DIRECT ARC POWER (DAPC) 0 (OFF)</td>
</tr>
</tbody>
</table>

- Group no. 3 (= DALI group 2) switches off
- The group membership is already saved in the ballasts
- DALI Gateway simulates the switch off behavior of the group and sends KNX group address 3/4/22 with value “0” and 3/4/25 with value “0%” (both depends on fade time and parameter “Behavior Switch Off Value”)

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Diagnostic with “DALI Monitor“ and DALI USB Interface

Example: Dim group 4 down

- Press rocker of control element
  - Group address 3/4/33 with value “01” (start dim down) is sent
- ETS group monitor records telegram with group address 3/4/33 with value “01”
- DALI Gateway converts KNX group address 3/4/33 with value “01” into DALI commands
  - “DTR0=7” – send fade time (e.g. 7=5.7 sec)
  - “G3 - set fade time” – store new fade time in all ballasts of the group
  - “G3 – direct arc power level 1 (0.1% light output)” – group starts dim down to level “1”
Diagnostic with “DALI Monitor“ and DALI USB Interface

Example: Dim group 4 down

- Release rocker of control element
  → Group address 3/4/33 with value “00” (stop dim down) is sent
- ETS group monitor records telegram with group address 3/4/33 with value “00”
- DALI Gateway converts KNX group address 3/4/33 with value “00” into DALI commands
  - “DTR0=1” – send fade time (1=0.7 sec, fastest possible time)
  - “G3 - set fade time” – store new fade time in all ballasts of the group
  - “G3 – direct arc power level 106 (1.8% light output)” – group stops dim down, the DALI Gateway calculates the dim stop value and send this value “106” (to synchronize all ballasts of the group to the value 106)
- DALI Gateway sends KNX group address 3/4/35 with value “58%” (106)
Diagnostic with “DALI Monitor“ and DALI USB Interface – Example: Dim group 4 down

- Press rocker of control element
- Group address 3/4/33 with value “01” (start dim down) is sent
- DALI Gateway converts KNX group address 3/4/33 with value “01” into DALI commands
  - “DTR0=7” – send fade time (e.g. 7=5.7 sec)
  - “G3 – set fade time” – store new fade time in all ballasts of the group
  - “G3 – direct arc power level 1 (0.1% light output)” – group starts dim down to level “1”

* Values written into the memory are sent twice
Diagnostic with “DALI Monitor“ and DALI USB Interface – Example: Dim group 4 down

- Release rocker of control element
  → Group address 3/4/33 with value “00” (stop dim down) is sent

<table>
<thead>
<tr>
<th>Source Name</th>
<th>Destination Name</th>
<th>Info</th>
</tr>
</thead>
</table>

- DALI Gateway converts KNX group address 3/4/33 with value “00” into DALI commands
  - “DTR0=1” – send fade time (1=0.7 sec, fastest possible time)
  - “G3 – set fade time” – store new fade time in all ballasts of the group
  - “G3 – direct arc power level 106 (1.8% light output)” – group stops dim down, the DALI Gateway calculates the dim stop value and send this value “106” to synchronize all ballasts of the group to the value

<table>
<thead>
<tr>
<th>Line #</th>
<th>Type</th>
<th>Hex Data</th>
<th>Address</th>
<th>Command</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>Spec</td>
<td>A301</td>
<td>*</td>
<td>DTR0= 1 (0x01)</td>
</tr>
<tr>
<td>8</td>
<td>Conf</td>
<td>872E</td>
<td>G3</td>
<td>SET FADE TIME (DTR0)</td>
</tr>
<tr>
<td>9</td>
<td>Conf</td>
<td>872E</td>
<td>G3</td>
<td>SET FADE TIME (DTR0)</td>
</tr>
<tr>
<td>10</td>
<td>DAP</td>
<td>855A</td>
<td>G3</td>
<td>DIRECT ARC POWER (DAPC) 106 (1.8 %)</td>
</tr>
</tbody>
</table>

- DALI Gateway sends KNX group address 3/4/35 with value “58%” (106)

* Values written into the memory are sent twice
Diagnostic with “DALI Monitor“ and DALI USB Interface

Example: Call scene 5

- Control element sends group address 3/4/141 with value “4” (call scene 5)
- ETS group monitor records telegram with group address 3/4/141 with value “4” (activate scene 5)
- DALI Gateway converts KNX group address 3/4/141 with value “4” into DALI command “Bcast – go to scene X”
  Scene number depends on scene mapping (ETS parameter)
- The scene values and fade times are saved in the ballasts → This values are called up for a scene
- The DALI Gateway simulates the behavior of all ballasts/groups which are members of the scene and sends KNX group addresses with corresponding values (depends on fade time)
Diagnostic with “DALI Monitor” and DALI USB Interface

- Control element sends group address 3/4/141 with value “4” (call scene 5)

- DALI Gateway converts KNX group address 3/4/141 with value “4” into DALI command “Bcast – go to scene 0”
  Scene number depends on scene mapping (ETS parameter)

- The scene values are stored in the ballasts
  → The stored values are called up for a scene

- The DALI Gateway simulates the behavior of all ballasts/groups which are members of the scene and sends KNX group addresses with corresponding values (depends on fade time)

KNX scene 1…64 can be mapped to a DALI scene 1…16 (0…15), e.g. KNX scene 5 is mapped to DALI scene 1 (0)
Diagnostic with “DALI Monitor“ and DALI USB Interface

Example: “FE” – Framing Error

- A framing error exists if no clear DALI telegram is received when the DALI device is polled.

- This can occur if:
  - The DALI device does not send a DALI compliant telegram.
  - The DALI telegram was disrupted by external signal interference.
  - Several DALI devices reply and their superimposed telegrams result in an unidentifiable DALI telegram being received (DALI double addresses).

![Example Table]

The query is repeated three times.
Diagnostic with an Oscilloscope – Why?

- KNX and DALI are standardized worldwide
- The DALI Gateways DG/S are certified according to DALI-2
- DALI-2 certification brings a significantly improved interoperability
- Nevertheless, problems can occur
  - DALI Installation guidelines observed?
    The cabling and the installation of the DALI devices was not done by the KNX commissioning engineer
    → Wiring error, more than 64 DALI devices per output, permissible cable length exceeded (longer telegram runtimes)
  - DALI-2 devices installed? DALI-1 devices have been installed which do not work in accordance with the DALI standard.
    DALI-1 is based on self-declaration
    → the DALI device does not respond in the specified time

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Diagnostic with an Oscilloscope

- PC oscilloscope with USB connection, e.g.
  - From the company "Pico Technology"
  - Software “PicoScope” can decode DALI waveforms (DALI protocol is available)
  - Further information: https://www.picotech.com/library/oscilloscopes/dali-serial-protocol-decoding
- DALI uses Manchester (biphase) encoding to send the start bit and the information bits
- The nominal data rate is 1,200 bit per second, so one bit time is 833.33 µs
**Diagnostic with an Oscilloscope**

Here is a table showing the communication data between a KNX DALI Gateway and a DALI device:

<table>
<thead>
<tr>
<th>Line #</th>
<th>Type</th>
<th>Hex Data</th>
<th>Address</th>
<th>Command</th>
</tr>
</thead>
<tbody>
<tr>
<td>493</td>
<td>Query</td>
<td>7900</td>
<td>A60</td>
<td>QUERY STATUS</td>
</tr>
<tr>
<td>494</td>
<td>Query</td>
<td>7B90</td>
<td>A61</td>
<td>QUERY STATUS</td>
</tr>
<tr>
<td>495</td>
<td>Query</td>
<td>7D90</td>
<td>A62</td>
<td>QUERY STATUS</td>
</tr>
<tr>
<td>496</td>
<td>Query</td>
<td>7F90</td>
<td>A63</td>
<td>QUERY STATUS</td>
</tr>
<tr>
<td>497</td>
<td>Query</td>
<td>0190</td>
<td>A6</td>
<td>QUERY STATUS</td>
</tr>
<tr>
<td>498</td>
<td>Answer</td>
<td>00</td>
<td></td>
<td>= 0 (0x00)</td>
</tr>
<tr>
<td>499</td>
<td>Query</td>
<td>01A0</td>
<td>A6</td>
<td>QUERY ACTUAL LEVEL</td>
</tr>
<tr>
<td>500</td>
<td>Answer</td>
<td>00</td>
<td></td>
<td>= 0 (0x00)</td>
</tr>
<tr>
<td>501</td>
<td>Query</td>
<td>0390</td>
<td>A1</td>
<td>QUERY STATUS</td>
</tr>
<tr>
<td>502</td>
<td>Answer</td>
<td>04</td>
<td></td>
<td>= 4 (0x04)</td>
</tr>
<tr>
<td>503</td>
<td>Query</td>
<td>0340</td>
<td>A1</td>
<td>QUERY ACTUAL LEVEL</td>
</tr>
<tr>
<td>504</td>
<td>Answer</td>
<td>07</td>
<td></td>
<td>= 133 (0x85)</td>
</tr>
<tr>
<td>505</td>
<td>Query</td>
<td>0690</td>
<td>A2</td>
<td>QUERY STATUS</td>
</tr>
<tr>
<td>506</td>
<td>Answer</td>
<td>04</td>
<td></td>
<td>= 4 (0x04)</td>
</tr>
<tr>
<td>507</td>
<td>Query</td>
<td>0540</td>
<td>A2</td>
<td>QUERY ACTUAL LEVEL</td>
</tr>
<tr>
<td>508</td>
<td>Answer</td>
<td>FE</td>
<td></td>
<td>= 254 (0xFE)</td>
</tr>
<tr>
<td>509</td>
<td>Query</td>
<td>0790</td>
<td>A3</td>
<td>QUERY STATUS</td>
</tr>
<tr>
<td>510</td>
<td>Answer</td>
<td>04</td>
<td></td>
<td>= 4 (0x04)</td>
</tr>
<tr>
<td>511</td>
<td>Query</td>
<td>07A0</td>
<td>A3</td>
<td>QUERY ACTUAL LEVEL</td>
</tr>
</tbody>
</table>
Diagnostic with an Oscilloscope

1. Command to address 07 with data 04
   2. Bit 2 = “1”: Lamp on
   3. Command to address 07 with data A0
      4. Query actual level

   Answer with data 44

   Time between forward frame and backward frame
   2.4 …12.4 ms
Diagnostic with an Oscilloscope

DALI telegram traffic

- Typical communication
  - Forward frames sent by the DALI Gateway to the DALI devices
  - Backward frames are sent back as a response from the DALI devices to the DALI Gateway
  - The voltage level is pulled below 10V

- In the event of communication problems, the following can be checked:
  - Are there overlaid backward frames?
  - Does the DALI device pull the voltage level below 10 volts in its response?
  - Does the DALI device send the response within the specified time?
Diagnostic with an Oscilloscope

DALI telegram traffic
- The bits are bi-phased encoded:
  - Logical 1: Rising edge
  - Logical 0: Falling edge
- Nominal DALI data rate of 1,200 bit per second → one bit time is 833.33 µs
Diagnostic with an Oscilloscope

Forward frames

- Forward frames are packets sent by the DALI Gateway to the DALI devices (ballasts and emergency lighting converters)
- They have one start bit (A), eight address bits (address byte) and eight data bits (data byte)
- More details: IEC 62386 Part 102: “General requirements – Control gear”
Diagnostic with an Oscilloscope

Forward frames

- Forward frames are packets sent by the DALI Gateway to the DALI devices (ballasts and emergency lighting converters)
- They have one start bit (A), eight address bits (address byte) and eight data bits (data byte)
- More details: IEC 62386 Part 102: “General requirements – Control gear”
- The address byte is structured as follows:
  - The first address bit 7 defines “0” as a short address for individual devices or “1” for group or broadcast messages
  - The last address bit is the selector (S), which defines the following data byte with “0” as a direct arc power level or “1” as a command

<table>
<thead>
<tr>
<th>Bit 7</th>
<th>Bit 6</th>
<th>Bit 5</th>
<th>Bit 4</th>
<th>Bit 3</th>
<th>Bit 2</th>
<th>Bit 1</th>
<th>Bit 0</th>
<th>Encoding of address byte</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>6</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td></td>
<td>64 short addresses</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>16 group addresses</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td></td>
<td>Broadcast unaddressed</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
<td>Broadcast addressed</td>
</tr>
</tbody>
</table>
Diagnostic with an Oscilloscope

Forward frames
- Forward frames are packets sent by the DALI Gateway to the DALI devices (ballasts and emergency lighting converters)
- They have one start bit (A), eight address bits (address byte) and eight data bits (data byte)
- More details: IEC 62386 Part 102: “General requirements – Control gear”
- The address byte is structured as follows:
  - The first address bit 7 defines “0” as a short address for individual devices or “1” for group or broadcast messages
  - The last address bit is the selector (S), which defines the following data byte with “0” as a direct arc power level or “1” as a command
Diagnostic with an Oscilloscope

Forward frames
- Forward frames are packets sent by the DALI Gateway to the DALI devices (ballasts and emergency lighting converters)
- They have one start bit (A), eight address bits (address byte) and eight data bits (data byte)
- More details: IEC 62386 Part 102: “General requirements – Control gear”
- The data byte is structured as follows:
  - Direct arc power command (DAPC), the requested light output (0…100%)
  - Standard commands, e.g. query lamp failure (92hex), query missing short address (96hex), query status (90hex), query device type (99hex), query max level (A1hex), …
Diagnostic with an Oscilloscope

Backward frame

- A backward frame is the response packet sent by the DALI device back to the DALI Gateway
- It consists of one start bit (A) and eight data bits
- More details: IEC 62386 Part 102: “General requirements – Control gear”
Diagnostic with an Oscilloscope

Backward frame

- A backward frame is the response packet sent by the DALI device back to the DALI Gateway
- It consists of one start bit (A) and eight data bits
- More details: IEC 62386 Part 102: “General requirements – Control gear”
- Example: The addressed DALI device “13” returns the queried property value (command “Query status 90hex”) in a backward frame with a status byte “00hex”
Typical communication

- Forward frames sent by the DALI Gateway to the DALI device
- Backward frame is sent back as a response from the DALI device to the DALI Gateway
- The voltage level is pulled below 10V
Typical communication

- Forward frames sent by the DALI Gateway to the DALI device
- Backward frame is sent back as a response from the DALI device to the DALI Gateway
- The voltage level is pulled below 10V
Framing error

• Forward frames sent by the DALI Gateway to the DALI device
• No clear DALI telegram is received
• Several DALI devices reply and their superimposed telegrams result in an unidentifiable DALI telegram being received

→ DALI double addresses of device 4 (address 03)
Forward frames sent by the DALI Gateway to the DALI device

- No clear DALI telegram is received
- Several DALI devices reply and their superimposed telegrams result in an unidentifiable DALI telegram being received

→ DALI double addresses of device 4 (address 03)
Training content

- This training mainly relates to the DALI basics and properties
- Extensive training content is available online for the DALI Gateway and ABB i-bus® Tool, e.g. emergency lighting, constant light control, human centric lighting, Dim2Warm, RGBW/HSVW, sequencer, load management, operating duration, standby switch-off, partial failure, …
- Slides, tutorials and video recordings of webinars, online and practical learning sessions
  - Training & Qualification Database
  - YouTube, Channel “ABB Home and Building Automation” [https://www.youtube.com/user/ABBibusKNX](https://www.youtube.com/user/ABBibusKNX)
- Function descriptions, application guides, video tutorials, step-by-step guides:
  - Engineering Guide Database
KNX DALI Gateways – Practical knowledge about DALI – Part 2
Online Learning Session

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– ETS Application
– ABB i-bus® Tool
– Product Manual
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– Installation and Operating Instructions
– Specification Text
– …
Software Repository

- Excel list in German and English
- Link to general product information
- Search for a KNX product and the corresponding software (firmware, ETS application) will be displayed
- Current firmware of Welcome IP and free@home devices
- A direct download of this software is possible via a link
- Historical ETS applications can also be downloaded (database for ETS App “Reconstruction Tool”)

- www.abb.com/KNX
  → Additional materials
  → Downloads for KNX
  → Software Repository
Training Material

Training & Qualification Database

- The database contains extensive training content
  - Webinar, Learning Sessions, ... slides and videos
  - Presentations
  - Video tutorials
  - and more …
  - https://go.abb/ba-training
  - www.abb.com/knx (→ Services & Tools → Training and Qualification → Training Database)

YouTube

- Channel “ABB Home and Building Automation”
  - https://www.youtube.com/user/ABBibusKNX
Light + Building will take place in March 2022

Onsite + digital: here we go

- At Light+Building the industry presents every two years the latest products for the fields of lighting, electrical engineering and home and building automation
- Light+Building opens in Frankfurt from 13th to 18th March 2022
- The new Light+Building digital additions functions will also be available at the same time and beyond
- We plan our participation in general as a hybrid event, so that customers can join remotely
- You will find ABB and BUSCH-JAEGER booth in the NEW hall 12.0
- More information to come before the end of this year
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