Digital Illumination Interface Alliance

# DiiA Specification

## DALI Part 253 – Diagnostics & Maintenance

(Device Type 52)

Version 1.1

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For any further explanation of the contents of this document, or in case of any perceived inconsistency or ambiguity of interpretation, please contact the DiiA:

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## Document History

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| August 2018 | | First publication |
| 22 October 2019 | V1.1 | Several locations made mandatory (counters, flags, gear temperature, light source voltage/current measurements). Formatting corrections for publication. |

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# DALI Part 253 – Diagnostics & Maintenance

## 1 Scope

This standard specifies the information related to diagnostics and maintenance information accessible through memory banks. This standard builds on the Digital Addressable Lighting Interface as specified in the IEC62386 series of standards, by adding specific requirements to address data exchange. The information given for light source in this standard is LED light source specific.

## 2 References

### 2.1 Normative references

The following normative documents are adopted, in whole or in part as indicated, in this Standards Publication. The latest edition of the publication applies (including amendments).

IEC62386-102:2014, Digital addressable lighting interface – Part 102: General requirements – control gear

IEC62386-102:2014/AMD1:2018, Digital addressable lighting interface – Part 102: General requirements – control gear

IEC62722-2-1:2014, Luminaire performance - Part 2-1: Particular requirements for LED luminaires

### 2.2 Informative references

This standard is intended to be used in conjunction with the following publications. The latest edition of the publication applies (including amendments).

None

## 3 Terms and definitions

### 3.1 General

For the purposes of this document, the terms and definitions given in IEC 62386-102:2014 and IEC 62386-102:2014/AMD1:2018, Clause 3 and the following apply.

### 3.2 Light source

LED light source

### 3.3 LampOn bit

LampOn bit as defined in IEC62386-102:2014

### 3.4 “controlGearFailure”

Variable “*controlGearFailure*” as defined in IEC62386-102:2014

### 3.5 "lampFailure"

Variable "*lampFailure*" as defined in IEC62386-102:2014

### 3.6 NVM-RO

Non-Volatile Memory Read-Only (cannot be changed through DALI)

### 3.7 NVM-RW

Non-Volatile Memory Read-Write

### 3.8 ROM

Read Only Memory (cannot be changed by the control gear)

### 3.9 RAM-RO

Random Access Memory Read-Only (cannot be changed through DALI)

### 3.10 RAM-RW

Random Access Memory Read-Write

## 4 General

### 4.1 General

The requirements of IEC 62386-102:2014 and IEC 62386-102:2014/AMD1:2018, Clause 4 apply, with the restrictions, changes and additions identified below.

### 4.2 Version number

In 4.2 of IEC 62386-102:2014 and IEC 62386-102:2014/AMD1:2018, "102" shall be replaced by "252", "version number" shall be replaced by "extended version number" and "*versionNumber*" shall be replaced by "*extendedVersionNumber*".

### 4.3 Restricting device type support

It is recommended that a control gear supporting device type 52 according to this document, should not support device type 16 (IEC62386-217: Particular requirements for control gear - Thermal gear) and device type 21 (IEC62386-Part 222: Particular requirements for control gear - Thermal lamp protection).

## 5 Electrical specification

The requirements of IEC 62386-102:2014 and IEC 62386-102:2014/AMD1:2018, Clause 5 apply.

## 6 Interface power supply

The requirements of IEC 62386-102:2014 and IEC 62386-102:2014/AMD1:2018, Clause 6 apply.

## 7 Transmission protocol structure

The requirements of IEC 62386-102:2014 and IEC 62386-102:2014/AMD1:2018, Clause 7 apply.

# 8 Timing

The requirements of IEC 62386-102:2014 and IEC 62386-102:2014/AMD1:2018, Clause 8 apply.

# 9 Method of operation

## 9.1 General

The requirements of IEC 62386-102:2014 and IEC 62386-102:2014/AMD1:2018, Clause 9 apply with the following additions.

## 9.2 Memory banks

### 9.2.1 General

The requirements of Clause 9.10 of IEC62386-102:2014 and IEC 62386-102:2014/AMD1:2018 apply with the following additions and changes.

This standard adds Read-Only and Read-Write attributes to locations in a memory bank as per the following table.

**Table 1 – Memory bank Read-Only and Read-Write attributes**

| **Memory Type** | **Accessibility via DALI bus**<br>**RO: Read-Only**<br>**RW: Read-Write** | **V: volatile (reset at power down)**<br>**NV: non-volatile** | **May be changed autonomously by the control gear during run time** | **Description** |
|---|---|---|---|---|
| ROM | RO | NV | No | ROM as defined in IEC62386-102:2014.<br>For all fixed value that will not change during run time of control gear.<br>Note: ROM is RO by its nature.<br>A ROM value may change if control gear is programmed during production. |
| RAM-RO | RO | V | Yes | For all measured values and flags that will be reset at power down. |
| RAM-RW | RW | V | Yes | For all input values that will be reset at power down. |
| NVM-RO | RO | NV | Yes | NVM as defined in IEC62386-102:2014 but with additional specification RO<br><br>For all counter values.<br>No reset at power down. |
| NVM-RW | RW | NV | Yes | NVM as defined in IEC62386-102:2014<br><br>For all input values that are non-volatile. |

### 9.2.1 Memory bank writing

Requirements of Clause 9.10.5 “Memory bank writing” in IEC62386-102:2014 apply with the following additions and changes.

To ensure consistent data when writing a multi-byte value into a memory bank, a RAM buffer shall be used such that the buffer stores the temporary bytes being written until the LSB of the multi-byte value is written, at which point the complete value is written to the memory bank locations.

NOTE: The contents of buffers used to store temporary bytes for multi-byte writing may be lost when a write operation is started to any other multi-byte value in the same memory bank, or during a power-cycle, or as a result of execution of RESET MEMORY BANK.

All writable memory locations other than location 0x02 shall be lockable.

For writable memory locations, unless specified otherwise in the memory bank table, if any of the following conditions are true when attempting to write to a location, the result shall be the same behaviour as if the memory location is not implemented:

- an attempt to write a value outside of the permitted range, or
- an attempt to write a value to a lockable memory location other than the lock byte, when the value of the lock byte is not 0x55, or
- an attempt to write a value to a protectable writable memory location that is currently protected.

Note: This means that when any of the above conditions apply, there will be NO REPLY to the WRITE MEMORY LOCATION command.

### 9.2.2 Memory bank reading

Requirements of Clause 9.11.4 “Memory bank reading” in IEC62386-102:2014 and IEC 62386-102:2014/AMD1:2018 apply with the following additions and changes.

A selected memory bank location can be read by means of command “READ MEMORY LOCATION (DTR1, DTR0)”. The answer shall be the value of the byte at the addressed memory bank location.

Reading from a multi-byte location shall reply with the stored value, and not values from the write-buffer that is used to buffer values before the complete value is written to memory.

If the selected memory bank is not implemented, the command shall be ignored. If the memory bank exists, and selected memory bank location is not implemented, the answer shall be MASK.

**Table 2 – MASK values for various data types**

| Data type: | MASK value |
|---|---|
| 1 Byte (unsigned char) | 0xFF |
| 2 Bytes (unsigned int): | 0xFFFF |
| 3 Bytes (unsigned int24): | 0xFFFFFF |
| 4 Bytes (unsigned long): | 0xFFFFFFFF |
| 6 Bytes (unsigned int48) | 0xFFFFFFFFFFFF |
| 1 Bytes (signed char): | 0x7F |
| 2 Bytes (signed int): | 0x7FFF |

| | |
|---|---|
| 4 Bytes (signed long): | 0x7FFFFFFF |

### 9.2.3 Latching of a multi-byte value for reading

To ensure consistent data when reading a multi-byte value from a memory bank, it is required that a mechanism be implemented that latches all bytes of the multi-byte value when the first byte of the multi-byte value is read and holds them latched until the first byte of any multi-byte or single byte value is read.

### 9.2.4 Latching of a full memory bank for reading

This standard specifies an additional method that enables latching of a full memory bank. The lock byte is used to control the memory bank latch as follows:

If the lock byte contains a value other than 0xAA, writing the following values to the lock byte shall cause the stated result:

- 0xAA: All locations in the memory bank shall be latched and shall not change until the lock byte is written, or a power cycle occurs.
- Other values: The memory bank latch is not affected.

If the lock byte contains the value 0xAA, writing the following values to the lock byte shall cause the stated result:

- 0xAA: All locations in the memory bank shall be re-latched (updated) and shall not change again until the lock byte is written, or a power cycle occurs.
- Other values: The memory bank latch shall be removed. Memory reads shall result in the latest values being returned.

An attempt to write to any location other than the lock byte of a latched memory bank shall result in the same behaviour as if the memory location is not implemented.

Latching of a full memory bank shall not affect reading or writing of other memory banks.

NOTE: If controller A latches a full memory bank 202, controller B needs to be aware that memory bank 202 is latched. When controller B reads from memory bank 202, B will get the latched data. Controller B can find out as B received the command to write the lock byte with 202 or B could read the lock byte to be on the safe side.

### 9.2.5 Memory bank values that are temporarily not available

In special situations certain memory bank value may not be available temporarily. Read access results in a reserved TMASK value defined for various data types in the table below. Except in fault conditions, the control gear shall provide a valid value within 30 seconds. If TMASK is returned repeatedly over a period of time, the controller may deduce there is a fault in the control gear.

**Table 3 – TMASK values for various data types**

| Data type: | TMASK value |
|---|---|
| 1 Byte (unsigned char) | 0xFE |
| 2 Bytes (unsigned int): | 0xFFFE |
| 3 Bytes (unsigned int24): | 0xFFFFFE |

| | |
|---|---|
| 4 Bytes (unsigned long): | 0xFFFFFFFE |
| 6 Bytes (unsigned int48) | 0xFFFFFFFFFFFE |
| 1 Bytes (signed char): | 0x7E |
| 2 Bytes (signed int): | 0x7FFE |
| 4 Bytes (signed long): | 0x7FFFFFFE |

NOTE Example: after an external supply power cycle, a memory bank value may not be available temporarily due to the settling time of digital filters. In this case TMASK should be indicated.

### 9.2.6 Vendor-specific protection

A manufacturer may provide a vendor-specific means to prevent read and/or write access to individual memory locations. Memory bank locations featuring this vendor-specific protection mechanism are marked as: "(protectable)".

The read/write properties of such (protectable) locations are set by the vendor-specific protection mechanism and can feature:

1) **Write Protection:** Locations cannot be overwritten
2) **Read Protection:** Read access results in a reserved MASK value.

If memory bank locations are marked with "(protectable)" and if Read Protection is active, the implementation or provision of the related feature is not mandatory for the manufacturer.

NOTE Read Protection may be active by default. If Read Protection is active this means that the related feature may not be implemented and there is no obligation for the manufacturer to provide a mechanism to deactivate Read Protection.

For protectable writable memory locations that are currently protected, an attempt to write a value shall result in the same behaviour as if the memory location is not implemented.

Note: This means NO REPLY to the WRITE MEMORY LOCATION command when attempting to write to a write-protected location.

### 9.2.7 Accuracy of measurements

The accuracy of measurements for the values in the memory banks is determined by the manufacturer and is not specified in this standard.

### 9.2.8 Rounding of measurement values

Rounding of measurement values shall be performed as follows: Rounding to the nearest integer and round 0.5 up.

### 9.2.9 Refresh rate of memory bank values

The minimum refresh rate of all memory bank values shall be 1 refresh cycle in 30 s. The minimum refresh rate shall be valid if the control gear is powered regardless of the status of lampOn.

### 9.2.10 No overflow of counters

Counters shall not overflow. Their maximum value shall be MASK -2.

### 9.2.11 Failure condition flags and failure condition counters related to control gear

Table 4 shows the failure condition flags and failure condition counters that are related to control gear failure conditions.

Table 4 – Failure condition flags and failure condition counters related to control gear

| Index of failure condition flag | Name of failure condition flag | Name of related failure condition counter |
|---|---|---|
| 0 | ControlGearOverallFailureCondition | ControlGearOverallFailureConditionCounter[1] |
| 1 | ControlGearExternalSupplyUnderVoltage | ControlGearExternalSupplyUnderVoltageCounter |
| 2 | ControlGearExternalSupplyOverVoltage | ControlGearExternalSupplyOverVoltageCounter |
| 3 | ControlGearOutputPowerLimitation | ControlGearOutputPowerLimitationCounter |
| 4 | ControlGearThermalDerating | ControlGearThermalDeratingCounter |
| 5 | ControlGearThermalShutdown | ControlGearThermalShutdownCounter |

[1] NOTE: As described for all failure counters described in this table, this value only increments when its own overall failure condition flag transitions from 0 to 1.

A failure condition counter counts up if a 0 to 1 transitions of the failure condition flag that is related to the counter occurs.

Read Protection shall be activated or de-activated always for the bundle of related failure condition flag and failure condition counter.

### 9.2.12 Behaviour of "controlGearFailure"

The behaviour of "controlGearFailure" shall be as defined in IEC62386-102:2014 with the following extensions:

"controlGearFailure" shall also be set to TRUE if one of the failure condition flags shown in Table 4 with index > 0 is TRUE.

If the value of a failure condition flag of Table 4 is the MASK value the flag shall not affect "controlGearFailure".

### 9.2.13 Failure condition flags and failure condition counters related to light source

Table 5 shows the failure condition flags and failure condition counters that are related to light source failure conditions.

Table 5 – Failure condition flags and failure condition counters related to light source

| Index of failure condition flag | Name of failure condition flag | Name of related failure condition counter |
|---|---|---|
| 0 | LightSourceOverallFailureCondition | LightSourceOverallFailureConditionCounter[1] |
| 1 | LightSourceOpenCircuit | LightSourceOpenCircuitCounter |
| 2 | LightSourceShortCircuit | LightSourceShortCircuitCounter |
| 3 | LightSourceThermalDerating | LightSourceThermalDeratingCounter |
| 4 | LightSourceThermalShutdown | LightSourceThermalShutdownCounter |

[1] NOTE: As described for all failure counters described in this table, this value only increments when its own overall failure condition flag transitions from 0 to 1.

A failure condition counter counts up if a 0 to 1 transitions of the failure condition flag that is related to the counter occurs.

Read Protection shall be activated or de-activated always for the bundle of related failure condition flag and failure condition counter.

### 9.2.14 Behaviour of "lampFailure"

The behaviour of "lampFailure" shall be as defined in IEC62386-102:2014 with the following extensions:
"lampFailure" shall also be set to TRUE if one of the failure condition flags shown in Table 5 with index > 0 is TRUE.
If the value of a failure condition flag of Table 5 is the MASK value the flag shall not affect "lampFailure".

### 9.2.15 Hold off time for failure condition flags

To avoid a high frequency fluctuation of failure condition flags the set and reset mechanism for the flag shall include a hold off time of at least 1 s that will start after every alternation of the flag. During the hold off time the state of the flag shall be stable.

NOTE E.g. if ControlGearThermalShutdown was set to 1 by high temperature it can stay at this level even 20 minutes after temperature was reduced to normal range due to the implemented hold off time.

NOTE The hold off time may be realised by using a hysteretic behaviour of the flag.

### 9.2.16 Memory bank 205, control gear diagnostics and maintenance (Mandatory)

The memory bank defined under this sub clause provides diagnostics and maintenance information related to the control gear.

| Address | Description | Default value (factory) | RESET value[a] | Memory type |
|---|---|---|---|---|
| 0x00 | Address of last addressable memory location | 0x1C | No change | ROM |
| 0x01 | Indicator byte | Manufacturer specific | Manufacturer specific | Manufacturer specific |
| 0x02 | Lock byte<br>Lockable bytes in the memory bank shall be read-only while the lock byte has a value different from 0x55. | 0xFF | 0xFF[b] | RAM-RW |
| 0x03 | Version of the memory bank | 0x01 | No change | ROM |
| 0x04 | ControlGearOperatingTime (MSB) | 0x00 | No change | NVM-RO |
| 0x05 | ControlGearOperatingTime | 0x00 | No change | NVM-RO |
| 0x06 | ControlGearOperatingTime | 0x00 | No change | NVM-RO |
| 0x07 | ControlGearOperatingTime (LSB)<br>Range of validity: [0,0xFF FF FF FD], TMASK<br>Scaling factor and unit: 1 s<br><br>Counts the control gear operating time in seconds if the control gear is powered regardless of the status of lampOn bit. | 0x00 | No change | NVM-RO |
| 0x08 | ControlGearStartCounter (MSB) | 0x00 | No change | NVM-RO |
| 0x09 | ControlGearStartCounter | 0x00 | No change | NVM-RO |
| 0x0A | ControlGearStartCounter (LSB)<br>Range of validity: [0,0xFF FF FD], TMASK<br><br>Counts the number of control gear starts that are induced by a power cycle of the external supply. A power cycle shall be counted if the power on time is at least 600ms. | 0x00 | No change | NVM-RO |
| 0x0B | ControlGearExternalSupplyVoltage (MSB) | c | No change | RAM-RO |
| 0x0C | ControlGearExternalSupplyVoltage (LSB)<br>Range of validity: [0,0xFF FD], TMASK, MASK<br>Scaling factor and unit: 0.1 Vrms<br><br>RMS value of external supply voltage | c | No change | RAM-RO (protectable)[d] |
| 0x0D | ControlGearExternalSupplyVoltageFrequency<br>Range of validity: [0,0xFD], TMASK, MASK<br>Scaling factor and unit: 1 Hz<br><br>Frequency of external supply voltage.<br>Indication as follows: 0 in case of 0 Hz (pure DC or rectified AC voltage).<br><br>NOTE Examples for frequency indication:<br>17 in case of 16,7 Hz<br>50 in case of 50 Hz<br>60 in case of 60 Hz | c | No change | RAM-RO (protectable)[d] |
| 0x0E | ControlGearPowerFactor<br>Range of validity: [0,100], TMASK, MASK<br>Scaling factor and unit: 0.01<br><br>NOTE ControlGearPowerFactor = 100 means: the control gear has a power factor of 1.00 | c | No change | RAM-RO (protectable)[d] |

| Address | Description | Default value (factory) | RESET value[a] | Memory type |
|---|---|---|---|---|
| 0x0F | ControlGearOverallFailureCondition<br>Range of validity: [0,1], TMASK<br><br>Failure condition flag indication as follows:<br>ControlGearOverallFailureCondition reflects the status of “controlGearFailure”. | c | No change | RAM-RO |
| 0x10 | ControlGearOverallFailureConditionCounter<br>Range of validity: [0,0xFD], TMASK | 0x00 | 0x00[e] | NVM-RO |
| 0x11 | ControlGearExternalSupplyUndervoltage<br>Range of validity: [0,1], TMASK, MASK<br><br>Failure condition flag indication as follows:<br>ControlGearExternalSupplyUndervoltage = 1 if ControlGearExternalSupplyVoltage < ControlGearExternalSupplyUndervoltage threshold.<br>Otherwise: ControlGearExternalSupplyUndervoltage = 0.<br><br>ControlGearExternalSupplyUndervoltage threshold shall fulfil the following conditions:<br>ControlGearExternalSupplyUndervoltage threshold shall be lower than the lower end of the specified input voltage range of the control gear and the value of the ControlGearExternalSupplyUndervoltage threshold is such that lifetime and/or performance of the control gear could be affected if the ControlGearExternalSupplyVoltageis lower than the threshold.<br><br>NOTE Two different thresholds can be implemented for AC and for DC supply voltage.<br>Example:<br>Control gear datasheet:<br>Nominal input voltage: 220 – 240 V<br>Input voltage ac: 198 – 264 V<br>Input voltage dc: 176 – 276 V | c | No change | RAM-RO (protectable)[d] |
| 0x12 | ControlGearExternalSupplyUndervoltageCounter<br>Range of validity: [0,0xFD], TMASK, MASK | 0x00 | 0x00[e] | NVM-RO (protectable)[d] |

| Address | Description | Default value (factory) | RESET value[a] | Memory type |
|---|---|---|---|---|
| 0x13 | ControlGearExternalSupplyOvervoltage<br>Range of validity: [0,1], TMASK, MASK<br><br>Failure condition flag indication as follows:<br>ControlGearExternalSupplyOvervoltage = 1 if ControlGearExternalSupplyVoltage > ControlGearExternalSupplyOvervoltage threshold.<br>Otherwise: ControlGearExternalSupplyOvervoltage = 0.<br><br>ControlGearExternalSupplyOvervoltage threshold shall fulfil the following conditions:<br>ControlGearExternalSupplyOvervoltage threshold shall be higher than the higher end of the specified input voltage range of the control gear and the value of the ControlGearExternalSupplyOvervoltage threshold is such that lifetime and/or performance of the control gear could be affected if the ControlGearExternalSupplyVoltage is higher than the threshold.<br><br>NOTE Two different thresholds can be implemented for AC and for DC supply voltage.<br>Example:<br>Control gear datasheet:<br>Nominal input voltage: 220 – 240 V<br>Input voltage ac: 198 – 264 V<br>Input voltage dc: 176 – 276 V | c | No change | RAM-RO (protectable)[d] |
| 0x14 | ControlGearExternalSupplyOvervoltageCounter<br>Range of validity: [0,0xFD], TMASK, MASK | 0x00 | 0x00[e] | NVM-RO (protectable)[d] |
| 0x15 | ControlGearOutputPowerLimitation<br>Range of validity: [0,1], TMASK, MASK<br><br>Failure condition flag indication as follows:<br>ControlGearOutputPowerLimitation = 1 if control gear output power > ControlGearOutputPowerLimitation threshold.<br>Otherwise: ControlGearOutputPowerLimitation = 0.<br><br>ControlGearOutputPowerLimitation threshold represents the output power limit of the control gear.<br><br>NOTE ControlGearOutputPowerLimitation = 1 if the control gear limits the output current due to its internal power limitation. This is the case if the LED voltage multiplied with the control gear output current is higher than the output power limit of the control gear. | c | No change | RAM-RO (protectable)[d] |
| 0x16 | ControlGearOutputPowerLimitationCounter<br>Range of validity: [0,0xFD], TMASK, MASK | 0x00 | 0x00[e] | NVM-RO (protectable)[d] |

| Address | Description | Default value (factory) | RESET value[a] | Memory type |
|---|---|---|---|---|
| 0x17 | ControlGearThermalDerating<br>Range of validity: [0,1], TMASK, MASK<br><br>Failure condition flag indication as follows:<br>ControlGearThermalDerating = 1 if<br>ControlGearTemperature > ControlGearThermalDerating threshold.<br>Otherwise: ControlGearThermalDerating = 0.<br><br>ControlGearThermalDerating threshold shall fulfil the following conditions:<br>The value of the ControlGearThermalDerating threshold is such that lifetime and/or performance of the control gear could be affected if the ControlGearTemperature is higher than the threshold.<br>If ControlGearThermalDerating = 1 the output current of the control gear may be reduced. | c | No change | RAM-RO (protectable)[d] |
| 0x18 | ControlGearThermalDeratingCounter<br>Range of validity: [0,0xFD], TMASK, MASK | 0x00 | 0x00[e] | NVM-RO (protectable)[d] |
| 0x19 | ControlGearThermalShutdown<br>Range of validity: [0,1], TMASK, MASK<br><br>Failure condition flag indication as follows:<br>ControlGearThermalShutdown = 1 if<br>ControlGearTemperature > ControlGearThermalShutdown threshold.<br>Otherwise: ControlGearThermalShutdown = 0.<br><br>ControlGearThermalShutdown threshold shall fulfil the following conditions:<br>The value of the ControlGearThermalShutdown threshold is such that lifetime and/or performance of the control gear could be affected if the ControlGearTemperature is higher than the threshold.<br>ControlGearThermalShutdown threshold shall be higher than ControlGearThermalDerating threshold.<br>If ControlGearThermalShutdown = 1 the output current of the control gear shall be reduced to zero. | c | No change | RAM-RO (protectable)[d] |
| 0x1A | ControlGearThermalShutdownCounter<br>Range of validity: [0,0xFD], TMASK, MASK | 0x00 | 0x00[e] | NVM-RO (protectable)[d] |
| 0x1B | ControlGearTemperature<br>Range of validity: [0,0xFD], TMASK<br>Scaling factor and unit: 1 °C<br>Offset value: 60<br><br>Indicates the internal temperature of the control gear.<br>NOTE Example: A value of 60 means 0 °C, a value of 0 means – 60 °C.<br>NOTE The temperature indicated by ControlGearTemperature is an internal temperature and may be different from the Tc temperature. | c | No change | RAM-RO |

| Address | Description | Default value (factory) | RESET value[a] | Memory type |
|---|---|---|---|---|
| 0x1C | ControlGearOutputCurrentPercent<br>Range of validity: [0,100], TMASK<br>Scaling factor and unit: 1 %<br><br>Control gear output current in % related to the nominal output current setting of the control gear.<br>ControlGearOutputCurrentPercent shall include all control gear internal reductions of output current except reduction by constant lumen functionality.<br><br>NOTE Example:<br>ControlGearOutputCurrentPercent includes the following reductions of output current:<br>- Reduction due to external supply over/under voltage<br>- Reduction due to power limitation<br>- Reduction due to thermal overload of control gear<br>- Reduction due to thermal overload of light source<br>ControlGearOutputCurrentPercent excludes the following changes of nominal output current:<br>- Changes due to constant lumen functionality | [c] | No change | RAM-RO |

[a] Reset value after “RESET MEMORY BANK”.

[b] Also used as power on value.

[c] The value should reflect the actual situation as soon as possible.

[d] This field is read protectable.

[e] This variable can be protected against reset by a manufacturer specific method. If this is the case, this variable shall not change upon execution of “RESET MEMORY BANK”.

### 9.2.17 Memory bank 206, light source diagnostics and maintenance (Mandatory)

The memory bank defined under this sub clause provides diagnostics and maintenance information related to the light source.

| Address | Description | Default value (factory) | RESET value[a] | Memory type |
|---|---|---|---|---|
| 0x00 | Address of last addressable memory location | 0x20 | No change | ROM |
| 0x01 | Indicator byte | Manufacturer specific | Manufacturer specific | Manufacturer specific |
| 0x02 | Lock byte<br>Lockable bytes in the memory bank shall be read-only while the lock byte has a value different from 0x55. | 0xFF | 0xFF[b] | RAM-RW |
| 0x03 | Version of the memory bank | 0x01 | No change | ROM |
| 0x04 | LightSourceStartCounterResettable (MSB) | 0x00 | No change | NVM-RW |
| 0x05 | LightSourceStartCounterResettable | 0x00 | No change | NVM-RW |
| 0x06 | LightSourceStartCounterResettable (LSB)<br>Range of validity: [0,0xFF FF FD] , TMASK<br><br>Counts the starts of the light source.<br>Counts one step up for every 0 to 1 transition of the lampOn bit.<br>An attempt to write a value ≥ (MASK-1) to LightSourceStartCounterResettable shall result in the same behaviour as if the memory location is not implemented.<br>Note: This means NO REPLY to the WRITE MEMORY LOCATION command when attempting to write a value ≥ (MASK-1) to LightSourceStartCounterResettable. For this case, NO REPLY occurs when writing to the final byte of this multi-byte value (normally the LSB). | 0x00 | No change | NVM-RW |
| 0x07 | LightSourceStartCounter (MSB) | 0x00 | No change | NVM-RO |
| 0x08 | LightSourceStartCounter | 0x00 | No change | NVM-RO |
| 0x09 | LightSourceStartCounter (LSB)<br>Range of validity: [0,0xFF FF FD], TMASK<br><br>Counts the starts of the light source.<br>Counts one step up for every 0 to 1 transition of the lampOn bit. | 0x00 | No change | NVM-RO |
| 0x0A | LightSourceOnTimeResettable (MSB) | 0x00 | No change | NVM-RW |
| 0x0B | LightSourceOnTimeResettable | 0x00 | No change | NVM-RW |
| 0x0C | LightSourceOnTimeResettable | 0x00 | No change | NVM-RW |
| 0x0D | LightSourceOnTimeResettable (LSB)<br>Range of validity: [0,0xFF FF FF FD], TMASK<br>Scaling factor and unit: 1 s<br><br>Counts the light source operating time in seconds.<br>Counts up during the time where lampOn bit = 1.<br>An attempt to write a value ≥ (MASK-1) to LightSourceOnTimeResettable shall result in the same behaviour as if the memory location is not implemented.<br>Note: This means NO REPLY to the WRITE MEMORY LOCATION command when attempting to write a value ≥ (MASK-1) to LightSourceOnTimeResettable. For this case, NO REPLY occurs when writing to the final byte of this multi-byte value (normally the LSB). | 0x00 | No change | NVM-RW |
| 0x0E | LightSourceOnTime (MSB) | 0x00 | No change | NVM-RO |
| 0x0F | LightSourceOnTime | 0x00 | No change | NVM-RO |

| Address | Description | Default value (factory) | RESET value[a] | Memory type |
|---|---|---|---|---|
| 0x10 | LightSourceOnTime | 0x00 | No change | NVM-RO |
| 0x11 | LightSourceOnTime (LSB)<br>Range of validity: [0,0xFF FF FF FD], TMASK<br>Scaling factor and unit: 1 s<br><br>Counts the light source operating time in seconds.<br>Counts up during the time where lampOn bit = 1. | 0x00 | No change | NVM-RO |
| 0x12 | LightSourceVoltage (MSB) | c | No change | RAM-RO |
| 0x13 | LightSourceVoltage (LSB)<br>Range of validity: [0,0xFF FD], TMASK<br>Scaling factor and unit: 0.1 V<br><br>Indicates the actual control gear output voltage | c | No change | RAM-RO |
| 0x14 | LightSourceCurrent (MSB) | c | No change | RAM-RO |
| 0x15 | LightSourceCurrent (LSB)<br>Range of validity: [0,0xFF FD], TMASK<br>Scaling factor and unit: 0.001 A<br><br>Indicates the actual control gear output current | c | No change | RAM-RO |
| 0x16 | LightSourceOverallFailureCondition<br>Range of validity: [0,1], TMASK<br><br>Failure condition flag indication as follows:<br>LightSourceOverallFailureCondition reflects the status of “lampFailure”. | c | No change | RAM-RO |
| 0x17 | LightSourceOverallFailureConditionCounter<br>Range of validity: [0,0xFD], TMASK | 0x00 | 0x00[e] | NVM-RO |
| 0x18 | LightSourceShortCircuit<br>Range of validity: [0,1], TMASK, MASK<br><br>Failure condition flag indication as follows:<br>LightSourceShortCircuit = 1 if the light source has a lamp failure with short circuit according to QUERY LAMP FAILURE defined in IEC62386-102:2014.<br>Otherwise: LightSourceShortCircuit = 0 | c | No change | RAM-RO (protectable)[d] |
| 0x19 | LightSourceShortCircuitCounter<br>Range of validity: [0,0xFD], TMASK, MASK | 0x00 | 0x00[e] | NVM-RO (protectable)[d] |
| 0x1A | LightSourceOpenCircuit<br>Range of validity: [0,1], TMASK, MASK<br><br>Failure condition flag indication as follows:<br>LightSourceOpenCircuit = 1 if the light source has a lamp failure with open circuit according to QUERY LAMP FAILURE defined in IEC62386-102:2014.<br>Otherwise: LightSourceOpenCircuit = 0 | c | No change | RAM-RO (protectable)[d] |
| 0x1B | LightSourceOpenCircuitCounter<br>Range of validity: [0,0xFD], TMASK, MASK | 0x00 | 0x00[e] | NVM-RO (protectable)[d] |

| Address | Description | Default value (factory) | RESET value[a] | Memory type |
|---|---|---|---|---|
| 0x1C | LightSourceThermalDerating<br>Range of validity: [0,1], TMASK, MASK<br><br>Failure condition flag indication as follows:<br>LightSourceThermalDerating = 1 if<br>LightSourceTemperature > LightSourceThermalDerating threshold.<br>Otherwise:<br>LightSourceThermalDerating = 0.<br>LightSourceThermalDerating threshold shall fulfil the following conditions:<br>The value of the LightSourceThermalDerating threshold is such that lifetime and/or performance of the light source could be affected if the LightSourceTemperature is higher than the threshold.<br>If LightSourceThermalDerating = 1 the output current of the control gear may be reduced. | c | No change | RAM-RO (protectable)[d] |
| 0x1D | LightSourceThermalDeratingCounter<br>Range of validity: [0,0xFD], TMASK, MASK | 0x00 | 0x00[e] | NVM-RO (protectable)[d] |
| 0x1E | LightSourceThermalShutdown<br>Range of validity: [0,1], TMASK, MASK<br><br>Failure condition flag indication as follows:<br>LightSourceThermalShutdown = 1 if<br>control gear temperature > LightSourceThermalShutdown threshold.<br>Otherwise:<br>LightSourceThermalShutdown = 0.<br><br>LightSourceThermalShutdown threshold shall fulfil the following conditions:<br>The value of the LightSourceThermalShutdown threshold is such that lifetime and/or performance of the light source could be affected if the LightSourceTemperature is higher than the threshold.<br>LightSourceThermalShutdown threshold shall be higher than LightSourceThermalDerating threshold.<br>If LightSourceThermalShutdown = 1 the output current of the control gear shall be reduced to zero. | c | No change | RAM-RO (protectable)[d] |
| 0x1F | LightSourceThermalShutdownCounter<br>Range of validity: [0,0xFD], TMASK, MASK | 0x00 | 0x00[e] | NVM-RO (protectable)[d] |
| 0x20 | LightSourceTemperature<br>Range of validity: [0,0xFD], TMASK, MASK<br>Scaling factor and unit: 1 °C<br>Offset value: 60<br><br>Indicates the temperature of the light source.<br><br>NOTE Example: A value of 60 means 0 °C, a value of 0 menas – 60 °C.<br>NOTE The temperature should be measured by an external sensor that is thermaly coupled to the light source.<br>NOTE The interface between sensor and controlgear is manufacturer specific and is configured in a manufacturer specific way. | c | No change | RAM-RO (protectable)[d] |

| Address | Description | Default value (factory) | RESET value[a] | Memory type |
|---|---|---|---|---|

[a] Reset value after “RESET MEMORY BANK”.

[b] Also used as power on value.

[c] The value should reflect the actual situation as soon as possible.

[d] This field is read protectable.

[e] This variable can be protected against reset by a manufacturer specific method. If this is the case, this variable shall not change upon execution of “RESET MEMORY BANK”.

### 9.2.18 Memory bank 207, luminaire maintenance data (Mandatory)

The memory bank defined under this sub clause provides information to enable predictive maintenance of the luminaire.

NOTE This memory bank is an extension to the memory bank 1. The parameters to be written into memory bank 207 are luminaire data and should be provided by the luminaire manufacturer.

| Address | Description | Default value (factory) | RESET value[a] | Memory type |
|---|---|---|---|---|
| 0x00 | Address of last addressable memory location | 0x07 | No change | ROM |
| 0x01 | Indicator byte | Manufacturer specific | Manufacturer specific | Manufacturer specific |
| 0x02 | Lock byte<br>Lockable bytes in the memory bank shall be read-only while the lock byte has a value different from 0x55. | 0xFF | 0xFF[b] | RAM-RW |
| 0x03 | Version of the memory bank | 0x01 | No change | ROM |
| 0x04 | RatedMedianUsefulLifeOfLuminaire<br>Range of validity: [0,0xFD], TMASK, MASK<br>Scaling factor and unit: 1000 h<br>MASK = unknown.<br>The parameter represents the rated median useful life time of the luminaire (including light source and other components) as defined in IEC62722-2-1:2014.<br>It is based on the L80/B50 criteria @ tq = 25°C<br>tq: rated ambient temperature of the luminaire as defined in IEC62722-2-1:2014.<br><br>NOTE A value of 50 means 50000 h.<br>NOTE RatedMedianUsefulLifeOfLuminaire represents the rated median useful life time of the luminaire including light source, control gear and other components. | 0xFF | No change | NVM-RW (protectable)[c] |
| 0x05 | InternalControlGearReferenceTemperature<br>Range of validity: [0,0xFD], TMASK, MASK<br>Scaling factor and unit: 1 °C<br>Offset value: 60<br>MASK = unknown.<br>NOTE Example: A value of 60 means 0 °C, a value of 0 means – 60 °C.<br><br>The parameter represent the internal control gear reference temperature.<br>The value is derived by the luminaire manufacturer by measuring the value ControlGearTemperature at tq = 25°C, at rated luminaire power (at 100% dimming level).<br>tq: rated ambient temperature of the luminaire as defined in IEC62722-2-1:2014. | 0xFF | No change | NVM-RW (protectable)[c] |
| 0x06 | RatedMedianUsefulLightSourceStarts (MSB)<br>MASK = unknown. | 0xFF | No change | NVM-RW (protectable)[c] |
| 0x07 | RatedMedianUsefulLightSourceStarts (LSB)<br>Range of validity: [0,0xFF FD], TMASK, MASK<br>Scaling factor and unit: 100<br>MASK = unknown.<br>The parameter represents the rated median useful light source starts of the luminaire.<br>A start is defined by 0 to 1 transition of the lampOn bit.<br><br>NOTE Example: A value of 5000 means 500000 starts | 0xFF | No change | NVM-RW (protectable)[c] |

| Address | Description | Default value (factory) | RESET value[a] | Memory type |
|---|---|---|---|---|
| [a] Reset value after “RESET MEMORY BANK”.<br>[b] Also used as power on value.<br>[c] This field is write protectable. | | | | |

# 10 Declaration of variables

The requirements of IEC 62386-102:2014 and IEC 62386-102:2014/AMD1:2018, Clause 10 apply, with the following additional variables for this device type, as indicated in following Table.

**Table 6 – Declaration of variables**

| VARIABLE | DEFAULT VALUE (factory) | RESET VALUE | POWER ON VALUE | RANGE OF VALIDITY | MEMORY TYPE |
|---|---|---|---|---|---|
| *“extendedversionNumber”* | 2.0 | no change | no change | 00001000b | ROM |
| *“deviceType”* | 52 | no change | no change | 52 | ROM |

# 11 Definition of commands

## 11.1 General

The requirements of IEC 62386-102:2014 and IEC 62386-102:2014/AMD1:2018, Clause 11, apply with the following additions.

## 11.2 Overview sheets

Following Table gives an overview of the application extended commands for this device type. Unused opcodes of application extended commands shall be reserved for future needs.

**Table 7 – Standard commands**

| Command name | Address byte | | Opcode byte | Ed. 1 cmd number | DTR0 | DTR1 | DTR2 | Answer | Send twice | References | Command reference |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Selector bit | | | | | | | | | |
| QUERY EXTENDED VERSION NUMBER | *Device* | *1* | *0xFF* | - | | | | ✓ | | | 11.3.2 |
| ENABLE DEVICE TYPE | *0xC1* | | *0x34* | | | | | | | | 11.4.2 |

## 11.3 Application extended commands

### 11.3.1 General

Application extended commands as defined in this document shall be preceded by “ENABLE DEVICE TYPE (data)” where data equals *“deviceType”*. For device types other than *“deviceType”* these commands may be used in a different way.

### 11.3.2 QUERY EXTENDED VERSION NUMBER

The answer shall be “*extendedVersionNumber”*.

## 11.4 Special commands

### 11.4.1 General

The requirements of IEC 62386-102:2014 and IEC 62386-102:2014/AMD1:2018, Clause 11.7 apply with the following additions.

### 11.4.2 ENABLE DEVICE TYPE (data)

To enable the command set as defined in this document, *“data”* shall be *“deviceType”*.