



| NMRA Standard                 |           |
|-------------------------------|-----------|
| Layout Command Control™ (LCC) |           |
| Unique Identifiers            |           |
| July 22, 2024                 | S-9.7.0.3 |

## Adopted as a NMRA Standard

The OpenLCB Standard document appended to this cover sheet has been formally adopted as a NMRA Standard by the NMRA Board of Directors on the date shown in the *Adopted* column in the *Version History* table below.

## Version History

| Date          | Adopted             | Summary of Changes   |
|---------------|---------------------|--|
| Feb 17, 2015  |                     | Initial version submitted for public comment   |
| Feb 6, 2016   | Feb 20, 2016        | Minor grammatical corrections and readability improvements as well as the following specific changes: <ul style="list-style-type: none"> <li>Added <b>Long (16-bit) NMRA DCC manufacturer identifiers</b> table entry to 5.1 Overview section</li> <li>Removed part of section <b>5.7 Specifically Assigned by Request</b> including the table of Unique ID Ranges allocated to named individuals</li> <li>Added notice to section <b>5.8 Locomotive Control Systems</b> to not use</li> <li>Added to section <b>5.10 Temporary Assigned by Software at Runtime</b></li> <li>Added section <b>5.11 Long (16-bit) NMRA DCC Manufacturer Specific</b></li> </ul> |
| Apr 25, 2021  | <b>July 2, 2021</b> | Changed LCC logo to include the ® symbol<br>Changed “Layout Command Control” to have the ™ symbol<br>Added the NMRA Legal Disclaimer fine-print<br>Changed the OpenLCB license to “Creative Commons Attribution-ShareAlike 4.0 International”<br>Added to section <b>5.4 Manufacturer Specific</b> for manufacturers without a NMRA Assigned DCC Manufacturer ID<br>Corrected comments in <b>5.7 Specifically Assigned by Request</b> for 16-bit and 24-bit allocations  |
| July 22, 2024 |                     | Updates ranges for various train control systems: DC, DCC,   |

| Date | Adopted | Summary of Changes |
|------|---------|--------------------|
|      |         | TMCC, etc          |

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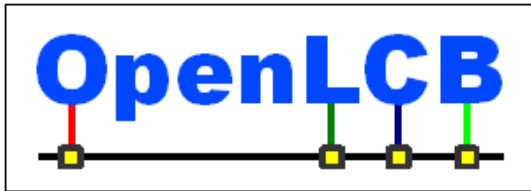
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|                           |                |
|---------------------------|----------------|
| <b>OpenLCB Standard</b>   |                |
| <b>Unique Identifiers</b> |                |
| <b>July 22, 2024</b>      | <b>Adopted</b> |

## 1 Introduction (Informative)

This standard describes the format and allocation of OpenLCB 48-bit Unique Identifiers. It is not specific to any wire protocol.

## 2 Intended Use (Informative)

- 5 Many OpenLCB protocols rely on each node having a Node ID, and those Node IDs being absolutely unique between nodes. OpenLCB defines 48-bit unique identifiers for this purpose. Unique Identifiers are also used to ensure that Event Identifiers are uniquely specified. This Standard is intended to ensure these Unique Identifiers are available. It applies to all OpenLCB uses of 48-bit Unique Identifiers, including as Node Identifiers.

## 3 References and Context (Normative)

This specification is in the context of the following OpenLCB Standards:

- The OpenLCB Message Network Standard, which defines the basic messages and how they interact. Higher-level protocols are based on this message network, but are defined elsewhere.
- The OpenLCB Event Identification Standard, which defines the well-known Events Identifiers.

## 4 Format (Normative)

An OpenLCB Unique Identifier (Unique ID) shall be six bytes of eight bits each.

The order of bytes in an OpenLCB unique Identifier shall be considered significant. The most-significant byte shall be transmitted first during communication operations. The most-significant byte shall be written first (left-most in Western format) in any human-readable representation. Within the tables below, byte 1 is considered the most-significant byte, while byte 6 is considered the least significant byte.

An OpenLCB Unique Identifier shall include one or more 1 bits.

Every OpenLCB node shall have a Unique Identifier to use as a Node Identifier (Node ID).

## 5 Allocation (Normative)

Unique Identifiers shall be allocated using one of the mechanisms in this section. When additional allocation methods are defined, the Unique Identifiers defined by those additional

- 30 methods shall only provide allocation ranges that do no overlap with existing allocation ranges. Ranges that are not explicitly allocated are reserved for future use unless otherwise noted within this document.

## 5.1 Overview

Unique Identifiers are allocated in groups starting with the most significant byte as the macro group assignment.

| Byte 1 | Byte 2 | Byte 3 | Byte 4 | Byte 5 | Byte 6 | Organization | Comment  |
|--------|--------|--------|--------|--------|--------|--------------|--|
| 00     | *      | *      | *      | *      | *      | OpenLCB      | Reserved, leading zero indicates uninitialized or non-standard Node ID   |
| 01     | *      | *      | *      | *      | *      | OpenLCB      | Reserved for well-known global identifiers                               |
| 02     | *      | *      | *      | *      | *      | OpenLCB      | Manufacturer Specific Assignments  |
| 03     | *      | *      | *      | *      | *      | OpenLCB      | Self-assigning groups space  |
| 04     | *      | *      | *      | *      | *      | OpenLCB      | Individual Unique Identifiers allocated by automatic requests            |
| 05     | *      | *      | *      | *      | *      | OpenLCB      | Specifically assigned ranges by request                                  |
| 06     | *      | *      | *      | *      | *      | OpenLCB      | Locomotive control systems (deprecated, may be reassigned in the future) |
| 07     | *      | *      | *      | *      | *      | OpenLCB      | (tentative) RFID and NFC messages as events                              |
| 08     | *      | *      | *      | *      | *      | OpenLCB      | Temporary individually Unique Identifiers leased by automatic requests   |
| 09     | *      | *      | *      | *      | *      | OpenLCB      | Long (16-bit) NMRA DCC manufacture identifiers                           |
| FF     | *      | *      | *      | *      | *      | OpenLCB      | Reserved, indicates an error (example: reset non-volatile memory)        |

## 5.2 Reserved Leading Zero

- 35 A value of zero in the most significant byte of the Unique Identifier indicates uninitialized or non-standard Node ID.

| Byte 1 | Byte 2 | Byte 3 | Byte 4 | Byte 5 | Byte 6 | Organization | Comment  |
|--------|--------|--------|--------|--------|--------|--------------|--|
| 00     | 00     | 00     | 00     | 00     | 00     | OpenLCB      | Convenient value for “no valid Node ID assigned” |

### 5.3 Well-Known Global Identifiers

OpenLCB defines specific well-known identification numbers and number ranges for specific uses. The details of these ranges are defined in in either the Event Identifiers Standard or another Standard.

| Byte 1 | Byte 2 | Byte 3 | Byte 4 | Byte 5       | Byte 6 | Organization | Comment  |
|--------|--------|--------|--------|--------------|--------|--------------|--|
| 01     | 00     | 00     | 00     | 00           | 00     | OpenLCB      | Reserved for automatically-routed Event Identifiers. See Event Identifiers Standard.                       |
| 01     | 01     | 00     | 00     | 00           | 00     | OpenLCB      | Reserved for well-known Event Identifiers. See Event Identifiers Standard.                                 |
| 01     | 01     | 01     | 00     | CBUS Node ID |        | MERG         | Reserved for CBUS-defined Event Identifiers (ON state). See Event Identifiers Standard and Technical Note. |
| 01     | 01     | 01     | 01     | CBUS Node ID |        | MERG         | Reserved for CBUS-defined Event Identifiers (OFF state). See Event Identifiers Standard Technical Note.    |
| 01     | 01     | 01     | *      | CBUS Node ID |        | MERG         | Reserved for CBUS-defined future expansion.  |
| 01     | 63     | *      | *      | *            | *      | OpenLCB      | XpressNet translation  |
| 01     | 81     | *      | *      | *            | *      | OpenLCB      | LocoNet translation  |
| 01     | EE     | *      | *      | *            | *      | OpenLCB      | DCC Translation  |

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### 5.4 Manufacturer Specific

Manufacturers shall ensure uniqueness for identifiers they assign. Short (8-bit) NMRA DCC manufacture ID's are assigned out of this pool. Please see section 5.11 for long (16-bit) NMRA DCC manufacture ID's. Some of the DCC manufacture ID's are called out specifically in the table below as an example and to draw attention to their existence, but they are assigned in accordance with their corresponding DCC manufacture ID. This pool may also be used for new, unique, non-DCC manufacture ID based assignments in the future.

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| Byte 1 | Byte 2 | Byte 3 | Byte 4        | Byte 5       | Byte 6 | Organization     | Comment   |
|--------|--------|--------|---------------|--------------|--------|------------------|---|
| 02     | 01     | DCC ID | Self-Assigned |              |        | DCC Manufacturer | Manufacturers who have been assigned a short DCC Manufacturer ID code may, but are not required to, use this range. These IDs are defined within the NMRA standard “S-9.2.2 Appendix A, DCC Manufacture ID Codes” |
| 02     | 01     | 0D     | Self-Assigned |              |        | DCC – DIY        | Do-It-Yourself (shared unmanaged space, not recommended for individual use)   |
| 02     | 01     | 12     | Self-Assigned |              |        | DCC – JMRI       | JMRI (for use in software solutions)  |
| 02     | 01     | A5     | *             | CBUS Node ID |        | DCC – MERG       | MERG Node ID translation  |
| 02     | 01     | EE     | *             | *            | *      | DCC – NMRA       | NMRA Reserved (for extended manufacture ID numbers). Not available for use.   |
| 02     | 02     | *      | *             | *            | *      | Manufacturer     | Manufacturers without a DCC Manufacturer ID   |

## 5.5 Self-Assigning Groups

These Unique Identifiers are assigned in association with an outside organization's unique identification scheme. The outside organization is responsible for assigning a globally unique identifier that maps into the OpenLCB Unique Identifier space designated in the table below.

50 Future definition of ranges for additional groups will use unique values in Byte 2.

| Byte 1 | Byte 2 | Byte 3            | Byte 4 | Byte 5       | Byte 6 | Organization | Comment   |
|--------|--------|-------------------|--------|--------------|--------|--------------|---|
| 03     | 00     | Membership Number |        | *            |        | NMRA         | NMRA members may, but are not required to, use their NMRA membership number to self-assign Unique Identifiers. The least significant byte is self-assigned. |
| 03     | 04     | Membership Number |        | *            |        | MERG         | MERG members may, but are not required to, use their MERG membership number to self-assign Unique Identifiers. The least significant byte is self-assigned. |
| 03     | 08     | CBUS Layout ID    |        | CBUS Node ID |        | MERG         | CBUS – for mapping existing modules, using the Layout ID defined by CBUS  |

### 5.6 Assigned by Software at Runtime

A program running in a computer with an IP address must not use that address to directly formulate a unique identifier. The program may use an IP connection to request a unique identifier from openlcb.org, or from another organization that is distributing unique identifiers from a range designated to it.

| Byte 1 | Byte 2 | Byte 3 | Byte 4                       | Byte 5 | Byte 6 | Organization | Comment                                   |
|--------|--------|--------|------------------------------|--------|--------|--------------|---|
| 04     | 00     | 00     | Sequentially Assigned Values |        |        | OpenLCB      | Allocated through OpenLCB.org             |
| 04     | 00     | *      | Sequentially Assigned Values |        |        | OpenLCB      | Reserved for OpenLCB.org future expansion |

### 5.7 Specifically Assigned by Request

These ranges are assigned by the OpenLCB group. The OpenLCB group regularly publishes the authoritative list of these assignments. The most up-to-date draft of these assignments are available on the OpenLCB Unique Identifiers website: <http://registry.openlcb.org>.

| Byte 1 | Byte 2 | Byte 3 | Byte 4                       | Byte 5                       | Byte 6 | Organization | Comment  |
|--------|--------|--------|------------------------------|------------------------------|--------|--------------|--|
| 05     | 01     | *      | *                            | *                            | *      | OpenLCB      | 8-bit assigned ranges. The least significant byte is sequentially assigned.          |
| 05     | 02     | *      | *                            | Sequentially Assigned Values |        | OpenLCB      | 16-bit assigned ranges. The least significant two bytes are sequentially assigned.   |
| 05     | 03     | *      | Sequentially Assigned Values |                              |        | OpenLCB      | 24-bit assigned ranges. The least significant three bytes are sequentially assigned. |

### 5.8 Locomotive Control Systems

This Unique Identifier range (starting with a most significant byte value of 0x06) is allocated for locomotive control systems. Unique Event Identifiers shall not be defined out of this range.



| Byte 1 | Byte 2 | Byte 3 | Byte 4 | Byte 5      | Byte 6  | Organization | Comment   |
|--------|--------|--------|--------|-------------|---------|--------------|---|
| 06     | 00     | 00     | 00     | 00          | 00 - FF | OpenLCB      | DC system. Valid byte 6 values are 0 to 255, and correspond with the DC cab ID in a multi-cab block system.   |
| 06     | 01     | *      | *      | *           | *       | OpenLCB      | DCC operated. Undefined values are reserved.  |
| 06     | 01     | 00     | 00     | 00          | 00 - 7F | OpenLCB      | DCC short (7-bit) address. Valid byte 6 values are 0 to 127. 0 is the broadcast address and can be used to control all DCC short and long address locomotives. All other values are reserved.   |
| 06     | 01     | 00     | 00     | C000 - E7FF |         | OpenLCB      | DCC long (14-bit) address Valid byte 5 and 6 values are 0 to 10239 logically or'd with 0xC000, consistent with DCC conventions. Byte 5 is the most significant byte and byte 6 is the least significant byte. All other values are reserved.  |
| 06     | 02     | *      | *      | *           | *       | OpenLCB      | TMCC.   |
| 06     | 02     | 00     | 00     | 00          | 01 - 63 | OpenLCB      | TMCC 2-digit address. Valid byte 6 values are 1 to 99, all other values are reserved. Address 99 is the broadcast address and can be used to control all TMCC 2-digit locomotives.  |
| 06     | 02     | 00     | 00     | C000 - E70F |         | OpenLCB      | TMCC 4-digit address. Valid byte 5 and 6 values are 0 to 9999 logically or'd with 0xC000. Byte 5 is the most significant byte and byte 6 is the least significant byte. 0xC000 is the broadcast address and can be used to control all TMCC 4-digit locomotives. All other values are reserved. |
| 06     | 03     | 00     | 00     | 00          | 01-50   | OpenLCB      | Märklin/Motorola system. Valid byte 6 values are 1 to 80, all other values are reserved.  |
| 06     | 04     | *      | *      | *           | *       | OpenLCB      | MTH DCS, reserved for future definition, do not use.  |

## 65 5.9 RFID and NFC

The RFID Unique Identifiers space is reserved for further standardization in the future. Do not use this space before contacting the OpenLCB organization first.

## 5.10 Temporary Assigned by Software at Runtime

70 This range has been reserved for specialized software and network services specifically designed to lease a Unique Identifier to nodes upon request. Nodes that come without a Unique Identifier (such as computer programs) may contact an instance of such leasing service to obtain a Unique Identifier. Nodes may use any method outside the OpenLCB network to locate and communicate with a leasing service (for example an Internet connection or a local TCP/IP network). The leases shall be limited in time, and a node shall not use an identifier after the lease time expires. The node may communicate with the leasing service to periodically extend the lease.

75 Each such service shall operate from a range assigned to the specific instance, and is responsible for ensuring uniqueness among its clients. The owner or maintainer of an OpenLCB Installation is responsible for ensuring that all the leasing services that all the nodes participating in the installation are using, have disjoint ranges. In particular, if the installation operates one or more leasing services, they must be assigned disjoint ranges to hand out identifiers from. Globally available leasing services (such as over the Internet) shall have a unique range assigned to them.

80 Because Unique Event Identifiers assigned out of this range could be captured and disseminated into use by nodes that could become unaware of a lease expiration and reassignment, Unique Event Identifiers shall not be assigned out of this range.

It is possible that a future OpenLCB protocol may, or may not, define a mechanism to negotiate a Unique Identifier lease over an OpenLCB network. It is important to note that no such protocol is prescribed by this standard.

| Byte 1 | Byte 2 | Byte 3      | Byte 4        | Byte 5        | Byte 6 | Organization     | Comment  |
|--------|--------|-------------|---------------|---------------|--------|------------------|--|
| 08     | 00     | 00          | Self-Assigned |               |        | OpenLCB          | Allocated through OpenLCB.org.   |
| 08     | 00     | *           | Self-Assigned |               |        | OpenLCB          | Reserved for future OpenLCB.org allocations.   |
| 08     | 01     | Long DCC ID |               | Self-Assigned |        | DCC Manufacturer | Manufacturers who have been assigned a DCC Manufacturer ID code may, but are not required to, use this range. These IDs are defined within the the NMRA standard “S-9.2.2 Appendix A, DCC Manufacture ID Codes”. |
| 08     | 01     | 00          | 0D            | Self-Assigned |        | DCC - DIY        | Do-It-Yourself (shared unmanaged space). Use with Caution.   |

### 5.11 Long (16-bit) NMRA DCC Manufacturer Specific

- 85 Manufacturers shall ensure uniqueness for identifiers they assign. Long (8-bit) NMRA DCC manufacture ID's are assigned out of this pool. Some of the DCC manufacture ID's are called out specifically in the table below as an example and to draw attention to their existence, but they are assigned in accordance with their corresponding DCC manufacture ID.

| Byte 1 | Byte 2      | Byte 3 | Byte 4        | Byte 5       | Byte 6 | Organization     | Comment   |
|--------|-------------|--------|---------------|--------------|--------|------------------|---|
| 09     | Long DCC ID |        | Self-Assigned |              |        | DCC Manufacturer | Manufacturers who have been assigned a DCC Manufacturer ID code may, but are not required to, use this range. These IDs are defined within the NMRA standard “S-9.2.2 Appendix A, DCC Manufacture ID Codes” |
| 09     | 00          | 0D     | Self-Assigned |              |        | DCC – DIY        | Do-It-Yourself (shared unmanaged space, not recommended for individual use)   |
| 09     | 00          | 12     | Self-Assigned |              |        | DCC – JMRI       | JMRI (for use in software solutions)  |
| 09     | 00          | A5     | *             | CBUS Node ID |        | DCC – MERG       | MERG Node ID translation  |
| 09     | 00          | EE     | *             | *            | *      | DCC – NMRA       | NMRA Reserved (for extended manufacture ID numbers). Not available for use.   |

### 5.12 Reserved Unique Identifiers

- 90 All other unique identifiers not specifically discussed in this Standard shall not be used until the Standard is revised to permit their use. Additionally, the following table identifies Unique Identifiers that shall be reserved indefinitely.

| Byte 1 | Byte 2 | Byte 3 | Byte 4 | Byte 5 | Byte 6 | Organization | Comment                         |
|--------|--------|--------|--------|--------|--------|--------------|---------------------------------|
| 00     | *      | *      | *      | *      | *      | OpenLCB      | Shall not be used at any point. |
| FF     | *      | *      | *      | *      | *      | OpenLCB      | Shall not be used at any point. |

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