	OpenLCB Standard
	LocoNet Gateway Protocol
04/07/2024	**Draft**

1 Introduction (Informative)

This document defines the OpenLCB LocoNet Gateway Protocol, a method for transporting messages to and from LocoNet segments and OpenLCB nodes. It provides an OpenLCB node the ability to send and receive any type of LocoNet message to and from one or more LocoNet
5   segments via the OpenLCB network.

LocoNet is a registered trademark of Digitrax, Inc., Panama City, Florida, USA.

2 Intended Use (Informative)

This document describes the required message formats for LocoNet message transport and the means by which OpenLCB LocoNet Gateway nodes may be identified.

10   # 3 References and Context (Normative)

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

- The OpenLCB Message Network Standard, which defines the basic messages and how they interact.

15   - The OpenLCB Datagram Transport Protocol, which defines the protocol for transporting 0-72 byte datagrams from node to node.

- The OpenLCB Event Transport Standard, which defines messages for transporting Event Ids and identifying producers and consumers.

- This OpenLCB Standard assumes adoption of the Event With Payload working note as a Standard.

20   - The OpenLCB Event Identifiers Standard, which defines the format and content of Event IDs including the class of Well-Known Event IDs and Automatically-Routed Event Ids.

This standard references the following document:

- LocoNet Personal Use Edition 1.0 Specification, Digitrax Inc., October 16, 1997 (hereinafter referred to as the "**LocoNet Specification**").

25   # 4 Messages

4.1 Definitions

"LocoNet Gateway" means an OpenLCB node that transports LocoNet messages to and from the OpenLCB network and a specific LocoNet segment. It may be a hardware device or a virtual node implemented by an application connected a LocoNet interface such as an RR-CirKits LocoBuffer.

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"Valid LocoNet Message" means a sequence of bytes that conforms in all respects to the message format requirements of the LocoNet Specification.

4.2 Defined Event IDs

Description	Event ID
Node is a LocoNet Gateway	01.01.00.00.00.00.04.01
LocoNet Message Received	01.81.*.*.*.*.*.*

35 ## 4.3 Generic Error Handing

The error codes returned by failed operations, either in the Datagram Rejected message, or the failed response datagrams, shall conform to the general error code specification as defined by the OpenLCB Message Network Standard.

In general, errors are of one of two types:

40 •   "Permanent Error" - This node will not ever be able to accept this particular datagram. The datagram should not be retransmitted.

•   "Temporary Error" - In contrast to the error above, the problem of accepting the datagram is of a transient nature, and the sending node should attempt retransmission at its discretion at some point in the immediate or near future.

45 The Message Network Standard contains error codes for several conditions that may be useful for LocoNet Gateway node implementations:

Error Code	Type	Description
0x1080	Permanent	Invalid Arguments. In the context of this Standard it means that a datagram was received by a LocoNet Gateway node that contains a LocoNet message that is not a Valid LocoNet Message.
0x2020	Temporary	Buffer unavailable or destination node busy.
0x2011	Temporary	Time-out, waiting for End-frame. In the context of this Standard it means that a LocoNet Gateway node has timed-out waiting for a Send LocoNet Message Final Part Command.
0x2041	Temporary	Out of Order, Middle- or End-frame without a Start-frame. In the

			context of this Standard it means that a LocoNet Gateway has received a Send LocoNet Message Final Part Command datagram before first receiving a Send LocoNet Message First Part Command datagram from the sender node.
0x2042	Temporary		Out of Order, Start-frame before finishing previous message. In the context of this Standard it means that a LocoNet Gateway has received a Send LocoNet Message First Part Command datagram before first receiving a Send LocoNet Message Final Part Command datagram for the previous interaction from the same sender node.
0x2080	Temporary		Transfer error. In the context of this Standard it means that the LocoNet Gateway was unable to determine that a LocoNet message was successfully transmitted to the LocoNet segment.

4.4 Transporting Messages from LocoNet to the OpenLCB network

A LocoNet Gateway shall transport a Valid LocoNet Message received from a LocoNet segment to the
50 OpenLCB network by means of a Producer/Consumer Event Report or a Producer/Consumer Event Report with payload. Each such Producer/Consumer Event Report shall transport a single LocoNet message. The Event ID shall be prefixed with the values 0x01, 0x81. The bytes following the prefix shall contain the LocoNet first 6 message bytes verbatim. If the LocoNet message is less than 6 bytes long then the message shall be padded with 0xFF at the end so that the Event ID space always contains
55 8 bytes in total including the prefix and the padding, if any. If the LocoNet message is longer than 6 bytes, then the message bytes in excess of the first 6 shall be carried in the payload after the Event ID space.

4.5 Transporting Messages from an OpenLCB node to LocoNet

An OpenLCB node transports a LocoNet message to a specific LocoNet segment by sending one or
60 two LocoNet Gateway Protocol command datagrams to the applicable LocoNet Gateway node for such segment. If the LocoNet message contains less than 71 bytes then a Send LocoNet Message Complete In Datagram Command is sent otherwise the LocoNet message is sent in two parts by first sending a Send LocoNet Message First Part Command followed by a Send LocoNet Message Final Part Command. A LocoNet Gateway node shall only transmit a LocoNet message to a LocoNet segment if
65 such message is a Valid LocoNet Message. A LocoNet Gateway shall verify that the transmission of a LocoNet message to a LocoNet segment was successful and shall report any transmission failures to the sender node. This Standard is silent on how such message transmission verification shall be implemented.

4.6 Send LocoNet Message Complete In Datagram Command

Byte 0	Byte 1	Remaining Bytes
0x40	0x00	LocoNet message (2 – 70 bytes)

70 The LocoNet Gateway shall reply to the sender node with a Datagram Received OK message with the Reply Pending bit set. The LocoNet Gateway may, but is not required to, include a specific timeout interval in the Datagram Received OK message.

4.7 Send LocoNet Message First Part Command

Byte 0	Byte 1	Remaining Bytes
0x40	0x01	First 70 bytes of the LocoNet message

75 The LocoNet Gateway shall reply to the sender node with a Datagram Received OK message with the Reply Pending bit cleared.

4.8 Send LocoNet Message Final Part Command

Byte 0	Byte 1	Remaining Bytes
0x40	0x02	Remaining bytes of the LocoNet message (1 – 57 bytes)

The LocoNet Gateway shall reply to the sender node with a Datagram Received OK message with the
80 Reply Pending bit set. The LocoNet Gateway may, but is not required to, include a specific timeout interval in the Datagram Received OK message.

4.9 Send LocoNet Message Reply

Byte 0	Byte 1	Remaining Bytes
0x40	0x10	

This datagram is sent to the sender node when the LocoNet Gateway verifies that a LocoNet message
85 has been successfully transmitted to the LocoNet segment.

4.10 Send LocoNet Message Reply Failure

Byte 0	Byte 1	Remaining Bytes
0x40	0x18	Error Code (two bytes)

This datagram is sent to the sender node when the LocoNet Gateway determines that a LocoNet message was not successfully transmitted to the LocoNet segment.

90 ## 5 LocoNet Gateway Identification

LocoNet Gateway nodes shall be producers of the well-known event 'Node is a LocoNet Gateway'.

A LocoNet Gateway shall set the Protocol Flags 0x00 0x00 0x08 in its Protocol Support Reply to indicate that it supports the LocoNet Gateway Protocol.

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