



Lionel LCS Partner Documentation

Legacy Command Protocol

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TMCC1 & TMCC2 BASE/Serial Communication Protocol

The Legacy Command Base's serial port allows connection to inject or monitor TMCC commands. TMCC commands may follow the TMCC1 format or the newly available Legacy format. TMCC1 commands are fully documented, and the most common Legacy commands are documented in the below tables.

- Communication on the DB9 is at 9600 baud, one stop bit, no parity.
- The DB9 serial port outputs all commands received from the Cab Remotes
- The first byte is 0xFE for TMCC1 commands
- The first byte is 0xF8 for Legacy Engine commands
- The first byte is 0xF9 for Legacy Train commands
- The first byte is 0xFB for Parameter commands

* NOTE: only 0xFE commands may be sent to the base (and your command equipped locomotives) unless the minimum LCS equipment is installed, for example - the LCS SER2 or LCS WiFi adapter.

TMCC1 Command Set

TMCC (0xFE) General command format

Bit order

MSB															LSB
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Switch commands

0	1	A	A	A	A	A	A	A	C	C	D	D	D	D	D
---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

Route commands

1	1	0	1	A	A	A	A	A	C	C	D	D	D	D	D
---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

Engine commands

0	0	A	A	A	A	A	A	A	C	C	D	D	D	D	D
---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

Train commands

1	1	0	0	1	A	A	A	A	C	C	D	D	D	D	D
---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

Accessory commands

1	0	A	A	A	A	A	A	A	C	C	D	D	D	D	D
---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

Group commands (accessory groupings, not implemented)

1	1	0	0	0	A	A	A	A	C	C	D	D	D	D	D
---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

Definitions:

“A” – Address field, the TMCC address (ID) for the object (Switch, Route, Engine, etc).

“C” – Command field, 00 = action, 01 = extended, 10 = relative speed, 11 – absolute speed

“D” – Data field, the data being sent to the addressed object

Switch and Route Commands

Switch Commands	Command field		Data Field				
Throw THROUGH	0	0	0	0	0	0	0
Throw OUT	0	0	1	1	1	1	1
Set Address	0	1	0	1	0	1	1
Assign to Route THROUGH (D = Route ID)	1	0	D	D	D	D	D
Assign to Route OUT (D = Route ID)	1	1	D	D	D	D	D

Route Commands	Command field		Data Field				
Route Throw	0	0	1	1	1	1	1
Route Clear	0	1	0	1	1	0	0

Engine and Train Commands

Engine or Train Commands	Command field		Data Field				
Forward Direction	0	0	0	0	0	0	0
Toggle Direction	0	0	0	0	0	0	1
Reverse Direction	0	0	0	0	0	1	1
Boost Speed	0	0	0	0	1	0	0
Brake Speed	0	0	0	0	1	1	1
Open Front Coupler	0	0	0	0	1	0	1
Open Rear Coupler	0	0	0	0	1	1	0
Blow Horn 1	0	0	1	1	1	0	0
Ring Bell	0	0	1	1	1	0	1
Let-Off Sound	0	0	1	1	1	1	0
Blow Horn 2	0	0	1	1	1	1	1
Aux1 Off	0	0	0	1	0	0	0
Aux1 Option 1 (Cab1 AUX1 button)	0	0	0	1	0	0	1
Aux1 option 2	0	0	0	1	0	1	0
Aux1 On	0	0	0	1	0	1	1
Aux2 Off	0	0	0	1	1	0	0
Aux2 Option 1 (Cab1 AUX2 button)	0	0	0	1	1	0	1
Aux2 option 2	0	0	0	1	1	1	0
Aux2 On	0	0	0	1	1	1	1
Numeric N (D = numeric command 0...9)	0	0	1	D	D	D	D

Engine and Train Extended Commands

Engine Extended Commands	Command field		Data Field				
Assign to Train (D = Train Address)	0	1	1	D	D	D	D
Assign as Single Unit Forward Direction	0	1	0	0	0	0	0
Assign as Single Unit Reverse Direction	0	1	0	0	1	0	0
Assign as Head End Unit Forward Direction	0	1	0	0	0	0	1
Assign as Head End Unit Reverse Direction	0	1	0	0	1	0	1
Assign as Middle Unit Forward Direction	0	1	0	0	0	1	0
Assign as Middle Unit Reverse Direction	0	1	0	0	1	1	0
Assign as Rear End Unit Forward Direction	0	1	0	0	0	1	1
Assign as Rear End Unit Reverse Direction	0	1	0	0	1	1	1
Set Momentum Low	0	1	0	1	0	0	0
Set Momentum Medium	0	1	0	1	0	0	1
Set Momentum High	0	1	0	1	0	1	0
Set Train Address (ID)	0	1	0	1	0	1	1

Train Extended Commands	Command field		Data Field				
Set Momentum Low	0	1	0	1	0	0	0
Set Momentum Medium	0	1	0	1	0	0	1
Set Momentum High	0	1	0	1	0	1	0
Set TMCC Address (ID)	0	1	0	1	0	1	1
Clear Consist (Lash-Up)	0	1	0	1	1	0	0

Engine or Train Speed Commands	Command field		Data Field				
Set Absolute Speed Step 32 (D = 0...31)	1	1	D	D	D	D	D
Set Relative Speed	1	0	0	D	D	D	D
Relative Speed "D" D = 0xA => +5 D = 0x9 => +4 D = 0x5 => 0 (no change) D = 0x1 => -4 D = 0x0 => -5							

Accessory Commands

Accessory Action Commands	Command field		Data Field				
Aux1 Off	0	0	0	1	0	0	0
Aux1 Option 1	0	0	0	1	0	0	1
Aux1 option 2	0	0	0	1	0	1	0
Aux1 On	0	0	0	1	0	1	1
Aux2 Off	0	0	0	1	1	0	0
Aux2 Option 1	0	0	0	1	1	0	1
Aux2 option 2	0	0	0	1	1	1	0
Aux2 On	0	0	0	1	1	1	1
Numeric N (D = numeric command 0...9)	0	0	1	D	D	D	D

Accessory Extended Commands	Command field		Data Field				
All Off	0	1	0	0	0	0	0
All On	0	1	0	1	1	1	1
Set Address	0	1	0	1	0	1	1
Assign AUX1 to Group (D = Group Address)	0	1	0	D	D	D	D
Assign AUX2 to Group (D = Group Address)	0	1	0	D	D	D	D

Group and System Commands

Group Commands	Command field		Data Field				
Group OFF	0	0	0	1	0	0	0
Option1	0	0	0	1	0	0	1
Option2	0	0	0	1	0	1	1
Group ON	0	0	0	1	0	1	1
Group Clear	0	1	0	1	1	0	0

System Halt Command

[illegible]

System NOP Command

1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

System reserved

1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1
---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

System Reserved

[illegible]

TMCC2 Command Set

The Legacy (TMCC2) command structure is formatted differently than the TMCC1 commands. With additional first byte identifiers beyond 0xFE allocated, the available commands are expandable beyond the basic TMCC1 command set. Note: Additionally the data bit patterns are in different bit locations, to allow for additional command range.

When the first byte is 0xF8, the command is directed to the Engine address, and when the first byte is 0xF9, the command is directed to the assigned train address. More complex commands, referred to as Multi-Word commands, utilize 0xFB for the first byte.

Note that TMCC2 commands cannot be injected directly into the Command Base's serial port (Legacy Base or Base-1L). An LCS SER2 or LCS WiFi device is required to inject TMCC2 commands into the base.

LEGACY (0xF8, 0xF9) General command format

Bit order

MSB															LSB
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Engine and Train commands

A	A	A	A	A	A	A	C	C	C	C	C	C	C	C	C
---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

Definitions:

“A” – Address field, the TMCC address (ID)

“C” – Command field, action being sent to the addressed object

“D” – Data field, Command with variable data field being sent to the addressed object

TMCC2 Commands, with Bit 9 = “0” Command Syntax

Engine or Train Commands	Command field									
Set Absolute Speed Step 200 (D = 0...199)	0	D	D	D	D	D	D	D	D	D
Set Momentum (D= 0...7)	0	1	1	0	0	1	D	D	D	D
Brake Level (D = 0...7)	0	1	1	1	0	0	D	D	D	D
Boost Level (D = 0...7)	0	1	1	1	0	1	D	D	D	D
Train Brake (D = 0...7)	0	1	1	1	1	0	D	D	D	D
Set Stall	0	1	1	1	1	1	0	0	0	0
Stop Immediate	0	1	1	1	1	1	0	1	1	1

TMCC2 Commands, with Bit 9 = “1” Command Syntax

Engine or Train Commands	Command field								
Forward Direction	1	0	0	0	0	0	0	0	0
Toggle Direction	1	0	0	0	0	0	0	0	1
Reserved	1	0	0	0	0	0	0	1	0
Reverse Direction	1	0	0	0	0	0	0	1	1
Boost Speed	1	0	0	0	0	0	1	0	0
Open Front Coupler	1	0	0	0	0	0	1	0	1
Open Rear Coupler	1	0	0	0	0	0	1	1	0
Brake Speed	1	0	0	0	0	0	1	1	1
Aux1 Off	1	0	0	0	0	1	0	0	0
Aux1 Option 1 (Cab1 AUX1 button)	1	0	0	0	0	1	0	0	1
Aux1 option 2	1	0	0	0	0	1	0	1	0
Aux1 On	1	0	0	0	0	1	0	1	1
Aux2 Off	1	0	0	0	0	1	1	0	0
Aux2 Option 1 (Cab1 AUX2 button)	1	0	0	0	0	1	1	0	1
Aux2 option 2	1	0	0	0	0	1	1	1	0
Aux2 On	1	0	0	0	0	1	1	1	1
Numeric N (D = numeric command 0...9)	1	0	0	0	1	D	D	D	D
Reserved	1	0	0	0	1	1	0	1	0
Forward Direction (not used)	1	0	0	0	1	1	0	1	1
Blow Horn 1	1	0	0	0	1	1	1	0	0
Ring Bell	1	0	0	0	1	1	1	0	1
Reserved	1	0	0	0	1	1	1	1	0
Blow Horn 2	1	0	0	0	1	1	1	1	1
Assign as Single Unit Forward Direction	1	0	0	1	0	0	0	0	0
Assign as Single Unit Reverse Direction	1	0	0	1	0	0	0	0	1
Assign as Head End Unit Forward Direction	1	0	0	1	0	0	0	1	0
Assign as Head End Unit Reverse Direction	1	0	0	1	0	0	0	1	1
Assign as Middle Unit Forward Direction	1	0	0	1	0	0	1	0	0
Assign as Middle Unit Reverse Direction	1	0	0	1	0	0	1	0	1
Assign as Rear End Unit Forward Direction	1	0	0	1	0	0	1	1	0
Assign as Rear End Unit Reverse Direction	1	0	0	1	0	0	1	1	1
Set Momentum Low	1	0	0	1	0	1	0	0	0
Set Momentum Medium	1	0	0	1	0	1	0	0	1
Set Momentum High	1	0	0	1	0	1	0	1	0
Set Engine or Train Address	1	0	0	1	0	1	0	1	1
Clear Consist (Lash-Up)	1	0	0	1	0	1	1	0	0
Locomotive Re-Fueling Sound	1	0	0	1	0	1	1	0	1
Reserved	1	0	0	1	0	1	1	1	0
Reserved	1	0	0	1	0	1	1	1	1
Assign to Train (D = Train Address)	1	0	0	1	1	D	D	D	D
Set Relative Speed (0x140 – 0x14A)	1	0	1	0	0	D	D	D	D
Reserved (0x14B – 0x15F)	1	0	1	0	0	-	-	-	-
Diesel Run Level (D= 0...7)	1	1	0	1	0	0	D	D	D
RS Trigger, Water Injector	1	1	0	1	0	1	0	0	0
RS Trigger, Aux Air Horn (not used)	1	1	0	1	0	1	0	0	1
System HALT	1	1	0	1	0	1	0	1	1
Bell Slider Position (D = 2...5)	1	1	0	1	1	0	D	D	D
Engine Labor (D = 0...31)	1	1	1	0	D	D	D	D	D
Quilling Horn Intensity (D = 0...16)	1	1	1	1	0	D	D	D	D
Bell One-Shot Ding (D = 0...3)	1	1	1	1	1	0	0	D	D
Bell Off	1	1	1	1	1	0	1	0	0
Bell On	1	1	1	1	1	0	1	0	1
Brake Squeal Sound	1	1	1	1	1	0	1	1	0
Auger Sound	1	1	1	1	1	0	1	1	1
RS Trigger, Brake Air Release	1	1	1	1	1	1	0	0	0
RS Trigger, Short Let-Off	1	1	1	1	1	1	0	0	1
RS Trigger, Long Let-Off	1	1	1	1	1	1	0	1	0
Start Up Sequence 1 (Delayed Prime Mover)	1	1	1	1	1	1	0	1	1
Start Up Sequence 2 (Immediate Start Up)	1	1	1	1	1	1	1	0	0
Shut Down Sequence 1 (Delay w/ Announcement)	1	1	1	1	1	1	1	0	1
Shut down Sequence 2 (Immediate Shut Down)	1	1	1	1	1	1	1	1	0

LEGACY (0xFB) FIXED 3 Word command format

Legacy Multi-Word commands are a series of 3 byte transmissions that allow for more data bytes to be transferred per command sequence. Multi-word commands can have either a fixed length of 9 bytes (3 words), or a variable byte length (many words), depending on the command syntax. All multi-word packets have checksums as part of the byte sequence to insure data integrity.

Sending a fixed length 3 word command, results in 9 bytes transmitted on the serial port. The bytes may be interspersed with other commands, but must retain the logical order of the entire packet. Each 3 byte transmission consists of an identifier, setting the start point of the 3 byte sequence.

When the identifier is 0xF8, the command is directed to the Engine address, and when the identifier is 0xF9, the command is directed to the assigned train address. The second and third byte sequences start with 0xFB, indicating Parameter Data and the Checksum.

Fixed 3 word transmission format:

0xF8, Address, Parameter Index

0xFB, Address + E/T, Parameter Data

0xFB, Address + E/T, Checksum

The Address in conjunction with the Parameter Index, the Parameter data, or the Parameter Checksum are represented in words; hence the “Fixed 3 Word Format”, with the following bit patterns.

Fixed 3 Word Format	Command field															
Word 1, Parameter Index	A	A	A	A	A	A	A	1	0	1	1	1	N	N	N	N
Word 2, Parameter Data	A	A	A	A	A	A	A	E/T	C	C	C	C	C	C	C	C
Word 3, Checksum	A	A	A	A	A	A	A	E/T	X	X	X	X	X	X	X	X

Definitions:

“A” – Address field, the TMCC address (ID)

“N” – Index field, the subsystem object the command affects

“E/T” – Engine/ Train field, selects Engine or Train (used in conjunction with Eng 0xF8, or TR 0xF9)

“C” – Command field, action being sent to the addressed object

“X” – Checksum, one’s compliment of the sum of the MOD256 of the previous 5 bytes (excluding Prefix)

Example: Setting the Loco ID #1 Cab Light to “Auto” mode

Looking at the Lighting (index = 0x0D) command tables, the Cab Light setting for “Auto mode” is a 0xF2 command. We must send index = 0x0D, followed by Parameter Data of 0xF2, to engine address #1.

The first 3 byte sequence consists of the Eng address, and index.

Parameter Index	A	A	A	A	A	A	A	1	0	1	1	1	N	N	N	N
	Loco Address = 0x01								Index = 0x0D							
Parameter Command	0	0	0	0	0	0	1	1	0	1	1	1	1	1	0	1

Remember we need to send 0xF8 for the Identifier (byte 1), then the Address and Index (byte 2 & 3)

Therefore the first 3 bytes are: 0xF8, 0x03, 0x7D

The next 3 byte sequence consists of the command we wish to execute.

Parameter Data	A	A	A	A	A	A	A	E/T	C	C	C	C	C	C	C	C
	Loco Address = 0x01								Command							
Cab Light Auto Request	A	A	A	A	A	A	1	0	1	1	1	1	0	0	1	0

The next 3 bytes are: 0xFB, the identifier, then the Address and Parameter Command.

Therefore the next 3 bytes are: 0xFB, 0x02, 0xF2

Now we need a checksum to confirm and complete the command sequence.

Checksum	A	A	A	A	A	A	A	E/T	X	X	X	X	X	X	X	X
	Loco Address = 0x01								Checksum							
Calculated Checksum	A	A	A	A	A	A	1	0	1	0	0	0	1	0	0	1

The next 3 bytes are: 0xFB, the identifier, then the Address and Checksum.

Finally we send the last 3 bytes: 0xFB, 0x02, **0x89** <- see checksum calculation

Checksum Calculation:

Starting with the data stream: 0xF8, 0x03, 0x7D, 0xFB, 0x02, 0xF2, 0xFB, 0x02, 0xFF

Add up the underlined data, MOD 256, and set the one's compliment.

Thusly: 0x03 + 0x7D + 0x02 + 0xF2 + 0x02 = 0x76, take the one's compliment of 0x76 => 89

Word #1 – Parameter Indexes

Parameter Indexes	Address / Index Format															
Reserved (0x1)	A	A	A	A	A	A	A	1	0	1	1	1	0	0	0	1
RailSounds Dialog Triggers (0x2)	A	A	A	A	A	A	A	1	0	1	1	1	0	0	1	0
Reserved (0x3)	A	A	A	A	A	A	A	1	0	1	1	1	0	0	1	1
RailSounds Effects Triggers (0x4)	A	A	A	A	A	A	A	1	0	1	1	1	0	1	0	0
Reserved (0x5)	A	A	A	A	A	A	A	1	0	1	1	1	0	1	0	1
RailSounds Masking Control (0x6)	A	A	A	A	A	A	A	1	0	1	1	1	0	1	1	0
Reserved 0x7)	A	A	A	A	A	A	A	1	0	1	1	1	0	1	1	1
Reserved (0x8)	A	A	A	A	A	A	A	1	0	1	1	1	1	0	0	0
Reserved (0x9)	A	A	A	A	A	A	A	1	0	1	1	1	1	0	0	1
Reserved (0xA)	A	A	A	A	A	A	A	1	0	1	1	1	1	0	1	0
Reserved (0xB)	A	A	A	A	A	A	A	1	0	1	1	1	1	0	1	1
Effects Controls (0xC)	A	A	A	A	A	A	A	1	0	1	1	1	1	1	0	0
Lighting Controls (0xD)	A	A	A	A	A	A	A	1	0	1	1	1	1	1	0	1
Reserved (0xE)	A	A	A	A	A	A	A	1	0	1	1	1	1	1	1	0
Variable Length Command (0xF)	A	A	A	A	A	A	A	1	0	1	1	1	1	1	1	1

Word #2 – Dialog Trigger control

Effects (index = 0x2)	Address / Parameter Data Format															
Reserved	A	A	A	A	A	A	A	0	0	0	0	0	0	0	0	0
Conventional Mode Shutdown	A	A	A	A	A	A	A	0	0	0	0	0	0	0	0	1
Scene <2> Key, context dependent (older RS5.5 engines only)	A	A	A	A	A	A	A	0	0	0	0	0	0	0	1	0
Scene <7> Key, context dependent (older RS5.5 engines only)	A	A	A	A	A	A	A	0	0	0	0	0	0	0	1	1
Scene <5> Key, context dependent (older RS5.5 engines only)	A	A	A	A	A	A	A	0	0	0	0	0	0	1	0	0
Conventional Short Horn Trigger	A	A	A	A	A	A	A	0	0	0	0	0	0	1	0	1
Tower, Initial Engine Startup	A	A	A	A	A	A	A	0	0	0	0	0	0	1	1	0
Engineer, Departure Denied	A	A	A	A	A	A	A	0	0	0	0	0	0	1	1	1
Engineer, Departure Granted	A	A	A	A	A	A	A	0	0	0	0	0	1	0	0	0
Engineer, Have Departed	A	A	A	A	A	A	A	0	0	0	0	0	1	0	0	1
Engineer, All Clear Ahead	A	A	A	A	A	A	A	0	0	0	0	0	1	0	1	0
Tower, Non-Emergency Stop	A	A	A	A	A	A	A	0	0	0	0	0	1	0	1	1
Tower, Restricted Speed	A	A	A	A	A	A	A	0	0	0	0	0	1	1	0	0
Tower, Slow Speed	A	A	A	A	A	A	A	0	0	0	0	0	1	1	0	1
Tower, Medium Speed	A	A	A	A	A	A	A	0	0	0	0	0	1	1	1	0
Tower, Limited Speed	A	A	A	A	A	A	A	0	0	0	0	0	1	1	1	1
Tower, Normal Speed	A	A	A	A	A	A	A	0	0	0	0	1	0	0	0	0
Tower, High-Ball Speed	A	A	A	A	A	A	A	0	0	0	0	1	0	0	0	1
Engineer, Arriving Soon	A	A	A	A	A	A	A	0	0	0	0	1	0	0	1	0
Engineer, Have Arrived	A	A	A	A	A	A	A	0	0	0	0	1	0	0	1	1
Engineer, Shut-Down	A	A	A	A	A	A	A	0	0	0	0	1	0	1	0	0
Engineer, Identify One's Self	A	A	A	A	A	A	A	0	0	0	0	1	0	1	0	1
Engineer, Ack Communication	A	A	A	A	A	A	A	0	0	0	0	1	0	1	1	0
Engineer, Ack Speed to Stop	A	A	A	A	A	A	A	0	0	0	0	1	0	1	1	1
Engineer, Ack Speed to Restricted	A	A	A	A	A	A	A	0	0	0	0	1	1	0	0	0
Engineer, Ack Speed to Slow	A	A	A	A	A	A	A	0	0	0	0	1	1	0	0	1
Engineer, Ack Speed to Medium	A	A	A	A	A	A	A	0	0	0	0	1	1	0	1	0
Engineer, Ack Speed to Limited	A	A	A	A	A	A	A	0	0	0	0	1	1	0	1	1
Engineer, Ack Speed to Normal	A	A	A	A	A	A	A	0	0	0	0	1	1	1	0	0
Engineer, Ack Speed to High-Ball	A	A	A	A	A	A	A	0	0	0	0	1	1	1	0	1
Engineer, Context Dependent	A	A	A	A	A	A	A	0	0	0	0	1	1	1	1	0
Emergency, Context Dependent	A	A	A	A	A	A	A	0	0	0	0	1	1	1	1	1
Tower, Context Dependent	A	A	A	A	A	A	A	0	0	0	1	0	0	0	0	0
Reserved	A	A	A	A	A	A	A	0	0	0	1	0	0	0	0	1
Tower, Departure Denied	A	A	A	A	A	A	A	0	0	0	1	0	0	0	1	0
Tower, Departure Granted	A	A	A	A	A	A	A	0	0	0	1	0	0	0	1	1
Tower, Have Departed	A	A	A	A	A	A	A	0	0	0	1	0	0	1	0	0
Tower, All Clear Ahead	A	A	A	A	A	A	A	0	0	0	1	0	0	1	0	1
Reserved Range (0x26 – 0x2C)	A	A	A	A	A	A	A	0	-	-	-	-	-	-	-	-
Tower, Arriving Soon	A	A	A	A	A	A	A	0	0	0	1	0	1	1	0	1
Tower, Have Arrived	A	A	A	A	A	A	A	0	0	0	1	0	1	1	1	0
Tower, Shut-Down	A	A	A	A	A	A	A	0	0	0	1	0	1	1	1	1
Conductor, All Aboard	A	A	A	A	A	A	A	0	0	0	1	1	0	0	0	0
Engineer, Ack Standing By	A	A	A	A	A	A	A	0	0	0	1	1	0	0	0	1
Engineer, Ack Cleared to Go	A	A	A	A	A	A	A	0	0	0	1	1	0	0	1	0
Engineer, Ack Clear Ahead	A	A	A	A	A	A	A	0	0	0	1	1	0	0	1	1
Engineer, Ack Clear Inbound	A	A	A	A	A	A	A	0	0	0	1	1	0	1	0	0
Engineer, Ack Welcome Back	A	A	A	A	A	A	A	0	0	0	1	1	0	1	0	1
Engineer, Ack Identify & Out	A	A	A	A	A	A	A	0	0	0	1	1	0	1	1	0
Scene <2> Key, Context Dependent	A	A	A	A	A	A	A	0	0	0	1	1	0	1	1	1
Scene AUX1 <2> Key, Context Dep	A	A	A	A	A	A	A	0	0	0	1	1	1	0	0	0
Scene <7> Key, Context Dependent	A	A	A	A	A	A	A	0	0	0	1	1	1	0	0	1
Scene AUX1 <7> Key, Context Dep	A	A	A	A	A	A	A	0	0	0	1	1	1	0	1	0
Scene <5> Key, Context Dependent	A	A	A	A	A	A	A	0	0	0	1	1	1	0	1	1
Scene AUX1 <5> Key, context Dep	A	A	A	A	A	A	A	0	0	0	1	1	1	1	0	0
Engineer, Speaks Fuel Level	A	A	A	A	A	A	A	0	0	0	1	1	1	1	0	1
Engineer, Speaks Fuel Refilled	A	A	A	A	A	A	A	0	0	0	1	1	1	1	1	0
Engineer, Speaks Speed	A	A	A	A	A	A	A	0	0	0	1	1	1	1	1	1
Engineer, Speaks Water Level	A	A	A	A	A	A	A	0	0	1	0	0	0	0	0	0
Engineer, Speaks Water Refilled	A	A	A	A	A	A	A	0	0	1	0	0	0	0	0	1

Word #2 – Dialog Trigger control continued, Sequence Control

Effects (index = 0x2)	Address / Parameter Data Format															
SeqCtl, Sequence Control Off	A	A	A	A	A	A	A	0	0	1	0	1	0	0	0	0
SeqCtl, Sequence Control On	A	A	A	A	A	A	A	0	0	1	0	1	0	0	0	1
SeqCtl, Cleared Out Bound	A	A	A	A	A	A	A	0	0	1	0	1	0	0	1	0
SeqCtl, Have Departed	A	A	A	A	A	A	A	0	0	1	0	1	0	0	1	1
SeqCtl, In Transit	A	A	A	A	A	A	A	0	0	1	0	1	0	1	0	0
SeqCtl, Max Authorized Speed	A	A	A	A	A	A	A	0	0	1	0	1	0	1	0	1
SeqCtl, "Post Gate", Clear Ahead	A	A	A	A	A	A	A	0	0	1	0	1	0	1	1	0
SeqCtl, "Post Gate", Random Status	A	A	A	A	A	A	A	0	0	1	0	1	0	1	1	1
SeqCtl, Is Arriving (Short Trip)	A	A	A	A	A	A	A	0	0	1	0	1	1	0	0	0
SeqCtl, Is Arriving (Long Trip)	A	A	A	A	A	A	A	0	0	1	0	1	1	0	0	1
Reserved	A	A	A	A	A	A	A	0	0	1	0	1	1	0	1	0
Reserved	A	A	A	A	A	A	A	0	0	1	0	1	1	0	1	1
SeqCtl, Has Arrived (Short Trip)	A	A	A	A	A	A	A	0	0	1	0	1	1	1	0	0
SeqCtl, Has Arrived (Long Trip)	A	A	A	A	A	A	A	0	0	1	0	1	1	1	0	1
Reserved	A	A	A	A	A	A	A	0	0	1	0	1	1	1	1	0
Reserved	A	A	A	A	A	A	A	0	0	1	0	1	1	1	1	1

Word #2 – Dialog Trigger control continued, Station Sounds Car

Effects (index = 0x2)	Address / Parameter Data Format															
Conductor, Next Stop...	A	A	A	A	A	A	A	0	0	1	1	0	1	0	0	0
Conductor, Watch Your Step	A	A	A	A	A	A	A	0	0	1	1	0	1	0	0	1
Conductor, All Aboard	A	A	A	A	A	A	A	0	0	1	1	0	1	0	1	0
Conductor, Tickets Please	A	A	A	A	A	A	A	0	0	1	1	0	1	0	1	1
Conductor, Premature Stop	A	A	A	A	A	A	A	0	0	1	1	0	1	1	0	0
Steward, Welcome Aboard	A	A	A	A	A	A	A	0	0	1	1	0	1	1	0	1
Steward, First Seating	A	A	A	A	A	A	A	0	0	1	1	0	1	1	1	0
Steward, Second Seating	A	A	A	A	A	A	A	0	0	1	1	0	1	1	1	1
Steward, Lounge Car Open	A	A	A	A	A	A	A	0	0	1	1	1	0	0	0	0
Station PA, Train Arriving	A	A	A	A	A	A	A	0	0	1	1	1	0	0	0	1
Station PA, Train Has Arrived	A	A	A	A	A	A	A	0	0	1	1	1	0	0	1	0
Station PA, Train Boarding	A	A	A	A	A	A	A	0	0	1	1	1	0	0	1	1
Station PA, Train Departed	A	A	A	A	A	A	A	0	0	1	1	1	0	1	0	0
Passenger Car Start Up	A	A	A	A	A	A	A	0	0	1	1	1	0	1	0	1
Passenger Car Shut Down	A	A	A	A	A	A	A	0	0	1	1	1	0	1	1	0
Scene <2> Key, Context Dependent	A	A	A	A	A	A	A	0	0	1	1	1	0	1	1	1
Scene AUX1 <2> Key, Context Dep	A	A	A	A	A	A	A	0	0	1	1	1	1	0	0	0
Scene <7> Key, Context Dependent	A	A	A	A	A	A	A	0	0	1	1	1	1	0	0	1
Scene AUX1 <7> Key, Context Dep	A	A	A	A	A	A	A	0	0	1	1	1	1	0	1	0
Scene <5> Key, Context Dependent	A	A	A	A	A	A	A	0	0	1	1	1	1	0	1	1
Scene AUX1 <5> Key, context Dep	A	A	A	A	A	A	A	0	0	1	1	1	1	1	0	0

Word #2 – Effects control

Effects (index = 0x4)	Address / Parameter Data Format															
Dialog List Pointer to List Start	A	A	A	A	A	A	A	0	0	0	0	0	0	0	0	0
Dialog List Pointer to List End	A	A	A	A	A	A	A	0	0	0	0	0	0	0	0	1
Dialog List Pointer to Next Element	A	A	A	A	A	A	A	0	0	0	0	0	0	0	1	0
Dialog List Pointer to Prev Element	A	A	A	A	A	A	A	0	0	0	0	0	0	0	1	1
Reserved Range (0x04 – 0x1F)	A	A	A	A	A	A	A	0	-	-	-	-	-	-	-	-
Prime Mover Off	A	A	A	A	A	A	A	0	0	0	0	1	0	0	0	0
Prime Mover On	A	A	A	A	A	A	A	0	0	0	0	1	0	0	0	1
Master Volume Down	A	A	A	A	A	A	A	0	0	0	0	1	0	0	1	0
Master Volume Up	A	A	A	A	A	A	A	0	0	0	0	1	0	0	1	1
Blend Volume Down	A	A	A	A	A	A	A	0	0	0	0	1	0	1	0	0
Blend Volume Up	A	A	A	A	A	A	A	0	0	0	0	1	0	1	0	1
Reserved Range (0x16 – 0x19)	A	A	A	A	A	A	A	0	-	-	-	-	-	-	-	-
Cylinder Cock Clearing Off	A	A	A	A	A	A	A	0	0	0	1	0	0	0	0	0
Cylinder Cock Clearing On	A	A	A	A	A	A	A	0	0	0	1	0	0	0	0	1
Reserved	A	A	A	A	A	A	A	0	0	0	1	0	0	0	1	0
Standby warning Bell On	A	A	A	A	A	A	A	0	0	0	1	0	0	0	1	1
Standby Mode Off	A	A	A	A	A	A	A	0	0	0	1	0	0	1	0	0
Standby Mode On	A	A	A	A	A	A	A	0	0	0	1	0	0	1	0	1
Force Coupler Impact (compress)	A	A	A	A	A	A	A	0	0	0	1	0	0	1	1	0
Force Coupler Impact (stretch)	A	A	A	A	A	A	A	0	0	0	1	0	0	1	1	1
Circuit Breaker, Main Lights	A	A	A	A	A	A	A	0	0	0	1	0	1	0	0	0
Circuit Breaker, Cab Lights	A	A	A	A	A	A	A	0	0	0	1	0	1	0	0	1
Circuit Breaker, Ground Lights	A	A	A	A	A	A	A	0	0	0	1	0	1	0	1	0
Reserved	A	A	A	A	A	A	A	0	0	0	1	0	1	0	1	1
Sequence Control Off	A	A	A	A	A	A	A	0	0	0	1	0	1	1	0	0
Sequence Control On	A	A	A	A	A	A	A	0	0	0	1	0	1	1	0	1
Reserved	A	A	A	A	A	A	A	0	0	0	1	0	1	1	1	0
Reserved	A	A	A	A	A	A	A	0	0	0	1	0	1	1	1	1
See Subway Stops Chart for Clarity	A	A	A	A	A	A	A	0	0	0	0	0	0	0	0	0
Dialog List Pointer to Element 0xC0	A	A	A	A	A	A	A	0	1	1	0	0	0	0	0	0
Dialog List Pointer to 0xC1 ... 0xFE	A	A	A	A	A	A	A	0	-	-	-	-	-	-	-	-
Dialog List Pointer to Element 0xFF	A	A	A	A	A	A	A	0	1	1	1	1	1	1	1	1

Word #2 – Effects control continued, NYC Subway Car Station Stops

Effects (index = 0x4)	Address / Parameter Data Format															
Stillwell Ave, Coney Island	A	A	A	A	A	A	A	0	1	1	0	0	0	0	0	0
West 8 th Street	A	A	A	A	A	A	A	0	1	1	0	0	0	0	0	1
Ocean Parkway	A	A	A	A	A	A	A	0	1	1	0	0	0	0	1	0
Brighton Beach	A	A	A	A	A	A	A	0	1	1	0	0	0	0	1	1
Sheepshead Bay	A	A	A	A	A	A	A	0	1	1	0	0	0	1	0	0
Neck Road	A	A	A	A	A	A	A	0	1	1	0	0	0	1	0	1
King's highway	A	A	A	A	A	A	A	0	1	1	0	0	0	1	1	0
Avenue "M"	A	A	A	A	A	A	A	0	1	1	0	0	0	1	1	1
Newkirk Avenue	A	A	A	A	A	A	A	0	1	1	0	0	1	0	0	0
Cortelyou road	A	A	A	A	A	A	A	0	1	1	0	0	1	0	0	1
Church Avenue	A	A	A	A	A	A	A	0	1	1	0	0	1	0	1	0
Parkside Avenue	A	A	A	A	A	A	A	0	1	1	0	0	1	0	1	1
Prospect Park	A	A	A	A	A	A	A	0	1	1	0	0	1	1	0	0
7 th Avenue	A	A	A	A	A	A	A	0	1	1	0	0	1	1	0	1
Atlantic Avenue	A	A	A	A	A	A	A	0	1	1	0	0	1	1	1	0
Dekalb Avenue	A	A	A	A	A	A	A	0	1	1	0	0	1	1	1	1
Lawrence Street	A	A	A	A	A	A	A	0	1	1	0	1	0	0	0	0
Court Street	A	A	A	A	A	A	A	0	1	1	0	1	0	0	0	1
Whitehall Manhattan	A	A	A	A	A	A	A	0	1	1	0	1	0	0	1	0
Cortlandt Street	A	A	A	A	A	A	A	0	1	1	0	1	0	0	1	1
City Hall	A	A	A	A	A	A	A	0	1	1	0	1	0	1	0	0
Canal Street	A	A	A	A	A	A	A	0	1	1	0	1	0	1	0	1
14 th Street, Union Square	A	A	A	A	A	A	A	0	1	1	0	1	0	1	1	0
23 rd Street, Lionel Headquarters	A	A	A	A	A	A	A	0	1	1	0	1	0	1	1	1
28 th Street	A	A	A	A	A	A	A	0	1	1	0	1	1	0	0	0
34 th Street	A	A	A	A	A	A	A	0	1	1	0	1	1	0	0	1
42 nd Street, Times Square	A	A	A	A	A	A	A	0	1	1	0	1	1	0	1	0
49 th Street	A	A	A	A	A	A	A	0	1	1	0	1	1	0	1	1
57 th Street	A	A	A	A	A	A	A	0	1	1	0	1	1	1	0	0
5 th Avenue	A	A	A	A	A	A	A	0	1	1	0	1	1	1	0	1
Lexington Avenue	A	A	A	A	A	A	A	0	1	1	0	1	1	1	1	0
Queensboro Avenue	A	A	A	A	A	A	A	0	1	1	0	1	1	1	1	1
39 th Avenue, Beebee Avenue	A	A	A	A	A	A	A	0	1	1	1	0	0	0	0	0
Astoria Blvd, Hoyt Avenue	A	A	A	A	A	A	A	0	1	1	1	0	0	0	0	1
Astoria Avenue, Ditmars Blvd	A	A	A	A	A	A	A	0	1	1	1	0	0	0	1	0
Reserved Range (0xE3 – 0xFF)	A	A	A	A	A	A	A	0	-	-	-	-	-	-	-	-

Note: Named stops shown for example only, other Lionel subway products have different station names.

Word #2 – Sound masking control

Sound Mask (index = 0x6)		Address / Parameter Data Format															
Dialogs	Signals																
No Change	No Change	A	A	A	A	A	A	A	0	0	0	0	0	0	0	0	0
Play Always	No Change	A	A	A	A	A	A	A	0	0	0	0	0	0	0	0	1
Play Never	No Change	A	A	A	A	A	A	A	0	0	0	0	0	0	0	1	0
Default	No Change	A	A	A	A	A	A	A	0	0	0	0	0	0	0	1	1
No Change	Play always	A	A	A	A	A	A	A	0	0	0	0	0	0	1	0	0
Play always	Play always	A	A	A	A	A	A	A	0	0	0	0	0	0	1	0	1
Play Never	Play always	A	A	A	A	A	A	A	0	0	0	0	0	0	1	1	0
Default	Play always	A	A	A	A	A	A	A	0	0	0	0	0	0	1	1	1
No Change	Play Never	A	A	A	A	A	A	A	0	0	0	0	0	1	0	0	0
Play Always	Play Never	A	A	A	A	A	A	A	0	0	0	0	0	1	0	0	1
Play Never	Play Never	A	A	A	A	A	A	A	0	0	0	0	0	1	0	1	0
Default	Play Never	A	A	A	A	A	A	A	0	0	0	0	0	1	0	1	1
No Change	Default	A	A	A	A	A	A	A	0	0	0	0	0	1	1	0	0
Play Always	Default	A	A	A	A	A	A	A	0	0	0	0	0	1	1	0	1
Play Never	Default	A	A	A	A	A	A	A	0	0	0	0	0	1	1	1	0
Default	Default	A	A	A	A	A	A	A	0	0	0	0	0	1	1	1	1
DCC Auto Brake Squeal Disable		A	A	A	A	A	A	A	0	0	0	1	0	0	0	0	0
DCC Auto Brake Squeal Enable		A	A	A	A	A	A	A	0	0	0	1	0	0	0	0	1

Word #2 – Effects control

Effects (index = 0xC)	Address / Parameter Data Format															
Smoke System Off	A	A	A	A	A	A	A	A	0	0	0	0	0	0	0	0
Smoke System Low	A	A	A	A	A	A	A	A	0	0	0	0	0	0	0	1
Smoke System Medium	A	A	A	A	A	A	A	A	0	0	0	0	0	0	1	0
Smoke System High	A	A	A	A	A	A	A	A	0	0	0	0	0	0	1	1
Pantograph Control - Front Up	A	A	A	A	A	A	A	A	0	0	0	0	1	0	0	0
Pantograph Control - Front Down	A	A	A	A	A	A	A	A	0	0	0	0	1	0	0	1
Pantograph Control - Rear Up	A	A	A	A	A	A	A	A	0	0	0	0	1	0	0	1
Pantograph Control - Rear Down	A	A	A	A	A	A	A	A	0	0	0	0	1	0	0	1
Subway - Left Door Open	A	A	A	A	A	A	A	A	0	0	0	1	0	0	0	0
Subway - Left Door Close	A	A	A	A	A	A	A	A	0	0	0	1	0	0	0	1
Subway - Right Door Open	A	A	A	A	A	A	A	A	0	0	0	1	0	0	0	1
Subway - Right Door Close	A	A	A	A	A	A	A	A	0	0	0	1	0	0	0	1
Stock Car - Option 1 On	A	A	A	A	A	A	A	A	0	0	0	1	1	0	0	0
Stock Car - Option 1 Off	A	A	A	A	A	A	A	A	0	0	0	1	1	0	0	1
Stock Car - Option 2 On	A	A	A	A	A	A	A	A	0	0	0	1	1	0	0	1
Stock Car - Option 2 Off	A	A	A	A	A	A	A	A	0	0	0	1	1	0	0	1
Stock Car - Load	A	A	A	A	A	A	A	A	0	0	0	1	1	0	1	0
Stock Car - Un-Load	A	A	A	A	A	A	A	A	0	0	0	1	1	0	1	1
Stock Car - FRED On	A	A	A	A	A	A	A	A	0	0	0	1	1	0	1	1
Stock Car - FRED Off	A	A	A	A	A	A	A	A	0	0	0	1	1	0	1	1
Stock Car - Flat Wheel On	A	A	A	A	A	A	A	A	0	0	0	1	1	1	0	0
Stock Car - Flat Wheel Off	A	A	A	A	A	A	A	A	0	0	0	1	1	1	0	1
Stock Car - Game On	A	A	A	A	A	A	A	A	0	0	0	1	1	1	0	1
Stock Car - Game Off	A	A	A	A	A	A	A	A	0	0	0	1	1	1	0	1

Word #2 – Lighting control

Lighting (index = 0xD)	Address / Parameter Data Format															
Doghouse Light Off	A	A	A	A	A	A	A	0	1	0	1	0	0	0	0	0
Doghouse Light On	A	A	A	A	A	A	A	0	1	0	1	0	0	0	0	1
Hazard Light Off	A	A	A	A	A	A	A	0	1	0	1	1	0	0	0	0
Hazard Light On	A	A	A	A	A	A	A	0	1	0	1	1	0	0	0	1
Hazard Light Auto	A	A	A	A	A	A	A	0	1	0	1	1	0	0	1	0
Ditch Lights Off	A	A	A	A	A	A	A	0	1	1	0	0	0	0	0	0
Ditch Lights Off, Pulse On w/ Horn	A	A	A	A	A	A	A	0	1	1	0	0	0	0	0	1
Ditch Lights On, Pulse Off w/ Horn	A	A	A	A	A	A	A	0	1	1	0	0	0	0	1	0
Ditch Lights On	A	A	A	A	A	A	A	0	1	1	0	0	0	0	1	1
Loco Marker Light Off	A	A	A	A	A	A	A	0	1	1	0	0	1	0	0	0
Loco Marker Light ON	A	A	A	A	A	A	A	0	1	1	0	0	1	0	0	1
Tender Marker Light Off	A	A	A	A	A	A	A	0	1	1	0	0	1	1	0	0
Tender Marker Light On	A	A	A	A	A	A	A	0	1	1	0	0	1	1	0	1
Ground Lights Off	A	A	A	A	A	A	A	0	1	1	0	1	0	0	0	0
Ground Lights On	A	A	A	A	A	A	A	0	1	1	0	1	0	0	0	1
Ground Lights Auto	A	A	A	A	A	A	A	0	1	1	0	1	0	0	1	0
Strobe Light Off	A	A	A	A	A	A	A	0	1	1	1	0	0	0	0	0
Strobe Light On, Single Flash	A	A	A	A	A	A	A	0	1	1	1	0	0	0	0	1
Strobe Light On, Double Flash	A	A	A	A	A	A	A	0	1	1	1	0	0	0	1	0
Mars Light Off	A	A	A	A	A	A	A	0	1	1	1	0	1	0	0	0
Mars Light On	A	A	A	A	A	A	A	0	1	1	1	0	1	0	0	1
Cab Light Off	A	A	A	A	A	A	A	0	1	1	1	1	0	0	0	0
Cab Light On	A	A	A	A	A	A	A	0	1	1	1	1	0	0	0	1
Cab Light Auto	A	A	A	A	A	A	A	0	1	1	1	1	0	0	1	0
Rule 17 Off	A	A	A	A	A	A	A	0	1	1	1	1	0	1	0	0
Rule 17 Auto	A	A	A	A	A	A	A	0	1	1	1	1	0	1	0	1
Rule 17 On	A	A	A	A	A	A	A	0	1	1	1	1	0	1	1	0
Car Cabin Light Off	A	A	A	A	A	A	A	0	1	1	1	1	1	0	0	0
Car Cabin Light On	A	A	A	A	A	A	A	0	1	1	1	1	1	0	0	1
Car Cabin Light Auto	A	A	A	A	A	A	A	0	1	1	1	1	1	0	1	0