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| Ford Motor Company |
| Trailer Lighting Feature Specification |
| >>> DRAFT <<< |
|  |
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| Approver: |

**CONFIDENTIAL**

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**Revision History**

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| --- | --- | --- | --- |
| **Author** | **Date** | **Modification** | **Number** |
| Csanc137 | 2020-Apr-20 | 1. Format Text updates. TRM as unique nomenclature for Trailer Modules included. | V 1.3 |
| Vgarza5 | 2020-Apr-14 | 1. Updated trailer connectors, wording and added appendix section. | V 1.2 |
| csanc137 | 2020-Feb-12 | 1. Sections 1.1, 1.2, 3.1, 3.2.1 and 3.2.2 updated.   TLF generic details added. IPC messages conditioned by Vehicle Equipment. | V 1.1 |
| mavila23, vgarza5 | 2019-01-16 | 1. First Release. | V 1.0 |

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Document Overview and Purpose

## Purpose

This specification contains the Trailer Lighting Feature (TLF) requirements for the Trailer Module. The Trailer Module is a generic name intended to cover the names TLM (trailer lighting module), TTLM (trailer tow lighting module), TRM (trailer module), and ITRM (integrated trailer module). For simplicity, TRM (Trailer Modules) will be used throughout this document.

## Scope

The scope of this document is to describe the interfaces between the Trailer Module, Trailer Tow Connector, Body Control Module, and Instrument Panel Control to provide the outputs in Trailer Connector to control and diagnostic Trailer Lights according to Vehicle Lights Activation and to document the functional requirements that apply to these interfaces. This document does not contain any hardware requirements, however, the hardware must be designed to enable the function dictated by the functional requirements.

## Document Conventions

### How to Read the Document

This document contains both descriptive text and explicit requirements. Descriptive text is used if the goal is to provide a higher level, easy to read understanding of what the system does. Note that this text is sometimes still written using the expression “shall”. This indicates that even though this is a higher level of requirement (a descriptive one) the behavior as described is still expected to be met.

Explicit requirements with requirement IDs are used to describe parts of the feature or function that can be easily described as “standalone”/ “traceable” requirements. Explicit requirements always use “shall” to emphasize that the requirement must be met.

Notes and rationale may be added to requirements and these are clearly marked as notes or rationale. A note always associates to the requirement ID immediately above it. Notes are not part of the requirement. They may contain additional background information or references to other requirements of this document or reference to other documents. The notes are meant to improve understanding of the motivation behind a requirement or to explain why a requirement is written in a certain way. They also may provide support in tracing requirement cascading between documents. Consider that referenced documents are provided if they are required for correct interpretation of requirements. In general, however, documents referenced in notes (and not in the requirement text) shall be considered as not relevant for correct interpretation of the requirement. Therefore consider that if a not-provided document is referenced in a note text only, the target is to facilitate Ford’s internal requirement tracking.

This document may also contain figures and tables. Figures may provide graphical illustrations of requirements. If not explicitly noted otherwise, figures shall always be considered as only a support to improve the readers understanding. If tables are used to group requirements, the requirements in the table will always have unique IDs.

### Document Change Management

Revisions of this document shall contain change markings that clearly identify the change paragraph, requirement ID and/ or text. It is recommended to use the automated MS Word change management feature only until release of the document. Once all affected parties have agreed to the revisions, the author shall go through the document, accept the changes and manually highlight them so that the reader can quickly understand where to look for revised content. Acceptable means of highlighting are color highlighting of affected text, use of strikethrough format and change bars at the side of a changed paragraph. The author shall also list the requirements that were changed in the list of changes in the appendix. Revision changes shall be clearly identifiable between document revisions. It is recommended to only highlight changes between revisions. It is expected that when the document has finished the draft release phase and is for the first time officially released within the system, all change markings can be deleted.

# Acronyms

|  |  |
| --- | --- |
| Acronym | Expansion |
| BCM | **B**ody **C**ontrol **M**odule |
| CAN | **C**ontroller **A**rea **N**etwork |
| CPU | **C**entral **P**rocessing **U**nit |
| ECU | **E**lectronic **C**ontrol **U**nit |
| EoL | **E**nd **o**f **L**ine |
| GIS | **G**lobal **I**nformation **S**tandards (Ford) |
| HS-CAN | **H**igh **S**peed **CAN** |
| IPC | **I**nstrument **P**anel **C**luster |
| ITRM | **I**ntegrated **Tr**ailer **M**odule |
| MBD | **M**odel **B**ased **D**esign |
| MS-CAN | **M**edium **S**peed **CAN** |
| Rx | **Receive** |
| SW | **S**oft**w**are |
| TLF | **T**railer **L**ighting **F**eature |
| TLM | **T**railer **L**ighting **M**odule |
| TRM | **Tr**ailer Relay **M**odule |
| TTLM | **T**railer **T**ow **L**ighting **M**odule |
| Tx | Transmit/Transmission |
| APIM | **A**ccessory **P**rotocol **I**nterface **M**odule |
| ATBC | **A**ftermarket **T**railer **B**rake **C**ontroller |

# Feature Description

## Trailer Lighting Feature (TLF)

TLF is in charge of replicating the vehicle lights (turn, stop, fog, reverse and park) in the trailer lights.

The TRM shall perform this action if a trailer is detected through the trailer tow connector.

The TLF follows the vehicle lighting behavior which is communicated by the BCM.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| StopLghtOn\_B\_Stat | TurnLghtLeft\_D\_Rq | TurnLghtRight\_D\_Rq | Stop/Turn Lamp Left | Stop/Turn Lamp Right |
| Off | On | Off or Null | On | Off |
| Off | Off or Null | On | Off | On |
| On | Anything Else | Anything Else | On | On |
| Off | Off or Null | Off or Null | Off | Off |

## Trailer Connector Types

### North America 7 way connector.

**1**

**2**

**3**

**4**

**5**

**6**

**7**

|  |  |
| --- | --- |
| **Pin #** | **Pin description** |
| 1 | LH Stop/Turn |
| 2 | Running Lamps |
| 3 | + |
| 4 | RH Stop/Turn |
| 5 | Electric Brakes |
| 6 | - |
| 7 | Backup lamps |

Vehicle side

**1**

**2**

**3**

**4**

**5**

**6**

**7**

Trailer side

### North America 4 way connector.

|  |  |
| --- | --- |
| **Pin #** | **Pin description** |
| 1 | Ground |
| 2 | Park Position |
| 3 | Left Stop/Turn |
| 4 | Right Stop/Turn |

**1**

**2**

**3**

**4**

Vehicle side

Trailer side

**1**

**2**

**3**

**4**

|  |  |
| --- | --- |
| **Pin #** | **Pin description** |
| 1 | LH Stop/Turn |
| 2 | Running Lamps |
| 3 | + |
| 4 | RH Stop/Turn |
| 5 | Electric Brakes |
| 6 | - |
| 7 | Backup lamps |

### North America combo connector.

**1**

**2**

**3**

**4**

**5**

**6**

**7**

**1**

**2**

**3**

**4**

|  |  |
| --- | --- |
| **Pin #** | **Pin description** |
| 1 | Ground |
| 2 | Park Position |
| 3 | Left Stop/Turn |
| 4 | Right Stop/Turn |

|  |  |
| --- | --- |
| **Pin #** | **Pin description** |
| 1 | Left indicator |
| 2 | Rear Fog Lamp |
| 3 | Earth |
| 4 | Right Indicator |
| 5 | Right Tail Lamp |
| 6 | Brake Lamp |
| 7 | Left Tail Lamp |
| 8 | Reverse Lamp |
| 9 | Permanent Power |
| 10 | Switched Supply (for fridge) |
| 11 | Earth for Pin 10 |
| 12 | No Current Allocation |
| 13 | Earth for Pin 9 |

### Europe 13 way connector

**2**

**1**

**3**

**4**

**13**

**12**

**11**

**10**

**9**

**8**

**7**

**6**

**5**

Vehicle side

**1**

**2**

**3**

**4**

**5**

**6**

**7**

**8**

**9**

**10**

**11**

**12**

**13**

Trailer side

|  |  |
| --- | --- |
| **Pin #** | **Pin description** |
| 1 | Left-hand turn |
| 2 | Reversing signal |
| 3 | Earth return |
| 4 | Right-hand turn |
| 5 | Service brakes |
| 6 | Stop lamp |
| 7 | Rear lamps, clearance & side marker lamps |
| 8 | Battery charger/winch |
| 9 | Auxiliaries/ battery lead |
| 10 | Earth return |
| 11 | Rear fog lamp |
| 12 | Auxiliaries |

### Australia/New Zealand (12 pin connector)

**1**

**2**

**3**

**4**

**5**

**6**

**7**

**8**

**9**

**10**

**11**

**12**

Vehicle side

Trailer side

**4**

**5**

**3**

**1**

**2**

**7**

**6**

**12**

**11**

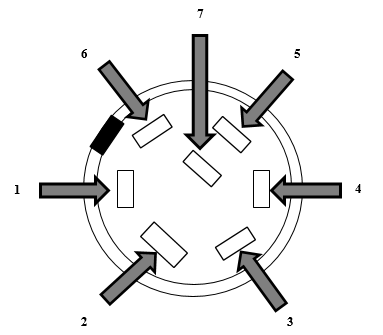
**10**

**9**

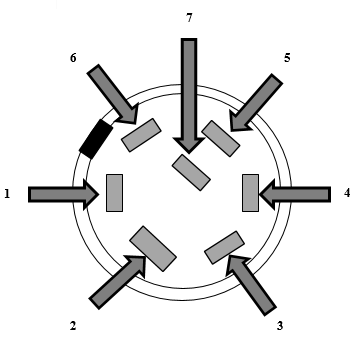
**8**

### South Africa and emerging Asia (7 pin round connector).

|  |  |
| --- | --- |
| **Pin #** | **Pin description** |
| 1 | Turn LH |
| 2 | Backup Lamps |
| 3 | Ground |
| 4 | Turn RH |
| 5 | Position RH |
| 6 | Stop Lamps |
| 7 | Position LH |



Vehicle side



Trailer side

TLF feature is available **only** if following condition is met:

Trailer connection is detected, for vehicles equipped, a notification on IPC or APIM is displayed.

\*For further details, please reference the trailer detection FS.

## TLF Use Cases

### TLF feature activation

|  |  |
| --- | --- |
| **Purpose** | TLF activation |
| **Actors** | User |
| **Precondition** | Engine Run, Trailer connected. |
| **Scenario Description** | User enables turn, stop, park, rear fog lamps. |
| **Post-condition** | Trailer replicates vehicle lighting behavior. |

### TLF lamp outage

|  |  |
| --- | --- |
| **Purpose** | TLF lamp outage notification |
| **Actors** | User |
| **Precondition** | Engine Run & trailer Turn lamps, either left or right is out. |
| **Scenario Description** | User connects the trailer to the trailer connector. |
| **Post-condition** | IPC/APIM displays trailer outage either left or right, if available. |

### TLF turn lamps feature

|  |  |
| --- | --- |
| **Purpose** | TLF activates trailer turn lamps |
| **Actors** | User |
| **Precondition** | Vehicle ON |
| **Scenario Description** | User activates (up/down) the turn indicator which activates vehicle turn lamps. |
| **Post-condition** | Trailer indicadors are active (right/left) per the turn indicator position. |

### TLF stop lamps feature

|  |  |
| --- | --- |
| **Purpose** | TLF activates trailer stop lamps |
| **Actors** | User |
| **Precondition** | Vehicle ON |
| **Scenario Description** | User press the brake and vehicle stop lamps activate. |
| **Post-condition** | Trailer stop lamps are active due to brake press. |

### TLF hazard feature

|  |  |
| --- | --- |
| **Purpose** | TLF activates trailer hazards |
| **Actors** | User |
| **Precondition** | Vehicle ON |
| **Scenario Description** | User activates vehicle hazards. |
| **Post-condition** | Trailer hazards are active. |

### TLF reverse lamps feature

|  |  |
| --- | --- |
| **Purpose** | TLF activates trailer reverse lamps |
| **Actors** | User |
| **Precondition** | Engine Run |
| **Scenario Description** | User moves the gear to reverse which activates vehicle’s reverse lamps. |
| **Post-condition** | Trailer reverse lamps are active. |

### TLF fog lamps feature

|  |  |
| --- | --- |
| **Purpose** | TLF activates trailer fog lamps |
| **Actors** | User |
| **Precondition** | Engine Run |
| **Scenario Description** | User activates vehicle fog lamps. |
| **Post-condition** | Trailer fog lamps are active. |

### TLF park lamps feature

|  |  |
| --- | --- |
| **Purpose** | TLF activates trailer park lamps |
| **Actors** | User |
| **Precondition** | Engine Run |
| **Scenario Description** | Vehicle park lamps are active due to headlamps. |
| **Post-condition** | Trailer park lamps are active. |

### TLF stop lamp activation drived by ATBC

|  |  |
| --- | --- |
| **Purpose** | TLF activates trailer stop lamps when ATBC is triggered |
| **Actors** | User |
| **Precondition** | Engine Run, Trailer has brakes, ATBC installed. |
| **Scenario Description** | User squeezes the ATBC slider. |
| **Post-condition** | Trailer stop lamps are active. |

# Interface Requirements

## TLF Interface signal

## Interface Signals

**Interface Signals (REQ-XXXX/A)**

The TBL feature, responds to the following signals sent by BCM with the following status:

Parklamp\_Status

|  |  |
| --- | --- |
| Off | 0x0 |
| On | 0x1 |
| Unknown | 0x2 |
| Invalid | 0x3 |

TurnLghtLeft\_D\_Rq

|  |  |
| --- | --- |
| Null | 0x0 |
| Off | 0x1 |
| On | 0x2 |
| Seq | 0x3 |

TurnLghtRight\_D\_Rq

|  |  |
| --- | --- |
| Null | 0x0 |
| Off | 0x1 |
| On | 0x2 |
| Seq | 0x3 |

StopLghtOn\_B\_Stat

|  |  |
| --- | --- |
| Off | 0x0 |
| On | 0x1 |

FogLghtRearOn\_B\_Stat

|  |  |
| --- | --- |
| Off | 0x0 |
| On | 0x1 |

RvrseLghtOn\_B\_Stat

|  |  |
| --- | --- |
| Off | 0x0 |
| On | 0x1 |

### TLF Interface with IPC/APIM

In order to notify the customer of a trailer connection and a trailer lamp outage, the TLF broadcast the following signals:

TrlrLampCnnct\_B\_Actl (event periodic cycle time 1000ms)

|  |  |
| --- | --- |
| No | 0x0 |
| Yes | 0x1 |

TurnLampTrlrRl\_B\_Stat (event periodic cycle time 1000ms)

|  |  |
| --- | --- |
| Null | 0x0 |
| Out | 0x1 |

TurnLampTrlrRr\_B\_Stat (event periodic cycle time 1000ms)

|  |  |
| --- | --- |
| Null | 0x0 |
| Out | 0x1 |

The IPC/APIM displays a message notifying the connection/disconnection as well as an outage messages, if available.

# Function Description

## Functional Block Diagram



# Data dictionary:

Name: **Parklamps\_Rqst\_IN\_CAN**

Description: Dataflow to indicate park lamp operation request received by ITRM on CAN.

Type: Discrete

Category: CAN

Initial Value: OFF

Storage Class: Volatile

Structure of Data: Scalar

Domain Domain Element Description

OFF Park lamp request is off

ON Park lamp request is ON

Name of Process Relationship

CAN Signal Translation Source

Trailer Park Position Lamp Input Processing Sink

Name: **LeftTurnLamp\_Rqst\_In\_CAN**

Description: Left turn lamp operation request sent by BCM on CAN.

Type: Discrete

Category: CAN

Initial Value: NULL

Storage Class: Volatile

Structure of Data: Scalar

Domain Domain Element Description

NULL Left turn lamp is not flashing.

OFF Left turn lamp is flashing: off at this moment

ON Left turn lamp is flashing: on at this moment

SEQ Left turn lamp flashing sequally: applicable for Mustang. For others inferred meaning is ON

Name of Process Relationship

CAN Signal Translation Source

Trailer Left Turn Lamp Input Processing Sink

Name: **RightTurnLamp\_Rqst\_In\_CAN**

Description: Right turn lamp operation request sent by BCM on CAN.

Type: Discrete

Category: CAN

Initial Value: NULL

Storage Class: Volatile

Structure of Data: Scalar

Domain Domain Element Description

NULL Right turn lamp is not flashing.

OFF Right turn lamp is flashing: off at this moment

ON Right turn lamp is flashing: on at this moment

SEQ Right turn lamp flasing in sequally: applicable for Mustang. For others inferred meaning is ON

Name of Process Relationship

CAN Signal Translation Source

Trailer Right Turn Lamp Input Processing Sink

Name: **StopLamps\_Rqst\_In\_CAN**

Description: Stop lamps operation request sent by BCM on CAN.

Type: Discrete

Category: CAN

Initial Value: OFF

Storage Class: Volatile

Structure of Data: Scalar

Domain Domain Element Description

OFF Turn off the stop lamps

ON Turn on the stop lamps

Name of Process Relationship

CAN Signal Translation Source

Trailer Stop Lamps Input Processing Sink

Name: **RearFogLamps\_Rqst\_In\_CAN**

Description: Rear fog lamps request as received from BCM on CAN

Type: Discrete

Category: CAN

Initial Value: OFF

Storage Class: Volatile

Structure of Data: Scalar

Domain Domain Element Description

OFF Turn off rear fog lamps

ON Turn on rear fog lamps

Name of Process Relationship

CAN Signal Translation Source

Trailer Rear Fog Lamps Input Processing Sink

Name: **RevLamps\_Rqst\_In\_CAN**

Description: Reverse lamps request as received from BCM on CAN

Type: Discrete

Category: CAN

Initial Value: OFF

Storage Class: Volatile

Structure of Data: Scalar

Domain Domain Element Description

OFF Turn off reverse lamps

ON Turn on reverse lamps

Name of Process Relationship

CAN Signal Translation Source

Trailer Reverse Lamps Input Processing Sink

# Appendix

### North America Trucks Trailer Lighting Requirements

#### Lighting distribution

a) Left Turn/Stop lights.

b) Right Turn/Stop lights.

c) Park/Position/Tail Lamps

d) Reverse Lamps



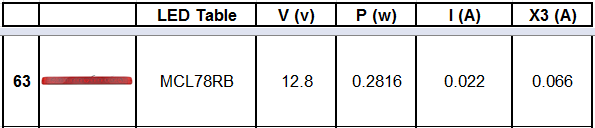
#### Market typical loads

The information shown on this section only recollects information from web sites, in particular from etrailer.com.

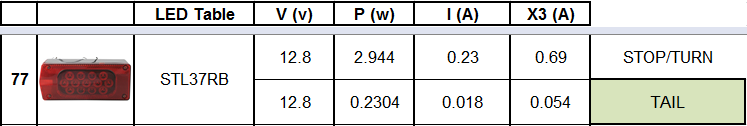
Other typical loads are registered in the range of 8-10 mA (lowest load).

**Lowest load (e trailer.com)**

**Stop**



**Tail**



**Average load (e trailer.com)**



**Higher load (e trailer.com)**

