Transportation Solutions

# Train Line Modem

## For high speed ethernet connections via train couplers and existing cabling

LUTZE TRANSPORTATION
powered by Amphenol

# Train Line Modem TLM

## Key Features


The Train Line Modem (TLM) is used for the transmission of Ethernet network data in railway vehicles over existing wires. The signals between the TLMs are modulated on existing wires. Developed specifically for use in railway applications.

- Encrypted communication 128-bit AES encryption (Advanced Encryption Standard) between the TLMs, this offers a high level of security.
- Application-optimized transmission profiles, the TLM can be adapted to any environment to enable maximum Ethernet transmission speed.
- Depending on the transmission profile, speeds of up to 1 Gbit/s can be achieved.
- Easy installation through plug-and-play. Device-specific settings and information can be easily made by using using the TLM configuration tool.
- The TLM has a wide-range power supply from 24 V to 110 V, but can also be supplied via PoE as an alternative.
- The optional heartbeat enables cyclical monitoring of diagnostic data via the Ethernet interface.
- Developed specifically for railway vehicle applications, the TLM complies with all current standards (FCC, EN 50155, EMV06, EN 45545, EN 50657) and regulations and can also be used in railway vehicles worldwide.

## Technical details

The Train Line Modem (TLM) is a device for the transmission of Ethernet data network data in railway vehicles over existing cables. The TLM transmits UDP packets with a maximum bandwidth up to 1 GBit/s. The data transmission is secured by 128-bit AES encryption. When transmitting via the coupling.

| | |
|---|---|
| **Ethernet** | |
| Properties IEEE 802.3 | IEEE 802.3x<br>IEEE 802.3u<br>128-Bit-AES (Advanced Encryption Standard) |
| Data rate | Up to 1 GBit/s (depending on variant) |
| Modulation | G.hn |
| **Voltage range** | |
| Rated voltage | DC 24 – 110 V |
| Voltage range | DC 16.8 – 137,5 V |
| Current Consumption | 160 mA @ 24 V<br>50 mA @72 V<br>34 mA @ 110 V |
| **Technical data** | |
| Protection device | Overvoltage protection (X2)<br>Short-Circuit protection (X1, X2) |
| Frequency range | 2 - 200 MHz |
| Range | The range depends on the transmission behavior of the cable, the cable length, as well as of coupled faults in the transmission line. The maximum range is 300 m. |
| Status indication | Power, LED yellow<br>Modul ON, LED yellow<br>Ethernet-Link/Act, LED green<br>TL-Link/Act, LED green |
| Connection type | X1: M12 X-coded Ethernet connector (female)<br>X2: Sub-D 9 pole male connector for Train Line (male)<br>X3: M12 A-coded Power Supply connector (male) |
| **General** | |
| Dimensions (w × h × d) | 50.5 mm × 128.5 mm × 184.0 mm (flange & plug-in without F48)<br>50.5 mm x 128.5 mm x 190.0 mm (plug-in with F48) |
| Weight/unit | 0.5 kg |
| Housing material | Aluminum |
| **Standards/Certifications** | |
| Standards | **EN 50155:2021:** Railway applications – Rolling stock – Electronic equipment<br>**EN 50121-3-2:2016+A1:2019:** Railway applications – Electromagnetic compatibility – Part 3-2: Rolling stock – Apparatus<br>**EN 50124-1:2017:** Railway applications – Insulation coordination – Part 1: Basic requirements – Clearances and creepage distances for all electrical and electronic equipment<br>**EN 50657:2017:** Basic Integrity (Application development)<br>EN 61373:1999: Railway applications – Rolling stock equipment – Shock and vibration tests<br>**EN 61373:2010:** Railway applications – Rolling stock equipment – Shock and vibration tests Regulation No. EMC 06: Technical Rules on Electromagnetic Compatibility - Verification of radio compatibility of rail vehicles with railroad radio services<br>**EN 45545-2:2020:** Railway applications – Fire protection on railway vehicles – Part 2: Requirements for fire behaviour of materials and components.<br>**Regulation No. EMC 06:** Technical Rules on Electro magnetic Compatibility - Verification of radio compatibility of rail vehicles with railroad radio services |

# Train Line Modem TLM

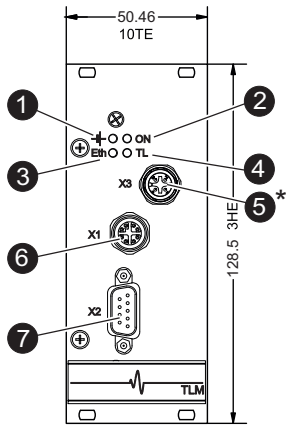
## Product Overview

| TLM-10 | |
|---|---|
| Part-No. | Type |
| 806610 | TLM-10 10TE DC 24-110V FM |
| 806611 | TLM-10 10TE DC 24-110V FM PB |
| 806600 | TLM-10 10TE DC 24-110V PI |
| 806601 | TLM-10 10TE DC 24-110V PI PB |
| 806710 | TLM-10 10TE DC 24-110V FM PoE |

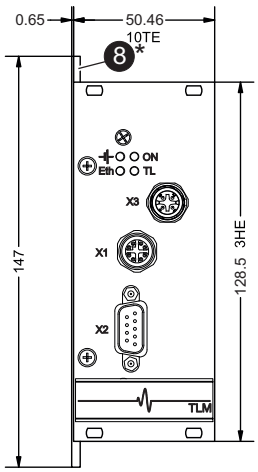
| TLM-X | |
|---|---|
| Part-No. | Type |
| 806110 | TLM-X DC 24-110V FM |
| 806112 | TLM-X FM PoE |

The TLM-X uses a robust transmission method that is ideally suited for retrofit projects with older, partially unshielded cabling. Its strengths are particularly evident in environments with electromagnetic interference (EMI) as well as in sensitive contact and coupling transitions. Under these conditions, the TLM-X enables a stable Ethernet connection with speeds up to 860 Mbps between train units. In contrast, the TLM-10 relies on a transmission method that can fully exploit its advantages in technically higher-quality infrastructure, allowing for bandwidths of up to 1 Gbps. Both Train Line Modems support the use of video technology, infotainment, operator terminals, passenger counting systems, LCD/TFT displays, Wi-Fi modules, GPS and mobile applications, as well as the reservation system on an Ethernet network basis.

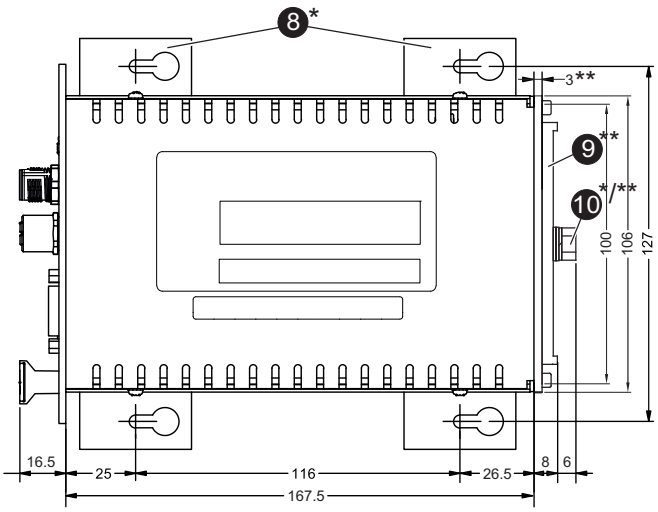
## Dimensions




*19" rack-mount version*




*EN *Flange version with base plates*




## PIN Assignment

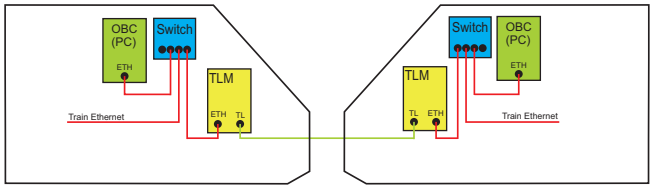
| | |
|---|---|
| 1 | Status LED: Power, yellow |
| 2 | Status LED: ON, yellow |
| 3 | Status LED: Ethernet-Link/Act, green |
| 4 | Status LED: TL-Link/Act, green |
| 5 | X3: M12 A-coded (Power supply), male* |
| 6 | X1: M12 X-coded (Ethernet), female |
| 7 | X2: Sub-D 9 pole male connector for 2-wire connection (for Train Line) |
| 8 | base plates (only flange version*) |
| 9 | F48 male connector (DIN 41612)** |
| 10 | M6 grounding bolt */** |

** Flange version* *** Band pass version*

# Sample Configurations

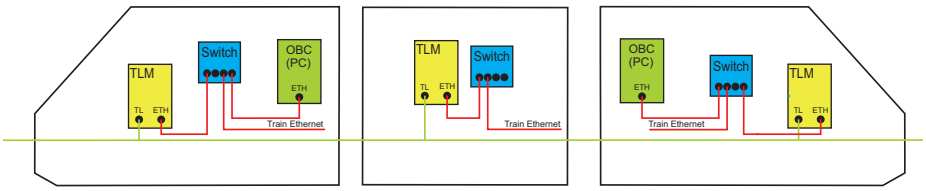
Discover the versatile application possibilities of our innovative solutions! The use of video, infotainment, control terminals, passenger counting systems, LCD/TFT displays, WLAN modules, and much more in rail vehicles can be effortlessly implemented on an Ethernet network basis. The TLM acts like a cable and ensures a transparent connection for all participants. This keeps the data traffic uninterrupted, making the retrofitting of Ethernet in existing vehicles both simple and straightforward. This allows the advantages of modern technologies to be integrated into rail vehicles, enhancing both comfort and efficiency. A variety of application cases are conceivable. Below, we will present three common examples:

## Example 1 - Direct transmission via coupling



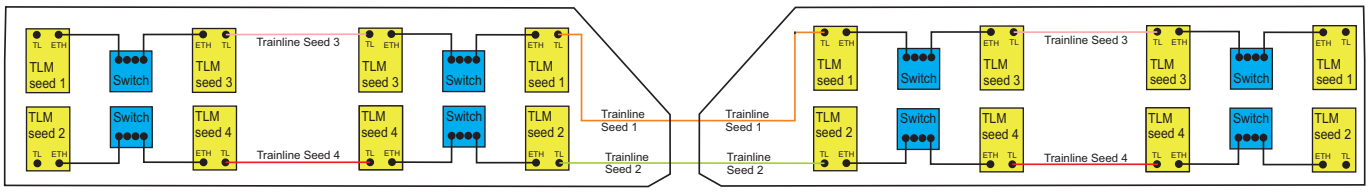

In this example, TLMs are used for efficient communication between vehicles. The vehicle already has integrated Ethernet communication, which is to be expanded throughout the entire vehicle. However, since there is no additional space available at the coupling, TLMs provide an ideal solution. By using a TLM at each vehicle head, a continuous Ethernet connection can be established throughout the entire vehicle network. This ensures seamless communication and optimized functionality within the vehicle.

## Example 2 - TLM inside the vehicle




In long vehicle configurations, the TLM can utilize a line that is already present throughout the entire train. This allows the Ethernet connection to be flexibly expanded at specific points with additional network participants, without the need for labor-intensive new cabling to be installed. Future retrofitting is also easily possible.

## Example 3 - Redundant system via coupling and within the vehicle




In this example, a possible redundant configuration for a system can be seen. Here, two TLM pairs are connected near the coupling to ensure fast and reliable data transmission between the two cars. Additionally, two more TLM pairs were installed within the train, allowing the entire vehicle to be equipped without the need to lay new Ethernet cables. Thanks to special configuration options, the cables can be placed closely together without interfering with each other. Depending on the size of the car and specific conditions, this configuration can also be realized with fewer modules.
Many other application examples are possible and conceivable. Our LÜTZE engineers accompany you from the first concept, through the measurements on your vehicle, to the creation of the configuration, and are happy to provide support and maintenance.

# Train Line Modem TLM

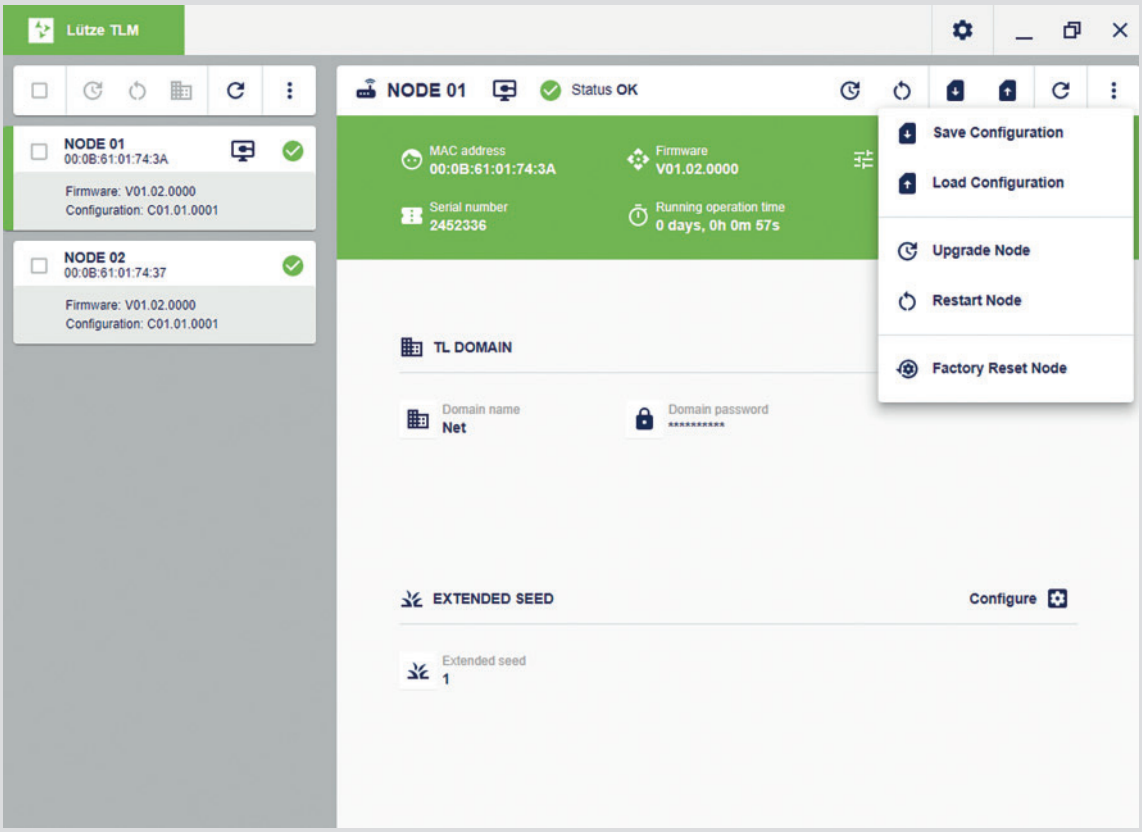
## TLM Configuration Tool

The TLM Configuration Tool from LÜTZE is used to configure the Train Line Modem, which is designed for secure Ethernet communication in rail vehicles. The tool provides functions for configuring and managing the TLM, as well as diagnostic information and the ability to perform updates. It supports commissioning to ensure reliable data communication in existing and already deployed rail vehicles.

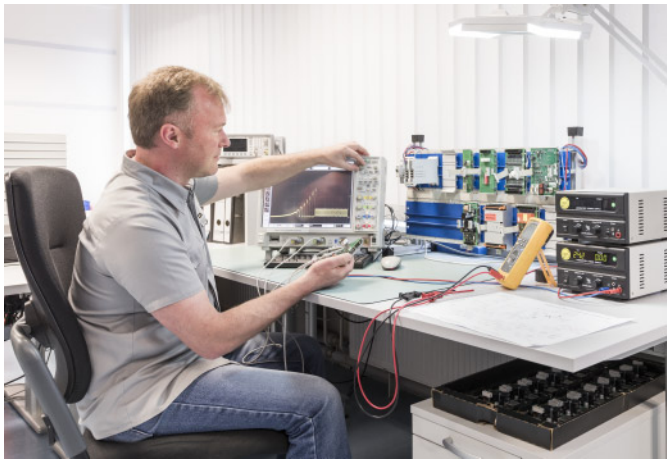
In the TLM Config Tool, you can configure the following settings for your own use:

Network settings

- Seeds for parallel networks
- Configuring the heartbeat
- Backing up and loading your own configurations
- Updating a single or multiple TLMs



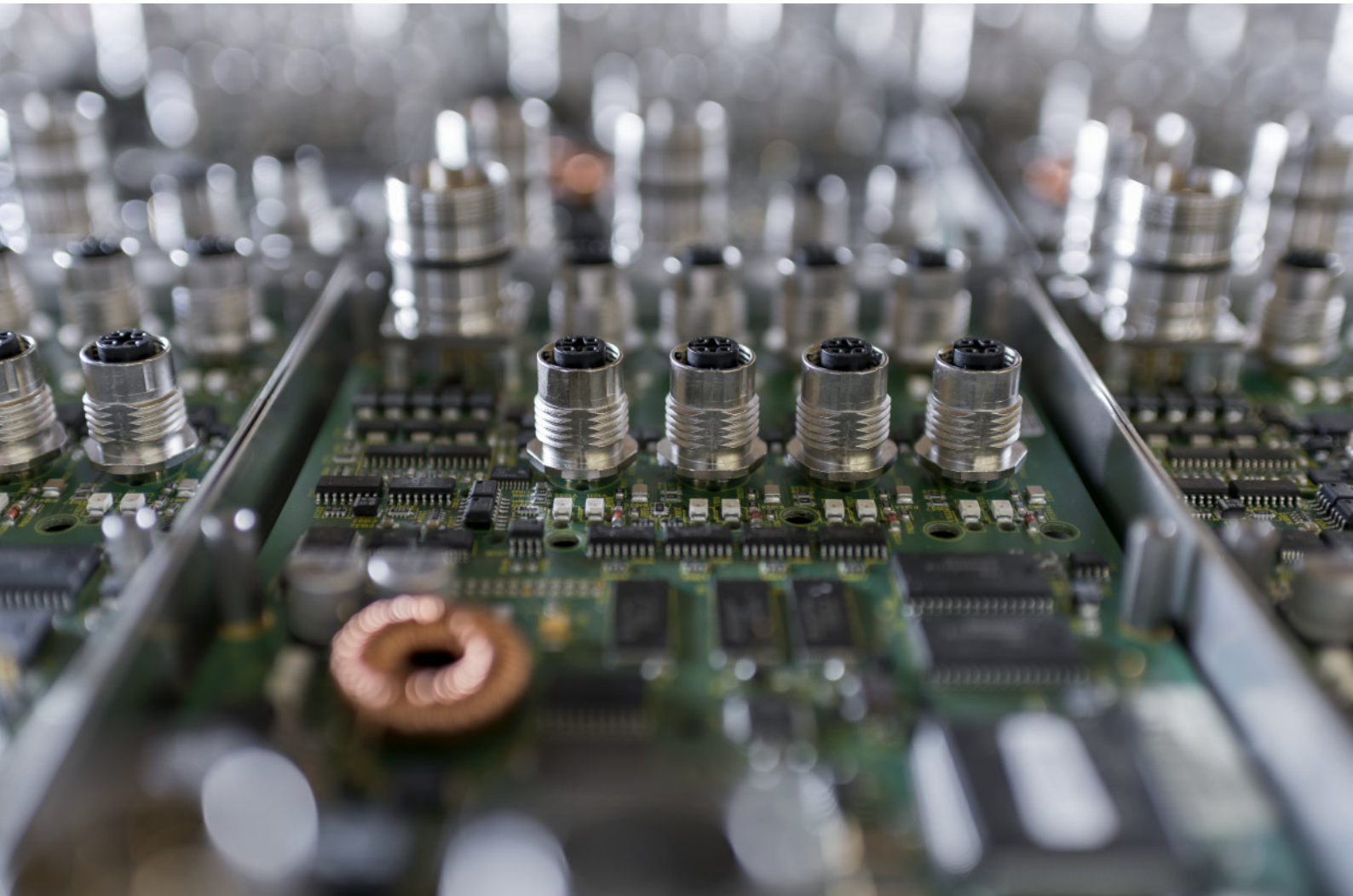
# Railway Technology Competence

LÜTZE has been developing and manufacturing electrical components for rail vehicles for over 35 years. Our extensive product range of standard components carries out many automation tasks in the most diverse vehicle applications.

Are you still looking for the appropriate product adapted to suit your specific application?

Get in touch with us. Our developers help you to find the best solution for your product, including the specification and design for the application on the vehicle, regardless of whether you need components for your control technology, interface components or optical and acoustic signals.



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