

Univox[®] TLS-2.2

Loop amplifier for railway use

User manual



Part no 213112

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Important information – checkpoints

- Installation and maintenance work must be performed by qualified personnel only
- Do not open the unit unless authorized by Univox
- Unit comes with default settings for highest efficiency
- Do not change any settings without consulting Univox
- Never change the default setting without consulting Univox
- Never connect units without a full understanding of the functions and interference of all connected units
- Always connect the loop before attaching power supply
- Always disconnect the power supply before maintenance
- Only connect CHASSIS using the mounting brackets and the bolt joint at the heat sink
- Leave GND/screen/ CHASSIS open at one unit, avoiding ground loops
- If in any doubt of understanding the basics of field distribution, please contact Univox support
- Ensure free airflow across the heat sink. Avoid installing close to any heat sources
- Never make any modifications whatsoever to the unit
- Never expose the unit to any liquid or moisture of any kind
- Field Strength varies depending on the loop wire location and the surrounding metal
- Speech Transfer Index, STI-not relevant as each Hearing instruments are adapted to the user's hearing loss
- Avoid using speakers as signal source being adjust for the acoustics environment

General – introduction

An induction loop system transfers the audio signal directly and wirelessly to a hearing instrument. This increases speech intelligibility with an enhanced signal-to-noise ratio (S/N) compared to an acoustic PA system. Each hearing instrument is configured with a custom frequency response and dynamic range adapted for the users' hearing impairment.

Univox TLS 2.2 hearing loop driver

Univox TLS-2.2 is an audio induction loop driver developed for hearing loop installations in modern aluminum vehicles, railway- and similar applications in rugged environments.

Reliability

Specifically designed for vehicles, with a focus on long-term use and mechanical and electrical ruggedness.

Power

Overdesigned power and cooling for long-term safe performance in modern aluminum vehicles with extensively high magnetic field absorption.

Quick set-up

No adjustment is required. The factory default settings with the regulations will guarantee optimal performance and easy installation. Do not change the settings without a technical consultation.

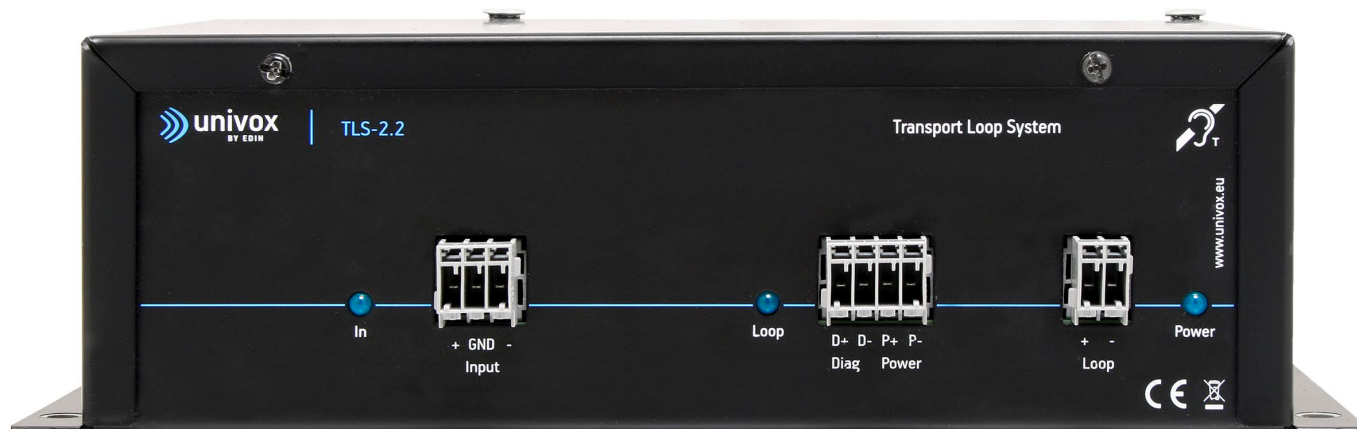
Input variation

Enabled automatically by the Dual Action AGC for a constant output within ± 1 dB.

Output control

Automatic frequency and impedance control for optimum efficiency.

Connections



	Terminal	Wago	Function	Data	Note
INPUT "In" LED	Audio In+	769-663	Balanced input	0dBu/0.775V	Floating
	Audio In-	769-663	Balanced input	0dBu/0.775V	Floating
	GND/screen	769-663	Screen	Chassis	Leave open
POWER "Power" LED	P+	769-664	Power supply	+24V / <15A	Fuse 8A (slow)
	P-	769-664		0V	
DIAG	D+	769-664	Loop Function	Indicates a functional transmission	Open transistor (Pull-up resistor Relay)
	D-	769-664	Fully isolated Opto-Coupler		External GND
LOOP "Loop" LED	+	769-662	Loop Output	<30Arms	Floating
	-	769-662	Loop Output	<35Vrms	Floating

INPUT

Input signal. Differential low-ohmic (op-amp) standard 0dBu/0.775Vrms signal source is recommended for high immunity. *Leave GND/screen open/NC.*

Avoid long parallel sections close to the loop wire or other wires carrying audio or low-frequency signals.

"In" LED indicates a proper signal level (2-5 sec delay) and is lit for several seconds once activated.

POWER

Power supply. A separate external fuse is recommended - (8A slow). Other fuse values might be suitable based on the installation requirements. Should be verified at the trial setup and documented.

DIAG

Isolated opto-transistor, synchronized with "Loop" LED. See the Informative section for details.

LOOP

Loop load connection. Loop figuration and wire coupling are vital for transmission and impedance matching. Long analog wires (like speaker cables) close parallel to the loop wires should be avoided. Contact Univox for detailed information and planning. "Loop" LED indicates transmission.

Electric Guidelines

Overvoltage

IEC 50155 requires a MINIMUM of 1.4 times headroom as overvoltage protection. Univox has measured voltage up to 35VDC at some points when charging a 24V system voltage battery system. 1.4 times 35V is 49VDC. TLS 2.2 Maximum voltage is 50VDC. Therefore, we recommend having the isolated DC/DC converter in train installation for long-term safety. All connections are protected by transient voltage suppressors.

CHASSIS voltages

Do not connect wires between equipment CHASSIS due to voltage differences at connection points to train chassis. This includes modern trains.

Common connections

Never use any common signal GND, negative or positive supply voltage.

Isolated differential input

Must be used connecting all vital parts isolated. NEVER use single mode connection.

Never connect units - Using Wires

It's a considerable risk of interference issues. If it is a shield wire leave it open in one end.

External fuse

8A slow fuse works in practice but requires to be verified at the test setup test. Standby idle current is 50-100mA.

System planning – general

Please contact Univox for guidance and detailed discussion regarding initial planning, protocol, and tuning of the first trial installation (technical and practical aspects regarding interface, 3D simulation, loop wire configuration, and placement).

Loop planning and installation in environments with high damping effects, particularly in trains, differs from standard loop installations.

Unit placement

Place/mount the unit in an adequate ventilated location, preferably close to the signal source. For unit dimensions and mounting details please see the **Informative** section.

Input signal cable

Follow audio standard installation practices and avoid installing the loop wire close and in parallel to analog cables or any inductive pickup systems. The signal source must be isolated to CHASSIS and any positive or negative power rail. Only connect the shield on one of the connection units.

Avoid connection between CHASSIS

Do not connect different units via wire (CHASSIS to CHASSIS) causing current loops

Power cable

Verify that the supply cable safely can handle the max peak current of approximately 10 ADC. A separate fused (8A, slow) wire is recommended but depends on the actual loop load. Use a tight parallel paired wire. If positive and negative wires are in separate wires, they should be twisted tightly. Both methods minimize stray magnetic fields and reduce the risk of interference.

Diagnostic cable - Onboard Computer

Cable type is not critical, but a paired cable is recommended. Halogen-free cable is commonly used.

Loop wire

The Loop wire placement should be planned carefully. The final result is highly dependent on its placement and figuration. We strongly recommends contacting Univox for guidance and consultation from long-term experienced experts. For an initial test setup, it is practical to use a junction box to connect the number of turns, See *Optimum Loop configuration*.

Guidance - Loop Wiring

- Do not cover the loop wire with metal if possible
- Keep the distance to metallic in general whenever possible
- Never place the wire tight to reinforced metal bars in longer sections
- Avoid installing the wire close to reinforced metal bars in longer sections, thus avoiding attenuated and fluctuating field strength.
- Particularly, avoid placing the loop wire close to reinforced thick and strong metal bars due to strong absorption. Meaning: never tie the loop wire or have it close to any supportive bar. Be extra observant a door openings where a massive metal supporting bar often dampens the FS.

Test equipment

- **LCR meter** – inductance measurements
- **Multimeter** – Loop wire resistance measurements
- **Oscilloscope** – Oscilloscope (normally not required) with current clamp
- **Univox Listener** – Detecting Field Strength, FS, peak and audio speech clarity
- **Field Strength Meter** – Field distribution/variation for sinusoidal signal tests
- **Loop Current Measurement, Clamp-meter** – Record value for FS and current - fault-finding

Input connection

Standard level for input signal is 0dBu (0.775Vrms) differential low-ohmic representative speech announcement level makes a good EMI resistance and is highly recommended.

Fixed signal source level

A balanced speech signal should be connected directly to the unit without any input setting adjustments. Any variation is regulated by the speech-optimized Dual Action AGC within +-1dB when Indicated at the "In"-LED.

Note: "In" LED activates after a short delay and remains active for several seconds.

Caution:

In case the signal source is not balanced **it must not** be connected.

If the input signal level is below 0dB and the "In" - LED does not indicate, the number one solution is to increase the level from the signal source. If that is not possible, contact Univox support for guidance.

Power connection – isolation is important!

It is highly recommended to use a DC/DC converter of 24VDC **to isolate the unit from any voltage potential variation between positive, negative, and train car CHASSIS ground**. This will reduce all sorts of issues and interference. Using the converter there is **no** reported fault of any installation using TLS 2.2 for over 15 years in use.

For less complicated 24V systems (generating 30V when charging) a DC/DC converter is normally not required.

Optimum Loop configuration

Discuss with Univox prior to the planning of loop wire installation. It saves times for all involved parties, as there is new knowledge on the subject.

Do not change the amplifiers' factory default settings. For maximum efficiency, the output power is best controlled by loop configuration. Please contact Univox for guidance regarding the loop configuration design size, mounting height, and number of turns.

Loop configurations - Loop size dependent. Consult Univox for the trial test verification. Always do a trial setup to verify the installation.

Full-size train car (approx. 20m in length):

3-Turn loop: 3 x 4mm² (most efficient)

3-Turn loop: 3 x 2.5mm² (often sufficient)

Short sectioned loop of (approx. 10m in length):

3-Turn loop: 3 x 2.5mm²

Very short sectioned loop (below 10m in length):

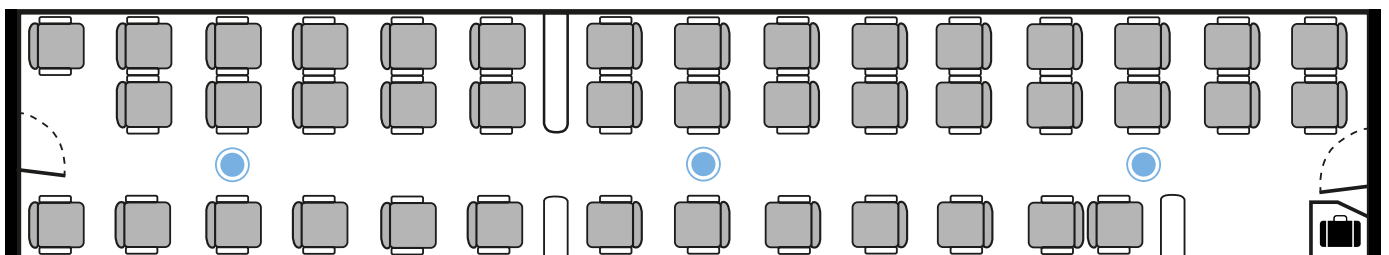
3-4-Turn loop: 3-4 x 1.5mm²

Note: Single-turn loop might reduce the output level during measurements.

Verify maximum peak Field Strength

1. Verify that the unit still is in factory default setting.
2. Firstly, connect Loop load and then connect the power supply of 24VDC.
3. Connect the signal source - **repetitive voice announcement**, NOT a sinusoidal wave, at approximately 0dBu / 0.775Vrms or slightly higher to secure activation of the AGC. Verify that "In" and "Loop" LED indicate at the speech signal after some settling time.
4. Select three measurement positions in the aisle: One at the middle of the car length, two on each side at ¼ from both ends at **1.7m** height. [See fig. below]. This is only to verify that the system can create required maximum peak levels 0dB_L (400mA/m) according to IEC-standard.
5. Document the highest reading holding the measure instrument in **vertical** mode.
6. When using Univox Listener observe LED indication:
 - Green indicates 0dB_L
 - Yellow indicates -6dB_LEach LED light indicates correct Field Strength.
7. Using Field Strength Meter, FSM,- document the readings in dB.
8. Communicate the readings with Univox for comments or fault findings.

Max Field Strength – 1.7 meter height



Verify Field Distribution variation

Note: If an FSM is not available, use the previous Max Field Strength results for documentation: "Max Field Strength of X dBL is verified at the documented positions". The Listener cannot be used.

1. Remove the voice announcement source and connect a 1kHz balanced sinusoidal signal to the input. (A sinusoidal signal is constant and stable making it ideal for level distribution measurements).
2. Connect an input level at 150 mVrms. **The "In" LED must NOT indicate.**

Note: Be observant that the unit will not reduce the output level during the measurement procedure.

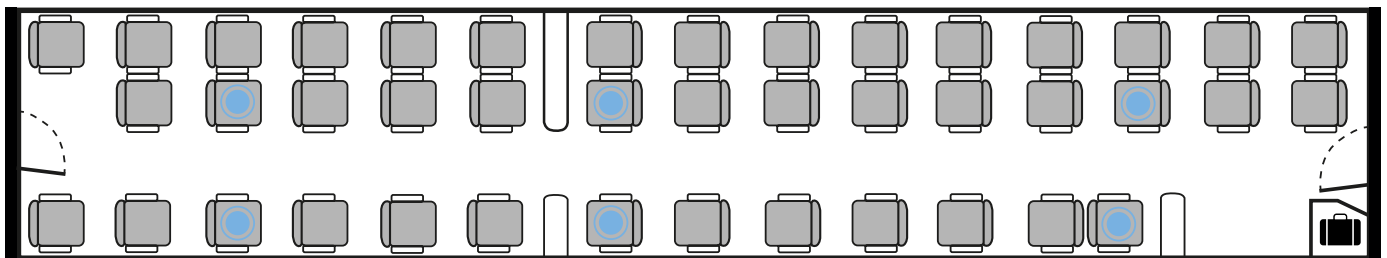
3. Hold the instrument at 1.45 meters height. Measure in the middle of a few seatings at $\frac{1}{4}$ from the end points of the car length and at middle. During measurement, document the highest reading within $\pm 30^\circ$ tilt angle relative vertical axis. [See fig. below]

Note 1: Theoretically, a tilting measurement by 45 degrees will reduce the vertical Field Strength by maximum 3dB. This is not recognizable in speech.

Note 2: The field strength drop is approximately 1 dm wide. A 10-degree tilt will increase the field strength. This is not a practical issue for the end-user and the field strength drop is only directly below the actual loop-wire.

4. The Field Strength distribution is directly correlated to the loop wire position, placement, and measurement directivity.
5. Avoid longer test periods when using a continuous sinusoidal signal. Be aware that the unit does not limit the output during long continuous sinusoidal signals.
6. Document the results and present it as variations in $\pm$ dB as a relative variation. Please communicate the results with Univox for comment or fault findings. On any abnormalities, please halt the process and contact Univox for early communication. We are happy to be of assistance as early as possible. Best is to synchronize the test dates with us for instant guidance.

Field Distribution – 1.45 meter height



Informative

The location of the loop amplifier should allow for easy access to available signal and the power source. The TLS-2.2 driver can be mounted in any position (horizontal/vertical) using the screw holes on the side flanges of the cover.

Note: The unit must be mounted in such a way that the heatsink overhangs the mounting surface and is positioned "in free air", allowing for proper ventilation/air flow. Failure to comply with this requirement may result in unit overheating and shutting down prematurely.

TROUBLE SHOOTING

“Power” LED not active

Check power connection and fuses.

“In” LED not active

Input signal missing or too low.

“Loop” LED not active

Input signal missing or open circuit – broken loop wire. Verify that loop wire is not open circuit, short circuit, or connected to chassis at any point.

In case of finding any faults, please contact Univox support.

DIAGNOSTIC OPTICAL OUTPUT

Purpose: Verify TLS 2.2 functionality, normally during vehicle start-up.

NOTE: It is strongly recommended to test the interface circuitry before final implementation. Please contact Univox for further details to verify the interface.

Realization: Galvanically isolated (5.3 kV) optical transistor coupler with open Collector (D+) and open Emitter (D-). Conducts during transmission, otherwise an open state.

There are several possible interface solutions when connecting to opto-transistors. Care for bias and working points is vital. Below is a voltage triggering example, but a current sense can also be used.

Example of a external voltage trig-interface

(D-) – Reference for the external interface circuitry

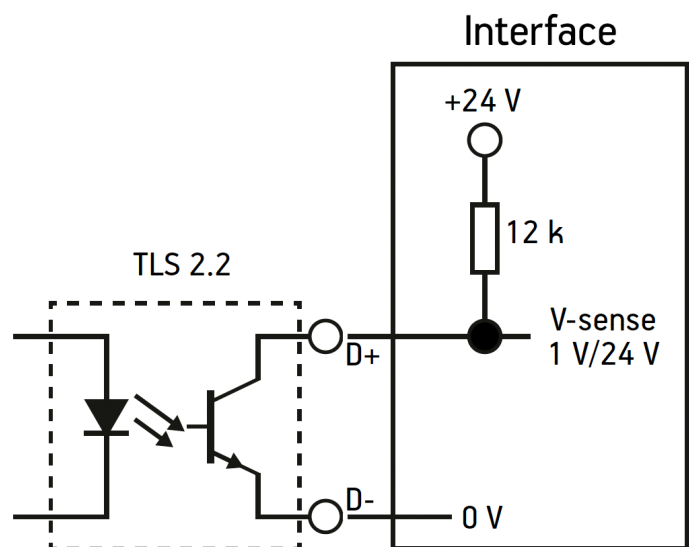
(D+) – V-sense, Logic out

+24 VDC (external) via a pull-up resistor

Indication state: With a 12 k pull-up resistor the opto transistor (D+) drops down to typically 0.5 V-1 V during transmission. During no transmission, V-sense is 24 V.

Typical boot/start-up sequence: Test audio signal sends to TLS unit. Transmission is verified by the opto-coupler and is read back to the vehicles computer system.

NOTE: “Loop” LED is in sync with the opto-coupler verifying a successful transmission visually.



Technical data

- Rugged oversized output circuitry with up to 30 Arms output
- Adjustable frequency Metal Loss Compensation, MLC
- Complies with all relevant standards
- Adapted for fixed installation in limited spaces
- Battery connection to nominal 24VDC
- All I/O connections – isolated by 3 kV and differential overvoltage protected
- No input trimming – adapted for consistent high-in-metal vehicles with 1 dB Dual Action AGCs
- Floating output – current drive with environmental gain and frequency compensation
- 0 dBL Field Strength peak levels. Fluctuation depends on Loop wiring placement
- EMI-hardened by several differential efficient LC- filters on all connections
- IP40 rated and durable WAGO 769 series connectors
- Transmission verification – 3.5 kV optocoupler / panel LED

Approvals

The unit complies with all relevant standards included in Railway applications.

EN-501555

- Temperature requirements (-25 to +70C)
- Uses components rated at 105C and higher

EN-61373

- Vibration compliance

EN-45545-2 Hazard Level 2

- Fire & Smoke compliance

EMC & EMI EN 50121-3-2

Safety/Warranty

Prior to installation,

Planning, knowledge in basic audio installation techniques as well as knowledge of other equipment's function and requirements to comply with functions and regulations that apply to the installation environment. The installer is responsible for the installation hereby avoiding any malfunction, interference with other equipment or risk or cause of fire. Please also note that the warranty is not valid for any damage or defects to the product due to incorrect or incautious handling.

Bo Edin AB shall not be held responsible or liable for any interference or to any direct or indirect incidental consequential damages or losses to any person or entity, if the equipment has been installed by unqualified personnel and/or if installation instructions stated in the product Installation Guide have not been strictly followed.

