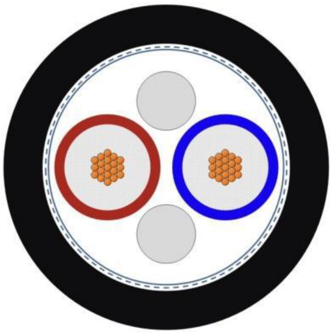
1. APPLICATION

Field of use:	Bus cable for the Multifunction Vehicle Bus (MVB) for serial data communication in railway vehicles. MVB is a component of the Train Communication Network (TCN) and standardized in IEC 61375-3-1.
Performance:	Screened foiled twisted pair cable, having a nominal impedance of 120 Ω. Designed for transmission rates of 1.5 Mbit/s. The MVB transmits time-critical control signals in real time.
Characteristics:	flame retardant, no flame propagation, halogen free, low smoke density, ozone resistant, UV resistant, oil resistant, fuel resistant, resistant to acids and alkalis
Applications:	MVB, TCN, RS-485 and others
Approvals:	EN 45545-2: Hazard Level HL1, HL2, HL3 NF F 16-101 Fire testing – Types of rolling stock: External category: A2, B Internal category: A1, A2, B NF F 16-101 Fire testing – Fire Classification: Flammability: class D Smoke and toxicity: class F0



2. DESIGN

Conductor	stranded tinned copper 0.5 mm² (19×0.185 mm) conductor diameter:	 nom. 0.92 mm
Insulation	foamed skin PE (Polyethylene) type A acc. to EN 50290-2-23, table 2 temperature class A acc. to ISO 19642 core diameter:	 2.45 mm ± 0.1 mm
Color identification code	red/blue	
Stranding	2 cores stranded to pair, with 2 fillers filler diameter: nom. lay length: ≥ 12 twists per meter	 1.5 mm
Wrapping	plastic tape (overlapping)	
Foil screen	plastic laminated aluminum foil (Al surface outside, overlapping, longitudinal)	
Braid screen	braid of tinned copper wires (coverage 85 % ±5 %) diameter over braid:	 nom. 5.6 mm
Separation layer (optional)	non-woven tape (longitudinal)	
Outer sheath	cross-linked polymer compound EM 104 acc. to EN 50264-1, table 4 black, similar RAL 9005 outer diameter: wall thickness:	 7.6 mm ± 0.3 mm nom. 1.0 mm

3. ELECTRICAL CHARACTERISTICS

Test procedures for electrical characteristics acc. to EN 50288-1.

Conductor resistance	Loop resistance: DC resistance:	≤ 80.2 Ω/km ≤ 40.1 Ω/km
Dielectric strength	core/core: core/screen:	1000 V (AC, 1 min) 1000 V (AC, 1 min)
Maximum operating voltage	IEC/EN:	125 V (not intended to be used in conjunction with low impedance sources, such as power grids)
Insulation resistance	core/core: core/screen:	≥ 5 GΩxkm ≥ 5 GΩxkm
Mutual capacitance	1.5 MHz:	≤ 46 nF/km
Capacitive unbalance to shield	1.5 MHz:	≤ 1500 pF/km
Transfer impedance	0.5 - 20 MHz:	≤ 20 mΩ/m

4. TRANSMISSION CHARACTERISTICS

The transmission characteristics meet the requirements of IEC 61375-3-1.

Characteristic impedance	0.75 – 3 MHz:	120 Ω ± 10 %
Attenuation	1.5 MHz: 3 MHz:	≤ 15 dB/ km ≤ 20 dB/ km
Velocity of propagation (NVP)		0.74 c (for information only)
Data transfer rate		1.5Mbit/s

5. MECHANICAL CHARACTERISTICS

Minimum bending radius	fixed installation: occasional flexing:	3× outer diameter 10× outer diameter
Temperature range	fixed installation:	-40 °C up to +90 °C

6. ENVIRONMENTAL CHARACTERISTICS

Flammability	flame retardant acc. to IEC 60332-1-2 resp. EN 60332-1-2 flame propagation acc. to IEC 60332-3-25 resp. EN 60332-3-25 class D acc. to NF C 32-070, category C1 and C2
Smoke density	acc. to IEC 61034-2 resp. EN 61034-2 class F0 acc. to NF X 10-702
Halogen free	acc. to IEC 60754-1 resp. EN 60754-1 acc. to EN 50264-1, appendix B
Corrosivity of gases	acc. to IEC 60754-2 resp. EN 60754-2
Toxicity	acc. to EN 50305 class F0 acc. to NF X 70-100
Weather and UV resistance	acc. to EN 50289-4-17 resp. VDE 0819-289-4-17 cables with black sheath are suitable for permanent outdoor use
Ozone resistance	acc. to EN 50305
Oil resistance	EM 104 acc. to EN 50264-1
Fuel resistance	EM 104 acc. to EN 50264-1
Acid and alkaline resistance	EM 104 acc. to EN 50264-1
General requirements	These cables are conform to the EU-Directive 2011/65/EU (RoHS, Restriction of the use of certain hazardous substances) and the LV-Directive 2014/35/EU (Low voltage Directive).

7. IDENTIFICATION

The identification is effected by ink-jet printing on the outer sheath.

Text:

LAPP KABEL STUTTGART **UNITRONIC® TRAIN MVB** ↔ 1x2x0.50mm² EN 50264-1 XM S CE 2173000↔RV MM

CE	Identification of the conformity according to LV-Directive 2014/35/EU and RoHS directive 2011/65/EU with the two stylised letters CE
RV	traceability coding
MM	meter sequence
XM S	X - No core insulation compound matching EN 50264-1 M - EM 104 sheath compound matching EN 50264-1 S – Cable with metallic shield

↔ Distance at least 10 mm (the blue arrow has not to be printed)

Color of the printing: white
The detailed print performance is defined in Works Specification WN00-2010.

In addition to the printing text there must be printed a meter sequence.
The identification text with traceability coding has to be printed twice within the meter sequence, for long identification text with traceability code > 400 mm only once.

Additional to the printing text with meter marking and traceability coding, the supplier symbol according to WN00-2010 is to print approx. 5 mm in front of “LAPP KABEL ...”.

8. GENERAL REQUIREMENTS

RoHS:
Dangerous and forbidden substances acc. to RoHS directive 2011/65/EU regarding **R**estriction **o**f the use of certain **h**azardous **s**ubstances **(RoHS)** are not allowed to the manufacturing.
REACH:
All materials used in the manufacturing process of the product are subjected to the EC Regulation No. 1907/2006 regarding **R**egistration, **E**valuation, and **A**uthorization of **C**hemicals **(REACH)**. If substances based on the current candidate list are used they must be listed with their designation and their concentration.

9. TESTS

9.1 Final production tests

Following tests have to be carried out in the final test field for each production length:

Electrical test	continuity (all cores) spark test (tests of defects in the insulation) conductor resistance (at least one core) Impedance, Attenuation
Mechanical test	insulation thickness and core diameter core identification jacket thickness and outer diameter stripping-ability of the sheath

Assuring the product features for the whole production length, further tests may be necessary. In case of claims we will fall back on our manufacturing-internal documentation.

9.2 Type Tests

Type tests shall be carried out by the supplier in case of modifications of materials or design, however at least every 36 months. The detailed test report has to be sent to the PDC Department of U.I. LAPP GmbH (for tests see Chapter 3, 4, 5, 6 and 9.1).

When providing the initial sample inspection report, a type test report must be enclosed. For product approval the designation of the compound has to be listed.

Deviations regarding the compound are subject to explicit consent of U.I. LAPP GmbH.