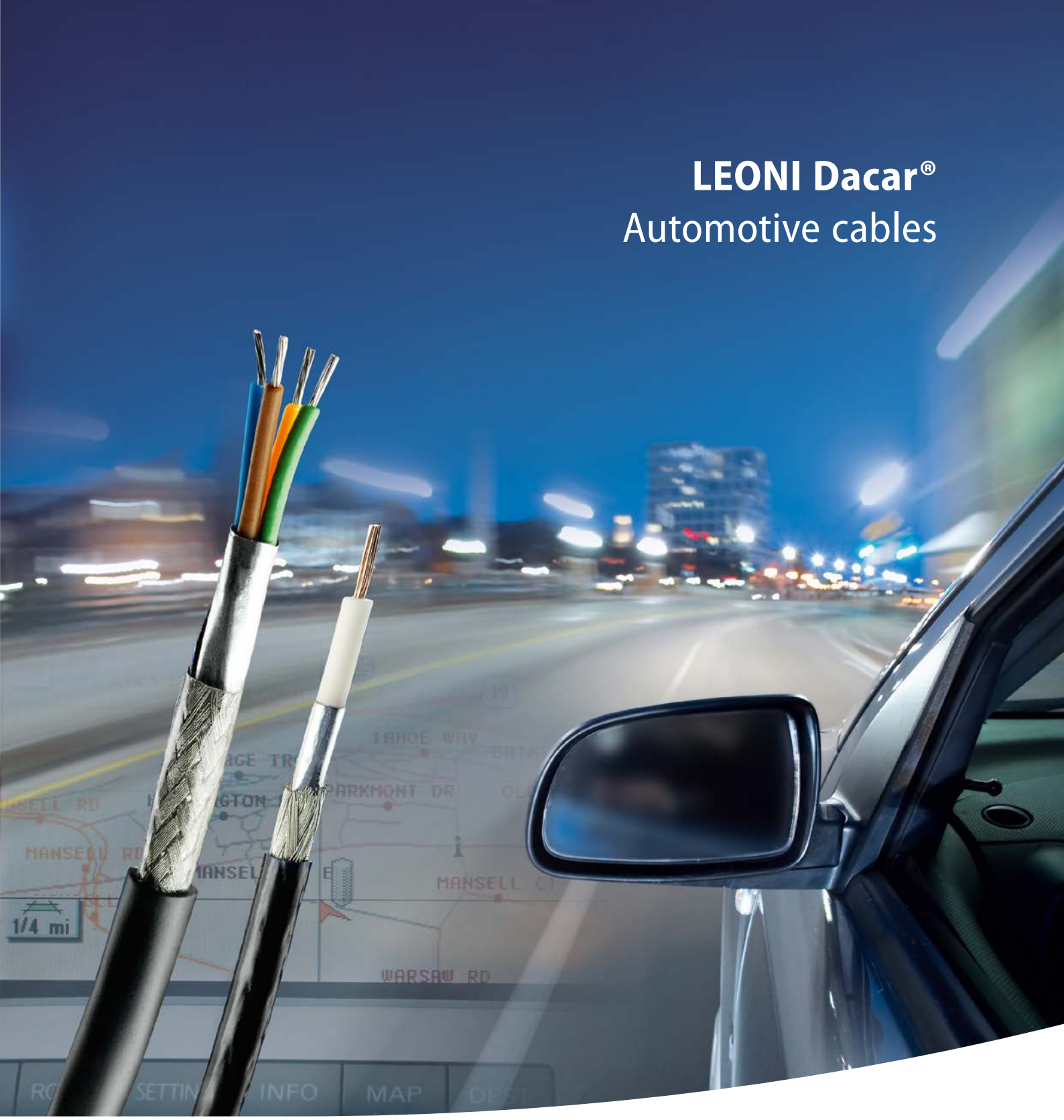
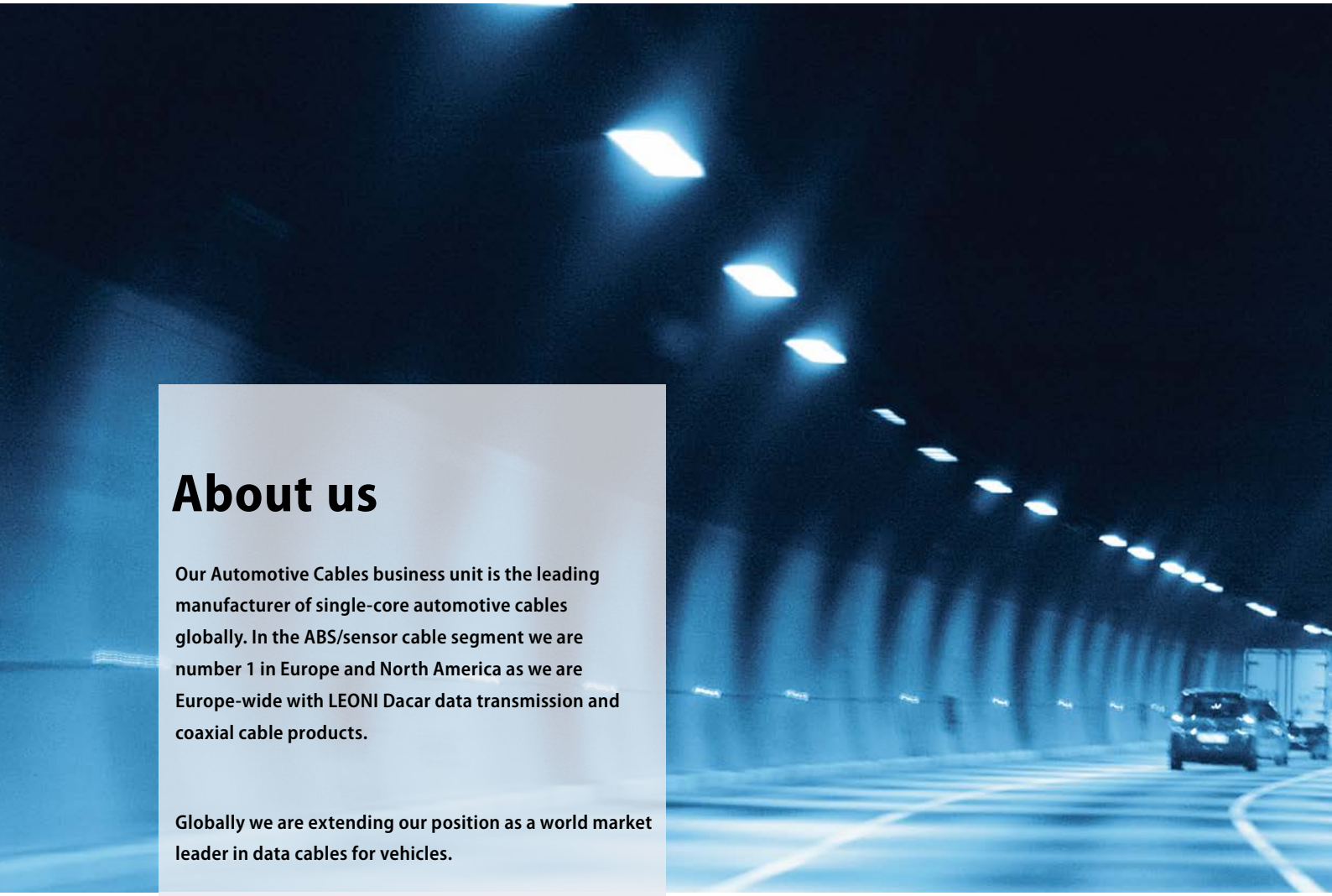
# LEONI Dacar®
## Automotive cables




**The Quality Connection**

LEONI



# About us

**Our Automotive Cables business unit is the leading manufacturer of single-core automotive cables globally. In the ABS/sensor cable segment we are number 1 in Europe and North America as we are Europe-wide with LEONI Dacar data transmission and coaxial cable products.**

**Globally we are extending our position as a world market leader in data cables for vehicles.**

Being strategically located near our customers is at the core of all our Automotive Cables activities. This close proximity allows to identify requirements and market demand at an early stage and to develop innovative solutions together with our direct and indirect customers. The basis for our successful growth lies in our service as well as in the stability and ongoing optimisation of our production processes – the proverbial LEONI quality.

International outlook of our Automotive Cables activities and its worldwide production network is reinforced by the proximity to customers.

***Issue: July 2009***
*Subject to technical changes.*

# Content

# Materials LEONI Dacar®

## Insulation materials

| Symbol | Name e.g. DIN ISO 1629 and 7728 | Code | Hardness Shore A/D DIN 53504 ± 5.0 | Tensile strength DIN 53504 MPa | Elongation at break DIN 53504 % | Service temperatures ISO 2578/6722, DIN 0472 °C | Dielectric strength DIN 53481 kV/mm | Dielectric constant DIN 53483 |
|---|---|---|---|---|---|---|---|---|
| **Thermoplastics** | | | | | | | | |
| PVC-P | Polyvinyl chloride (plasticized) | Y | acc. to sample (75 A–95 A)* | >12,5 | >150 | –40 up to +90 | >10 | 4–6 |
| PVC-P | (heat resistant) lead free | YW | acc. to sample (90 A–97 A)* | >15 | >150 | –40 up to +105 | >10 | 4–6 |
| PE-LD-E | Cellular polyethylene | 02Y | 40D | >10 | >100 | –40 up to +85 | >10 | 1.25–1.7 |
| PE | Polyethylene | 2Y | 50D | >10 | >300 | –40 up to +85 | >30 | 2.3 |
| PP | Cellular polypropylene | 09Y | 50D | >15 | >100 | –40 up to +105 | >10 | 1.5–1.7 |
| PP | Polypropylene | 9Y | 70D | >25 | >300 | –40 up to +125 | >30 | 2.3 |
| FEP | Tetrafluoroethylene/hexafluoropropylene | 6Y | 55D | >15 | >200 | –65 up to +210 | >30 | 21 |
| ETFE | Ethylene/tetrafluoroethylene | 7Y | 75D | >30 | >200 | –65 up to +180 | >30 | 2.6 |
| **Thermoplastic elastomers** | | | | | | | | |
| TPE-U | Thermoplastic polyether polyurethane | 11Y | 85 A–95 A | >30 | >400 | –40 up to +125 | >10 | 7 |
| TPE-O | Thermoplastic polyolefin elastomer | 91Y | 60 A–50 D | >10 | >300 | –40 up to +125 | >20 | 3 |
| **Cross-linked plastics** | | | | | | | | |
| PE-X | Polyethylene, crosslinked | 2X | 95 A | >10 | >200 | –40 up to +125 | >20 | 3–4 |

* depends on recipe

## Conductor materials

| | Symbol | Material Number | Conductivity at 20 °C | Density | Tensile strength | Elongation at break | Melting point |
|---|---|---|---|---|---|---|---|
| **Copper acc. to DIN 40500 Part 4** | E-Cu 58 F 21 | 2.0065 | >58.0 m/mm$^2$ | 8.9 g/cm$^3$ | >210 MPa | > 21 % | 1,083 °C |
| **Copper acc. to DIN EN 13602** | Cu-ETP1 | | >58.58 m/mm$^2$ | | | | |
| **Copper clad steel wire** | Staku 40: Class 40 HS | | 23.2 m/mm$^2$, >40 % IACS | 8.2 g/cm$^3$ | >770 MPa | < 5 % | |

## Galvanic coatings

| Tin | |
|---|---|
| Designation | Tin 99.90 |
| Density | 7.29 g/cm$^3$ |
| Melting point | 232 °C |
| Symbol | Sn |

| Silver | |
|---|---|
| Designation | Fine silver 99.97 |
| Density | 10.5 g/cm$^3$ |
| Melting point | 960 °C |
| Symbol | Ag |

# Coding key

The type designation provides information on the type of wire, the insulation and sheath materials used and the principle design features in abbreviated and simplified form.

A type designation is made up of several groups. The type of wire is specified first and then its construction from inside to outside.

**1. Type of wire (German abbreviations)**

| | |
|---|---|
| **FL** | = Automotive wire |
| **FZL** | = Automotive ignition wire |
| **EFL** | = Automotive wires for electric vehicles |

**2. Special conductor materials (excl. electrolytic copper)**

| | |
|---|---|
| **M** | Materials other than E-Cu or resistance conductors (e. g. aluminium, steel, steel copper, etc.) |
| **W** | Resistance conductors (usually copper alloys with Ni, Cr, Mn, etc.) |

**3. Geometric construction of insulation**

Normal thickness of insulation
(equivalent to ISO 6722 "Thick wall") is not coded.

| | |
|---|---|
| **U** | Greatly reduced thickness of insulation equivalent to ISO 6722 |
| **R** | Reduced thickness of insulation equivalent to ISO 6722✖ |
| **S** | Reinforced insulation (thickness bigger than specified in ISO 6722) |

✖ The code can also be used for other thicknesses.
The relevant standard or thickness is then also named.

**4. Codes for the dielectrics**

Code for the dielectrics used for the insulation and sheath.

| | |
|---|---|
| **Y** | Soft-PVC (polyvinyl chloride) |
| **YW** | Soft-PVC, heat-resistant, hot-pressure resistant |
| **YK** | Soft-PVC, cold-resistant |
| **2Y** | PE (polyethylene) |
| **4Y** | PA (polyamide) |
| **6Y** | FEP (tetrafluoroethylene/hexafluoropropylene) |
| **7Y** | E/TFE (ethylene/tetrafluoroethylene) |
| **9Y** | PP (polypropylene) |
| **10Y** | PVDF (polyvinylidenfluoride) |
| **11Y** | TPE-U (thermoplastic elastomer on polyurethane basis) |
| **12Y** | TPE-E (thermopl. polyester elastomer on polyether ester basis) |
| **13Y** | TPE-E (thermopl. polyester elastomer on polyester ester basis) |
| **31Y** | TPE-S (thermopl. polyester elastomer on polystyrene basis) |
| **41Y** | TPE-A (thermopl. polyester elastomer on polyamide basis) |
| **51Y** | PFA (perfluoroalkoxy copolymer) |
| **91Y** | TPE-O (thermopl. polyester elastomer on polyolefin basis) |
| **X** | PVC-X (polyvinyl chloride crosslinked) |
| **2X** | XLPE (polyethylene crosslinked) |
| **4G** | EVA (ethylene/vinyl acetate) |

In foamed materials the code is preceded by a "zero":
e. g. **02Y** = foamed or cellular PE.

**5. Codes for constructional elements**

Codes for further constructional elements and non-extruded coverings (where applicable).

| | |
|---|---|
| **B** | Foil shield |
| **C** | Copper wire braiding |
| **D** | Copper wire spiral shield |
| **G** | Glass fiber braiding |
| **P** | Insulation foil |
| **T** | Textile braiding |

**6. Special design features**

| | |
|---|---|
| **F** | Flat wire |
| **Z** | Multi-core wire with separable cores |

**7. Finally…**

… the number of cores (except in the case of single core wires) and the nominal cross section in $mm^2$ are specified. Especially flexible or highly flexible stranded conductors are identified by additional specification of the nominal crosssection of the single wire. In some cases the type of metal plating is specified for metal-plated copper wires as follows:

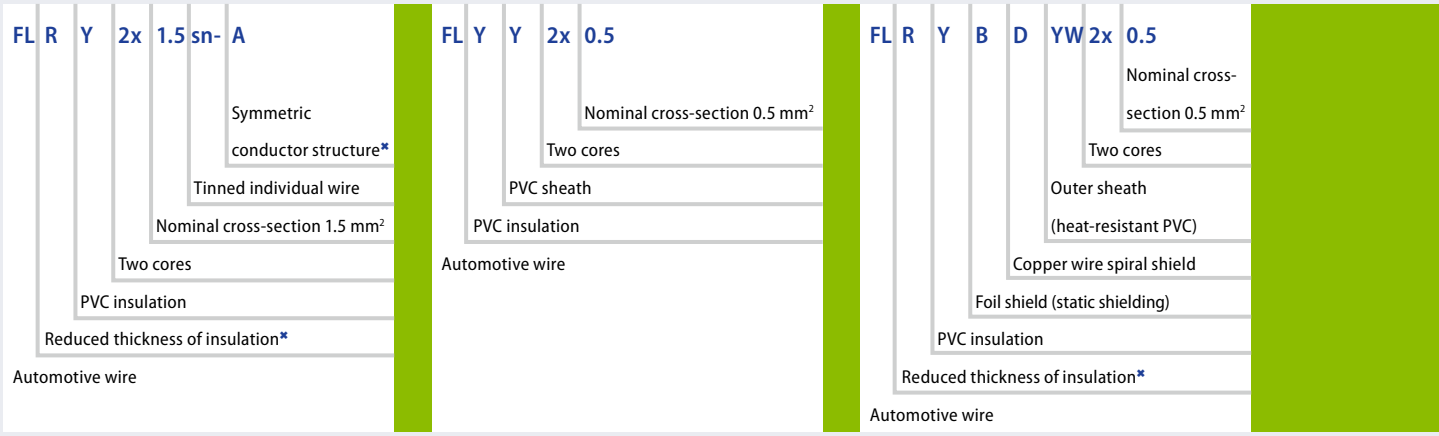
| | |
|---|---|
| **SN** | tin-plated |
| **NI** | nickel-plated |
| **AG** | silver-plated |

Bare copper has no special code.

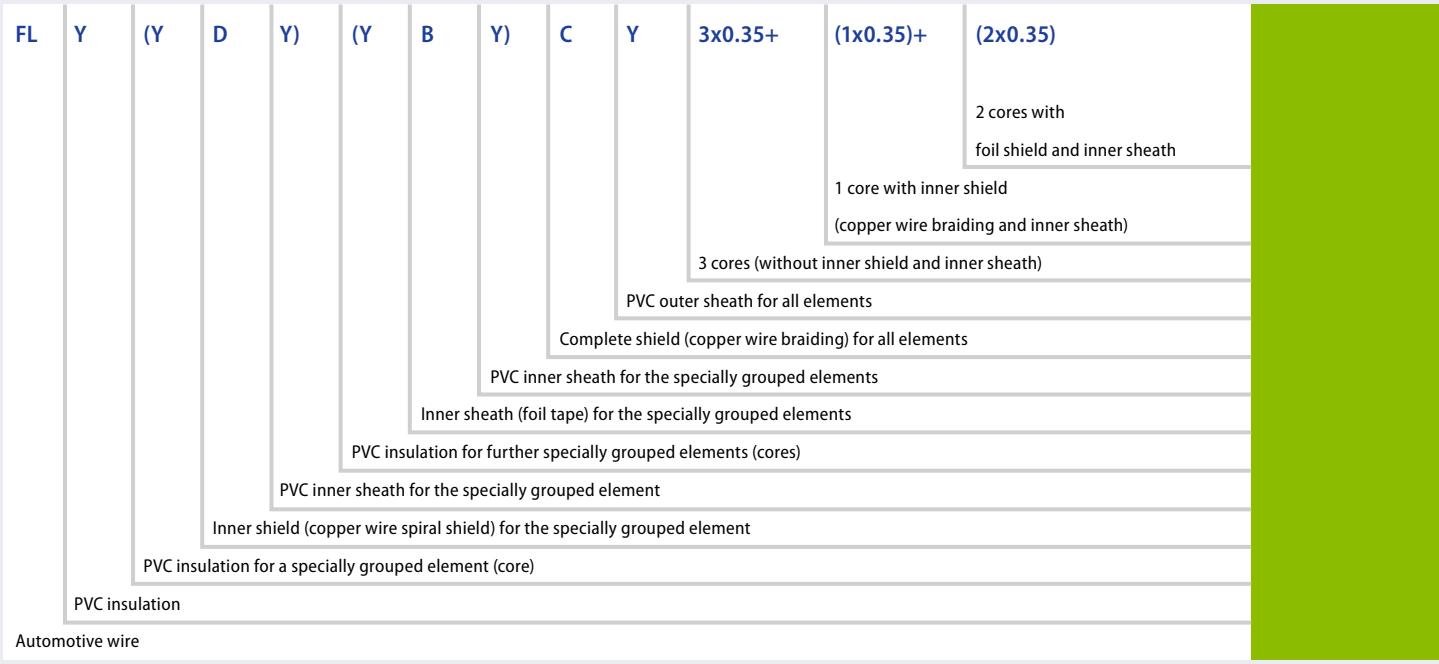
Various components joined by specific structural elements (e. g. inner sheaths or inner shields) are grouped in parentheses in the type code (see examples of coding).

# Examples

## Multi-core cables




* according to ISO 6722



# LEONI Dacar®
# Data transmission cables

**Symmetrical data transmission cables for a wide variety of telematic systems.**

## BENEFITS/PROPERTIES

- flexible
- heat resistant
- very good transmission properties
- outstanding coupling resistance and shield attenuation properties
- stable impedance
- lowest Alien Next
- superior environmental properties/recyclability
- flame resistant

## APPLICATIONS

CD changer, multimedia / MP3 player, TFT, rear view camera system, bus systems (Flexray/FireWire/CAN/USB), LVDS, mobile phone interface and iPod.

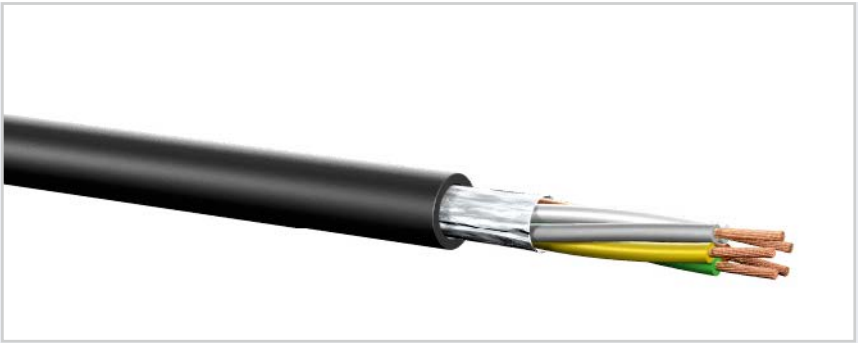
## PROPERTIES

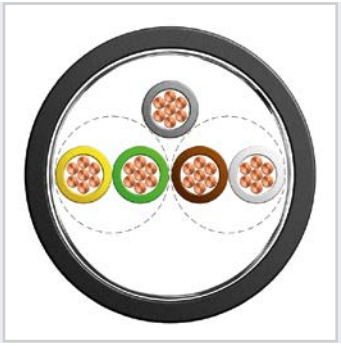
- solid/foam dielectrics
- standard temperature range –40 °C up to + 105 °C
- high mechanical strength


ON/OFF
VOL


LEONI Dacar

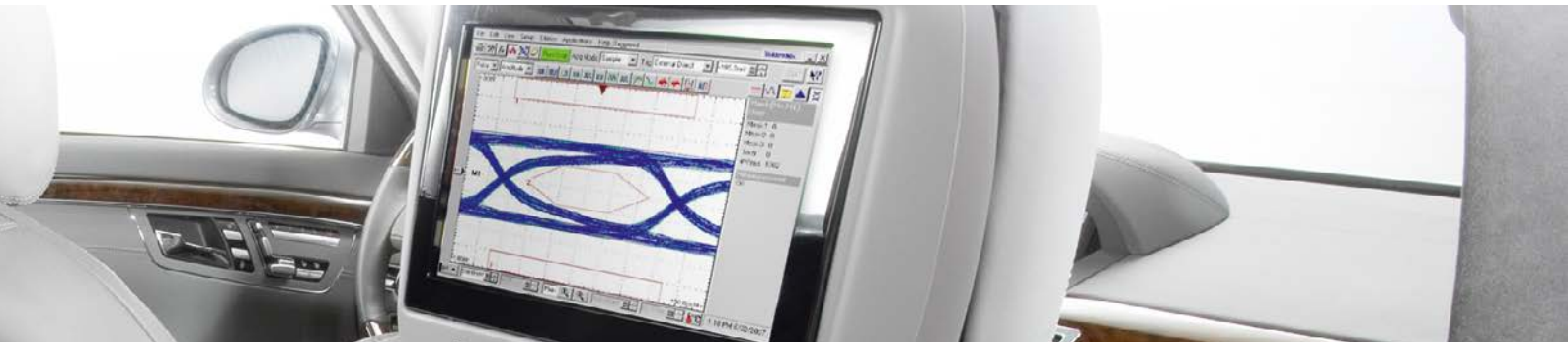
# Probe cables *Data transmission cables*





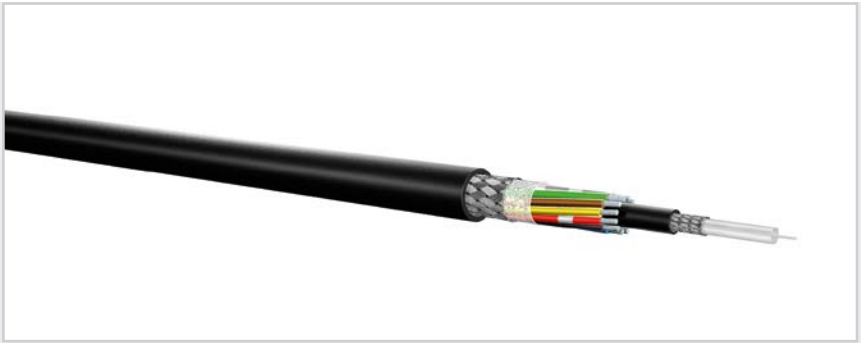
| Code | Part Number | Cable structure | Conductor diameter | Core diameter | Shield type | Outer diameter |
|---|---|---|---|---|---|---|
| | | | [mm] | [mm] | | [mm] |
| **LEONI Dacar 540** | 76841012A | 2x2x0.35+(0.35) | 0.80 | 1.30 | PETP-AL | 6.20 |
| **LEONI Dacar 541** | 76881015A | 2x2x0.35+(0.35)+(0.35) | 0.80 | 1.30 | PETP-AL | 6.20 |
| **LEONI Dacar 550** | 76780000A | 1x0.35+(0.35) | 0.80 | 1.25 | PVC-AL | 4.10 |
| **LEONI Dacar 551** | 76780002A | 2x0.35+(0.35) | 0.80 | 1.30 | PVC-AL | 4.30 |

# *Focused on communication.*



| Insulation material | Jacket material | Service temperature | Capacity | Conductor resistance | Weight |
|---|---|---|---|---|---|
| | | [°C] | [max. pF/m] | [Ω/km] | [kg/km] |
| PVC | PVC | –40 up to +105 | 200 | 52 | 52 |
| PVC | PVC | –40 up to +105 | 200 | 52 | 52 |
| PVC | TPE-U | –40 up to +105 | 380 | 52 | 22 |
| PVC | TPE-U | –40 up to +105 | 360 | 52 | 25 |

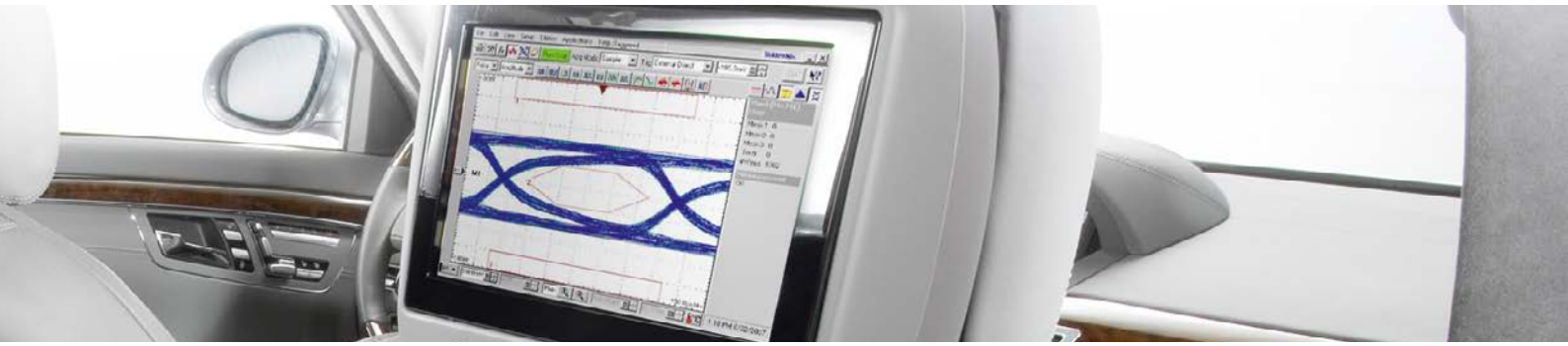
# LVDS + Bus systems *Data transmission cables*



| Code | Part number | Cable structure | Conductor material / shield type | Diameter over shield nom. |
|---|---|---|---|---|
| | | | | [mm] |
| **LVDS** | | | | |
| **LEONI Dacar 501** | 76981008A | 4x2x0.22+0.22 | Cu bare / PETP-AL / C-shield | 5.80 |
| **LEONI Dacar 502** | 76981009A | 4x2x0.22+0.22 | Cu bare / PETP-AL / C-shield | 5.80 |
| **LEONI Dacar 503** | 76981003A | 4x2x0.22 | Cu bare / PETP-AL / C-shield | 5.60 |
| **LEONI Dacar 505** | 76981000A | 4x2x0.22+(0.22) | Cu bare / AL coated foil / C-shield | 5.50 |
| **LEONI Dacar 506** | 76981020A | 4x2x0.22+(0.22) | Cu tinned / AL coated foil / C-shield | 5.50 |
| **LEONI Dacar 508** | 76981006A | 5x2x0.22 | Cu bare / PETP-AL / C-shield | 6.50 |
| **LEONI Dacar 509** | 76981007A | 5x2x0.22 | Cu bare / PETP-AL / C-shield | 6.00 |
| **LEONI Dacar 511** | 76981060A | 5x2x0.22 | Cu bare / PETP-AL / C-shield | 6.00 |
| **LEONI Dacar 522** | 76981035A | 2x0.14 | Cu tinned / PVC-AL / C-shield | 3.10 |
| **LEONI Dacar 538** | 76981056A | 4x0.14 | Cu tinned / PVC-AL / C-shield | 3.40 |
| **CAN** | | | | |
| **LEONI Dacar 520** | 79116800A | 2x0.35 | Cu bare / PETP | – |
| **LEONI Dacar 560** | 76731000A | 2x0.35 | Cu bare | – |
| **LEONI Dacar 562** | 76731010A | 2x0.5 | Cu bare / PETP | – |
| **LEONI Dacar 565** | 76981030A | 2x0.75+(0.75) | Cu bare / PETP-AL | – |
| **Flexray** | | | | |
| **LEONI Dacar 533** | 76981025A | 2x0.35+(0.35) | Cu bare / PETP-AL | – |
| **Fire Wire** | | | | |
| **LEONI Dacar 536** | 76981040A | 4x0.14 | Cu tinned / PVC-AL / C-shield | 3.40 |
| **USB** | | | | |
| **LEONI Dacar 516** | 76981063A | (2x0.089)+2x0.24+(0.089) | Cu tinned / PETP-AL / C-shield | 3.20 |
| **LEONI Dacar 518** | 76981065A | (2x0.35)+2x0.35+(0.35) | Cu bare / PETP-AL / C-shield | 4.10 |

The table only shows an excerpt of our portfolio – please contact us for further cable designs.

# *Your way to be connected.*

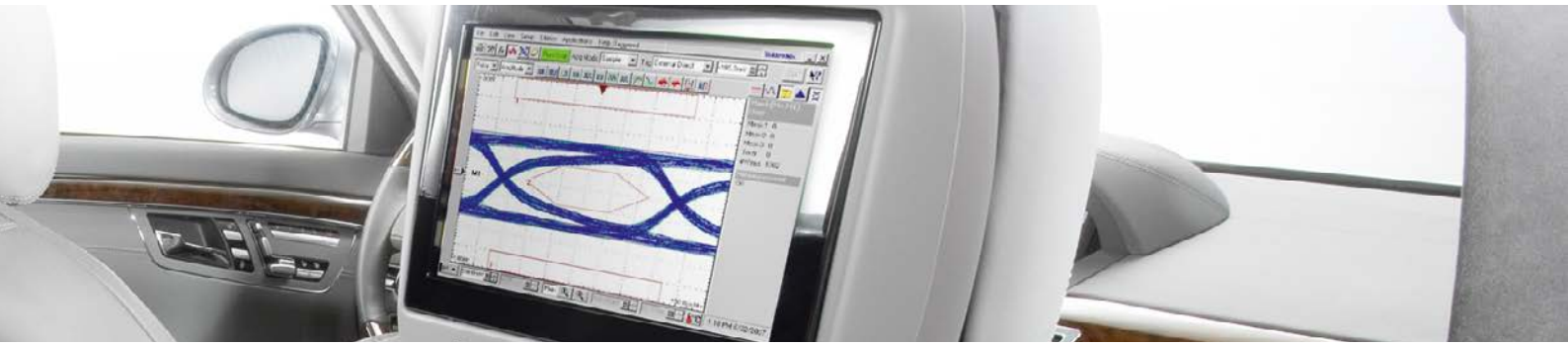


| Outer cable diameter nom. | Insulation material | | Jacket material | Service temperature | Impedance | Weight |
|---|---|---|---|---|---|---|
| [mm] | 1 | 2 | | [°C] | [Ω] | [kg/km] |
| | | | | | | |
| 6.80 | PE | – | PVC | –40 up to +90 | 100 | 56.0 |
| 6.80 | PP | – | PVC | –40 up to +105 | 100 | 55.0 |
| 6.80 | cellular PP | – | PVC | –40 up to +105 | 100 | 56.0 |
| 6.30 | PE | – | TPE-U | –40 up to +90 | 100 | 51.0 |
| 6.30 | FEP | – | TPE-U | –40 up to +110 | 100 | 61.0 |
| 7.40 | PE | – | PVC | –40 up to +90 | 100 | 63.5 |
| 7.40 | PP | – | PVC | –40 up to +105 | 100 | 71.0 |
| 7.00 | cellular PP | – | PVC | –40 up to +105 | 100 | 69.0 |
| 4.60 | PP | – | PVC | –40 up to +105 | 100 | 27.0 |
| 4.60 | PP | – | PVC | –40 up to +105 | 100 | 34.0 |
| | | | | | | |
| 4.90 | cellular PP | – | TPE-U | –40 up to +105 | 120 | 22.0 |
| 5.00 | TPE-O-X | – | TPE-U | –40 up to +125 | 120 | 28.5 |
| 5.40 | TPE-O-X | – | TPE-U | –40 up to +120 | 120 | 31.0 |
| 8.00 | cellular PP | – | PVC | –40 up to +105 | 120 | 62.0 |
| | | | | | | |
| 4.80 | cellular PP | – | PVC | –40 up to +105 | 100 | 28.0 |
| | | | | | | |
| 4.60 | cellular PP | – | PVC | –40 up to +105 | 110 | 32.0 |
| | | | | | | |
| 4.30 | PP | PVC | PVC | –40 up to +105 | 90 | 29.0 |
| 5.80 | cellular PP | PVC | PVC | –30 up to +105 | 90 | 54.0 |

# Multimedia *Data transmission cables*

| Code | Part number | Cable structure | Conductor material / shield type |
|---|---|---|---|
| **Multimedia** | | | |
| **LEONI Dacar 594** | 76981103A | (3x0.14)+4x0.14+2x0.5+Z50+(0.14) | Cu bare / Copper clad steel conductor bare / PETP / C-shield |
| **LEONI Dacar 805** | 76981108A | (2x0.055)+((2x0.14)+(0.14))+4xZ53 | Cu bare / PETP-AL / D-shield |
| **Car phone** | | | |
| **LEONI Dacar 590** | 76981090A | 8x0.22+2x0.35+Z50 | Cu tinned / Cu bare / PETP-AL / C-shield |
| **LEONI Dacar 514** | 76981080A | 5x2x0.14+2x0.5 | Cu tinned / Cu bare / AL-PETP-AL / C-shield |
| **iPod** | | | |
| **LEONI Dacar 533** | 76981025A | 2x0.35+(0.35) | Cu bare / PETP-AL |
| **LEONI Dacar 592** | 76981025A | ((2x0.089)+2x0.22+(0.22))+2x(3x0.089) | Cu tinned / AL-PETP-AL / C-shield |

## *Pioneering digital entertainment.*



| Diameter over shield nom. | Outer cable diameter nom. | Insulation material | | | | Jacket material | Service temperature | Impedance | Weight |
|---|---|---|---|---|---|---|---|---|---|
| [mm] | [mm] | 1 | 2 | 3 | 4 | | [°C] | [Ω] | [kg/km] |
| | | | | | | | | | |
| 5.50 | 6.70 | PVC | PVC | PP | – | PVC | –40 up to +105 | 50 | 70 |
| 5.50 | 5.80 | PP | PP | PP | – | PVC | –25 up to +90 | 53 | 54 |
| | | | | | | | | | |
| | | | | | | | | | |
| 5.60 | 6.70 | ETFE | ETFE | PE | – | TPE-U | –40 up to +85 | 50 | 104 |
| 4.60 | 5.80 | TPE-E | TPE-E | – | – | PVC | –40 up to +105 | – | 60 |
| | | | | | | | | | |
| | | | | | | | | | |
| – | 4.80 | cellular PP | – | | | PVC | –40 up to +105 | 100 | 28.0 |
| 5.40 | 7.10 | PP | PVC | PVC | PVC | PVC | –40 up to +105 | 90 | 75 |

# LEONI Dacar®
# Coaxial cables

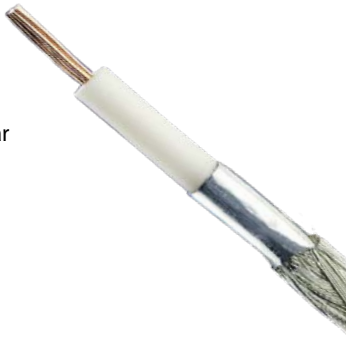
**Coaxial cables for antennas made for special and standard applications.**

## BENEFITS/PROPERTIES

- fits all standard components
- excellent properties for processing
- approvals from all major OEMs
- outstanding coupling resistance and shield attenuation properties
- stable impedance
- low signal attenuation
- best environmental properties/recyclability
- solid / foam dielectrics
- standard temperature range
  –40 up to +85 °C / –65 up to +205 °C
- standard diameter ranging from 1.6 to 6.7 mm
- standard impedances of 50/75/120/125/130 Ω available

## APPLICATIONS

GSM, GPS/Galileo, DVB, Radio, WCDMA, HSPDA, WLAN, WUSB, WiMAX, mobile broadcast, Car to Car Communication



## CUSTOMISED OPTIMISATIONS OF

- high frequency properties such as
  - ➔ EMC properties
  - ➔ Impedance
  - ➔ Reflection and transmission parameters
- mechanical properties
- chemical and thermal parameters based on inhouse material design and radio frequency laboratories


Emden
Dollard
Groningen
Oldenbu
Assen
Emmen
10 km
TMC
1/min x 1000
R
N
D
P

# Coaxial cables *with foam dielectric*

| Code | Part number | Cross section nom. [mm²] | Diameter of conductor nom. [mm] | Conductor material | Diameter of core nom. [mm] |
|---|---|---|---|---|---|
| **50 Ohm** | | | | | |
| **LEONI Dacar 031** | 85120003A | 0.40 | 0.81 | Cu bare | 2.10 |
| **LEONI Dacar 037** | 85120030D | 0.75 | 1.11 | Cu bare | 2.95 |
| **LEONI Dacar 302** | 85120380D | 0.40 | 0.81 | Cu bare | 2.10 |
| **LEONI Dacar 380** | 85120385A | 0.22 | 0.60 | Cu bare | 1.53 |
| **75 Ohm** | | | | | |
| **LEONI Dacar 360** | 85120370A | 0.089 | 0.385 | Cu bare | 1.68 |
| **LEONI Dacar 362** | 85120381D | 0.141 | 0.48 | Cu tinned | 2.10 |
| **120 Ohm** | | | | | |
| **LEONI Dacar 077** | 85120035D | 0.055 | 0.32 | Copper clad steel conductor bare | 3.10 |

| Code | Impedance [Ω] | Capacity at 1kHz [pF/m] | Conductor resistance at 20 °C [Ω/km] | Velocity of propagation [%] | Weight [kg/km] | 0.1 | 0.2 | 0.5 | 0.8 |
|---|---|---|---|---|---|---|---|---|---|
| **50 Ohm** | | | | | | | | | |
| **LEONI Dacar 031** | 50.00 | 85.00 | 48.50 | 77 | 23.00 | 20.5 | 25.9 | – | 48.3 |
| **LEONI Dacar 037** | 50.00 | 88.50 | 25.50 | 78 | 39.00 | 11.2 | 16.1 | 26 | 33.5 |
| **LEONI Dacar 302** | 50.00 | 92.00 | 48.50 | 78 | 23.00 | – | 21.1 | 30.3 | 43.7 |
| **LEONI Dacar 380** | 50.00 | 90.00 | 85.00 | 78 | 12.00 | 22.7 | 33.7 | 54.4 | 69.7 |
| **75 Ohm** | | | | | | | | | |
| **LEONI Dacar 360** | 75.00 | 61.00 | 208.00 | – | 11.00 | 22.8 | – | – | – |
| **LEONI Dacar 362** | 75.00 | 58.00 | 126.00 | – | 13.50 | 15.6 | 22.2 | 35.9 | 46.2 |
| **120 Ohm** | | | | | | | | | |
| **LEONI Dacar 077** | 120.00 | 37.00 | 850.00 | – | 23.00 | 14.2 | 20.3 | 32.7 | 42.1 |

*Connecting the world.*


| Foil shield | Shield optical coverage nom. | Diameter over shield nom. | Shield material | Outer diameter nom. | Material jacket | Material dielectric | Service temperature |
|---|---|---|---|---|---|---|---|
| | [%] | [mm] | | [mm] | | | [°C] |
| | | | | | | | |
| AL-PP-AL | 92.00 | 2.65 | Cu tinned | 3.20 | PVC | cellular PE | –40 up to +85 |
| PETP-AL | 95.00 | 3.58 | Cu tinned | 4.95 | PVC | cellular PP | –40 up to +105 |
| AL-PETP-AL | 90.00 | 2.50 | Cu tinned | 3.20 | PVC | cellular PP | –40 up to +105 |
| AL-PETP-AL | 80.00 | 2.03 | Cu tinned | 2.60 | PVC | cellular PP | –40 up to +105 |
| | | | | | | | |
| | | | | | | | |
| – | 90.00 | 2.08 | Cu tinned | 2.70 | PVC | cellular PP | –40 up to +105 |
| – | 89.00 | 2.50 | Cu tinned | 3.10 | PVC | cellular PP | –40 up to +105 |
| | | | | | | | |
| | | | | | | | |
| – | 75.00 | 3.50 | Cu bare | 4.80 | PVC | cellular PE | –40 up to +85 |

| Attenuation [dB/100 m] | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Frequency [GHz] | | | | | | | | | | | | | | |
| 1 | 1.2 | 1.5 | 1.8 | 2 | 2.2 | 2.8 | 3 | 3.5 | 4 | 4.5 | 5 | 5.5 | 5.60 | 6 |
| | | | | | | | | | | | | | | |
| 53.5 | 58.6 | 65.3 | 72.4 | 76.7 | 81.7 | 95 | 99.1 | 110.0 | 120.0 | 131.0 | 141.3 | 151.2 | 153.5 | 161.1 |
| 38 | 41.8 | 47.8 | 53.3 | 56.6 | 60 | 69.3 | 72.4 | 80.1 | 87.9 | 95.3 | 103.1 | 110.7 | 112.6 | 119.6 |
| 48.9 | 53.6 | 60.5 | 66.3 | 70.5 | 74 | 84.4 | 88.1 | 96.6 | 104.2 | 112.3 | 120.4 | 127.8 | 129.3 | 134.9 |
| 78.7 | 86.2 | 97.8 | 107.9 | 113.9 | 118.4 | 134.4 | 138.7 | 150.0 | 160.4 | 171.2 | 182.0 | 192.9 | – | 203.0 |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| 74.50 | – | – | – | – | – | – | – | – | – | – | – | – | – | – |
| 52.1 | 57.5 | 65.1 | – | – | – | – | – | – | – | – | – | – | – | – |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| 47.5 | 52.5 | 59.4 | 65.7 | 69.7 | 73.6 | 84.4 | 87.8 | – | – | – | – | – | – | – |

# Coaxial cables *with solid dielectric*

| Code | Part number | Cross section nom. | Diameter of conductor nom. | Conductor material | Diameter of core nom. |
|---|---|---|---|---|---|
| | | [mm²] | [mm] | | [mm] |
| **50 Ohm** | | | | | |
| **LEONI Dacar 100** | 85020350D | 0.14 | 0.48 | copper clad steel conductor | 1.50 |
| **LEONI Dacar 110** | 85020610D | 0.50 | 0.9 | Cu tinned | 2.95 |
| **LEONI Dacar 300** | 85120355D | 0.14 | 0.5 | copper clad steel conductor | 1.52 |
| **LEONI Dacar 310** | 85122990D | 0.50 | 0.9 | Cu tinned | 2.95 |
| **LEONI Dacar 400** | 85022050A | 0.14 | 0.51 | Copper clad steel conductor silver plated | 1.48 |
| **LEONI Dacar 403** | 85022055A | 0.15 | 0.51 | Cu tinned | 1.48 |
| **LEONI Dacar 410** | 85021080A | 0.057 | 0.31 | Copper clad steel conductor silver plated | 0.81 |
| **75 Ohm** | | | | | |
| **LEONI Dacar 200** | 85023015D | 0.182 | 0.55 | Cu tinned | 3.10 |
| **LEONI Dacar 450** | 85020360A | 0.055 | 0.31 | Copper clad steel conductor silver plated | 1.60 |
| **LEONI Dacar 210** | 85040320D | 0.22 | 0.58 | Copper clad steel conductor bare | 3.70 |

| Code | Impedance | Capacity at 1kHz | Conductor resistance at 20 °C | Velocity of propagation | Weight |
|---|---|---|---|---|---|
| | [Ω] | [pF/m] | [Ω/km] | [%] | [kg/km] |
| **50 Ohm** | | | | | |
| **LEONI Dacar 100** | 50.00 | 106.00 | 317.00 | 66 | 13.00 |
| **LEONI Dacar 110** | 50.00 | 105.00 | 41.00 | 66 | 39.00 |
| **LEONI Dacar 300** | 50.00 | 106.00 | 317.00 | 66 | 13.00 |
| **LEONI Dacar 310** | 50.00 | 105.00 | 41.00 | 66 | 39.00 |
| **LEONI Dacar 400** | 50.00 | 106.00 | 317.00 | 70 | 17.00 |
| **LEONI Dacar 403** | 50.00 | 98.00 | 125.00 | 67 | 14.00 |
| **LEONI Dacar 410** | 50.00 | 105.00 | 800.00 | 70 | 9.00 |
| **75 Ohm** | | | | | |
| **LEONI Dacar 200** | 75.00 | 70.00 | 97.00 | – | 36.00 |
| **LEONI Dacar 450** | 75.00 | 75.00 | 802.00 | – | 17.00 |
| **LEONI Dacar 210** | 75.00 | 73.00 | 157.00 | – | 56.00 |

*Your link to mobile communication.*


| Shield optical coverage nom. | Diameter over shield nom. | Shield material | Outer diameter nom. | Material jacket | Material dielectric | Service temperature |
|---|---|---|---|---|---|---|
| [%] | [mm] | | [mm] | | | [°C] |
| | | | | | | |
| 86.00 | 1.90 | Cu tinned | 2.80 | PVC | PE | –40 up to +85 |
| 94.00 | 3.50 | Cu tinned | 4.95 | PVC | PE | –40 up to +85 |
| 85.00 | 1.92 | Cu tinned | 2.80 | PVC | PP | –40 up to +105 |
| 95.00 | 3.45 | Cu tinned | 4.95 | PVC | PP | –40 up to +85 |
| 96.00 | 1.90 | Cu silver plated | 2.50 | FEP | FEP | –65 up to +205 |
| 96.00 | 1.90 | Cu tinned | 2.50 | TPE-E | FEP | –40 up to +125 |
| 96.00 | 1.25 | Cu silver plated | 1.80 | FEP | FEP | –65 up to +205 |
| | | | | | | |
| 95.00 | 3.70 | Cu tinned | 4.60 | PVC | PE | –40 up to +85 |
| 92.00 | 2.00 | Cu silver plated | 2.60 | FEP | FEP | –65 up to +205 |
| 94.00 | 4.35 | Cu tinned | 6.15 | PVC | PE | –40 up to +85 |

| Attenuation [dB/100 m] frequency [GHz] | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.1 | 0.2 | 0.5 | 0.8 | 1 | 1.2 | 1.5 | 1.8 | 2 | 2.2 | 2.5 | 2.8 | 3 |
| | | | | | | | | | | | | |
| 31.3 | 43.8 | 69.3 | 85.9 | 96.7 | 105.9 | 121.1 | 134.5 | 141.8 | 152.5 | 162.6 | 172.1 | 180.9 |
| 20.3 | 27.2 | 43.0 | 53.5 | 60.4 | 66.2 | 77.8 | 87.9 | 92.7 | 103.8 | 110.6 | 122.1 | 126.3 |
| 29.7 | 41.8 | 66.2 | 81.9 | 91.9 | 100.8 | 115.5 | 128.5 | 135.5 | 145.5 | 155.1 | 165.9 | 171.7 |
| 20.3 | 27.2 | 43.0 | 53.5 | 60.4 | 66.2 | 77.8 | 87.9 | 92.7 | 103.8 | 110.6 | 122.1 | 126.3 |
| 29.5 | 42.0 | 67.7 | 86.6 | 97.5 | 108.0 | 121.0 | 134.0 | 142.0 | 149.0 | 160.0 | 170.0 | 177.0 |
| 29.4 | – | 61.7 | 92.8 | 106.4 | – | 137.7 | – | 163.9 | – | 189.2 | – | – |
| 50.4 | 71.3 | 112.8 | 152.6 | 173.5 | 198.7 | 222.1 | 247.0 | 260.4 | 285.7 | 304.5 | 328.6 | 340.1 |
| | | | | | | | | | | | | |
| 16 | 22.5 | 37.0 | 48.0 | 55.0 | 62.0 | 72.0 | 81.0 | 88.0 | 94.0 | 103.0 | 112.0 | 117.0 |
| 27.6 | 38.1 | 59.3 | 75.0 | 84.1 | 92.3 | 103.7 | 114.2 | 120.7 | 127.0 | 136.0 | 144.6 | 150.1 |
| 12.4 | 17.9 | 29.3 | 37.9 | 42.9 | – | – | – | – | – | – | – | – |

# LEONI Dacar® FP Automotive cables

**For data communication between audio devices and airbag management in vehicles.**

## BENEFITS / PROPERTIES

- easy and cost-efficient assembly
- very good processing properties
- insusceptibility to interference from electromagnetic radiation
- low weight
- large bandwidths
- direct assembly of sockets
- length 5,000 m
- where subject to heavy mechanical strain and in highly flexible applications with small bending radii

The core jacket always consists of two polyamide layers: a black inner jacket to rule out possible interference from outside light and a coloured outer sheath (blue, green, yellow or orange).

The fibre consists of a PMMA core and optimised double cladding.

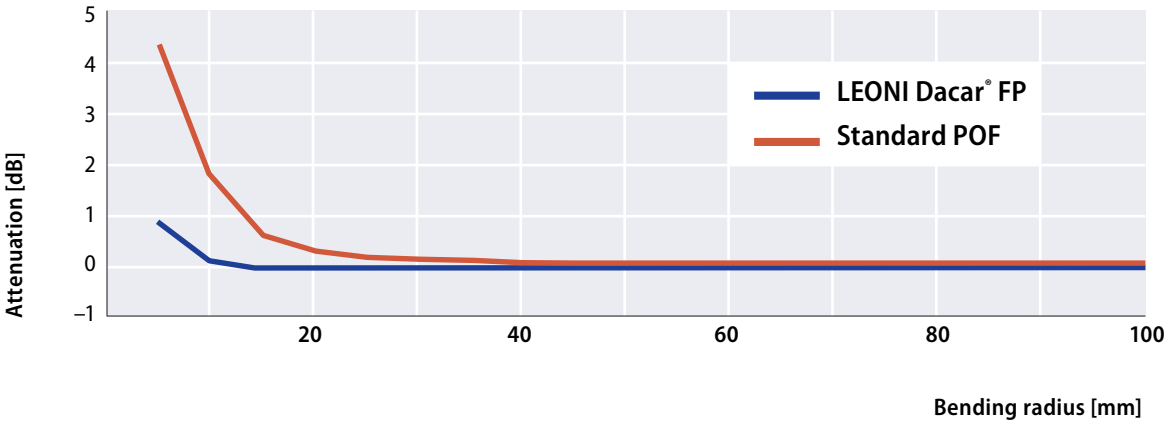
The design significantly reduces the attenuation that occurs when the fibre optic cable is bent compared with standard polymer optical fibre.

## Coding LEONI Dacar® FP:

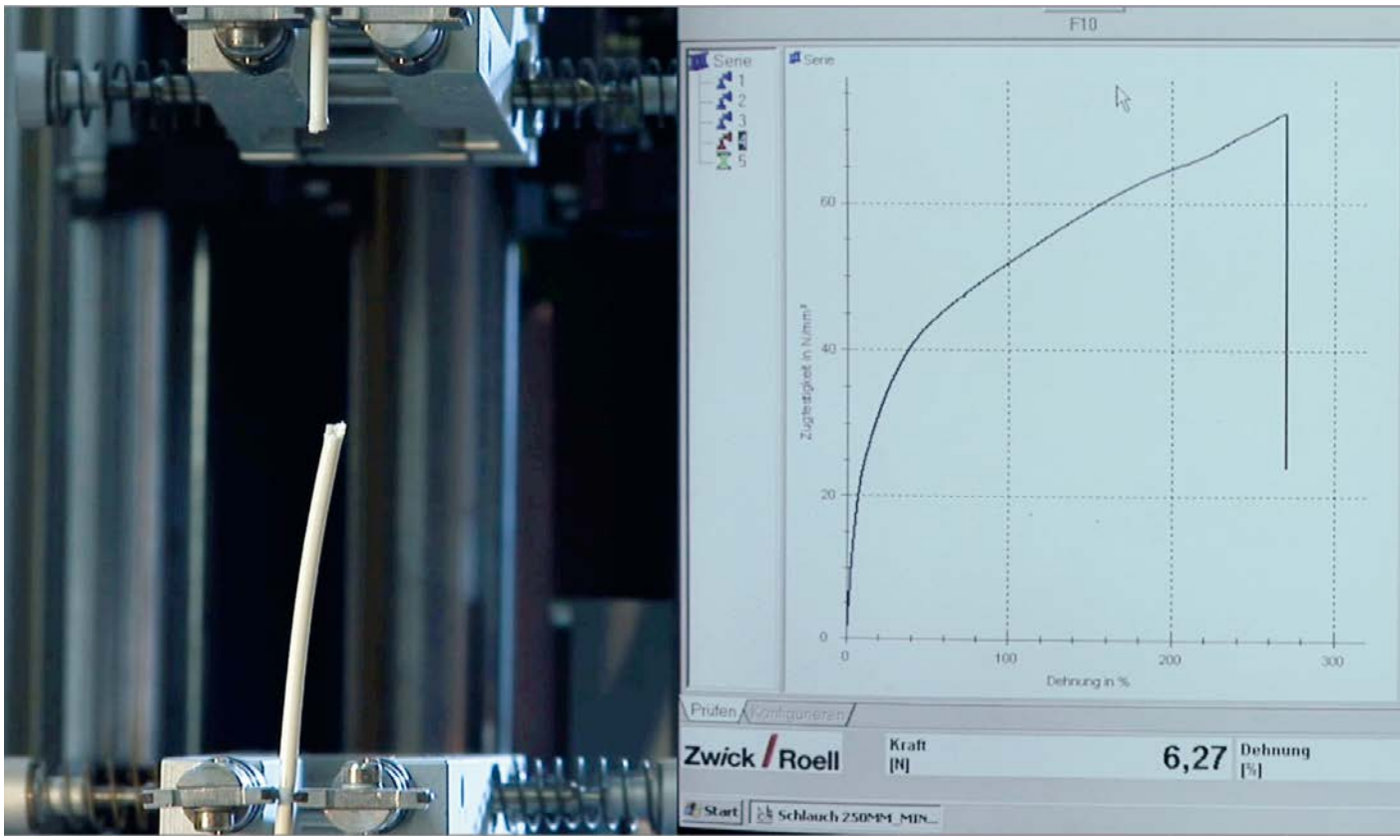
| Colour | Code Number | Part Number |
|---|---|---|
| orange | 17 | 84A00500S262 |
| green | C7 | 84A00500S666 |
| blue | C8 | 84A00500S519 |
| yellow | C9 | 84A00500S201 |

**Diagram:**

Dependance attenuation to bending radius (standard POF compared to LEONI Dacar® FP)



# LEONI Roth radio frequency lab




LEONI cables are used in various sectors and applications. They are therefore subject to differing mechanical, electrical and climatic requirements, which are specified and published in our data sheets. Radio frequency properties are significant especially when it comes to the coaxial and data cables of the LEONI Dacar® line. To meet these different requirements, we integrated a laboratory within the test lab at our facility in Roth fitted with state-of-the-art equipment for measuring and ascertaining the radio frequency properties of our cables. To guarantee a high level of production quality at all plants that are producing LEONI data cables the necessary measuring devices were installed and specialised staff in laboratories and quality management has been trained.

**Scope of the RF lab's activity**

The tasks of the lab for radio frequency measurements are wide ranging. In addition to development and production-related measurements and analysis, the lab measures, evaluates and assures the cables' radio frequency properties pursuant to the pertinent national and international test standards as well as customer specifications in the context of qualification and requalification tests. The properties of cables under different ambient conditions such as cold, heat (constant or cyclical changes) or humidity as well as various kinds of mechanical strain such as flex cycles and torsion are of increasing importance. This enables making predictions about the long-term behaviour and useful life of the cables in the various areas of use.

The characteristic impedance (wave impedance) of a cable can be ascertained by various measurement methods. Time domain reflectrometry (TDR) determines and shows the pattern of a cable's wave resistance over time. The impedance pattern is scrutinised for irregularities, i.e. for reflections in the cable's make-up. This makes it possible to identify and correct for example discontinuities or damage caused in the manufacturing process or during fitting. A network analyser makes it possible to ascertain all the key parameters of a cable. The wave impedance is determined indirectly by means of two reflection measurements set off against each other. This complex process makes sure that the measured impedance of the cable is only marginally affected by the properties of the measuring instrument and the measuring set-up. Due to the modern equipment

that, besides different standard network analysers also comprises a symmetric network analyser, measurements become possible that go far beyond the limitations of usual baluns (symmetric transmitters).

Rather like four-terminal attenuation, the parameter of wave attenuation describes the transmission property of a cable depending on its length and is usually quoted in the unit [dB/100m] on data sheets and in specifications. Either wave or four-terminal attenuation enables determining the maximum length of a cable along which reliable and faultless data transmission is possible.
In the case of cables with either a foil or braided shield, or a combination of the two, the quality of the shield is determined by measuring the electromagnetic radiation of the cable by means of line injection or triaxial measuring methods. Both measuring methods can be performed in the radio frequency lab at LEONI. Measurements of shield attenuation values beyond –100dB can be carried out using the shield attenuation chamber set up for the line injection method.

Besides the desired effect, the transmission of signals, all methods of transmitting data involve unwanted noise transmission. These effects are defined by several different terms like NEXT, FEXT, PSNEXT, ELFEXT, ALIENNEXT, etc. When an electrical signal, such as a data signal, is transmitted via a core pair that is fed through a cable with several other core pairs (for instance star quad cables), this signal is coupled to other core pairs. The intensity of coupling the signal to another core pair is described, depending on the end at which the interfering signal is received, by the parameters of either near-end crosstalk (NEXT) or far-end crosstalk (FEXT).

**Overview of the RF lab's equipment**

- Digital Sampling Oscilloscope 20GHz/tr=17.5 ps
- Symmetric Network Analyser 300 kH up to 8 GHz
- Network analyser 300 kHz to 8.5 GHz
- Precision LCR meter 10 Hz to 1 MHz
- Shield attenuation chamber with measuring space for the line injection method
- Network analyser 30 kHz to 4 GHz
- Triaxial measurement tube 1–3 m, climate chamber for measurements under climatic conditions with temperatures ranging from –40 °C to +180 °C

## Radio frequency properties of cables

**Transfer parameters:**

- Impedance
- Structured return loss
- Attenuation
- Shield attenuation
- Transfer impedance
- Cross-talk (NEXT, FEXT, PSNEXT, Alien NEXT)

**Primary cable parameters:**

- R' / G'
- C'
- L'

LEONI has invested repeatedly over the past few years to bring the RF laboratory within the LEONI group to such a high level it is currently at. With their automated measuring systems, the production plants are able to record all RF parameters that are relevant to the production. This guarantees a stable and high level of quality of the transmission parameters. The facility of Roth, as development and competence centre, has been equipped with additional high-precision measurement devices. This equipment allows us to respond to the highest quality and performance requirements from the development phase to serial production.

Neither the ongoing expansion nor further development of measurement methods in the area of high frequency measuring is just for internal purposes, but rather also important to serve the interests of our customers.

# Quality management

## Automotive Cables

### LEONI quality management

We are able to satisfy the exceptionally high standards of our customers from the automobile industry. The quality management at all the LEONI Wire and Cable locations throughout the world is certified as complying with ISO 9001: 2008; locations producing automotive cables are also certified according to ISO/TS 16949:2009. Our efforts are concentrated on preventive quality assurance involving fault-inhibiting instruments such as FMEA or machine and process capability analysis.

We use state-of-the-art systems to continuously measure, monitor and control the diameter and dielectric strength of our cables and wires during the production process. Regular testing of random samples guarantees product compliance with the required limit values. With these tests conducted directly alongside the production line it is possible to respond quickly to any faults.


Product properties are tested in accordance with our customers' own specifications and/or German and international standards.

They include:

- **cable and wire behaviour under extreme temperature conditions**
- **functionality after artificial ageing**
- **resistance to fuels, lubricants and environmental influences**
- **resistance of the insulated covering to stretching, abrasion and tearing**
- **mechanical and electrical properties of the conductor**
- **alternate bending strength and resistance to torsion**

Through the combined efforts of these quality assurance activities we are able to continuously optimize our ambitious quality goals.

### LEONI environmental management

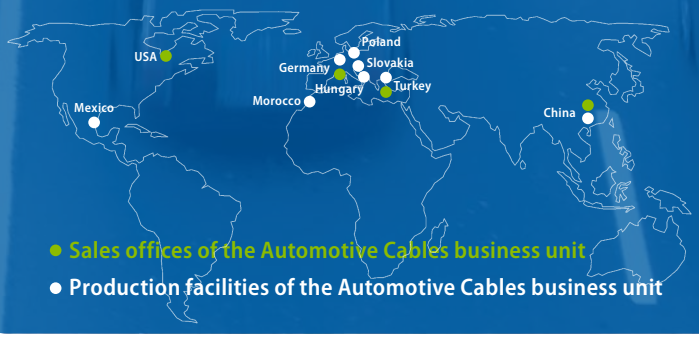
For us, business success with ecological responsibility is not a contradiction in terms. As a globally active producer we acknowledge our co-responsibility in protecting the world's natural resources and basis of life. It is our objective to strike a harmony between nature's needs and our company's interests. As such, environmental protection is an intrinsic element of our corporate activities. We motivate our contractual partners to follow environmental guidelines that are equivalent to our own and advise our customers on how to use and dispose our products in an environmentally responsible manner.

Our environmental management system is certified as complying with DIN EN ISO 14001, confirming that our environmental policy is effectively implemented.

# LEONI worldwide

## Cable facilities of the LEONI group

| | |
|---|---|
| **Germany** | ➔ LEONI Kabel GmbH,<br>LEONI HighTemp Solutions GmbH |
| **China** | ➔ LEONI Cable (Changzhou) Co. Ltd. |
| **Hungary** | ➔ LEONI Kábelgyár Hungaria Kft. |
| **Poland** | ➔ LEONI Kabel Polska S.p.z.o.o. |
| **Morocco** | ➔ LEONI Cable Maroc S.A.R.L. |
| **Mexico** | ➔ LEONI Cable Mexico S.A. de C.V. |
| **Turkey** | ➔ LEONI Kablo ve Teknolojileri San. ve Tic. Ltd. Sti. |
| **Slovakia** | ➔ LEONI Slowakia spol. s.r.o. |




● Sales offices of the Automotive Cables business unit
● Production facilities of the Automotive Cables business unit

Proximity to our customers is a core element of our corporate policy. LEONI is a dependable partner to its customers – all over the world. We also regard maintaining, as well as raising quality and service at the same high level everywhere in the world as a sign of proximity.

We support efficient operating as well as our customers' power of innovation and market position on the basis of our own international positioning, standardised methods and clearly defined processes. No matter where we apply and realise our know-how, commitment and ideas: we want confident customers around the world.

# LEONI news

Our regularly updated information services such as the customer publication "LEONI inTeam" keep you abreast of recent developments at LEONI and on the market, either by mail or by e-mail. So that we can tailor our choice of topics even more closely to your requirements and interests, we would be delighted to receive your suggestions and comments.

**Visit our website**
**www.leoni-automotive-cables.com**

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