WTB (Wired Train Bus) Cables
FRL-WTB-02YCH-2G0.75/FRL-WTB-02YCH-1P0.75S/FRL-WTB-02YCH-2P0.75S

A. Conductor  B. Insulation  C. Screen  D. Sheath

Application
The cables are designed for permanent installation inside of rolling stock to connect fixed parts. A typical application is a communication system in a locomotive. The system uses a wire backed bus system to the TCN standard for control and instrumentation and for diagnostics. This bus system consists of the rail bus WTB (Wired Train Bus) and the road bus MVB (Multifunction Vehicle Bus) which are connected via redundant gateways.

Construction
Conductors
Stranded tinned copper conductor according to IEC 60228 class 5
Insulation
Foam PE or foam skin PE
Core Wrapping
Plastic tape(s)
EMC Screen
Tinned copper braid
Outer Sheath
Cross-linked oil resistant LSZH compound

Electrical & Mechanical Properties
Nominal Voltage 300 V
Max. Temperature 90 °C
Min. Temperature -40 °C
Bending Radius 12 x Overall Diameter

Chemical & Environmental Properties
EN 60684-2 No fluorine
EN 50305; EN 60811-2-1 Resistance to mineral oil & fuel oil, acid & alkali
EN 50305 Resistance to ozone

Fire Performance for Rolling Stock Application
EN 50306-2 Hazard levels HL1, HL2/HL3, HL4
DIN 5510-2 Protection level 1/2/3/4
BS 6853 Interior use 1a, 1b, II; Exterior use 1a, 1b, II
NF F 16-101 F0
### Fire Performance in General

- **EN 50265-2-1; IEC 60332-1-2; NF C 32-070 2.1 (C2)**: Vertical flame propagation for a single insulated wire or cable
- **EN 50266-2-4 + EN 50305; IEC 60332-3-24; NF C 20-902; VDE 0472 Teil 816**: Vertical flame spread of vertically mounted bunched wires or cables
- **EN 50267-2-1; IEC 60754-1; NF C 32-074; NF C 20-454; VDE 0472 Teil 815**: Low Smoke Emission
- **NF C 32-070 2.2 (C1); VDE 0472 Teil 804**: Halogen Free
- **NF C 20-453; VDE 0472 Teil 813**: Low Corrosivity (Acidity & Conductivity)
- **NF C 20-902; NF F 16 101**: Low Toxicity
- **NF F 63 808; BS6853; NF X 70-100; NF F 63 808; TM1-04; BS6853**: Smoke Index
- **NF F 63 808; BS6853; NF F 16 101**: Zero Halogen
- **ISM 903**: Fuel Oil Resistant
- **IRM 902**: Mineral Oil Resistant
- **Flame Retardant**: Flame Retardant
- **Low Toxicity**: Low Toxicity
- **Low Corrosivity**: Low Corrosivity
- **Low Smoke Emission**: Low Smoke Emission
- **Zero Halogen**: Zero Halogen
- **Corona Resistant**: Corona Resistant
- **UV Resistant**: UV Resistant
- **Ozone Resistant**: Ozone Resistant
- **Acid & Alkaline Resistant**: Acid & Alkaline Resistant
- **Highly Flexible**: Highly Flexible
- **Abrasion Resistant**: Abrasion Resistant
- **Cold Resistant**: Cold Resistant
- **Zero Halogen**: Zero Halogen

### Test Values

#### FRL-WTB-02YCH-2G0.75

<table>
<thead>
<tr>
<th>Nominal Cross-Sectional Area</th>
<th>Number &amp; Nominal Diameter of Strands</th>
<th>Nominal Sheath Thickness</th>
<th>Nominal Overall Diameter</th>
<th>Nominal Weight</th>
<th>Max. Conductor Resistance</th>
<th>Impedance</th>
<th>Max. Transfer Impedance</th>
<th>Max. Attenuation</th>
</tr>
</thead>
<tbody>
<tr>
<td>mm²</td>
<td>No/mm</td>
<td>mm</td>
<td>mm</td>
<td>kg/km</td>
<td>20 °C @1-10MHz f&lt;=30MHz @1MHz @1.5MHz @2MHz @3MHz</td>
<td>Ω/km</td>
<td>Ω mΩ/m dB/km dB/km dB/km dB/km</td>
<td></td>
</tr>
<tr>
<td>0.75</td>
<td>19/0.22</td>
<td>1.4</td>
<td>8.3</td>
<td>97</td>
<td>26.7</td>
<td>120 +/-12</td>
<td>10 dB/km 13 dB/km 14 dB/km 18 dB/km</td>
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#### FRL-WTB-02YCH-1P0.75S

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<th>Nominal Cross-Sectional Area</th>
<th>Number &amp; Nominal Diameter of Strands</th>
<th>Nominal Sheath Thickness</th>
<th>Nominal Overall Diameter</th>
<th>Nominal Weight</th>
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<th>Impedance</th>
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</thead>
<tbody>
<tr>
<td>mm²</td>
<td>No/mm</td>
<td>mm</td>
<td>mm</td>
<td>kg/km</td>
<td>20 °C @1-10MHz f&lt;=30MHz @1MHz @1.5MHz @2MHz @3MHz</td>
<td>Ω/km</td>
<td>Ω mΩ/m dB/km dB/km dB/km dB/km</td>
<td></td>
</tr>
<tr>
<td>0.75</td>
<td>19/0.22</td>
<td>1.4</td>
<td>9.0</td>
<td>110</td>
<td>26.7</td>
<td>120 +/-12</td>
<td>10 dB/km 13 dB/km 14 dB/km 18 dB/km</td>
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#### FRL-WTB-02YCH-2P0.75S

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<th>Nominal Cross-Sectional Area</th>
<th>Number &amp; Nominal Diameter of Strands</th>
<th>Nominal Sheath Thickness</th>
<th>Nominal Overall Diameter</th>
<th>Nominal Weight</th>
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<th>Impedance</th>
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</tr>
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<tbody>
<tr>
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<td>mm</td>
<td>mm</td>
<td>kg/km</td>
<td>20 °C @1-10MHz f&lt;=30MHz @1MHz @1.5MHz @2MHz @3MHz</td>
<td>Ω/km</td>
<td>Ω mΩ/m dB/km dB/km dB/km dB/km</td>
<td></td>
</tr>
<tr>
<td>0.75</td>
<td>19/0.22</td>
<td>1.4</td>
<td>11.4</td>
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<td>26.7</td>
<td>120 +/-12</td>
<td>10 dB/km 13 dB/km 14 dB/km 18 dB/km</td>
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MVB (Multifunction Vehicle Bus) Cables
FRL-MVB-02YCH-1P0.5S+1G0.5/FRL-MVB-02YCH-2P0.5S

Application
The cables are designed for permanent installation inside of rolling stock to connect fixed parts. A typical application is a communication system in a locomotive. The system uses a wire backed bus system to the TCN standard for control and instrumentation and for diagnostics. This bus system consists of the rail bus WTB (Wired Train Bus) and the road bus MVB (Multifunction Vehicle Bus) which are connected via redundant gateways.

Construction
Conductor
Stranded tinned copper conductor according to IEC 60228 class 5
Insulation
Foam PE or foam skin PE
Core Wrapping
Plastic tape(s)
EMC Screen
Tinned copper braid
Outer Sheath
Cross-linked oil resistant LSZH compound

Electrical & Mechanical Properties
Nominal Voltage 300 V
Max. Temperature 90 °C
Min. Temperature -40 °C
Bending Radius 10 × Overall Diameter

Chemical & Environmental Properties
EN 60684-2 No fluorine
EN 50305; EN 60811-2-1 Resistance to mineral oil & fuel oil, acid & alkali
EN 50305 Resistance to ozone
Databus Cables

Fire Performance for Rolling Stock Application
EN 50306-2
DIN 5510-2
BS 6853
NF F 16-101

Fire Performance in General
EN 50265-2-1; IEC 60332-1-2; NF C 32-070 2.1 (C2)
EN 50266-2-4 + EN 50305; IEC 60332-3-24;
NF C 32-070 2.2 (C1); VDE 0472 Teil 804
EN 50268-2; IEC 61034-2; NF C 32-073;
NF C 20-902; NF F 16 101; VDE 0472 Teil 816
EN 50267-2-1; IEC 60754-1; NF C 32-074;
NF C 20-454; VDE 0472 Teil 815
EN 50267-2-2/3; IEC 60754-2; NF C 32-074;
NF C 20-453; VDE 0472 Teil 813
EN 50305; NF X 70-100; NF F 63 808; TM1-04; BS6853
NF F 63 808; BS6853; NF F 16 101

FRL-MVB-02YCH-1P0.5S+1G0.5

<table>
<thead>
<tr>
<th>Nominal Cross-Sectional Area</th>
<th>Number &amp; Nominal Diameter of Strands</th>
<th>Nominal Sheath Thickness</th>
<th>Nominal Overall Diameter</th>
<th>Nominal Weight</th>
<th>Max. Conductor Resistance</th>
<th>Impedance</th>
<th>Max. Transfer Impedance</th>
<th>Max. Attenuation</th>
</tr>
</thead>
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<tr>
<td></td>
<td>mm² No/mm</td>
<td>mm</td>
<td>mm</td>
<td>kg/km</td>
<td>Ω/km</td>
<td>Ω</td>
<td>@1MHz</td>
<td>@2MHz</td>
</tr>
<tr>
<td>0.5</td>
<td>19/0.18</td>
<td>1.2</td>
<td>6.8</td>
<td>62</td>
<td>41</td>
<td>120+/-12</td>
<td>20</td>
<td>12.5</td>
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FRL-MVB-02YCH-2P0.5S

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<th>Nominal Cross-Sectional Area</th>
<th>Number &amp; Nominal Diameter of Strands</th>
<th>Nominal Sheath Thickness</th>
<th>Nominal Overall Diameter</th>
<th>Nominal Weight</th>
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<th>Impedance</th>
<th>Max. Transfer Impedance</th>
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</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>mm² No/mm</td>
<td>mm</td>
<td>mm</td>
<td>kg/km</td>
<td>Ω/km</td>
<td>Ω</td>
<td>@1MHz</td>
<td>@2MHz</td>
</tr>
<tr>
<td>0.5</td>
<td>19/0.18</td>
<td>1.2</td>
<td>8.3</td>
<td>100</td>
<td>41</td>
<td>120+/-12</td>
<td>20</td>
<td>12.5</td>
</tr>
</tbody>
</table>

Corona Resistant
Highly Flexible
UV Resistant
Ozone Resistant
Abrasion Resistant
Cold Resistant
Resistance To Soldering Heat
Acid & Alkaline Resistant

IRM 903
Fuel Oil Resistant
IRM 902
Mineral Oil Resistant
Fire Retardant
NF C20-072-2.2/21
EC006333-3-24F368328-2.4
Flame Retardant
NF C20-072-3.1/21C1
EC006333.1-3568328-3.1
Low Toxicity
EN 50335; NF X70-105/1NF F3568328-4
Low Corrosivity (Acidity & Conductivity)
IEC 60754-1; EN 5298-2
Low Smoke Emission
IEC 60754-1; EN 5290-1; NF C20-454
Zero Halogen
IEC 60754-1; EN 5207-2.1; NF C20-454
Zero Flammable
MVB (Multifunction Vehicle Bus) Cables (Redundant Version)
FRM-VB-02YCH-1Q0.5S+4G0.25

Application
The cables are designed for permanent installation inside of rolling stock to connect fixed parts. A typical application is a communication system in a locomotive. The system uses a wire backed bus system to the TCN standard for control and instrumentation and for diagnostics. This bus system consists of the rail bus WTB (Wired Train Bus) and the road bus MVB (Multifunction Vehicle Bus) which are connected via redundant gateways.

Construction
Conductor
Stranded tinned copper conductor according to IEC 60228 class 5
Insulation
0.6mm foam PE/foam skin PE (for 0.5mm² conductor), 0.2mm PE (for 0.25mm² conductor)
Core Wrapping
Plastic tape(s)
EMC Screen
Tinned copper braid
Outer Sheath
Cross-linked oil resistant LSZH compound

Electrical & Mechanical Properties
Nominal Voltage                      300 V
Max. Temperature                    90 °C
Min. Temperature                    -40 °C
Bending Radius                      10 × Overall Diameter

Chemical & Environmental Properties
EN 60684-2                           No fluorine
EN 50305; EN 60811-2-1               Resistance to mineral oil & fuel oil, acid & alkali
EN 50305                              Resistance to ozone

Fire Performance for Rolling Stock Application
EN 50306-2                           Hazard levels HL1, HL2/HL3, HL4
DIN 5510-2                            Protection level 1/2/3/4
BS 6853                                Interior use 1a, 1b, II; Exterior use 1a, 1b, II
NF F 16-101                            F0
Fire Performance in General
EN 50265-2-1; IEC 60332-1-2; NF C 32-070 2.1 (C2) Vertical flame propagation for a single insulated wire or cable
EN 50266-2-4 + EN 50305; IEC 60332-3-24; NF C 32-070 2.2 (C1); VDE 0472 Teil 804 Vertical flame spread of vertically mounted bunched wires or cables
EN 50268-2; IEC 60754-1; NF C 32-074; VDE 0472 Teil 815 Low Smoke Emission
EN 50268-2; IEC 60332-3-24; VDE 0472 Teil 815 Halogen Free
NF C 20-902; NF F 63 808; TM1-04; BS6853 Low Corrosivity (Acidity & Conductivity)
EN 50268-2; IEC 60332-1-2; NF C 32-074; VDE 0472 Teil 813 Low Toxicity
NF C 20-453; VDE 0472 Teil 813 Smoke Index
NF C 20-454; VDE 0472 Teil 815
NF C 20-902; NF F 63 808; NF F 63 808; BS6853; NF F 16 101
NF F 16 101

FRL-MVB-02YCH-1Q0.5S+4G0.25

<table>
<thead>
<tr>
<th>Nominal Cross-Sectional Area</th>
<th>Number &amp; Nominal Diameter of Strands</th>
<th>Nominal Sheath Thickness</th>
<th>Nominal Overall Diameter</th>
<th>Nominal Weight</th>
<th>Max. Conductor Resistance</th>
<th>Impedance @0.75-3MHz</th>
<th>Max. Transfer Impedance @1.5MHz</th>
<th>Max. Attenuation @3MHz</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5</td>
<td>19/0.18</td>
<td>1.2</td>
<td>7.9</td>
<td>95</td>
<td>41</td>
<td>120+/−12</td>
<td>20</td>
<td>17</td>
</tr>
</tbody>
</table>

---

Corona Resistant
Mineral Oil Resistant
Fuel Oil Resistant
IRM 902
IRM 903
Highly Flexible
UV Resistant
Ozone Resistant
Abrasion Retardant
Cold Resistant
Resistance To Soldering Heat
Acid & Alkaline Resistant
Zero Halogen
Highly Flexible
Flame Retardant
Low Toxicity
Low Corrosivity
Low Smoke Emission
Zero Halogen
WTB (Wired Train Bus) / MVB (Multifunction Vehicle Bus) Cables
FRL-WTB/MVB-02Y(ST+C)H-1P20A

Application
The cables are designed for permanent installation inside of rolling stock to connect fixed parts. A typical application is a communication system in a locomotive. The system uses a wire backed bus system to the TCN standard for control and instrumentation and for diagnostics. This bus system consists of the rail bus WTB (Wired Train Bus) and the road bus MVB (Multifunction Vehicle Bus) which are connected via redundant gateways.

Construction
Conductor
Stranded tinned copper conductor according to IEC 60228 class 5

Insulation
Foam PE or foam skin PE

Cable Element
Twisted pair

Core Wrapping
Plastic tape(s)

EMC Screen 1
Aluminium clad polyester foil

EMC Screen 2
Tinned copper braid

Core Wrapping
Plastic tape(s)

Outer Sheath
Cross-linked oil resistant LSZH compound

Electrical & Mechanical Properties
Nominal Voltage 300 V
Max. Temperature 90 °C
Min. Temperature -40 °C
Bending Radius 12 × Overall Diameter

Chemical & Environmental Properties
EN 60684-2
EN 50305; EN 60811-2-1
EN 50305

No fluorine
Resistance to mineral oil & fuel oil, acid & alkali
Resistance to ozone

Fire Performance for Rolling Stock Application
EN 50306-2
DIN 5510-2
BS 6853
NF F 16-101

Hazard levels HL1, HL2/HL3, HL4
Protection level 1/2/3/4
Interior use 1a, 1b, II; Exterior use 1a, 1b, II
F0
Databus Cables

Fire Performance in General

- EN 50265-2-1; IEC 60332-1-2; NF C 32-070 2.1 (C2)
- EN 50266-2-4 + EN 50305; IEC 60332-3-24; NF C 32-070 2.2 (C1); VDE 0472 Teil 804
- EN 50268-2; IEC 61034-2; NF C 32-073; NF C 20-902; NF F 16 101; VDE 0472 Teil 816
- EN 50267-2-1; IEC 60754-1; NF C 32-074; NF C 20-454; VDE 0472 Teil 815
- EN 50267-2-2/3; IEC 60754-2; NF C 32-074; NF C 20-453; VDE 0472 Teil 813
- EN 50305; NF X 70-100; NF F 63 808; TM1-04; BS6853
- NF F 63 808; BS6853; NF F 16 101

FRL-WTB/MVB-02Y(ST+C)H-1P20A

<table>
<thead>
<tr>
<th>Nominal Cross-Sectional Area</th>
<th>Number &amp; Nominal Diameter of Strands</th>
<th>Nominal Sheath Thickness</th>
<th>Nominal Overall Diameter</th>
<th>Nominal Weight</th>
<th>Max. Conductor Resistance 20 °C</th>
<th>Impedance @0.75-3MHz</th>
<th>Impedance @1MHz</th>
<th>Impedance @2MHz</th>
<th>Max. Attenuation dB/km</th>
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</thead>
<tbody>
<tr>
<td>0.62 mm²</td>
<td>20 AWG</td>
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<td>33.1</td>
<td>120+/-12</td>
<td>10</td>
<td>15</td>
</tr>
</tbody>
</table>

- Vertical flame propagation for a single insulated wire or cable
- Vertical flame spread of vertically mounted bunched wires or cables
- Low Smoke Emission
- Halogen Free
- Low Corrosivity (Acidity & Conductivity)
- Low Toxicity
- Smoke Index
- Corona Resistant
- Highly Flexible
- UV Resistant
- Ozone Resistant
- Abrasion Retardant
- Cold Resistant
- Resistance To Soldering Heat
- Acid & Alkaline Resistant
- IRM 903 Fuel Oil Resistant
- IRM 902 Mineral Oil Resistant
- Fire Retardant NF C22-074-2 ECPF EC50332-3-2; EN3385308-2-4
- Flame Retardant NF C22-074-1 EN60332-1-3; EN385308-3-1
- Low Toxicity NF C22-074 NF F63 808 T2-4; TM1-04; BS6853
- Low Corrosivity NF C22-074 NF C22-074 NF C22-074
- Low Smoke Emission NF C22-074 NF C22-074 NF C22-074
- Zero Halogen NF C22-074 NF C22-074 NF C22-074-3-1 NF C22-074-5-1
Integrated 9/11/18/20 Cores 0.75mmsq UIC Databus Cables

FRL-UIC-4G10+2G6+1G2.5+2G0.75
FRL-UIC-4G10+2G6+1G2.5+2G1+2G0.75
FRL-UIC-4Q1S+2G0.75/FRL-UIC-4Q1S+2P0.75S

Application

The cables are used as connecting cables to transmit digital signals inside railway rolling stocks.

Construction

For 9 cores UIC databus cables

4 cores: 10 mm² stranded tinned copper conductor with LSZH insulation
Combined Element: 3 cores (with Cu-strand 2 x 6mm², 1 x 2.5mm²) are twisted with a filling element to form a combined element
Core Wrapping: Overlapped plastic-foil(s)
Elements Sheaths: TPE
UIC Data Bus 0.75mm²: Two foam PE or foam skin PE insulated tinned copper stranded conductors are twisted together with two filling elements to form a pair
Core Wrapping: Overlapped plastic-foil(s)
Screen: Tin plated copper braid
Elements Sheaths: TPE
Core Wrapping: Overlapped plastic-foil(s)
Stranding: 4 strands are twisted to a core together with 3 cored element, the UIC data bus and two fillers
Core Wrapping: Overlapped plastic-foil(s)
Outer Sheath: Cross-linked oil resistant LSZH compound

For 11 cores UIC databus cables

4 cores: 10 mm² stranded tinned copper conductor with LSZH insulation
Combined Element: 5 cores (with Cu-strand 2 x 6mm², 1 x 2.5mm² and 2 x 1.0 mm²) are twisted with a filling element to form a combined element
Core Wrapping: Overlapped plastic-foil(s)
Element sheaths: TPE
UIC Data Bus 0.75mm²: Two foam PE or foam skin PE insulated tinned copper stranded conductors are twisted together with two filling elements to form a pair
Core Wrapping: Overlapped plastic-foil(s)
Screen: Tin plated copper braid
Element Sheaths: TPE
Core Wrapping: Overlapped plastic-foil(s)
Databus Cables

Stranding: 4 strands are twisted to a core together with 5 cored element, the UIC data bus and two fillers
Core Wrapping: Overlapped plastic-foil(s)
Outer Sheath: Cross-linked oil resistant LSZH compound

For 18/20 cores UIC databus cables
Star Quad: Four LSZH insulated 1mm² stranded tinned copper conductors are twisted to form a star quad.
UIC Data Bus 0.75mm²: Two foam PE or foam skin PE insulated tinned copper stranded conductors are twisted together with two filling elements to form a pair
Core Wrapping: Overlapped plastic-foil(s)
Screen: Tin plated copper braid
Element Sheaths: TPE
Core Wrapping: Overlapped plastic-foil(s)
Stranding: 4 star quads are stranded together with 2 or 4 UIC data bus cable and several fillers
Core Wrapping: Overlapped plastic-foil(s)
Screen: Tin plated copper braid.
Outer Sheath: Cross-linked oil resistant LSZH compound

Electrical & Mechanical Properties
Nominal Voltage 300 V
Max. Temperature 90 °C
Min. Temperature -40 °C
Bending Radius 12 × Overall Diameter

Chemical & Environmental Properties
EN 60684-2
EN 50305; EN 60811-2-1
EN 50305

Fire Performance for Rolling Stock Application
EN 50306-2
DIN 5510-2
BS 6853
NF F 16-101

Fire Performance in General
EN 50265-2-1; IEC 60332-1-2; NF C 32-070 2.1 (C2)
EN 50266-2-4 + EN 50305; IEC 60332-3-24;
NF C 32-070 2.2 (C1); VDE 0472 Teil 804
EN 50268-2; IEC 61034-2; NF C 32-073 ;
NF C 20-902; NF F 16 101; VDE 0472 Teil 816
EN 50267-2-1; IEC 60754-1; NF C 32-074;
NF C 20-454; VDE 0472 Teil 815
EN 50267-2-2/3; IEC 60754-2; NF C 32-074;
NF C 20-453; VDE 0472 Teil 813
EN 50305; NF X 70-100; NF F 63 808; TM1-04; BS6853
NF F 63 808; BS6853; NF F 16 101

Vertical flame propagation for a single insulated wire or cable
Vertical flame spread of vertically mounted bunched wires or cables
Low Smoke Emission
Halogen Free
Low Corrosivity (Acidity & Conductivity)
Low Toxicity
Smoke Index
### Caledonian

**FRL-UIC-4G10+2G6+1G2.5+2G0.75**

<table>
<thead>
<tr>
<th>Nominal Cross-Sectional Area</th>
<th>Number &amp; Nominal Diameter of Strands</th>
<th>Nominal Sheath Thickness</th>
<th>Nominal Overall Diameter</th>
<th>Nominal Weight</th>
<th>Max. Conductor Resistance</th>
<th>Impedance</th>
<th>Max. Attenuation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>mm²</td>
<td>No/mm/mm/mm/kg/km/mm</td>
<td></td>
<td></td>
<td>20 °C @0.75-3MHz @1MHz @1.5MHz @2MHz @3MHz</td>
<td>Ω/Ω/Ω/Ω/Ω</td>
<td>dB/km dB/km dB/km dB/km dB/km</td>
</tr>
<tr>
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<td>917</td>
<td>26.7 120+/−12 10 13 14 18</td>
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<tr>
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### FRL-UIC-4G10+2G6+1G2.5+2G1+2G0.75

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<th>Nominal Sheath Thickness</th>
<th>Nominal Overall Diameter</th>
<th>Nominal Weight</th>
<th>Max. Conductor Resistance</th>
<th>Impedance</th>
<th>Max. Attenuation</th>
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<tr>
<td></td>
<td>mm²</td>
<td>No/mm/mm/mm/kg/km/mm</td>
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<td>20 °C @0.75-3MHz @1MHz @1.5MHz @2MHz @3MHz</td>
<td>Ω/Ω/Ω/Ω/Ω</td>
<td>dB/km dB/km dB/km dB/km dB/km</td>
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<tr>
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<th>Max. Conductor Resistance</th>
<th>Impedance</th>
<th>Max. Attenuation</th>
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<td>mm²</td>
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<td>20 °C @0.75-3MHz @1MHz @1.5MHz @2MHz @3MHz</td>
<td>Ω/Ω/Ω/Ω/Ω</td>
<td>dB/km dB/km dB/km dB/km dB/km</td>
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### FRL-UIC-4Q1S+2P0.75S

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<th>Nominal Weight</th>
<th>Max. Conductor Resistance</th>
<th>Impedance</th>
<th>Max. Attenuation</th>
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<tr>
<td></td>
<td>mm²</td>
<td>No/mm/mm/mm/kg/km/mm</td>
<td></td>
<td></td>
<td>20 °C @0.75-3MHz @1MHz @1.5MHz @2MHz @3MHz</td>
<td>Ω/Ω/Ω/Ω/Ω</td>
<td>dB/km dB/km dB/km dB/km dB/km</td>
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<td>20 - - - -</td>
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Category 5E Data Cables
FRL-Cat5E-4C0.5S/FRL-Cat5E-4C22A/FRL-Cat5E-4P22A

Application
The cables are designed for permanently protected installation, inside and outside railway rolling stock, buses and other vehicles to connect fixed parts. Ethernet based networks as: infotainment, multimedia, passenger information system etc.

Construction
For 4 x 0.5mm², 4 x 22 AWG cables
Conductor: Stranded tin plated copper conductor (for 0.5mm² cables) or stranded silver plated copper conductor (for 22AWG cables) according to IEC 60228 class 5
Insulation: Electron beam crosslinkable compound
Cable Element: Individual conductor stranded together
EMC Screen 1: Plastic laminated aluminium tape
EMC Screen 2: Tin plated copper braid
Core Wrapping: Plastic tape(s)
Outer Sheath: Electron beam crosslinkable compound

For 4 x 2 x 22 AWG cables
Center: PE filler.
Conductor: Stranded tin plated copper conductor according to IEC 60228 class 5
Insulation: Electron beam crosslinkable compound
EMC Screen 1: Plastic laminated aluminium tape
EMC Screen 2: Tin plated copper braid
Core Wrapping: Plastic tape(s)
Outer Sheath: Electron beam crosslinkable compound

Electrical & Mechanical Properties
Nominal Voltage 300 V
Max. Temperature 90 °C
Min. Temperature -40 °C
Bending Radius 6 × Overall Diameter

Chemical & Environmental Properties
EN 60684-2 No fluorine
EN 50305; EN 60811-2-1 Resistance to mineral oil & fuel oil, acid & alkali
EN 50305 Resistance to ozone

Fire Performance for Rolling Stock Application
EN 50306-2 Hazard levels HL1, HL2/HL3, HL4
DIN 5510-2 Protection level 1/2/3/4
BS 6853 Interior use 1a, 1b, II; Exterior use 1a, 1b, II
NF F 16-101 F0
**Fire Performance in General**

EN 50265-2-1; IEC 60332-1-2; NF C 32-070 2.1 (C2)  
Vertical flame propagation for a single insulated wire or cable

EN 50266-2-4 + EN 50305; IEC 60332-3-24;  
Vertical flame spread of vertically mounted bunched wires or cables

NF C 32-070 2.1; IEC 60754-1; NF C 32-074;  
Low Smoke Emission

NF C 20-902; NF F 16 101; VDE 0472 Teil 813  
Low Toxicity

EN 50267-2-1; IEC 60754-1; NF C 32-074;  
Halogen Free

NF C 20-454; VDE 0472 Teil 815  
Zero Halogen

EN 50267-2-2/3; IEC 60754-2; NF C 32-074;  
Low Corrosivity (Acidity & Conductivity)

NF C 20-453; VDE 0472 Teil 813  
Ultraviolet Resistant

EN 50305; NF X 70-100; NF F 63 808; TM1-04; BS6853  
Highly Flexible

NF F 63 808; BS6853; NF F 16 101  
Resistance to Soldering Heat

---

### FRL-Cat5E-4C0.5S

<table>
<thead>
<tr>
<th>Nominal Cross-Sectional Area</th>
<th>Nominal Sheath Thickness</th>
<th>Nominal Overall Diameter</th>
<th>Nominal Weight</th>
<th>Max. Conductor Resistance 20 °C</th>
<th>Max. Resistance Unbalance</th>
<th>Characteristic Impedance @100MHz</th>
<th>Transfer Impedance</th>
<th>Max.Capacitance</th>
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<tbody>
<tr>
<td>mm²</td>
<td>mm</td>
<td>mm</td>
<td>kg/km</td>
<td>Ω/km</td>
<td>Ω/km</td>
<td>Ω</td>
<td>mΩ/m</td>
<td>pF/m</td>
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<tr>
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### FRL-Cat5E-4C22A

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<th>Max. Conductor Resistance 20 °C</th>
<th>Max. Resistance Unbalance</th>
<th>Characteristic Impedance @100MHz</th>
<th>Transfer Impedance</th>
<th>Max.Capacitance</th>
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<tbody>
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<td>AWG</td>
<td>mm</td>
<td>mm</td>
<td>kg/km</td>
<td>Ω/km</td>
<td>Ω/km</td>
<td>Ω</td>
<td>mΩ/m</td>
<td>pF/m</td>
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<tr>
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### FRL-Cat5E-4P22A

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<th>Nominal Weight</th>
<th>Max. Conductor Resistance 20 °C</th>
<th>Max. Resistance Unbalance</th>
<th>Characteristic Impedance @100MHz</th>
<th>Transfer Impedance</th>
<th>Max.Capacitance</th>
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<tr>
<td>AWG</td>
<td>mm</td>
<td>mm</td>
<td>kg/km</td>
<td>Ω/km</td>
<td>Ω/km</td>
<td>Ω</td>
<td>mΩ/m</td>
<td>pF/m</td>
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<tr>
<td>22</td>
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<td>1.1</td>
<td>100+/-5</td>
<td>200</td>
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RS 485 Databus Cables
300/500 V
FRL-MVB-02Y(ST)CH-IOS-xPyS/FRL-MVB-02YCH-OS-xPyS

Application
120 Ohm data transmission cables

Construction
Multipair Databus RS 485 Double Screened Cable
Conductor: Stranded tin plated copper conductor according to IEC 60228 class 5(0.22mm²-1mm²).
Insulation: Cross linked foam PE or foam skin PE
Cable Element: Twisted pair
Pair Screen: Individual Aluminium tape
Overall Screen: Copper wire braid
Outer Sheath: Cross linked EVA rubber type EM 104 or equivalent, in accordance with EN 50264-1

Multipair Databus RS 485 Single Screened Cable
Conductor: Stranded tin plated copper conductor according to IEC 60228 class 5(0.22mm²-1mm²)
Insulation: Cross linked foam PE or foam skin PE
Cable Element: Twisted pair
Overall Screen: Copper wire braid
Outer Sheath: Cross linked EVA rubber type EM 104 or equivalent, in accordance with EN 50264-1

Electrical & Mechanical Properties
Nominal Voltage 300/500 V
Impedance 120 Ω +/- 15 %
Capacitance@1KHz 41 nF/km
Min. Insulation Resistance 5000 MΩ

Chemical & Environmental Properties
EN 60684-2 No fluorine
EN 50305; EN 60811-2-1 Resistance to mineral oil & fuel oil, acid & alkali
EN 50305 Resistance to ozone

Fire Performance for Rolling Stock Application
EN 50306-2 Hazard levels HL1, HL2/HL3, HL4
DIN 5510-2 Protection level 1/2/3/4
BS 6853 Interior use 1a, 1b, II; Exterior use 1a, 1b, II
NF F 16-101 F0

Fire Performance in General
EN 50265-2-1; IEC 60332-1-2; NF C 32-070 2.1 (C2) Vertical flame propagation for a single insulated wire or cable
EN 50266-2-4 + EN 50305; IEC 60332-3-24; Vertical flame spread of vertically mounted bunched wires or cables
NF C 32-070 2.2 (C1); VDE 0472 Teil 804
EN 50268-2; IEC 61034-2; NF C 32-073 ; Low Smoke Emission
NF C 20-902; NF F 16 101; VDE 0472 Teil 816
EN 50267-2-1; IEC 60754-1; NF C 32-074;
NF C 20-454; VDE 0472 Teil 815
EN 50267-2-2/3; IEC 60754-2; NF C 32-074;
NF C 20-453; VDE 0472 Teil 813
EN 50305; NF X 70-100; NF F 63 808; TM1-04; BS6853
NF F 63 808; BS6853; NF F 16 101

**Halogen Free**
**Low Corrosivity (Acidity & Conductivity)**
**Low Toxicity**
**Smoke Index**

FRL-MVB-02Y(ST)CH-IOS-xPyS 300/500 V

<table>
<thead>
<tr>
<th>No.of Pair</th>
<th>Nominal Cross-Sectional Area (mm²)</th>
<th>Number &amp; Nominal Diameter of Strands (No/mm)</th>
<th>Nominal Overall Diameter (mm)</th>
<th>Nominal Weight (kg/km)</th>
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FRL-MVB-02YCH-OS-xPyS 300/500 V

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<th>Nominal Weight (kg/km)</th>
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