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 32-070 2.2 (C1); VDE 0472 Teil 804	Vertical flame spread of vertically mounted bunched wires or cables
EN 50268-2; IEC 61034-2; NF C 32-073 ; NF C 20-902; NF F 16 101; VDE 0472 Teil 816	Low Smoke Emission
EN 50267-2-1; IEC 60754-1; NF C 32-074; NF C 20-454; VDE 0472 Teil 815	Halogen Free
EN 50267-2-2/3; IEC 60754-2; NF C 32-074; NF C 20-453; VDE 0472 Teil 813	Low Corrosivity (Acidity & Conductivity)
EN 50305; NF X 70-100; NF F 63 808; TM1-04; BS6853	Low Toxicity
NF F 63 808; BS6853; NF F 16 101	Smoke Index

FRL-WTB-02YCH-2G0.75

Nominal Cross-Sectional Area	Number & Nominal Diameter of Strands	Nominal Sheath Thickness	Nominal Overall Diameter	Nominal Weight	Max. Conductor Resistance	Impedance	Max. Transfer Impedance	Max.Attenuation			
					20 °C	@1-10MHz	f<=30MHz	@1MHz	@1.5MHz	@2MHz	@3MHz
mm^2	No/mm	mm	mm	kg/km	Ω/km	Ω	mΩ/m	dB/km	dB/km	dB/km	dB/km
0.75	19/0.22	1.4	8.3	97	26.7	120+/-12	30	10	13	14	18

FRL-WTB-02YCH-1P0.75S

Nominal Cross-Sectional Area	Number & Nominal Diameter of Strands	Nominal Sheath Thickness	Nominal Overall Diameter	Nominal Weight	Max. Conductor Resistance	Impedance	Max. Transfer Impedance	Max.Attenuation			
					20 °C	@1-10MHz	f<=30MHz	@1MHz	@1.5MHz	@2MHz	@3MHz
mm^2	No/mm	mm	mm	kg/km	Ω/km	Ω	mΩ/m	dB/km	dB/km	dB/km	dB/km
0.75	19/0.22	1.4	9.0	110	26.7	120+/-12	30	10	13	14	18

FRL-WTB-02YCH-2P0.75S

Nominal Cross-Sectional Area	Number & Nominal Diameter of Strands	Nominal Sheath Thickness	Nominal Overall Diameter	Nominal Weight	Max. Conductor Resistance	Impedance	Max. Transfer Impedance	Max.Attenuation			
					20 °C	@1-10MHz	f<=30MHz	@1MHz	@1.5MHz	@2MHz	@3MHz
mm^2	No/mm	mm	mm	kg/km	Ω/km	Ω	mΩ/m	dB/km	dB/km	dB/km	dB/km
0.75	19/0.22	1.4	11.4	150	26.7	120+/-12	30	10	13	14	18

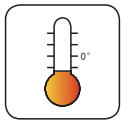

Corona Resistant

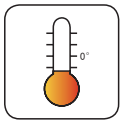

Highly Flexible


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 C32-070-2.2(C1)
IEC60332-3-24/EN50266-2-4


Flame Retardant
NF C32-070-2.1(C2)
IEC60332-1-2/EN50265-2-1


Low Toxicity
EN 50305; NF X70-100/NF F63 808/TM1-04/BS 6853


Low Corrosivity
IEC60754-2/EN50267-2-2/3
NF C32-074/NF C20-453


Low Smoke Emission
IEC 61034-2 / EN 50268-2
NF C32-073/NF C 20-902

Zero Halogen
IEC 60754-1/EN 50267-2-1
NF C20-454

MVB (Multifunction Vehicle Bus) Cables FRL-MVB-02YCH-1P0.5S+1G0.5/FRL-MVB-02YCH-2P0.5S

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

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

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 61034-2; NF C 32-073 ; NF C 20-902; NF F 16 101; VDE 0472 Teil 816	Low Smoke Emission
EN 50267-2-1; IEC 60754-1; NF C 32-074; NF C 20-454; VDE 0472 Teil 815	Halogen Free
EN 50267-2-2/3; IEC 60754-2; NF C 32-074; NF C 20-453; VDE 0472 Teil 813	Low Corrosivity (Acidity & Conductivity)
EN 50305; NF X 70-100; NF F 63 808; TM1-04; BS6853	Low Toxicity
NF F 63 808; BS6853; NF F 16 101	Smoke Index

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

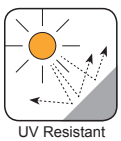
Nominal Cross-Sectional Area	Number & Nominal Diameter of Strands	Nominal Sheath Thickness	Nominal Overall Diameter	Nominal Weight	Max. Conductor Resistance	Impedance	Max. Transfer Impedance	Max.Attenuation			
					20 °C	@0.5-2MHz	f<=20MHz	@1MHz	@1.5MHz	@2MHz	@3MHz
mm^2	No/mm	mm	mm	kg/km	Ω/km	Ω	mΩ/m	dB/km	dB/km	dB/km	dB/km
0.5	19/0.18	1.2	6.8	62	41	120+/-12	20	12.5	15	18	21

FRL-MVB-02YCH-2P0.5S

Nominal Cross-Sectional Area	Number & Nominal Diameter of Strands	Nominal Sheath Thickness	Nominal Overall Diameter	Nominal Weight	Max. Conductor Resistance	Impedance	Max. Transfer Impedance	Max.Attenuation			
					20 °C	@1-10MHz	f<=20MHz	@1MHz	@1.5MHz	@2MHz	@3MHz
mm^2	No/mm	mm	mm	kg/km	Ω/km	Ω	mΩ/m	dB/km	dB/km	dB/km	dB/km
0.5	19/0.18	1.2	8.3	100	41	120+/-12	20	12.5	15	18	21

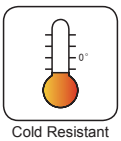

Corona Resistant


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 C32-070-2.2(C1)
IEC60332-3-24/EN50266-2-4


Flame Retardant
NF C32-070-2.1(C2)
IEC60332-1-2/EN50265-2-1

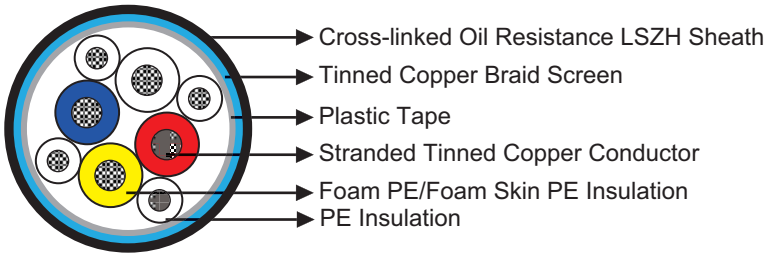

Low Toxicity
EN 50305; NF X70-100/NF F63 808/TM1-04/BS 6853


Low Corrosivity
IEC60754-2/EN50267-2-2/3
NF C32-074/NF C20-453


Low Smoke Emission
IEC 61034-2 / EN 50268-2
NF C32-073/NF C 20-902

Zero Halogen
IEC 60754-1/EN 50267-2-1
NF C20-454

MVB (Multifunction Vehicle Bus) Cables (Redundant Version) FRL-MVB-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. 5mmsq conductor), 0.2mm PE (for 0.25mmsq 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

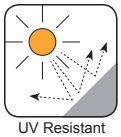
EN 50265-2-1; IEC 60332-1-2; NF C 32-070 2.1 (C2)	Vertical flame propagation for a single insulated wire or cable
EN 50266-2-4 + EN 50305; IEC 60332-3-24; NF C 32-070 2.2 (C1); VDE 0472 Teil 804	Vertical flame spread of vertically mounted bunched wires or cables
EN 50268-2; IEC 61034-2; NF C 32-073 ;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

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

Nominal Cross-Sectional Area	Number & Nominal Diameter of Strands	Nominal Sheath Thickness	Nominal Overall Diameter	Nominal Weight	Max. Conductor Resistance	Impedance	Max.Transfer Impedance	Max.Attenuation	
					20 °C	@0.75-3MHz	f<=20MHz	@1.5MHz	@3MHz
mm^2	No/mm	mm	mm	kg/km	Ω/km	Ω	mΩ/m	dB/km	dB/km
0.5	19/0.18	1.2	7.9	95	41	120+/-12	20	17	25

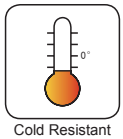

Corona Resistant


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 C32-070-2.2(C1)
IEC60332-3-24/EN50266-2-4


Flame Retardant
NF C32-070-2.1(C2)
IEC60332-1-2/EN50265-2-1


Low Toxicity
EN 50305; NF X70-100/NF F63 808/TM1-04/BS 6853


Low Corrosivity
IEC60754-2/EN50267-2-2/3
NF C32-074/NF C20-453


Low Smoke Emission
IEC 61034-2 / EN 50268-2
NF C32-073/NF C 20-902

Zero Halogen
IEC 60754-1/EN 50267-2-1
NF C20-454

WTB (Wired Train Bus) / MVB (Multifunction Vehicle Bus) Cables FRL-WTB/MVB-02Y(ST+C)H-1P20A

A. Conductor B. Insulation C. EMC Screen 1 & 2 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

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	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

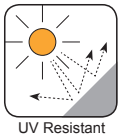
EN 50265-2-1; IEC 60332-1-2; NF C 32-070 2.1 (C2)	Vertical flame propagation for a single insulated wire or cable
EN 50266-2-4 + EN 50305; IEC 60332-3-24; NF C 32-070 2.2 (C1); VDE 0472 Teil 804	Vertical flame spread of vertically mounted bunched wires or cables
EN 50268-2; IEC 61034-2; NF C 32-073 ;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

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

Nominal Cross-Sectional Area		Number & Nominal Diameter of Strands	Nominal Sheath Thickness	Nominal Overall Diameter	Nominal Weight	Max. Conductor Resistance	Impedance	Max.Attenuation	
						20 °C	@0.75-3MHz	@1MHz	@2MHz
mm^2	AWG	No/mm	mm	mm	kg/km	Ω/km	Ω	dB/km	dB/km
0.62	20	19/0.2	1.2	8.3	80	33.1	120+/-12	10	15

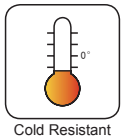

Corona Resistant


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 C32-070-2.2(C1)
IEC60332-3-24/EN50266-2-4


Flame Retardant
NF C32-070-2.1(C2)
IEC60332-1-2/EN50265-2-1


Low Toxicity
EN 50305; NF X70-100/NF F63 808/TM1-04/BS 6853


Low Corrosivity
IEC60754-2/EN50267-2-2/3
NF C32-074/NF C20-453


Low Smoke Emission
IEC 61034-2 / EN 50268-2
NF C32-073/NF C 20-902

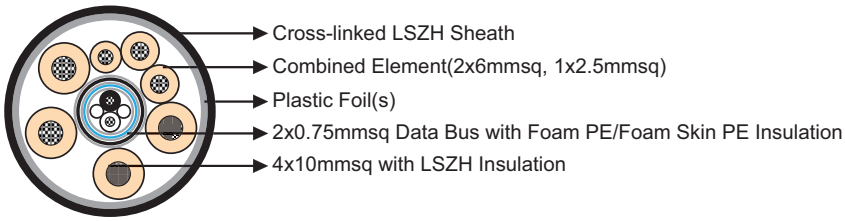
Zero Halogen
IEC 60754-1/EN 50267-2-1
NF C20-454

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

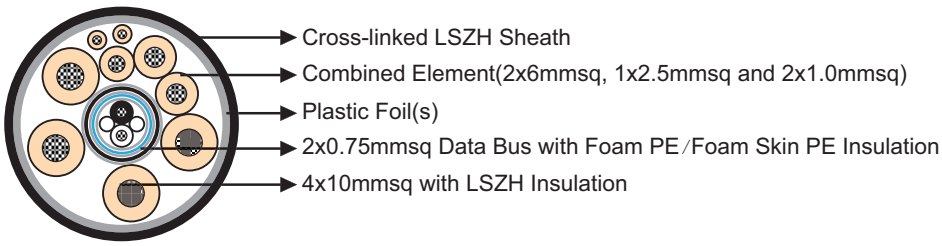
The cables are used as connecting cables to transmit digital signals inside railway rolling stocks.

Construction



For 9 cores UIC databus cables

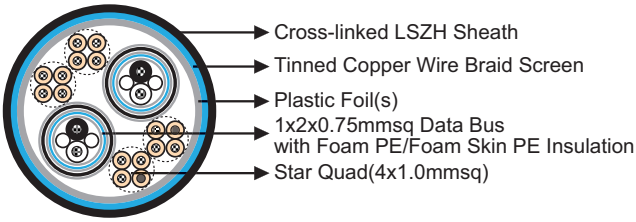
4 cores: 10 mm² stranded tinned copper conductor with LSZH insulation
Combined Element: 3 cores (with Cu-strand 2 x 6mm², 1 x 2.5mm²) are twisted with a filling element to form a combined element
Core Wrapping: Overlapped plastic-foil(s)
Elements Sheaths: TPE
UIC Data Bus 0.75mm²: Two foam PE or foam 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

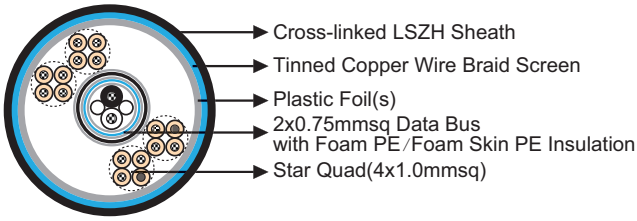


For 11 cores UIC databus cables

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)

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 1mm^2 stranded tinned copper conductors are twisted to form a star quad.
UIC Data Bus 0.75mm^2: 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	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 61034-2; NF C 32-073 ; NF C 20-902; NF F 16 101; VDE 0472 Teil 816	Low Smoke Emission
EN 50267-2-1; IEC 60754-1; NF C 32-074; NF C 20-454; VDE 0472 Teil 815	Halogen Free
EN 50267-2-2/3; IEC 60754-2; NF C 32-074; NF C 20-453; VDE 0472 Teil 813	Low Corrosivity (Acidity & Conductivity)
EN 50305; NF X 70-100; NF F 63 808; TM1-04; BS6853	Low Toxicity
NF F 63 808; BS6853; NF F 16 101	Smoke Index

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

Nominal Cross-Sectional Area	Number & Nominal Diameter of Strands	Nominal Sheath Thickness	Nominal Overall Diameter	Nominal Weight	Max. Conductor Resistance	Impedance	Max.Attenuation			
					20 °C	@0.75-3MHz	@1MHz	@1.5MHz	@2MHz	@3MHz
mm²	No/mm	mm	mm	kg/km	Ω/km	Ω	dB/km	dB/km	dB/km	dB/km
0.75	19/0.22	1.8	25	917	26.7	120+/-12	10	13	14	18
10	80/0.4				1.95	-	-	-	-	-
6	84/0.3				3.39	-	-	-	-	-
2.5	37/0.29				8.21	-	-	-	-	-

FRL-UIC-4G10+2G6+1G2.5+2G1+2G0.75

Nominal Cross-Sectional Area	Number & Nominal Diameter of Strands	Nominal Sheath Thickness	Nominal Overall Diameter	Nominal Weight	Max. Conductor Resistance	Impedance	Max.Attenuation			
					20 °C	@0.75-3MHz	@1MHz	@1.5MHz	@2MHz	@3MHz
mm²	No/mm	mm	mm	kg/km	Ω/km	Ω	dB/km	dB/km	dB/km	dB/km
0.75	19/0.22	1.8	25	969	26.7	120+/-12	10	13	14	18
10	80/0.4				1.95	-	-	-	-	-
6	84/0.3				3.39	-	-	-	-	-
2.5	37/0.29				8.21	-	-	-	-	-

FRL-UIC-4Q1S+2G0.75

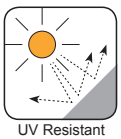
Nominal Cross-Sectional Area	Number & Nominal Diameter of Strands	Nominal Sheath Thickness	Nominal Overall Diameter	Nominal Weight	Max. Conductor Resistance	Impedance	Max.Attenuation			
					20 °C	@0.75-3MHz	@1MHz	@1.5MHz	@2MHz	@3MHz
mm²	No/mm	mm	mm	kg/km	Ω/km	Ω	dB/km	dB/km	dB/km	dB/km
0.75	19/0.22	1.8	18.5	498	26.7	120+/-12	10	13	14	18
1	19/0.25				20	-	-	-	-	-

FRL-UIC-4Q1S+2P0.75S

Nominal Cross-Sectional Area	Number & Nominal Diameter of Strands	Nominal Sheath Thickness	Nominal Overall Diameter	Nominal Weight	Max. Conductor Resistance	Impedance	Max.Attenuation			
					20 °C	@0.75-3MHz	@1MHz	@1.5MHz	@2MHz	@3MHz
mm²	No/mm	mm	mm	kg/km	Ω/km	Ω	dB/km	dB/km	dB/km	dB/km
0.75	19/0.22	1.5	23	530	26.7	120+/-12	10	13	14	18
1	19/0.25				20	-	-	-	-	-


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 C32-070-2.2(C1)
IEC60332-3-24/EN50266-2-4


Flame Retardant
NF C32-070-2.1(C2)
IEC60332-1-2/EN50265-2-1

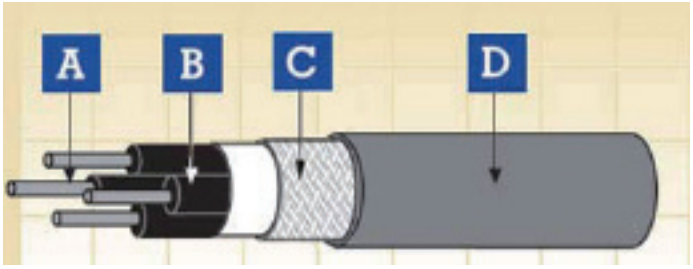

Low Toxicity
EN 50305; NF X70-100/NF F63 808/TM1-04/BS 6853


Low Corrosivity
IEC60754-2/EN50267-2-2/3
NF C32-074/NF C20-453


Low Smoke Emission
IEC 61034-2 / EN 50268-2
NF C32-073/NF C 20-902

Zero Halogen
IEC 60754-1/EN 50267-2-1
NF C20-454

Category 5E Data Cables
FRL-Cat5E-4C0.5S/FRL-Cat5E-4C22A/FRL-Cat5E-4P22A



A. Conductor B. Insulation C. EMC Screen 1 & 2 D. Sheath

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 0.5mm^2, 4 x 22 AWG cables

Conductor: Stranded tin plated copper conductor (for 0.5mm^2 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 & alkalil
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 61034-2; NF C 32-073 ; NF C 20-902; NF F 16 101; VDE 0472 Teil 816	Low Smoke Emission
EN 50267-2-1; IEC 60754-1; NF C 32-074; NF C 20-454; VDE 0472 Teil 815	Halogen Free
EN 50267-2-2/3; IEC 60754-2; NF C 32-074; NF C 20-453; VDE 0472 Teil 813	Low Corrosivity (Acidity & Conductivity)
EN 50305; NF X 70-100; NF F 63 808; TM1-04; BS6853	Low Toxicity
NF F 63 808; BS6853; NF F 16 101	Smoke Index

FRL-Cat5E-4C0.5S

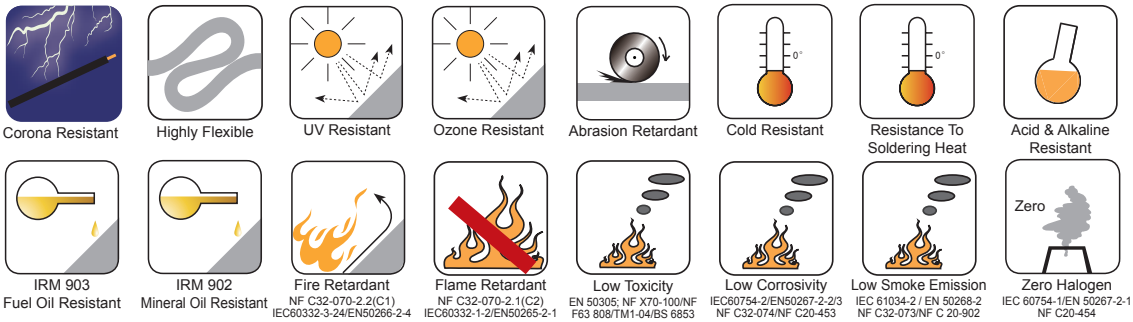
Nominal Cross-Sectional Area	Nominal Sheath Thickness	Nominal Overall Diameter	Nominal Weight	Max. Conductor Resistance 20 °C	Max. Resistance Unbalance	Characteristic Impedance	Transfer Impedance	Max.Capacitance	
						@100MHz	f≤30MHz	core to core	Core to screen
mm^2	mm	mm	kg/km	Ω/km	Ω/km	Ω	mΩ/m	pF/m	pF/m
0.5	1.2	8.3	102	40.1	1.1	100+/-5	200	65	100

FRL-Cat5E-4C22A

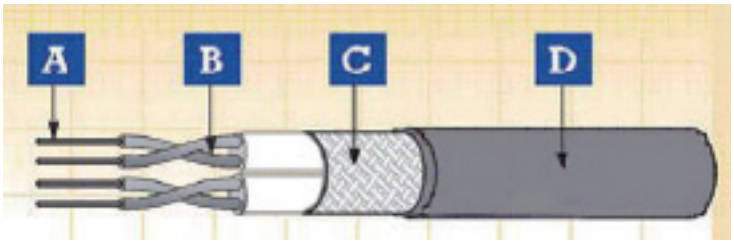
Nominal Cross-Sectional Area	Nominal Sheath Thickness	Nominal Overall Diameter	Nominal Weight	Max. Conductor Resistance 20 °C	Max. Resistance Unbalance	Characteristic Impedance	Transfer Impedance	Max.Capacitance	
						@100MHz	f≤30MHz	core to core	Core to screen
AWG	mm	mm	kg/km	Ω/km	Ω/km	Ω	mΩ/m	pF/m	pF/m
22	1.2	7.25	81	54.4	1.1	100+/-5	200	65	100

FRL-Cat5E-4P22A

Nominal Cross-Sectional Area	Nominal Sheath Thickness	Nominal Overall Diameter	Nominal Weight	Max. Conductor Resistance 20 °C	Max. Resistance Unbalance	Characteristic Impedance	Transfer Impedance	Max.Capacitance	
						@100MHz	f≤30MHz	core to core	Core to screen
AWG	mm	mm	kg/km	Ω/km	Ω/km	Ω	mΩ/m	pF/m	pF/m
22	1.2	12.6	174	54.4	1.1	100+/-5	200	65	100



RS 485 Databus Cables
300/500 V
FRL-MVB-02Y(ST)CH-IOS-xPyS/FRL-MVB-02YCH-OS-xPyS



A. Conductor B. Insulation+Pair Screen C. Overall Screen D. Sheath

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; 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 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; — Halogen Free
NF C 20-454; VDE 0472 Teil 815
EN 50267-2-2/3; IEC 60754-2; NF C 32-074; — Low Corrosivity (Acidity & Conductivity)
NF C 20-453; VDE 0472 Teil 813
EN 50305; NF X 70-100; NF F 63 808; TM1-04; BS6853 — Low Toxicity
NF F 63 808; BS6853; NF F 16 101 — Smoke Index

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

No.of Pair x	Nominal Cross-Sectional Area y	Number & Nominal Diameter of Strands	Nominal Overall Diameter	Nominal Weight
	mm^2	No/mm	mm	kg/km
1	0.22	7/0.2	4.5	58
2	0.22	7/0.2	6.2	79
4	0.22	7/0.2	6.5	118
1	0.5	16/0.2	6.6	79
2	0.5	16/0.2	9.0	105
4	0.5	16/0.2	9.8	145
1	0.75	24/0.2	9.5	115
2	0.75	24/0.2	10.3	135
4	0.75	24/0.2	11.6	182
1	1	30/0.2	11.5	125
2	1	30/0.2	12.5	150
4	1	30/0.2	13.5	180

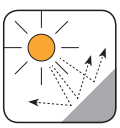
FRL-MVB-02YCH-OS-xPyS 300/500 V

No.of Pair x	Nominal Cross-Sectional Area y	Number & Nominal Diameter of Strands	Nominal Overall Diameter	Nominal Weight
	mm^2	No/mm	mm	kg/km
1	0.22	7/0.2	4.2	55
2	0.22	7/0.2	5.9	75
4	0.22	7/0.2	6.2	115
1	0.5	16/0.2	6.3	75
2	0.5	16/0.2	8.5	100
4	0.5	16/0.2	9.4	140
1	0.75	24/0.2	9.0	110
2	0.75	24/0.2	9.7	130
4	0.75	24/0.2	11.1	178
1	1	30/0.2	11.0	120
2	1	30/0.2	12.0	145
4	1	30/0.2	13.0	175

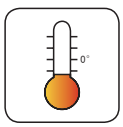

Corona Resistant


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

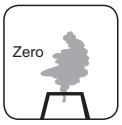

Fire Retardant
NF C32-070-2.2(C1)
IEC60332-3-24/EN50266-2-4


Flame Retardant
NF C32-070-2.1(C2)
IEC60332-1-2/EN50265-2-1


Low Toxicity
EN 50305; NF X70-100/NF F63 808/TM1-04/BS 6853


Low Corrosivity
IEC60754-2/EN50267-2-2/3
NF C32-074/NF C20-453


Low Smoke Emission
IEC 61034-2 / EN 50268-2
NF C32-073/NF C 20-902



Zero Halogen
IEC 60754-1/EN 50267-2-1
NF C20-454