

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)
 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

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
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
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

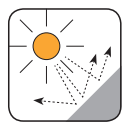
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					20 °C			@1-10MHz	f<=30MHz	@1MHz	@1.5MHz
mm ²	No/mm	mm	mm	kg/km	Ω/km	Ω	mΩ/m	dB/km	dB/km	dB/km	dB/km
0.75	19/0.22	1.4	11.4	150	26.7	120+/-12	30	10	13	14	18



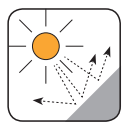
Corona Resistant



Highly Flexible



UV Resistant



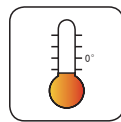
Ozone Resistant



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



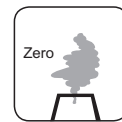
Low Toxicity
 EN 50305; NF X70-100/NF
 F63 808/TM1-04/BS 6853



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
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

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

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		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

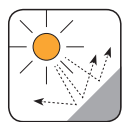
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					20 °C		f<=20MHz	@1MHz	@1.5MHz	@2MHz	@3MHz
mm ²	No/mm	mm	mm	kg/km	Ω/km	Ω	mΩ/m	dB/km	dB/km	dB/km	dB/km
0.5	19/0.18	1.2	8.3	100	41	120+/-12	20	12.5	15	18	21



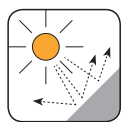
Corona Resistant



Highly Flexible



UV Resistant



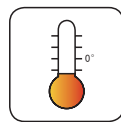
Ozone Resistant



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



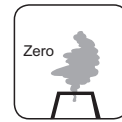
Low Toxicity
EN 50305; NF X70-100/NF
F63 808/TM1-04/BS 6853



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

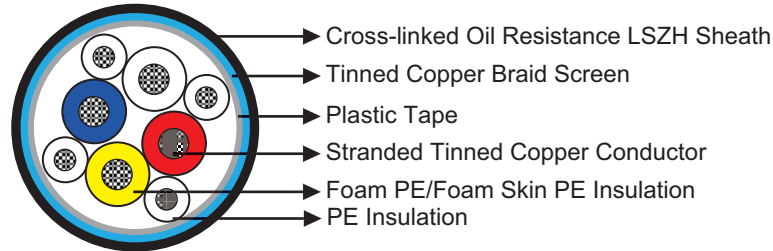


Low Smoke Emission
IEC 61034-2 / EN 50268-2
NF C32-073/NF C 20-902



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 0.5mm² 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)
 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

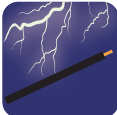

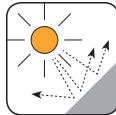
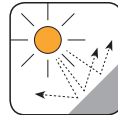
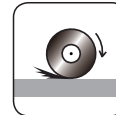
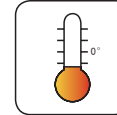
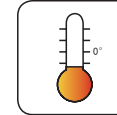








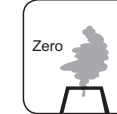
Low Corrosivity (Acidity & Conductivity)

Low Toxicity
 Smoke Index

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
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)
 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

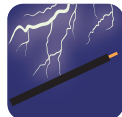

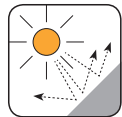
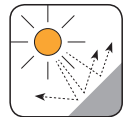
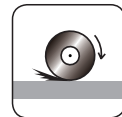
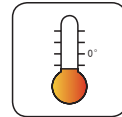









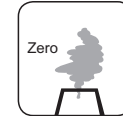
Low Corrosivity (Acidity & Conductivity)

Low Toxicity
 Smoke Index

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	
mm ²	AWG					20 °C		@0.75-3MHz	@1MHz
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

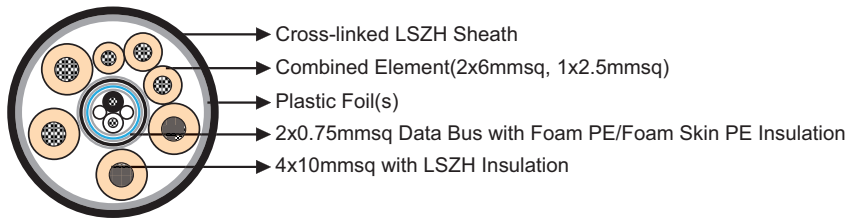
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FRL-UIC-4Q1S+2G0.75/FRL-UIC-4Q1S+2P0.75S

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

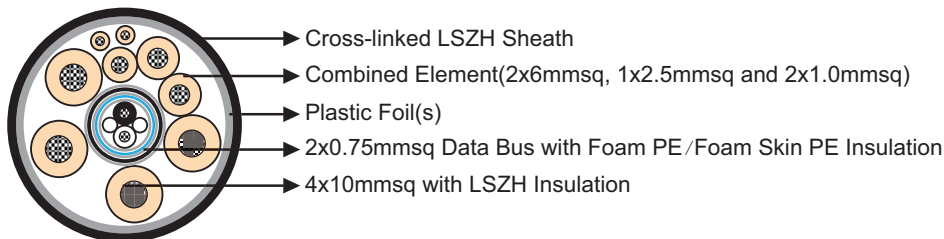
Elements Sheaths: TPE

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

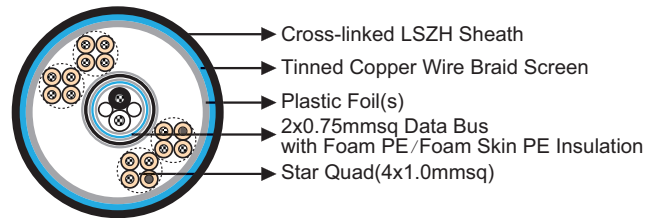
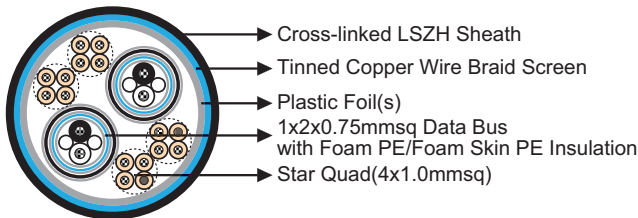
Core Wrapping: Overlapped plastic-foil(s)

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 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	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;	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-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
mm ²	No/mm	mm	mm	kg/km	Ω/km	Ω	dB/km	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
mm ²	No/mm	mm	mm	kg/km	Ω/km	Ω	dB/km	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
mm ²	No/mm	mm	mm	kg/km	Ω/km	Ω	dB/km	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

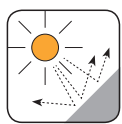
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					20 °C		@0.75-3MHz	@1MHz	@1.5MHz	@2MHz	@3MHz
mm ²	No/mm	mm	mm	kg/km	Ω/km	Ω	dB/km	dB/km	dB/km	dB/km	dB/km
0.75	19/0.22	1.5	23	530	26.7	120+/-12	10	13	14	18	
1	19/0.25				20	-	-	-	-		



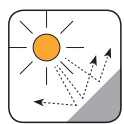
Corona Resistant



Highly Flexible



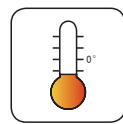
UV Resistant



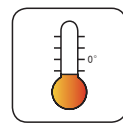
Ozone Resistant



Abrasion Retardant



Cold Resistant



Resistance To Soldering Heat



Acid & Alkaline Resistant


 IRM 903
Fuel Oil Resistant

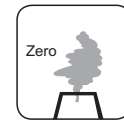
 IRM 902
Mineral Oil Resistant

 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/EN50266-2-1

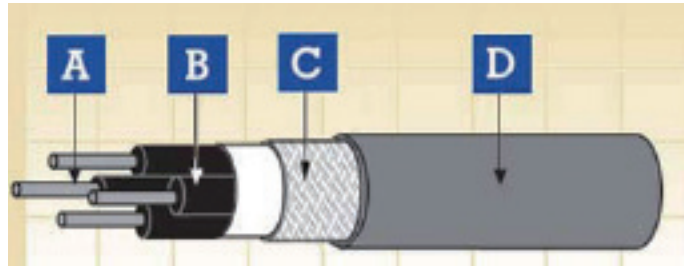
 Low Toxicity
EN 50305; NF X70-100/NF
F63 808/TM1-04/BS 6853

 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 0.5mm², 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)
 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

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

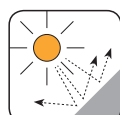
Nominal Cross-Sectional Area	Nominal Sheath Thickness	Nominal Overall Diameter	Nominal Weight	Max. Conductor Resistance 20 °C	Max. Resistance Unbalance	Characteristic Impedance	Transfer Impedance	Max.Capacitance	
						@100MHz	f≤30MHz	core to core	Core to screen
AWG	mm	mm	kg/km	Ω/km	Ω/km	Ω	mΩ/m	pF/m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



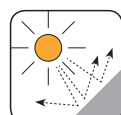
Corona Resistant



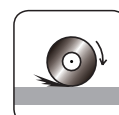
Highly Flexible



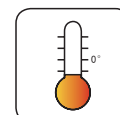
UV Resistant



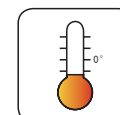
Ozone Resistant



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



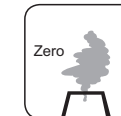
Low Toxicity
EN 50305; NF X70-100/NF
F63 808/TM1-04/BS 6853



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

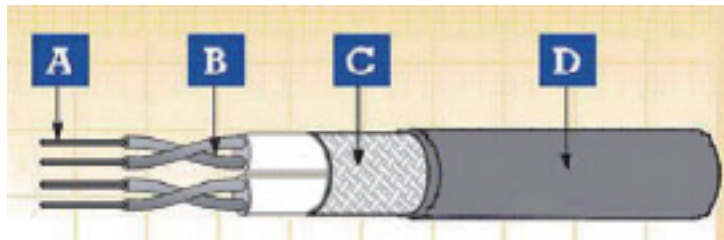


Zero Halogen
IEC 60754-1/EN 50267-2-1
NF C20-454

RS 485 Databus Cables

300/500 V

FRL-MVB-02Y(ST)CH-IO5-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;	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

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

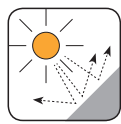
No. of Pair x	Nominal Cross-Sectional Area y	Number & Nominal Diameter of Strands	Nominal Overall Diameter	Nominal Weight
	mm ²	No/mm	mm	kg/km
1	0.22	7/0.2	4.2	55
2	0.22	7/0.2	5.9	75
4	0.22	7/0.2	6.2	115
1	0.5	16/0.2	6.3	75
2	0.5	16/0.2	8.5	100
4	0.5	16/0.2	9.4	140
1	0.75	24/0.2	9.0	110
2	0.75	24/0.2	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



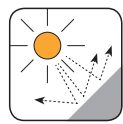
Corona Resistant



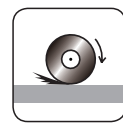
Highly Flexible



UV Resistant



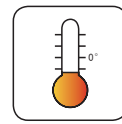
Ozone Resistant



Abrasion Retardant



Cold Resistant



Resistance To Soldering Heat



Acid & Alkaline Resistant


 IRM 903
 Fuel Oil Resistant

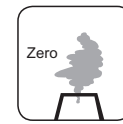
 IRM 902
 Mineral Oil Resistant

 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