CONNECTIVITY SOLUTIONS FOR INFOTAINMENT APPLICATIONS

Industrial & Commercial Transportation

TE Connectivity (TE) Industrial & Commercial Transportation is dedicated to providing best-in-class infotainment connectivity products that will support the next generation of connected vehicles. We offer an extensive portfolio of fast, reliable, and responsive harsh environment connectivity solutions. Our deep understanding of the technical properties and requirements of signal integrity has allowed us to create heavy-duty products that stand up to the demands of the construction, trucking, recreational, and agricultural industries.

Our harsh environment infotainment products enable our customers to easily design-in high-speed data communication systems associated with operator awareness, safety, security, and in-cab entertainment.

At TE Industrial & Commercial Transportation, we provide you with the cutting-edge connection solutions required for all of your infotainment system needs.
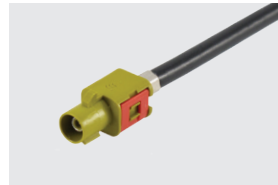
FAKRA RF Connector Overview

The industrial and commercial transportation market is experiencing tremendous growth in telematics and multimedia applications that require high frequency transmission systems. Today's equipment features high-tech GPS, digital satellite radios, mobile phone connectivity, and mobile television systems. FAKRA meets the growing demand for infotainment applications using coaxial wiring products.

TE FAKRA RF PRODUCTS FEATURE:

• Single or dual pocket male or female housings
• Right-angle or straight male or female housings
• Up to 14 different mechanical key configurations
• Termination to 50, 75, and 150 ohm coaxial cable

FAKRA Gen4 Male Plug (2098287-1)

FAKRA Gen4 Female Housing Kit (2098288-1)
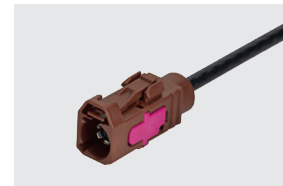
FAKRA Gen4 2 Pol (2035049-1)

FAKRA Headers Vertical (2203452-1)

FAKRA II Right-Angle (1719261-2)

FAKRA II Female Housing Kit (1452584-1)

FAKRA II 2 Pol (1452480-1)

FAKRA II Board Right-Angle (2287903-1)

Note: Image may not be representative of exact part number

CONTACT KIT PART NUMBERS FOR RTK 031 CABLES

Description	Gen4 P/N	FAKRA II P/N
180° male contact	1438890-7*	1488171-2*
180° female contact	1438896-2*	1488175-2*
90° female contact	1438896-2**	1719252-1

*Representative part numbers, for other configurations and acceptable cable types, see full line catalog
**FAKRA Gen4 uses same contact part number for 180° and 90° housings

APPLICABLE TE PRODUCT DOCUMENTATION

1308073-3 (Full Line Catalog)   108-94089 (Product Specification)
114-18623 (Application Specification)

Sealed M8/M12 Connector Overview

TE's M8/M12 connector system provides high bandwidth, networked communication connections in harsh environments. M8/M12 products were initially designed for high definition vision systems, which are common in processing equipment and smart mail sorting devices. Today, they are increasingly being applied to agricultural harvesters, fruit & seed sorters, other picking and grappling applications, and marine communication networks found in the industrial and commercial transportation industry.

TE'S M8/M12 CONNECTORS & CABLE ASSEMBLIES:

• Designed to IEC 61076-2-101 standards
• Withstand high vibration and IP67 compliant
• Support higher bandwidth needs (up to 10 Gb/s)
• Offered in a full range of coded, shielded, and unshielded variants
• UL 2238 compliant cable assemblies, panel mounted and field installable connectors
• General multi-conductor shielded sensor and switch cables and data transmission cables for fieldbus applications

Female Cable Assembly (2273035-X*)

High Speed X Code Cable Assembly (2241021-X*)

Male Cable Assembly (2273034-X*)

Sealed Panel Mounted Connectors (4-2271143-2*)

Field Installable Connector (4-2271116-1*)

IO Module (2273167-1*)

*Representative part numbers, for other configurations and acceptable cable types, see full line catalog

APPLICABLE TE PRODUCT DOCUMENTATION

1-1773701-8 (Full Line Catalog)
1-1773730-5 (Flyer)
108-106140 (Product Specification)
114-32127 (Application Specification)

High Speed Data (HSD) Connector Overview

TE Connectivity's High Speed Data (HSD) connector portfolio is designed for high speed data transmission to meet industrial and commercial transportation application requirements. The HSD connectors can be utilized on multifunction displays, media gateway, head units, instrument cluster displays, and infotainment modules. Environmentally sealed HSD products can be used for external camera connections or other exposed operator situational awareness devices like RADAR or LIDAR modules. HSD connector products are also suitable for applications requiring high frequency communications and related EMC immunity.

TE OFFERS HSD PRODUCTS IN SEVERAL DIFFERENT CONFIGURATIONS, INCLUDING:

• Female or male
• Right-angle or straight male or female plugs and headers
• Ground shielded pin headers
• 9 different mechanical key configurations
• Unique color coding
• Sealed or unsealed

HSD HEADERS

180° Headers   90° Header   90° Shielded Header

Note: TE offers capabilities for custom cable assemblies using HSD connectors. Please contact your TE representative for any additional products needed for your application.
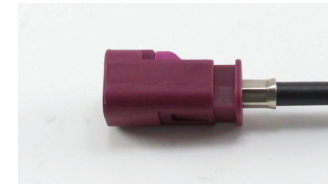
ORDERING INFORMATION - HSD HEADERS

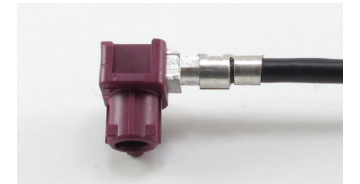| Description	Series P/N
Pin header, 180°, Code A	2286547-1
Pin header, 90°, Code A	2286546-1
Pin header, 90°, with device ground shield, Code A	2286797-1

HSD CABLE ASSEMBLIES

Male 180°   Male 180° Sealed   Female 180° Sealed   Male 90°

ORDERING INFORMATION - HSD CABLE ASSEMBLIES

Description	Series P/N
Cable assembly, female 90°/female 90°, Code Z	2177131-1
Cable assembly, female 90°/female 180°, Code Z	2177257-1
Cable assembly, female 180°/female 180° sealed, Code Z	2112030-1
Cable assembly, female 180°/male 180°, Code Z	2141724-1

APPLICABLE TE PRODUCT DOCUMENTATION

1308074-2 (Full Line Catalog)
108-94331 (Product Specification)
114-18867 (Application Specification)

Circular Sealed USB Connector Overview

To support the increasingly wide-spread use of standard Universal Serial Bus (USB) in industrial and commercial transportation equipment applications, TE offers ruggedized, circular sealed USB connectors. The circular sealed USB connectors provide the popular high speed standard USB 2.0 consumer and operator interface for service ports and other transportation related harsh environment applications.

TE'S CIRCULAR SEALED USB CONNECTORS FEATURE:

- IP67 sealing performance
- 1/4 turn bayonet coupling ring
- Standard A plug and standard B plug
- Through-panel mating receptacles
- Pre-made standard length cable assemblies
- Available in both plastic and metal shell configurations
- USB 2.0 compliant

ORDERING INFORMATION

Description	Part Number
Plug kit, USB series A	1954637-1
Plug kit, USB series B	1954640-1
Recept kit, series A to series A	1954643-1
USB 2 row recept, right angle board header assembly	1903815-1
USB single row recept, right angle board header assembly	1903814-1
Plug kit, USB series A, metal shell	2058362-1
Plug kit, USB series B, metal shell	2058363-1
Recept kit, series A to series A	2058364-1
Recept kit, series B to series A	2058365-1
Cable assembly, metal circular sealed type A plug to overmolded type B plug	2058188-1
Cable assembly, metal circular sealed type A plug to metal circular sealed type B plug	2058187-1
Cable assembly, plastic circular sealed type A plug to plastic circular sealed type B plug	2058689-1
Cable assembly, plastic circular sealed type A plug to overmolded type B plug	2008690-1

*Representative part numbers, for other configurations and acceptable cable types, see full line catalog

APPLICABLE TE PRODUCT DOCUMENTATION

1-1773463-4 (Full Line Catalog)
108-2318 (Product Specification, Circular Sealed)
108-78523 (Product Specification)
114-13211 (Application Specification, Circular Sealed)
114-5434 (Application Specification)

Ethernet Connector System Overview

TE Connectivity's new portfolio of Ethernet connectors provide robust full duplex, wire-to-wire connections for multifunction displays, telematics, telemetry units, infotainment modules, and media access controllers. The new Ethernet products can be utilized to connect external cameras and sensing modules to improve operator situation awareness for enhanced safety using Ethernet differential signal transmission communication protocols.

TE'S NEW ETHERNET CONNECTORS:

- Utilize unshielded twisted pair (UTP) cable
- Employ industry proven 1.2 mm MCON terminals with MAT seal technology
- Are designed for 100 Base-T1 one pair Ethernet (OPEN) applications and compatible with BroadR-Reach compliant single port automotive Ethernet transceivers
- Provide low cost, high performance solutions for high speed (up to 100 Mb/s) communications

ORDERING INFORMATION

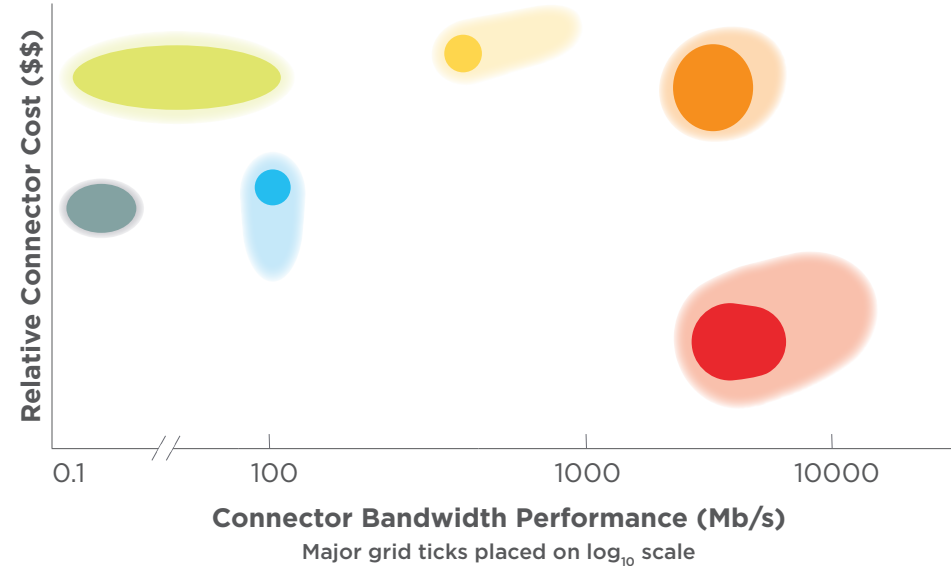| Description	Series P/N
Sealed 2P Ethernet plug, key A with CPA	2292906-1
Sealed 2P Ethernet plug, key B with CPA	2292906-2
Sealed 2P Ethernet cap, in-line, key A	2292937-1
Sealed 2P Ethernet cap, in-line, key B	2292937-2
MCON 1.2 mm clean body receptacle terminal	1670144-2
MCON 1.2 mm clean body pin terminal	1718350-2

APPLICABLE TE PRODUCT DOCUMENTATION

108-18782 (Product Specification)
114-18464 (Application Specification)

Note: Our portfolio of Ethernet connectors is growing. Please contact your TE representative for any additional products needed for your application. With a specialized global team and dedicated engineering, we can help develop solutions to accommodate your designs.
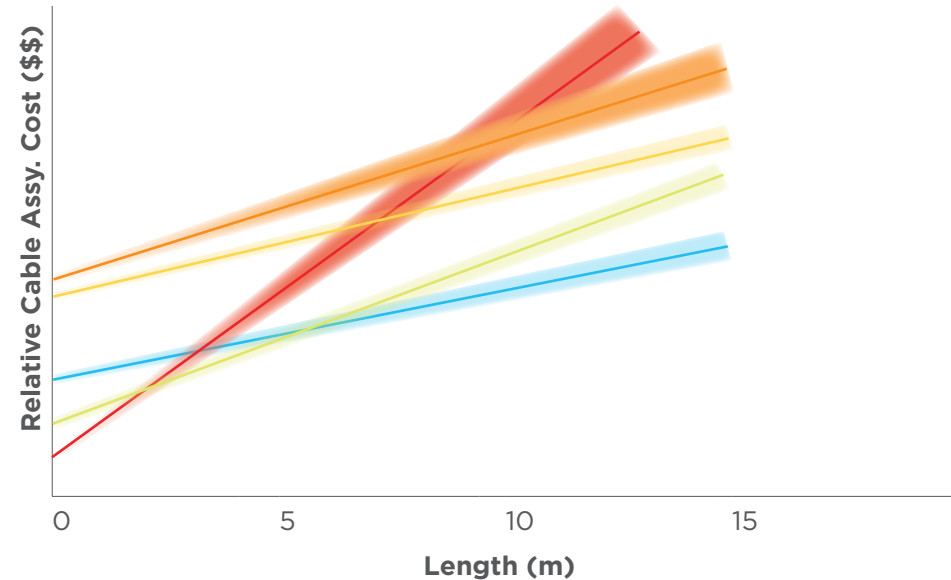
Infotainment Connector Solutions

TE offers a wide variety of harsh environment infotainment solutions. Our fast, reliable, and responsive connectivity products are available to meet specific customer needs. Whether outright performance or low costs are your priority, we have a solution. To determine the best product for your application needs, the following graphs provide profile tradeoffs to aid with connector and cable assembly selection.

Infotainment Connector Products
Relative Cost vs Bandwidth
Connector Portfolio Size and Growth Trajectory

Relative Connector Cost ($$)

Connector Bandwidth Performance (Mb/s)
Major grid ticks placed on $\log_{10}$ scale

Cable Assembly Cost vs Cable Length

Relative Cable Assy. Cost ($$)

Length (m)

| Ethernet Conn Sys | M8/M12 | Sealed USB 2.0 | HSD | FAKRA | DT CAN BUS |

*Connector product portfolio size denoted by core shape; expected portfolio, bandwidth, and product volume growth indicated by transparent shape
*Cone shape indicates relative variants dependent on volume attainment, cable type, and other factors

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	Data Rate (Mb/s)	Transmission Media Type	Example Protocol	Example Application
FAKRA	8000	Coaxial	GMSL, FPD-Link, APIX	Telemetry, Camera systems, Sensors
HSD	3000	StarQuad/STP	GMSL, FPD-Link, APIX (unsuitable for APIX3), 100 Base-T, USB, LVDS	Media access controllers, Camera systems, Infodisplays
USB 2.0	480	USB	USB	Consumer/media ports
M8/M12	100	Multi-conductor/STP	10/100 Base-T, Fieldbus protocols/CAN	Cameras, Sensors, Actuators, Network managers
Ethernet Conn Sys	100	Twisted Pair (UTP)	100 Base-T1	Camera systems, Infodisplays, Media access controllers
DT CAN BUS	0.5	Twisted Pair (UTP)/ Parallel Pair	CAN BUS J1939/11	Engine system controllers, sensors

CONCLUSIONS

- 100 Base-T1 Ethernet protocol allows for cost effective wiring and harnesses for the given bandwidth
- FAKRA enables the largest bandwidth using coaxial cables while maintaining cost effective and reliable connectors
- Sealed USB provides sealed and reliable connectivity for entertainment and consumer device interfaces and will continue to grow with market trends
- HSD maintains excellent signal integrity with high speeds at long distances
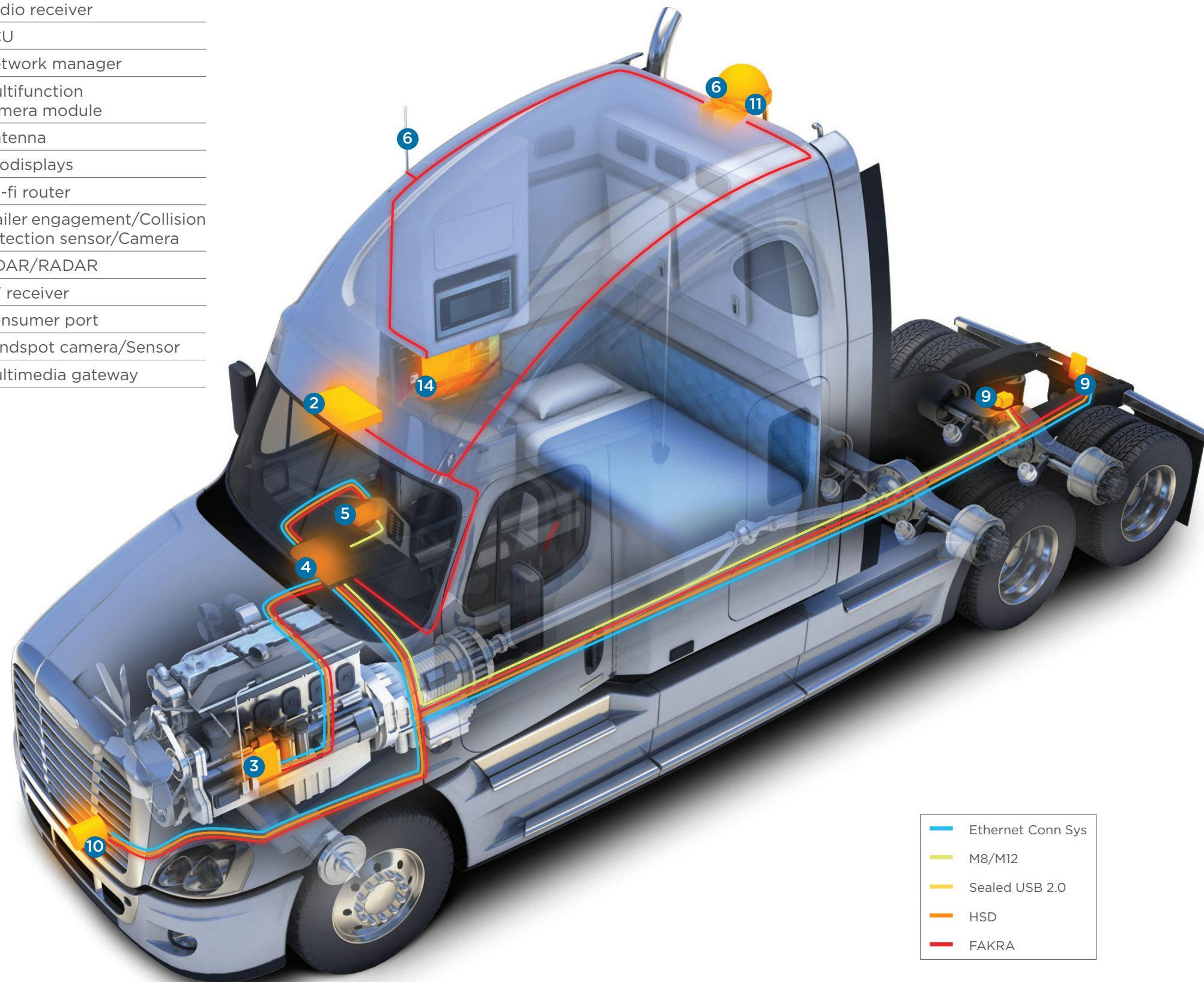
ANALYSIS CONSIDERATIONS

- Solutions for data transmissions
- Standard USB cables have 5 meter limit, custom cables required for longer distances
- FAKRA utilizes coaxial cable
- Ethernet connector system product utilizes 100 Base-T1 protocol
- M8/M12 utilizes overmolded cable assemblies and field installable connectors
- Analysis only considers M8/M12 utilizing 10/100 Base-T protocol. M12 product portfolio has additional variants which increase performance capabilities up to 10 Gb/s when utilizing 10GBase-T in accordance with IEEE 802.3an.
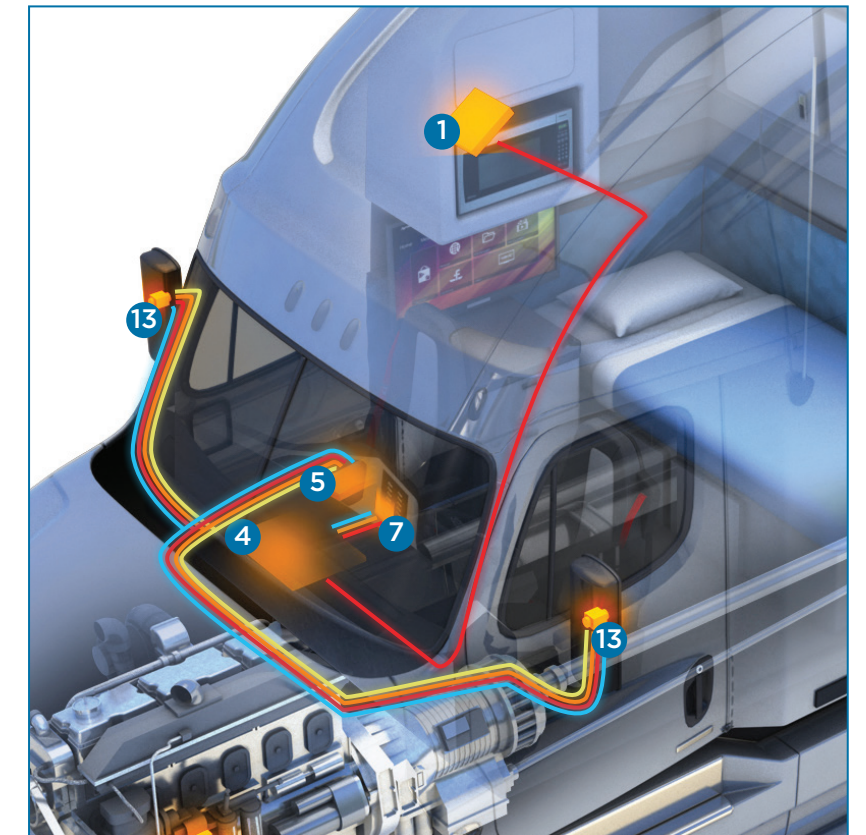
Notes:
- All data and conclusions are approximate and subject to change
- Charts do not reflect full physical layer or system channel costs, and is only a reflection of the relative connector and cable assembly costs

Description

1	Telemetry gateway
2	Radio receiver
3	ECU
4	Network manager
5	Multifunction camera module
6	Antenna
7	Infodisplays
8	Wi-fi router
9	Trailer engagement/Collision detection sensor/Camera
10	LIDAR/RADAR
11	TV receiver
12	Consumer port
13	Blindspot camera/Sensor
14	Multimedia gateway

Ethernet Conn Sys

M8/M12

Sealed USB 2.0

HSD

FAKRA

EVERY CONNECTION COUNTS

At TE Industrial & Commercial Transportation, we have a product for nearly all of the world's harsh environment connectivity challenges. Our products are on the cutting edge. They are made of the highest quality materials and can withstand extreme temperatures and years of environmental exposure. Products are not the only reason equipment manufacturers turn to TE Industrial & Commercial Transportation. The people behind our products are equally as important. Our engineers collaborate with customers to create innovative connectivity solutions that will make the next generation of equipment smarter, safer, greener, and more connected.

TE TECHNICAL SUPPORT CENTER

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