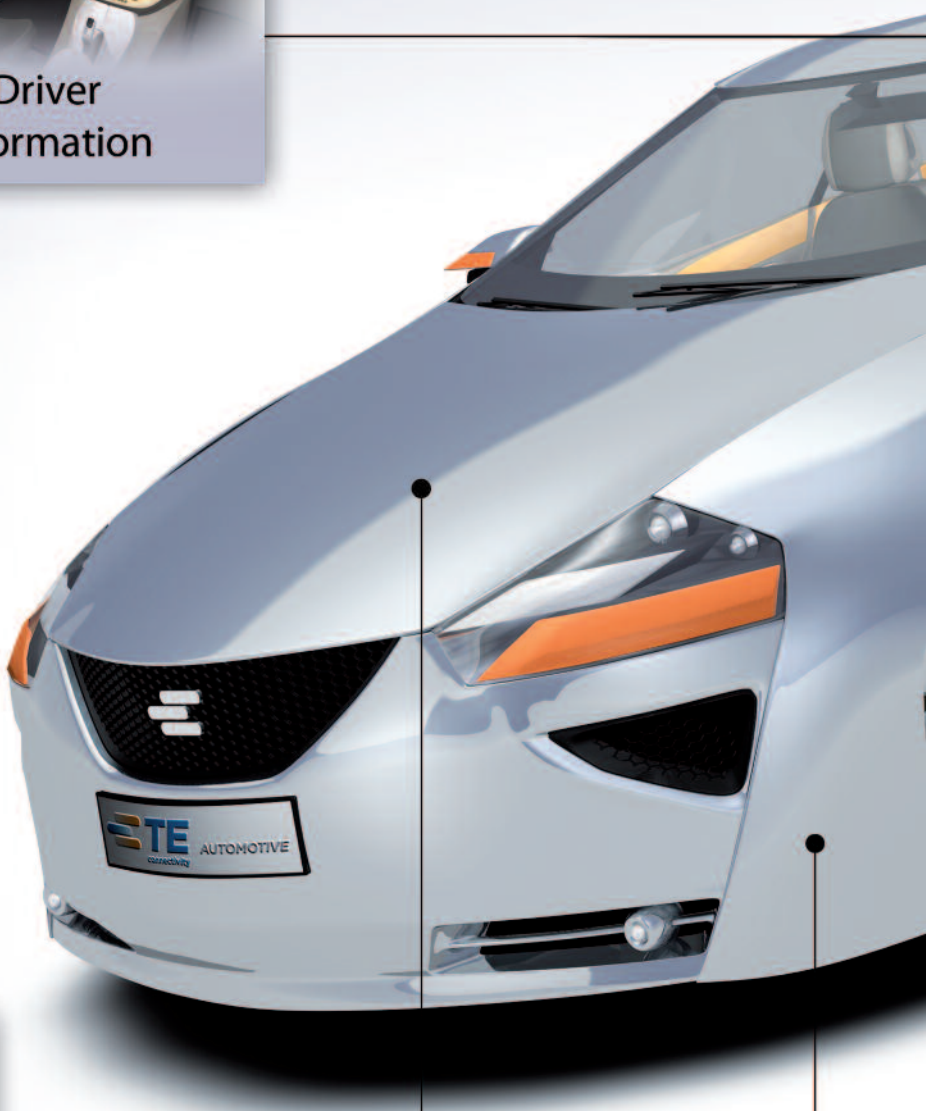
High Speed Data Communication

HSD (High Speed Data) Connectors

TE connectivity

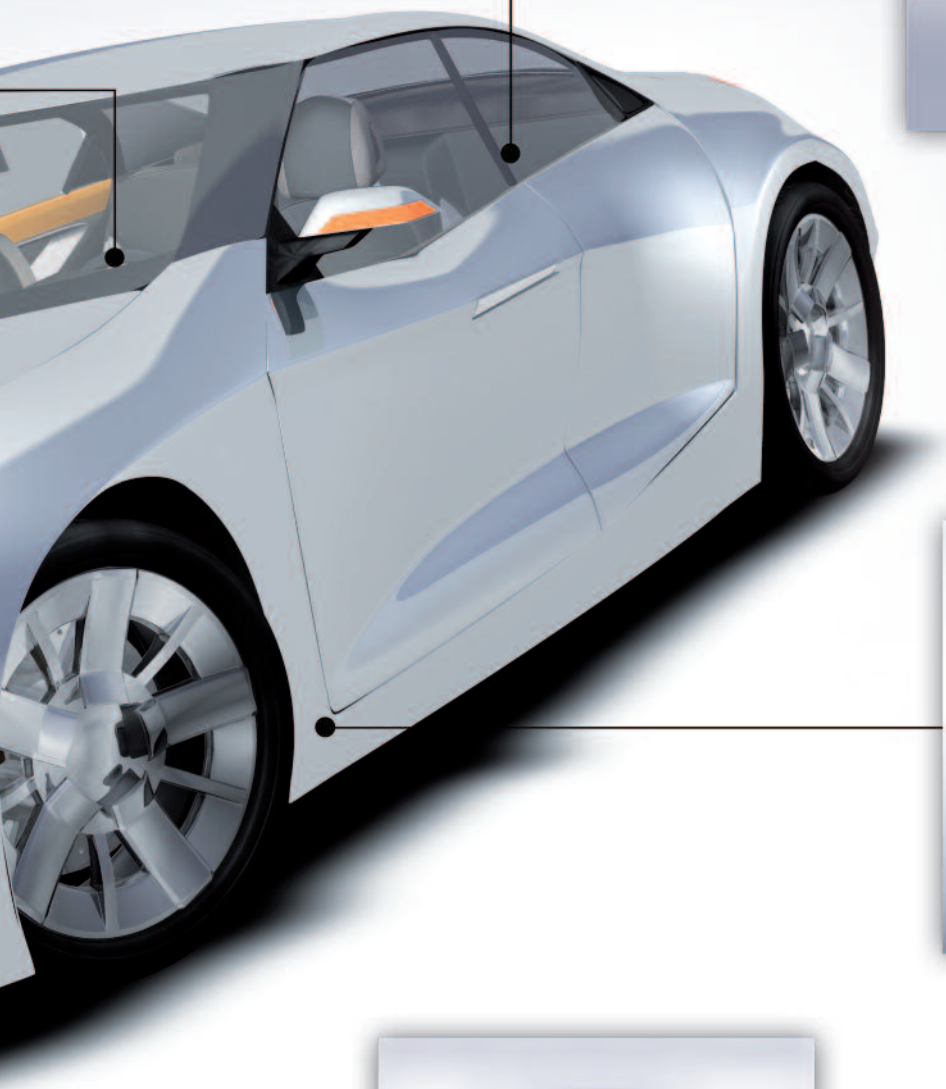
AUTOMOTIVE

Driver Information



Powertrain Systems

THE 5 APPLICATION AREAS



Convenience

Safety & Security Systems

Body & Chassis Systems

INNOVATIVE TECHNOLOGIES

TE Automotive – a business segment of TE Connectivity – follows the globalization goals of our customers, speeds up the integration of new technologies and enables our customers access to our vast product portfolio and services.

TERMINALS & CONNECTORS

TE Automotive offers a broad range of high quality terminals and connectors.
Our electrical/electronic interconnection products and solutions are used to electrically and mechanically join wires and cables, printed circuit boards, integrated circuit packages and batteries. TE Automotive expanding capabilities include new copper and fiber-optic connectors, wires, cables/cable management systems that are designed to meet automotive industry demands. Our brands encompass the broadest range of connectors in the world, including high-density, high-speed designs for leading-edge communications equipment.

HYBRID & ELECTRIC MOBILITY SOLUTIONS

Complete the connections you need to safely, and reliably make hybrid and electric mobility a reality for everyone, everyday. With over 50 years experience in automotive, industrial and energy connectivity, TE is an expert in pushing innovation from one industry to the next. Our portfolio of AMP+ high voltage relays, resistors, AMP+ headers, connectors, IPT/APT and cable assemblies and vehicle charging solutions are designed to connect and protect electric distribution inside and outside of the vehicle.

CABLE ASSEMBLY SYSTEMS

TE Automotive is your partner for special cable assemblies.
We offer research and development capabilities, prototyping, samples as well as manufacturing facilities for special cable assemblies. This includes overmold technology, semi/fully automatic manufacturing, testing equipment and appliances for handling of high volume production.

SENSORS

Contact-less measuring eliminates interference effects, wear and tear, and provides increased reliability. TE Automotive, one of the largest technology providers for the automobile industry, offers contact-less sensors for a variety of applications.

As sensor manufacturer and processing partner, TE Automotive also provides project planning support for new sensor applications, assistance in the selection of the appropriate sensor technology for the respective application, and assistance with defining the corresponding mechanical, electrical and magnetic interface.

TE Automotive has a broad electro-mechanical portfolio that includes robust housing technologies, connector systems, and temperature stable designs based on foil and cable networks. This combination of technologies and experience ensures that reliable and cost effective sensor solutions are available for all application types.

INFOTAINMENT

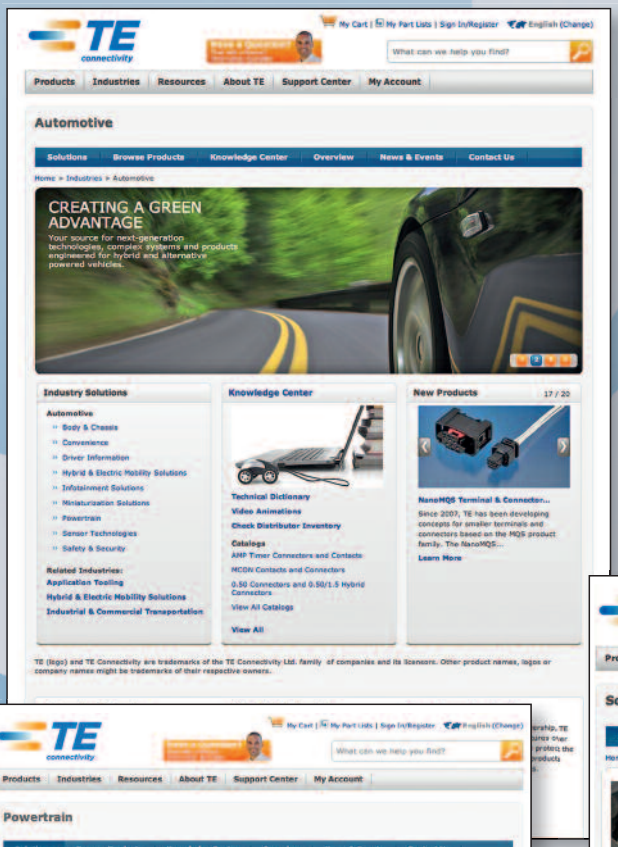
TE Automotive is focused on providing the best in class infotainment technology to support high speed data communication in the automotive industry. Data communication based optical, coaxial as well as shielded electrical physical layers are supported by a wide product portfolio of Automotive grade connector systems.

Through a deep understanding of the technical properties and requirements of signal integrity and combined with our application knowledge both in the vehicle as well as in the logistics chain, TE Automotive is well positioned to offer the right solution for all current and next generation Infotainment Systems.

INDUCTIVE COIL SYSTEMS

TE Automotive is your source for interconnection technologies for automotive, truck and off-highway OEMs and Tier 1 suppliers. With our global design center in Belgium and manufacturing sites in all regions, TE Automotive's Inductive Coil Systems (ICS) group is ready to design your next-generation coil modules and provide local production support.

The ICS group maintains a leading market position in braking modules and other automotive coil applications. Through early involvement with you on your next design, TE Automotive can offer the benefits of miniaturization, design-in of platform components and optimized process flow for your standard, hybrid and electric vehicle project needs.



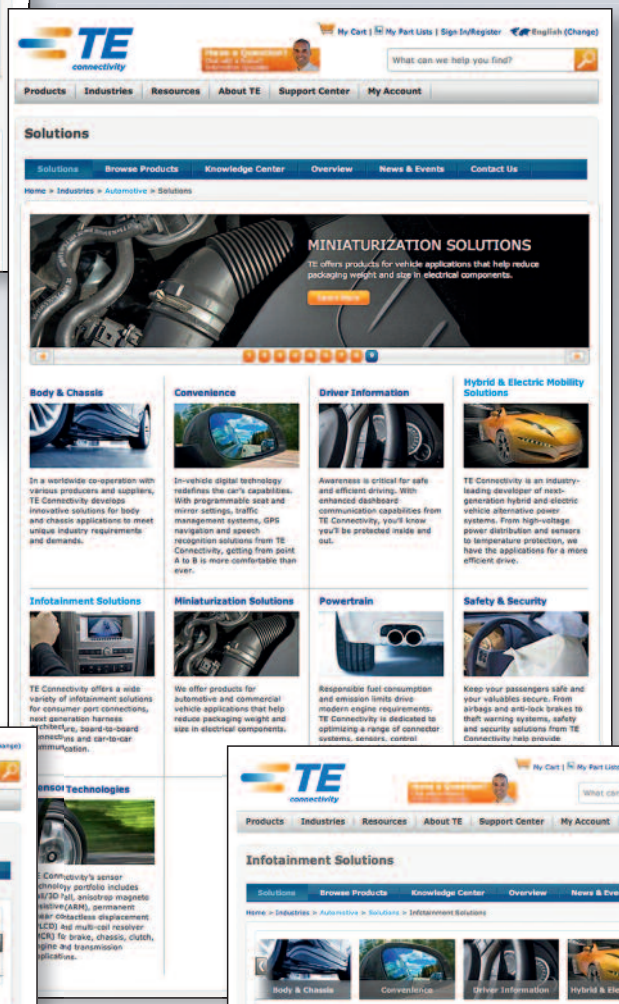
TE Automotive Online

The TE Automotive website is an innovative and interactive source for application information, product updates and technical solutions.

Please contact us at:
www.te.com/automotive

TE Products

www.te.com/en/products/product-landing.html



Product and Machine Literature

TE Automotive offers a variety of product specific catalogs, brochures and high impact flyers to help better serve you!

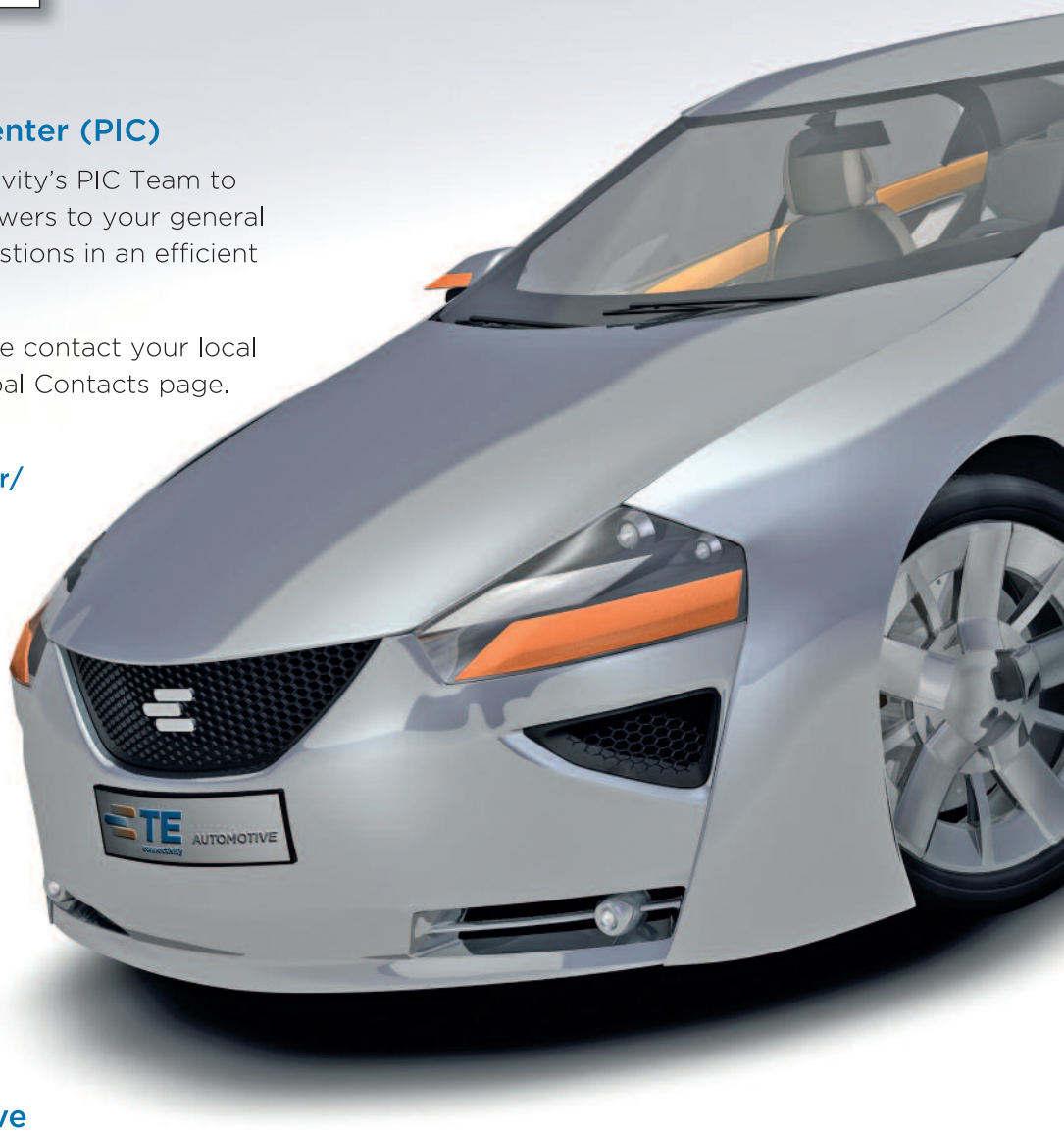
For more information on literature for TE Automotive, please contact your local organization or go to
www.te.com/automotive

Product Information Center (PIC)

You can rely on TE Connectivity's PIC Team to provide you support for answers to your general information or technical questions in an efficient and effective manner.

To reach our PIC staff, please contact your local organization or see our Global Contacts page.

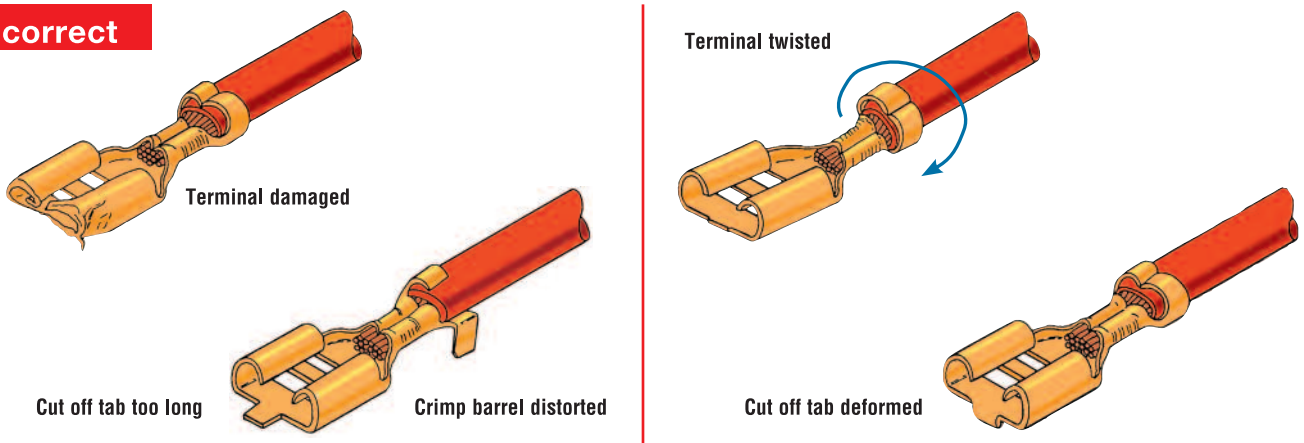
Please contact us at:
www.te.com/support-center/

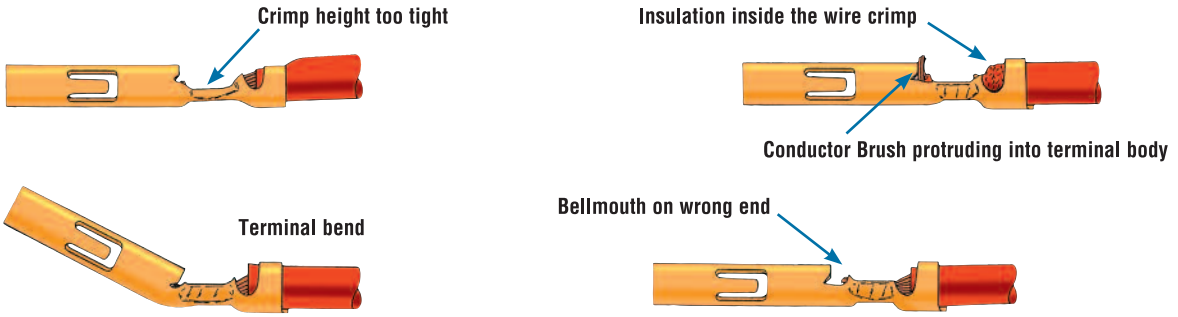


www.te.com
www.te.com/automotive
www.te.com/automotive/most

Quality Guidelines

Incorrect



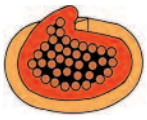


INSULATION CRIMP

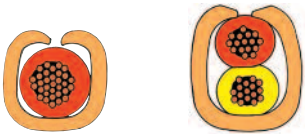
Insulation is pierced and could damage conductor

Insulation material is pierced

Insulation is not securely held



Insulation is over crimped



Insulation legs are not closed

Insulation is not securely held
Legs do not overlap

WIRE CRIMP

Incorrect applicator adjustment

Asymmetric crimp

Terminal feed incorrectly adjusted

Unacceptable formation excessive flash and/or cracks

Anvil and crimper not aligned or worn

Incorrect terminal/wire selection

Wire size too large

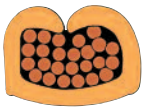
Crimp barrel does not close

Wire size too small

Legs too close to bottom of crimp. Insufficient deformation of strands, showing voids

Incorrect crimp height adjustment

Crimp height too loose



Insufficient deformation, showing voids

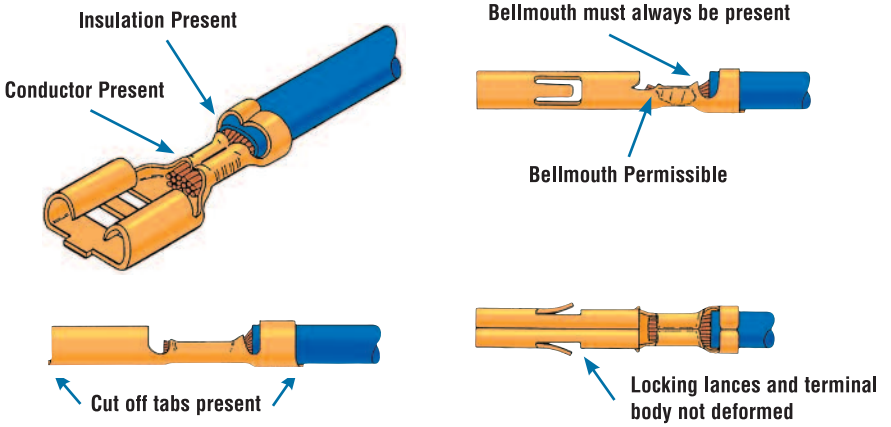
Crimp height too tight

Flash at under side of crimp, due to over crimping

Quality Guidelines (continued)

Correct

WIRE CRIMP



Correct selection of wire, terminal and applicator

Crimp barrel is closed, legs support each other

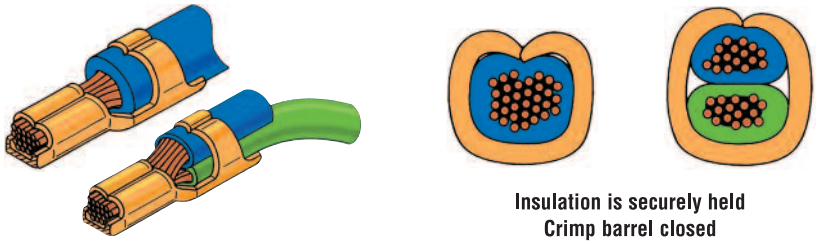
Sufficient gap between legs and bottom of crimp

All strands are equally distributed and deformed

INSULATION CRIMP

Correct Insulation Diameter, Applicator and Terminal

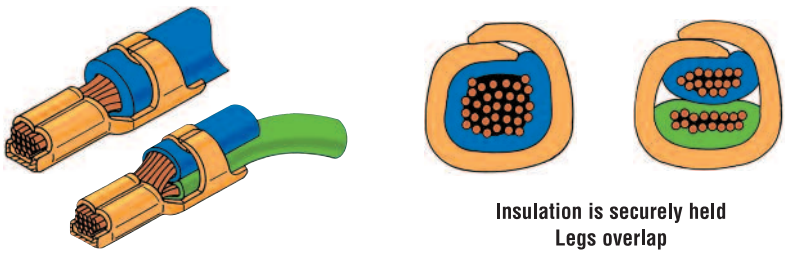
F-CRIMP



Insulation is securely held
Crimp barrel closed

For double wire applications with different size wires always place wire with smallest outer diameter in the bottom

OVERLAP CRIMP



Insulation is securely held
Legs overlap

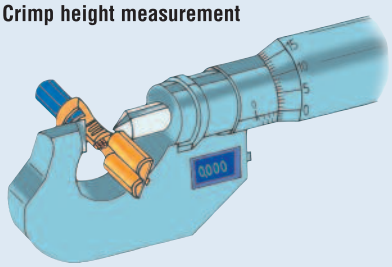
WRAP OVER CRIMP

Insulation securely held
Legs must pass each other

Test

WIRE CRIMP

Crimp height measurement



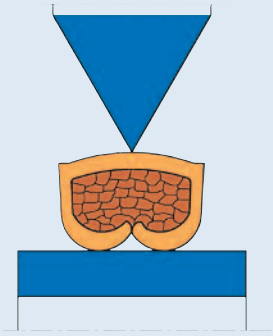
Crimp heights and tolerances

For crimp height tolerances for any given contact, please refer to the relevant application specification.

Examples:

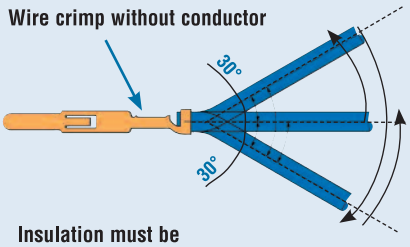
Contact	Part No.	Wire Range (mm^2)	Tolerance (mm)	Application Spec.
MQS	962885 962886	0.2–0.5	±0.03	114-18025
JPT	927775	0.5–1.0	±0.05	114-18050
JPT	927773	1.5–2.5	±0.05	114-18050

Digital Crimp Height Micrometer
(0.001 mm increments) acc. to DIN ISO 9001
Part No. 547203-1



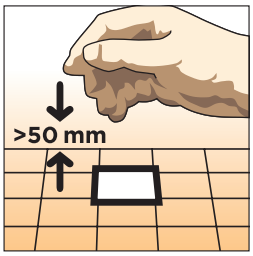
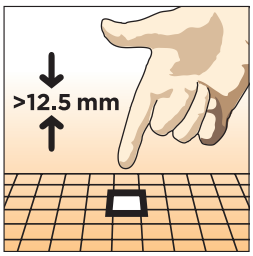
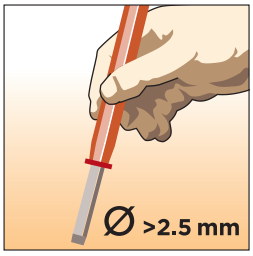
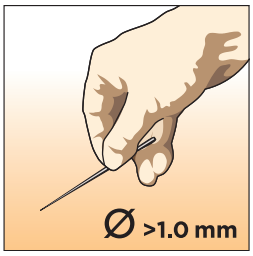
INSULATION CRIMP

Wire crimp without conductor



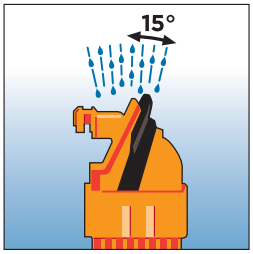
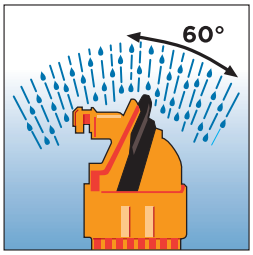
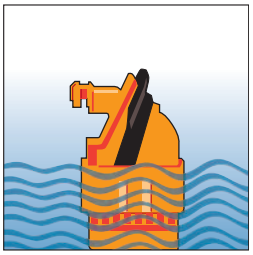
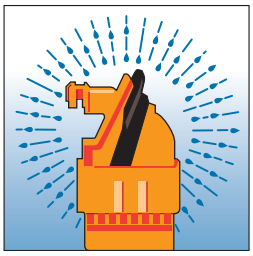
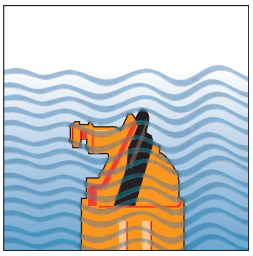
Insulation must be securely held after bend test

IP Code (Elements and Significance acc. to IEC 60529 and DIN 40050)

1st Digit	Against Foreign Objects (incl. Dust)	
0		Not protected.
1		Protected against solid objects greater than 50 mm (ex. back of hand).
2		Protected against solid objects greater than 12.5 mm (ex. finger).
3		Protected against solid objects greater than 2.5 mm (ex. tool).
4		Protected against solid objects greater than 1.0 mm (ex. wire).

1st Digit	Against Foreign Objects (incl. Dust)	
5K		Dust protected.
6K		Dust tight.

IP Code (Elements and Significance acc. to IEC 60529 and DIN 40050)

2nd Digit	Against Water		2nd Digit	Against Water	
0		Not protected.	5		Protected against jetting water.
1		Protected against vertically dripping water.	6		Protected against powerfully jetting water.
2		Protected against dripping water when tilted up to 15°.	6K		Protected against powerfully jetting water with increased pressure (Automotive).
3		Protected against spraying water (up to 60° inclination).	7		Protected against the temporary effects of immersion up to 1 meter.
4		Protected against splashing water.	8		Protected against continuous submersion agreed with customer, but more severe than code 7.
4K		Protected against splashing water with increased pressure.	9K		Protected against high-pressure/ steam-jet cleaning (Automotive).

Restriction on the use of Hazardous Substances (RoHS)

At TE Connectivity, we're ready to support your RoHS requirements. We've assessed more than 1.5 million end items/components for RoHS compliance, and issued new part numbers where any change was required to eliminate the restricted materials. Part numbers in this catalog are identified as:

RoHS Compliant

Part numbers in this catalog are RoHS Compliant, unless marked otherwise.

These products comply with European Union Directive 2002/95/EC as amended 1 January 2006 that restricts the use of lead, mercury, cadmium, hexavalent chromium, PBB, and PBDE in certain electrical and electronic products sold into the EU as of 1 July 2006.

Note: For purposes of this Catalog, included within the definition of RoHS Compliant are products that are clearly "Out of Scope" of the RoHS Directive such as hand tools and other non-electrical accessories.

Non-RoHS Compliant

These part numbers are identified with a "♦" symbol. These products do not comply with the material restrictions of the European Union Directive 2002/95/EC.

5 of 6 Compliant

A "●" symbol identifies these part numbers. These products do not fully comply with the European Union Directive 2002/95/EC because they contain lead in solderable interfaces (they do not contain any of the other five restricted substances above allowable limits). However, these products may be suitable for use in RoHS applications where there is an application-based exception for lead in solders, such as the server, storage, or networking infrastructure exemption.

Note: Information regarding RoHS compliance is provided based on reasonable inquiry of our suppliers and represents our current actual knowledge based on the information provided by our suppliers. This information is subject to change. For latest compliance status, refer to our website referenced below.

Getting the information you need

Our comprehensive on-line RoHS Customer Support Center provides a forum to answer your questions and support your RoHS needs. A RoHS FAQ (Frequently Asked Questions) is available with links to more detailed information. You can also submit RoHS questions and receive a response within 24 hours during a normal work week. The Support Center also provides:

- Cross-Reference from Non-compliant to Compliant Products
- Ability to browse RoHS Compliant Products in our on-line catalog: http://www.te.com/commerce/alt/RohsAltHome.do
- Downloadable Technical Data Customer Information Presentation
- More detailed information regarding the definitions used above

So whatever your questions when it comes to RoHS, we've got the answers at http://www.te.com/customersupport/rohssupportcenter/

RoHS Customer Support Center

AWG Conversion Table (Average Value)

Conversion Tables

Most of the wire size ranges are mentioned in mm^2, as well as the insulation diameters which are in many cases only in mm's.

We therefore included the conversion tables on page X and page XI.

Please note that wire and insulation sizes are for guidance only.

Consult the customer drawing for precise detail.

AWG Code	Diameter (Inch)	Diameter (mm)	F (mm^2)
000000	0.5800	14.733	170.0
00000	0.5165	13.13	135.0
0000	0.4600	11.684	103.8
000	0.4096	10.40	79.0
00	0.3648	9.27	67.5
0	0.3249	8.25	53.4
1	0.2893	7.34	42.2
2	0.2576	6.55	33.7
3	0.2294	5.82	26.6
4	0.2043	5.18	21.0
5	0.1819	4.62	16.9
6	0.1620	4.115	13.25
7	0.1443	3.66	10.25
8	0.1285	3.26	8.34
9	0.1144	2.90	6.6
10	0.1019	2.59	5.27
11	0.0907	2.30	4.15
12	0.0808	2.05	3.3
13	0.0720	1.83	2.63
14	0.0641	1.63	2.08
15	0.0571	1.45	1.65
16	0.0508	1.29	1.305
17	0.0453	1.14	1.01
18	0.0403	1.02	0.79
19	0.0359	0.91	0.65
20	0.0320	0.81	0.51
21	0.0285	0.72	0.407
22	0.0253	0.64	0.32
23	0.0226	0.57	0.255
24	0.0201	0.51	0.205
25	0.0179	0.455	0.162
26	0.0159	0.40	0.125
27	0.0142	0.36	0.102
28	0.0126	0.320	0.08
29	0.0113	0.287	0.0646
30	0.0100	0.254	0.0516
31	0.0089	0.226	0.04
32	0.0080	0.203	0.0324
33	0.0071	0.180	0.0255
34	0.0063	0.160	0.02
35	0.0056	0.142	0.0158
36	0.0050	0.127	0.0127
37	0.0045	0.114	0.01
38	0.0040	0.101	0.008
39	0.0035	0.089	0.0062
40	0.0031	0.079	0.0049
41	0.0028	0.071	0.00395
42	0.0025	0.064	0.00321
43	0.0022	0.056	0.00246
44	0.00198	0.050	0.00196
45	0.00176	0.045	
46	0.00157	0.040	
47	0.00140	0.036	
48	0.00124	0.031	
49	0.00110	0.028	
50	0.00099	0.025	

FLK/FLR Cable

FLK and FLR stand for German DIN (72551) abbreviations.

FLK means:

In German:
- **F**ahrzeug **L**eitung **K**unststoff

In English:
- Vehicle Cable Plastic

FLR means:

In German:
- **F**ahrzeug **L**eitung **R**eduziert

In English:
- Thin Walled Cable (reduced insulation thickness)

Remark: Starting from 0.03 mm^2 (AWG 32) a wire can be crimped.

Conversion Table – Inch/mm

Inch	0	0.001	0.002	0.003	0.004	0.005	0.006	0.007	0.008	0.009
0	0	0.0254	0.0508	0.0762	0.1016	0.1270	0.1524	0.1778	0.2032	0.2286
0.010	0.2540	0.2794	0.3048	0.3302	0.3556	0.3810	0.4064	0.4318	0.4572	0.4826
0.020	0.5080	0.5334	0.5588	0.5842	0.6096	0.6350	0.6604	0.6858	0.7112	0.7366
0.030	0.7620	0.7874	0.8128	0.8382	0.8636	0.8890	0.9144	0.9398	0.9652	0.9906
0.040	1.0160	1.0414	1.0668	1.0922	1.1176	1.1430	1.1684	1.1938	1.2192	1.2446
0.050	1.2700	1.2954	1.3208	1.3462	1.3716	1.3970	1.4224	1.4478	1.4732	1.4986
0.060	1.5240	1.5494	1.5748	1.6002	1.6256	1.6510	1.6764	1.7018	1.7272	1.7526
0.070	1.7780	1.8034	1.8288	1.8542	1.8796	1.9050	1.9304	1.9558	1.9812	2.0066
0.080	2.0320	2.0574	2.0828	2.1062	2.1336	2.1590	2.1844	2.2098	2.2352	2.2606
0.090	2.2860	2.3114	2.3368	2.3622	2.3876	2.4130	2.4384	2.4638	2.4892	2.5146
0.100	2.5400	2.5654	2.5908	2.6162	2.6416	2.6670	2.6924	2.7178	2.7432	2.7686
0.110	2.7940	2.8194	2.8448	2.8702	2.8956	2.9210	2.9464	2.9718	2.9972	3.0226
0.120	3.0480	3.0734	3.0988	3.1242	3.1496	3.1750	3.2004	3.2258	3.2512	3.2766
0.130	3.3020	3.3274	3.3528	3.3782	3.4036	3.4290	3.4544	3.4798	3.5052	3.5306
0.140	3.5560	3.5814	3.6068	3.6322	3.6576	3.6830	3.7084	3.7338	3.7592	3.7846
0.150	3.8100	3.8354	3.8608	3.8862	3.9116	3.9370	3.9624	3.9878	4.0132	4.0386
0.160	4.0640	4.0894	4.1148	4.1402	4.1656	4.1910	4.2164	4.2418	4.2672	4.2926
0.170	4.3180	4.3434	4.3688	4.3942	4.4196	4.4450	4.4704	4.4958	4.5212	4.5466
0.180	4.5720	4.5974	4.6228	4.6482	4.6736	4.6990	4.7244	4.7498	4.7752	4.8006
0.190	4.8260	4.8514	4.8768	4.9022	4.9276	4.9530	4.9784	5.0038	5.0292	5.0546
0.200	5.0800	5.1054	5.1308	5.1562	5.1816	5.2070	5.2324	5.2578	5.2832	5.3086
0.210	5.3340	5.3594	5.3848	5.4102	5.4356	5.4610	5.4864	5.5118	5.5372	5.5626
0.220	5.5880	5.6134	5.6388	5.6642	5.6896	5.7150	5.7404	5.7658	5.7912	5.8166
0.230	5.8420	5.8674	5.8928	5.9182	5.9436	5.9690	5.9944	6.0198	6.0452	6.0706
0.240	6.0960	6.1214	6.1468	6.1722	6.1976	6.2230	6.2484	6.2738	6.2992	6.3246
0.250	6.3500	6.3754	6.4008	6.4262	6.4516	6.4770	6.5024	6.5278	6.5532	6.5786
0.260	6.6040	6.6294	6.6548	6.6802	6.7056	6.7310	6.7564	6.7818	6.8072	6.8326
0.270	6.8580	6.8834	6.9088	6.9342	6.9596	6.9850	7.0104	7.0358	7.0612	7.0866
0.280	7.1120	7.1374	7.1628	7.1882	7.2136	7.2390	7.2644	7.2898	7.3152	7.3406
0.290	7.3660	7.3914	7.4168	7.4422	7.4676	7.4930	7.5184	7.5438	7.5692	7.5946
0.300	7.6200	7.6454	7.6708	7.6962	7.7216	7.7470	7.7724	7.7978	7.8232	7.8486
0.310	7.8740	7.8994	7.9248	7.9502	7.9756	8.0010	8.0264	8.0518	8.0772	8.1026
0.320	8.1280	8.1534	8.1788	8.2042	8.2296	8.2550	8.2804	8.3058	8.3312	8.3566
0.330	8.3820	8.4074	8.4328	8.4582	8.4836	8.5090	8.5344	8.5598	8.5852	8.6106
0.340	8.6360	8.6614	8.6868	8.7122	8.7376	8.7630	8.7884	8.8138	8.8392	8.8646
0.350	8.8900	8.9154	8.9408	8.9662	8.9916	9.0170	9.0424	9.0678	9.0932	9.1186
0.360	9.1440	9.1694	9.1948	9.2202	9.2456	9.2710	9.2964	9.3218	9.3472	9.3726
0.370	9.3980	9.4234	9.4488	9.4742	9.4996	9.5250	9.5504	9.5758	9.6012	9.6266
0.380	9.6520	9.6774	9.7028	9.7282	9.7536	9.7790	9.8044	9.8298	9.8552	9.8806
0.390	9.9060	9.9314	9.9568	9.9822	10.0076	10.0330	10.0584	10.0838	10.1092	10.1346
0.400	10.1600	10.1854	10.2108	10.2362	10.2616	10.2870	10.3124	10.3378	10.3632	10.3886
0.410	10.4140	10.4394	10.4648	10.4902	10.5156	10.5410	10.5664	10.5918	10.6172	10.6426
0.420	10.6680	10.6934	10.7188	10.7442	10.7696	10.7950	10.8204	10.8458	10.8712	10.8966
0.430	10.9220	10.9474	10.9728	10.9982	11.0236	11.0490	11.0744	11.0998	11.1252	11.1506
0.440	11.1760	11.2014	11.2268	11.2522	11.2776	11.3030	11.3284	11.3538	11.3792	11.4046
0.450	11.4300	11.4554	11.4808	11.5062	11.5316	11.5510	11.5824	11.6078	11.6332	11.6586
0.460	11.6840	11.7094	11.7348	11.7602	11.7856	11.8110	11.8364	11.8618	11.8872	11.9126
0.470	11.9380	11.9634	11.9888	12.0142	12.0396	12.0650	12.0904	12.1158	12.1412	12.1666
0.480	12.1920	12.2174	12.2428	12.2682	12.2936	12.3190	12.3444	12.3698	12.3952	12.4206
0.490	12.4460	12.4714	12.4968	12.5222	12.5476	12.5730	12.5984	12.6238	12.6492	12.6746
0.500	12.7000									
Inch	**0**	**0.001**	**0.002**	**0.003**	**0.004**	**0.005**	**0.006**	**0.007**	**0.008**	**0.009**

Conversion Table – Inch/mm (continued)

Inch	0	0.001	0.002	0.003	0.004	0.005	0.006	0.007	0.008	0.009
0.500	12.7000	12.7254	12.7508	12.7762	12.8016	12.8270	12.8524	12.8778	12.9032	12.9286
0.510	12.9540	12.9794	13.0048	13.0302	13.0556	13.0810	13.1064	13.1318	13.1572	13.1826
0.520	13.2080	13.2334	13.2588	13.2842	13.3096	13.3350	13.3604	13.3858	13.4112	13.4366
0.530	13.4620	13.4874	13.5128	15.5382	13.5636	13.5890	13.6144	13.6398	13.6652	13.6906
0.540	13.7160	13.7414	13.7668	13.7922	13.8176	13.8430	13.8684	13.8938	13.9192	13.9446
0.550	13.9700	13.9954	14.0208	14.0462	14.0716	14.0970	14.1224	14.1478	14.1732	14.1986
0.560	14.2240	14.2494	14.2748	14.3002	14.3256	14.3510	14.3764	14.4018	14.4272	14.4526
0.570	14.4780	14.5034	14.5288	14.5542	14.5796	14.6050	14.6304	14.6558	14.6812	14.7066
0.580	14.7320	14.7574	14.7828	14.8082	14.8336	14.8590	14.8844	14.9098	14.9352	14.9606
0.590	14.9860	15.0114	15.0368	15.0622	15.0876	15.1130	15.1384	15.1638	15.1892	15.2146
0.600	15.2400	15.2654	15.2908	15.3162	15.3416	15.3670	15.3924	15.4178	15.4432	15.4686
0.610	15.4940	15.5194	15.5448	15.5702	15.5956	15.6210	15.6464	15.6718	15.6972	15.7226
0.620	15.7480	15.7734	15.7988	15.8242	15.8496	15.8750	15.9004	15.9258	15.9512	15.9766
0.630	16.0020	16.0274	16.0528	16.0782	16.1036	16.1290	16.1544	16.1798	16.2052	16.2306
0.640	16.2560	16.2814	16.3068	16.3322	16.3576	16.3830	16.4084	16.4338	16.4592	16.4846
0.650	16.5100	16.5354	16.5608	16.5862	16.6116	16.6370	16.6624	16.6878	16.7132	16.7386
0.660	16.7640	16.7894	16.8148	16.8402	16.8656	16.8910	16.9164	16.9418	16.9672	16.9926
0.670	17.0180	17.0434	17.0688	17.0942	17.1196	17.1450	17.1704	17.1958	17.2212	17.2466
0.680	17.2720	17.2974	17.3228	17.3482	17.3736	17.3990	17.4244	17.4498	17.4752	17.5006
0.690	17.5260	17.5514	17.5768	17.6022	17.6276	17.6530	17.6784	17.7038	17.7292	17.7546
0.700	17.7800	17.8054	17.8308	17.8562	17.8816	17.9070	17.9324	17.9528	17.9832	18.0086
0.710	18.0340	18.0594	18.0848	18.1102	18.1356	18.1610	18.1864	18.2118	18.2372	18.2626
0.720	18.2880	18.3134	18.3388	18.3642	18.3896	18.4150	18.4404	18.4658	18.4912	19.5166
0.730	18.5420	18.5674	18.5928	18.6182	18.6436	18.6690	18.6944	18.7198	18.7452	18.7706
0.740	18.7960	18.8214	18.8468	18.8722	18.8976	18.9230	18.9484	18.9738	18.9992	19.0246
0.750	19.0500	19.0754	19.1008	19.1262	19.1516	19.1170	19.2024	19.2278	19.2532	19.2786
0.760	19.3040	19.3294	19.3548	19.3802	19.4056	19.4310	19.4564	19.4818	19.5072	19.5326
0.770	19.5580	19.5834	19.6088	19.6342	19.6596	19.6850	19.7104	19.7358	19.7612	19.7886
0.780	19.8120	19.8374	19.8628	19.8882	19.9136	19.9390	19.9644	19.9898	20.0152	20.0406
0.790	20.0660	20.0914	20.1168	20.1422	20.1676	20.1930	20.2184	20.2438	20.2692	20.2946
0.800	20.3200	20.3454	20.3708	20.3962	20.4216	20.4470	20.4724	20.4978	20.5232	20.5486
0.810	20.5740	20.5994	20.6248	20.6502	20.6756	20.7010	20.7264	20.7518	20.7772	20.8026
0.820	20.8280	20.8534	20.8788	20.9042	20.9296	20.9550	20.9804	21.0058	21.0312	21.0566
0.830	21.0820	21.1074	21.1328	21.1582	21.1836	21.2090	21.2344	21.2598	21.2852	21.3106
0.840	21.3360	21.3614	21.3868	21.4122	21.4376	21.4630	21.4884	21.5138	21.5392	21.5646
0.850	21.5900	21.6154	21.6408	21.6662	21.6916	21.7170	21.7424	21.7678	21.7932	21.8186
0.860	21.8440	21.8694	21.8948	21.9202	21.9456	21.9710	21.9964	22.0218	22.0472	22.0726
0.870	22.0980	22.1234	22.1488	22.1742	22.1996	22.2250	22.2504	22.2758	22.3012	22.3266
0.880	22.3520	22.3774	22.4028	22.4282	22.4536	22.4790	22.5044	22.5298	22.5552	22.5806
0.890	22.6060	22.6314	22.6568	22.6822	22.7076	22.7330	22.7584	22.7838	22.8092	22.8346
0.900	22.8600	22.8854	22.9108	22.9362	22.9616	22.9870	23.0124	23.0378	23.0632	23.0886
0.910	23.1140	23.1394	23.1648	23.1902	23.2156	23.2410	23.2664	23.2918	23.3172	23.3426
0.920	23.3680	23.3934	23.4188	23.4442	23.4696	23.4950	23.5204	23.5458	23.5712	23.5966
0.930	23.6220	23.6474	23.6728	23.6982	23.7236	23.7490	23.7744	23.7998	23.8252	23.8506
0.940	23.8760	23.9014	23.9268	23.9522	23.9776	24.0030	24.0284	24.0538	24.0792	24.1046
0.950	24.1300	24.1554	24.1808	24.2062	24.2316	24.2570	24.2824	24.3078	24.3332	24.3586
0.960	24.3840	24.4094	24.4348	24.4602	24.4856	24.5110	24.5364	24.5618	24.5812	24.6126
0.970	24.6380	24.6634	24.6888	24.7142	24.7396	24.7650	24.7904	24.8158	24.8412	24.8666
0.980	24.8920	24.9174	24.9428	24.9682	24.9936	25.0190	25.0444	25.0698	25.0952	25.1206
0.990	25.1460	25.1714	25.1968	25.2222	25.2476	25.2730	25.2984	25.3228	25.3492	25.3746
1.000	25.4000									
Inch	**0**	**0.001**	**0.002**	**0.003**	**0.004**	**0.005**	**0.006**	**0.007**	**0.008**	**0.009**


Safety & Security Systems


Convenience


Driver Information


Body & Chassis Systems

✓	✓	✓	✓
✓	✓	✓	✓
✓	✓	✓	✓
✓	✓	✓	✓
✓	✓	✓	✓
✓	✓	✓	✓
✓	✓	✓	✓
✓	✓	✓	✓
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✓	✓	✓	✓
✓	✓	✓	✓
✓	✓	✓	✓

Engineering Notes

Introduction

Automotive compatible High Speed Data connection portfolio

The requirements for High Speed Data connection systems based on Shielded Twisted Pair (STP) or Shielded Star Quad (SSQ) cable is increasing greatly. These requirements are been driven by the growth and complexity of Telematic and Information applications being introduced in the automobile. TE Connectivity's commitment to support this technology segment has been strengthened with the introduction of the HSD (High Speed Data) product portfolio.

The HSD (High Speed Data) product portfolio is focused on various application areas in the automobile, such as the inside compartment for connections to displays, head units, cluster displays and rear seat infotainment modules. Additionally the portfolio covers harsh environment conditions for camera applications such as bumper zones or side mirrors.

The product portfolio can be used in combination with a variety of protocols such as LVDS (Low Voltage Differential Signaling), GVIF (Gigabit Video Interface), USB, IEEE 1394 as well as Ethernet protocols.

TE Connectivity has incorporated its broad spectrum of knowledge and experience in the development of this product portfolio. This knowledge and experience is not just restricted to over 40 years automotive experience, supporting every global OEM in their connection requirements, but also supporting the Infotainment requirements of OEM's and Tier 1's for over 12 years with coaxial, optical as well as connection systems based on STP.

Once more, TE Connectivity offers a world class product portfolio exceeding the market requirements, offering a full product spectrum covering connectors and if required cable assemblies.

Product Features

- Full product range of header connections based on the planned AK (German OEM Working Group) Interface
- Full product range of connectors based on the planned AK (German OEM Working Group) Interface
- Sealed applications ideal for camera connections
- All connections available through cable assemblies if required
- Products compatible to AK (German OEM Working Group) as well as USCAR requirements

Standardized data transmission systems are using the serial data processing

Today standard data transmission systems are using the serial data processing. Due to the serial data processing the number of conductors and single contacts in a connector can be drastically reduced. This is necessary due to proceeding miniaturization of connecting devices. On the other hand the whole data processing will be transmitted by one (or only a few) cable therefore a higher bandwidth is mandatory. In the following the fundamentals of serial data processing and influences will be described.

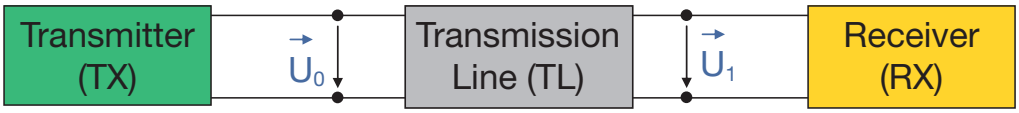


Fig. 1

Differential Data Transmission

The differential data transmission offers an advantage over the noise immunity combined with a low emitted interference compared to the asymmetrical signal transmission. The reason for that is, that the differential data signal is lead through twisted pair wires and an external interference affects both wires with the same intensity. This results in a constant differential signal under ideal conditions.

➔$\Delta U = (U_+ + U_{interfer}) - (U_- + U_{interfer})$ = const. Emissions are minimized due to the erasement of the electromagnetic fields beyond the twisted cable affiliation.

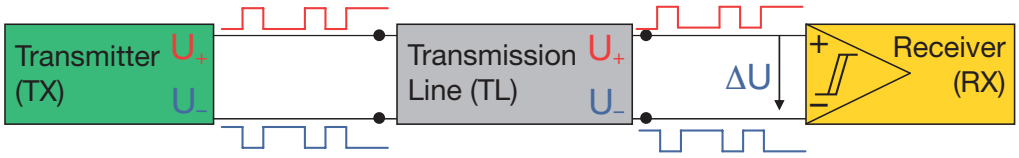


Fig. 2

Parameters of Data Transmission Cables in the Time Domain

Impedance

The impedance in the Time Domain describes the current/voltage ratio along the signal propagation direction on a data transmission channel. The impedance is not the same as the ohmic resistance. The absolute value needs to be constant in common with the system impedance along the whole data transmission line in order to avoid signal reflections. Due to connector-mechanic reasons this target is not achievable at all times. Target is to minimize the impedance aberration and the spatial width in the connector. The impedance is largely defined by the connector geometry, the distance between the conductors and the dielectric constant. Therefore the impedance will be influenced by an appropriate insulation material (ε_r) (see Formula 1).

$$Z \sim \sqrt{\frac{1}{\varepsilon_r}}$$

Formula 1

Technical Introduction (continued)

Time Delay

Time Delay describes the time it takes for an electrical signal to pass through a specific distance. With s = distance and v = velocity –> time delay t = v * s. The typical velocity of the HSD system is about 2/3 of the speed of light in vacuum (c_0 = 300000 km/s). This is caused by the mechanical additive length of the wire conditioned by the twist on one hand and by the material properties of the transmission line on the other hand. The velocity (v) is mainly influenced by the dielectric constant (see Formula 2).

$$v \approx c_0 \cdot \frac{1}{\sqrt{\varepsilon_r}}$$

Formula 2

Intra Pair Skew

Intra Pair Skew describes the difference of the propagation delay between electrical signals within a signal wire pair. This will be influenced by the mechanical length differences of conductors within a signal pair or by different dielectric constants. This mainly appears in 90° variants of connectors. HSD 90° headers have a basic grid of 2 mm which results in a length difference of 4 mm between 2 conductors of a pair. This implicates approximately 20 ps difference in time delay. Intra Pair Skew causes signal distortions and a decrease of the transmission bandwidth. Furthermore higher electromagnetic emissions and lower noise immunity takes place.

Inter Pair Skew

Inter Pair Skew describes the difference of the propagation delay between two or more signal wire pairs in one cable. The reasons for Inter Pair Skew are comparable with Intra Pair Skew. Inter Pair Skew leads into a reduction of bandwidth due to the fact that with most of the multi-channel data bus systems all datas must be valid simultaneously. Otherwise the time frames for a secure acceptance of valid information must be set unnecessary high.

Eye Diagram

The graph of the eye diagram (Fig. 3) of digital signals provides a first quantification of the signal quality. Therefore an array of curves will be superposed. The time trigger can be chosen as fixed or regained out of the signal. This depends on the parameter chosen to be measured. An ideal signal quality is indicated by an eye of rectangular form that means with high signal rise time and a constant amplitude. For the appraisal of the eye diagram it is of importance that a high signal rise time or a flat amplitude response with a visible noise may cause a high bit error rate. Therefore the probable bit error rate will be calculated via the eye diagram using statistical methods.

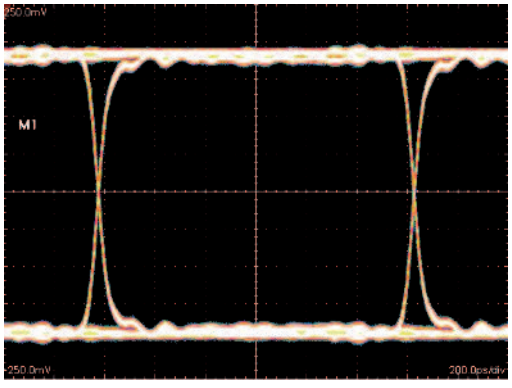


Fig. 3

From Time Domain to Frequency Domain

In order to get a sufficient description of the data transmission line in the frequency range it is useful to have a look at the frequency spectrum which has to be transmitted. A continuing rectangular pulse pattern consists of (referring to Fourier) a sum of sinus and cosinus functions (Fourier composition). Every signal in the time domain can be degraded in its several spectral frequency shares. The decay of the amplitudes of each spectral frequency will be determined by the signal rise time. The fundamental frequency will be determined by the signal period time.

Regarding the outcome of Fouriers decompensation with a finite number of harmonics (5. harmonic = 11 * f_0). The superposition of the several harmonics will lead into a continuing rectangular pulse pattern again (see Fig. 4, Fig. 5). As a result a data transmission line must not transmit only the fundamental wave but also even higher frequencies to avoid signal distortion.

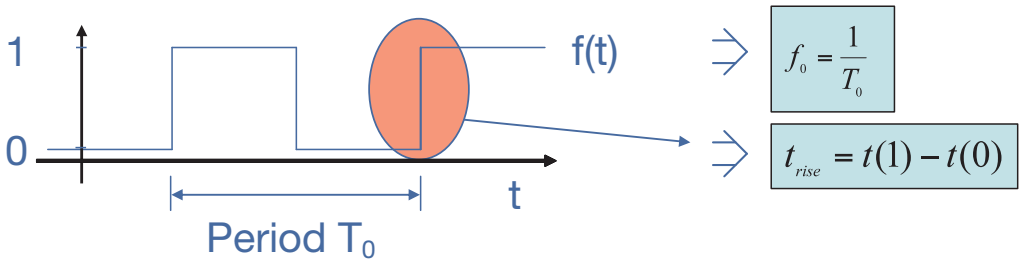


Fig. 4

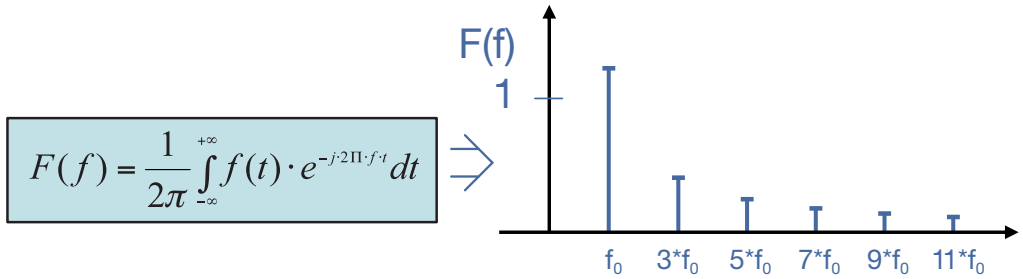


Fig. 5

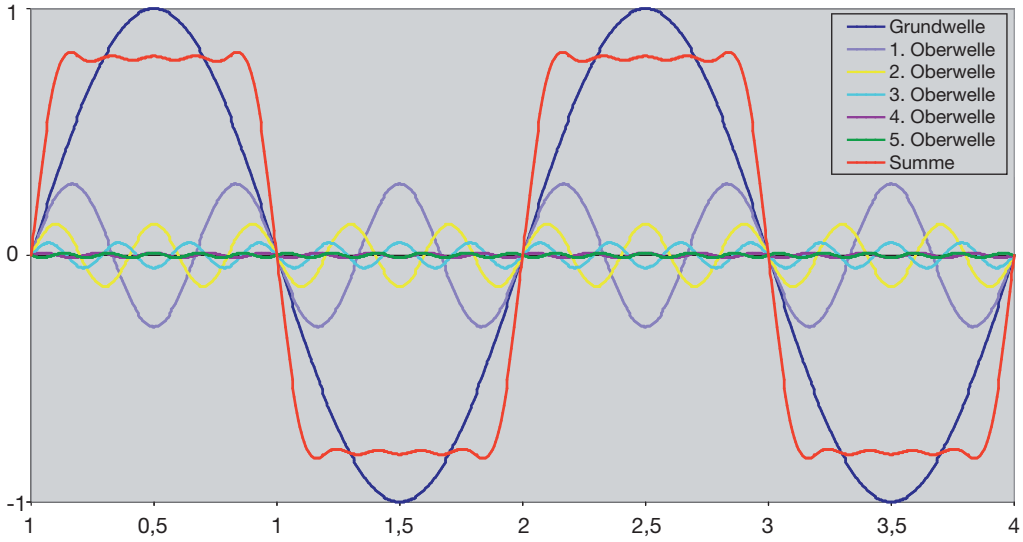


Fig. 6

Technical Introduction (continued)

Important Parameters of the Frequency Range

The description of a time discrete signal with the aid of the Fourier composition shows the importance of analysing parameters in the frequency range.

Attenuation:

Attenuation is the ratio of output voltage to input voltage of a transmission network D = U_1/U_0 (see Fig. 1). Normally the logarithmic voltage ratio is declared (see Formula. 3). In the lower frequency range attenuation is mainly caused by ohmic loss (conductance, conductor cross-section). With increasing frequency the dielectric losses and current displacement (Skin Effect) will be added.

$$D[dB] = -20 * \log\left[\frac{U_1}{U_0}\right]$$

Formula 3

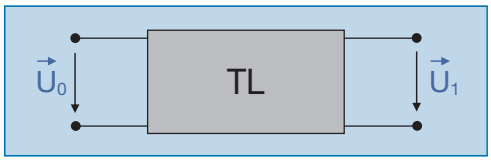


Fig. 7

Reflection Loss

Reflection loss is the ratio between the reflecting signal amplitude $U_{refl.}$ and the transmitted signal amplitude U_0 (see Formula 4, Fig. 8). Reasons for bad reflection loss ratio are inhomogeneities of the impedance on the transmission network. These are mainly caused by inhomogeneous geometries, inhomogeneous dielectrica and frequency depend dielectric constants of the insulating material.

Good Reflection loss values, even at higher frequencies, imply short lateral dimensions of possible impedance fluctuations.

$$A_{refl.}[dB] = -20 \cdot \log\left[\frac{U_{refl.}}{U_0}\right]$$

Formula 4

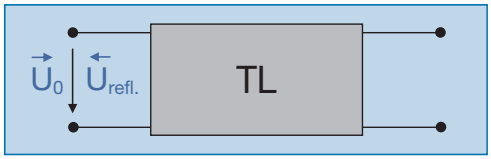


Fig. 8

Crosstalk

Crosstalk is an undesirable transmission of electrical signals between two or more transmission media due to inductive or capacitive coupling. More reasons are inhomogeneities of the transmission media and Skew effects in the signal transmission pair. Crosstalk causes on the one hand additional attenuation on the transmitted signal and on the other hand undesirable signal distortion on the adjoining signal channels. There are two different kinds of Crosstalk:

- Near End Crosstalk (NEXT, see Fig. 9)
- Far End Crosstalk (FEXT, see Fig. 10).

Technical Introduction (continued)

$$NEXT[dB] = 20 \cdot \log\left[\frac{U_{NEXT}}{U_0}\right]$$

Formula 5

$$FEXT[dB] = 20 \cdot \log\left[\frac{U_{FEXT}}{U_0}\right]$$

Formula 6

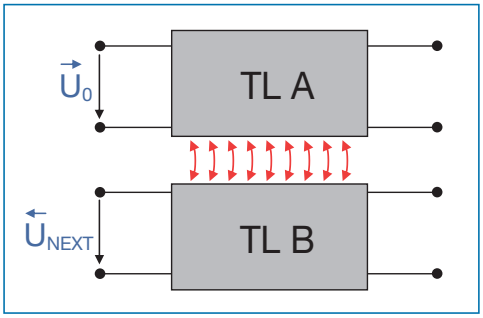


Fig. 9

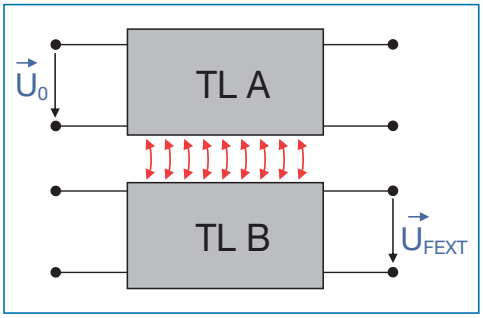


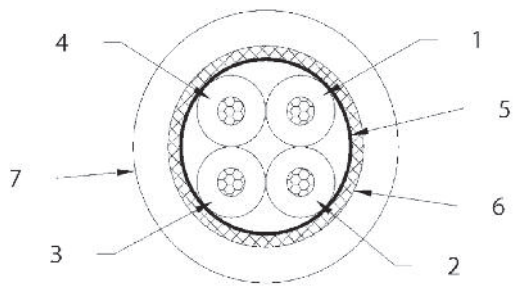
Fig. 10

EMC

EMC is the generic term of radiation and immunity of electrical systems. Radiation may cause a negative influence on adjoining systems. A high immunity is a fundamental assumption to avoid erroneous data transmission. Missing or insufficient shielding causes also a bad EMC performance, this will be improved by using twisted pair cables. Aside from optimal requirements a bad connection of the component shields, connectors, housings and wires also causes a bad EMC performance. Furthermore Skew effects will influence the EMC performance negative. For passive components as connectors and wires it is necessary to mention the shielding effectiveness. There must be differentiated between shielding effectiveness and coupling attenuation. Shielding effectiveness describes the behaviour of the shielding of the “coaxial” cable shield only. Coupling attenuation is the combination of the shielding effectiveness and the common mode rejection of the signal pair. The performance of the shielding connectivity of PCB connectors (pin header) relating to a metallic device housing is very important for the shielding performance. The quality of such a connection can be described with the parameter bulkhead feed-through.

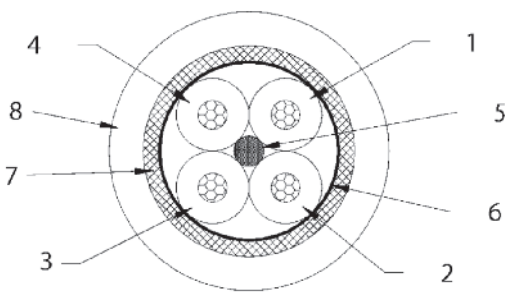
Cable

The applied interconnection cable is designed as a star quad. Detailed information concerning the cable are listed in several data sheets of the cable manufacturers. The construction shown in Fig. 10 shows the principle construction of the star quad cable.



1 Conductor
2 Insulation
3 Stranding
4 Insulation
5 Foil
6 Shield
7 Sheath

Fig. 11



1 Conductor
2 Insulation
3 Stranding
4 Total stranding
5 Stranding with filler
6 Foil
7 Shield
8 Sheath

Fig. 12

Header – Technical and Electrical Data

Documents

Application Specification
114-18867 HSD Pin Header

Product Specification
108-94331 HSD Connector System

Interface

According to
HSD Interface Drawing
114-18950

Mechanical Data

Mating Cycles
min. 25 (Contact Surface: Gold)

Mating and Unmating Force
max. 30N

Coding Efficiency
min. 80N

Pin Retention Force
min. 25N

Environmental Data

Temperature Range
–40°C to +105°C

Thermal Shock
DIN IEC 60068-2-14

Temperature and Humidity
DIN IEC 60068-2-30

High Temperature Exposure
DIN IEC 60068-2-2

Vibration (Random) and Mechanical Shock
DIN IEC 60068-2-64

Soldering Profile
Lead-free wave and reflow soldering according Specification 114-18867

2002/95/EC (RoHS)
compliant

Material and Plating

Center Contact
CuZn35Pbz
CuSn4

Outer Contact
CuZn30
CuSn4
CuSn6

Dielectric
LCP-GF30
LCP-GF15

Housing
LCP-GF30
PPA-GF25
PBT-GF10
PA46

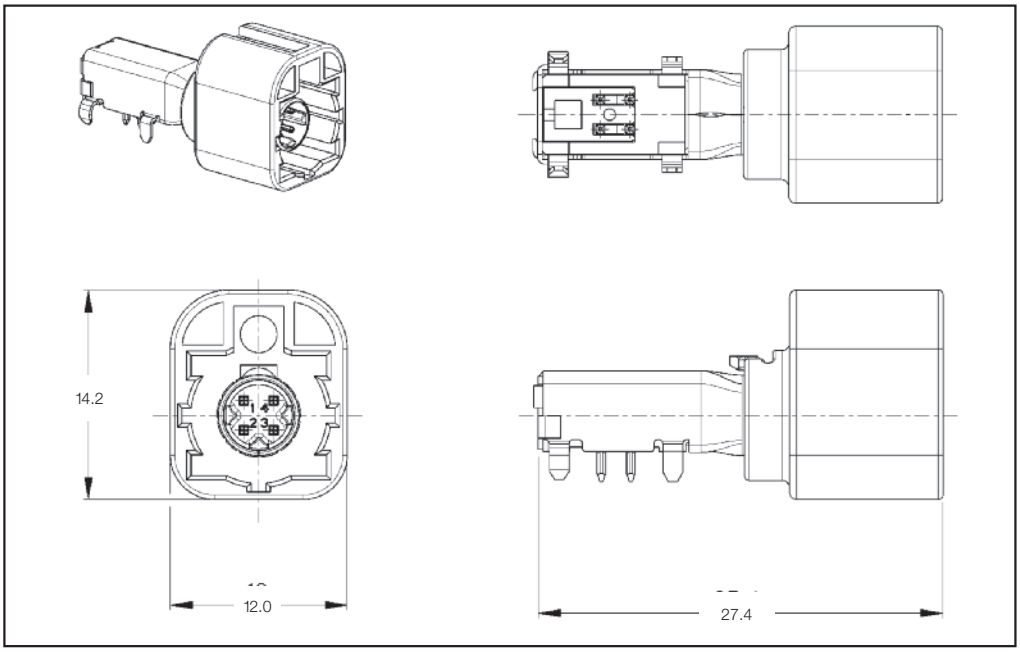
Header – Electrical Data

Test Case	Condition	Limit		
		PN 1823071/ PN 2141966	PN 2112507	PN 1823271/ PN 1823361-1 PN 2177258
Impedance	–	100 Ω ±15 %	100 Ω ±15 %	100 Ω ±15 %
Propagation Delay	–	≤ 100 ps	≤ 125 ps	≤ 50 ps
Intra-pair Skew	–	≤ 25 ps	≤ 20 ps	≤ 5 ps
Inter-pair Skew	–	≤ 5 ps	≤ 5 ps	≤ 5 ps
Attenuation	≤ 1 GHz	≤ 0.1 dB	≤ 0.1 dB	≤ 0.1 dB
Reflection Loss	≤ 1 GHz ≤ 2 GHz	≥ 20 dB ≥ 17 dB	≥ 20 dB ≥ 17 dB	≥ 20 dB ≥ 17 dB
Cross Talk	≤ 1 GHz	≤ -40 dB	≤ -35 dB	≤ -40 dB
Differential Shielding Effectiveness	≤ 1 GHz ≤ 2 GHz	≥ 70 dB ≥ 65 dB	≥ 70 dB ≥ 65 dB	≥ 70 dB ≥ 60 dB
Bulkhead Feed-Through	≤ 1 GHz ≤ 2 GHz	– –	≥ 75 dB ≥ 65 dB	– –

Pin Header 90°

Assembly

Part No. **1823071**



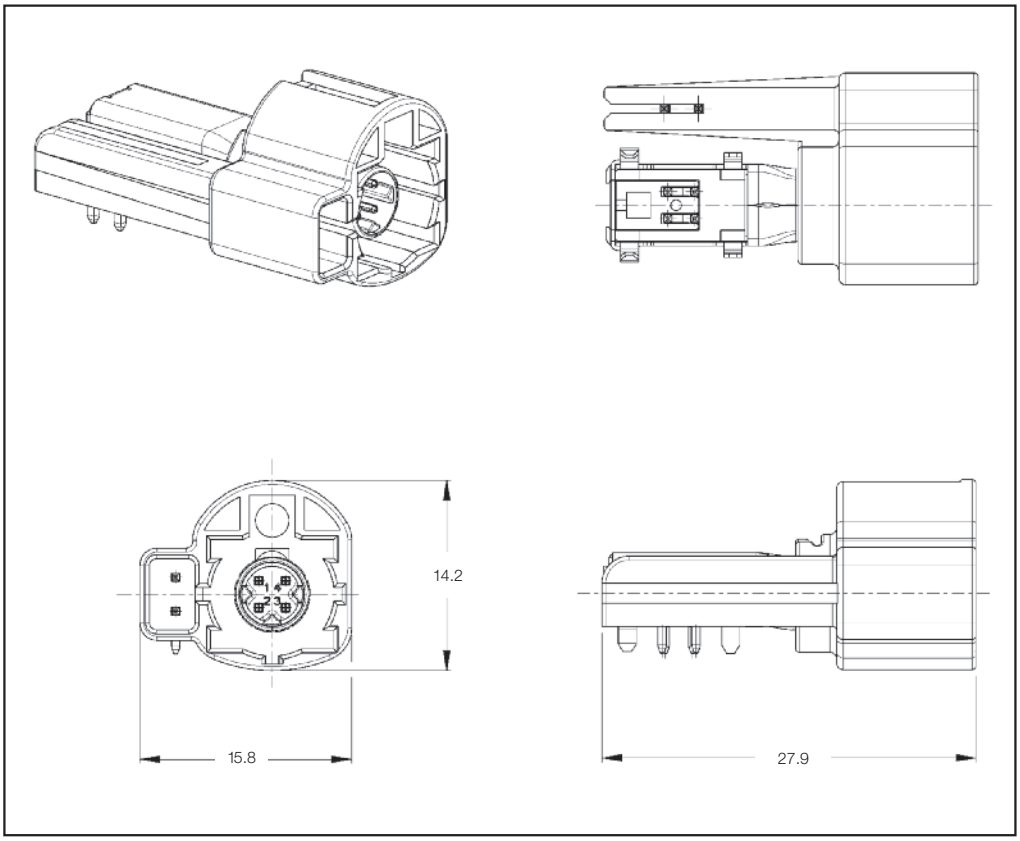
Coding

Coding	Plug	Color	RAL		Part Number
A		Black	9011		0-1823071-1
B		Natural	–		0-1823071-2
C		Blue	5012		0-1823071-3
D		Claret Violet	4004		0-1823071-4
E		Green	6001		0-1823071-5
F		Brown	8011		0-1823071-6
H		Heather Violet	4003		1-1823071-2
K		Curry	1027		1-1823071-4

Pin Header 90° + 2 MQS

Assembly

Part No. **2141966**



Coding

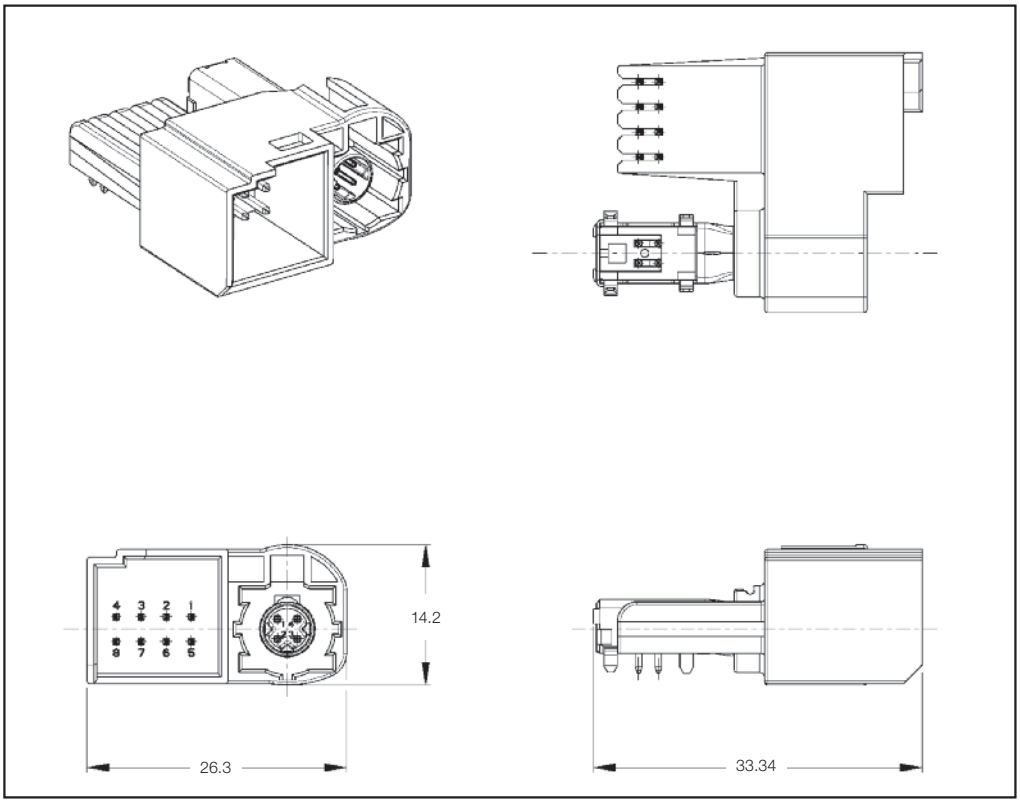
Coding	Plug	Color	RAL	Part Number
Z		Water Blue	5021	8-2141966-9

Additional Codings on request

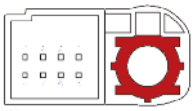
Pin Header 90° + 8 MQS

Assembly

Part No. **2177258**



Coding

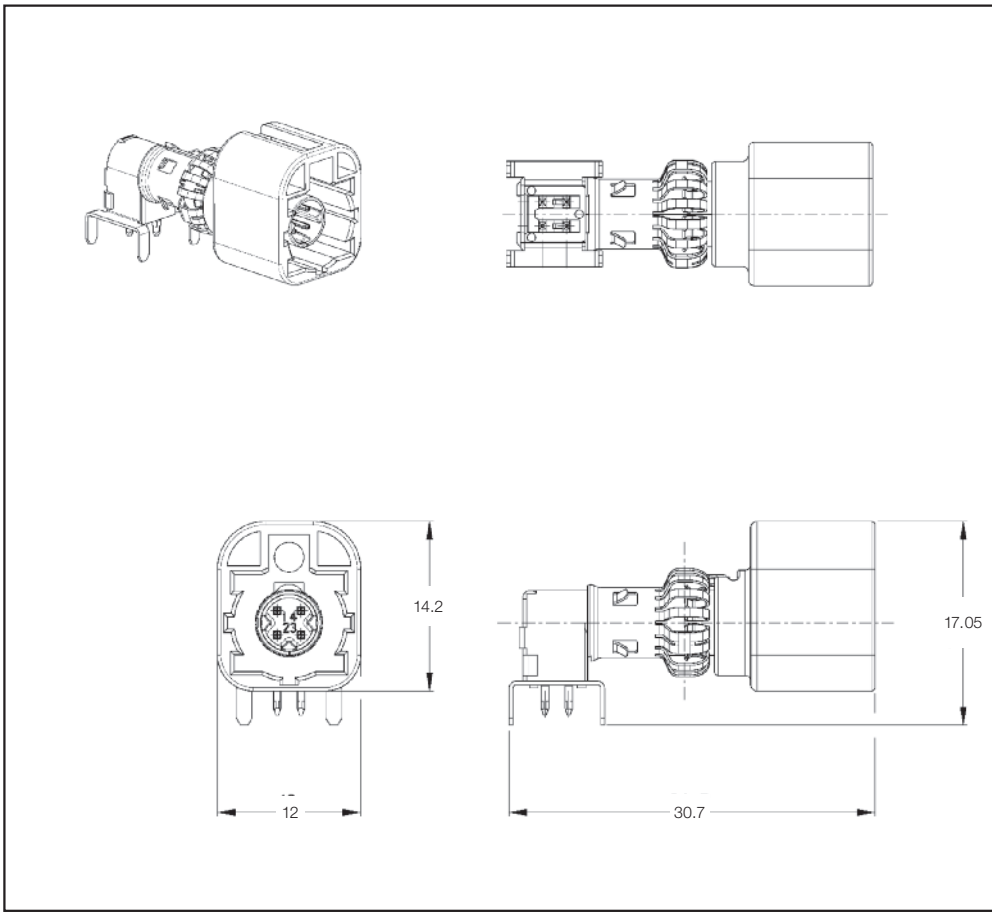
Coding	Plug	Color	RAL	Part Number
Z		Water Blue	5021	8-2177258-9

Additional Codings on request

Pin Header 90° with Shielding Device

Pin Connector

Part No. **2112507**



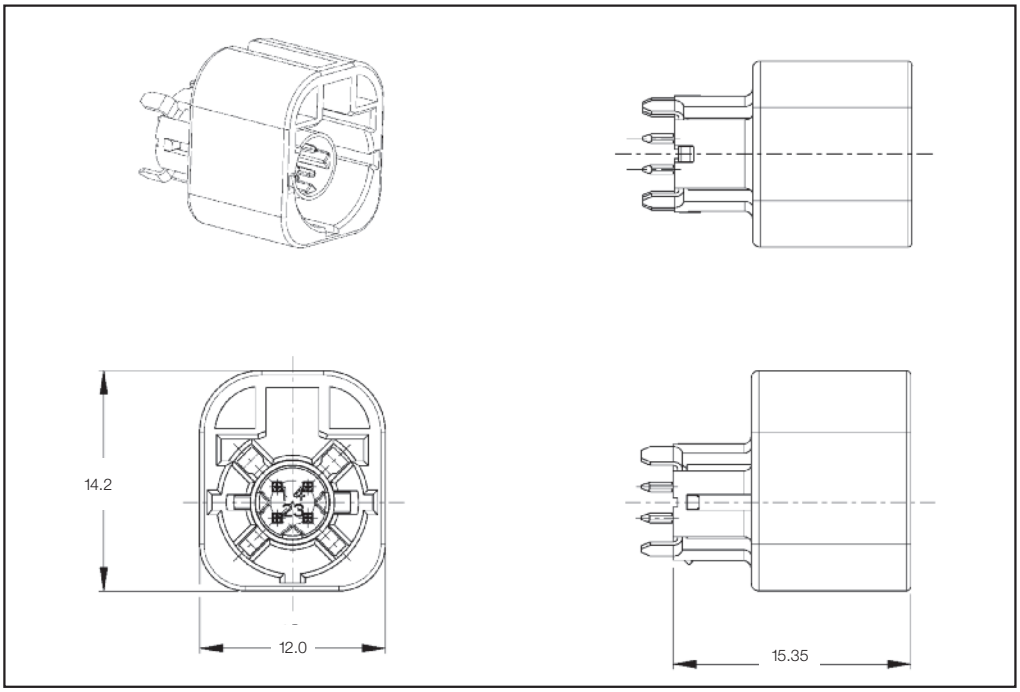
Coding

Coding	Plug	Color	RAL	Part Number
A		Black	9011	0-2112507-1
B		Natural	–	0-2112507-2
C		Blue	5012	0-2112507-3
D		Claret Violet	4004	0-2112507-4
E		Green	6001	0-2112507-5

Pin Header 180°

Assembly

Part No. **1823271**

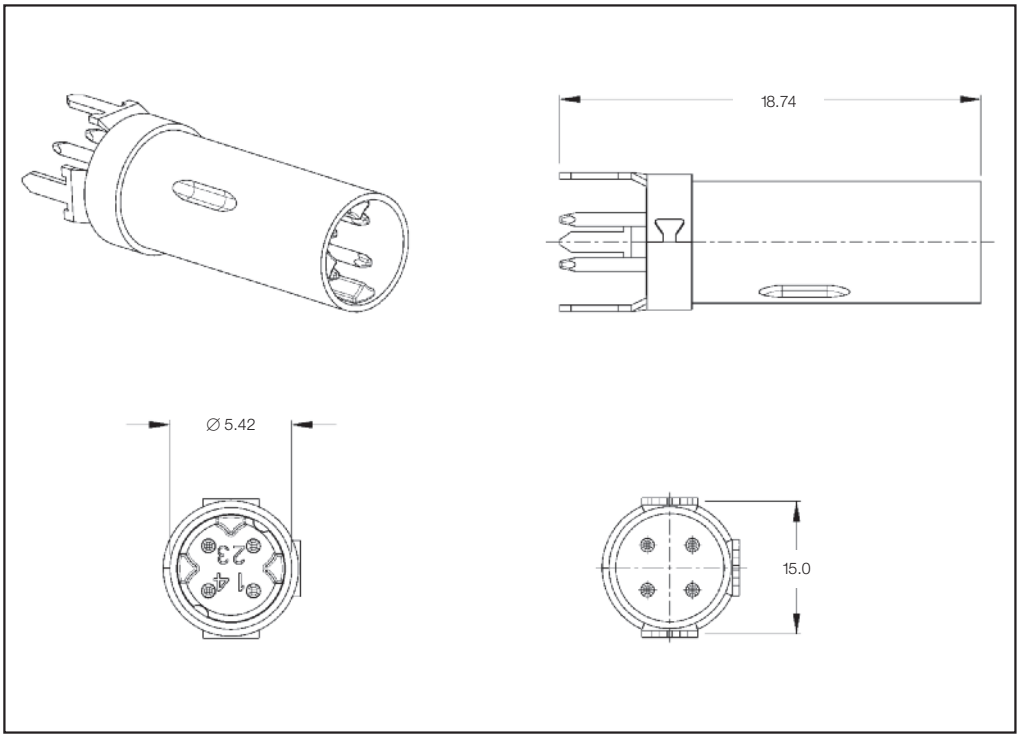


Coding

Coding	Plug	Color	RAL		Part Number
A		Black	9011		0-1823271-1
B		Natural	–		0-1823271-2
C		Blue	5012		0-1823271-3
D		Claret Violet	4004		0-1823271-4
E		Green	6001		0-1823271-5
F		Brown	8011		0-1823271-6
Z		Water Blue	5021		0-1823271-9

Pin Header 180°, Sealed

Pin Connector Part No. **1823361-1**



Cable Assembly – Technical Data

Documents

Product Specification
90°
108-94105 HSD Connector System
180°
108-94334 HSD Connector System

Test Specification
108-94106 HSD Connector System

Interface

Mating Interface
114-18950 HSD Interface Drawing

Mechanical Data

Mating Cycles
min. 25 (Contact Surface: Gold)

Mating and Unmating Force
max. 30N

Coding Efficiency
min. 80N

Pin Retention Force
min. 25N

Environmental Data

Temperature Range
–40°C to +105°C

Thermal Shock
DIN IEC 60068-2-14

Temperature and Humidity
DIN IEC 60068-2-30

High Temperature Exposure
DIN IEC 60068-2-2

Vibration (Random) and Mechanical Shock
DIN IEC 60068-2-64

2002/95/EC (RoHS)
compliant

Material and Plating

Connector Parts HSD

Center Contact
CuZn35Pb2, gold (Au)

Outer Contact
CuZn30, tin (Sn)

Dielectric
LCP-GF30, black

Housing
PPA-GF25, see drawing

Connector Parts USB

Contacts
CuNiSi, gold (Au)

Housing
PA66-GF13, black

EMI Shielding
CuSn4, tin (Sn)

Cable Assemblies – Electrical Data

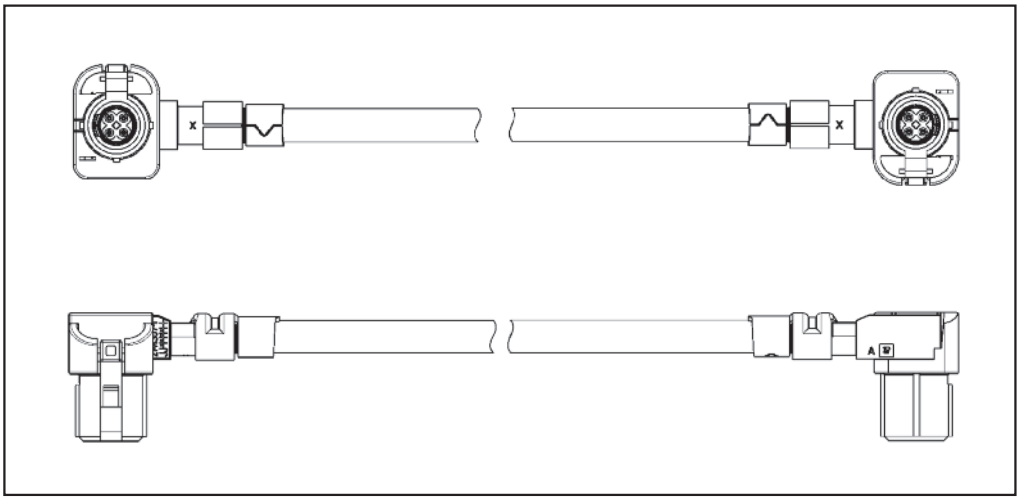
Test Case	Condition	Limit	
Impedance	–	100 Ω ±15 %	
Propagation Delay	–	≤ 5.05 ns/m	
Intra-pair Skew Connector Connectors straight – straight Connectors straight – angled	 – –	 ≤ 5 ps ≤ 25 ps	
Intra-pair Skew Cable	–	≤ 25 ps/m	
Inter-pair Skew Connector Connectors straight – straight Connectors straight – angled	 – –	 ≤ 5 ps ≤ 5 ps	
Inter-pair Skew Cable	–	≤ 25 ps/m	
Attenuation mated Cable Assembly	F [MHz]	D @ 5.0 m	D @ 10.0 m
	250 MHz 400 MHz 500 MHz 800 MHz 1000 MHz	≤ 3.10 dB ≤ 3.80 dB ≤ 4.40 dB ≤ 5.90 dB ≤ 6.80 dB	≤ 6.10 dB ≤ 7.60 dB ≤ 8.60 dB ≤ 11.60 dB ≤ 13.20 dB
Reflection Loss	≤ 1 GHz ≤ 2 GHz	≥ 20 dB ≥ 17 dB	
Near End Cross Talk	≤ 1 GHz	≤ -30 dB	
Far End Cross Talk	≤ 1 GHz	≤ -35 dB	
Cable Assembly Differential Shielding Effectiveness	≤ 1 GHz ≤ 2 GHz	≥ 75 dB ≥ 65 dB	

Cable Assemblies

Assembly

Part No. **2177131**

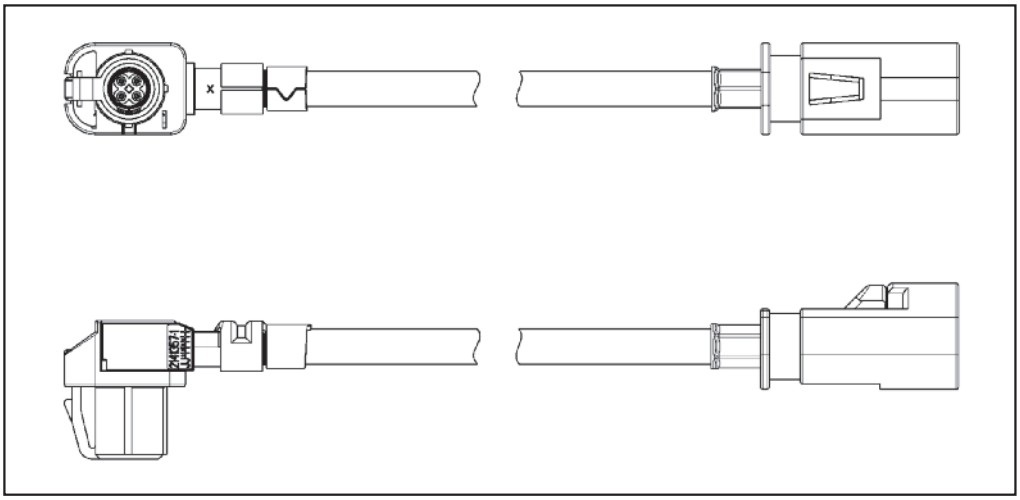
Cable Assembly
90° Jack (Female) /
90° Jack (Female)



Assembly

Part No. **2177132**

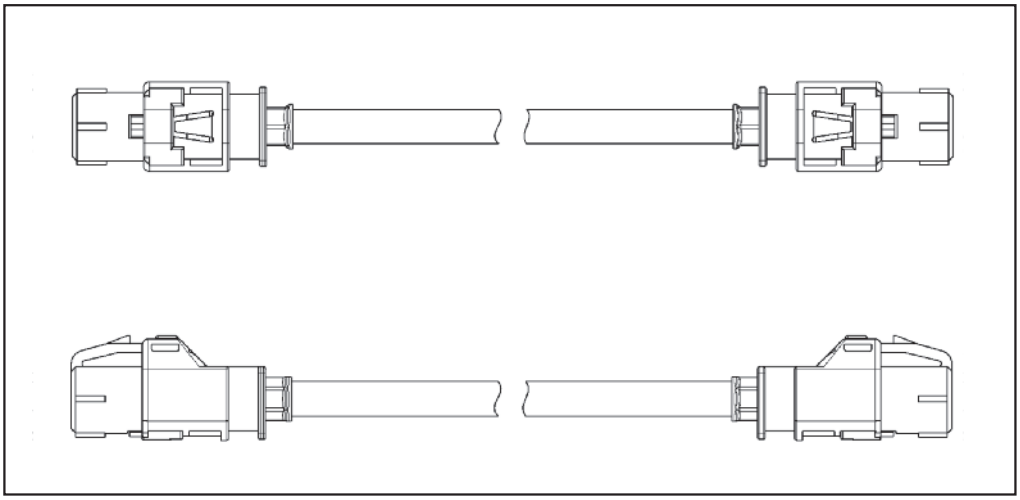
Cable Assembly
90° Jack (Female) /
AK 180° Plug (Male)



Assembly

Part No. **2141723**

Cable Assembly
AK 180° Jack (Female) /
AK 180° Jack (Female)

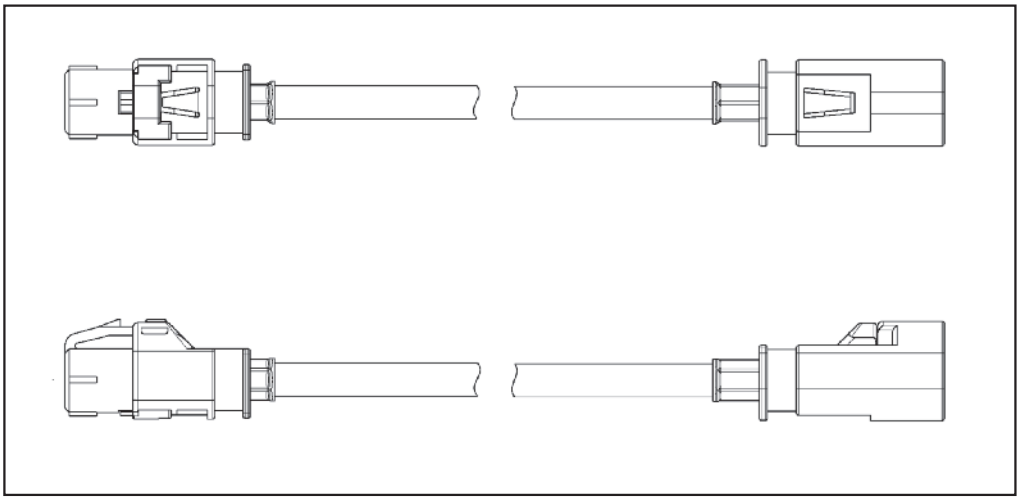


Cable Assemblies

Assembly

Part No. **2141724**

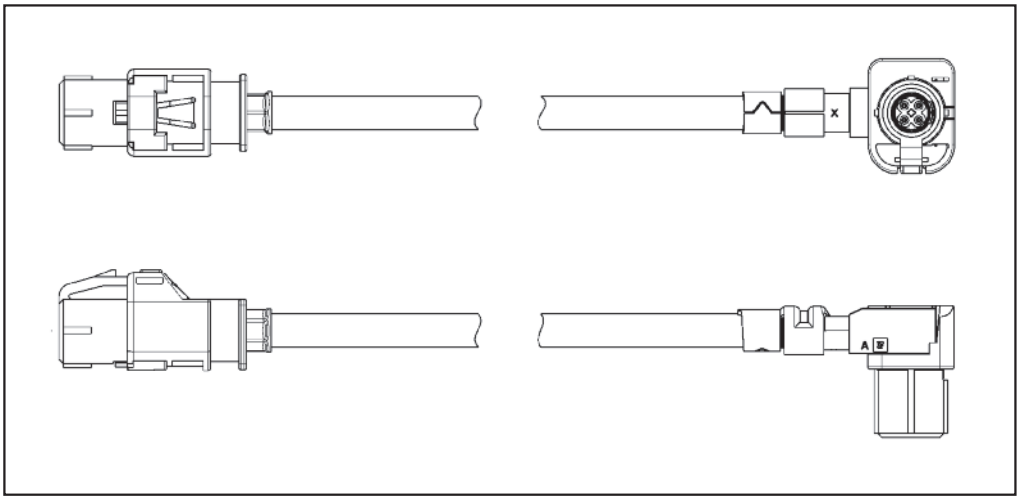
Cable Assembly
AK 180° Jack (Female) /
AK 180° Plug (Male)



Assembly

Part No. **2177130**

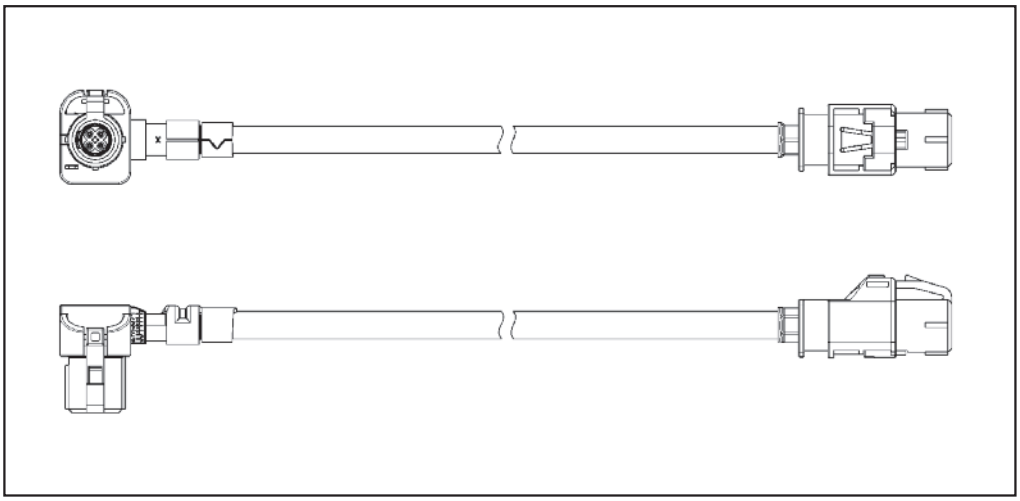
Cable Assembly
AK 180° Jack (Female) /
90° Jack (Female)



Assembly

Part No. **2177257**

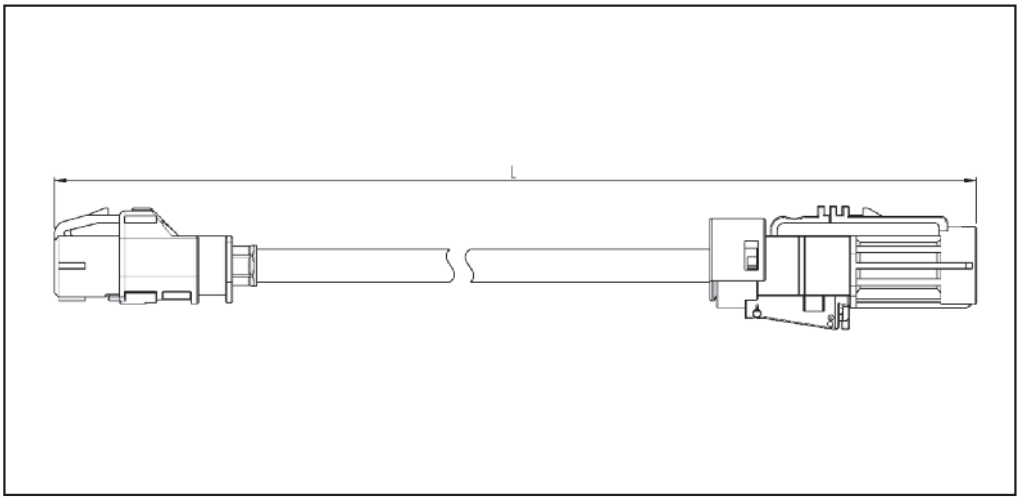
Cable Assembly
90° Jack (Female) /
AK 180° Jack (Female)



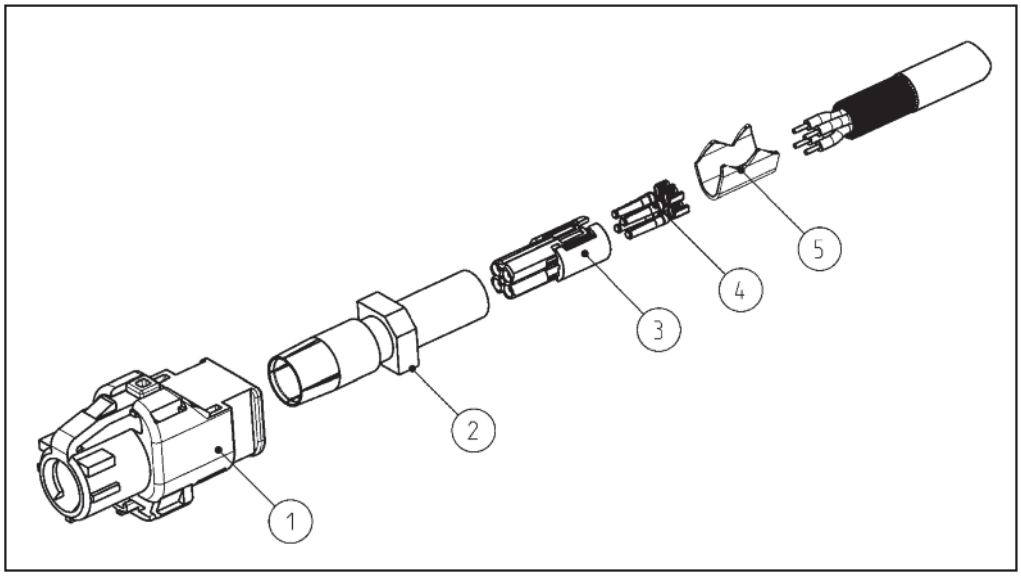
Assembly

Part No. **2112030**

Cable Assembly
AK 180° Jack (Female) /
180° watersealed (Female)



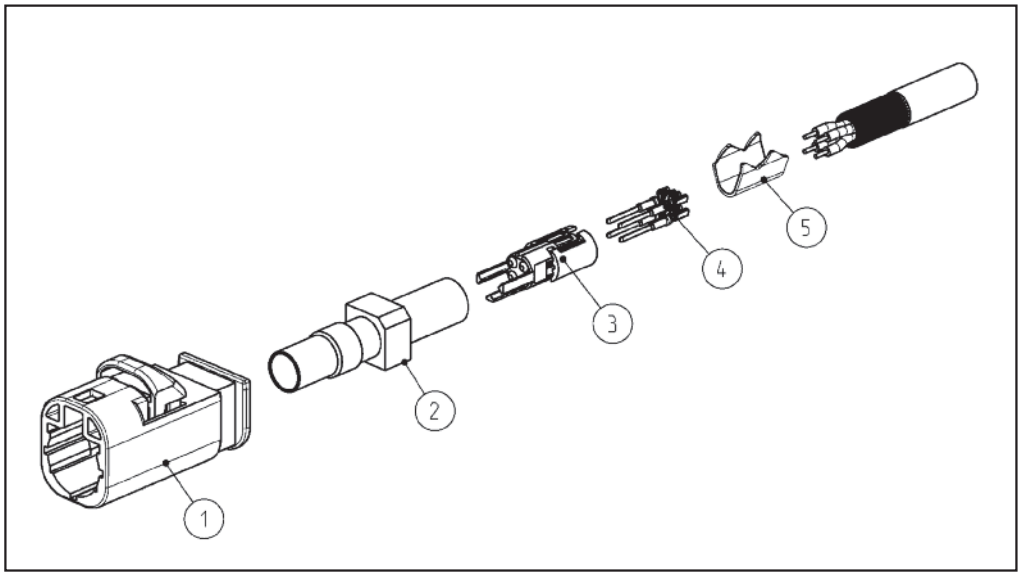
HSD 180° Contact (female)



Position	Part Number	Description
1	1823898	Pin Housing Assembly
2	1823895	Shield Female
3	1823894	Cavity Block
4	2112028	Female Contact
5	1823899	Impedance Crimp

Keying Options	Subassy Hsg / Ret	Shield Contact	Contact Carrier	Contact	Impedance Crimp
A	0-1823898-1	0-1823895-1	0-1823894-1	0-2112028-1	0-1823899-1
B	0-1823898-2				
C	0-1823898-3				
D	0-1823898-4				
E	0-1823898-5				
F	0-1823898-6				
Z	0-1823898-9				

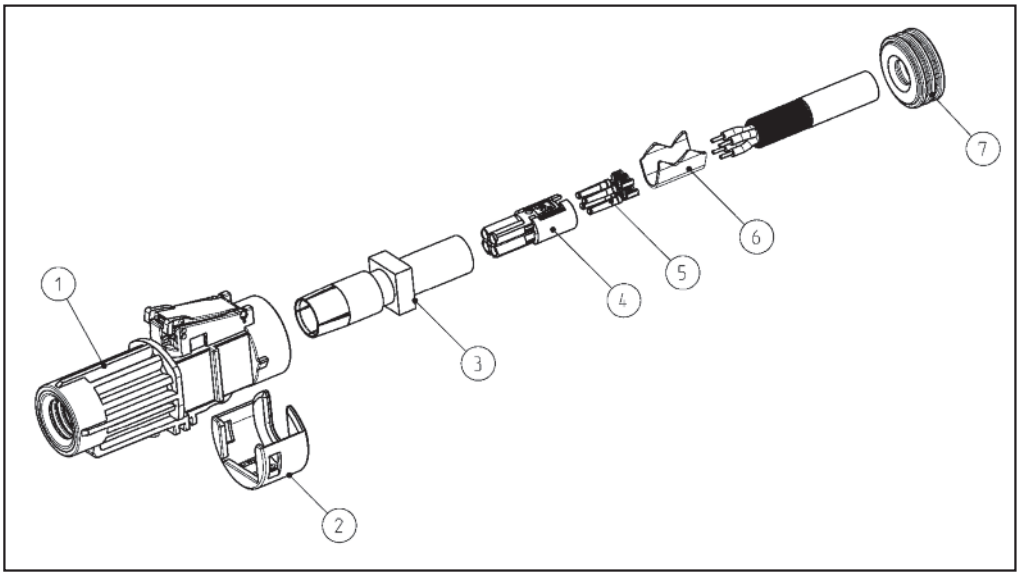
HSD 180° Contact (male)



Position	Part Number	Description
1	1823905	Receptacle Housing Assembly
2	1823902	Shield Male
3	1823901	Cavity Block
4	2112027	Male Contact
5	1823899	Impedance Crimp

Keying Options	Subassy Hsg / Ret	Shield Contact	Contact Carrier	Contact	Impedance Crimp
A	0-1823905-1	0-1823902-1	0-1823901-1	0-2112028-1	0-1823899-1
B	0-1823905-2				
C	0-1823905-3				
D	0-1823905-4				
E	0-1823905-5				
F	0-1823905-6				
Z	0-1823905-9				

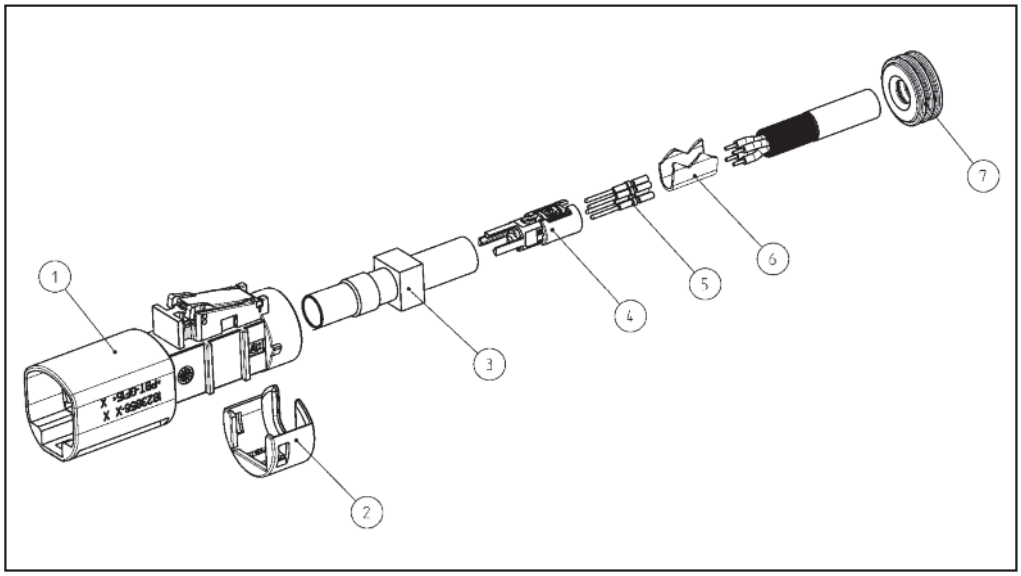
HSD 180° watersealed (female)



Position	Part Number	Description
1	1823853	Housing Assembly
2	1823855	Seal Holder
3	1823895	Shield Female
4	1823894	Cavity Block
5	2112028	Female Contact
6	1823899	Impedance Crimp
7	1823854	Radial Seal

Keying Options	Subassy Hsg / Ret	Seal Holder	Reuse of 180° female	Radio Seal
Z	0-1823853-1			
A	0-1823853-2			
B	0-1823853-3			
C	0-1823853-4	0-1823855-1	–	0-1823854-1
D	0-1823853-5			
E	0-1823853-6			
F	0-1823853-7			

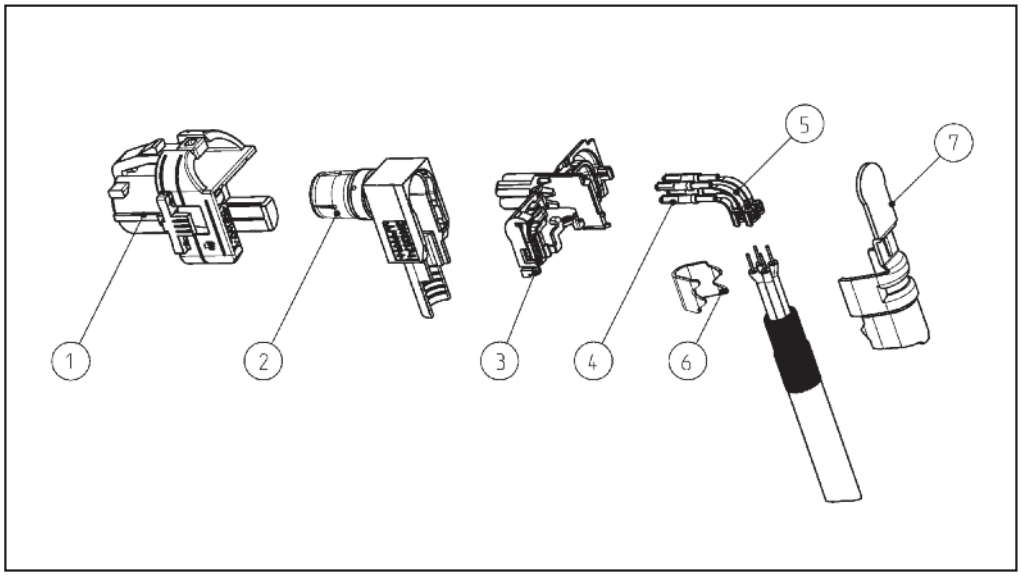
HSD 180° watersealed (male)



Position	Part Number	Description
1	1823857	Housing Assembly
2	1823855	Seal Holder
3	1823902	Shield Male
4	1823901	Cavity Block
5	2112027	Male Contact
6	1823899	Impedance Crimp
7	1823854	Radial Seal

Keying Options	Subassy Hsg / Ret	Seal Holder	Reuse of 180° female	Radio Seal
Z	0-1823857-1			
A	0-1823857-2			
B	0-1823857-3			
C	0-1823857-4	0-1823855-1	–	0-1823854-1
D	0-1823857-5			
E	0-1823857-6			
F	0-1823857-7			

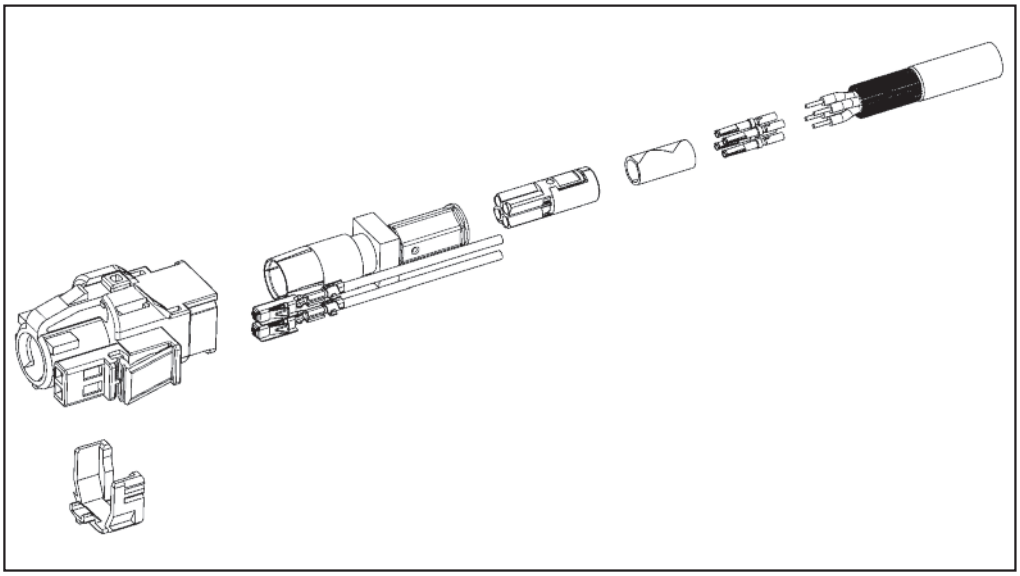
HSD 90° Contact (female)



Keying Options	① Subassy Hsg / Ret	② Hsg Shield	③ Contact Carrier	④ ⑤ Contact	⑥ Impedance Crimp	⑦ Cover
Z	2/0-2208145-1	1-2141366-1	2141361-1	2141373-2 2141374-2	2141360-1	2141356-1
A	2/0-2208145-2					
B	2/0-2208145-3					
C	2/0-2208145-4					
D	2/0-2208145-5					
E	2/0-2208145-6					
F	2/0-2208145-7					

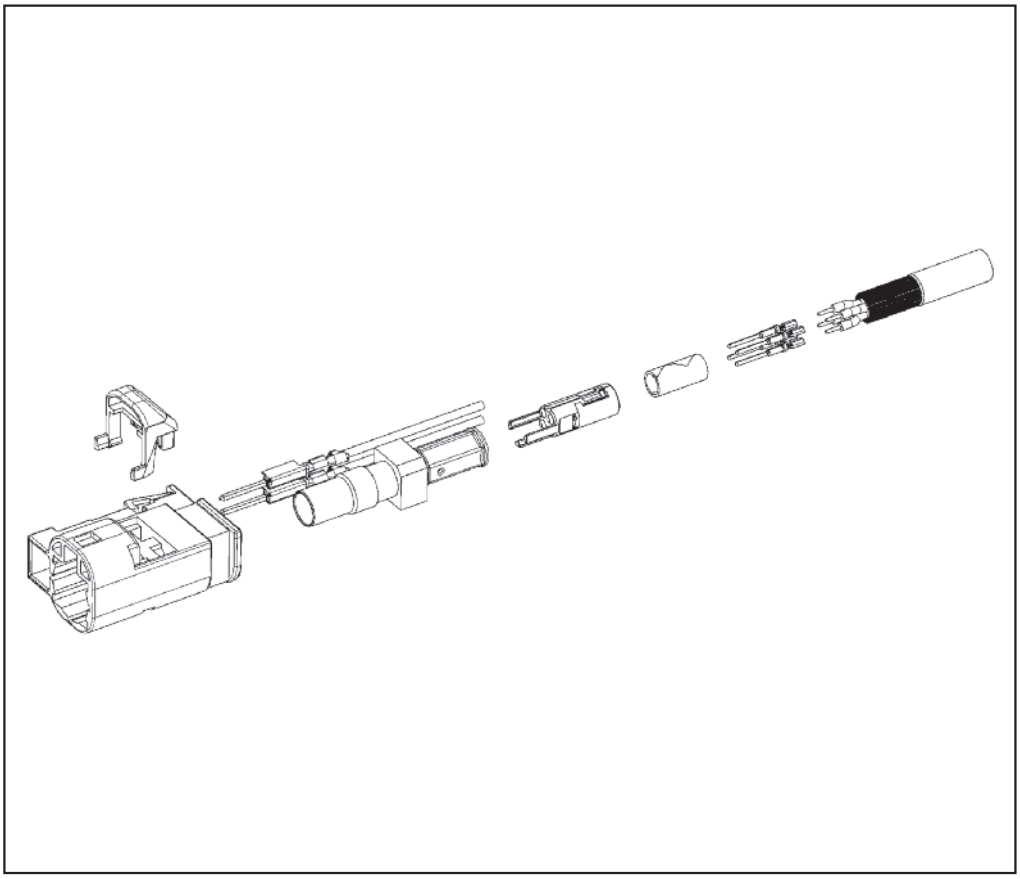
Keying Options	① Subassy Hsg / Ret	② Hsg Shield	③ Contact Carrier	④ ⑤ Contact	⑥ Impedance Crimp	⑦ Cover
O	3-2208145-1	1-2141366-1	2141361-1	2141373-2 2141374-2	2141360-1	2141356-1
G	3-2208145-2					
H	3-2208145-3					
J	3-2208145-4					
K	3-2208145-5					
L	3-2208145-6					
M	3-2208145-7					

HSD 180° + 2 MQS Contact (female)



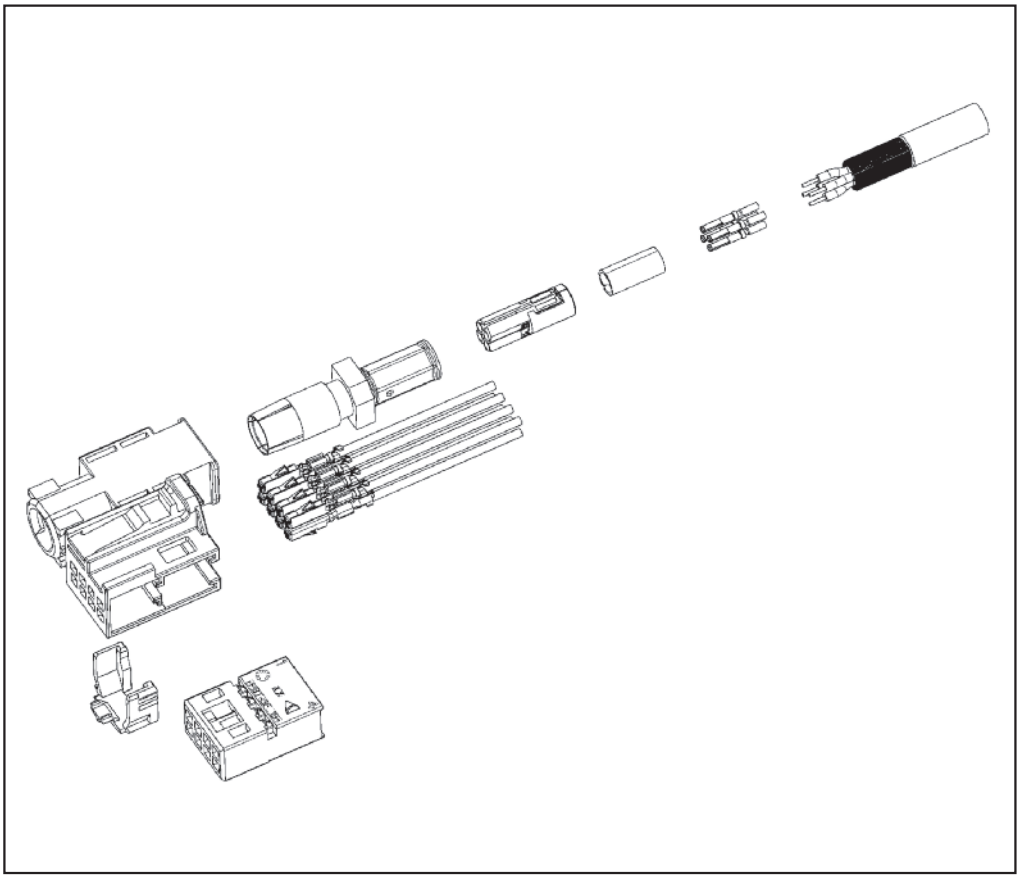
Keying Options	HSD + 2 MQS female	MQS Contact	Cavity block	Shield	HSD Contact
Z	2177694	144969	1823894	1823895	2112028

HSD 180° + 2 MQS Contact (male)



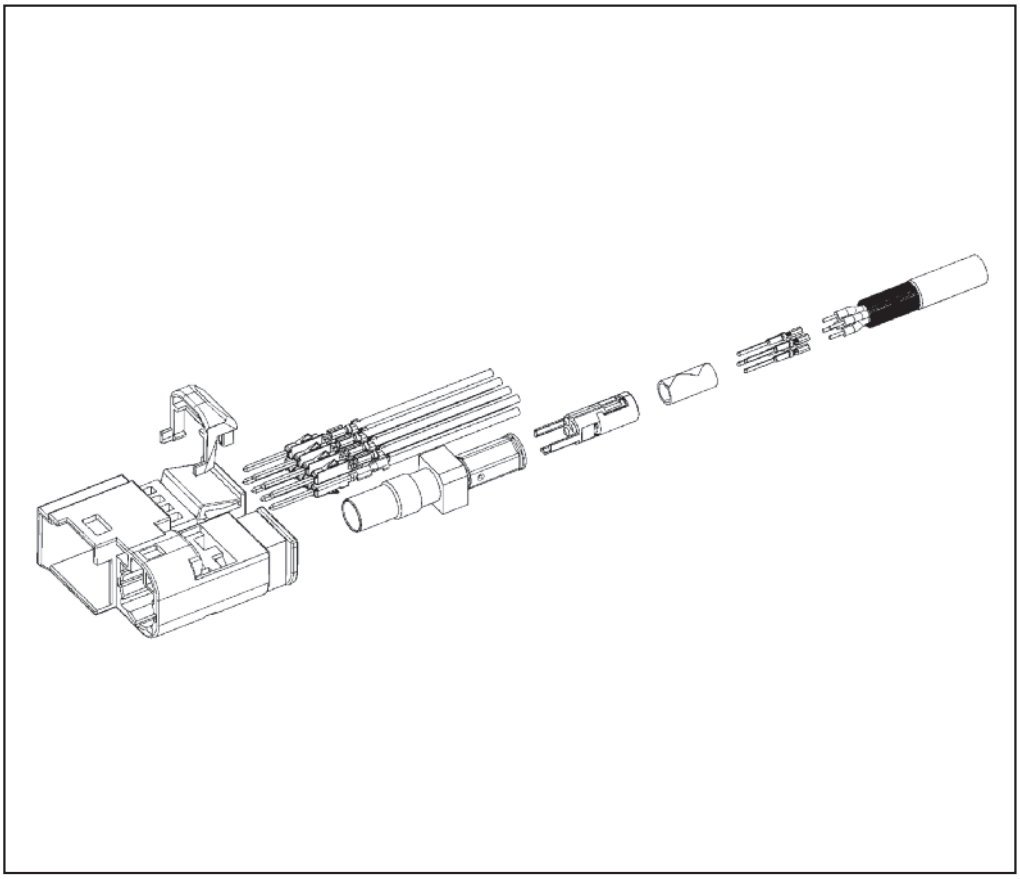
Keying Options	HSD + 2 MQS Pin Connector	MQS Contact	Cavity block	Shield	HSD Contact
Z	2177954	963716	1823901	1823902	2112027

HSD 180° + 8 MQS Contact (female)



Keying Options	HSD + 8 MQS female	8 MQS HSG	MQS Contact	Cavity block	Shield	HSD Contact
Z	2177754	965601	144969	1823894	1823895	2112028

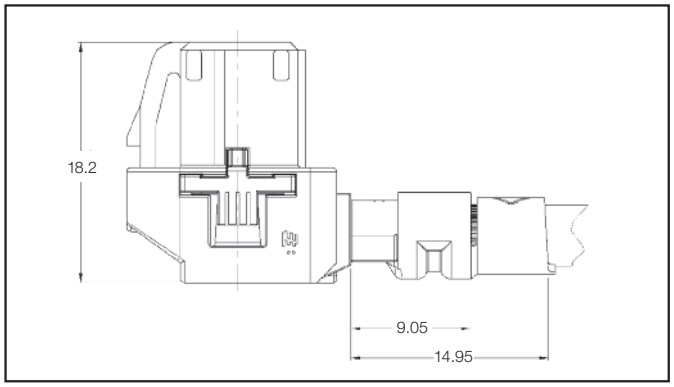
HSD 180° + 8 MQS Contact (male)



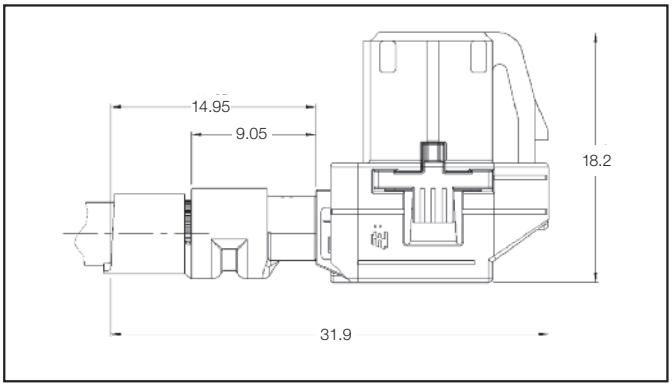
Keying Options	HSD + 8 MQS Pin Connector	MQS Contact	Cavity block	Shield	HSD Contact
Z	2177956	963716	1823901	1823902	2112027

HSD 90° and HSD 180° Overview

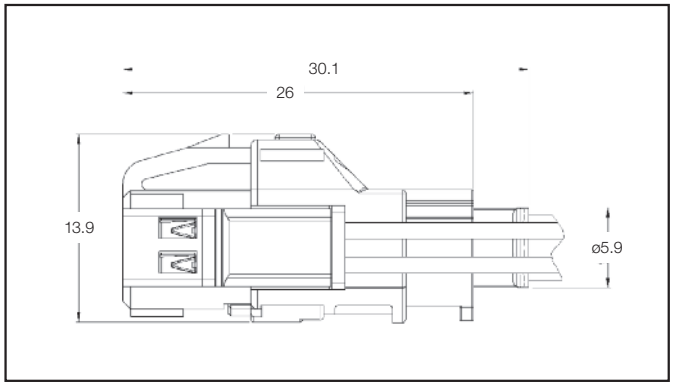
HSD 90° Receptacle Up



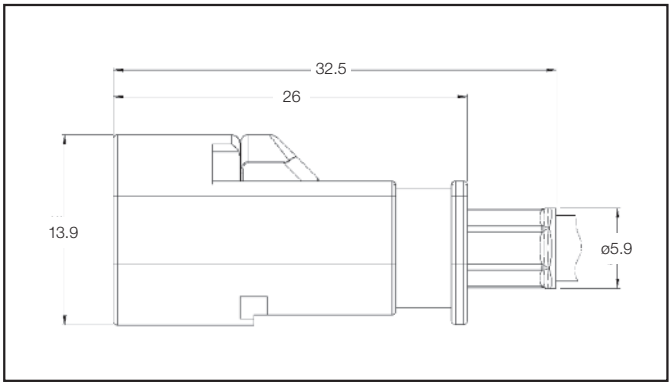
HSD 90° Receptacle Down



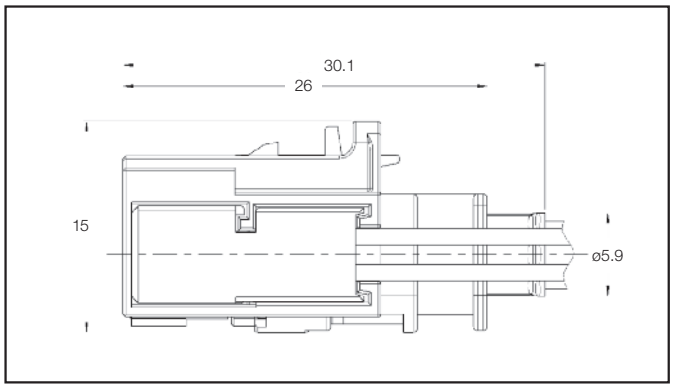
HSD 180° + 2 MQS Female



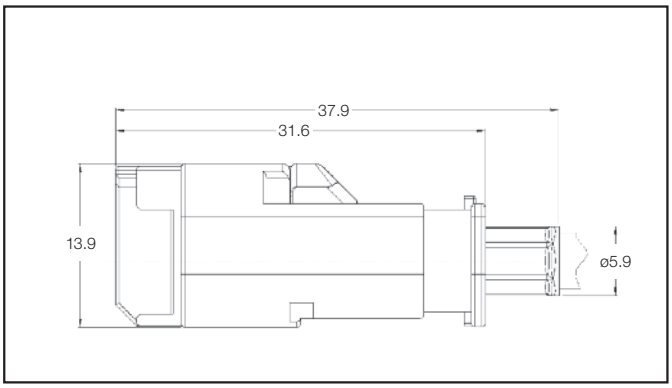
HSD 180° + 2 MQS Male



HSD 180° + 8 MQS Female

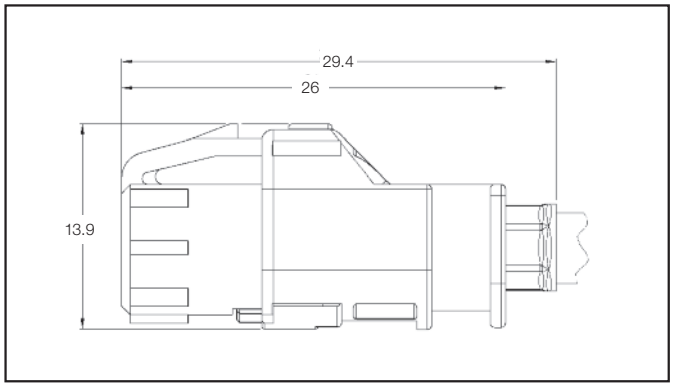


HSD 180° + 8 MQS Male

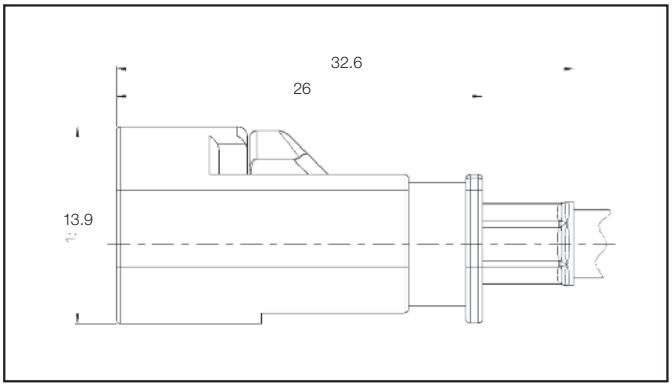


HSD 180° Overview

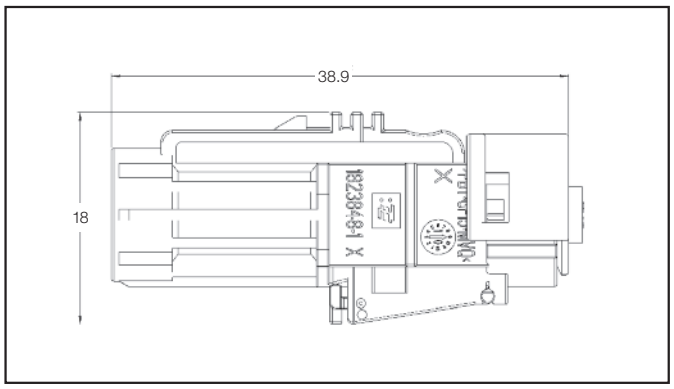
HSD 180° unsealed, Female



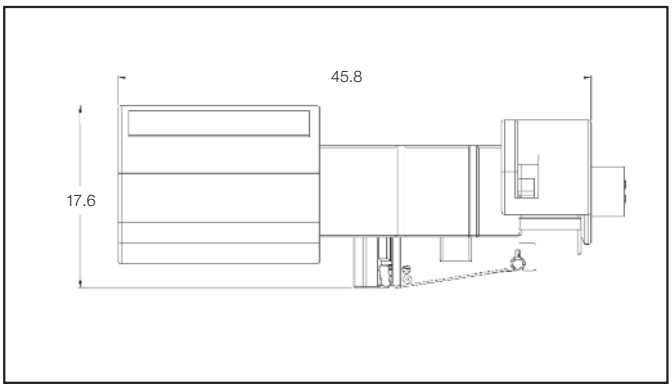
HSD 180° unsealed, Male



HSD 180° sealed, Female



HSD 180° sealed, Male



Engineering Notes

As automated as you like

Flexibility for connector production

TE Connectivity offers a range of tooling for producing cables with male or female connectors in either 180° or 90° formats – from the initial wire preparation process right through to the finished connector. Depending on your needs, you can choose between different levels of automation, from compact single-function machines to advanced multi-stage devices. Making our machines the ultimate flexible solution for connector production.

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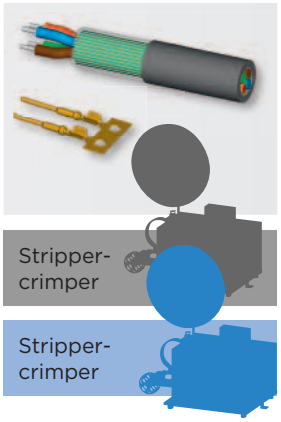
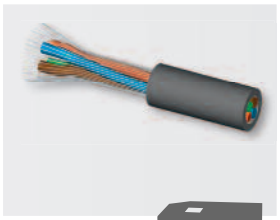
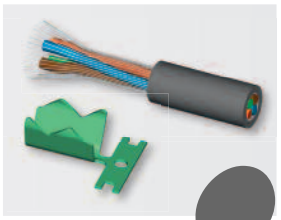
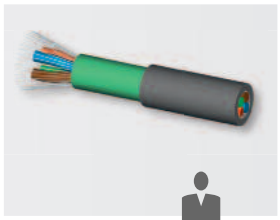
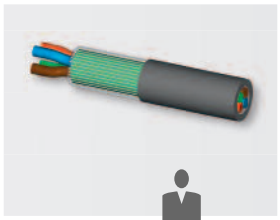
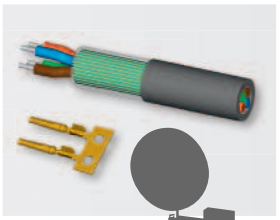
Pin 180°

5 First cut: stripping and crimping



Pin 180° / Socket 180° / Socket 90°

Socket 180°

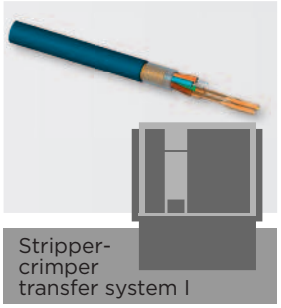
1 Wire feeding, cut and dismantle	2 Impedance barrel crimping	3 Braid turn over	4 Foil and infill cutting	5 First cut: stripping and crimping
				
AL I: Cutting and stripping machine	AL I: Crimp terminator with applicator	AL I: Manual process	AL I: Manual process	AL I: Stripper-crimper
AL II: Fully automatic lead maker with crimp terminator and braid turn over			AL II: Manual process	AL II: Stripper-crimper

Tool kit

For repair purposes

Socket 90°

5 Short socket contact First cut: stripping and crimping

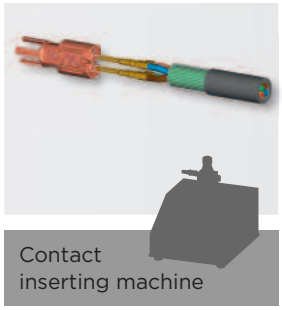
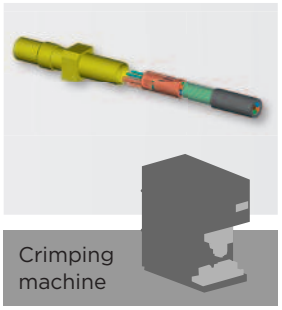
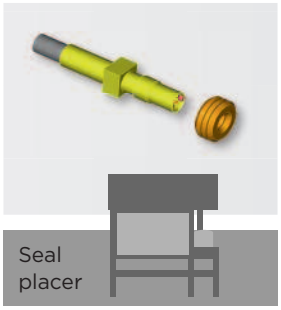
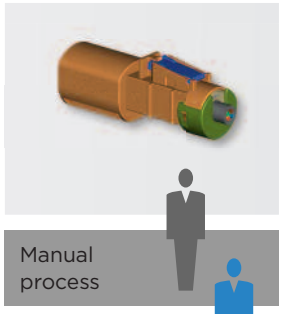


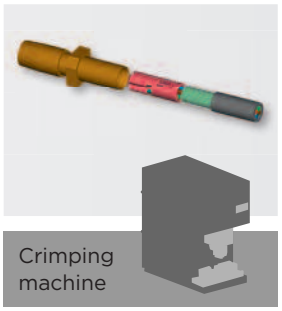
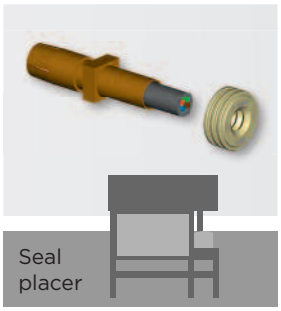
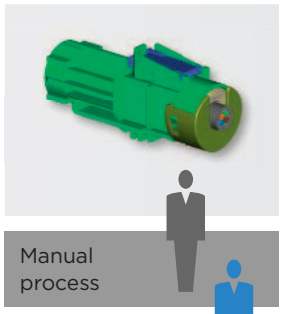
AL I Automation Level I

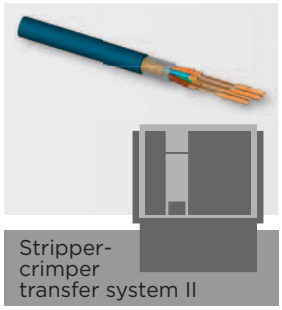
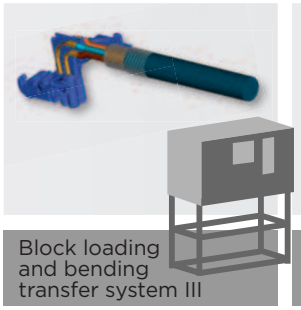
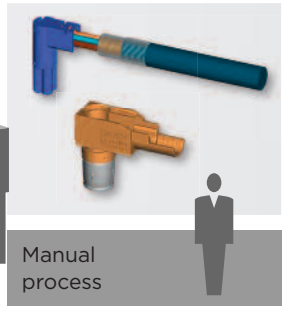
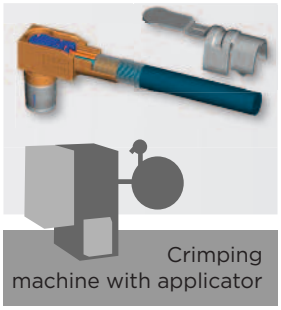
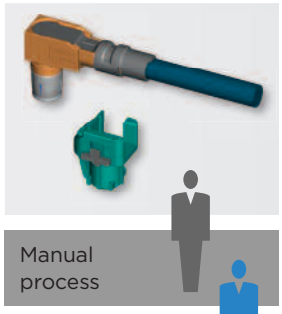
AL II Automation Level II

optional

Fully automatic transfer

6 Contact block loading	7 Shield contact mounting and crimping	8 Housing assembly	8.1 Seal placing	8.2 Housing / seal assembly
				
Contact inserting machine	Crimping machine	Manual process	Seal placer	Manual process
Automatic contact inserting and crimping machine		Manual process	Seal placer	Manual process

6 Contact block loading	7 Shield contact mounting and crimping	8 Housing assembly	8.1 Seal placing	8.2 Housing / seal assembly
				
Contact inserting machine	Crimping machine	Manual process	Seal placer	Manual process
Automatic contact inserting and crimping machine		Manual process	Seal placer	Manual process

6 Long socket contact First cut: stripping and crimping	7 Block loading, contact bending and housing closure	8 Contact housing and shielding assembling	9 Crimping of shielding assembly and cover	10 Housing assembling
				
Stripper-crimper transfer system II	Block loading and bending transfer system III	Manual process	Crimping machine with applicator	Manual process
system in development				Manual process

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