

**MD Group**  
**HANDLING INSTRUCTION**  
For assembled Multi-Core-Cables for the data  
transmission in the automotive sector

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# 1 List of Abbreviations

<b>MCC</b>	<u>M</u> ulti- <u>C</u> ore- <u>C</u> able
<b>HSD</b>	<u>H</u> igh <u>S</u> peed <u>D</u> ata
<b>Assembled cables</b>	Cables consisting of goods on reels and connector(s)
<b>Coding</b>	Unambiguous distinction of the coding housings in terms of geometry and color
<b>Interface specification</b>	Definition of an electrical supply terminal on the basis of the geometry and the mechanical and electrical properties
<b>OEM</b>	<u>O</u> riginal <u>E</u> quipment <u>M</u> anufacturer
<b>DMU/PMU</b>	<u>D</u> igital <u>M</u> ock <u>U</u> p/ <u>P</u> hysical <u>M</u> ock <u>U</u> p
<b>Customer</b>	Requester or ordering party of the assembled cables (OEM, Tier1, other customers)

## 2 Range of Application

This instruction describes the intended installation and the intended handling of assembled Multi-Core-Cables of the MD Group. The data and values indicated in this handling instruction refer to the technical specifications of the individual components and to the experiences in the automotive field of application. The (mechanical, electrical, thermal and environmental) requirements are binding for the intended use and for the handling of the products.

## 3 General Specifications

When handling assembled cables and their components, all mechanical influences that are not caused by the mating process itself have to be avoided. It has to be always considered that strong deformations (e.g. by the load of heavy objects or by stepping on the cables and their add-on parts) are not allowed and have to be avoided during handling. In general, tensile loads are not allowed. It is not allowed to throw assembled cables (e.g. into the vehicle body). The placement of the assembled cables in the vehicle has to be adapted by the customer in the KSK design according to the installation situation (e.g. static/dynamic, engine compartment/passenger compartment, tensile loads, ...). Continuous loads (e.g. tensile loads) during operation are not covered by the manufacturer specifications (see respective data sheets) and have to be coordinated with the component manufacturer if necessary (see chapter 4). Only substances/media (e.g. lubricants) that are released according to the manufacturer's standard and OEM specification and that are qualified in combination with the assembled cables are allowed to be used in order to facilitate the processing. In order to minimize the loads on the assembled cables, an optimum design and installation of the cable harness (DMU/PMU) is to be strived for. In order to ensure this requirement, the wide variety of connectors (e.g. cable exit directions) is to be used and low loads are explicitly to be considered. Additionally, the MD document "Application Instruction" (C30301) has to be considered.

This handling instruction makes no claim to be complete. It refers to all Multi-Core-Cables, even if they are not explicitly mentioned or illustrated. Solely such handling and/or applications being defined as allowed in this document are released. Any other handling and/or applications is/are explicitly deemed to be not released and is/are the sole responsibility of the customer.

### **3.1 Interface**

Only components that are qualified and released according to the respective OEM interface specification are allowed to be used. The mating compatibility has to be ensured by the individual manufacturers.

### **3.2 Order and cleanliness**

When handling assembled Multi-Core-Cables, any type of dirt has to be avoided and order and cleanliness are required at any time.

### **3.3 Delivery and storage**

The delivery, receipt and storage of assembled cables, see also the Storage Advice MD ELEKTRONIK – finished products, must not take place outdoors without any protection. Under such conditions, the protection of the mating areas against dirt or humidity is not ensured. Additionally, UV irradiation and increased temperature can result in an unintentional aging.

### **3.4 Simplified installation by heating**

The cables must not be preconditioned above +60 °C (140 °F) for the purpose of simplified cable harness installation because this can result in an unintentional aging/damage of the cables. In consequence, this can adversely affect their function and lifetime.

### **3.5 Handling**

In order to avoid injuries during mating, disconnecting and installing cables, it is recommended to wear protective gloves.

When placing the cables in the cable harness and/or in the vehicle, no loop or similar must occur.

## 4 Mechanical and Thermal Loads

### 4.1 Tensile load

Regarding the mechanical load, Multi-Core-Cables are subject to special criteria. During processing and operation, tensile forces on the cable or the connector are not allowed.

Tensile forces between the cable and connector that will result in the malfunction of the assembly can be caused by:

- a cable length that is too short
- a cable fixation that is under tension
- an insufficient fixation and therefore damage due to self-weight, vibration or strokes
- jerky pulling (impulse)
- loops (below the bending radii)



Figure 4-1 Incorrect handling (example: impulse)



Figure 4-2 Incorrect handling (example: impulse)



Figure 4-3 Incorrect handling (example: loop)

The manufacturer specifications refer merely to qualification tests according to the required specifications for the components. These tests are only a snapshot of the moment of qualification. In case of a deviation from these requirements, a qualification according to the divergent conditions is mandatory.

### 4.2 Bending load

During the installation of assembled cables, it has to be ensured that the bending radii on all assembled cables are complied with. This applies to all variants.

#### 4.2.1 Static installation in the vehicle

For a static installation of the cables, i.e. installation without movement, the values can be found in the manufacturer specifications under the item “Bending radius” (e.g. under “Single” or at “Single bending”).

#### 4.2.2 Dynamic installation in the vehicle

For the installation with dynamically recurring bending (flexible application) of the cable (e.g. in doors, exterior mirrors or tailgates), the values can be found in the manufacturer specifications under the item “Bending radius” (e.g. under “Multiple” or at “Repeated bending”).

Loads that exceed the specifications of the individual components (connectors) have to be validated on a case-by-case basis or they must be independently tested and released by the OEM or the cable harness supplier.

#### 4.2.3 Definition of the bending radius

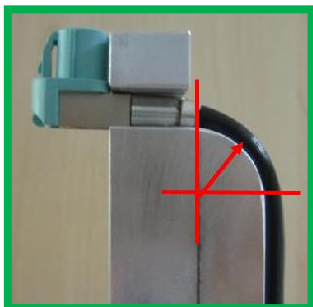


Figure 4-4 Correct bending



Figure 4-5 Incorrect bending

#### 4.2.4 Use of MQS stranded wires

If additional stranded wires are used with dynamic applications, the addition of the stranded wire length according to the bending radius has to be considered. Otherwise, the risk of damaging the points 1 – 3 arises. Furthermore, the length of the additional stranded wires has to be selected accordingly so that an axial load on the cables is avoided.

When taping, the loop of the additional stranded wires has to be in such a shape that it cannot come into contact with the outer conductor (see figure 4-6).

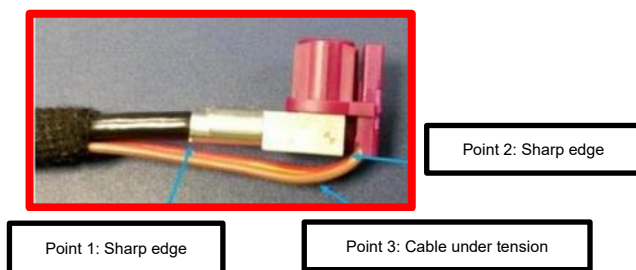


Figure 4-6 Critical points for avoiding damage (example: HSD)



Figure 4-7 Example: HSD device

### 4.3 Load due to torsion

Since in case of Multi-Core-Cables the rotation of the connector in the cable axis (see pictures of examples below) cannot be avoided due to the pitch length of the cores, it may be necessary to twist the assembled cable up to an angle of 180°. In general, it is recommended to verify this on a case-by-case basis because this significantly depends on the cable and contact (see data sheet). Regarding the taping, it has to be considered that a minimum free cable length must be complied with (see point 5.2).

#### 4.4 Combined load (bending-torsional load)

Combined loads that occur due to special applications (e.g. retracting the mirror, panorama display, retractable display, tailgate) have to be minimized by the cable



harness design. Since combined loads exceed the specified loads, it is necessary to prove the fulfillment of the application-related requirements of the customer.

Figure 4-8



Figure 4-9

#### 4.5 Thermal load

The individual components of an assembled cable have different thermal specifications. The total load limit depends on the weakest part of the assembled cable, thus specifying the area of application. The temperature ranges can be found in the component data sheets.

## 5 Add-on Parts and Taping

### 5.1 Add-on parts

The improper assembling of add-on parts can result in changed properties, damage and/or additional loads. The MD Group does not assume warranty for subsequently assembled add-on parts and affixed tapings. Additionally, the bending radii (see chapter 4.2.3) for the continuing cables (e.g. fixing elements) have to be complied with.

### 5.2 Taping of Multi-Core-Cables

When taping an assembled cable, it has to be ensured that no mechanical loads influence the cable/cables.

The non-taped minimum length between the end of the connector and the end of the taping that is specified below must be obligatorily complied with. (Separate manufacturer specifications have to be considered.)

System	Case	Distance between component and taping
HSD 4x0.14 mm <sup>2</sup>	Single HSD cable	L ≥ 30 mm
	Several cables within one taping	L ≥ 150 mm
HSD 4x0.18 mm <sup>2</sup>	Single HSD cable	L ≥ 30 mm
	Several cables within one taping	L ≥ 150 mm
HSD 4x0.50 mm <sup>2</sup>	Single HSD cable	L ≥ 50 mm
	Several cables within one taping	L ≥ 250 mm
HSDe 4x0.35 mm <sup>2</sup>	Single HSDe cable	L ≥ 30 mm
	Several cables within one taping	L ≥ 150 mm
H-MTD	Single H-MTD cable	L ≥ 50 mm
	Several cables within one taping	L ≥ 100 mm
MATenet	Single and several cables	L ≥ 200 mm
MX74	Single JUTP / STP cable	L ≥ 30 mm
	Several cables within one taping	L ≥ 100 mm
HFD U2	Single JUTP / STP cable	L ≥ 30 mm
	Several cables within one taping	L ≥ 100 mm
GEMnet	Single cable	L ≥ 50 mm
	Several cables within one taping	L ≥ 100 mm
BEAMnet	Single cable	according to manufacturer specifications
	Several cables within one taping	according to manufacturer specifications
ADTCon-UTP	Single cable	L ≥ 100 mm
	Several cables within one taping	L ≥ 150 mm
AMEC	Single and several cables	L ≥ 200 mm

Table 5-1

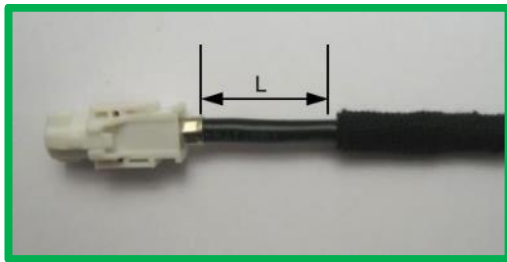


Figure 5-1 Taped single cable (example: HSD)

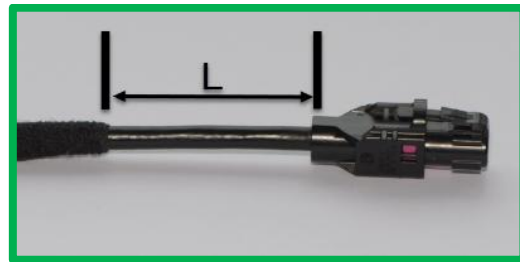


Figure 5-2 Taped single cable (example: H-MTD)



Figure 5-3 Several cables within one taping (example: HSD)

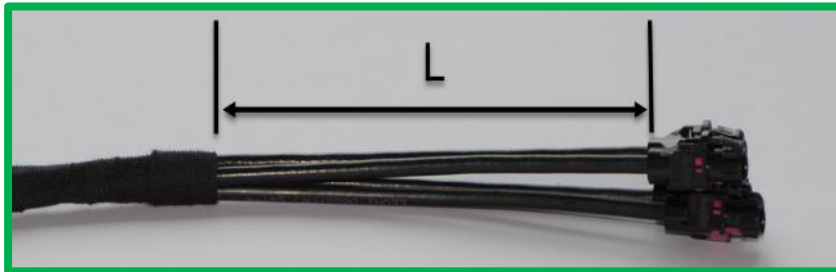


Figure 5-4 Several cables within one taping (example: double H-MTD)



Figure 5-5 Several cables (example: quad-port H-MTD with full assignment)

In case of any deviations between the MD handling instruction and the current version of the contact part manufacturer's instruction, the values of the contact part manufacturer's document must be considered. If it is necessary to use a smaller banding distance, approval from the contact part manufacturer is required.

When taping MQS stranded wires, a defined stranded wire bending must obligatorily complied with.



Figure 5-6 Taping of MQS stranded wires

When detaching the adhesive tape after the taping process has been finished, it must be ensured that the cable is not exposed to mechanical tensile load. Only adhesive tapes and auxiliary means which have been released by the OEM are allowed to be used.

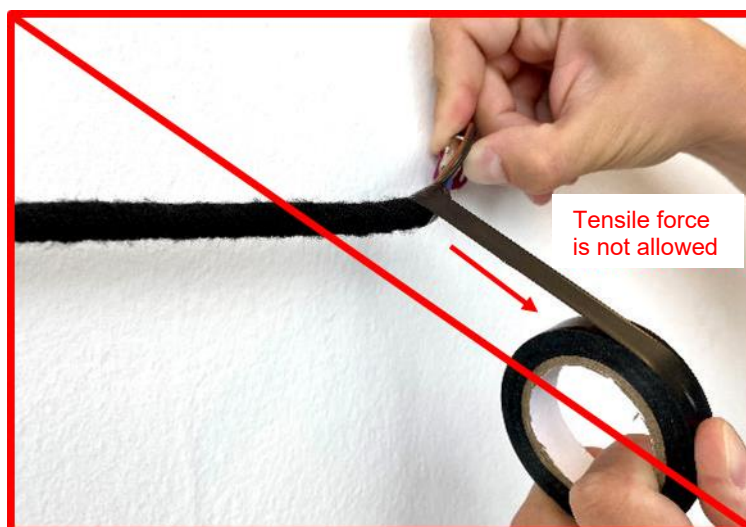


Figure 5-7 Incorrect detaching of the adhesive tape

### 5.3 Torsion-free processing in the case of multiple systems

The manner of taping and the location where the cable is fixed have a direct influence on the torsion of every single cable within the multiple system. No rotational load is allowed to occur during taping. The minimum clamping length (distance between the mated housing on the cable side and the cable fixation) ensures that a twist (torsion) of the cables towards each other is avoided. In the case of multiple systems, the minimum distance (see table 5-1) without taping/fixation has to be complied with.



Figure 5-8 Example: incorrect processing

### 5.4 Attaching fixing elements (e.g. cable ties, holders)

The cable fixation must be designed in such a way that it does not require additional physical effort when mating. Squeezing/damaging the cable by the fixing elements is not allowed. Fixing with cable ties is only allowed on taped surfaces. For fixing inline connections only fixing elements of the MD Group are allowed.

### 5.5 Splice connections

Splice connections must not be exposed to mechanical loads neither during further assembling nor during the installation in the vehicle.

## 5.6 Multiple connectors

If multiple connectors are used, it is necessary to insert the single conductors into the multiple connector cavity intended for this purpose.

Solely the customer is responsible for the correct pin assignment.

If the connector is waterproof, the watertightness specification must be complied with.

If not all slots of the waterproof connectors are assigned, it must be ensured that a released sealing element (e.g. blind plug) is used to fill them.



Figure 5-9 Check of blind plug (example: AMEC)

## 6 Mating of Assembled Cables

### 6.1 Mating process of the assembled cable

As a basic principle, it has to be ensured that the assembled cable is held during mating on the connector housing or contact (if partially assembled), but not on the cable itself. The connector has to be inserted in the correct direction into the correct slot (coding) until it locks clearly audibly.



Figure 6-1 Incorrect handling (example: HSD)



Figure 6-2 Incorrect handling (example: H-MTD)



Figure 6-3 Incorrect handling (example: AMEC)



Figure 6-4 Incorrect handling (example: AMEC)

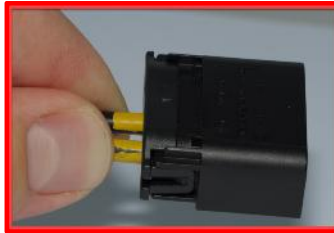


Figure 6-5 Incorrect handling (example: AMEC)



Figure 6-6 Correct handling (example: HSD)



Figure 6-7 Correct handling (example: HSD)



Figure 6-8 Correct handling (example: H-MTD)

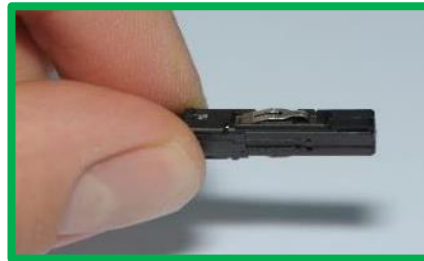


Figure 6-9 Correct handling (example: AMEC)



Figure 6-10 Correct handling (example: AMEC)

During the mating process, the housings must not tilt. Tilting may result in bent contacts. Male and female housings must be connected without any large physical effort. It is mandatory to comply with the component manufacturer's requirements.



Figure 6-11 Incorrect mating (example: HSD)



Figure 6-12 Incorrect mating (example: HSD)

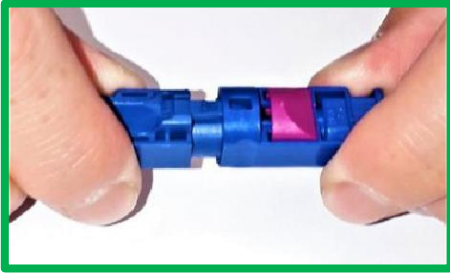


Figure 6-13 Correct mating (example: HSD)

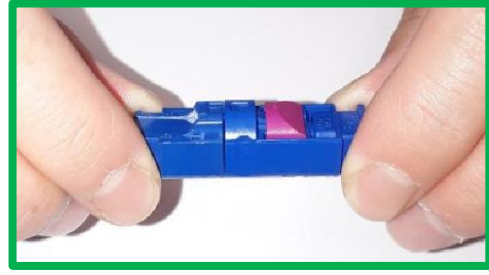


Figure 6-14 Correct mating (example: HSD)

## 6.2 Disconnecting the connectors/cable

In order to disconnect the connectors, it is necessary to follow these steps:

First push the housings together to make the connection free of forces (without load). Then push the locking latch with the finger so that the locking element opens. Finally, pull off the two connectors in axial direction. The two connectors are only allowed to be held at the housings.

Tools (such as screwdrivers, knives or similar) must not be used for pushing the locking latch.

## 6.3 Mating cycles

The quantity of the maximum permissible mating cycles is defined by the component manufacturer (data sheet) and must not be exceeded.

# 7 Positioning of the Cable Exit

For Multi-Core-Cables, there are solely fixed exit directions (left, right, up and down) which have to be taken into consideration for cable harness design.

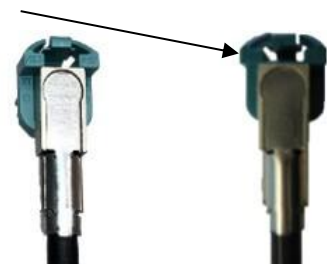
(See figure 7-1 Position lateral protrusion on the housing)



Figure 7-1 Exit right



Exit left



Exit up

Exit down

## 8 Tests

It is not allowed to mate the cables delivered and tested by the MD Group prior to the installation in the vehicle. If the OEM requires the mating in the course of a 100 % functional test, the special OEM specifications have to be observed. In this case, the MD Group does not assume warranty for any complaints after the performed test.

### 8.1 Error test

In some instances, the automotive manufacturers have specifications for tests in the event of errors. If a test is necessary, solely test devices and test adapters being suitable for the connector, both released by MD ELEKTRONIK GmbH, are allowed to be used. Only instructed persons are allowed to perform the error analysis. The test devices are designed exclusively for the diagnosis of suspicious cables in the rework zone on the customer's premises.

Sorting by means of short-circuit testers is prohibited.

These test devices can be purchased from MD ELEKTRONIK GmbH upon request. The following test devices are available:

- MD short-circuit tester for HSD/HSDe (Multi-Core-Cables)



Figure 8-1 Correct testing equipment

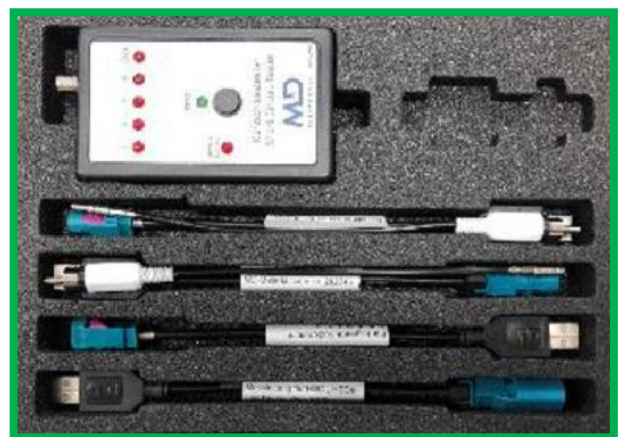


Figure 8-2 Correct testing equipment

## 8.2 Not allowed electrical tests

It is not allowed in any case to use contacts for the electrical test of assembled cables. Reason: Using contacts can damage the connector.

The following pictures show examples for tests of HSD/HSDe connectors that are not allowed:

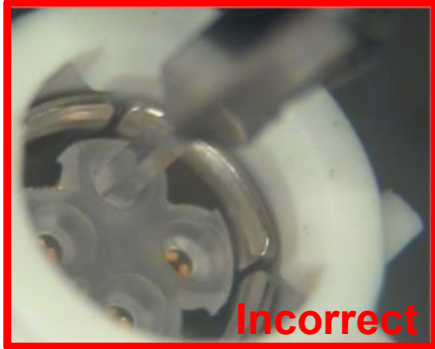


Figure 8-3 Example: HSD connector



Figure 8-4 Incorrect pin

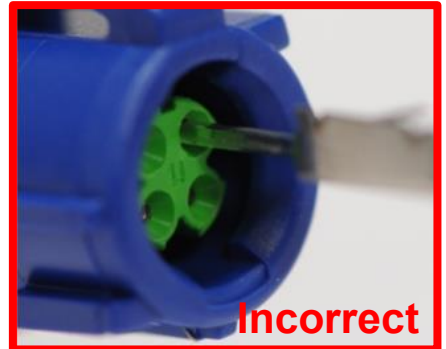


Figure 8-5 Example: HSDe connector



Figure 8-6 Example: HSD connector

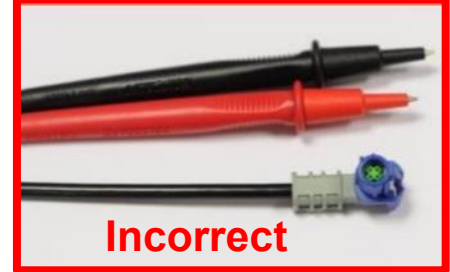


Figure 8-7 Example: HSDe connector



Figure 8-8 Example: HSD connector



Figure 8-9 Example: HSDe connector

## 9 Protection Note

If protectable information is transmitted in this handling instruction or the related drawing, MD ELEKTRONIK GmbH reserves all rights for a patent and/or protective right application. Each power of disposition, including the right of reproduction and disclosure, is the sole property of MD ELEKTRONIK GmbH.

## 10 Additional Notes

Subject to errors and changes. The original version of this handling instruction was created in German. Additionally, other language versions can be made available. If the contents of two language versions differ from each other, solely the original version applies.

## Legal Notice

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