# SMC – Receptacle with Ribbon Cable – IDC & Header

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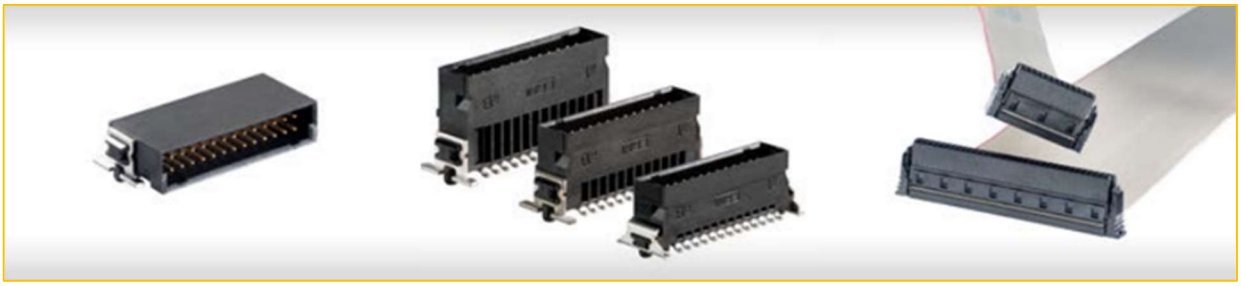
# 1. SCOPE

## 1.1. Content

This specification describes the requirements, performance and testing for the double row Insulation Displacement Connector (IDC) system SMC.

The platform is intended for use with flat ribbon cables and has pin counts from 12 to 80 positions.

SMC Female connector with cable outlet 90° in combination with Male connector PCB orientation straight or right-angled.



## 1.2. General Product Description

This double row Insulation Displacement Connector (IDC) contact system combines the features of high packing density, robust construction and highest functional requirements. Despite its miniaturized design with a grid of 1,27mm, it fulfills all requirements for a contact system suitable for use in an industrial environment and as well in automobiles on a high-performance level.

The electrical contact is made by a rectangle pin with dimension of 0.3mm x 0.42mm. The IDC socket contact has two contact points for electrical connection. The contact normal force is generated by a dual beam contact system.

The IDC contact is inseparably attached to the female housing. The IDC supports a AWG30 flat ribbon cable sizes exclusively.

A primary and secondary locking device (TPA) is not needed for IDC connection.

A Connector Position Assurance (CPA) is not available.

The connector system is unsealed.

## 1.3. Qualification

When tests are performed for the System, procedures specified in Chapter **Fehler! Verweisquelle konnte nicht gefunden werden.** shall be used.

All tests must be carried out according to the associated inspection plans and drawings.

## 1.4. Qualification Test Results

The product performs the electrical, mechanical and climatic requirements of Chapter 3.5

## 2. APPLICABLE DOCUMENTS AND FORMS

The following documents constitute a part of this specification to the extent specified herein. Unless otherwise indicated, the latest edition of the document is applicable.

### 2.1. TE Documents

- 114-160992: Application Specification (SMC IDC Socket Housing)
- 114-TBD: Application Specification (SMC SMT Male Housing)
- 107-TBD: Product Packaging Specification
- 501- …….: Qualification Test Report

| | Industrial + MIL | Industrial UL | Automotive | Automotive |
|---|---|---|---|---|
| Specification | IEC60603*<br>EN 60352-2** | UL 1977 (USR)<br>UL/CSA | USCAR2<br>USCAR21 | LV214 |
| Test Report No | 501-917e_IND*<br>501-918e_IND** | File E84703 | - | 501-3001_AE<br>501-3002_AE<br>501-3003_AE |

* Connector Qualification

** Ribbon Cable Qualification

### 2.2. Industry Documents and Standards

- DIN/IEC 60512 Electromechanical components for electrical equipment, basic testing procedures and measuring methods
- DIN EN 60068 Environmental testing
- EN 60352-4 Solderless connections – solderless non-accessible insulation displacement connections; General requirements
- IEC 60603-2 Connectors for frequencies below 3MHz for use with printed boards
- MIL-STD-1344A Military Standard – Test for Electrical Connectors
- UL1977 Component Connectors for Use in Data, Signal, Control and Power Applications (Rev 3: 2007-12)
- LV214 Motor Vehicle Connectors (VW75174:2018-10; VW75174:2010-04)
- IPC/JEDEC J-STD-020 Moisture/Reflow Sensitivity Classification for Non-hermetic Solid State Surface Mount Devices

### 2.3. Reference Document

- 109-197 Test Specification (TE Test Specification vs EIA and IEC Test Methods)

## 3. REQUIREMENTS

### 3.1. Design and Construction

Product shall be of the design, construction, materials and physical dimensions specified on the applicable product drawing.

The product has the following ratings (operating):

| | Industrial + MIL | Industrial UL | Automotive | Automotive |
|---|---|---|---|---|
| Specification | IEC60603 | UL 1977** (USR) | USCAR2 USCAR21 | LV214 |
| Temperature Class - Au | -40°C to 125°C | (130°C)** | - | -40°C to 125°C |
| Vibration Class - Sinusoidal - Random - Shock | Performance Category 1 10-2000Hz/ 7,5h/ 20g 30-1050Hz/ 20h/ 3,5g; 1,2g 10 shocks @ 50g/ 11ms | - | - | PG17 S2 |
| Sealing Class IP Class (IEC 60529) | IP00 | | - | Unsealed |
| Operating Voltage ($U_{RMS}$) | 10VDC* | | | |
| Durability Mating Cycles - Au | Performance Category 1 500 cycles | - | - | 100 cycles |
| Current Carrying Capability (AWG30) | - | - | - | 1,23A (20-pole) 0,98A (40-pole) 0,91A (80-pole) |
| Wire Size | 0,13mm² AWG26 | | | |
| IDC Qualification | DIN EN 60352-4 | - | - | LV214*** DIN EN 60352-4 |
| Flammability (Connector HSG Components) | UL94 V0 | | | |

* Voltage Rating is in accordance with IEC 60 664-1 (DIN VDE 0110) – corresponding to C&C, CTI and Pollution Degree 2

** Base Material Temperature Rating for Molding Materials (Male/Female)

*** Applicable and Relevant Test Groups

### 3.2. Materials

| Description | Material | Color<br>* with Mechanical Coding | Characteristics |
|---|---|---|---|
| Female housing | LCP reinforced | black | CTI = 175 |
| Cable guide | LCP reinforced | black | CTI = 175 |
| Female IDC contact | Copper Alloy | | |
| Plating connection area | Sn over Ni | | |
| Plating contact area | Au finish | | |
| Male housing (angled) | LCP reinforced | black | CTI = 175 |
| Male contact (angled) | Copper Alloy | | |
| Plating connection area | Sn over Ni | | |
| Plating contact area | Au finish | | |
| Male housing (straight) | LCP reinforced | black | CTI = 175 |
| Male contact (straight) | Copper Alloy | | |
| Plating connection area | Sn over Ni | | |
| Plating contact area | Au finish | | |

### 3.3. Ratings

| Pin count | Voltage Rating<br>($U_{RMS}$) | Maximum Current[2]<br>(AWG30) | Ambient Temperature[3] for operation | Maximum Operating temperature[4] |
|---|---|---|---|---|
| 12-80 | 10 VDC[1] | 1.6 at 20 °C<br>0.9 at 90 °C<br>0.5 A at 110°C<br>0.0 A at 125°C | -40 °C to 125 °C<br><br>Additional restrictions may result from the applied wire. | 125 °C with 0 A<br><br>Additional restrictions may result from the applied wire. |

[1] Voltage Rating is in accordance with IEC 60 664-1 (DIN VDE 0110) – corresponding to C&C, CTI and Pollution Degree 2.
[2] Maximum current for 12-pin connector (type Q male header 90°& type B female receptacle 90°) on Standard one-layer FR4 PCB. For other number of poles the number of poles specific derating curve must be applied.
[3] Environmental temperatures wherein the assembly is allowed to operate in.
[4] Maximum operating temperature - including temperature rise of the contacts by applying an electrical current.

| | |
|---|---|
| **Applicable Wire**<br>Flat Ribbon Cable | AWG 30/7Sn (7x0,102 / 0,06mm²)<br>AWG 30/7Ag (7x0,102 / 0,06mm²)<br>  |
| | |

## 3.4. Quality Assurance Provision

### 3.4.1. Operation Mode

- Pollution degrees 2 addition: restricted to a non-condensing environment. (IEC 61010-1)
- Overvoltage category 2 (IEC 60664-1)
- Maximum operating altitude 2000 m (IEC 60664-1)
- Condensation: Not permitted
- Icing: Not permitted
- Precipitation, rainfall: Not permitted
- Water (except rainfall): Not permitted
- Moisture: Permitted

### 3.4.2. IP Protection Class

- IP00 Female housing type P cable outlet 90°

### 3.4.3. Storage Condition

- According to IEC 60721-3-1 Class 1K4

### 3.4.4. Technical Cleanliness

- VDA Band 19 / ISO 16232, max. metallic flitter size: 400µm

### 3.4.5. Soldering and MSL

- IPC/JEDEC J-STD-020
- MSL 1

### 3.4.6. Test Condition

Unless otherwise specified, all tests shall be performed at ambient environmental conditions.

| | |
|---|---|
| Temperature | 15 – 35 °C |
| Relative humidity | 25 - 75% |
| Atmospheric pressure | 86 – 106 kPa |

3.5. Test Requirements and Procedures Summary

Unless otherwise specified, all tests shall be performed at ambient environmental conditions.

**Test Coverage:**

IEC 60603-2 Connectors for frequencies below 3MHz for use with printed boards - performance level 1

MIL-STD-1344A Military Standard – Test for Electrical Connectors

LV214 Motor vehicles connectors - according to the qualification matrix LV214-1.

| TEST DESCRIPTION | REQUIREMENT | PROCEDURE |
|---|---|---|
| | **VISUAL / GENERAL** | |
| **LV214 TG0 / TG1**<br>Initial examination of product /<br>Visual inspection<br>Dimensions | Meets requirements of product drawing (drawing conformity) | VW75174:2018-10<br>E0.1 / DIN EN 60512-1-1<br>E1.1 / DIN EN 60512-1-2 |
| **LV214 TG1**<br>Dimension of processed components<br><br>**DIN EN 60352-4**<br>Solderless connections - IDC | Meets requirements of product drawing (drawing conformity) | VW75174:2018-10<br>E1.2 / DIN EN 60512-1-2<br><br>DIN EN 60352-2 ZP1 |

| | ELECTRICAL | |
|---|---|---|
| **LV214 – TG0**<br>**Inspection of as-received condition** | | VW75174:2018-10 |
| Volume resistance | R < 50mΩ (AWG30) | P 0.2 / DIN EN 60512-2-1 |
| Insulation resistance | $R_{ins}$ > 100MΩ at U=500V, t=60s | P 0.3 / DIN EN 60512-3-1 |
| **DIN EN 60603-2 – P3**<br>**Contact resistance** | R ≤ 25mΩ | DIN EN 60512-2-1<br>MIL STD-1344 A 3002.1 |
| **DIN EN 60603-2 – P4**<br>**Insulation resistance** | R ≥ $10^{10}$ Ω | DIN EN 60512-3-1<br>MIL STD-1344 A 3003.1 |
| **DIN EN 60603-2 – P5**<br>**Voltage proof** | $U_{test}$ = 500$V_{eff}$ (contact/contact) | DIN EN 60512-4-1<br>MIL STD-1344 A 3001.1 |
| **LV214 – TG12**<br>**Current heating, derating** | | VW75174:2018-10 |
| Derating without contact housing | Documentation and Determination Nominal current $I_{nom}$ | P 12.2 n.a.<br>Contact parts are inseparably attached to the housing. It is not possible to assemble the wire without a housing. |
| | $I_{nominal}$ = 1,23A (20-pole)<br>$I_{nominal}$ = 0,98A (40-pole)<br>$I_{nominal}$ = 0,91A (80-pole) | For nominal current ($I_{nom}$ /$I_{test}$) a current I [A] from TG13 derating curve at 80°C ambient temperature is used. |
| **LV214 – TG13**<br>**Influence of the contact housing on the derating** | See Chapter **4.1** Derating - Number of Poles Specific | VW75174:2018-10 |
| Derating with contact housing | | P13.2 |
| **LV214 – TG14**<br>**Thermal time constant (current overtemperature at n times the nominal current)** | See Chapter **4.3** Thermal Time Constant – LV214 TG14 | VW75174:2018-10 |
| Thermal time constant | | P 14.1<br>The nominal current $I_{nom}$ is picked from TG13 (at 80°C ambient temperature)<br>$I_{nominal}$ = 1,23A (20-pole)<br>$I_{nominal}$ = 0,98A (40-pole)<br>$I_{nominal}$ = 0,91A (80-pole)<br>Wire Size: AWG30<br>$T_{max}$: 125°C |
| P 0.1 Visual inspection | No defects were detected.<br>No changes on the contact surfaces were detected. | |

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| **DIN EN 60603-2 – Test Batch DP** | | |
| Gauge retention force | $F_{contact\ retention} \geq 0{,}1N$ (per contact) | DP0 / DIN EN 60512-16-5 |
| Mechanical operation | Carry out | DP1 / DIN EN 60512-9-1<br>MIL STD-1344 A 2016<br>V = ≤ 10mm/s<br>Rest period: ≤ 30s (not inserted)<br>No of cycles: 250 |
| Electrical load and temperature | | DP2 / DIN EN 60512-9-2<br>MIL STD-1344 A 1005<br>T = 125°C<br>I = [A] not applied<br>t = 1000h |
| Contact resistance | R ≤ 25mΩ | DP3 / DIN EN 60512-2-1<br>MIL STD-1344 A 3002.1 |
| Gauge retention force | $F_{contact\ retention} \geq 0{,}1N$ (per contact) | DP0.1 / DIN EN 60512-16-5 |
| Voltage proof | $U_{test} = 500V_{eff}$ (contact/contact) | DP4 / DIN EN 60512-4-1<br>MIL STD-1344 A 3001.1 |
| Visual examination | No faults | DP8 / DIN EN 60512-1-1 |

| | MECHANICAL | |
|---|---|---|
| **LV214 – TG4** | | |
| **Contact overlap** | | VW75174:2018-10 |
| Contact overlap | Contact overlap 2.24mm<br>Clearance 0.78mm | P 4.1 CAD determined |
| **LV214 – TG6** | | |
| **Interaction between contact and contact housing** | | VW75174:2018-10 |
| Function of the primary locking device/latch play | n.a., contact parts are inseparably pre-assembled in the housing (state of delivery) | P 6.2 |
| Function of the secondary locking device/latch play | | P 6.3 |
| Actuation forces for the secondary locking device | n.a. IDC connector has no secondary locking | P 6.4 |
| Drop test | while drop test the pre-latched parts remain in pre-latched position - transport of unequipped contact housings<br>assembled parts stay assembled - transport of equipped contact housings | L 6.1 |

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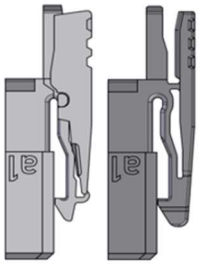
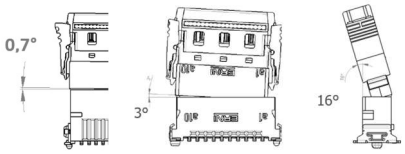
| **LV214 – TG7**<br>**Handling and functional reliability of the contact housings** | | VW75174:2018-10 |
| Distinctiveness of the unequipped contact housings (keying/polarization) | $F_{keying}$ ≥ 50 N (0,5mm blade size) | P 7.1 / DIN EN 60512-13-5 |
| Holding force of the contact housing latching/locking | $F_{holding}$ > 60N (12 to 80-pin) Design 2<br>$F_{holding}$ > 20N (12 to 80-pin) Design 1<br>  <br>Design 1 Design 2 | P 7.2 / DIN EN 60512-15-6 |
| CPA function check | n.a. The connector system has no CPA feature | P 7.3 |
| Insertion force or actuation force for insertion and extraction aids | $F_{insertion}$ < 75N<br>(typical <30N for 80-pole Design 2) | P 7.4 |
| **LV214 – TG8**<br>**Insertion and holding forces of the contact parts in the contact housing** | n.a., contact parts are inseparably pre-assembled in the housing (state of delivery) | VW75174:2018-10 |
| **LV214 – TG9**<br>**Pin insertion angle / misuse-proofing (scoop-proofing)** | | VW75174:2018-10 |
| Scoop proof testing of contact housing | SMC IDC do not meet the requirement for scoop-proofing.<br><br>Maximum allowed mating angle:<br>  <br><br>80-pole & 20-pole | P 9.3 CAD determined |

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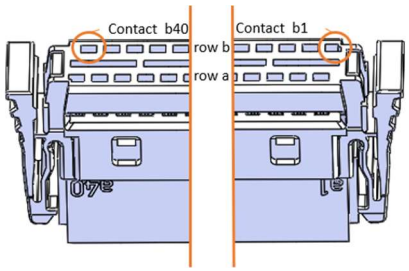
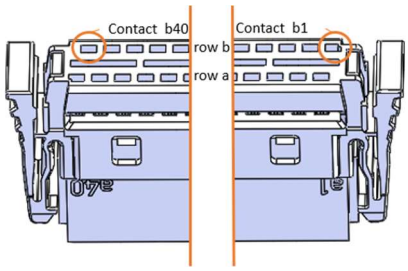
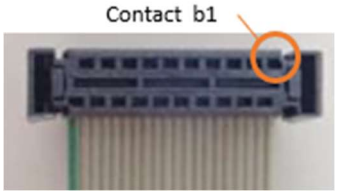
| **LV214 – TG10**<br>**Contacts: conductor pull-out strength** | | VW75174:2018-10 |
| Conductor pull-out strength<br>(only in connection with crimp) | n.a. | P 10.1 |
| Pull-out force from the IDC<br>(only in connection with IDC) | $F_{pull-out}$ > 50N (AWG30 ribbon cable) | P 10.2 |
| **LV214 – TG11**<br>**Contacts: insertion and extraction forces, number of mating cycles** | | VW75174:2018-10 |
| Insertion and removal force | $F_{insert/extract}$ < 25% Change of insertion / extraction force before and after load | P 11.1 |
| Number of mating cycles | AU: 100 mating cycles | L11.1 |
| **DIN EN 60603-2 – Test AP - AP1**<br>**Gauge retention force** | $F_{contact\ retention}$ ≥ 0,1N (per contact) | DIN EN 60512-16-5 |
| **LV214 – TG17** (12 - 68-pole)<br>**Dynamic load** | | VW75174:2018-10 |
| Volume resistance | $R_{before/after\ test}$ ≤ 50 mΩ | P 0.2 / DIN EN 60512-2-1<br>After deduction of the cable resistance, the final contact resistances P0.2 ≤ 50 mΩ |
| Volume resistance – continuous monitoring during mechanical loads L17.1 & L17.2 | No current interruption<br>(> 1 µs / >7 Ω) | P 14.0 Test is performed according to Severity level 2 (body – sealed) |
| Dynamic load, sinusoidal | | L 17.1 / DIN EN 600068-2-6<br>No sine wave load at S2 |
| Dynamic load, broadband noise | | L 17.2 / DIN EN 60068-2-64<br>$a_{RMS}$ 27.8m/s²; t = 20h per axis |
| Shock durability testing | | L 17.3 / DIN EN 60068-2-27<br>a = 30g; t = 6ms; shocks 6000 |

| | | |
|---|---|---|
| **LV214 – TG17** (80-pole)<br>**Dynamic load** | | VW75174:2018-10 |
| Volume resistance | $R_{before/after\ test}$ ≤ 50 mΩ<br>Outmost contacts show a slightly increased contact resistance, result is below the limit of ≤ 50 mΩ,<br>**Deviate from that applies:**<br>**Contact $b_1$ $R_{after\ test}$ < 7Ω** | P 0.2 / DIN EN 60512-2-1<br>After deduction of the cable resistance, the final contact resistances P0.2 ≤ 72 mΩ |
| Volume resistance –<br>continuous monitoring during mechanical loads L17.1 & L17.2 | No current interruption<br>(> 1 µs / >7 Ω)<br>  | P 14.0<br>Test is performed according to Severity level 2 (body – sealed) |
| **DIN EN 60603-2 – Test Batch AP** | | |
| Gauge retention force | $F_{contact\ retention}$ ≥ 0,1N (per contact) | AP1 / DIN EN 60512-16-5 |
| Total insertion and withdrawal force | $F_{I\&W}$ ≤ 26N (50-pole)<br>$F_{I\&W}$ ≤ 40N (80-pole) | AP2 / DIN EN 60512-13-2<br>MIL STD-1344 A 2013.1 |
| Solderability | Not applicable | AP3 / DIN EN 60512-12-1 |
| Voltage proof | $U_{test}$ = 500$V_{eff}$ (contact/contact) | AP4 / DIN EN 60512-4-1<br>MIL STD-1344 A 3001.1 |
| Vibration sinusoidal<br>Monitoring contact break | Contact break ≤ 1 µs | AP6 / DIN EN 60512-6-3<br>MIL STD-1344 A 3004.1<br>a = 1,5mm or 20g<br>f = 10 – 2000Hz<br>t = 7,5h<br>No of cycles = 10 |
| Shock<br>Monitoring contact break | Contact break ≤ 1 µs | AP7 / DIN EN 60512-6-3<br>MIL STD-1344 A 1003.1<br>a = 490m/s (50g) half sine:<br>3,43m/s²<br>t = 11ms<br>No of cycles: 10 shocks/axis |
| Rapid change of temperature | Carry out | AP9 / DIN EN 60512-11-4<br>MIL STD-1344 A 1003.1<br>T = -55°C to +125°C<br>t = 30 min<br>No of cycles = 5 |
| Insulation resistance | R ≥ $10^{10}$ Ω | AP10 / DIN EN 60512-3-1<br>MIL STD-1344 A 3003.1 |
| Voltage proof | $U_{test}$ = 500$V_{eff}$ (contact/contact) | AP11 / DIN EN 60512-4-1<br>MIL STD-1344 A 3001.1 |

| | | |
|---|---|---|
| Visual examination | No faults | AP12 / DIN EN 60512-1-1 |
| Climatic sequence | Carry out | AP13 / DIN EN 60512-11-1 |
| Dry heat | | 13.1 / DIN EN 60512-11-9<br>T = +125°C<br>t = 16h |
| Damp heat, cyclical | | 13.2 /DIN EN 60512-11-13 variant 1 |
| Cycle 1 | | T = 55°C |
| Cold | | 13.3 / DIN EN 60512-11-10<br>T = -55°C |
| Damp heat, cyclical | | 13.5 / DIN EN 60512-11-1 |
| Cycle 2 - 6 | | T = 55°C |
| Insulation resistance | $R \geq 10^{10}\ \Omega$ | AP14 / DIN EN 60512-3-1<br>MIL STD-1344 A 3003.1 |
| Contact resistance | $R \leq 25m\Omega$ | AP15 / DIN EN 60512-2-1<br>MIL STD-1344 A 3002.1 |
| Voltage proof | $U_{test} = 500V_{eff}$ (contact/contact) | AP16 / DIN EN 60512-4-1<br>MIL STD-1344 A 3001.1 |
| Total insertion and withdrawal force | $F_{I\&W} \leq 26N$ (50-pole)<br>$F_{I\&W} \leq 40N$ (80-pole) | AP17 / DIN EN 60512-13-2<br>MIL STD-1344 A 2013.1 |
| Visual examination | No faults | AP18 / DIN EN 60512-1-1 |

| | ENVIRONMENTAL | |
|---|---|---|
| **LV214 TG5** | | |
| Mechanical and thermal relaxation behavior | | VW75174:2010-04 |
| Contact normal force | | |
| Unused | ≥ 0,1 N | E5.2 (retention force with gauge) |
| After B5.3 aging in dry heat | ≥ 0,1 N | E5.2 (retention force with gauge)<br>B5.3 / DIN EN 60068-2-2 /Test B<br>1000 h @ 125°C |
| **LV214 – TG15** | | |
| **Electrical stress test** | | VW75174:2018-10 |
| Volume resistance | $R_{before/after\ test} \leq 50\ m\Omega$ (AWG30) | P 0.2 / DIN EN 60512-2-1 |
| Derating (before/after test) | $I_{nominal\ change} < 20\%$ | P12.2 / DIN EN 60512-5-2 with housing<br>$I_{nom}$ = 2,98A / 2,8A (20-pole)<br>3,0A / 3,0A (40-pole)<br>3,3A / 3,3A (80-pole) |
| Temperature/ current cycle endurance test: | | B15.2 / 60 cycl. -40°C/$T_o$=125°C<br>$I_{test}$= 3,7A (20-pole); 3,0A (40-pole)<br>3,8A (80-pole) |

| | | |
|---|---|---|
| Humidity heat, cyclic:<br><br>Temperature/ current cycle endurance test: | | B15.3 / DIN EN 60068-2-30<br>21x1day @ 25°C/55°C @ 95%RH<br>B15.2 |
| **LV214 – TG18A**<br>**Coastal climate load**<br>Volume resistance<br><br>Salt spray, cyclic | $R_{before/after\ test}$ ≤ 50 mΩ | VW75174:2018-10<br>P 0.2 / DIN EN 60512-2-1<br><br>B 18.2 / DIN EN 60068-2-52<br>Severity 3 |
| **LV214 – PG19**<br>**Environmental simulation**<br>Volume resistance | **Connector 12-pole to 40-pole**<br>$R_{before/after\ test}$ ≤ 50 mΩ<br><br>**Connector 50-pole to 80-pole**<br>$R_{before/after\ test}$ ≤ 50 mΩ<br>**Deviate from that applies:**<br>Contact resistance of contact $b_1$, $a_1$ & $b_n$, $a_n$ increases after temperature load.<br>*Contact $b_1$, $a_1$, $b_n$, $a_n$ $R_{after\ test}$ < 7Ω | VW75174:2018-10<br>P 0.2 / DIN EN 60512-2-1 |
| Temperature shock | | L 19.1 / DIN EN 60068-2-14, Test Na<br>Duration: 144 cycles (72h)<br>Temperature: -40 °C/130°C<br>(a 15min; ↕10s) |
| Temperature change |  | L 19.2 / DIN EN 60068-2-14, Test Nb<br>Duration: 20 cycles<br>Temperature: -40 °C/130°C<br>(a 3h; ↕ 2h) |
| Aging in dry heat |  | L 19.3 / DIN EN 60068-2-2, Test B<br>Duration: 120 h<br>Temperature: 130°C |
| Industrial climate (multi-component climate) | * n-contact for:<br>50-pin: $a_n = a_{25}$ ; $b_n = b_{25}$<br>68-pin: $a_n = a_{34}$ ; $b_n = b_{34}$<br>80-pin: $a_n = a_{40}$ ; $b_n = b_{40}$ | L 19.4 / DIN EN 60512-11-7<br>Duration: 21d<br>SO2, 0,2 ppm<br>H2S, 0,01 ppm<br>NO2, 0,2 ppm<br>CI2 0,01 ppm<br>Temperature: 25°C<br>Humidity: 75% RH<br>Flow rate: 1 m³/h |

| | | |
|---|---|---|
| Damp heat, cyclic | | L 19.5 / DIN EN 60068-2-30, variant 2<br>Duration: 10 cycles of 24h each<br>$T_u$ = 25 °C, $T_o$ = 55 °C, RH 95% |
| Dynamic load, Broadband noise | | L 19.6 / DIN EN 60068-2-64<br>$a_{RMS}$ 13.9m/s²; t = 6h per axis |
| Mechanical shock testing (individual shocks) | | L 19.7 / DIN EN 60068-2-27<br>a = 30g; t = 6ms; shocks 50 per axis |
| **LV214 – PG20**<br>**Climate load of the housing** | Conformity to TestGroup specific functional requirements. | VW75174:2018-10 |
| Aging in dry heat | | L 20.1 / DIN EN 60068-2-2, Test B<br>Duration: 120 h<br>Temperature: 125°C |
| Aging in damp heat | | L 20.2 / DIN EN 60068-2-30<br>Duration: 10 days<br>Temperature: 40°C<br>Relative humidity: 95 % |
| Low-temperature aging | | L 20.3 / DIN EN 60068-2-1<br>Duration: 48 h<br>Temperature: -40°C |
| Extracting and inserting at -20°C | | L 20.4 |
| Aging in dry heat | | L 20.5 / DIN EN 60068-2-2, Test B<br>Duration: 48 h<br>Temperature: 80°C |
| Drop test in the unplugged state | | L 6.1 / VW75174:2018-10 |
| **LV214 – TG21**<br>**Long-term temperature aging** | Conformity to TestGroup specific functional requirements | VW75174:2018-10 |
| Volume resistance | $R_{before/after\ test}$ ≤ 50 mΩ | P 0.2 / DIN EN 60512-2-1 |
| Long-term aging in dry heat | | L 21.1 / DIN EN 60068-2-2, Test B<br>Duration: 1000 h<br>Temperature: 130°C<br>Subsequent aging: 48h at RT |
| B 6.1 Drop test | | VW75174:2018-10 |

| | | |
|---|---|---|
| **LV214 – TG22A** | | |
| **Chemical resistance** | | VW75174:2018-10 |
| | Conformity to TestGroup specific material & functional requirements | |
| Insulation resistance | $R_{ins\ before/after\ test}$ > 100MΩ<br>at U=500V, t=60s | P 0.3 / DIN EN 60512-3-1 |
| Resistance to agents | | L 22.1A / VW75174:2018-10<br>Appendix E.1 media list<br>Duration: 48h<br>Temperature: media specific |
| **DIN EN 60603-2 – Test Batch BP** | | |
| Gauge retention force | $F_{contact\ retention}$ ≥ 0,1N (per contact) | BP1 / DIN EN 60512-16-5 |
| Mechanical operation<br>1st half | Carry out | BP2 / DIN EN 60512-9-1<br>MIL STD-1344 A 2016<br>V = ≤ 10mm/s<br>Rest period: ≤ 30s (not inserted)<br>No of cycles: 250 |
| Industrial atmosphere | Carry out | BP3.2 / DIN EN 60512-11-7<br>Test climate: 25°C/ 75% RH<br>Gas concentration: mixed flowing gas 0,5ppm $SO_2$ + 0,1ppm $H_2S$<br>t = 10 days<br>one half of specimen inserted; the other half not inserted. |
| Contact resistance | R ≤ 25mΩ | BP4 / DIN EN 60512-2-1<br>MIL STD-1344 A 3002.1 |
| Mechanical operation<br>2nd half | Carry out | BP5 / DIN EN 60512-9-1<br>MIL STD-1344 A 2016<br>V = ≤ 10mm/s<br>Rest period: ≤ 30s (not inserted)<br>No of cycles: 250 |
| Insulation resistance | R ≥ $10^{10}$ Ω | BP6 / DIN EN 60512-3-1<br>MIL STD-1344 A 3003.1 |
| Voltage proof | $U_{test}$ = 500$V_{eff}$ (contact/contact) | BP7 / DIN EN 60512-4-1<br>MIL STD-1344 A 3001.1 |
| Gauge retention force | $F_{contact\ retention}$ ≥ 0,1N (per contact) | BP9 / DIN EN 60512-16-5 |
| Visual examination | No faults | BP10 / DIN EN 60512-1-1 |
| **DIN EN 60603-2 – Test Batch CP** | | |
| Damp heat, steady | | CP1 / DIN EN 60512-11-3<br>MIL STD-1344 A 1002.1<br>Polarization voltage: not applied<br>Test climate: 40°C/ 93% RH<br>t = 56 days |

| | | |
|---|---|---|
| Insulation resistance | R ≥ $10^{10}$ Ω | CP2 / DIN EN 60512-3-1<br>MIL STD-1344 A 3003.1 |
| Contact resistance | R ≤ 25mΩ | CP3 / DIN EN 60512-2-1<br>MIL STD-1344 A 3002.1 |
| Voltage proof | $U_{test}$ = 500$V_{eff}$ (contact/contact) | CP4 / DIN EN 60512-4-1<br>MIL STD-1344 A 3001.1 |
| Visual examination | No faults | CP5 / DIN EN 60512-1-1 |
| | | |

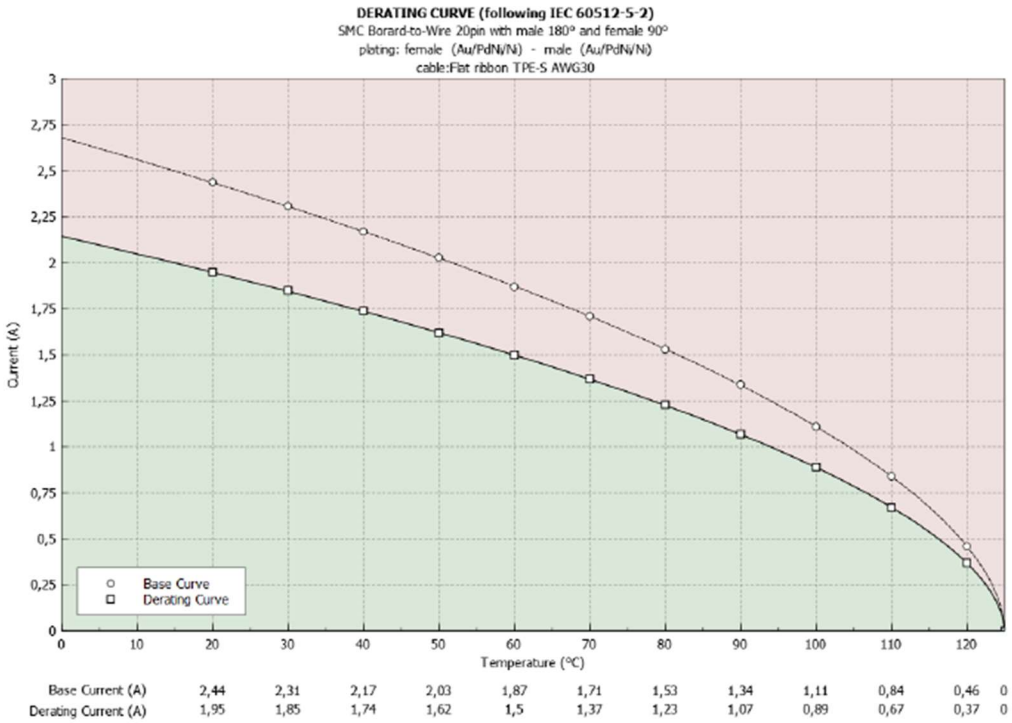
## 3.6. Product Qualification and Requalification Test Sequences

For the product qualification all test groups and sequences are carried out in accordance with DIN EN 60603-2 and LV214 as per Chapter 3.5.

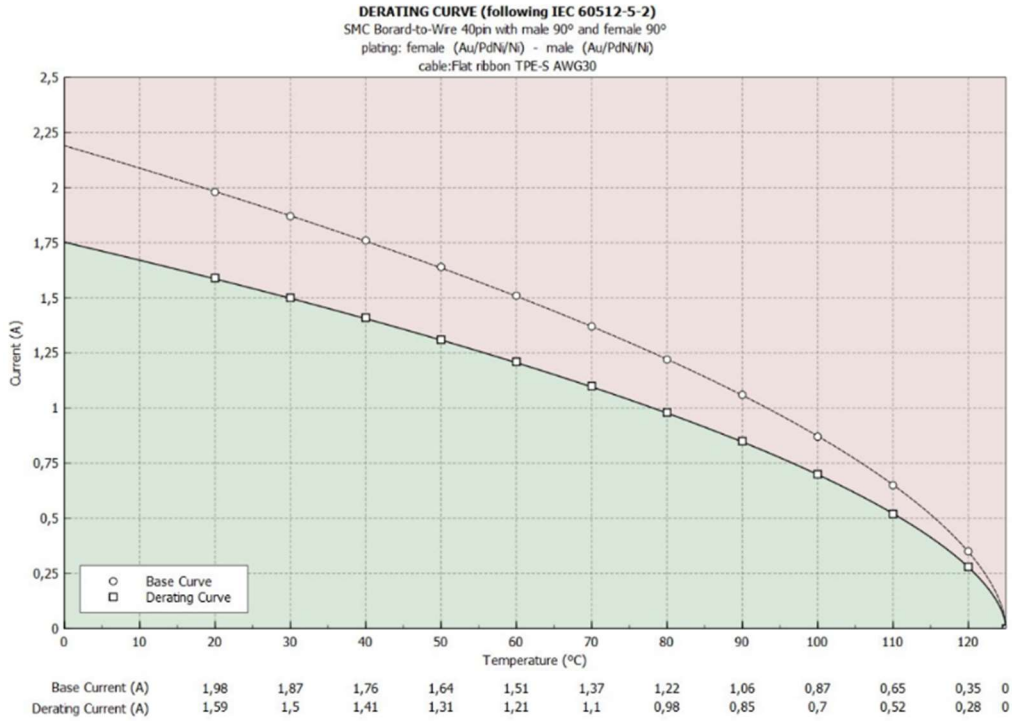
A product requalification is performed annually with at least one selected connector type of a product family. Every requalification includes tests to ensure the functionality and dimensional accuracy of the products. Unless otherwise specified by TE, a requalification test will be carried out at the same revision level as specified in Chapter 3.5

# 4. APPENDIX

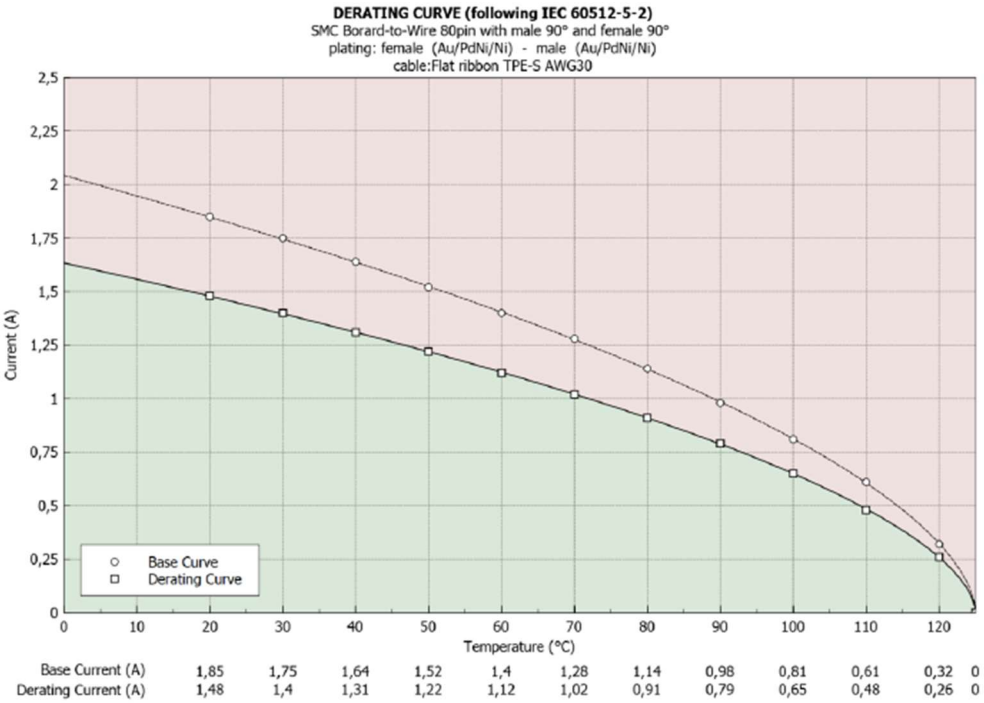
## 4.1. Derating - Number of Poles Specific




| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Base Current (A) | 2,44 | 2,31 | 2,17 | 2,03 | 1,87 | 1,71 | 1,53 | 1,34 | 1,11 | 0,84 | 0,46 | 0 |
| Derating Current (A) | 1,95 | 1,85 | 1,74 | 1,62 | 1,5 | 1,37 | 1,23 | 1,07 | 0,89 | 0,67 | 0,37 | 0 |



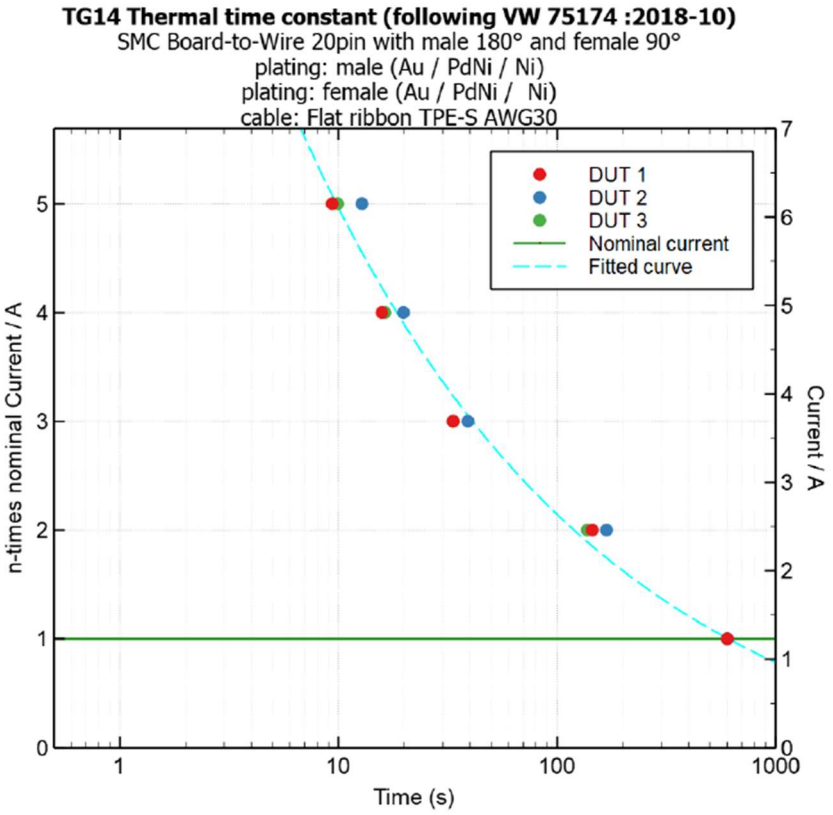

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Base Current (A) | 1,98 | 1,87 | 1,76 | 1,64 | 1,51 | 1,37 | 1,22 | 1,06 | 0,87 | 0,65 | 0,35 | 0 |
| Derating Current (A) | 1,59 | 1,5 | 1,41 | 1,31 | 1,21 | 1,1 | 0,98 | 0,85 | 0,7 | 0,52 | 0,28 | 0 |

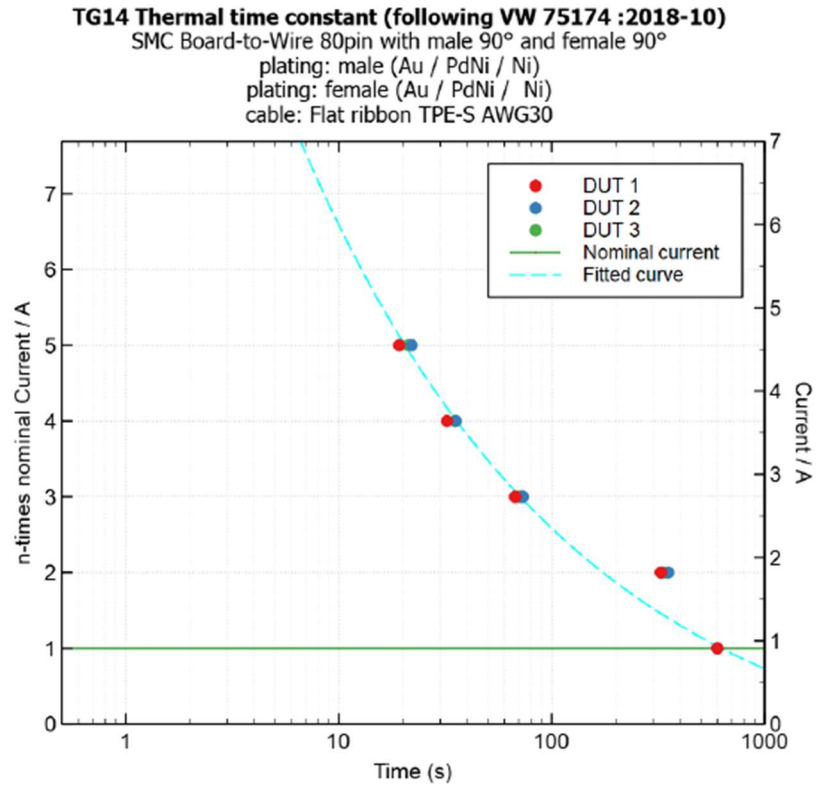



## 4.2. Resistance Limits – LV214 Appendix Table D.1

| | Group 1 | | | | | | Group 2 | | | | | Group 3 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Conductor cross section in $mm^2$/contact size in mm | 0.13 | 0.22 | 0.35 | 0.5 | 0.75 | 1 | 1.5 | 2.5 | 4 | 6 | 10 | 16 | > 16 |
| 0.5 | 50 | 40 | 30 | - | - | - | - | - | - | - | - | - | - |
| 0.63 | 30 | 30 | 15 | 15 | 15 | - | - | - | - | - | - | - | - |
| 1.2 | 20 | 20 | 15 | 15 | 15 | 15 | 10 | - | - | - | - | - | - |
| 1.5 | 15 | 15 | 15 | 15 | 15 | 15 | 10 | 10 | - | - | - | - | - |
| 2.8 | 15 | 15 | 15 | 15 | 15 | 10 | 10 | 10 | 5 | - | - | - | - |
| 4.8 – 6.3 | 10 | 10 | 10 | 8 | 8 | 8 | 5 | 5 | 3 | 3 | 2 | - | - |
| 8 | - | - | - | - | - | - | - | 3 | 3 | 3 | 2 | 2 | - |
| 9.5 – 12 | - | - | - | - | - | - | - | - | 3 | 2 | 2 | 1 | 1 |

4.3. Thermal Time Constant – LV214 TG14



4.4. Dynamic Load – LV214 TG17

4.5. Shaker Table Mounting – LV214 Appendix B

See figure B.1 and figure B.2

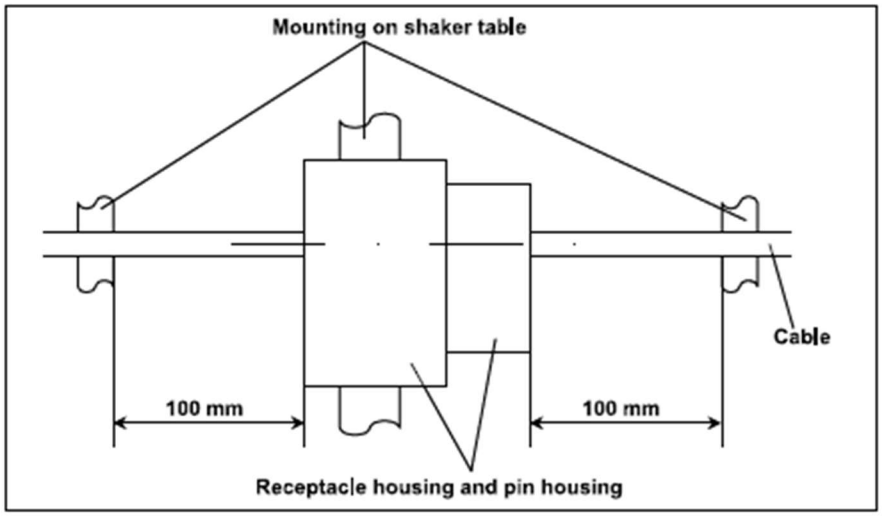



Figure B.1 – Mounting on shaker table, coupling

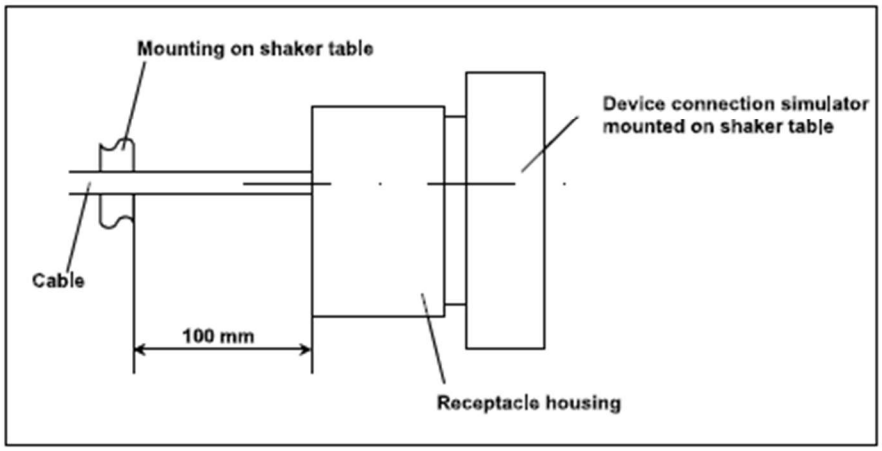



Figure B.2 – Mounting on shaker table, device connection

## 5. REVISION HISTORY TABLE

| REV | Revision record | Drawn | Checked | Approved | Date |
|---|---|---|---|---|---|
| **A** | Published to PDM Link & DSD | T. Lengenfelder | T. Oberschelp | S. Kaminski | 23 Apr 2024 |
| | | | | | |
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