



PRODUCT SPECIFICATION

## **HPS In-Line Connector Male SCC**

EPS-100186



HIRSCHMANN  
AUTOMOTIVE



# TABLE

1	General .....	2
1.1	Introduction .....	2
1.2	Other valid documents .....	2
1.3	Product design .....	2
1.3.1	BOM, PN, description, weight, MOQ .....	2
1.3.2	Product features .....	3
2	Technical product information .....	4
2.1	Current class .....	4
2.2	Operating condition .....	4
2.3	Voltage class .....	4
2.4	Ambient condition .....	4
2.5	EMC performance .....	5
2.6	Shield area .....	5
2.7	IP-Degree of protection .....	5
2.8	HVIL system .....	5
2.9	Technical cleanliness .....	5
2.10	Ampacity (derating) .....	6
2.10.1	Calculation .....	6
3	Performed delta tests .....	7
4	Result of performed tests .....	8
4.1	Ampacity (I/t) measurement results .....	8
4.2	Insulation resistance .....	8
4.3	Contact resistance HV and HVIL .....	8
4.4	Watertightness .....	9
4.5	Vibration load .....	9
4.6	Amount of mating cycles .....	9
4.7	Polarization/ Koshiri-safety .....	9
4.8	Retention force of the contact in the housing .....	9
4.9	Secondary locking .....	9
4.10	Mating/ unmating force .....	9
5	Table of change .....	10

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# 1 General

## 1.1 Introduction

This product specification is valid for the HPS IN-LINE CONNECTOR SCC, assembled according to the process specification listed below, and contains the product design and the condition upon delivery, the technical characteristics as well as the qualification inspections performed. In the case of improper application or deviation from specification that results in quality issues, the right of complaint is void.

## 1.2 Other valid documents



A	Hirschmann product drawing	809-999-...00
B	Interface drawing	808-279-...00
C	Process specification	EVS-100132
D	Operating guideline	HPS In-Line connector
E	Working committee directive LV214 (cf. TLF 0214)	Working committee test specification for motor vehicle plug-in connector – version March 2010
F	Working committee directive LV215 (cf. TLF 0214)	Electrics/ electronic requirements of HV-plug-in connectors – version May 2013
G	German norm DIN EN 60352-2	Solderless electric connections – part 2: crimp connections
H	DIN EN 60664-1	Insulation coordination for electronic equipment in low voltage systems – part 1: principles, requirement, and tests
I	2000/53/EG	Directive of the European Parliament and of the council on end-of life vehicles incl. attachments; European Union
J	ISO 6469-3	Electric road vehicles – safety specifications part 3: protection of persons against electric hazards
K	ISO 26053	Road vehicles; degrees of protection (IP-Code); protection against foreign objects, water, and access; electrical equipment;

## 1.3 Product design

### 1.3.1 BOM, PN, description, weight, MOQ

The female connector HPS IN-LINE CONNECTOR SCC consists of following parts. (see BOM)



HPS In-Line connector male SCC 2x 4.0 mm <sup>2</sup>		809-999-...00	Weight without wire:		47,40 g
Article picture	Article description	Article number	Needed parts per system	Packaging unit / MOQ	Weight per pcs.
	HPS Inline locking sleeve with HVIL	810-000-501	1	100 pcs.	4,14 g
	HPS Inline contact carrier (possible codings in the Article number list, same price for all codings)	809-365-541 (A) 809-365-542 (B) 809-365-543 (C) 809-365-544 (D)	1	600 pcs.	5,00 g
	HPS Inline shielding sleeve SCC 4.0 mm <sup>2</sup>	810-001-502	1	520 pcs.	13,00 g
	HPS40-2 stress relief 4.0 mm <sup>2</sup> SCC	710-195-502	2	2000 pcs.	0,75 g
	HPS40-2 cable seal 4.0 mm <sup>2</sup> SCC	709-972-502	1	5000 pcs.	1,75 g
	HPS40-2 cover cap 4.0 mm <sup>2</sup> SCC	706-822-503	1	4000 pcs.	2,37 g
	HCT4 short male terminal 4.0 mm <sup>2</sup>	709-633-505	2	4000 pcs.	1,89 g

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HPS In-Line connector male SCC 2x 6.0 mm <sup>2</sup>		809-999-...00	Weight without wire:		50,04 g
	HPS Inline locking sleeve with HVIL	810-000-501	1	100 pcs.	4,14 g
	HPS Inline contact carrier (possible codings in the Article number list, same price for all codings)	809-365-541 (A) 809-365-542 (B) 809-365-543 (C) 809-365-544 (D)	1	600 pcs.	5,00 g
	HPS Inline shielding sleeve SCC 6.0 mm <sup>2</sup>	810-001-503	1	520 pcs.	14,20 g
	HPS40-2 stress relief 6.0 mm <sup>2</sup> SCC	710-671-501	2	20000 pcs.	0,54 g
	HPS40-2 X-Ring 6.0 mm <sup>2</sup> SCC	710-675-501	2	5000 pcs.	0,10 g
	HPS40-2 cable seal 6.0 mm <sup>2</sup> SCC	709-972-504	1	5000 pcs.	1,60 g
	HPS40-2 cover cap 6.0 mm <sup>2</sup> SCC	706-822-505	1	4000 pcs.	2,33 g
	HCT4 short male terminal 6.0 mm <sup>2</sup>	709-633-506	2	3700 pcs.	1,89 g

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HPS In-Line connector male SCC 2x 4.0 mm <sup>2</sup> without HVIL		809-999-...00	Weight without wire:		59,91 g
	HPS Inline locking sleeve without HVIL	706-880-502	1	500 pcs.	16,65 g
	HPS Inline contact carrier (possible codings in the Article number list, same price for all codings)	809-365-541 (A) 809-365-542 (B) 809-365-543 (C) 809-365-544 (D)	1	600 pcs.	5,00 g
	HPS Inline shielding sleeve SCC 4.0 mm <sup>2</sup>	810-001-502	1	520 pcs.	13,00 g
	HPS40-2 stress relief 4.0 mm <sup>2</sup> SCC	710-195-502	2	2000 pcs.	0,75 g
	HPS40-2 cable seal 4.0 mm <sup>2</sup> SCC	709-972-502	1	5000 pcs.	1,75 g
	HPS40-2 cover cap 4.0 mm <sup>2</sup> SCC	706-822-503	1	4000 pcs.	2,37 g
	HCT4 short male terminal 4.0 mm <sup>2</sup>	709-633-505	2	4000 pcs.	1,89 g


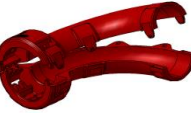

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HPS In-Line connector male SCC 2x 6.0 mm <sup>2</sup> without HVIL		809-999-...00	Weight without wire:		62,55 g
	HPS Inline locking sleeve without HVIL	706-880-502	1	500 pcs.	16,65 g
	HPS Inline contact carrier (possible codings in the Article number list, same price for all codings)	809-365-541 (A) 809-365-542 (B) 809-365-543 (C) 809-365-544 (D)	1	600 pcs.	5,00 g
	HPS Inline shielding sleeve SCC 6.0 mm <sup>2</sup>	810-001-503	1	520 pcs.	14,20 g
	HPS40-2 stress relief 6.0 mm <sup>2</sup> SCC	710-671-501	2	20000 pcs.	0,54 g
	HPS40-2 X-Ring 6.0 mm <sup>2</sup> SCC	710-675-501	2	5000 pcs.	0,10 g
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	HPS40-2 cover cap 6.0 mm <sup>2</sup> SCC	706-822-505	1	4000 pcs.	2,33 g
	HCT4 short male terminal 6.0 mm <sup>2</sup>	709-633-506	2	3700 pcs.	1,89 g

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HPS In-Line connector male SCC Optional Parts					
	HPS40-2 coding clip (possible codings in the Article number list, same price for all codings)	706-505-501 (A) 706-505-502 (B) 706-505-503 (C) 706-505-504 (D)	1	20000 pcs.	0,15 g
	HPS40-2 90° angle cap	706-506-503	1	520 pcs.	9,21 g
	HPS40-2 protection cap male	706-673-501	1	5000 pcs.	1,20 g

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### 1.3.2 Product features

The plug is locked, but the CPA is not locked yet.

- Locking hooks are not deflected.
- The gap between the front stop and the CPA is approx. 4 mm.

Plug and CPA are locked in the end position.

- Locking hooks are not deflected.
- NO gap between the front stop and the CPA anymore.

## 2 Technical product information

The connector can be placed in the entire vehicle if the specified characteristics will not be exceeded. The characteristics are determined by tests (see verification plan) and material datasheets.

### 2.1 Current class

The connector system fulfills the class 1 and 2 according to the LV215-1: 2013-02 (cf. TLF 0214).

### 2.2 Operating condition

Nominal voltage	1,000 VDC
Maximum altitude	4,000 m
Insulating material group:	1
Degree of contamination:	2
Overvoltage category:	1
Rated impulse voltage:	4,000 VDC
Test voltage for electric strength:	4,242 VDC (3,000 VAC)

### 2.3 Voltage class

Class B according to ISO 6469-3

60 VDC < U ≤ 1,000 VDC

25 VAC < U<sub>eff</sub> ≤ 707 VAC (15-150 Hz)

### 2.4 Ambient condition

Permissible temperature range for the plastic used:

-40° C to +140° C according to "temperature collective 4" for 8,000 h

The details of the changes in the properties of the plastics can be found in the plastics data sheets.

***"Temperature collective 4" of MBN 10306, 2020-06 or GS 95024-3-1, 2013-07***

Temperature in ° C	Distribution in %
-40	6
23	20
85	65
135	8
140	1



## 2.5 EMC performance

Delta transfer impedance of the HV connector system.

<b>6.0 mm<sup>2</sup></b>
Until 2 MHz: < 2,5 mΩ/ m Until 30 MHz: < 5 mΩ/ m
Shielding attenuation:
<b>6.0 mm<sup>2</sup></b>
> 75 dB (10 kHz to 100 MHz) > 100 dB (100 MHz to 1,000 MHz)

## 2.6 Shield area

Shield transfer: 360° circumferential

Shield contact resistance  $R < 2 \text{ m}\Omega$  (Total from shielded cable until the component housing.)

## 2.7 IP-Degree of protection

IPxxD (plugged female connector)

IPxxB (unplugged female connector)

min. air distance HV contacts to shock-proof protection finger inline connector interface at IPxxB: 0,8 mm

## 2.8 HVIL system

HV Interlock contacts are leading to the load contact at unmating.

## 2.9 Technical cleanliness

Inside the connector and on the connector, there are no metallic particles  $> 1,000 \mu\text{m}$  allowed

For metallic particles at each connector: CCC =  $N (J4/ K0)$  acc. to VDA Band 19

For all other particles at each connector: CCC =  $N (J10/ K0)$  acc. to VDA Band 19



## 2.10 Ampacity (derating)

The derating in the housing shows exemplary values. Requirement related to the current capability of the connector has also to be considered with the derating.

- 1x 6.0 mm<sup>2</sup> incl. HCT4 female contact and HCT4short male contact (Automotive, tested with In-Line connector)
- 1x 4.0 mm<sup>2</sup> incl. HCT4 female contact and HCT4short male contact (Automotive, tested with In-Line connector)

### 2.10.1 Calculation

Calculation for t- / I-curve determination

$$I(t, T_u)_{x \text{ mm}^2 \text{ Material}} = \sqrt{\frac{(T_{grenz} - T_u)}{k_1 * (1 - e^{-\frac{t}{\tau}})}} + \sqrt{\frac{(T_{grenz} - T_u) * (1 - e^{-\frac{t}{\tau}})}{k_2}}$$

T= time [s]

T<sub>u</sub> = ambient temperature [° C]

T<sub>grenz</sub> = limit temperature connector system [° C]

k<sub>1</sub> = constant heat capacity (dynamic time domain) [K/A<sup>2</sup>]

k<sub>2</sub> = constant heat conduction (quasi-statical time domain) [K/A<sup>2</sup>]

t = time constant [s]

x mm<sup>2</sup> Material = used cross section incl. Material (for example: 35 mm<sup>2</sup> Cu)

Leitung Cu wire Cu	2x6mm <sup>2</sup>	
Kontaktsystem contact system	HCT4	
T <sub>grenz</sub>	200	°C
K <sub>1</sub>	0,10099	K/A <sup>2</sup>
K <sub>2</sub>	0,23968	K/A <sup>2</sup>
t	185,582	s
log10 Abweichung log10 deviation	+1 / -3	%

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## 3 Performed delta tests

Tests acc. to LV214 / LV215 (cf. TLF 0214)

Details see DVP-Plan HPS IN-LINE CONNECTOR SCC serial validation

1.1	PG 0 – Receiving inspection and testing (contacts + shield)	Shield contact resistance: < 2 mΩ Insulation resistance: R > 200 mΩ at 1,000 VDC; Withstand voltage 3,000 VAC for 1 min. (acc. to DIN EN 1987-3 and LV215) min. air distance 3.9 mm + min. creepage distance 5.0 mm
1.2	PG 1 – Dimension	
1.3	PG 2 – Material and surface test (contacts)	All metal parts
1.4	PG 3 – Material and surface test (housing)	All plastic parts and seals
1.5	PG 10 – Contacts: Conductor pull-out strength	Shielding >150 N
1.12	PG 13 – Housing influence on the derating	Tmax. 180° C see drawing
1.13	PG 14 – Thermal time constant	Up to 5 times nominal current and i/t curve
1.14	PG 15 – Electrical stress test	
1.15	PG 16 – Fretting corrosion	
1.16	PG 17 – Dynamic stress	Shield contact > 2 mΩ - Vibration SG2 Temp. SG4 (HV contact + shield) - Vibration SG3 Temp. SG4 (HV contact + shield) - Vibration SG3 Temp. SG4+45A load (HV c. + sh.) - Vibration SG4 Temp. SG4 (HV contact + shield)
1.17	Corrosion test	720 h salt spray test with salt mixture of severity level 3 and following PG23
1.18	PG 19 – Environmental simulation	Max. test temperature: 140° C
1.22	PG 23 – Water leak tightness	All wire cross section and wire type (2.5mm <sup>2</sup> / 4.0 mm <sup>2</sup> / 6.0 mm <sup>2</sup> Coroplast, Kroschu, Leoni)
1.2	PG 50 – EMC test	Acc. to IEC 62153-4-3 At frequency area of 10 kHz to 1,000 MHz

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## 4 Result of performed tests

### 4.1 Ampacity (I/t) measurement results

1x 6.0 mm<sup>2</sup> incl. HCT4 female contact and HCT4short male contact (Automotive, tested with In-Line connector)

Time for calculation (s)	60° calculated	65° calculated	70° calculated	75° calculated	80° calculated	85° calculated	90° calculated	95° calculated	100° calculated	105° calculated	110° calculated	115° calculated	120° calculated
100000	64,49	63,13	61,74	60,32	58,87	57,38	55,85	54,28	52,66	50,98	49,26	47,46	45,6
3600	64,49	63,13	61,74	60,32	58,87	57,38	55,85	54,28	52,66	50,98	49,26	47,46	45,6
501	65,79	64,41	62,99	61,54	60,06	58,54	56,98	55,37	53,72	52,01	50,25	48,42	46,52
236	70,43	68,94	67,43	65,88	64,29	62,66	60,99	59,27	57,5	55,68	53,79	51,83	49,8
46,5	107,63	105,37	103,05	100,68	98,26	95,77	93,21	90,59	87,88	85,089	82,21	79,22	76,11
18,9	155,59	152,32	148,97	145,54	142,04	138,44	134,75	130,95	127,04	123,01	118,84	114,51	110,02
10,2	205,98	201,64	197,21	192,68	188,03	183,27	178,38	173,36	168,18	162,84	157,32	151,6	145,65
0,1	2011,26	1968,92	1925,64	1881,37	1836,02	1789,54	1741,81	1692,73	1642,19	1590,04	1536,13	1480,25	1422,18

1x 4.0 mm<sup>2</sup> incl. HCT4 female contact and HCT4short male contact (Automotive, tested In-Line connector)

Time for calculation (s)	60° calculated	65° calculated	70° calculated	75° calculated	80° calculated	85° calculated	90° calculated	95° calculated	100° calculated	105° calculated	110° calculated	115° calculated	120° calculated
100000	51,41	50,33	49,22	48,09	46,93	45,74	44,52	43,27	41,97	40,64	39,26	37,84	36,35
3600	51,41	50,33	49,22	48,09	46,93	45,74	44,52	43,27	41,97	40,64	39,26	37,84	36,35
570	52,04	50,94	49,82	48,67	47,5	46,3	45,06	43,789	42,49	41,14	39,74	38,3	36,79
247	57,42	56,21	54,98	53,71	52,42	51,09	49,73	48,33	46,89	45,4	43,86	42,26	40,6
47,1	99,871	97,71	95,56	93,36	91,11	88,8	89,44	84	81,49	78,69	76,23	73,46	70,57
16,8	159,31	155,95	152,52	149,02	145,43	141,74	137,96	134,08	130,07	125,94	121,67	117,25	112,65
8,4	222,26	217,58	212,8	207,9	202,89	197,76	192,48	187,06	181,47	175,71	169,75	163,58	157,16
0,1	2009,69	1967,38	1924,13	1879,89	1834,59	1788,13	1740,44	1691,41	1640,9	1588,8	1534,93	1479,09	1421,06

### 4.2 Insulation resistance

Over complete lifetime: >200 MΩ  
 Lowering during humidity load: >25 MΩ  
 In plugged condition between HV contacts, HV contacts and shield.

### 4.3 Contact resistance HV and HVIL

Acc. to LV215-1: 2013-02 (cf. TLF 0214)

wire cross section mm <sup>2</sup>	contact resistance (total resistance incl. Crimp)		group 1						
	new condition mΩ	after aging mΩ	wire cross section mm <sup>2</sup> / contact size mm	0,13	0,22	0,35	0,5	0,75	1
2,5	1,17	2,34	0,63	30	30	15	15	15	-
4	0,72	1,44	1,2	20	20	15	15	15	15
6	0,68	1,36	1,5	-	15	15	15	15	15
			2,8	-	15	15	15	15	10
			4,8-6,3	-	10	10	8	8	8
			8	-	-	-	-	-	-
			9,5-12	-	-	-	-	-	-
acc. to LV215			acc. to LV214						

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## 4.4 Watertightness

IP6K9K and IPx8

PG23 acc. to working group inspection guideline LV214 and LV215 (cf. TLF 0214)

## 4.5 Vibration load

Vibration stability: PG17 acc. to working group inspection guideline LV214 and LV215 (cf. TLF 0214)

Fixing length: free cable length between connector and first cable fixing point where the cable is fixed with the same oscillation as the connector. The cable fixing must be designed for every operation mode.

## 4.6 Amount of mating cycles

Max. 50 cycles (Ag)

## 4.7 Polarization/ Koshiri-safety

Failed insertion force min. 200 N (3 times assembly force)

Koshiri-safety is given

## 4.8 Retention force of the contact in the housing

HV contacts:

Primary locking / secondary locking min. 120 N

IL Bridge (stamped part):

F > 25 N per Pin

## 4.9 Secondary locking

Activation force < 40 N, no unintentional opening possible

## 4.10 Mating/ unmating force

Assembly force of the female plug into the plug / plug socket:	< 56 N
Disassembly force from the female plug out of the plug / plug socket:	< 65 N
Retention force of the female plug in the plug / plug socket:	> 400 N
Retention force of the female plug in the plug / plug socket incl. CPA:	> 500 N
Operating force of the CPA:	< 30 N

## 5 Table of change

Version	Change description	Change date	Editor
1	First edition	10.05.2020	Breuss L.
2	Adapted assembly force	02.02.2020	Breuss L.
3	Added SCC version	25.02.2021	Breuss L.
4	Added derating and I/T curve	25.11.2021	Breuss L.
5	Update design specification	15.06.2023	Jussel E-M.
6	Adjusting data of the bottom line	08/ 2023	Jussel E-M.
7	Adjusting data "Ambient Condition"	10/ 2023	Jussel E-M.
8	Update Topic 2.9 – wording VDA	04/ 2024	Jussel E-M.