

PRODUCT SPECIFICATION
HPS40-2 2+2
Female Connector MCC

EPS-100096



HIRSCHMANN
AUTOMOTIVE



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1 General

1.1 Introduction

This product specification is valid for the HPS40-2 2+2 female connector MCC, 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	807-655-...00
B	Interface drawing	808-188-...00
C	Process specification	EVS-100096
D	Operating guideline	HPS40-2 female plug socket
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 HPS40-2 2+2 female connector MCC consists of following parts. (see BOM)



HPS40-2 Female MCC 2x 2.5 mm ²		807-655-...00	Weight without wire:		53,59 g
Article picture	Article description	Article number	Needed parts per system	Packaging unit / MOQ	Weight per pcs.
	HPS40-2 locking sleeve	807-656-501	1	500 pcs.	22,90 g
	HPS40-2 female contact carrier (possible codings in the Article number list)	807-657-501 (A) 807-657-502 (B) 807-657-503 (C) 807-657-504 (D) 807-657-507 (Z)	1	1200 pcs.	5,30 g
	HPS40-2 shielding sleeve MCC	709-840-504	1	2000 pcs.	4,39 g
	HPS40-2 stress relief 2.5 mm ² MCC	709-841-501	1	1000 pcs.	3,60 g
	HPS40-2 cable seal 2.5 mm ² MCC	709-113-504	1	5000 pcs.	1,50 g
	HPS40-2 cover cap 2.5 mm ² MCC	706-430-501	1	3200 pcs.	2,30 g
	HCT4 terminal 2.5 mm ²	709-427-502	2	2600 pcs.	1,13 g

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HPS40-2 Female MCC 2x 4.0 mm ²		807-655-...00	Weight without wire:		53,59 g
	HPS40-2 locking sleeve	807-656-501	1	500 pcs.	22,90 g
	HPS40-2 female contact carrier (possible codings in the Article number list)	807-657-501 (A) 807-657-502 (B) 807-657-503 (C) 807-657-504 (D) 807-657-507 (Z)	1	1200 pcs.	5,30 g
	HPS40-2 shielding sleeve MCC	709-840-504	1	2000 pcs.	4,39 g
	HPS40-2 stress relief 4.0 mm ² MCC	709-841-502	1	1000 pcs.	3,60 g
	HPS40-2 cable seal 4.0 mm ² MCC	709-113-505	1	5000 pcs.	1,50 g
	HPS40-2 cover cap 4.0 mm ² MCC	706-430-502	1	3200 pcs.	2,30 g
	HCT4 terminal 4.0 mm ²	709-427-504	2	2600 pcs.	1,13 g

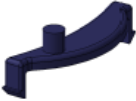
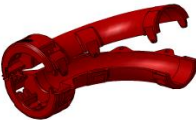
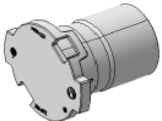
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HPS40-2 Female MCC 2x 6.0 mm ²		807-655-...00	Weight without wire:		53,59 g
	HPS40-2 locking sleeve	807-656-501	1	500 pcs.	22,90 g
	HPS40-2 female contact carrier (possible codings in the Article number list)	807-657-501 (A) 807-657-502 (B) 807-657-503 (C) 807-657-504 (D) 807-657-507 (Z)	1	1200 pcs.	5,30 g
	HPS40-2 shielding sleeve MCC	709-840-504	1	2000 pcs.	4,39 g
	HPS40-2 stress relief 6.0 mm ² MCC	709-841-503	1	1000 pcs.	3,60 g
	HPS40-2 cable seal 6.0 mm ² MCC	709-113-506	1	5000 pcs.	1,50 g
	HPS40-2 cover cap 6.0 mm ² MCC	706-430-503	1	3200 pcs.	2,30 g
	HCT4 terminal 6.0 mm ²	709-427-505	2	2600 pcs.	1,13 g

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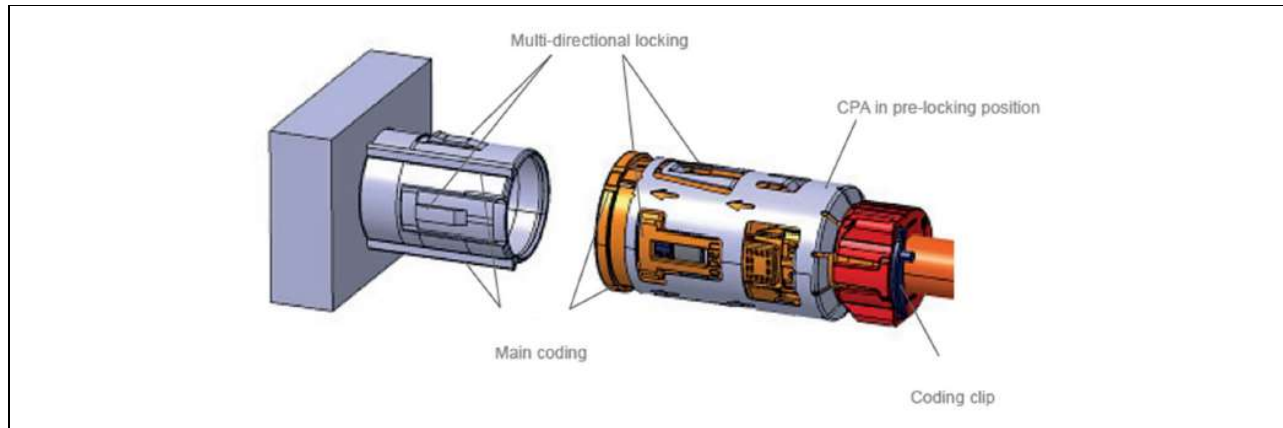


HPS40-2 Female MCC Optional Parts					
	HPS40-2 coding clip (possible codings in the Article number list)	706-505-501 (A) 706-505-502 (B) 706-505-503 (C) 706-505-504 (D) 706-505-507 (Z)	1	20000 pcs.	0,15 g
	HPS40-2 90° angle cap	706-506-503	1	520 pcs.	9,21 g
	HPS40-2 protection cap	706-672-501	1	1500 pcs.	4,80 g

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1.3.2 Product features



- Multi-directional locking
- Main coding/ polarisation
- HPS40-2 locking sleeve is always with CPA
- HPS40-2 female contact carrier has always integrated an HVIL bridge
- HPS40-2 female contact carrier has 5 coding options (A, B, C, D, Z)

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.

2.2 Operating condition

Nominal voltage	1,000 VDC/ 707 VAC
Maximum altitude	acc. to OEM specification or the device manufacturer
Insulating material group:	1 (CTI \geq 600) – for components with direct contact to HV
Degree of contamination:	acc. to OEM specification or the device manufacturer
Overvoltage category:	1
Rated impulse voltage:	acc. to OEM specification or the device manufacturer
Test voltage for electric strength:	acc. to OEM specification or the device manufacturer
Real min. distance in mated condition:	The clearance and creepage distances at the transition of the connector to the unit interface is not considered and must be considered additional – e.g. when using bade versions.
Min. clearance distance:	HV-HV: 3.9 mm HV-HVIL: 13.5 mm HV-Shield: 6.0 mm
Min. creepage distance:	HV-HV: 5.0 mm HV-HVIL: > 13.5 mm HV-Shield: 6.5 mm Shield outside housing: > 10.0 mm

2.2.1 Calculation Example

Clearance and creepage distance based on the exemplary following requirements according to DIN EN 60664-1.

Max. operating voltage:	1,000 VDC
Insulating material group:	1
Degree contamination:	2
Altitude:	5,600 m
Rated impulse voltage:	2,500 VDC
Test voltage for electric strength:	2,150 VDC/ 1,500 VAC (basic insulation) 4,300 VDC/ 3,000 VAC (reinforced-, double insulation)
Normative min. clearance distance:	2.45 mm basic insulation 4.90 reinforced insulation
Normative min. creepage distance:	5.00 mm basic insulation 10.0 reinforced insulation

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2.3 Voltage class

Class B according to ISO 6469-3

60 VDC < U ≤ 1,000 VDC

25 VAC < U_{eff} ≤ 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.

2.5 mm ²	4.0 mm ²	6.0 mm ²
Until 2 MHz: < 2.5 mΩ/ m Until 30 MHz: < 5 mΩ/ m	Until 30 MHz: < 1 mΩ	Until 30 MHz: < 1 mΩ
Shielding attenuation:		
2.5 mm ²	4.0 mm ²	6.0 mm ²
> 70 dB (10 kHz to 100 MHz) > 65 dB (100 MHz to 1,000 MHz)	> 70 dB (10 kHz to 1,000 MHz)	> 75 dB (10 kHz to 500 MHz) > 65 dB (500 MHz to 1,000 MHz)

2.6 Shield area

Shield transfer: 360° circumferential

Shield contact resistance R < 2 mΩ (Total from sheathed cable until the device 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 female connector interface at IPxxB: 0.9 mm

min. air distance HV contacts to shock-proof protection finger male connector interface at IPxxB: 0.8 mm

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2.8 HVIL system

Min. 1 mm leading HV Interlock contacts to HV load contact at unmating (nominal 2 mm)

2.9 Technical cleanliness

Inside the connector and on the connector, there are no metallic particles > 1,000 µm 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 MCC (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.

2.10.1 Calculation

Calculation for t- / I-curve determination

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

- T = time [s]
- T_u = ambient temperature [° C]
- T_{grenz} = limit temperature connector system [° C]
- k₁ = constant heat capacity (dynamic time domain) [K/A²]
- k₂ = constant heat conduction (quasi-statical time domain) [K/A²]
- t = time constant [s]

x mm² Material = used cross section incl. Material (for example: 35 mm² Cu)

Leitung Cu wire Cu	2x2,5mm ²		2x4mm ²		2x6mm ²		2x6mm ²	
Kontaktsystem contact system	HCT4		HCT4		HCT4		Drehkontakt turned contact	
T _{grenz}	200	°C	200	°C	200	°C	200	°C
K ₁	0,189036	K/A²	0,13265	K/A²	0,10099	K/A²	0,07106	K/A²
K ₂	0,563691	K/A²	0,4042	K/A²	0,23968	K/A²	0,2169	K/A²
t	290,5736	s	193,285	s	185,582	s	432,516	s
log10 Abweichung log10 deviation	+3 / -2	%	+1 / +3	%	+1 / -3	%	+1 / -2	%

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For details see the derating in housing

2x 2.5 mm² incl. HCT4 female contact and HCT4short male contact (Automotive)

Ambient temperature	23°C		70°C		80°C		100°C		120°C	
	Interpretation (current-20%) (A)	Time(s) TU=23°C	Interpretation (current-20%) (A)	Time(s) TU=70°C	Interpretation (current-20%) (A)	Time(s) TU=80°C	Interpretation (current-20%) (A)	Time(s) TU=100°C	Interpretation (current-20%) (A)	Time(s) TU=120°C
60	48	100000	44,3	100000	41,9	100000	37,6	100000	33	100000
60	48	3600	44,3	3600	41,9	3600	37,6	3600	33	3600
70	56	330	56	127	56	107	56	73	56	48
90	72	88	72	51	772	44	72	33	72	24
110	88	46	88	27	88	24	88	19	88	14
140	112	19	112	13	112	12	112	10	112	8
190	152	15	152	11	152	10	152	8	152	7
211,5	169,2	10	169,2	7	169,2	7	169,2	6	169,2	5

2x 4.0 mm² incl. HCT4 female contact and HCT4short male contact (Automotive)

Ambient temperature	23°C		70°C		80°C		100°C		120°C	
	Interpretation (current-20%) (A)	Time(s) TU=23°C	Interpretation (current-20%) (A)	Time(s) TU=70°C	Interpretation (current-20%) (A)	Time(s) TU=80°C	Interpretation (current-20%) (A)	Time(s) TU=100°C	Interpretation (current-20%) (A)	Time(s) TU=120°C
70	56	100000	54	100000	51,5	100000	45,8	100000	39,2	100000
70	56	3600	54	3600	51,5	3600	45,8	3600	39,2	3600
80	64	453	64	171	64	141	64	95	64	62
90	72	184	72	94	72	80	72	57	72	38
100	80	107	80	59,5	850	51,5	80	38	80	26,5
120	96	45	96	28	96	25	96	19	96	14
140	112	29,5	112	19	112	17	112	13,5	112	10
150	120	23	120	15	120	13,5	120	10,5	120	8
170	136	15	136	10	136	9	136	7	136	6
208	166,4	10	166,4	7	166,4	6	166,4	5	166,4	4
260	208	6	208	3,5	208	3	208	2,5	208	1,5

2x 6.0 mm² incl. HCT4 female contact and HCT4short male contact (Automotive)

Ambient temperature	23°C		70°C		80°C		100°C		120°C	
	Interpretation (current-20%) (A)	Time(s) TU=23°C	Interpretation (current-20%) (A)	Time(s) TU=70°C	Interpretation (current-20%) (A)	Time(s) TU=80°C	Interpretation (current-20%) (A)	Time(s) TU=100°C	Interpretation (current-20%) (A)	Time(s) TU=120°C
85	68	10000	62,9	10000	59,6	10000	53	10000	45,6	10000
85	68	3600	62,9	3600	59,6	3600	53	3600	45,6	3600
90	72	1768	68	302	68	234	68	145	68	91,6
100	80	381	72	155	72	129	72	90	72	14
120	96	60	96	31	96	27	96	20	96	6
180	144	18	136	11	136	10	1326	8	136	3
240	192	9	192	6	192	5	192	5	192	2
300	240	6	240	3	240	3	240	3	240	

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3 Performed tests MCC

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

Details see DVP-Plan HPS40-2 2+2 female connector 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 4 – Contact overlap	Min. 1 mm contact overlap (HV /IL /shield) > 0 mm contact free space Min. 1 mm lead (IL to HV at opening)
1.6	PG 5 – Mechanical and thermal relaxation behavior	Shield contact: 1,000 h at 160° C
1.7	PG 6 – Interaction between terminal and housing	Locked secondary lock after barrel fall test
1.8	PG 7 – Handling and functional reliability of the housing	
1.9	PG 8 – Insertion and retention forces of the contact parts in the housing	Max. 60.2 N mounting force 400 N housing locking force without CPA
1.10	PG 9 – Koshiri angle safety	
1.11	PG 11 – Contact insertion and retention forces, mounting cycled	50 mounting cycles
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 – Electric 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
1.19	PG 20 – Climatic load of the housing	Max. test temperature: 140° C
1.20	PG 21 – Long-term temperature	1,000 h at 140° C
1.21	PG 22B – Chemical durability	

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1.22	PG 23 – Water leak tightness	All wire cross section and wire type (2.5 mm ² / 4.0 mm ² / 6.0 mm ² Coroplast, Kroschu, Leoni)
1.23	PG 28 – Locking noise	main locking: > 80 dB CPA: > 90 dB
1.24	PG 50 – EMC test	Acc. to IEC 62153-4-3 At frequency area of 10 kHz to 1,000 MHz
1.25	PG 51 – Contact protection	IPXXB and IPXXD
1.26	K12 – Thermal shock with water surge	Acc. to LV124:2013
1.27	K15b – Climatic test	Acc. to LV124:2013

4 Result of performed tests

4.1 Ampacity MCC (I/t) measurement results

2x 2.5 mm² incl. HCT4 female contact and HCT4short male contact (Automotive)

Ambient temperature	72.20	90.70	125.10	146.50	164.60
Current (A)	44	40	32	24	16

2x 4.0 mm² incl. HCT4 female contact and HCT4short male contact (Automotive)

Ambient temperature	64.20	94.70	130.30	157.10	173.70
Current (A)	56	48	36	24	12

2x 6.0 mm² incl. HCT4 female contact and HCT4short male contact (Automotive)

Ambient temperature	68.40	-	115.10	149.60	171.90
Current (A)	64	-	48	32	16

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 ²	contact resistance (total resistance incl. Crimp)		group 1						
	new condition mΩ	after aging mΩ	wire cross section mm ² / 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						

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.

4.5.1 MCC:

Vibration class severity level 2:	no fixation point needed
Vibration class severity level 3:	first fixation point max. 200 mm, second fixation point max. 250 mm from the first fixation point
Vibration class severity level 4:	first fixation point max. 50 mm, second fixation point max. 250 mm from the first fixation point

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 > 50 N

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:	< 65 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
Max. pull-off force of the angled cap:	< 60 N

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5 Table of change

Version	Change description	Change date	Editor
1	First version	02.07.2016	-
2	English version added	04.11.2016	-
3	Update to serial design	16.05.2017	-
4	Update deratings	07.07.2017	-
5	Update serial SVP and characteristics	05.09.2017	-
6	Revision of layout, angled cap and transportation cap added	07.03.2018	-
7	Update vibration load	23.07.2019	-
8	Added SCC version	02.12.2020	-
9	Updated ampacity of SCC version	15.09.2021	-
10	Added SCC 4mm ² derating and ampacity	16.11.2021	-
11	Updated SCC 6mm ² ampacity	25.05.2022	-
12	Update design specification	14.06.2023	Jussel E-M.
13	Adjusting data of the bottom line	07/ 2023	Jussel E-M.
14	Update "Ambient Conditions"	10/ 2023	Jussel E-M.
15	Topic 2.9 – updating of VDA wording	04/ 2024	Jussel E-M.
16	EPS-100096-00 is valid	01/ 2025	Jussel E-M.

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