HEIDENHAIN

Product Information

HMC 2

Hybrid Motor Cable

08/2023

HMC 2: the single-cable solution

Power supply and communication via two wires

Servomotors normally require two separate cables:
- An encoder cable for the motor's rotary encoder
- A cable for powering the motor

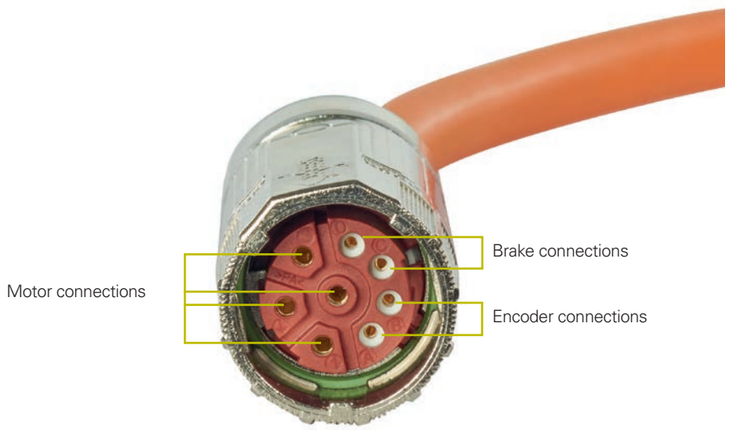
With the **HMC 2** hybrid motor cable, HEIDENHAIN has integrated the encoder cable into the power cable. As a result, only **a single cable** is needed between the motor and the electrical cabinet.

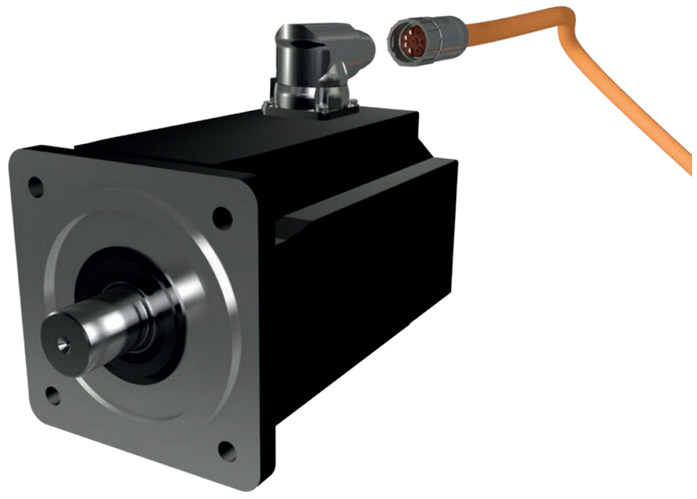
The HMC 2 single-cable solution was designed specifically for the HEIDENHAIN **EnDat 3** interface. It carries serial data transmissions and power for the encoder via two wires at cable lengths of up to 100 m.

Similarly to HMC 6, HMC 2 accommodates the wires for the encoder, motor and brake within a single cable. This cable is connected to the motor via a special connector. For connection to the frequency inverter, the cable is split into power connections, brake connections, and an encoder connector.

When implemented correctly, the motor connection attains an IP67 rating.

Benefits
The HMC 2 single-cable solution offers a series of cost and quality benefits for motor and machine manufacturers:
- Smaller drag chains
- Reduced mechanical requirements (flange socket on the motor and cable ducts in the machine housing)
- Reduced logistics for cables and connectors
- Easier and faster installation
- Fewer required wear components
- Smaller motor profile with cable attached, enabling easier integration into the machine housing
- HEIDENHAIN-tested combined power and encoder cable

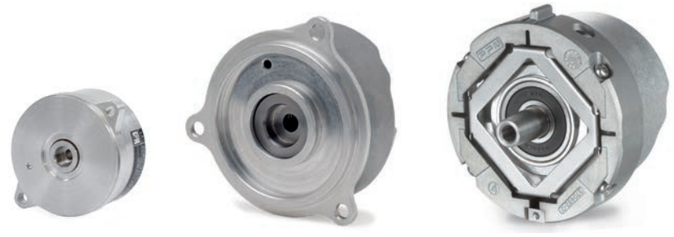




The universal design of the HMC 2 solution gives motor and machine manufacturers high flexibility, allowing them to use standardized components on both the motor and the control.

The HMC 2 single-cable solution can be used with **motor encoders featuring the EnDat 3 interface** (ordering designation: E30-R2) and purely serial, **two-wire data transmission**. Suitable rotary encoders are currently the ExI 1100/1300 series for functionally safe applications with up to SIL 2, and the ExN 1300 for up to SIL 2.

The HMC 2 solution also makes matters easy on the control side of things, allowing you to continue using your already existing drives and controller units. The HMC 2 cable is designed for easy assembly with the appropriate connecting elements.



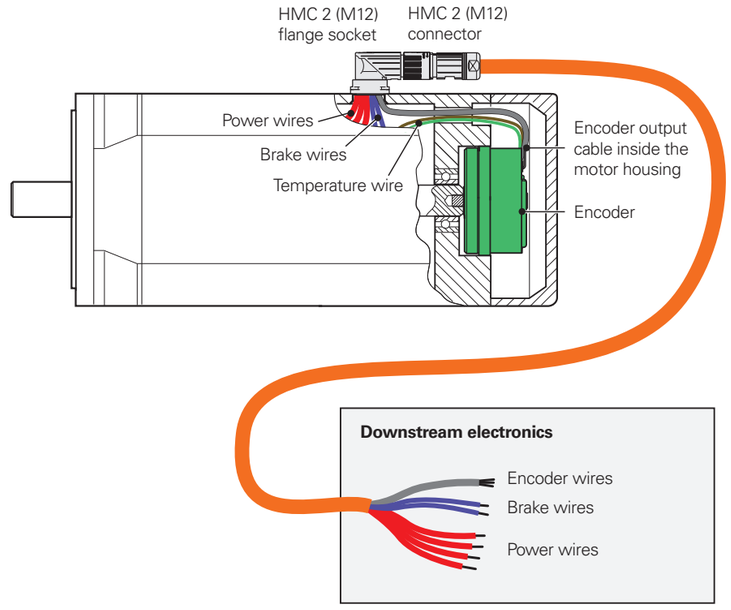
Components
Preparing a motor for the single-cable solution requires only a handful of components.

Connecting element on the motor
The motor housing requires a standardized angle flange socket that draws together the brake wires, encoder wires and motor power wires.

Crimping tools
The crimp contacts for the brake wires, power wires and encoder wires are assembled using typical tools.

Output cables inside the motor housing
The rotary encoder is connected via the output cable inside the motor housing.

Hybrid motor cable with a standardized connector
The HMC 2 motor cable accommodates the brake, power and encoder wires.



Components

Output cables inside the motor housing
Output cables for inside the motor housing are available for rotary encoders of the ECI/EQI 1100, ECI/EQI 1300 and ECN/EQN 1300 series.

For information on compatible temperature sensors, see the *Encoders for Servo Drives* brochure.

Crimp connector
For joining (crimping) the wires of the temperature sensor's output cable to the wires of the temperature sensor in the motor winding.
ID 1148157-01

Output cable inside the motor (AGK)	ECI/EQI 1100	ECI/EQI 1300 ECN/EQN 1300
15-pin PCB connector with wires for data transmission and a temperature sensor	ID 1302347-xx[1]	–
15-pin PCB connector and an M12 SpeedTEC angle flange socket for data transmission and a 2-pin connector for a temperature sensor	ID 1279930-xx[2]	–
12-pin PCB connector for data transmission, along with strain relief on the encoder housing	–	ID 1302701-xx[1]
4-pin PCB connector and 2-pin connector for a temperature sensor	–	ID 1302763-xx[2]
12-pin PCB connector and an M23 SpeedTEC angle flange socket and strain relief on the encoder's cover	–	ID 1275042-xx

[1] The connecting element must be suitable for the maximum data rate to be used
[2] See Product Note D576762 regarding the temperature sensor connector

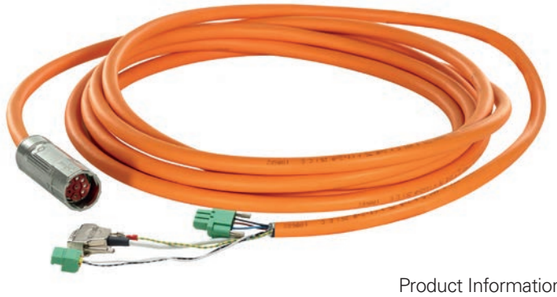
Hybrid motor cable with connectors
The HMC 2 cables are available with power wires in cross sections of 0.5 mm², 1.5 mm² or 4.0 mm². The cable end to be connected with the drive is assembled with a D-sub connector and 3-pin or 4-pin power connector.

The hybrid motor cable can also be used as a testing cable for the PWM 21.

For other cable lengths, larger quantities, and custom cable assemblies for the drive, please contact your HEIDENHAIN sales agency.

Hybrid motor cable with connectors (APK)	
Fully assembled with a straight M12 SpeedTEC connector	PUR cable Ø 9.3 mm (4 x 0.5 mm²) + (2 x 0.34 mm²) + (2 x 0.14 mm²) 10 m: ID 1279881-10 25 m: ID 1279881-25 50 m: ID 1279881-50
Fully assembled with a straight M23 SpeedTEC connector	PUR cable Ø 11 mm (4 x 1.5 mm²) + (2 x 0.75 mm²) + (2 x 0.25 mm²) 10 m: ID 1275291-10 25 m: ID 1275291-25 50 m: ID 1275291-50
	PUR cable Ø 15.8 mm (4 x 4.0 mm²) + (2 x 1.00 mm²) + (2 x 0.38 mm²) 10 m: ID 1352456-10 25 m: ID 1352456-25 50 m: ID 1352456-50

EnDat 3 adapter (SA 1210)
Adapter for connecting an encoder with EnDat 3 (E30-R2) to the PWM 21
15-pin D-sub connector (male) and
15-pin D-sub connector (female)
ID 1317260-01



Service pack
For field assembly of the HMC 2 hybrid motor cable, the required components can also be obtained individually.

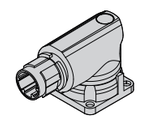
The crimp contacts for the brake, power and encoder wires are included in the service pack.

Angle flange socket
Common angle flange sockets are used for the electrical connection of the motor to the downstream electronics. The two encoder wires (communication and power), the motor power wires and the brake wires are brought together inside the angle flange socket.

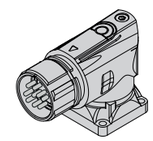
Angle flange sockets are available with a fastening hole circle in Ø 23.75 mm and an M12 external thread, or in Ø 28 mm and an M23 external thread.

Connectors and couplings
The M12 and M23 SpeedTEC connectors are used for connection to the respective angle flange socket. The M12 and M23 SpeedTEC couplings can be used in order to extend cables.

Angle flange socket	M12	M23
Fastening hole circle	Ø 23.75 mm	Ø 28 mm
Contact pins	4x1.0 mm + 4x0.6 mm	4x2.0 mm + 4x1.0 mm
ID number	1304347-02 (0.5 mm²)	1304347-01 (1.5 mm²) 1304347-03 (4.0 mm²)

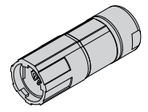


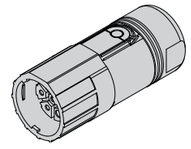
M12 SpeedTEC angle flange socket



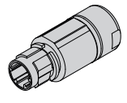
M23 SpeedTEC angle flange socket

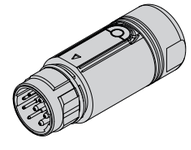
Connectors	M12	M23
Female contact	4x1.0 mm + 4x0.6 mm	4x2.0 mm + 4x1.0 mm
ID number	1305176-02 (0.5 mm²)	1305176-01 (1.5 mm²) 1305176-03 (4.0 mm²)

M12 

M23 

Couplings	M12	M23
Contact pins	4x1.0 mm + 4x0.6 mm	4x2.0 mm + 4x1.0 mm
ID number	1305283-02 (0.5 mm²)	1305283-01 (1.5 mm²) 1305283-03 (4.0 mm²)

M12 

M23 

Crimping tools
The brake, power and encoder wire contacts for insertion into the angle flange socket, connector or coupling are typical crimp contacts. Assembling them requires only a crimping tool and adjusting aids.

Please comply with the current user's manual for crimping tools from the company TE Connectivity.

These crimping tools can be ordered directly from:

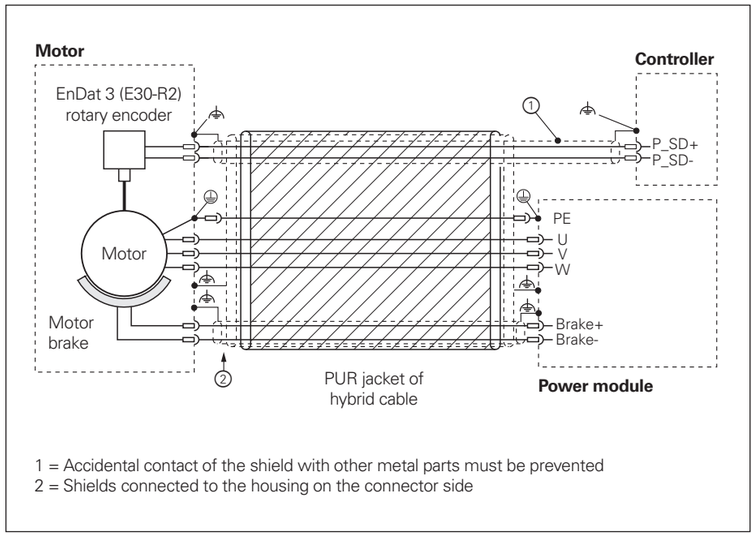
TE Connectivity Industrial GmbH
Bernriederstraße 15
94559 Niederwinkling, Germany
Tel.: +49 9962 2002-0
Fax: +49 9962 2002-70
E-mail: intercontec@te.com
Web: www.te.com

General electrical information

Use of the hybrid motor cables is subject to the general electrical information contained in the *Interfaces of HEIDENHAIN Encoders* brochure.

Please also note the following:
- **Shielding** must be implemented in accordance with the earthing diagram.
- Unneeded **brake wires** must be connected to earth on the power module.
- The temperature range of the output cable within the motor housing is –20 °C to 120 °C (motor at rest).

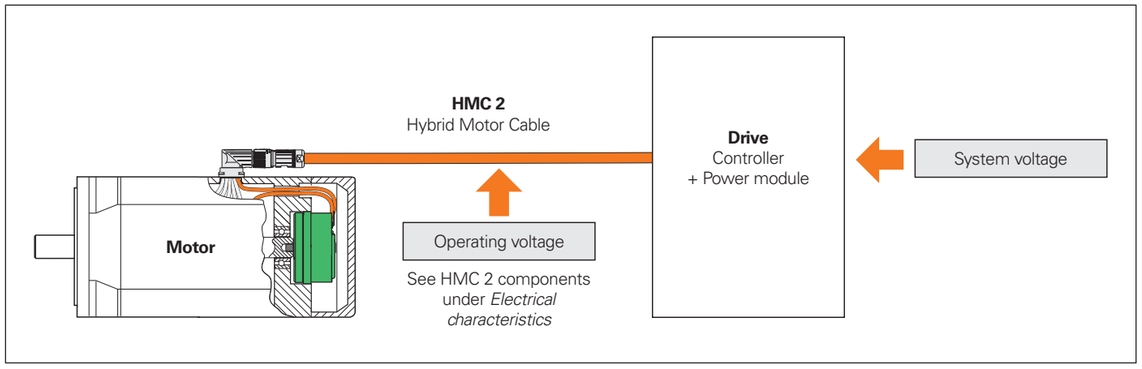
- The **NRTL certification** of the HMC 2 hybrid motor cable is documented with the following label: AWM Style 21223 80°C 1000V.
- Permissible **cable length** of up to 100 m and a data rate corresponding to the EnDat 3 specification
- One section point is permissible for the hybrid motor cable (extension of the hybrid motor cable).



1 = Accidental contact of the shield with other metal parts must be prevented
2 = Shields connected to the housing on the connector side

Earthing diagram

System design in accordance with EN 61800-5-1



	Power wires	Encoder wires and brake wires
System voltage (supply voltage of power module and controller)	300 V	≤ 50 V
Voltage class	C	*Encoder wires:* B *Brake wires:* C
Overvoltage category	III	II

Electrical characteristics

	Ampacity	Working voltage	Impulse withstand voltage
PUR cable Ø 9.3 mm[1]			
4 x 0.5 mm² (power wires)	8 A[2]	≤ 1000 V (AC)	4 kV
2 x 0.34 mm² (brake wires)	–		
2 x 0.14 mm² (encoder wires)	–		
M12 SpeedTEC connecting element			
4 x Ø 1.0 mm contact	8 A	≤ 630 V (AC/DC)	6 kV
4 x Ø 0.6 mm contact	1 A	≤ 48 V (AC/DC)	1.5 kV

[1] Multi-wire PUR cable in accordance with DIN VDE 0298-4 Table 11, at an ambient temperature of +40 °C
[2] Ampacity based on VDE 0298-4 Table 11, widened range for 0.5 mm²

SpeedTEC is a registered trademark of TE Connectivity Industrial GmbH.

	Ampacity	Working voltage	Impulse withstand voltage
PUR cable Ø 11 mm			
4 x 1.5 mm² (power wires)	13.2 A[1]	≤ 1000 V (AC)	4 kV
2 x 0.75 mm² (brake wires)	–		
2 x 0.25 mm² (encoder wires)	–		
PUR cable Ø 15.8 mm			
4 x 4.0 mm² (power wires)	30.0 A[1]	≤ 1000 V (AC)	4 kV
2 x 1.00 mm² (brake wires)	–		
2 x 0.38 mm² (encoder wires)	–	≤ 300 V (AC)	1 kV
SpeedTEC M23 connecting element			
4 x Ø 2.0 mm contact	30 A	≤ 630 V (AC/DC)	6 kV
4 x Ø 1.0 mm contact	7 A	≤ 250 V (AC/DC)	2.5 kV

[1] Ampacity in accordance with VDE 0891-1 at an ambient temperature of +40 °C

SpeedTEC is a registered trademark of TE Connectivity Industrial GmbH.

	Working voltage	Test voltage
ETFE single wires for output cables inside the motor		
2 x 0.15 mm², twisted (power supply and encoder communication)	< 50 V (AC/DC)	3.4 kV peak AC / DC[1] Test duration: 1 s
2 x 0.15 mm² with heat shrink tubing (temperature sensor connection)		

[1] In accordance with MIL-W-22759/18

Also comply with the specifications and mating dimensions for the M12 and M23 connectors from TE Connectivity Industrial GmbH.

Mechanical characteristics

	Hybrid motor cable (0.5 mm²) with M12 connecting element	**Hybrid motor cable (1.5 mm²)** with M23 connecting element
Outside diameter	9.3 mm ±0.2 mm	11 mm ±0.4 mm
Bend radius for stationary routing	≥ 47 mm	≥ 44 mm
Frequent flexing	≥ 70 mm	≥ 83 mm
Temperature for stationary routing	–30 °C to 80 °C	
Temperature for frequent flexing	–20 °C to 60 °C	–20 °C to 80 °C
Drag chain[1)]	Frequent flexing ≤ 5 000 000 cycles	
Connecting element	Connecting cycles ≤ 500	
Protection EN 60529	IP67 on the motor side when connected	

[1)] Maximum acceleration: 5 m/s² at up to a 3 m traversing distance
Maximum speed: 240 m/min

SpeedTEC is a registered trademark of TE Connectivity Industrial GmbH.

	Hybrid motor cable (4.0 mm²) with M23 connecting element
Outside diameter	15.8 mm
Bend radius for stationary routing	≥ 79 mm
Frequent flexing	≥ 118.5 mm
Temperature for stationary routing	–50 °C to 90 °C (EN) –50 °C to 80 °C (UL)
Temperature for frequent flexing	–40 °C to 90 °C (EN) –40 °C to 80 °C (UL)
Drag chain[1)]	Frequent flexing ≤ 5 000 000 cycles
Connecting element	Connecting cycles ≤ 500
Protection EN 60529	IP67 on the motor side when connected

[1)] Maximum acceleration: 50 m/s² at up to a 20 m traversing distance
Maximum speed: 300 m/min

SpeedTEC is a registered trademark of TE Connectivity Industrial GmbH.

Also comply with the specifications and mating dimensions for the M12 and M23 connecting elements from TE Connectivity Industrial GmbH.

Electrical connection

Pin layout for ECI/EQI 1100 output cables inside the motor housing

	15-pin connector (female)	**2-pin connector (male)**	**HMC 2 8-pin M12 SpeedTEC angle flange socket (male)**
	15	2	M12

	Encoder			
	Power supply / Serial data transfer		Connections for an external temperature sensor	
15	**9**	**10**	**5**	**6**
2	**/**	**/**	**2**	**1**
M12	**A**	**B**	**/**	**/**
	P_SD+[1)]	**P_SD–**[1)]	**T+**[2)]	**T–**[2)]
	Violet	Yellow	Brown	Green

[1)] Power supply and data: P_SD+ contains U_P (power supply)
P_SD– contains 0 V
[2)] Connections for an external temperature sensor

Pin layout of hybrid motor cable (0.5 mm²) with M12 connector technology

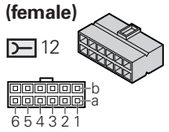
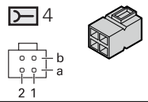
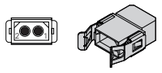
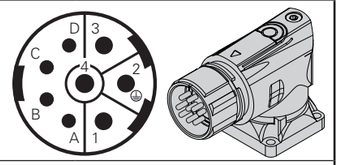
	HMC 2 8-pin M12 SpeedTEC connector (female)	**15-pin D-sub connector (male)**	**4-pin header (male)**	**3-pin header (female)**	**Earth cable terminal**
	M12	15	4	3	

	Encoder		**Motor**					
	Power supply / Serial data transfer		Brake		Power			
M12	**A**	**B**	**C**	**D**	**1**	**2**	**3**	**4**
15	**8**	**15**	**/**	**/**	**/**	**/**	**/**	**/**
4	**/**	**/**	**4**	**3**	**/**	**/**	**/**	**/**
3	**/**	**/**	**/**	**/**	**U**	**V**	**W**	**/**
⏚	**/**	**/**	**/**	**/**	**/**	**/**	**/**	**Earth**
	P_SD+[1)]	**P_SD–**[1)]	**Brake+**	**Brake–**	**U**	**V**	**W**	**PE**
	Blue	White	Black 5	Black 6	Black 1	Black 2	Black 3	Yellow/Green

[1)] Power supply and data: P_SD+ contains U_P (power supply)
P_SD– contains 0 V
The HMC 2 hybrid motor cable has three cable shields (an outer shield, a shield for the encoder wires and a shield for the brake wires).
The cable shields are bonded with the M12 SpeedTEC connector housing.
Vacant pins or wires must not be assigned.

Electrical connection

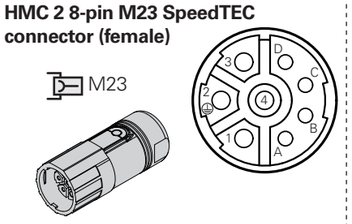
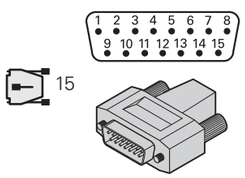
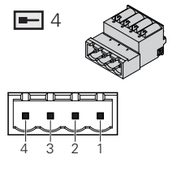
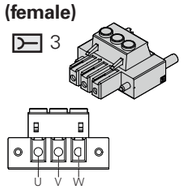
Pin layout for output cables inside the motor housing for the ECI/EQI 1300 and ECN/EQN 1300

12-pin connector (female)	4-pin connector (female)	2-pin connector (male)	HMC 2 8-pin M23 SpeedTEC angle flange socket (male)
			

	Encoder			
	Power supply / Serial data transfer		Connections for an external temperature sensor	
12	**2b**	**5a**	**/**	**/**
4	**/**	**/**	**1a**	**1b**
2	**/**	**/**	**2**	**1**
M23	**A**	**B**	**/**	**/**
	P_SD+[1]	**P_SD–**[1]	**T+**[2]	**T–**[2]
	Violet	Yellow	Brown	Green

[1] Power supply and data: P_SD+ contains U_P (power supply)
P_SD– contains 0 V
[2] Connections for an external temperature sensor

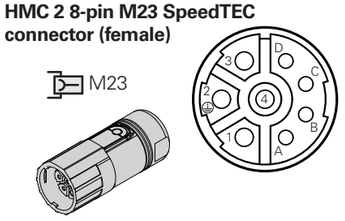
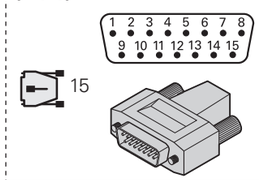
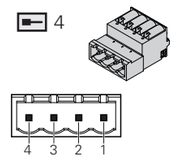
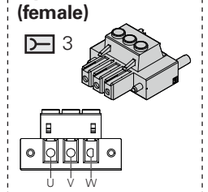
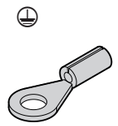
Pin layout for hybrid motor cable (1.5 mm²) with M23 connector technology

HMC 2 8-pin M23 SpeedTEC connector (female)	15-pin D-sub connector (male)	4-pin header (male)	3-pin header (female)	Earth cable terminal
				

	Encoder		Motor					
	Power supply / Serial data transfer		Brake		Power			
M23	**A**	**B**	**C**	**D**	**1**	**4**	**3**	**2**
15	**8**	**15**	**/**	**/**	**/**	**/**	**/**	**/**
4	**/**	**/**	**4**	**3**	**/**	**/**	**/**	**/**
3	**/**	**/**	**/**	**/**	**U**	**V**	**W**	**/**
⏚	**/**	**/**	**/**	**/**	**/**	**/**	**/**	**Earth**
	P_SD+[1]	**P_SD–**[1]	**Brake+**	**Brake–**	**U**	**V**	**W**	**PE**
	Gray	Pink	Black 5	Black 6	Black 1	Black 2	Black 3	Yellow/Green

[1] Power supply and data: P_SD+ contains U_P (power supply)
P_SD– contains 0 V
The HMC 2 hybrid motor cable has three cable shields (an outer shield, a shield for the encoder wires and a shield for the brake wires).
The cable shields are bonded to the M23 SpeedTEC connector housing.
Vacant pins or wires must not be assigned.

Pin layout for hybrid motor cable (4.0 mm²) with M23 connector technology

HMC 2 8-pin M23 SpeedTEC connector (female)	15-pin D-sub connector (male)	4-pin header (male)	3-pin header (female)	Earth cable terminal
				

	Encoder		Motor					
	Power supply / Serial data transfer		Brake		Power			
M23	**A**	**B**	**C**	**D**	**1**	**4**	**3**	**2**
15	**8**	**15**	**/**	**/**	**/**	**/**	**/**	**/**
4	**/**	**/**	**4**	**3**	**/**	**/**	**/**	**/**
3	**/**	**/**	**/**	**/**	**U**	**V**	**W**	**/**
⏚	**/**	**/**	**/**	**/**	**/**	**/**	**/**	**Earth**
	P_SD+[1]	**P_SD–**[1]	**Brake+**	**Brake–**	**U**	**V**	**W**	**PE**
	Blue	White	Black 5	Black 6	Black 1	Black 2	Black 3	Yellow/Green

[1] Power supply and data: P_SD+ contains U_P (power supply)
P_SD– contains 0 V
The HMC 2 hybrid motor cable has three cable shields (an outer shield, a shield for the encoder wires and a shield for the brake wires).
The cable shields are bonded to the M23 SpeedTEC connector housing.
Vacant pins or wires must not be assigned.

SpeedTEC is a registered trademark of TE Connectivity Industrial GmbH.

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This Product Information document supersedes all previous editions, which thereby become invalid. The basis for ordering from HEIDENHAIN is always the Product Information document edition valid when the order is placed.

Further information:

Comply with the requirements described in the following documents to ensure correct and intended operation:

- Brochure: *Cables and Connectors* 1206103-xx
- Brochure: *Encoders for Servo Drives* 208922-xx
- Brochure: *Interfaces of HEIDENHAIN Encoders* 1078628-xx

For more information on EnDat 3, visit: *www.endat.de*
For brochures and Product Information documents, visit: *www.heidenhain.com*

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