IEEE P802.3cg 10 Mb/s
Single Twisted Pair Ethernet Task Force (10SPE)

Details for MDI Connectors discussion

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MDI details

The key for the market success of SPE in non automotive applications is a dedicated well defined MDI connector.
See also presentation from Peter Jones:
http://www.ieee802.org/3/cg/public/adhoc/8023cg_adhoc_optional_mdi.pdf

A defined and uniform connector is needed for a plug and play Single Pair Ethernet (SPE) eco system usable for 10 / 100 / 1000 / potential MultiGig BASE-T1.

IEC working group SC 48B work on a project for an uniform SPE connector eco system with **IEC 61076-3-125**.
Completion estimated 2019.

Page 5 Presentation "Optional MDI discussion" from Peter Jones

Goals for optional MDI(s)

- The following is a wish list of items that I think we should address to define optional MDI(s) for 10SPE, and enable us to better address a "plug-and-play" market.

    1. One MDI for "normal" environments (RJ45 equivalent) and one for a "harsh" environments (M12 equivalent)

    2. "binary connector" either in or out (as opposed to the screw terminal), physically robust and resistant to vibration etc.

    3. Interoperable between the harsh and normal connectors at different ends of a cable.

    4. Relatively small (~50% of 4 pair equivalent).

    5. Field termination should be possible.

    6. Support for optional power distribution techniques.

    7. Reasonable balance of cost of connector within system (different absolute numbers between normal and harsh environment connectors).

    8. Should support uses for higher speeds (e.g., 100BASE-T1, 1000BASE-T1, etc etc)

IEEE 802.3cg 10SPE TF AdHoc

MDI details

An optional uniform SPE connector is beneficial for the plug and play functionality of the 10Mbit/s SPE.
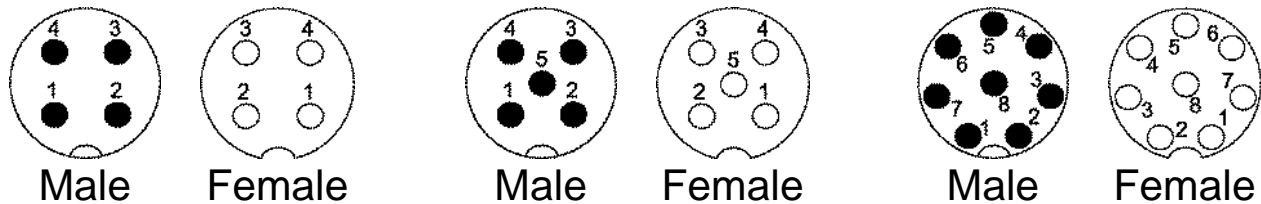Draft 1.1, page 180:

"For industrial applications also a four pin M8/M12 or a four pin 7/8" connector may be used as long as it conforms to the requirements of the link segment defined in 146.7."

→ Question: What could be a possible M8 / M12 coding version for SPE?
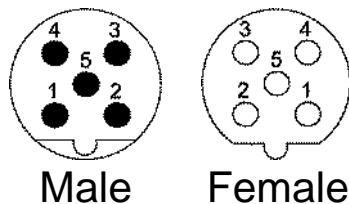
MDI details – Info existing M8 / M12

For M12 a big variety of different coding's for signal – power and data for different applications are used
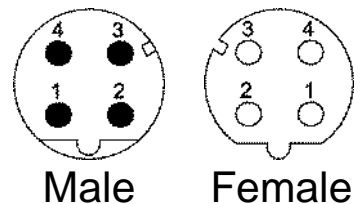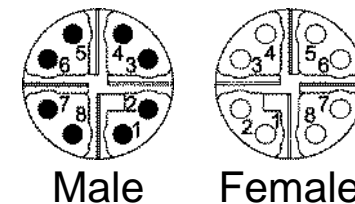
A-coding *for sensors and actuators*

Male Female   Male Female   Male Female

B-coding   **D-coding**   **X-coding**

Male Female   Male Female   Male Female

Fast-Ethernet   *Gigabit-Ethernet*

K-, L-, M-, S- and T coding *for different Power levels*

MDI details

Several 4 pin M8/M12 coding's are existing and all of them are specified for different applications. For example:

- A- coding for Sensors and actors
- B-coding for PROFIBUS
- D- and X-coding for Ethernet and so on.

→ Non of all this different coding types is free for the dedicated use for SPE and all of them are not designed for SPE HF requirements up to 600MHz or better.

→ A new coding just designed for SPE is needed.

→ Same story for RJ45, because the RJ45 is the main connector for "Multi-pair-Ethernet" and not for SPE.

→ For users a connector is always related to a special application. (RJ45→ Ethernet, HDMI-Video, USB…)
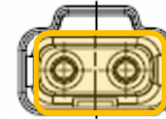
MDI details – IEC 61076-3-125 proposal

Main specifications SPE connector:

- Identical mating face for IP20 and IP 65/67
- Ready for PoDL with 2A / 60 V DC
- Crimp and IDC field termination
- Fully shielding and robust locking system
- Usable from 10BASE-T1 up to 1GBASE-T1 (if possible also for MultiGig BASE-T1)
- Popular and market accepted M8 and M12 screw locking and additional easy to handle PushPull locking

MDI details – IEC 61076-3-125 proposal

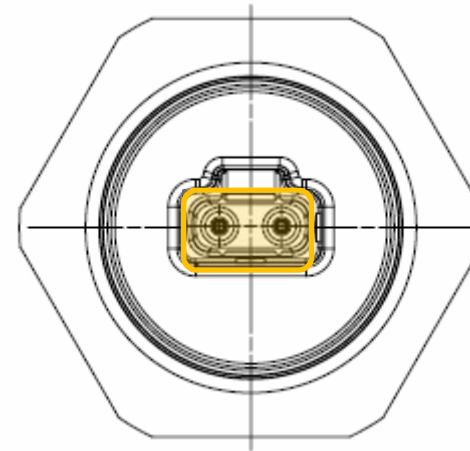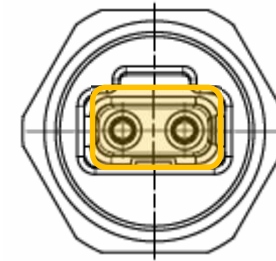**IP20 Version**

IP65/67 versions
approx. 8 mm diameter
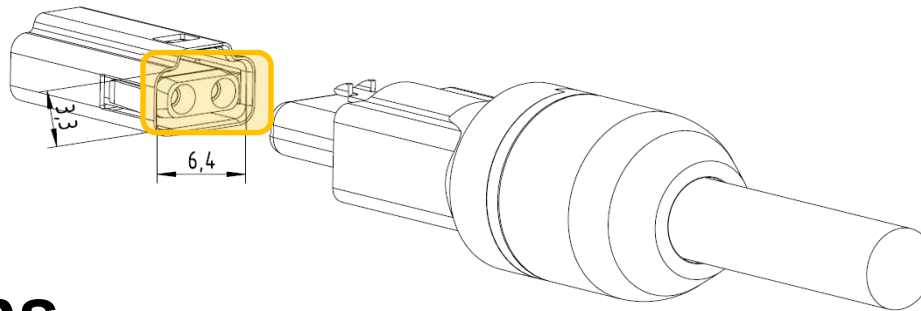*(usable with thin cable for short lengths)*

or

12 mm diameter
(usable with big cable for long lengths)
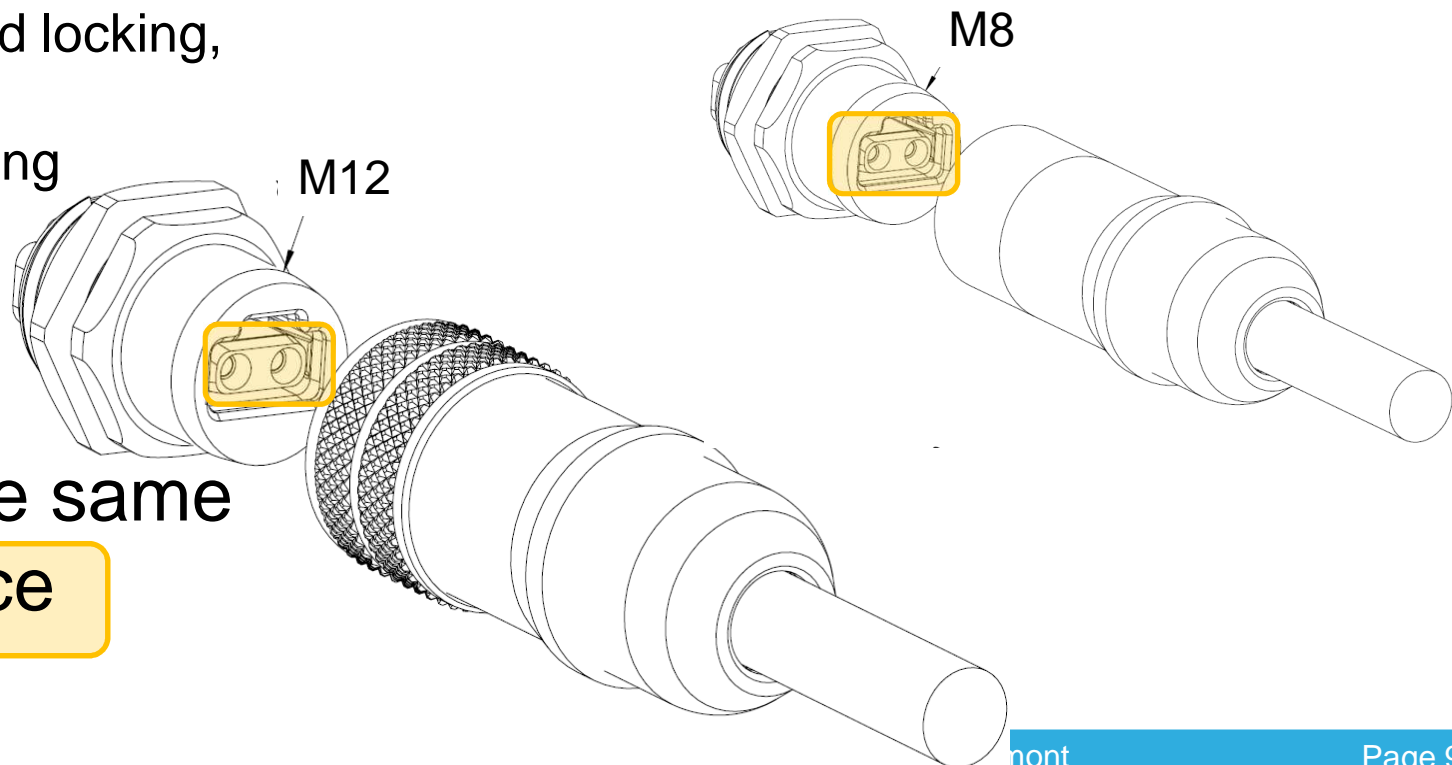

Always the same
mating face
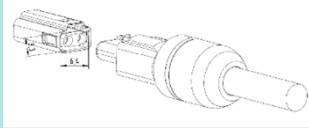
MDI details – IEC 61076-3-125 proposal

IP20 Version
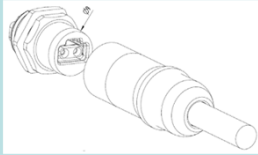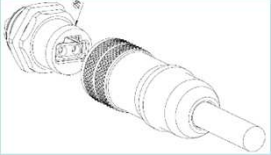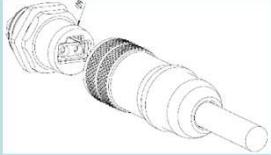
3,3

6,4

IP65/67 versions

M8/M12 thread locking,
Snap-In or
PushPull locking

M8

M12

Always the same
mating face

Design concept of the Industrial style 1-pair copper connector

made to fulfil the wide range of requirements in industrial applications but meets low manufacturing costs by using a lot of same parts

| Connecting Hardware Interface*	IP20	M8 Snap-In	M8 screw thread / PushPull	M12 screw thread / PushPull
Transmission standards				
10Base-T1 (1.000m) IEEE 802.3cg Estimated in 2019	OK	OK	OK	OK
100Base-T1 (15/40m) IEEE 802.3bw published	OK	OK	OK	Ok – but not relevant
1000Base-T1 (15/40m) IEEE 802.3bp published	OK	OK	OK	Ok – but not relevant
NGBase-T1 IEEE 802.3ch Estimated in 2018/19	OK	OK	OK	Ok – but not relevant
Cable diameter	4-6mm			4-12mm

* mated face according IEC 61076-3-125 ED1

Typical Free Connector

- The same "HF container" for all types

- Mated face acc. **IEC 61076-3-125 ED1**

- Several connection technologies possible like Crimp, IDC or other ones

M12 style with screw locking
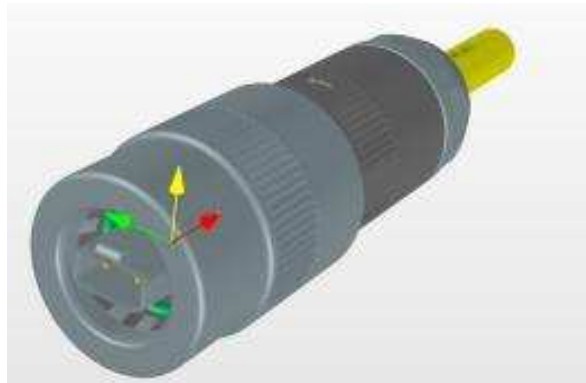
M8 style with PushPull locking

IP20 style

* **mated face according IEC 61076-3-125 ED1**

# Advantages of industrial style modular connector concept

- 1-pair copper connector for industrial delivers exactly what the industry needs

- The pin design (mated face acc. IEC 61076-3-125 ED1) supports all single pair Ethernet services and remote powering respectively PoDL.

- The "HF container" used in all variants of the connector guaranties high performance up to 600MHz

- The fully shielded "HF container" delivers high EMC capabilities

- The use of M12 and M8 housings delivers IP65/67 performance and stands for MICE3 use cases.

- Metal housing with screw locking (or PushPull locking) stands for robust design, reliable use and easy operation.

- M12 and M8 connector are approved and very popular in industrial applications

- The 1-pair copper connector can be mounted as an MDI connector for equipment

- Other future product variants allow smart cabling solutions like bulkheads aom.

Compatibility

- The industrial 1-pair connector supports Ethernet in all industrial applications and especially in the field area (sensor/actuator networks)

  → supports TCP/IP network infrastructure

- This design drives Ethernet in industrial applications from the field up to the cloud and supports IIoT applications

- Equipment designers and engineers have access to much detailed information to integrate the industrial style connector into their design and installation

- The balanced 1-pair copper industrial connector can be mounted in standardized M8 or M12 openings → integration is very easy

- With the container concept for industrial style 1-pair copper connectors, design and manufacturing of related products become less expensive

- This connector type will be used not just within the area of ISO/IEC11801-3 but also in IEC 61784-5-x series (Communicaion Profiles) and IEC61918 (Installation)
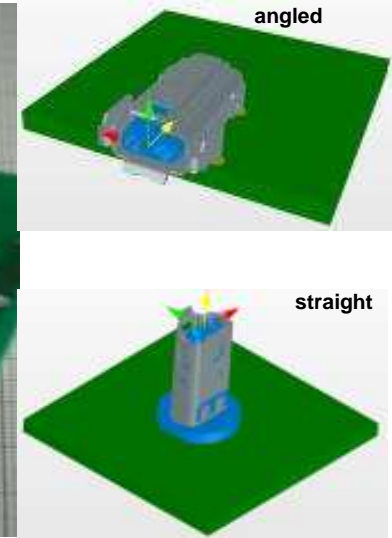
Typical 2-pin SPE Connector

- usually in PCB design for implementation of SPE connectivity into devices (DevCon)

- feasible as „cable jack" e.g. as in-line coupler
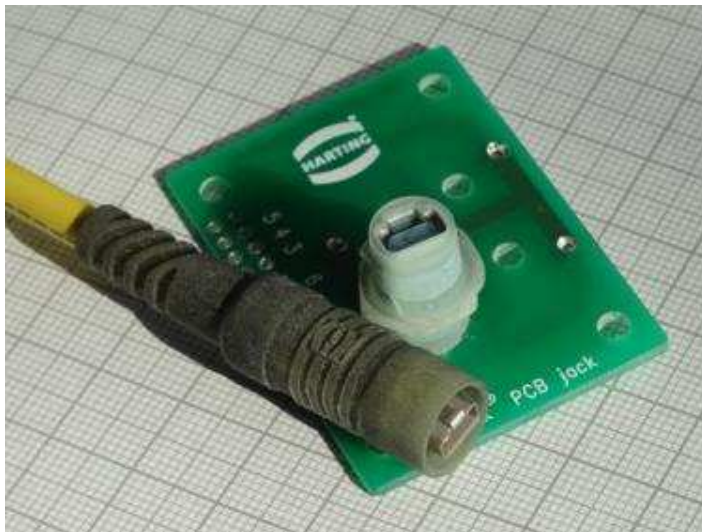
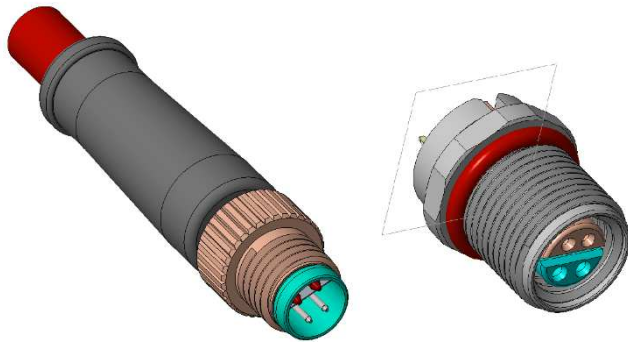**Industrial 1-pair connector M8 style**
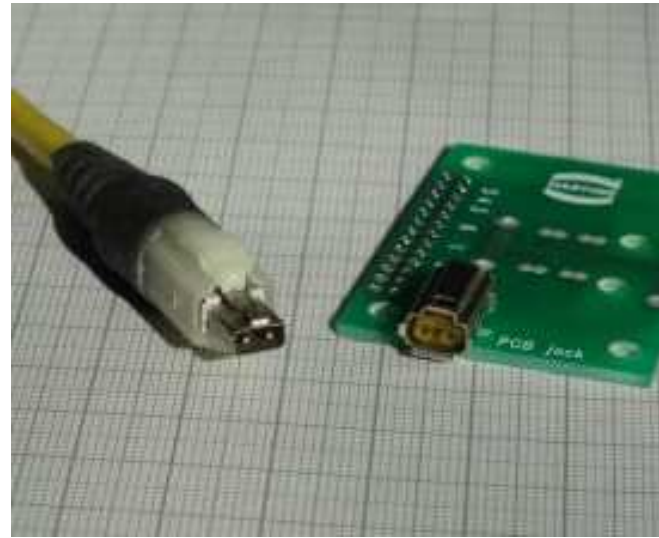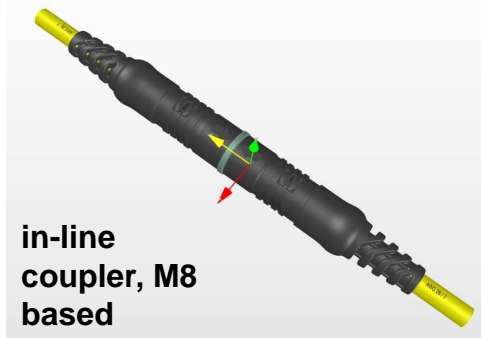
Industrial 1-pair connector IP20 style

angled

straight

in-line coupler, M8 based

Mated face of SPE connector samples acc. IEC 61076-3-125 ED1 made by HARTING

Typical 4-pin SPE Connector

- usually in PCB design for implementation of SPE connectivity into devices (DevCon)

- data and power pins separated and fully shielded design

Industrial 2-pair connector M8 style with 2 data pins and 2 power pins

Mated face of SPE connector samples acc. IEC 61076-3-125 ED1 made by TE

Summary

Standardization of this **mating face** in IEC SC48B has progressed with the approval of new work item proposal and the creation of new project IEC 61076-3-125 ED1 for this industrial style connector – publication scheduled for 2019

Popular robust IP65/67 interface in a compact size following M12- and M8 design will promote 1-pair cabling in industrial applications and drives I4.0 and IIoT

Installation by using Crimp tools will enable installation in the field and delivers reliable contact as required in industrial applications. IDC versions for some of the plug products will raise the acceptance of the industrial style 1-pair connector.

Mechanical and electrical contact interface dimensions will become to an open IEC standard! That allows a wide range of products from different suppliers. No single source, No patent protection.

Questions?

Thank you!