



**SLOVENSKI STANDARD**  
**oSIST prEN 4165-001:2023**  
**01-julij-2023**

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**Aeronavtika - Konektorji, električni, pravokotni, modularni - Stalna delovna temperatura 175 °C - 001. del: Tehnična specifikacija**

Aerospace series - Connectors, electrical, rectangular, modular - Operating temperature 175°C continuous - Part 001: Technical specification

Luft- und Raumfahrt - Elektrischer Rechtecksteckverbinder in modularer Bauweise - Betriebstemperatur 175 °C - Teil 001: Technische Lieferbedingungen

Série aérospatiale - Connecteurs électriques rectangulaires modulaires - Température d'utilisation 175 °C continu - Partie 001: Spécification technique

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**Aerospace series - Connectors, electrical, rectangular,  
modular - Operating temperature 175°C continuous - Part  
001: Technical specification**

Série aérospatiale - Connecteurs électriques  
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175 °C continu - Partie 001: Spécification technique

Luft- und Raumfahrt - Elektrischer  
Rechtecksteckverbinder in modularer Bauweise -  
Betriebstemperatur 175 °C - Teil 001: Technische  
Lieferbedingungen

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## **European foreword**

This document (prEN 4165-001:2023) has been prepared by the Aerospace and Defence Industries Association of Europe — Standardization (ASD-STAN).

After enquiries and votes carried out in accordance with the rules of this Association, this document has received the approval of the National Associations and the Official Services of the member countries of ASD-STAN, prior to its presentation to CEN.

This document is currently submitted to the CEN Enquiry.

This document will supersede EN 4165-001:2015.

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## 1 Scope

This document specifies the general characteristics, the conditions for qualification, acceptance and quality assurance, as well as the test programs and groups for rectangular connectors with one or multiple removable modules, intended for use in a temperature range from -55 °C to 175 °C continuous.

This family of connectors is particularly suitable for aeronautic use in zones of severe environmental conditions on board aircraft, applying EN 2282.

The maximum in-service temperature can be limited by maximum temperature of contacts.

## 2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 2591-100, *Aerospace series - Elements of electrical and optical connection - Test methods - Part 100: General*

EN 2591-101, *Aerospace series - Elements of electrical and optical connection - Test methods - Part 101: Visual examination*

EN 2591-205, *Aerospace series - Elements of electrical and optical connection - Test methods - Part 205: Housing (shell) electrical continuity*

EN 2591-303, *Aerospace series - Elements of electrical and optical connection - Test methods - Part 303: Cold/low pressure and damp heat*

EN 2591-306, *Aerospace series - Elements of electrical and optical connection - Test methods - Part 306: Mould growth*

EN 2591-314, *Aerospace series - Elements of electrical and optical connection - Test methods - Part 314: Immersion at low air pressure*

EN 2591-315, *Aerospace series - Elements of electrical and optical connection - Test methods - Part 315: Fluid resistance*

EN 2591-324, *Aerospace series - Elements of electrical and optical connection - Test methods - Part 324: Interfacial sealing*

EN 2591-402, *Aerospace series - Elements of electrical and optical connection - Test methods - Part 402: Shock*

EN 2591-403, *Aerospace series - Elements of electrical and optical connection - Test methods - Part 403: Sinusoidal and random vibration*

EN 2591-419, *Aerospace series - Elements of electrical and optical connection - Test methods - Part 419: Stability of male contacts in insert*

EN 3155-002, *Aerospace series - Electrical contacts used in elements of connection - Part 002: List and utilization of contacts*

EN 3155-070, *Aerospace series - Electrical contacts used in elements of connection - Part 070: Contacts, electrical, male, type A, crimp, class S - Product standard*

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EN 3155-071, *Aerospace series - Electrical contacts used in elements of connection - Part 071: Contacts, electrical, female, type A, crimp, class S - Product standard*

EN 3155-082, *Aerospace series - Electrical contacts used in elements of connection - Part 082: Contacts, electrical, female, type A, crimp, class S - Product standard*

EN 3197, *Aerospace series - Design and installation of aircraft electrical and optical interconnection systems*

EN 3909, *Aerospace series - Test fluids and test methods for electrical and optical components and sub-assemblies*

EN 4165-002, *Aerospace series - Connectors, electrical, rectangular, modular - Operating temperature 175 °C continuous - Part 002: Specification of performance and contact arrangements*

EN 4165-003, *Aerospace series - Connectors, electrical, rectangular, modular - Operating temperature 175 °C continuous - Part 003: Modules series 2 and series 3 - Product standard*

EN 4165-020, *Aerospace series - Connectors, electrical, rectangular, modular - Operating temperature 175 °C continuous - Part 020: Coupling system keyway for receptacle - Product standard*

EN 4165-021, *Aerospace series - Connectors, electrical, rectangular, modular - Operating temperature 175 °C continuous - Part 021: Coupling system keyway for plug - Product standard*

EN 4165-024, *Aerospace series - Connectors, electrical, rectangular, modular - Operating temperature 175 °C continuous - Part 024: Single module plug - Product standard*

EN 4165-025, *Aerospace series - Connectors, electrical, rectangular, modular - Operating temperature 175 °C continuous - Part 025: Single module receptacle - Product standard*

EN 9133, *Aerospace series - Quality Management Systems - Qualification Procedure for Aerospace Standard Products*

ISO 263, *ISO inch screw threads — General plan and selection for screws, bolts and nuts — Diameter range 0,06 to 6 in*

### **3 Terms and definitions**

For the purposes of this document, the terms and definitions given in EN 2591-100 apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp/>
- IEC Electropedia: available at <https://www.electropedia.org/>



## 4 Description

### 4.1 General

#### 4.1.1 Introduction

Different variants of materials, housings, modules and contact arrangements are provided according to the Class depending on the service conditions.

These connectors have rectangular housings, with removable modules and contacts. They can be fitted with cable outlets. Male or female modules can be inserted or intermixed in plug or receptacle housings.

These connectors use different types of contacts (signal, power, coaxial, quadrax, optical, ...) defined in EN 3155-002.

These connectors can also be fitted with optical modules EN 4701 and EN 4830 with associated optical contacts.

This specification covers three variations in housing and coupling mechanisms to mate and unmate:

- centre coupling screw;
- rack and panel;
- push-pull latching.

#### 4.1.2 Centre coupling

The connectors are mated and unmated by a centre coupling screw, which provides when the connectors are fully mated a shell to shell bottoming between plug and receptacle.

The plug contains a coupling screw and the receptacle a coupling nut.

This family of connectors provides two housing sizes (2 or 4 modules) and two series (series 2 and scoop proof series 3).

The connectors are polarized by centre keying mechanism; polarization shall be obtained before the male contacts enter the module of the female contacts and before the coupling system is engaged. Keying mechanism shall provide 36 position keying capabilities.

#### 4.1.3 Rack and panel plug

The rack and panel plugs contain a clipped centre coding socket clipped with internal keyways. Polarization is ensured by the different positions which the secondary keyway may take and different positions which the centre coding socket may take clipped in the housing.

The centre coupling screw is replaced by a centre guide pin. The floating fixation with coupling spring ensures the alignment and the metal to metal bottoming between plug and receptacle.

#### 4.1.4 Push-pull latching

The connectors are mated and unmated by a push-pull latching mechanism (for more detail, see 4.3.2 for receptacle and 4.4.4 for plug).

This family of connectors provides single housing size (1 module series 2).

The connectors are polarized by integral key and keyways mechanism associated with dedicated colour identification.

Polarization shall be obtained before the male contacts enter the module of the female contacts and before the coupling system is engaged.

**prEN 4165-001:2023 (E)****4.2 Housing**

All parts except module are considered “housing”.

All “ housings ” models, except class C, shall meet electrical performances described in Table 39.

**4.3 Receptacle****4.3.1 Centre coupling mechanism**

The receptacle may be attached by:

- Rectangular flange with two mounting holes;
- Two end flanges with transversal holes (panel mounting) and lateral holes (stackable mounting).

The receptacle contains a coupling nut which ensures also the polarization function (coding pin) by external keys. The main key fixed and is wider than the other. Polarization is ensured by the different positions which the secondary key may take and different positions which the coding pin may be fixed in the housing.

The module cavities are identified on the housing of the receptacle by letter A, B, C, D for size 4 (four modules) and letter A, B for size 2 (two modules). The cavities are polarized by two keyways location.

**4.3.2 Push-pull latching mechanism**

The receptacle can be attached by rectangular flange.

The receptacle shell design incorporates specific design feature that provides a mechanical and electrical interface to the plug. The electrical ground path established by the mounting design feature incorporated in the receptacle shell maintains a stable, low resistance electrical ground path for the life of the installation. This electrical ground path that is provided by the mechanical mounting feature shall require no preparations during the initial assembly processes or maintenance once in service.

**4.4 Plugs****4.4.1 General**

The plugs contain a clipped centre coding socket clipped with internal keyway options. Polarization is ensured by the different positions which the secondary keyway may take and different positions which the centre coding socket may take clipped in the housing.

**4.4.2 Centre coupling mechanism**

The coupling screw permanently fitted on the plug enables the connectors to be coupled and uncoupled. The internal thread of the coupling ring may be treated with a suitable lubricant compatible with the performance required in this standard.

The module cavities are identified on the housing of the plug by letter A, B, C, D for size 4 (four modules) and letter A, B for size 2 (two modules). The cavities are polarized with two keyway locations.

**4.4.3 Rack and panel**

The plug contains a clipped centre coding socket clipped with internal keyway options. Polarization is ensured by the different positions which the secondary keyway may take and different positions which the centre coding socket may take clipped in the housing.

The centre coupling screw is replaced by a centre guide pin. The floating fixations with coupling spring ensure the alignment and the metal to metal bottoming between plug and receptacle.

#### 4.4.4 Push-pull latching mechanism

The plug shell is mated to the receptacle shell by sliding the plug into the receptacle where the two shells engage. The latch mechanism then engages the specific features located on the receptacle forcing the two connectors shells together creating a mechanically rigid assembly. The receptacle shell shall contain design features that interface to the plug shell providing not only a mechanically rigid assembly but a 360 degree enclosure essential to the EMI shielding performance. The coupling mechanism and connector shell design shall incorporate a means of providing a visual reference that the plug is fully mated to the receptacle. No tools shall be required to activate and release the latch mechanism to either mate or unmate the plug to the receptacle. The coupling mechanism shall withstand 500 mating and unmating cycles. This mechanism shall be self-lockable.

#### 4.5 Rear accessories

The rear accessories used with this family are specified in product standards (see EN 4165-002).

#### 4.6 Modules

The module shall be single-bloc type design complete with contact retention systems and appropriate seals.

The female modules use female contacts and male modules use male contacts. These Modules use crimp or solder contacts of sizes 23, 22, 20, 16, 12 and 8. They are rear release and held in the housing by two retention tines. They are removable from the rear with a specific tool.

The modules have two keys which engage in the keyways of the housing. Polarization is ensured by the different positions which the secondary keys may take. The module polarization is identified by letter A, B, C, D, E, F or N (universal).

A blank module is installed in a cavity where no contacts are required. This module is a male module with a universal polarization (N) installable in all coding cavities (A, B, C, D, E, F) and in all housing types (plug or receptacle).

Modules shall be interchangeable in cavities of housing with different configurations.

Modules are available in four configurations:

- |                              |     |                                 |           |
|------------------------------|-----|---------------------------------|-----------|
| — Without peripheral sealing | and | with standard fuel resistance   | : type 1; |
| — With peripheral sealing    | and | with standard fuel resistance   | : type 2; |
| — Without peripheral sealing | and | with reinforced fuel resistance | : type 3; |
| — With peripheral sealing    | and | with reinforced fuel resistance | : type 4. |

#### 4.7 Keying mechanism

##### 4.7.1 Central coupling mechanism and rack and panel

##### 4.7.1.1 Coding pin (receptacle)

Keying mechanism shall provide 36 position keying capabilities. These 36 positions are given with 6 different coding pins, identified by colour code. The main key is wider than the other, polarization is ensured by the different positions which the secondary key may take. Universal coding pin is compatible with all polarization codes. Coding pin shall be interchangeable between different housing models. They are fitted in the housing with a specific tool and the modification of coding position shall be made at the front face of the connector with specific tool.

**prEN 4165-001:2023 (E)****4.7.1.2 Clipped coding socket (plug)**

Keying mechanism shall provide 36 position keying capabilities. These 36 positions are given with 6 different coding sockets, identified by colour code. The main keyway is wider than the other; polarization is ensured by the different positions which the secondary keyway may take. Universal coding socket is compatible with all polarization codes. Coding socket shall be interchangeable between different housing models. They are front clipped in the housing without specific tool and the modification of coding position shall be either made by the front face of the connector with a new coding pin (a removed coding socket is not reusable).

**4.7.2 Push-pull latching mechanism**

Polarization of the connector shells provides a means of preventing mismatching connectors in close proximity to one another. Shell polarization of the connector should be accomplished by means of integral keys and keyways. It shall be impossible to mate a plug to a receptacle shell when these polarization keys are polarized differently. Polarization engagement shall occur after initial shell engagement and before the pin makes contact with the socket contact. The connector shells should use the code defined by this specification.

Colour and coding are defined in product standard EN 4165-024 and EN 4165-025.

**4.8 Materials and surface treatment****4.8.1 General**

When dissimilar metals are in close contact, adequate protection against corrosion shall be used for the electromotive force of the cell not to exceed 0,25 V.

**4.8.2 Housings**

The material of the housing for the connectors shall as follows (see EN 4165-002 for more details):

- Aluminium alloy with plating;
- Composite with plating;
- Composite without plating.

**4.8.3 Contacts**

Removable contacts (see EN 3155-002).

**4.8.4 Non-metallic materials**

The materials used for module, seals and grommets shall have mechanical characteristics compliant with the required use.

## 5 Design

### 5.1 Housings

The connector housings shall be a one piece construction. They shall accommodate the rear accessories and other fittings defined in this specification (see EN 4165-002). The rectangular flange receptacle can furthermore be fitted with a conductive gasket ensuring electrical continuity between the connector housing and panel.

For centre coupling mechanism, the threads shall conform to ISO 263, and the coupling mechanism shall be designed so that the male and female contacts engage when it is rotated clockwise the right and disengage when it is rotated anticlockwise to the left. The centre coupling screw shall be a hexagonal socket head screw and compatible with the coupling torque values defined in the product standard.

For push-pull latching mechanism, the locking mechanism shall be designed so that coupling is done by pushing the plug onto the receptacle. The mechanism has also a sliding perpendicular to the axis of engagement of the plug onto the receptacle.

Unlocking is done by pressure on the mechanism and perpendicular to the axis of engagement of the plug onto the receptacle.

The accessories shall be fixed by screw or clip on the rear of connectors.

### 5.2 Modules

The module carrying the male and female contacts shall be in hard material and have a cross section and radii such that no cracks, flaking or breaks can occur in normal operation.

The module for contacts shall be removable; it shall be mechanically held in the housing by two retention tines peripheral sealing can be provided between the housing and modules.

The front face of the modules shall be such that sealing is ensured when the connectors are coupled. The interfacial seal of the module shall be permanently fastened on the hard module.

The grommet shall permit sealing for all cable diameters indicated in EN 4165-002 and shall not be removable.

Module insertion shall be from the rear without tools and removal of the module shall be from the rear with the tools specified in the product standards. Module design shall prevent wrong mating.

The mechanical contacts retention system shall be integrated in the hard part of module. The design of module shall permit individual installation of the contacts without removal grommet. Fitting and removal of the contacts shall be from the rear with the tools specified in the product standards.

When mated, the minimum engagement of contact shall be 1,27 mm.

### 5.3 Connector mating sequence

#### 5.3.1 Centre coupling mechanism

The mating sequence shall be:

- Face to face positioning;
- Keyways polarization guide;
- Central thread coupling ;
- Grounding screening system;
- Electrical contact;

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- Sealed interface compression;
- Metal/metal or composite shell to shell bottoming.

**5.3.2 Push-pull latching mechanism**

The connector mating sequence shall be as follow:

- Face to face positioning;
- Keyways polarization guiding;
- Grounding screening;
- Electrical contact;
- Sealed interface compression;
- Locking.

**5.3.3 Rack and panel coupling**

The connector mating sequence shall be as follow:

- Face to face positioning;
- Central guiding pin ;
- Keyways polarization guiding
- Grounding screening;
- Electrical contact;
- Sealed interface compression.

**5.4 Connector mating**

Housing design shall prevent incorrect mating of the plug onto receptacle.

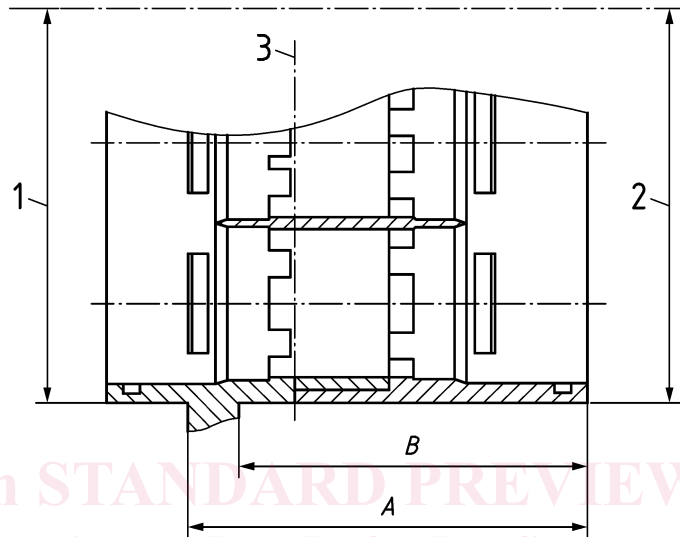
## 6 Definition drawings and masses

The general dimensions and the masses are given in the product standards.

### 6.1 Receptacle and plug mating dimensions

#### 6.1.1 Connector mated conditions, series 2 and 3

Dimensions are in millimetres, see Figure 1, Figure 2 and Table 1.



#### Key

1 Receptacle assembly

2 Standard plug assembly

3 Mechanical bottoming plate

**Figure 1 — Standard plug mated with receptacle**