



DPC: 23 / 30483560 DC

BSI Group Headquarters

389 Chiswick High Road London W4 4AL

Tel: +44 (0)20 8996 9000

Fax: +44 (0)20 8996 7400

www.bsigroup.com

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Responsible committee: EPL/48 Electromechanical components and mechanical structures for electronic equipment

Interested committees:

Title: BS EN IEC 61076-2-111 Connectors for electrical and electronic equipment - Product requirements

Part 2-111: Circular connectors - Detail specification for power connectors with M12 screw-locking

Please notify the secretary if you are aware of any keywords that might assist in classifying or identifying the standard or if the content of this standard

- i) has any issues related to 3rd party IPR, patent or copyright
- ii) affects other national standard(s)
- iii) requires additional national guidance or information

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Introduction

This draft standard is based on national and international discussions. Your comments on this draft are invited and will assist in the preparation of the consequent standard.

For international standards, comments will be reviewed by the relevant UK national committee before sending the consensus UK vote and comments to the international committee, which will then decide appropriate action. If the international standard is approved, it is usual for the text to be published as a British Standard.

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UK Vote

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Template for comments and secretariat observations

Date: xx/xx/20xx	Document: ISO/DIS xxxx
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1	2	(3)	4	5	(6)	7
MB	Clause No./ Subclause No./Annex (e.g. 3.1)	Paragraph/Figure/ Table/Note	Type of comment	Commend (justification for change) by the MB	Proposed change by the MB	Secretariat observations on each comment submitted
	3.1	Definition 1	ed	Definition is ambiguous and needs clarifying.	Amend to read '...so that the mains connector to which no connection...'	
	6.4	Paragraph 2	te	The use of the UV photometer as an alternative cannot be supported as serious problems have been encountered in its use in the UK.	Delete reference to UV photometer.	



48B/3078/CD

COMMITTEE DRAFT (CD)

PROJECT NUMBER:

IEC 61076-2-111 ED2

DATE OF CIRCULATION:

2023-11-17

CLOSING DATE FOR COMMENTS:

2024-02-09

SUPERSEDES DOCUMENTS:

48B/3077/RR

IEC SC 48B : ELECTRICAL CONNECTORS

SECRETARIAT:

United States of America

SECRETARY:

Mr Jeffrey Toran

OF INTEREST TO THE FOLLOWING COMMITTEES:

PROPOSED HORIZONTAL STANDARD:



Other TC/SCs are requested to indicate their interest, if any, in this CD to the secretary.

FUNCTIONS CONCERNED:

☐ EMC

☐ ENVIRONMENT

☐ QUALITY ASSURANCE

☐ SAFETY

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TITLE:

Connectors for electrical and electronic equipment - Product requirements - Part 2-111: Circular connectors - Detail specification for power connectors with M12 screw-locking

NOTE FROM TC/SC OFFICERS:

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

CONNECTORS FOR ELECTRONIC EQUIPMENT – PRODUCT REQUIREMENTS –

Part 2-111: Circular connectors – Detail specification for power connectors with M12 screw-locking

FOREWORD

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International Standard IEC 61076-2-111 has been prepared by subcommittee 48B: Electrical connectors, of IEC technical committee 48: Electrical connectors and mechanical structures for electrical and electronic equipment.

This International Standard cancel and replaces the first edition of IEC 61076-2-111 (2017). This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- a) The structure of this document has been adapted to the new ICE template for standards. New subclauses have been added. In Clauses 5 Dimensional information and 6 Characteristics, technical specifications have been updated.
- b) This document no longer includes the mating faces for M12 E-coded connectors.

243 c) Annex B (informative) Orientation of cable outlet in relation to coding has been added.

244 The text of this International Standard is based on the following documents:

Draft	Report on voting
XX/XX/FDIS	XX/XX/RVD

245

246 Full information on the voting for its approval can be found in the report on voting indicated in
247 the above table.

248 The language used for the development of this International Standard is **English** [change
249 **language if necessary**].

250 This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in
251 accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement,
252 available at www.iec.ch/members_experts/refdocs. The main document types developed by
253 IEC are described in greater detail at www.iec.ch/publications.

254 The committee has decided that the contents of this document will remain unchanged until the
255 stability date indicated on the IEC website under webstore.iec.ch in the data related to the
256 specific document. At this date, the document will be

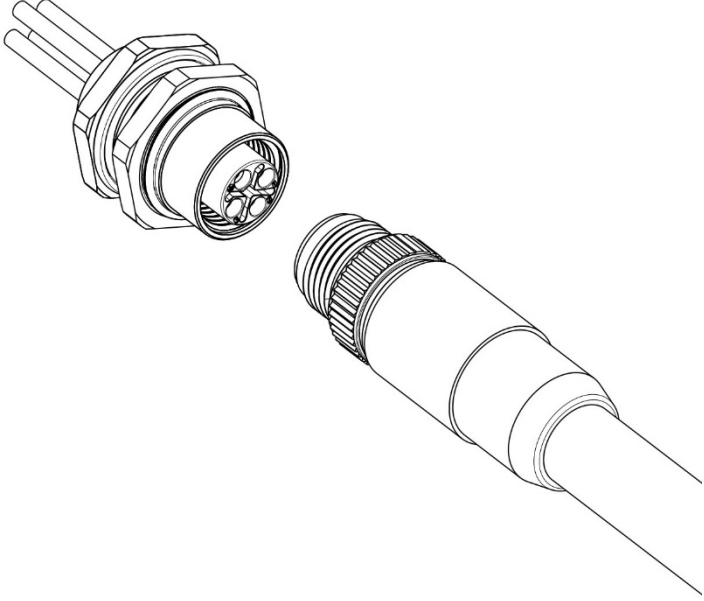
- 257 • reconfirmed,
- 258 • withdrawn, or
- 259 • revised.

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IEC SC 48B – Electrical connectors Specification available from: IEC General secretariat or from the addresses shown on the inside cover.	IEC 61076-2-111 Ed 2
Electronic components of assessed quality in accordance with: IEC 61076-2	
	Circular connectors Power connectors with M12 screw-locking Male and female connectors Male and female contacts Rewirable – Non-rewirable
	Free cable connectors Straight and right-angled connectors Fixed connectors Flange mounting Single hole mounting

264

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**CONNECTORS FOR ELECTRONIC EQUIPMENT –
PRODUCT REQUIREMENTS –****Part 2-111: Circular connectors –
Detail specification for power connectors with M12 screw-locking****1 Scope**

This part of IEC 61076-2 describes 4- to 6-way circular connectors with M12 screw-locking. For connection of power supply and power applications in industrial premises with current ratings up to 16 A rated current per contact and voltage ratings of 63 V or 630 V.

These connectors consist of both, fixed and free connectors either rewirable or non-rewirable. Male connectors have round contacts Ø1,0mm and Ø1,5mm.

The different codings provided by this document prevent the mating of differently coded male or female connectors.

NOTE M12 is the dimension of the thread of the screw locking mechanism of these circular connectors.

2 Normative references

The following referenced documents are indispensable for the application 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.

IEC 60050-581, *Advance edition of the International Electrotechnical Vocabulary – Chapter 581: Electromechanical components for electronic equipment*

IEC 60068-1, *Environmental testing – Part 1: General and guidance*

IEC 60068-2-60, *Environmental testing – Part 2: Tests – Test Ke: Flowing mixed gas corrosion test*

IEC 60352 (all parts), *Solderless connections*

IEC 60512-1, *Connectors for electronic equipment – Tests and measurements – Part 1: General*

IEC 60512-1-1, *Connectors for electronic equipment – Tests and measurements – Part 1-1: General examination – Test 1a: Visual examination*

IEC 60512-1-2, *Connectors for electronic equipment – Tests and measurements – Part 1-2: General examination – Test 1b: Examination of dimension and mass*

IEC 60512-2-1, *Connectors for electronic equipment – Tests and measurements – Part 2-1: Electrical continuity and contact resistance tests – Test 2a: Contact resistance – Millivolt level method*

IEC 60512-2-2 *Connectors for electronic equipment – Tests and measurements – Part 2-2: Electrical continuity and contact resistance tests – Test 2b: Contact resistance – Specified test current method*

- 306 IEC 60512-2-5 *Connectors for electronic equipment – Tests and measurements – Part 2-5:*
307 *Electrical continuity and contact resistance tests – Test 2e: Contact disturbance*
- 308 IEC 60512-3-1, *Connectors for electronic equipment – Tests and measurements – Part 3-1:*
309 *Insulation tests – Test 3a: Insulation resistance*
- 310 IEC 60512-4-1, *Connectors for electronic equipment – Tests and measurements – Part 4-1:*
311 *Voltage stress tests – Test 4a: Voltage proof*
- 312 IEC 60512-5-1, *Connectors for electronic equipment – Tests and measurements – Part 5-1:*
313 *Current-carrying capacity tests – Test 5a: Temperature rise*
- 314 IEC 60512-6-3, *Connectors for electronic equipment – Tests and measurements – Part 6-3:*
315 *Dynamic stress tests – Test 6c: Shock*
- 316 IEC 60512-6-4, *Connectors for electronic equipment – Tests and measurements – Part 6-4:*
317 *Dynamic stress tests – Test 6d: Vibration (sinusoidal)*
- 318 IEC 60512-9-1, *Connectors for electronic equipment – Tests and measurements – Part 9-1:*
319 *Endurance tests – Test 9a: Mechanical operation*
- 320 IEC 60512-9-2, *Connectors for electronic equipment – Tests and measurements – Part 9-2:*
321 *Endurance tests – Test 9b: Electrical load and temperature*
- 322 IEC 60512-11-1, *Electromechanical components for electronic equipment – Basic testing* 339
323 *procedures and measuring methods – Part 11: Climatic tests – Section 1: Test 11a – Climatic*
324 *sequence*
- 325 IEC 60512-11-4, *Connectors for electronic equipment – Tests and measurements – Part 11-4:*
326 *Climatic tests – Test 11d: Rapid change of temperature*
- 327 IEC 60512-11-7, *Connectors for electronic equipment – Tests and measurements – Part 11-7:*
328 *Climatic tests – Test 11g: Flowing mixed gas corrosion test*
- 329 IEC 60512-11-9, *Connectors for electronic equipment – Tests and measurements – Part 11-9:*
330 *Climatic tests – Test 11i: Dry heat*
- 331 IEC 60512-11-10, *Connectors for electronic equipment – Tests and measurements – Part 11-*
332 *10: Climatic tests – Test 11j: Cold*
- 333 IEC 60512-11-12, *Connectors for electronic equipment – Tests and measurements – Part 11-*
334 *12: Climatic tests – Test 11m: Damp heat, cyclic*
- 335 IEC 60512-13-2, *Connectors for electronic equipment – Tests and measurements – Part 13-2:*
336 *Mechanical operation tests – Test 13b: Insertion and withdrawal forces*
- 337 IEC 60512-13-5, *Connectors for electronic equipment – Tests and measurements – Part 13-5:*
338 *Mechanical operation tests – Test 13e: Polarizing and keying method*
- 339 IEC 60512-14-7 *Electromechanical components for electronic equipment – Basic testing*
340 *procedures and measuring methods – Part 14: Sealing tests – Section 7: Test 14g: Impacting*
341 *water*
- 342 IEC 60512-15-1 *Connectors for electronic equipment – Tests and measurements – Part 15-1:*
343 *Connector tests (mechanical) – Test 15a: Contact retention in insert*

- 344 IEC 60512-16-5, *Connectors for electronic equipment – Tests and measurements – Part 16-5:*
345 *Mechanical tests on contacts and terminations – Test 16e: Gauge retention force (resilient*
346 *contacts)*
- 347 IEC 60512-19-3, *Electromechanical components for electronic equipment – Basic testing*
348 *procedures and measuring methods – Part 19: Chemical resistance tests – Section 3: Test*
349 *19c – Fluid resistance*
- 350 IEC 60512-23-3 *Connectors for electrical and electronic equipment – Tests and*
351 *measurements – Part 23-3: Screening and filtering tests – Test 23c: Shielding effectiveness of*
352 *connectors and accessories – Line injection method*
- 353 IEC 60529, *Degrees of protection provided by enclosures (IP code)*
- 354 IEC 60664-1, *Insulation coordination for equipment within low-voltage systems – Part 1:*
355 *Principles, requirements and tests*
- 356 IEC 60998-2-1, *Connecting devices for low-voltage circuits for household and similar*
357 *purposes – Part 2-1: Particular requirements for connecting devices as separate entities with*
358 *screw-type clamping units*
- 359 IEC 60999-1, *Connecting devices – Electrical copper conductors – Safety requirements for*
360 *screw-type and screwless-type clamping units – Part 1: General Requirements and particular*
361 *requirements for clamping units for conductors from 0,2mm² up 35mm² (included)*
- 362 IEC 61076-1, *Connectors for electronic equipment – Product requirements – Part 1: Generic*
363 *specification*
- 364 IEC 61076-2, *Connectors for electronic equipment – Product requirements – Part 2: Sectional*
365 *specification for circular connectors*
- 366 IEC 61984, *Connectors – Safety requirements and tests*
- 367 IEC TR 63040, *Guidance on clearances and creepage distances in particular for distances*
368 *equa l to or less than 2mm – Test results of research on influencing parameters*
- 369 ISO 11469: 2016, *Plastics – Generic identification and marking of plastic products*
- 370 ISO 21920-1 (2021), *Geometrical Products Specifications (GPS) – Surface texture: Profile –*
371 *Part 1: Indication of surface texture*

372 **3 Terms and definitions**

373 For the purposes of this document, terms and definitions from IEC 60050-581, IEC 61076-1,
374 IEC 60512-1 and IEC 61984 as well as the following apply.

375 ISO and IEC maintain terminological databases for use in standardization at the following
376 addresses:

377 • ISO Online browsing platform: available at <https://www.iso.org/obp>

378 • IEC Electropedia: available at <http://www.electropedia.org/>

379 **3.1**

380 **protective conductor PE**

381 PE conductor provided for purposes of safety, for example protection against electric shock

382 Note 1 to entry: In an electrical installation, the conductor identified PE is normally also considered as protective
 383 earthing conductor.

384 [IEC 60050-581:2008, 581-27-26]

385 3.2

386 functional earth conductor FE

387 FE functional grounding conductor in US
 388 earthing conductor provided for functional earthing.

389 Note 1 to entry: Functional earthing a point or points in a system or in an installation or in equipment, for
 390 purposes other than electrical safety. [IEC 60050-195, Amendment 1: 2001, 195-01-13]

391 [IEC 60050-195:1998, 195-02-15]

392 3.3

393 mounting orientation

394 Circular mounting position of the connector in relation to the polarization of the mating
 395 interface.

397 4 Technical information

398 4.1 Recommended method of termination for rewirable connectors

399 The contact termination for rewirable connectors shall be of the following types: screw, crimp,
 400 spring clamp, insulation piercing, insulation displacement, press-in connections according to
 401 the respective part of IEC 60352 series and IEC 60999-1.

402 4.2 Connector coding, number of contacts, ratings and characteristics

403 Table 1 provides the coding of these connectors as a function of their style, number of
 404 contacts, rated voltage and rated current.

405 **Table 1 – Ratings of connectors**

Coding	Style	Number of contacts	Rated voltage AC or DC	Rated current A
F	4-way	2	50 V AC / 60 V DC	16
		3		
		4		
K	5-way (4+PE)	3 (2+PE)	630 V	12
		4 (3+PE)		
		5 (4+PE)		
L	5-way	3 (2+FE)	50 V AC / 60 V DC	16
		4 (3+FE)		
		5 (4+FE)		
	4-way	2		
		3		
		4		
M	6-way (5+PE)	3 (2+PE)	630 V	8
		4 (3+PE)		
		5 (4+PE)		
		6 (5+PE)		

S	4-way (3+PE)	3 (2+PE)	630 V	12
		4 (3+PE)		
T	4-way	2	50 V AC / 60 V DC	12
		3		
		4		
NOTE – The rated current refers to the interface. It does not take into account the contact termination nor the <u>terminated</u> conductor cross-section.				

406

407

408 Insulation resistance: $10^8 \Omega \text{ min.}$

409 Contact spacing: see interface dimensions 5.4

410 **4.3 Systems of levels**411 **4.3.1 Performance level**

412 Connectors according to this standard are classified by mating performance level (MPL). See
413 6.5.1 for details.

414 **4.3.2 Compatibility levels, according to IEC 61076-1**

415 Connectors according to this standard are intermateable and interoperable according to IEC
416 61076-1 (level 3).

417 Interoperability is granted, provided that the same performance level as defined in 4.3.1 and
418 the same surface of contacts as defined in 6.2 is considered.

419 **4.4 Classification into climatic categories**

420 See 6.3 in this standard.

421 **4.5 Creepage and clearance distances**

422 The creepage and clearance distances shall be dimensioned according to rated insulation
423 voltage values specified in Table 30 (see 6.4.1), in accordance with IEC 60664-1 and shall be
424 measured only in mated position according to IEC 60512-1-2.

425 NOTE – Creepage distances are defined for pollution degree 2 for connectors IP54 or higher, see IEC 61984
426 (2008), subclause 6.19.3

427 The creepage and clearance distances that cover performance requirements in IEC 60664-1
428 may be reduced, based on IEC TR 63040.

429 NOTE As indicated in IEC 60664-1, IEC TR 63040 provides an alternative and more precise dimensioning
430 procedure for clearances equal to or less than 2mm.

431 In practice, reductions in creepage or clearance distances may occur due to the conductive
432 pattern of the printed board, or the wiring used and should in such case duly be taken into
433 account.

434 NOTE: The permissible rated voltage depends on the application and the specified safety requirements.

435 **4.6 Current-carrying capacity**

436 See 6.4.3 in this standard.

437 **4.7 Marking**

438 The marking of the connector and the package shall be in accordance with 2.7 of
439 IEC 61076-1.

440 **4.8 Safety aspects**

441 Some of the connector types covered by this document are only applicable for extra-low
442 voltage (ELV) applications. For styles without a PE contact, IEC 61984 dealing with safety
443 aspects of connectors is applicable as a guidance.

444 For K-coding, M-coding, and S-coding connectors IEC 61984 applies.

445 Connectors according to this standard are COC (connectors without breaking capacity) per
446 IEC 61984, unless otherwise specified by the manufacturer.

447

5 Dimensional information

5.1 General

Throughout this standard, dimensions are in mm. Drawings are shown in the first angle projection. The shape of the connectors may deviate from those given in the following drawings, as long as the specified dimensions are not influenced.

Missing dimensions shall be chosen according to common characteristics and intended use.

For all connector styles with cables, the length L of the cable shall be agreed between manufacturer and user.

Alternative installation situations are possible and shall be specified upon between manufacturer and user. Requirements defined in this document must be adhered to.

For free connectors with right angled cable outlets, the direction of the coding in relation to the cable outlet shall be specified to assure that the cable leaves the housing in the specified direction. This is indicated by an arrow ▼ and described in Annex B.

For interface dimensions see 5.4.

The interface dimensions of the female styles shall be chosen according to the common characteristics of the male styles.

For reliable intermateability, the dimensions of the female connector body as detailed in Annex A should be met.

5.2 Fixed connectors

Table 2 shows the different styles of fixed connectors.

Table 2 – Styles of fixed connectors

Style	Description
EM	Fixed connector, male contacts, mounting with thread M12 × 1, with wire ends, single hole mounting M16 × 1,5
FM	Fixed connector, male contacts, mounting with thread M12 × 1, with wire ends, single hole mounting M20 × 1,5
EF	Fixed connector, female contacts, mounting with thread M12x1, with wire ends, single hole mounting M16 × 1,5
FF	Fixed connector, female contacts, mounting with thread M12x1, with wire ends, single hole mounting M20 × 1,5
IM	Fixed connector, male contacts, mounting with thread M12x1, with wire ends, single hole mounting M16 × 1,5, rear mounting
IF	Fixed connector, female contacts, mounting with thread M12x1, with wire ends, single hole mounting M16 × 1,5, rear mounting

5.2.1 Style EM

Figure 1 shows a fixed connector, with male contacts, mounting with thread M12 × 1, with wire ends and a single hole mounting thread M16 × 1,5.

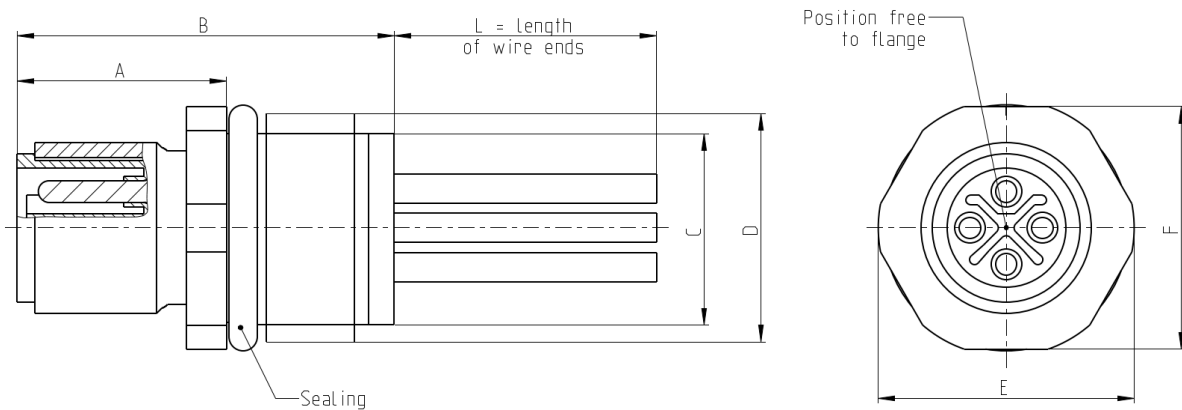


Figure 1 – Fixed connector, male contacts, mounting with thread M12 x 1, with wire ends, single hole mounting thread M16 x 1,5

Table 3 – Dimensions of style EM, Figure 1

Dimensions in millimetres

Letter	Minimum	Nominal	Maximum
A	-	-	16
B	-	-	32
C	-	Ø13,4	-
D	-	M16x1,5	-
E	-	-	Ø18,2
F	-	17	-

5.2.2 Style FM

Figure 2 shows fixed connectors, with male contacts, mounting with thread M12 × 1, with wire ends and a single hole mounting thread M20 × 1,5.

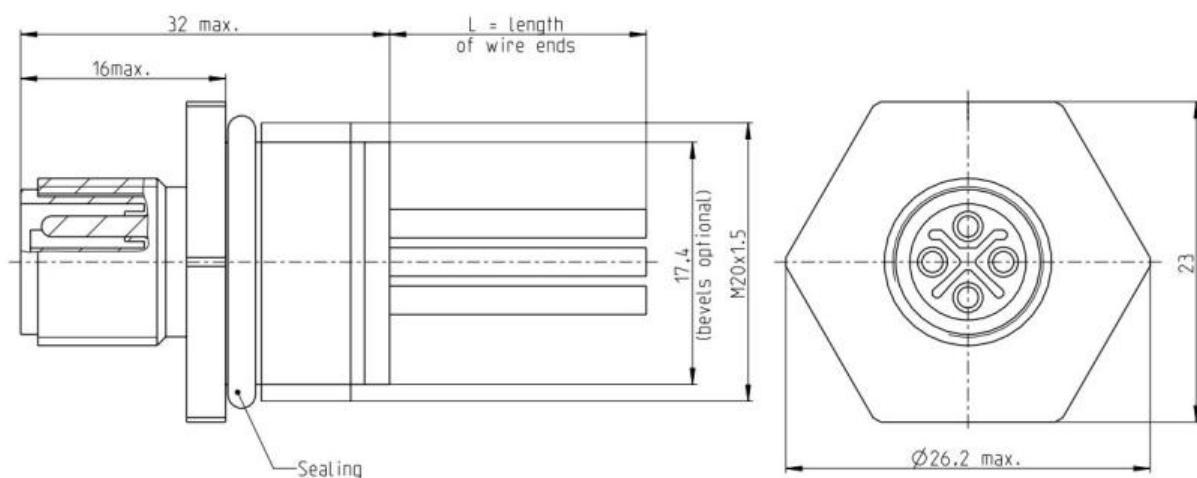


Figure 2 – Fixed connector, male contacts, mounting with thread M12 x 1, with wire ends, single hole mounting thread M20 x 1,5

Table 4 – Dimensions of style FM, Figure 2

487

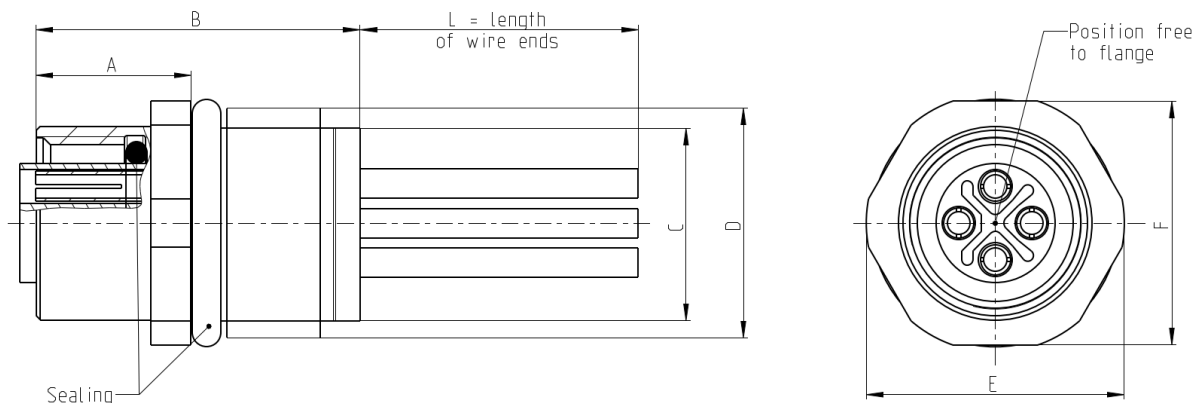
Dimensions in millimetres

Letter	Minimum	Nominal	Maximum
A	-	-	16
B	-	-	32
C	-	Ø17,4	-
D	-	M20x1,5	-
E	-	-	Ø26,2
F	-	23	-

488

489 **5.2.3 Style EF**

490 Figure 3 shows a fixed connector, female contacts, a mounting with thread M12 × 1, with wire
 491 ends and a single hole mounting thread M16 × 1,5.



492

493 **Figure 3 – Fixed connector, female contacts, mounting with thread M12 × 1,**
 494 **with wire ends, single hole mounting thread M16 × 1,5**

495 NOTE 1) Dimension for width across flats

496 NOTE 2) Length of wires shall be agreed upon between the manufacturer and user

497

498 **Table 5 – Dimensions of style EF, Figure 3**

499

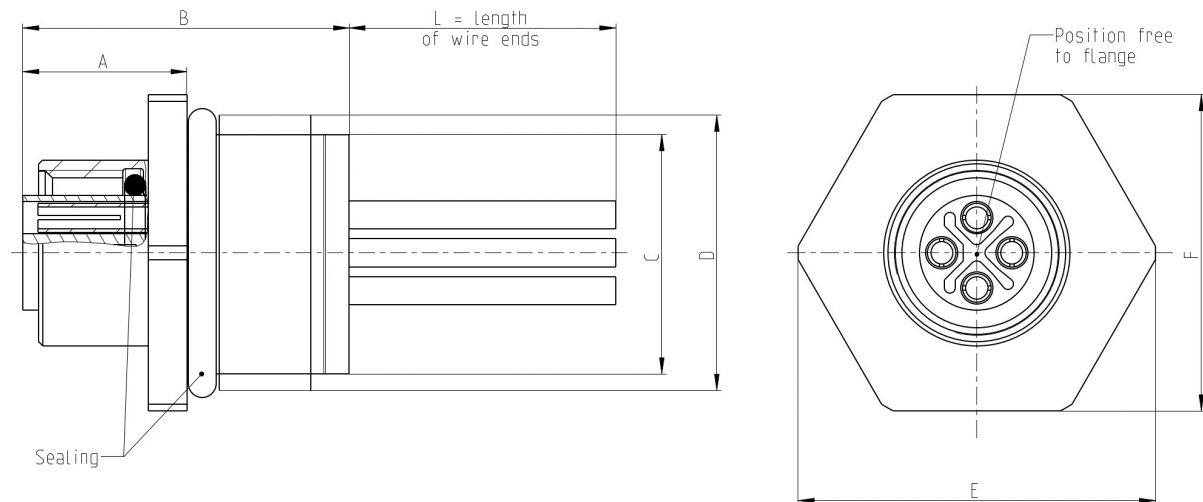
Dimensions in millimetres

Letter	Minimum	Nominal	Maximum
A	-	-	16
B	-	-	32
C	-	Ø13,4	-
D	-	M16x1,5	-
E	-	-	Ø18,2
F	-	17	-

500

501 **5.2.4 Style FF**

502 Figure 4 shows a fixed connector, with female contacts, a mounting with thread M12 × 1, with
 503 wire ends and a single hole mounting thread M20 × 1,5.



NOTE 1) Dimension for width across flats

NOTE 2) Length of wires/cable shall be agreed upon between the manufacturer and user

Figure 4 – Fixed connector, female contacts, mounting with thread M12 × 1, with wire ends, single hole mounting thread M20 × 1,5

Table 6 – Dimensions of style FF, Figure 4

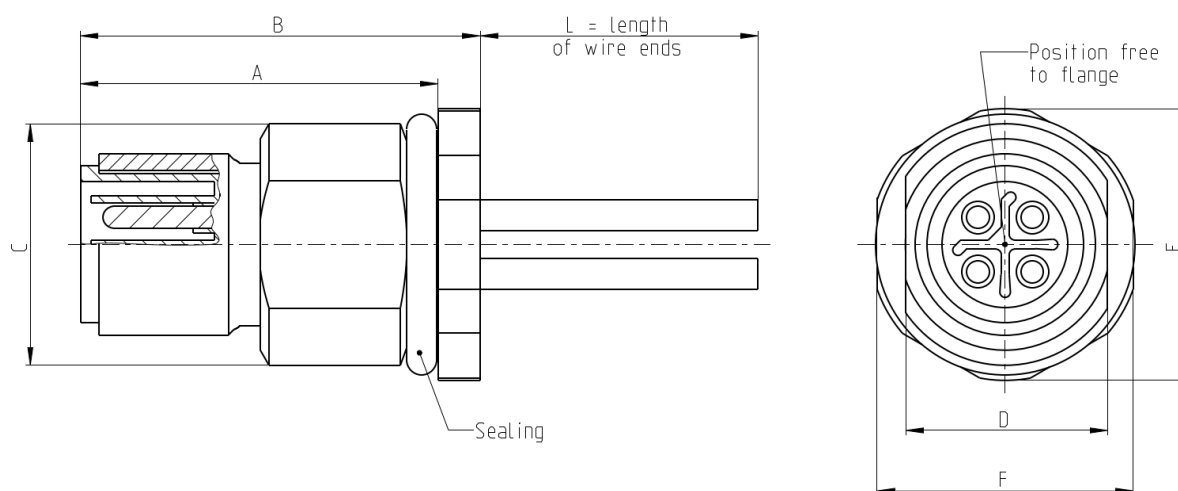
Dimensions in millimetres

Letter	Minimum	Nominal	Maximum
A	-	-	16
B	-	-	32
C	-	Ø17,4	-
D	-	M20x1,5	-
E	-	-	Ø26,2
F	-	23	-

5.2.5 Style IM

Figure 5 shows a fixed connector, with male contacts, mounting with thread M12 × 1, with wire ends, a single hole mounting thread M16 x 1,5 rear mounting.

515

Dimensions in millimetres

516

517 **Figure 5 – Fixed connector, male contacts, mounting with thread M12 × 1, with wire**
 518 **ends, single hole mounting thread M16 × 1,5, rear mounting**

519 **Table 7 – Dimensions of style IM, Figure 5**

520

Dimensions in millimetres

Letter	Minimum	Nominal	Maximum
A	-	-	30
B	-	-	32
C	-	M16x1,5	-
D	-	13,4	-
E	-	-	Ø18,2
F	-	17	-

521

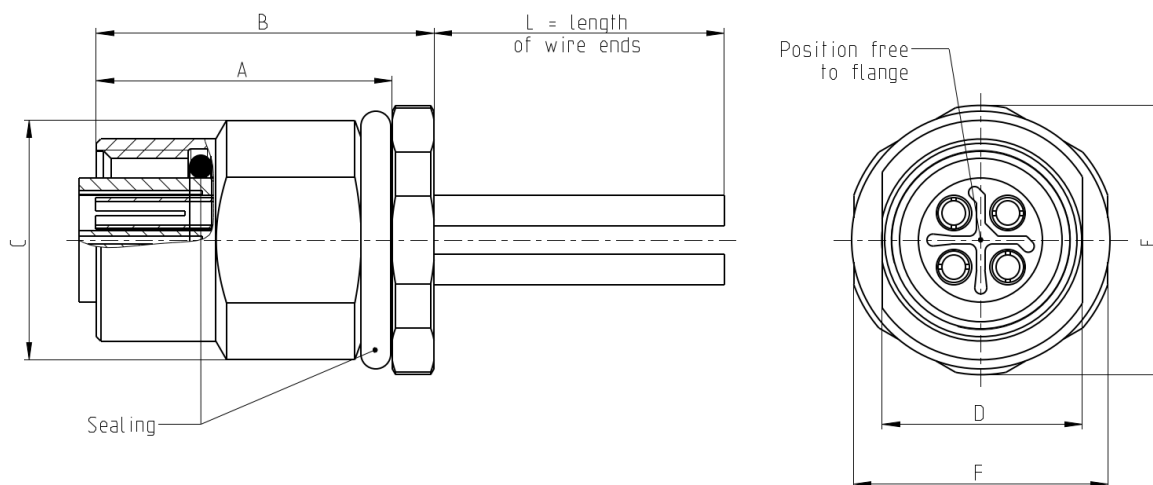
522

523 5.2.6 Style IF

524 Figure 6 shows a fixed connector, with female contacts, mounting with thread M12 x 1, with
 525 wire ends, a single hole mounting thread M 16 x 1,5, rear mounting.

526

Dimensions in millimetres



527

528 **Figure 6 – Fixed connector, female contacts, mounting with thread M12 × 1, with wire**
 529 **ends, single hole mounting thread M16 × 1,5, rear mounting**

530 **Table 8 – Dimensions of style IF, Figure 6**

531

Dimensions in millimetres

Letter	Minimum	Nominal	Maximum
A	-	-	30
B	-	-	32
C	-	M16x1,5	-
D	-	13,4	-
E	-	-	Ø18,2
F	-	17	-

532

533 5.3 Free connectors

534 Table 9 shows the styles of free connectors.

535 **Table 9 – Styles of free connectors**

Style	Description
JM	Rewirable connector, male contacts, straight version, with locking nut ^a
KM	Rewirable connector, male contacts, right angled version, with locking nut ^a
LM	Non-rewirable connector, male contacts, straight version, with locking nut ^a
MM	Non-rewirable connector, male contacts, right angled version, with locking nut
JF	Rewirable connector, female contacts, straight version, with locking nut
KF	Rewirable connector, female contacts, right angled version, with locking nut
LF	Non-rewirable connector, female contacts, straight version, with locking nut
MF	Non-rewirable connector, female contacts, right angled version, with locking nut
^a Knurled ring or hexagonal ring upon agreement.	

536