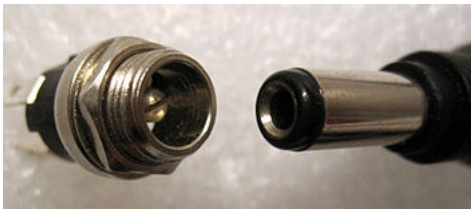
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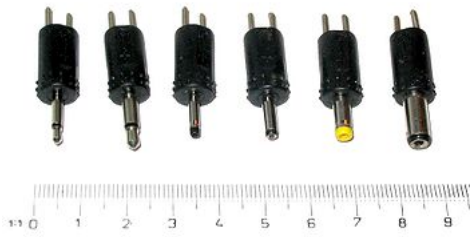
Coaxial power connector

A **coaxial power connector** is an electrical power connector used for attaching extra-low voltage devices such as consumer electronics to external electricity. Also known as **barrel connectors**, **concentric barrel connectors** or **tip connectors**, these small cylindrical connectors come in an enormous variety of sizes.

Barrel plug connectors are commonly used to interface the secondary side of a power supply with the device. Some of these jacks contain a normally closed switch; the switch can disconnect internal batteries whenever the external power supply is connected.



A common coaxial power connector, male (left) and female (right), 5.5 × 2.5 mm. Connector sex is determined by the center contact.



Common DC power connectors

Contents

- Connector construction and terminology
  - Plug (male)
  - Socket or receptacle (female)
- Connector sizes
- Common sizes and interchangeability
- Locking and retention features
- Standards
  - IEC 60130-10
  - EIAJ power connectors
  - DIN 45323
- Listing of DC coaxial connectors
- RadioShack Adaptaplug
- See also
- References
- External links

Connector construction and terminology

The connector pairs for barrel connectors are defined in terms of "plugs" and "receptacles"; receptacles are more commonly called "sockets" or "jacks" in the United States. Receptacles may be panel-mounted or circuit board-mounted. Plugs are on cables. Some in-line receptacles are also cable-mounted.

There is a long history in electrical engineering of referring to such power plugs — that is to say, plugs with holes instead of prongs — as female,[1] particularly regarding coaxial transmission of electricity,[2] and data communication and computer cables.[3] Type N connectors,[4][5] and all IEC 60320 "appliance coupler" plugs, and VGA cables with male connectors on the cable and female connectors on the devices[3] are examples of this. That said, while IEC 60320 provides gender-based standards for higher-voltage plugs (such as the cable plugged into a standard computer power supply), they have not yet defined gender-based standards for low-voltage coaxial power connectors such as those discussed herein; i.e., which component is "male" and which is "female". As a result, there are varying opinions in this regard. Many industrial suppliers avoid gender terminology[6] but many do not.[7] Similarly, some people view the corded plug as female[8] and some perceive it as male.[9] Some, after consideration and surveys, found that user perception of which was male and which female was evenly split.[10]

Regardless of user perception surveys, the connector that resembles the male sex organ is the male connector or plug, and the connector it is inserted in is the female connector or socket or receptacle.[3]

Power is generally supplied *by* a plug *to* a receptacle. Cables are available with one in-line receptacle fanning out to a number of plugs, so that many devices may be supplied by one supply. As the use of a plug implies a cable, even a short stub, some power supplies carry panel-mounted receptacles instead to avoid this cable, *i.e.*, the normal convention of power from plug to receptacle is reversed. Cables for such cases are available with a plug at each end, although cables or adapters with two *receptacles* are not widely available.

Plug (male)

On the male plug, the outer body is metallic and cylindrical in shape, and comprises one of the two contacts. The second, inside contact is a hollow metallic cylinder constructed to accept insertion of the pin in the corresponding male connector. The inner and outer barrels are separated by an insulating layer, which is flared at the tip to prevent a short circuit when the plug is inserted or removed.

Socket or receptacle (female)

There is typically a single spring-loaded contact at the side of the female socket and a pin in the center.

Connector sizes

There are many different sizes of coaxial power connectors. See the table at the end of this article.

Page 1 of 9 (PGR2021-00078)
G&H DIVERSIFIED MANUFACTURING, LP v.
DYNAENERGETICS EUROPE GMBH

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Contact ratings commonly vary from unspecified up to 5 A (11 A for special high-power versions). Voltage is often unspecified, but may be up to 48 V with 12 V typical. The smaller types usually have lower current and voltage ratings.

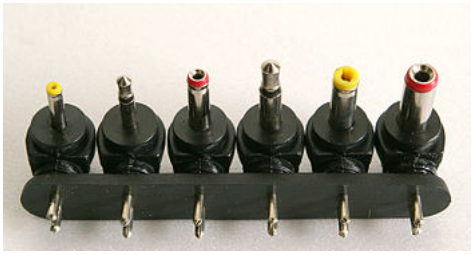
It is quite possible that new sizes will continue to appear and disappear. One possible reason that a particular manufacturer may use a new size is to discourage use of third-party power supplies, either for technical reasons or to force use of their own accessories, or both.

The sizes and shapes of connectors do not consistently correspond to the same power specifications across manufacturers and models. Two connectors from different manufacturers with different sizes could potentially be attached to power supplies with the same voltage and current. Alternatively, connectors of the same size can be part of power supplies with different voltages and currents. Use of the wrong power supply may cause severe equipment damage, or even fire.

Common sizes and interchangeability

Generic plugs are often described by their inside diameter, such as *2.1 mm DC plugs* and *2.5 mm DC (direct current) plugs*.

After the two common 5.5 mm **OD** (Outer Diameter) plugs, the next-most common size is 3.5 mm OD with a 1.3 mm **ID** (Inner Diameter), usually about 9.5 mm in length, although both longer and shorter versions also exist. These 3.5 mm OD plugs are normally used for lower voltages and currents.



Some common DC power connectors

Locking and retention features

A ring-shaped "locking detent" or "high-retention feature", present on the barrel of some DC coaxial connectors, is a feature intended to prevent accidental disconnection. Typically, this feature is a conical cut-back section of the tip, just behind the insulator that separates the inner from outer contact surfaces.

A "lock-ring DC coaxial connector" uses a captive threaded ring or collar to secure the connection between the plug and jack. This design offers strong resistance to unplugging when used properly.

A "lock-tab DC coaxial connector" (also called "bayonet lock") offers a compromise that resists unplugging, but which will disengage when pulled hard enough. This connector uses small metal tab protrusions on the connector barrel to lock the plug in place, requiring a special push-and-rotate motion to engage the locks.



Lock-ring DC coaxial connectors. The knurled barrel allows the plug to be secured to jacks that have mating male threads.

Standards

There are several standards in existence, such as IEC, EIAJ in Japan and DIN in Germany. More recently, some manufacturers appear to have implemented their own system correlating voltage and plug size. In addition, there appears to be a trend to standardize DC connector to negative **barrel** (or sleeve) of a coaxial power connector.

IEC 60130-10

IEC 60130-10:1971 defines five DC power connectors.[11]

- Type A: 5.5 mm OD, 2.1 mm ID (with optional screw lock)
- Type A: 5.5 mm OD, 2.5 mm ID (with optional screw lock)
- Type B: 6.0 mm OD, 2.1 mm ID
- Type B: 6.0 mm OD, 2.5 mm ID
- Type C: 3.8 mm OD, 1.1 mm ID
- Type D: 6.3 mm OD, 3.1 mm ID
- Type E: 3.4 mm OD, 1.3 mm ID

EIAJ power connectors

Five plug and matching socket or jack designs are defined by the EIAJ standard RC-5320A (also called JEITA RC-5320A). Each of these plugs is used with a specified voltage range. Most manufacturers use a yellow insulating material to distinguish these plugs from other similar-looking DC plugs.



Close-up of a yellow-tipped EIAJ connector. Note two round adapter pins on the opposite end.

- EIAJ-01: For 0–3.15 V. 2.5 mm OD, 0.7 mm ID.
- EIAJ-02: For 3.15–6.3 V. 4.2 mm OD, 1.7 mm ID.
- EIAJ-03: For 6.3–10.5 V. 5.0 mm OD, 1.7 mm ID.
- EIAJ-04 (also called JSBP 4): For 10.5–13.5 V. 5.5 mm OD, 3.4 mm ID.
- EIAJ-05 (also called JSBP 5): For 13.5–18 V. 6.5 mm OD, 4.4 mm ID.

EIAJ-04 and 05 have an internal male pin in the plug. The 01 through 03 sizes do not and are similar to the generic plugs in structure. These five EIAJ plugs are 9.5 mm in length and have a current rating of 2A.

There are two other, less common, connectors defined by EIAJ; RC-5321 and RC-5322. The latter is designed for both 12 V and 24 V automotive applications.

DIN 45323

The German national standards organization DIN (Deutsches Institut für Normung—German Institute for Standardization) issued DIN 45323, which defines two DC power plug and jack (respectively) sizes. At least one of these sizes has a maximum rating of 34 V and 3 A. The information here is inferred from catalog references,[12] as the German standard has not been translated into English yet.

- 5.00 mm OD, 2.00 mm ID, 14 mm long?
- 6.00 mm OD, 1.98 mm ID

Listing of DC coaxial connectors

This list attempts to show all known sizes, and is annotated with some manufacturers producing selected types, since each manufacturer makes its own unique subset of the known types. Note that the example part numbers given may have different connector barrel (sleeve) lengths, and are not necessarily exact equivalents. There are many more design variants than can be listed in this table, so only a small sampling of part numbers is given.

Connector size is often listed in the format OD (outer diameter) × ID (inner diameter) × L (length of barrel) and expressed in millimeters. Designations may vary between manufacturers.

Coaxial plugs that have a male center pin will have another measurement, Center Pin Diameter (CPD). These plugs are often used for higher power applications such as portable computers.

There are a number of sizes listed below that appear to be quite similar, and while the tolerances of these connectors are typically indicated as ±0.05 or ±0.03 mm by the manufacturers, there is still ambiguity as to whether two sizes differing by only 0.05 mm (or where the specification is only given to the nearest 0.10 mm) warrants listing them separately here.

OD (mm)	ID (mm)	CPD (mm)	Barrel length (mm)	Adaptaplug	Standard	Volts	Plug part numbers	Jack part numbers	Notes
2.00	0.60		6.3		Nokia 2-mm DC Charging Interface Specification[13]	4.65–9.3 V	Nokia DC-096 (0.48×2.1 mm on socket side)	Nokia AC-3 charger	Nokia 2-mm DC Charging Interface, used in Nokia phones and Bluetooth headphones
2.35	0.70		9.5	A	EIAJ-01	0–3.15 V	Kobiconn 3218-EX Lumberg 1636 01	Kobiconn 0307-EX (inline)	Canon ACK-800, also used on very old Motorola phones (SPN4364/4365/4366/4474)
2.40	0.70						Egston 212		possibly a rounded-off representation of EIAJ-01
2.40	0.80						Egston 213		
2.50	0.80								Used in Samsung Bluetooth headsets and few tablet PCs
3.00	1.00								
3.00	1.10			G			CUI Inc. PP-019 Egston 214		Used in satellite radio docks and other devices
3.20	0.90						CUI Inc. PP-017		
3.30	1.00							Motorola AAPN4064A	Used in older Motorola phones (SPN4680/4681/4682/4677/5296A) and also used in some rare Nokia phones (ACH-6)
3.40	1.30			H			Kobiconn 3210-E	Kobiconn 0309-EX (inline)	
3.40	1.35						Egston 218 Medical, 220		
3.40	1.40						Lumberg NES/J 135		
3.50	0.90							Possible nokia acp-7 charger[14]	Used in many older Nokia phones (ACP-12?)
3.50	1.10						CUI Inc. PP3–002C Philmore 202		
3.50	1.30						Egston 238 Philmore 204,2049	Kobiconn 0308-EX (inline) Philmore 256 (inline)	Also used in older Alcatel phones (3DS07008A?AA, 3DS09371A?AA, 3DS10628A?AA)
3.50	1.35						CUI Inc. P7 CUI Inc. PP3–002D Egston 215 Kobiconn PA35135-E		Also used for Canon CA-570 Charger (Output: 8.4V 2A)[15]
3.60	1.15						Egston 216		
3.80	1.10			I			CUI Inc. P9 but with 1.05 mm ID		
3.80	1.30						Egston 217		
3.80	1.35						CUI Inc. P8		
3.80	1.40		9.0			12VDC @ 0.5A	Marushin Electric MP-138NK		Used in TP-Link Gigabit switch model TL-SG105(UN) Ver:6.0
4.00	1.70		9.5	B	EIAJ-02	3.15–6.3 V	Kobiconn 3219-EX Lumberg 1636 02	Kobiconn 0311-EX (inline)	Used in Lenovo Flex 4 adapter Used for Sony PSP Charger (Input: 100-240VAC, Output: 5VDC @ 1500mA for PSP 1000, 2000, 3000)
4.5	3.0	0.5	12			19.5v			Newer HP and Dell laptop computers
4.75	1.70		9.5	C	EIAJ-03	6.3–10.5 V	Kobiconn 3220-EX Lumberg 1636 03	Kobiconn 0310-EX (inline)	
4.75	?.??		2.5 protruding	C	EIAJ RC-5321				
5.00	1.50			J					
5.00	2.00				DIN 45323?		Egston 206,207,219		
5.00	2.10			K			CUI Inc. P3		
5.00	2.50			L			CUI Inc. P4		
5.50	1.50			S					
5.50	1.70								Used in Acer Aspire V5 adapter and some Hikvision 48V NVRs

OD (mm)	ID (mm)	CPD (mm)	Barrel length (mm)	Adaptaplug	Standard	Volts	Plug part numbers	Jack part numbers	Notes
5.50	2.10			M			CUI Inc. P5 CUI Inc. PP3–002A Kobiconn 3217-EX Philmore 210, 210L, 2109 Switchcraft 762, 763[16]	CUI Inc. PR-002A (inline) Kobiconn 0302 (inline) Philmore 257 (inline) Switchcraft 721A (panel)[17]	2.1 mm center pin Common on guitar effect pedals Arduino power adapter
5.50	2.10						CUI Inc. P10 Kobiconn 7391 Philmore 2560 Switchcraft 768K[18]		2.1 mm center pin, **lock-ring**
5.50	2.10						Kobiconn 0721-EX	Kobiconn 1000-EX (panel)	2.1 mm center pin, **lock-tab**
5.50	2.50			N			CUI Inc. P6 CUI Inc. PP3–002B Egston 222 Kobiconn 0702-EX Philmore 250, 250L, 2509 Switchcraft 760, 765	CUI Inc. PR-002B (inline) Kobiconn 0303 (inline) Philmore 258 (inline) Switchcraft 712A (panel)	2.5 mm center pin used in Miniware TS100 soldering iron by e-Design
5.50	2.50						CUI Inc. P11 Kobiconn 7395 Philmore 2560 Switchcraft 760K		2.5 mm center pin, **lock-ring**
5.50	2.50						Kobiconn 0725-EX	Kobiconn 1100-EX (panel)	2.5 mm center pin, **lock-tab**
5.50	2.80			O					
5.50	3.0					5V, 1.5A, Efficiency Level V	Philmore Coaxial Power Plug 3.0mm I.D./5.5mm O.D. No. 206		Roku 2 XS HDTV Streaming Box
5.50	3.0	1.0							Samsung laptop computers (many), for instance 400B2B
5.50	3.30	1.00	9.5	D	EIAJ-04, JSBP4	10.5–13.5 V	Lumberg 1636 04		Microsoft Xbox 360 HD DVD drive
5.50	3.80	1.80		P					
6.00	1.98				DIN 45323		Lumberg 1632 01		
6.30	2.50								found in an ISP specific modem/router, 12VDC power connector, manufactured by Compal, unknown standard
6.30	3.00			Q			Icom R75, R8500		
6.50	?.??				EIAJ RC-5322				
6.50	3.00								Used in Yamaha keyboard power supply
6.50	3.10	1.00					Philmore 285		
6.50	3.40	1.40	9.0			18 VDC @5A	Kobiconn 6014-E		used often for laptop computers
6.50	4.10	1.00		U	JEITA RC-5322	24 VDC @ 2A	Lumberg 1636 06		Epson Photo Scanners V600, etc.
6.50	4.30	1.40		T	EIAJ-05, JSBP5	13.5–18.0 V	Lumberg 1636 05 Philmore 265 CUI Inc. PP-016	Philmore 214 CUI Inc. PJ-025	OD is of ring at tip Common for Sony laptop computers and scanning radios
6.90	4.20	0.70		R					
7.00	??	1.00					Philmore 48-412		
7.4	5.1		12.5						Mini-ITX motherboards, *e.g.*, Intel DH61AG, Asus H310T
7.4	5.5	0.5	12.5						Some Asus, Dell, HP, Sony laptop computers; Dyson hand-held vacuum cleaners
8.0	5.5	1.5 (?)	10.5			42V 2A			ES2 and M365 electric scooters & Goal Zero Solar devices (Sherpa & Yeti). IBM Lenovo laptop computer PSUs
9.0	5.5	1.0 (?)	10.5			?V 2A			Goal Zero Solar device Chaining cable (Sherpa only)

RadioShack Adaptaplug

RadioShack sold a line of adapter plugs for universal AC adapters. Each "Adaptaplug" had a single-letter code, but did not provide any other official designation, nor did RadioShack publish the complete specifications and tolerances on barrel and pin dimensions. RadioShack's Web site listed the diameters to the nearest 0.1 mm, and sometimes differs slightly from the official EIAJ RC-5320A standard dimensions. This list may include some parts RadioShack has discontinued but are retained here for completeness.[19]

Adaptaplug	Outside diameter	Inside diameter	Pin diameter	Standard type	Voltage range	color
A	2.3 mm	0.7 mm		EIAJ-01	< 3.15 V	Yellow
B	4.0 mm	1.7 mm		EIAJ-02	3.15–6.3 V	Yellow
C	4.7 mm	1.7 mm		EIAJ-03	6.3–10.5 V	Yellow
D	5.5 mm	3.3 mm	0.9 mm	EIAJ-04	10.5–13.5 V	Yellow
E	2.5 mm (3/32" submini plug)					Black
F	3.5 mm (1/8" mini-phone plug)					Black
G	3.0 mm	1.1 mm				Turquois
H	3.4 mm	1.3 mm		IEC 60130-10 Type E		Orange
I	3.8 mm	1.1 mm		IEC 60130-10 Type C		Pink
J	5.0 mm	1.5 mm				Red
K	5.0 mm	2.1 mm				Purple
L	5.0 mm	2.5 mm				Dark Gr
M	5.5 mm	2.1 mm		IEC 60130-10 Type A		Navy
N	5.5 mm	2.5 mm		IEC 60130-10 Type A		White
O	5.5 mm	2.8 mm				Brown
P	5.5 mm	3.8 mm	1.8 mm			Not Spe

Adaptaplug	Outside diameter	Inside diameter	Pin diameter	Standard type	Voltage range	color
Q	6.3 mm	3.0 mm				Yellow-C
R	6.9 mm	4.2 mm	0.7 mm			Not Spe
S	5.5 mm	1.5 mm				Gray
T	6.5 mm	4.3 mm	1.4 mm	EIAJ-05	13.5–18.0 V	Yellow
U	6.5 mm	4.1 mm / 3.10 mm	1.0 mm	IEC 60130-10 Type D?		Light Ye

See also

- AC adapter
- Anderson Powerpole
- Cigarette lighter receptacle
- DC connector
- Gender of connectors and fasteners

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External links

- Guide to Understanding Power Conversion (http://support.radioshack.com/support_tutorials/batteries/pwrgde-0.htm), RadioShack

Datasheets (drawings and dimensions)

- CUI Devices (https://www.cuidevices.com/catalog/interconnect/connectors/dc-power-connectors)
- Hosiden (https://web.archive.org/web/20150803020914/http://www.hosiden.com/product/pdf/e_dcp.pdf#dcpower)
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Page 8 of 9 (PGR2021-00078)
G&H DIVERSIFIED MANUFACTURING, LP v.
DYNAENERGETICS EUROPE GMBH

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