

Complete Connections



# Connector Guide





# Common Connector Types and Cable Specifications.

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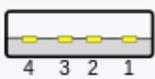
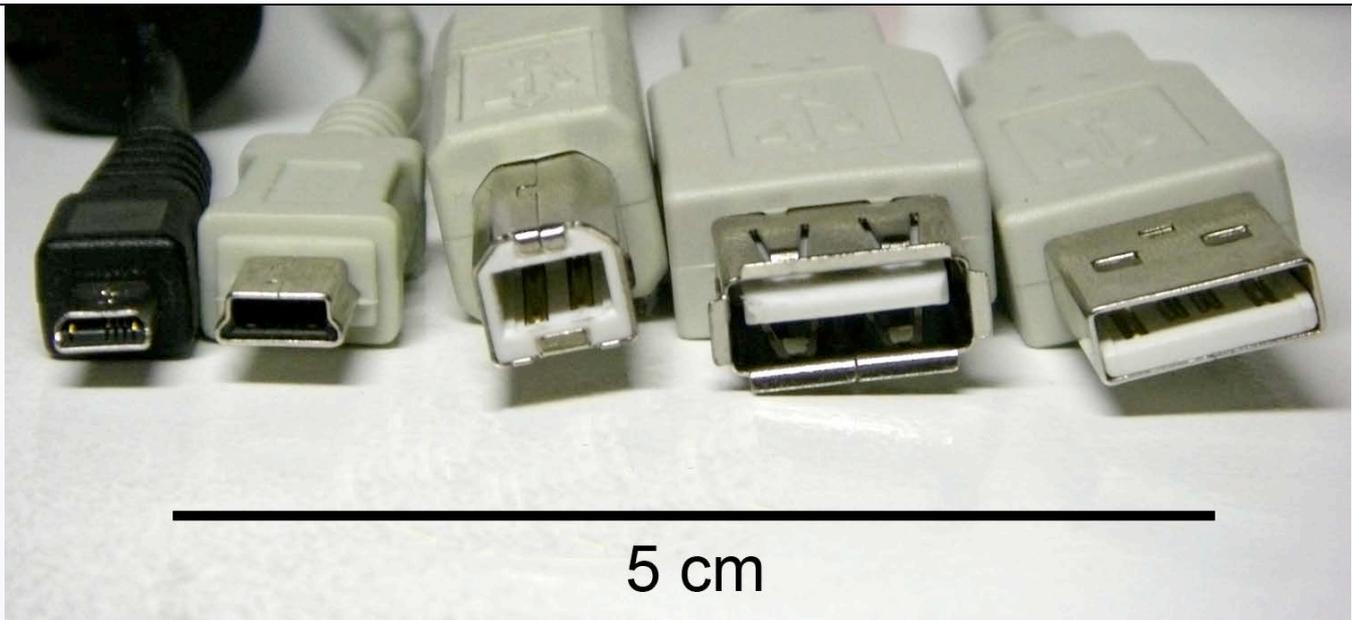


## USB Connectors

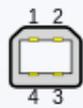
The universal serial bus is now the standard serial interface on almost all devices. The main PC interfaces are shown below, the PC or "Host" generally has a "A" connector and the device or peripheral a "B" connector. Lengths are restricted to 5m without boosting the signal.



The connectors below are the main ones in use today they are from left to right Micro USB (Blackberry, Nokia etc) Mini USB (MP3, Devices camera's etc) USB B (printers scanners) USB A female and USB A male PC/Laptop other Host devices



Type A



Type B



Mini-A



Mini-B



Micro-A



Micro-B



Micro USB

Connectors not shown at exact sizes



USB plugs – Including some of the more obscure connectors



USB-A



USB-B



IEEE 1394 A  
MINI 4P



IEEE 1394 B  
9P



USB-MINI4A



USB-MINI4B



USB-MINI4P



USB-MINI-TDK



USB-MINI5A



USB-MINI5B



USB-MINI8M



USB-MINI8P

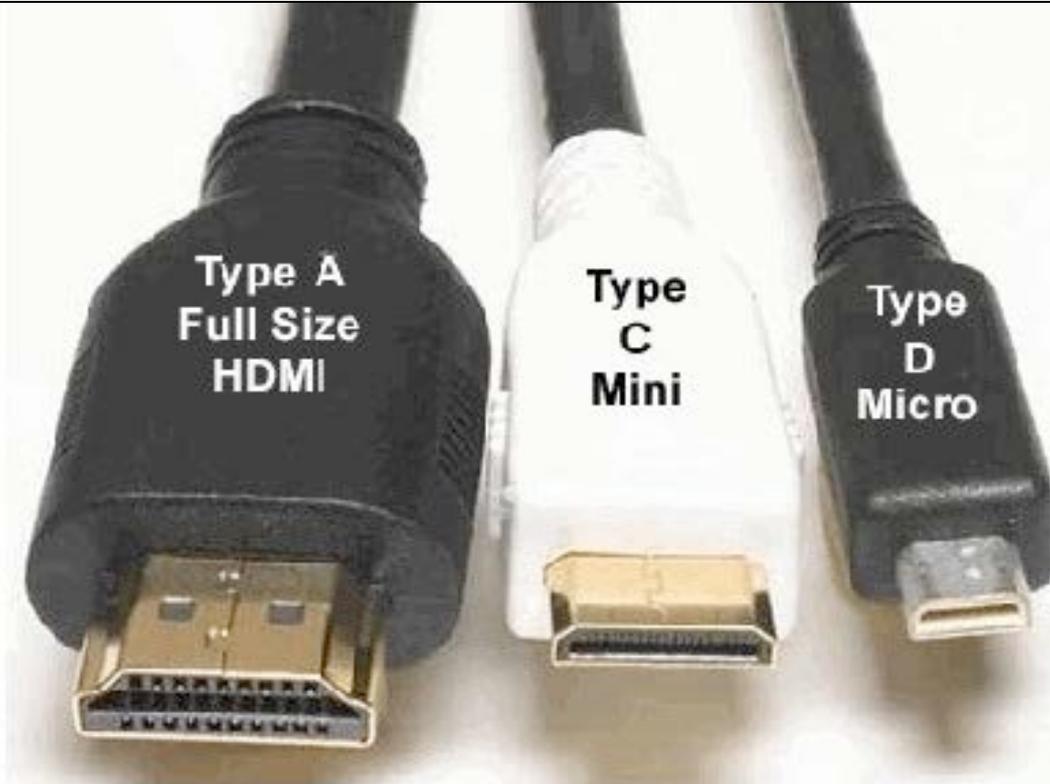
<p><b>DisplayPort</b></p>	
	<p><b>DisplayPort</b> is a digital display interface developed by the Video Electronics Standards Association (VESA). The interface is primarily used to connect a video source to a display device such as a computer monitor, though it can also be used to transmit audio, USB, and other forms of data.</p>
	<p>The Mini DisplayPort (abbreviated MiniDP or mDP) is a miniaturized version of the DisplayPort digital audio-visual interface. Apple, Inc. announced the development in the fourth quarter of 2008, and now applies it in the LED Cinema Display and in all new Macintosh computers: MacBook, MacBook Pro, MacBook Air, iMac, Mac mini, Mac Pro, and Xserve. It is also used in new PC notebooks from various manufacturers such as Lenovo, Toshiba, HP and Dell.</p>



### HDMI

HDMI stands for High Definition Multimedia Interface.

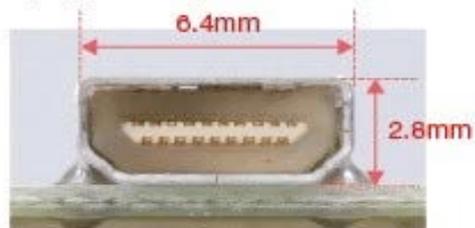
This technology carries the same video information as DVI but adds the capacity for digital audio and control signals as well. The current version of HDMI carries one TMDS link of digital video. Found on many home-theater/consumer electronics devices, HDMI uses a 19-pin connector that is held in place by friction. This connector is technically described as a Type A HDMI connector. The Type B connector is larger (28 pins), but it is not currently used by any devices in the marketplace. The type C mini and Type D micro types are shown below.



a) Type D and Type A plugs



b) Type D receptacle



c) Connector specifications

Connector type <sup>1</sup>	HDMI			Micro USB
	Type A	Type C	Type D	
Height (receptacle)	About 5.55mm <sup>2</sup>	3.2mm	2.8mm	2.94mm
Width (receptacle)	About 15mm <sup>2</sup>	11.2mm	6.4mm	7.8mm
Pin count	19	19	19	5
Pin pitch (horizontal)	0.5mm	0.4mm	0.4mm <sup>3</sup>	0.65mm
Pin rows	2	1	2	1
Insertion cycles	10,000 min	5,000 min	5,000 min	10,000 min

<sup>1</sup> There is also an HDMI Type B connector.

<sup>2</sup> Based on HDMI specification.

<sup>3</sup> Pin pitch in vertical direction 0.6mm.

**Powered USB**, also known as *Retail USB*, *USB Plus Power*, and *USB + Power*, is an addition to the Universal Serial Bus standard that allows for higher-power devices to obtain power through



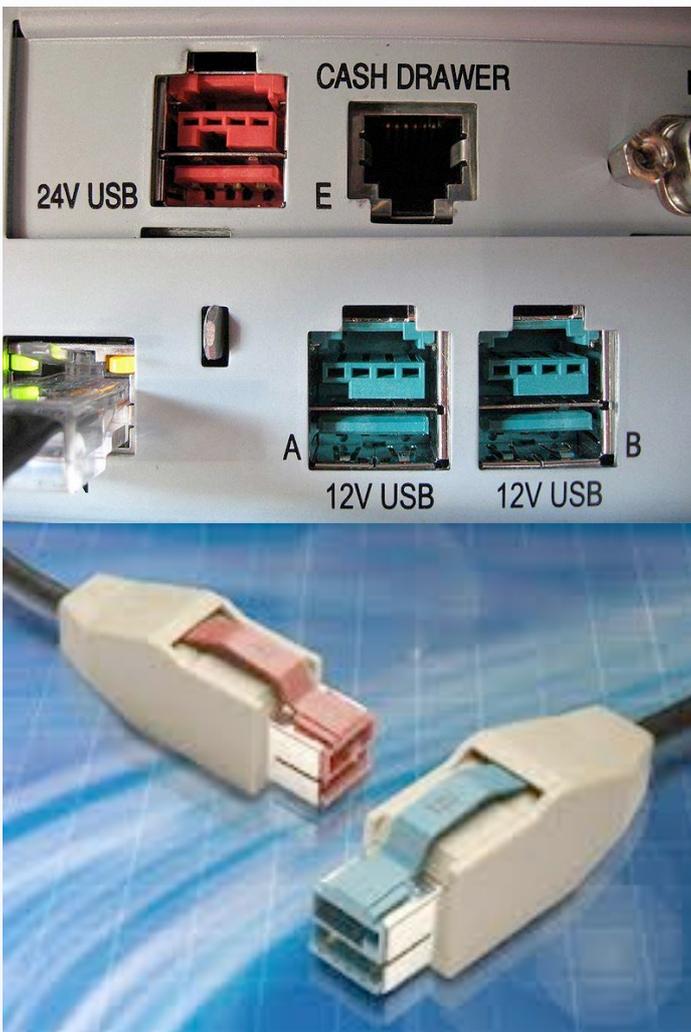
their USB host instead of requiring an independent power supply or external AC adapter. It is mostly used in point-of-sale equipment, such as receipt printers and barcode readers.

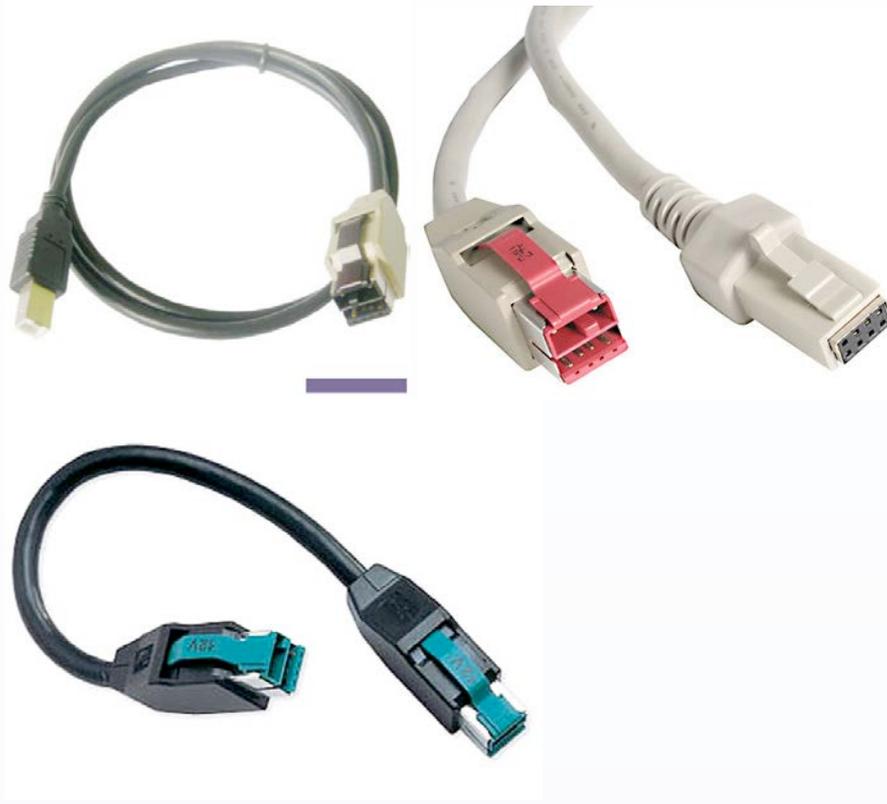
Powered USB, as a proprietary variant of USB, was developed by IBM, NCR, and FCI/Berg but is not endorsed by the USB Implementers Forum (USB-IF). IBM, who owns the patents to Powered USB, charges a licensing fee for its use.

Powered USB uses a more complex connector than standard USB, maintaining the standard USB interface for data communications and adding a second connector for power. Physically, it is essentially two connectors stacked such that the bottom connector accepts a standard USB plug and the top connector takes a power plug.

The implementation allows a choice of three different voltages, providing power at 5 V (30 W), 12 V (72 W), or 24 V (144 W). The three voltages are able to operate at up to 6 A. USB 1.0 and 2.0 supplies 5 V at up to 0.5 A (2.5 W). USB 3.0 supplies 5 V at up to 0.9 A (4.5 W).

As each Powered USB plug provides one of three voltages, the plugs come keyed in three versions so they will only accept connections from devices requiring that version's voltage. They are also color coded – Ivory = 5V – Teal/Blue = 12v – Red = 24v





### DVI CONNECTOR TYPES

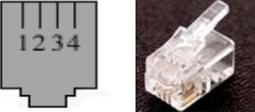
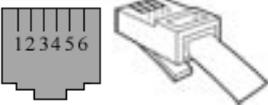
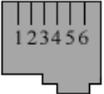
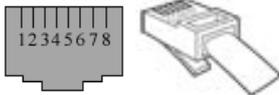
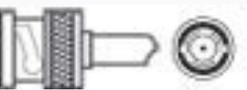
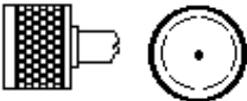
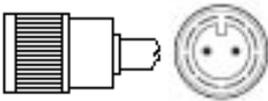
<b>DVI-D Dual Link</b>	
	<p>Connector has 24 pins in 3 rows of 8 with a wide ground bar to the left                  Dual-link DVI connector provides 2 TMDS links up to 10 Gbps.                  Dual link cables are backward compatible with single link                  Majority of DVI applications will use this DVI-D dual link connector.</p>
<b>DVI-D Single Link</b>	
	<p>Single-link DVI connector presents 18 pins. The male plug has them arranged in two groups of nine pins, with the flat ground bar on the left                  Single-link interface provides one TMDS link</p>
<b>DVI-I Dual Link</b>	
	<p>Almost identical to DVI-D dual link except has 4 additional pins around the ground bar for analog signals. Most DVI ports will not have the sockets to receive these pins, and as the ground bar is a different shape removing the analog pins will not make this connector fit a standard socket. This connector is for specialist applications only certain KVM switches etc.</p>
<b>DVI-I Single Link</b>	



	<p>This is similar to the dual-link DVI-I, but it carries only a single TMDS link</p>
<p><b>DVI-A</b></p>	
	<p>DVI-A allows a VGA device to connect to a DVI interface, it carries only the analog pins and will need an adapter or VGA connector at the VGA end.</p> <p>It is not an "official" standard according to the DDWG</p>
<p><b>VGA/SVGA</b></p>	
	<p><b>Video Graphics Array</b> connector- this was the default analogue video connector for many years and is still fitted as standard on many PC's TV's and monitors.</p>

Connectors not shown at exact sizes



<b>Network / Telecom Connectors</b>	
	<p align="center"><b>BT 431A Plug</b></p> <p>Standard BT UK telephone connector, it has space for 6 pins (631A) and a keyed latch, the standard latch is on the left but there are variants with a right hand latch for special requirements.</p>
	<p align="center"><b>RJ11 4 pin 4 conductor</b></p> <p>A narrow version of the RJ11/12 plug, having only 4 conductors and normally used for telephone handset connection.</p>
	<p align="center"><b>RJ11/12 4 and 6 pin</b></p> <p>This connector is referred to as both RJ11 and RJ12 some consider the 4 pin version the RJ11 and the 6 pin the RJ12. Both will mate with the same socket. They will also mate with an RJ45 socket but this is not advised as the shoulders of the plug bend pins 1 &amp; 8 on the RJ45.</p>
	<p align="center"><b>MMJ Modified Modular Jack</b></p> <p>Developed by Dec as their proprietary system in the early days of networking, this is now pretty much an obsolete connector.</p>
	<p align="center"><b>RJ45</b></p> <p>Originally developed for telecommunication purposes, this connector is now the standard for networks. It is available as a shielded connector with the earth connecting to a metal shield on the body of the plug. There is also a 10 pin version used on some specialized equipment.</p>
<p align="center"><b>Other Legacy Network Connectors</b></p>	
	<p align="center"><b>BNC</b></p> <p>Used for early Ethernet 50 Ohm coaxial networks systems, is still used for video cables usually 75 Ohm. IBM also used a 93 Ohm RG68 system for their mainframes.</p>
	<p align="center"><b>N Series – Thicknet</b></p> <p>Used in conjunction with RG58 the thick Ethernet formed the backbone of the network and was used for the longer transmission distances.</p>
	<p align="center"><b>TNC</b></p> <p>Primarily used in radio applications is a screw thread version of the BNC</p>
	<p align="center"><b>TWINAX</b></p> <p>Used for IBM mainframe cabling systems</p>
	<p align="center"><b>Data Connector</b></p> <p>Developed for the IBM token ring system, the plug has a self shorting function when disconnected to allow maintenance of the redundant ring. Although a great system the sheer size of the cable and connectors proved impractical.</p>

Connectors not shown at exact sizes

**AUDIO CONNECTOR TYPES**

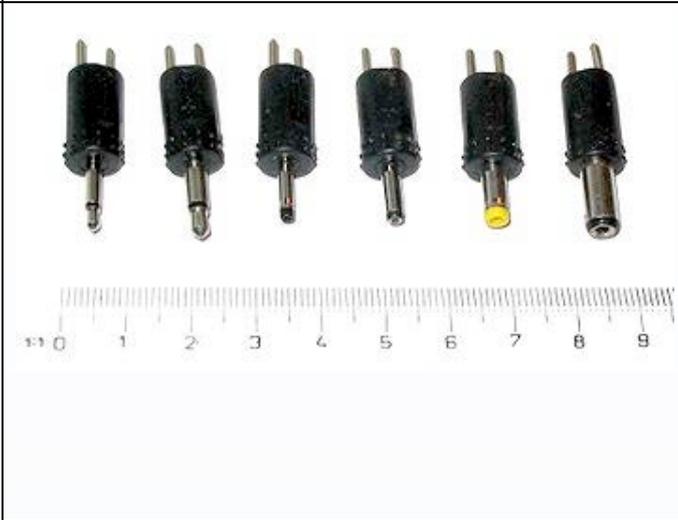


<p><b>Mini / Headphone jack 3.5mm – mono/stereo</b></p> 	<p>The most common audio connector on most modern devices, MP3 players, mobile phones, TV's, PC's etc.</p>
<p><b>1/4 Inch /6.3mm/Guitar jack –mono/stereo</b></p> 	<p>The mono version is the standard connector for electric guitars, microphones and most amplifiers.</p> <p>The stereo version was the standard headphone connector and is used in many stage audio applications.</p>
<p><b>4 pole 3.5mm “Iphone” jack</b></p> 	<p>Mainly known for its use on the “Iphone” family, this connector has an additional pole wich is used to carry the external microphone signal.</p>
<p><b>RCA or Phono Connector</b></p> 	<p>RCA or Phono connector default audio connector on most Stereo equipment, line out and auxiliary connectors for hi Fi amplifiers, DVD players, Satellite boxes etc.</p>
<p><b>XLR or Cannon Connector</b></p> 	<p>XLR or Cannon connector – available in 3 and 5pin versions – Used in stage audio, default connector on microphone.</p>



**Various Audio Connectors**

Jack Plugs 2.5mm/3.5mm mono/stereo/6.3 Stereo

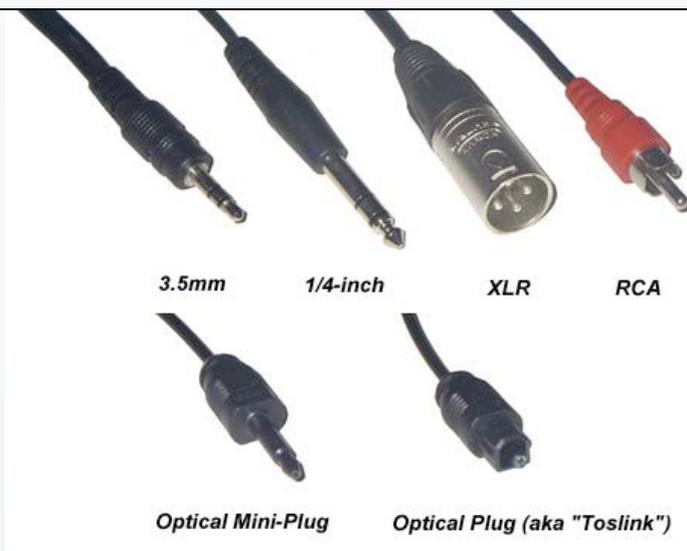


**DC Power Jacks**

These come in a variety of designs some of which are shown above. The two most common types are the single connector (far left) with an inside diameter of 2.1 or 2.5mm and an outside diameter of 5.5mm.

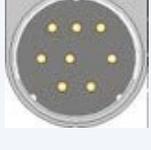
They are also available as in line extension plugs as the picture below

**Various Audio/Video connectors**





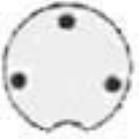
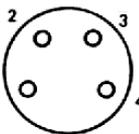
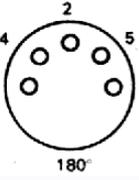
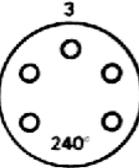
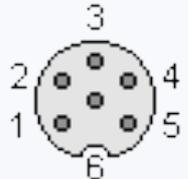
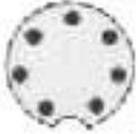
**MINI DIN CONNECTOR TYPES**

		<p>Mini 3 pin DIN – Original Apple local talk connector</p>
		<p>Mini 4 pin DIN - used for S-Video and Camcorder applications.</p>
		<p>Mini 5 Pin DIN – Often used for Low Voltage Power supply connector</p>
		<p>Mini 6 pin DIN – standard connector for keyboard and mouse interfaces</p>
		<p>Mini 7 Pin DIN</p>
		<p>Mini 7 Pin DIN – S video combined type</p>
		<p>Mini 8 pin DIN – Many proprietary uses – was the main Apple connector in the past.</p>



## DIN CONNECTOR

DIN is an acronym for Deutsche Industry Norm which is the German standards organization responsible for setting industrial standards for products made in Germany. Circular DIN plugs are available in 3 to 14 pins.

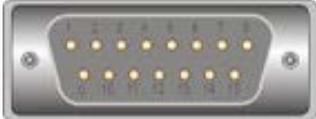
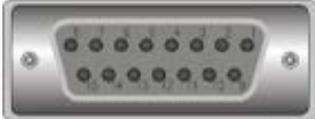
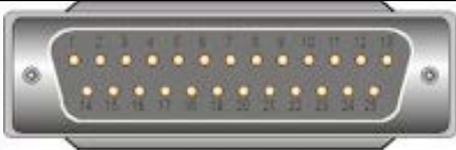
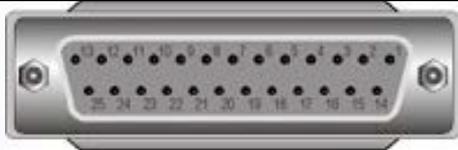
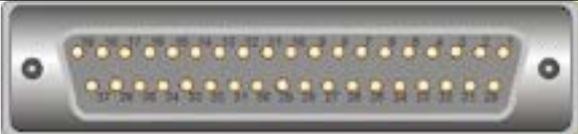
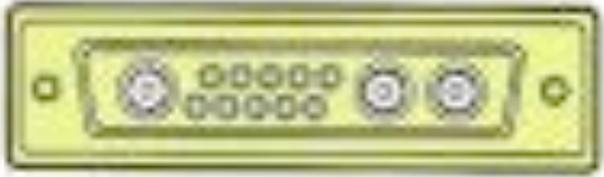
		3 Pin DIN Plug
		4 pin DIN plug
		5 pin 180 degree DIN plug
		5 pin 240 degree DIN plug
		5 pin "Domino" DIN plug
		6 pin 270 degree DIN plug
		7 pin 270 degree DIN plug
		8 pin 270 degree DIN plug

Connectors not shown at exact sizes

### D Type or DB Connectors

Connectors used by serial and parallel and video interfaces.

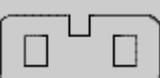
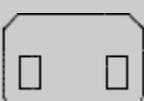
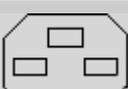
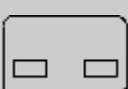


	
<p><b>DB 9 Male</b></p>	<p><b>DB 9 Female</b></p>
	
<p><b>DB HD15 Male</b></p>	<p><b>DB HD15 Female</b></p>
	
<p><b>DB 15 Male</b></p>	<p><b>DB 15 Female</b></p>
	
<p><b>DB 25 Male</b></p>	<p><b>DB 25 Female</b></p>
	
<p><b>DB 37 Male</b></p>	<p><b>DB 37 Female</b></p>
	
<p><b>DB 50 Male</b></p>	<p><b>D13W3F</b></p>

Connectors not shown at exact sizes



## IEC Mains Connectors

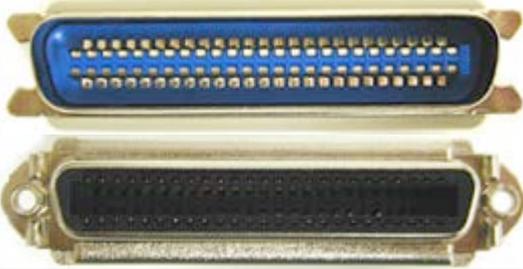
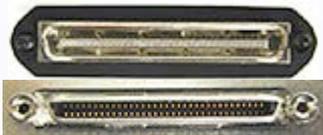
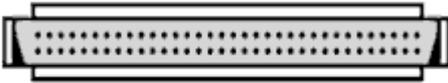
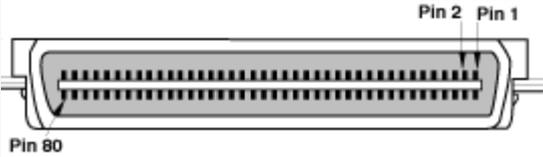
Appliance Connector	Connector Outlet Female Socket/ Connector Inlet Plug	Rated Current (Amps)	Equipment Construction Class	Rated Temperature
	C1 / C2	0.2	II	65°C
	C3 / C4	2.5	0	65°C
	C5 / C6	2.5	I	65°C
	C7 / C8	2.5	II	65°C
	C9 / C10	6	II	65°C
	C11 / C12	10	0	65°C
	C13 / C14	10/15	I	65°C
	C15 / C16	10/15	I	120°C
	C15A / C16A	10/16	I	155°C
	C17 / C18	10/17	II	65°C
	C19 / C20	16/20	I	65°C
	C21 / C22	16/21	I	155°C
	C23 / C24	16/22	II	65°C

Connectors shown for illustrative purposes - not dimensionally correct



**SCSI Connectors**

The following are the more common SCSI connectors by their recognized industry titles, SCSI 1,2,3 & 5 (I don't know what happened to SCSI 4).

<b>External Connectors</b>	
	<p style="text-align: center;"><b>SCSI 1 -CENTRONICS 50</b></p> <p>Usually referred to as SCSI 1. Sometimes cable had a D25 male at one end for some scanners and early apple machines.</p>
	<p style="text-align: center;"><b>SCSI 2 – HD 50</b></p> <p>Usually known as the SCSI 2 connector, high density D type connector approximate width 36mm</p>
	<p style="text-align: center;"><b>SCSI 3 - HD 68</b></p> <p>Usually known as SCSI 3, the connector pictured has thumb screws but some variants used clips. Approximate width 47mm.</p>
	<p style="text-align: center;"><b>SCSI 5 –VHDCI</b></p> <p>Usually known as SCSI 5, very high density centronics 68 pin connector</p>
	<p style="text-align: center;"><b>HDI 30</b></p> <p>Used on apple powerbooks</p>
<b>Internal Connectors</b>	
	<p style="text-align: center;"><b>SCSI 1/2 - IDC 50 ribbon</b></p> <p>Ribbon cable used for connecting internal SCSI 1 &amp; 2 devices, connectors are female.</p>
	<p style="text-align: center;"><b>SCSI 3 – HD 68 ribbon</b></p> <p>Internal ribbon cable for connecting SCSI 3 devices, connectors are male.</p>
	<p style="text-align: center;"><b>SCA</b></p> <p>Used mainly for server “Hot swap” drives as the extra pins carry power.</p>

Connectors not shown at exact sizes

<b>Standard Fibre Connectors</b>	
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	<p><b>ST Connector</b>                  Was the industry standard for many years, is now slowly being superseded. ST stands for Straight tip connector, it has a 2.5mm ferrule with a twist on bayonet style fastener</p>
	<p><b>SC Connector</b>                  SC also houses one fibre around a central 2.5mm ferrule the plastic body has a push on pull of fastening, they can also be clipped together to form a duplex connector.</p>
<p><b>High Density SFF (Small Form Factor) Connectors</b></p>	
	<p><b>LC Connector</b>                  Another popular small form connector developed by lucent (hence LC Lucent Connector) resemble a small SC with 1.25mm ferrule and can be clipped together to form duplex connector.</p>
	<p><b>MTRJ Connector</b>                  MTRJ stands for Mechanical Transfer Registered Jack. Popular small form factor connector housing 2 fibers in a single connector resembling a RJ45 modular jack.</p>



Other less common connectors	
	<p><b>FDDI Connector</b>                      Developed as a networking standard the Fibre Distributed Data Interface connector holds two ferrules within a fairly bulky housing using a squeeze tab retention mechanism.</p>
	<p><b>SMA Connector</b>                      Was the standard connector for many years but has now fallen out of use.</p>
	<p><b>FC Connector</b></p>
	<p><b>MTP connector</b></p>

Connectors not shown at exact sizes



## Cable Specifications

### Serial Cables

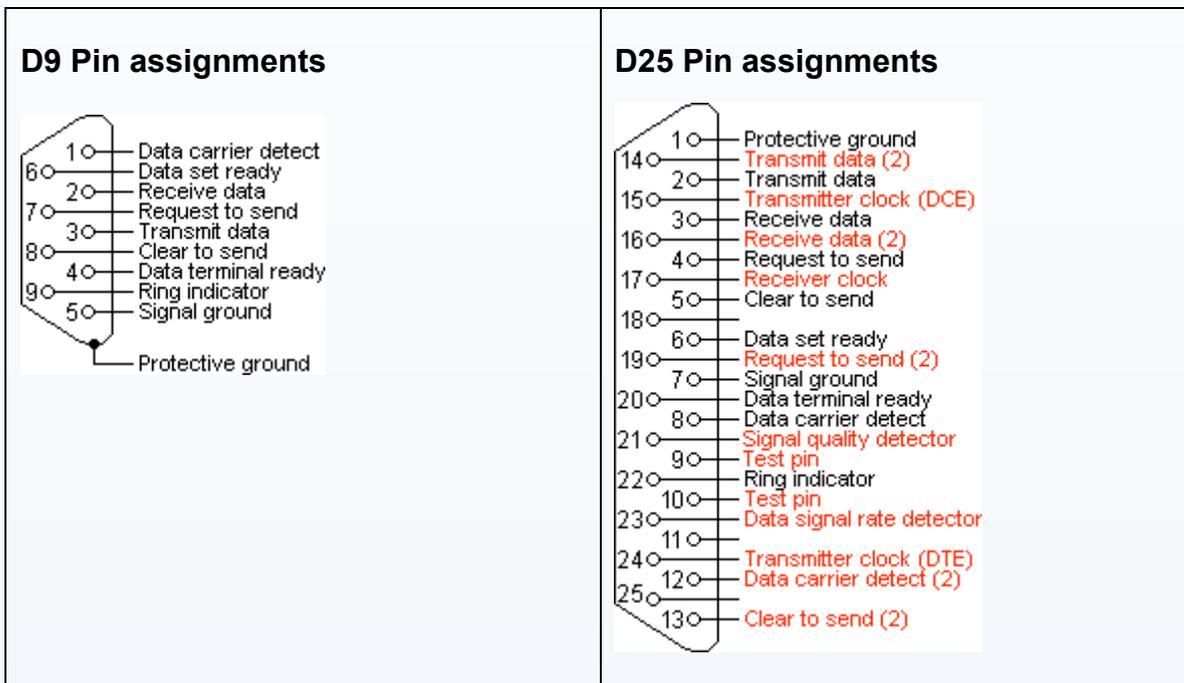
Although less common now serial interface cables are probably the biggest source of confusion when connecting equipment. The RS 232 specification was developed around the D25 connector and has two principle pin assignments.

In order to supposedly make it easier to connect modems to Computers and terminals the committee decided to have 2 types of equipment DTE (Data Terminal Equipment), Computers, terminals. Printers etc and DCE (Data Communication Equipment) equipment the idea was that you could use a straight pinned ribbon or standard cable to connect between DTE and DCE equipment. Although a good idea in principle it has probably caused more problems than anything else in the history of computer communications.

The first problem was that printers were defined as DTE so you needed a special cross over cable between PC and printer, the problems were compounded by the fact that different manufacturers used different “hand shaking” pins thus no one cable would solve all problems. Then came the gender of the interfaces, A male D25 interface on the equipment tended to be DTE and a female one tended to be DCE unfortunately this was not followed religiously.

Then IBM brought out the AT model with a D9 male interface wired differently from the D25 version with transmit on pin 3 instead of pin 2 and all the other signals on new pins. Complete confusion now reigned.

Taking all the above into account there now follows some common serial cable specifications but please understand when it comes to RS232 signaling there is no absolute standard, and these specifications will not work for all applications.





**RS232 null modem cables**

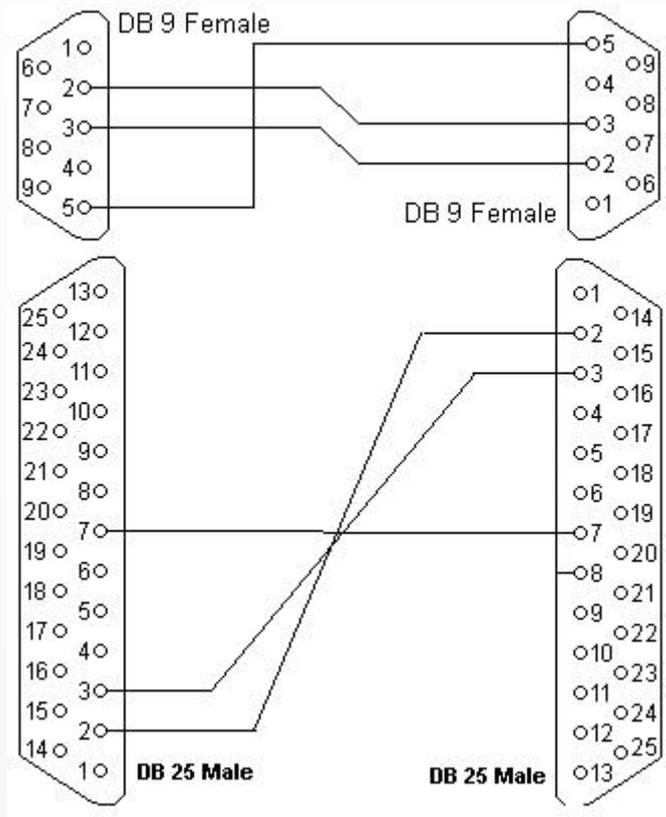
The using of a null modem cable is easiest way to connect two PC's. For simple connections, a three line cable connecting the signal ground and receive and transmit lines is sufficient.

Depending of the software used, some sort of handshaking may however be necessary. Use the selection table to find the right cable for each purpose.

For Microsoft Windows use direct cable connection, the null modem cable with loop back handshaking.

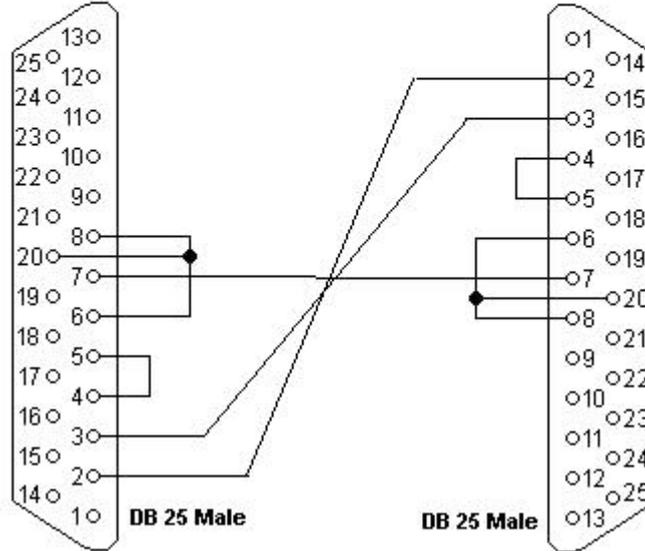
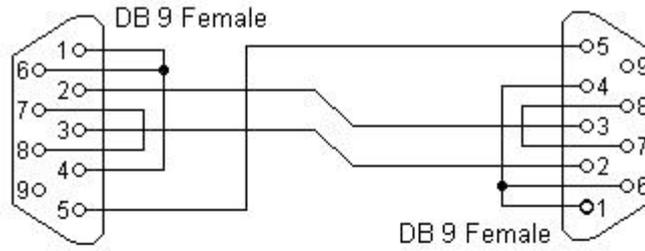
Null modem cables with handshaking can be defined in numerous ways, with loop back handshaking to each PC, or complete handshaking between the two systems. The most common cable types are shown here.

**Simple null modem without handshaking**



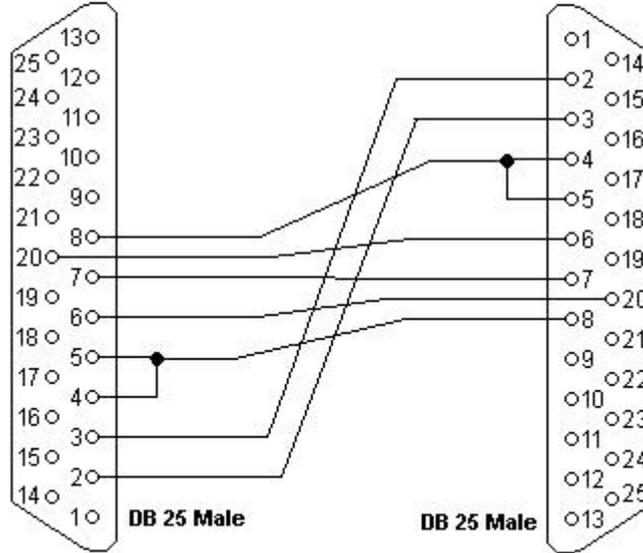
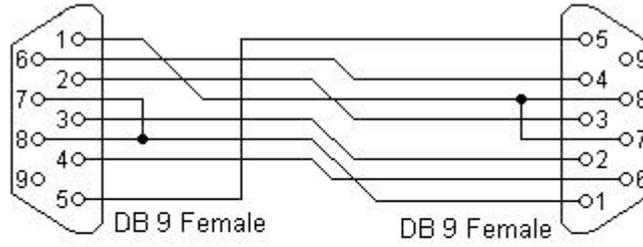


**Null modem with loop back handshaking**



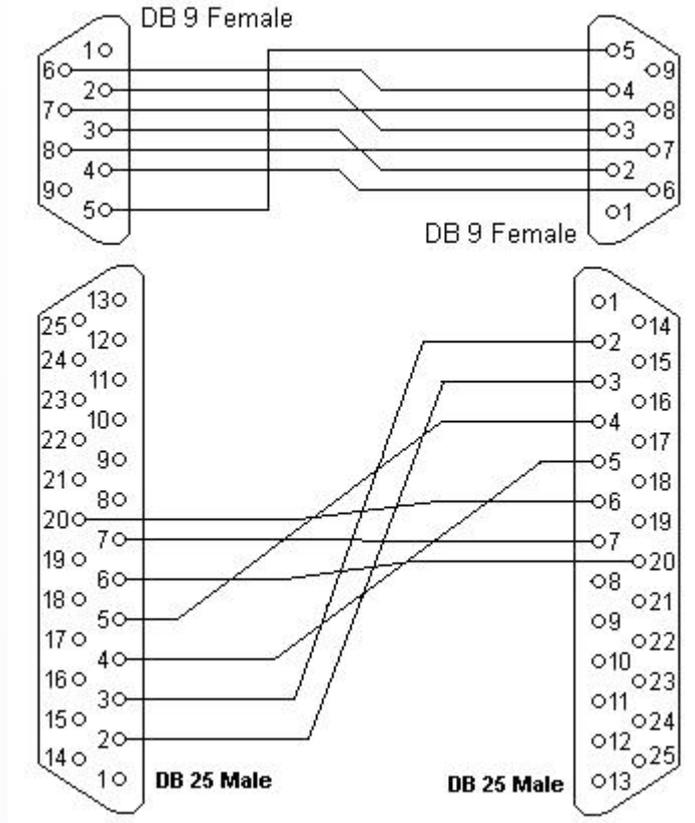


**Null modem with partial handshaking**



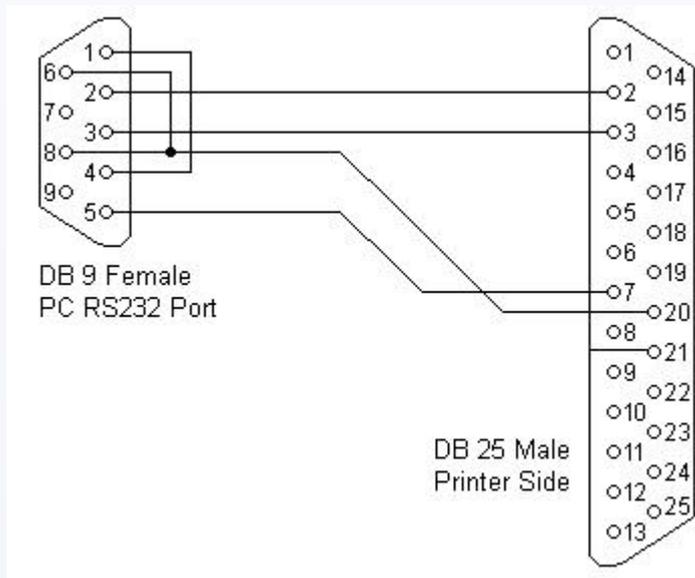


**Null modem with full handshaking**



**RS232 printer cable**

When a serial printer is connected to a PC, the handshaking is not symmetrical any more. In that case a cable is used where some handshaking lines at the PC side are looped back. On the printer side only the data lines and one handshaking line are used.





**Table 3**  
**DB-9 pin assignments**

<b>DB-9 Pin</b>	<b>Corresponding DB-25 Pin</b>	<b>Signal</b>	<b>Function</b>
2	3	RD	Received data
3	2	TD	Transmitted data
8	4	RTS	Request to send
7	5	CTS	Clear to send
6	6	DSR	Data set ready
5	7	SG	Signal ground
4	8	DCD	Data carrier detect
1	20	DTR	Data terminal ready

<b>Name</b>	<b>NIC1</b>	<b>Color</b>	<b>NIC2</b>	<b>Name</b>
TX+ (BI_DA+)	1	White/Orange	3	RX+ (BI_DB+)
TX- (BI_DA-)	2	Orange	6	RX- (BI_DB-)
RX+ (BI_DB+)	3	White/Green	1	TX+ (BI_DA+)
- (BI_DC+)	4	Blue	7	- (BI_DD+)
- (BI_DC-)	5	White/Blue	8	- (BI_DD-)
RX- (BI_DB-)	6	Green	2	TX- (BI_DA-)
- (BI_DD+)	7	White/Brown	4	- (BI_DC+)
- (BI_DD-)	8	Brown	5	- (BI_DC-)