

SATA Cables, Connectors, and Ports

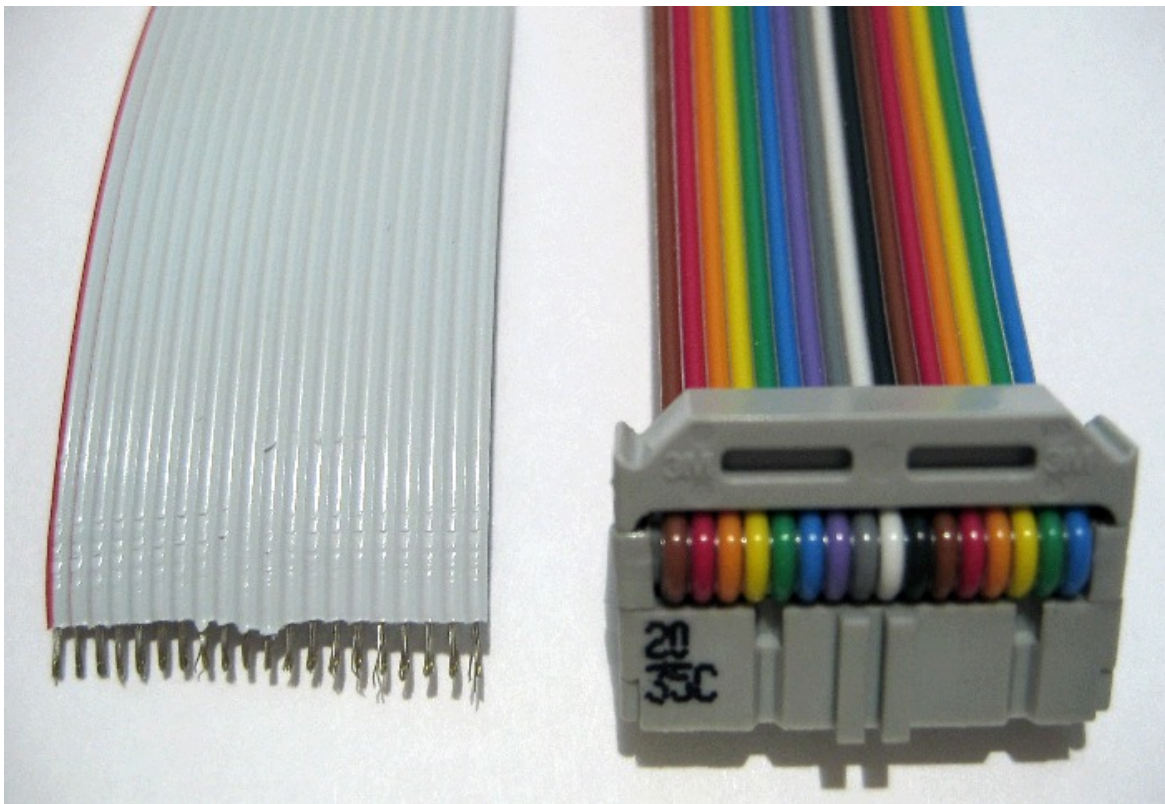
Connectors and cables present the most visible differences between SATA and parallel ATA drives. Unlike PATA, the same connectors are used on 3.5 in SATA hard disks for desktop and server computers and 2.5 in disks for portable or small computers; this allows 2.5 in drives to be used in desktop computers with only a mounting bracket and no wiring adapter. Smaller disks may use the mini-SATA spec, suitable for small-form-factor Serial ATA drives and mini SSDs.

There is a special connector (eSATA) specified for external devices, and an optionally implemented provision for clips to hold internal connectors firmly in place. SATA drives may be plugged into SAS controllers and communicate on the same physical cable as native SAS disks, but SATA controllers cannot handle SAS disks.

There are SATA ports (on motherboards of a PC) that can use SATA data cable with locks or clips, thus, reducing the chance of accidentally unplugging while the PC is turned on. So does the same with SATA power connector and SATA data connector connected to a SATA HDD or SATA optical drive. Also, there are right-angled and left-angled connectors only on one end of SATA data cable, which can only be used when connecting to a SATA HDD or SATA optical drive.

Data

The SATA standard defines a data cable with seven conductors (3 grounds and 4 active data lines in two pairs) and 8 mm wide wafer connectors on each end. SATA cables can have lengths up to 1 metre (3.3 ft), and connect one motherboard socket to one hard drive. PATA ribbon cables, in comparison, connect one motherboard socket to up to two hard drives, carry either 40 or 80 wires, and are limited to 45 centimetres (18 in) in length by the PATA specification (however, cables up to 90 centimetres (35 in) are readily available).



Left: 20-way grey ribbon cable with wire no. 1 marked red, insulation partly stripped. Right: 16-way rainbow ribbon with IDC connector.

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Thus, SATA connectors and cables are easier to fit in closed spaces and reduce obstructions to air cooling. They are more susceptible to accidental unplugging and breakage than PATA, but cables can be purchased that have a locking feature, whereby a small (usually metal) spring holds the plug in the socket.

One of the problems associated with the transmission of data at high speed over electrical connections is loosely described as noise. Despite attempts to avoid it, some electrical coupling will exist both between data circuits and between them and other circuits. As a result, the data circuits can both affect other circuits, whether they are within the same piece of equipment or not, and can be affected by them. Designers use a number of techniques to reduce the undesirable effects of such unintentional coupling. One such technique used in SATA links is differential signaling. This is an enhancement over PATA, which uses single-ended signaling. Twisted pair cabling also gives superior performance in this regard.

Pin #	Function
1	Ground
2	A+ (Transmit)
3	A- (Transmit)
4	Ground
5	B- (Receive)
6	B+ (Receive)
7	ground
8	coding notch



A 7-pin Serial ATA right-angle Data Cable

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Power Supply Standard Connector

The SATA standard specifies a different power connector than the decades-old four-pin Molex connector found on pre-SATA devices. Like the data cable, it is wafer-based, but its wider 15-pin shape prevents accidental mis-identification and forced insertion of the wrong connector type. Native SATA devices favor the SATA power-connector, although some early SATA drives retained older 4-pin Molex in addition to the SATA power connector.

SATA features more pins than the traditional connector for several reasons:

- A third voltage is supplied, 3.3 V, in addition to the traditional 5 V and 12 V.
- Each voltage transmits through three pins ganged together, because the small contacts by themselves cannot supply sufficient current for some devices. (Each pin should be able to provide 1.5 A.)
- Five pins ganged together provide ground.

For each of the three voltages, one of the three pins serves for hotplugging. The ground pins and power pins 3, 7, and 13 are longer on the plug (located on the SATA device) so they will connect first. A special hot-plug receptacle (on the cable or a backplane) can connect ground pins 4 and 12 first.

Pin 11 can function for staggered spinup, activity indication, or nothing. Staggered spinup is used to prevent many drives from spinning up simultaneously, as this may draw too much power. Activity is an indication of whether the drive is busy, and is intended to give feedback to the user through a LED.

Adapters exist which can convert a 4-pin Molex connector to a SATA power connector. However, because the 4-pin Molex connectors do not provide 3.3 V power, these adapters provide only 5 V and 12 V power and leave the 3.3 V lines unconnected. This precludes the use of such adapters with drives that require 3.3 V power. Understanding this, drive manufacturers have largely left the 3.3 V power lines unused.



A 15-pin Serial ATA power receptacle. This connector does not provide the extended pins 4 and 12 needed for hot-plugging.

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Pin #	Mating	Function
—		coding notch
1	3rd	3.3 V
2	3rd	
3	2nd	
4	1st	Ground
5	2nd	
6	2nd	
7	2nd	5 V
8	3rd	
9	3rd	
10	2nd	Ground
11	3rd	Staggered spinup/activity (in supporting drives)
12	1st	Ground
13	2nd	12 V
14	3rd	
15	3rd	

Slimline Connector

SATA 2.6 first defined the slimline connector, intended for smaller form-factors; e.g., notebook optical drives.

Pin #	Function
1	Device Present
2	5 V
3	
4	Manufacturing Diagnostic
5	Ground
6	

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A 6-pin Slimline Serial ATA power connector. Note that pin 1 (device present) is shorter than the others.

Micro Connector

The micro connector originated with SATA 2.6. It is intended for 1.8-inch hard drives. There is also a micro data connector, which is similar to the standard data connector but is slightly thinner.

Pin #	Function
1	3.3 V
2	
3	Ground
4	
5	5 V
6	
7	Reserved
8	Vendor Specific
9	