The Official SCSI Cheat Sheet

Finally… To-The-Point SCSI Answers!

Nobody wants to read an entire SCSI book just to solve a SCSI configuration problem, right? Well, after helping people through hundreds of SCSI problems, I finally put together this SCSI cabling "Cheat Sheet" to make life easier for others. If you are baffled by terms such as *SCSI 1*, *Ultra*, *SCSI 2*, *Wide*, *LVD* and such, this sheet is for you! However, I recommend forgetting the terms SCSI 1, 2, 3 and 5 because these terms complicate matters. Also, please *read the entire sheet before making any SCSI decisions.* Have Fun! - Scott Makarchuk

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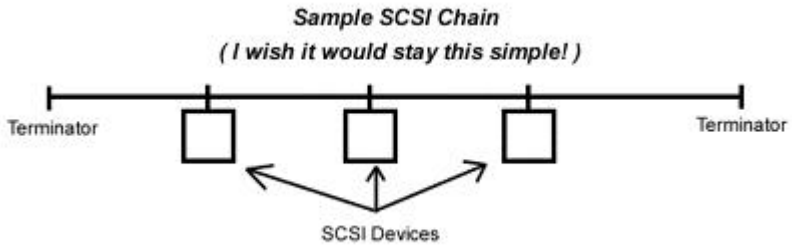
Introduction

SCSI stands for “Small Computer Serial Interface” and is a form of serial communications that allow SCSI devices (SCSI controllers, SCSI hard drives, SCSI tape drives, SCSI scanners, etc.) to communicate along a SCSI chain. A SCSI chain is composed of either internal or external SCSI cables (or both) that attach SCSI devices together and requires SCSI terminators at each end of the SCSI chain. Some SCSI devices have terminators built into them. SCSI cabling is also confusing because SCSI standards and terminology have evolved and grown more complicated over time.



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The 3 Types of SCSI Signals – SE, LVD, HVD

1. SE SCSI Specifications (Most Common)

SE SCSI (SINGLE-ENDED SCSI) - Unless a device says it is HVD, Differential, or LVD, it is probably an SE SCSI device. If a device says it is LVD or LVD/SE it will work on an SE SCSI chain but in SE mode, not in LVD mode so you will lose the LVD speed/distance benefits. See the SE and LVD SCSI Specifications charts below for speed/distance specifications of each.
SE SCSI Termination: SE Termination can be Passive, Active, FPT or LVD/SE termination but not LVD only. See termination section below.

SCSI Type	Number of Pins	Number of SCSI Devices (plus host adapter)	Max. Distance	Speed
SCSI-1	25 Pins (Narrow SCSI)	7 or less	6 meters	5 MBytes/Sec.
Fast SCSI	50 Pins (Narrow SCSI)	7 or less	3 meters	10 MBytes/Sec.
Fast Wide SCSI	68 or 80 Pins (Wide SCSI)	15 or less	3 meters	20 MBytes/Sec.
Ultra SCSI	50 Pins (Narrow SCSI)	3 or less	3 meters	20 MBytes/Sec.
Ultra SCSI	50 Pins (Narrow SCSI)	4 to 7	1.5 meters	20 MBytes/Sec.
Wide Ultra SCSI	68 or 80 Pins (Wide SCSI)	3 or less	3 meters	40 MBytes/Sec.
Wide Ultra SCSI	68 or 80 Pins (Wide SCSI)	4 to 7	1.5 meters	40 MBytes/Sec.

Narrow SCSI = 25-Pin or 50-Pin = 8-bit SCSI.
Wide SCSI = 68-Pin or 80-Pin = 16-bit SCSI.

2. LVD SCSI Specifications (Latest)

Low Voltage Differential/ Single-Ended

LVD SCSI (LOW-VOLTAGE DIFFERENTIAL SCSI) - LVD SCSI devices offer faster speeds, longer distances, and a higher quantity of SCSI devices on your SCSI chain. LVD SCSI devices will work on SE SCSI chains but in SE mode, so the speed/distance benefits of LVD SCSI will be lost. If just one device on a SCSI chain is SE SCSI, all LVD benefits will be downgraded to SE SCSI specifications. See the SE and LVD SCSI Specifications charts below for speed/distance specifications of each.
LVD Termination: To achieve the benefits of LVD, LVD SCSI chains require LVD or LVD/SE termination. For Ultra2 LVD, Ultra2 LVD termination is required. For Ultra3 LVD, Ultra3 LVD termination is required. See termination section below.

SCSI Type	Number of Pins	Number of SCSI Devices (plus host adapter)	Max. Distance	Speed
SCSI-1	25 Pins (Narrow SCSI)	7 or less	12 meters	5 MBytes/Sec.
Fast SCSI	50 Pins (Narrow SCSI)	7 or less	12 meters	10 MBytes/Sec.
Ultra SCSI	50 Pins (Narrow SCSI)	7 or less	12 meters	20 MBytes/Sec.
Fast Wide SCSI	68 or 80 Pins (Wide SCSI)	15 or less	12 meters	20 MBytes/Sec.
Ultra2 SCSI	50 Pins (Narrow SCSI)	7 or less	12 meters	40 MBytes/Sec.
Wide Ultra SCSI	68 or 80 Pins (Wide SCSI)	15 or less	12 meters	40 MBytes/Sec.
Wide Ultra2 SCSI	68 or 80 Pins (Wide SCSI)	15 or less	12 meters	80 MBytes/Sec.
Wide Ultra3 SCSI (Ultra160 SCSI)	68 or 80 Pins (Wide SCSI)	15 or less	12 meters	160 MBytes/Sec.
Wide Ultra320 SCSI	68 or 80 Pins (Wide SCSI)	15 or less	12 meters	320 MBytes/Sec.

Narrow SCSI = 25-Pin or 50-Pin = 8-bit SCSI.
Wide SCSI = 68-Pin or 80-Pin = 16-bit SCSI.

3. HVD SCSI Specifications (Least Common)

HVD SCSI (HIGH-VOLTAGE DIFFERENTIAL SCSI) - Often simply called "Differential" SCSI. HVD SCSI is completely incompatible with SE SCSI and LVD SCSI, so ALL devices on an HVD SCSI chain must be HVD SCSI devices. The benefits of HVD SCSI cabling is that it works well in noisy areas and can operate at distances up to 25 meters. See HVD SCSI Specifications chart below for speed/distance specifications. **HVD Termination:** You must use an HVD terminator. Cannot be mixed with SE or LVD SCSI devices.

SCSI Type	Number of Pins	Number of SCSI Devices (plus host adapter)	Max. Distance	Speed
SCSI-1	25 Pins (Narrow SCSI)	7 or less	25 meters	5 MBytes/Sec.
Fast SCSI	50 Pins (Narrow SCSI)	7 or less	25 meters	10 MBytes/Sec.
Ultra SCSI	50 Pins (Narrow SCSI)	7 or less	25 meters	20 MBytes/Sec.
Fast Wide SCSI	68 or 80 Pins (Wide SCSI)	15 or less	25 meters	20 MBytes/Sec.
Ultra2 SCSI	50 Pins (Narrow SCSI)	7 or less	25 meters	40 MBytes/Sec.
Wide Ultra SCSI	68 or 80 Pins (Wide SCSI)	15 or less	25 meters	40 MBytes/Sec.
Wide Ultra2 SCSI	68 or 80 Pins (Wide SCSI)	15 or less	25 meters	80 MBytes/Sec.

Narrow SCSI = 25-Pin or 50-Pin = 8-bit SCSI.
Wide SCSI = 68-Pin or 80-Pin = 16-bit SCSI.

SCSI Terminators

SCSI terminators must be placed onto or just beyond the last SCSI device on a SCSI chain. SCSI controllers usually have automatically enabled/disabled termination or offer jumper pin caps that can be placed onto pins to enable/disable termination. “High-byte” terminators are not the same as terminators because they go somewhere in the middle of your SCSI chain and terminate only 18 of the 68 wires in a 68-pin SCSI cable/device and allow the other 50 wires to continue to the end of your SCSI chain. See below for more details.

Passive Terminators - Used in SCSI-1 Cabling (see SE SCSI chart above) when only one or two SCSI devices are on your SCSI chain.

Active Terminators - Used in SE SCSI Cabling (see chart). Active terminators are SE terminators.

FPT Terminators (Forced Perfect Terminators) - Often used instead of active terminators in Narrow SE SCSI cabling (see chart) for long cabling distances.

HVD Terminators (High Voltage Differential Terminators) - Often simply called "Differential" terminators, HVD terminators MUST BE USED with HVD SCSI devices and ONLY with HVD SCSI devices.

Active Negation Terminators - These terminators offer better termination than active terminators, however I recommend simply using an LVD/SE terminator when your hardware calls for an active negation terminator because it offers better termination and will be more useful in the future.

Feed-through Terminators (Pass-through Terminators) - Used when there is no place to attach a terminator at the end of a SCSI chain. Placed between your SCSI cable and last SCSI device. Feed-Through terminators can be passive, active, SE, LVD, etc.

LVD Terminators (Low Voltage Differential Terminators) - Required for LVD SCSI cabling (see LVD SCSI chart). LVD/SE terminators will automatically work in either SE or LVD SCSI mode, however ALL devices on a SCSI chain must be LVD to achieve LVD benefits (again, see the LVD SCSI chart). LVD ONLY terminators will not work in SE mode and will shut down a SCSI chain. Important Notes: To achieve Ultra2 LVD or Ultra3 LVD speeds (see LVD chart), you must use a corresponding Ultra2 LVD or Ultra3 LVD terminator.

High Byte Terminators (50-Pin/68-Pin SCSI Adapters) – See my “68-Pin to 50-Pin or 25-Pin Adapters” section and my “High-Byte Termination Situations” section.

Common SCSI Misunderstandings

Narrow SCSI
Narrow SCSI means an 8-bit data bus and uses a 25-pin or 50-pin connector.

Wide SCSI
Wide SCSI means a 16-bit data bus and uses a 68 or 80-pin connector.

Speed
No, 68-pin and 80-pin devices cannot reach maximum speed when they are adapted to 25-pin or 50-pin connectors or if your SCSI controller only offers a 25-pin or 50-pin connector. Sorry.

68-Pin to 50-Pin or 25-Pin Cables (Beware!)
68-Pin to 50-Pin external SCSI cables will work ONLY when the 25-pin or 50-pin side is towards the SCSI controller and the 68-pin side is towards the SCSI device you want to connect. To connect a 25-pin or 50-pin external SCSI device to either a 68-pin SCSI controller or to a 68-pin SCSI device, you will need a 68-Pin/50-Pin SCSI adapter *with a high-byte terminator* built in plus a 50-pin to 50-pin cable or 50-pin to 25-pin SCSI cable. See my next section and my “High-Byte Termination Situations” diagram.

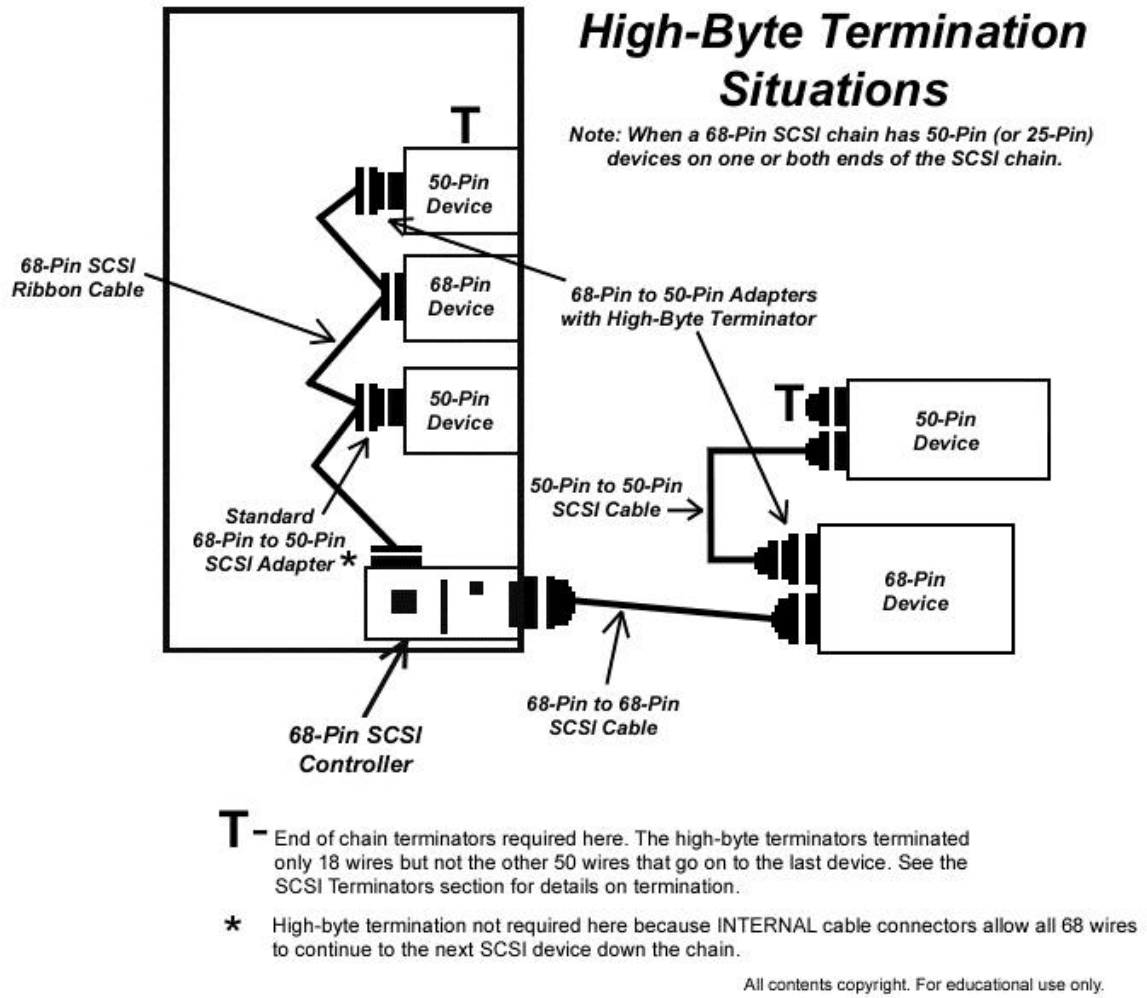
68-Pin to 50-Pin or 25-Pin Adapters (Beware!)
When connecting 68-Pin devices onto a 25-pin or 50-pin SCSI cable, you simply need a 68-pin to 50-pin adapter (not an adapter with high-byte termination). However often a 68-Pin/50-Pin SCSI adapter *with a built-in high-byte terminator* will be required. SCSI adapters with high-byte terminators are needed *only* used when you are using a 68-pin connector on your SCSI controller card and want to connect 25-pin or 50-pin devices onto the end of your 68-pin SCSI chain. If you are using a 50-pin connector on your SCSI controller, you do not have to worry about high-byte termination. *Externally*, high-byte terminators are required when attaching 50-pin SCSI devices to a 68-pin SCSI controller card or a 68-pin SCSI device. *Internally*, high-byte terminators are required when attaching a 50-pin internal cable to a 68-pin SCSI controller card or when the last device on a 68-pin internal cable is a 50-pin SCSI device. Internally, it is okay to use a standard 50-pin/68-pin adapter *without* high-byte termination *when placed in the middle of your SCSI chain and your last device on the 68-pin internal cable is a 68-pin device with termination*. The point is this: A high-byte terminator will terminate the 18 wires that will not continue on to your 50-pin SCSI device(s). Note: 68 - 50 = 18 wires. See also my “High-Byte Termination Situations” diagram.

80-Pin SCSI Adapters
SCA80 adapters (some include built-in terminators) are often used to connect an 80-pin SCSI drive to either a 50-pin or 68-pin internal SCSI cable. BEFORE plugging an 80-pin SCSI adapter into your drive, FIRST connect your internal power connector and 50-Pin or 68-Pin SCSI cable to your 80-pin adapter and then plug the adapter into the 80-pin drive.

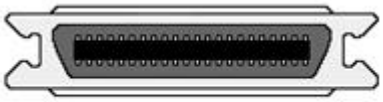
SCSI IDs
Each device on your SCSI chain must have a unique SCSI ID on your SCSI chain. You can set up the ID on each device by using tiny jumper pin caps that are usually provided on SCSI devices. SCSI controllers are usually set to an ID of 7. For 25-pin or 50-pin SCSI devices, your IDs must be between 0 and 6. For 68-pin or 80-pin devices, an ID between 0 and 17 must be used but NOT 7 because this is usually reserved for the SCSI controller.

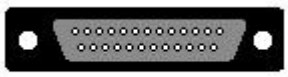
High-Byte Terminators

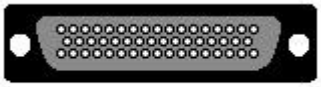
This is where people get most confused. Please see my "High-Byte Terminator Situations" section below, my "68-Pin to 50-Pin or 25-Pin Adapters" section and my "68-Pin to 50-Pin or 25-Pin Cables" section.

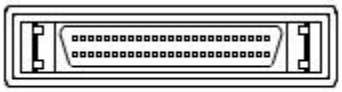


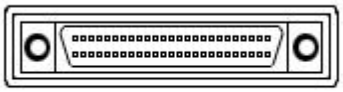
External SCSI Connectors

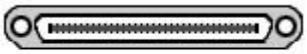

Centronics 50-Pin

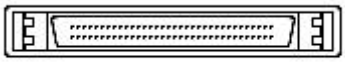

DB 25-Pin


DB 50-Pin


High Density DB 50-Pin (Clip Type)


High Density DB 50-Pin (Screw Type)


VHDCI 68-Pin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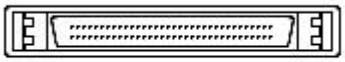
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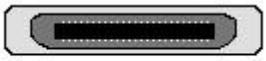
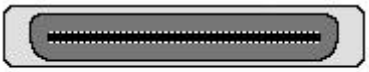
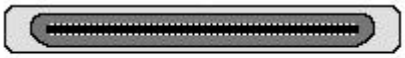

High Density Centronics 50-Pin


High Density Centronics 60-Pin


High Density Centronics 68-Pin


HDI30 (Apple/Mac)

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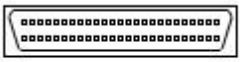
Internal SCSI Connectors


IDC 50-Pin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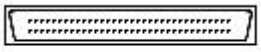
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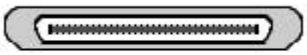
VHDCI 68-Pin (Internal)


SCA 80-Pin (Internal)