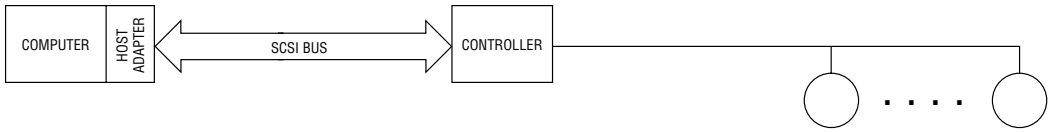
SCSI Applications

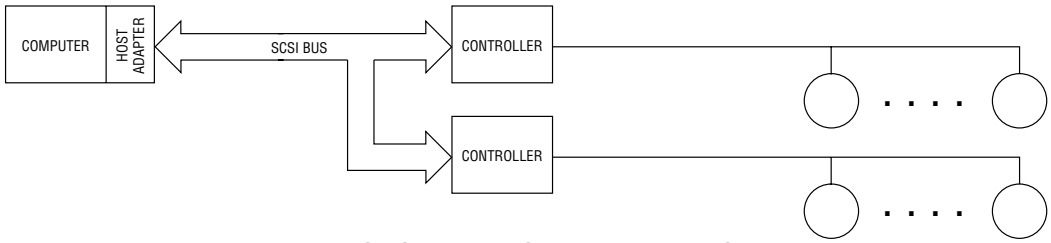
BOURNS®

AMERICAN NATIONAL STANDARD X3 131-1986

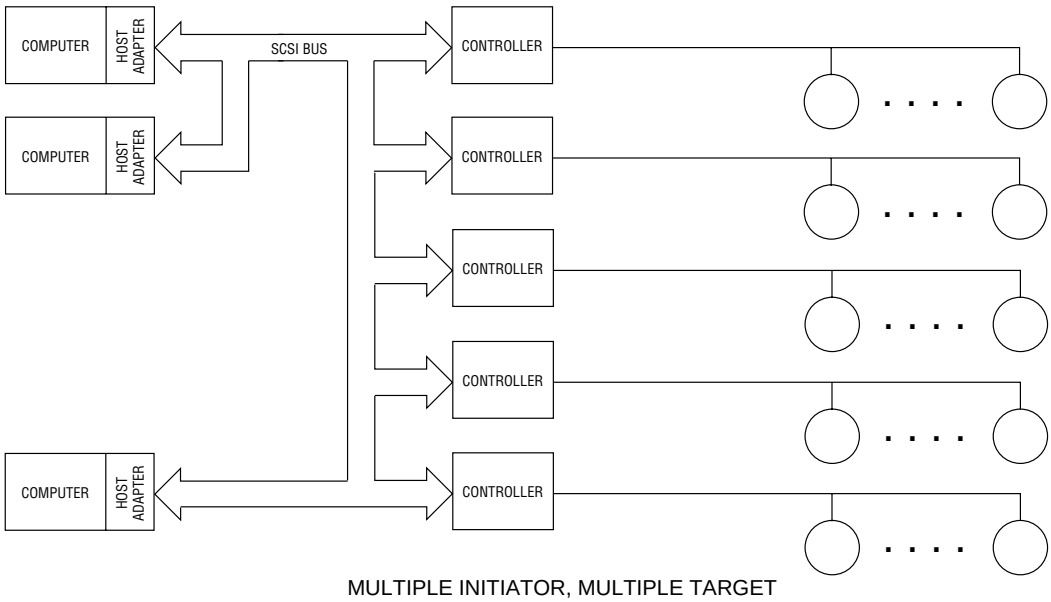
Peripheral devices such as magnetic-disks, printers, optical-disks, and magnetic-tapes.



SINGLE INITIATOR, SINGLE TARGET



SINGLE INITIATOR, MULTIPLE TARGET



MULTIPLE INITIATOR, MULTIPLE TARGET

BLOCK DIAGRAM OF SCSI SYSTEM

Use Bourns Networks to:

- *Provide the terminating resistors required for SCSI implementation.*
- *Optimize signal transmission by eliminating overshoot and ringing.*
- *Minimize space and routing problems, and reduce manufacturing cost per installed resistive function.*
- *Increase board yields and reliability by reducing component count.*

Termination Of The SCSI Bus

The Small Computer System Interface follows American National Standard which provides the mechanical, electrical, and functional requirements for an input/output bus to connect small computers with a variety of peripheral devices. The most common application of this bus is to connect small computers with disk drive (mass storage) units.

The primary resistor network application in SCSI busses is line termination. The termination method is specified in ANSI X3.131-1986 as either a Thevenin equivalent dual terminator

configuration (Fig. 1) for the single-ended implementation of the SCSI bus, or a three-resistor terminator configuration (Fig. 2) for the differential-line version of the SCSI bus.

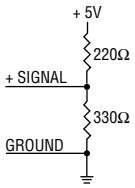


FIGURE 1.

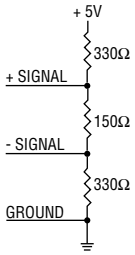


FIGURE 2.

In the single-ended configuration, the SCSI bus is defined for lengths up to 6 meters, while the differential-line version provides for better commonmode noise immunity over cable lengths up to 25 meters.

The signal assignments on the single-ended SCSI bus include 8 data lines, 1 parity line, and 9 control lines. Each of these 18 lines must be terminated, and it is convenient to do this using a resistor network which contains all of the required resistors. An additional 32 lines are ground or power lines which do not require termination (there are 50 lines total in the cable). In a similar fashion, the differential configuration of the SCSI bus uses 18 pairs of lines, each requiring termination.

As of 1989, an extended version of the SCSI standard has been in develop-ment by ANSI, called the SCSI-2 bus. This new standard allows for 16-bit to 32-bit wide data transfers, while also allowing a higher bit transfer rate.

Two cables are defined in the SCSI-2 bus, termed Cable A and Cable B, where Cable B is optional ("wide SCSI" option). Cable A is no different than the single cable used in the original SCSI bus, and therefore uses the same number and types of resistive terminators (i.e., dual terminators for single-ended and triple terminators for differential).

Cable B, however, is a 68-line cable, of which 29 lines (single-ended) or 29 line-pairs (differential) require termination.

Application Guidelines

The principles of transmission-line theory apply to SCSI terminators, and therefore for proper operation their placement must be restricted to the ends of the bus and nowhere else. This implies that the terminators should be placed as close to the SCSI devices as possible. It is permissible to place the terminator inside the SCSI device, but only if that device is located at the end of the bus.

For disk drive applications, SCSI terminators must be present on the host adapter card and at the disk drive end as well. Many disk drive manufacturers have opted to design in removable SCSI terminators into their units to account for the possibility that their unit may not be the one at the end of the cable. For these manufacturers, the combination of a resistor network in a through-hole version plus a matching socket represents the only (and expensive) alternative.

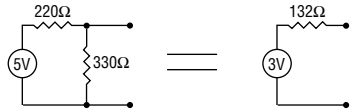
A final consideration is the cable itself. Since the terminators are comprised of 220 ohm and 330 ohm resistors (single-ended), the cable ideally should have a characteristic impedance which matches the Thevenin equivalent of this resistor combination, that is, 132 ohms. In the differential case, a characteristic impedance of 122 ohms would be ideal.

In addition, it is inadvisable to mix different, unmatched cables in the same bus. Such a practice will result in undesirable signal reflections which may compromise the integrity of the data transfer.

Bourns supplies a number of resistor network models designed for both SCSI and SCSI-2 termination .

Cable A (SCSI and SCSI-2) Single-ended

Dual Terminators



PACKAGE	NO. REQ'D.	BOURNS P/N
DIP	1	4120R-3-221/331
CSIP*	2	4611X-104-221/331
CSIP*	3	4608X-104-221/331
MSIP*	3	4308R-104-221/331

Differential:

PACKAGE	NO. REQ'D.	BOURNS P/N
		4120R-820-1
DIP	2	4120R-820-2
DIP	3	4116R-8-2
CSIP*	3	4614M-8-2
MSIP	5	4310M-820-2
		4120P-830-2
		4420P-820-1
		4420P-820-2
		4420P-830-2

Cable B (SCSI-2 Only) Single-ended

PACKAGE	NO. REQ'D.	BOURNS P/N
DIP	2	4118R-3-221/331
CSIP*	3	4612X-104-221/331
CSIP*	4	4610X-104-221/331
MSIP*	4	4310R-104-221/331

Differential:

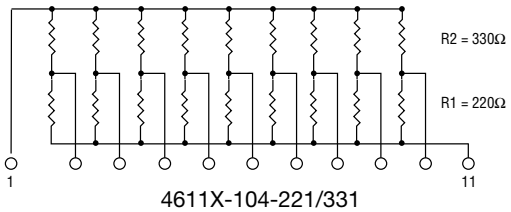
PACKAGE	NO. REQ'D.	BOURNS P/N
DIP	4	4118R-820-2
DIP	5	4116R-8-2
CSIP*	5	4614M-820-2
MSIP*	8	4310M-820-2

*MEDIUM PROFILE (.250" SEATED HEIGHT) AND HIGH PROFILE (.350" SEATED HEIGHT) ARE AVAILABLE BY PLACING THE LETTER "M" OR "H," RESPECTIVELY, IN THE FIFTH POSITION OF THE PART NUMBER.

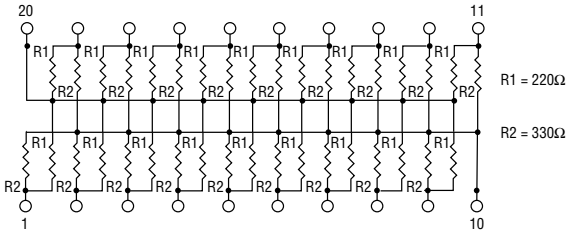
SCSI Applications Representative Terminator Schematics

BOURNS®

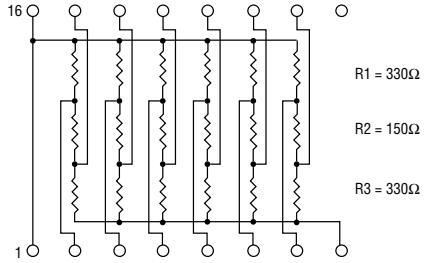
Representative Terminator Schematics



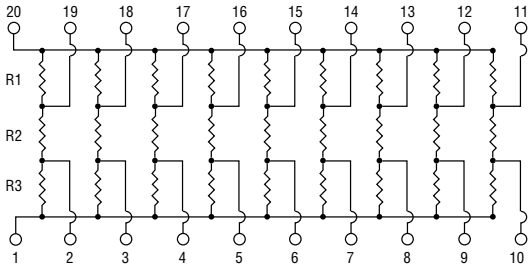
4611X-104-221/331



4120R-3-221/331

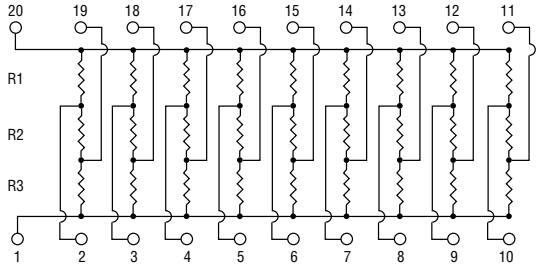


4116R-8-2



820 ELECTRICAL SCHEMATIC

4120R-820-1 4420P-820-1	4120R-820-2 4420P-820-2
R1 = 270Ω	R1 = 330Ω
R2 = 820Ω	R2 = 150Ω
R3 = 180Ω	R3 = 330Ω



830 ELECTRICAL SCHEMATIC

4120R-830-1 4420P-830-1	4120R-830-2 4420P-830-2
R1 = 270Ω	R1 = 330Ω
R2 = 820Ω	R2 = 150Ω
R3 = 180Ω	R3 = 330Ω

Abbreviations

DIP = Dual In-Line Package
MSIP = Molded Single In-Line Package
CSIP = Conformal Coated Single In-Line Package
PCC = Plastic Chip Carrier
SOM = Small Outline Surface Mount Package, Medium Body (.220")
SOL = Small Outline Surface Mount Package, Wide Body (.300")
SON = Small Outline Surface Mount Package, Narrow Body (.154")

References

1. "Small Computer System Interface", (ANSI X3.131-1986), American National Standards Institute Inc., 1986.
2. "Small Computer System Interface 2" (working draft proposal), Revision 5, American National Standards Institute Inc., August 9, 1988.
3. Standard Products Data Book, NCR Corporation, 1988.

*MEDIUM PROFILE (.250" SEATED HEIGHT) AND HIGH PROFILE (.350" SEATED HEIGHT) ARE AVAILABLE BY PLACING THE LETTER "M" OR "H," RESPECTIVELY, IN THE FIFTH POSITION OF THE PART NUMBER.