SFF Committee documentation may be purchased (see p4).
SFF Committee documents are available by FaxAccess at 408-741-1600

SFF Committee

SFF-8046 Specification for

80-pin SCA-2 Connector for SCSI Disk Drives

Rev 2.7 October 3, 1996

Secretariat: SFF Committee

Abstract: This document defines the SCA-2 (Single Connector Attach) connector for use in applications for parallel interface SCSI disk drives racked in a cabinet. This second generation design includes several enhanced capabilities beyond SFF-8015.

This document provides a common specification for systems manufacturers, system integrators, and suppliers of magnetic disk drives. This is an internal working document of the SFF Committee, an industry ad hoc group.

This document is made available for public review, and written comments are solicited from readers. Comments received by the members will be considered for inclusion in future revisions of this document.

Support: This document is supported by the identified member companies of the SFF Committee.

Documentation: This document has been prepared in a similar style to that of the ISO (International Organization of Standards).

POINTS OF CONTACT:

Bob Snively
Sun Microsystems
MS MTV15-46
2550 Garcia Ave
Mountain View
CA 94043-1100
415-786-6694
415-969-9131Fx
bob.snively@sun.com

I. Dal Allan
Chair SFF Committee
ENDL
1446 Black Walnut Ct
Saratoga
CA 95070
408-867-6630
408-867-2115Fx
250-1752@mcimail.com

Date of Printing: February 12, 1997

EXPRESSION OF SUPPORT BY MANUFACTURERS

The following member companies of the SFF Committee voted in favor of this industry specification.

Adaptec
AMP
Berg
Conner Peripherals
DEC
ENDL
Harting Elect
Hewlett Packard
Honda Connector
IBM
Integral Peripherals
Madison Cable
Matsushita
Maxtor
Methode
Quantum
Robinson Nugent
Seagate
Sigmax
Sony
Sun Microsystems
Thomas & Betts
Toshiba America
Unisys
Wearnes Peripherals
Winchester Elect
Woven Elect

The following member companies of the SFF Committee voted against this industry specification.

Molex
Western Digital

The following member companies of the SFF Committee voted to forward this industry specification to an accredited standards body.

AMP
Harting Elect
Honda Connector
IBM
Integral Peripherals
Maxtor
Methode
Quantum
Robinson Nugent
Unisys

To save space for SFF Specifications being reviewed, the information on the principles of the SFF Committee and how to join has not been printed.

TABLE OF CONTENTS

FIGURES

TABLES

SFF Committee --

80-pin SCA-2 Connector for SCSI Disk Drives

1. Scope

In an effort to broaden the applications for small form factor disk drives, an ad hoc industry group of companies representing system integrators, peripheral suppliers, and component suppliers decided to address the issues involved.

The purpose of this SFF Specification is to define a single connector suitable for the direct attachment of SCSI disk drives to backplanes and motherboards. It extends the functionality described in SFF-8015 to provide blind mating and other provisions for the live insertion of disk drives into a backplane.

The SCA-2 has been designed for 8-bit and 16-bit SCSI devices, and carries all required SCSI signals as defined by the SPI (SCSI-3 Parallel Interface) proposed standard. In addition, all required power and auxiliary signals are carried by the same single connector. The SCA-2 mechanical definition allows the device to be plugged into a board socket. The dimensions are provided for both 1" and 1.6" high 3 1/2" disk devices. The same connector structure is appropriate for 2 1/2" devices as well.

The SFF Committee was formed in August, 1990 and the first working document was introduced in January, 1991.

1.1 Description of Clauses

Clause 1 contains the Scope and Purpose.

Clause 2 contains Referenced and Related Standards and SFF Specifications.

Clause 3 contains the General Description.

Clause 4 contains the Glossary.

Clause 5 contains the physical positioning requirements.

Clause 6 contains the signal assignments.

Clause 7 defines the connector requirements.

Clause 8 specifies the connector.

2. References

The SFF Committee activities support the requirements of the storage industry, and it is involved with several standards.

2.1 Industry Documents

The following interface standards are relevant to many SFF Specifications.

- X3.131R-199x SCSI-2 Small Computer System Interface
- X3T9.2/0855D SPI (SCSI-3 Parallel Interface)

2.2 SFF Specifications

There are several projects active within the SFF Committee. At the date of printing document numbers had been assigned to the following projects. The status of Specifications is dependent on committee activities.

F = Forwarded	The document has been approved by the members for forwarding to a formal standards body.
P = Published	The document has been balloted by members and is available as a published SFF Specification.
A = Approved	The document has been approved by ballot of the members and is in preparation as an SFF Specification.
C = Canceled	The project was canceled, and no Specification was Published.
D = Development	The document is under development at SFF.
E = Expired	The document has been published as an SFF Specification, and the members voted against re-publishing it when it came up for annual review.
i = Information	The document has no SFF project activity in progress, but it defines features in developing industry standards. The document was provided by a company, editor of an accredited standard in development, or an individual. It is provided for broad review (comments to the author are encouraged).
s = submitted	The document is a proposal to the members for consideration to become an SFF Specification.

Spec #	Rev	List of Specifications as of February 12, 1997
SFF-8000		SFF Committee Information
SFF-8001i	E	44-pin ATA (AT Attachment) Pinouts for SFF Drives
SFF-8002i	E	68-pin ATA (AT Attachment) for SFF Drives
SFF-8003	1.1	SCSI Pinouts for SFF Drives
SFF-8004	1.1	Small Form Factor 2.5" Drives
SFF-8005	2.5	Small Form Factor 1.8" Drives
SFF-8006	2.0	Small Form Factor 1.3" Drives
SFF-8007	E	2mm Connector Alternatives
SFF-8008	E	68-pin Embedded Interface for SFF Drives
SFF-8009	3.1	Unitized Connector for Cabled Drives
SFF-8010	1.0	Small Form Factor 15mm 1.8" Drives
SFF-8011i	E	ATA Timing Extensions for Local Bus
SFF-8012	1.0	Power Connector Pin Dimensions
SFF-8013	E	ATA Download Microcode Command
SFF-8014	C	Unitized Connector for Rack Mounted Drives
SFF-8015	3.7	SCA Connector for Rack Mounted SFF SCSI Drives
SFF-8016	C	Small Form Factor 10mm 2.5" Drives
SFF-8017	1.7	SCSI Wiring Rules for Mixed Cable Plants
SFF-8018	E	ATA Low Power Modes
SFF-8019	E	Identify Drive Data for ATA Disks up to 8 GB
SFF-8020i	2.6	ATA Packet Interface for CD-ROMs
SFF-8028i	C	- Errata to SFF-8020 Rev 2.5
SFF-8029	C	- Errata to SFF-8020 Rev 1.2
SFF-8030	1.7	SFF Committee Charter
SFF-8031		Named Representatives of SFF Committee Members
SFF-8032	1.2	SFF Committee Principles of Operation

SFF-8033i	E	Improved ATA Timing Extensions to 16.6 MBs
SFF-8034i	3.0	High Speed Local Bus ATA Line Termination Issues
SFF-8035i	2.0	Self-Monitoring, Analysis and Reporting Technology
SFF-8036i	E	ATA Signal Integrity Issues
SFF-8037i	1.0	Intel Small PCI SIG
SFF-8038i	1.0	Intel Bus Master IDE ATA Specification
SFF-8039i	1.1	Phoenix EDD (Enhanced Disk Drive) Specification
SFF-8040	1.2	25-pin Asynchronous SCSI Pinout
SFF-8041	C	SCA-2 Connector Backend Configurations
SFF-8042	C	VHDCI Connector Backend Configurations
SFF-8043	1.0	40-pin MicroSCSI Pinout
SFF-8045	3.7	40-pin SCA-2 Connector w/Parallel Selection
SFF-8046	2.7	80-pin SCA-2 Connector for SCSI Disk Drives
SFF-8047	C	40-pin SCA-2 Connector w/Serial Selection
SFF-8048	C	80-pin SCA-2 Connector w/Parallel ESI
SFF-8049	1.2	80-conductor ATA Cable Assembly
SFF-8050i	1.0	Bootable CD-ROM
SFF-8051i	0.2	Small Form Factor 3" Drives
SFF-8052i	0.9	ATA Interface for 3" Removable Devices
SFF-8053i	3.1	GBIC (Gigabit Interface Converter)
SFF-8055i	2.0	SMART Application Guide for ATA Interface
SFF-8056	1.0	50-pin 2mm Connector
SFF-8057	1.2	Unitized ATA 2-plus Connector
SFF-8058	1.2	Unitized ATA 3-in-1 Connector
SFF-8065	C	40-pin SCA-2 Connector w/High Voltage
SFF-8066	C	80-pin SCA-2 Connector w/High Voltage
SFF-8067	1.8	40-pin SCA-2 Connector w/Bidirectional ESI
SFF-8068	1.0	Guidelines to Import Drawings into SFF Specs
SFF-8069	1.0	Fax-Access Instructions
SFF-8070i	1.0	ATAPI for Rewritable Removable Media - Part 1
SFF-8071i		ATAPI for Rewritable Removable Media - Part 2
SFF-8072i		ATAPI for Rewritable Removable Media - Part 3
SFF-8080	1.2	ATAPI for CD-Recordable Media - Part 1
SFF-8081		ATAPI for CD-Recordable Media - Part 2
SFF-8082		ATAPI for CD-Recordable Media - Part 3
SFF-8090	.99	ATAPI for DVD (Digital Video Data)
SFF-8200	1.1	2 1/2" drive form factors (all of 82xx family)
SFF-8201	1.3	2 1/2" drive form factor dimensions
SFF-8212	1.2	2 1/2" drive w/SFF-8001 44-pin ATA Connector
SFF-8300	1.1	3 1/2" drive form factors (all of 83xx family)
SFF-8301	1.2	3 1/2" drive form factor dimensions
SFF-8302	1.1	3 1/2" Cabled Connector locations
SFF-8332	1.2	3 1/2" drive w/80-pin SFF-8015 SCA Connector
SFF-8337	1.2	3 1/2" drive w/SCA-2 Connector
SFF-8342	1.3	3 1/2" drive w/Serial Unitized Connector
SFF-8400	C	Very High Density Cable Interconnect
SFF-8441	9.0	VHDCI Shielded Configurations
SFF-8451	5.3	SCA-2 Unshielded Connections

SFF-8500	1.1	5 1/4" drive form factors (all of 85xx family)
SFF-8501	1.1	5 1/4" drive form factor dimensions
SFF-8508	1.1	5 1/4" ATAPI CD-ROM w/audio connectors
SFF-8551	1.2	5 1/4" CD-ROM 1" High form factor

2.3 Sources

Copies of ANSI standards or proposed ANSI standards may be purchased from Global Engineering.

15 Inverness Way East	800-854-7179 or 303-792-2181
Englewood	303-792-2192Fx
CO 80112-5704	

Copies of SFF Specifications are available by FaxAccess or by joining the SFF Committee as an Observer or Member.

14426 Black Walnut Ct	408-867-6630x303
Saratoga	408-867-2115Fx
CA 95070	FaxAccess: 408-741-1600

FaxAccess is a computer-operated service capable of faxing copies of documents selected from a menu. Anyone ordering documents over FaxAccess must be using the handset of a fax machine, as the documents are transmitted over the same line as the caller dialed in on to make the selection(s).

3. General Description

The environment for this SFF Specification is any SCSI disk drive which wants a common connector structure for racking disk drives in a cabinet.

In addition to the capabilities provided by SFF-8015, the SCA-2 system includes:

- Blind mating
- Provision for pre-charge circuitry within the host system
- Variable length pins to detect when a drive is completely seated
- Alignment guides
- Ground contacts in the guide pins

The SCA-2 is designed and placed to allow plugging a drive directly into a backplane by providing the necessary electrical connection. Mechanical stability and device retention must be provided by other mechanisms, including mounting brackets, guide rails, clips, or screw attachments.

The SCA-2 connector is an 80 position ribbon (aka leaf or single beam) connector with guides that include grounding contacts. Various options are available to meet the different mounting requirements of the connector to the SCSI device and the different drive plugging requirements.

The SCA-2 connector will allow drive-to-board mating.

Since power and address information are provided to the drives through the connector, special cables must be provided if daisy-chaining of drives is required.

The SCA-2 is designed principally for the direct plugging of drives into a backplane. Hot plugging is appropriate according to Cases 1, 2, and 3 specified in the SPI Annex.

- Cases 1 and 2 are required of all devices and allow the insertion of the drives into unpowered SCSI buses or SCSI buses with the RST signal held active.
- Case 3 allows hot plugging while no current I/O processes are active. The use of Case 3 hot plugging is optional and specified by the drive manufacturer. Where hot plugging is a requirement for a system using SCA-2 devices, the ESD protection provided by the guides may have to be complemented by the rails and chassis slots.

4. Definitions and Conventions

4.1 Definitions

For the purpose of SFF Specifications, the following definitions apply:

4.1.1 Optional: This term describes features which are not required by the SFF Specification. However, if any feature defined by the SFF Specification is implemented, it shall be done in the same way as defined by the Specification. Describing a feature as optional in the text is done to assist the reader. If there is a conflict between text and tables on a feature described as optional, the table shall be accepted as being correct.

4.1.2 Reserved: Where this term is used for bits, bytes, fields and code values; the bits, bytes, fields and code values are set aside for future standardization. The default value shall be zero. The originator is required to define a Reserved field or bit as zero, but the receiver should not check Reserved fields or bits for zero.

4.1.3 VU (Vendor Unique): This term is used to describe bits, bytes, fields, pins, signals, code values and features which are not described in this SFF Specification, and may be used in a way that varies between vendors.

4.1.4 VU Mode: A mode of execution by the drive in which its use is not defined by this SFF Specification. The means by which a vendor invokes vendor unique operations within a drive is defined by this SFF Specification.

4.2 Conventions

Certain terms used herein are the proper names of signals. These are printed in uppercase to avoid possible confusion with other uses of the same words; e.g., ATTENTION. Any lower-case uses of these words have the normal American-English meaning.

A number of conditions, commands, sequence parameters, events, English text, states or similar terms are printed with the first letter of each word in uppercase and the rest lower-case; e.g., In, Out, Request Status. Any lower-case uses of these words have the normal American-English meaning.

The American convention of numbering is used i.e., the thousands and higher multiples are separated by a comma and a period is used as the decimal point. This is equivalent to the ISO convention of a space and comma.

American:	0.6	ISO:	0,6
	1,000		1 000
	1,323,462.9		1 323 462,9

4.3 Glossary

4.3.1 Backplane: The components of the enclosure that mechanically support the SCA connector and create or route the required signals and power to the SCA connector from the enclosure. The backplane may be a true multi-drive backplane, a paddle card inserted in a host computer, a paddle card attached to an appropriately designed cable, or any component with similar capabilities.

4.3.2 Drive: The SCSI peripheral that plugs into the backplane using the SCA connector. The device may be removable from the enclosure through an external port or may be permanently installed in the enclosure. The SCSI peripheral may be any SCSI device of any type that meets one of the standard form factors and establishes its connection to the backplane through an SCA-2 connector.

5. Physical Positioning Requirements

The SCA-2 connector is fixed with respect to the drive form factor as specified by SFF-8337.

- The connector is located in the Y dimension with respect to the drive mounting holes with the specified tolerances.
- The connector is centered side to side in the end of the drive in the X dimension with the specified tolerances.
- The connector is centered at a fixed location above the base of the drive with the specified tolerances.

When the SCA-equipped disk drive is mated to a vertical board mount receptacle, there is 3.45+/-0.7mm clearance (reference value for the standard height receptacle) between the disk drive and the mated backplane. To insure a minimum contact wipe of 1.32mm, the drive must be fully seated with the mating socket connector.

Fully seated is defined by the distance from the backplane printed circuit board surface to the connector face of the disk drive (Datum C in SFF-8337) as being 3.55+/-0.20mm for the standard height vertical receptacle, or 9.55+/-0.20mm for the extended height vertical receptacle. For right angle and cable receptacle applications, the connectors are considered fully seated when the two connector housings limit further engagement.

6. Signals

Other than where information is provided, the descriptions in SFF-8015 apply directly to this specification. The descriptions are not being re-printed here to assure that no discrepancies can arise.

6.1 Signal Conventions

Signal names are shown in all upper case letters. Signals can be asserted (active, true) in either a high (more positive voltage) or low (less positive voltage) state. A dash character (-) at the beginning or end of a signal name indicates it is asserted at the low level (active low). No dash or a plus character (+) at the beginning or end of a signal name indicates it is

asserted high (active high). An asserted signal may be driven high or low by an active circuit, or it may be allowed to be pulled to the correct state by the bias circuitry. Details of the requirements are included in the signal definitions.

Unless noted otherwise, tables specify the voltage and/or current requirements at the device connector. Current flow into the device is positive and current flow out of the device is negative.

6.2 Signal Assignments

The signals that are not defined in this clause are defined in X3.131R-1994 (SCSI-2) and X3.0855 (SCSI-3 Parallel Interface).

The signal pinout shown in Table 6-1 is for single ended devices.

The signal pinout shown in Table 6-2 is for differential devices.

Pin 1 shall be located as shown in SFF-8337.

A signal identified as NC (Not Connected) shall not be connected.

The pins identified as being short (S) and long (L) only applies to the host receptacle and not the connector on the drive. All pins on the drive connector are the same length.

TABLE 6-1 SINGLE ENDED SIGNAL ASSIGNMENTS

80-pin SFF-8046 Connector Contact and Signal Name	Cable conductor numbers are not applicable.	80-pin SFF-8046 Connector Contact and Signal Name
1 12V CHARGE (L)		(L) 12V GROUND 41
2 12V (S)		(L) 12V GROUND 42
3 12V (S)		(L) 12V GROUND 43
4 12V (S)		(S) MATED 1 44
5 OPT 3.3 VOLTS (S)		(L) OPT 3.3V CHARGE 45
6 OPT 3.3 VOLTS (S)		(L) GROUND 46
7 -DB(11) (S)		(S) GROUND 47
8 -DB(10) (S)		(S) GROUND 48
9 -DB(9) (S)		(S) GROUND 49
10 -DB(8) (S)		(S) GROUND 50
11 -I/O (S)		(S) GROUND 51
12 -REQ (S)		(S) GROUND 52
13 -C/D (S)		(S) GROUND 53
14 -SEL (S)		(S) GROUND 54
15 -MSG (S)		(S) GROUND 55
16 -RST (S)		(S) GROUND 56
17 -ACK (S)		(S) GROUND 57
18 -BSY (S)		(S) GROUND 58
19 -ATN (S)		(S) GROUND 59
20 -DB(P0) (S)		(S) GROUND 60
21 -DB(7) (S)		(S) GROUND 61
22 -DB(6) (S)		(S) GROUND 62
23 -DB(5) (S)		(S) GROUND 63
24 -DB(4) (S)		(S) GROUND 64
25 -DB(3) (S)		(S) GROUND 65
26 -DB(2) (S)		(S) GROUND 66
27 -DB(1) (S)		(S) GROUND 67
28 -DB(0) (S)		(S) GROUND 68
29 -DB(P1) (S)		(S) GROUND 69
30 -DB(15) (S)		(S) GROUND 70
31 -DB(14) (S)		(S) GROUND 71
32 -DB(13) (S)		(S) GROUND 72
33 -DB(12) (S)		(S) GROUND 73
34 5V (S)		(S) MATED 2 74
35 5V (S)		(L) 5V GROUND 75
36 5V CHARGE (L)		(L) 5V GROUND 76
37 SPINDLE SYNC (L)		(L) ACTIVE LED OUT 77
38 RMT_START (L)		(L) DLYD_START 78
39 SCSI ID (0) (L)		(L) SCSI ID (1) 79
40 SCSI ID (2) (L)		(L) SCSI ID (3) 80

TABLE 6-2 DIFFERENTIAL SIGNAL ASSIGNMENTS

80-pin SFF-8046 Connector Contact and Signal Name	Cable conductor numbers are not applicable.	80-pin SFF-8046 Connector Contact and Signal Name
1 12V CHARGE (L)		(L) 12V GROUND 41
2 12V (S)		(L) 12V GROUND 42
3 12V (S)		(L) 12V GROUND 43
4 12V (S)		(S) MATED 1 44
5 OPT 3.3 VOLTS (S)		(L) OPT 3.3V CHARGE 45
6 OPT 3.3 VOLTS (S)		(L) DIFFSNS 46
7 -DB(11) (S)		(S) +DB(11) 47
8 -DB(10) (S)		(S) +DB(10) 48
9 -DB(9) (S)		(S) +DB(9) 49
10 -DB(8) (S)		(S) +DB(8) 50
11 -I/O (S)		(S) +I/O 51
12 -REQ (S)		(S) +REQ 52
13 -C/D (S)		(S) +C/D 53
14 -SEL (S)		(S) +SEL 54
15 -MSG (S)		(S) +MSG 55
16 -RST (S)		(S) +RST 56
17 -ACK (S)		(S) +ACK 57
18 -BSY (S)		(S) +BSY 58
19 -ATN (S)		(S) +ATN 59
20 -DB(P0) (S)		(S) +DB(P0) 60
21 -DB(7) (S)		(S) +DB(7) 61
22 -DB(6) (S)		(S) +DB(6) 62
23 -DB(5) (S)		(S) +DB(5) 63
24 -DB(4) (S)		(S) +DB(4) 64
25 -DB(3) (S)		(S) +DB(3) 65
26 -DB(2) (S)		(S) +DB(2) 66
27 -DB(1) (S)		(S) +DB(1) 67
28 -DB(0) (S)		(S) +DB(0) 68
29 -DB(P1) (S)		(S) +DB(P1) 69
30 -DB(15) (S)		(S) +DB(15) 70
31 -DB(14) (S)		(S) +DB(14) 71
32 -DB(13) (S)		(S) +DB(13) 72
33 -DB(12) (S)		(S) +DB(12) 73
34 5V (S)		(S) MATED 2 74
35 5V (S)		(L) 5V GROUND 75
36 5V CHARGE (L)		(L) 5V GROUND 76
37 SPINDLE SYNC (L)		(L) ACTIVE LED OUT 77
38 RMT_START (L)		(L) DLYD_START 78
39 SCSI ID (0) (L)		(L) SCSI ID (1) 79
40 SCSI ID (2) (L)		(L) SCSI ID (3) 80

6.3 Design Considerations

6.3.1 General

No termination power supply lines are included. The SCSI termination circuits shall be provided on the platform backplane. The drives shall not provide termination.

Special cable structures are required if the drives are being connected using cables instead of direct backplane insertion.

- The cable structures shall provide SCSI Device ID and control information, power, and the required characteristic impedance and loading for the SCSI signals.
- The cable structures shall be designed with special care to prevent the coupling of power supply noise into the SCSI signals.

Differential and single-ended drives are physically identical. The system designers are responsible for providing any mechanical interlocks or labeling mechanisms necessary to identify the drives and be sure that they are plugged only in the appropriate locations. The differential and single-ended SCSI drives will not damage each other if plugged into the same bus, but they will not operate on the wrong bus.

Backplane applications shall use power planes for power distribution.

All disk drives shall connect the guide pins to 5V GROUND. All backplanes shall connect the guide pins to the 5V GROUND. This is required to assist in protecting the signal and power pins from possible ESD (Electro Static Discharge) damage and from power sequencing damage.

6.3.2 Optional Voltages

The 3.3V signals are optional in compliant backplanes and optionally used by compliant disk drives. It is a system integrator's decision whether or not drives with a 3.3V requirement are able to operate on a particular backplane.

If the backplane does not provide 3.3V:

- all the OPT 3.3 VOLTS signals on the backplane may be bussed together and left with no other connection or the backplane may leave the OPT 3.3 VOLTS signals unconnected.
- the OPT 3.3 CHARGE signal may be connected to an unpowered 3.3V charge management circuit or may be not connected.

If the drive does not use a particular voltage, all the power signals associated with that voltage shall be not connected.

Regardless of whether or not a particular voltage is provided by the backplane or used by the disk drive, all ground signals shall always be connected by the backplane and by the disk drive.

6.4 Signal Definitions

6.4.1 VOLTAGE and GROUND signals

Three voltage supplies and corresponding ground return signals are provided by the backplane connector to the drive. Table 6-3 provides the specifications for each of the voltage supplies. NOTE: The details of the actual drive supply requirements need to be studied for each drive and enclosure combination.

TABLE 6-3 VOLTAGE SPECIFICATION LIMITS

Voltage	# of pins	# of GNDs	Requirements on Supply at SCA Connector	Current Capability Average/Peak
12 VOLTS	3	3	12V +5% -7%	0/0 to 2.5/5 Amps
5 VOLTS	2	2*	5V +/- 5%	0/0 to 2/2.5 Amps
OPT 3.3 VOLTS	2	2*	3.3V +/- 5%	0/0 to 3/3 Amps

* the two logic level grounds are shared between +5V and +3.3V.

The peak current capability is measured during operation or initialization after voltages have stabilized at the operating level. Inrush currents are managed by the power supply during normal power up and by the CHARGE signals during hot plugging.

For each voltage, the current supplied to the drive should be distributed as evenly as possible among the connecting pins.

The backplane power supplies shall operate correctly and maintain regulation from zero current to the peak current. Drive sequencing provisions may be required to avoid overloading power supplies during drive spin-up sequencing. Voltage dips to -10% are allowed on the 12 VOLTS supply during spin up.

For each voltage, an appropriate number of current return GROUND signal pins have been assigned.

- The GROUND signal pins for all voltages shall be tied together in the disk drive.
- The GROUND signals in the backplane may be tied together or connected separately to the power supplies as required by the particular subsystem.
- The logic level grounds, GROUND (5V/3.3V) are shared between the currents provided by the 5 VOLTS and 3.3 VOLTS signals. The sum of the 5 VOLTS and 3.3 VOLTS currents shall not exceed 3 Amps.

6.4.2 CHARGE signals

Three charge signals, one for each of the power supply voltages, provide controlled precharging of the disk drive's internal circuits to avoid excessive surge currents during hot plugging.

The precharge pin mates early to allow the precharge to take place before the voltage pins make contact. The precharge control circuits are located on the backplane side of the connector if required. The backplane should assume that the VOLTS signals for each voltage are shorted together with the corresponding CHARGE signal on the drive. Systems without a hot-plug capability or with an alternative hot plugging mechanism are not required to implement the precharge control circuit and are not required to use long and short pins on the backplane connector.

After the drive capacitance is charged, but before the MATED signal indicates that the power signals are seated, the drive shall not use more than 1 Amp on the precharge voltage pin. This is required to protect the precharge pin from over-current damage and to provide additional flexibility in the design of the precharge circuit. The voltage provided by the precharge circuitry shall be as specified by Table 6-4. Note that any circuitry on the drive that uses the

CHARGE voltage for executing initialization operations shall operate within the current and voltage constraints specified for the CHARGE signals.

TABLE 6-4 CHARGE SUPPLY TO DRIVE

CHARGE signal	Requirements on Supply at SCA Connector from backplane after CHARGE complete	Max Surge to drive	Max Continuous required by drive
12 VOLTS	12V +5%, -12%	6 Amps	1 Amp
5 VOLTS	5V +5%, -17%	6 Amps	1 Amp
OPT 3.3 VOLTS	3.3V +5%, -24%	6 Amps	1 Amp

After precharge is complete and the drive is mated, there is no guarantee that the precharge signal can provide any current to the drive and the drive should not depend on such current for operation.

The system designer should assume that the VOLTS signal(s) and the corresponding CHARGE signal are shorted together on the drive.

6.4.3 SPINDLE SYNC

The spindle synch is assigned a single pin, SPINDLE SYNC. The synchronization protocol and the electronic requirements for the SPINDLE SYNC signal are defined in the drive specification. Industry practice presently requires that drives interconnected for synchronization be the same or equivalent models.

Spindle synchronization is managed by the SCSI command set. The signal current requirements shall not exceed 100 milliamperes and the signal voltage shall not be higher than 5.25V or lower than -0.25V. The minimum driver capability required by the SPINDLE SYNC signal shall be sufficient to drive the receivers on 30 identical disk drives.

The SPINDLE SYNC signal when driving should be capable of driving a minimum of 30 identical disk drives.

The SPINDLE SYNC signal is a source for noise and may be affected by noise. The design of the SPINDLE SYNC signal interconnections should take this into account by properly laying out the SPINDLE SYNC signals on the backplane or motherboard. Proper layout shall consider routing relative to other signals, the proper line impedance, and terminations if necessary. The selection of the electronic transceiver shall also take into account the possibility of noise. The signal levels, signal rise time, receiver thresholds, and receiver hysteresis shall be considered as part of that selection.

6.4.4 ACTIVE LED OUT

The ACTIVE LED OUT signal is driven by the drive when a SCSI operation is being performed. The ACTIVE LED OUT signal is required to be implemented and

is used to indicate that the disk drive is operating on a command. Other optional indications can be provided by flashing the LED. The host system is not required to generate any visual output when the ACTIVE LED OUT signal is raised, but if such a visual output is provided, it shall be white or green to indicate that normal activity is being performed.

The ACTIVE LED OUT signal is designed to pull down the cathode of an LED. The anode is attached to the proper +5V supply through an appropriate current limiting resistor. The LED and the current limiting resistor are external to the drive.

TABLE 6-5 OUTPUT CHARACTERISTICS OF DRIVE ACTIVE LED SIGNAL

State	Current Drive Available	Output Voltage
DRIVE LED OFF	0 < IOH < 100 uA	
DRIVE LED ON	IOL < -30 mA	0 < VOL < 0.8V

6.4.5 Motor Start Controls

The method of starting the drive's motor is established by the signals RMT_START and DLYD_START, as described in Table 6-6. The state of these signals can either be wired into the backplane socket or driven by logic on the backplane.

Each drive location should have these signals supplied independently to ensure proper operation. If the signals were bussed, a drive with a power failure might clamp the signals in a condition that caused operational drives to behave incorrectly.

- If the GROUND state is implemented for RMT_START, bussing between drives is permissible.
- If the GROUND state is implemented for DLYD_START, bussing between drives is permissible.
- If the OPEN state is implemented for RMT_START, this signal shall not be bussed between drives.
- If the OPEN state is implemented for DLYD_START, this signal shall not be bussed between drives.

TABLE 6-6 DEFINITION OF MOTOR START CONTROLS

Case	DLYD_START	RMT_START	Motor Spin Function
1	OPEN	OPEN	Motor spins up at DC power on.
2	OPEN	GROUND	Motor spins up only when SCSI "Start" command is received.
3	GROUND	OPEN	Motor spins up at DC power on after a delay in seconds of 12 times* the value of the numeric SEL_ID of the drive.
4	GROUND	GROUND	Reserved. Drives not implementing this option shall execute power control according to the rules of Case 2.

* This value may be reduced by drive suppliers to reflect the worst case time duration of peak current drains at the 12V or 5V source (or both) during motor spin up. In no case should the delay exceed 12 seconds.

The OPEN and GROUND states are established as described in Table 6-7.

TABLE 6-7 ELECTRONIC REQUIREMENTS FOR INPUT CONTROLS

State	Current	Voltage
OPEN	0 < IIH < 100 uA	2.4 < VIH < VCC+0.5
GROUND	0 < IOH < -3 mA	-0.5V < VIL < 0.4V

6.4.6 SCSI ID Selection

The SCSI device address of the attached drive is determined by the state of the signals SCSI ID(0-3). Table 6-8 indicates the relationship between the level of the SCSI ID signals and the selected SCSI device address.

TABLE 6-8 SCSI DEVICE ID SELECTION SIGNALS

Address	ID (0)	ID (1)	ID (2)	ID (3)
0	OPEN	OPEN	OPEN	OPEN
1	GROUND	OPEN	OPEN	OPEN
2	OPEN	GROUND	OPEN	OPEN
3	GROUND	GROUND	OPEN	OPEN
4	OPEN	OPEN	GROUND	OPEN
5	GROUND	OPEN	GROUND	OPEN
6	OPEN	GROUND	GROUND	OPEN
7	GROUND	GROUND	GROUND	OPEN
8*	OPEN	OPEN	OPEN	GROUND
9*	GROUND	OPEN	OPEN	GROUND
10*	OPEN	GROUND	OPEN	GROUND
11*	GROUND	GROUND	OPEN	GROUND
12*	OPEN	OPEN	GROUND	GROUND
13*	GROUND	OPEN	GROUND	GROUND
14*	OPEN	GROUND	GROUND	GROUND
15*	GROUND	GROUND	GROUND	GROUND

* Addresses in the range of 8 to 15 are only supported by drives implementing the 16-bit SCSI option.

The OPEN and GROUND states are established as specified in Table 6-7.

6.4.7 SCSI Signals

The SCSI signals define an interface in which the voltage and current levels supplied to and expected from the drives are as defined in the SCSI-2 standard for 8-bit operation and in SPI for 16-bit operation.

6.4.8 Reserved Signals

No unallocated reserved signals are defined.

6.4.9 MATED Signals

The MATED 1 and MATED 2 signals are used to indicate to the disk drive that the drive is seated in an SCA-2 connector and can begin its power on processing. The circuit described in Figure 6-1 or a similar circuit is used to implement the MATED function. The signal requirements are indicated below, but may be met by the example circuit or by similar circuits.

6.4.9.1 MATED 2/Drive Side

The signal is attached to signal ground on the drive side.

6.4.9.2 MATED 2/Backplane Side

The signal is attached either directly or through optional logic in such a manner that the MATED 1 signal is held to a ground level when the MATED 2 connection is completed. If optional logic is used the backplane shall require the drive to sink no more than 100 mA to Ground through the MATED 2

pin.

6.4.9.3 MATED 1/Drive Side

The signal is sensed by the disk drive. When the MATED 1 connection is determined to be at a ground level, the disk drive can assume that the drive has been completely mated. Normal power up procedures, including sensing of the SCSI ID Selection signals and the motor start controls, can begin 250 msec after the MATED 1 signal is observed to transition to the ground level. When the MATED 1 connection is determined to be at the open level, the drive is not mated. The MATED 1 signal shall be tied up to a TTL positive level when the drive is not installed.

If the drive is mated and operating, it may optionally detect the open level of MATED 1 as an indication that the drive is about to be removed.

If the drive supports detection of the open level of MATED 1 to prepare itself for power removal or for physical removal from the enclosure, the detection shall occur within 1 second from the time that the Mated 1 open level is presented to the drive.

The following drive behaviors are defined.

a) The drive may optionally perform a spin-down operation. This option is controlled by a MODE SELECT operation.
b) The drive may optionally transfer any cached information to the media. This option is controlled by a MODE SELECT operation.

6.4.9.4 MATED 1/Backplane Side

The signal is held to a ground level when the MATED 2 connection is completed. The MATED 1 signal is held to the open level when the MATED 2 connection is not completed. The ground and open levels are defined by Table 6-8.

The enclosure can optionally control the MATED 1 signal to indicate that the drive is about to be removed.

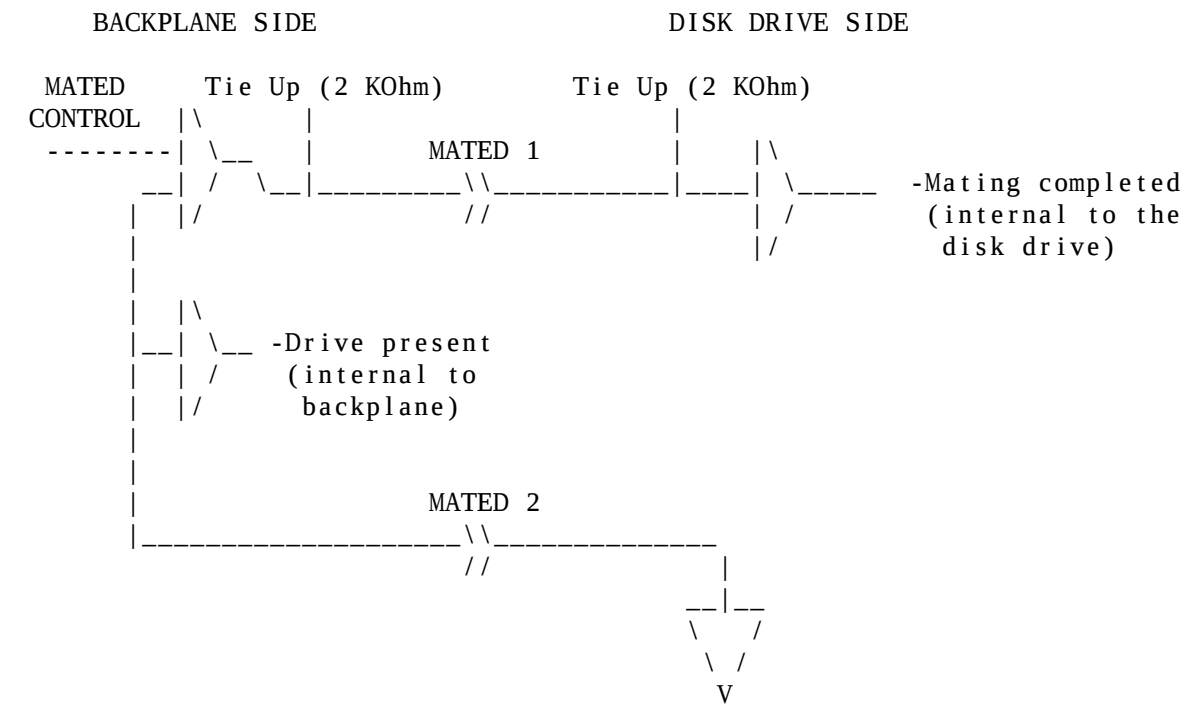


FIGURE 6-1 SAMPLE CIRCUIT FOR MATED INDICATIONS

6.5 SCSI Options

The device shall use the appropriate mandatory commands of the SCSI-2 command set. The support of optional SCSI-2 commands is negotiated between the drive vendor and customer.

The device shall have SCSI parity always enabled.

If the drive does not support 16-bit SCSI data transfers, then the signals DB(8) through DB(15) and DB(P1) shall not be electronically connected to the drive circuitry.

Drives supporting 16-bit SCSI data transfers shall have a high impedance pull-up on the signals DB(8) through DB(15) and DB(P1) to prevent false arbitration or selection by the drives when driven by 8-bit host adapters.

The motherboard may optionally connect or not connect the high order SCSI signals to its internal SCSI host adapter. If the signals are supported by the motherboard, the signals shall follow the SCSI rules specified by the relevant standard for routing, characteristic impedance, and termination whether or not the attached drives connect to the signals.

7. Connector Configuration

7.1 Connector Characteristics

The drive and backplane connectors are multiple sourced components.

Drive right angle plug	AMP 917593-9 (or equivalent)
Drive vertical plug	AMP 787319-1 (or equivalent)
Drive straddle mount plug	AMP 787312-1 (or equivalent)
Ribbon cable receptacle	to be defined
Mating vertical receptacle	AMP 787311-1 (or equivalent)
Mating right angle receptacle	to be defined

The connector technology meets the requirements specified in SFF-8015 plus the following:

- Guide pins
- Initial Ground connection made with the guide pins
- Variable length pins in the receptacle

The connector technology is fully forward and backwards compatible with the SFF-8015 connectors. Some disk drives or back panels may have installed components that interfere with the guide pins. Compatibility with such drives or backpanels may be limited.

7.2 Connector Properties

The 'ribbon' or 'leaf' contact connector on 0.050" centers meets the requirements listed in Table 7-1.

TABLE 7-1 PROPERTIES OF CONNECTOR

Pin count	80
Contact resistance	35 milli Ohm maximum
Contact current rating	1.5 A per isolated contact
CHARGE current rating	6 Amp per contact during insertion, not to exceed 1 msec duration.
Durability	500 mating cycles minimum
Insertion force	90 grams/contact, maximum
Withdraw force	15 grams/contact, minimum
Insulation resistance	1000 Meg Ohm minimum at 250V DC; 500V DC desired
Dielectric withstanding voltage	500V AC (rms), one minute
Contact plating	Appropriate to application requirements
Housing material	Appropriate to application requirements
Board retention features	Provided by backplane and associated hardware

7.3 Drive Environment

The connector shall not be required to support the weight of the drive,

although some vibration modes may place forces on the connector. Drives shall be installed with appropriate brackets that locate the drive and lock it in place.

8. Connector Specifications

8.1 Plug

This connector on the drive may be used to mate to a specially constructed cable or a hard-mounted receptacle. The dimensions defined in Table 8-1 are for the mating interface shown in Figure 8-1. References offset to the left in the dimensions column are variables, and those to the right are tolerances.

TABLE 8-1 CONNECTOR PLUG ON DRIVE

P1 P2 P3 P4	Pin 1 Pin 41	Pin 40 Pin 80		P1 P2 P3 P4	Pin 1 Pin 41	Pin 40 Pin 80
Dimension	Millimeter	Inches		Dimension	Millimeter	Inches
A 1	51.17	2.015		A20	6.50 #	0.256 #
A 2	1.60	0.063		A21	0.10	0.004
A 3	0.10	0.004		A22	0.08	0.003
A 4	1.80 R	0.071 R		A23	66.40	2.614
A 5	15 degrees	15 degrees		A24	63.30	2.492
A 6	57.87	2.278		A25	2.42	0.095
A 7	28.935	1.139		A26	4.00	0.157
A 8	55.27	2.176		A27	66.50	2.618
A 9	27.635	1.088		A28	1.85	0.073
A10	0.20	0.008		A29	0.90	0.035
A11	1.00 R	0.039 R		A30	5.00	0.197
A12	7.00	0.276		A31	0.28	0.011
A13	5.325	0.210	/2\	A32	0.24	0.009
A14	3.50	0.138		A33	0.25	0.010
A15	2.663	0.105		A34	1.35	0.053
A16	1.27	0.050		A35	0.05	0.002
A17	24.765	0.975		A36	0.80	0.031
A18	2.00	0.079		A37	0.15	0.006
A19	0.60 #	0.024 #		A38	0.13	0.005

* = maximum # = minimum

/1\ A20 internal clearance for mating connector

/2\ Measured at A20 dimension

/3\ Distance measured across contact mating surfaces along effective mating area

/4\ Contact must be above plastic along effective mating area

/5\ 0.75mm min plastic lead-in prior to initial point of contact (signal) A2 +/-A22 thickness (dimension applies as measured across contacts) required for pre-deflection of receptacle contacts.

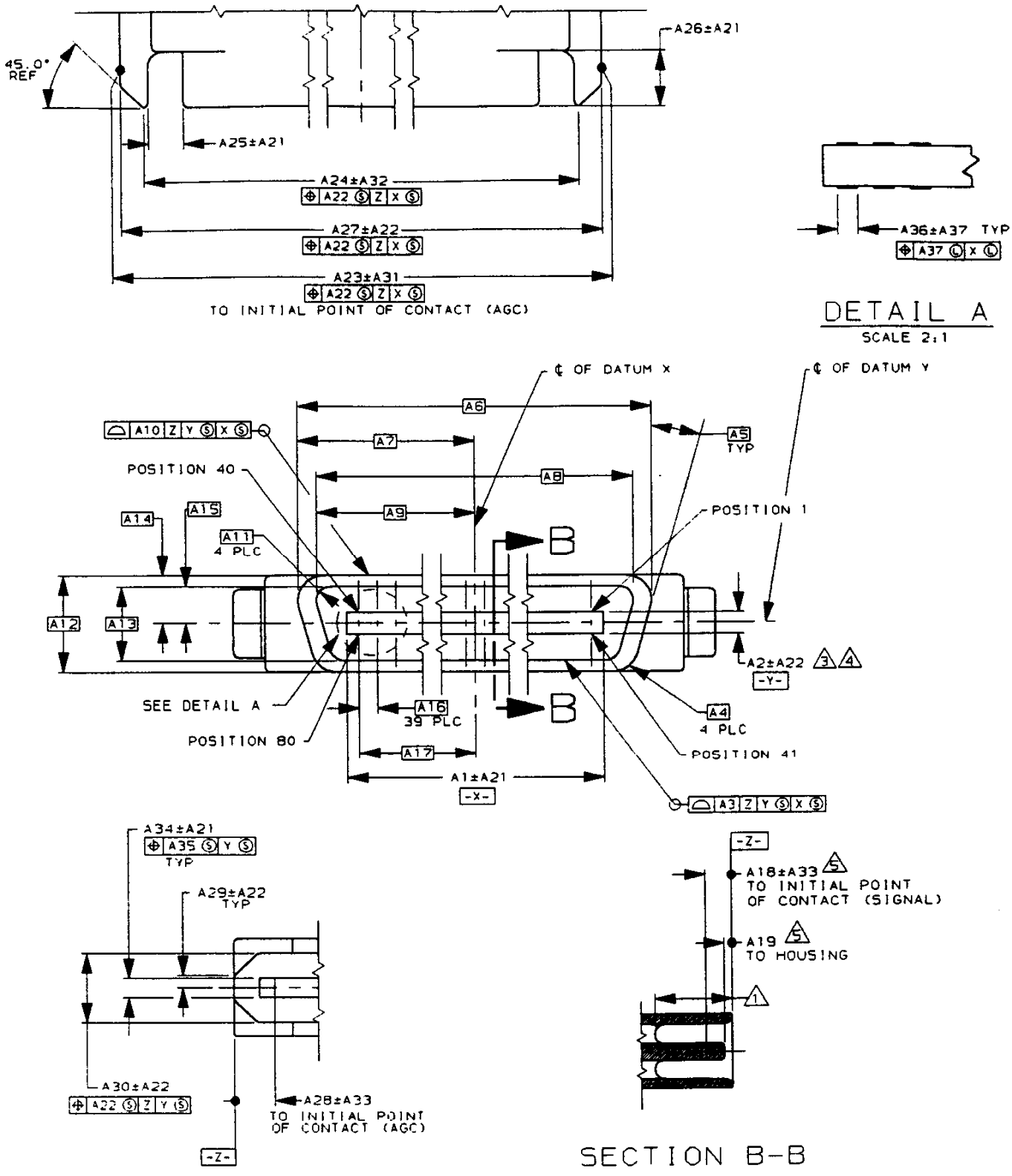


FIGURE 8-1 CONNECTOR PLUG

8.2 Receptacle

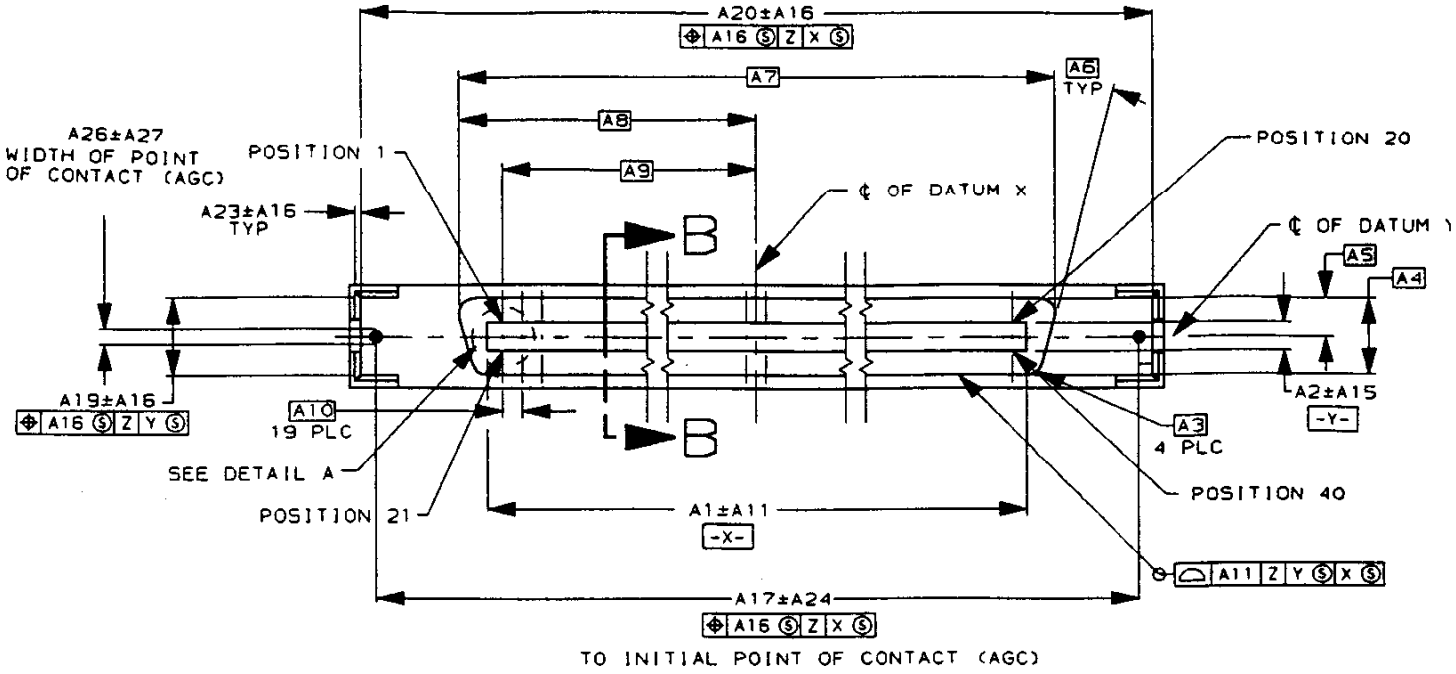
The dimensions defined in Table 8-2 are for the mating interface shown in Figure 8-2. References offset to the left in the dimensions column are variables, and those to the right are tolerances.

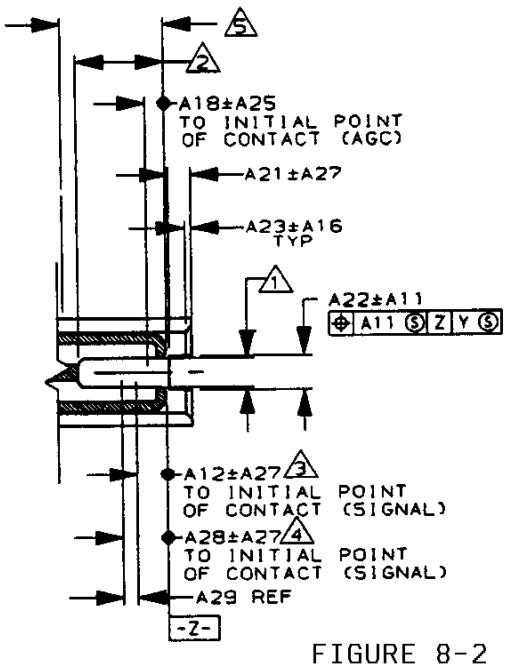
TABLE 8-2 CONNECTOR RECEPTACLE

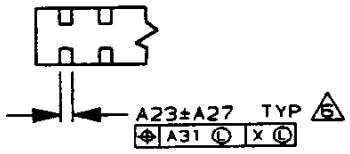
P1 P2 P3 P4	Pin 1 Pin 41	Pin 40 Pin 80		P1 P2 P3 P4	Pin 1 Pin 41	Pin 40 Pin 80	
Dimension	Millimeter	Inches		Dimension	Millimeter	Inches	
A 1	51.43	2.025		A16	0.08	0.003	
A 2	1.90	0.075		A17	65.60	2.583	
A 3	1.00 R	0.039 R		A18	0.98	0.039	
A 4	5.05	0.199		A19	5.30	0.209	
A 5	2.525	0.0995		A20	66.80	2.630	
A 6	15 degrees	15 degrees		A21	1.45	0.057	
A 7	55.07	2.168		A22	2.20	0.087	
A 8	27.54	1.084		A23	0.40	0.016	/6\
A 9	24.765	0.975		A24	0.28	0.011	
A10	1.27	0.050		A25	0.15	0.006	
A11	0.10	0.004		A26	0.95	0.037	
A12	1.98	0.078	/3\	A27	0.15	0.006	
A13	1.60	0.063		A28	2.48	0.098	/4\
A14	5.70	0.224		A29	0.35 #	0.014 #	
A15	0.05	0.002		A30	6.50 #	0.256 #	/5\
				A31	0.30	0.012	

* = maximum # = minimum

/1\ Contact gap will accommodate mating connector of A13+/-A16
/2\ A14+/-A11 internal clearance for mating connector
/3\ Sequenced (first mate) contact
/4\ Sequenced (second mate) contact
/5\ A30 External clearance for mating connector
/6\ Effective contact width







DETAIL A

SCALE 2.1

FIGURE 8-2 CONNECTOR RECEPTACLE