This specification was developed by the SFF Committee prior to it becoming the SFF TA (Technology Affiliate) TWG (Technical Working Group) of SNIA (Storage Networking Industry Association).

The information below should be used instead of the equivalent herein.

POINTS OF CONTACT:

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If you are interested in participating in the activities of the SFF TWG, the membership application can be found at:
http://www.snia.org/sff/join

The complete list of SFF Specifications which have been completed or are currently being worked on can be found at:
http://www.snia.org/sff/specifications/SFF-8000.TXT

The operations which complement the SNIA's TWG Policies & Procedures to guide the SFF TWG can be found at:
http://www.snia.org/sff/specifications/SFF-8032.PDF

Suggestions for improvement of this specification will be welcome, they should be submitted to:
http://www.snia.org/feedback

READ EDITOR'S NOTES IN FRONT OF TABLE OF CONTENTS

SFF Committee

SFF-8452 Specification for

Glitch Free Mating Connections for Multidrop Aps

Rev 3.1 June 19, 2001

Secretariat: SFF Committee

Abstract: This document defines the physical interface and performance requirements for glitch free mating connections used in multidrop applications such as parallel SCSI and PCI. A specific example is given for required modifications to SCA-2 (Single Connector Attach -2) free gender (plug) connectors to achieve glitch free mating and unmating. Other uses of this general-purpose connection system are also possible.

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.

The description of a connector in this document does not assure that the specific component is actually available from connector suppliers. If such a connector is supplied it must comply with this specification to achieve interoperability between suppliers.

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).

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EXPRESSION OF SUPPORT BY MANUFACTURERS

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

Intel
Toshiba America
Unisys

The following SFF member companies voted no on the technical content of this industry specification.

Compaq
FCI/Berg
IBM
Maxtor
Molex
Seagate

The following member companies of the SFF Committee voted to abstain on this industry specification.

Circuit Assembly
DDK Fujikura
ENDL
Tyco AMP

The user's attention is called to the possibility that implementation to this Specification may require use of an invention covered by patent rights. By distribution of this Specification, no position is taken with respect to the validity of this claim or of any patent rights in connection therewith. The patent holder has filed a statement of willingness to grant a license under these rights on reasonable and non-discriminatory terms and conditions to applicants desiring to obtain such a license.

If you are not a member of the SFF Committee, but you are interested in participating, the following principles have been reprinted here for your information.

PRINCIPLES OF THE SFF COMMITTEE

The SFF Committee is an ad hoc group formed to address storage industry needs in a prompt manner. When formed in 1990, the original goals were limited to defining de facto mechanical envelopes within which disk drives can be developed to fit compact computer and other small products.

Adopting a common industry size simplifies the integration of small drives (2 1/2" or less) into such systems. Board-board connectors carrying power and signals, and their position relative to the envelope are critical parameters in a product that has no cables to provide packaging leeway for the integrator.

In November 1992, the SFF Committee objectives were broadened to encompass other areas which needed similar attention, such as pinouts for interface applications, and form factor issues on larger disk drives. SFF is a forum for resolving industry issues that are either not addressed by the standards process or need an immediate solution.

Documents created by the SFF Committee are expected to be submitted to bodies such as EIA (Electronic Industries Association) or an ASC (Accredited Standards Committee). They may be accepted for separate standards, or incorporated into other standards activities.

The principles of operation for the SFF Committee are not unlike those of an accredited standards committee. There are 3 levels of participation:

- Attending the meetings is open to all, but taking part in discussions is limited to member companies, or those invited by member companies
- The minutes and copies of material which are discussed during meetings are distributed only to those who sign up to receive documentation.
- The individuals who represent member companies of the SFF Committee receive documentation and vote on issues that arise. Votes are not taken during meetings, only guidance on directions. All voting is by letter ballot, which ensures all members an equal opportunity to be heard.

Material presented at SFF Committee meetings becomes public domain. There are no restrictions on the open mailing of material presented at committee meetings. In order to reduce disagreements and misunderstandings, copies must be provided for all agenda items that are discussed. Copies of the material presented, or revisions if completed in time, are included in the documentation mailings.

The sites for SFF Committee meetings rotate based on which member companies volunteer to host the meetings. Meetings have typically been held during the ASC T10 weeks.

The funds received from the annual membership fees are placed in escrow, and are used to reimburse ENDL for the services to manage the SFF Committee.

If you are not receiving the documentation of SFF Committee activities or are interested in becoming a member, the following signup information is reprinted here for your information.

Annual SFF Committee Membership Fee	$ 1,800.00
Annual SFF Committee Paper Documentation Fee	$ 300.00
Annual Surcharge for AIR MAIL to Overseas	$ 100.00
Annual Surcharge for Electronic Documentation	$ 360.00

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Please register me as a Member of the SFF Committee for one year.

Paper documentation	$ 1,800
Electronic documentation	$ 2,160

Check Payable to SFF Committee for $_______ is Enclosed

Please invoice me $_______ on PO #: ___________________

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Please register me as an Observer on the SFF Committee for one year.

Paper documentation	$ 300 U.S.	$ 400 Overseas
Electronic documentation	$ 660 U.S.	$ 760 Overseas

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Foreword

When 2 1/2" diameter disk drives were introduced, there was no commonality on external dimensions e.g. physical size, mounting locations, connector type, connector location, between vendors.

The first use of these disk drives was in specific applications such as laptop portable computers in which space was at a premium and time to market with the latest machine was an important factor. System integrators worked individually with vendors to develop the packaging. The result was wide diversity, and with space being such a major consideration in packaging, it was not possible to replace one vendor's drive with a competitive product.

The desire to reduce disk drive sizes to even smaller dimensions such as 1.8" and 1.3" made it likely that devices would become even more constrained in dimensions because of a possibility that such small devices could be inserted into a socket, not unlike the method of retaining semiconductor devices.

The problems faced by integrators, device suppliers, and component suppliers led to the formation of an industry ad hoc group to address the marketing and engineering considerations of the emerging new technology in disk drives. After two informal gatherings on the subject in the summer of 1990, the SFF Committee held its first meeting in August.

During the development of the form factor definitions, other activities were suggested because participants in the SFF Committee faced problems other than the physical form factors of disk drives. In November 1992, the members approved an expansion in charter to address any issues of general interest and concern to the storage industry. The SFF Committee became a forum for resolving industry issues that are either not addressed by the standards process or need an immediate solution.

At the same time, the principle was adopted of restricting the scope of an SFF project to a narrow area, so that the majority of documents would be small and the projects could be completed in a rapid timeframe. If proposals are made by a number of contributors, the participating members select the best concepts and uses them to develop specifications which address specific issues in emerging storage markets.

Those companies which have agreed to support a documented specification are identified in the first pages of each SFF Specification. Industry consensus is not an essential requirement to publish an SFF Specification because it is recognized that in an emerging product area, there is room for more than one approach. By making the documentation on competing proposals available, an integrator can examine the alternatives available and select the product that is felt to be most suitable.

Suggestions for improvement of this document will be welcome. They should be sent to the SFF Committee, 14426 Black Walnut Ct, Saratoga, CA 95070.

The development work on this specification was done by the SFF Committee, an industry group. The membership of the committee since its formation in 1990 has included a mix of companies which are leaders across the industry.

SFF Committee --

Glitch Free Mating Connections for Multidrop Aps

1. Scope

This specification defines the terminology and physical requirements for achieving glitch free mating in multidrop applications. Multidrop applications are those where multiple devices are attached to a main path such as SCSI, PCI and 10 BASE-2 Ethernet. When multidrop devices are added or removed from the main path, noise (glitches) may be generated that may affect other devices already connected and operating. The requirements specified in this document eliminate this noise.

A general requirement for devices used in multidrop applications is that devices that are not actively driving the bus need to be high impedance at the point of attachment to the main path. The high impedance requirement applies to devices added or removed since these devices cannot be actively driving the bus during the insertion or removal. A high impedance connection has the important property that it cannot extract current from the active path other than that required to initially charge the device capacitances and to sustain the low level leakage currents. The glitch produced on the bus is severely affected by the transient current drawn during the capacitance charging period. The requirements specified in this document limit the amount of transient current and reduce the noise produced to negligible levels as long the current limit is not exceeded.

The purposeful limiting of current levels also eliminates EMI and radiation caused by the insertion and removal process by eliminating the high frequency content associated with rapid arc-like discharges that are possible between good conductors.

A detailed example of the modifications and performance requirements that apply to the SCA-2 free connector for glitch free mutidrop applications are contained in this document. No changes are required on the fixed gender SCA-2 connector to attain glitch free performance.

THE DESCRIPTION OF THESE REQUIREMENTS IN THIS DOCUMENT DOES NOT IMPLY THAT MODIFIED SCA-2 FREE GENDER CONNECTORS THAT MEET THESE REQUIREMENTS ARE AVAILABLE IN THE MARKET. THEY ALSO DO NOT IMPLY THAT A LICENSE FEE OR PROPRIETARY PROCESSES ARE NEEDED TO MANUFACTURE A GLITCH FREE SCA-2 CONNECTOR.

The modified SCA-2 free connector is identical to the SCA-2 free connector defined in SFF-8451 except that a special, non-metallic region is added to a part of the mating interface that is required to be insulating in SFF-8451. This special region limits the current flow that charges or discharges the capacitance on either side of the mating interface during mating prior to allowing the metal to metal contact that is used in service. Such connections are especially desirable in SCSI and PCI applications where devices need to dynamically blindmate with backplanes.

This special material is required for all signal contacts and may be present on all contacts. For contacts that carry sustained current such as power and ground the presence of the special material is benign since it cannot pass significant current.

The SPI-2 (SCSI-3 Parallel Interface 2) and follow on standards call out EIA-PN-3651 and defines the position numbering for SCSI for the 80-pin version as an unshielded device and cable connector.

The glitch free multidrop mating requirements break down into four key features:

(1) the connector must consist of a single housing on both sides of the mating interface to manage the positional mounting tolerances,
(2) there must be a means to mechanically "guide" (without aid of visual feedback) the mating interfaces into a position where the electrical contact can mate without damage,
(3) the contact pins must have a specific sequence of mating and demating, and
(4) there must be a means to equalize the voltage on both sides of the mating contacts prior to allowing metal to metal contacts

Modified SCA-2 free connectors are compatible with SCA-1 and SCA-2 fixed connectors in the sense they will physically intermate. SCA-1 connectors do not have the latter two features listed above and are therefore not suitable for blind mating and hot plugging. Unmodified SCA-2 free connectors do not have the fourth property and therefore are not suitable for glitch free hot plugging.

This document incorporates by reference all the requirements specified in SFF-8451 on the termination and mating sides of the modified SCA-2 free connector for all the versions listed in SFF-8451.

Other, non SCA-2 connector designs that incorporate the essential current limiting features defined in this document should also have glitch free mating performance.

The SFF Committee was formed in August, 1990 to broaden the applications for storage devices, and is an ad hoc industry group of companies representing system integrators, peripheral suppliers, and component suppliers.

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 Table of Contents.
Clause 4 contains the Table of Figures.
Clause 5 contains the Table of Tables.
Clause 6 contains the General Description.
Clause 7 contains the Definitions and Conventions.
Clause 8 defines the Modified SCA-2 connector example descriptions.

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-1994 SCSI-2 Small Computer System Interface
- X3.253-1995 SPI (SCSI-3 Parallel Interface)
- X3.302-xxxx SPI-2 (SCSI-3 Parallel Interface -2)
- X3.277-1996 SCSI-3 Fast 20
- X3.221-1995 ATA (AT Attachment) and subsequent extensions

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.
e = electronic	Used as a suffix to indicate an SFF Specification which has Expired but is still available in electronic form from SFF e.g. a specification has been incorporated into a draft or published standard which is only available in hard copy.
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 June 19, 2001
SFF-8000		SFF Committee Information
INF-8001i	E	44-pin ATA (AT Attachment) Pinouts for SFF Drives
INF-8002i	E	68-pin ATA (AT Attachment) for SFF Drives
SFF-8003	E	SCSI Pinouts for SFF Drives
SFF-8004	E	Small Form Factor 2.5" Drives
SFF-8005	E	Small Form Factor 1.8" Drives
SFF-8006	E	Small Form Factor 1.3" Drives
SFF-8007	E	2mm Connector Alternatives
SFF-8008	E	68-pin Embedded Interface for SFF Drives
SFF-8009	4.1	Unitized Connector for Cabled Drives
SFF-8010	E	Small Form Factor 15mm 1.8" Drives
INF-8011i	E	ATA Timing Extensions for Local Bus
SFF-8012	3.0	4-Pin Power Connector Dimensions
SFF-8013	E	ATA Download Microcode Command
SFF-8014	C	Unitized Connector for Rack Mounted Drives
SFF-8015	E	SCA Connector for Rack Mounted SFF SCSI Drives
SFF-8016	C	Small Form Factor 10mm 2.5" Drives
SFF-8017	E	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
INF-8020i	E	ATA Packet Interface for CD-ROMs
INF-8028i	E	- Errata to SFF-8020 Rev 2.5
SFF-8029	E	- Errata to SFF-8020 Rev 1.2
SFF-8030	1.8	SFF Committee Charter
SFF-8031		Named Representatives of SFF Committee Members
SFF-8032	1.4	SFF Committee Principles of Operation
INF-8033i	E	Improved ATA Timing Extensions to 16.6 MBs
INF-8034i	E	High Speed Local Bus ATA Line Termination Issues
INF-8035i	E	Self-Monitoring, Analysis and Reporting Technolog
INF-8036i	E	ATA Signal Integrity Issues
INF-8037i	E	Intel Small PCI SIG
INF-8038i	E	Intel Bus Master IDE ATA Specification
INF-8039i	E	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	E	40-pin MicroSCSI Pinout
SFF-8045	4.3	40-pin SCA-2 Connector w/Parallel Selection
SFF-8046	E	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	E	80-conductor ATA Cable Assembly
INF-8050i	1.0	Bootable CD-ROM
INF-8051i	E	Small Form Factor 3" Drives
INF-8052i	E	ATA Interface for 3" Removable Devices
SFF-8053	5.5	GBIC (Gigabit Interface Converter)
INF-8055i	E	SMART Application Guide for ATA Interface
SFF-8056	C	50-pin 2mm Connector
SFF-8057	E	Unitized ATA 2-plus Connector
SFF-8058	E	Unitized ATA 3-in-1 Connector
SFF-8059	E	40-pin ATA Connector
SFF-8060	1.1	SFF Committee Patent Policy
SFF-8061	1.1	Emailing drawings over the SFF Reflector
SFF-8062		Rolling Calendar of SSWGs and Plenaries
SFF-8065	C	40-pin SCA-2 Connector w/High Voltage
SFF-8066	C	80-pin SCA-2 Connector w/High Voltage
SFF-8067	2.8	40-pin SCA-2 Connector w/Bidirectional ESI
INF-8068i	1.0	Guidelines to Import Drawings into SFF Specs
SFF-8069	E	Fax-Access Instructions
INF-8070i	1.2	ATAPI for Rewritable Removable Media
SFF-8072	1.2	80-pin SCA-2 for Fibre Channel Tape Applications
SFF-8073	-	20-pin SCA-2 for GBIC Applications
INF-8074i	1.0	SFP (Small Formfactor Pluggable) Transceiver
SFF-8080	E	ATAPI for CD-Recordable Media
INF-8090i	5.3	ATAPI for DVD (Digital Video Data)
SFF-8101		3 Gbs and 4 Gbs Signal Characteristics
SFF-8110	C	5V Parallel 1.8" drive form factor

SFF-8111	1.1	1.8" drive form factor (60x70mm)
SFF-8120	1.1	1.8" drive form factor (78x54mm)
SFF-8200e	1.1	2 1/2" drive form factors (all of 82xx family)
SFF-8201e	1.3	2 1/2" drive form factor dimensions
SFF-8212e	1.2	2 1/2" drive w/SFF-8001 44-pin ATA Connector
SFF-8300e	1.1	3 1/2" drive form factors (all of 83xx family)
SFF-8301e	1.2	3 1/2" drive form factor dimensions
SFF-8302e	1.1	3 1/2" Cabled Connector locations
SFF-8332e	1.2	3 1/2" drive w/80-pin SFF-8015 SCA Connector
SFF-8337e	1.2	3 1/2" drive w/SCA-2 Connector
SFF-8342e	1.3	3 1/2" drive w/Serial Unitized Connector
INF-8350i	6.1	3 1/2" Packaged Drives
SFF-8400	C	VHDCI (Very High Density Cable Interconnect)
SFF-8410	16.1	High Speed Serial Testing for Copper Links
SFF-8411		High Speed Serial Testing for Backplanes
SFF-8412	3.1	HSS Requirements for Duplex Optical Links
SFF-8415	1.1	HPEI (High Performance Electrical Interconnect)
SFF-8416		HSS Bulk Cable Performance Requirements
SFF-8420	11.1	HSSDC-1 Shielded Connections
SFF-8421	1.1	HSSDC-2 Shielded Connections
SFF-8422	C	FCI Shielded Connections
SFF-8423	C	Molex Shielded Connections
SFF-8430	4.1	MT-RJ Duplex Optical Connections
SFF-8441	14.1	VHDCI Shielded Configurations
SFF-8451	10.1	SCA-2 Unshielded Connections
SFF-8452	3.1	Glitch Free Mating Connections for Multidrop Aps
SFF-8460	1.1	HSS Backplane Design Guidelines
SFF-8470		Four Lane Copper Connector
SFF-8472		Diagnostic Monitoring Interface for Optical Xcvrs
SFF-8480	2.1	HSS (High Speed Serial) DB9 Connections
SFF-8500e	1.1	5 1/4" drive form factors (all of 85xx family)
SFF-8501e	1.1	5 1/4" drive form factor dimensions
SFF-8508e	1.1	5 1/4" ATAPI CD-ROM w/audio connectors
SFF-8551	3.2	5 1/4" CD Drives form factor
SFF-8572	-	5 1/4" Tape form factor
SFF-8610	C	SDX (Storage Device Architecture)

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 joining the SFF Committee as an Observer or Member or by download at ftp://ftp.seagate.com/sff

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Editor’s notes:

This version contains all the changes recommended by the May 2001 SSWG and is complete to the best of the editor’s knowledge.

This document is ready for a technical content vote and may also be considered for a publication vote.

Note that extensive non-linear conversions have been executed on the original electronic files used for the figures and that any dimensions extracted from features of the figures that are not specifically dimensioned or toleranced are not representative of actual dimensions in any products.

3. TABLE OF CONTENTS

4. FIGURES

5. TABLES

6. General Description

6.1 Transient behavior of multidrop connections

The presently standardized connection systems available for use with multidrop applications require that the system integrator or designer choose between alternatives that produce noise glitches on the operating signal lines when a device is added or removed. These glitches are the result of extracting the charge from the operating signal line to charge the capacitance of the circuitry on the signal line for the incoming device. The magnitude of this disturbance on the operating signal line is maximized when direct metal to metal contact is allowed while the potential on either side of the contact is different. A direct metal to metal contact provides low resistance to current flow and very rapid charge transfer can result. The rapid charge transfer maximizes the intensity of the glitch on the operating signal line.

Studies have shown that these glitches can be several hundred millivolts lasting for a few nanoseconds when direct metal to metal initial contact is allowed. The modified SCA-2 free connector incorporates a resistive region that allow gradual equalization of the potential on both sides of the mating signal contacts prior to allowing the direct metal to metal contact. The charge transfer required to equalize the potential is spread over a much longer time and produces a much lower intensity glitch on the operating signal line.

Figure 1 shows how increasing the time used for completing the charging transient affects the glitch magnitude. The most disruptive case shown in the leftmost part of Figure 1 occurs when there is straight metal to metal contact and the charging transient only occupies a few nanoseconds. In the center and right parts of Figure 1 something in the contact interface (resistive material) is causing the transient to spread out over time. As the transient spreads out over time the noise induced on the multidrop path reduces to the point of effective non-existence.

The basic goal of glitch free mating for multidrop applications is to guarantee by design that the gradual transient occurs by purposefully adding a resistive region to part of the connector contact.

Notice that for the SCSI application shown in Figure 1 that the glitch disappears when the transient is spread out over a few hundred nanoseconds. For real connectors mating at a velocity of 1 meter/second (very fast) the distance covered in a few hundred nanoseconds is a few hundred nanometers (less than the wavelength of visible light). Therefore for real resistive regions that occupy at least several hundred micrometers the glitch magnitude is reduced by many orders of magnitude beyond that shown in the right side of Figure 1. For this reason, the specifications of the electrical performance requirements for the resistive region in this document are very conservative and apply to virtually any multidrop application.

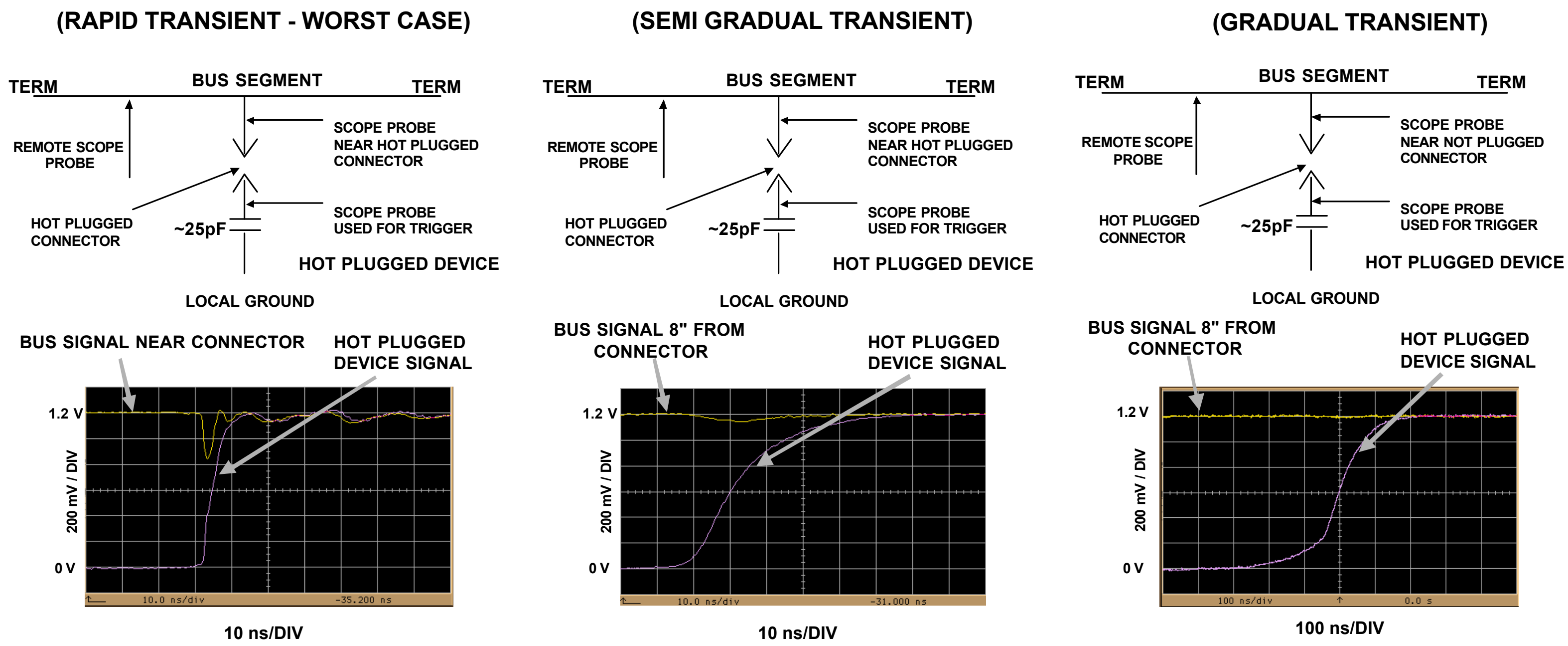


Figure 1 - Glitch effects with different charging times

6.2 Contact sequencing overview

Modified SCA-2 free connectors also find application where device removability is important. The advanced grounding contacts not only provide for establishing a reference potential and for electrostatic discharge but also provide a low resistance path for power supply return current during the mating process. This ensures that any power pin will provide its return current to the system ground and will not find sneak paths through diodes or other lower voltage power pins. If there were no advanced grounding contact system there would be only two nominal lengths of metallic contact provided in the SCA-2. This was required to maintain physical compatibility with the SCA-1 family. This means that power and ground contacts would be on the same length pin and it would not be possible to predict whether a power or ground contact would actually be the first to make upon insertion (or last to break upon removal).

The two lengths of signal/power/ground pins are designed to ensure that the longer pins will all make before any shorter pins make upon insertion. The converse is true upon removal. The advanced grounding contacts are also designed to ensure that no signal or power pin makes before the advanced grounding contacts.

Within the group of contacts with the same nominal length there is a distribution of actual lengths. This causes uncertainty for the sequencing relationship between different contacts of the same nominal length. Between the different groups of contact lengths there is a sufficiently wide separation of lengths to guarantee that no contact from one group will overlap into the next group.

Figure 2 shows this important feature in graphical form. The distance shown is the distance between the peaks of the contacts on the long and short contacts. The coplanar surface between the free contact metallic region, the resistive region on the free contact housing provides for precise vertical positioning of the fixed contact prior to mating with either the resistive or the metallic free contact. It is permissible for the resistive region to extend all the way to the end of the housing although this is not shown in Figure 2. This scheme eliminates a major source of variation in the contact sequencing distances due to variations in vertical position of the fixed contact prior to mating while maintaining the glitch free functionality.

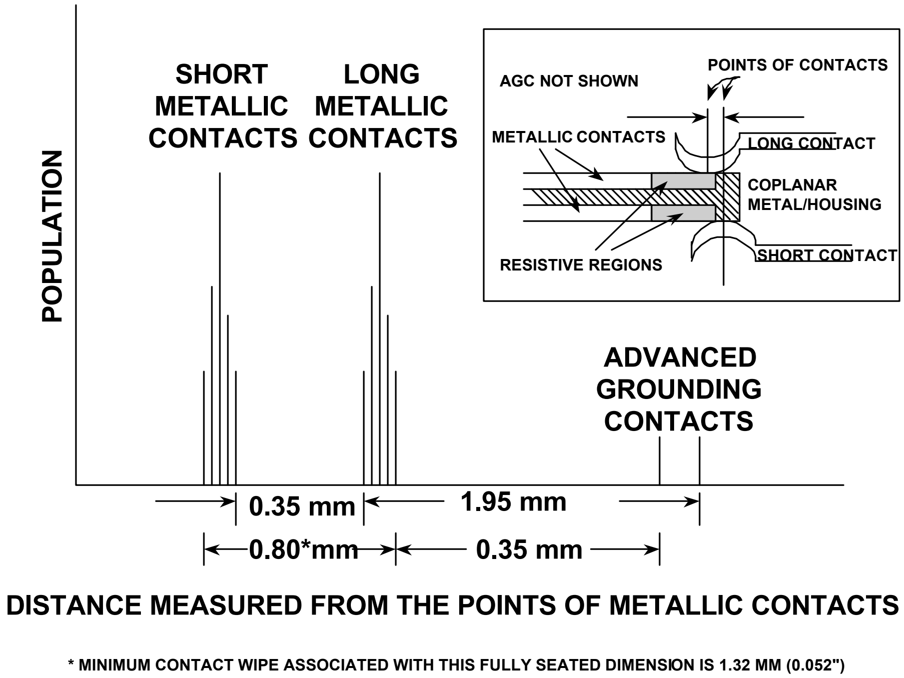


Figure 2 - Contact architecture

With the addition of the resistive region to the metallic contacts on the free connector it becomes possible that contact between a long contact and a resistive region could happen before the advanced grounding contacts mate. Even in this case the sequencing of the metallic regions is maintained as specified in SFF-8451. The resistive regions are required to limit the current levels to a few microamps and mitigate the risks associated with not maintaining strict sequencing of any conductive contact features.

In other words, the resistive regions are not capable of passing enough current to cause glitches, damage or radiation even if they allow mating between the fixed contact and the resistive region on the free contacts associated with the long contacts before the advanced grounding contacts mate.

In both the resistive (this document) and metallic (SFF-8451) contact cases one should not depend on the advanced grounding contacts to protect against high levels of electro static charge. Discharging electrostatic charge to system ground prior to engagement (or prior to coming in close proximity of engagement) of the advanced grounding contacts (by means not specified in this document) is recommended in all cases. The 0.35mm gap between long fixed contacts and the free contacts (which could exist just before the worst case advanced grounding contacts mate) is not enough to guarantee whether the electrostatic charge will jump the advanced grounding contact gap or the long contact gap. The advanced grounding contact / long metallic contact sequencing guarantees that no significant power supply return current can flow in a path other than directly to system ground for both the metallic and resistive contacts.

The resistive region is physically long compared to the worst case gaps and the resistive region acts as an insulator for ESD arcing purposes.

Summarizing: extending the resistive region on the free connector contacts causes no additional risk provided the device is discharged prior to coming in close proximity of any SCA-2 mating contacts. The unmodified SCA-2 mating interface also is exposed to ESD risk if the device is not discharged. The important contact sequencing features of the SCA-2 connector are not compromised by using the resistive regions.

7. Definitions and Conventions

7.1 Definitions

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

Advanced grounding contacts: Connector pins that make first and break last and are capable of carrying power ground return currents and performing electrostatic discharge. Other terms sometimes used to describe these features are: grounding pins, ESD contacts, grounding contacts, static drain, and pre-grounding contacts.

Alignment guides: Connector features that are used to direct the connectors during the mating process. Other terms sometimes used to describe these features are: guide pins, guide posts, blind mating features, mating features, alignment features, and mating guides

Board Termination Technologies: The lead configuration used for attachment of printed circuit board to the termination side of the connector. Schemes commonly used in the industry are: surface mount single row, surface mount dual row, through hole, hybrid, straddle mount

Cable Termination: The attachment of wires to the termination side of a connector. Schemes commonly used in the industry are IDC (Insulation Displacement Contact), IDT (Insulation Displacement Termination), wire slots, solder, weld, crimp, braise, etc.

Contact mating sequence: Order of electrical contact during mating/unmating process. Other terms sometimes used to describe this feature are: contact sequencing, contact positioning, make first/break last, EMLB (early make late break) staggered contacts, and long pin / short pin.

Fixed: Used to describe the gender of the mating side of the connector that accepts its mate upon mating. This gender is frequently, but not always, associated with the common terminology "receptacle". Other terms commonly used are "female" and "socket connector". The term "fixed" is adopted from EIA standard terminology as the gender that most commonly exists on the fixed end of a connection, for example, on the board or bulkhead side. In this document "fixed" is specifically used to describe the mating side gender illustrated in Figure 3.

Free: Used to describe the gender of the mating side of the connector that penetrates its mate upon mating. This gender is frequently, but not always, associated with the common terminology "plug". Other terms commonly used are "male" and "pin connector". The term "free" is adopted from EIA standard terminology as the gender that most commonly exists on the free end of a connection, for example, on the cable side. In this document "free" is specifically used to describe the mating side gender illustrated in Figure 3.

Frontshell: That metallic part of a connector body that directly contacts the backshell or other shielding material that provides mechanical and shielding continuity between the connector and the cable media. Other terms sometimes used to describe this part of a cable assembly are: housing, nosepiece, cowling, and metal shroud.

Free Board: A connector that uses a free gender mating side and a termination side suitable for any of the printed circuit board termination technologies

Fixed Board: : A connector that uses a fixed gender mating side and a termination side suitable for any of the printed circuit board termination technologies

Mating side: The side of the connector that joins and separates from the mating side of a connector of opposite gender. Other terms commonly used in the industry are mating interface, separable interface and mating face.

Offset: An alignment shift from the center line of the connector

Optional: This term describes features which are not required by the SFF Specification.

Right Angle: A connector design for use with printed circuit board assembly technology where the mating direction is parallel to the plane of the printed circuit board

Single row: A connector design for use with surface mount printed circuit board assembly technology where the termination side points are arranged in one line

Single sided termination: A cable termination assembly style and a connector design style where only one side of the connector is accessible when attaching wires. This style frequently has IDC termination points that point in the same direction.

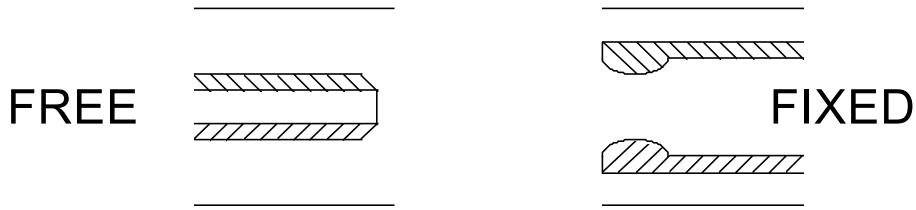
Straddle mount: A connector design style and a printed circuit board design style that uses surface mount termination points on both sides of the board. The connector is frequently centered between the top and bottom surfaces of the board.

Straight: A connector design for use with printed circuit board assembly technology where the mating direction is perpendicular to the plane of the printed circuit board

Surface mount: A connector design and a printed circuit board design style where the connector termination points do not penetrate the printed circuit board and are subsequently soldered to the printed circuit board

Termination side: The side of the connector opposite the mating side that is used for permanently attaching conductors to the connector. . Due to pin numbering differences between mating side genders the termination side shall always be specified in conjunction with a mating side of a specific gender. Other terms commonly used in the industry are: back end, non-mating side, footprint, pc board side, and post side

Through hole: A connector design and a printed circuit board design style where the connector termination points penetrates the printed circuit board and are subsequently soldered to the printed circuit board.



THE FREE GENDER IS USED ON THE DEVICE SIDE EXCEPT WHEN USED WITH WIRE TERMINATION

Figure 3 - Mating side gender definition for SCA-2 example

7.2 Conventions

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

If any feature defined by the SFF Specification is implemented, it shall be done in a way consistent with other requirements defined by the Specification. Describing a feature as optional in the text is done to assist the reader.

If there is a conflict between figures, text or tables, the table shall be accepted as being correct followed by the text and finally by the figure.

8. Modified SCA-2 connector example descriptions:

All material in this clause applies to unmodified SCA-2 connectors except where specifically called out as different.

8.1 General

The general view of the mating sides is shown in Figure 4.

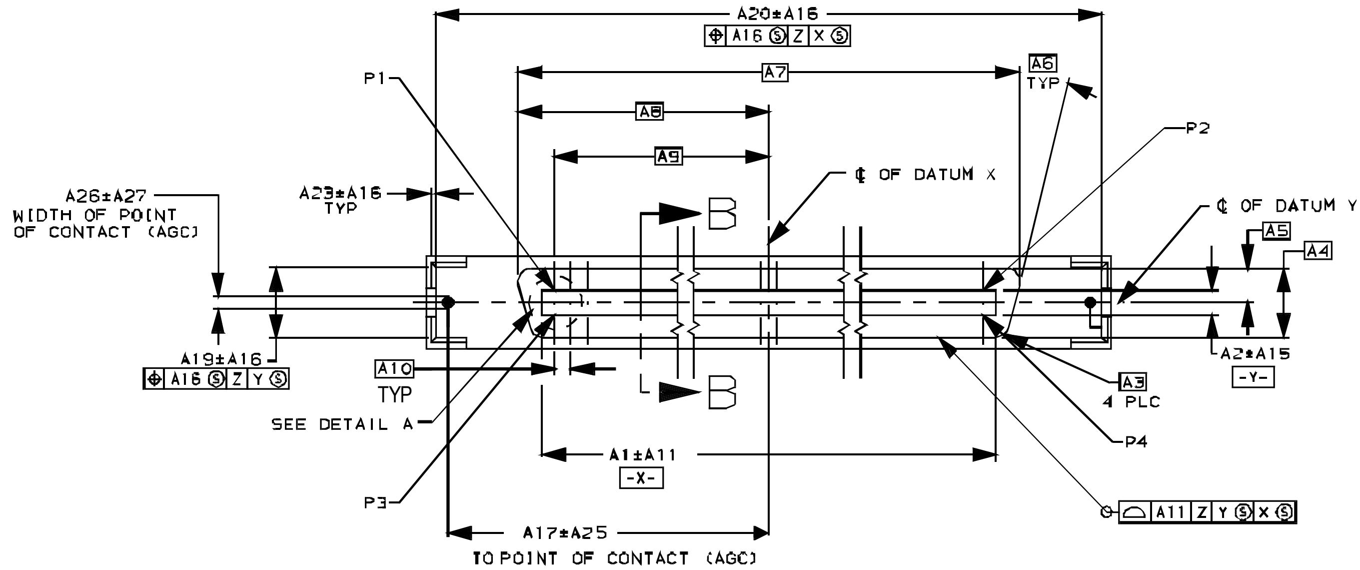
The dimensional requirements for mating interface displacements are shown in Figure 5. The contact length relationships are shown in Figure 6. The mating dimensions are shown in Figure 7.

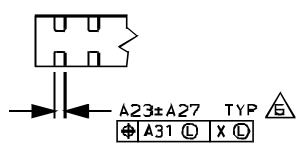
The process of mating an SCA-2 connector pair should be accomplished in a "free fit" manner where no excessive mechanical stresses are placed on the connectors during or after the mating process. The mating process should be considered in the context of the packaging surrounding the device with the SCA-2 connector. Stresses considered include those transmitted to the mated connector through the device: for example, the weight of the drive, that resulting from resilient device guide members in the enclosure, the device retention mechanism, acceleration stresses (mechanical shock testing) and interference with enclosure parts. Mechanical interference between the device with the mated SCA-2 connectors and fixed or solid parts of the packaging will generally not be tolerated by the SCA-2 system.

The mating interface specifications require a three stage process to arrive at the final mated contact:

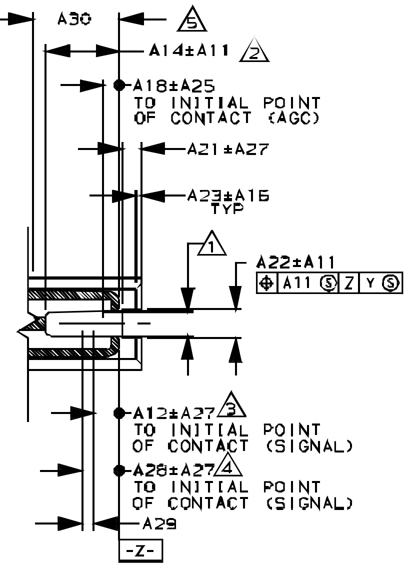
The first stage must be delivered by the device enclosure system to achieve center to center alignment of less than 2.0 mm prior to any part of the SCA-2 connector pair engaging.

The second stage (connector blind mate pre-alignment features) positions the connectors from ±2.0 mm at initial engagement through a process influenced by the following dimensions: A19, A20 and A23 in





DETAIL A
SCALE 2:1



SECTION B-B

Figure 8 and A24, A27, A29, and A30 in

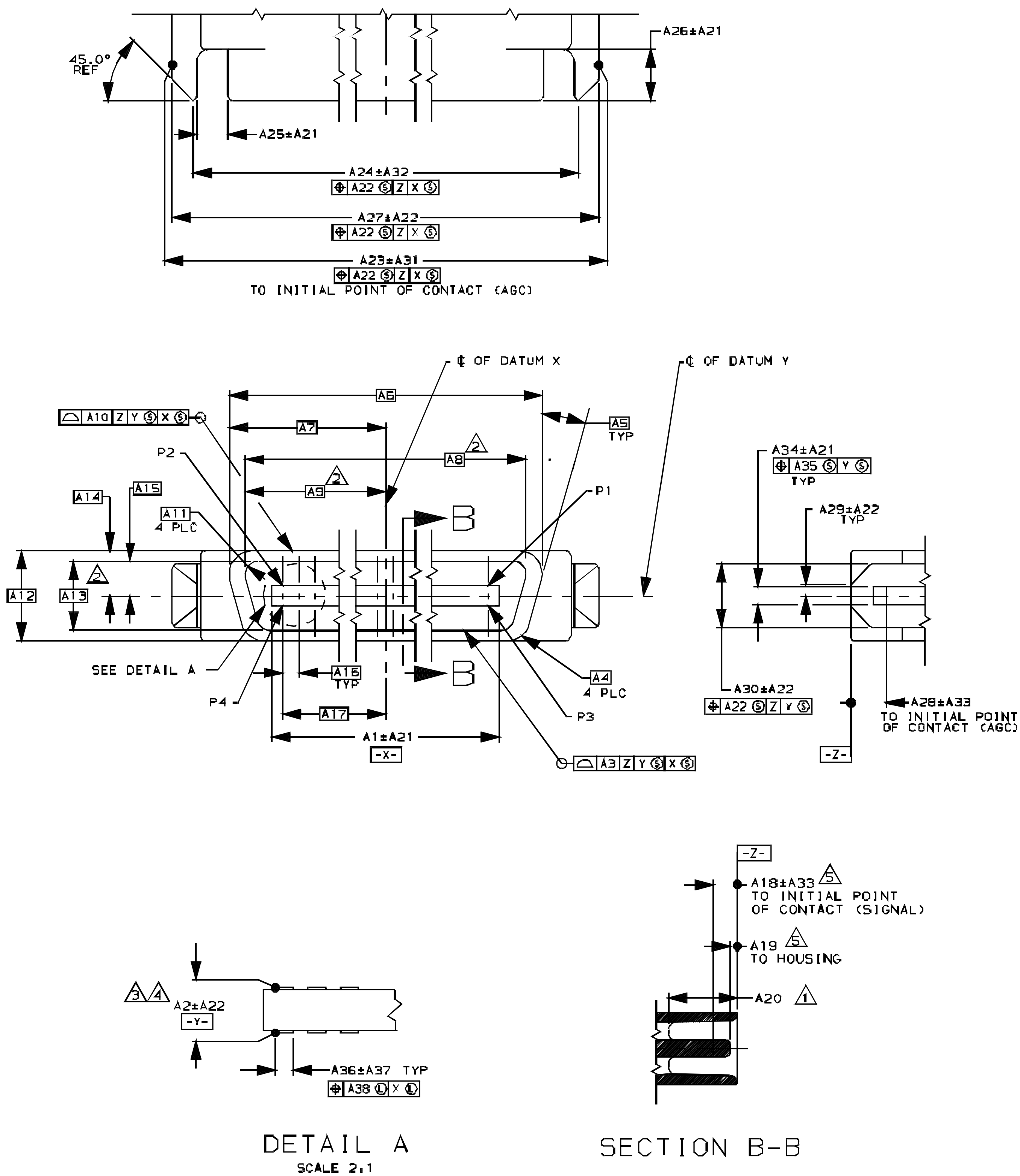
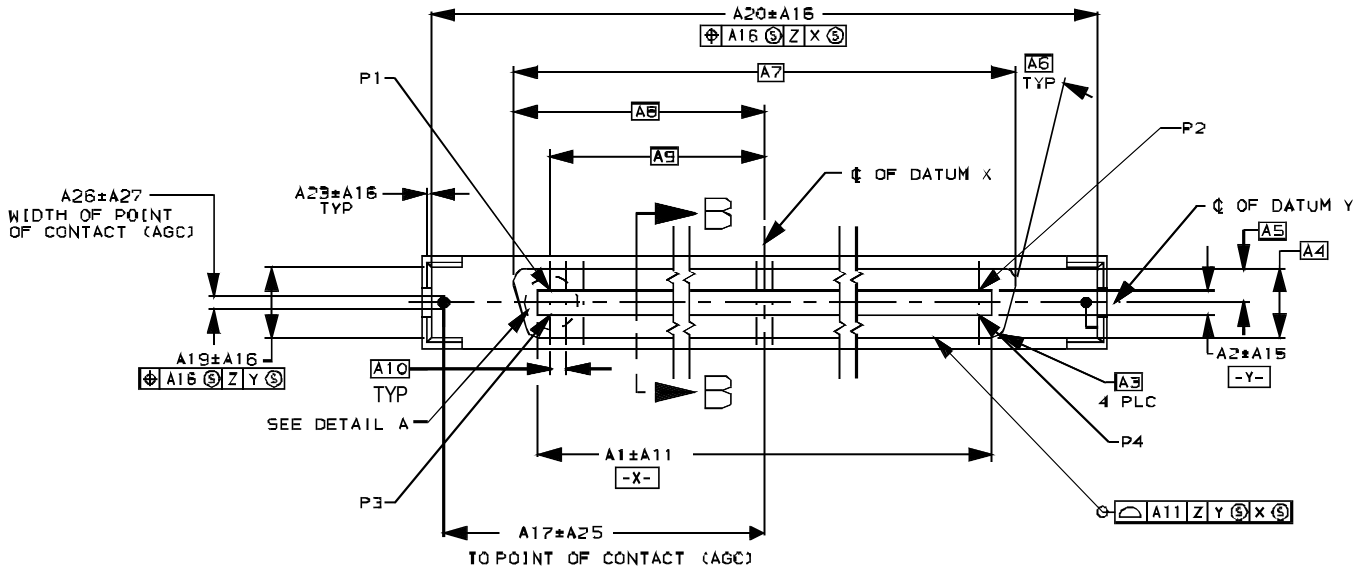
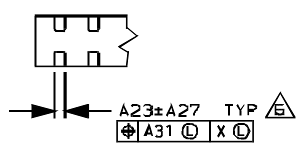


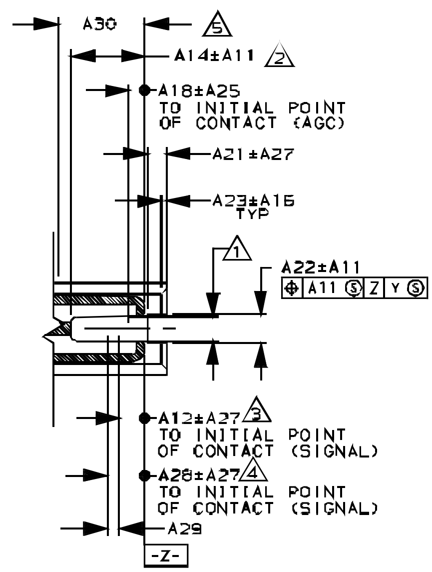
Figure 9.

The third stage further positions the connectors to their final mated position through a process influenced by the following dimensions: A1, A4, A5, A6, A7, and A11 in





DETAIL A
SCALE 2:1



SECTION B-B

Figure 8 and A1, A3, A8, A9, A11, and A13 in

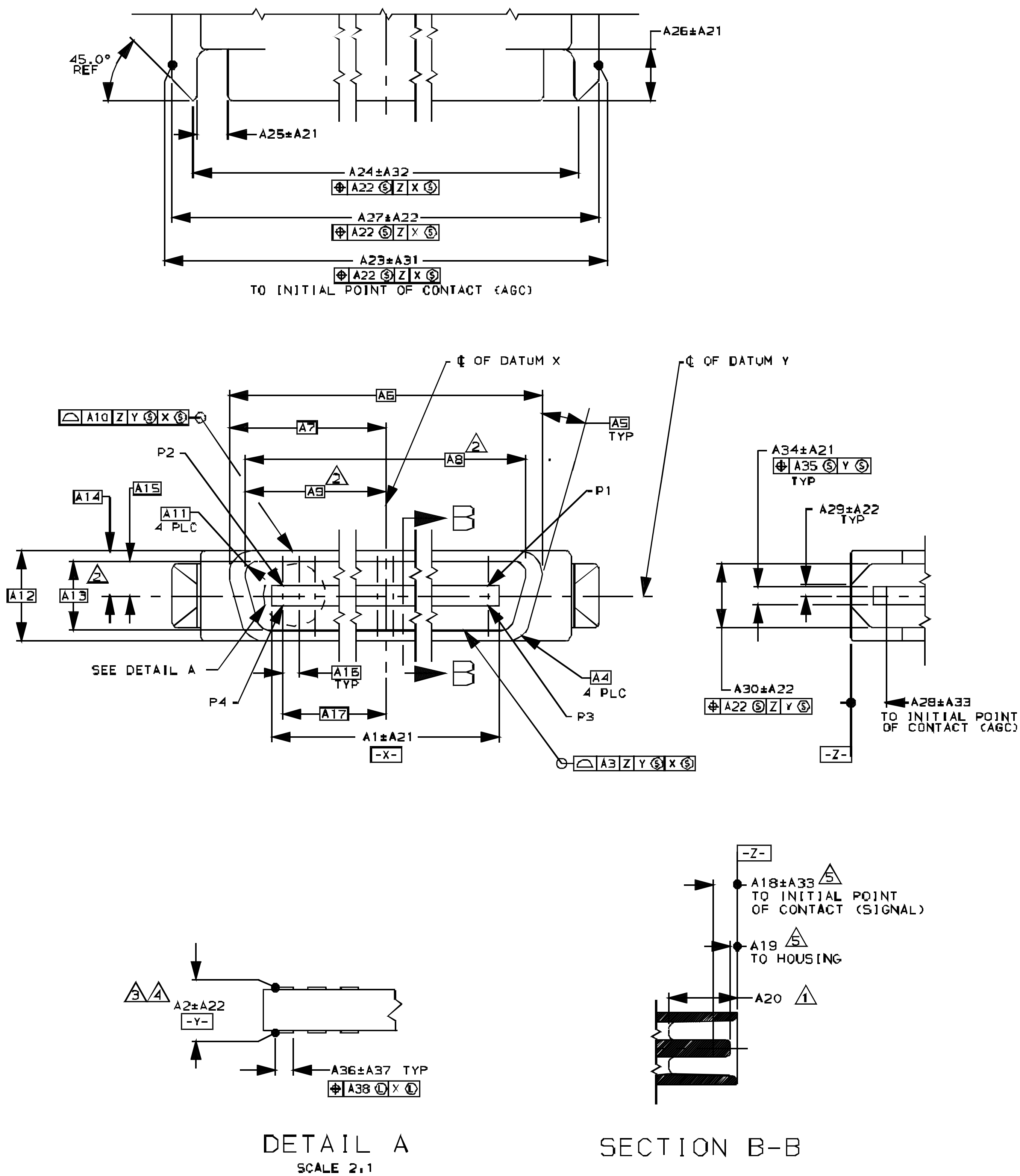


Figure 9.

Connector designers should recognize that certain lateral movement between free gender contacts and fixed gender contacts may occur between the time the pre-alignment features engage and the contacts reach the final mated position.

The positional requirements in Figure 7 define the fully mated condition.

All dimensions in this document apply to the unmated finished product (after assembly to printed circuit boards / backplanes).

While the SCA-2 connectors in this document should intermate with those termed "SCA-1" there is no specification to control the SCA-1 dimensions and the lead-in features and the different contact position lengths are not present on the SCA-1 connectors. It is therefore recommended that SCA-2 connectors not be used with SCA-1 connectors in a blind mating application.

CAUTION:

When mating SCA connectors without the aid of guide rails (or other premating guiding systems not part of the SCA-2 connector) there is a risk of shorting signals to power. This event may damage the devices on either side of the connector.

8.2 Dimensional requirements

The drawings in this section use the dimensioning conventions described in ANSI-Y14.5M, Dimensioning and tolerancing. All dimensions are in millimeters.

All dimensions are the same as in SFF-8451 except for the details of the mating interface for the free gender as described in Figure 11. The key requirements for the mating interface are retained in this document for convenience.

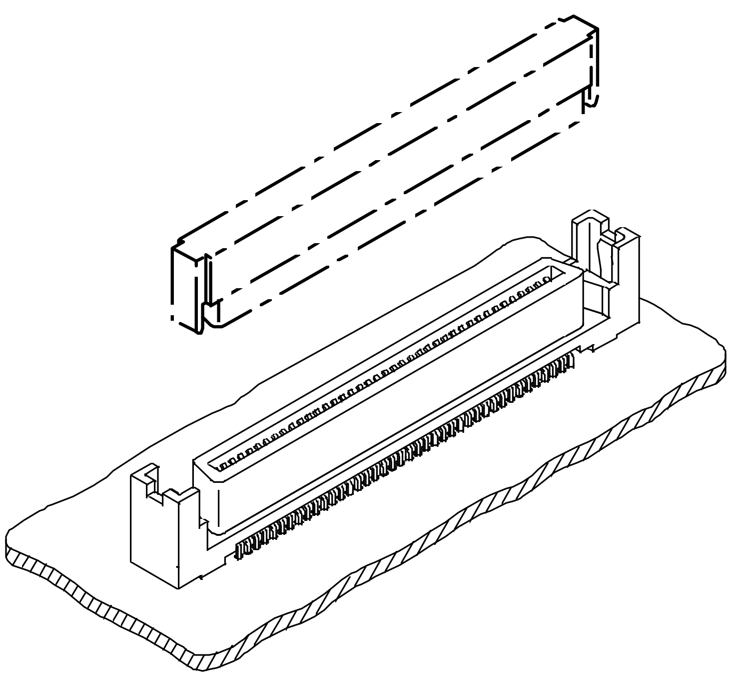


Figure 4 - General view of mating sides

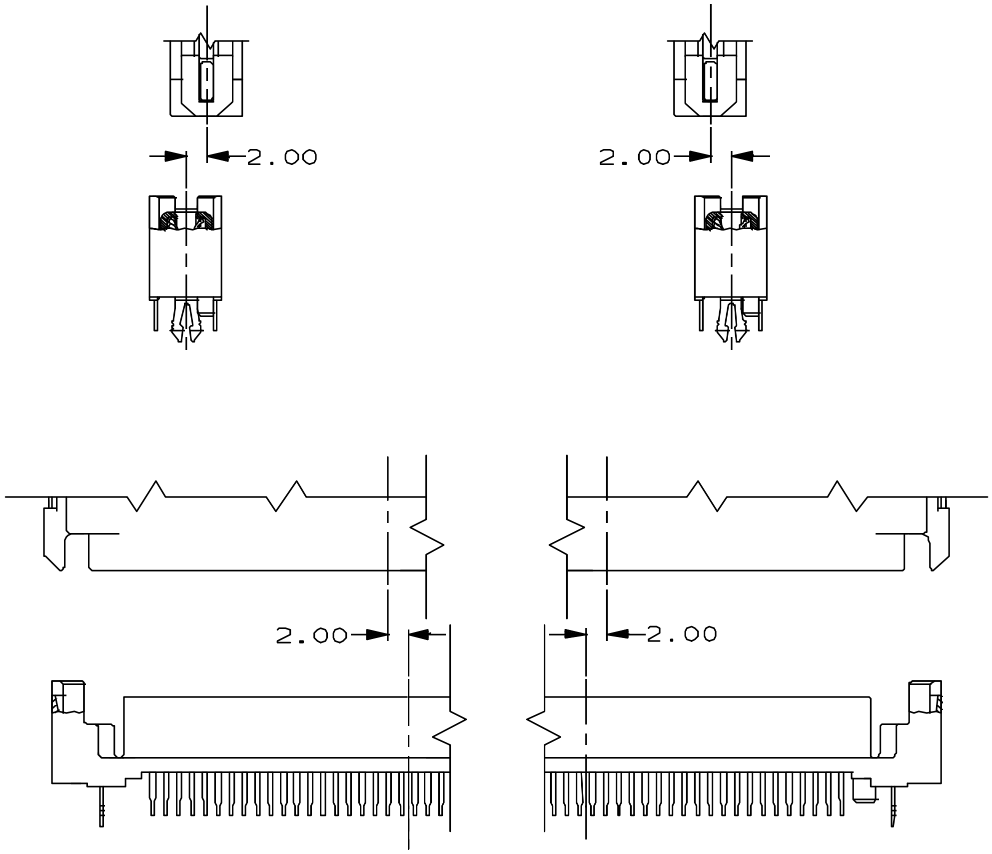


Figure 5 - Connector displacement (Reference SFF-8451)

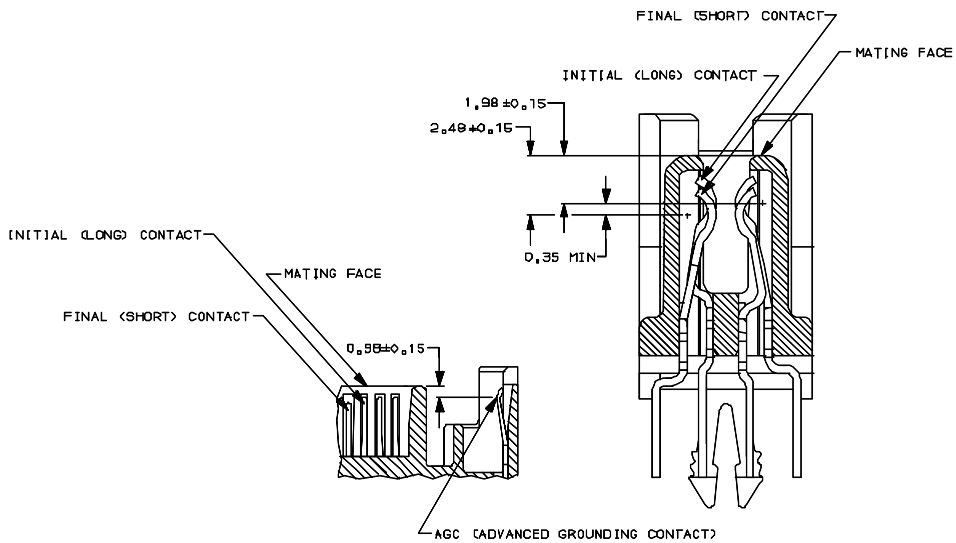


Figure 6 - Contact levels (reference SFF-8451)

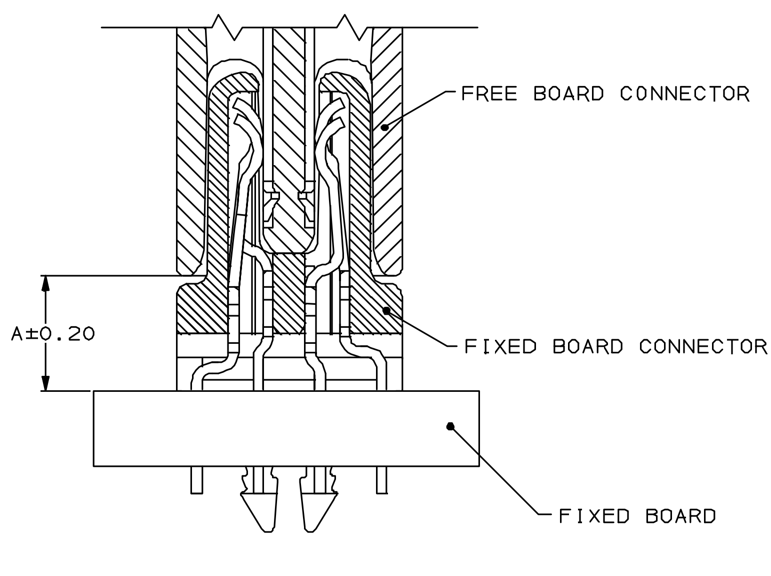


Figure 7 - Fully mated dimensions (reference SFF-8451)

Standard height 40 and 80 position A = 3.55
Extended height 40 and 80 position A = 9.55

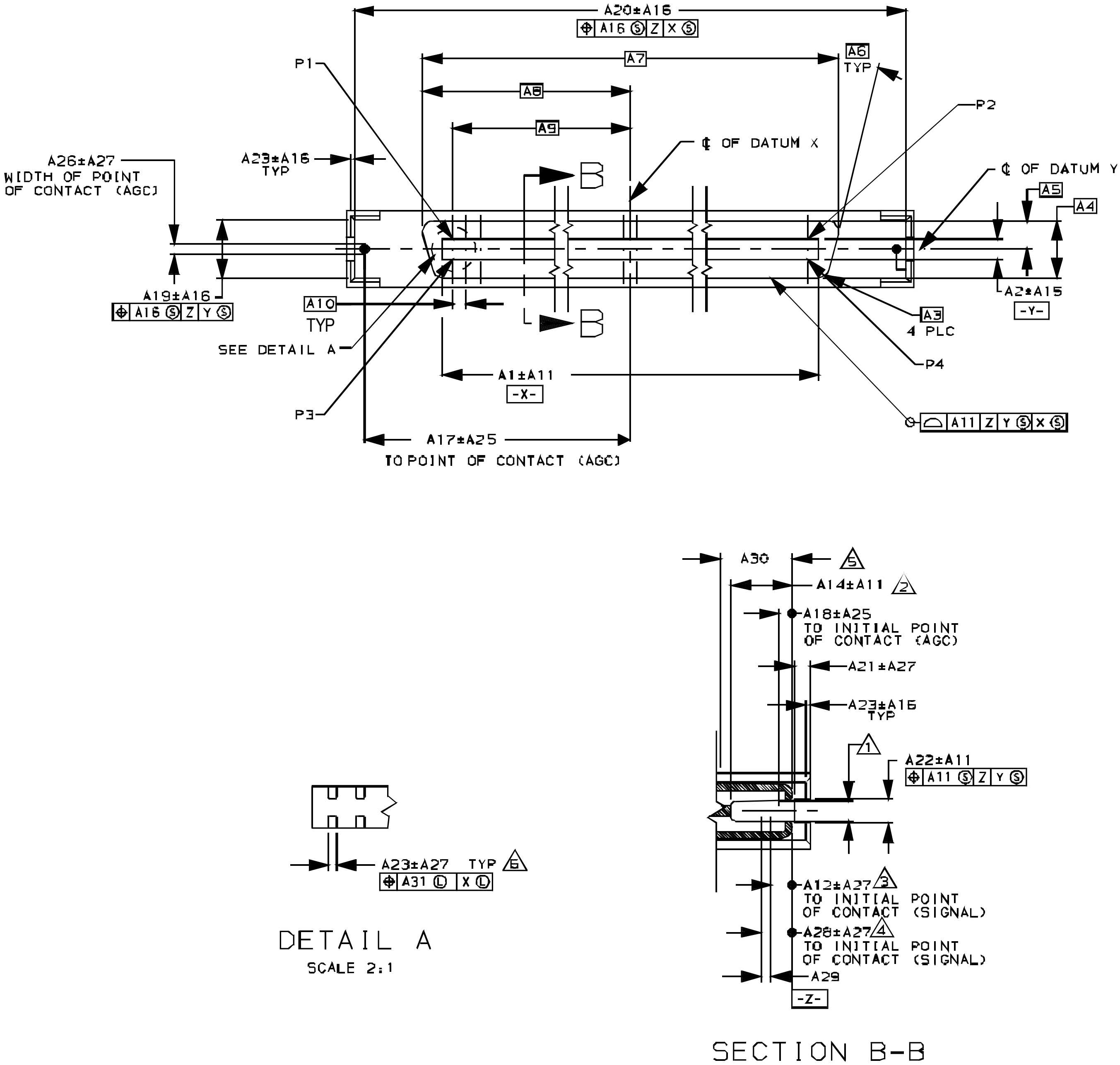


Figure 8 - Mating interface fixed gender (reference SFF-8451)

See Table 1 for 40 position dimensions and notes. See SFF-8451 for the details for the 80 position version. No modifications are required for the fixed connectors.

Table 1 - Dimensions and notes for 40 position fixed gender interface

1. CONTACT GAP WILL ACCOMMODATE MATING CONNECTOR OF A13±A16.
2. INTERNAL CLEARANCE FOR MATING CONNECTOR
3. SEQUENCED (FIRST MATE) CONTACT
4. SEQUENCED (SECOND MATE) CONTACT
5. EXTERNAL CLEARANCE FOR MATING CONNECTOR
6. EFFECTIVE WIDTH OF THE POINT OF CONTACT ZONE

40 POSITION			
P1 = POSITION 1		P3 = POSITION 21	
P2 = POSITION 20		P4 = POSITION 40	
DIMENSION	MILLIMETERS	INCHES	
A1	26.03	1.025	
A2	1.90	.075	
A3	1.00 R	.039 R	
A4	5.05	.199	
A5	2.525	.0995	
A6	15°	15°	
A7	29.67	1.168	
A8	14.84	.584	
A9	12.065	.475	
A10	1.27	.050	
A11	0.10	.004	
A12	1.98	.078	3
A13	1.60	.063	
A14	5.70	.224	
A15	0.05	.002	
A16	0.08	.003	
A17	20.10	0.791	
A18	0.98	.039	
A19	5.30	.209	
A20	41.40	1.630	
A21	1.45	.057	
A22	2.20	.087	
A23	0.40	.016	
A24	0.28	.011	
A25	0.15	.006	
A26	0.95	.037	
A27	0.15	.006	
A28	2.48	.098	4
A29	0.35 MIN	.014 MIN	
A30	6.50 MIN	.256 MIN	
A31	0.30	.012	

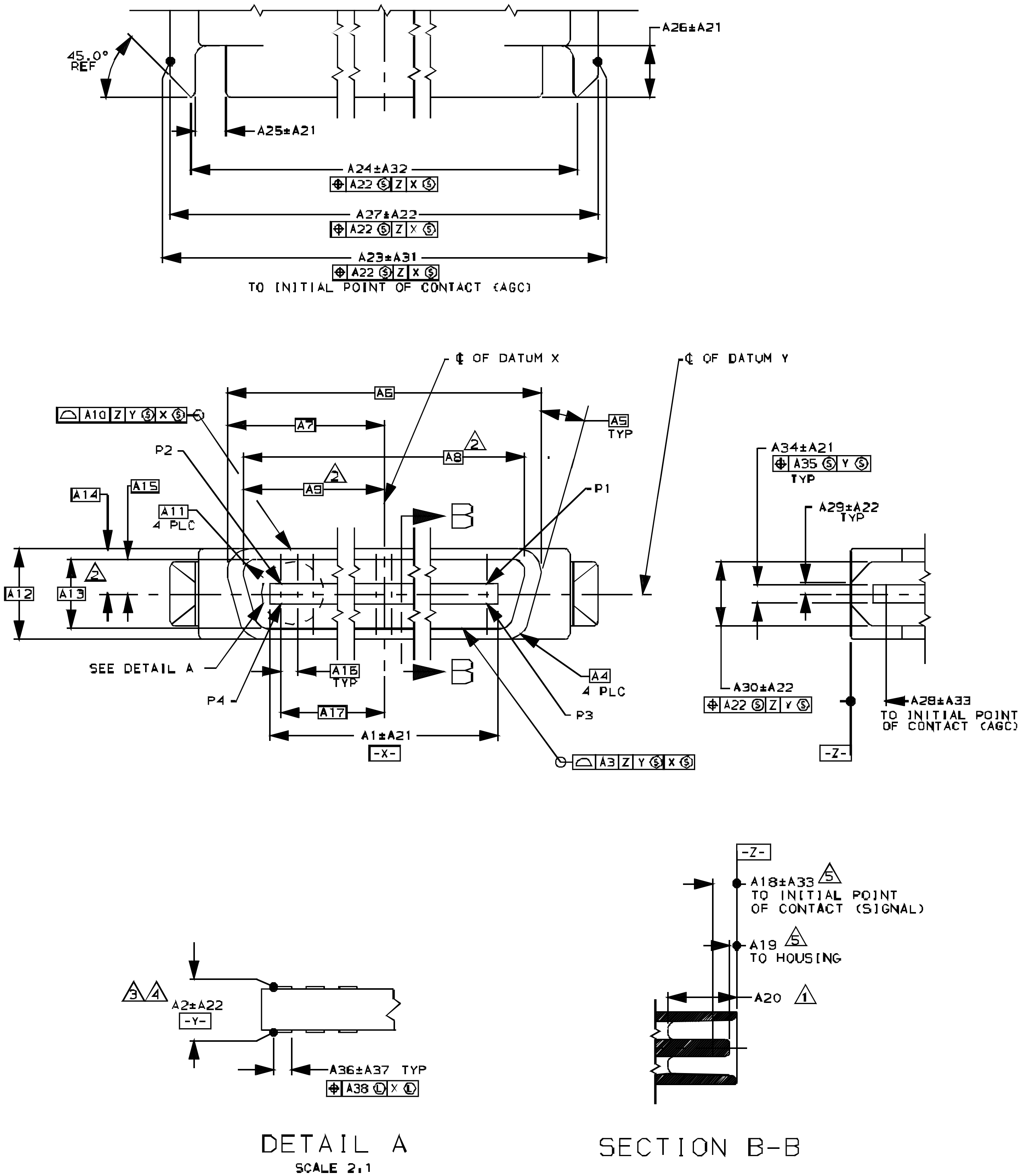


Figure 9 - Mating interface free gender (Reference SFF-8451)

See **Error! Reference source not found.** for 40 position dimensions and notes and Table 3 for 80 position dimensions and notes.

Table 2 - Dimensions and notes for 40 position free gender

1. 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 REQUIRED FOR PRE-DEFLECTION OF RECEPTACLE CONTACTS

40 POSITION		
P1 = POSITION 1	P3 = POSITION 21	
P2 = POSITION 20	P4 = POSITION 40	

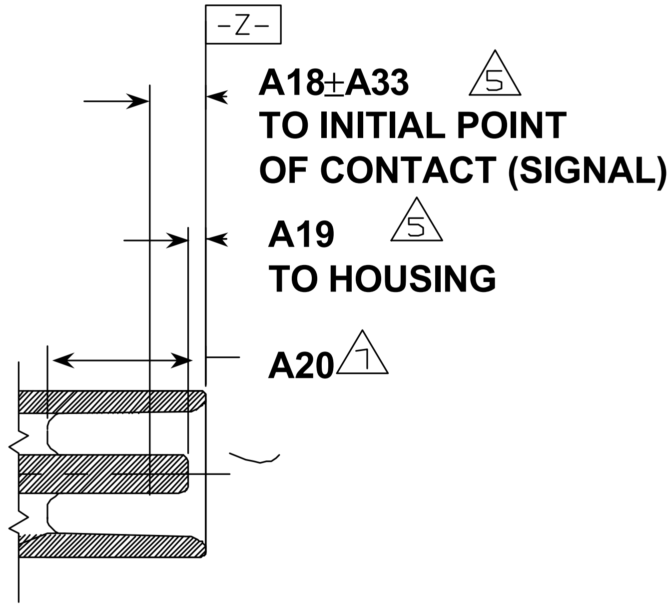
DIMENSION	MILLIMETERS	INCHES	
A1	25.77	1.015	
A2	1.60	.063	
A3	0.10	.004	
A4	1.80 R	.071 R	
A5	15°	15°	
A6	32.47	1.278	
A7	16.235	.639	
A8	29.87	1.176	
A9	14.935	.588	
A10	0.20	.008	
A11	1.00 R	.039 R	
A12	7.00	.276	
A13	5.325	.210	2
A14	3.50	.138	
A15	2.663	.105	
A16	1.27	.050	
A17	12.065	.475	
A18	2.00	.079	
A19	0.60 MIN	.024 MIN	
A20	6.50 MIN	.256 MIN	
A21	0.10	.004	
A22	0.08	.003	
A23	41.00	1.614	
A24	37.90	1.492	
A25	2.42	.095	
A26	4.00	.157	
A27	41.10	1.618	
A28	1.85	.073	
A29	0.90	.035	
A30	5.00	.197	
A31	0.28	.011	
A32	0.24	.009	
A33	0.25	.010	
A34	1.35	.053	
A35	0.05	.002	
A36	0.80	.031	
A37	0.15	.006	
A38	0.13	.005	

Table 3 - Dimensions and notes for 80 position free gender interface

1. 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 REQUIRED FOR PRE-DEFLECTION OF RECEPTACLE CONTACTS

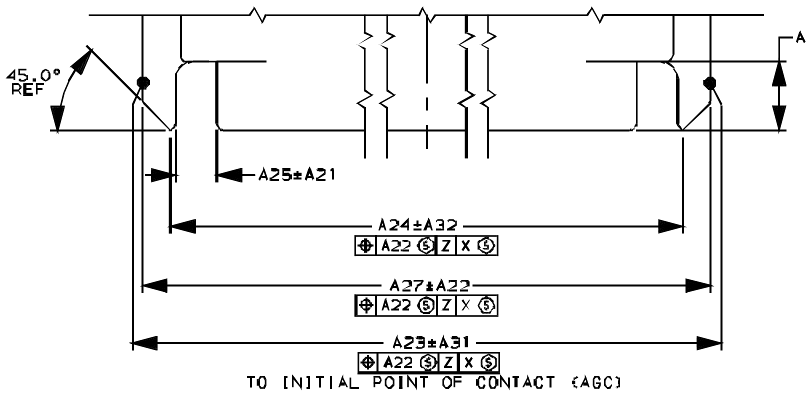
80 POSITION	
P1 = POSITION 1	P3 = POSITION 41
P2 = POSITION 40	P4 = POSITION 80

DIMENSION	MILLIMETERS	INCHES	
A1	51.17	2.015	
A2	1.60	.063	
A3	0.10	.004	
A4	1.80 R	.071 R	
A5	15°	15°	
A6	57.87	2.278	
A7	28.935	1.139	
A8	55.27	2.176	
A9	27.635	1.088	
A10	0.20	.008	
A11	1.00 R	.039 R	
A12	7.00	.276	
A13	5.325	.210	2
A14	3.50	.138	
A15	2.663	.105	
A16	1.27	.050	
A17	24.765	.975	
A18	2.00	.079	
A19	0.60 MIN	.024 MIN	
A20	6.50 MIN	.256 MIN	
A21	0.10	.004	
A22	0.08	.003	
A23	66.40	2.614	
A24	63.30	2.492	
A25	2.42	.095	
A26	4.00	.157	
A27	66.50	2.618	
A28	1.85	.073	
A29	0.90	.035	
A30	5.00	.197	
A31	0.28	.011	
A32	0.24	.009	
A33	0.25	.010	
A34	1.35	.053	
A35	0.05	.002	
A36	0.80	.031	
A37	0.15	.006	
A38	0.13	.005	



SECTION B-B

Figure 10 - Detail of section B-B in



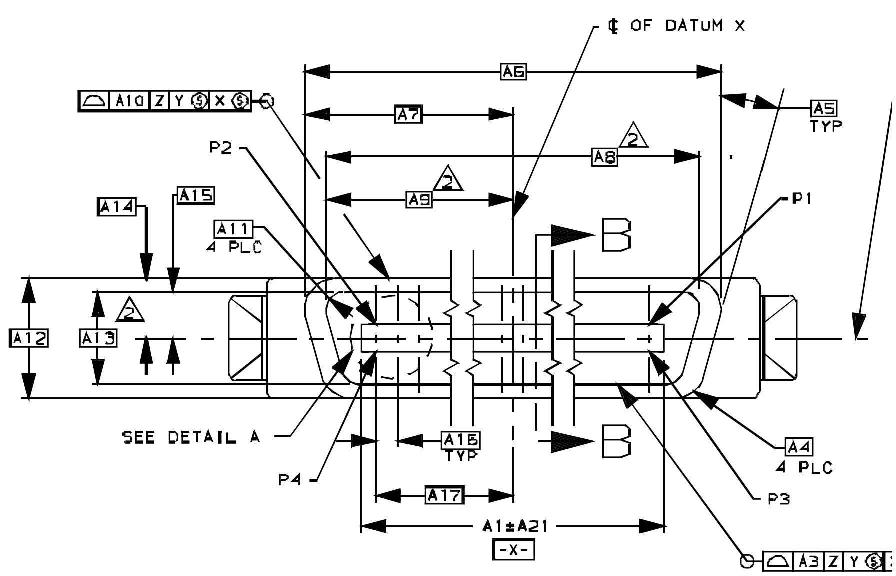


Figure 9 (expanded for clarity)

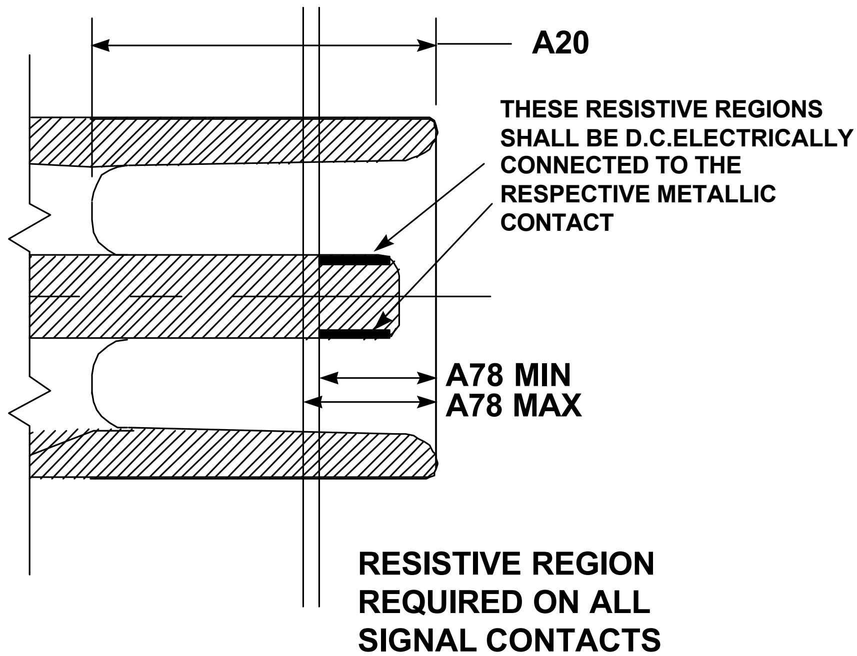


Figure 11 – Detail of section B-B in

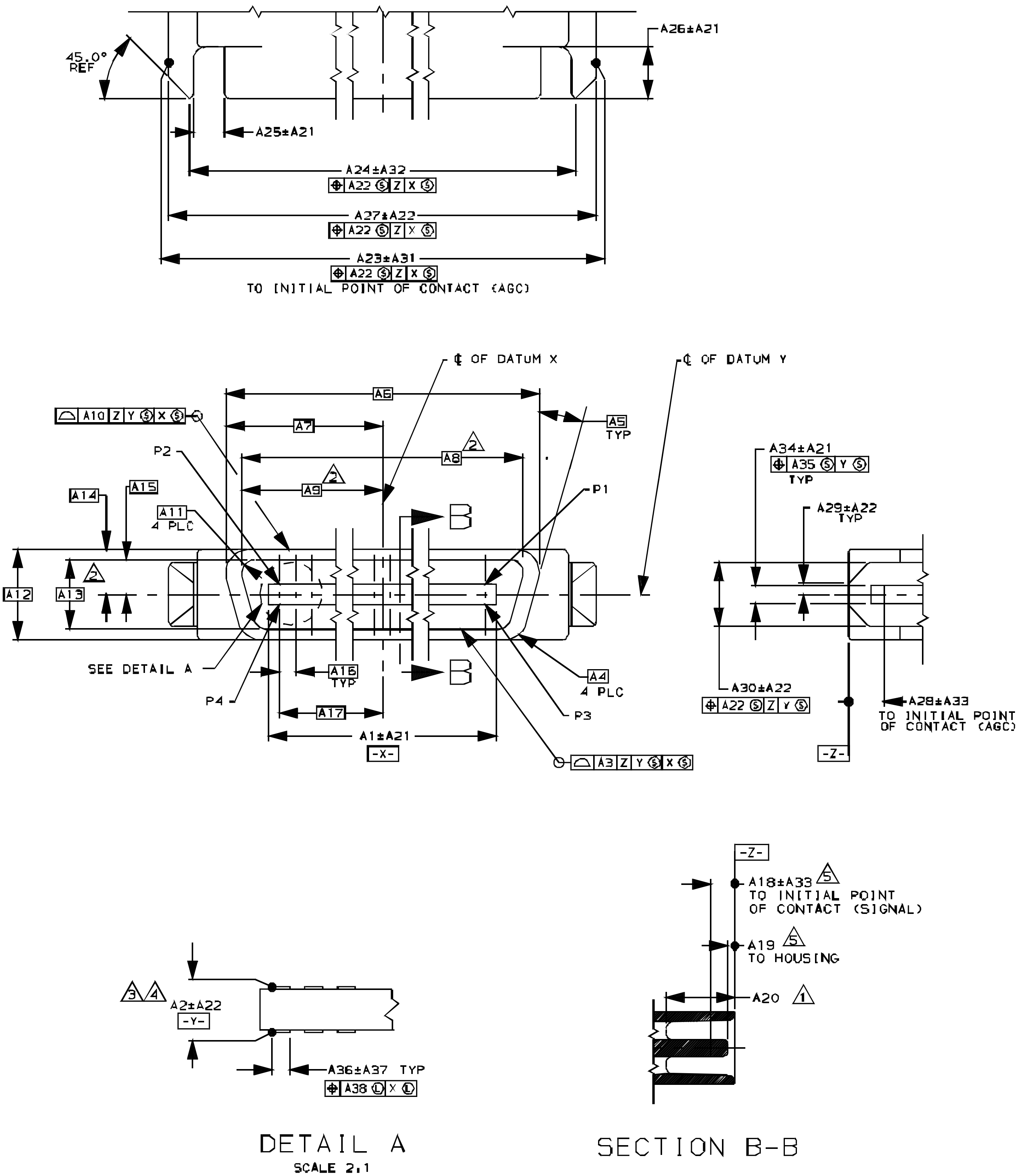


Figure 9 showing the positional requirements for the resistive regions

8.3 Performance requirements

8.3.1 General performance requirements

The requirements in this section are the same as those in SFF-8451.

Modified SCA-2 free connectors when used with SCA-2 fixed connectors shall meet the performance requirements specified in EIA-700A0AE (SP-3651). Some of these are summarized in Table 4 and Table 5.

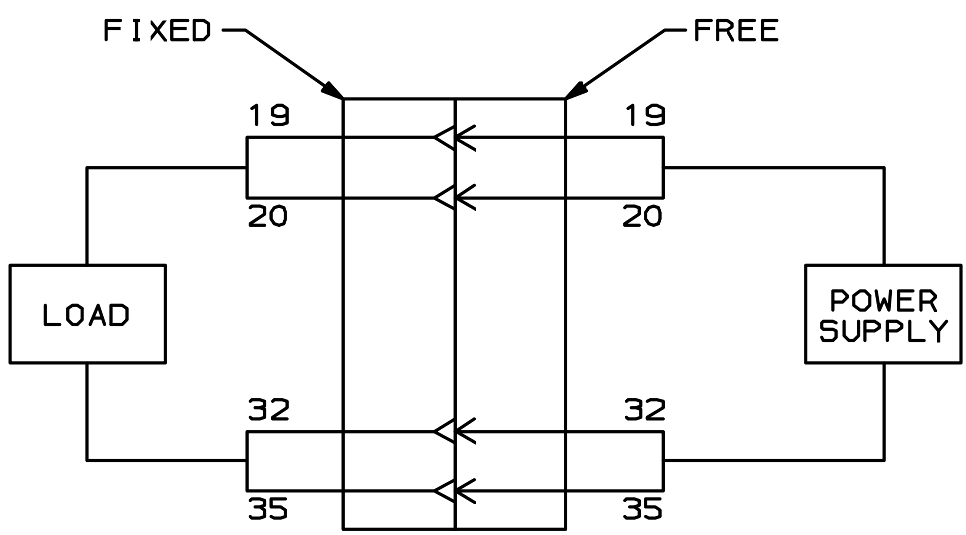
Table 4 - Some performance requirements for fully mated modified SCA-2 connectors

PARAMETER	REQUIREMENTS
RATED VOLTAGE	250 V rms
CURRENT RATINGS	See Table 5
INSULATION RESISTANCE	1000 megohms min
AMBIENT TEMPERATURE	-55°C to 85°C
MATING CYCLES	500 min
CONTACT RESISTANCE NON-AGC CONTACTS	< 35 milliohms
CONTACT RESISTANCE AGC CONTACTS	< 50 milliohms

Table 5 - Fully mated contact current rating requirements

Number of contacts	Current, amps	Voltage, volts	Contact number with voltage applied (in parallel)	Contact number with ground (in parallel)
40	2	5	19, 20	32, 35
40	2.5	12	2, 3, 4	22, 23, 26, 29
80	2	5	34, 35	75, 76
80	3	12	2, 3, 4	41, 42, 43

Notes: (1) Current levels are based on steady state conditions. When the connector is used in "hot plug" applications, current spikes shall be minimized using a current limiting device.
(2) Example shown below for a 40 contact connector on 2 amp, 5 volt contacts.
(3) The Advanced Grounding Contacts were originally designed to provide ESD protection and equipment grounding only, but because of system tolerances may sometimes be the first ground return path for the power supply instead of the normal sequenced ground contacts.
There is no implied current rating for these contacts and it is not recommended that the Advanced Grounding Contacts be used as a current path in the power circuit.



8.3.2 Performance requirements for the dynamic mating process

The test circuit in Figure 12 shall be used to measure the dynamic performance of the modified SCA-2 free connector signal contacts for initial mating. The capacitor is discharged prior to mating the connector.

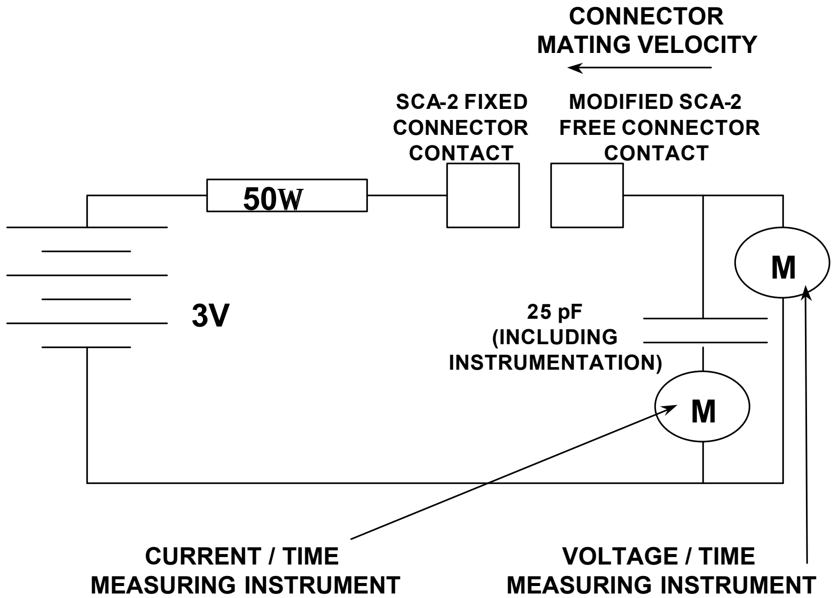


Figure 12 – Modified SCA-2 free connector signal contact dynamic mating test conditions

During the mating process charge will begin to flow when the fixed contact connects to the resistive region of the free contact and stops flowing when the capacitor is charged to approximately 3V. Mathematically, infinite time is required to charge to exactly 3 volts so the practical definition for the beginning and end points is based on passing the 1 nanoamp point. The charging time, t_{CHARGE}, starts when the charging current first exceeds one nanoamp. The charging time ends when the current falls below 1 nanoamp and the capacitor is charged to at least 2.95V. Contact bounce may cause the current to fall below 1 nanoamp without having completed the charging of the capacitor. It is therefore required to monitor the voltage as well as the current for this test. Figure 13 shows an example of a current - time mating transient with no bounce present.

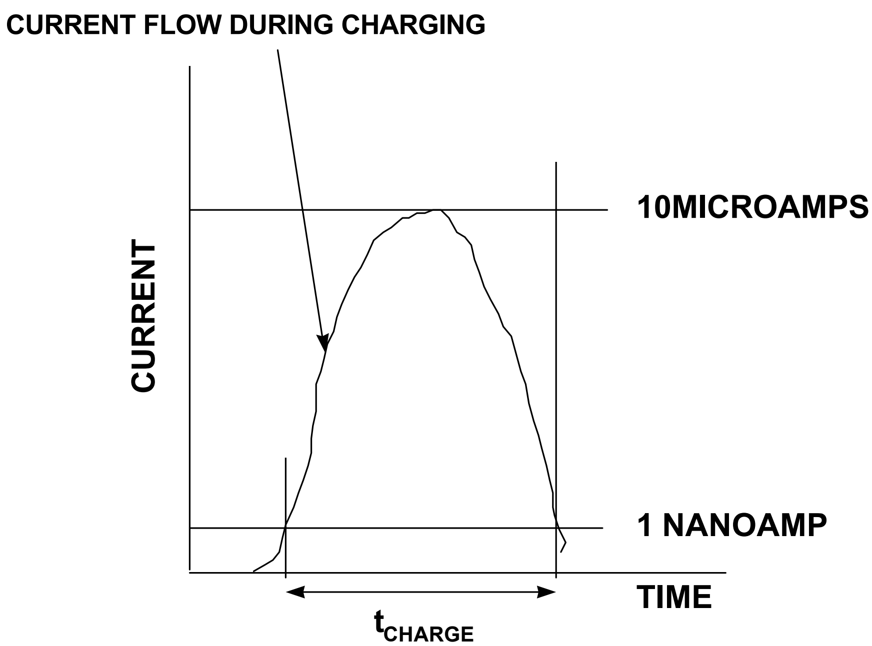


Figure 13 - Dynamic mating performance requirements

During the charging time the current shall not exceed 10 microamps. Further, with the mating connector moving at 1 meter/sec the charging time shall not exceed the time required for the incoming contact to reach the metallic contact.