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SFF Committee

**SFF-8223 Specification for**

**2.5" Drive Form Factor with SAS Connector**

Rev 0.1 April 27, 2002

Secretariat: SFF Committee

Abstract: This document defines the dimensions for location of the Serial Attached SCSI (SAS) connector on the 2.5" Drive Form Factors. The location is similar to that of the Serial ATA (SATA) connector location such that a backplane with a SAS receptacle connector may accept either a SAS or SATA drive.

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).

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**EXPRESSION OF SUPPORT BY MANUFACTURERS**

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

tbd

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

tbd

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

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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.

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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.

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## Foreword

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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.

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SFF Committee --

## **2.5" Drive Form Factor with SAS Connector**

### **1 Scope**

The 82xx suite of specifications defines the configuration characteristics associated with 2.5" disk drives.

The purpose of the 82xx suite is to define the external characteristics of drives such that products from different vendors may be used in the same mounting configurations.

The set of specifications provide external dimensions, connector placement, and mounting holes to assist manufacturers in the systems integration of small form factor disk drives.

- SFF-8200 contains general information regarding connector space, mounting considerations and measurement requirements.
- SFF-8201 defines the dimensions of 2.5" disk drives.
- SFF-8221 defines the dimensions of the Aligned 2.5" Drive Form Factor.
- Other specifications in the 82xx family define the location of connectors on the 2.5" Drive Form Factors.

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 General Description.

Clause 4 contains the Definitions and Conventions.

Clause 5 contains the 2.5" Drive Form Factor with SAS 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 standards are relevant to many SFF Specifications.

- 02-157R0 SAS Proposed Serial Attached SCSI working draft
- ANSI-Y14.5M Dimension and Tolerancing
- SFF 8xxx SAS Connector ???

#### **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 March 29, 2002	Status	Pages
SFF-8000		SFF Committee Information		
INF-8001i	E	44-pin ATA (AT Attachment) Pinouts for SFF Drives	E	
INF-8002i	E	68-pin ATA (AT Attachment) for SFF Drives	E	
SFF-8003	E	SCSI Pinouts for SFF Drives	E	
SFF-8004	E	Small Form Factor 2.5" Drives	E	
SFF-8005	E	Small Form Factor 1.8" Drives	E	
SFF-8006	E	Small Form Factor 1.3" Drives	E	
SFF-8007	E	2mm Connector Alternatives	E	
SFF-8008	E	68-pin Embedded Interface for SFF Drives	E	
SFF-8009	4.1	Unitized Connector for Cabled Drives	P	
SFF-8010	E	Small Form Factor 15mm 1.8" Drives	E	
INF-8011i	E	ATA Timing Extensions for Local Bus	E	
SFF-8012	3.0	4-Pin Power Connector Dimensions	P	
SFF-8013	E	ATA Download Microcode Command	E	
SFF-8014	C	Unitized Connector for Rack Mounted Drives	C	
SFF-8015	E	SCA Connector for Rack Mounted SFF SCSI Drives	E	
SFF-8016	C	Small Form Factor 10mm 2.5" Drives	C	
SFF-8017	E	SCSI Wiring Rules for Mixed Cable Plants		
SFF-8018	E	ATA Low Power Modes	E	
SFF-8019	E	Identify Drive Data for ATA Disks up to 8 GB	E	
INF-8020i	E	ATA Packet Interface for CD-ROMs	E	
INF-8028i	E	- Errata to SFF-8020 Rev 2.5	E	
SFF-8029	E	- Errata to SFF-8020 Rev 1.2	E	
SFF-8030	1.8	SFF Committee Charter		
SFF-8031		Named Representatives of SFF Committee Members		
SFF-8032	1.5	SFF Committee Principles of Operation		
INF-8033i	E	Improved ATA Timing Extensions to 16.6 MBs	E	
INF-8034i	E	High Speed Local Bus ATA Line Termination Issues	E	
INF-8035i	E	Self-Monitoring, Analysis and Reporting Technology	E	
INF-8036i	E	ATA Signal Integrity Issues	E	
INF-8037i	E	Intel Small PCI SIG	E	



INF-8038i	E	Intel Bus Master IDE ATA Specification	E
INF-8039i	E	Phoenix EDD (Enhanced Disk Drive) Specification	E
SFF-8040	1.2	25-pin Asynchronous SCSI Pinout	P
SFF-8041	C	SCA-2 Connector Backend Configurations	C
SFF-8042	C	VHDCI Connector Backend Configurations	C
SFF-8043	E	40-pin MicroSCSI Pinout	E
SFF-8045	4.5	40-pin SCA-2 Connector w/Parallel Selection	P
SFF-8046	E	80-pin SCA-2 Connector for SCSI Disk Drives	
SFF-8047	C	40-pin SCA-2 Connector w/Serial Selection	C
SFF-8048	C	80-pin SCA-2 Connector w/Parallel ESI	C
SFF-8049	E	80-conductor ATA Cable Assembly	E
INF-8050i	1.0	Bootable CD-ROM	i
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)	i
INF-8055i	E	SMART Application Guide for ATA Interface	E
SFF-8056	C	50-pin 2mm Connector	C
SFF-8057	E	Unitized ATA 2-plus Connector	E
SFF-8058	E	Unitized ATA 3-in-1 Connector	E
SFF-8059	E	40-pin ATA Connector	E
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	C
SFF-8066	C	80-pin SCA-2 Connector w/High Voltage	C
SFF-8067	3.0	40-pin SCA-2 Connector w/Bidirectional ESI	D
INF-8068i	1.0	Guidelines to Import Drawings into SFF Specs	i
SFF-8069	E	Fax-Access Instructions	E
INF-8070i	1.3	ATAPI for Rewritable Removable Media	i
SFF-8072	1.2	80-pin SCA-2 for Fibre Channel Tape Applications	D
SFF-8073	-	20-pin SCA-2 for GBIC Applications	D
INF-8074i	1.0	SFP (Small Formfactor Pluggable) Transceiver	i
SFF-8075	1.0	PCI Card Version of SFP Cage	D
SFF-8080	E	ATAPI for CD-Recordable Media	
INF-8090i	5.4	ATAPI for DVD (Digital Video Data)	i
SFF-8101		3 Gbs and 4 Gbs Signal Characteristics	
SFF-8110	C	5V Parallel 1.8" drive form factor	
SFF-8111	1.2	1.8" drive form factor (60x70mm)	
SFF-8120	2.6	1.8" drive form factor (78x54mm)	
SFF-8200e	1.1	2 1/2" drive form factors (all of 82xx family)	P
SFF-8201e	1.3	2 1/2" drive form factor dimensions	D
SFF-8212e	1.2	2 1/2" drive w/SFF-8001 44-pin ATA Connector	P
SFF-8221	1.0	Aligned 2 1/2" drive form factor dimensions	D
SFF-8222	1.1	2 1/2" drive w/SCA-2 Connector	D
SFF-8300	1.2	3 1/2" drive form factors (all of 83xx family)	P
SFF-8301	1.4	3 1/2" drive form factor dimensions	P
SFF-8302e	1.1	3 1/2" Cabled Connector locations	P
SFF-8332e	1.2	3 1/2" drive w/80-pin SFF-8015 SCA Connector	P
SFF-8337e	1.2	3 1/2" drive w/SCA-2 Connector	P
SFF-8342e	1.3	3 1/2" drive w/Serial Unitized Connector	P
INF-8350i	6.1	3 1/2" Packaged Drives	i
SFF-8400	C	VHDCI (Very High Density Cable Interconnect)	C
SFF-8410	16.1	High Speed Serial Testing for Copper Links	D
SFF-8411		High Speed Serial Testing for Backplanes	D
SFF-8412	6.1	High Speed Serial Testing for Optical Links	D
SFF-8415	2.1	HPEI (High Performance Electrical Interconnect)	

SFF-8416	0.1	HPEI Measurement of Bulk Cable		
SFF-8420	11.1	HSSDC-1 Shielded Connections	P	
SFF-8421	2.1	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	P	
SFF-8441	14.1	VHDCI Shielded Configurations	P	
SFF-8451	10.1	SCA-2 Unshielded Connections	P	
SFF-8452	3.1	Glitch Free Mating Connections for Multidrop Aps	D	
SFF-8453		Shielded High Speed Serial connectors		
SFF-8460	1.2	HSS Backplane Design Guidelines	P	
SFF-8470	1.2	Multi Lane Copper Connector	D	
SFF-8471		ZFP Multi Lane Copper Connector		D
SFF-8472	9.1	Diagnostic Monitoring Interface for Optical Xcvrs	D	
SFF-8480	2.1	HSS (High Speed Serial) DB9 Connections	P	
SFF-8500e	1.1	5 1/4" drive form factors (all of 85xx family)	P	
SFF-8501e	1.1	5 1/4" drive form factor dimensions	P	
SFF-8508e	1.1	5 1/4" ATAPI CD-ROM w/audio connectors	P	
SFF-8551	3.2	5 1/4" CD Drives form factor	D	
SFF-8572	-	5 1/4" Tape form factor	D	
SFF-8610	C	SDX (Storage Device Architecture)		C

### 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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 CA 95070

### 3 General Description

The application environment for the 2.5" Drive Form Factors is any computer, cabinet, or enclosure connecting to one or more drives in a restricted packaging environment. This specification defines the location of the SAS interface connector on the 2.5" Drive Form Factors. The purpose of an SFF Specification is to provide information that will assist vendors to design products that can fit the same packaging envelope.

### 4 Definitions and Conventions

#### 4.1 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:	0.6	ISO:	0,6
	1,000		1 000
	1,323,462.9		1 323 462,9

### 5 2.5" Drive Form Factor with SAS Connector

SFF-8223 defines the location of the Serial Attached SCSI (SAS) interface connector on the 2.5" Drive Form Factors.

This specification defines a drive that can be directly inserted into the backplane of a cabinet, without the need for a cable, and provides information necessary to assist manufacturers in the systems integration of small form factor disk drives. Alternately, a cable may be used to supply power and to connect to the primary data port of the drive. This specification allows only one location for the interface connector on the drive. The location is similar to that of the Serial ATA (SATA) connector location such that a backplane with a SAS receptacle connector may accept either a SAS or SATA drive.

Provision exists in the SAS connector for improved mating via guides. Staggered pin lengths incorporate provision for mating ground prior to mating any other signals.

Table 5-1 defines the dimensions associated with the positioning of the SAS connector on the drive as illustrated in Figure 5-1.

TABLE 5-1 SAS CONNECTOR LOCATION

Dimension	Millimeters	Inches
A1	69.85	2.750
A2	42.73	1.682
A3	33.39	1.315
A4	0.40	0.016
A5	4.00	0.157
A6	0.76	0.030
A7	3.50	0.138
A8	9.40	0.370
A9	0.40	0.016
A10	1.00	0.039
A11	4.80	0.189
A12	0.38	0.015
A13	13.43	0.529

## NOTES:

- 1) Reference drawings: EIA-720 (SFF-8201 Form Factor of 2.5" Disk Drives), SFF-8221 Aligned 2.5" Drive Form Factor, SFF-8xxx SAS Connector ???
- 2) Millimeter is the controlling dimensional unit.

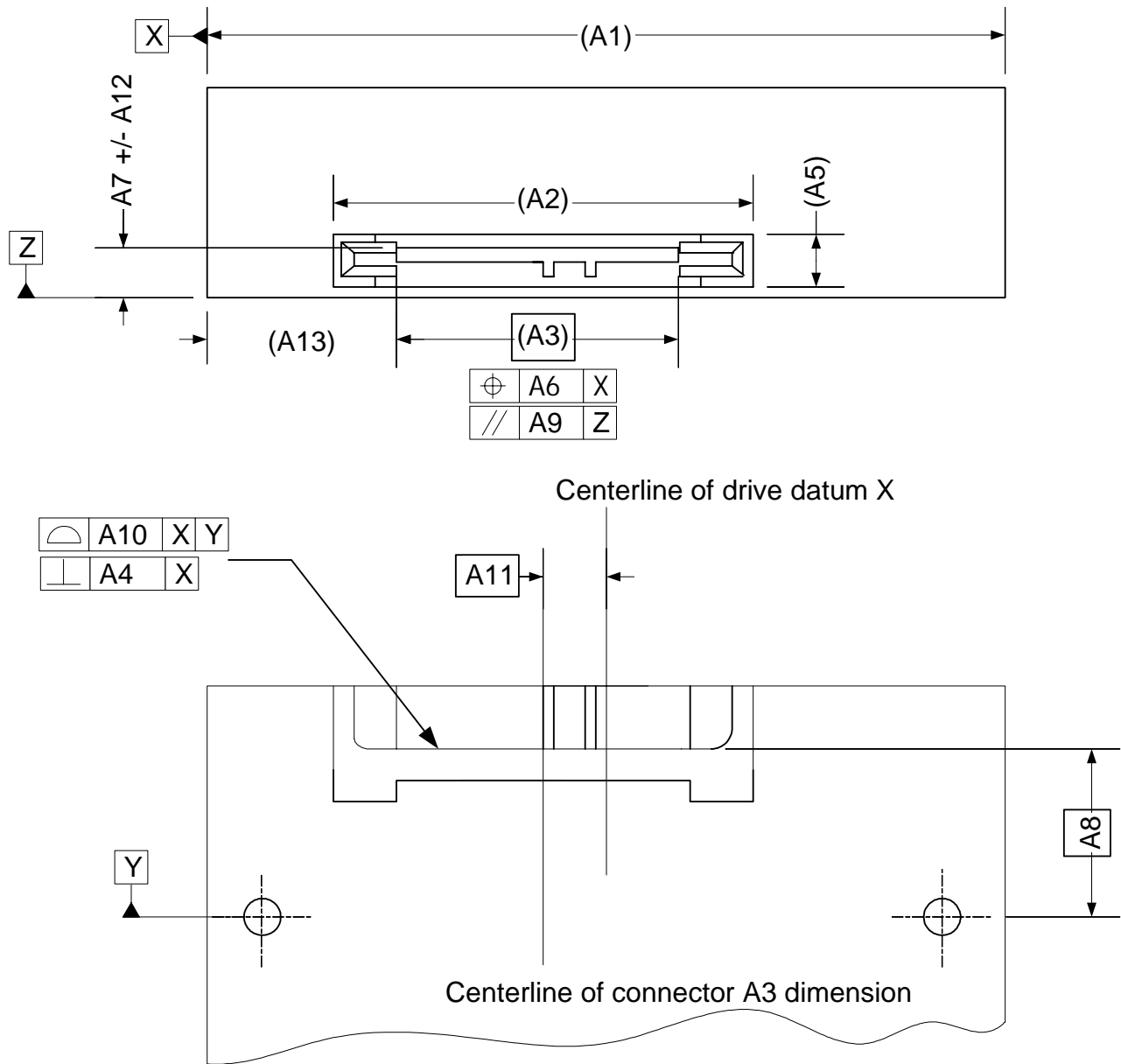


Figure 5-1 2.5" DRIVE FORM FACTOR WITH SAS CONNECTOR

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**SFF-83xx Specification for**

**3.5" Drive Form Factor with SAS Connector**

Rev 0.1 April 27, 2002

Secretariat: SFF Committee

Abstract: This document defines the dimensions for location of the Serial Attached SCSI (SAS) connector on the 3.5" Drive Form Factor. The location is similar to that of the Serial ATA (SATA) connector location such that a backplane with a SAS receptacle connector may accept either a SAS or SATA drive.

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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.

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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.

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2	REFERENCES	7
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5	3.5" DRIVE FORM FACTOR WITH SAS CONNECTOR	11

SFF Committee --

### **3.5" Drive Form Factor with SAS Connector**

#### **1 Scope**

The 83xx suite of specifications defines the configuration characteristics associated with 3.5" disk drives.

The purpose of the 83xx suite is to define the external characteristics of drives such that products from different vendors may be used in the same mounting configurations.

The set of specifications provide external dimensions, connector placement, and mounting holes to assist manufacturers in the systems integration of small form factor disk drives.

- SFF-8300 contains general information regarding connector space, mounting considerations and measurement requirements.
- SFF-8301 defines the dimensions of 3.5" disk drives.
- Other specifications in the 83xx family define the location of connectors on the 3.5" Drive Form Factors.

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 General Description.

Clause 4 contains the Definitions and Conventions.

Clause 5 contains the 3.5" Drive Form Factor with SAS 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 standards are relevant to many SFF Specifications.

- 02-157R0 SAS Proposed Serial Attached SCSI working draft
- ANSI-Y14.5M Dimension and Tolerancing
- EIA 740 Detail, SFF 3.5" Disk Drives
- SFF-8301 3.5" drive form factor dimensions
- SFF 8xxx SAS Connector ???

## 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.

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P = Published	The document has been balloted by members and is available as a published SFF Specification.
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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).
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SFF-8000		SFF Committee Information		
INF-8001i	E	44-pin ATA (AT Attachment) Pinouts for SFF Drives	E	
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SFF-8003	E	SCSI Pinouts for SFF Drives	E	
SFF-8004	E	Small Form Factor 2.5" Drives	E	
SFF-8005	E	Small Form Factor 1.8" Drives	E	
SFF-8006	E	Small Form Factor 1.3" Drives	E	
SFF-8007	E	2mm Connector Alternatives	E	
SFF-8008	E	68-pin Embedded Interface for SFF Drives	E	
SFF-8009	4.1	Unitized Connector for Cabled Drives	P	
SFF-8010	E	Small Form Factor 15mm 1.8" Drives	E	
INF-8011i	E	ATA Timing Extensions for Local Bus	E	
SFF-8012	3.0	4-Pin Power Connector Dimensions	P	
SFF-8013	E	ATA Download Microcode Command	E	
SFF-8014	C	Unitized Connector for Rack Mounted Drives	C	
SFF-8015	E	SCA Connector for Rack Mounted SFF SCSI Drives	E	
SFF-8016	C	Small Form Factor 10mm 2.5" Drives	C	
SFF-8017	E	SCSI Wiring Rules for Mixed Cable Plants		
SFF-8018	E	ATA Low Power Modes	E	
SFF-8019	E	Identify Drive Data for ATA Disks up to 8 GB	E	
INF-8020i	E	ATA Packet Interface for CD-ROMs	E	
INF-8028i	E	- Errata to SFF-8020 Rev 2.5	E	
SFF-8029	E	- Errata to SFF-8020 Rev 1.2	E	
SFF-8030	1.8	SFF Committee Charter		
SFF-8031		Named Representatives of SFF Committee Members		
SFF-8032	1.5	SFF Committee Principles of Operation		
INF-8033i	E	Improved ATA Timing Extensions to 16.6 MBs	E	

INF-8034i	E	High Speed Local Bus ATA Line Termination Issues	E
INF-8035i	E	Self-Monitoring, Analysis and Reporting Technology	E
INF-8036i	E	ATA Signal Integrity Issues	E
INF-8037i	E	Intel Small PCI SIG	E
INF-8038i	E	Intel Bus Master IDE ATA Specification	E
INF-8039i	E	Phoenix EDD (Enhanced Disk Drive) Specification	E
SFF-8040	1.2	25-pin Asynchronous SCSI Pinout	P
SFF-8041	C	SCA-2 Connector Backend Configurations	C
SFF-8042	C	VHDCI Connector Backend Configurations	C
SFF-8043	E	40-pin MicroSCSI Pinout	E
SFF-8045	4.5	40-pin SCA-2 Connector w/Parallel Selection	P
SFF-8046	E	80-pin SCA-2 Connector for SCSI Disk Drives	
SFF-8047	C	40-pin SCA-2 Connector w/Serial Selection	C
SFF-8048	C	80-pin SCA-2 Connector w/Parallel ESI	C
SFF-8049	E	80-conductor ATA Cable Assembly	E
INF-8050i	1.0	Bootable CD-ROM	i
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)	i
INF-8055i	E	SMART Application Guide for ATA Interface	E
SFF-8056	C	50-pin 2mm Connector	C
SFF-8057	E	Unitized ATA 2-plus Connector	E
SFF-8058	E	Unitized ATA 3-in-1 Connector	E
SFF-8059	E	40-pin ATA Connector	E
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	C
SFF-8066	C	80-pin SCA-2 Connector w/High Voltage	C
SFF-8067	3.0	40-pin SCA-2 Connector w/Bidirectional ESI	D
INF-8068i	1.0	Guidelines to Import Drawings into SFF Specs	i
SFF-8069	E	Fax-Access Instructions	E
INF-8070i	1.3	ATAPI for Rewritable Removable Media	i
SFF-8072	1.2	80-pin SCA-2 for Fibre Channel Tape Applications	D
SFF-8073	-	20-pin SCA-2 for GBIC Applications	D
INF-8074i	1.0	SFP (Small Formfactor Pluggable) Transceiver	i
SFF-8075	1.0	PCI Card Version of SFP Cage	D
SFF-8080	E	ATAPI for CD-Recordable Media	
INF-8090i	5.4	ATAPI for DVD (Digital Video Data)	i
SFF-8101		3 Gbs and 4 Gbs Signal Characteristics	
SFF-8110	C	5V Parallel 1.8" drive form factor	
SFF-8111	1.2	1.8" drive form factor (60x70mm)	
SFF-8120	2.6	1.8" drive form factor (78x54mm)	
SFF-8200e	1.1	2 1/2" drive form factors (all of 82xx family)	P
SFF-8201e	1.3	2 1/2" drive form factor dimensions	D
SFF-8212e	1.2	2 1/2" drive w/SFF-8001 44-pin ATA Connector	P
SFF-8221	1.0	Aligned 2 1/2" drive form factor dimensions	D
SFF-8222	1.1	2 1/2" drive w/SCA-2 Connector	D
SFF-8300	1.2	3 1/2" drive form factors (all of 83xx family)	P
SFF-8301	1.4	3 1/2" drive form factor dimensions	P
SFF-8302e	1.1	3 1/2" Cabled Connector locations	P
SFF-8332e	1.2	3 1/2" drive w/80-pin SFF-8015 SCA Connector	P
SFF-8337e	1.2	3 1/2" drive w/SCA-2 Connector	P
SFF-8342e	1.3	3 1/2" drive w/Serial Unitized Connector	P
INF-8350i	6.1	3 1/2" Packaged Drives	i
SFF-8400	C	VHDCI (Very High Density Cable Interconnect)	C

SFF-8410	16.1	High Speed Serial Testing for Copper Links	D	
SFF-8411		High Speed Serial Testing for Backplanes	D	
SFF-8412	6.1	High Speed Serial Testing for Optical Links	D	
SFF-8415	2.1	HPEI (High Performance Electrical Interconnect)		
SFF-8416	0.1	HPEI Measurement of Bulk Cable		
SFF-8420	11.1	HSSDC-1 Shielded Connections	P	
SFF-8421	2.1	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	P	
SFF-8441	14.1	VHDCI Shielded Configurations	P	
SFF-8451	10.1	SCA-2 Unshielded Connections	P	
SFF-8452	3.1	Glitch Free Mating Connections for Multidrop Aps	D	
SFF-8453		Shielded High Speed Serial connectors		
SFF-8460	1.2	HSS Backplane Design Guidelines	P	
SFF-8470	1.2	Multi Lane Copper Connector	D	
SFF-8471		ZFP Multi Lane Copper Connector		D
SFF-8472	9.1	Diagnostic Monitoring Interface for Optical Xcvrs	D	
SFF-8480	2.1	HSS (High Speed Serial) DB9 Connections	P	
SFF-8500e	1.1	5 1/4" drive form factors (all of 85xx family)	P	
SFF-8501e	1.1	5 1/4" drive form factor dimensions	P	
SFF-8508e	1.1	5 1/4" ATAPI CD-ROM w/audio connectors	P	
SFF-8551	3.2	5 1/4" CD Drives form factor	D	
SFF-8572	-	5 1/4" Tape form factor	D	
SFF-8610	C	SDX (Storage Device Architecture)		C

### 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>

14426 Black Walnut Ct      408-867-6630x303  
 Saratoga                    408-867-2115Fx  
 CA 95070

### 3 General Description

The application environment for the 3.5" Drive Form Factor is any computer, cabinet, or enclosure connecting to one or more drives in a restricted packaging environment. This specification defines the location of the SAS interface connector on the 3.5" Drive Form Factor. The purpose of an SFF Specification is to provide information that will assist vendors to design products that can fit the same packaging envelope.

### 4 Definitions and Conventions

#### 4.1 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:	0.6	ISO:	0,6
	1,000		1 000
	1,323,462.9		1 323 462,9

### 5 3.5" Drive Form Factor with SAS Connector

SFF-83xx defines the location of the SAS (Serial Attached SCSI) interface connector on the 3.5" Drive Form Factor.

This specification defines a drive that can be directly inserted into the backplane of a cabinet, without the need for a cable, and provides information necessary to assist manufacturers in the systems integration of small form factor disk drives. Alternately, a cable may be used to supply power and to connect to the primary data port of the drive. This specification allows only one location for the interface connector on the drive. The location is similar to that of the Serial ATA (SATA) connector location such that a backplane with a SAS receptacle connector may accept either a SAS or SATA drive.

Provision exists in the SAS connector for improved mating via guides. Staggered pin lengths incorporate provision for mating ground prior to mating any other signals.



Table 5-1 defines the dimensions associated with the positioning of the SAS connector on the drive as illustrated in Figure 5-1.

TABLE 5-1 SAS CONNECTOR LOCATION

Dimension	Millimeters	Inches
A1	101.60	4.000
A2	42.73	1.682
A3	33.39	1.315
A4	0.40	0.016
A5	4.00	0.157
A6	0.76	0.030
A7	3.50	0.138
A8	23.60	0.929
A9	0.40	0.016
A10	1.00	0.039
A11	20.68	0.814
A12	0.38	0.015
A13	13.43	0.529

## NOTES:

- 1) Reference drawings: EIA 740 Detail, SFF 3.5" Disk Drives, SFF-8301 3.5" drive form factor dimensions, SFF-8xxx SAS Connector ???
- 2) Millimeter is the controlling dimensional unit.

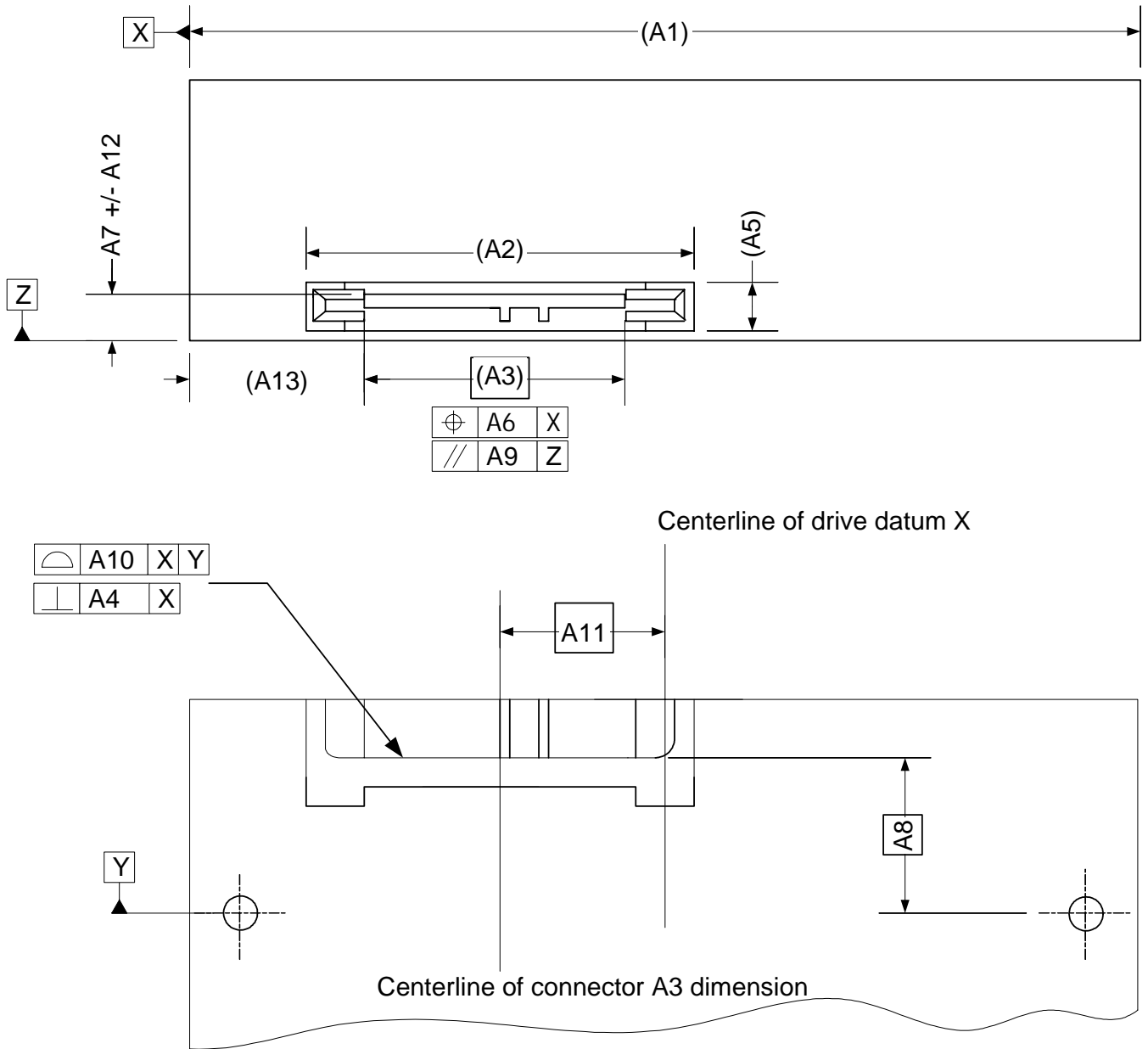


Figure 5-1 3.5" DRIVE FORM FACTOR WITH SAS CONNECTOR

SFF Committee documentation may be purchased in hard copy or electronic form.  
SFF specifications are available at <ftp://ftp.seagate.com/sff>

SFF Committee

**SFF-83xx Specification for**

**5.25" Drive Form Factor with SAS Connector**

Rev 0.1 April 27, 2002

Secretariat: SFF Committee

Abstract: This document defines the dimensions for location of the Serial Attached SCSI (SAS) connector on the 5.25" Drive Form Factor. The location is similar to that of the Serial ATA (SATA) connector location such that a backplane with a SAS receptacle connector may accept either a SAS or SATA drive.

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:

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I. Dal Allan  
Chairman SFF Committee  
14426 Black Walnut Court  
Saratoga CA 95070

Ph: 408-867-6630 Fx: 408-867-2115  
[endlcom@acm.org](mailto:endlcom@acm.org)

**EXPRESSION OF SUPPORT BY MANUFACTURERS**

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

tbd

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

tbd

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

tbd

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

Name: \_\_\_\_\_

Title: \_\_\_\_\_

Company: \_\_\_\_\_

Address: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Phone: \_\_\_\_\_

Fax: \_\_\_\_\_

Email: \_\_\_\_\_

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 #: \_\_\_\_\_

MC/Visa/AmX\_\_\_\_\_ Expires\_\_\_\_\_

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

Check Payable to SFF Committee for \$\_\_\_\_\_ (POs Not Accepted)

MC/Visa/AmX\_\_\_\_\_ Expires\_\_\_\_\_

SFF Committee  
 14426 Black Walnut Ct  
 Saratoga CA 95070

408-867-6630  
 408-867-2115Fx  
 250-1752@mcimail.com

## 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.

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1.1	Description of Clauses	7
2	REFERENCES	7
2.1	Industry Documents	7
2.2	SFF Specifications	8
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3	GENERAL DESCRIPTION	11
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4.1	Conventions	11
5	5.25" DRIVE FORM FACTOR WITH SAS CONNECTOR	11



SFF Committee --

## **5.25" Drive Form Factor with SAS Connector**

### **1 Scope**

The 85xx suite of specifications defines the configuration characteristics associated with 5.25" disk drives.

The purpose of the 85xx suite is to define the external characteristics of drives such that products from different vendors may be used in the same mounting configurations.

The set of specifications provide external dimensions, connector placement, and mounting holes to assist manufacturers in the systems integration of small form factor disk drives.

- SFF-8500 contains general information regarding connector space, mounting considerations and measurement requirements.
- SFF-8501 defines the dimensions of 5.25" disk drives.
- Other specifications in the 83xx family define the location of connectors on the 5.25" Drive Form Factors.

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 General Description.

Clause 4 contains the Definitions and Conventions.

Clause 5 contains the 5.25" Drive Form Factor with SAS 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 standards are relevant to many SFF Specifications.

- 02-157R0 SAS Proposed Serial Attached SCSI working draft
- ANSI-Y14.5M Dimension and Tolerancing
- EIA 741 Detail, SFF 5.25" Disk Drives
- SFF-8501 5 1/4" drive form factor dimensions
- SFF 8xxx SAS Connector ???

## 2.2 SFF Specifications

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SFF-8010	E	Small Form Factor 15mm 1.8" Drives	E	
INF-8011i	E	ATA Timing Extensions for Local Bus	E	
SFF-8012	3.0	4-Pin Power Connector Dimensions	P	
SFF-8013	E	ATA Download Microcode Command	E	
SFF-8014	C	Unitized Connector for Rack Mounted Drives	C	
SFF-8015	E	SCA Connector for Rack Mounted SFF SCSI Drives	E	
SFF-8016	C	Small Form Factor 10mm 2.5" Drives	C	
SFF-8017	E	SCSI Wiring Rules for Mixed Cable Plants		
SFF-8018	E	ATA Low Power Modes	E	
SFF-8019	E	Identify Drive Data for ATA Disks up to 8 GB	E	
INF-8020i	E	ATA Packet Interface for CD-ROMs	E	
INF-8028i	E	- Errata to SFF-8020 Rev 2.5	E	
SFF-8029	E	- Errata to SFF-8020 Rev 1.2	E	
SFF-8030	1.8	SFF Committee Charter		
SFF-8031		Named Representatives of SFF Committee Members		
SFF-8032	1.5	SFF Committee Principles of Operation		
INF-8033i	E	Improved ATA Timing Extensions to 16.6 MBs	E	

INF-8034i	E	High Speed Local Bus ATA Line Termination Issues	E
INF-8035i	E	Self-Monitoring, Analysis and Reporting Technology	E
INF-8036i	E	ATA Signal Integrity Issues	E
INF-8037i	E	Intel Small PCI SIG	E
INF-8038i	E	Intel Bus Master IDE ATA Specification	E
INF-8039i	E	Phoenix EDD (Enhanced Disk Drive) Specification	E
SFF-8040	1.2	25-pin Asynchronous SCSI Pinout	P
SFF-8041	C	SCA-2 Connector Backend Configurations	C
SFF-8042	C	VHDCI Connector Backend Configurations	C
SFF-8043	E	40-pin MicroSCSI Pinout	E
SFF-8045	4.5	40-pin SCA-2 Connector w/Parallel Selection	P
SFF-8046	E	80-pin SCA-2 Connector for SCSI Disk Drives	
SFF-8047	C	40-pin SCA-2 Connector w/Serial Selection	C
SFF-8048	C	80-pin SCA-2 Connector w/Parallel ESI	C
SFF-8049	E	80-conductor ATA Cable Assembly	E
INF-8050i	1.0	Bootable CD-ROM	i
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)	i
INF-8055i	E	SMART Application Guide for ATA Interface	E
SFF-8056	C	50-pin 2mm Connector	C
SFF-8057	E	Unitized ATA 2-plus Connector	E
SFF-8058	E	Unitized ATA 3-in-1 Connector	E
SFF-8059	E	40-pin ATA Connector	E
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	C
SFF-8066	C	80-pin SCA-2 Connector w/High Voltage	C
SFF-8067	3.0	40-pin SCA-2 Connector w/Bidirectional ESI	D
INF-8068i	1.0	Guidelines to Import Drawings into SFF Specs	i
SFF-8069	E	Fax-Access Instructions	E
INF-8070i	1.3	ATAPI for Rewritable Removable Media	i
SFF-8072	1.2	80-pin SCA-2 for Fibre Channel Tape Applications	D
SFF-8073	-	20-pin SCA-2 for GBIC Applications	D
INF-8074i	1.0	SFP (Small Formfactor Pluggable) Transceiver	i
SFF-8075	1.0	PCI Card Version of SFP Cage	D
SFF-8080	E	ATAPI for CD-Recordable Media	
INF-8090i	5.4	ATAPI for DVD (Digital Video Data)	i
SFF-8101		3 Gbs and 4 Gbs Signal Characteristics	
SFF-8110	C	5V Parallel 1.8" drive form factor	
SFF-8111	1.2	1.8" drive form factor (60x70mm)	
SFF-8120	2.6	1.8" drive form factor (78x54mm)	
SFF-8200e	1.1	2 1/2" drive form factors (all of 82xx family)	P
SFF-8201e	1.3	2 1/2" drive form factor dimensions	D
SFF-8212e	1.2	2 1/2" drive w/SFF-8001 44-pin ATA Connector	P
SFF-8221	1.0	Aligned 2 1/2" drive form factor dimensions	D
SFF-8222	1.1	2 1/2" drive w/SCA-2 Connector	D
SFF-8300	1.2	3 1/2" drive form factors (all of 83xx family)	P
SFF-8301	1.4	3 1/2" drive form factor dimensions	P
SFF-8302e	1.1	3 1/2" Cabled Connector locations	P
SFF-8332e	1.2	3 1/2" drive w/80-pin SFF-8015 SCA Connector	P
SFF-8337e	1.2	3 1/2" drive w/SCA-2 Connector	P
SFF-8342e	1.3	3 1/2" drive w/Serial Unitized Connector	P
INF-8350i	6.1	3 1/2" Packaged Drives	i
SFF-8400	C	VHDCI (Very High Density Cable Interconnect)	C

SFF-8410	16.1	High Speed Serial Testing for Copper Links	D	
SFF-8411		High Speed Serial Testing for Backplanes	D	
SFF-8412	6.1	High Speed Serial Testing for Optical Links	D	
SFF-8415	2.1	HPEI (High Performance Electrical Interconnect)		
SFF-8416	0.1	HPEI Measurement of Bulk Cable		
SFF-8420	11.1	HSSDC-1 Shielded Connections	P	
SFF-8421	2.1	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	P	
SFF-8441	14.1	VHDCI Shielded Configurations	P	
SFF-8451	10.1	SCA-2 Unshielded Connections	P	
SFF-8452	3.1	Glitch Free Mating Connections for Multidrop Aps	D	
SFF-8453		Shielded High Speed Serial connectors		
SFF-8460	1.2	HSS Backplane Design Guidelines	P	
SFF-8470	1.2	Multi Lane Copper Connector	D	
SFF-8471		ZFP Multi Lane Copper Connector		D
SFF-8472	9.1	Diagnostic Monitoring Interface for Optical Xcvrs	D	
SFF-8480	2.1	HSS (High Speed Serial) DB9 Connections	P	
SFF-8500e	1.1	5 1/4" drive form factors (all of 85xx family)	P	
SFF-8501e	1.1	5 1/4" drive form factor dimensions	P	
SFF-8508e	1.1	5 1/4" ATAPI CD-ROM w/audio connectors	P	
SFF-8551	3.2	5 1/4" CD Drives form factor	D	
SFF-8572	-	5 1/4" Tape form factor	D	
SFF-8610	C	SDX (Storage Device Architecture)	C	

### 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>

14426 Black Walnut Ct      408-867-6630x303  
 Saratoga                    408-867-2115Fx  
 CA 95070

### 3 General Description

The application environment for the 5.25" Drive Form Factor is any computer, cabinet, or enclosure connecting to one or more drives in a restricted packaging environment. This specification defines the location of the SAS interface connector on the 5.25" Drive Form Factor. The purpose of an SFF Specification is to provide information that will assist vendors to design products that can fit the same packaging envelope.

### 4 Definitions and Conventions

#### 4.1 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:	0.6	ISO:	0,6
	1,000		1 000
	1,323,462.9		1 323 462,9

### 5 5.25" Drive Form Factor with SAS Connector

SFF-85xx defines the location of the SAS (Serial Attached SCSI) interface connector on the 5.25" Drive Form Factor.

This specification defines a drive that can be directly inserted into the backplane of a cabinet, without the need for a cable, and provides information necessary to assist manufacturers in the systems integration of small form factor disk drives. Alternately, a cable may be used to supply power and to connect to the primary data port of the drive. This specification allows only one location for the interface connector on the drive. The location is similar to that of the Serial ATA (SATA) connector location such that a backplane with a SAS receptacle connector may accept either a SAS or SATA drive.

Provision exists in the SAS connector for improved mating via guides. Staggered pin lengths incorporate provision for mating ground prior to mating any other signals.

Table 5-1 defines the dimensions associated with the positioning of the SAS connector on the drive as illustrated in Figure 5-1.

TABLE 5-1 SAS CONNECTOR LOCATION

Dimension	Millimeters	Inches
A1	146.05	5.750
A2	42.73	1.682
A3	33.39	1.315
A4	0.40	0.016
A5	4.00	0.157
A6	0.76	0.030
A7	3.50	0.138
A8	47.50	1.870
A9	0.40	0.016
A10	1.00	0.039
A11	42.90	1.689
A12	0.38	0.015
A13	13.43	0.529

## NOTES:

- 1) Reference drawings: EIA 741 Detail, SFF 5.25" Disk Drives, SFF-8501 5 1/4" drive form factor dimensions, SFF-8xxx SAS Connector ???
- 2) Millimeter is the controlling dimensional unit.

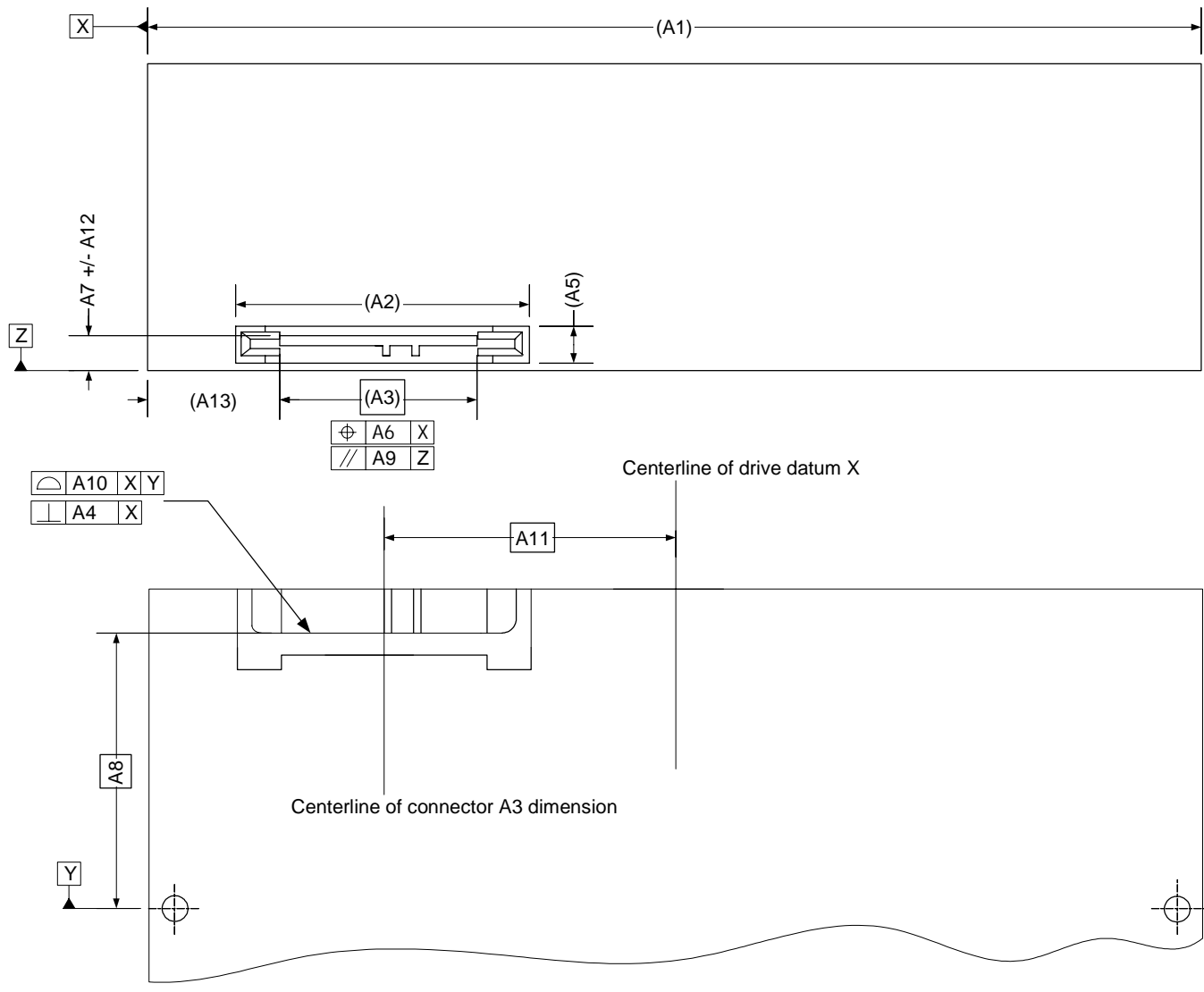


Figure 5-1 5.25" DRIVE FORM FACTOR WITH SAS CONNECTOR