SFF specifications are available at http://www.snia.org/sff/specifications
or ftp://ftp.seagate.com/sff

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:

Chairman SFF TA TWG
Email: SFF-Chair@snia.org

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

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-8085 Specification for

100 Mbs Small Formfactor Transceivers

Rev 0.9 October 8th, 2003

Secretariat: SFF Committee

Abstract: This specification defines a set of electrical, mechanical, and optical requirements for Small Formfactor transceivers operating at a nominal 100 Mbs data rate. (125 Mbs when including 4b5b encoding)

This specification provides a common definition 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 specification 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.

POINT OF CONTACT:

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

Ph: 408-867-6630
Fx: 408-867-2115
endlcom@acm.org

EXPRESSION OF SUPPORT BY MANUFACTURERS

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

Dell
ENDL
Hewlett Packard
Intel
Madison Cable
Nexans
Sun Microsystems
Toshiba America
Unisys
Vitesse Semi

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

Adaptec
Amphenol
FCI/Berg
Fujitsu CPA
Hitachi GST
IBM
Maxtor
Molex
Seagate
Tyco AMP

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. Goals were expanded to include the definition of fiber optic transceivers used to connect mass storage units together.

Adopting a common industry size, electrical and optical interface, simplifies the integration of Fibre Channel transceivers into such systems. Specifications which define the electrical and optical signals, mechanical form factor, diagnostic interfaces, and hot-plug capability are important standards for systems integrators.

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.

Membership includes voting privileges on SFF Specs under development.

CD_Access Electronic documentation contains:
- Minutes for the year-to-date plus all of last year
- Email traffic for the year-to-date plus all of last year
- The current revision of all the SFF Specifications, as well as any previous revisions distributed during the current year.

Meeting documentation contains:
- Minutes for the current meeting cycle.
- Copies of Specifications revised during the current meeting cycle.

Each electronic document mailing obsoletes the previous mailing of that year e.g. July replaces May. To build a complete set of archives of all SFF documentation, retain the last SFF CD_Access mailing of each year.

Name: _____ Title: _____

Company: _____

Address: _____

_____

Phone: _____ Fax: _____

Email: _____

Please register me with the SFF Committee for one year.

___ Voting Membership w/Electronic documentation $ 2,160

___ Voting Membership w/Meeting documentation $ 1,800

___ Non-voting Observer w/Electronic documentation $ 660 U.S.
$ 760 Overseas

___ Non-voting Observer w/Meeting documentation $ 300 U.S.
$ 400 Overseas

Check Payable to SFF Committee for $_____ is Enclosed

Please invoice me for $_____ on PO #: _____

MC/Visa/AmX_____ Expires_____

SFF Committee
14426 Black Walnut Ct
Saratoga CA 95070

408-867-6630
408-867-2115Fx
endlcom@acm.org

Foreword

When Fibre-Channel transceivers were first introduced, the devices targeted the 1.063 Gbs data rate. The resulting Small Formfactor transceiver mechanical and electrical definitions proved so popular that other data rate devices not explicitly covered have evolved.

The advantages of reusing the specifications at data rates other then those initially conceived are manifold. Mechanical housings and electrical connectors can be used across different data rates, and the potentially broad choice of product offerings from transceiver vendors allows a system integrator or an end user to provision a system with different transceivers as requirements change over time. Additional pluggable transceivers or boards containing an array of transceivers can be installed as system capacity requirements grow over time.

One such family of devices which has become popular are devices intended for OC3 (155 Mbs) data rates in Small Formfactor configurations. Transceiver vendors have struggled with the problem of making these devices compliant to the turn on time of the Gigabit Ethernet and Fibre Channel data rates, while complying with the baseline wander requirements of OC3 and 100 Mbs Ethernet specifications.

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.

1. Scope

This specification defines the set of characteristics associated Small Formfactor Fibre Optic transceivers operating at a nominal data rate of 100 Mbs.

The turn-on time specified for Small Formfactor devices is too short for analog automatic power control loops used in the simplest, lowest cost transceivers to simultaneously meet the Small Formfactor specified turn on time and at the same time meet the baseline wander requirements for 100 Mbs Ethernet and OC3 SONET.

In an effort to broaden the applications for these transceiver modules around different applications, this extension to the existing specification has been developed.

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 Glossary
- Clause 5 contains the Specific content for this Standard

2. References

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

2.1 Industry Documents

There are many industry standards associated with 100 Mbs optical transceivers, and any of those which define timing requirements are superseded by products which ship in accordance with this specification.

	MSA Original Small Formfactor
	MSA Revised Small Formfactor July 2000
INF-8074I	SFP (Small Formfactor) Pluggable Transceiver

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). As the copyright on such documents is retained by the author, the INF or 'i' specifications cannot be freely copied for distribution.

s = submitted The document is a proposal to the members for consideration to become an SFF Specification.

Spec #	Rev	List of Specifications as of May 21, 2004
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
SFF-8025	0.5	SFF Committee Specification Categories
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	1.5	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 & Reporting Technology
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	4.5	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)
SFF-8054	0.1	Automation Drive Interface Connector
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	E	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	3.2	40-pin SCA-2 Connector w/Bidirectional ESI
INF-8068i	E	Guidelines to Import Drawings into SFF Specs
SFF-8069	E	Fax-Access Instructions
INF-8070i	1.3	ATAPI for Rewritable Removable Media
SFF-8072	1.2	80-pin SCA-2 for Fibre Channel Tape Applications
SFF-8073	C	20-pin SCA-2 for GBIC Applications
INF-8074i	1.0	SFP (Small Formfactor Pluggable) Transceiver
SFF-8075	1.0	PCI Card Version of SFP Cage
SFF-8076	-	SFP Additional IDs
INF-8077i	3.1	XFP (10 Gbs Small Form Factor Pluggable Module)
SFF-8078	C	XFP-E
SFF-8079	1.3	SFP Rate and Application Selection
SFF-8080	E	ATAPI for CD-Recordable Media
SFF-8082	3.1	Labeling of Ports and Cable Assemblies
SFF-8085	0.9	100 Mbs Small Formfactor Transceivers
SFF-8089	1.0	SFP Rate and Application Selection Values
INF-8090i	5.5	ATAPI for DVD (Digital Video Data)
SFF-8101	C	3 Gbs and 4 Gbs Signal Characteristics
SFF-8110	C	5V Parallel 1.8" drive form factor
SFF-8111	1.3	1.8" drive form factor (60x70mm)
SFF-8122		1.8" (60x70mm) w/SCA-2 Connector
SFF-8120	2.6	1.8" drive form factor (78x54mm)
SFF-8123	2.1	1.8" (60x70mm) w/Serial Attachment Connector
SFF-8200e	1.1	2 1/2" drive form factors (all of 82xx family)
SFF-8201	2.2	2 1/2" drive form factor dimensions
SFF-8212e	1.2	2 1/2" drive w/SFF-8001 44-pin ATA Connector
SFF-8221	3.4	Pre-Aligned 2.5" Drive >10mm Form Factor
SFF-8222	2.0	2.5" Drive w/SCA-2 Connector
SFF-8223	2.2	2.5" Drive w/Serial Attachment Connector
SFF-8225	C	2.5" Single Voltage Drive
SFF-8300	1.2	3 1/2" drive form factors (all of 83xx family)
SFF-8301	1.4	3 1/2" drive form factor dimensions
SFF-8302e	1.1	3 1/2" Cabled Connector locations
SFF-8323	1.2	3 1/2" drive w/Serial Attachment Connector
SFF-8332e	E	3 1/2" drive w/80-pin SFF-8015 SCA Connector
SFF-8337e	E	3 1/2" drive w/SCA-2 Connector
SFF-8342e	1.3	3 1/2" drive w/Serial Unitized Connector
INF-8350i	E	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
INF-8411	1.0	High Speed Serial Testing for Backplanes
SFF-8412	12.2	HSOI (High Speed Optical Interconnect) Testing
SFF-8415	4.1	HPEI (High Performance Electrical Interconnect)
SFF-8416	10.0	HPEI Bulk Cable Measurement/Performance Reqmnts

SFF-8420	11.1	HSSDC-1 Shielded Connections
SFF-8421	2.4	HSSDC-2 Shielded Connections
SFF-8422	C	FCI Shielded Connections
SFF-8423	C	Molex Shielded Connections
SFF-8424	0.5	Dual Row HSSDC-2 Shielded Connections
SFF-8425	1.4	Single Voltage 12V Drives
SFF-8426		HSSDC Double Width
SFF-8429		Signal Specification Architecture for HSS Links
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-8453		Shielded High Speed Serial connectors
SFF-8460	1.2	HSS Backplane Design Guidelines
SFF-8464		Improved MM HSS Optical Link Performance
SFF-8470	2.9	Multi Lane Copper Connector
SFF-8471	C	ZFP Multi Lane Copper Connector
SFF-8472	9.4	Diagnostic Monitoring Interface for Optical Xcvrs
INF-8475i	2.2	XPAK Small Formfactor Pluggable Receiver
SFF-8480	2.1	HSS (High Speed Serial) DB9 Connections
SFF-8482	1.3	Internal Serial Attachment Connector
SFF-8483	C	External Serial Attachment Connector
SFF-8484	0.4	Multi Lane Internal Serial Attachment Connector
SFF-8485	0.3	Serial GPIO (General Purpose Input/Output) Bus
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-8523	1.2	5 1/4" drive w/Serial Attachment Connector
SFF-8551	3.2	5 1/4" CD Drives form factor
SFF-8552	0.5	5 1/4" Slimline Optical Drive Form Factor
SFF-8572	C	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.

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

SFF specifications are available at ftp://ftp.seagate.com/sff

Electronic copies of documents are also made available via CD_Access, a service which provides copies of all the specifications plus SFF reflector traffic. CDs are mailed every 2 months as part of the document service, and provide the letter ballot and paper copies of what was distributed at the meeting as well as the meeting minutes.

3. General Description

The environment for this SFF Specification includes any 100 Mbs Small Formfactor optical transceiver.

4. Definitions and Conventions

4.1 Definitions

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

4.1.1 Optional: This term describes features which are not required by the SFF Specification. However, if any feature defined by the SFF Specification is implemented, it shall be done in the same way as defined by the Specification.

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

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

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

4.2 Conventions

If there is a conflict between text and tables on a feature described as optional, the table shall be accepted as being correct.

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

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

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

American:	ISO:
0.1	0,6
1,000	1 000
1,323,462.9	1 323 462,9

TABLE OF CONTENTS

Page numbers not accurate in this revision

5. 100 Mbs Small Formfactor Transceiver Description.

5.1 Mechanical and Optical Interface. The mechanical and optical interfaces shall be defined by the Small Formfactor specifications and INF-8074i as referenced in 2.1.

5.2 Electrical Interface.

5.2.1 Timing Requirements

Table 1 below shows the timing requirements for the 100 Mbs version of Small Formfactor device types. The contents of Table 1 have been taken from INF-8074i, and the t_on time parameter increased to 10 msec. This is to allow the RC time constant of analog power control loops in the transmit sections of these types of transmitters to both meet the baseline wander requirements and t_on time requirements.

Table 1 Timing Requirements

Parameter	**Symbol**	**Min**	**Max**	**Unit**	**Condition**
TX Disable NegateTime	t_on		10	msec	Time from falling edge of TX Disable to when the modulated optical output rises above 90% of nominal

All other timing and electrical specifications are the same as in INF-8074i.