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
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
endicom@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                         408-867-6630
14426 Black Walnut Ct                 408-867-2115Fx
Saratoga   CA 95070                    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 than 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.

<table>
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<th>Code</th>
<th>Status</th>
<th>Description</th>
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<td>The document has been approved by the members for forwarding to a formal standards body.</td>
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<tr>
<td>P</td>
<td>Published</td>
<td>The document has been balloted by members and is available as a published SFF Specification.</td>
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<td>A</td>
<td>Approved</td>
<td>The document has been approved by ballot of the members and is in preparation as an SFF Specification.</td>
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<tr>
<td>C</td>
<td>Canceled</td>
<td>The project was canceled, and no Specification was Published.</td>
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<td>D</td>
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<td>The document is under development at SFF.</td>
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<tr>
<td>E</td>
<td>Expired</td>
<td>The document has been published as an SFF Specification, and the members voted against re-publishing it when it came up for annual review.</td>
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<tr>
<td>e</td>
<td>electronic</td>
<td>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</td>
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</table>
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.

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

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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
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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 E SMART Application Guide for SCA Interface
SFF-8075 1.0 PCI Card Version of SFF Cage
SFF-8076 E 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
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SFF-8337e E 3 1/2" drive w/SCA-2 Connector
SFF-8342e 1.3 3 1/2" drive w/Serial Unitized Connector
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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 Regmnts
SFF-8420 11.1 HSSDC-1 Shielded Connections
SFF-8421 2.4 HSSDC-2 Shielded Connections
SFF-8422 C FCI Shielded Connections
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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-84751 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.

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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>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Min</th>
<th>Max</th>
<th>Unit</th>
<th>Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>TX Disable NegateTime</td>
<td>t_on</td>
<td>10</td>
<td>msec</td>
<td></td>
<td>Time from falling edge of TX Disable to when the modulated optical output rises above 90% of nominal</td>
</tr>
</tbody>
</table>

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