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Information technology –
High-Performance Parallel Interface –

Part 9:
Serial Specification (HIPPI-Serial)

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Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work.

In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1. Draft International Standards adopted by the joint technical committee are circulated to national bodies for voting. Publication as an International Standard requires approval by at least 75% of the national bodies casting a vote.

International Standard ISO/IEC 11518-9 was prepared by subcommittee 25: *Interconnection of information technology equipment*, of ISO/IEC Joint Technical Committee 1: *Information technology.*

ISO/IEC 11518 consists of the following parts, under the general title *Information technology – High-Performance Parallel Interface:*

- *Part 1: Mechanical, electrical, and signalling protocol specification (HIPPI-PH)*
- *Part 2: Framing Protocol (HIPPI-FP)*
- *Part 3: Encapsulation of ISO/IEC 8802-2 (IEEE Std 802.2) Logical Link Control Protocol Data Units (HIPPI-LE)*
- *Part 4: Mapping of HIPPI to IPI device generic command sets (HIPPI-IPI)*
- *Part 5: Memory Interface (HIPPI-MI)*
- *Part 6: Physical Switch Control (HIPPI-SC)*
- *Part 8: Mapping to Asynchronous Transfer Mode (HIPPI-ATM)*
- *Part 9: Serial Specification (HIPPI-Serial)*

Annexes A to E of this part of ISO/IEC 11518 are for information only.

Introduction

This High-Performance Parallel Interface, Serial Specification (HIPPI-Serial), defines a physical-level interface for transmitting digital data at 800 Mbit/s or 1 600 Mbit/s serially over fibre-optic cables across distances of up to 10 km. The signalling sequences and protocol used are compatible with HIPPI-PH, ISO/IEC 11518-1, which is limited to 25 m distances. HIPPI-Serial may be integrated as a host's native interface, or used as an external extender for HIPPI-PH ports.

Characteristics of a HIPPI Serial interface include:

- Point-to-point connections use one or two pairs of fibre-optic cables for distances of up to 10 km.
- Long wavelength and short-wavelength optics options.
- May be used in a simplex or duplex configuration.
- Support for 800 Mbit/s or 1 600 Mbit/s data rates.
- Use as an integrated host interface without an intervening HIPPI-PH is supported.
- Use as an external extender for HIPPI-PH ports is supported.
- The coding scheme provides low-latency, automatic link reset, and robust operation.

Information technology –
High-Performance Parallel Interface –

Part 9:
Serial Specification (HIPPI-Serial)

1 Scope

This part of ISO/IEC 11518 specifies a physical-level interface for transmitting digital data at 800 Mbit/s or 1 600 Mbit/s serially over fibre-optic cables across distances of up to 10 km. The signalling sequences and protocol used are compatible with HIPPI-PH, ISO/IEC 11518-1, which is limited to 25 m distances. HIPPI-Serial may be integrated as a host's native interface or used as an external extender for HIPPI-PH ports.

Specifications are included for:

- the encoding and serialisation of the parallel data;
- the sequence of signals required for link reset;
- the timing and optical requirements of the serial signals;
- 32-bit (800 Mbit/s, 100 MByte/s) and 64-bit (1 600 Mbit/s, 200 MByte/s) operation;
- simplex and dual simplex operation.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO/IEC 11518. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of ISO/IEC 11518 are encouraged to investigate the possibility of applying the most recent edition of the standards listed below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO/IEC 11518-1:1995, *High-Performance Parallel Interface – Part 1: Mechanical, electrical, and signalling protocol specification (HIPPI-PH)*

ISO/IEC 14165-111:199x, *Fibre Channel – Part 111: Physical and Signalling Interface (FC-PH)*

ITU-T G.652: *Characteristics of a single mode optical fibre cable*

IEC 61300-3-6: *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3-6: Examinations and measurements – Return loss*

IEC 61280-1-3: *Fibre optic communication subsystem basic test procedures – Part 1-3: Test procedures for general communication subsystems – Central wavelength and spectral width measurement*

IEC 61280-2-1: *Fibre optic communication subsystem basic test procedures – Part 2-1: Test procedures for digital systems – Receiver sensitivity and overload measurement*

3 Definitions and conventions

3.1 Definitions

For the purposes of this standard, the following definitions apply.

3.1.1
attenuation
The power loss expressed in units of dB.

3.1.2
average power
The optical power measured using an average reading power meter when transmitting continuous valid information.

3.1.3
bit error rate (BER)
The statistical probability of a transmitted bit being erroneously received in a communication system. The BER is measured by counting the number of erroneous bits at the output of the receiver and dividing by the total number of bits.

3.1.4
B0-B19
Bits in the 20-bit data field.

3.1.5
centre wavelength (laser)
The nominal value of the central operating wavelength, defined by a peak mode measurement. (See IEC 61280-1-3.)

3.1.6
coding nibble
The 4 bits appended to a 20-bit data field to form a frame. They signal data inversion, indicate fill frames, and supply the Master Transition.

3.1.7
D0-D31, D32-D63
Bits in the 32-bit, and extension for 64-bit, parallel HIPPI word.

3.1.8
data field
The 20-bit data portion of a 24-bit frame.

3.1.9
debounced signal
A signal that has been converted from an intermittent signal to a stable one. (See 7.2.)

3.1.10
Destination
A HIPPI-PH Destination.

3.1.11
extinction ratio
The ratio, expressed in units of dB of the low, or “off” optical power level (PL), to the high, or “on” optical power level (PH), when the station is transmitting valid information.

3.1.12
fibre-optic test procedure (FOTP)
Standards developed and published by the Electronic Industries Association (EIA) under the EIA-RS-455 series of standards.

3.1.11
fibre plant
All of the optical elements, for example, fibre, connectors, splices, etc., between an optical transmitter and an optical receiver.

3.1.14
frame
24 bits consisting of a 20-bit data field and 4-bit coding nibble.

3.1.15

functional unit
A functional partition of the entire system. Partitioning is for the purpose of explanation only. Implementers are free to combine or divide functional units.

3.1.16
HIPPI-PH
High-Performance Parallel Interface – Mechanical, Electrical, and Signalling Protocol Specification (HIPPI-PH), ISO/IEC 11518-1. Data is transmitted in parallel over copper twisted-pair cables.

3.1.17
HIPPI port
A HIPPI-PH Source or Destination.

3.1.18
link
One way serial connection between HIPPI-Serial devices.

3.1.19

Master Transition
A bit transition that always appears between the second and third bits of the coding nibble.

3.1.20
mean launch power
The average optical power for a continuous valid information stream coupled into a fibre.

3.1.21
Optical Fibre System Test Practice (OFSTP)
Standards developed and published by the Electronics Industries Association (EIA) under the EIA/TIA-526 series of standards.

3.1.22
optical return loss
The ratio (expressed in units of dB) of optical power reflected by a component or an assembly to the optical power incident on a component port when that component or assembly is introduced into a link or system.
(See IEC 61300-3-6 method 1.)

3.1.23
optional
Characteristics that are not required by HIPPI-Serial. However, if any optional characteristic is implemented, it shall be implemented as defined in HIPPI-Serial.

3.1.24
Overhead bit (OH1-OH8)
A bit, local to the HIPPI-Serial hardware, which is transmitted along with the HIPPI-PH data over the serial link to provide extra capacity for control and maintenance functions.

3.1.25
Receiver Link Interface (RLI)
A functional unit that deserialises and decodes the serial input data into 20-bit data fields.

3.1.26
Source
A HIPPI-PH Source.

3.1.27
spectral width (RMS)
The root mean square (RMS) width of the Active Output interface optical spectrum.
(See IEC 61280-1-3.)

3.1.28
SUBMUX, SUBDEMUX
Functional units that combine (extract) the CONNECT, READY, and Overhead bits for transmission across the serial links as bits M0 and M1.

3.1.29
time slot
a contiguous group of 16 frame pairs. Note that a frame pair contains one 40-bit word.

3.1.30
Transmitter Link Interface (TLI)
A functional unit that encodes and serialises 20-bit data fields, preparing them for serial transmission.

3.1.31
unit
See functional unit.

3.1.32
XDEMUX
A functional unit that decodes two 20-bit data fields into HIPPI data and control signals.

3.1.33
XMUX
A functional unit that encodes the HIPPI data and control signals into two 20-bit data fields.

3.2 Editorial conventions

In this standard, certain terms that are proper names of signals or similar terms are printed in uppercase to avoid possible confusion with other uses of the same words (e.g. FLAG). Any lowercase uses of these words have the normal technical English meaning.

A number of conditions, sequence parameters, events, states or similar terms are printed with the first letter of each word in uppercase and the rest lowercase (e.g. State, Source). Any lowercase uses of these words have the normal technical English meaning.

The word *shall*, when used in this standard, states a mandatory rule or requirement. The word *should*, when used in this standard, states a recommendation.

3.3 Acronyms and other abbreviations

BER	bit error rate
dB	decibel
dBm	decibel (relative to 1 mW power)
FOTP	Fibre Optic Test Procedure
HIPPI	High-Performance Parallel Interface
LLRC	Length/Longitudinal Redundancy Checkword
ns	nanoseconds
nm	nanometers
OFSTP	Optical Fibre System Test Practice
PLL	phase locked loop
PRBS	pseudo random bit sequence
RIN	relative intensity noise
RLI	Receiver Link Interface
RMS	root mean square
SUBMUX	Sub Multiplexer
SUBDEMUX	Sub De-Multiplexer
TLI	Transmitter Link Interface
UI	Unit interval = 1 bit period
XDEMUX	Receive De-Multiplexer
XMUX	Transmit Multiplexer
µs	microseconds
Ω	ohms

4 System overview

The HIPPI-Serial provides a serial communication facility for HIPPI. The primary purpose of HIPPI-Serial is to extend the physical range of HIPPI beyond 25 m. A secondary purpose is to replace the parallel HIPPI-PH cable and connectors with a fibre-optic cable.

The primary characteristics of HIPPI-Serial are:

Signalling Rate	1,2 GBaud
Maximum station separation:	10 km
Bit-Error Rate	$\leq 10^{-12}$
64-Bit (1 600 Mbit/s) HIPPI supported by two HIPPI-Serials in parallel	
HIPPI simplex or dual simplex operation	

Since error rates are specified to be at or below 10^{-12}, forward error correction, error correcting codes and CRCs are not addressed in this specification. If additional error detection is deemed necessary, it shall be included as part of the higher-level protocols.

4.1 Functional units

Figure 1 is an example showing functional unit building blocks that may be used in a HIPPI-Serial implementation. This specification is written in terms of the functional units shown in figure 1. However, implementers are free to split or combine functions as they choose. This document does not intend to specify any of the interfaces between functional units. The only requirement for compatibility is that the external functionality, at the serial optical interfaces, conform to the overall functionality specified in this document.

4.2 HIPPI-PH signals

The HIPPI-PH Source and Destination signals shown in figure 1 shall conform to the signalling protocol specified in ISO/IEC 11518-1, HIPPI-PH. These HIPPI-PH signals do not need to conform to the HIPPI-PH mechanical and electrical specifications. The HIPPI-PH INTERCONNECT signals shall not be transported over the serial link to the remote end.

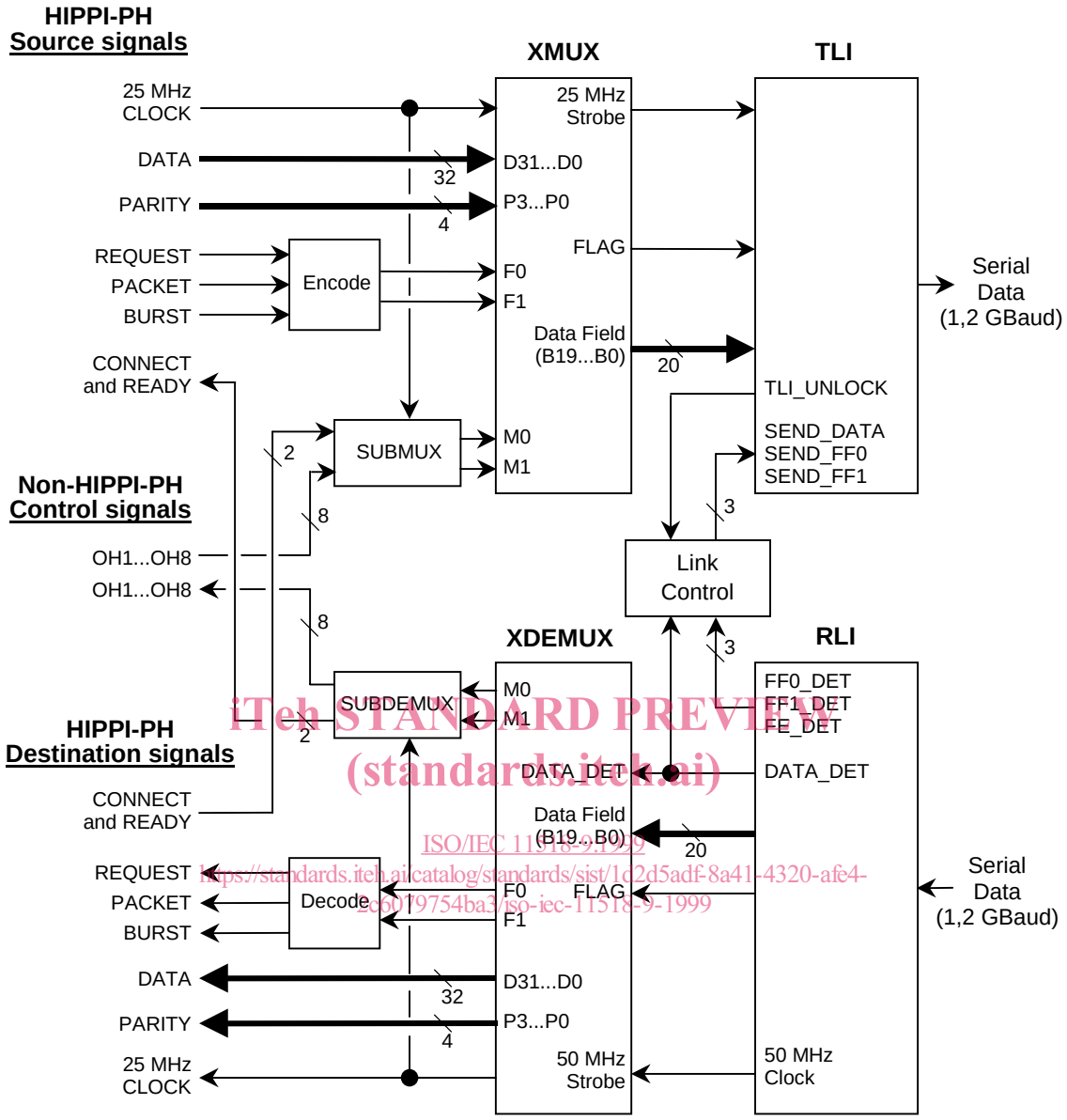

Figure 1 – 32-bit, dual-simplex, HIPPI-Serial functional units example