

# INTERNATIONAL STANDARD

# ISO/IEC 11518-10

First edition  
2001-03

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**Information technology –  
High-performance parallel interface**

**Part 10:  
6 400 Mbit/s Physical Layer (HIPPI-6400-PH)**

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## INFORMATION TECHNOLOGY – HIGH-PERFORMANCE PARALLEL INTERFACE –

### Part 10: 6 400 Mbit/s Physical Layer (HIPPI-6400-PH)

#### FOREWORD

- 1) ISO (International Organization for Standardization) and IEC (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.
- 2) In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC1. 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.
- 3) Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. ISO and IEC shall not be held responsible for identifying any or all such patent rights.

International Standard ISO/IEC 11518-10 was prepared by subcommittee 25: Interconnection of information technology equipment, of ISO/IEC joint technical committee 1: Information technology.

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This publication has been drafted in accordance with the ISO/IEC Directives, Part 3.

ISO/IEC 11518 consists of the following parts, under the general title *Information technology – High-Performance Parallel Interface: ISO/IEC 11518-10:2001*

- *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) <sup>1)</sup>*
- *Part 5: Memory Interface (HIPPI-MI) <sup>1)</sup>*
- *Part 6: Physical Switch Control (HIPPI-SC)*
- *Part 8: Mapping to Asynchronous Transfer Mode (HIPPI-ATM)*
- *Part 9: Serial Specification (HIPPI-Serial)*
- *Part 10: 6 400 Mbit/s Physical Layer (HIPPI-6400-PH)*
- *Part 11: 6 400 Mbit/s Physical Switch Control (HIPPI-6400-SC) <sup>1)</sup>*
- *Part 12: 6 400 Mbit/s Optical Specification (HIPPI-6400-OPT) <sup>1)</sup>*

Annex A is for information only.

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<sup>1)</sup> Under consideration.

## INTRODUCTION

Characteristics of a HIPPI-6400-PH physical-layer interface include:

- user data transfer bandwidth of 6 400 Mbit/s (800 MByte/s);
- a full-duplex link capable of independent full-bandwidth transfers in both directions simultaneously;
- four virtual circuits providing a limited multiplexing capability;
- a fixed-size transfer unit, i.e., a 32-byte micropacket, for hardware efficiency;
- a small transfer unit resulting in low latency for short Messages, and a component for large transfers;
- credit-based flow control that prevents buffer overflow;
- end-to-end, as well as link-to-link, checksums;
- automatic retransmission to correct flawed data providing guaranteed, in-order, reliable, data delivery;
- an a.c. coupled parallel electrical interface for driving parallel copper cable over limited distances;
- a parallel electrical interface for driving a local optical interface for longer distances.

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## INFORMATION TECHNOLOGY – HIGH-PERFORMANCE PARALLEL INTERFACE –

### Part 10: 6 400 Mbit/s Physical Layer (HIPPI-6400-PH)

#### 1 Scope

This part of ISO/IEC 11518 specifies a physical-level, point-to-point, full-duplex, link interface for reliable, flow-controlled transmission of user data at 6 400 Mbit/s per direction, across distances of up to 1 km. A parallel copper cable interface for distances of up to 40 m is specified. Connections to a separate longer-distance optical interface are provided. Small fixed-size micropackets provide an efficient, low-latency structure for small transfers, and a component for large transfers.

Specifications are included for:

- automatic retransmission to correct flawed data;
- the format of a small data transfer unit called a micropacket;
- a message structure that includes routing information for network applications;
- end-to-end, as well as link-to-link, checksums;
- the timing requirements of the parallel signals;
- a parallel interface using copper coaxial cable;
- connections to a separate local optical interface;
- a link-level protocol tuned for a maximum distance of 1 km.

#### 2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO/IEC 11518. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, 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 normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO/IEC TR 8802 (all parts), *Information technology – Telecommunications and information exchange between systems – Local and metropolitan area networks – Specific requirements*

ISO/IEC TR 8802-1:1997, *Information technology – Telecommunications and information exchange between systems – Local and metropolitan area networks – Specific requirements – Part 1: Overview of Local Area Network Standards*

ISO/IEC 8802-2:1998, *Information technology – Telecommunications and information exchange between systems – Local and metropolitan area networks – Specific requirements – Part 2: Logical link control*

ISO/IEC 15802-3:1998, *Information technology – Telecommunications and information exchange between systems – Local and metropolitan area networks – Common specifications – Part 3: Media Access Control (MAC) Bridges*

### 3 Definitions and conventions

#### 3.1 Definitions

For the purposes of this part of ISO/IEC 11518, the following definitions apply.

##### 3.1.1

##### **acknowledge (ACK)**

confirmation that the Destination has received the micropacket without errors

##### 3.1.2

##### **administrator**

station management entity providing external management control

##### 3.1.3

##### **credit**

credit corresponds to one micropacket's worth of buffer space available in the Destination's VC buffer

##### 3.1.4

##### **destination**

receiving end of a physical link

##### 3.1.5

##### **element**

component of a HIPPI-6400 system that is able to receive, process, and send Admin micropackets

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##### 3.1.6

##### **final destination**

end device that receives, and operates on, the data payload portion of the micropackets

This is typically a host computer system, but may also be a non-transparent translator, bridge, or router.

##### 3.1.7

##### **link**

full-duplex connection between HIPPI-6400-PH devices

##### 3.1.8

##### **log**

act of making a record of an event for later use

##### 3.1.9

##### **message**

ordered sequence of one or more micropackets that have the same VC, Originating Source, and Final Destination

Messages are the basic transfer unit between an Originating Source and a Final Destination. The first micropacket of a Message is a Header micropacket. The last micropacket, which may also be the first micropacket, has the TAIL bit set (see 4.5).

##### 3.1.10

##### **micropacket**

basic transfer unit, between a Source and Destination, consisting of 32 data bytes and 64 bits of control information (see 4.4)

### 3.1.11

#### **next-layer**

protocols above the service interface

These could be implemented in hardware or software, or they could be distributed between the two.

### 3.1.12

#### **optional**

characteristics that are not required by HIPPI-6400-PH

However, if any optional characteristic is implemented, it shall be implemented as defined in HIPPI-6400-PH.

### 3.1.13

#### **originating source**

end device that generates the data payload portion of the micropackets

This is typically a host computer system, but may also be a non-transparent translator, bridge, or router.

### 3.1.14

#### **source**

sending end of a physical link

### 3.1.15

#### **station management (SMT)**

supervisory entity that monitors and controls the HIPPI-6400-PH entity

### 3.1.16

#### **syndrome**

value (should be zero if no error) obtained by exclusive ORing the calculated CRC value with the CRC value received with the micropacket

### 3.1.17

#### **Universal LAN MAC Address (ULA)**

logical address stored in a Source or Destination field that uniquely identifies an Originating Source or Final Destination

The ULA conforms to the 48-bit MAC address specified by ISO/IEC 8802-1.

### 3.1.18

#### **Virtual Channel (VC)**

one of four logical paths within each direction of a single link

## 3.2 Editorial conventions

In this part of ISO/IEC 11518, certain terms that are proper names of signals or similar terms are printed in upper case to avoid possible confusion with other uses of the same words (e.g., FRAME). Any lower case 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 upper case and the rest lower case (e.g., Block, Source). Any lower case uses of these words have the normal technical English meaning.

The word *shall*, when used in this part of ISO/IEC 11518, states a mandatory rule or requirement. The word *should*, when used in this part of ISO/IEC 11518, states a recommendation.

### 3.2.1 Binary notation

Binary notation is used to represent relatively short fields. For example a two-bit field containing the binary value of 10 is shown in binary format as b'10'.

### 3.2.2 Hexadecimal notation

Hexadecimal notation is used to represent some fields. For example a two-byte field containing a binary value of b'1100010000000011' is shown in hexadecimal format as x'C403'.

### 3.3 Acronyms and abbreviations

ACK	acknowledge indication
CR	credit amount parameter
CRC	cyclic redundancy check
DSAP	Destination Service Access Protocol
ECRC	end-to-end CRC
HIPPI	High-Performance Parallel Interface
K	kilo ( $2^{10}$ or 1024)
LCRC	link CRC
LLC	Logical Link Control
lsb	least significant bit
M	mega ( $10^6$ )
MAC	Media Access Control
ms	milliseconds
msb	most significant bit
ns	nanoseconds
ps	picoseconds
RSEQ	receive sequence number
SMT	station management
SNAP	SubNetwork Access Protocol
SSAP	Source Service Access Protocol
TSEQ	transmit sequence number
ULA	Universal LAN Address
VC	Virtual Channel
VCR	Virtual Channel Credit selector
µs	microseconds
Ω	ohms

## 4 System overview

### 4.1 Overview

This clause provides an overview of the structure, concepts, and mechanisms in HIPPI-6400-PH. Figure 1 shows an example HIPPI-6400 system.

### 4.2 Links

HIPPI-6400-PH defines a point-to-point physical link for transferring micropackets. The physical links, as shown in figure 2 between a local end and a remote end, are bi-directional. The logical links are simplex, i.e., the data inbound and outbound are completely separate. Some control information, e.g., credit, flows in the reverse direction, and it is included in the micropackets flowing in the reverse direction. This is why the physical links must be bi-directional with information flowing in both directions simultaneously.

A link is composed of two Sources that transmit information, and two Destinations that receive information. Each end of a link has a Source and a Destination.

The data path is 16 bits wide for the copper implementation, and is 8 bits wide for a fibre implementation. The control path is one-fourth the width of the data path, e.g., the control path for the copper implementation is 4 bits wide. CLOCK, CLOCK\_2, and FRAME are individual signals carried on separate conductors. The CLOCK\_2 signal is only used in 16-bit systems.

### 4.3 Virtual Channels

Four Virtual Channels, VC0, VC1, VC2, and VC3 are available in each direction on each link. The VCs are assigned to specific Message sizes and transfer methods.

All of the micropackets of a Message are transmitted on a single VC, i.e., the VC number does not change as the micropackets travel from the Originating Source to the Final Destination over one or more links. Messages to a Final Destination are delivered in order on a single VC. Multiple messages may be out of order if sent over different VCs-even if the VCs are in the same physical link. The VCs provide a multiplexing mechanism that can be used to prevent a large Message from Blocking a small Message until the large Message has completed.

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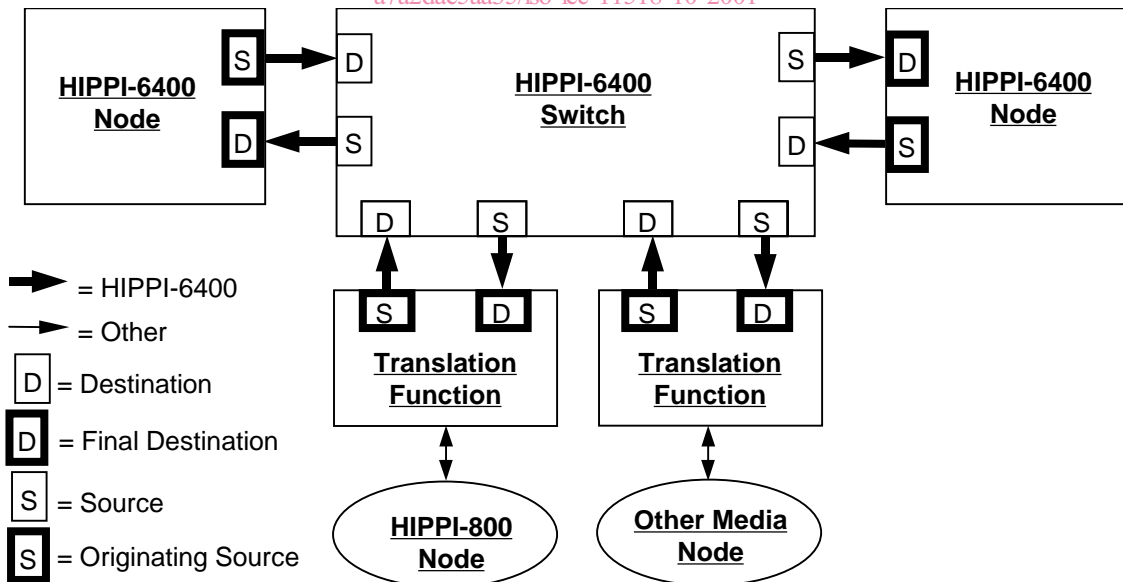


Figure 1 – System overview

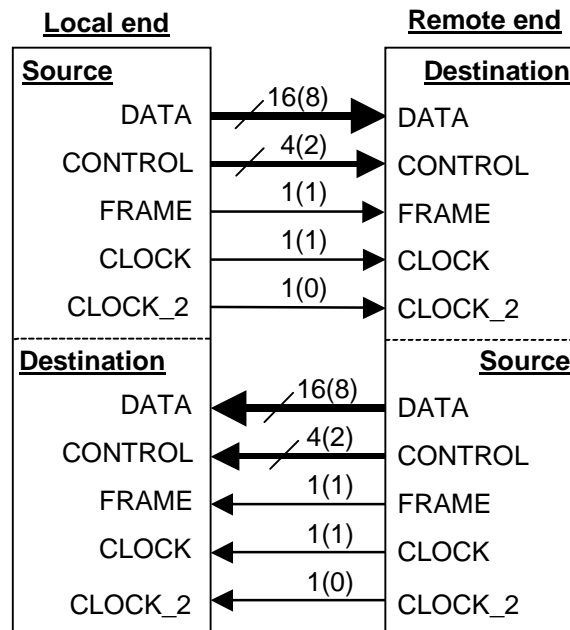


Figure 2 – HIPPI-6400-PH link showing signal lines

#### 4.4 Micropacket

Micropackets are the basic transfer unit from Source to Destination on a link. As shown in figure 3, a micropacket is composed of 32 data bytes and 64 bits of control information. At 6 400 Mbit/s a micropacket is transmitted every 40 ns, with Null micropackets transmitted when other micropackets are not available. Credit and retransmit operations are performed on a micropacket basis.

The 64 bits of control information in each micropacket includes parameters for:

- selecting a VC;
- detecting missing micropackets;
- denoting the types of information in the micropacket;
- marking the last micropacket of a Message;
- signaling that the Message was truncated at its originator, or damaged en-route;
- passing credit information from the Destination to the Source;
- Link-level and end-to-end checksums.