



FIPS PUB 130

NBS
PUBLICATIONS

REFERENCE



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**FEDERAL INFORMATION
PROCESSING STANDARDS PUBLICATION**

1987 JULY 16

U.S. DEPARTMENT OF COMMERCE/National Bureau of Standards



**INTELLIGENT PERIPHERAL
INTERFACE (IPI)**

**CATEGORY: HARDWARE STANDARD
SUBCATEGORY: INTERFACE**

FIPS PUB 130

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No. 130
1987

U.S. DEPARTMENT OF COMMERCE, Malcolm Baldrige, *Secretary*
NATIONAL BUREAU OF STANDARDS, Ernest Ambler, *Director*

Foreword

The Federal Information Processing Standards Publication Series of the National Bureau of Standards is the official publication relating to standards, guidelines, and documents adopted and promulgated under the provisions of Public Law 89-306 (Brooks Act) and under Part 6 of Title 15, Code of Federal Regulations. These legislative and executive mandates have given the Secretary of Commerce important responsibilities for improving the utilization and management of computers and automatic data processing in the Federal Government. To carry out the Secretary's responsibilities, the NBS, through its Institute for Computer Sciences and Technology, provides leadership, technical guidance, and coordination of Government efforts in the development of standards, guidelines and documents in these areas.

Comments concerning Federal Information Processing Standards Publications are welcomed and should be addressed to the Director, Institute for Computer Sciences and Technology, National Bureau of Standards, Gaithersburg, MD 20899.

James H. Burrows, *Director*
Institute for Computer Sciences and Technology

Abstract

This standard defines the functional, electrical, and mechanical specifications for a 16-bit parallel master/slave bus interface, suitable for connecting a host computer or controller to mass storage peripherals. This standard also provides the following command set specifications:

- a. Device Specific Command Set for Magnetic Disk Drives
- b. Device Generic Command Set for Magnetic and Optical Disks
- c. Command Set for Generic Tape

This standard facilitates plug-to-plug interchangeability of storage equipment as a part of computer systems. The Government's intent in employing this standard is to reduce the cost of satisfying its data processing requirements through increasing its available alternative sources of supply for computer system components at the time of initial system acquisition, as well as in system replacement and augmentation and in system component replacement. This standard is also expected to lead to improved reutilization of system components.

Key words: automatic data processing (ADP); computer peripherals; computers; controller; Federal Information Processing Standard (FIPS); input/output; Intelligent Peripheral Interface (IPI); interfaces; magnetic disk; magnetic tape; mass storage interface.

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1987 July 16

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1987



Announcing the Standard for

INTELLIGENT PERIPHERAL INTERFACE (IPI)

Federal Information Processing Standards Publications (FIPS PUBS) are issued by the National Bureau of Standards pursuant to section 111 (f) (2) of the Federal Property and Administrative Services Act of 1949, as amended, Public Law 89-306 (79 Stat. 1127), Executive Order 11717 (38 FR 12315, dated May 11, 1973), and Part 6 of Title 15 Code of Federal Regulations (CFR).

1. **Name of Standard.** Intelligent Peripheral Interface (IPI) (FIPS PUB 130).
2. **Category of Standard.** Hardware Standard, Interface.
3. **Explanation.** This standard defines the functional, electrical, and mechanical specifications for a 16-bit parallel master/slave bus interface, suitable for connecting a host computer or controller to mass storage peripherals. This standard also provides the following command set specifications:
 - a. Device Specific Command Set for Magnetic Disk Drives for interconnecting one to eight disk drives acting as an IPI "bus slave" to a storage controller acting as an IPI "bus master." This command set places the minimum function in the drive which is consistent with a parallel bus interface; that is, data encoding/separation, serialization/deserialization, and sector or block format control.
 - b. Device Generic Command Set for Magnetic and Optical Disks for higher level command set for interconnecting a host computer, acting as an IPI bus master, and either a storage controller or a drive with an embedded storage controller, acting as an IPI bus slave.
 - c. Command Set for Generic Tape for interconnecting a host computer, which functions as bus master, and one to eight tape storage controllers, which function as bus slaves.

This standard facilitates plug-to-plug interchangeability of storage equipment as a part of computer systems. This standard may be employed in lieu of FIPS PUB 60 and FIPS PUB 61, plus associated operational specifications (FIPS PUB 62, FIPS PUB 63, or FIPS PUB 97), whenever they would otherwise be required. Its use is encouraged for the connection of mass storage devices such as magnetic disk, optical disk, or tape drives, to minicomputer systems, where FIPS PUB 60 is not required.

The Government's intent in employing this standard is to reduce the cost of satisfying its data processing requirements through increasing its available alternative sources of supply for computer system components at the time of initial system acquisition, as well as in system replacement and augmentation and in system component replacement. This standard is also expected to lead to improved reutilization of system components.

4. **Approving Authority.** Secretary of Commerce.
5. **Maintenance Agency.** U.S. Department of Commerce, National Bureau of Standards (Institute for Computer Sciences and Technology).
6. **Cross Index.**
 - a. FIPS PUB 60-2, I/O Channel Interface.
 - b. FIPS PUB 61-1, Channel Level Power Control Interface.
 - c. FIPS PUB 62, Operational Specifications for Magnetic Tape Subsystems.
 - d. FIPS PUB 63-1, Operational Specifications for Variable Block Rotating Mass Storage Subsystems.

- e. FIPS PUB 63-1 SUPPLEMENT, Additional Operational Specifications for Variable Block Rotating Mass Storage Subsystems.
- f. FIPS PUB 97, Operational Specifications for Fixed Block Rotating Mass Storage Subsystems.
- g. FIPS PUB 111, Storage Module Interfaces (with extensions for enhanced storage module interfaces).
- h. FIPS PUB 131, Small Computer System Interface (SCSI).

7. **Objectives.** The objectives of this standard are to:
- improve the interchangeability of storage equipment as part of computer systems
 - reduce the cost of computer equipment by increasing alternative sources of supply
 - improve the reutilization of system components
 - facilitate the use of advanced technology by the Federal Government.

8. **Applicability.** This standard applies to the connection of computers to storage peripheral device controllers, and is analogous to FIPS PUB 60, I/O Channel Interface, plus the operational specifications FIPS PUB 62, FIPS PUB 63, and FIPS PUB 97. When used with the device specific command set this standard is used to connect magnetic disk drives to a storage controller and is approximately analogous to FIPS PUB 111, Storage Module Interfaces.

For the acquisition of magnetic disk drives or subsystems, this standard may be cited as an alternative to specifying FIPS PUB 60 and 61, plus one of the associated operational specifications, FIPS PUB 63 or FIPS PUB 97, when FIPS PUB 60 would otherwise apply. This standard may also be cited as an alternative to specifying FIPS PUB 60, FIPS PUB 61, and FIPS PUB 62, for the acquisition of magnetic tape drives or subsystems.

A procuring agency may require vendors to verify that the interface on their products conforms to this standard. Agencies may employ means of verification such as that prescribed for FIPS PUB 60 by the *Federal Register* notice published on December 11, 1979 (44 FR 71444). In special cases, NBS may assist agencies in evaluating conformance to this standard.

9. **Specifications.** Affixed. This standard shall be specified by American National Standards X3.129-1986, X3.147-1987, X3.132-1987, and X3.130-1986.

There are four incompatible electrical options in this standard.

1. Three-State
2. Voltage Mode Differential
3. Current Mode Differential
4. Open Emitter

The Three-State drivers use single ended signals and are suitable for short distances (5 m or less) within shielding enclosures. Products which utilize Three-State signals are not widely available and the use of this mode by agencies is therefore not recommended.

The two differential options are similar in many respects. As compared to the Three-State and Open Emitter options, both offer improved common mode noise characteristics. Common mode noise usually results when shifts occur in the ground potential at different points in the power distribution network. Therefore it is most likely to be a problem when computer equipments are powered from different distribution circuits. Both differential options are used with twisted pair cable.

Products which implement either current or voltage mode differential operation are both available. Federal users are cautioned that, despite their similarities, current and voltage mode IPI devices cannot be mixed on the same bus.

The open emitter option is similar to the electrical specifications of FIPS PUB 60. While this technology is well proven, it is not as fast as the other IPI options, and, when used over long distances, requires comparatively expensive coaxial cable signal paths. Use of this option by Federal agencies is not recommended.

The IPI bus includes control signals and two 8-bit paths called BUS A and BUS B. During the various states of the bus protocol where selection, command and status transfers take place BUS A carries signals "out" from the host (master) to the peripheral (slave) while BUS B carries signals "in" to the host from the peripherals. There are two "Information Transfer" (data transfer) modes. In "Single Octet Mode" BUS A is always out, while BUS B is in. In "Double Octet Mode" BUS A and BUS B operate in the same direction, either in or out, and are used to transfer 16 bits in parallel.

Most available IPI products implement Double Octet Mode operation. The use of Single Octet Mode storage products can increase bus contention, even where the recording rate of the storage product is lower than the Single Octet Mode transfer rate. The use of Single Octet Mode storage products on high performance systems is therefore not recommended.

10. Implementation. This standard is effective December 16, 1987. Agencies may use this standard prior to the effective date if they choose to do so. All equipment which is within the scope of the Applicability provision of FIPS PUB 60, and which is ordered on or after the effective date of this standard, or procurement actions for which solicitation documents have not been issued by that date, must conform to the provisions of this standard or to FIPS PUB 60 plus associated power control and operational specification standards, or to any other permitted alternative to FIPS PUB 60, unless a waiver has been granted in accordance with the procedure described elsewhere in this publication.

11. Waivers. Since this standard is an alternative to FIPS PUB 60, plus associated power control and operational specification standards, waiver procedures for this standard shall be as designated in FIPS PUB 60. Waivers of this standard are not required where FIPS PUB 60 does not apply. Any waiver of FIPS PUB 60 also is a waiver of this standard.

12. Where to Obtain Copies. Copies of this publication are for sale by the National Technical Information Service, U.S. Department of Commerce, Springfield, VA 22161. (Sale of the included specifications documents is by arrangement with the American National Standards Institute.) When ordering, refer to Federal Information Processing Standards Publication 130 (FIPSPUB130), and title. Payment may be made by check, money order, purchase order, credit card, or deposit account.

**U.S. DEPARTMENT OF COMMERCE
National Technical Information Service**

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U.S. DEPARTMENT OF COMMERCE
NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY

CHANGE NUMBER 2 - FIPS 60-2 & 62
1-FIPS 61-1,63-1,97,111,130&131

DATE OF CHANGE
1990 December 26

FIPS PUBLICATION NUMBER
See above.

FIPS PUBLICATION CHANGE NOTICE

PUBLICATION TITLE FIPS 60-2, I/O Channel Interface; 62, Operational Specifications for Magnetic Tape Subsystems; 61-1, Channel Level Power Control Interface; 63-1, Operational Specifications for Variable Block Rotating Mass Storage Subsystems; 97, Operational Specifications for Fixed Block Rotating Mass Storage Subsystems; 111, Storage Module Interfaces (w/extends. for enhanced storage module interface); 130, Intelligent Peripheral Interface (IPI); 131, Small Computer System Interface (SCSI).

THIS OFFICE HAS A RECORD OF YOUR INTEREST IN RECEIVING CHANGES TO THE ABOVE FIPS PUBLICATION. THE CHANGE(S) INDICATED BELOW HAVE BEEN PROVIDED BY THE MAINTENANCE AGENCY FOR THIS PUBLICATION AND WILL BE INCLUDED IN THE NEXT PUBLISHED REVISION TO THIS FIPS PUBLICATION. QUESTIONS OR REQUESTS FOR ADDITIONAL INFORMATION SHOULD BE ADDRESSED TO THE MAINTENANCE AGENCY:

Department of Commerce
National Institute of Standards and Technology
National Computer Systems Laboratory
Gaithersburg, MD 20899

CHANGE ITEM(S)

Attached is a reprint from the December 18, 1990, FEDERAL REGISTER (55 FR 51941) which provides approved revisions by the Secretary of Commerce to the FIPS family of input/output interface standards, and the approved discontinuation of the Exclusion and Verification Lists for these standards.

These approved revisions became effective on December 18, 1990, and become an integral part of FIPS 60-2, 61-1, 62, 63-1, 97, 111, 130 and 131, and, as such, are considered to be included whenever reference is made to them.

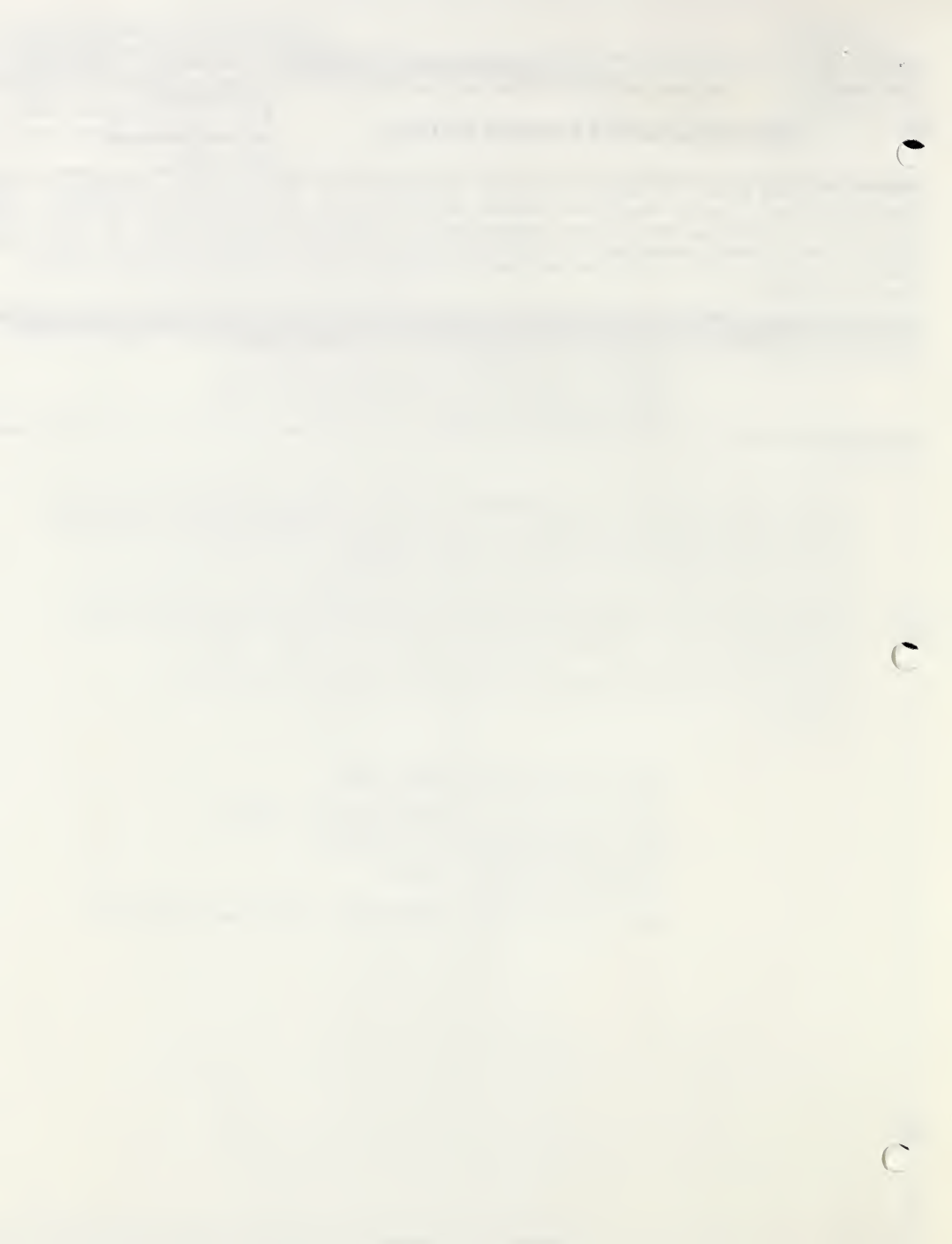
These approved revisions should be filed with each FIPS listed above.

Attachment

Copies of FIPS are available from:

National Technical Information Service (NTIS)
ATTN: Sales Office, Sills Building
5285 Port Royal Road
Springfield, Virginia 22161

Phone - 703/487-4650 Office Hours - 7:45 a.m. to 4:15 p.m.



Federal Register

Tuesday
December 18, 1990

National Institute of Standards and Technology
NOTICES
Information processing standards, Federal:
Family of input/output interface standards, 51941

National Institute of Standards and
Technology

[Docket No. 900101-0219]

RIN 0693-AA59

**Approval of Revisions to Federal
Information Processing Standards
(FIPS) Family of Input/Output Interface
Standards**

AGENCY: National Institute of Standards and Technology (NIST), Commerce.
ACTION: The purpose of this notice is to announce that the Secretary of Commerce has approved revisions to the Federal Information Processing Standards (FIPS) family of input/output interface standards, and has approved discontinuation of the exclusion and verification lists for these standards.

SUMMARY: On March 20, 1990, notice was published in the Federal Register (55 FR 10272) proposing revision of Federal Information Processing Standards (FIPS) 60-2, 61-1, 62, 63-1, 97, 111, 130, and 131 to make them non-mandatory, and discontinue the exclusion and verification lists for these standards. This proposal superseded the proposal for revision of these standards announced in the Federal Register (52 FR 44462) of November 19, 1987. Procedures for the Exclusion List for FIPS 60, 61, 62, 63, and 97 were published in the Federal Register on

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September 3, 1982 (47 FR 38959-38960). Procedures for the Verification List for FIPS 60, 61, 62, 63, and 97 were published in the **Federal Register** on December 11, 1979 (44 FR 71444-71445) and on April 7, 1981 (46 FR 20719-20720).

The written comments submitted by interested parties and other material available to the Department relevant to these proposed revisions were reviewed by NIST. On the basis of this review, NIST recommended that the Secretary approve revisions to the input/output family of standards and approve discontinuation of the exclusion and verification lists for these standards. NIST prepared a detailed justification document for the Secretary's review in support of those recommendations.

This notice provides only the changes to the revised standards.

EFFECTIVE DATE: These revisions are effective December 18, 1990.

ADDRESSES: Interested parties may obtain copies of FIPS PUBS 60-2, 61-1, 62, 63-1, 97, 111, 130, and 131 from the National Technical Information Service, U.S. Department of Commerce, Springfield, VA 22161.

FOR FURTHER INFORMATION CONTACT: Ms. Shirley Radack, National Institute of Standards and Technology, Gaithersburg, MD 20899, telephone (301) 975-2833.

SUPPLEMENTARY INFORMATION: Under the provisions of 40 U.S.C. 759(d), the Secretary of Commerce is authorized to promulgate standards and guidelines for Federal computer systems, and to make such standards compulsory and binding to the extent to which the Secretary determines necessary to improve the efficiency of operation, or security and privacy of Federal computer systems.

The family of I/O interface standards currently includes:

- a. FIPS 60-2, I/O Channel Interface, revised July 29, 1983.
- b. FIPS 61-1, Channel Level Power Control Interface, revised July 13, 1982.
- c. FIPS 62, Operational Specifications for Magnetic Tape Subsystems, revised December 30, 1980.
- d. FIPS 63-1, Operational Specifications for Variable Block Rotating Mass Storage Subsystems, revised April 14, 1983; Supplement to FIPS PUB. 63-1, Additional Operational Specifications for Variable Block Rotating Mass Storage Subsystems, April 14, 1983.
- e. FIPS 97, Operational Specifications for Fixed Block Rotating Mass Storage Subsystems, February 4, 1983.
- f. FIPS 111, Storage Module Interfaces with extensions for enhanced storage module interfaces, April 18, 1985.

g. FIPS 130, Intelligent Peripheral Interface (IPI), July 18, 1987.

h. FIPS 131, Small Computer System Interface (SCSI) July 18, 1987.

The following revisions are being made effective immediately upon publication. A delayed effective date is not required because these standards are exempt from the Administrative Procedure Act by U.S.C. 553(a)(2).

Revisions to Federal Information Processing Standards 60-2, 61-1, 62, 63-1, 97, 111, 130, and 131.

FIPS 60-2, I/O Channel Interface, is revised as follows:

Applicability. This standard addresses the interconnection of computer peripheral equipment as a part of ADP systems for the following types of peripherals: (1) Magnetic tape equipment employing open reel-to-reel magnetic tape storage devices, specifically excluding magnetic tape cassette and tape cartridge storage devices, (2) magnetic disk storage equipment employing disk drives each having a capacity greater than 7 megabytes per storage module, excluding flexible disk and disk cartridge devices having a smaller storage capacity per device, and (3) other peripheral equipment employing peripheral device types for which operational specifications standards have been issued as Federal Information Processing Standards. This standard is recommended for use in the acquisition of peripheral equipment for ADP systems with input/output channel interfaces as specified in the technical specifications, when it is determined that interchange of equipment between different systems is likely.

Implementation. The original version of this standard became effective December 13, 1979. The first revision became effective June 23, 1980, and the second revision became effective July 29, 1983. This revision becomes effective December 18, 1990.

Waivers. This standard is non-mandatory. No waivers are required.

FIPS 61-1, Channel Level Power Control Interface, is revised as follows:

Applicability. This standard addresses the power control interface in connecting computer peripheral equipment to ADP systems. It is recommended for use when FIPS 60-2 is used, when it is determined that interchange of equipment between different systems is likely.

Implementation. The original version of this standard became effective June 23, 1980, and the first revision became effective July 13, 1982. This revision becomes effective December 18, 1990.

Waivers. This standard is non-mandatory. No waivers are required.

FIPS 62, Operational Specifications for Magnetic Tape Subsystems, is revised as follows:

Applicability. This standard addresses magnetic tape equipment connected to ADP systems through FIPS 60 interfaces. It is recommended for use in the acquisition of such equipment, when it is determined that interchange of equipment between different systems is likely.

Implementation. The original version of this standard became effective June 23, 1980. This revision becomes effective December 18, 1990.

Waivers. This standard is non-mandatory. No waivers are required.

FIPS 63-1, Operational Specifications for Variable Block Rotating Mass Storage Subsystems, is revised as follows:

Applicability. This standard addresses peripheral device dependent operational interfaces for connecting variable block rotating mass storage equipment to ADP systems through FIPS 60 interfaces. It is recommended for use in the acquisition of such variable block rotating mass storage equipment for connection to ADP systems, when it is determined that interchange of equipment between different systems is likely.

Implementation. This standard became effective June 23, 1980, and the first revision became effective April 14, 1983. This revision becomes effective December 18, 1990.

Waivers. This standard is non-mandatory. No waivers are required.

FIPS 97, Operational Specifications for Fixed Block Rotating Mass Storage Subsystems, is revised as follows:

Applicability. This standard addresses the peripheral device dependent operational interface specifications for connecting fixed block rotating mass storage equipment to ADP systems through FIPS 60 interfaces. It is recommended for use in the acquisition of such fixed block rotating mass storage equipment for connection to ADP systems, when it is determined that interchange of equipment between different systems is likely.

Implementation. The original version of this standard became effective February 4, 1983. This revision becomes effective December 18, 1990.

Waivers. This standard is non-mandatory. No waivers are required.

FIPS 111, Storage Module Interfaces, is revised as follows:

Applicability. This standard addresses connection of a disk drive to a controller as part of an ADP system. This standard is recommended for use in the acquisition of disk systems that are

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connected to small and medium sized computer systems, when it is determined that interchange of equipment between different systems is likely.

Implementation. This standard became effective May 18, 1985. This revision becomes effective December 18, 1990.

Waivers. This standard is non-mandatory. No waivers are required.

FIPS 130, Intelligent Peripheral Interface (IPI), is revised as follows:

Section 8, Applicability. This standard applies to the connection of computers to storage peripheral device controllers. This standard is recommended for use in the acquisition of magnetic disk drives, optical disk drives, and tape drives to be connected to minicomputer systems, when it is determined that interchange of equipment between different systems is likely.

Section 10, Implementation. This standard became effective December 16, 1987. This revision becomes effective December 18, 1990.

Section 11, Waivers. This standard is non-mandatory. No waivers are required.

FIPS 131, Small Computer System Interface (SCSI) is revised as follows:

Section 8, Applicability. This standard addresses the connection of small computers to peripheral devices with integral controllers. This standard is recommended for use in the acquisition of storage peripherals and small computer systems for office or laboratory use, when it is determined that interchange of equipment between different systems is likely.

Section 10, Implementation. This standard became effective December 16, 1987. This revision becomes effective December 18, 1990.

Section 11, Waivers. This standard is non-mandatory. No waivers are required.

Dated: December 12, 1990.

John W. Lyons,
Director.

[FR Doc. 90-29563 Filed 12-17-90; 8:45 am]

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