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First edition
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Higher performance protocol for the standard digital interface for programmable instrumentation –

Part 1: General

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

HIGHER PERFORMANCE PROTOCOLE FOR THE STANDARD DIGITAL INTERFACE FOR PROGRAMMABLE INSTRUMENTATION –

Part 1: General

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International Standard IEC/IEEE 60488-1 has been processed through subcommittee 65C: Digital communications, of IEC technical committee 65: Industrial-process measurement and control.

This standard cancels and replaces the second edition of IEC 60625-1 (1993).

At times in this standard, specific reference is made to IEEE Std 488.1-1987, which constituted an earlier version of IEEE Std 488.1-2003, the IEEE edition upon which this standard is based. Where specific dated references were made to the 1987 edition, these references have been maintained.

Furthermore, it is to be noted that full compatibility of this standard with IEC/IEEE 60488-2:2004 requires implementation of all revisions indicated previously in the IEEE Introduction. Therefore, readers of this standard are encouraged to read also the companion standard IEEE Std 488.2-1987, which constitutes an earlier edition of IEC 60488-2:2004.

The text of this standard is based on the following documents:

IEEE Std	FDIS	Report on voting
488.1 (2003)	65C/319A/FDIS	65C/343/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

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

The committee has decided that the contents of this publication will remain unchanged until 2009.

IEC/IEEE 60488 consists of the following publications:

- Higher performance protocol for the standard digital interface for programmable instrumentation – Part 1: General (60488-1).
- Standard digital interface for programmable instrumentation – Part 2: Codes, formats, protocols and common commands (60488-2).

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IEEE Standard for Higher Performance Protocol for the Standard Digital Interface for Programmable Instrumentation

Sponsor

Technical Committee on Automated Test Systems and Instrumentation (TC-8)
of the
IEEE Instrumentation and Measurement Society

Approved 10 October 2003
American National Standard Institute

Approved 12 June 2003
IEEE-SA Standards Board

Abstract: This standard applies to interface systems used to interconnect both programmable and nonprogrammable electronic measuring apparatus with other apparatus and accessories necessary to assemble instrumentation systems. It applies to the interface of instrumentation systems, or portions of them, in which the

a) Data exchanged among the interconnected apparatus is digital (as distinct from analog)

b) Number of devices that may be interconnected by one contiguous bus does not exceed 15

c) Total transmission path lengths over the interconnecting cables does not exceed 20 m

d) Data rate among devices does not exceed 8 000 000 B/s

The basic functional specifications of this standard may be used in digital interface applications that require longer distances, more devices, increased noise immunity, or combinations of these. Different electrical and mechanical specifications may be required (for example, symmetrical circuit configurations, high threshold logic, special connectors, or cable configurations) for these extended applications.

Keywords: GPIB, HPIB, HS488, non-interlocked handshake, three-wire handshake

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IEEE Introduction

IEEE Std 488™ has enjoyed continuous and widespread use since its initial publication in 1975. The first revision occurred in 1978 as a result of practical experience and recognition that certain clauses needed clarification to improve compatibility among independently designed products. No major changes were made in 1978; many changes were pure editorial; however, 20 clauses had textual changes with technical implications, although none contradicted the concepts as defined in the original publication. Supplement A was introduced in 1980 to correct one minor deficiency in the controller function related to "take control synchronously."

In 1987, a systematic review was undertaken as a result of both the normal 5-year review cycle and related work on IEEE 488 device-dependent message syntax structures. In addition, there was a strong desire on the part of both IEEE participants and our IEC colleagues to bring equivalent standards (IEC 625-1) into closer alignment. IEEE Std 488.1-1987 represents the culmination of this review cycle. Again, no major technical changes were made, and care was exercised to preserve compatibility with earlier versions of IEEE Std 488.

The IEEE Std 488.1-2003 specification adds new interface functions to allow designers the option of implementing noninterlocked handshake transfers.

In preparing this specification, several stylistic changes to IEEE Std 488.1-1987 were necessary to bring the document up to IEEE standards. The following changes were made:

— Clause 1, which previously consisted of an overview, definitions, and references, was divided into three separate sections. Clause 1 now contains the overview, Clause 2 contains references, and Clause 3 contains definitions.
— The first level of ordered lists was previously numbered (1, 2, 3...). To comply with the IEEE standards, the first level of ordered lists is now lettered (a, b, c...), and the second level of ordered lists is numbered (1, 2, 3...).
— In the earlier version of this specification, tables had no grids. Grids have been added to the tables in this version.

The IEEE 488.1-2003, IEEE Standard for Digital Interface for Programmable Instrumentation, deals with systems that use a byte-serial, bit-parallel means to transfer digital data among a group of instruments and system components. The interface system described herein is optimized as an interdevice interface for system components in relatively close proximity able to communicate over a contiguous party-line bus system.

This document contains seven sections as follows:

— Clause 1 contains the scope, the object, and summary description of the interface.
— Clause 2 contains helpful references.
— Clause 3 contains basic definitions.
— Clause 4 deals with functional concepts and specifications of the interface system described in this standard. One or more interface functions contained within a device are each able to process messages and change states to maintain an orderly flow of information among a set of interconnected devices.
— Clause 5 deals with the electrical realization of the interface in order to transfer messages among a set of interconnected devices.
— Clause 6 deals with the mechanical realization of the interface in order to implement the electrical aspects of the interface system.
— Clause 7 deals with system considerations that must be given to the design of an individual device in order to make it compatible with other devices of a measurement system.

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— Clause 8 deals with system considerations that must be recognized by the user of devices designed in accordance with this standard.
— Annexes deal with explanatory matter and examples.

In order to interconnect and program equipment designed in accordance with this standard, the user should have knowledge of Clause 1 and Clause 8. If the coding and transfer of messages is not done automatically by the apparatus to be programmed, it will be necessary that the user have knowledge of Clause 4. General familiarity with the other sections is recommended. The user must also be familiar with device-dependent characteristics of apparatus that may be used in a system, but that are beyond the scope of this standard.

This standard defines an interface with the objective to assure that messages may be accurately communicated between two or more devices in a system, but it does not guarantee that each device will interpret properly all possible messages sent to it or will properly generate all necessary messages. A wide latitude of interface capability is permitted within the scope of this standard, which may permit operational incompatibility among interconnected devices.

Device designers must have sufficient awareness of the characteristics of systems, which might include their devices, in order to select correctly among the options provided in this standard. Likewise, system configurators must have sufficient awareness of the options included in each of the devices in their systems in order to ensure that the correct communication techniques are used.

This standard does not specify the device-dependent or operational characteristics required for complete system compatibility. Therefore, following the rules and procedures of this standard alone will not guarantee unconditional compatibility.

The 1987 version of this standard was based on work initiated by the International Electrotechnical Commission (IEC) within Technical Committee 65, Subcommittee 65C, Working Group 3 (formerly TC66/ WG3), and it follows the general concepts of a standard prepared by the IEC. In 1992, the IEEE technical working group enhanced the 1987 standard to improve performance over IEEE Std 488.1-1987.

The “helpful note” on metric threads found in previous editions has been deleted because metric thread use is common IEEE Std 488 practice. Consequently, the recommendation to coat such parts in black material to call attention to metric threads is also considered unnecessary. Electrical conductivity on the surface of these parts is, however, still considered essential.

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HIGHER PERFORMANCE PROTOCOL FOR THE STANDARD DIGITAL INTERFACE FOR PROGRAMMABLE INSTRUMENTATION –

Part 1: General

1. Overview

1.1 Scope

This standard applies to interface systems used to interconnect both programmable and nonprogrammable electronic measuring apparatus with other apparatus and accessories necessary to assemble instrumentation systems. It applies to the interface of instrumentation systems, or portions of them, in which the

a) Data exchanged among the interconnected apparatus is digital (as distinct from analog)

b) Number of devices that may be interconnected by one contiguous bus does not exceed 15

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d) Data rate among devices does not exceed 8 000 000 B/s

The basic functional specifications of this standard may be used in digital interface applications that require longer distances, more devices, increased noise immunity, or combinations of these. Different electrical and mechanical specifications may be required (for example, symmetrical circuit configurations, high threshold logic, special connectors, or cable configurations) for these extended applications.

This standard may also be applicable to other instrumentation system elements, such as processors, stimulus, display, or storage devices, and terminal units found useful in instrumentation systems. It applies generally to laboratory and production test environments that are both electrically quiet and restricted as to physical dimensions (distances between the system components).

This standard deals only with the interface characteristics of instrumentation systems to the exclusion of design specifications' consideration of radio-interface regulations, performance requirements, and safety requirements of apparatus.

NOTE—For the latter two items, reference is made to IEC 61010-1: 2001, and IEC 60359:2001.[1]

[1]For information on references, see Clause 2.

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