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American National Standard (ANSI)

ANSI/IEEE Std 91-1984
ANSI/IEEE Std 91a-1991

IEEE Standard Graphic Symbols for Logic Functions

(Including and incorporating IEEE Std 91a-1991, Supplement to IEEE Standard Graphic Symbols for Logic Functions)

Sponsor
IEEE Standards Coordinating Committee 11,
Graphic Symbols and Designations

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Abstract: Graphic symbols for representing logic functions or physical devices capable of carrying out logic functions are presented. Descriptions of logic functions, the graphic representation of these functions, and examples of their applications are provided. The symbols are presented in the context of electrical applications, but most may also be applied to nonelectrical systems (for example, pneumatic, hydraulic, or mechanical). The supplement provided additional internationally approved graphic symbols and made corrections as needed to IEEE Std 91-1984.
Keywords: dependency notation, industry standards, logic diagrams, logic function, logic symbols, military standards

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ANSI/IEEE Std 91-1984
10 May 1984
(Superseding
ANSI Y32.14-1973
IEEE Std 91-1973)

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Introduction

(This introduction is not part of IEEE Std 91-1984, IEEE Standard Graphic Symbols for Logic Functions, or of IEEE Std 91a-1991, Supplement to IEEE Std 91-1984.)

Two standards are included in this document: IEEE Std 91-1984, IEEE Standard Graphic Symbols for Logic Functions, and IEEE Std 91a-1991, Supplement to IEEE Std 91-1984. In this edition (published in 1996), the two standards have been merged to make it more convenient for the user.

The following sections of the original IEEE Std 91-1984 were extensively revised and replaced by IEEE Std 91a-1991:

Pictorial Table of Contents
Table of Contents
Section 6: Symbols for Highly Complex Functions
Appendix A: Recommended Symbol Proportions
Appendix D: Integrated Circuits Used as Examples, Commercial Part Numbers vs. Symbol Numbers
Index

Numerous other revisions to IEEE Std 91-1984 in Sections 1 through 5 were made. The new Table of Contents and the new Index indicate specifically where revisions were made. Further, change bars marked in the outside margins indicate the locations of significant changes. Each standard has a unique foreword, included below.

IEEE Std 91-1984 foreword

This standard defines an international *language* by which it is possible to determine the functional behavior of a logic circuit as described on a logic or circuit diagram with minimal reference to supporting documentation. Like natural languages, the *language* set forth in this standard has been designed to allow a single concept to be expressed in one of several different ways, according to the demands of a particular situation. Consequently, this standard does not attempt, nor intend to establish single *correct* symbols for particular devices. A symbol appropriate for one application of a device may not be appropriate for another.

The contributors to this standard represent a broad range of institutions, technologies, and documentation needs. They include industrial, governmental, and educational organizations, producers and consumers of devices and equipment, users and non-users of computer-aided design and drafting, and a considerable range of aesthetic preferences. That a consensus of such diverse interests could be achieved in producing this standard is indicative of not only the utility of the approach, but more importantly, of the increasing need among designers and maintainers of digital systems for a common and more nearly complete symbolic language.

This revision is the result of a continuing activity to arrive at a useful notation to permit free interchange of information on the design of binary-operated controls and systems. It is the latest step in a program that began in 1956 within the IEEE to develop a comprehensive single standard, consistent with ongoing developments in technology and logic symbology, from several ad hoc, industry, military, and international standards. In 1960, an ad hoc group on logic diagram graphic symbols was formed within the American National Standards Institute in order to develop a draft American Standard. In 1961, this committee became a permanent subcommittee, Y32.14, of the Graphic Symbols Committee, Y32, under the cosecretariat of ASME and IEEE. Its work resulted in the publication of IEEE Std 91-1962 (ANSI Y32.14-1962), adopted in 1965 by the US Navy. The subcommittee was reorganized in 1969 to prepare a new draft standard that would have broader acceptance and be in accord with the developments within the International Electrotechnical Commission (IEC). ANSI/IEEE Std 91-1973 (Y32.14-1973) subsequently received approval from ANSI, and the US Department of Defense, and was substantially compatible with IEC Pub 117-15, Recommended Graphical Symbols: Binary Logic Elements. Since 1977 the preparing committee, IEEE SCC 11.9, has worked closely with IEC Technical Committee 3 to prepare major new revisions of this standard and IEC Pub 617, Part 12 (the successor to Pub 117, Part 15). The aim was for a US standard that would be mutually compatible with the IEC standard, broadly acceptable, and that would provide notation or guidelines by which any SSI through VLSI

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device might be usefully and accurately represented. Fourteen drafts of this document were prepared in parallel with drafts of the new IEC document by an ad hoc working group of SCC 11.9 before the preparers and reviewers believed that these goals had been met.

Symbology, such as language and technology, will continue to evolve, and IEEE SCC 11.9 will continue to work with IEC TC3 to update logic symbol standards as future needs dictate. Suggestions for improvement of this standard are welcomed. They should be addressed to:

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When this standard was approved, the IEEE Standards Coordinating Committee on Graphic Symbols and Designations, Subcommittee SC 11.9 on Logic Symbols, had the following membership:

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IEEE Std 91a-1991 foreword

IEEE Std 91-1991 provides a way to describe a single logic function with a symbol. The symbols that result from using IEEE Std 91-1984 have sometimes been called "the new logic symbols," despite the fact that one can still find distinctive-shape AND and OR gates, J and K inputs to flip-flops, and most other time-honored features of logic symbols. However, prior to IEEE Std 91-1984, there were no standardized symbols or symbology methods, for example, for memories, demultiplexers, arithmetic elements, multifunction registers, open-collector outputs, digital switches, or devices with multiple clocks or address ports. What was truly new was that these features were integrated into a comprehensive system for constructing logic symbols to meet not only current, but future needs. Where the "old" system relied on an inventory of symbols, the "new" system relies on an inventory of symbol elements and techniques. The inherent ability of the "language" to describe new devices can be seen in the relatively few additions that have been required in this supplement.

Because IEEE Std 91-1984 is not based on English-language mnemonics, symbols based on it may communicate less to the uninitiated reader who has already memorized a component catalog. However, if the reader knows the language, and especially if he or she does not intimately know the device, the system can communicate far more than any nonstandard mnemonic-based system, with a smaller set of things to be remembered. The notation does more than suggest to the knowledgeable user what various inputs and outputs do. Instead, it provides a rather detailed description.

The use of this system requires training, as does any other system of notation. The difference between this system and those that preceded it is that, once trained, the user has available more information in less space, from more sources, and with less need for supporting documentation. Once the user has learned the rules, he or she has learned them not only for existing devices, but for new ones as well. That IEEE Std 91-1984 is virtually identical to the national standards of dozens of other countries is more than a small bonus.

Future editions of IEEE Std 91 and IEC 617-12 are expected to continue to evolve to address developments in the technology of logic devices. Suggestions for the improvement of this standard are welcomed.

The supplement to IEEE Std 91-1984, IEEE Std 91a-1991 was the result of nearly ten years of ongoing work by an ad hoc Working Group of IEEE SCC 11.9 and IEC TC3 (International Electrotechnical Commission Technical Committee 3) to harmonize IEEE Std 91 and its international counterpart, IEC 617-12. The supplement brings IEEE Std 91-1984 into conformance with IEC 617-12 (1991) and, once more, includes some additional symbols and techniques published in advance of their publication by IEC.

In addition to corrections and clarifications to IEEE Std 91-1984, the supplement included new material to cover simplification of arrays (2.3.1.2), inputs with special amplification (3.3-9.5), in-line negation indication (4.3.1), definitions of codes used in coders (5.4.1, 5.4.2), display elements (5.15), bus indicators (6.1.9), and representation of data paths on internal diagrams (6.2.2).

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