

Guide to the

Application of digital computers to nuclear reactor instrumentation and control

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- British Institute of Non-destructive Testing
- British Institute of Radiology
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- Institute of Physics
- Nuclear Power Co. Ltd.
- Nuclear Power Group

This British Standard, having been prepared under the direction of the Nuclear Engineering Standards Committee, was published under the authority of the Executive Board and comes into effect on 30 October 1981

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National foreword

This British Standard is identical with IEC Publication 643 “*Application of digital computers to nuclear reactor instrumentation and control*” published in 1979 by the International Electrotechnical Commission (IEC).

This standard has been prepared under the direction of the Nuclear Engineering Standards Committee, and the United Kingdom took part in the work of IEC Technical Committee SC 45A that prepared IEC 643.

The formal decisions or agreements of the IEC on technical matters, prepared by technical committees on which all the national committees having a special interest therein are represented, express, as nearly as possible, an international consensus of opinion on the subjects dealt with.

Terminology and conventions. The text of the International Standard has been approved as suitable for publication as a British Standard without deviation. Some terminology and certain conventions are not identical with those used in British Standards; attention is especially drawn to the following. Wherever the word “report” appears, referring to this publication, it should be read as “guide”.

Cross-reference. The technical committee has reviewed the provisions of IEC 50, referred to in the text, and has decided that they are acceptable for use in conjunction with this standard.

A British Standard related to IEC 50 is BS 4727 “*Glossary of electrotechnical, power, telecommunication, electronics, lighting and colour terms*”.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 8, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

Introduction

The use of process computers with nuclear reactor units has become general. While logging remains the basic function of many computer systems, widespread use is made of computers as a means of enhancing conventional instrumentation and of obtaining information not otherwise available. The assignment of tasks vital to plant operation to computer systems requires careful consideration of the factors affecting availability and reliability, when determining the system configuration.

1 Scope and object

This report covers the principles which should be followed in the use of digital computers for alarm, instrumentation, record, control and equipment protection purposes on nuclear reactor units. This report is not a document on design but a guide to the application of digital computer systems.

The application of digital computers to reactor protection is under rapid development at the time of writing and is not included in this edition of the report. The application of distributed digital processing may require additional recommendations to those given in this report.

This report applies to all on-line applications of digital process computer systems to nuclear reactors and to off-line applications immediately associated with the on-line system, such as would normally use the same equipment. The recommendations are based on recognized practice in the process computer field and are functional in nature. These recommendations are not intended to affect the obligations that a supplier of equipment, services or programmes may have for satisfactory performance in any specific application. General recommendations are given for the application of such systems, for the equipment and programmes and for performance and maintenance.

2 Definitions

For the definitions of general terms used in this report, reference should be made to IEC Publication 50, International Electrotechnical Vocabulary (I.E.V.). The following definitions are applicable for the purpose of this publication. A meaning consistent with current use is given, although in some cases no generally agreed definition exists and divergent use is made of a term in different countries.

digital computer system, computer system

an equipment system of computers, storage units, input/output units, computer programmes, but not including the measurement transducers or plant actuators

nuclear power plant – plant

all that plant including the nuclear reactor and its protection systems, coolant systems and electrical supplies, which is necessary for the generation of electricity, or the provision of thermal power

analogue signal

a time-continuous signal whose amplitude is directly related to the information conveyed by the signal

binary signal

a two-state signal

computer log, log

a pre-specified legible record of plant conditions made by the computer system on demand or automatically, in permanent form

availability

the proportion of time for which the computer system is capable of performing all functions or a specified function

reliability

the probability that an item will perform a required function under stated conditions for a stated period of time

redundancy

the existence of more than one means of performing a given function

digitized signal

a coded signal hold in binary form, whose information is equivalent to an analogue signal at a discrete time

on-line

the mode of operation of the computer system in which the input data used by the programme being performed is acquired automatically from the process plant to represent its current state. An output function is usually available when the system is on-line

off-line

the mode of operation of the computer system in which the input data used by the programme being performed is independent of the current state of the process plant