

Australian Standard[®]

**Programming Language
FORTRAN**

This Australian standard was prepared under the direction of Committee IS/1, Information Processing Systems. It was approved on behalf of the Council of the Standards Association of Australia on 23 February 1983 and published on 6 June 1983.

The following interests are represented on Committee IS/1:

Australian Banks Payment Systems Committee
Australian Bureau of Statistics
Australian Computer Equipment Suppliers Association
Australian Computer Services Association
Australian Computer Users Association
Australian Electrical and Electronic Manufacturers Association
Australian Public Service Board
CSIRO, Division of Computing Research
Department of Defence
Life Insurance Federation of Australia
National Library of Australia
Office Equipment Industry Association of Australia
Public Service Board, N.S.W.
Qantas Airways Limited
Telecom Australia
Universities and Colleges

Review of Australian Standards. To keep abreast of progress in industry, Australian Standards are subject to periodic review and are kept up to date by the issue of amendments or new editions as necessary. It is important therefore that Standards users ensure that they are in possession of the latest edition, and any amendments thereto.

Full details of all Australian Standards and related publications will be found in the Standards Australia Catalogue of Publications; this information is supplemented each month by the magazine 'The Australian Standard', which subscribing members receive, and which gives details of new publications, new editions and amendments, and of withdrawn Standards.

Suggestions for improvements to Australian Standards, addressed to the head office of Standards Australia, are welcomed. Notification of any inaccuracy or ambiguity found in an Australian Standard should be made without delay in order that the matter may be investigated and appropriate action taken.

Australian Standard[®]

**Programming Language
FORTRAN**

First published	1973
Second edition	1983

PUBLISHED BY STANDARDS AUSTRALIA
(STANDARDS ASSOCIATION OF AUSTRALIA)
1 THE CRESCENT, HOMEBUSH, NSW 2140

ISBN 0 7262 2945 8

PREFACE

This edition of this standard was prepared under the authority of the Association's Committee on Information Processing Systems to supersede AS 1486—1973. It is identical with International Standard 1539—1979 which in turn is identical with American National Standard ANSI X3.9—1978. The text of the latter has been used throughout in this standard and is reproduced with permission from American National Standard X3.9—1978, American National Standard Programming Language FORTRAN, copyright 1978 by the American National Standards Institute. Copies of ANSI X3.9 may be purchased from the American National Standards Institute at 1430 Broadway, New York, NY 10018.

Australian Standard Programming Language FORTRAN specifies the form and establishes the interpretation of programs expressed in the FORTRAN language. It consists of a full language and a subset language. Its purpose is to promote portability of FORTRAN programs for use on a variety of data processing systems.

It is suggested that the designation FORTRAN 77 be used to distinguish this standard from previous FORTRAN standards and any possible future revisions.

FORTRAN 77 is a revision of AS 1486—1973, which was based on ISO/R 1539—1972 and ANSI X3.9—1966. It describes two levels of the FORTRAN language, referred to as FORTRAN and subset FORTRAN. FORTRAN is the full language and appears on the righthand pages; Subset FORTRAN is a subset of the full language and appears on the lefthand pages. Because FORTRAN 77 includes the subset, AS 1486—1973 is accordingly superseded by this standard.

Appendix A gives some background to the development of this standard and its relationship to the previous standard. References to 'ANSI X3.9—1966' in Appendix A should be taken to mean 'AS 1486—1973'.

© Copyright — STANDARDS AUSTRALIA

Users of Standards are reminded that copyright subsists in all Standards Australia publications and software. Except where the Copyright Act allows and except where provided for below no publications or software produced by Standards Australia may be reproduced, stored in a retrieval system in any form or transmitted by any means without prior permission in writing from Standards Australia. Permission may be conditional on an appropriate royalty payment. Requests for permission and information on commercial software royalties should be directed to the head office of Standards Australia.

Standards Australia will permit up to 10 percent of the technical content pages of a Standard to be copied for use exclusively in-house by purchasers of the Standard without payment of a royalty or advice to Standards Australia.

Standards Australia will also permit the inclusion of its copyright material in computer software programs for no royalty payment provided such programs are used exclusively in-house by the creators of the programs.

Care should be taken to ensure that material used is from the current edition of the Standard and that it is updated whenever the Standard is amended or revised. The number and date of the Standard should therefore be clearly identified.

The use of material in print form or in computer software programs to be used commercially, with or without payment, or in commercial contracts is subject to the payment of a royalty. This policy may be varied by Standards Australia at any time.

Contents

SECTION	PAGE
1. Introduction	1-1
1.1 Purpose	1-1
1.2 Processor	1-1
1.3 Scope	1-1
1.4 Conformance	1-2
1.5 Notation Used in This Standard	1-3
1.6 Subset Text	1-4
2. FORTRAN Terms and Concepts	2-1
2.1 Sequence	2-1
2.2 Syntactic Items	2-1
2.3 Statements, Comments, and Lines	2-2
2.4 Program Units and Procedures	2-2
2.5 Variable	2-3
2.6 Array	2-3
2.7 Substring	2-3
2.8 Dummy Argument	2-4
2.9 Scope of Symbolic Names and Statement Labels	2-4
2.10 List	2-4
2.11 Definition Status	2-4
2.12 Reference	2-5
2.13 Storage	2-5
2.14 Association	2-6
3. Characters, Lines, and Execution Sequence	3-1
3.1 FORTRAN Character Set	3-1
3.2 Lines	3-2
3.3 Statements	3-3
3.4 Statement Labels	3-3
3.5 Order of Statements and Lines	3-3
3.6 Normal Execution Sequence and Transfer of Control	3-5
4. Data Types and Constants	4-1
4.1 Data Type	4-1
4.2 Constants	4-2
4.3 Integer Type	4-3
4.4 Real Type	4-3
4.5 Double Precision Type	4-3
4.6 Complex Type	4-4
4.7 Logical Type	4-4
4.8 Character Type	4-5
5. Arrays and Substrings	5-1
5.1 Array Declarator	5-1
5.2 Properties of an Array	5-2
5.3 Array Element Name	5-4
5.4 Subscript	5-4
5.5 Dummy and Actual Arrays	5-7
5.6 Use of Array Names	5-8
5.7 Character Substring	5-9
6. Expressions	6-1
6.1 Arithmetic Expressions	6-1
6.2 Character Expressions	6-7
6.3 Relational Expressions	6-9

SECTION	PAGE
6.4 Logical Expressions	6-10
6.5 Precedance of Operators	6-14
6.6 Evaluation of Expressions	6-15
6.7 Constant Expressions	6-20
7. Executable and Nonexecutable Statement Classification	7-1
7.1 Executable Statements	7-1
7.2 Nonexecutable Statements	7-1
8. Specification Statements	8-1
8.1 DIMENSION Statement	8-1
8.2 EQUIVALENCE Statement	8-1
8.3 COMMON Statement	8-3
8.4 Type-Statements	8-5
8.5 IMPLICIT Statement	8-7
8.6 PARAMETER Statement	8-8
8.7 EXTERNAL Statement	8-9
8.8 INTRINSIC Statement	8-9
8.9 SAVE Statement	8-10
9. DATA Statement	9-1
9.1 Form of a DATA Statement	9-1
9.2 DATA Statement Restrictions	9-1
9.3 Implied-DO in a DATA Statement	9-2
9.4 Character Constant in a DATA Statement	9-3
10. Assignment Statements	10-1
10.1 Arithmetic Assignment Statement	10-1
10.2 Logical Assignment Statement	10-2
10.3 Statement Label Assignment (ASSIGN) Statement	10-2
10.4 Character Assignment Statement	10-2
11. Control Statements	11-1
11.1 Unconditional GO TO Statement	11-1
11.2 Computed GO TO Statement	11-2
11.3 Assigned GO TO Statement	11-2
11.4 Arithmetic IF Statement	11-2
11.5 Logical IF Statement	11-3
11.6 Block IF Statement	11-3
11.7 ELSE IF Statement	11-4
11.8 ELSE Statement	11-5
11.9 END IF Statement	11-5
11.10 GOTO Statement	11-5
11.11 CONTINUE Statement	11-9
11.12 STOP Statement	11-9
11.13 PAUSE Statement	11-9
11.14 END Statement	11-10
12. Input/Output Statements	12-1
12.1 Records	12-1
12.2 Files	12-2
12.3 Units	12-6
12.4 Format Specifier and Identifier	12-7
12.5 Record Specifier	12-8
12.6 Error and End-of-File Conditions	12-8

SECTION	PAGE
12.7 Input/Output Status, Error, and End-of-File Specifiers	12-9
12.8 READ, WRITE, and PRINT Statements	12-10
12.9 Execution of a Data Transfer Input/Output Statement	12-13
12.10 Auxiliary Input/Output Statements	12-18
12.11 Restrictions on Function References and List Items	12-29
12.12 Restriction on Input/Output Statements	12-29
13. Format Specification	13-1
13.1 Format Specification Methods	13-1
13.2 Form of a Format Specification	13-2
13.3 Interaction Between Input/Output List and Format	13-3
13.4 Positioning by Format Control	13-4
13.5 Editing	13-5
13.6 List-Directed Formatting	13-13
14. Main Program	14-1
14.1 PROGRAM Statement	14-1
14.2 Main Program Restrictions	14-1
15. Functions and Subroutines	15-1
15.1 Categories of Functions and Subroutines	15-1
15.2 Referencing a Function	15-1
15.3 Intrinsic Functions	15-2
15.4 Statement Function	15-4
15.5 External Functions	15-6
15.6 Subroutines	15-9
15.7 ENTRY Statement	15-11
15.8 RETURN Statement	15-13
15.9 Arguments and Common Blocks	15-15
15.10 Table of Intrinsic Functions	15-22
16. Block Data Subprogram	16-1
16.1 BLOCK DATA Statement	16-1
16.2 Block Data Subprogram Restrictions	16-1
17. Association and Definition	17-1
17.1 Storage and Association	17-1
17.2 Events That Cause Entities to Become Defined	17-3
17.3 Events That Cause Entities to Become Undefined	17-4
18. Scope and Classes of Symbolic Names	18-1
18.1 Scope of Symbolic Names	18-1
18.2 Classes of Symbolic Names	18-2
Tables	
Table 1 Subscript Value	5-6
Table 2 Type and Interpretation of Result for $x_1 + x_2$	6-5
Table 3 Type and Interpretation of Result for $x_1 ** x_2$	6-6
Table 4 Arithmetic Conversion and Assignment of e to v	10-1
Table 5 Intrinsic Functions	15-22
Fig. 1 Required Order of Statements and Comment Lines	3-4
Appendixes	
Appendix A Criteria, Conflicts, and Portability	A-1
A1 Criteria	A-1
A2 Conflicts with ANSI X3.9-1966	A-1

SECTION	PAGE
A3 Standard Items That Inhibit Portability	A-4
A4 Recommendation for Enhancing Portability	A-5
Appendix B Section Notes	B-1
B1 Section 1 Notes	B-1
B2 Section 2 Notes	B-2
B3 Section 3 Notes	B-2
B4 Section 4 Notes	B-3
B5 Section 5 Notes	B-3
B6 Section 6 Notes	B-3
B7 Section 7 Notes	B-4
B8 Section 8 Notes	B-4
B9 Section 9 Notes	B-5
B10 Section 10 Notes	B-5
B11 Section 11 Notes	B-5
B12 Section 12 Notes	B-6
B13 Section 13 Notes	B-11
B14 Section 14 Notes	B-13
B15 Section 15 Notes	B-13
B16 Section 16 Notes	B-15
B17 Section 17 Notes	B-15
B18 Section 18 Notes	B-15
Appendix C Hollerith	C-1
C1 Hollerith Data Type	C-1
C2 Hollerith Constant	C-1
C3 Restrictions on Hollerith Constants	C-1
C4 Hollerith Constant in a DATA Statement	C-2
C5 Hollerith Format Specification	C-2
C6 A Editing of Hollerith Data	C-2
C7 Hollerith Constant in a Subroutine Reference	C-3
Appendix D Subset Overview	D-1
D1 Background	D-1
D2 Criteria	D-2
D2.1 Full Language	D-2
D2.2 Subset Language	D-2
D3 Summary of Subset Differences	D-2
D3.1 Section 1: Introduction	D-2
D3.2 Section 2: FORTRAN Terms and Concepts	D-2
D3.3 Section 3: Characters, Lines, and Execution Sequence	D-2
D3.4 Section 4: Data Types and Constants	D-3
D3.5 Section 5: Arrays and Substrings	D-3
D3.6 Section 6: Expressions	D-3
D3.7 Section 7: Executable and Nonexecutable Statement Classification	D-3
D3.8 Section 8: Specification Statements	D-3
D3.9 Section 9: DATA Statement	D-4
D3.10 Section 10: Assignment Statements	D-4
D3.11 Section 11: Control Statements	D-4
D3.12 Section 12: Input/Output Statements	D-4
D3.13 Section 13: Format Specification	D-5
D3.14 Section 14: Main Program	D-5
D3.15 Section 15: Functions and Subroutines	D-5
D3.16 Section 16: Block Data Subprogram	D-6

SECTION	PAGE
D3.17 Section 17: Association and Definition	D-6
D3.18 Section 18: Scope and Classes of Symbolic Names	D-6
D3.19 Sections 1 to 18: Character Type	D-6
D4 Subset Conformance	D-7
D4.1 Subset Processor Conformance	D-7
D4.2 Subset Program Conformance	D-7
Appendix E FORTRAN Statements	E-1
Appendix F Syntax Charts	F-1
F1 Chart Conventions	F-1
F2 Charts	F-2
F3 Cross-Reference Index to Syntax Charts	F-29
Index	Index-1

1. INTRODUCTION

1.1 Purpose

5 This standard specifies the form and establishes the interpretation of programs expressed in the FORTRAN language. The purpose of this standard is to promote portability of FORTRAN programs for use on a variety of data processing systems.

10

1.2 Processor

The combination of a data processing system and the mechanism by which programs are transformed for use on that data processing system is called a processor in this standard.

15

1.3 Scope

20 1.3.1 Inclusions. This standard specifies:

- (1) The form of a program written in the FORTRAN language
- 25 (2) Rules for interpreting the meaning of such a program and its data
- (3) The form of writing input data to be processed by such a program operating on data processing systems
- 30 (4) The form of the output data resulting from the use of such a program on data processing systems

1.3.2 Exclusions. This standard does not specify:

- 35 (1) The mechanism by which programs are transformed for use on a data processing system
- (2) The method of description of programs or their input or output data to or from a data processing medium
- 40 (3) The operations required for setup and control of the use of programs on data processing systems
- 45 (4) The results when the rules of this standard fail to establish an interpretation
- 50 (5) The size or complexity of a program and its data that will exceed the capacity of any specific data processing system or the capability of a particular processor
- 55 (6) The range or precision of numeric quantities and the method of rounding of numeric results