

---

---

**Information technology — Further  
interoperability of Fortran with C**

*Technologies de l'information — Interopérabilité ultérieure de Fortran  
avec C*

Withdrawal

Withdrawn



**COPYRIGHT PROTECTED DOCUMENT**

© ISO/IEC 2012

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office  
Case postale 56 • CH-1211 Geneva 20  
Tel. + 41 22 749 01 11  
Fax + 41 22 749 09 47  
E-mail [copyright@iso.org](mailto:copyright@iso.org)  
Web [www.iso.org](http://www.iso.org)

Published in Switzerland

# Contents

1	Scope . . . . .	1
2	Normative references . . . . .	3
3	Terms and definitions . . . . .	5
4	Compatibility . . . . .	7
4.1	New intrinsic procedures . . . . .	7
4.2	Fortran 2008 compatibility . . . . .	7
5	Type specifiers and attributes . . . . .	9
5.1	Assumed-type objects . . . . .	9
5.2	Assumed-rank objects . . . . .	9
5.3	ALLOCATABLE, OPTIONAL, and POINTER attributes . . . . .	10
5.4	ASYNCHRONOUS attribute . . . . .	11
5.4.1	Introduction . . . . .	11
5.4.2	Asynchronous communication . . . . .	11
6	Procedures . . . . .	13
6.1	Characteristics of dummy data objects . . . . .	13
6.2	Explicit interface . . . . .	13
6.3	Argument association . . . . .	13
6.4	Intrinsic procedures . . . . .	13
6.4.1	SHAPE . . . . .	13
6.4.2	SIZE . . . . .	13
6.4.3	UBOUND . . . . .	14
7	New intrinsic procedure . . . . .	15
7.1	General . . . . .	15
7.2	RANK (A) . . . . .	15
8	Interoperability with C . . . . .	17
8.1	Removed restrictions on ISO_C_BINDING module procedures . . . . .	17
8.2	C descriptors . . . . .	17
8.3	ISO_Fortran_binding.h . . . . .	17
8.3.1	Summary of contents . . . . .	17
8.3.2	CFL_dim_t . . . . .	18
8.3.3	CFL_cdesc_t . . . . .	18
8.3.4	Macros and typedefs . . . . .	19
8.3.5	Functions . . . . .	22
8.4	Restrictions on C descriptors . . . . .	29
8.5	Restrictions on formal parameters . . . . .	29
8.6	Restrictions on lifetimes . . . . .	30
8.7	Interoperability of procedures and procedure interfaces . . . . .	30
9	Required editorial changes to ISO/IEC 1539-1:2010(E) . . . . .	33
9.1	General . . . . .	33
9.2	Edits to Introduction . . . . .	33

9.3	Edits to clause 1 . . . . .	33
9.4	Edits to clause 4 . . . . .	34
9.5	Edits to clause 5 . . . . .	34
9.6	Edits to clause 6 . . . . .	35
9.7	Edits to clause 12 . . . . .	36
9.8	Edits to clause 13 . . . . .	37
9.9	Edits to clause 15 . . . . .	39
9.10	Edits to clause 16 . . . . .	41
9.11	Edits to annex A . . . . .	41
9.12	Edits to annex C . . . . .	42
Annex A	(informative) Extended notes . . . . .	43
A.1	Clause 5 notes . . . . .	43
A.1.1	Using assumed type in the context of interoperation with C . . . . .	43
A.1.2	Mapping of interfaces with void * C parameters to Fortran . . . . .	43
A.1.3	Using assumed-type variables in Fortran . . . . .	45
A.1.4	Simplifying interfaces for arbitrary rank procedures . . . . .	46
A.2	Clause 8 notes . . . . .	46
A.2.1	Dummy arguments of any type and rank . . . . .	46
A.2.2	Creating a contiguous copy of an array . . . . .	48
A.2.3	Changing the attributes of an array . . . . .	49
A.2.4	Creating an array section in C using CFLsection . . . . .	50
A.2.5	Use of CFLsetpointer . . . . .	51
A.2.6	Mapping of MPI interfaces to Fortran . . . . .	52

## List of Tables

8.1	Macros specifying attribute codes . . . . .	20
8.2	Macros specifying type codes . . . . .	20
8.3	Macros specifying error codes . . . . .	21

Withdrawn

## Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and nongovernmental, in liaison with ISO and IEC, also take part in the work. In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of the joint technical committee is to prepare International Standards. Draft International Standards adopted by the joint technical committee are circulated to national bodies for voting. Publication as an International Standard requires approval by at least 75 % of the national bodies casting a vote.

In other circumstances, particularly when there is an urgent market requirement for such documents, the joint technical committee may decide to publish an ISO/IEC Technical Specification (ISO/IEC TS), which represents an agreement between the members of the joint technical committee and is accepted for publication if it is approved by 2/3 of the members of the committee casting a vote.

An ISO/IEC TS is reviewed after three years in order to decide whether it will be confirmed for a further three years, revised to become an International Standard, or withdrawn. If the ISO/IEC TS is confirmed, it is reviewed again after a further three years, at which time it must either be transformed into an International Standard or be withdrawn.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO and IEC shall not be held responsible for identifying any or all such patent rights.

ISO/IEC TS 29113:2012 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC22, *Programming languages, their environments and system software interfaces*.

# Introduction

The system for interoperability between the C language, as standardized by ISO/IEC 9899:1999, and Fortran, as standardized by ISO/IEC 1539-1:2010, provides for interoperability of procedure interfaces with arguments that are non-optional scalars, explicit-shape arrays, or assumed-size arrays. These are the cases where the Fortran and C data concepts directly correspond. Interoperability is not provided for important cases where there is not a direct correspondence between C and Fortran.

The existing system for interoperability does not provide for interoperability of interfaces with Fortran dummy arguments that are assumed-shape arrays, have assumed character length, or have the `ALLOCATABLE`, `POINTER`, or `OPTIONAL` attributes. As a consequence, a significant class of Fortran subprograms is not portably accessible from C, limiting the usefulness of the facility.

The provision in the existing system for interoperability with a C formal parameter that is a pointer to void is inconvenient to use and error-prone. C functions with such parameters are widely used.

This Technical Specification extends the facility of Fortran for interoperating with C to provide for interoperability of procedure interfaces that specify dummy arguments that are assumed-shape arrays, have assumed character length, or have the `ALLOCATABLE`, `POINTER`, or `OPTIONAL` attributes. New Fortran concepts of assumed type and assumed rank are introduced. The former simplifies interoperation with formal parameters of type (void \*). The latter facilitates interoperability with C functions that can accept arguments of arbitrary rank. An intrinsic function, `RANK`, is specified to obtain the rank of an assumed-rank variable.

The facility specified in this Technical Specification is a compatible extension of Fortran as standardized by ISO/IEC 1539-1:2010. It does not require that any changes be made to the C language as standardized by ISO/IEC 9899:1999.

It is the intention of ISO/IEC JTC 1/SC22 that the semantics and syntax specified by this Technical Specification be included in the next revision of ISO/IEC 1539-1 without change unless experience in the implementation and use of this feature identifies errors that need to be corrected, or changes are needed to achieve proper integration, in which case every reasonable effort will be made to minimize the impact of such changes on existing implementations.

This Technical Specification is organized in 9 clauses:

Scope	Clause 1
Normative references	Clause 2
Terms and definitions	Clause 3
Compatibility	Clause 4
Type specifiers and attributes	Clause 5
Procedures	Clause 6
New intrinsic procedure	Clause 7
Interoperability with C	Clause 8
Required editorial changes to ISO/IEC 1539-1:2010(E)	Clause 9

It also contains the following nonnormative material:

Extended notes	Annex A
----------------	---------

## NOTE 0.1

ISO/IEC 1539-1:2010 references ISO/IEC 9899:1999. For consistency, this Technical Specification also references ISO/IEC 9899:1999, not ISO/IEC 9899:2011.

Withdrawn



# Information technology — Further interoperability of Fortran with C

## 1 Scope

This Technical Specification specifies the form and establishes the interpretation of facilities that extend the Fortran language defined by ISO/IEC 1539-1:2010. The purpose of this Technical Specification is to promote portability, reliability, maintainability, and efficient execution of programs containing parts written in Fortran and parts written in C, for use on a variety of computing systems.

Withdrawn

(Blank page)

Withdrawn

## 2 Normative references

The following referenced standards are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/IEC 1539-1:2010, *Information technology—Programming languages—Fortran—Part 1:Base language*

ISO/IEC 9899:1999, *Programming languages—C*

Withdrawn