
**Information technology — ASN.1
encoding rules —**

Part 8:
**Specification of JavaScript Object
Notation Encoding Rules (JER)**

iTeh Standards
(<https://standards.itih.ai>)
Document Preview

[ISO/IEC 8825-8:2021](https://standards.itih.ai/catalog/standards/iso/125f13fb-af0e-493b-afcf-5543a5d3e5ab/iso-iec-8825-8-2021)

<https://standards.itih.ai/catalog/standards/iso/125f13fb-af0e-493b-afcf-5543a5d3e5ab/iso-iec-8825-8-2021>



iTeh Standards
(<https://standards.iteh.ai>)
Document Preview

[ISO/IEC 8825-8:2021](https://standards.iteh.ai/catalog/standards/iso/125f13fb-af0e-493b-afcf-5543a5d3e5ab/iso-iec-8825-8-2021)

<https://standards.iteh.ai/catalog/standards/iso/125f13fb-af0e-493b-afcf-5543a5d3e5ab/iso-iec-8825-8-2021>



COPYRIGHT PROTECTED DOCUMENT

© ISO/IEC 2021

All rights reserved. Unless otherwise specified, or required in the context of its implementation, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier; Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

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 non-governmental, in liaison with ISO and IEC, also take part in the work.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives or www.iec.ch/members_experts/refdocs)

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents) or the IEC list of patent declarations received (see patents.iec.ch).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html. In the IEC, see www.iec.ch/understanding-standards.

This document was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology, Subcommittee SC 6, Telecommunications and information exchange between systems*, in collaboration with ITU-T. The identical text is published as ITU-T X.697 (02/2021).

This second edition cancels and replaces the first edition (ISO/IEC 8825-8:2018), which has been technically revised.

A list of all parts in the ISO/IEC 8825 series can be found on the ISO and IEC websites.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html and www.iec.ch/national-committees.

CONTENTS

Page

1	Scope	1
2	Normative references	1
	2.1 Identical Recommendations International Standards	1
	2.2 Additional references	1
3	Definitions.....	2
	3.1 Specification of Basic Notation	2
	3.2 Information Object Specification.....	2
	3.3 Constraint Specification.....	2
	3.4 Parameterization of ASN.1 Specification	2
	3.5 Basic Encoding Rules (BER).....	2
	3.6 Packed Encoding Rules (PER).....	2
	3.7 Additional definitions	2
4	Abbreviations	3
5	Encodings specified by this Recommendation International Standard.....	3
6	Conformance.....	4
7	General provisions	4
	7.1 Use of the type notation	4
	7.2 Constraints	5
	7.3 Type and value model used for encoding.....	6
	7.4 Types to be encoded.....	6
	7.5 Encoding instructions.....	6
	7.6 Production of a complete JER encoding	7
8	Notation, lexical items and keywords used in JER encoding instructions	7
9	Specifying JER encoding instructions.....	8
10	Assigning a JER encoding instruction using a type prefix.....	9
11	Assigning a JER encoding instruction using a JER encoding control section.....	9
12	Identification of the targets for a JER encoding instruction.....	9
	12.1 General rules	9
	12.2 Types defined in the module.....	10
	12.3 Built-in types.....	10
	12.4 Types imported from another module.....	10
13	Multiple assignment of JER encoding instructions	10
	13.1 Order in which multiple assignments are considered.....	10
	13.2 Effect of assigning a negating encoding instruction	11
	13.3 Multiple assignment of JER encoding instructions of the same category	11
14	The ARRAY encoding instruction	11
	14.1 General	11

14.2	Restrictions	11
15	The BASE64 encoding instruction.....	11
15.1	General	11
15.2	Restrictions	12
16	The NAME encoding instruction	12
16.1	General	12
16.2	Restrictions	13
17	The OBJECT encoding instruction.....	13
17.1	General	13
17.2	Restrictions	13
18	The TEXT encoding instruction	13
18.1	General	13
18.2	Restrictions	14
19	The UNWRAPPED encoding instruction.....	14
19.1	General	14
19.2	Restrictions	14
20	Encoding of boolean values	14
21	Encoding of integer values.....	15
22	Encoding of enumerated values	15
23	Encoding of real values.....	15
23.1	General	15
23.2	Encoding of the special real values.....	15
23.3	Encoding as a JSON number.....	16
23.4	Encoding as a JSON object.....	16
24	Encoding of bitstring values.....	16
24.1	General	16
24.2	Encoding of bitstring types with a fixed size	16
24.3	Encoding of bitstring types with a variable size.....	16
24.4	Alternative encoding of bitstring types with a JER-visible contents constraint.....	16
25	Encoding of octetstring values	17
25.1	General	17
25.2	Encoding of an octetstring value as a JSON string containing a Base64 encoding.....	17
25.3	Encoding of an octetstring value as a JSON string containing a hexadecimal encoding	17
25.4	Alternative encoding of an octetstring type with a JER-visible contents constraint	17
26	Encoding of the null value	17
27	Encoding of sequence values	17
27.1	General	17
27.2	Array-based encoding	17
27.3	Object-based encoding.....	17

<https://standards.iteh.ai/standards/iso-1257536-ar06-4936-ar01-99-43a5d5e5ab/iso-iec-8825-8-21>

28	Encoding of sequence-of values.....	18
29	Encoding of set values	18
30	Encoding of set-of values.....	18
	30.1 General	18
	30.2 Array-based encoding	18
	30.3 Object-based encoding.....	18
31	Encoding of choice values.....	19
	31.1 General	19
	31.2 Unwrapped encoding	19
	31.3 Wrapped encoding	19
32	Encoding of object identifier values.....	19
33	Encoding of relative object identifier values.....	19
34	Encoding of values of the internationalized resource reference type	19
35	Encoding of values of the relative internationalized resource reference type	19
36	Encoding of values of the embedded-pdv type	19
37	Encoding of values of the external type	20
38	Encoding of values of the restricted character string types	20
39	Encoding of values of the unrestricted character string type.....	20
40	Encoding of values of the time types	20
41	Encoding of open type values	20
42	Object identifier values referencing the encoding rules	20
Annex A	Examples of JER encodings.....	21
	A.1 ASN.1 description of the record structure.....	21
	A.2 ASN.1 description of a record value	21
	A.3 Example JER representation of this record value	21
	A.4 Additional examples of JER encodings	22
Annex B	Examples of JER encoding instructions and their effect on the encodings	25
	B.1 ASN.1 description of the record structure.....	25
	B.2 ASN.1 description of a record value	25
	B.3 JER representation of this record value.....	26
	B.4 Additional examples of JER encodings	26
	B.5 Examples of JER encodings of choice types.....	28

ISO/IEC 8825-8:2021(E)

Introduction

Rec. ITU-T X.680 | ISO/IEC 8824-1, Rec. ITU-T X.681 | ISO/IEC 8824-2, Rec. ITU-T X.682 | ISO/IEC 8824-3 and Rec. ITU-T X.683 | ISO/IEC 8824-4 together describe Abstract Syntax Notation One (ASN.1), a notation for the definition of messages to be exchanged between peer applications.

This Recommendation | International Standard defines encoding rules that may be applied to values of ASN.1 types defined using the notation specified in the publications listed in the previous paragraph. Application of these encoding rules produces a transfer syntax for such values. It is implicit in the specification of these encoding rules that they are also to be used for decoding.

There is more than one set of encoding rules that can be applied to values of ASN.1 types. This Recommendation | International Standard defines a set of JavaScript Object Notation Encoding Rules (JER), so called because the encodings they produce are instances of the JSON grammar specified in ECMA-404.

This Recommendation | International Standard specifies the syntax and semantics of JER encoding instructions that modify the JSON text produced by the application of JER to certain ASN.1 types.

Clauses 8 to 12 list the JER encoding instructions and specify the syntax for their assignment to an ASN.1 type or component using either a JER type prefix (see Rec. ITU-T X.680 | ISO/IEC 8824-1, clause 31.3) or a JER encoding control section (see Rec. ITU-T X.680 | ISO/IEC 8824-1, clause 54).

Clause 13 defines the order of precedence if JER encoding instructions are present in both a JER type prefix and in a JER encoding control section.

Clauses 14 to 19 specify:

- a) the syntax of each JER encoding instruction used in a type prefix or a JER encoding control section;
- b) restrictions on the JER encoding instructions that can be associated with a particular ASN.1 type (resulting from inheritance and multiple assignments).

Clauses 20 to 41 specify the JER encoding of ASN.1 types, referencing earlier clauses that define the JER encoding instructions.

Annex A is informative and contains examples of JER encodings where JER encoding instructions are not used.

Annex B is informative and contains examples of JER encoding instructions and their effect on the JER encodings.

[ISO/IEC 8825-8:2021](https://standards.iteh.ai/catalog/standards/iso/125f13fb-af0e-493b-afcf-5543a5d3e5ab/iso-iec-8825-8-2021)

<https://standards.iteh.ai/catalog/standards/iso/125f13fb-af0e-493b-afcf-5543a5d3e5ab/iso-iec-8825-8-2021>

**INTERNATIONAL STANDARD
ITU-T RECOMMENDATION**

**Information technology – ASN.1 encoding rules: Specification of JavaScript
Object Notation Encoding Rules (JER)**

1 Scope

This Recommendation | International Standard specifies a set of JavaScript Object Notation Encoding Rules (JER) that may be used to derive a transfer syntax for values of types defined in Rec. ITU-T X.680 | ISO/IEC 8824-1, Rec. ITU-T X.681 | ISO/IEC 8824-2, Rec. ITU-T X.682 | ISO/IEC 8824-3 and Rec. ITU-T X.683 | ISO/IEC 8824-4. It is implicit in the specification of these encoding rules that they are also to be used for decoding.

The encoding rules specified in this Recommendation | International Standard:

- are used at the time of communication;
- are intended for use in circumstances where interoperability with applications using JSON is the major concern in the choice of encoding rules;
- allow the extension of an abstract syntax by addition of extra values for all forms of extensibility described in Rec. ITU-T X.680 | ISO/IEC 8824-1.

This Recommendation | International Standard also specifies the syntax and semantics of JER encoding instructions, as well as the rules for their assignment and combination. JER encoding instructions can be used to control JER encoding for specific Abstract Syntax Notation One (ASN.1) types.

2 Normative references

The following Recommendations and International Standards contain provisions which, through reference in this text, constitute provisions of this Recommendation | International Standard. At the time of publication, the editions indicated were valid. All Recommendations and Standards are subject to revision, and parties to agreements based on this Recommendation | International Standard are encouraged to investigate the possibility of applying the most recent edition of the Recommendations and Standards listed below. Members of IEC and ISO maintain registers of currently valid International Standards. The Telecommunication Standardization Bureau of the ITU maintains a list of currently valid ITU-T Recommendations.

NOTE – This Recommendation | International Standard is based on ISO/IEC 10646:2003 and the Unicode standard version 3.2.0:2002. It cannot be applied using later versions of these two standards. <https://standards.iteh.ai/catalog/standards/iso/125f13fb-af0e-493b-afcf-5543a5d3e5ab/iso-iec-8825-8-2021>

2.1 Identical Recommendations | International Standards

- Recommendation. ITU-T X.226 (1994) | ISO/IEC 8823-1:1994, *Information technology – Open Systems Interconnection – Connection-oriented Presentation protocol: Protocol specification.*
- Recommendation ITU-T X.680 (2021) | ISO/IEC 8824-1:2021, *Information technology – Abstract Syntax Notation One (ASN.1): Specification of basic notation.*
- Recommendation ITU-T X.681 (2021) | ISO/IEC 8824-2:2021, *Information technology – Abstract Syntax Notation One (ASN.1): Information object specification.*
- Recommendation ITU-T X.682 (2021) | ISO/IEC 8824-3:2021, *Information technology – Abstract Syntax Notation One (ASN.1): Constraint specification.*
- Recommendation ITU-T X.683 (2021) | ISO/IEC 8824-4:2021, *Information technology – Abstract Syntax Notation One (ASN.1): Parameterization of ASN.1 specifications.*
- Recommendation ITU-T X.690 (2021) | ISO/IEC 8825-1:2021, *Information technology – ASN.1 encoding rules: Specification of Basic Encoding Rules (BER), Canonical Encoding Rules (CER) and Distinguished Encoding Rules (DER).*
- Recommendation ITU-T X.691 (2021) | ISO/IEC 8825-2:2021, *Information technology – ASN.1 encoding rules: Specification of Packed Encoding Rules (PER).*

NOTE – The references above shall be interpreted as references to the identified Recommendations | International Standards together with all their published amendments and technical corrigenda.

2.2 Additional references

- ECMA Standard ECMA-404 (2017), *The JSON Data Interchange Syntax.*

- IETF RFC 2045 (1996), *Multipurpose Internet Mail Extensions (MIME) Part One: Format of Internet Message Bodies*.
-
- ISO/IEC 10646:2003, *Information technology – Universal Multiple-Octet coded character set (UCS)*.

3 Definitions

For the purposes of this Recommendation | International Standard, the following definitions apply:

3.1 Specification of basic notation

For the purposes of this Recommendation | International Standard, all the definitions in Rec. ITU-T X.680 | ISO/IEC 8824-1 apply.

3.2 Information object specification

For the purposes of this Recommendation | International Standard, all the definitions in Rec. ITU-T X.681 | ISO/IEC 8824-2 apply.

3.3 Constraint specification

This Recommendation | International Standard makes use of the following terms defined in Rec. ITU-T X.682 | ISO/IEC 8824-3:

- a) component relation constraint;
- b) table constraint.

3.4 Parameterization of ASN.1 specification

This Recommendation | International Standard makes use of the following term defined in Rec. ITU-T X.683 | ISO/IEC 8824-4:

- variable constraint.

3.5 Basic Encoding Rules (BER)

This Recommendation | International Standard makes use of the following terms defined in Rec. ITU-T X.690 | ISO/IEC 8825-1:

- a) data value;
- b) dynamic conformance;
- c) encoding (of a data value);
- d) receiver;
- e) sender;
- f) static conformance.

3.6 Packed Encoding Rules (PER)

This Recommendation | International Standard makes use of the following terms defined in Rec. ITU-T X.691 | ISO/IEC 8825-2:

- a) composite type;
- b) composite value;
- c) outermost type;
- d) relay-safe encoding;
- e) simple type;
- f) textually dependent.

3.7 Additional definitions

3.7.1 abstract syntax value: A value of an abstract syntax (defined as a set of values of a single ASN.1 type) which is to be encoded by JER or which is generated by JER decoding.

- 3.7.2 associated encoding instruction (for a type):** A set of JER encoding instructions associated with a type.
- 3.7.3 effective value constraint (of an integer type):** The smallest integer range that includes all the values of the integer type that are permitted by the JER-visible constraints (see clause 7.2.7).
- 3.7.4 effective size constraint (of a bitstring type):** The smallest integer range that includes the lengths of all the values of the string type that are permitted by the JER-visible constraints (see clause 7.2.8).
- 3.7.5 final encoding instructions (for a type):** The set of JER encoding instructions associated with a type as a result of the complete ASN.1 specification, and which are applied in producing encodings of that type.
- 3.7.6 inherited encoding instructions:** A set of JER encoding instructions that are associated with the type identified by a type reference.
- 3.7.7 JSON array:** A series of JSON tokens that constitute an array structure as specified in ECMA-404, clause 7.
- 3.7.8 JSON member name string (of a component of a sequence, set or choice type that is encoded as a JSON object):** The Unicode character string denoted by the name of the member of the JSON object identifying the component in the JER encoding.
- 3.7.9 JSON number:** A JSON token that is a number as specified in ECMA-404, clause 8.
- 3.7.10 JSON object:** A series of JSON tokens that constitute an object structure as specified in ECMA-404, clause 6.
- 3.7.11 JSON string:** A JSON token that is a string as specified in ECMA-404, clause 9.
NOTE – A JSON string is part of a JER encoding, it begins and ends with a quotation mark, may contain escapes, and is distinct from the Unicode character string that it denotes.
- 3.7.12 JSON token:** A Unicode character string that is one of the several kinds of tokens specified in ECMA-404, clause 4.
- 3.7.13 JER encoding instruction:** Notation used to change the JER encoding of a type.
- 3.7.14 JER-visible constraint:** An instance of use of the ASN.1 constraint notation that affects the JER encoding of a value.
- 3.7.15 octet:** A group of eight consecutive bits, numbered from bit 8 (the most significant bit) to bit 1 (the least significant bit).
- 3.7.16 prefixed encoding instruction:** A JER encoding instruction that is assigned to a type using a type prefix.
NOTE – Prefixed encoding instructions can delete, replace or add to the associated encoding instructions of a type.
- 3.7.17 targeted encoding instruction:** A JER encoding instruction that is assigned to multiple types using a target list in a JER encoding control section.
NOTE – Targeted encoding instructions can delete, replace or add to the associated encoding instructions of multiple types.

4 Abbreviations

For the purposes of this Recommendation | International Standard, the following abbreviations apply:

ASN.1	Abstract Syntax Notation One
BER	Basic Encoding Rules
JER	JavaScript Object Notation Encoding Rules
OSI	Open Systems Interconnection
PER	Packed Encoding Rules
UTF-8	Unicode Transformation Format 8 bit

5 Encodings specified by this Recommendation | International Standard

5.1 This Recommendation | International Standard specifies a set of encoding rules that can be used to encode and decode the values of an abstract syntax defined as the values of a single (known) ASN.1 type. This clause describes their applicability and properties.

5.2 JER encodings are always relay-safe provided the abstract values of the types **EXTERNAL**, **EMBEDDED PDV**, and **CHARACTER STRING** are constrained to prevent the carriage of open systems interconnection (OSI) presentation context identifiers.

5.3 If a type encoded with JER contains **EXTERNAL**, **EMBEDDED PDV**, or **CHARACTER STRING** types, then the outer encoding ceases to be relay-safe unless the transfer syntax used for all the **EXTERNAL**, **EMBEDDED PDV**, or **CHARACTER STRING** types is relay-safe.

NOTE – The character transfer syntaxes supporting all character abstract syntaxes of the form {iso standard 10646 level-1(1) ...} are canonical. Those supporting {iso standard 10646 level-2(2) ...} and {iso standard 10646 level-3(3) ...} are not always canonical. All these character transfer syntaxes are relay-safe.

5.4 JER encodings are self-delimiting. Encodings are always a whole multiple of 8 bits. When carried in an **EXTERNAL** type, they shall be carried in the **OCTET STRING** choice alternative, unless the **EXTERNAL** type itself is encoded in JER, in which case the value may be encoded as a single ASN.1 type (i.e., an open type). When carried in an OSI presentation protocol, the "full encoding" (as defined in Rec. ITU-T X.226 | ISO/IEC 8823-1) with the **OCTET STRING** alternative shall be used.

5.5 This Recommendation | International Standard also specifies the syntax and semantics of JER encoding instructions (see clauses 14 to 19).

5.6 ASN.1 forms a basic JSON schema notation. The ASN.1 schema is used to define the content and structure of data using ASN.1 and the JavaScript Object Notation Encoding Rules. It can be used without JER encoding instructions.

5.7 JER encoding instructions provide wider flexibility in the JSON texts that can be specified.

5.8 JER encoding instructions are assigned to ASN.1 type definitions or to type references using either or both JER type prefixes (see Rec. ITU-T X.680 | ISO/IEC 8824-1, clause 31.3) and a JER encoding control section (see Rec. ITU-T X.680 | ISO/IEC 8824-1, clause 54). If encoding instructions are associated with a type definition, they are carried with the ASN.1 type (through its type reference) into other type definitions and other ASN.1 modules. The final encoding instructions of a type are applied when the type is encoded in JER and modify the JSON text produced.

6 Conformance

6.1 Dynamic conformance for the JavaScript Object Notation Encoding Rules is specified in clauses 7 to 41.

6.2 Static conformance is specified by those standards that specify the application of these encoding rules.

6.3 Alternative encodings are permitted by the JavaScript Object Notation Encoding Rules as encoder's options. Decoders that claim conformance to JER shall support all JER encoding alternatives.

6.4 The rules in this Recommendation | International Standard are specified in terms of an encoding procedure. Implementations are not required to mirror the procedure specified, provided the octet string produced as the complete encoding of an abstract syntax value is identical to one of those specified in this Recommendation | International Standard for the applicable transfer syntax.

6.5 Implementations performing decoding are required to produce the abstract syntax value corresponding to any received octet string that could be produced by a sender conforming to the encoding rules identified in the transfer syntax associated with the material being decoded.

6.6 If an ASN.1 specification assigns JER encoding instructions in accordance with clauses 8 to 13 such that an ASN.1 type or component has final encoding instructions that violate the restrictions specified in clauses 14 to 19, then that ASN.1 specification is not in conformity with this Recommendation | International Standard, even if (without the encoding instructions) it would conform to all the requirements of Rec. ITU-T X.680 | ISO/IEC 8824-1.

NOTE – It is only occasionally invalid to assign an encoding instruction to a "type", as it can be negated (removed from the set of associated encoding instructions) by a further assignment. It is the final encoding instructions that determine conformity of the specification.

7 General provisions

7.1 Use of the type notation

7.1.1 These encoding rules make specific use of the ASN.1 type notation as specified in Rec. ITU-T X.680 | ISO/IEC 8824-1, Rec. ITU-T X.681 | ISO/IEC 8824-2, Rec. ITU-T X.682 | ISO/IEC 8824-3 and Rec. ITU-T X.683 | ISO/IEC 8824-4, and can only be applied to encode the values of a single ASN.1 type specified using that notation.

7.1.2 In particular, but not exclusively, they are dependent on the following information being retained in the ASN.1 type and value model underlying the use of the notation:

- a) the identifiers of the components of a sequence or set type and of the alternatives of a choice type;
- b) the identifiers of the enumeration items of an enumerated type;
- c) whether a set or sequence type component has a default value or not;