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JSON Structure: Symbols, Scientific Units, and Currencies
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Abstract

This document specifies "JSON Structure Symbols, Scientific Units, and Currencies", an extension to JSON Structure Core. This specification defines a set of annotation keywords for associating scientific unit and currency metadata and constraints, primarily for use with numeric values.

JSON Structure Scientific Units provides a mechanism for schema authors to explicitly declare the unit associated with numeric data, thereby enabling precise mapping between schema representations and external data systems.

About This Document

This note is to be removed before publishing as an RFC.

The latest revision of this draft can be found at <https://json-structure.github.io/units/draft-vasters-json-structure-units.html>. Status information for this document may be found at <https://datatracker.ietf.org/doc/draft-vasters-json-structure-units/>.

Source for this draft and an issue tracker can be found at <https://github.com/json-structure/units>.

Status of This Memo

This Internet-Draft is submitted in full conformance with the provisions of BCP 78 and BCP 79.

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1. Introduction

This document is a companion specification to JSON Structure Core [JSTRUCT-CORE]. It defines annotation keywords that allow numeric types to be enriched with measurement unit or currency information.

The primary purpose of this extension is to help numeric values be interpreted consistently by specifying their associated scientific units or currencies.

This specification defines the syntax and semantics of the keywords that annotate numeric types with scientific unit or currency information. Implementations of JSON Structure Core that support this extension MUST process these keywords according to the rules defined herein.

2. Conventions

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "NOT RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in BCP 14 [RFC2119] [RFC8174] when, and only when, they appear in all capitals, as shown here.

3. Symbol Annotations

This section defines the keywords used to annotate schema elements with symbols that accompany values when presented to users.

3.1. The symbol Keyword

The symbol keyword provides a mechanism for annotating a schema element with a symbol that annotates the value of the element when presented to users.

The keyword MAY appear alongside the type keyword in object properties or array items or map values.

- * The value of symbol MUST be a JSON string.
- * The string value of symbol SHOULD contain a Unicode character or a multi-character symbol that represents the value of the annotated element.
- * The symbol keyword MAY be used as an annotation on any schema element.
- * symbol MAY be used in conjunction with unit or currency annotations or independently.

Example:

```
{
  "type": "number",
  "currency": "EUR",
  "symbol": "€ "
}
```

or

```
{
  "type": "number",
  "unit": "m/s^2",
  "symbol": "m/s2 "
}
```

or

```
{
  "type": "number",
  "description": "Number of bunnies",
  "symbol": "bunnies"
}
```

3.1.1.1. The symbols Keyword

The symbols keyword provides a mechanism for annotating a schema element with a set of symbols that annotate the value of the element when presented to users.

The keyword MAY appear alongside the type keyword in object properties or array items or map values.

- * The value of symbols MUST be a map.
- * The keys of the symbols map MUST be strings that represent a purpose indicator. The lang: prefix is reserved for language-specific symbols. The suffix after the colon specifies the language code. The language code MUST conform to the [RFC4646] standard.
- * The values of the symbols map MUST be strings that represent the symbol.
- * The symbols keyword MAY be used as an annotation on any schema element.

Example:

```
{
  "type": "number",
  "description": "Number of bunnies",
  "symbols": {
    "lang:en": "Bunnies",
    "lang:de": "Kaninchen",
    "lang:fr": "Lapins"
  }
}
```

4. Scientific Unit Annotations

This section defines the keywords used to annotate numeric types with scientific unit information.

4.1. The unit Keyword

The unit keyword provides a mechanism for annotating a numeric schema (or a schema based on a numeric extended type such as number, int32, uint32, int64, uint64, int128, uint128, float, double, or decimal) with its measurement unit.

The keyword MAY appear alongside the type keyword in object properties or array items or map values.

* The value of unit MUST be a JSON string.

* The string value of unit SHOULD contain:

- An SI unit symbol or derived unit symbol conforming to the Bureau International des Poids et Mesures (BIPM) International System of Units (SI) [IEEE_260.1_2024]
- A unit symbol defined in ISO/IEC 80000 series [IEC_80000-1_2025]
- A non-SI unit symbol defined in NIST Handbook 44 Appendix C [NIST_HB_44_2023]

For "derived" SI units that reflect a multiplication, the unit symbols MUST be separated by the asterisk character (*). For derived units that reflect a division, the unit symbols MUST be separated by the forward slash (/). The notation for exponentiation MUST be indicated using the caret (^). For example, acceleration SHALL be denoted as "m/s^2".

Units that use Greek-language symbols (including supplementary or derived units) such as Ohm ("Ω") MUST be denoted with those Greek symbols (using the corresponding Unicode code points).

The unit keyword MAY be used as an annotation on any schema element whose underlying type is numeric. Schema processors that support JSON Structure Scientific Units MUST use the value of the unit keyword to interpret, convert, or display numeric values appropriately.

Example:

```
{
  "type": "number",
  "unit": "m/s^2"
}
```

4.2. Unit Annotations

This is a list of common scientific units that MAY be used with the unit. Units are defined according to ISO/IEC 80000, BIPM SI, and NIST HB44:

Measure	unit	Description	Reference
Length	m	Meters, SI unit of length	[IEC_80000-3_2025]
Velocity	m/s	Meters per second	[IEC_80000-3_2025]
Acceleration	m/s ²	Meters per second squared	[IEC_80000-3_2025]
Weight	kg	Kilograms, SI unit of mass	[IEC_80000-4_2025]
Time	s	Seconds, SI unit of time	[IEEE_260.1_2024]
Temperature	K	Kelvin, SI unit of temperature	[IEEE_260.1_2024]
Volume	L	Liters, non-SI unit accepted in SI	[IEEE_260.1_2024]
Pressure	psi	Pounds per square inch, non-SI unit	[NIST_HB_44_2023]

Energy	J	Joules, SI unit of energy	[IEEE_260.1_2024]
Power	W	Watts, SI unit of power	[IEEE_260.1_2024]
Electrical Resistance	ホウ	Ohms, SI unit of electrical resistance	[IEEE_260.1_2024]
Electrical Current	A	Amperes, SI unit of electric current	[IEEE_260.1_2024]
Light Intensity	cd	Candelas, SI unit of luminous intensity	[IEEE_260.1_2024]
Area	m^2	Square meters, SI unit of area	[IEEE_260.1_2024]
Volume	m^3	Cubic meters, SI unit of volume	[IEEE_260.1_2024]
Length	ft	Feet, non-SI unit	[NIST_HB_44_2023]
Volume	gal	Gallon, non-SI unit	[NIST_HB_44_2023]
Pressure	bar	Bar, non-SI unit	[NIST_HB_44_2023]
Digital Storage	B	Bytes, non-SI unit	[IEC_80000-13_2025]
Data Rate	bit/s	Bits per second	[IEC_80000-13_2025]

Table 1

4.3. Unit Prefixes

The following SI prefixes MAY be used with base units:

Prefix	Symbol	Factor	
yotta	Y	10 ²⁴	イ 竅 エ
zetta	Z	10 ²¹	イ ツ ケ
exa	E	10 ¹⁸	ケ 竅 ク
peta	P	10 ¹⁵	ケ 竅 オ
tera	T	10 ¹²	ケ ツ イ
giga	G	10 ⁹	竅 ケ
mega	M	10 ⁶	竅 カ
kilo	k	10 ³	ツ ウ
milli	m	10 ⁻³	竅 サ ツ ウ
micro	ホシ	10 ⁻⁶	竅 サ 竅 カ
nano	n	10 ⁻⁹	竅 サ 竅 ケ
pico	p	10 ⁻¹²	竅 サ ツ ケ ツ イ
hecto	h	10 ²	ツ イ

Table 2

Examples:

- * "km": Kilometers
- * "mm": Millimeters
- * "ホシm": Micrometers
- * "nm": Nanometers
- * "ps": Picoseconds
- * "mホウ ": Milliohms
- * "kホウ ": Kilohms

- * "MW": Megawatts

5. Currency Annotations

This section defines the keywords used to annotate numeric types with currency information.

5.1. The currency Keyword

The currency keyword provides a mechanism for annotating a numeric schema (or a schema based on a numeric extended type such as number, int32, uint32, int64, uint64, int128, uint128, float, double, or decimal) with a currency annotation.

The keyword MAY appear alongside the type keyword in object properties or array items or map values.

- * The value of currency MUST be a JSON string.
- * The string value of currency SHOULD contain a three-letter currency code conforming to the [ISO_4217_2015] standard.
- * The currency keyword MAY be used as an annotation on any schema element.

Example:

```
{
  "type": "number",
  "currency": "EUR"
}
```

5.2. Enabling the Annotations

These annotations can be enabled in a schema or meta-schema by adding the JSONSchemaUnits key to the \$uses clause when referencing the extended meta-schema:

```
{
  "$schema": "https://json-structure.org/meta/extended/v0/#",
  "$id": "myschema",
  "$uses": [
    "JSONSchemaUnits"
  ],
  "type": "object",
  "properties": {
    "name": {
      "type": "decimal",
      "unit": "m/s^2"
    }
  }
}
```

The annotations are enabled by default in the validation meta-schema:

```
{
  "$schema": "https://json-structure.org/meta/validation/v0/#",
  "$id": "myschema",
  "type": "object",
  "properties": {
    "name": {
      "type": "decimal",
      "unit": "m/s^2"
    }
  }
}
```

6. Security and Interoperability Considerations

Alternate unit annotations do not affect the fundamental validation of instance data. They are purely metadata and MUST be ignored by validators that do not support this extension. Applications that rely on unit annotations for conversion or display MUST implement appropriate validation against recognized standards (BIPM SI and NIST HB44) to ensure consistency.

7. IANA Considerations

This document has no IANA actions.

8. Normative References

[IEC_80000-13_2025]

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[RFC4646] Phillips, A. and M. Davis, "Tags for Identifying Languages", RFC 4646, DOI 10.17487/RFC4646, September 2006, <<https://www.rfc-editor.org/rfc/rfc4646>>.

[RFC8174] Leiba, B., "Ambiguity of Uppercase vs Lowercase in RFC 2119 Key Words", BCP 14, RFC 8174, DOI 10.17487/RFC8174, May 2017, <<https://www.rfc-editor.org/rfc/rfc8174>>.

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