

Additional Units for SenML
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Abstract

The Sensor Measurement Lists (SenML) media type supports the indication of units for a quantity represented. This short document registers a number of additional unit names in the IANA registry for Units in SenML. It also defines a registry for secondary units that cannot be in SenML's main registry as they are derived by linear transformation from units already in that registry.

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[1.](#) Introduction

The Sensor Measurement Lists (SenML, [\[RFC8428\]](#)) media type supports the indication of a unit, using the SenML field "u", for the quantity given as a data value in a SenML record. For this purpose, SenML defines an IANA registry of defined Unit names and their meanings.

This short document registers a number of additional units in the IANA registry for Units in SenML that appear to be necessary for further adopting SenML in other Standards Development Organizations (SDOs).

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.

[2.](#) New Units

IANA is requested to assign new units in the "SenML Units" subregistry of the SenML registry [[IANA.senml](#)] (as defined in [\[RFC8428\]](#)):

Symbol	Description	Type	Reference
B	Byte (information content)	float	RFCthis
VA	volt-ampere (Apparent Power)	float	RFCthis
var	volt-ampere reactive (Reactive Power)	float	RFCthis
vars	volt-ampere reactive seconds (Reactive Energy)	float	RFCthis
J/m	joule per meter (Energy per distance)	float	RFCthis
kg/m3	kilograms per cubic meter (mass concentration)	float	RFCthis
deg	degrees (angle)*	float	RFCthis

Table 1: New units registered for SenML

3. Rationale

SenML [RFC8428] takes the position that unscaled SI units should always be used. However, SenML makes one exception: The degree Celsius (as Cel) is allowed as an alternative to the K (Kelvin).

This document takes the position that the same should apply to a small number of alternative units in wide use:

- o The Byte. [IEC-80000-13] defines both the bit (item 13-9.b) and the byte (item 13-9.c, also called octet) as alternative names for the coherent unit one for the purpose of giving storage capacity and related quantities. While the name octet is associated with the symbol o, this is in wide use only in French-speaking countries. Globally more wide-spread is the symbol B for byte, even though B is already taken in SI for bel. [RFC8428] therefore registers dB as the SenML unit for logarithmic relative power, leaving B free for the usage proposed here. While this is potentially confusing, the situation is widely understood in engineering circles and is unlikely to cause actual problems.
- o The Volt-Ampere. [IEC-80000-6] item 6-57.a defines the VA (volt ampere) as a unit for apparent power; items 6-59.a, 6-60.a and

6-61.a also use the unit for complex, reactive, and non-active power.

- o The Volt-Ampere-reactive. [[IEC-80000-6](#)] item 6-60.b defines the var (volt ampere reactive) as an alternative (and fully equivalent) unit to VA specifically for reactive power (with the primary unit VA). It is not presently known to this author how the upcoming revision of IEC 80000-6 will update this, but it has become clear since that there is strong interest in using this unit specifically for the imaginary content of complex power, reactive power [[IEEE-1459](#)].

The unit "degrees" is unit in wide use in practice for plane angle (as in heading, bearing, etc.). It is marked with an asterisk because the preferred coherent SI unit is radian ("rad").

The Joule per meter is not a traditional electromagnetic unit. It and its scaled derivatives (in particular Wh/km) are used to describe the energy expended for achieving motion over a given distance, e.g., as an equivalent for electrical cars of the inverse of "mileage".

4. New Registry

IANA is requested to create a "secondary units" subregistry in the SenML registry [[IANA.senml](#)] defined in [[RFC8428](#)].

The registry has four columns:

- o secondary unit: a newly registered name allocated within the same namespace as SenML units
- o SenML unit: an existing SenML unit from the SenML units registry
- o scale, offset: two rational numbers, expressed in decimal (optionally, with a decimal exponent given) or as a fraction divided by a "/" character.

Quantities expressed in the secondary unit can be converted into the SenML unit by first multiplying their value with the scale number and then adding the offset, yielding the value in the given SenML unit.

The initial content of the secondary units registry is:

secondary unit	SenML unit	scale	offset	Reference
ms	s	1/1000	0	RFCthis
min	s	60	0	RFCthis
h	s	3600	0	RFCthis
kW	W	1000	0	RFCthis
kVA	VA	1000	0	RFCthis
kvar	var	1000	0	RFCthis
Ah	C	3600	0	RFCthis
Wh	J	3600	0	RFCthis
kWh	J	3600000	0	RFCthis
kvar	var	1000	0	RFCthis
varh	vars	3600	0	RFCthis
Wh/km	J/m	3.6	0	RFCthis
KiB	B	1024	0	RFCthis
mV	V	1/1000	0	RFCthis
mA	A	1/1000	0	RFCthis
dBm	dBW	1	-30	RFCthis
ug/m3	kg/m3	1e-9	0	RFCthis
mm/h	m/s	1/3600000	0	RFCthis
ppm	/	1e-6	0	RFCthis
hPa	Pa	100	0	RFCthis
mm	m	1/1000	0	RFCthis

Example: the value of a quantity given as 100 ms is first multiplied by 1/1000, yielding the number 0.1, and then the offset 0 is added,

yielding the number 0.1 again, leading to a quantity of 0.1 s. The value of a quantity given as 10 dBm is first multiplied by 1, yielding the number 10, and then the offset -30 is added, yielding the number -20, leading to a quantity of -20 dBW.

New entries can be added to the registration by Expert Review as defined in [RFC8126]. Experts should exercise their own good judgment, with the same guidelines as used for SenML units (Section 12.1 of [RFC8428]), but without applying the rules 4 and 5. Guidelines to the difference between units (which can go into the registry) and quantities are widely available, see for instance [RS].

SenML packs MAY, but SHOULD NOT use secondary units in place of SenML units, where the exception of the "SHOULD NOT" lies in the context of specific existing data models that are based on these secondary units.

[So does this spec update RFC 8428?]

5. Security Considerations

The security considerations of [RFC8428] apply. The introduction of new measurement units poses no additional security considerations except from a possible potential for additional confusion about the proper unit to use.

6. IANA Considerations

See [Section 2](#) and [Section 4](#).

Acknowledgements

Ari Keranen pointed out the need for additional units in SenML.

8. References

8.1. Normative References

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