

Detailed Rule concerned with units
of ECALS Dictionary

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Version 2.7

Abstract: This rule specifies the extended range and detailed rule about the unit set for the 'Description Rule of Property Dictionary' .

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1. Purpose and Scope

(1) Purpose

This rule specifies the extended range and detailed rule about the unit set for the 'Description Rule of Property Dictionary' .

(2) Scope

This rule is applied to Property Dictionary and EXCEL Dictionary Files.

(3) Normative References

- ISO31: 1992 General principles concerning quantities, units and symbols
- ISO1000: 1992 SI units and recommendations for the use of their multiples and certain other units Amendment 1 (1998)
- IEC61360-1: 1995 Standard data element types with associated classification scheme for electric components—Part1:Definitions—Principles and methods
- JIS Z 8203:2000 (ISO1000:1992)
- JIS X 0124:1993

2. Available units in ECALS Dictionary

(1) SI Units

Available units are SI base units, SI derived units and units that are accepted for use with SI base units.

(a) SI base Units

The International System of Units (SI) is founded on seven SI base units shown in Appendix 1.

(b) SI Derived Units

SI derived units are obtained from the seven SI basic units. The unit is combined using the symbol of the multiplying and dividing method in mathematics.

Ex) Electric field strength: V/m Moment: N.m Resistance: Ω

(c) Units which are accepted for use with SI base unit

Ex) Time: min, h, d Mass: t Volume: l(liter)

(2) Authorized Units by Technical Committee for Standardization

(a) Mass unit 'g' is accepted to use

Mass unit adopted in ECALS Dictionary is "kg" or "g." When "g" is used as a mass unit, it is recommended to add a note in the 'Remark' of the Property, 'Pay attention to 'g' is not SI unit.'

Reason: 'kg' must be requested to use as SI basic unit. But it is confusing in some case.

Ex) mkg (milli-kilogram , milli-kilo-gram ?).

(b) Area unit 'mm²' and 'cm²' are accepted to use

Ex. 1) (mm**2)

Ex. 2) kg/cm**2

Note: Describe it so that it may not be confused with a prefix.

(c) Reasonable Units to be approved in connecting with a prefix.

A customary unit consists of a unit that contains a prefix in a denominator. When this unit system is divided into a basic unit and a prefix, it will lose an original meaning. In this case it is allowed to use the customary unit.

Ex.1) Accepted: A customary unit for throughput: V/micro.s

Unaccepted: Based on a rule, a prefix M(Mega) and a unit V/s is connected.

Ex2) Accepted: A customary unit for Gate Power Consumption: W/MHz

Unaccepted: Based on a rule, a prefix micro and a unit W/Hz is connected.

Reason: When a unit contains a prefix in a denominator, the unit having the prefix becomes very important. In many cases, converting a prefix in the denominator into the equivalent one in the numerator will lose the original meaning.

(d) 10**⁻⁶

It is allowed to use a 10**⁻⁶ unit and ‘ppm’ to represent an extremely small value.

Ex1) Frequency tolerance: 10**⁻⁶ (QUARTZ CRYSTAL UNITS)

Ex2) Temperature Coefficient of Cap: 10**⁻⁶/Cel (CERA-CAP, CLASS1)

Ex3) Frequency Aging: 10**⁻⁶/year (QUARTZ CRYSTAL UNITS)

Note: it is allowed to use ‘10**⁻⁶’ as a description of ‘ppm’ in case of using customary in a class. It is not allowed to use ‘10**⁻⁶’ and ‘ppm’ in a same category (Class).

3. Prefix

Use a prefix defined by SI unit. Basically Prefix is not included in Unit in ECALS Dictionary. Unit with Prefix can be used only when it is allowed in this rule.

When the DataType is ‘IntC’, ‘IntM’, ‘RealC’ or ‘RealM’, it is allowed to describe a value with Prefix. However in case of ‘Int’ or ‘Real’ DataType, it is not allowed to use Prefix in a value.

4. How to describe a Unit.

(1) A first formulation which is defined in JIS X 0124:1993 should be used as a rule.

Ex) Time unit(Second) in ECALS Dictionary

Accepted: ‘s’ Unaccepted ‘sec’

(2) A plural form and period are unavailable for description of Unit. Period ‘.’ is used as a sign of multiplication.

(3) Describe in alphabets for Greek characters.

Ex) Resistance: Ω description: Ohm

- (4) How to use an Upper case / a Lower case for the first letter of Unit
Normally, a Lower case is used. If the Unit is a proper noun, the first letter should be an Upper case.

- (5) A period can be inserted between two letters for a multiple units. If there is no room to misunderstand, a period can be omitted.

Ex) torque: N.m or Nm

- (6) In case of a unit which has an exponential expression

It is represented a unit with a number followed by the unit symbol

Ex) $A^2s \rightarrow A2s$

To make it clearer, two asterisks (**) are following a unit, then a number follows asterisks.

Ex) $m^2 \rightarrow m^{**2}$

Even though JIS X 0124:1993 uses a unit symbol like m2, exponential symbols are used in ECALS Dictionary.

- (7) A quotient of a unit can be expressed with inserting a slash between a numerator and a denominator.

Ex) Velocity : m/s

- (8) In case of more complicated formulation, parentheses ‘()’ should be used to avoid misunderstanding.

Ex) Thermal conductor: W/(m.K)

sensitivity: V/(lx.s)

compressed density: $N/m^{**}(3/2)$

Note)

1. Technical Committee for Standardization (TCS) is the only authority who is able to modify and withdraw ECALSDS08.
2. This specification was opened to the public.
3. Revision history

Date	Status	Version /Revision	Major changes
2001/ 3/14	Published	001-01	
2002/10/23	Revised	002-01	<ul style="list-style-type: none"> • Clauses are modified. • A purpose and a scope are added. • An example of units is deleted. A list of units is added.
2003/ 6/17	Revised	002-02	<ul style="list-style-type: none"> • Table 2.1 in Appendix 2 is modified.
2004/12/01	Revised	002-03	<ul style="list-style-type: none"> • Totally reviewed
2005/ 4/28	Revised	002-04	<ul style="list-style-type: none"> • Change of disclosure scope.
2005/ 5/20	Revised	002-05	<ul style="list-style-type: none"> • Modification of Table 2.1 in Appendix 2
2005/ 7/28	Revised	002-06	<ul style="list-style-type: none"> • Modification of Table 2.1 in Appendix 2
2005/10/25	Revised	002-07	<ul style="list-style-type: none"> • Modification of Table 2.1 in Appendix 2

Appendix 1. Unit system (excerpt from JIS Z 8203:2000)

1. Structure of Unit System

Fig.1 shows the structure of the Units system. The SI consists of elements described in table 1.1, table 1.2 and table 1.4.

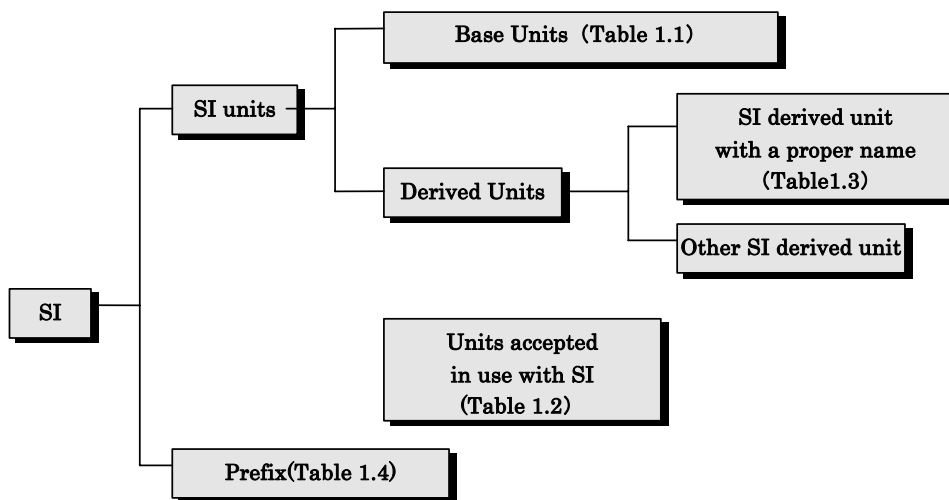


Fig. 1.1 Structure of Unit system

Table 1.1 SI Base Units

Base quantity	Name	Symbol
Length	meter	m
Mass	kilogram	kg
Time	second	s
Electric Current	ampere	A
Thermodynamic temperature	kelvin	K
Amount of substance	mole	mol
Luminous intensity	candela	cd

Table 1.2 Units accepted in use with the SI

Base quantity	Name	Symbol
Time	minute	min
	hour	h
	day	d
Plane angle	degree	°
	minute	'
	second	”
Volume	liter	l, L
Mass	metric ton (tonne)	t

Table 1.3 SI derived units with a proper name

Base quantity	Name	Symbol	Expression in terms of SI base units and SI derived units
Plane angle	radian	rad	$1\text{rad}=1\text{m}/\text{m}=1$
Solid angle	steradian	sr	$1\text{sr}=1\text{m}^2/\text{m}^2=1$
Frequency	Hertz	Hz	$1\text{Hz} = 1\text{s}^{-1}$
Force	Newton	N	$1\text{N} = 1\text{kg}\cdot\text{m}/\text{s}^2$
Pressure, stress	Pascal	Pa	$1\text{Pa} = 1\text{N}/\text{m}^2$
Energy, work, Quantity of heat	Joule	J	$1\text{J} = 1\text{N}\cdot\text{m}$
Power, Radiant flux	Watt	W	$1\text{W} = 1\text{J}/\text{s}$
Electric charge, Quantity of electricity	Coulomb	C	$1\text{C} = 1\text{A}\cdot\text{s}$
Electric potential, Potential difference, Tension, Electromotive force	Volt	V	$1\text{V} = 1\text{J}/\text{C}$
Capacitance	Farad	F	$1\text{F} = 1\text{C}/\text{V}$
Electric resistance	Ohm	Ω	$1\Omega = 1\text{V}/\text{A}$
Electric conductance	Siemens	S	$1\text{S} = 1\Omega^{-1}$
Magnetic flux	Weber	Wb	$1\text{Wb} = 1\text{V}\cdot\text{s}$
Magnetic flux density	Tesla	T	$1\text{T} = 1\text{Wb}/\text{m}^2$
Inductance	Henry	H	$1\text{H} = 1\text{Wb}/\text{A}$
Celsius temperature	degree Celsius	°C	$1\text{°C} = 1\text{K}$
Luminous flux	lumen	lm	$1\text{lm} = 1\text{cd}\cdot\text{sr}$

Illuminance	lux	lx	$1 \text{ lx} = 1 \text{ lm/m}^2$
Activity(of a radionuclide)	Becquerel	Bq	$1 \text{ Bq} = 1 \text{ s}^{-1}$
Absorbed dose, Specific energy imparted, Kerma	Gray	Gy	$1 \text{ Gy} = 1 \text{ J/kg}$
Dose equivalent	Sievert	Sv	$1 \text{ Sv} = 1 \text{ J/kg}$

Table 1.4 SI prefixes

Factor	Prefix		
	Name	Symbol	Description
10^{18}	Exa	E	E
10^{15}	Peta	P	P
10^{12}	Tera	T	T
10^9	Giga	G	G
10^6	Mega	M	M
10^3	Kilo	k	k
10^2	Hecto	h	h
10	Deca	da	da
10^{-1}	Deci	d	d
10^{-2}	Centi	c	c
10^{-3}	Milli	m	m
10^{-6}	Micro	μ	micro
10^{-9}	Nano	n	n
10^{-12}	Pico	p	p
10^{-15}	Femto	f	f
10^{-18}	Atto	a	a

Note): prefixes more than 10^{21} and less than 10^{-21} are omitted

Appendix 2 List of units used in ECALS Dictionary

Table 2.1 List of units used in ECALS Dictionary

Name of Unit	Symbol	Usage
Parts per million	10^{-6}	10**-6
Percentage	%	%
% per degree Celsius	%/°C	%/Cel
Parts per million per milli-Tesla	$(10^{-6}) / (\text{mT})$	$(10**-6) / (\text{mT})$
Square millimeter	mm ²	(mm**2)
Per degree Celsius	1/°C	1/Cel
Parts per million per degree Celsius	$10^{-6}/\text{°C}$	10**-6/Cel
Parabolic coefficient	$10^{-6}/\text{°C}^2$	10**-6/Cel**2
Parts per million per kelvin	$10^{-6}/\text{K}$	10**-6/K
Parts per million per meter	$10^{-6}/\text{m}$	10**-6/m
Parts per million per year	$10^{-6}/\text{year}$	10**-6/year
Ampere	A	A
Ampere per meter	A/m	A/m
Ampere per million instructions per second	A/MIPS	A/MIPS
Ampere per volt	A/V	A/V
Square Ampere second	A ² s	A2s
Bit	bit	bit
Bit per second	bit/s	bit/s
Byte	byte	byte
Coulomb	C	C
Candela	cd	cd
Candela per square meter	cd/m ²	cd/m**2
Degree Celsius	°C	Cel
Degree Celsius per Watt	°C/W	Cel/W
Channel	ch	ch
Character per second	character/s	character/s
Column	column	column
Character per inch	cpi	cpi
Cycle	cycle	cycle
Decibel	dB	dB
Decibel per meter	dB/m	dB/m
Decibel per Pascal	dB/Pa	dB/Pa
Decibel per Carrier	dBc	dBc
Milli-Watt decibel	dBm	dBm
Angle	deg	deg
Dot	dot	dot
Dot per inch	dot/inch	dot/inch
Dot per millimeter	dot/mm	dot/mm

Dot per second	dot/s	dot/s
Farad	F	F
Farad per meter	F/m	F/m
Frequency per second	f/s	f/s
Gram	g	g
Gram per cubic meter	g/m ³	g/m**3
Gal	Gal	Gal
Hour	h	h
Henry	H	H
Hertz	Hz	Hz
Hertz meter	Hz. m	Hz. m
Hertz per Volt	Hz/V	Hz/V
Joule	J	J
Joule per kilogram kelvin	J/(kg. K)	J/(kg. K)
Joule per cubic meter	J/m ³	J/m**3
Kelvin	K	K
Kilogram per square centimeter	kg/cm ²	kg/cm**2
Kilogram per cubic meter	kg/m ³	kg/m**3
Line	line	line
Line per second	line/s	line/s
Least significant bit	LSB	LSB
Lux second	lx. s	lx. s
Meter	m	m
Per meter	m ⁻¹	m** -1
Meter per second	m/s	m/s
Meter per Volt	m/V	m/V
Mean character between failure lines	MCBF lines	MCBF lines
Megahertz kilometer	MHz. km	MHz. km
Million instructions per second	MIPS	MIPS
Newton	N	N
Torque	Nm	N. m
Newton per cubic root meter	N/m ^{3/2}	N/m**(3/2)
Ohm	Ω	Ohm
Ohm meter	Ω m	Ohm. m
Ohm per meter	Ω /m	Ohm/m
Pascal	Pa	Pa
Pixel	pixel	pixel
Parts per million	ppm	ppm
Parts per million per degree Celsius	ppm/°C	ppm/Cel
Pulse	pulse	pulse
Revolution per minute	r/min	r/min
Radian	rad	rad
Second	s	s

Electric conductance (Siemens)	S	S
Tesla	T	T
Track per millimeter	tpmm	tpmm
Turn	turn	turn
Volt	V	V
Volt Ampere	VA	V. A
Volt per root Hertz	V/(Hz ^{1/2})	V/(Hz**(1/2))
Volt per Lux second	V/(lx. s)	V/(lx. s)
Volt per micro second	V/(μs)	V/(micro. s)
Volt per degree Celsius	V/°C	V/Cel
Volt per meter	V/m	V/m
Volt per second	V/s	V/s
Volt meter per Newton	Vm/N	Vm/N
Watt	W	W
Watt per meter Kelvin	W/(m. K)	W/(m. K)
Watt per Ampere	W/A	W/A
Watt per degree Celsius	W/°C	W/Cel
Watt per Hertz	W/Hz	W/Hz
Watt per kilogram	W/kg	W/kg
Watt per cubic meter	W/m ³	W/m**3
Word	word	word
Year	year	year