

Introduction to UCUM *Unified Code for Units of* *Measure*

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UCUM - Unified Code for Units of Measure

- Developed by the Regenstrief Institute (Indianapolis, USA)
- Not a list, a **system**
- Example: **mg/dl**
 - "m" = milli (prefix)
 - "g" = gramm
 - "/" = per
 - "d" = deci (prefix)
 - "l" = liter
- Website: www.unitsofmeasure.org

UCUM - Other valid constructs

- $10^9/l$: billion per liter, e.g. for thrombocytes
- % : percent
- $10^3/\mu l$: thousand per microliter
- mmol/mol : milli-moles per mole
- cm[Hg] : centimeter mercury column (pressure)
- m[H₂O] : meter water column (pressure)

UCUM - also non-SI units

- [ft_i] : foot
- [in_i] : inch
- [lbf_av] : pound

- Non-SI units may not be prefixed!

UCUM - Other valid constructs

Table of Example* UCUM codes for Electronic Messaging – version 1.1

10/4/2011

(Table sorted by "Description of the Unit" column)

Row # (not a code)	UCUM_CODE	Description of the Unit (using UCUM descriptions where they exist)
1	10.L/min	10 liter per minute
2	10.L/(min.m2)	10 liter per minute per square meter
3	10.uN.s/(cm5.m2)	10 micronewton second per centimeter to the fifth power per square meter
4	10*4/uL	10 thousand per microliter
5	10*8	100 million
6	24.h	24 hour
7	{absorbance}	absorbance
8	{activity}	activity

Row # (not a code)	UCUM_CODE	Description of the Unit (using UCUM descriptions where they exist)
22	10*9/uL	billion per microliter
23	10*9/mL	billion per milliliter
24	{binding_index}	binding index
25	[bdsk'U]	Bodansky unit
26	{CAG_repeats}	CAG trinucleotide repeats
27	cal	calorie
28	{cells}	cells
29	{cells}/[HPF]	cells per high power field
30	{cells}/uL	cells per microliter

The ucum-essence.xml

- XML file containing all symbols used in UCUM
 - And their conversion factors when not basic
- Allows to do automated conversions

The ucum-essence.xml

```
<unit Code="bar" CODE="BAR" isMetric="yes" class="iso1000">  
  <name>bar</name>  
  <printSymbol>bar</printSymbol>  
  <property>pressure</property>  
  <value Unit="Pa" UNIT="PAL" value="1e5">1 &#215; 10<sup>5</sup></value>  
</unit>
```

```
<unit Code="Pa" CODE="PAL" isMetric="yes" class="si">  
  <name>Pascal</name>  
  <printSymbol>Pa</printSymbol>  
  <property>pressure</property>  
  <value Unit="N/m2" UNIT="N/M2" value="1">1</value>  
</unit>
```

```
<unit Code="[psi]" CODE="[PSI]" isMetric="no" class="misc">  
  <name>pound per sqare inch</name>  
  <printSymbol>psi</printSymbol>  
  <property>pressure</property>  
  <value Unit="[lbf_av]/[in_i]2" UNIT="[LBF_AV]/[IN_I]2" value="1">1</value>  
</unit>
```

```
<unit Code="[in_i]" CODE="[IN_I]" isMetric="no" class="intcust">  
  <name>inch</name>  
  <printSymbol>in</printSymbol>  
  <property>length</property>  
  <value Unit="cm" UNIT="CM" value="254e-2">2.54</value>  
</unit>
```

Commonly Used UCUM Codes for Healthcare Units

Commonly Used UCUM Codes - Data

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Commonly Used UCUM Codes for Healthcare Units

Document Instructions

This document contains a list of UCUM codes for commonly used units in clinical lab value reporting. The tables below display the valid UCUM code, descriptive name, non-UCUM common synonym, and an IUPAC dimension for the unit. Units are grouped by general type. You may browse the list, use the links to the left to jump to a specific unit type, or use the search box to the left to search for a particular unit.

Additional Resources

To save a copy of these tables to your computer, right click on the desired link and choose "Save Target As..." or "Save Link As..."

[Commonly Used UCUM Codes \(XML Format\)](#)

[Commonly Used UCUM Codes \(TSV Format\)](#)

[How To Download UCUM Codes from CDC PHIN VADS](#)

Unit Types

Most Common Healthcare Units

Valid UCUM Code	Descriptive Name	Common Synonym (non-UCUM)	Dimension (IUPAC)
%	Percent	%	1
/uL	PerMicroLiter	/uL	L-3
[IU]/L	InternationalUnitsPerLiter	IU/L	L-3[arb]
10 ³ /uL	ThousandsPerMicroLiter	K/uL, x10 ³ /mm ³	L-3

Commonly Used UCUM Codes for Healthcare Units

Commonly Used UCUM Codes - Data

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[I]/g{Hgb}	InternationalUnitsPerGramHemoglobin	IU/g Hgb	M-1[arb]
{Ehrlich_U}/100g	EhrlichUnitsPer100Gram	EU/100 g	M-1[arb]
[I]/kg	InternationalUnitsPerKilogram	IU/kg	M-1[arb]
umol/min/g	MicroMolesPerMinutePerGram	umol/min/g	M-1T-1N
mU/g	MilliUnitsPerGram	mU/g	M-1T-1N
mU/g{Hgb}	MilliUnitsPerGramHemoglobin	mU/g Hgb	M-1T-1N
U/g	UnitsPerGram	U/g	M-1T-1N
U/g{Hgb}	UnitsPerGramHemoglobin	U/g Hgb	M-1T-1N
U/g{Cre}	UnitsPerGramCreatinine	U/g Cre	M-1T-1N
mU/mg{Cre}	MilliUnitsPerMilliGramCreatinine	mU/mg Cre	M-1T-1N
mU/mg	MilliUnitsPerMilligram	mU/mg	M-1T-1N
kU/g	KiloUnitsPerGram	kU/g	M-1T-1N
kat/kg	KatalPerKilogram	kat/kg	M-1T-1N

Volume Content Units

Valid UCUM Code	Descriptive Name	Common Synonym (non-UCUM)	Dimension (IUPAC)
mL/kg	MilliLitersPerKiloGram	mL/kg	L3M-1
L/kg	LitersPerKilogram	L/kg	L3M-1

Energy Content Units

Valid UCUM Code	Descriptive Name	Common Synonym (non-UCUM)	Dimension (IUPAC)
kCal/[oz_av]	KiloCaloriesPerOunce	kCal/oz	L2T-2

Special remarks

- mU/g{Hgb} : milliUnits per gram Hemoglobin
 - {Hgb} is NOT part of the unit! It is an "annotation"

§6 curly braces ■¹ The full range of characters 33–126 can be used within a pair of curly braces ('{' and '}'). The material enclosed in curly braces is called *annotation*. ■² Annotations do not contribute to the semantics of the unit but are meaningless by definition. Therefore, any fully conformant parser must discard all annotations. Parsers of limited conformance *should* not value annotations in comparison of units. ■³ Annotations do, however, signify the end of a unit symbol. ■⁴ An annotation without a leading symbol implies the default unit 1 (the unity). ■⁵ Curly braces must not be nested.

Other common examples:

{cells} {cre} {specimen} {RBC}

Annotations and "bad habits"

Curly braces are here because people want annotations and deeply believe that they need annotations. Especially in chemistry and biomedical sciences, there are traditional habits to write annotations at units or instead of units, such as "% vol.", "RBC", "CFU", "kg(wet tis.)", or "mL(total)". These habits are hard to overcome. Any attempt of a coding scheme to restrict this perceived expressiveness will ultimately result in the coding scheme not being adopted, or just "half-way" adopted (which is as bad as not adopted).

Two alternative responses to this reality exist: either give in to the bad habits and blow up of the code with dimension- and meaningless unit atoms, or canalize this habit so that it does no harm. *The Unified Code for Units of Measure* canalizes this habit using **curly braces**. Nevertheless we do continuing efforts to upgrade doubtful units to genuine units of *The Unified Code for Units of Measure* by defining and linking them to the other units as good as possible.

LOINC and UCUM

- LOINC database contains example UCUM units for each test

LOINC Number	789-8
Component	Erythrocytes
Property	NCnc
Time Aspect	Pt
System	Bld
Scale Type	Qn
Method Type	Automated count
Class	HEM/BC

Short Name	RBC # Bld Auto
Order OBS	Observation
Example Units	10*12/L
Long Common Name	Erythrocytes [# /volume] in Blood by Automated count
Example UCUM Units	10*3/uL

Use of UCUM in healthcare

- Mandatory in HL7-CDA (EHRs)
- Mandatory in FDA-SPL
- Strongly encouraged by LOINC

3.1.2. Active ingredient

The active ingredient includes the active ingredient class code, ingredient name, identifier and strength, the active moiety name(s) and identifier and a reference drug name and identifier. The element `<ingredient>` is a child of `<manufacturedProduct>`. The class code for active ingredient is dependent on the basis of the strength. If the basis of strength is the active ingredient, the class code is “ACTIB”. If the basis of strength is the active moiety, the class code is “ACTIM”. If the basis of strength is a reference drug, the class code is “ACTIR”. The strength is represented as a numerator and denominator. The UCUM code is used for the unit of measure. The UCUM code for a unit that is an “each” is “1” Examples of “each” is in the table below.

UCUM usage by CDISC

- CDISC-CT team refuses usage of UCUM
- Has developed its own list (not a system)



WHY?

...AND I HAVE FOUND THIS ONE WORKS A LOT BETTER.

Next part: Use of LOINC and UCUM in CDISC SDTM and SEND