BOVNAR · V1.1

# Bovnar (BVNR) — Units & Currencies Reference

Bovnar (BVNR) v1.1 documentation · Units & Currencies Cheat Sheet · 2026-06-21

> Spec version 1.1 · 163 physical units · 166 fiat currencies · 50 cryptocurrencies

## Contents



## 1. SI Prefixes

Written as `prefix~base` (mandatory `~` separator). Example: `k~m` = kilometre.

| Name | Symbol | Factor | Enum ( `si_prefix_id_t` ) |
|---|---|---|---|
| quetta | `Q` | $10^{30}$ | `si_quetta` |
| ronna | `R` | $10^{27}$ | `si_ronna` |
| yotta | `Y` | $10^{24}$ | `si_yotta` |
| zetta | `Z` | $10^{21}$ | `si_zetta` |
| exa | `E` | $10^{18}$ | `si_exa` |

| Name | Symbol | Factor | Enum ( `si_prefix_id_t` ) |
|---|---|---|---|
| peta | `P` | $10^{15}$ | `si_peta` |
| tera | `T` | $10^{12}$ | `si_tera` |
| giga | `G` | $10^{9}$ | `si_giga` |
| mega | `M` | $10^{6}$ | `si_mega` |
| kilo | `k` | $10^{3}$ | `si_kilo` |
| hecto | `h` | $10^{2}$ | `si_hecto` |
| deca | `da` | $10^{1}$ | `si_deca` |
| (none) | — | $10^{0}$ | `si_none` |
| deci | `d` | $10^{-1}$ | `si_deci` |
| centi | `c` | $10^{-2}$ | `si_centi` |
| milli | `m` | $10^{-3}$ | `si_milli` |
| micro | `µ` (or `u` ) | $10^{-6}$ | `si_micro` |
| nano | `n` | $10^{-9}$ | `si_nano` |
| pico | `p` | $10^{-12}$ | `si_pico` |
| femto | `f` | $10^{-15}$ | `si_femto` |
| atto | `a` | $10^{-18}$ | `si_atto` |
| zepto | `z` | $10^{-21}$ | `si_zepto` |
| yocto | `y` | $10^{-24}$ | `si_yocto` |
| ronto | `r` | $10^{-27}$ | `si_ronto` |
| quecto | `q` | $10^{-30}$ | `si_quecto` |

> `µ` is U+00B5 MICRO SIGN (UTF-8 `0xC2 0xB5` ). U+03BC (Greek small letter mu) is **not** accepted. ASCII `u` is accepted as an input-only alias for `µ` (e.g. `u~m` = `µ~m` ); the canonical output is always `µ` . `da` is a two-character prefix: `da~m` = decametre.

**Prefix-base ambiguities** — resolved by the mandatory `~` :

| Bare token | Is a base unit | With `~` becomes prefix |
|---|---|---|
| `m` | meter ( `bu_meter` ) | milli |
| `d` | day ( `bu_day` ) | deci |
| `h` | hour ( `bu_hour` ) | hecto |
| `T` | tesla ( `bu_tesla` ) | tera |
| `G` | gauss ( `bu_gauss` ) | giga |
| `P` | poise ( `bu_poise` ) | peta |

| Bare token | Is a base unit | With `~` becomes prefix |
|---|---|---|
| `R` | röntgen (`bu_roentgen`) | ronna |
| `f` | farad (`bu_farad`) | femto |
| `u` | dalton (`bu_dalton`) | micro (ASCII alias for `µ`) |
| `S` | siemens (`bu_siemens`) | (not a prefix — `S` has no prefix role) |

Examples: bare `m` = metre; `m~s` = millisecond. Bare `d` = day; `d~s` = decisecond.

## 2. IEC Binary Prefixes

Used **only** on `b` (bit) and `B` (byte). Written as `prefix~base`: `Ki~B` = kibibyte.

| Name | Symbol | Factor | Enum (`iec_prefix_id_t`) |
|---|---|---|---|
| kibi | `Ki` | $2^{10}$ | `iec_kibi` |
| mebi | `Mi` | $2^{20}$ | `iec_mebi` |
| gibi | `Gi` | $2^{30}$ | `iec_gibi` |
| tebi | `Ti` | $2^{40}$ | `iec_tebi` |
| pebi | `Pi` | $2^{50}$ | `iec_pebi` |
| exbi | `Ei` | $2^{60}$ | `iec_exbi` |
| zebi | `Zi` | $2^{70}$ | `iec_zebi` |
| yobi | `Yi` | $2^{80}$ | `iec_yobi` |
| robi | `Ri` | $2^{90}$ | `iec_robi` |
| quebi | `Qi` | $2^{100}$ | `iec_quebi` |

## 3. Prefix Validity Rules

| Unit category | SI prefixes | IEC prefixes |
|---|---|---|
| All physical units (default) | All 24 allowed | Forbidden |
| `b` (bit) and `B` (byte) | Only ≥ kilo (`k`, `M`, `G`, …, `Q`) | All 10 allowed |
| `b` and `B` with sub-kilo SI (`d`, `c`, `m`, `µ`, `n`, `p`, `f`, `a`, `z`, `y`, `r`, `q`, `da`, `h`) | **Forbidden** | — |
| Currency codes | All 24 allowed | **Forbidden** |
| Old German units (`bu_pfund` … `bu_scheffel`) | **None** (`si_none` only) | **Forbidden** |

# 4. Physical Units

> **Symbol** = canonical serialized form (produced on output; accepted on input). **Long forms** = accepted on input only; never produced on output. **Factor** = conversion factor to SI base units unless noted.

## 4.1 SI Base Units

| Symbol | Long forms | Name | Enum |
|---|---|---|---|
| `s` | `sec`, `second`, `seconds` | second | `bu_second` |
| `m` | `meter`, `metre`, `meters`, `metres` | metre | `bu_meter` |
| `g` | `gram`, `grams` | gram | `bu_gram` |
| `A` | `amp`, `amps`, `ampere`, `amperes` | ampere | `bu_ampere` |
| `K` | `kelvin`, `kelvins` | kelvin | `bu_kelvin` |
| `mol` | `mole`, `moles` | mole | `bu_mol` |
| `cd` | `candela`, `candelas` | candela | `bu_candela` |

> `g` (gram) is the base symbol; `k~g` = kilogram.

## 4.2 Named SI-Derived Units

| Symbol | Long forms | Name | Enum | SI definition |
|---|---|---|---|---|
| `Hz` | `hertz` | hertz | `bu_hertz` | $s^{-1}$ |
| `N` | `newton`, `newtons` | newton | `bu_newton` | $kg \cdot m \cdot s^{-2}$ |
| `Pa` | `pascal`, `pascals` | pascal | `bu_pascal` | $kg \cdot m^{-1} \cdot s^{-2}$ |
| `J` | `joule`, `joules` | joule | `bu_joule` | $kg \cdot m^{2} \cdot s^{-2}$ |
| `W` | `watt`, `watts` | watt | `bu_watt` | $kg \cdot m^{2} \cdot s^{-3}$ |
| `V` | `volt`, `volts` | volt | `bu_volt` | $kg \cdot m^{2} \cdot A^{-1} \cdot s^{-3}$ |
| `Ω` | `ohm`, `ohms`, `Ohm` | ohm | `bu_ohm` | $kg \cdot m^{2} \cdot A^{-2} \cdot s^{-3}$ — U+2126 OHM SIGN; U+03A9 (Greek capital omega) **not** accepted |
| `F` | `farad`, `farads` | farad | `bu_farad` | $kg^{-1} \cdot m^{-2} \cdot A^{2} \cdot s^{4}$ |
| `C` | `coulomb`, `coulombs` | coulomb | `bu_coulomb` | $A \cdot s$ |
| `S` | `siemens` | siemens | `bu_siemens` | $kg^{-1} \cdot m^{-2} \cdot A^{2} \cdot s^{3}$ |

| Symbol | Long forms | Name | Enum | SI definition |
|---|---|---|---|---|
| `Wb` | `weber`, `webers` | weber | `bu_weber` | kg·m²·A⁻¹·s⁻² |
| `T` | `tesla`, `teslas` | tesla | `bu_tesla` | kg·A⁻¹·s⁻² |
| `H` | `henry`, `henrys`, `henries` | henry | `bu_henry` | kg·m²·A⁻²·s⁻² |
| `lm` | `lumen`, `lumens` | lumen | `bu_lumen` | cd·sr |
| `lx` | `lux` | lux | `bu_lux` | cd·sr·m⁻² |
| `Bq` | `becquerel`, `becquerels` | becquerel | `bu_becquerel` | s⁻¹ |
| `Gy` | `gray`, `grays` | gray | `bu_gray` | m²·s⁻² |
| `Sv` | `sievert`, `sieverts` | sievert | `bu_sievert` | m²·s⁻² |
| `kat` | `katal`, `katals` | katal | `bu_katal` | mol·s⁻¹ |
| `rad` | `radian`, `radians` | radian | `bu_radian` | dimensionless (m/m) |
| `sr` | `steradian`, `steradians` | steradian | `bu_steradian` | dimensionless (m²/m²) |

## 4.3 Non-SI Units Accepted with SI

| Symbol | Long forms | Name | Enum | Factor / notes |
|---|---|---|---|---|
| `L`, `l` | `liter`, `litre`, `liters`, `litres` | litre | `bu_liter` | 10⁻³ m³ |
| `min` | `minute`, `minutes` | minute | `bu_minute` | 60 s |
| `h` | `hour`, `hours` | hour | `bu_hour` | 3600 s |
| `d` | `day`, `days` | day | `bu_day` | 86400 s |
| `wk` | `week`, `weeks` | week | `bu_week` | 604 800 s |
| `mo` | `month`, `months` | month (Julian) | `bu_month` | 2 629 800 s (= 365.25 d / 12) |
| `fn` | `fortnight`, `fortnights` | fortnight | `bu_fortnight` | 1 209 600 s (= 14 d) |
| `yr` | `year`, `years` | year (Julian) | `bu_year` | 31 557 600 s |
| `°`, `deg` | `degr`, `degree`, `degrees` | degree (angle) | `bu_degree` | π/180 rad — U+00B0 |
| `t` | `tonne` | tonne | `bu_tonne` | 10³ kg |
| `bar` | — | bar | `bu_bar` | 10⁵ Pa |
| `eV` | `electronvolt` | electronvolt | `bu_electronvolt` | 1.602176634×10⁻¹⁹ J |

| Symbol | Long forms | Name | Enum | Factor / notes |
|---|---|---|---|---|
| `Da` | `dalton`, `amu`, `u` | dalton | `bu_dalton` | $1.66053906660\times10^{-27}$ kg |
| `au` | — | astronomical unit | `bu_astronomical_unit` | $1.495978707\times10^{11}$ m |
| `ha` | `hectare` | hectare | `bu_hectare` | $10^4$ m² |

## 4.4 Imperial & US Customary — Length

| Symbol | Long forms | Name | Enum | Factor |
|---|---|---|---|---|
| `in` | `inch`, `inches` | inch | `bu_inch` | 0.0254 m (exact) |
| `ft` | `foot`, `feet` | foot | `bu_foot` | 0.3048 m (exact) |
| `yd` | `yard`, `yards` | yard | `bu_yard` | 0.9144 m (exact) |
| `mi` | `mile`, `miles` | statute mile | `bu_mile` | 1609.344 m (exact) |
| `nmi` | `nautical_mile`, `nautical_miles` | nautical mile | `bu_nautical_mile` | 1852 m (exact) |
| `Å` (U+212B) | `angstrom`, `angstroms`, Å (U+00C5) | ångström | `bu_angstrom` | $10^{-10}$ m |
| `ly` | `light_year`, `light_years` | light-year | `bu_light_year` | $9.4607304725808\times10^{15}$ m |
| `pc` | `parsec`, `parsecs` | parsec | `bu_parsec` | $3.085677581491367\times10^{16}$ m |
| `fur` | `furlong`, `furlongs` | furlong | `bu_furlong` | 201.168 m (exact) |
| `fath` | `fathom`, `fathoms` | fathom | `bu_fathom` | 1.8288 m (exact) |
| `thou` | `thou`, `mil`, `mils` | thou | `bu_thou` | $25.4\times10^{-6}$ m (exact) |
| `ch` | `chain`, `chains` | chain (Gunter's) | `bu_chain` | 20.1168 m (exact) |
| `rd` | `rod`, `rods` | rod (pole, perch) | `bu_rod` | 5.0292 m (exact) |

> `thou` and `mil` are synonyms. Canonical output is `thou`. `mil` does **not** mean milliradian; milliradians are written `m~rad`.

## 4.5 Imperial & US Customary — Mass

| Symbol | Long forms | Name | Enum | Factor |
|---|---|---|---|---|
| `lb` | `lbs`, `pound`, `pounds` | pound (avoirdupois) | `bu_pound` | 0.45359237 kg (exact) |

| Symbol | Long forms | Name | Enum | Factor |
|---|---|---|---|---|
| `oz` | `ounce`, `ounces` | ounce (avoirdupois) | `bu_ounce` | 0.028349523125 kg (exact) |
| `gr` | `grain`, `grains` | grain | `bu_grain` | $6.479891\times10^{-5}$ kg (exact) |
| `st` | `stone`, `stones` | stone | `bu_stone` | 6.35029318 kg (exact) |
| `tn_sh` | `short_ton`, `short_tons` | short ton (US) | `bu_short_ton` | 907.18474 kg (exact) |
| `tn_l` | `long_ton`, `long_tons` | long ton (UK) | `bu_long_ton` | 1016.0469088 kg (exact) |
| `oz_t` | `troy_ounce`, `troy_ounces` | troy ounce | `bu_troy_ounce` | 0.0311034768 kg (exact) |
| `ct` | `carat`, `carats` | metric carat | `bu_carat` | $2\times10^{-4}$ kg (exact) |
| `slug` | `slugs` | slug | `bu_slug` | 14.593902937 kg |
| `dr` | `dram`, `drams` | dram (avoirdupois) | `bu_dram` | $1.7718451953125\times10^{-3}$ kg (exact) |
| `dwt` | `pennyweight`, `pennyweights` | pennyweight (troy) | `bu_pennyweight` | $1.55517384\times10^{-3}$ kg (exact) |

## 4.6 Temperature

| Symbol | Long forms | Name | Enum | Conversion |
|---|---|---|---|---|
| `°C`, `degC` | `degrC`, `degreeC`, `degreesC`, `celsius` | degree Celsius | `bu_celsius` | K = °C + 273.15 **(affine)** |
| `°F`, `degF` | `degrF`, `degreeF`, `degreesF`, `fahrenheit` | degree Fahrenheit | `bu_fahrenheit` | K = (°F + 459.67) × 5/9 **(affine)** |
| `°Ra`, `degRa` | `degrRa`, `degreeRa`, `degreesRa`, `rankine` | degree Rankine | `bu_rankine` | K = °Ra × 5/9 (linear) |
| `°De`, `degDe` | `degrDe`, `degreeDe`, `degreesDe`, `delisle` | degree Delisle | `bu_delisle` | K = 373.15 − °De × 2/3 **(affine)** |
| `°N`, `degN` | `degrN`, `degreeN`, `degreesN`, `newton_temperature` | degree Newton | `bu_newton_temp` | K = °N × 100/33 + 273.15 **(affine)** |
| `°Re`, `degRe` | `degrRe`, `degreeRe`, `degreesRe`, `reaumur` | degree Réaumur | `bu_reaumur` | K = °Re × 5/4 + 273.15 **(affine)** |
| `°Ro`, `degRo` | `degrRo`, `degreeRo`, `degreesRo`, `romer` | degree Rømer | `bu_romer` | K = (°Ro − 7.5) × 40/21 + 273.15 **(affine)** |

> Kelvin (`K`) is in §4.1. `R` is reserved for röntgen (§4.20). `N` alone is newton (§4.2); use `°N` or `degN` for Newton temperature.

## 4.7 Pressure

| Symbol | Long forms | Name | Enum | Factor |
|---|---|---|---|---|
| `atm` | `atmosphere`, `atmospheres` | standard atmosphere | `bu_atmosphere` | 101 325 Pa (exact) |
| `at` | `atmosphere_technical` | atmosphere technical | `bu_atmosphere_technical` | 98 066.5 Pa (= 1 kgf/cm²) |
| `mmHg` | — | millimetre of mercury | `bu_mmhg` | 133.322387415 Pa |
| `Torr` | `torr` | torr | `bu_torr` | 101 325/760 Pa |
| `psi` | — | pound-force per square inch | `bu_psi` | 6894.757293168361 Pa |
| `inHg` | `inch_hg`, `inch_mercury` | inch of mercury | `bu_inch_hg` | 3386.388645 Pa |

> `at ≠ atm`: 1 at = 98 066.5 Pa; 1 atm = 101 325 Pa.

## 4.8 Energy

| Symbol | Long forms | Name | Enum | Factor |
|---|---|---|---|---|
| `cal` | `calorie`, `calories` | thermochemical calorie | `bu_calorie` | 4.184 J (exact) |
| `Btu` | `btu`, `BTU` | International Table BTU | `bu_btu` | 1055.05585262 J |
| `erg` | `ergs` | erg | `bu_erg` | $10^{-7}$ J (exact) |
| `thm` | `therm`, `therms` | US therm | `bu_therm` | $1.05480400 \times 10^{8}$ J (exact) |
| `ft_lb` | `foot_pound`, `foot_pounds` | foot-pound | `bu_foot_pound` | 1.3558179483 J |

> `BTU` (all-caps) is a valid alias: with no `$` sigil the token is a physical-unit lookup (the currency table is only consulted for `$`-prefixed tokens), and it matches `bu_btu`. `Btu` and `btu` are also accepted.

## 4.9 Power

| Symbol | Long forms | Name | Enum | Factor |
|---|---|---|---|---|
| `hp` | `horsepower` | mechanical horsepower | `bu_horsepower` | 745.69987158227 W |

| Symbol | Long forms | Name | Enum | Factor |
|---|---|---|---|---|
| `PS` | `CV`, `metric_horsepower` | metric horsepower | `bu_metric_horsepower` | 735.49875 W (exact) |

## 4.10 Force

| Symbol | Long forms | Name | Enum | Factor |
|---|---|---|---|---|
| `lbf` | `pound_force` | pound-force | `bu_pound_force` | 4.4482216152605 N |
| `dyn` | `dyne`, `dynes` | dyne | `bu_dyne` | $10^{-5}$ N (exact) |
| `kip` | `kips` | kip (kilopound-force) | `bu_kip` | 4448.2216152605 N |
| `kgf` | `kilogram_force` | kilogram-force | `bu_kilogram_force` | 9.80665 N (exact) |

## 4.11 Speed & Rotation

| Symbol | Long forms | Name | Enum | Factor |
|---|---|---|---|---|
| `kn` | `knot`, `knots` | knot | `bu_knot` | 1852/3600 m/s |
| `rpm` | — | revolutions per minute | `bu_rpm` | 1/60 $s^{-1}$ |

## 4.12 Acceleration

| Symbol | Long forms | Name | Enum | Factor |
|---|---|---|---|---|
| `gn` | `standard_gravity` | standard gravity | `bu_standard_gravity` | 9.80665 $m \cdot s^{-2}$ (exact) |

## 4.13 Volume — US Liquid

| Symbol | Long forms | Name | Enum | Factor |
|---|---|---|---|---|
| `gal` | `gallon`, `gallons` | US liquid gallon | `bu_gallon` | $3.785411784 \times 10^{-3}$ $m^3$ (exact) |
| `qt` | `quart`, `quarts` | US liquid quart | `bu_quart` | $9.46352946 \times 10^{-4}$ $m^3$ |
| `pt` | `pint`, `pints` | US liquid pint | `bu_pint` | $4.73176473 \times 10^{-4}$ $m^3$ |
| `cup` | `cups` | US cup | `bu_cup` | $2.365882365 \times 10^{-4}$ $m^3$ |
| `gi` | `gill`, `gills` | US gill | `bu_gill` | $1.18294118250 \times 10^{-4}$ $m^3$ |
| `fl_oz` | `fluid_ounce`, `fluid_ounces` | US fluid ounce | `bu_fluid_ounce` | $2.95735295625 \times 10^{-5}$ $m^3$ |
| `tbsp` | `tablespoon`, `tablespoons` | US tablespoon | `bu_tablespoon` | $1.47867648 \times 10^{-5}$ $m^3$ |
| `tsp` | `teaspoon`, `teaspoons` | US teaspoon | `bu_teaspoon` | $4.92892159375 \times 10^{-6}$ $m^3$ |
| `bbl` | `barrel`, `barrels` | petroleum barrel | `bu_barrel` | 0.158987294928 $m^3$ |

> `cup` (lowercase) = US cup; `CUP` (uppercase) = Cuban Peso. See §6.

## 4.14 Volume — UK Imperial

| Symbol | Long forms | Name | Enum | Factor |
|---|---|---|---|---|
| `gal_uk` | `gallon_uk`, `gallons_uk` | imperial gallon | `bu_gallon_uk` | $4.54609 \times 10^{-3}$ m³ (exact) |
| `qt_uk` | `quart_uk`, `quarts_uk` | imperial quart | `bu_quart_uk` | $1136.5225 \times 10^{-6}$ m³ |
| `pt_uk` | `pint_uk`, `pints_uk` | imperial pint | `bu_pint_uk` | $568.26125 \times 10^{-6}$ m³ |
| `gi_uk` | `gill_uk`, `gills_uk` | imperial gill | `bu_gill_uk` | $1.420653125 \times 10^{-4}$ m³ (exact) |
| `fl_oz_uk` | `fluid_ounce_uk`, `fluid_ounces_uk` | imperial fluid ounce | `bu_fluid_ounce_uk` | $28.4130625 \times 10^{-6}$ m³ |

## 4.15 Volume — US Apothecary & Dry

| Symbol | Long forms | Name | Enum | Factor |
|---|---|---|---|---|
| `fl_dr` | `fluid_dram`, `fluid_drams` | US fluid dram | `bu_fluid_dram` | $3.6966911953125 \times 10^{-6}$ m³ |
| `minim` | `minims` | US minim | `bu_minim` | $6.16115199218750 \times 10^{-8}$ m³ |
| `pk` | `peck`, `pecks` | US dry peck | `bu_peck` | $8.80976754172 \times 10^{-3}$ m³ |
| `bsh` | `bushel`, `bushels` | US bushel | `bu_bushel` | $3.523907016688 \times 10^{-2}$ m³ |

> `minim` not `min` (which is the minute).

## 4.16 Area

| Symbol | Long forms | Name | Enum | Factor |
|---|---|---|---|---|
| `ac` | `acre`, `acres` | acre | `bu_acre` | 4046.8564224 m² (exact) |
| `barn` | `barns` | barn | `bu_barn` | $10^{-28}$ m² (exact) |

## 4.17 Angle

| Symbol | Long forms | Name | Enum | Factor |
|---|---|---|---|---|
| `arcmin` | `arcminute`, `arcminutes` | arcminute | `bu_arcminute` | π/10800 rad |
| `arcsec` | `arcsecond`, `arcseconds` | arcsecond | `bu_arcsecond` | π/648000 rad |

| Symbol | Long forms | Name | Enum | Factor |
|---|---|---|---|---|
| `grad` | `gradian`, `gradians`, `gon` | gradian | `bu_grad` | π/200 rad |
| `rev` | `turn`, `revolution`, `revolutions`, `turns` | revolution | `bu_revolution` | 2π rad |

## 4.18 Digital

| Symbol | Long forms | Name | Enum |
|---|---|---|---|
| `b` | `bit`, `bits` | bit | `bu_bit` |
| `B` | `byte`, `bytes`, `Byte`, `Bytes` | byte | `bu_byte` |

## 4.19 CGS Units

| Symbol | Long forms | Name | Enum | SI equivalent |
|---|---|---|---|---|
| `P` | `poise`, `poises` | poise (dynamic viscosity) | `bu_poise` | 0.1 Pa·s |
| `St` | `stokes`, `stoke` | stokes (kinematic viscosity) | `bu_stokes` | $10^{-4}$ m²·s⁻¹ |
| `G` | `gauss` | gauss (magnetic flux density) | `bu_gauss` | $10^{-4}$ T |
| `Mx` | `maxwell`, `maxwells` | maxwell (magnetic flux) | `bu_maxwell` | $10^{-8}$ Wb |
| `Oe` | `oersted`, `oersteds` | oersted (magnetic field strength) | `bu_oersted` | 1000/(4π) A/m |
| `sb` | `stilb`, `stilbs` | stilb (luminance) | `bu_stilb` | $10^{4}$ cd/m² |
| `ph` | `phot`, `phots` | phot (illuminance) | `bu_phot` | $10^{4}$ lx |
| `Gal` | `galileo`, `galileos` | galileo (acceleration) | `bu_galileo` | $10^{-2}$ m/s² |

## 4.20 Radiation

| Symbol | Long forms | Name | Enum | SI equivalent |
|---|---|---|---|---|
| `Ci` | `curie`, `curies` | curie (radioactivity) | `bu_curie` | $3.7\times10^{10}$ Bq |
| `R` | `roentgen`, `roentgens` | röntgen (radiation exposure) | `bu_roentgen` | $2.58\times10^{-4}$ C/kg |
| `rem` | `rems` | rem (dose equivalent) | `bu_rem` | $10^{-2}$ Sv |

## 4.21 Logarithmic

| Symbol | Long forms | Name | Enum | Notes |
|---|---|---|---|---|
| `Np` | `neper`, `nepers` | neper | `bu_neper` | dimensionless; 1 Np = 20/ln(10) dB ≈ 8.686 dB |
| `dB` | `decibel`, `decibels` | decibel | `bu_decibel` | dimensionless |

## 4.22 Electrical Power

| Symbol | Long forms | Name | Enum | Notes |
|---|---|---|---|---|
| `var` | `vars` | var (volt-ampere reactive) | `bu_var` | reactive power; same SI dim as W |
| `VA` | `volt_ampere`, `volt_amperes` | volt-ampere | `bu_volt_ampere` | apparent power; same SI dim as W |

> `W`, `var`, and `VA` all have SI dimension kg·m²·s⁻³. `bvn_units_compatible` returns `true` across them; use `.components[0].base` to distinguish.

## 4.23 Textile Linear Density

| Symbol | Long forms | Name | Enum | Factor |
|---|---|---|---|---|
| `tex` | — | tex | `bu_tex` | $1\times10^{-6}$ kg/m (ISO 1144) |
| `den` | `denier`, `deniers` | denier | `bu_denier` | 1/9 000 000 kg/m |

> 9 den = 1 tex.

## 4.24 Old German Units

No Old German unit accepts any SI or IEC prefix (`bvn_prefix_unit_valid` rejects all non-`si_none` prefixes for `bu_pfund` … `bu_scheffel`). Enum values 348–360.

### Mass (metric-compatible)

| Symbol | Long forms | Name | Enum | Factor |
|---|---|---|---|---|
| `Pfd` | `pfund`, `pfunds` | Pfund | `bu_pfund` | 0.5 kg (exact) |
| `Ztr` | `zentner` | Zentner | `bu_zentner` | 50 kg (exact) |
| `dz` | `doppelzentner` | Doppelzentner | `bu_doppelzentner` | 100 kg (exact) |
| `lot` | `lots` | Lot | `bu_lot` | $15.625\times10^{-3}$ kg (exact) |

### Length (historical Prussian)

| Symbol | Long forms | Name | Enum | Factor |
|---|---|---|---|---|
| `prln` | `prussian_line`, `linie` | Prussian line | `bu_prussian_line` | $2.17953\times10^{-3}$ m |
| `prz` | `prussian_zoll`, `zoll` | Prussian Zoll | `bu_prussian_zoll` | $2.61544\times10^{-2}$ m |
| `prf` | `prussian_fuss`, `preussischer_fuss` | Prussian Fuß | `bu_prussian_fuss` | $3.13853\times10^{-1}$ m |

| Symbol | Long forms | Name | Enum | Factor |
|---|---|---|---|---|
| `elle` | `prussian_elle`, `preussische_elle` | Prussian Elle | `bu_prussian_elle` | 6.67160×10⁻¹ m |
| `rute` | `prussian_rute`, `preussische_rute` | Prussian Rute | `bu_prussian_rute` | 3.76624 m |
| `klafter` | `prussian_klafter` | Klafter | `bu_klafter` | 1.88312 m |
| `dt_mi` | `deutsche_meile`, `german_mile` | Geographische Meile | `bu_german_mile` | 7420.44 m |

### Area (historical Prussian)

| Symbol | Long forms | Name | Enum | Factor |
|---|---|---|---|---|
| `morgen` | `prussian_morgen` | Morgen (Prussian) | `bu_morgen` | 2553.22 m² |

### Volume (historical Prussian)

| Symbol | Long forms | Name | Enum | Factor |
|---|---|---|---|---|
| `schffl` | `scheffel`, `prussian_scheffel` | Scheffel (Prussian) | `bu_scheffel` | 54.961×10⁻³ m³ |

## 4.25 Additional Physical Units (361–367)

### Length

| Symbol | Long forms | Name | Enum | Factor |
|---|---|---|---|---|
| `ftUS` | `survey_foot` | US survey foot | `bu_survey_foot` | 1200/3937 m ≈ 0.30480061 m |
| `lea` | `league`, `leagues` | League (US statute, 3 mi) | `bu_league` | 4828.032 m |
| `cbl` | `cable`, `cables` | Cable (international, ⅒ nmi) | `bu_cable` | 185.2 m |
| `hand` | `hands` | Hand (4 in) | `bu_hand` | 0.1016 m |

### Mass

| Symbol | Long forms | Name | Enum | Factor |
|---|---|---|---|---|
| `qntl` | `quintal`, `quintals` | Metric quintal | `bu_quintal` | 100 kg |
| `sc` | `scruple`, `scruples` | Apothecary scruple (20 gr) | `bu_scruple` | 1.2959782×10⁻³ kg |

### Signal Rate

| Symbol | Long forms | Name | Enum | SI dimension |
|---|---|---|---|---|
| `Bd` | `baud`, `bauds` | Baud (symbol/s) | `bu_baud` | s⁻¹ |

SI prefixes are accepted on all units in this section. IEC prefixes are rejected for all non-digital units.

### 4.26 Ratio and Proportion (372–377)

Dimensionless scaling factors: `5 %` ≡ `0.05`, `250 ppm` ≡ `0.00025`. These do **not** accept SI or IEC prefixes.

| Symbol | Long forms | Name | Enum | Factor |
|---|---|---|---|---|
| `%` | `percent` | per cent | `bu_percent` | $10^{-2}$ |
| `‰` | `per_mille` | per mille | `bu_per_mille` | $10^{-3}$ |
| `‱` | `per_myriad` | per myriad | `bu_per_myriad` | $10^{-4}$ |
| `pcm` | `per_cent_mille` | per cent mille | `bu_per_cent_mille` | $10^{-5}$ |
| `ppm` | — | parts per million | `bu_ppm` | $10^{-6}$ |
| `ppb` | — | parts per billion | `bu_ppb` | $10^{-9}$ |

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## 5. Currencies

### 5.1 The Mandatory Currency Sigil

As of spec 1.0 a currency code carries a **mandatory `$` sigil**: write `$USD`, `$BTC`, `k~$EUR`, `$USD/oz_t`. The codes listed in the tables below are the bare ISO 4217 / crypto identifiers — prefix each with `$` when you use it in a document. A bare code (no `$`) is **not** a currency; it is matched against the physical-unit table and raises `error_unit_illegal` if it is not a unit. This removes every currency/unit namespace collision (e.g. `$CUP` the Cuban Peso vs `cup` the unit).

### 5.2 ISO 4217 Fiat Currencies

166 codes: 164 occupying `value_base_unit_t` slots **134 … 297** (`BVN_CURRENCY_FIAT_FIRST … BVN_CURRENCY_FIAT_LAST`), plus `ZWG` and `XCG` appended past the unit block at slots **378 … 379** (`BVN_CURRENCY_EXT_FIRST … BVN_CURRENCY_EXT_LAST`) so that adding them shifted no existing enum value. The 134–297 codes have no named `bu_*` enumerators — they are resolved from the `$`-sigil code by `bvn_parse_currency_str` and carried as the numeric `base` value; query them with `bvn_unit_is_fiat` / `bvn_currency_info`.

> **Min** = minor unit exponent N: 1 major unit = 10^N minor units (e.g. 1 USD = 100 cents, N=2). Minor units are **bold** when they differ from 2. `numeric_code` is the ISO 4217 numeric identifier.

| Code | Num | Min | Name |
|---|---|---|---|
| AED | 784 | 2 | UAE Dirham |
| AFN | 971 | 2 | Afghan Afghani |
| ALL | 8 | 2 | Albanian Lek |
| AMD | 51 | 2 | Armenian Dram |
| ANG | 532 | 2 | Netherlands Antillean Guilder |
| AOA | 973 | 2 | Angolan Kwanza |
| ARS | 32 | 2 | Argentine Peso |
| AUD | 36 | 2 | Australian Dollar |
| AWG | 533 | 2 | Aruban Florin |
| AZN | 944 | 2 | Azerbaijani Manat |
| BAM | 977 | 2 | Bosnia-Herzegovina Convertible Mark |
| BBD | 52 | 2 | Barbados Dollar |
| BDT | 50 | 2 | Bangladeshi Taka |
| BGN | 975 | 2 | Bulgarian Lev (historical; retired 2026-01-01) |
| BHD | 48 | **3** | Bahraini Dinar |
| BIF | 108 | **0** | Burundian Franc |
| BMD | 60 | 2 | Bermudian Dollar |
| BND | 96 | 2 | Brunei Dollar |
| BOB | 68 | 2 | Boliviano |
| BRL | 986 | 2 | Brazilian Real |
| BSD | 44 | 2 | Bahamian Dollar |
| BTN | 64 | 2 | Bhutanese Ngultrum |
| BWP | 72 | 2 | Botswana Pula |
| BYN | 933 | 2 | Belarusian Ruble |
| BZD | 84 | 2 | Belize Dollar |
| CAD | 124 | 2 | Canadian Dollar |
| CDF | 976 | 2 | Congolese Franc |
| CHF | 756 | 2 | Swiss Franc |
| CLF | 990 | **4** | Unidad de Fomento |
| CLP | 152 | **0** | Chilean Peso |
| CNY | 156 | 2 | Chinese Yuan |
| COP | 170 | 2 | Colombian Peso |

| Code | Num | Min | Name |
|---|---|---|---|
| CRC | 188 | 2 | Costa Rican Colon |
| CUP | 192 | 2 | Cuban Peso |
| CVE | 132 | 2 | Cape Verdean Escudo |
| CZK | 203 | 2 | Czech Koruna |
| DJF | 262 | **0** | Djiboutian Franc |
| DKK | 208 | 2 | Danish Krone |
| DOP | 214 | 2 | Dominican Peso |
| DZD | 12 | 2 | Algerian Dinar |
| EGP | 818 | 2 | Egyptian Pound |
| ERN | 232 | 2 | Eritrean Nakfa |
| ETB | 230 | 2 | Ethiopian Birr |
| EUR | 978 | 2 | Euro |
| FJD | 242 | 2 | Fijian Dollar |
| FKP | 238 | 2 | Falkland Islands Pound |
| GBP | 826 | 2 | Pound Sterling |
| GEL | 981 | 2 | Georgian Lari |
| GHS | 936 | 2 | Ghanaian Cedi |
| GIP | 292 | 2 | Gibraltar Pound |
| GMD | 270 | 2 | Gambian Dalasi |
| GNF | 324 | **0** | Guinean Franc |
| GTQ | 320 | 2 | Guatemalan Quetzal |
| GYD | 328 | 2 | Guyanese Dollar |
| HKD | 344 | 2 | Hong Kong Dollar |
| HNL | 340 | 2 | Honduran Lempira |
| HRK | 191 | 2 | Croatian Kuna (historical; retired 2023-01-01) |
| HTG | 332 | 2 | Haitian Gourde |
| HUF | 348 | 2 | Hungarian Forint |
| IDR | 360 | 2 | Indonesian Rupiah |
| ILS | 376 | 2 | Israeli New Shekel |
| INR | 356 | 2 | Indian Rupee |
| IQD | 368 | **3** | Iraqi Dinar |
| IRR | 364 | 2 | Iranian Rial |

| Code | Num | Min | Name |
|---|---|---|---|
| ISK | 352 | **0** | Icelandic Krona |
| JMD | 388 | 2 | Jamaican Dollar |
| JOD | 400 | **3** | Jordanian Dinar |
| JPY | 392 | **0** | Japanese Yen |
| KES | 404 | 2 | Kenyan Shilling |
| KGS | 417 | 2 | Kyrgyzstani Som |
| KHR | 116 | 2 | Cambodian Riel |
| KMF | 174 | **0** | Comorian Franc |
| KPW | 408 | 2 | North Korean Won |
| KRW | 410 | **0** | South Korean Won |
| KWD | 414 | **3** | Kuwaiti Dinar |
| KYD | 136 | 2 | Cayman Islands Dollar |
| KZT | 398 | 2 | Kazakhstani Tenge |
| LAK | 418 | 2 | Laotian Kip |
| LBP | 422 | 2 | Lebanese Pound |
| LKR | 144 | 2 | Sri Lankan Rupee |
| LRD | 430 | 2 | Liberian Dollar |
| LSL | 426 | 2 | Lesotho Loti |
| LYD | 434 | **3** | Libyan Dinar |
| MAD | 504 | 2 | Moroccan Dirham |
| MDL | 498 | 2 | Moldovan Leu |
| MGA | 969 | 2 | Malagasy Ariary |
| MKD | 807 | 2 | Macedonian Denar |
| MMK | 104 | 2 | Myanmar Kyat |
| MNT | 496 | 2 | Mongolian Togrog |
| MOP | 446 | 2 | Macanese Pataca |
| MRU | 929 | 2 | Mauritanian Ouguiya |
| MUR | 480 | 2 | Mauritian Rupee |
| MVR | 462 | 2 | Maldivian Rufiyaa |
| MWK | 454 | 2 | Malawian Kwacha |
| MXN | 484 | 2 | Mexican Peso |
| MYR | 458 | 2 | Malaysian Ringgit |

| Code | Num | Min | Name |
|---|---|---|---|
| MZN | 943 | 2 | Mozambican Metical |
| NAD | 516 | 2 | Namibian Dollar |
| NGN | 566 | 2 | Nigerian Naira |
| NIO | 558 | 2 | Nicaraguan Cordoba |
| NOK | 578 | 2 | Norwegian Krone |
| NPR | 524 | 2 | Nepalese Rupee |
| NZD | 554 | 2 | New Zealand Dollar |
| OMR | 512 | **3** | Omani Rial |
| PAB | 590 | 2 | Panamanian Balboa |
| PEN | 604 | 2 | Peruvian Sol |
| PGK | 598 | 2 | Papua New Guinean Kina |
| PHP | 608 | 2 | Philippine Peso |
| PKR | 586 | 2 | Pakistani Rupee |
| PLN | 985 | 2 | Polish Zloty |
| PYG | 600 | **0** | Paraguayan Guarani |
| QAR | 634 | 2 | Qatari Riyal |
| RON | 946 | 2 | Romanian Leu |
| RSD | 941 | 2 | Serbian Dinar |
| RUB | 643 | 2 | Russian Ruble |
| RWF | 646 | **0** | Rwandan Franc |
| SAR | 682 | 2 | Saudi Riyal |
| SBD | 90 | 2 | Solomon Islands Dollar |
| SCR | 690 | 2 | Seychellois Rupee |
| SDG | 938 | 2 | Sudanese Pound |
| SEK | 752 | 2 | Swedish Krona |
| SGD | 702 | 2 | Singapore Dollar |
| SHP | 654 | 2 | Saint Helena Pound |
| SLE | 925 | 2 | Sierra Leonean Leone |
| SLL | 694 | 2 | Sierra Leonean Leone (old) (historical; replaced by SLE 2022) |
| SOS | 706 | 2 | Somali Shilling |
| SSP | 728 | 2 | South Sudanese Pound |
| SRD | 968 | 2 | Surinamese Dollar |

| Code | Num | Min | Name |
|---|---|---|---|
| STN | 930 | 2 | Sao Tome and Principe Dobra |
| SVC | 222 | 2 | Salvadoran Colon |
| SYP | 760 | 2 | Syrian Pound |
| SZL | 748 | 2 | Swazi Lilangeni |
| THB | 764 | 2 | Thai Baht |
| TJS | 972 | 2 | Tajikistani Somoni |
| TMT | 934 | 2 | Turkmenistan Manat |
| TND | 788 | **3** | Tunisian Dinar |
| TOP | 776 | 2 | Tongan Pa'anga |
| TRY | 949 | 2 | Turkish Lira |
| TTD | 780 | 2 | Trinidad and Tobago Dollar |
| TWD | 901 | 2 | New Taiwan Dollar |
| TZS | 834 | 2 | Tanzanian Shilling |
| UAH | 980 | 2 | Ukrainian Hryvnia |
| UGX | 800 | **0** | Ugandan Shilling |
| USD | 840 | 2 | US Dollar |
| UYU | 858 | 2 | Uruguayan Peso |
| UZS | 860 | 2 | Uzbekistani Som |
| VES | 928 | 2 | Venezuelan Bolivar Soberano |
| VND | 704 | **0** | Vietnamese Dong |
| VUV | 548 | **0** | Vanuatu Vatu |
| WST | 882 | 2 | Samoan Tala |
| XAF | 950 | **0** | CFA Franc BEAC |
| XAG | 961 | **0** | Silver |
| XAU | 959 | **0** | Gold |
| XCD | 951 | 2 | East Caribbean Dollar |
| XCG | 532 | 2 | Caribbean Guilder |
| XDR | 960 | **0** | Special Drawing Rights |
| XOF | 952 | **0** | CFA Franc BCEAO |
| XPD | 964 | **0** | Palladium |
| XPF | 953 | **0** | CFP Franc |
| XPT | 962 | **0** | Platinum |

| Code | Num | Min | Name |
|---|---|---|---|
| `XTS` | 963 | **0** | Test (ISO 4217 reserved) |
| `YER` | 886 | 2 | Yemeni Rial |
| `ZAR` | 710 | 2 | South African Rand |
| `ZMW` | 967 | 2 | Zambian Kwacha |
| `ZWG` | 924 | 2 | Zimbabwe Gold |
| `ZWL` | 932 | 2 | Zimbabwean Dollar (historical; superseded by ZWG 2024) |

> `CLF` is the only currency with 4 minor units. `XTS` is the ISO 4217 testing code; present in the table but should not appear in production data.

## 5.3 Cryptocurrencies

50 codes occupying `value_base_unit_t` slots **298 … 347** (`BVN_CURRENCY_CRYPTO_FIRST … BVN_CURRENCY_CRYPTO_LAST`). Like the fiat codes they have no named `bu_*` enumerators — resolved by `bvn_parse_currency_str`, queried with `bvn_unit_is_crypto` / `bvn_currency_info`. `numeric_code = 0` for all.

> **Min** = `minor_unit` = on-chain decimal places. E.g. `<uint:64,$BTC>` stores satoshis; divide by $10^8$ to obtain BTC.

| Code | Min | Subunit | Name |
|---|---|---|---|
| `BTC` | 8 | satoshi | Bitcoin |
| `ETH` | 18 | wei | Ethereum |
| `SOL` | 9 | lamport | Solana |
| `XRP` | 6 | drop | XRP |
| `BNB` | 18 | — | BNB |
| `ADA` | 6 | lovelace | Cardano |
| `LTC` | 8 | — | Litecoin |
| `DOT` | 10 | planck | Polkadot |
| `XMR` | 12 | piconero | Monero |
| `ETC` | 18 | — | Ethereum Classic |
| `BCH` | 8 | — | Bitcoin Cash |
| `XLM` | 7 | stroop | Stellar |
| `FIL` | 18 | — | Filecoin |
| `ICP` | 8 | — | Internet Computer |
| `TRX` | 6 | — | TRON |

| Code | Min | Subunit | Name |
|---|---|---|---|
| EOS | 4 | — | EOS |
| VET | 18 | — | VeChain |
| NEO | 0 | — | Neo |
| ZEC | 8 | — | Zcash |
| UNI | 18 | — | Uniswap |
| ARB | 18 | — | Arbitrum |
| SUI | 9 | — | Sui |
| TON | 9 | — | Toncoin |
| INJ | 18 | — | Injective |
| SEI | 6 | — | Sei |
| APT | 8 | — | Aptos |
| TAO | 9 | — | Bittensor |
| WIF | 6 | — | dogwifhat |
| DOGE | 8 | koinu | Dogecoin |
| LINK | 18 | — | Chainlink |
| USDT | 6 | — | Tether |
| USDC | 6 | — | USD Coin |
| AVAX | 18 | — | Avalanche |
| ATOM | 6 | — | Cosmos |
| POL | 18 | — | Polygon |
| NEAR | 24 | — | NEAR Protocol |
| ALGO | 6 | — | Algorand |
| HBAR | 8 | — | Hedera |
| AAVE | 18 | — | Aave |
| MKR | 18 | — | Maker |
| DAI | 18 | — | Dai |
| STX | 6 | — | Stacks |
| GRT | 18 | — | The Graph |
| LDO | 18 | — | Lido DAO |
| BONK | 5 | — | Bonk |
| PEPE | 18 | — | Pepe |
| SHIB | 18 | — | Shiba Inu |

| Code | Min | Subunit | Name |
|---|---|---|---|
| `JUP` | 6 | — | Jupiter |
| `PYTH` | 6 | — | Pyth Network |
| `RUNE` | 8 | — | THORChain |

### 5.4 Currency Prefix Rules

All 24 SI prefixes are allowed on all currency units. IEC binary prefixes are forbidden on all currencies (`error_unit_illegal`).

| Example | Meaning |
|---|---|
| `k~USD` | thousands of USD (×10³) |
| `M~EUR` | millions of EUR (×10⁶) |
| `G~ETH` | giga-ETH = Gwei scale (×10⁹) |
| `m~USD` | milli-USD = one tenth of a cent (×10⁻³) |

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## 6. Symbol Disambiguation

As of spec 1.0 a currency is written **only** with the `$` sigil (§5.1), so the bare form is always a physical-unit lookup and the namespaces never collide:

| Token | Bare form (no `$`) | `$`-sigil form |
|---|---|---|
| `cup` / `CUP` | `cup` → US cup (`bu_cup`); `CUP` → `error_unit_illegal` | `$CUP` → Cuban Peso (ISO 4217:192) |
| `BTU` | `BTU` → BTU (`bu_btu`); `Btu`, `btu` also accepted | (not ISO 4217) |
| `SOL` | `SOL` → `error_unit_illegal` | `$SOL` → Solana (crypto) |
| `BAR` | `BAR` → `error_unit_illegal`; use lowercase `bar` | (not ISO 4217) |
| `ERG` | `ERG` → `error_unit_illegal`; use lowercase `erg` | (not ISO 4217) |
| `CAD`, `XAU` | `error_unit_illegal` (no physical unit) | `$CAD` → Canadian Dollar; `$XAU` → Gold (X-code) |

No bare token is simultaneously a valid physical unit and a currency: currencies live entirely under `$`, physical units entirely without it.

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Physical unit enum range: 1–133, 348–367, 368–371, and 372–377 (163 total) · Fiat: 134–297 and 378–379 (166) · Crypto: 298–347 (50) `BVN_VALUE_BASE_UNIT_COUNT` = 380 (`bu_xcg + 1`)