

Version 3.1 Amendment Document

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Version History

Version

Date

Changes

v3.0

2026

Initial publication. Nine primary domains. Full CDP specification.

v3.1

2026

Addition of ENV (Environmental Conditions) as 10th domain (§5-AMD-1). Addition of BIO (Biological Observations) as 11th domain (§5-AMD-2). Removal of inline version strings from all running text. Realm cardinality correction in segment reference table. Domain conflict resolution rule updated for ENV priority. Errata acknowledgement for sensorhetero paper domain table.

Purpose of this Amendment

This document specifies all amendments to the Modulign Standard that constitute version 3.1. It is a formal amendment document — not a replacement of the v3.0 specification. All v3.0 provisions not explicitly amended remain in force. The v3.1 complete specification incorporates all v3.0 provisions together with the amendments herein.

Version 3.1 was prompted by three categories of finding:

First: Empirical inter-rater reliability data (Gonzalez, V. 2026g, DOI: 10.5281/zenodo.19643322) revealed systematic disagreement at a domain boundary that the v3.0 specification did not explicitly define. Cross-reference with operational registry data confirmed that two domain codes — ENV and BIO — were operationally implemented and classifying live observations but were absent from the formal v3.0 domain taxonomy. This amendment formalises those domains retroactively.

Second: The v3.0 specification and companion papers contained inline version strings ("v3.0", "Version 3.0", "Modulign Standard v3.0") in running prose, creating a maintenance burden. Version 3.1 removes all inline versioning from running text. The Standard is henceforth referred to in prose as "the Modulign Standard" without version qualification. Version strings appear only in document headers, footers, and the canonical version history table.

Third: The sensorhetero companion paper (Gonzalez, V. 2026d) contained an internal inconsistency in its segment cardinality table, which listed nine domains excluding ENV and BIO while the domain coverage table in the same paper listed ENV and BIO among the active domains. This amendment resolves that inconsistency by formalising ENV and BIO. A v1.0.1

errata note is appended to the sensorhetero paper.

§5-AMD-1 · ENV — Environmental Conditions Domain (NEW)

Rationale

The ENV domain captures observations whose primary purpose is the continuous measurement or documentation of environmental conditions — atmospheric state, climate variables, air quality indices, hydrological measurements — as distinct from static or ecological natural environments (NAT) or natural events (NAT·GEO, NAT·ATM). The distinction is purpose-driven: a wildlife camera in a forest observes the natural environment (NAT); a NOAA atmospheric sensor observes an environmental condition (ENV). Both may share geographic location; they differ in observational purpose and epistemic function.

Prior to this amendment, ENV was operationally present in the canonical Modulign Observation Registry with 40+ classifications derived from Open-Meteo climate data and NWS alert feeds. The v3.0 specification did not include ENV in the domain taxonomy, creating a compliance gap between the published specification and the operational registry. This amendment resolves that gap retroactively. All pre-amendment ENV classifications are fully compliant with v3.1.

Domain Definition

Code

Full Name

v1.0

Primary Scope

ENV

Environmental Conditions

1000

Ongoing environmental measurement and monitoring: atmospheric conditions, climate variables, air quality indices, hydrological state, oceanographic conditions, space weather. Applies when the primary observational purpose is the documentation of an environmental condition rather than a physical environment or natural feature.

ENV Subdomain Registry

Code

Name

Description

ATM

Atmospheric State

Surface and upper-atmosphere weather conditions: temperature, pressure, humidity, wind, precipitation. NOAA surface stations, weather cam networks, NWS sensor feeds.

AQI

Air Quality Index

Particulate matter (PM2.5, PM10), ozone, CO, NO2, SO2. EPA AirNow, regional air quality monitoring networks.

HYD

Hydrological State

River gauges, tidal measurements, lake levels, groundwater. USGS water data, NOAA CO-OPS tidal stations. Distinct from TRN·PPL (pipeline) and INF·WTR (water infrastructure).

OCN

Oceanographic Conditions

Sea surface temperature, salinity, wave height, ocean current state. NOAA NDBC buoys, Argo floats.

CLM

Climate / Long-range

Climate anomaly indices, seasonal forecasts, multi-year trend data. Open-Meteo, NCEI climate normals.

SWX

Space Weather

Solar wind, geomagnetic storm indices (Kp), ionospheric conditions. NOAA SWPC feeds.

UNK

Unknown Environmental

Environmental measurement context confirmed; specific condition type indeterminate.

NAT / ENV Boundary Rule

The NAT/ENV distinction is purpose-driven, not location-driven. Apply this rule:

Classify as NAT when:

Classify as ENV when:

The observation documents a physical natural environment: a forest, coastline, mountain, river, wildlife, sky as visual scene.

The observation documents an ongoing environmental condition: atmospheric state, air quality measurement, tidal reading, oceanographic data, climate index.

A wildlife camera in a forest: NAT·FOR

A NOAA atmospheric sensor: ENV·ATM

A weather camera showing clouds as a visual scene: NAT·ATM

A weather station reporting temperature/humidity values: ENV·ATM

A river camera showing water flow: NAT·RVR

A river gauge reporting water level: ENV·HYD

Amendment note: The v3.0 NAT subdomain NAT·ATM (Sky/Atmosphere) remains valid for visual sky and atmospheric scene observations. ENV·ATM is the correct domain for instrument-based atmospheric measurement feeds. The two codes are not in conflict: they address different observational purposes.

Domain Conflict Resolution Update

The §5.1 Domain Conflict Resolution rule is amended to add ENV priority between SEC and TRN:

(1) EVT if active event overrides at majority scale. (2) SEC if dedicated security installation. (2a) ENV if the primary observational purpose is environmental condition measurement, regardless of physical setting. (3) TRN if transportation infrastructure is dominant. (4) COM if commercial activity dominates. (5) NAT if natural environment is clear and unambiguous primary subject. (6) Otherwise, designed purpose of space.

§5-AMD-2 · BIO — Biological Observations Domain (NEW)

Rationale

The BIO domain captures observations at the biological organism scale whose primary purpose is the classification, identification, or monitoring of living organisms — individual specimens, taxa, or ecological populations — rather than the natural environment those organisms inhabit. The distinction from NAT is scale and purpose: a wildlife camera in a forest is NAT (the environment is the subject); an iNaturalist research-grade observation of a specific bird species at a specific location is BIO (the organism is the subject). BIO aligns with the |BIO| scale tier already specified in the Scale Axis (§10), which covers biological organism scale (10^{-3} to 10^1 m).

Prior to this amendment, BIO was operationally present in the canonical registry with 7,294+ classifications derived from iNaturalist research-grade observations. The v3.0 domain taxonomy did not include BIO, creating the same compliance gap as ENV. All pre-amendment BIO classifications are fully compliant with v3.1.

Domain Definition

Code

Full Name

v1.0

Primary Scope

BIO

Biological Observations

1100

Observation, identification, and monitoring of living organisms at the individual or population level: species identification, ecological surveys, biodiversity records, clinical and medical organism-scale observations, genomic and cellular data. Applies when the organism or taxon is

the primary subject of observation, not the environment it inhabits.

BIO Subdomain Registry

Code

Name

Description

WLD

Wildlife / Fauna

Individual animal observations, species identification, wildlife monitoring. iNaturalist fauna, camera trap records, eBird sightings.

FLR

Flora / Vegetation

Individual plant observations, species identification, vegetation surveys. iNaturalist flora, herbarium records.

MRN

Marine / Aquatic Organisms

Marine species, fish, invertebrates, algae. Distinct from ENV·OCN (oceanographic conditions) and NAT·OCN (open ocean environment).

MCR

Microbial / Cellular

Bacterial cultures, cellular imaging, microscopy observations. Typically |MLC| scale.

HMN

Human Biology / Clinical

Medical imaging, clinical specimen observations, anatomical records. Strong consent requirements apply (§29 of the base specification).

ECO

Ecological / Community

Multi-species surveys, biodiversity assessments, ecological transect data. Observations where the community rather than individual organism is the primary unit.

UNK

Unknown Biological

Biological observation context confirmed; taxon or organism type indeterminate.

NAT / BIO Boundary Rule

Classify as NAT when:

Classify as BIO when:

The natural environment is the primary subject. Organisms may be present but are incidental.

A specific organism, specimen, or taxon is the primary subject. The environment is context, not subject.

A wildlife camera covering a forest watering hole: NAT·FOR

An iNaturalist observation of a specific eagle species at a specific location: BIO·WLD

A coral reef camera showing the reef environment: NAT·OCN

A marine biologist's species count survey at that reef: BIO·MRN

§AMD-3 · Removal of Inline Version Strings

All references to version strings in running prose — "v3.0", "Version 3.0", "Modulign Standard v3.0", "the Modulign Standard v3.0" — are removed from all specification documents and companion papers as part of this amendment cycle. The canonical form in all running prose is: "the Modulign Standard".

Version strings are retained only in:

- (a) Document headers, footers, and title blocks.
- (b) The canonical Version History table in each document.
- (c) Zenodo metadata, DOI landing pages, and citation records.
- (d) Code implementations, database schema comments, and API version fields where machine-readable version tracking is required.

This change is non-substantive. No architectural, definitional, or procedural provisions are altered by the removal of inline version strings.

§AMD-4 · Realm Cardinality Correction

The segment reference table in the sensorhetero companion paper (Gonzalez, V. 2026d, §2.2) listed Realm cardinality as |5| with set {SR, AT, DQ, OR, VR}. This was incorrect. The complete Realm set as specified in §8 of the base specification contains 9 realms:

Code

Realm

Description

SR

Surface (default)

Earth land and near-surface up to ~100m altitude.

AT

Atmosphere

Earth atmosphere above surface: weather balloons, drones above 100m, atmospheric monitoring.

SS

Subsurface

Underground: mines, tunnels, caves, underground infrastructure. [Omitted from sensorhetero table — now corrected.]

AQ

Aquatic

Open water at or near surface: ocean, lake, river, shallow coastal. [Omitted from sensorhetero table — now corrected.]

DQ

Deep Aquatic

Submarine and deep-sea: ROV feeds, deep-sea sensor arrays.

OR

Orbital

Earth orbit: LEO, MEO, GEO, HEO, Lagrange points.

LN

Lunar

Moon surface and lunar orbit. [Omitted from sensorhetero table — now corrected.]

IP

Interplanetary

Beyond lunar orbit: Mars, Venus, asteroids, deep space probes. [Omitted from sensorhetero table — now corrected.]

VR

Virtual / Synthetic

Fully simulated or generated environments. Required with :SYN medium.

The correct Realm cardinality is [9]. The sensorhetero paper's table listing [5] is superseded by this correction. The base specification §8 was correct in v3.0; only the companion paper table was in error.

§AMD-5 · Domain Set and Cardinality Update

The Domain cardinality is updated from [9] to [11] to reflect the formal addition of ENV and BIO. The canonical Domain set is:

Code

Full Name

v1.0

Status

URB

Urban / Built Environment

100

v3.0 — unchanged

NAT

Natural World

200

v3.0 — scope clarified (NAT/ENV and NAT/BIO boundary rules added)

TRN

Transportation Systems

300

v3.0 — unchanged

COM

Commerce & Industry

400

v3.0 — unchanged

RES

Residential / Private Life

500

v3.0 — unchanged

EVT

Events & Entertainment

600

v3.0 — unchanged

SEC

Security & Surveillance

700

v3.0 — unchanged

INF

Infrastructure / Utilities

800

v3.0 — unchanged

UNK

Unknown / Mixed / Experimental

900

v3.0 — unchanged

ENV

Environmental Conditions

1000

v3.1 NEW — see §5-AMD-1

BIO

Biological Observations

1100

v3.1 NEW — see §5-AMD-2

The formal logic document (Gonzalez, V. 2026b) segment cardinality definition for DOM is updated to: DOM {URB, NAT, TRN, COM, RES, EVT, SEC, INF, UNK, ENV, BIO} — |11|.

Errata Acknowledgements

E-1 · sensorhetero companion paper (Gonzalez, V. 2026d)

The segment cardinality table in §2.2 listed DOM cardinality as |9| and omitted ENV and BIO from the domain set. The domain coverage table in §6.2 of the same paper correctly listed ENV and BIO as active domains, creating an internal inconsistency. The inconsistency is resolved by this amendment: ENV and BIO are now formally specified in v3.1. The paper's cardinality table is superseded; the domain coverage table was correct.

The segment cardinality table in §2.2 also listed Realm cardinality as |5|, omitting SS, AQ, LN, and IP. The base specification §8 was correct. The paper's realm cardinality entry is superseded by §AMD-4 of this document.

A v1.0.1 version of the sensorhetero paper will be published on Zenodo acknowledging these errata and citing this amendment document.

E-2 · Inter-rater reliability paper (Gonzalez, V. 2026g)

The inter-rater reliability paper (DOI: 10.5281/zenodo.19643322) described the NAT/ENV disagreement pattern as "a structural boundary ambiguity in the current domain taxonomy." This was accurate at the time of writing — ENV was operationally present but not formally specified. Following this amendment, the correct characterisation is: the disagreement revealed an operationally implemented domain (ENV) that was absent from the v3.0 formal specification, now formalised in v3.1. The paper's empirical findings are unchanged. A citation to this amendment document should be added to any subsequent version of that paper.

The paper also registered the second classifier under the system name "Modulign Claude Reasoning Classifier v1.0.0." As deployed, the classifier uses a weighted heuristic algorithm, not a language model API. A v1.0.1 correction will update the system name to "Modulign Weighted Accumulation Classifier v1.1.0."

Formal Logic Updates (Gonzalez, V. 2026b)

The following formal definitions in the Formal Logic document are updated by this amendment:

Definition 1.2 — The Modulign Address Space (amended)

The DOM segment domain is updated from:

DOM {URB, NAT, TRN, COM, RES, EVT, SEC, INF, UNK} — |9|

To:

DOM {URB, NAT, TRN, COM, RES, EVT, SEC, INF, UNK, ENV, BIO} — |11|

All other elements of Definition 1.2 are unchanged.

CDP Step 1 — Domain Resolution (amended)

The instruction "Classify ω into one of nine primary domains" is amended to: "Classify ω into one of eleven primary domains." The domain conflict resolution rule is updated per §AMD-1 (ENV priority insertion). All other CDP steps are unchanged.

Backward Compatibility

Version 3.1 is fully backward compatible with v3.0. All v3.0 compliant MGN codes remain v3.1 compliant. No existing classification requires reclassification. The additions of ENV and BIO expand the domain set; they do not invalidate any existing domain assignment.

All pre-v3.1 ENV and BIO classifications already present in the canonical Modulign Observation Registry are retroactively fully compliant with v3.1. No registry entries require amendment.

Implementations that do not use ENV or BIO are not required to update. Implementations that wish to classify environmental conditions or biological observations are required to use the ENV and BIO domain codes as specified in this document.

Citation

To cite the Modulign Standard: Gonzalez, V. 2026. Modulign Standard: A Dimensional Address Grammar for Observable Reality. v3.1 amendment. Zenodo. <https://doi.org/10.5281/zenodo.19348703>

The v3.0 DOI resolves to the current version. This amendment document will be published as a companion record on Zenodo and linked from the canonical v3.0 record.

References

Gonzalez, V. 2026a. Modulign Standard v3.0: A Dimensional Address Grammar for Observable Reality. Zenodo. <https://doi.org/10.5281/zenodo.19348703>

Gonzalez, V. 2026b. The Formal Logic of Modulign. Zenodo. <https://doi.org/10.5281/zenodo.19350847>

Gonzalez, V. 2026c. Modulign as Evidence: A Legal Epistemology Treatise. Zenodo. <https://doi.org/10.5281/zenodo.19351250>

Gonzalez, V. 2026d. Modulign Standard Applied to Heterogeneous Sensor Networks: A Computational Systems Paper. Zenodo. <https://doi.org/10.5281/zenodo.19642557>

Gonzalez, V. 2026e. Chain of Custody Formalisation in Digital Forensics: The Modulign Standard. Zenodo. <https://doi.org/10.5281/zenodo.19642385>

Gonzalez, V. 2026f. Modulign Standard: Automated Classifier Certification Framework (AUT). Zenodo. <https://doi.org/10.5281/zenodo.19559602>

Gonzalez, V. 2026g. Inter-Rater Reliability of Automated Modulign Standard Classifiers: A Two-Algorithm Empirical Study on N = 234 Live Observation Streams. Zenodo. <https://doi.org/10.5281/zenodo.19643322>

Table Colour Legend

Green

New content added in v3.1

Amber

Corrections to prior companion paper errors

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