S11 — E&M; (Equipment & Machinery) — Screen + Domain Spec (MVP)

Status: Draft (aligned to EM Domain Module Spec v1.0 + dataset templates)

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Purpose: E&M; is the **source of truth** for equipment master data, relationships, and document linkage. It feeds Daily Log, PM Matrix, Defects, WOs/Tasks, Inventory, Projects, and Archive.

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1) Purpose (engineer-first)

E&M; exists to:

- Onboard the vessel quickly using **template-driven equipment types** (30–60m library as defaults).
- Store **master data** once (manufacturer/model/serial, locations, criticality, relationships).
- Drive “no double-entry” across the app:

  - Daily Log captures readings against known meters

  - PM generates tasks against known equipment

  - Defects/WOs/Projects link back to equipment for history + reporting

- Make it easy to **amend** equipment details as the engineer learns the boat.

Key separation: E&M; = master data; Daily Log = time-series readings; PM/Defects/WOs = workflows.

Global Library (system-native knowledge layer)

E&M; operates on **two layers**:

1) Global Library (maintained by YachtPMS team)

This is the system-native dataset that ships with the product and improves over time:

- **Builder → Model → Template Pack (versioned)**
- Equipment Type templates (default meters/states + suggested PM)
- Default instance counts and naming patterns
- Generic checklists (daily/weekly/monthly patterns)
- Optional OEM/vendor references (where legally allowed)

- Generic procedures / tips (non-proprietary)

Rule: Global library updates must **never overwrite** a vessel's local instance data automatically.

2) Vessel Instance Data (owned by each yacht)

This is the yacht's source of truth:

- Real equipment instances fitted onboard (names, locations, serials)
- Their PM intervals, readings history, defects/WOs/projects
- Their uploaded manuals/certificates (stored in Archive vault)
- Local custom meters/states and notes

Template Packs and versioning

- Template Packs are **versioned** (e.g., "Benetti 55m Pack v1.2").
- A yacht "instantiates" a specific pack version during onboarding.
- When newer pack versions are published:

- Existing yachts get **suggested updates** (opt-in)

- Options: apply to **new items only**, or apply to existing items with a **review list**

- Engineers can submit "Suggest to Library" items; the team reviews before promoting to Global Library.

Admin UI note (internal tool)

To maintain the Global Library, YachtPMS should include a **Library Admin UI** (internal/admin-only) to:

- Create/edit Builder/Model packs
- Manage equipment type templates and dataset templates
- Version and publish packs
- Review "Suggest to Library" submissions and promote changes safely

2) Inputs (what the user adds/edits here)

A) Vessel structure (MVP)

- Spaces/locations (ECR, ER, Laz, Garage, Bridge, Crew areas, etc.)
- Systems (optional grouping): Propulsion, Electrical, HVAC, Plumbing, Safety, etc.

B) Equipment Types (templates)

Seeded from **Equipment & Machinery Library (30–60m)**.

- Type fields (admin-level): type_id, category, default meters, default PM suggestions, default criticality, default document slots.
- MVP UI rule: onboarding supports up to **6 instances** for most types (e.g., DG1–DG6), but DB must not hard-limit (high-count exceptions: AHU/FCU, heads, AV/IT assets).

C) Equipment Instances (the real boat)

Per instance:

- Display name (DG1, ME1, CHW Pump #2, etc.)
- Manufacturer / model / serial / year (optional)
- Location + parent system
- Criticality class (engineer-first “what matters most”)
- Operational state + maintenance state (e.g., In service / Out of service / Decommissioned)
- Parent/child relationships (e.g., **Chiller plant** → **chiller units**)
- Notes + attachments (photos, spec sheets)

D) Meters / Datasets (link layer)

Each equipment instance can have:

- Meters (hours, pressures, temps, V/Hz/load, etc.)
- Manual state fields (ON/OFF/AUTO/FAULT; leak state; cleaned/not cleaned; etc.)
- Dataset templates supported in MVP (from your templates):

- Bilge & Dewatering

- Chiller/HVAC Plant

- Electrical Power & Distribution

- Exhaust / Wet Exhaust

- Fresh Water Pressure / Hydrophore

- Gearbox / Shafting / Propulsion Train

(Additional templates can be added later without breaking schema.)

E) Documents (file links)

- Manuals, wiring diagrams, service bulletins
- Certificates/evidence links (where relevant)
- Links to Archive file vault (do not duplicate storage)

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3) Outputs (what E&M; updates elsewhere)

Daily Log (S06)

- Provides the list of active equipment + meters to log against.
- Enables “toggle blocks” (e.g., chillers 1–6 ON/OFF, CHW temps/pressures, boilers on/off, hydrophore pressure, etc.) based on fitted equipment.

PM Matrix (S05)

- Equipment can have default PM suggestions; engineer confirms/edits in PM Matrix.
- PM tasks and compliance items link back to equipment.

Defects (S01)

- Defect can link to equipment (hybrid: optional but strongly prompted).
- Equipment history shows defects timeline.

Tasks & Work Orders (S02) + WOT Reports (S03)

- WOs/Tasks link to equipment; WOT reports write service history to equipment record.

Inventory & Requisitions (S04)

- Parts can be linked to equipment (recommended) for faster ordering and usage tracking.

Projects (S09)

- Project line items can link to equipment and inherit the vendor/category context.

Archive (S08)

- Completed work/report packs and evidence remain in Archive; E&M; only links to them.

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4) Layout (tabs / sections / subviews)

A) E&M; Home (search-first)

- Global search: equipment, systems, locations, tags
- Filters: category (mechanical/electrical/HVAC/IT/etc.), criticality, state, location
- Quick actions: Add equipment, Bulk add (high-count types), Import from template

B) Onboarding Wizard (template-driven)

1) Select vessel profile (30–60m default)

2) Choose equipment types to install

3) Add instances (UI “max 6” convenience for most; bulk-add for exceptions)

4) Confirm meters/datasets per type (accept defaults)

5) Link manuals/docs (optional now; can add later)

C) Equipment Detail (single instance)

Tabs:

1) **Overview** (identity, location, criticality, state)

2) **Meters & States** (the list that Daily Log uses)

3) **PM & Compliance** (links to PM rows; view due items)

4) **Defects & WOs** (open items + history)

5) **Parts & Inventory** (linked spares, fast requisition)

6) **Documents** (manuals, wiring, photos; links to Archive vault)

7) **History** (service history from WOT reports, events)

D) Systems View (optional but useful)

- e.g., Chiller Plant system with child units and supporting pumps/valves.

Equipment Detail (tight pass UX)

Goal: the engineer can answer “what is it, where is it, what’s wrong, what’s due, what parts, what history” in <30 seconds.

Above the fold (always visible)

1) **Identity bar**

- Display name + category + location + criticality badge

- Operational state (In service / Out of service) + Tag-out flag

- Quick icons: Manual, Wiring, Photos, Certificates (links open Archive vault)

2) **Status strip (live counters)**

- Open Defects (count)

- Open WOs/Tasks (count)

- PM due soon / overdue (count)

- Compliance due/overdue (count)

3) **Primary action buttons (one-click)**

- Create Defect (pre-linked)

- Request WO/Task (pre-linked)

- Log Reading / Add Note (quick entry)

- Add Part / Requisition (pre-filtered)

- Add to Project (creates project line item)

Default tab order (engineer-first)

Tabs should be ordered by frequency of use:

1) **Overview**

2) **Meters & States**

3) **Open Items** (Defects + WOs/Tasks unified view)

4) **PM & Compliance**

5) **Parts**

6) **Documents**

7) **History**

8) **Advanced** (hidden unless toggled)

Tab contents (tight pass)

1) Overview

- Key fields: manufacturer, model, serial (optional), install year (optional)
- Relationship view: parent system + child components (simple tree)
- “Common labels” (tags): port/stbd, zone, circuit/bus, cooling loop, etc.

2) Meters & States

- Show ONLY log_enabled meters/states by default (what Daily Log needs)
- Each meter has:

- unit, expected range (optional), last recorded value + timestamp

- quick “Add reading” button

- State toggles (ON/OFF/AUTO/FAULT; cleaned/not cleaned; in use/out of use)
- Note: this defines layout blocks for Daily Log; Daily Log stores the readings.

3) Open Items (unified)

A single list with filter chips:

- Defects (open/unreviewed)
- WOs/Tasks (requested/in progress/report pending)
- Project items (if linked)

Each row shows:

- title, priority, status, assigned-to (later), last update, next action

One-click actions:

- open item
- add comment/update
- escalate/de-escalate (where allowed)

4) PM & Compliance

- “Next due” list (PM) + “Due/Overdue” list (Compliance)
- Quick complete checkbox for checklist-style items
- “Create/adjust PM row” deep link to PM Matrix
- On completion:

- writes record to Archive

- updates next due

5) Parts

- Linked parts list (preferred)
- Fast actions:

- “Consume” (reduces qty + writes usage event)

- “Requisition” (pre-fills item + preferred suppliers)

- “Common spares for this equipment type” (from library, optional suggestions)

6) Documents

- Links to Archive vault folders:

- Manuals

- Wiring/diagrams

- Certificates/evidence

- Photos

- Upload button routes to Archive and returns a link

7) History

Timeline view:

- WOT reports (completed work)
- major defects
- PM completions
- parts consumption events (optional summary)

Filters: last 30/90/365 days, all time

8) Advanced (rarely used)

- Edit type template link (admin only)
- Meter schema editing (advanced)
- Archive/inactivate equipment
- Merge duplicates (admin)

Engineer-safety rules

- **No destructive edits**: equipment cannot be deleted; only inactivated.
- Key edits require reason and write to Activities Log.
- Global Library changes never overwrite local instance data automatically.

E&M; Home (tight pass UX)

Goal: find anything in <10 seconds and edit lots of items without making a mess.

Home layout (search-first)

1) **Global search bar (always on top)**

- Searches: equipment name, tags, location, category, manufacturer/model, serial, system, project/job references

2) **Filter rail (left or top)**

- Category (Mechanical / Pumps & Valves / Electrical / AV/IT / HVAC / Plumbing / Safety / Other)

- Location/zone

- Criticality (Critical / Important / Normal)

- State (Operational / Tagged Out / Out of Service / Archived)

- “Has open items” (Defects/WOs)

- “Due soon” (PM/Compliance)

3) **Results table (Excel-fast)**

- Columns (default): Name, Category, Location, Criticality, State, Open Items, PM Due, Compliance Due

- Row click opens Equipment Detail

- Multi-select enabled

Bulk tools (engineer-first)

Bulk actions work on the selected set and always log to Activities Log:

- **Bulk move location**
- **Bulk tag / untag**
- **Bulk change state** (Operational / Out of Service / Archived)
- **Bulk enable/disable log fields** (log_enabled meters/states)
- **Bulk assign to system** (optional)
- **Bulk export list** (CSV/PDF later; MVP can be CSV)
- **Bulk add / clone**

- Clone an equipment pattern (e.g., “FCU template”) then generate 20 instances

High-count equipment handling (no pain)

For AHUs/FCUs, heads, AV/IT assets:

- Provide a **Group view** (e.g., “Guest Deck FCUs”)
- Group-level defaults:

- location, tags, criticality

- log_enabled presets

- Instance-level overrides allowed but minimal.

Guardrails (avoid data decay)

- No deletion; only archive/inactivate.
- Bulk changes require a reason when the action affects criticality/state/log schema.
- Show “diff preview” for bulk edits (even MVP can show a simple summary: “25 items will change location to ER”).

Power user shortcuts (optional MVP)

- Keyboard navigation (up/down, enter to open)
- “/” to focus search
- Quick filter chips (e.g., “Tagged Out”, “Due Soon”, “Open Defects”)

Daily Log auto-layout (tight pass)

Goal: Daily Log becomes “smart” without extra admin: it shows the right widgets for the yacht, and only the right fields.

Source of truth

- E&M; stores **meters and state fields** for each equipment instance.
- Each meter/state has a boolean: **log_enabled**.
- Daily Log (S06) is the **official meter log** and stores time-series readings against those fields.

How widgets are generated (rules)

Daily Log renders widgets in this order:

1) **Core Snapshot widgets** (always):

- Operational context (underway/anchor/dock/shipyard)

- Official hour meters (ME/DG/Tenders/other hours meters)

- Tanks/consumables (from vessel config)

2) **System widgets** (auto, based on E&M;):

- For each equipment/system category where at least one log_enabled field exists,

create a widget group:

- HVAC/Chillers

- Fresh water pressure/hydrophore

- Boilers/hot water

- Air compressors

- Electrical (shore/gen/bus snapshots)

- Bilges & dewatering

- Sea strainers (if configured)

- Cathodic protection (VDC)

3) **High-count groups** (special rendering):

- AHU/FCU: group by location/zone, show counts + exceptions first

- AV/IT: group by network zones or racks; show status toggles and subscription reminders (later)

Exception-first display (engineer-first)

Daily Log should bias to showing:

- Items tagged Out of Service / Tagged Out
- Items with open defects/WOs
- Items due/overdue (PM/Compliance)

…at the top of each widget group.

Mapping rules (how an E&M; field becomes a Daily Log row)

Each log_enabled field generates:

- A label
- An input type (number, toggle, selector, text)
- Units (from E&M; units appendix)
- Optional expected range (for later warnings)

Example:

- CHW Supply Temp (number, °C/°F)
- Boiler 2 On/Off (toggle)
- Hydrophore pressure (number, bar/psi)
- Cathodic VDC (number, VDC)

Config overrides (MVP)

- Vessel admins can hide entire widget groups (rare)
- Engineer can “pin” a widget group to top for their program
- Per-equipment log_enabled can be toggled from Equipment Detail → Meters & States.

Data storage rule (critical)

- Daily Log stores readings **by equipment_id + field_id + timestamp**.
- If an equipment instance is renamed, history stays attached (equipment_id stable).
- If log_enabled is turned off, history remains, but the field stops appearing in Daily Log.

Implementation note (dev)

- Treat widget generation as a deterministic function:

`widgets = buildWidgets(vessel_config, em_equipment_instances, em_fields where log_enabled=true)`

- Cache widget structure; refresh when E&M; changes (not every page load).

5) Rules & behaviors (automations + triggers)

A) Hybrid equipment linking (capture unknowns)

When a user creates a defect/WO and equipment is unknown:

- Allow “Unknown equipment” selection
- Prompt: “Capture equipment now?” → quick-add minimal record (name, location, category) then refine later.

B) State-aware logging

- If equipment is marked Out of Service, Daily Log hides it by default but can be shown.
- Toggles like “in use/out of use” affect derived alerts (e.g., sea strainer growth escalation only if line is in use).

C) Template defaults

- Equipment type defines default meters, states, and suggested PM items.
- Changing a type default does **not** retroactively overwrite an engineer’s custom instance settings without confirmation.

D) Audit trail

- Key edits (criticality changes, equipment renamed, state changes) write to **Archive** → **Activities Log**.

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6) Links to other screens (drill-down + create-from-here)

From Equipment Detail:

- Create Defect (S01) pre-linked to equipment

- Create WO/Task request (S02) pre-linked
- Add PM row (S05) for this equipment
- Create requisition (S04) for linked parts
- Add to Project line item (S09)
- Open related Archive records (S08)

MVP scope notes (keep it buildable)

- Deliver the onboarding wizard + equipment detail + template-driven meters/states.
- Keep “systems modeling” lightweight: parent/child links + system view.
- Defer advanced BOM, deep sensor streaming, and complex CMMS features to Phase 2.

Suggested template updates (engineer-safe)

When Global Library packs improve, the yacht sees a notification:

- “Template improvements available” with a diff summary

Engineer options:

- Apply to **new equipment only** (safe default)
- Apply to existing equipment (shows a review list before changes)