**OEM Integration Brief (PDF)**

# Automated Sanitization for Public Restrooms
# OEM-Ready DABOTechnology

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**Prepared by:** DABOTechnology — Stefano Bottesin
**Contact:** info@dabo.it | +39 347 2664913
**Website:** dabohts.eu

## Confidentiality Notice (non-confidential)

This document contains high-level technical information intended for restroom cabin manufacturers (OEMs), system integrators, and potential investors. Detailed design files, performance datasets, and integration drawings can be provided under NDA.

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# 1) Executive Summary

Public restroom cabins operate in high-traffic, high-turnover conditions where hygiene, user trust, and operational efficiency directly affect usage and reputation. DABOTechnology enables **automated sanitization cycles** designed for **OEM integration** into automated toilet cabins and modular restroom systems.

**What it provides**

- **Sealed UV-C sanitization approach** engineered with **safety interlocks**
- **Repeatable cycle control** (between-users cycles and scheduled cycles)
- **Traceability via cycle logging** and optional remote reporting
- Integration pathways for **new manufacturing** and **retrofit kits** (where applicable)

**Who it is for**

- Automated restroom cabin **manufacturers (OEMs)** seeking differentiation and premium feature sets
- **System integrators/operators** who need auditable cycle records and reliable service procedures
- **Investors/partners** interested in scalable OEM supply and licensing/co-development models

**Reference deployment**
A reference deployment exists and can be shared under NDA.

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# 2) The Market Need (OEM & Operators)

## OEM drivers

- Differentiation in tenders and private deployments (smart cities, parks, transport hubs)
- Premium "hygiene upgrade" feature without redesigning the entire cabin
- Integration-friendly technology with clear safety states and documentation

### Operator drivers

- Fast turnover with consistent hygiene procedures
- Reduced dependence on frequent manual chemical cleaning cycles
- Traceable cycles for internal QA, audits, and reporting to stakeholders

### User drivers

- Higher perceived cleanliness and trust
- Clear "ready/occupied/service" states
- Improved experience in dense public environments

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## 3) Solution Overview

DABOTechnology introduces a controlled sanitization layer for automated restroom cabins, built around:

- **Cycle-based operation** (triggered by vacancy, time schedules, or operator rules)
- **Safety interlocks** preventing unsafe operation states
- **Traceability logs** capturing cycle outcomes and fault states

### Typical integration scope (configurable)

- **Air hygiene cycles** between users and/or scheduled
- Optional **high-touch zone** treatment (layout dependent; defined per cabin design)
- Optional **remote monitoring** for fleet-level visibility

Note: Final configuration (air only vs air + targeted zones) is defined jointly during OEM integration, based on cabin geometry, airflow paths, and service constraints.

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# 4) System Architecture

## 4.1 High-level blocks

**[Figure 1 — System Block Diagram Placeholder]**

**Core components**

1. **Sanitization Core Module**
   - UV-C treatment subsystem in a controlled/shielded arrangement
   - Designed to operate only in safe states (interlocked)
2. **Control & Safety Logic**
   - Cycle controller, safety state machine, fault handling
   - Interfaces to cabin PLC/ECU or a dedicated controller (integration option)
3. **Sensors & Interlocks (integration-dependent)**
   - Door status (main door)
   - Occupancy/vacancy signal (cabin sensors)
   - Service access status (maintenance panel)
   - Emergency stop / fault reset (operator)
4. **Power & Protections**
   - Power conditioning, fusing/e-protection, safe shutdown
5. **Data Logging & Communications (optional)**
   - Local logs, export (CSV/JSON), remote reporting via OEM gateway

## 4.2 Integration topologies

- **Topology A — Integrated with OEM PLC/ECU**
  DABO module controlled by OEM logic via defined I/O/communications.

- **Topology B — Standalone controller + OEM signals**
  DABO controller runs cycles, OEM provides interlock signals and "ready" outputs.
- **Topology C — Retrofit kit (selected platforms)**
  Cabin-specific kit developed with OEM/integrator.

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# 5) Operating Modes & Cycle Logic

## 5.1 Standard "Between-Users" mode (recommended)

**Trigger:** cabin becomes vacant + door closed + safe state confirmed
**Sequence (example):**

1. Verify vacancy signal
2. Verify door closed and service access closed
3. Enter "Sanitization Pending" with visual state (optional)
4. Run cycle for configured duration
5. Log cycle data and result (pass/fail/fault)
6. Set cabin status to "Ready"

## 5.2 Scheduled cycles

- Night cycles or periodic cycles (e.g., every N hours)
- Useful for high-heat periods, peak seasons, or operator policy

## 5.3 Maintenance / Service mode

- Sanitization disabled or restricted
- Requires service key/authorization + safe lockout conditions

## 5.4 Fault behavior (safe stop)

- Any interlock violation → immediate safe stop
- Fault code logged + cabin status optionally set to "Out of Service" until reset

**[Figure 2 — Cycle State Machine Placeholder]**

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# 6) Safety-by-Design & Interlocks

Safety is enforced via a **state-machine approach** and hard/soft interlocks depending on OEM topology.

## 6.1 Mandatory interlocks (baseline)

- **Occupancy / vacancy** (must indicate vacant)
- **Door closed** (main door)
- **Service access closed** (maintenance panel)
- **Emergency stop / safety stop** (where implemented by OEM)

## 6.2 Optional safety features

- Tamper detection
- Dual-channel door confirmation (mechanical + sensor)
- "Two-person rule" service enablement (operator policy)
- Event signing / audit trail hardening (for regulated sites)

## 6.3 Safety status outputs (recommended)

- READY
- OCCUPIED
- SANITIZING
- SERVICE
- FAULT / OUT OF SERVICE

Compliance note: UV-C integration must follow applicable safety standards and installation rules. DABOTechnology provides design guidance and documentation support; final compliance responsibility depends on OEM integration and the target market.

# 7) Data Logging, Traceability & Reporting

## 7.1 What is logged (example schema)

Each cycle record can include:

- Timestamp (start/end), cycle ID
- Mode (between-users / scheduled / service test)
- Duration, subsystem runtime counters
- Interlock states at start and during cycle
- Result (completed / aborted / fault) + fault code
- Maintenance counters (hours, cycles, service reminders)

## 7.2 Local + remote reporting (optional)

- **Local export:** CSV/JSON via service port or OEM interface
- **Remote reporting:** via OEM gateway/cloud to dashboards:
    - cycles/day, uptime, fault rates
    - location/site fleet view
    - maintenance alerts and service KPIs

**[Figure 3 — Example Dashboard Mockup Placeholder]**

## 7.3 Audit-readiness (optional)

- Immutable logs / signed event entries
- Operator access levels (viewer vs maintainer)
- Basic cybersecurity requirements aligned with OEM policies

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# 8) OEM Integration Guide

This section is written to reduce OEM integration time and risk.

## 8.1 Mechanical integration

### Inputs needed from OEM

- Cabin drawings (interior, service compartment, airflow paths)
- Mounting constraints, service access constraints
- Expected environment: temperature range, humidity, cleaning routines

### Integration outputs

- Proposed mounting position(s)
- Service workflow (filter access if used, inspection points)
- Cable routing concept and connector spec

## 8.2 Electrical integration

### Power options (example)

- OEM low-voltage DC rail integration, or dedicated supply module
- Protection strategy: fuse/e-fuse, safe shutdown, fault reporting

## 8.3 Signals & communications

### Baseline signals (example)

- Inputs: Vacancy, Door Closed, Service Closed, E-Stop, Reset
- Outputs: Ready, Sanitizing, Fault, Service

### Comms options (integration-dependent)

- Dry contacts / discrete I/O
- RS-485 Modbus
- CAN (if OEM standard)
- Ethernet (optional, via gateway)

## 8.4 Thermal / environmental considerations

- Condensation control and enclosure rating

- Thermal management within service compartments
- Materials compatibility with routine cleaning procedures

### 8.5 Maintenance concept

- Designed for low routine maintenance
- Preventive maintenance counters (hours/cycles)
- Operator quick checks + service intervals defined with OEM

**[Table 1 — Integration Inputs Checklist Placeholder]**

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## 9) Validation Approach (Test Plan Outline)

Validation depends on final configuration and target market. This brief provides a practical, OEM-friendly outline.

### 9.1 Engineering validation

- Cycle safety validation (interlock violation tests)
- Fault injection tests (sensor failure, door open mid-cycle, power loss)
- Duty cycle reliability tests (cycles/day, endurance)

### 9.2 Performance verification (example framework)

- Define target indicators (air / surfaces) based on configuration
- Measure repeatability across representative cabin conditions
- Document test conditions and acceptance criteria

> Important: Performance results are highly dependent on cabin geometry, airflow, target zones, and operating settings. DABOTechnology supports a structured test plan and reporting methodology.

### 9.3 Deliverables (typical)

- Test protocol + acceptance criteria
- Test report summary (non-confidential)
- Detailed data package under NDA (if required)

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# 10) Commercial Models & Partnership Options

## Option 1 — OEM module supply

- Module + harness + integration support package
- Pricing scales by volume and configuration

## Option 2 — Licensing + co-development

- Joint roadmap, cabin-specific optimization, shared IP boundaries defined

## Option 3 — Retrofit kits (selected platforms)

- Cabin-model specific kit developed with OEM/integrator
- Defined installation SOP and service training

## Support packages

- Integration engineering support
- Validation/test support
- Documentation bundle for tenders and operator handover

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# 11) Deployment Roadmap

A typical fast path to a pilot program:

**Phase 0 — Technical alignment (1–2 weeks)**

- Exchange drawings, define integration topology, confirm interlock signals
- Define cycle logic and reporting requirements

**Phase 1 — Prototype integration (2–4 weeks)**

- Install module on a reference cabin
- Validate interlocks and safety states
- Initial cycle tuning

**Phase 2 — Pilot validation (2–6 weeks)**

- Endurance and fault tests
- Performance verification with defined metrics
- OEM manufacturing review (DFM/DFA considerations)

**Phase 3 — Pre-series & rollout**

- Final BOM and assembly procedures
- Service training + deployment playbook

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# 12) Appendices

## Appendix A — OEM Integration Checklist (copy/paste)

**OEM to provide**

- Cabin CAD / drawings + service compartment dimensions
- Sensor list (occupancy, door, service, emergency stop)
- Available power rails + electrical constraints
- Target markets (EU/US/Asia) and compliance expectations
- Operator requirements (reporting, maintenance, uptime KPIs)

**DABOTechnology to provide**

- Integration concept + mounting proposal
- Signal map and recommended state outputs

- Cycle logic proposal + fault codes list
- Documentation bundle (non-confidential)
- NDA package for detailed design files (if requested)

### Appendix B — Example Signal Map (template)

- IN: Vacancy
- IN: Door Closed
- IN: Service Closed
- IN: E-Stop
- IN: Reset
- OUT: Ready
- OUT: Sanitizing
- OUT: Fault
- OUT: Service

### Appendix C — Example Cycle Log (template)

- Cycle ID: [000123]
- Start: [timestamp]
- End: [timestamp]
- Mode: Between-Users
- Result: Completed
- Interlocks OK: Yes
- Fault Code: None
- Notes: [optional]

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## Closing (short, for last page)

**Next step:** request the OEM Integration Brief PDF package and schedule a technical alignment call.
**Contact:** info@dabo.it | +39 347 2664913
**Reference deployment:** available under NDA.

# DABOTECHNOLOGY

Automated Sanitization for Public Restrooms

Stefano Bottesin inventor - technology