

CONFIDENTIAL ENGINEERING PROPOSAL

Industrial Automation Concept

AI-Assisted Industrial Architecture Proposal for **Water Treatment** operations, delivering secure, scalable, and resilient automation infrastructure.

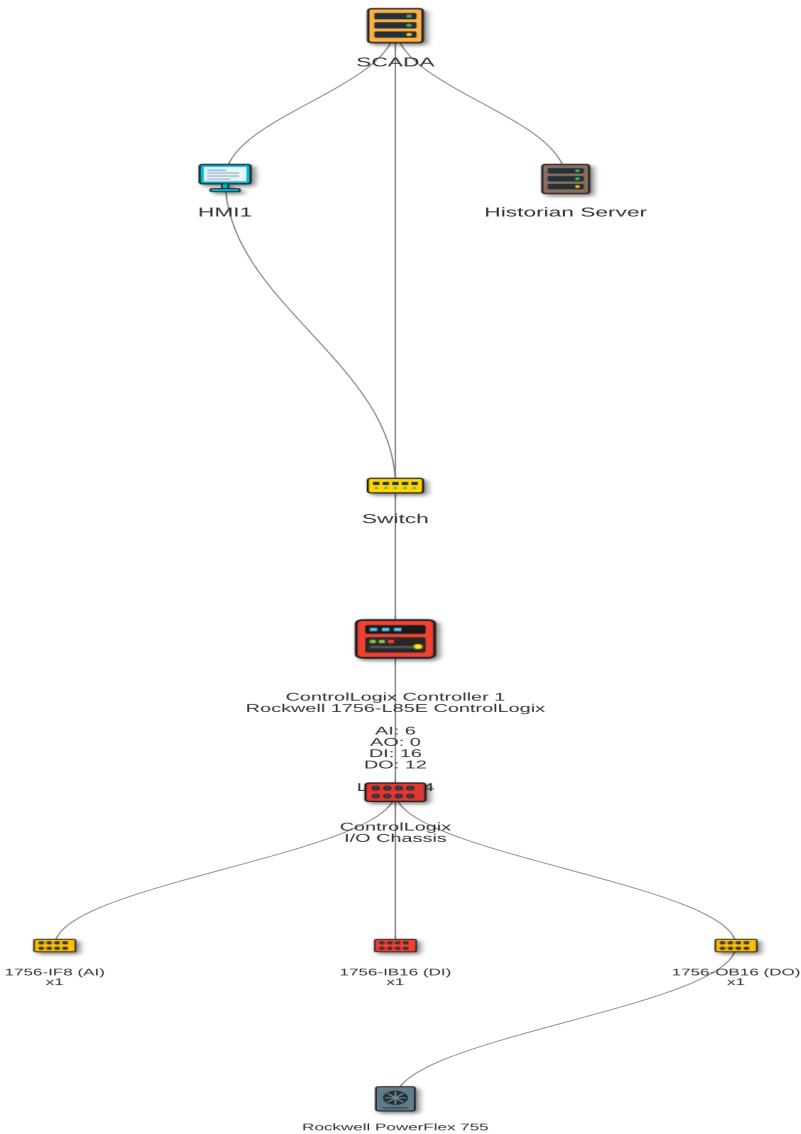
VENDOR Rockwell Automation	PLATFORM PLC	SECURITY Basic	REDUNDANCY None
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 **AI-generated draft.** This document was produced by an LLM from user-supplied inputs. It is a fast starting point, not a certified engineering deliverable — a qualified automation engineer must review and validate the design before it is used for procurement, construction, or commissioning.

Industrial Network Architecture

The diagram below represents the generated industrial automation and network topology, including field devices, control layer, operations zone, and enterprise connectivity.

Architecture is segmented across three ISA/IEC 62443 security zones: **Field Layer**, **Control Layer**, and **Operations Layer**.



- ▶ Ethernet/IP (Control Layer)

▶ PROFINET (Field Devices)

▶ Modbus TCP (Legacy Integration)

▶ OPC UA (Enterprise Connectivity)
- ▶ Enterprise / IT Network

▶ DMZ / Secure Gateway

▶ Operations Network (Level 3)

▶ Control Network (Level 2)

▶ Field Bus (Level 1/0)



Engineering Summary

This section provides a high-level overview of the proposed automation system, including platform selection rationale, design objectives, and expected performance outcomes.

PROJECT PARAMETERS

VENDOR	Rockwell Automation
PLATFORM	PLC
INDUSTRY	Water Treatment
SECURITY LEVEL	Basic
REDUNDANCY	None
REPORT DATE	14 September 2026

DESIGN OBJECTIVES

- ▶ High-availability control with None redundancy
- ▶ Cyber-secure architecture per Basic standard
- ▶ Scalable remote I/O for process expansion
- ▶ Standardised vendor ecosystem (Rockwell Automation)
- ▶ Reduced engineering time via AI-assisted design
- ▶ IEC 62443-compliant network segmentation

AUTOMATION SUMMARY

Design Basis & Engineering Rationale

The assumptions this design was built from, and the reasoning behind the key hardware and architecture choices, stated explicitly so they can be reviewed and confirmed during detailed engineering rather than taken as given.

DESIGN ASSUMPTIONS

SYSTEM SIZE	Medium
NUMBER OF PUMPS	3
NUMBER OF VALVES	2
TOTAL FIELD DEVICES (I/O POINTS)	34
AVAILABILITY TARGET	~99.0% (no redundancy — single points of failure in controller/network)
ENVIRONMENTAL REQUIREMENTS	Industrial indoor/outdoor, IP65 recommended near wet process areas, corrosion-resistant enclosures
PROCESS CONTROL FUNCTIONS	water treatment process control, pump control, chemical dosing control, clarifier and filtration control, SCADA integration, redundant historian, high-availability operator stations

Pump/valve counts are from Step 1's project definition — confirm actual quantities during detailed engineering. Environmental requirements are a standard assumption for this industry, not a site survey result.

WHY ROCKWELL 1756-L85E CONTROLLOGIX

Selected for the **Rockwell Automation PLC** platform based on: an estimated **34-point** I/O count for this design (6 AI, 0 AO, 16 DI, 12 DO); the **None** configuration selected; and Rockwell Automation's standard controller family for this platform at medium scale.

Lifecycle Note: Rockwell Automation product lifecycles are revised periodically (new generations, end-of-sale, end-of-support dates). This report does not independently verify the current lifecycle or obsolescence status of the **Rockwell 1756-L85E ControlLogix** or other named components — confirm directly with Rockwell Automation before placing an order.

WHY NO REDUNDANCY

No redundancy was selected. This is a reasonable choice for a medium-scale, non-critical, or pilot system where planned maintenance windows can absorb downtime. It leaves single points of failure at both the controller and network layer — reconsider for continuous processes or Water Treatment operations where unplanned downtime carries significant safety or production cost.

SIZING CALCULATIONS

Spare I/O Capacity: 34 of 40 installed channels used (85% utilization, **15% spare**). Based on 3 I/O module(s) (8 channels/module for AI & AO, 16 channels/module for DI & DO), rounded up to whole modules — spare capacity is a direct result of that rounding, not an arbitrary margin.

Network Bandwidth: 34 I/O points at an assumed 100 ms cyclic update rate and ~6 bytes/point protocol overhead ≈ 1.99 KB/s of cyclic traffic — **0.02%** of a 100 Mbps industrial Ethernet link. Cyclic I/O traffic at this scale is not a bandwidth constraint; network sizing should instead be driven by redundancy topology and diagnostic/engineering traffic.

Cabinet / Rack Loading: 3 I/O module(s) against 8 assumed available slots across 1 rack(s) (8 slots/rack assumed — confirm against the selected rack model) ≈ **38% rack fill**.

System Architecture

The system architecture follows a hierarchical control model aligned with the ISA-95 / Purdue Reference Model, enabling clear separation of operational and information technology.

LEVEL 3 – OPERATIONS

- ▶ SCADA / HMI Server
- ▶ Historian & Data Logging
- ▶ MES Integration Interface
- ▶ Alarm Management System

LEVEL 2 – CONTROL

- ▶ Rockwell 1756–L85E ControlLogix (Primary)
- ▶ Engineering Workstation
- ▶ Industrial Managed Switch

LEVEL 1/O – FIELD

- ▶ Remote I/O Modules
- ▶ Variable Speed Drives
- ▶ Process Instrumentation
- ▶ Safety Instrumented System (SIS)
- ▶ Motor Control Centres (MCC)

PLATFORM HIGHLIGHTS

- ▶ Vendor: **Rockwell Automation**
- ▶ Platform: **PLC**
- ▶ Redundancy: **None**

Redundancy Note: The selected **None** redundancy configuration ensures continuous operation in the event of primary controller failure, meeting the uptime requirements for **Water Treatment** operations.

Estimated Hardware

Indicative bill of materials based on the selected **Rockwell Automation PLC** platform, **1** controller(s), and **Basic** security level. Final quantities should be confirmed during detailed engineering.

CONTROLLERS	1 × Rockwell 1756–L85E ControlLogix
I/O RACKS / CHASSIS	1 × ControlLogix I/O Chassis
I/O CARDS	1 × 1756–IF8 (AI) 1 × 1756–IB16 (DI) 1 × 1756–OB16 (DO)
POWER SUPPLIES	1
UPS UNITS	1 (1 per cabinet)
CABINETS	1
NETWORK / FIBER SWITCHES	1
OPERATOR STATIONS	1
ENGINEERING STATION	1
INDUSTRIAL FIREWALLS	0
VARIABLE FREQUENCY DRIVES	3 × Rockwell PowerFlex 755

INDICATIVE CAPEX ESTIMATE

Order-of-magnitude budgetary estimate (AACE Class 5, ±30–50%) based on the bill of materials above and ballpark unit costs for mid-range industrial hardware — **not a vendor quotation**. Request formal quotes for firm pricing.

CONTROLLERS	1 × €3,500 = €3,500
I/O RACKS / CHASSIS	1 × €1,200 = €1,200
I/O CARDS	3 × €450 = €1,350
POWER SUPPLIES	1 × €350 = €350
UPS UNITS	1 × €2,500 = €2,500
CABINETS	1 × €4,000 = €4,000
NETWORK / FIBER SWITCHES	1 × €1,800 = €1,800
OPERATOR STATIONS	1 × €6,000 = €6,000

ENGINEERING STATION	1 × €7,000 = €7,000
VARIABLE FREQUENCY DRIVES	3 × €2,500 = €7,500
HARDWARE SUBTOTAL	€35,200
ENGINEERING & COMMISSIONING	91 hrs × €95/hr = €8,645
CONTINGENCY (10%)	€4,385

Engineering hours estimated from 34 I/O points (1.5 hr/point) + 1 controller(s) (40 hr each for this platform type), adjusted 1.00× for the selected redundancy and cybersecurity level — a scope-driven estimate, not a fixed percentage of hardware cost.

INDICATIVE TOTAL CAPEX

€48,230



PLC I/O Design

The following table summarises process instrumentation and remote I/O allocation across the control architecture. Signal counts include design spare capacity per IEC 62381 guidelines.

I/O allocation is based on the selected **Rockwell Automation PLC** platform with **None** redundancy enabled. Spare I/O capacity of $\geq 20\%$ has been applied.

AI: 6

DI: 16

DO: 12

Total: 34

⚠ 12 flagged for review

↔ Scroll sideways to see all columns (Signal Range, Unit, Safety Class, Cabinet, Module/Channel)

Tag	Type	Address	Description	Signal Range	Unit	Safety Class	Node / Cabinet	Module / Channel
⚠ PUMP_1_START	DO	1756-OB8/0	Pump 1 Start Command	24VDC	-	Non-SIL / BPCS	Cabinet 1	1756-OW8 Ch.0
⚠ PUMP_1_STOP	DO	1756-OB8/1	Pump 1 Stop Command	24VDC	-	Non-SIL / BPCS	Cabinet 1	1756-OW8 Ch.1
⚠ PUMP_1_RUNNING	DI	1756-IQ16/0	Pump 1 Running Status	24VDC	-	Non-SIL / BPCS	Cabinet 1	1756-IQ16 Ch.0
⚠ PUMP_1_FAULT	DI	1756-IQ16/1	Pump 1 Fault Status	24VDC	-	Non-SIL / BPCS	Cabinet 1	1756-IQ16 Ch.1
PUMP_1_SPEED	AI	1756-IA16/0	Pump 1 Speed Feedback	4-20mA	RPM	Non-SIL / BPCS	Cabinet 1	1756-IF8 Ch.0
PUMP_1_PRESSURE	AI	1756-IA16/1	Pump 1 Discharge Pressure	4-20mA	bar	Non-SIL / BPCS	Cabinet 1	1756-IF8 Ch.1
⚠ PUMP_2_START	DO	1756-OB8/2	Pump 2 Start Command	24VDC	-	Non-SIL / BPCS	Cabinet 1	1756-OW8 Ch.2
⚠ PUMP_2_STOP	DO	1756-OB8/3	Pump 2 Stop Command	24VDC	-	Non-SIL / BPCS	Cabinet 1	1756-OW8 Ch.3
⚠ PUMP_2_RUNNING	DI	1756-IQ16/2	Pump 2 Running Status	24VDC	-	Non-SIL / BPCS	Cabinet 1	1756-IQ16 Ch.2
⚠ PUMP_2_FAULT	DI	1756-IQ16/3	Pump 2 Fault Status	24VDC	-	Non-SIL / BPCS	Cabinet 1	1756-IQ16 Ch.3
PUMP_2_SPEED	AI	1756-IA16/2	Pump 2 Speed Feedback	4-20mA	RPM	Non-SIL / BPCS	Cabinet 1	1756-IF8 Ch.2
PUMP_2_PRESSURE	AI	1756-IA16/3	Pump 2 Discharge Pressure	4-20mA	bar	Non-SIL / BPCS	Cabinet 1	1756-IF8 Ch.3
⚠ PUMP_3_START	DO	1756-OB8/4	Pump 3 Start Command	24VDC	-	Non-SIL / BPCS	Cabinet 1	1756-OW8 Ch.4
⚠ PUMP_3_STOP	DO	1756-OB8/5	Pump 3 Stop Command	24VDC	-	Non-SIL / BPCS	Cabinet 1	1756-OW8 Ch.5
⚠ PUMP_3_RUNNING	DI	1756-IQ16/4	Pump 3 Running Status	24VDC	-	Non-SIL / BPCS	Cabinet 1	1756-IQ16 Ch.4
⚠ PUMP_3_FAULT	DI	1756-IQ16/5	Pump 3 Fault Status	24VDC	-	Non-SIL / BPCS	Cabinet 1	1756-IQ16 Ch.5

PUMP_3_SPEED	AI	1756-IA16/4	Pump 3 Speed Feedback	4-20mA	RPM	Non-SIL / BPCS	Cabinet 1	1756-IF8 Ch.4
PUMP_3_PRESSURE	AI	1756-IA16/5	Pump 3 Discharge Pressure	4-20mA	bar	Non-SIL / BPCS	Cabinet 1	1756-IF8 Ch.5
VALVE_1_OPEN_CMD	DO	1756-OB16:0/0	Valve 1 Open Command	24VDC	-	Non-SIL / BPCS	Cabinet 1	1756-OB16 Ch.0
VALVE_1_CLOSE_CMD	DO	1756-OB16:0/1	Valve 1 Close Command	24VDC	-	Non-SIL / BPCS	Cabinet 1	1756-OB16 Ch.1
VALVE_1_OPEN_FB	DI	1756-IB16:0/0	Valve 1 Open Position Feedback	24VDC	-	Non-SIL / BPCS	Cabinet 1	1756-IB16 Ch.0
VALVE_1_CLOSED_FB	DI	1756-IB16:0/1	Valve 1 Closed Position Feedback	24VDC	-	Non-SIL / BPCS	Cabinet 1	1756-IB16 Ch.1
VALVE_1_FAULT	DI	1756-IB16:0/2	Valve 1 Fault Status	24VDC	-	Non-SIL / BPCS	Cabinet 1	1756-IB16 Ch.2
VALVE_1_LOCAL_MODE	DI	1756-IB16:0/3	Valve 1 Local Mode Indication	24VDC	-	Non-SIL / BPCS	Cabinet 1	1756-IB16 Ch.3
VALVE_1_REMOTE_MODE	DI	1756-IB16:0/4	Valve 1 Remote Mode Indication	24VDC	-	Non-SIL / BPCS	Cabinet 1	1756-IB16 Ch.4
VALVE_1_CMD_OVERRIDE	DO	1756-OB16:0/2	Valve 1 Command Override Enable	24VDC	-	Non-SIL / BPCS	Cabinet 1	1756-OB16 Ch.2
VALVE_2_OPEN_CMD	DO	1756-OB16:0/4	Valve 2 Open Command	24VDC	-	Non-SIL / BPCS	Cabinet 1	1756-OB16 Ch.4
VALVE_2_CLOSE_CMD	DO	1756-OB16:0/5	Valve 2 Close Command	24VDC	-	Non-SIL / BPCS	Cabinet 1	1756-OB16 Ch.5
VALVE_2_OPEN_FB	DI	1756-IB16:0/5	Valve 2 Open Position Feedback	24VDC	-	Non-SIL / BPCS	Cabinet 1	1756-IB16 Ch.5
VALVE_2_CLOSED_FB	DI	1756-IB16:0/6	Valve 2 Closed Position Feedback	24VDC	-	Non-SIL / BPCS	Cabinet 1	1756-IB16 Ch.6
VALVE_2_FAULT	DI	1756-IB16:0/7	Valve 2 Fault Status	24VDC	-	Non-SIL / BPCS	Cabinet 1	1756-IB16 Ch.7
VALVE_2_LOCAL_MODE	DI	1756-IB16:1/0	Valve 2 Local Mode Indication	24VDC	-	Non-SIL / BPCS	Cabinet 1	1756-IB16 Ch.8
VALVE_2_REMOTE_MODE	DI	1756-IB16:1/1	Valve 2 Remote Mode Indication	24VDC	-	Non-SIL / BPCS	Cabinet 1	1756-IB16 Ch.9
VALVE_2_CMD_OVERRIDE	DO	1756-OB16:0/6	Valve 2 Command Override Enable	24VDC	-	Non-SIL / BPCS	Cabinet 1	1756-OB16 Ch.6

Cybersecurity Architecture

This section audits what the generated design at **Basic** security level actually contains against an OT/ICS baseline checklist — not a claim that every control below is already in place.



CYBERSECURITY READINESS SCORE

Needs Improvement

1 of 11 baseline controls confirmed for this design — see the breakdown below.

✓ FOUND (1)

- ▶ **Historian / Secure Data Replication**
Historian present in the generated topology

✗ MISSING (10)

- ▶ **Industrial Firewall**
No firewall node in this topology — add one at the OT/IT boundary
- ▶ **DMZ / Zone Segmentation**
No DMZ in this design — SCADA/historian traffic is not isolated from IT
- ▶ **ISA-95 Network Segmentation**
Security level is Basic — network is effectively flat
- ▶ **Multi-Factor Authentication (MFA)**
Not assumed at this security level — enforce MFA for remote/engineering access
- ▶ **Control / Network Redundancy**
No redundancy configured — single points of failure in controllers/network
- ▶ **Central Log Server / SIEM**
Not in this design — add "log server" or "SIEM" to the network description, or plan separately
- ▶ **Intrusion Detection / Prevention (IDS/IPS)**
Not in this design — add "IDS" to the network description, or add OT-aware IDS at the DMZ/control boundary separately
- ▶ **Backup & Disaster Recovery**
Not in this design — add "backup" to the network description, or define backup targets, RPO/RTO and offsite copies separately
- ▶ **Endpoint Protection (EDR / Anti-malware)**
Not confirmed — check "Endpoint protection deployed" in Step 1 once in place, or apply to engineering stations and servers
- ▶ **Patch Management Process**
Not confirmed — check "Documented patch management process" in Step 1 once defined

ENTERPRISE ZONE	IT network — NOT separated from OT; no DMZ present in this design
DMZ	Not present in this design
OPERATIONS ZONE	SCADA, HMI, and engineering workstations; no firewall detected in this topology
CONTROL ZONE	PLC and control hardware; air-gapped from enterprise network
FIELD ZONE	Sensors, actuators, and drives; access limited to control zone devices



FAT/SAT Commissioning Checklist

Standard Factory Acceptance Test (FAT) and Site Acceptance Test (SAT) checklist items for this design, generated from the actual architecture selected above — items only appear where the corresponding system is part of this design. This is a starting checklist to be tailored during detailed engineering, not a substitute for a site-specific test plan.

FACTORY ACCEPTANCE TEST (FAT)

Performed at the integrator's/panel builder's works before shipment.

Test Item	Sign-off / Date
POINT-TO-POINT I/O CHECKOUT (34 POINTS, PER ATTACHED I/O LIST)	
CONTROLLER CPU DIAGNOSTICS AND SELF-TEST (1 CONTROLLER)	
POWER SUPPLY AND UPS LOAD TEST	
OPERATOR INTERFACE VERIFICATION (SCREENS, TAGS, ALARMS)	
ALARM AND INTERLOCK FUNCTIONAL TEST	
FIREWALL AND DMZ RULE VERIFICATION	
SCADA SERVER TAG DATABASE AND SCREEN VERIFICATION	
ADDITIONAL HMI CLIENT VERIFICATION	
HISTORIAN DATA LOGGING VERIFICATION	
DOCUMENTATION REVIEW (AS-BUILT DRAWINGS, I/O LIST, CAUSE & EFFECT MATRIX)	

SITE ACCEPTANCE TEST (SAT)

Performed on-site after installation, repeating relevant FAT tests under real field conditions.

Test Item	Sign-off / Date
AS-INSTALLED I/O VERIFICATION AGAINST FAT RESULTS	
FIELD INSTRUMENT LOOP CALIBRATION AND FUNCTIONAL CHECK	
NETWORK COMMISSIONING (CABLING, SWITCHES)	

CYBERSECURITY COMMISSIONING (FIREWALL RULES LIVE, ACCESS CONTROL)	
OPERATOR TRAINING AND HANDOVER	
FINAL PUNCH-LIST CLOSEOUT AND CUSTOMER ACCEPTANCE SIGN-OFF	



Reliability, Power & Spare Parts

Estimates derived from the same bill of materials and redundancy configuration used throughout this report — ballpark industry figures for MTBF and component power draw, not vendor-guaranteed values. Confirm against actual datasheets during detailed engineering.

POWER CONSUMPTION & CABINET HEAT DISSIPATION

ESTIMATED CONNECTED LOAD	389 W (0.39 kW)
ESTIMATED HEAT DISSIPATION	1,327 BTU/hr
FORCED COOLING / CABINET A/C	Natural convection likely sufficient at this load

Connected-load estimate (no usage diversity factor applied) for controllers, I/O cards, network switches, firewall, operator/engineering stations, and UPS standby overhead. Variable Frequency Drives are excluded — their heat output is dominated by the driven motor's size, which isn't modeled here; size VFD cooling from the motor nameplate and drive datasheet.

Note: this is the control cabinet's own electronics draw, not the wider industrial process — for a plant-wide energy savings estimate, use the separate Energy Savings Calculator with your facility's actual annual consumption.

AVAILABILITY ESTIMATE (MTBF/MTTR)

Subsystem	MTBF (hours)	Redundant	Availability
CONTROLLER	200,000	No	99.998%
POWER SUPPLY	150,000	No	99.997%
NETWORK	300,000	No	99.999%

ESTIMATED SYSTEM AVAILABILITY

99.994%

≈ 0.5 hours/year of unplanned downtime at this availability, assuming a 4-hour mean time to repair (spares on hand — see below — and trained personnel available). Subsystems combine in series; redundant subsystems use the standard parallel-redundancy formula ($A' = 1-(1-A)^2$), reflecting the redundancy configuration selected in Step 1 (None).

SPARE PARTS RECOMMENDATIONS

Component	Installed Qty	Recommended Spares
CONTROLLER / CPU	1	0 — consider 1 for high-uptime applications
1756-IF8 (AI)	—	1
1756-IB16 (DI)	—	1
1756-OB16 (DO)	—	1

POWER SUPPLIES	1	1
NETWORK / FIBER SWITCHES	1	1

Rule-of-thumb spares (I/O cards 10%, power supplies 20%, switches 15%, minimum 1 each where applicable) — adjust based on lead times and site criticality during detailed engineering.



Preventive Maintenance Plan

Recommended recurring maintenance tasks for this design — standard tasks always apply; the rest only appear where the corresponding system is part of this design. Intervals are starting recommendations to be tailored to actual site conditions and manufacturer guidance.

Task	Recommended Interval
CABINET DUST/FILTER CLEANING AND ENCLOSURE INSPECTION	Quarterly
VISUAL INSPECTION OF TERMINATIONS, WIRING, AND CABLE GLANDS	Annually
UPS BATTERY HEALTH CHECK	Annually
NETWORK SWITCH FIRMWARE AND HEALTH CHECK	Annually
SPARE PARTS INVENTORY AUDIT AGAINST RECOMMENDATIONS ABOVE	Annually
HISTORIAN ARCHIVE AND DISK SPACE CHECK	Quarterly
FIRMWARE AND SECURITY PATCH REVIEW	Annually

Future Expansion & Roadmap

The architecture has been designed with scalability and future technology integration in mind, supporting a phased roadmap from foundational automation toward Industry 4.0 connectivity.

PHASE 1 – FOUNDATION (NOW)

- ▶ Core PLC & remote I/O deployment
- ▶ SCADA / HMI commissioning
- ▶ Industrial network infrastructure
- ▶ Cybersecurity baseline controls

PHASE 2 – CONNECTIVITY (6–18 MO.)

- ▶ OPC UA server integration
- ▶ MES / ERP data bridge
- ▶ Remote monitoring & diagnostics
- ▶ Historian analytics dashboard

PHASE 3 – INTELLIGENCE (18–36 MO.)

- ▶ Edge computing nodes
- ▶ Predictive maintenance AI models
- ▶ Digital twin integration
- ▶ Cloud-based data lake (OT data)

PHASE 4 – AUTONOMY (36+ MO.)

- ▶ Closed-loop AI process optimisation
- ▶ Autonomous fault recovery
- ▶ Advanced cybersecurity (SIEM/SOC)
- ▶ Full Industry 4.0 / IIoT integration

ENERGY & SUSTAINABILITY ANALYSIS

This proposal was generated by the **Aicon–Platform AI Engineering Platform**. All configurations should be validated by a qualified control systems engineer prior to implementation. Reference: **EW–MUOW4CK1** · 14 September 2026