



Market Requirements Specification (MRS)

Project name: Project Goldstein

Project number: 955

Product/working title: [Falco](#)Falco 2 0-10000 ppm MRS

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1. Associated documents

Document	Reference	Notes
Business case	IO-004210-BC	Detailed financial model sits outside this MRS.
Product Requirements Specification (PRS)	IO-006413-TC	Technical requirements source and downstream traceability document.
Competitor comparison	IO-005761-CO	Detailed matrix referenced, not duplicated here.
MiniPID 2 PPM WR datasheet	MiniPID 2 PPM WR	Sensor performance and lamp-life reference.

2. Executive summary

Falco 2 0-10000 ppm is a variant extension of the existing Falco 2 fixed VOC platform rather than a ground-up product, reusing the current hardware, approvals and user interface layout while extending the detection range to 0-10,000 ppm using a dedicated MiniPID 2 10.6 eV sensor and associated gain and scaling changes

The product addresses a market gap between standard PID products that over-range above roughly 6,000 ppm and IR or pellistor LEL devices that are weak at early ppm-level leak detection, particularly in carbon bed breakthrough monitoring, petrochemical leak detection and process-area monitoring [[IO-004205-PP](#)].

As a variant project, this MRS focuses on market gap, positioning, target users, use cases, commercial logic and high-level market requirements, while detailed engineering behaviour, validation and implementation belong in the PRS.

3. Project type

Field	Response
Project type	Variant
Existing platform reused?	Yes
What is reused?	Existing Falco 2 hardware, approvals, enclosure, UI layout and core architecture.
What is genuinely new?	New 0-10,000 ppm variant configuration, dedicated high-range sensor Stock Keeping Unit (SKU), gain/scaling changes and locale-specific decimal separator feature.
Why this matters	Enables ION to break into the wider market and to support new applications, such as carbon bed monitoring and low LEL detection, that other systems miss.
Is there IP captured?	IP on the wide range PID for fixed instruments

4. Purpose

This MRS defines the market need, target users, use cases, commercial logic and high-level market requirements for the Falco 2 0-10,000 ppm variant [[IO-004205-PP](#)]. It is the product-management-owned source document for marketing requirements and should be used to create a traceable PRS in which

engineering and product management jointly refine, own and sign off on the final product requirements before development begins.

5. Market opportunity

5.1. Problem statement

Prompt	Response
What problem exists in the market?	Industrial sites need continuous VOC detection in a range where standard PID detectors can over-range above a few thousand ppm, while conventional LEL sensors are optimised for 0–100% LEL with alarms typically set around 10–20% LEL and are not designed for ppm-level quantitative trend monitoring. For low-LEL gases such as toluene (LEL typically about 1.1–1.2% by volume, or roughly 11,000–12,000 ppm), a 20–40% LEL early-warning alarm corresponds to roughly 2,200–4,800 ppm, whereas a 0–10,000 ppm PID can still provide meaningful, quantitative readings in that band ^[1, 2, 3, 4, 5] .
Who experiences it most acutely?	HSE teams, process and operations engineers, and instrumentation technicians in refineries, petrochemical plants, chemical plants and carbon-bed applications [IO-006327-MM] .
What are customers doing today instead?	Using IR or pellistor LEL detectors for flammable risk and standard PIDs for VOC detection, often leaving a practical gap in early warning and breakthrough monitoring [IO-006308-PP] .
Why are current alternatives inadequate?	Standard PID detectors are typically specified for ranges up to a few thousand ppm (e.g. 0–1,000 or 0–4,000 ppm) and may over-range or become less reliable at higher concentrations ^[6] .
What happens if the problem is not solved?	Customers continue to miss early leaks, struggle with breakthrough events and rely on tools that are weak in the critical early-warning range [IO-006327-MM] .

6. Societal & environmental value

Falco 2 0-10,000 ppm supports earlier detection of VOC leaks before they escalate into larger emission events, which is especially relevant in carbon bed breakthrough monitoring and process-area leak detection [\[IO-004205-PP\]](#). For our customers, this strengthens compliance support, reduces uncontrolled VOC releases and provides a clearer environmental and safety justification for adoption [\[IO-006327-MM\]](#) [\[IO-006328-MM\]](#), [\[IO-006326-MM\]](#).

7. Why now

Driver type	Evidence/explanation
Regulatory and compliance pressure	Compliance and auditable early warning remain important customer drivers in fixed gas detection [IO-006327-MM] .
Competitor movement	Existing competitive options either lack the required range or are optimised for a different use profile [IO-006327-MM] .
Installed base trend	A large installed base of LEL units exists, including distributor feedback citing 50,000-100,000 units in France alone [IO-006327-MM] .
Portfolio gap	Falco currently lacks a 0-10,000 ppm fixed PID offer, leaving a gap between existing VOC ranges and LEL alternatives [IO-006327-MM] .
Technology readiness	The variant reuses the Falco 2 platform and certifications, reducing technical risk. However, a new PID variant is required to meet the requirements [IO-006307-PP] .
Customer pull	Distributor and internal feedback requesting a device that detects low-level leaks and provides an earlier warning than IR/Pallister [IO-006308-PP] [IO-006327-MM] .

8. Market size and attractiveness

Measure	Value/interpretation
Total Addressable Market (TAM)	The global LEL gas detector market is estimated at about 1.5bn in 2022 and projected to reach around 2.5bn by 2030, serving as a high-level market proxy [IO-004205-PP] .
Serviceable Addressable Market (SAM)	Priority heavy-industry fixed gas detection applications using VOC/LEL infrastructure [IO-004205-PP] .
Serviceable Obtainable Market (SOM)	Near-term addressable opportunity of about 70 units in the year 1 base case [IO-004210-BC] .
Expected growth	Portfolio and market assumptions indicate a 7.5% market CAGR, with Falco portfolio growth assumptions of 8-9% [IO-004205-PP] .
Priority verticals	Petrochemical, refinery, chemical manufacturing, pharma and carbon bed monitoring [IO-004205-PP] .
Priority geographies	France first, then wider EMEA, Americas and APAC [IO-004205-PP] [IO-006327-MM] .

9. Regional prioritisation

Rank	Country/region	Why prioritised	Route-to-market note	Confidence
1	France	Strong distributor advocacy and a large installed LEL base [IO-006327-MM] .	Distributor-led pilot market [IO-006327-MM] .	High
2	USA	Large petrochemical infrastructure and emissions regulation [IO-006327-MM] .	Existing US/India channel, but mixed growth performance [IO-006328-MM] , [IO-006326-MM] .	Medium
3	Germany	Strong industrial base and channel relevance (ISM).	Key EMEA market [IO-006327-MM] , [IO-006326-MM] .	Medium
4	UK	Home market, industrial base and channel support.	Familiar route to market.	Medium
5	UAE/Saudi Arabia	Large downstream assets and harsh environments are needed [IO-004205-PP] .	Good fit for robust fixed monitoring.	Medium

10. Strategic & Supply Chain Justification

Factor	MiniPID 2 6-pin	ION Science Sensor
Supply	Available to 2030	New technology, unproven supply chain
Certification	ATEX/IECEX certified—no Falco re-certification	Requires full Falco re-certification (12-18 months)
Pinout	6-pin (matches Falco 2 hardware)	3-pin requires PCB redesign
Timeline	Revenue Q3 2026	Delays Falco 3 by 12+ months
Roadmap Fit	Funds Falco 3 (2-3 year ground-up redesign)	Blocks revenue needed for Falco 3

Decision: Use proven MiniPID 2 6-pin for immediate revenue (< 12-month payback) to fund Falco 3 development, the comprehensive next-gen platform. ION Science sensor transition targets Falco 3 (post-2028) to avoid certification/PCB redesign delays.

11. Strategic fit

Question	Response
How does this fit segment strategy?	It broadens Falco's relevance in fixed VOC and early-warning industrial monitoring [IO-004205-PP].
How does this fit the product portfolio?	It fills a gap between the current Falco VOC ranges and the customer need for higher fixed PID coverage [IO-004205-PP , IO-006327-MM , IO-006328-MM , IO-006326-MM].
What does it strengthen, defend or unlock?	It defends fixed gas market share, opens applications for carbon-bed and early-warning processes, and reduces hand-offs to competitors for adjacent use cases [IO-004205-PP , IO-006327-MM].
What makes ION credible?	ION already owns the PID technology base, Falco platform, approvals and installed market reputation.
What is the opportunity cost of not doing this?	Missed share in early-warning VOC applications and continued reliance on competitors for adjacent use cases [IO-004205-PP].

12. Target customers

12.1. Buyer and user summary

Persona	Role	Industry segment	Core goal	Main pain point	Why they care
Safety/HSE Manager	Buyer/influencer	Refining, petrochemical, chemical	Reduce risk and maintain compliance	Existing systems miss or understate early leaks	Safety, compliance and auditable records [IO-006457-CO , IO-006346-CO and IO-006342-CO].
Process Operations Engineer	User/influencer	Process industries	Keep operations stable and detect issues early	Poor visibility around tanks, carbon beds and lines	Avoid incidents, upset conditions and emissions [IO-006457-CO , IO-006346-CO and IO-006342-CO].
Instrumentation/Maintenance Technician	User	Fixed gas systems	Install, configure and maintain without added complexity	Calibration burden, menu complexity and fault handling	Simpler maintenance and clearer set-up.

13. Customer journey summary

A lightweight customer journey view is provided because it helps align product management, engineering and marketing around where the pain occurs. A more detailed version can be found here [\[IO-006346-CO\]](#). Workshops can be developed at Gate 1 and reused in launch planning where needed.

Stage	Customer is doing	Pain/barrier	Opportunity for ION
Awareness	Looking for better low-level leak and VOC breakthrough solutions	Hard to compare PID vs LEL options	Publish clearer application and positioning guidance.
Evaluation	Comparing technologies and suppliers	Confusion over ppm vs LEL and fit-for-purpose use	Simplify positioning and use-case guidance.
Purchase	Selecting approved supplier and model	Budget sign-off and documentation burden	Reuse approvals and provide strong commercial pack.
Deployment	Installing and commissioning	Calibration confidence and configuration choices	Keep variant behaviour close to existing Falco workflows.
Ongoing use	Running, calibrating and servicing	Maintenance expectations in high-VOC environments	Provide clear calibration and servicing guidance.

14. Use cases and applications

Use case	Priority	Why included	Product implication
Carbon bed VOC breakthrough monitoring	Must	Strongest product-market fit and clear range need [IO-006308-PP] .	Stable, linear monitoring up to 10,000 ppm in a fixed installed form [IO-006307-PP] .
Early low-level leak detection	Must	Strong market pain versus incumbent LEL devices [IO-006327-MM] .	ppm-level early warning where LEL systems are weak.
LEL detection for <2% volume gases	Must	Addresses IR/catalytic dead bands for low-LEL% flammables (e.g., 20-40% alarms at 2-4k ppm)	ppm-level monitoring below LEL sensor dead band (~0.5%).
Tank and process area monitoring	Should	Broadens adoption in installed fixed gas environments [IO-004205-PP]	Continuous fixed VOC monitoring with appropriate outputs and installation options.

15. Value proposition

15.1. Positioning statement

For industrial safety and operations teams in VOC-sensitive fixed monitoring environments who need earlier warning and wider-range fixed VOC detection, Falco 2 0-10,000 ppm is a fixed VOC detector variant that provides continuous ppm-level visibility across applications where standard PIDs over-range and LEL devices underperform [[IO-004205-PP](#)]. Unlike conventional low-range PID products or standard IR and pellistor LEL systems, it combines a proven certified Falco platform with higher-range PID coverage and lower implementation risk [[IO-006307-PP](#), [IO-006308-PP](#)].

15.2. Value proposition summary

The master value proposition can be found here: [[IO-006342-CO](#)]. The details below highlight key elements from the business model canvas and value proposition.

Category	Summary
Customer jobs	Detect VOC leaks, monitor breakthrough, maintain site safety and compliance.
Customer pains	Missed early leaks, over-ranging PIDs, confusion between ppm and LEL and calibration burden in harsh environments.
Customer gains	Earlier warning, better fit to the application, integrated fixed monitoring and improved confidence.
Pain relievers	0-10,000 ppm range, retained Falco workflows and outputs.
Gain creators	Better coverage in a gap between standard VOC and LEL solutions with low-risk adoption on a known platform.
Reasons to believe	Existing Falco platform, ION PID heritage, strong use-case fit and attractive economics.

16. Competitive landscape

Competitor/alternative	Strengths	Weaknesses	Our angle
Standard fixed PID VOC detector	Good low-end sensitivity	Over-ranges above about 1,000-6,000 ppm, depending on model	Extend useful range materially ^[1, 2, 3, 4, 5] .
IR LEL detector	Common and established for 0-100% LEL protection	Weak at early ppm-level leak warning	Complement it in the early-warning window ^[1, 2, 3, 4, 5] .
Pellistor LEL detector	Lower cost and common deployment	Lower early sensitivity, wear and poisoning concerns	Offer stronger low-level VOC visibility ^[1, 2, 3, 4, 5] .

17. Competitive positioning summary

Dimension	Intended position	Comment
Performance	Strong in early-warning VOC and a wide fixed ppm range	Not a full 0-100% LEL replacement [IO-006307-PP , IO-006308-PP].
Ease of use	Close to current Falco workflows	Important for a variant launch [IO-006106-PP]
Maintenance burden	Similar baseline to Falco with caveats in high-VOC use	Guidance needed on service frequency.
Connectivity/data	Strong	Existing Falco outputs retained.
Compliance/approvals	Strong	Reuses approved platform.
Route to market	Best in EMEA-led rollout	France is the champion, and EMEA fit is strongest [IO-006327-MM], [IO-006328-MM], [IO-006326-MM].

18. Commercial guardrails

Area	Guidance
Pricing intent	Accessible entry variant within the Falco portfolio [IO-004205-PP , IO-004210-BC].
Indicative ASP	Diffused about 1,750; pumped about 2,500 ^[7] .
Margin target	Around 55-60% by model, with around 60% overall target ^[7] .
Revenue model	Hardware with accessories and service support.
Expected model mix	Approx. 70% diffused, 30% pumped ^[7] .
Sales channel assumptions	Distributor-led with the strongest early fit in EMEA [IO-006327-MM].
Launch phasing	France/EMEA first, then wider regions [IO-006327-MM , IO-006328-MM , IO-006326-MM].
Key commercial dependencies	Firmware delivery, sensor SKU readiness, pilot validation and distributor enablement.
Launch tier recommendation	Tier C line extension with global rollout discipline, recognising this is a variant rather than a ground-up product.

19. High-level market requirements

Note this list in order of priority:

ID	Requirement statement	Priority	Rationale/evidence	Related use case	PRS reference needed?
MR-001	The product must provide fixed continuous VOC monitoring across a 0-10,000 ppm range.	Must	Core market gap and product concept [IO-006327-MM] .	All	Yes
MR-002	The product must detect low-level leaks earlier than conventional LEL-only systems in target applications.	Must	Main positioning and customer pain point [IO-006327-MM] .	Early leak detection	Yes
MR-003	The product must remain usable during carbon bed breakthrough events without exceeding standard PID over-range limitations.	Must	Signature use case [IO-006308-PP] .	Carbon bed	Yes
MR-004	The variant must preserve simple adoption for existing Falco customers by reusing the current platform and workflows as far as practical.	Must	Variant logic and reduced adoption risk.	Deployment	Yes
MR-005	The product must integrate into site control and monitoring systems used in fixed gas detection environments.	Must	Fixed installation use case and value proposition.	Tank/process monitoring	Yes
MR-006	The product must offer clear positioning and documentation explaining ppm use and scope limits.	Must	Prevent market confusion and support adoption [IO-006308-PP]	Evaluation/deployment	Yes
MR-007	The product should support regional display conventions where this materially affects market acceptance.	Should	EU locale requirement highlighted by distributor feedback.	Deployment	Yes
MR-008	The product should preserve commercially attractive margin and low-risk payback for ION.	Must	Variant business case foundation [IO-004210-BC]	All	No
MR-009	The product should support customer outcomes that reduce VOC release risk and strengthen compliance positioning in target applications.	Should	Adds societal and environmental value without turning the MRS into an ESG document.	Carbon bed/early leak	Yes
MR-010	The product must support calibration using commonly supplied 10,000 ppm isobutylene span gases (including diamond-grade and cert-grade mixtures with typical analytical tolerances) without entering over-range, while maintaining a declared measurement range of 0–10,000 ppm.	Must	Customers typically purchase nominal 10,000 ppm certified calibration gas; manufacturing and certification tolerances mean true concentrations can be slightly above 10,000 ppm. The instrument needs sufficient internal algorithm headroom and linearisation (beyond 10,000 ppm) to accept these span gases reliably for field calibration.	Calibration gas compatibility	Yes

20. Scope boundaries

20.1. In scope

In-scope item	Why in scope
0-10,000 ppm Falco 2 variant configuration	Core product concept.
New high-range MiniPID 2 SKU and associated scaling/gain changes	Needed to deliver the range extension.
Route-to-market positioning for early-warning and breakthrough monitoring	Critical to market success.

20.2. Out of scope

Out-of-scope item	Why excluded
Mechanical redesign of the Falco enclosure or mounting	Variant reuses the existing platform.
New ATEX/IECEX/North America approvals programme	Existing approvals are to remain unchanged.
Methane/hydrogen LEL detection	Outside PID technology fit and current project scope.
Full packaging specification and box branding detail	No change to packaging specification and box contents. Details belong in the launch marketing collateral and controlled packaging drawing. Refer to the released transport packaging drawing: [IO-003438-PP] .
Optional LEL display and unit handling	PPM/mg/m ³ primary; %LEL secondary only (gas-dependent, e.g., IPA 10k ppm vs VCM 20k ppm at 50% LEL). Excluded due to PID's multi-gas response profile and variable gas cocktails, unlike single-gas LEL calibrants, accurate %LEL conversion is technically complex to implement and difficult to explain to customers without confusion or support burden
Detailed GTM campaign assets and execution plans	Belong in the marketing launch framework and launch plan [IO-005786-CD]

21. Risks and assumptions

21.1. Key risks

Risk	Im- pact	Likeli- hood	Mitigation	Owner
Customers misunderstand the product as a full LEL replacement	High	Medium	Strong positioning, training and collateral on early-warning role.	PM/Marketing
Sustained high-VOC use reduces lamp life and increases maintenance burden	High	Medium	Clear guidance and validation for servicing in representative profiles.	Engineering/PM
Non-linearity at high concentrations weakens trust	High	Medium	Multi-point calibration and validation across target gases.	Engineering
Firmware scope or supplier timing slips	High	Medium	Lock phase scope and manage dependencies tightly.	PM/Engineering
Customers request wider 20k-50k ppm coverage	Medium	Medium	Position this variant clearly and log future demand as input to the roadmap [IO-006326-MM].	PM
The variant uses MiniPID 2, while the planned next-generation platform will transition to ION Sense, creating short-term dependency on the current sensor and a future migration requirement	Medium	Medium	Launch this variant on MiniPID 2 to avoid delaying revenue; manage the ION Sense transition as a separate next-generation workstream with its own design and certification plan	Engineering/PM/Supply Chain

21.2. Key assumptions

Assumption	Why it matters	Validation method
Existing Falco approvals remain valid for this variant	Keeps the project low-risk and low-cost.	Engineering and compliance confirmation.
France/EMEA can provide credible pilot traction	Supports launch phasing [IO-006327-MM, IO-006328-MM] [IO-006326-MM].	Distributor-backed pilot activity.
Customers value early-warning ppm coverage enough to adopt a complementary device	Core positioning assumption [IO-006327-MM].	Pilot feedback and sales learning.

21.3. Market impact and success measures

Area	Measure	Target/placeholder	Notes
Customer outcome	Detect leaks incumbent LEL systems miss	Positive pilot evidence	From targeted deployments.
Commercial outcome	Year-1 unit sales	70 base cases	Business case summary [IO-004210-BC]
Strategic outcome	Gross margin	60% target	Variant economics [IO-004210-BC]
Product adoption outcome	Distributor pilot acceptance	Strong France-led uptake	Early launch proof point.
Quality feedback outcome	Pilot customer feedback	Majority positive	PRS and launch learning input.

22. Governance and traceability

The MRS should remain the product-management-owned source of marketing requirements, while the PRS should be the jointly owned downstream document where engineering and product management translate market requirements into validated product requirements. Each PRS requirement should include a reference back to one or more market requirements in this MRS so that commercial intent, technical implementation and sign-off remain traceable.

A simple sign-off model is recommended: Product Management is accountable for the MRS, R&D and Product Management are jointly accountable for the PRS, and Marketing is consulted on positioning and launch readiness rather than owning core product requirements.

23. Product Manager Recommendation

Proceed. This is a well-justified variant extension with a credible market problem, strong use-case fit, and relatively low technical and commercial risk, as it reuses the Falco 2 platform rather than creating a new product from scratch. The main requirement for success is disciplined positioning, so the product is sold as an early-warning and breakthrough-monitoring tool, not as a full replacement for conventional 0-100% LEL systems, with marketing execution handled through the launch framework rather than being overloaded into the MRS.

24. References

Document ID	Short title	URL	Notes
IO-004210-BC	Business case	LINK	Financial model sits outside this MRS
IO-006413-TC	Product requirements specification	LINK	Technical requirements source and downstream traceability document
IO-005761-CO	Competitor comparison	LINK	Detailed matrix referenced, not duplicated here
MiniPID 2 PPM WR datasheet	Sensor datasheet	LINK	Sensor performance and lamp-life reference
IO-004205-PP	Product positioning/related evidence	LINK	Referenced repeatedly as supporting evidence
IO-006327-MM	Market evidence/distributor feedback France	LINK	Used for market gap, regions and channel evidence
IO-006308-PP	Head of instruments project feedback	LINK	Referenced for carbon bed and customer pull
IO-006328-MM	Regional/channel evidence US	LINK	Used for regional prioritisation
IO-006326-MM	Regional/channel evidence India	LINK	Used for regional prioritisation and future demand
IO-006307-PP	Technical readiness/sensor transition note	LINK	Used for technology readiness and strategic supply chain justification
IO-006342-CO	Value proposition/master doc	LINK	Referenced as master value proposition
IO-006106-PP	Internal Kick-off notes/use-case evidence	LINK	Reference internal stakeholder project kick-off feedback
IO-006346-CO	Customer journey/workshop	LINK	Referenced for journey detail
IO-006457-CO	Persona/customer evidence	LINK	Referenced for buyer-user summary
IO-005786-CD	GTM campaign assets	LINK	Use for marketing governance
IO-003438-PP	Falco 2 ELOK Transport packaging	LINK	Falco packaging drawings

25. External web reference list

Ref no.	Source type	Short title	URL	Referenced	Notes
Web 1	Web PDF	Principles of Gas Detection: LEL, PID and NDIR Sensors and Applications	Link	Supports general LEL/PID/NDIR background, flammability range, PID operating principle, and PID vs LEL comparison.	Good candidate for the technical background/problem statement section.
Web 2	Web article	How to Monitor LEL in Industrial Settings	Link	Supports definitions of LEL, alarm set points, detector types, and safety monitoring practices.	Good for plain-language support, but check whether you want supplier marketing content in an MRS.
Web 3	Web article	Understanding Gas Measurement Units: %LEL, %VOL, and PPM in Flammable and Toxic Gas Detection	Link	Supports unit conversion and the distinction between %LEL, %VOL, and ppm.	Useful for explaining ppm versus LEL.
Web 4	Web datasheet	Toluene - CAMEO Chemicals - NOAA	Link	Supports toluene LEL, toxic exposure values, vapour density, flash point, and ionisation energy.	Strong factual source for toluene properties and sensor relevance.
Web 5	Web application note	Using PIDs for 10% of LEL Decisions	Link	Likely supports the argument that PIDs and LEL instruments have different decision thresholds and use cases.	I could not fetch this one in the current turn, so I would treat it as a placeholder until verified.
Web 6	Web product page	RAEGuard 2 PID Gas Detector	Link	Supports competitor/market comparison for fixed PID detectors.	I could not fetch this one in the current turn, so I would treat it as a placeholder until verified.