PDR-AMR-002 SENSOR INTEGRATION GUIDE

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1. INTRODUCTION AND SCOPE

1. This Sensor Integration Guide ("Guide") is a controlled document that establishes the mandatory technical and legal requirements for integrating third-party sensors with Polar Dynamics Robotics' ("PDR") IceNav(TM)-enabled Autonomous Mobile Robot platforms.

2. This Guide applies to all Series 3000 and 4000 cold-environment AMR units manufactured after March 1, 2023, operating in temperature ranges from +25 C to -40 C.

2. DEFINITIONS

1. "Approved Sensor" means any sensor device listed in Appendix A that has passed PDR's Cold Environment Certification Protocol (CECP-2023).

2. "IceNav(TM) Platform" refers to PDR's proprietary navigation and control system, including all associated firmware, software, and APIs.

3. "Integration Protocol" means the technical specifications and procedures detailed in Section 4 of this Guide.

4. "Thermal Management System" or "TMS" refers to PDR's proprietary temperature control and sensor protection system.

3. LEGAL COMPLIANCE AND WARRANTIES

1. Warranty Limitations

- Integration of non-approved sensors voids all PDR warranties
- PDR assumes no liability for sensor malfunction in sub-zero environments
- Third-party sensor warranties must be separately maintained

2. Regulatory Compliance

- All sensor integrations must comply with ISO/IEC 60068-2-1:2007
- Certification requirements per jurisdiction listed in Appendix B
- ANSI/RIA R15.08-1-2020 compliance mandatory

4. TECHNICAL INTEGRATION REQUIREMENTS

1. Physical Integration

- Mounting locations restricted to designated sensor ports
- Maximum sensor weight: 2.5kg per mounting point
- IP67 rating required for all external components
- Thermal isolation compliance per TMS-spec-2023

2. Electrical Integration

- Operating voltage: 12V/24V DC 5%
- Maximum current draw: 2A per sensor
- Surge protection requirements per Section 4.2.3
- EMI shielding specifications per IEC 61000-4-3

3. Data Integration

- IceNav(TM) API version 3.2 or higher required
- Maximum latency: 50ms
- Data format: JSON/Protocol Buffers
- Encryption requirements per Section 4.3.4

5. THERMAL MANAGEMENT PROTOCOLS

1. Sensor Heating Requirements

- Minimum operating temperature certification
- Heating element specifications
- Power consumption limitations
- Temperature monitoring requirements

2. Cold Start Procedures

- Sensor warm-up sequence

- System checks and validations
- Error handling protocols
- Recovery procedures

6. TESTING AND CERTIFICATION

1. Required Testing Protocols

- Environmental chamber testing (-40 C to +25 C)
- Vibration testing per MIL-STD-810H
- EMC compliance testing
- Integration validation testing

2. Documentation Requirements

- Test results submission format
- Certification application process
- Compliance documentation
- Maintenance records

7. INTELLECTUAL PROPERTY

1. All intellectual property rights in the IceNav(TM) Platform, including integration APIs and protocols, remain the exclusive property of Polar Dynamics Robotics, Inc.

2. Integration of third-party sensors does not grant any license to PDR's intellectual property beyond the limited right to interface with the IceNav(TM) Platform.

8. MODIFICATION AND UPDATES

1. PDR reserves the right to modify this Guide at any time upon written notice to certified integrators.

2. Updates to the IceNav(TM) Platform may require sensor recertification or modification.

9. CONTACT INFORMATION

Technical Support: support@polardynamics.com

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Emergency Support: +1 (888) 555-0123

APPENDICES

Appendix A: Approved Sensor List

Appendix B: Jurisdictional Requirements

Appendix C: Integration Checklist

Appendix D: Test Protocol Templates

DOCUMENT CONTROL

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