SYSTEM DIAGNOSTICS TECHNICAL GUIDE

Polar Dynamics Robotics, Inc.

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Classification: Confidential - Internal Use Only

1. INTRODUCTION AND SCOPE

1. This System Diagnostics Technical Guide ("Guide") establishes the standard diagnostic protocols and procedures for Polar Dynamics Robotics' IceNav(TM)-enabled Autonomous Mobile Robots ("AMRs") operating in temperature-controlled environments ranging from -40 C to +25 C.

2. This Guide applies to all Series X200 and X300 AMR units incorporating PDR-proprietary cold-resistant actuator technology and thermal management systems.

2. DEFINITIONS

1. "Diagnostic Protocol" means the sequence of automated and manual testing procedures designed to evaluate AMR operational status.

2. "Critical Systems" include:

a) IceNav(TM) Navigation Core

b) Thermal Management System (TMS)

c) Cold-Resistant Actuator Assembly

d) Environmental Sensing Array

e) Safety Control Module

3. "Performance Parameters" refers to the established operational metrics defined in Schedule A of this Guide.

3. DIAGNOSTIC PROCEDURES

1. Pre-Operation Diagnostics

1.1. System Boot Sequence Verification

1.2. Sensor Calibration Check

1.3. TMS Temperature Gradient Analysis

1.4. Actuator Response Testing

2. Operational Diagnostics

2.1. Real-time Performance Monitoring

2.2. Environmental Adaptation Metrics

2.3. Navigation Accuracy Assessment

2.4. Power Consumption Analysis

3. Post-Operation Diagnostics

3.1. System Log Analysis

3.2. Component Stress Evaluation

3.3. Thermal Cycle Impact Assessment

4. ERROR CODE INTERPRETATION

1. Primary Error Categories

1.1. Navigation Errors (NAV-XXX)

1.2. Thermal Management Errors (TMS-XXX)

1.3. Actuator Errors (ACT-XXX)

1.4. Sensor Errors (SEN-XXX)

1.5. Safety System Errors (SAF-XXX)

2. Error Resolution Protocols

2.1. Level 1 - Operator Resolvable

2.2. Level 2 - Technician Required

2.3. Level 3 - Engineering Support Required

5. MAINTENANCE REQUIREMENTS

1. Scheduled Diagnostics

1.1. Daily System Health Check

1.2. Weekly Performance Analysis

1.3. Monthly Component Evaluation

1.4. Quarterly Full System Assessment

2. Documentation Requirements

2.1. Diagnostic Log Retention

2.2. Maintenance Record Updates

2.3. Performance Trend Analysis

6. SAFETY PROTOCOLS

1. Emergency Shutdown Procedures

2. Thermal Management Override Protocols

3. Manual Recovery Operations

4. Safety System Validation Requirements

7. PROPRIETARY INFORMATION

1. All diagnostic procedures, error codes, and technical specifications contained within this Guide constitute confidential and proprietary information of Polar Dynamics Robotics, Inc.

2. Distribution of this Guide is restricted to authorized personnel who have executed the Company's Standard Non-Disclosure Agreement.

8. DISCLAIMER

1. This Guide is provided "as is" without warranty of any kind, either express or implied, including but not limited to the implied warranties of merchantability and fitness for a particular purpose.

2. Polar Dynamics Robotics reserves the right to modify this Guide at any time without prior notice.

9. REVISION HISTORY

Version | Date | Description

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2.1 | 2024-01-15 | Updated TMS diagnostic procedures

2.0 | 2023-11-30 | Added X300 series support

1.2 | 2023-09-15 | Enhanced error code definitions

10. APPROVAL AND AUTHORIZATION

This Guide has been reviewed and approved by:

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