

TRACTION CONTROLLER

→ SPECIFICATIONS ←

VERSION 1.0



Document History

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January 2, 2025	1.0	Initial Release

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1 Introduction

This document outlines the specifications for the Smartrise Traction Controller, a cutting-edge solution designed to optimize elevator performance, improve energy efficiency, and ensure compliance with industry standards.

2 Product Specifications

The C4 Traction Controller key specifications are listed in the table below.

Application	Geared, gearless, overhead, basement, and machine room-less
Speed	2000 fpm
Stops	96
Openings	192
Dispatch	8-car group
Power Requirements	208 – 600 VAC, 50/60 Hz, three-phase
Motor Control	<u>AC Induction, Permanent Magnet</u> <ul style="list-style-type: none"> · Variable voltage variable frequency VVVF elevator drive with encoder feedback · Dynamic Braking Resistors · Power back regenerative drive. <u>DC</u> <ul style="list-style-type: none"> · SCR elevator drive with encoder feedback · Dynamic Braking Resistors
Positioning	Absolute
Environment	32 – 104 °F, 0 – 40 °C; Humidity 95% non- condensing
NEMA Enclosures	NEMA 1, 4, 4X, 7, 12

* Non-NEMA 1 enclosures can be equipped with a built-in A/C unit for optimal temperature regulation.

3 Code Compliance

The elevator controller uses a microprocessor-based logic system and complies with North American applicable elevator and electrical safety codes.

3.1 Elevator Safety Code Compliance

The elevator safety code complies with:

- ASME A17.1/CSA B44
- NFPA 70/CSA C22.1 Electrical Codes (U.S. & Canada)
- CSA B44.1/ASME A17.5 Elevator and Escalator Electrical Equipment Standards

3.2 Americans with Disabilities Act Requirements

The elevator controller complies with the requirements of the Americans with Disabilities Act (ADA).

The elevator complies with ICC/ANSI A117.1, the American National Standard for Accessible and Usable Buildings and Facilities.

- ◆ **Leveling Accuracy:** The controller includes a self-leveling feature that automatically positions the car at floor landings with high precision under all loading conditions up to the rated load.
- ◆ **Hall Lanterns:** The controller provides outputs to drive the visible and audible signals required at each hoistway entrance, indicating which elevator car is responding to a call. Audible signals sound once for an upward direction and twice for a downward direction. In-car lanterns, visible from the vicinity of the hall call buttons and conforming to the above requirements, are also acceptable.
- ◆ **Car Position Indicators:** The controller includes a position indicator output to drive the required position indicator, which indicates the corresponding floor numbers as the car passes or stops at a floor. An audible signal sounds as the position indicator changes floors.
- ◆ **Voice Annunciator (Optional):** The controller includes a voice annunciator output to announce the car's direction and floor number.

NOTE: The voice annunciator is required for destination-based dispatching elevators or elevators with speeds exceeding 200 fpm.

4 Non-Proprietary Equipment

Only universally "Serviceable and Maintainable" non-proprietary elevator control equipment is accepted. Non-proprietary standards recognize specific owner's rights:

- ◆ The right to access all necessary information for diagnosis, servicing, and repair.
- ◆ The right to access on-board computers, including stored information, with the capability to diagnose, repair, and reprogram these systems.
- ◆ The right to select from among multiple sources for maintenance and repair in a competitive marketplace.

5 Environmental Considerations

The elevator controller must operate within the following environmental conditions:

- ◆ **Ambient Temperature:** 32 °F to 104 °F (0 °C to 40 °C). Higher temperature ranges are available.
- ◆ **Humidity:** Non-condensing up to 95%
- ◆ **Altitude:** Up to 7500 feet (2286 m)

Smartrise specializes in manufacturing control products for adverse environmental conditions. For example, dust-proof, waterproof, corrosion-resistant, explosion-proof, or air-conditioned controller cabinets can be engineered to meet specific applications.

Contact Smartrise Sales for more details.

6 Elevator Controller

Smartrise's C4 Traction controller is a microprocessor-based system designed for elevator applications, with separate control logic for elevator operation, safety systems, and safety redundancy, i.e., compliance with ASME A17.1 and CSA

B44.1 standards. The controller offers significant memory capacity for configuration, diagnostics, and event recording, with re-programmable and user-adjustable settings in the field.

The system features a built-in LCD display for diagnostics, dedicated indicators for system status, and switches for a variety of operations. It supports web-based communication for configuration and troubleshooting and integrates safety and control functions with easy-to-use diagnostics.

The controller ensures smooth operation with adjustable brake voltage, brake failure detection, and precise car positioning using an absolute position device. It also includes a system for pre-torquing the hoist motor and automatic leveling. The feedback power control continuously monitors speed and ensures precision speed regulation, even under varying loads.

The system provides step-less acceleration, deceleration, and smooth operation, with automatic braking during power failure. The elevator's performance is monitored, and excessive speeds during inspection or leveling trigger an automatic shutdown.

6.1 Simplex Selective Collective Operation

Simplex selective collective automatic operation is provided for single-car installations. The car starts and runs automatically when car or hall call pushbuttons are pressed, as long as the hoistway door interlocks and car door contacts are closed. The car stops at calls in the direction of travel in the order they are reached, regardless of the registration sequence. If only hall calls in the opposite direction remain, the car proceeds to the farthest call, reverses direction, and collects the calls.

6.2 Group Operation

In group configurations, each elevator operates independently with its own computer and dispatching algorithm. If one controller fails or loses power, the remaining controllers take over hall call management. When all controllers are functional, a single controller handles hall call dispatching for the group.

The system supervises, dispatches, and coordinates up to eight elevators per group, optimizing operations to reduce passenger wait times and handle varying traffic demands efficiently. It monitors cars in service, locations, directions, and call demands, using a rolling forecast to assign hall calls to the most optimal car. If the projected response time exceeds acceptable limits, another car is assigned to ensure prompt service.

6.3 Parking

The Smartrise C4 Controller supports flexible parking configurations that can be manually enabled, disabled, or scheduled based on time. Scheduling options include time of day, day of the week, month, year, or specific dates. Users can assign specific cars to programmed parking floors or leave all cars eligible by default.

- ◆ **Flexible Parking Assignments:** Specific cars can be assigned to programmed floors, with all cars eligible by default.
- ◆ **Door Configurations:** Supports parking with doors always open, always closed, or open for a set duration.
- ◆ **Dynamic Parking:** Predictions optimize parking based on historical and current demand.
- ◆ **Combined Parking Modes:** Allows essential cars and floors to be user-defined while dynamically parking remaining idle cars.

6.4 Fire Service Operation

The Fire Service operation and normal operating features comply with the applicable state and local codes.

6.5 Out of Service Timer

An Out of Service Timer is provided to take the car out of service if it is delayed in leaving the landing while calls exist in the system.

6.6 Uncanceled Call Bypass

A timer is provided to limit the time a car remains at a floor due to a defective hall call or car call, including stuck pushbuttons. Call demand at another floor causes the car, after a predetermined time, to ignore the defective call and continue providing service in the building.

6.7 Anti-Nuisance (Photo Eye)

The controller cancels all remaining car calls if a user-defined number of car calls are answered without detecting a change in the photo eye input, indicating that no one is passing through the car door opening.

6.8 NEMA Landing/Positioning System

NEMA 1, 4, 4X, 7, and 12 rated landing/positioning systems are available to ensure reliable operation in harsh hoistway conditions.

- ◆ **NEMA 1:** Designed for general-purpose indoor use, offering basic protection against dust and light incidental contact.
- ◆ **NEMA 4:** Provides protection against water spray and splashing, making it suitable for wet or outdoor environments.
- ◆ **NEMA 4X:** Similar to NEMA 4 but also resistant to corrosion, ideal for environments with exposure to corrosive agents or chemicals.
- ◆ **NEMA 7:** Specifically designed for use in hazardous locations with the potential for explosive gas or vapors, such as petrochemical facilities.
- ◆ **NEMA 12:** Protects against dust, dirt, and non-corrosive liquids, suitable for industrial applications with moderate environmental exposure.

6.9 Leveling

The car is equipped with two-way leveling to automatically bring the car level at any landing, ensuring precise alignment with the floor. This system operates within the required range of leveling accuracy and adjusts to maintain accurate floor leveling regardless of the load in the car. The leveling system is designed to function effectively with any load, from empty to full capacity, ensuring smooth, reliable operation even under varying weight conditions. This feature enhances passenger safety and comfort by minimizing the gap or step between the car and landing, particularly when the elevator is under different loading conditions.

6.10 Smart Connect

Smartrise's Car Top Inspection Box, the Smart Connect, comes pre-wired for an easy installation via a CAT cable and seamlessly integrates with all Smartrise controllers. Located on the top of the car, Smart Connect has pre-drilled mounting brackets with a light bulb socket.

Main Features:

- Light Bulb Socket
- 0.3" Diameter Plastic Service Lamp Guard
- Pre-Drilled Mounting Holes
- 3-Prong Electrical Cord Duplex Outlet GFCI, 15A 125 VAC

Optional Accessories:

- Pushbutton and Switch Safety Guards
- Permanently Attached Work Light

6.11 Operating Modes

Smartrise's C4 controller supports multiple modes of operation.

6.11.1 Construction Mode

In Construction mode, the elevator is configured to operate specifically during building construction or renovation to accommodate the specific needs of the building process as the elevator system is physically incomplete. Construction mode is activated by a key switch on the construction box, accessible only to authorized personnel.

6.11.2 Inspection Mode

In Inspection mode, the elevator is taken out of automatic operation to allow for manual control, typically for maintenance, inspection, or troubleshooting by authorized personnel. The elevator moves at a reduced inspection speed for careful inspection or testing. Emergency stop buttons remain functional to halt the elevator if needed. Automatic door operation is disabled, requiring doors to be opened and closed manually if necessary. Normal call buttons (inside and outside the cab) are deactivated.

6.11.3 Test Mode

In Test mode, the elevator control system is used for testing purposes prior to placing the car into normal operation. The mechanic can conduct various tests, including one year and five year tests.

6.11.4 Independent Service

In Independent Service operation, the elevator control system removes the selected car from a group, allowing it to operate independently from the other cars. The selected car no longer responds to the group's hall calls or normal dispatching logic but rather follows its own call system, operating without interference from the group's optimization routine.

6.11.5 Attendant Service

In Attendant Operation, a designated attendant manually manages the elevator's functions via the control panel inside the elevator to enhance passenger service. The attendant monitors up and down lamps located on the panel which indicate when there is a request for service above or below the car's current floor. The attendant uses these lamps, as well as up and down direction buttons, which control the next direction of the car, to pick up passengers and drop them

off at their desired location. Once the elevator car arrives at a landing, the car doors will open manually and must be manually closed by the attendant via the door close button.

6.11.6 Emergency Medical Service

In Emergency Medical Service Operation, the system enables elevator use during medical emergencies. EMS is activated by emergency medical personnel using a key switch or button at the hall station. This allows the car to bypass all other floors and to proceed directly to the designated landing.

6.11.7 Seismic/Earthquake

In Seismic/Earthquake operation, the elevator controller takes specific actions to protect passengers and equipment when a seismic event is detected. This operation is activated when seismic sensors detect ground movement that exceeds predefined thresholds. Once activated, the elevator will immediately stop at the nearest floor and the doors open automatically to allow passengers to exit.

6.11.8 Sabbath

In Sabbath operation, the elevator controller is specialized to accommodate the needs of individuals observing the Sabbath by automatically operating the elevator without direct human intervention. The Sabbath Operation can be activated either by a key switch or by the controller when the clock reaches the Sabbath start time. Once in Sabbath operation, the elevator car functions automatically by going to each door that has a valid Sabbath opening and skipping those without a valid Sabbath opening. Sabbath operation has a separate door dwell timer. The door remains open based on the Sabbath timer and not the original door dwell timer. The car exits Sabbath operation if the Sabbath key is turned off or once the controller clock reaches the Sabbath end time.

6.11.9 Emergency Power

In Emergency Power operation, the elevator controller allows the cars to operate on generator power. Once the mainline power has been lost, the controller stops the car until the generator is active. While on emergency power generator, each car within a single car group is individually recalled to a defined recall floor. Once all active cars have been recalled, a defined number of cars are placed back into operation at the defined emergency power operation speed.

6.11.10 Out of Service

In Out of Service operation, the elevator controller temporarily deactivates the elevator system. This operation is typically engaged when maintenance, repairs, or inspections are required. Additionally, this operation can be automatically engaged when some predefined high priority faults during a specific time are detected by the control system. Only authorized personnel, such as maintenance staff or technicians, can access the elevator.

6.11.11 Battery Rescue

In Battery Rescue operation, the system, in the event of a power loss, safely and securely guides the car to the nearest floor, allowing passengers to exit the car. The car automatically moves in the direction of least resistance as determined by the system.

Smartrise Emergency Rescue Device

The Smartrise Emergency Rescue Device (ERD) is a battery backup system designed to supply emergency power during a mainline power outage. The ERD continuously monitors the mainline for power loss. Upon detecting a power outage, the ERD isolates the elevator from the mainline and generates enough power to move the elevator to the nearest floor in the pre-selected direction. Once there, it opens the doors to ensure the safe rescue of trapped passengers.

Key Specifications:

- ◆ A dedicated battery testing circuit automatically applies a load to the battery and monitors its discharge profile.
- ◆ High-efficiency two-step inverter design.
- ◆ Utilizes advanced SiC (Silicon Carbide) power modules to generate high-current AC outputs with very low thermal losses.
- ◆ The Smartrise ERD produces pure sine-wave AC output, reducing heat and noise in magnetic devices.
- ◆ Internal dedicated contactor for seamless switching between the mainline and emergency line, with automatic mainline fault detection.
- ◆ Built-in disconnect feature for easy battery service and maintenance.

Manual Rescue Operation via Smartrise Battery Lowering Device Kit

The Smartrise Battery Lowering Device (BLD) kit is designed to facilitate the manual rescue of passengers during power outages. Upon activation, the user energizes/deenergizes the power to the brakes via a pushbutton to drift the elevator to the nearest opening. Once the elevator reaches the designated floor, the doors can be opened using the Door Open button to safely rescue trapped passengers.

6.11.12 Wander Guard

In Wander Guard operation, the elevator control system restricts access to unauthorized passengers by skipping predefined wander guard floors during normal operation. This operation mode ensures that vulnerable individuals are unable to leave secure areas without supervision. Authorized personnel, such as caregivers or staff, can override the system using a key or code to allow the elevator to operate normally when needed.

6.11.13 Flood

In Flood operation, the elevator control system limits the elevator car's travel to floors above the user-defined flood floor. If the car happens to be at/below the flood floor during a flood detection, the system will automatically move the car to the floor above the flood floor.

6.11.14 Active Shooter

In Active Shooter operation, the elevator control system automatically operates in a manner to restrict the shooter's access to the elevator to use as an escape route. This mode is activated via a key switch. Once enabled, the elevator doors close automatically, the PI display switches from the floor number to a "CR" crisis indicator, and the elevators stop responding to both hall and car calls. All cars within a group are recalled to an alternate recall floor or to a configured recall floor, where the doors open and remain open. Once the Active Shooter mode is disabled, the elevators return to normal operation.

6.11.15 Marshal Mode

In Marshal mode, the elevator is removed from group operation via a key switch input, clearing all car and hall calls. The car stops at the nearest landing with both front and rear doors remaining closed. It does not respond to calls, and door open/close buttons are disabled. The marshal uses a remote controller to operate the car, selecting a landing where doors remain closed until the marshal holds the door open button. If not held, doors close automatically. Fully opened

doors stay open until the marshal holds the door close button to fully close them. For multiple car calls, the car waits 10 seconds at each landing for the marshal to open the doors. If the door open button is not pressed within the timeout, the car moves to the next call. Once the doors are fully open or closed, the car follows the next latched car call sequence.

6.11.16 VIP Service

In VIP Service mode, the elevator control system provides priority service for designated individuals. This mode is activated via a key located at a hall station. Upon activation, the car completes any existing car calls, bypasses all hall calls, and responds exclusively to the VIP hall call. A minimum of five seconds is allowed for the VIP passenger to place a car call. The system ensures exclusive, uninterrupted service during this time. Once all car calls have been completed, the car exits VIP mode.

6.12 Destination Dispatching

The Smartrise Destination Dispatch system optimizes elevator travel by grouping passengers based on floor destinations, reducing intermediate stops, speeding up transportation, and minimizing energy use. Passengers input their floor destinations using hall kiosks, which assign them to the most efficient elevator. Real-time data is used to adapt assignments for peak and non-peak traffic.

Key Features:

- ◆ **Floor & Kiosk Support:** Up to 96 floors and 8 kiosks per floor.
- ◆ **Installation & Configuration:** Simple setup with a single board and two wires. Supports hybrid (kiosks on high-traffic floors and hall buttons on other floors) or full (kiosks on all floors) configurations.
- ◆ **Security:** Passcode entry and integration with key switches, card readers, and other devices.
- ◆ **Accessibility (ADA):** Features extended door times, adjacent elevator assignments, and guidance annunciations.
- ◆ **Advanced Capabilities:** Supports VIP service, split group operation, third-party security integration, swing car operation, and smartphone call commands.

6.13 Cross Registration

The Smartrise C4 control system supports cross-registration, enabling integration with non-Smartrise controllers. Through this feature, hall calls can be shared and coordinated between Smartrise controllers and other elevator control systems. This allows for controlled cross-registration of hall calls across both systems, ensuring smooth operation and optimal service in mixed-controller environments.

6.14 Diagnostics

The control system shall provide robust access to the computer memory for elevator diagnostics and include permanent indicators for critical elevator status conditions as an integral part of the controller.

The microprocessor boards shall feature on-board diagnostics for ease of troubleshooting and field programmability of control variables. Field changes shall be stored permanently using non-volatile memory. Key features of the microprocessor board include:

- ◆ **User-Friendly Diagnostics:** On-board diagnostic switches and an alphanumeric display for intuitive interaction between mechanics and the controller.

- ◆ **Event Logging:** An on-board event log to store and display time-stamped events for diagnostics (viewable only with monitoring software).
- ◆ **Real-Time Clock:** An on-board real-time clock to display and adjust time and date using on-board switches.
- ◆ **Field Programmability:** Specific timer values (e.g., door times) can be viewed and adjusted through on-board switches and pushbuttons.
- ◆ **Extensive Diagnostic Capability:** A built-in LCD display or equivalent provides access to essential functions and diagnostic features, displaying data and menus in a clear, user-friendly format.

7 S-Curve Technology™ (U.S. Patent Pending) Profile

The S-curve Technology™ (U.S. Patent Pending) control is an advanced motion profile used in Smartrise's C4 Traction controllers to ensure smooth and efficient elevator operation. This control method modifies the acceleration and deceleration profiles to minimize mechanical stress, improve ride comfort, and enhance overall system performance.

In Smartrise's C4 Traction controllers, S-curve Technology™ (U.S. Patent Pending) profiles are standard, ensuring consistent performance across various elevator configurations (e.g., geared, gearless, machine room-less).

The controller allows fine-tuning of parameters like jerk limits, acceleration rates, and deceleration rates to match the specific requirements of the building and elevator system.

Key Features of S-curve Technology™ (U.S. Patent Pending) Control

- ◆ **Smooth Transitions:**
 - Reduces abrupt force changes when starting or stopping the elevator.
 - Creates a more comfortable ride for passengers by eliminating sudden jolts.
- ◆ **Precision:**
 - Enhances speed regulation, ensuring accurate stops at desired floors.
 - Reduces overshoot and oscillation, providing greater positional accuracy.
- ◆ **Reduced Wear and Tear:**
 - Minimizes mechanical stress on components like cables, motors, and braking systems.
 - Extends the lifespan of critical elevator parts by reducing the impact of high loads.
- ◆ **Energy Efficiency:**
 - Optimizes power usage during the acceleration and deceleration phases.
 - Lowers energy spikes, which can lead to cost savings over time.

8 Security

The Smartrise C4 controller offers robust security options to ensure only authorized individuals can access specific floors or functionalities. These measures integrate seamlessly with various access control systems, enabling customization to meet diverse building security requirements. The controller also prioritizes safety by allowing emergency operations, such as Fire Service, to override security restrictions.

Security Options:

- ◆ **Card Reader Interface:** An optional card reader interface enables access control by integrating with third-party card readers. Card reader vendors must provide a dry contact output to restrict call registration. Restriction can be applied per opening, per call, or for groups of calls and openings as required.
- ◆ **Floor Key Lockout:** An optional floor key lockout interface allows disabling of call registration for designated floors. Restriction can be applied per opening, per call, or for groups of calls and openings as required.
- ◆ **Access Code:** An optional access code feature that when a car call is initiated, its corresponding lamp flashes, and the user has a set amount of time to enter a 4-digit code (one digit at time). Access codes are available for a total combination of 16 landings the car serves (16 Front only, 16 Rear only, or 8 Front + 8 Rear only).

Additional Features:

- ◆ **Time-Based Restrictions:** Security modes can be scheduled based on time of day, day of the week, or holidays. For example, restricting floor access outside of business hours.
- ◆ **Dynamic User Management:** Authorized users can be added or removed in real time via the controller's monitoring application or remote interface.

9 Load Weighing Device

The Load Weighing Device measures the weight of the elevator car and its passengers to ensure safe operation and prevent overload.

9.1 Smartrise Load Weighing Device

Smartrise's Load Weighing Device is designed to monitor the weight of the elevator car, ensuring efficient operation and passenger comfort. The system utilizes high-resolution, 24-bit analog-to-digital converters to accurately read load cell sensors. It is compatible with cross head and rope deflection sensors.

Key Specifications:

- ◆ Designed with a high-resolution, 24-bit analog-to-digital converter to read load cell sensors with exceptional accuracy.
- ◆ Capable of communicating through CANBUS or discrete digital signals.
- ◆ Features automatic floor-by-floor calibration for seamless operation.
- ◆ The controller automatically adjusts itself if the signal drifts due to mechanical creep or temperature changes, ensuring continued accuracy.

9.2 Third Party Load Weighing Device

The option to interface to a third-party load weighing device shall be available.

10 Drives

The C4 Traction controller is compatible with both AC and DC motor drives.

11 Regenerative Kit

Smartrise Engineering offers a Regenerative Kit designed to enhance the energy efficiency of elevator systems by converting excess energy generated during operation back into usable power.

12 Monitoring Systems

Smartrise offers comprehensive monitoring solutions to enhance elevator system performance and reliability.

12.1 Smartrise Monitoring Systems

Smartrise offers three monitoring systems:

1. **Machine Room Monitoring:** A user-friendly system provided with every C4 controller for elevator monitoring and control. It operates on any device requiring no internet connection for local access.

Key Features:

◆ Live Monitoring:

- Displays real-time elevator data, including mode of operation, speed, position, current floor, destination, and door status.

◆ Fault and Alarm Tracking:

- Logs and displays faults with details such as fault codes, descriptions, solutions, timestamps, and car IDs.
- Event logs can be saved and reviewed offline for diagnostics.

◆ Parameter Management:

- Allows users to view and adjust elevator parameters and settings.
- Enables software updates, parameter backups, and restoration of saved setups.

2. **Lobby/Security Desk Monitoring:** A user-friendly program that communicates with elevators and group dispatchers through Ethernet and TCP/IP. The server is located on the Local Area Network (LAN) with the elevator equipment, enabling users to log on to the server using any workstation running the Smartrise Client application.

Key Features:

◆ System Information Management:

- Collects, stores, and recalls system data for performance analysis or other purposes.

◆ Real-Time Alerts:

- Automatically sends alerts to workstations in case of system issues.

◆ Traffic Data Retention:

- Retains records of building elevator traffic for analysis and reporting.

◆ Report Viewing and Printing:

- Allows users to view, print, and export detailed report screens for various performance metrics.

◆ Data Export:

- Saves historical data for further analysis and record-keeping.

3. **Remote Monitoring:** A comprehensive system that allows users to monitor and control elevator operations from any internet-connected device. It enables real-time access to elevator performance data, fault alerts, and system diagnostics, all from a remote location. This system provides the flexibility to monitor multiple elevators, track their statuses, and perform maintenance tasks from anywhere.

Key Features:**◆ Real-Time Data Access:**

- Provides live data on elevator operation, including speed, position, floor level, door status, and more, accessible from any internet-connected device.

◆ Fault and Alarm Notifications:

- Sends immediate notifications and detailed reports of faults or system issues to ensure prompt response and prevent downtime.

◆ Diagnostic Tools:

- Allows remote troubleshooting by providing access to system diagnostics, event logs, and fault history for efficient issue resolution.

◆ User Access Management:

- Enables customizable access levels to ensure proper control and security for different users, including administrators and service technicians.

◆ Historical Data Storage:

- Stores and allows the retrieval of past performance and event data for analysis, reporting, and trend monitoring.

12.2 Third Party Monitoring

The option to interface to a third-party monitoring system shall be available.