SAFE BOX

Optimization of energy isolation processes through remote isolation systems

Mercedes Valli

Workplace Safety North Mining Health and Safety Conference

Agenda

About SafeBox and Lockout/Tagout

Ionic Technology Group

SafeBox is part of Ionic Technology Group, in business since 1999

150 employees, with two assembly facilities in Canada

Implementations around the world in heavy industry and factory automation

- Industrial Automation and Robotics
- Systems Integration and Assembly
- Software Development
- Consulting Engineering

Our Experience with Machine Safeguarding

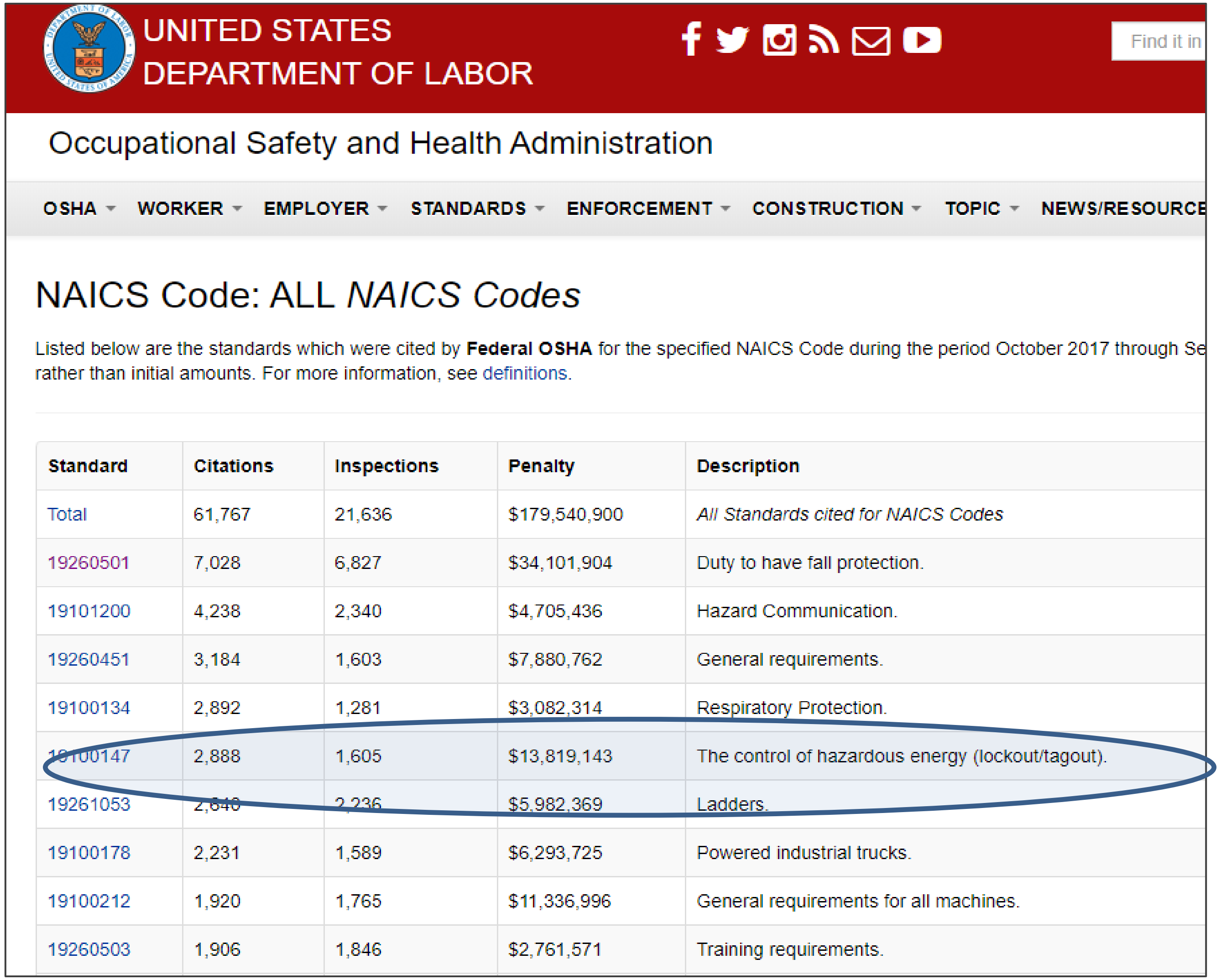
- Our Certified Machinery Safety Experts design systems with machine safeguarding that protect against **operator** intervention.
- However, for **maintenance** intervention, a manual lockout/tagout (LOTO) process is the most common control.

CERTIFIED MACHINERY SAFETY EXPERT CMSE®

Lockout/Tagout (LOTO)

- Lockout/Tagout is a **manual** process where energy sources are identified, isolated, and locked and tagged.
- It is an **administrative** safety control.
- When administered properly, it protects workers against exposure to energy during maintenance.

Why Remote Isolation and Validation for Lockout/Tagout?



NAICS Code: ALL *NAICS Codes*

Listed below are the standards which were cited by **Federal OSHA** for the specified NAICS Code during the period October 2017 through Se
rather than initial amounts. For more information, see definitions.

Standard	Citations	Inspections	Penalty	Description
Total	61,767	21,636	$179,540,900	*All Standards cited for NAICS Codes*
19260501	7,028	6,827	$34,101,904	Duty to have fall protection.
19101200	4,238	2,340	$4,705,436	Hazard Communication.
19260451	3,184	1,603	$7,880,762	General requirements.
19100134	2,892	1,281	$3,082,314	Respiratory Protection.
19100147	2,888	1,605	$13,819,143	The control of hazardous energy (lockout/tagout).
19261053	2,640	2,236	$5,982,369	Ladders.
19100178	2,231	1,589	$6,293,725	Powered industrial trucks.
19100212	1,920	1,765	$11,336,996	General requirements for all machines.
19260503	1,906	1,846	$2,761,571	Training requirements.

Problem 1: Lockout validation

Lockout/Tagout failure is one of the most cited workplace violations.

When:

1. An energy source is not properly locked out as part of lockout/tagout

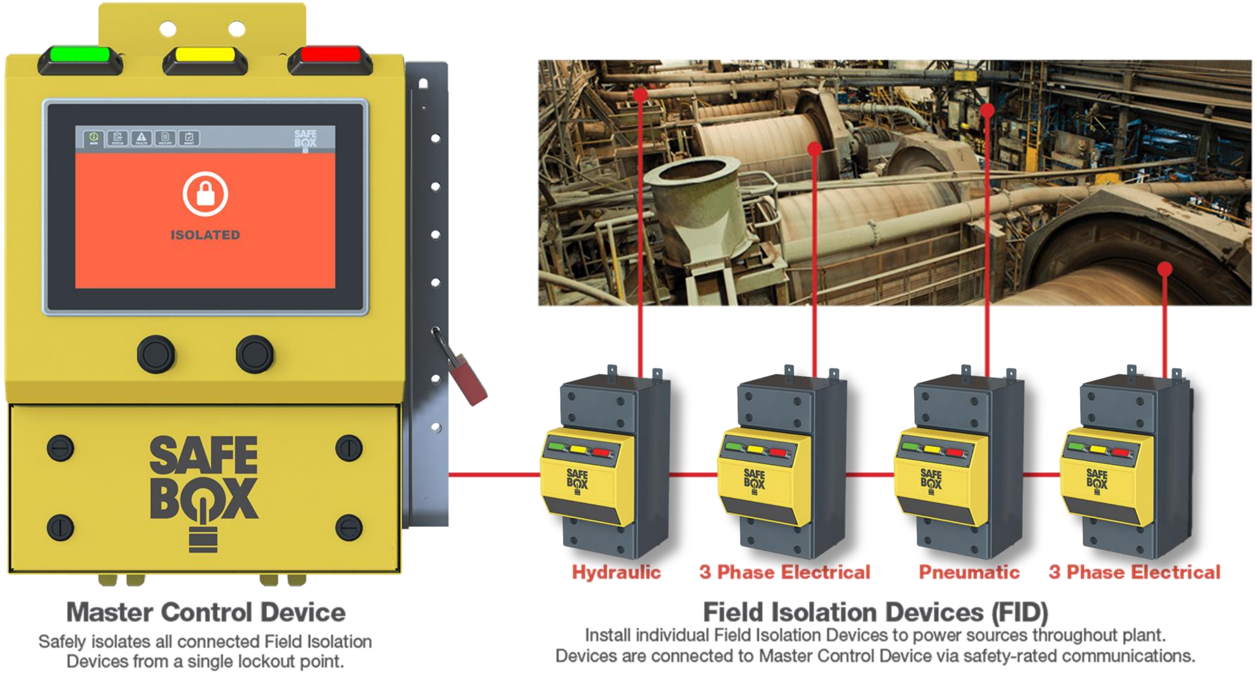
and

2. The mistake is missed by the administrative process

Equipment remains energized during work.

Without validation, there is no way to confirm that the correct lockout sequence has been applied to the designated maintenance job.

Problem 2: Lockouts are time-consuming



- The administrative process of completing lockouts can take **minutes** or **hours**.
- SafeBox is an engineered system for validating and executing **pre-programmed remote lockouts** within seconds.
- Locks out up to **50 electrical, pneumatic, and hydraulic energy sources** at the same time.
- Physical disconnects can be used in **multiple sequences**.
- Sequences can be locked out from **different locations**.

What about alternatives?

	Validation	Time	Cost
Manual Lockouts	✗	✗	⚠
Radio Remote Lockouts	✗ ✗	✓	⚠
Extend electrical cabling and add disconnects	✗	✓	✗
Custom engineered lockouts	✓	✓	✗
SafeBox Remote Lockout System	✓	✓	✓

Applications for SafeBox

Where is this adopted?

- **Five Sold Systems within mining**
  - 4 in Canada, 1 in Chile
- **Applications Include**
  - SAG Mill
  - Overland Conveyors
  - Underground Conveyor
  - Potash Compactor
  - Smelter
- **Installations expected Q2/Q3 2023**

When are remote isolation systems most applicable?

Validation

Where there is complexity or risk of error

Time

Critical assets with a high cost of downtime

Nuisance

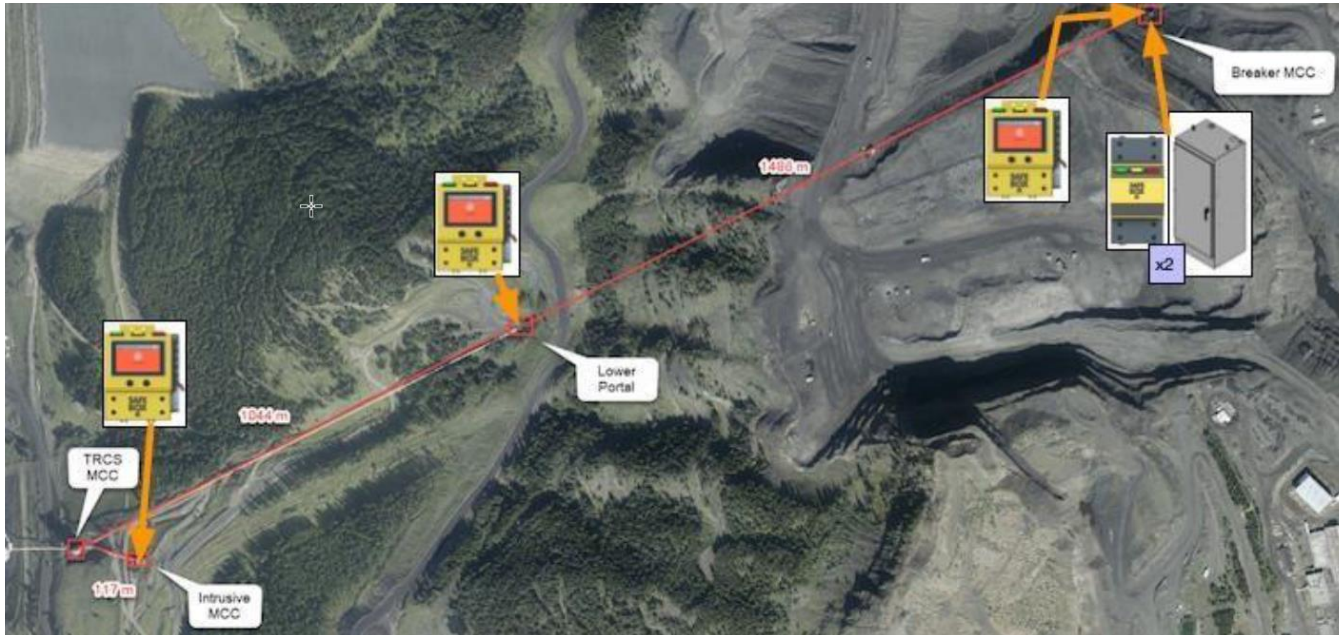
Frequent time-consuming lockouts

Overland Conveyors

50 conveyor lockout sequences per year:

- Each event involved a 2-hour lockout procedure.
- Coordination across departments required

100 hours (4 days) per year for lockouts @ 19000 tons per day

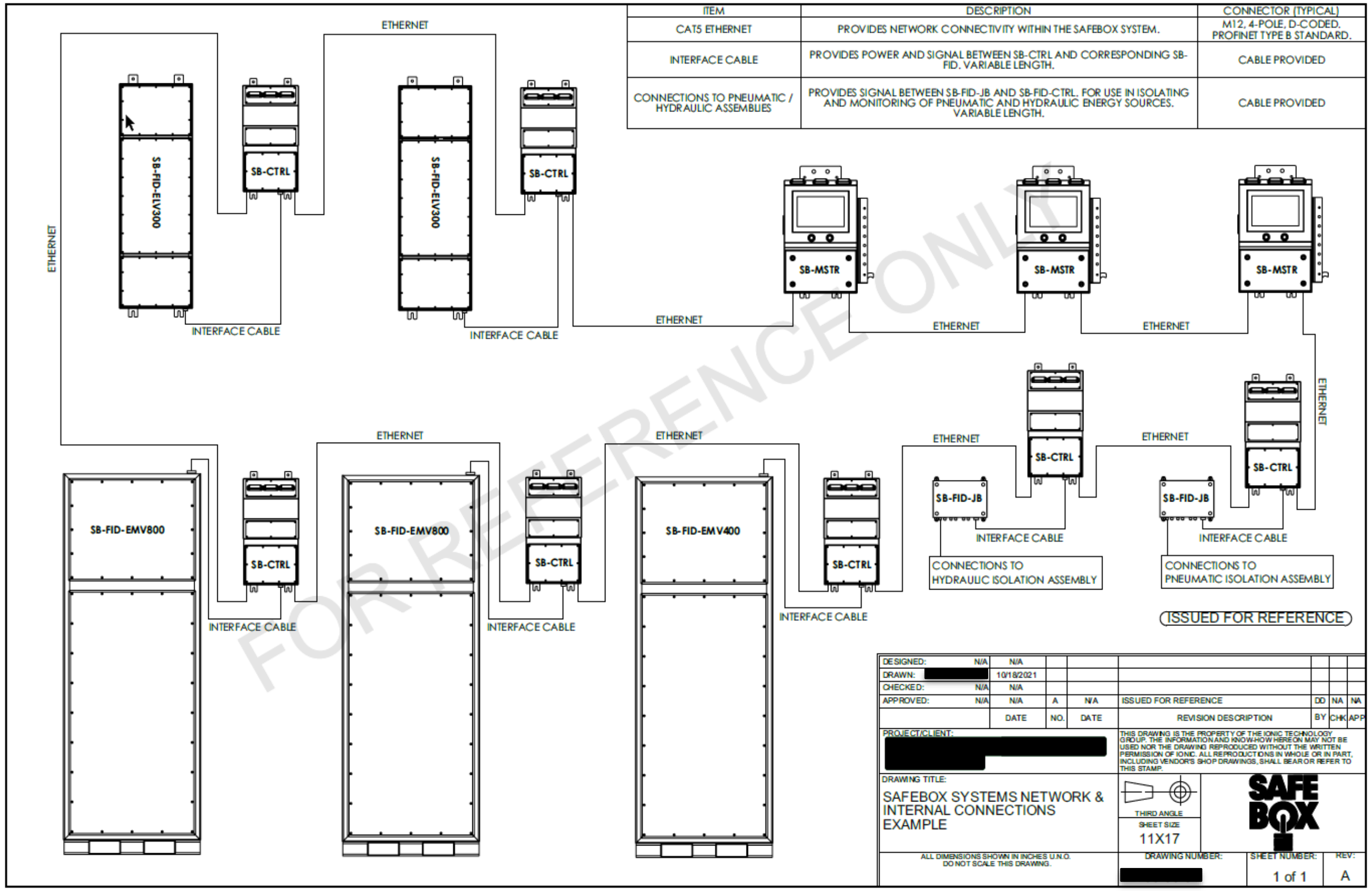


SAG Mill Liner Change

200 partial lockouts sequences for mill liner changes per year

- Each event involved a 30-minute lockout procedure

100 hours (4 days) per year for lockouts @ 60000 tons per day



Nuisance Lockouts

Daily conveyor lockouts:

- Each lockout involved walking uphill along a 750ft conveyor to lockout a low voltage disconnect.

Safety and Functionality

How does the system protect against unintentional energization?

OPERATOR CONTROL – PHYSICAL LINE BREAK – ENGINEERED FOR FUNCTIONAL SAFETY

- For use in applications up to **SIL 3** and **Performance Level e (Ple)**
- **CAT IV (4)** Safety rating
- Common Industry Protocols (CIP) Safety Control Reliable
- **Tamper-Proof**
- **NEMA 4X** enclosure rating
- Product has received **CSA Approval**, and acceptance by multiple regulatory bodies

The design of safety equipment is regulated by national and international standards

- Z432-16 Safeguarding of Machinery
- Z460-13 Control Hazardous Energy

- 12100 Safety of Machinery – General Design Principles
- 13849-1/2 Safety of Machinery – Control System design

- 60204 Design of Electrical Equipment
- 62061 Safety of Machinery for Electronics

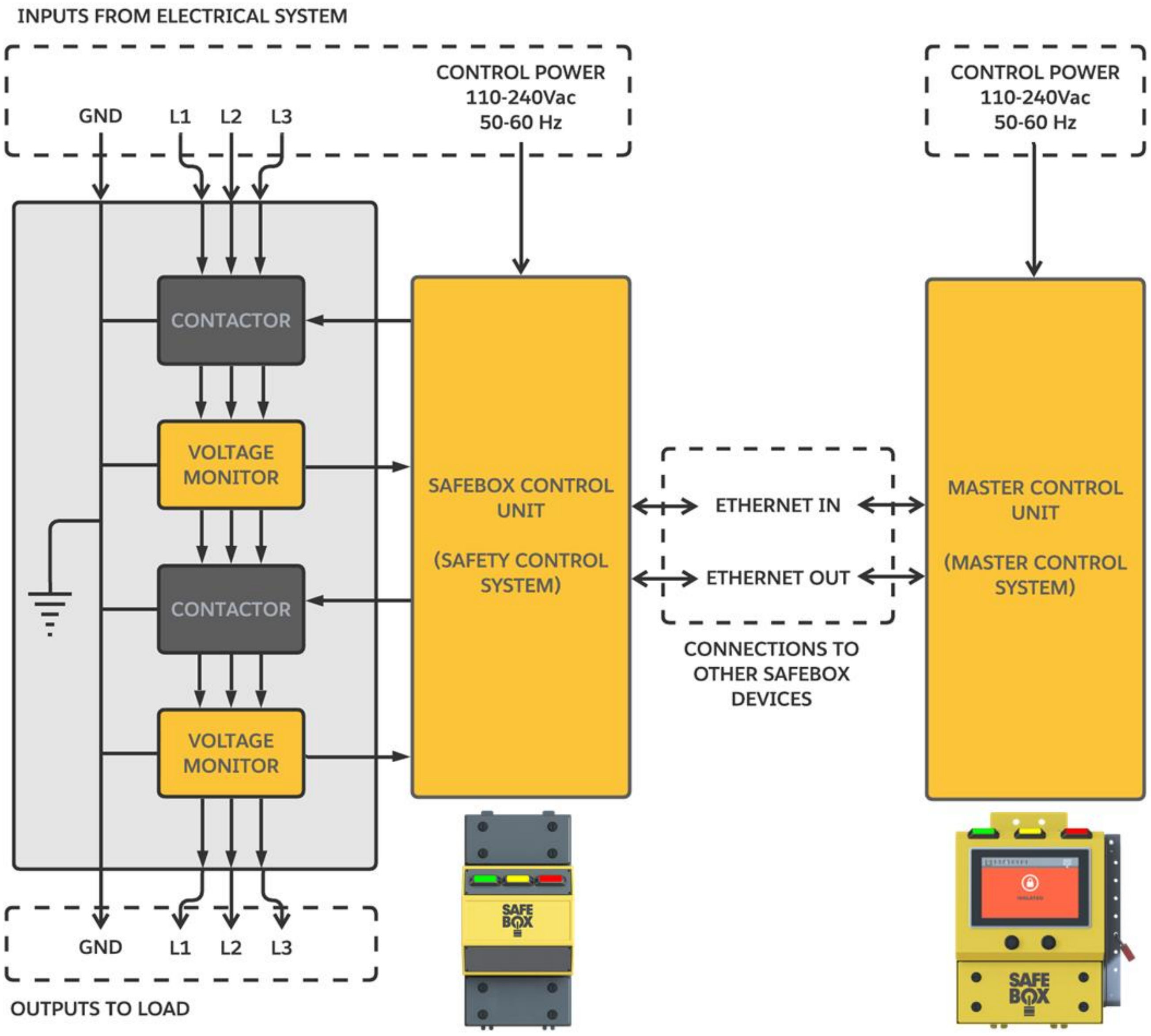
SafeBox Remote Energy Isolation Systems

Master unit has a safety-rated, mechanically trapped bar. The bar lifts when:

1. **Zero Energy** is detected at every associated field isolation device

2. **Energy isolation** is physically verified by feedback from open contactors or valves

The **mechanically trapped bar** can be lifted and locked. It is impossible to reenergize until the bar is lowered.

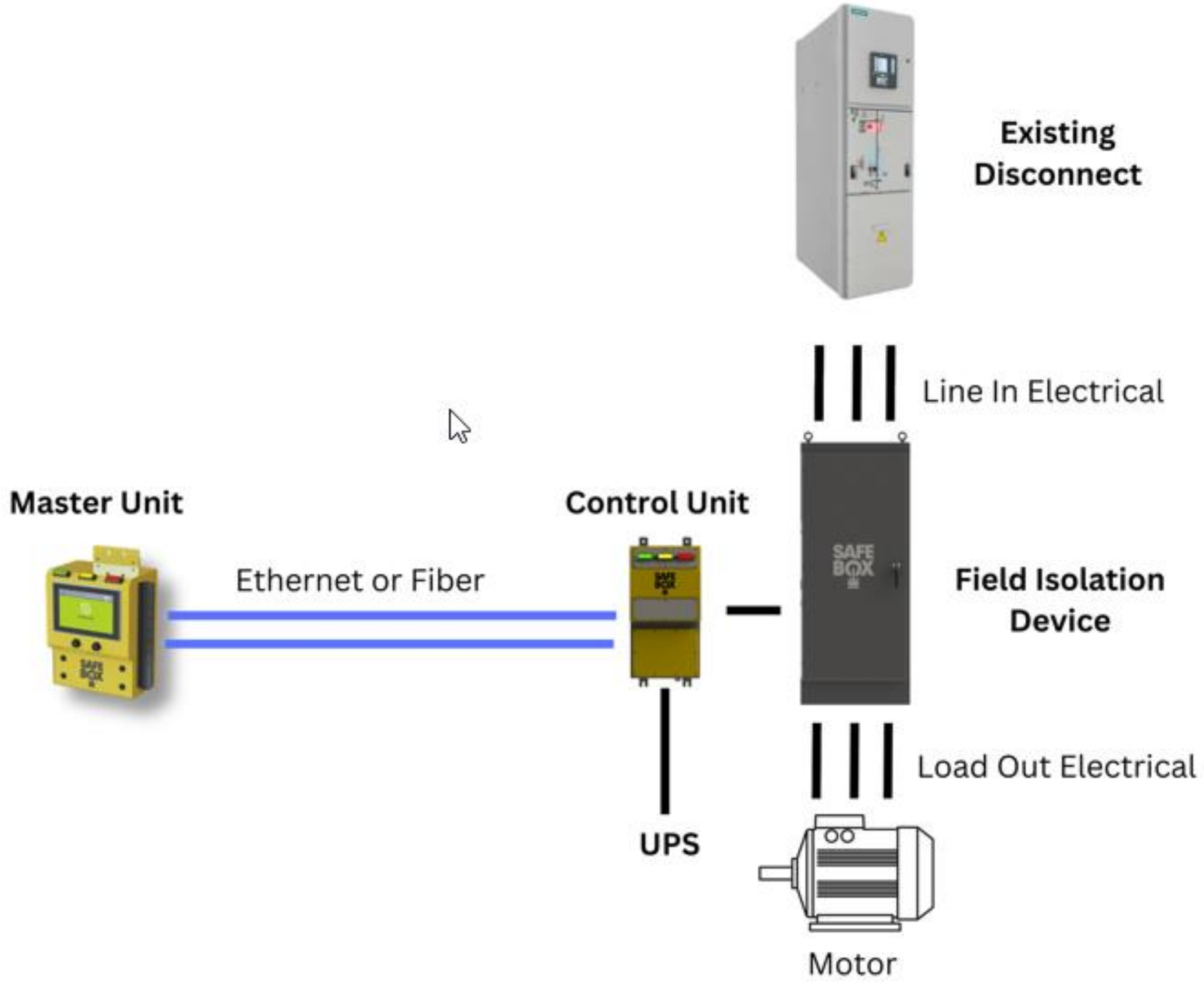


Safety and Mechanical Isolation

- **Energy Monitoring** Examples include standstill motor relays and line-to-line voltage monitoring in series
- **Physical Position Monitoring** Redundant, mechanically-linked contactors enable flow of energy from line to load. Mechanically trapped locking bar on Master prevents accidental energization
- **Energization/Isolation** Validated by NO/NC contacts and test pulse from all 4 physical position and energy monitoring sources
- **Fail-Safe Safety PLCs** Intelligently hold state in the case of communications failure

Connection Examples

- **Ethernet** connections with D-Coded M12 connections (fiber also possible)
- **SCADA** 4 configurable safety outputs (NO/NC) and 4 inputs
- **Wiring** control power accepts 28-12 wire, 1000V/100A accepts up to 2/0 wire. All other devices offer terminal lug connections with busbar.
- **Contactors** rated from low voltage 1000V/100A to medium voltage 7.2kv/800A



Fail-Safe Behavior

Loss of ethernet or fiber

- System holds last state. Connection must be restored before isolation or energization can be requested

Loss of control power

- Control Units that lose control power will fail-safe, and contactors/valves will open. A UPS is required.

System run over by truck (or equivalent)

- Jumper around SafeBox and isolate/energize with upstream disconnects until replacement parts can be installed

Master Control Device

- **Single Mechanical Lockout Point** with safety-rated components
- Outputs for **SCADA** and **DCS**
- **User Centric Interface**:
  - Main
  - Field Isolation Device (FID) Status
  - Faults
  - History
  - Maintenance

Field Isolation Devices (FID)

- **Control** as well as means for physical disconnection
- **Mechanically fail-safe**
- **Redundant system** for active monitoring and isolation.
- **Fault Monitoring** feedback signals and safety logic
- **Common Industrial Protocol (CIP) Safety** for functional safety applications on industrial networks
- All hardware subcomponents **MTTFd > HIGH**

Project Considerations

Step 1: Internal Evaluation

- Determine the **application** for SafeBox (e.g., overland conveyor, SAG mill liner change, nuisance lockout, etc…)
- Communicate **Single Line Drawings** and **lockout procedures**
- Perform a **budgetary assessment**
- **Stakeholder engagement** (recommended to include key electrical, health and safety, and maintenance personnel)
- Evaluate and eliminate **critical obstacles** (e.g., space restrictions, jurisdictional approval, total project costs)
- **Approvals** from JOHSC and for proceeding with engineering phase

Step 2: Project Development and Engineering

- **Safety and Risk Assessment** report as per ISO 12100
- **Revise single line drawings** to reflect SafeBox devices
- **Site Layout** for location of devices, with cabling and mounting specifications
- **Lockout procedure updates**
- **Variance and regulatory compliance approvals**
- Finalize **contract** for hardware

Step 3: Implementation

- Complete **cabling and site preparation** as per engineering report
- **PLC integration and customizations** to integrate with existing procedures and protocols
- **Factory Acceptance Test (FAT)** typically performed before shipment
- All equipment arrives **pre-configured and tested.** Can be **pre-installed and dry tested** without interfering with production, until ready for **commissioning**
- **Final power connections** performed during **shutdown**
- **Review and training** with staff and operators

ELIMINATE LOCKOUT **ERRORS**