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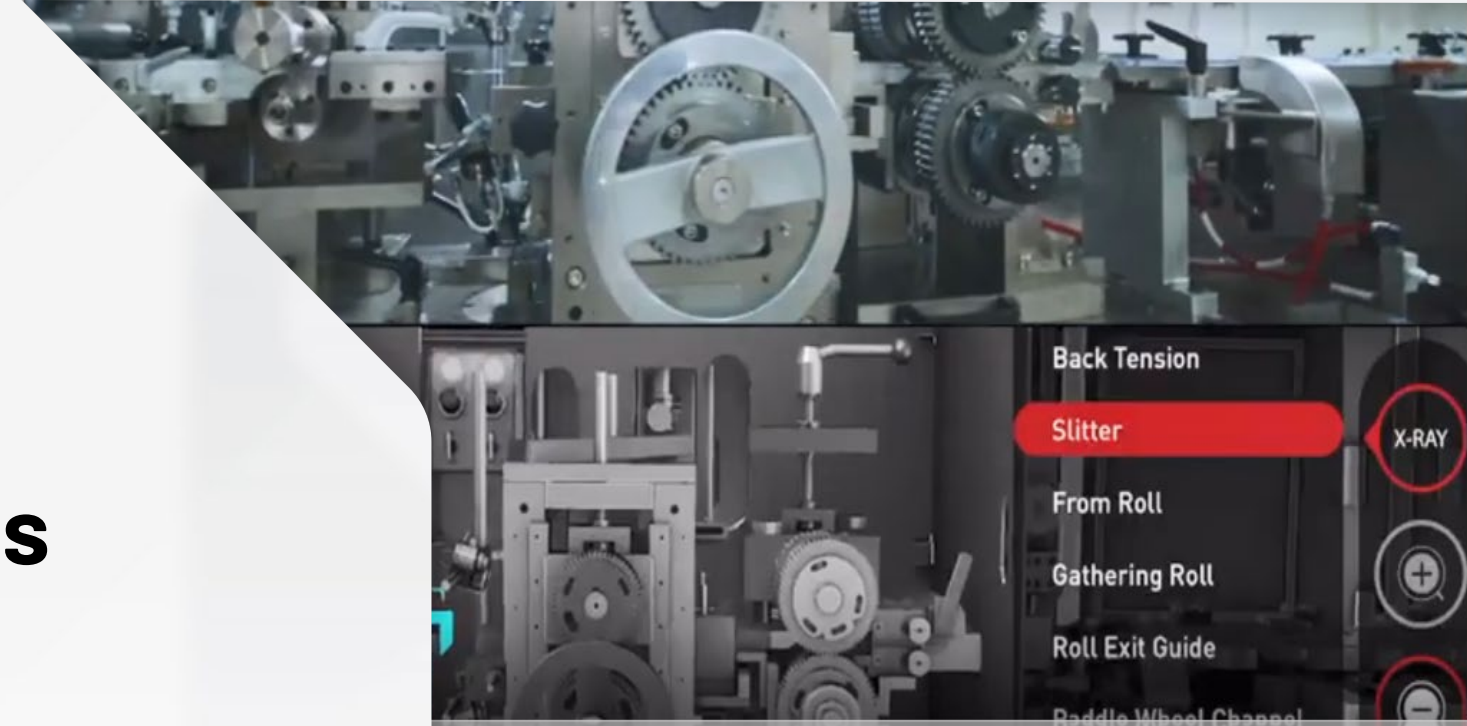
Smart Machines and Industrial Safety Solutions



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April 14, 2022

Agenda

1 Smart Safety – The Challenges and Benefits

2 Smart Safety and the Connected Enterprise

3 Smart Safety and Real Time Information

4 Smart Safety and Collaborative Workspace Solutions

5 Summary & Safety Resources

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Smart Safety – The Challenges and Benefits

Smart Safety – Enabling Smarter Machines and Equipment

Challenges to Safety Operations

Worker behaviours

- Operators bypassing poorly designed safety systems
- Systems that don't account for procedural anomalies
- Standard operating procedures not being followed

Evolving workforce

- Safety implications of major workforce shift worldwide
- Older workers nearing retirement at higher risk for musculoskeletal injuries
- Younger, less experienced workers more prone to injury

Machinery downtime

- Downtime for jams, misfeeds, adjustments, changeovers and maintenance
- Minimal visibility of downtime information
- No context of downtime issues (workers interaction, machinery fault, shift patterns)
- Limited information to remedy issues

Regulatory compliance

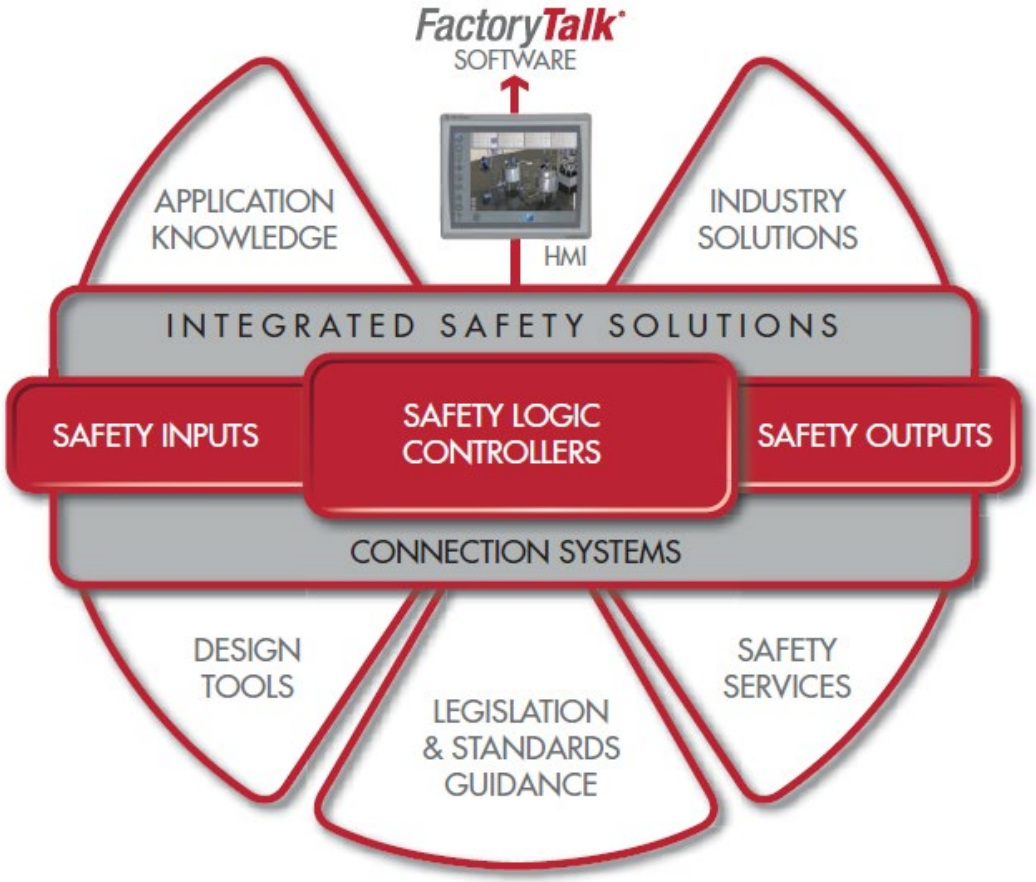
- Compliance with industry standards can be challenging
- Documenting and reporting on approved safety systems can be challenging

Data management

- Continuing reliance on outdated data collection and reporting methods
- Safety data often manually entered for inspections, compliance logs, incident reports, training and other processes
- Systems in which data is stored typically not connected to plant floor systems

Smart Safety – Enabling Smarter Machines and Equipment

Benefits of a Smart Safety Solution



Improve insight into worker behaviour and compliance
By incorporating safety information into EHS management systems, day to day discrepancies between policies and operating procedures can be identified

Enhance safety
Connecting people, equipment and worksites creates new opportunities to enhance worker and environmental safety, including remote access, operations visibility, worker locating and information delivery via mobile devices.

Reduce safety-related downtime
Better visibility into safety-system performance and stoppages can help determine the root cause of shutdowns. Safety and production data also can be combined to understand the frequency, duration, time and location of safety-related shutdowns.

Improve compliance
The safety data required for compliance and reporting purposes is largely collected through time-consuming, error-prone manual audits today. By integrating auditing functions into the HMI and controller, organisations can automate and speed up the auditing process, free up personnel to focus on other priorities, and reduce the likelihood of errors.

POLL QUESTION #1

Do you believe your machine's productivity is enhanced or diminished by your existing safety system?

a) Productivity is **enhanced** by existing safety system
b) Productivity is **diminished** by existing safety system

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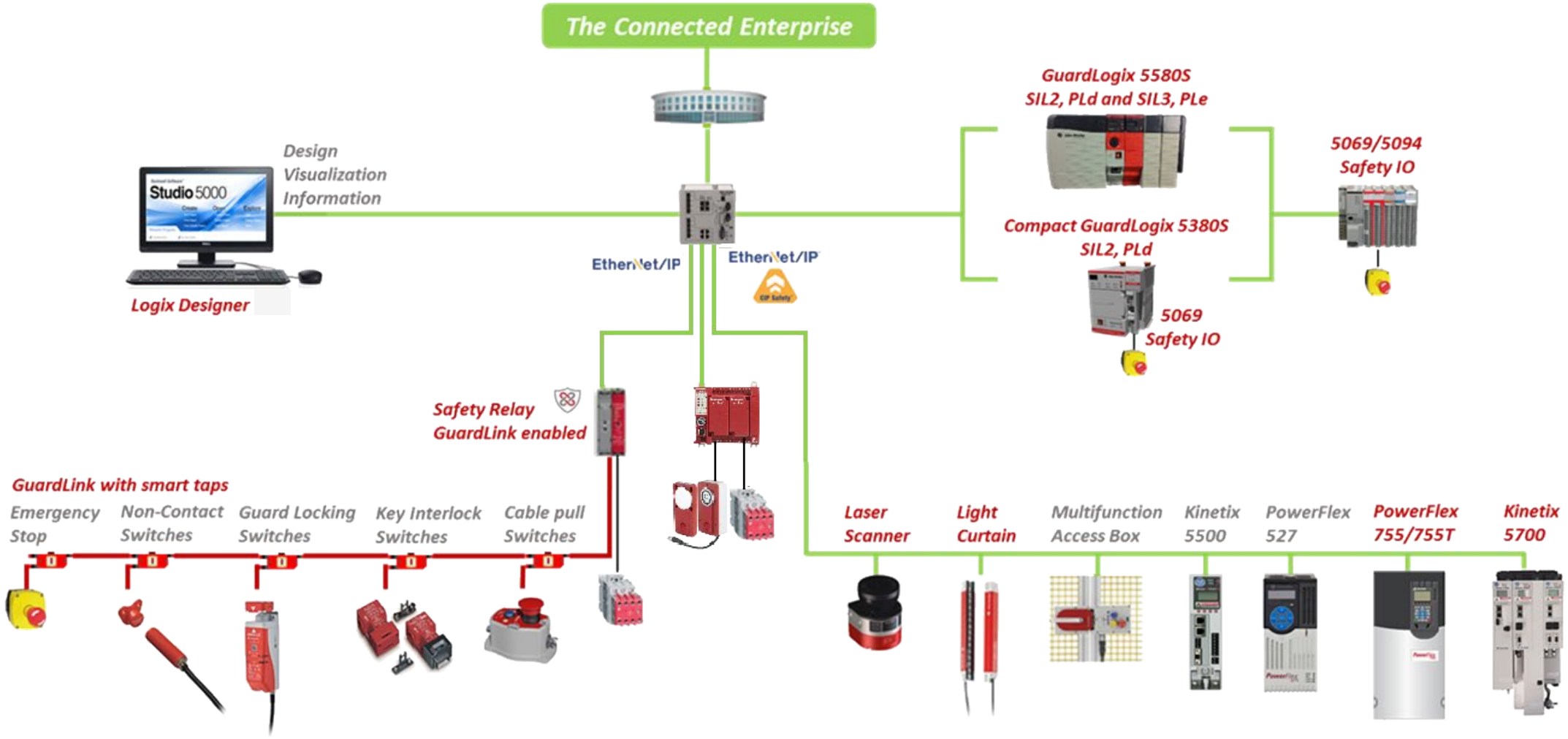
Smart Safety and the Connected Enterprise

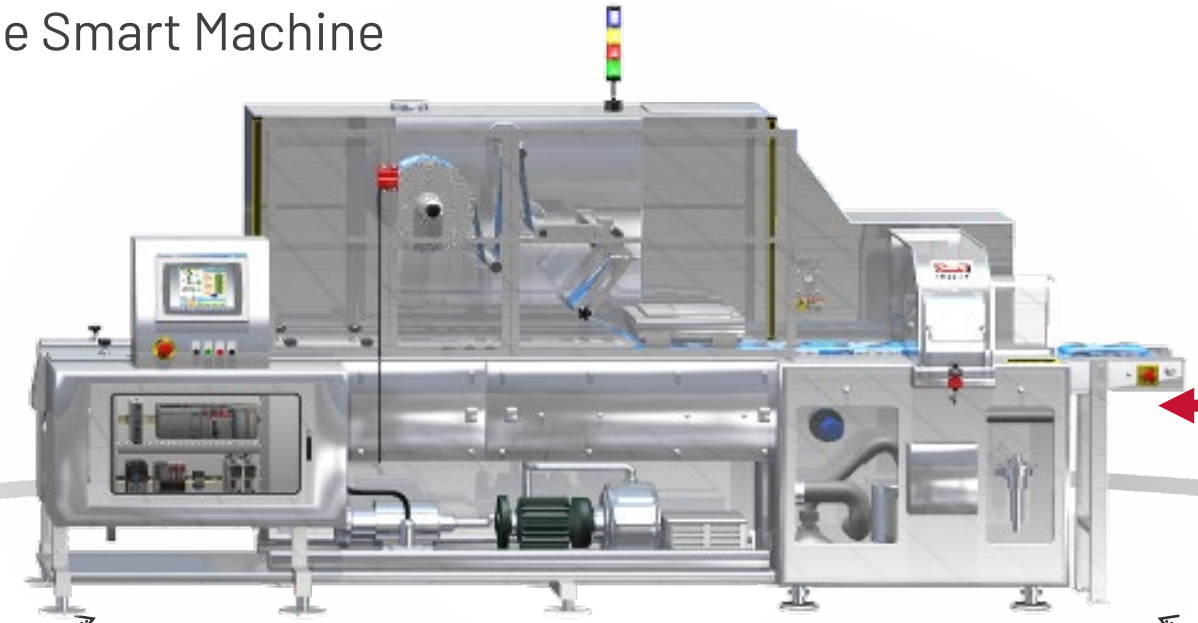
Smart Machine Architecture

Safety Integrated into The Connected Enterprise



Smart Machines & Equipment

Safety Integrated into the Smart Machine



Real-time Data

Status of all Safety Devices

Information

CONTEXTUALIZATION

Light Curtain becoming misaligned

Knowledge

ANALYTICS

Light Curtain beam intensity status on HMI

Optimize

ACTION

Perform maintenance during scheduled downtime

TECHNOLOGY + **PROCESS** + **PEOPLE**

The Smart & Safe Machine

Performance

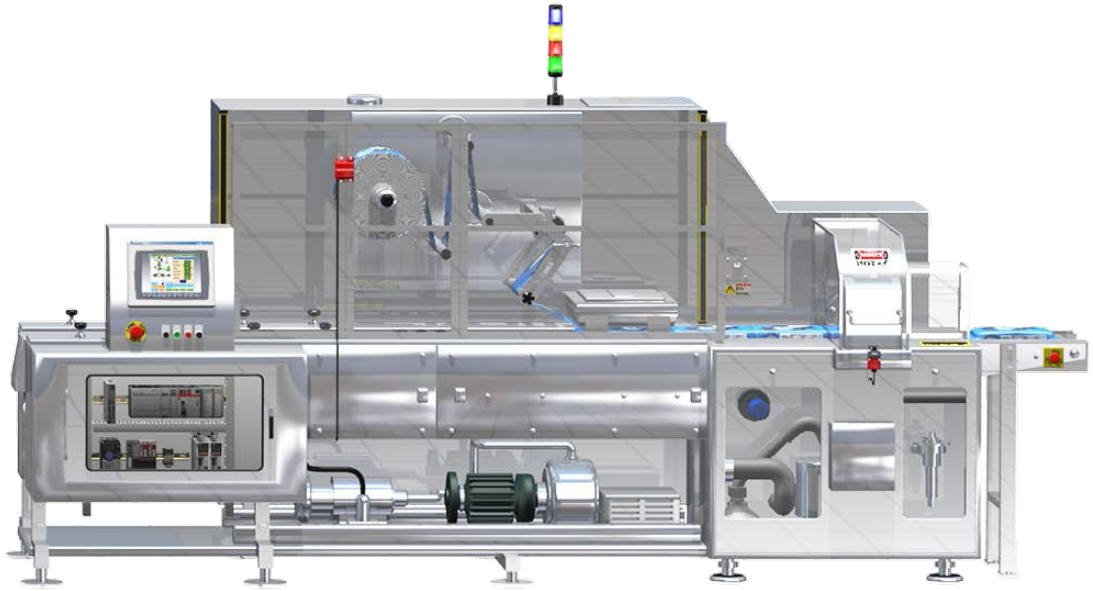
- Production Forecasting
- Downtime Tracking / Root Cause
- Diagnostics to improve MTTR
- Cycle Time Analysis
- Energy Optimization

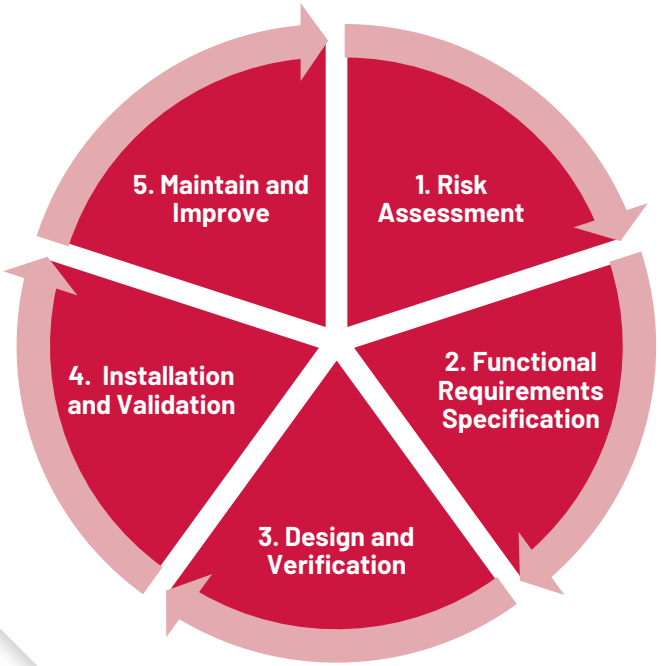
Quality

- Inline Quality Analysis – 100%
- Quality Alerts / Limit Tracking
- Real-time SPC
- Recipe / Parameter Tracking

Safety

- Procedural Compliance
- The Safety Audit process
- Safety Program Tracking
- Safety Event tracking
- Safety System Monitoring





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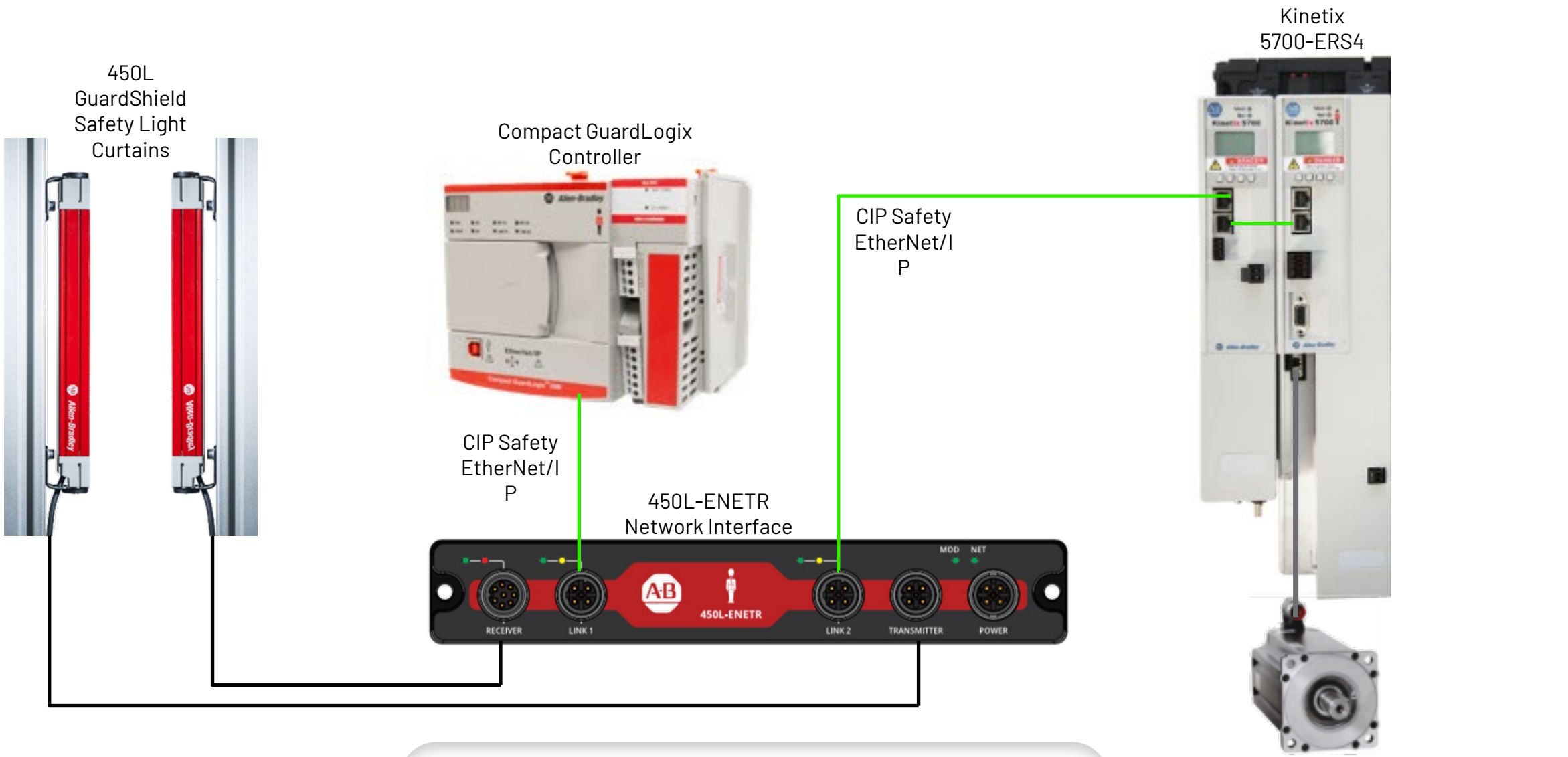
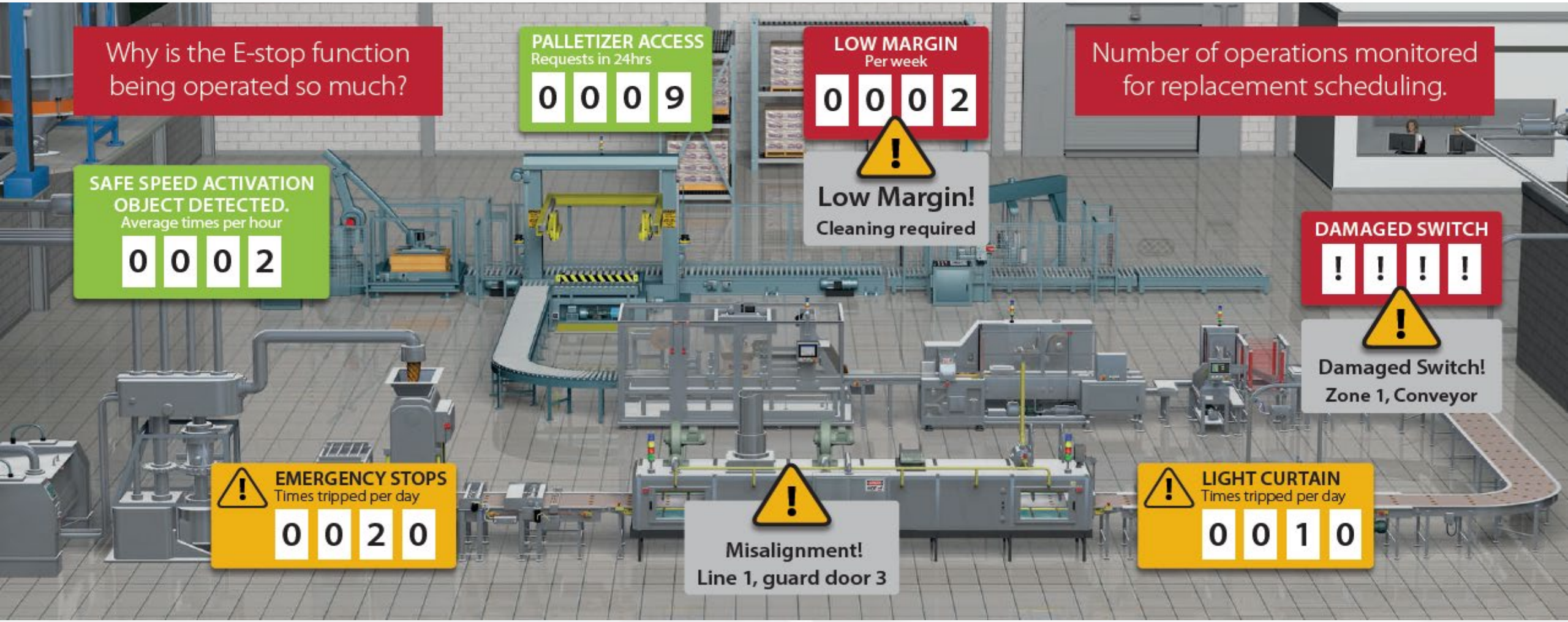
Smart Safety and Real Time Information

450L CIP Safety Light Curtain Architecture



A Smart Machine is...Real-time Information Enabled

Smart Safety Data & Diagnostics



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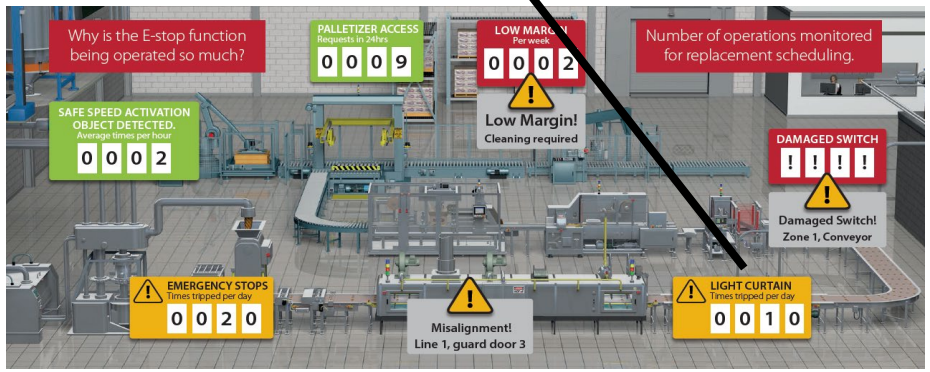
Smart Safety and Real Time Information

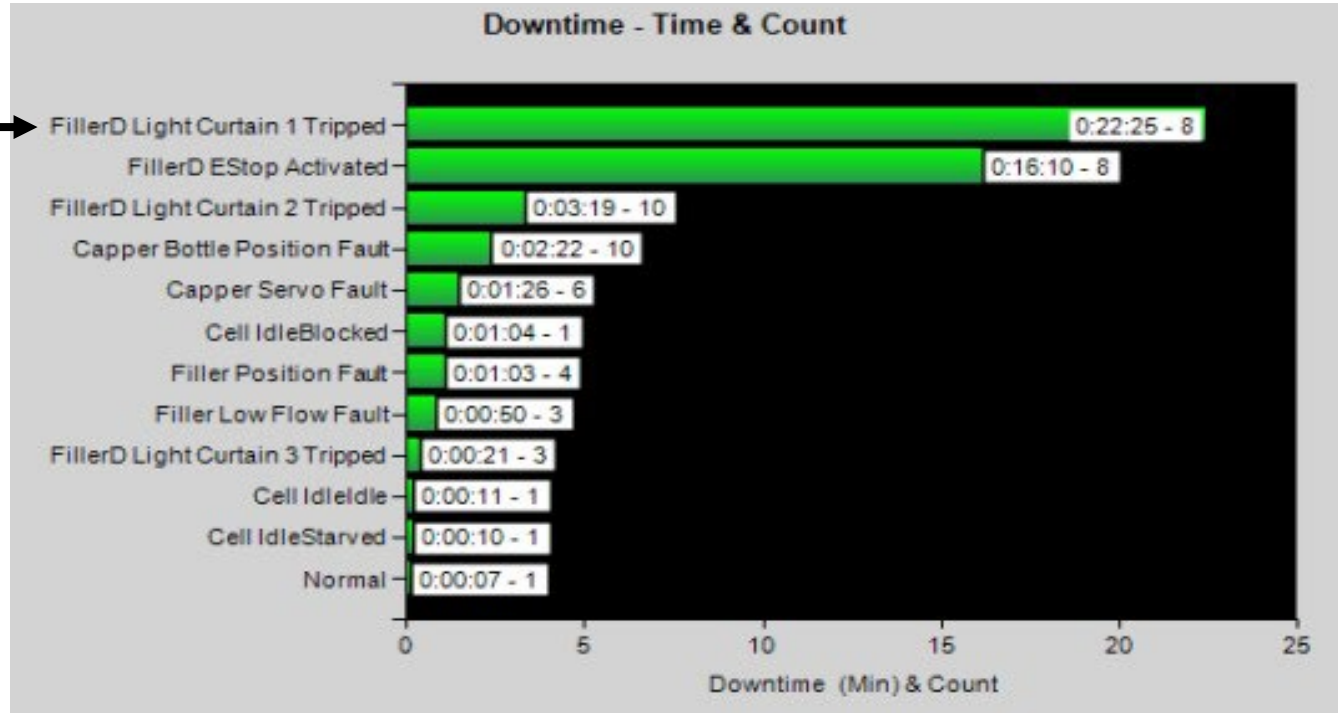
- Integration of Safety Information
- Creation of Safety Key Performance Indicators (KPI)
- Extract the Machine's Safety KPI Information in Real Time
- Establish Protocols to Monitor and Drive Actions

KPI = Key Performanc e Indicators

Real Time Information – Light Curtain Example

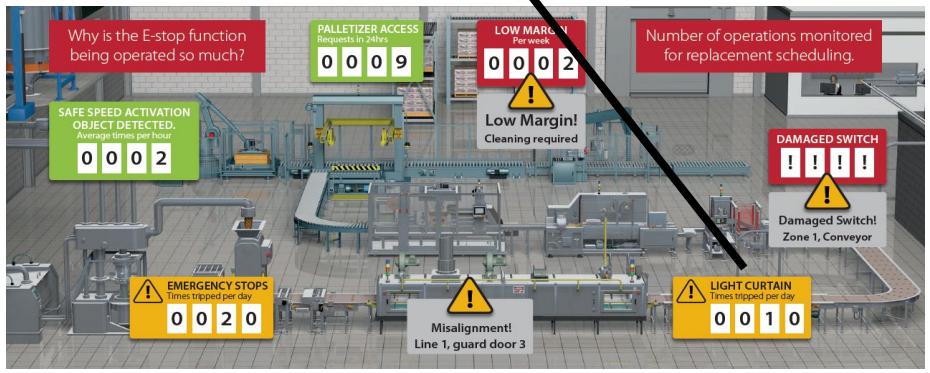
- Track higher than normal or out of range safety events.
- Monitor daily, weekly or monthly events to find trends.
- Monitor device status and performance.

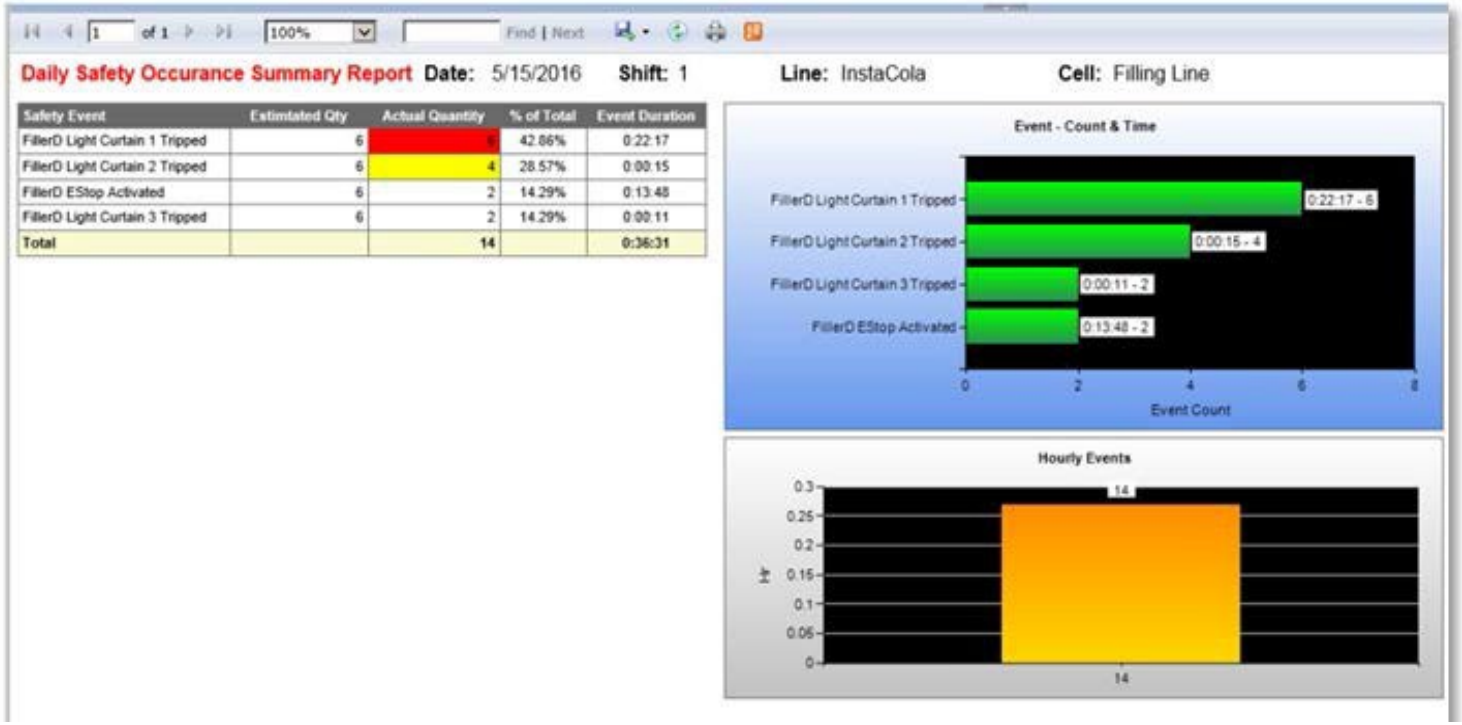




Real Time Information – Light Curtain Example

- Utilize reports to help determine the root cause of safety events
- Quantify the impact of the safety events
- Plan corrective actions





POLL QUESTION #2

Do you have safety applications where people need to interact closely with the machine?

a) Yes
b) No

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Smart Safety and Collaborative Workspace Solutions

Smart Safety and “Collaborative Workspace” Solutions

Integrated Safety Solutions Maximize Machine Efficiency and Uptime

Safe Speed

Minor machine servicing like adjustments, feeding, cleaning & wash-downs without shutting the machine down.

Safe Direction

Cleaning & adjustments without shutting the machine down. Hazard has been removed by reversing hazard causing motion.

Safe Position

Allows for interaction with equipment as long as the hazard is in a safe position/location.

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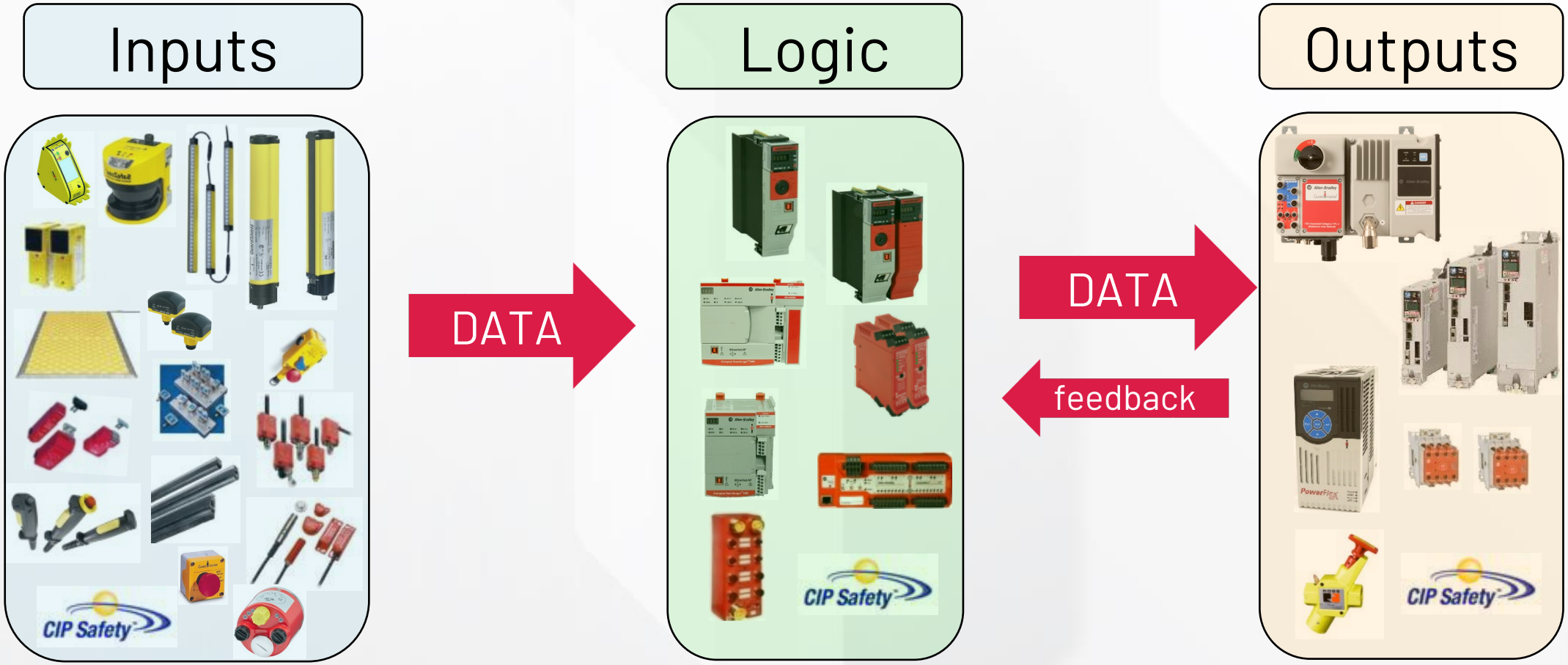
A Traditional Safety Function



Safety "DATA" is Discrete (bits) and often hard-wired

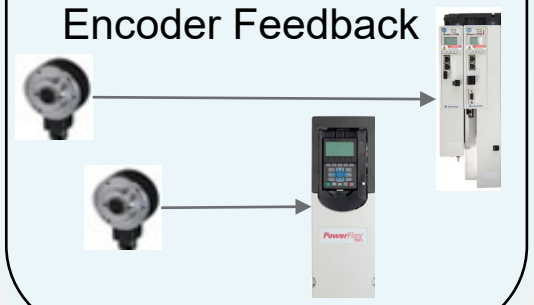
Information Enabled “Smart” Safety

Inputs

1791ES-ID2SSIR

Bulletin 843ES

Encoder Feedback



DATA

Velocity, Position

DATA

Logic

GuardLogix

Compact GuardLogix

DATA

Safe Limited Speed Setpoints

Outputs

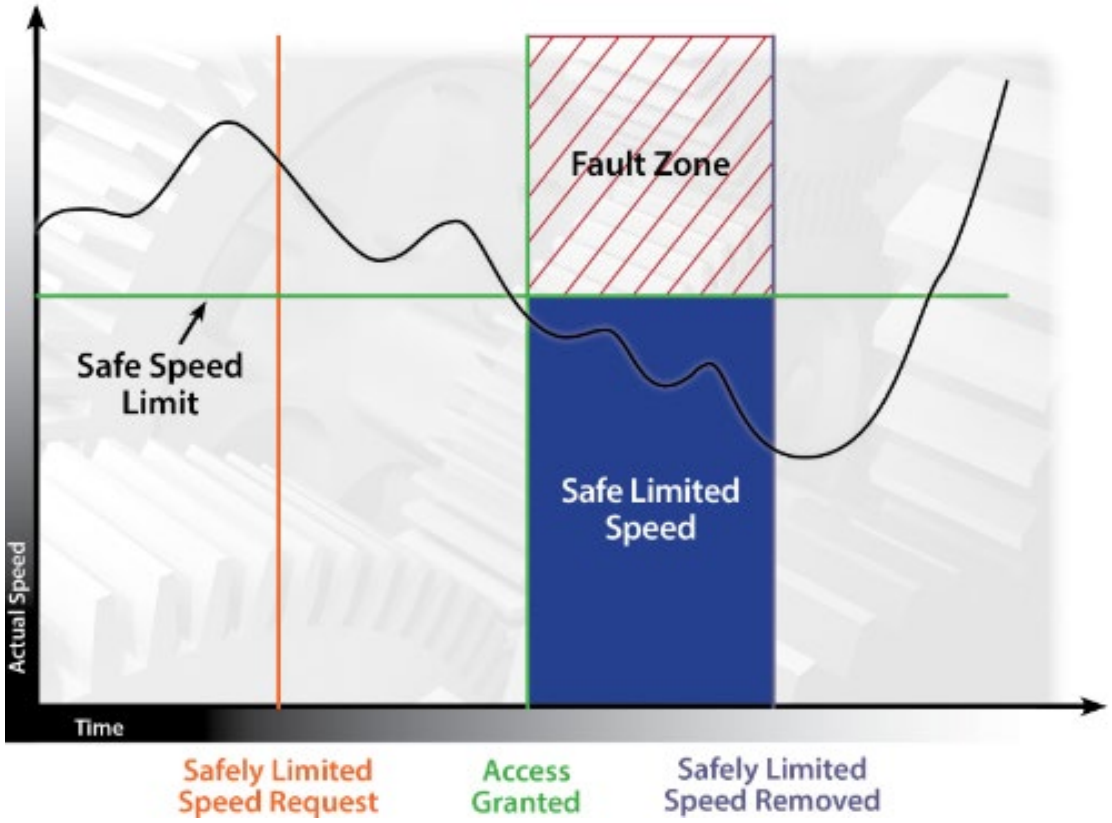
Kinetix 5700 Bulletin 2198

PowerFlex 755 Bulletin 26G

“Smart” Safety data includes VELOCITY and POSITION and is on Ethernet

Safely-Limited Speed (SLS)

- Monitors speed to safe speed limit
- Indicates when less than safe speed limit

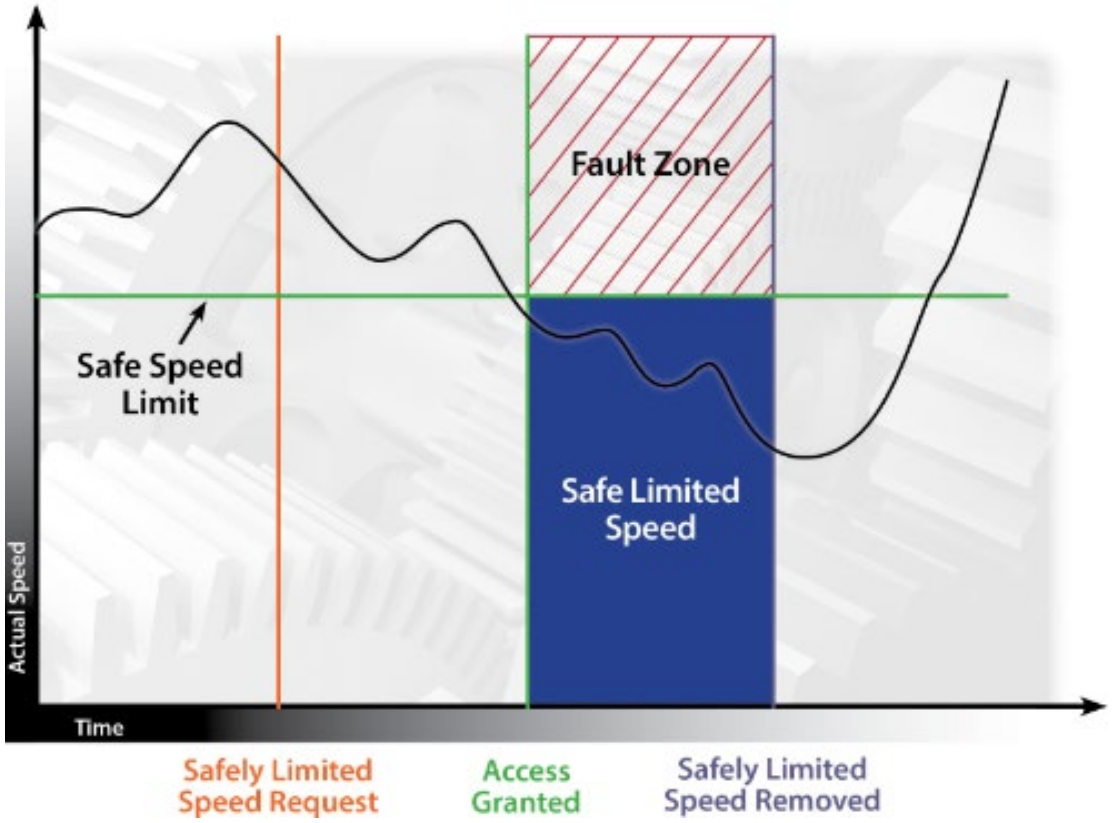


Application: machine set up / troubleshooting

- Guard door bypass: SLS and enable switch
  - Request SLS mode
  - Hold enable switch
  - Open guard door
  - Jog machine below SLS

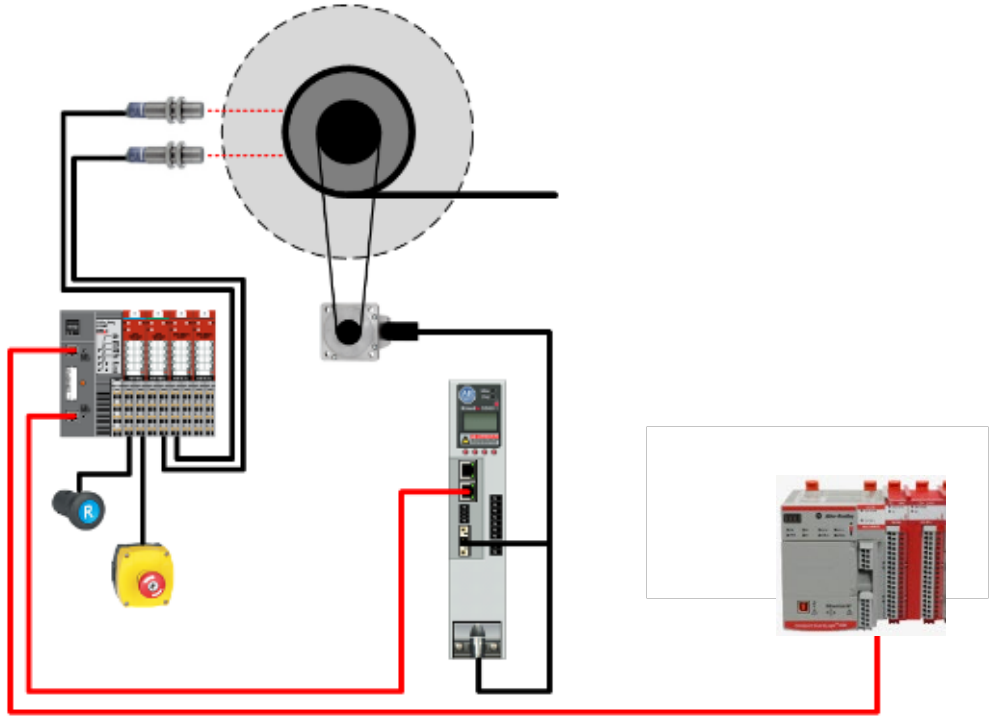
Safely-Limited Speed (SLS) – dynamic setpoint

- Monitors speed to safe speed limit
- Indicates when less than safe speed limit



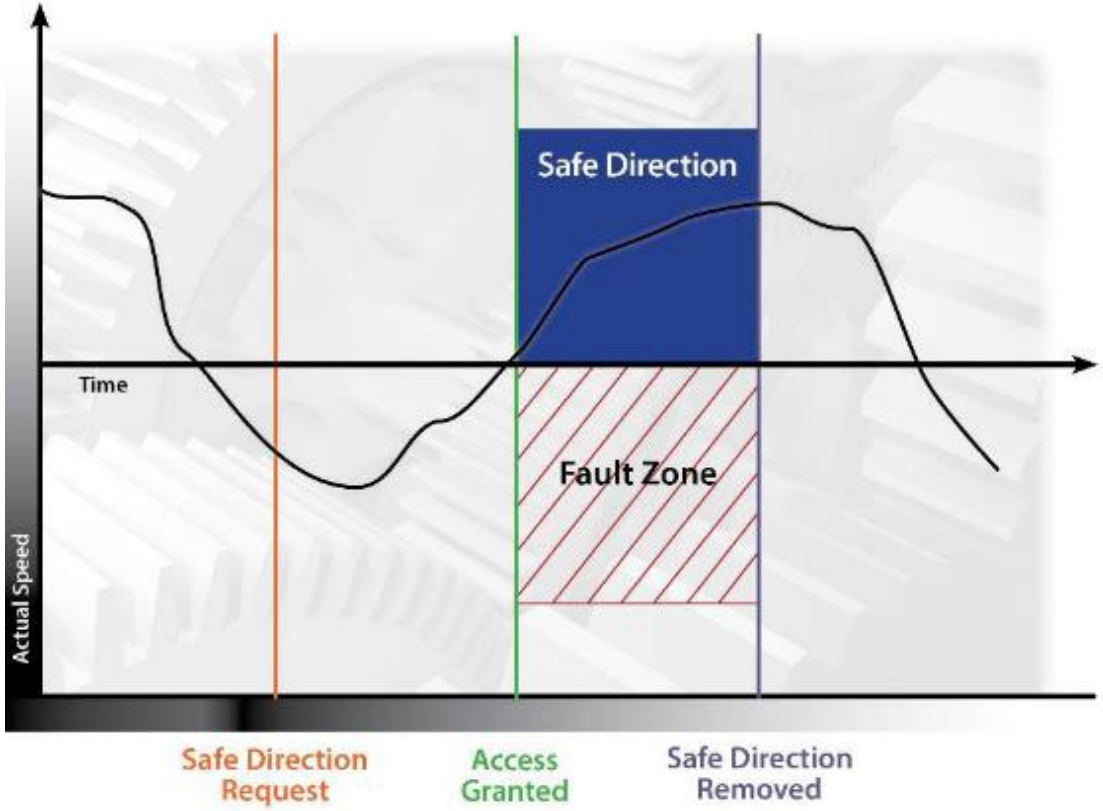
Application: threading – material unwind

- Guard door bypass: SLS & enable switch
  - Historically: fixed limited speed setpoint
  - GuardLogix® controller allows changing



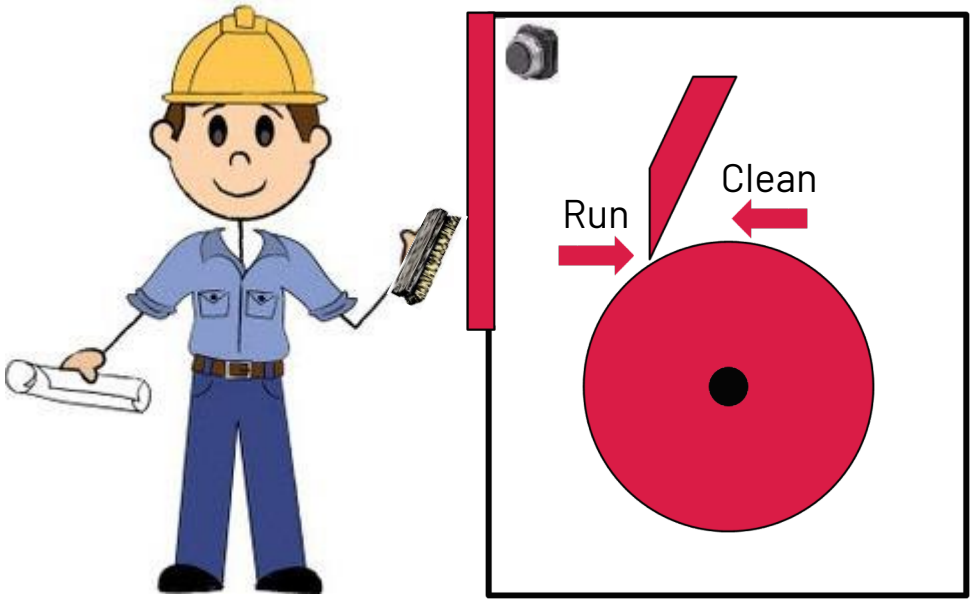
Safe Direction (SDI)

- Prevents unintended motor shaft direction
- Operation is allowed only in Safe Direction



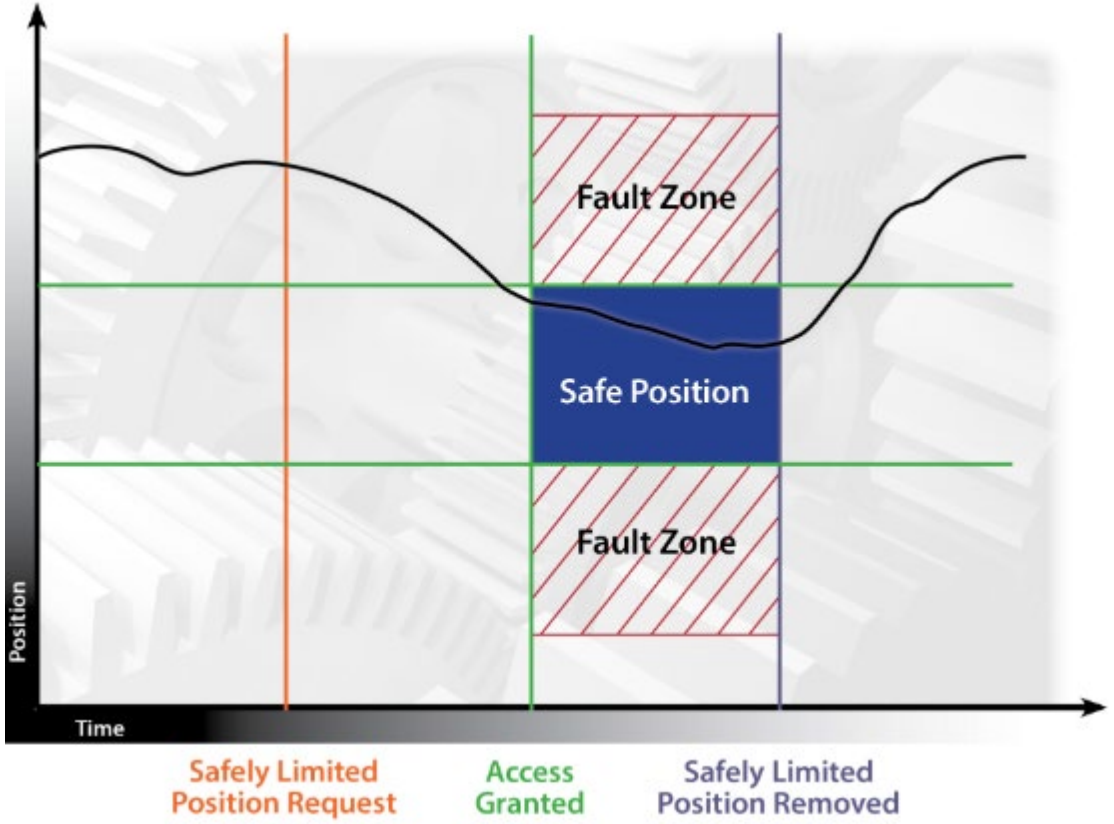
Application: machine cleaning

- Guard door bypass: Safe Direction
  - Cleaning mode selects Safe Direction
  - Safe limit speed also applied
  - Hold to run control



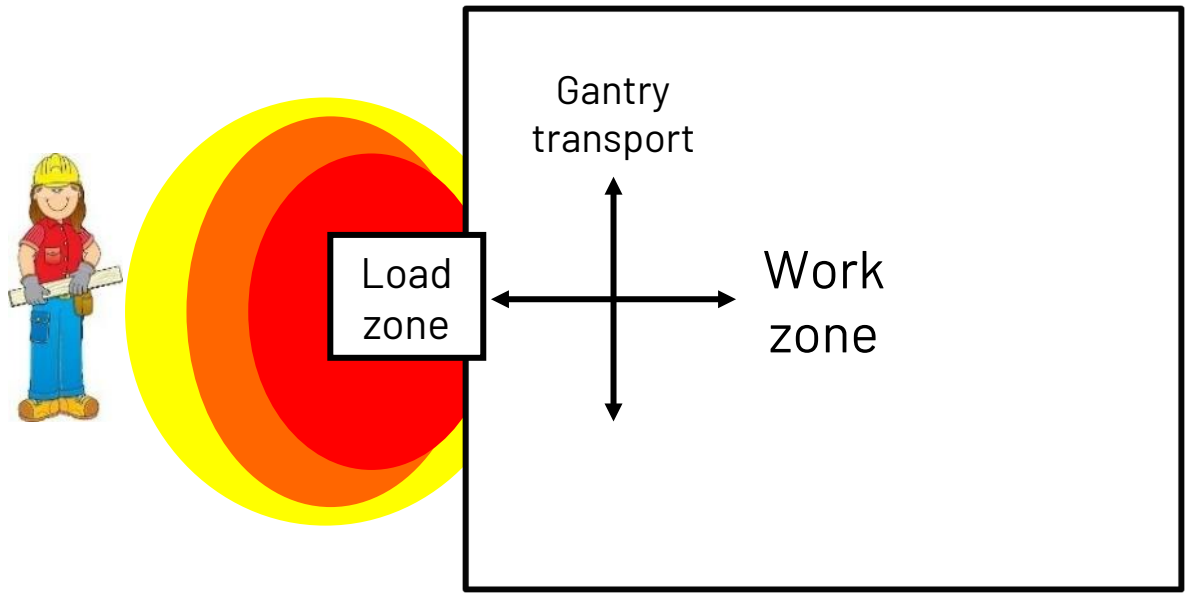
Safely-Limited Position (SLP)

- Monitors position: between two limits
- Indicates when in safe position window



Application: machine parts loading

- If gantry is in safe position, continue operation while operator loads part



Speed / Position monitoring system – SCALABLE PLd or PLe

PLd

Compact GuardLogix® 5380-S2 controller

OR

GuardLogix® 5580 controller

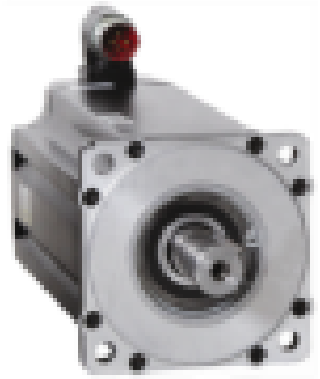
PLe

Compact GuardLogix® 5380-**S3** controller

OR

GuardLogix® 5580 controller with **safety partner module**

Many options for bringing in Speed/Position data



Kinetix 5700-ERS4

Kinetix® 5700
ERS4 drive

VPL motor with SIL2/PLd
safety rated encoder

OR

Kinetix® MP motor with “M” or “S”
encoder (absolute – Sin/Cos)

VPL motor with SIL2/PLd
safety rated encoder

AND

842HR Sin/Cos encoder

Speed monitoring PLe
Position monitoring PLd limited

PowerFlex 755

PowerFlex® 755 and 755T drives

20-750-DENC-1		20-750-UFB-1
 Quadrature encoder	**OR**	 Sin/Cos
 Quadrature encoder **AND**  Quadrature encoder	**OR**	 Sin/Cos **AND**  Quadrature encoder

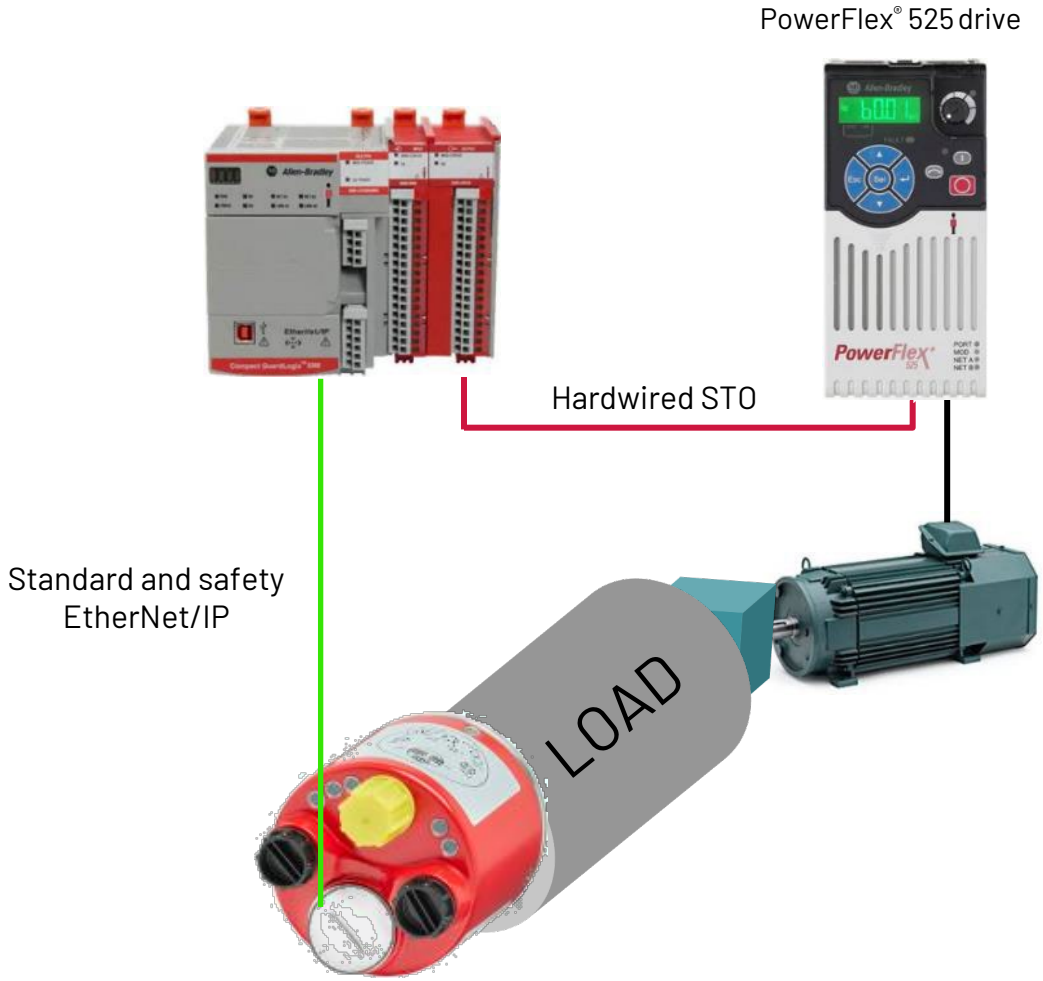
1791ES Safety Interface for Encoders

1791ES encoder interface module

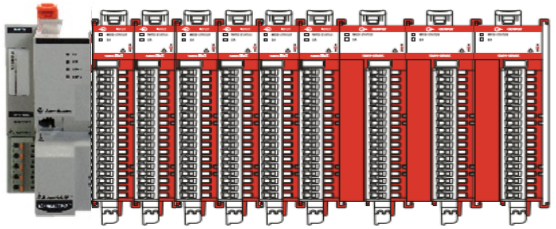
Channel 0	Channel 1
Sin/Cos or Hiperface	None
Sin/Cos or Hiperface	A quad B
	SSI
A quad B	A quad B
	SSI
SSI	A quad B
	SSI

1791es-um002; Table 2

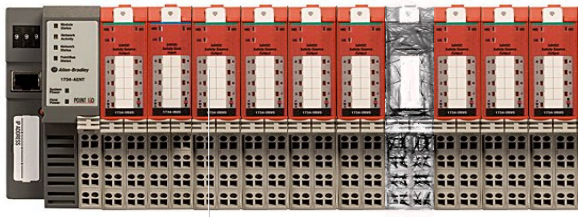
Speed and position control system
Now: 843ES CIP Safety encoder



New Options for Safety I/O

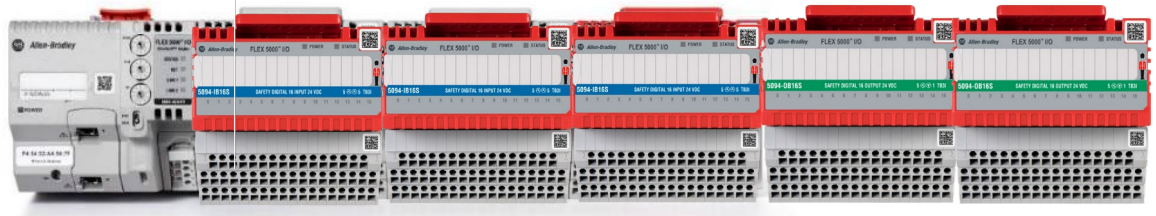


Compact 5000™ I/O



Point™ I/O

1756 ControlLogix® I/O



FLEX 5000™ I/O

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Summary & Safety Resources

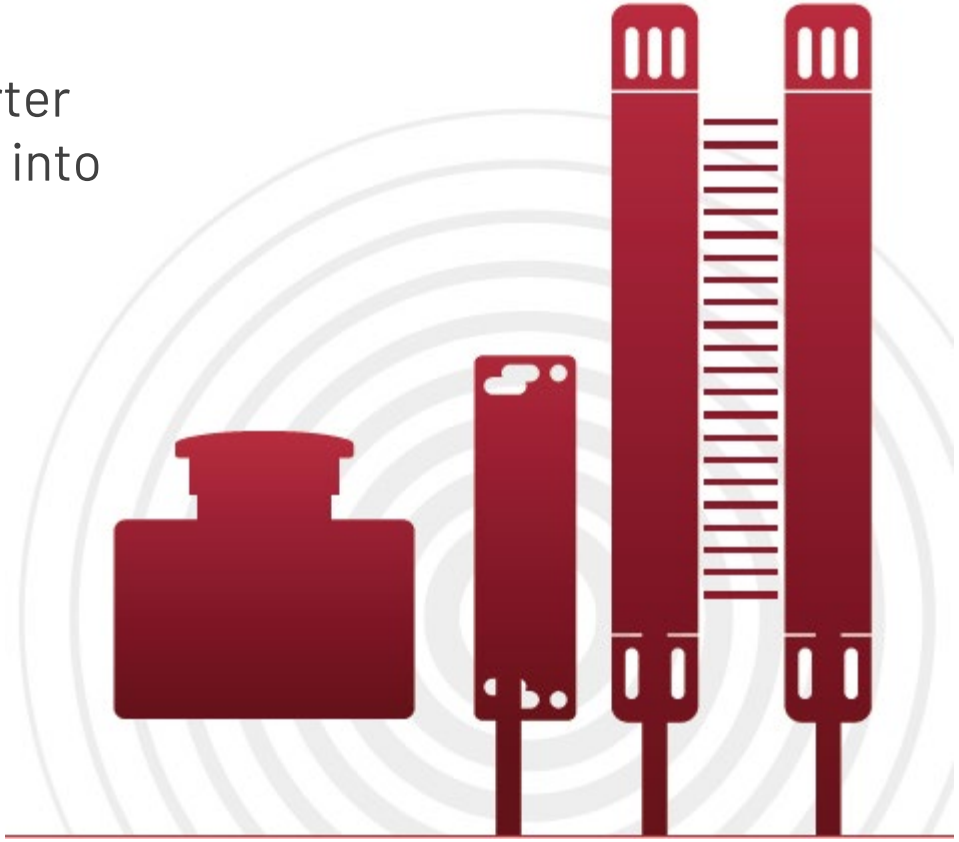
Summary

Manufacturers face many challenges when balancing machinery safety and productivity.

Machine Builders can differentiate themselves by enabling smarter machines to harness the safety system data and transforming it into meaningful information.

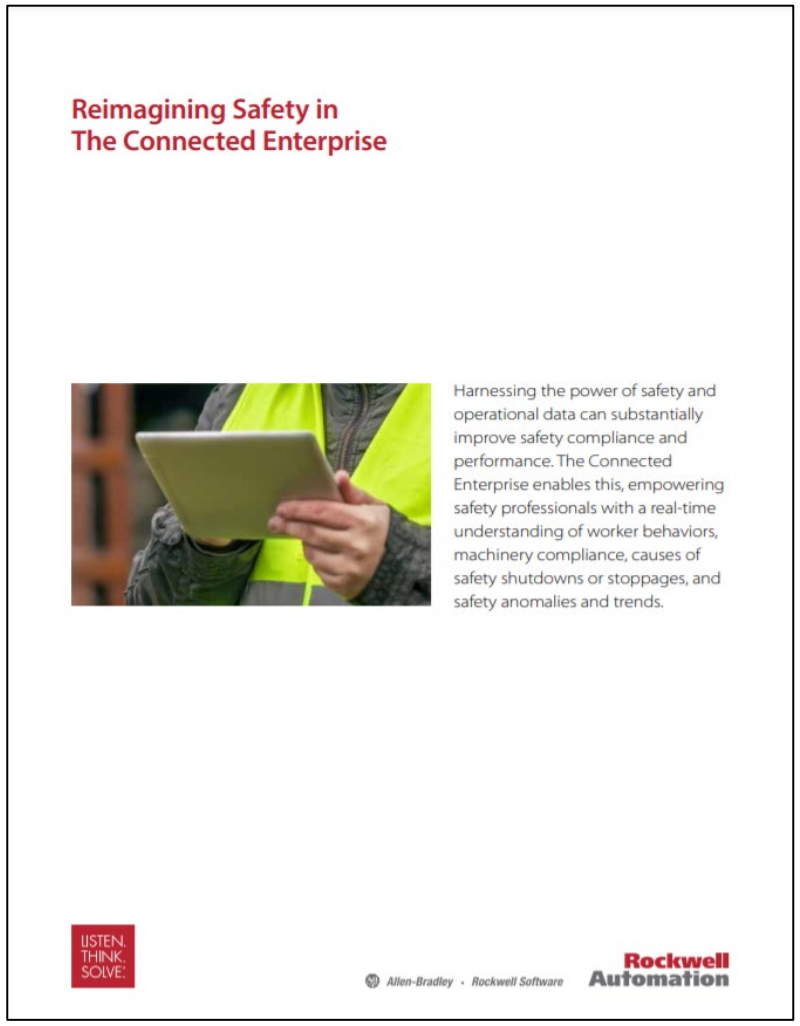
Benefits of integrating Smart Safety Solutions:

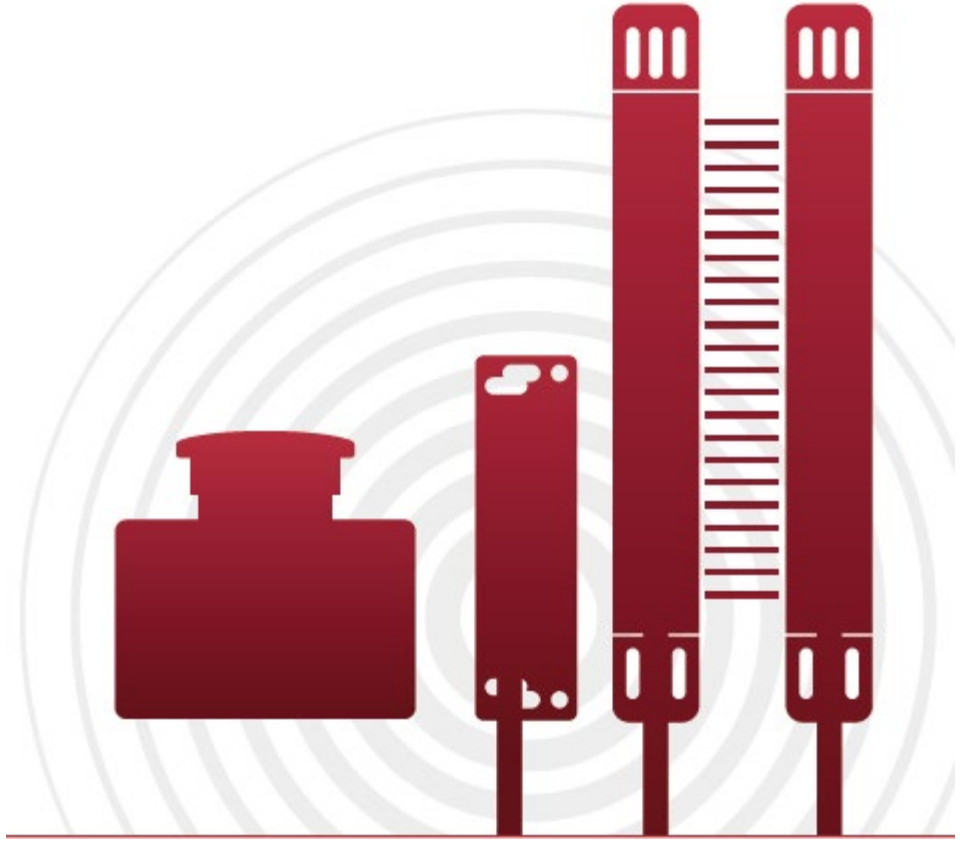
- Improve insight into worker behavior
- Enhance worker safety
- Reduced safety-related downtime
- Improve regulatory compliance



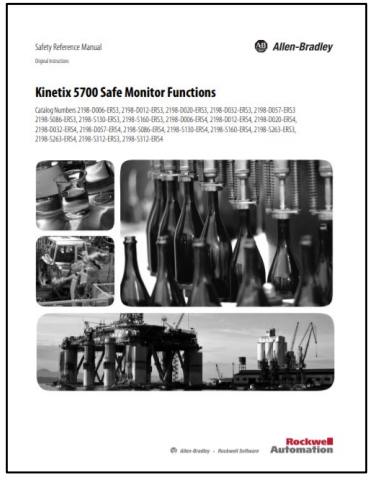
Summary

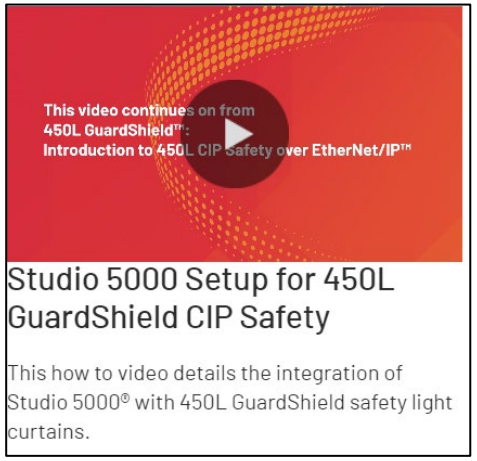
Whitepaper: Reimagining Safety In the Connected Enterprise (Safety-WP034)

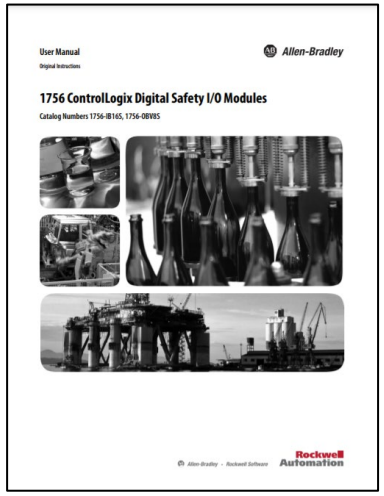


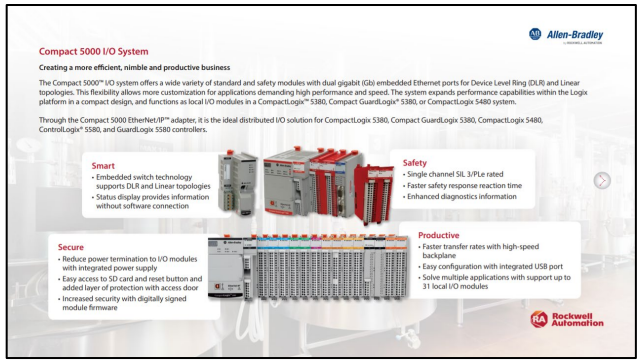


Safety Tools and Resources









Q&A