



**Rockwell  
Automation**

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# Innovation & Technology Forum

Smart Devices: Helping Design Operate and Maintain  
The Connected Enterprise: T09

**Peter Madarász**

Commercial Engineer

# The market is changing

Flexible systems that change more often

Increased collaboration between people and machines

Analytics evolution

Pressures to maximize OEE

Demand for Information everywhere

# THE CONNECTED ENTERPRISE

ROCKWELL AUTOMATION'S VISION FOR SMART MANUFACTURING

**SMART  
PLANTS**

**SMART  
MACHINES &  
EQUIPMENT**

**SMART  
DEVICES**



I/Os



Actuators



Intelligent Motor Control



Automated Control Systems



Terminals



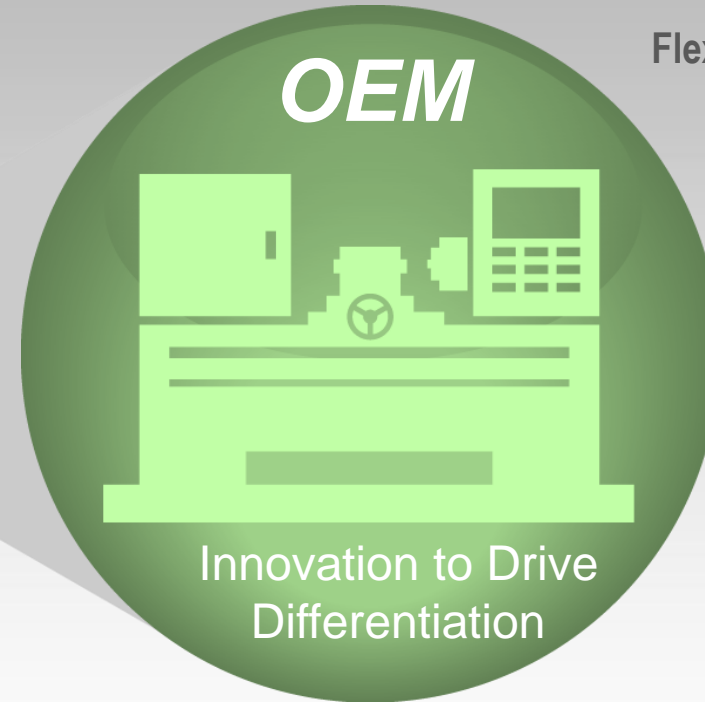
Audio



Security



# BUSINESS DRIVERS



Faster Time to Market

Improved Asset Utilization

Enterprise Risk Management

Lower Total Cost of Ownership

Flexibility

Integration & Standardization

Performance/OEE

After Market Service & Support

Total Cost to Design, Develop & Deliver

**SMART  
MANUFACTURING**

**SMART  
MACHINES & EQUIPMENT**

# SMART DEVICES

## Variable Frequency Drives

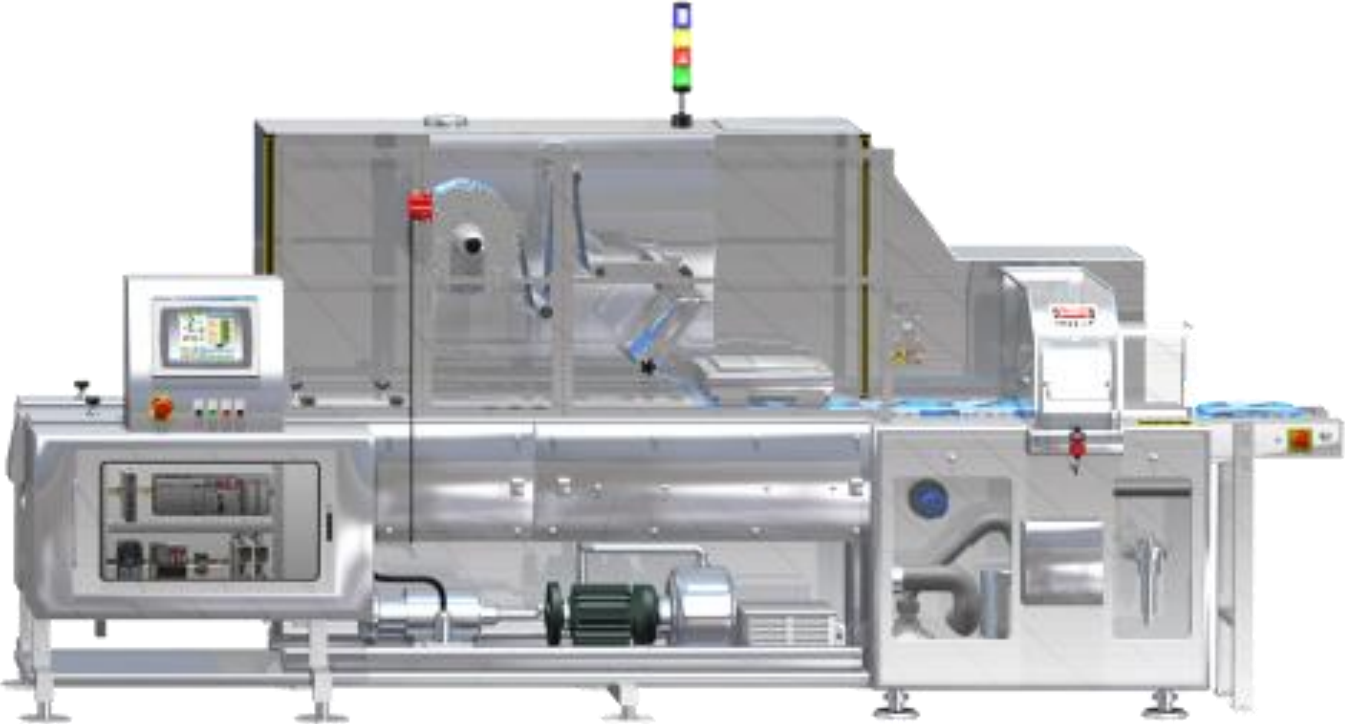


PowerFlex® AC Drives

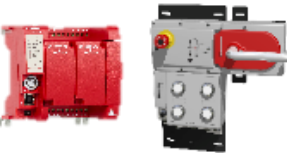
## Servo Drives



Kinetix® Motion



## Smart Safety



Guardmaster® Safety

## Smart Sensors



Photo, Pressure & Proximity Sensors

## Smart Motor Starters



SMC™ Soft Starter

## Smart Motor Protection



E300™ Overload Relays

## Smart Power Monitoring



PowerMonitor™ Energy Monitor

## Condition Monitoring



Dynamix™ 1444 Condition Monitor

# What makes Devices Smart?

Device  
information  
and  
diagnostics

Enabling  
technologies

Outstanding  
customer  
experience

Designed  
for analytics

# What makes Devices Smart?

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# Device Information and Diagnostics

- The best information is the one created at the source
- The more diagnostics/device information the higher the value
  - Integrated device-specific warnings and alarms
  - Device-specific tags and user-friendly configuration
  - Application-based diagnostics (duty cycle, power usage, target drift, etc.)
  - Smarter linking technologies
- Core enabler of frictionless customer experience



We continue to improve the portfolio of Smart Devices so they provide enhanced device and process-specific information and diagnostics

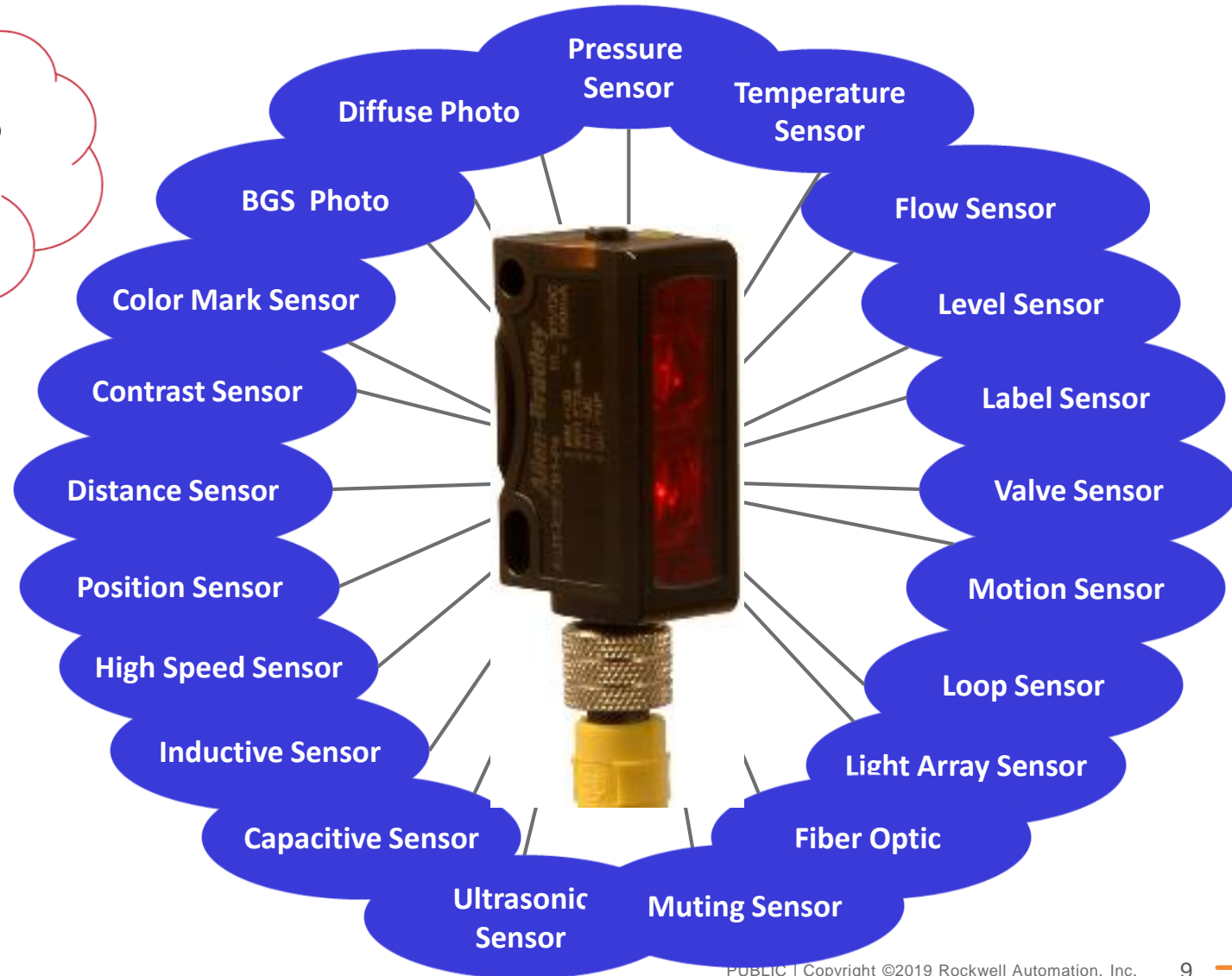


# Which Sensor is the most critical ?

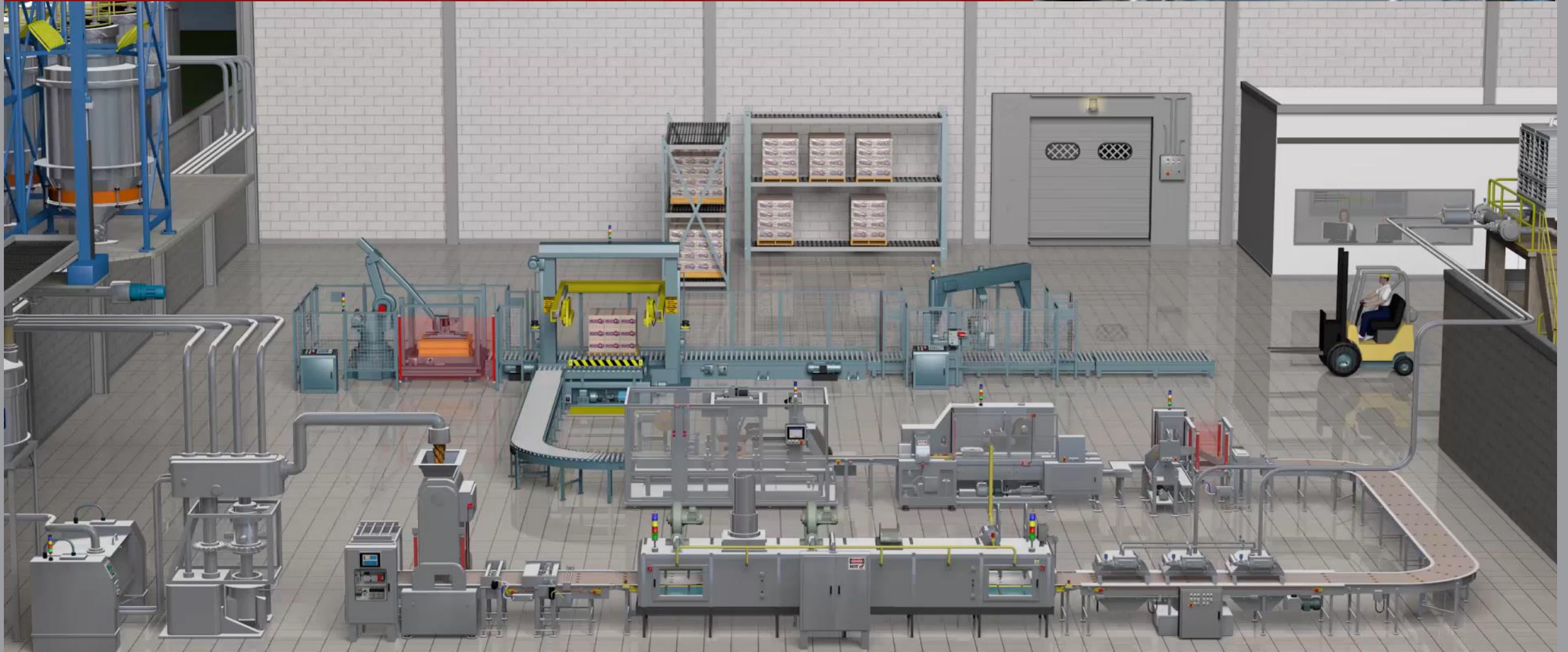
Is there a sensor problem we are running into ?

Is the right setup loaded ?

- What is the actual sensor status they are operate right now !
- How can we identify if a sensor is working on the edge?
- Conventional sensors do not offer any diagnostic data nor parameter data to be exchanged with a controller



*With Smart Sensors available for pressure, temperature, distance, motion, level and flow - it is possible to get a comprehensive view of your process. Knowledge of current sensor situation and status also ensures timely identification of any type of potential sensor issue.*



# Sensors – The Eyes & Ears of the Factory !



## Cost of Sensors

- Multiple sensing technologies to set up and maintain
- Re-Teaching for every production change over
- Analog signal converting
- Replacement of damaged sensors
- Installation and wiring
- Machine commissioning
- Failure analyze
- Many sensor variants



## Why Sensors fail

- Margin getting low due to dust
- Mechanical damages during production
- Wrong setup or unintended teach
- Cable break
- Swapped sensor cable
- Material or target change during a production change over
- Contamination
- Component failure
- Short circuit



## Cost of downtime

- Loss of production
- Manufacturing scrappage
- Establishing cause of failure (Mechanical/Electrical)
- Sensor replacement costs
- Safety issues
- Impact on other equipment



## Increase productivity

- Reducing unplanned downtime improves productivity
- Be in control of your production process
- Make fact based decisions with advanced diagnostic information
- Faster production change over due to multiple sensor profiles
- Faster device change over due to auto device configuration



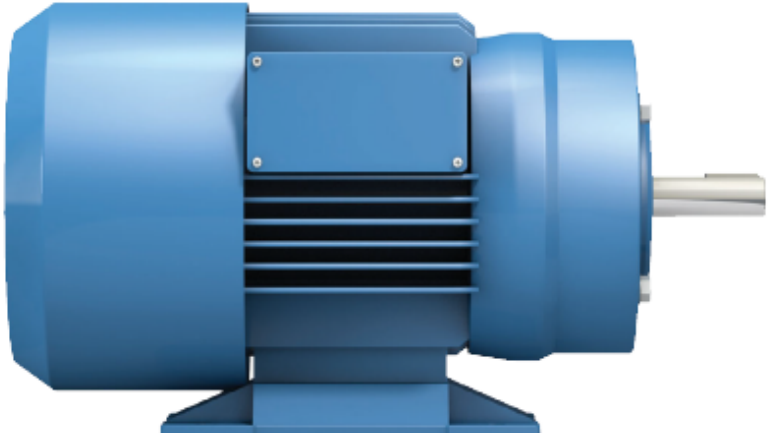
## Maintenance options

- Advanced diagnostic information
- Preventative not reactive maintenance
- Planned downtime possible
- Be in control of your plant
- Reduced maintenance costs

*Integrated Smart Sensor Solution provides mix. 5-10% production increase*

# Smart Motor Control

**75%**  
*of motor failures could be prevented by appropriate protection measures*  
Source: IEEE Petro-Chemical Paper PCIC-94-01



### Today's smart Approach

- Seamless communication and system visibility for increased performance and flexibility
- Control & maintain motor performance through smart equipment and networks
- Reduce unplanned downtime with alarms and advanced diagnostic information
- Monitor energy consumption
- Simplify troubleshooting and reduce startup times

- % Thermal Capacity Utilisation
- Trip / Warning Histories
- Current
- Voltage
- Time to Trip
- Time to Reset
- Energy & Power
- Number of Starts
- Operational Hours

# Smart Overload Relay

- Traditional Overload Relay
  - Overcurrent condition trips relay, helping to protect the motor from damage
  - Production is down – purely reactive maintenance
- Smart Overload Relay
  - Primary function is the same
  - Network connection allows enhanced diagnostics

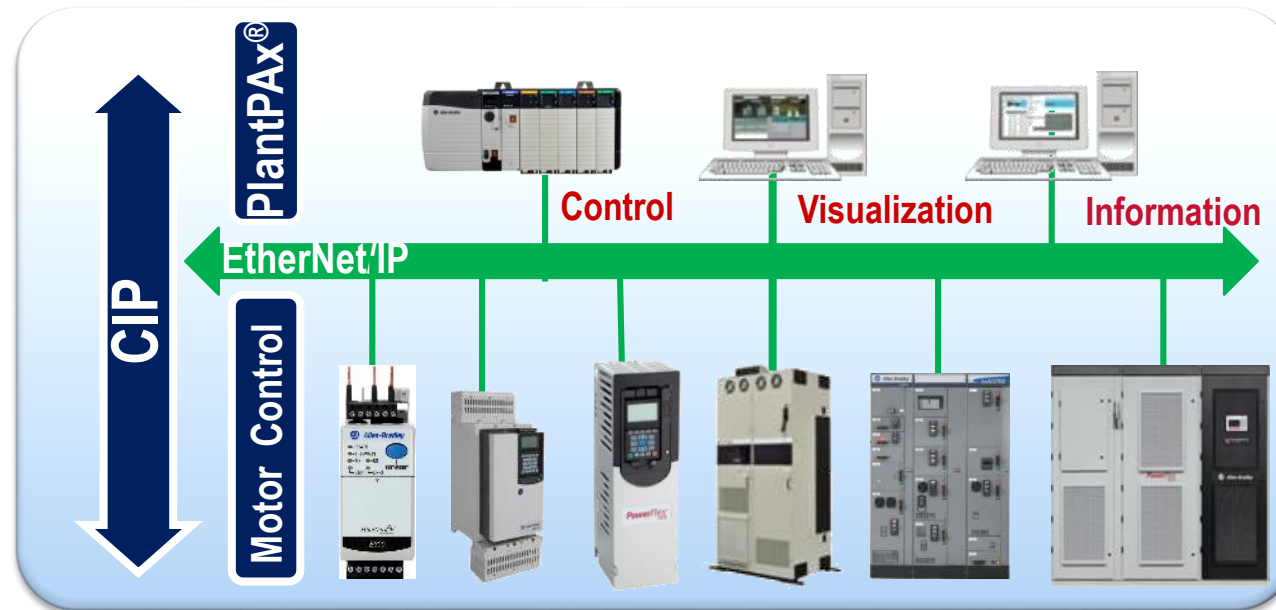


Shift from reactive maintenance to predictive maintenance

# Intelligent Motor Control

## ***The E300 is fully integrated into the Integrated Architecture®***

- Network connectivity - *Native EtherNet/IP and DeviceNet reduces hardware and engineering cost*
- Integrated into Logix – *Device profiles and faceplates reduce engineering time and project development*
- Automatic Device Configuration – *Reduces time to repair*



**Simultaneous real-time control, configuration, and data acquisition**

# Motor Diagnostics

- The E300 provides a wide variety of diagnostic information to monitor motor performance and proactively alert users to potential operational issues
- This information can trigger either manual or automatic intervention before the occurrence of an unplanned shutdown
  - Voltage, Current, and Energy
  - CIP Energy Enabled
  - Trip / Warning Histories
  - % Thermal Capacity Utilization
  - Motor Winding Temperature
  - Trip Snap Shot
  - Time to Trip
  - Time to Reset
  - Operational Hours
  - Number of Starts

The screenshot displays the Allen-Bradley E300 6In3Out24VDC VIGPt5to30Amp motor diagnostic interface. The interface is titled "E300 6In3Out24VDC VIGPt5to30Amp" and features the Rockwell Automation logo. A sidebar on the left contains a navigation menu with options: Home, Parameters, Device Monitor, Current Monitor (selected), Voltage Monitor, Power Monitor, Energy Monitor, Analog Monitor, Trip/Warn Histry, Trip Snapshot, Command, Overload Setup, Device Setup, and Options Setup. The main content area shows a "Current Monitor" tab with a table of parameters.

Parameter	Name	Data Type	Value	Unit
43	L1Current	DINT	3.29	Amps
44	L2Current	DINT	3.29	Amps
45	L3Current	DINT	0.00	Amps
46	AverageCurrent	DINT	2.20	Amps
47	L1PercentFLA	UINT	109.9	%
48	L2PercentFLA	UINT	109.8	%
49	L3PercentFLA	UINT	0.3	%
50	AvgPercentFLA	UINT	73.2	%

# E300 Communication Modules

- Consists of Three Styles
  - EtherNet/IP
  - DeviceNet
  - *Parameter Configuration Module (E200/PCM)*







**Lack of granular safety system diagnostics leads to unnecessary machine downtime**

Diagnostics are critical for quickly identifying the reason for the demand on the safety system as well as guiding operators through a quick and effective recovery





# What Makes Devices Smart?

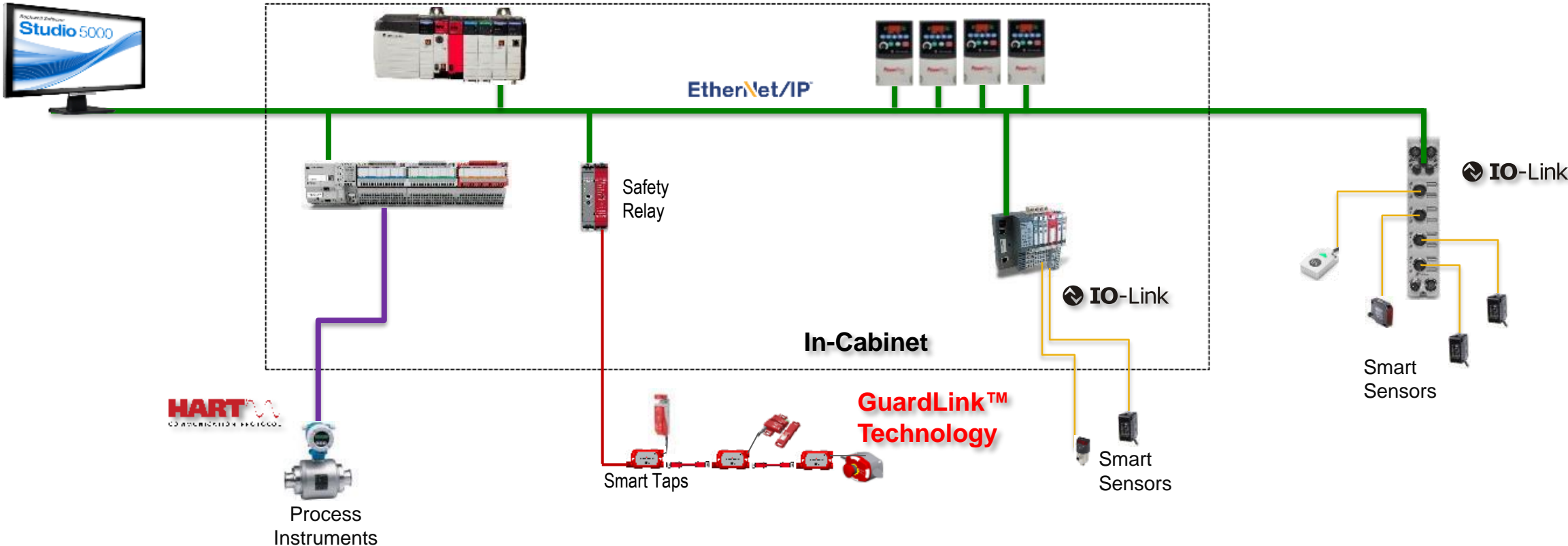
Device  
information  
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diagnostics

Enabling  
technologies

Outstanding  
customer  
experience

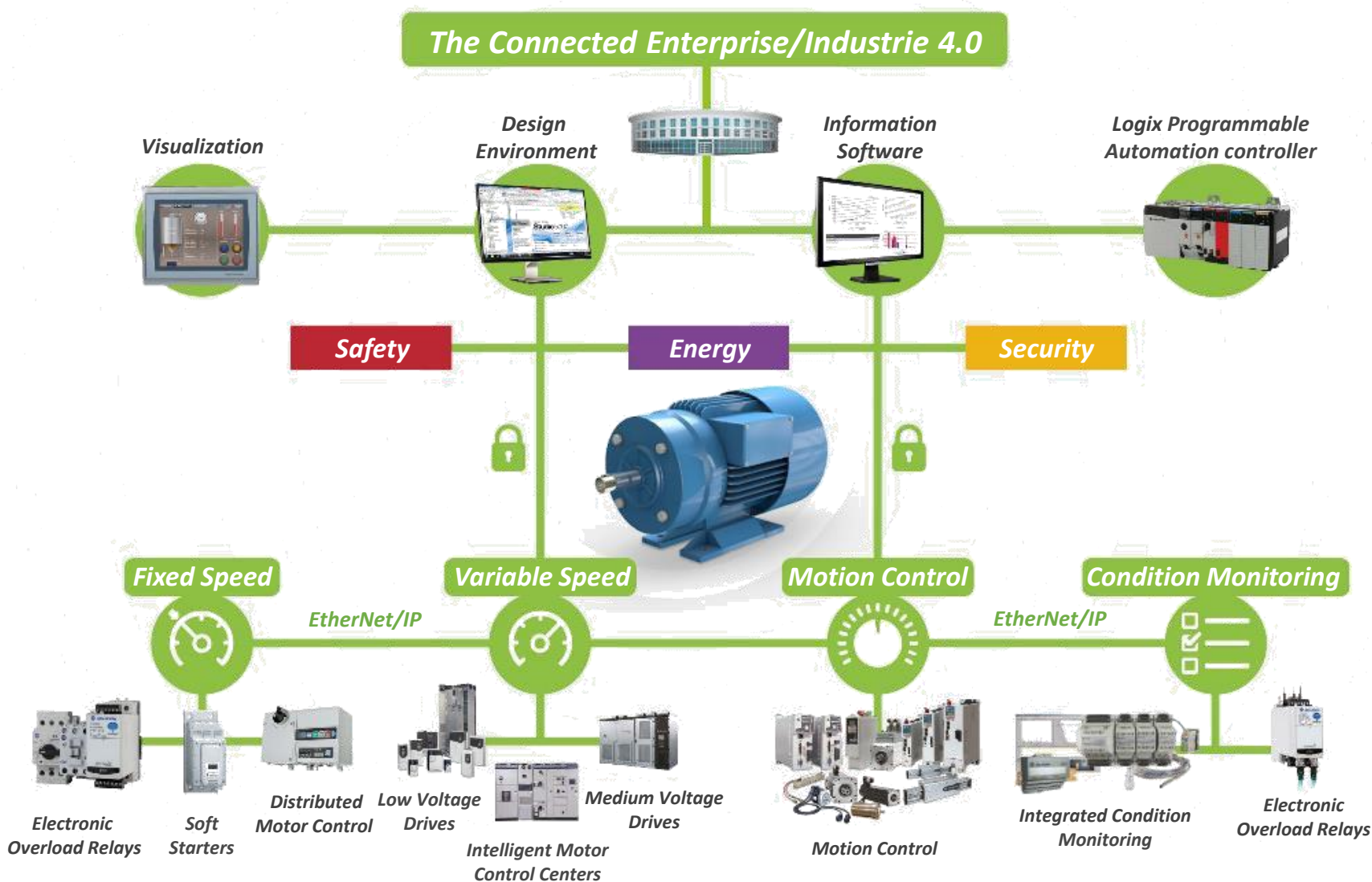
Designed  
for analytics

# Smart Device Connectivity

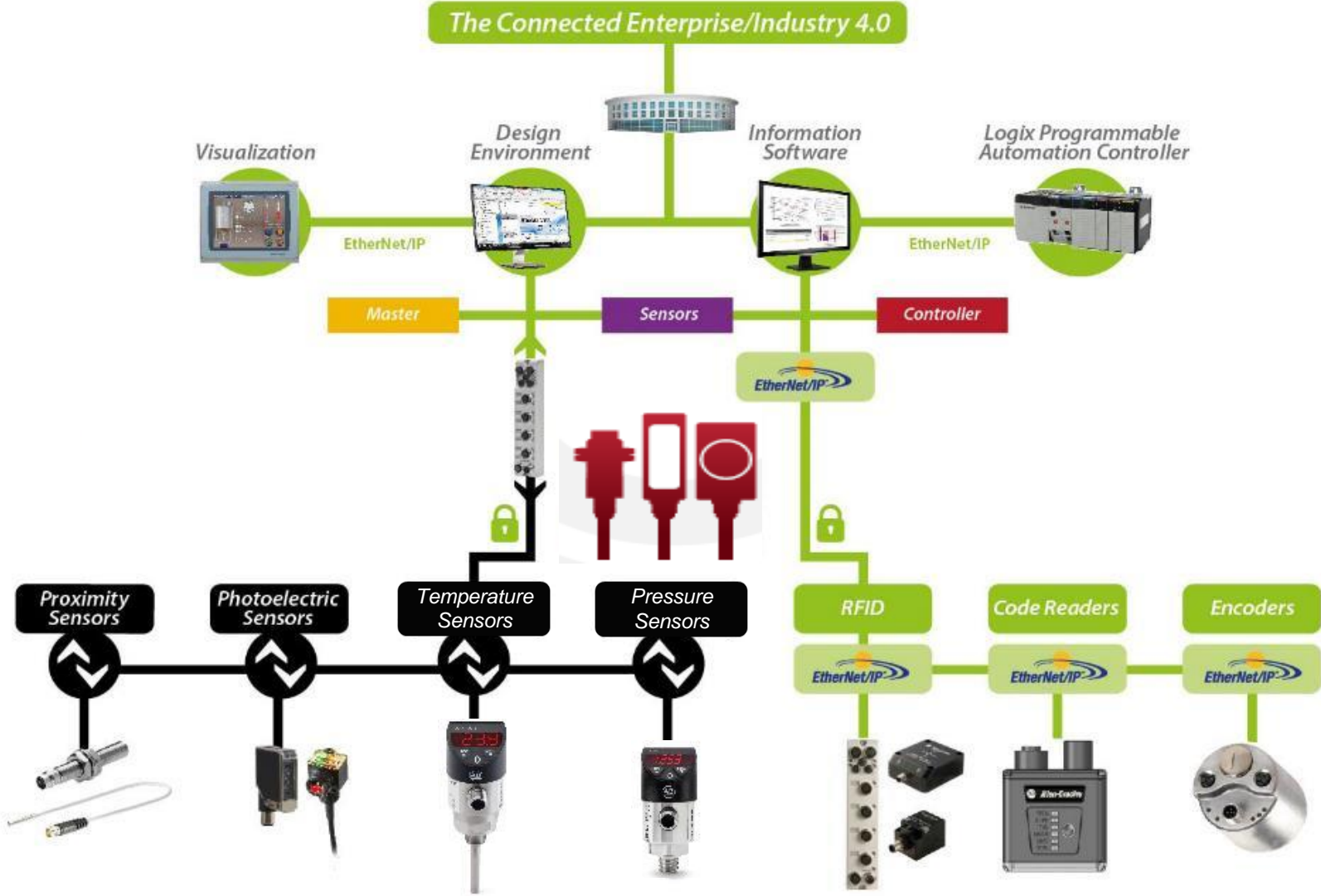


Increased value integrating Smart Devices to  
The Connected Enterprise

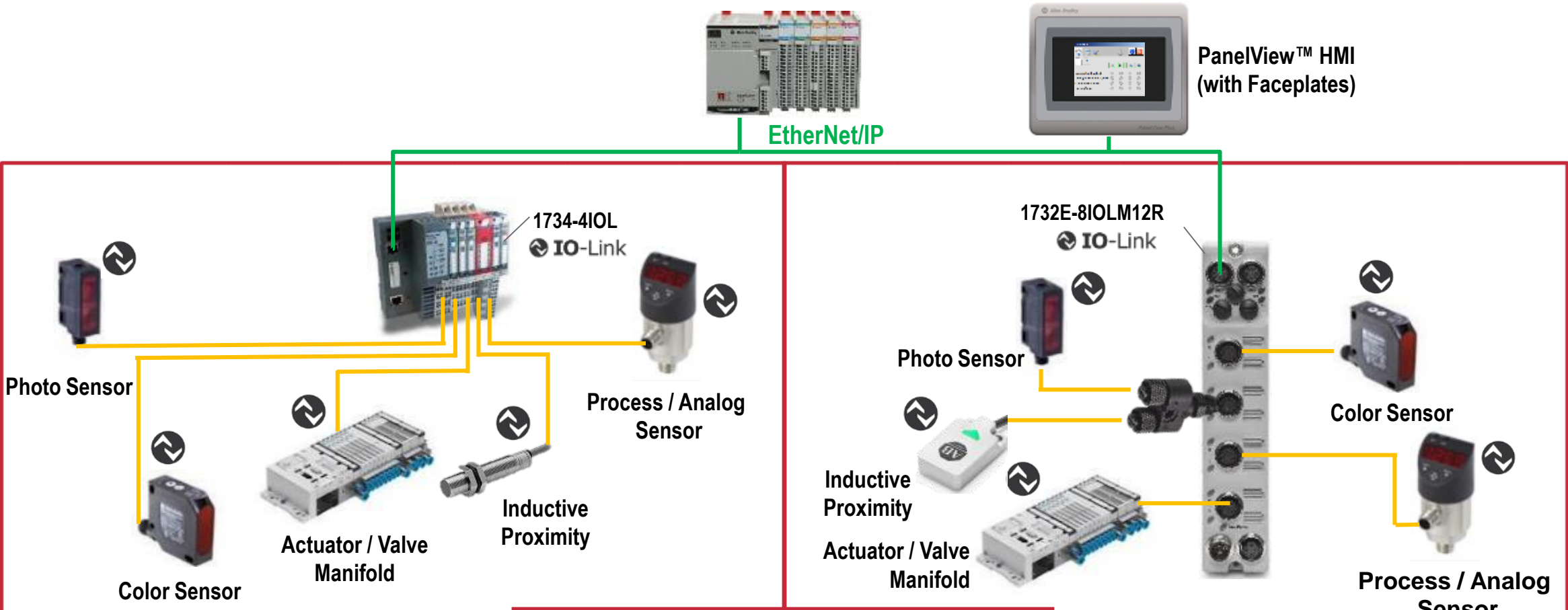
# Smart Motor Control



# Smart Sensors



# Smart Sensing Architecture

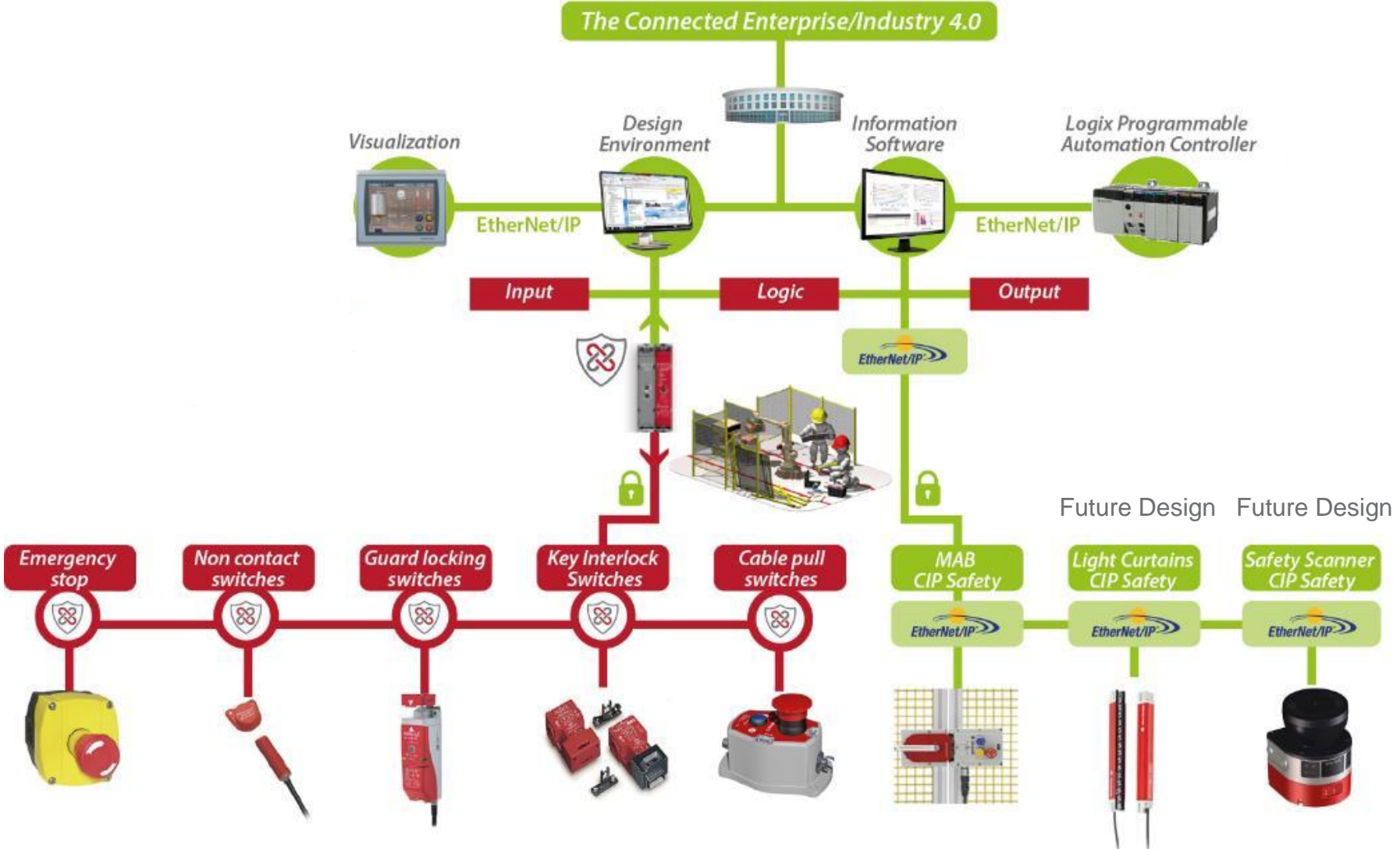


- With IO-Link:
- Single type of wiring (3-wire)
  - Single configuration platform (Studio 5000®)

POINT I/O™ Solution

ArmorBlock® Solution

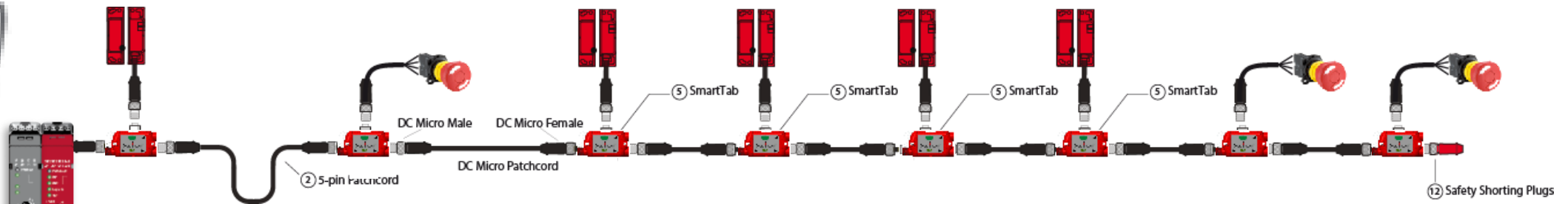
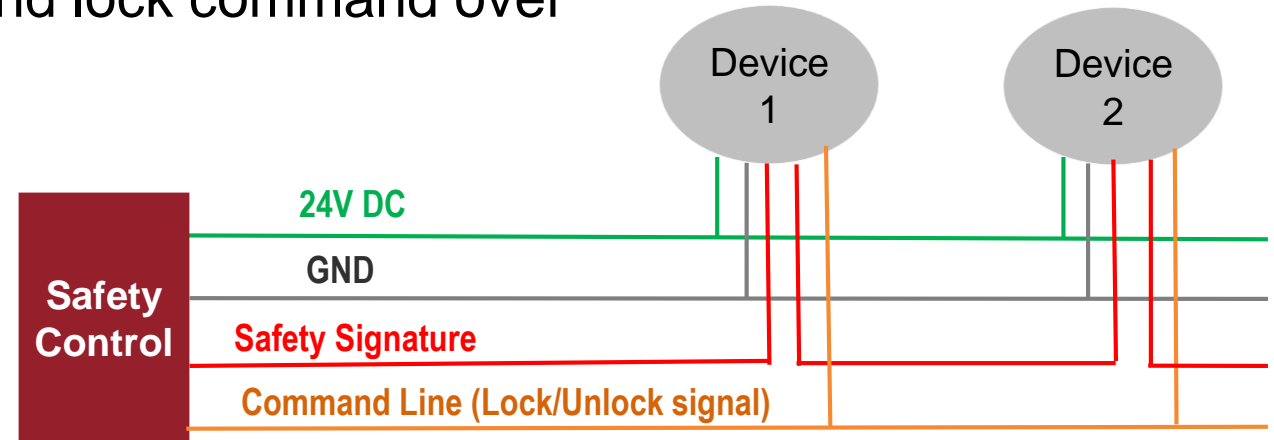
# Smart Safety Devices





# Smart Safety Architecture

- Safety-rated series wiring with enhanced diagnostics
- Support safety, diagnostics, remote reset, and lock command over one cable
- System knows which device is tripped
  - Also differentiates tripped vs faulted
- TÜV certified PLe
- Trunk and drop topology
- Plug and play, no configuration required



**GuardLink enables series connections and diagnostics**

# What makes Devices Smart?

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# Premier Integration

*Delivers increased value when combining:*



**Studio 5000 Software**



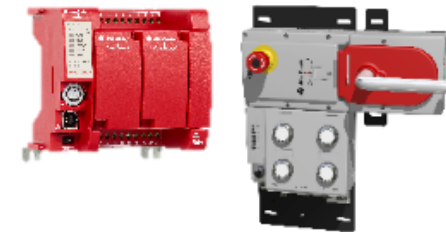
**Logix Controllers**



**Smart Motor Control**

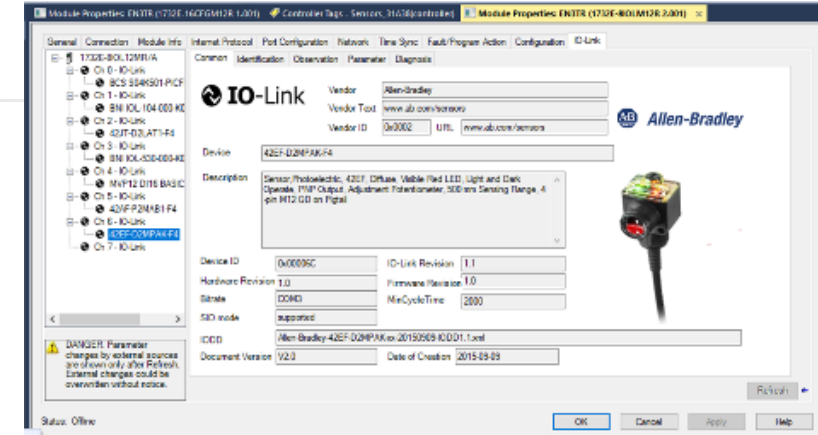


**Smart Sensors**



**Smart Safety**

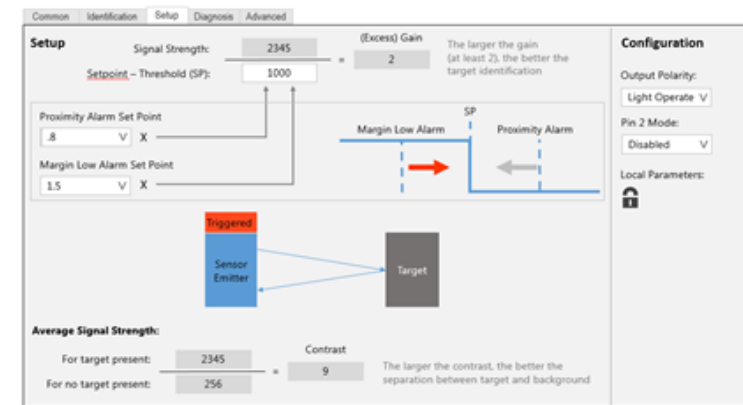
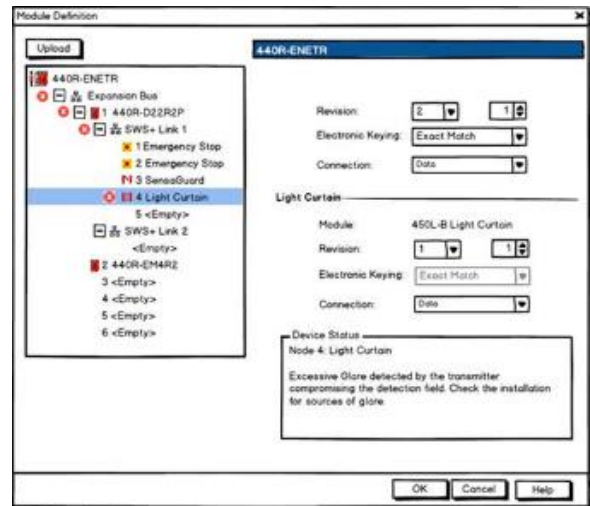
# Add-On Profiles in Studio 5000 Environment



## ■ Integrated Add-On Profile in Studio 5000 design environment

- Device data tags in the Tag Database
- Time Stamping
- Device-specific screens / configuration

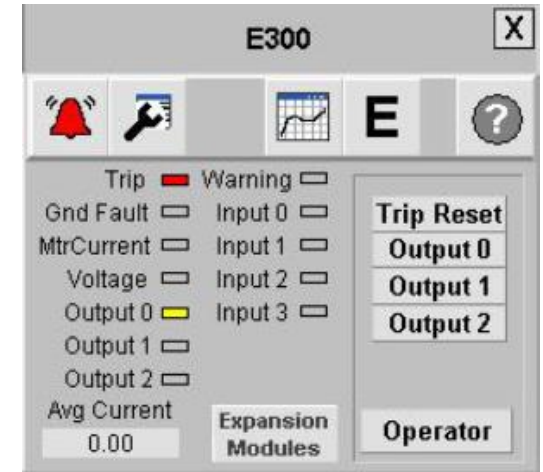
Module Name	Value	DataType	Description
Module Name_SWSLNK01	{ . . . }	SWS_...	SWS Structure
Module Name_SWSLNK01.LinkSafetyActive	0	BOOL	SWS Structure Indicates when the complete SWS+ link
Module Name_SWSLNK01.SafetyDemandPresent	0	BOOL	SWS Structure Indicates that a safety device on the SV
Module Name_SWSLNK01.DiagnosticPresent	0	BOOL	SWS Structure Indicates that one of the safety devices
Module Name_SWSLNK01.FaultPresent	0	BOOL	SWS Structure Indicates that one of the safety devices
Module Name_SWSLNK01.DiagnosticCode	0	SINT	SWS Structure Indicates the diagnostic status of the first
Module Name_SWSLNK01.FaultCode	0	SINT	SWS Structure Indicates the fault status of the first safe
Module Name_SWSLNK01.DemandNode	0	DINT	SWS Structure Indicates the specific safety devices on
Module Name_SWSLNK01.DiagnosticNode	0	DINT	SWS Structure Indicates the specific safety device on t
Module Name_SWSLNK01.FaultNode	0	DINT	SWS Structure Indicates the specific safety device on t
Module Name_SWSLNK01.NodesConfigured	0	DINT	SWS Structure Indicates the safety device nodes detec



Smart Devices provide premier integration with Studio 5000 design environment

# FactoryTalk View Faceplates

- FactoryTalk® View faceplates are available for the many devices
  - FactoryTalk View (ME or SE)
  - PlantPAx® process automation system
- Pre-written and tested human machine interface graphics
  - Import into FactoryTalk View Studio projects to minimize engineering time



# Automatic Device Configuration

**Field Device**

+

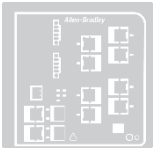
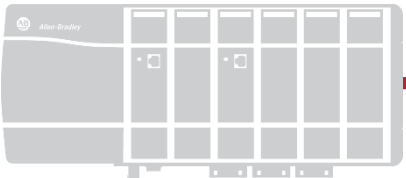
**Controller**

+

**EtherNet/IP**



**LOWER  
TIME TO  
REPAIR**



Configuration

IP Address

Also available  
for IO-Link  
devices!

# What makes Devices Smart?

Device  
information  
and  
diagnostics

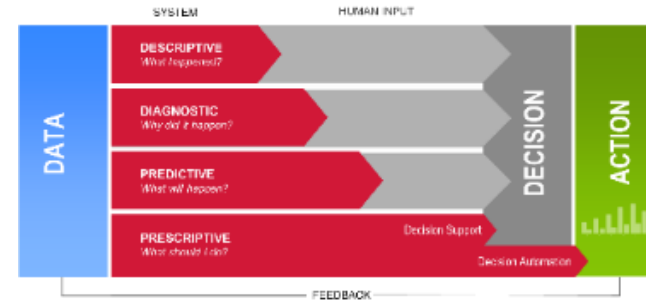
Enabling  
technologies

Outstanding  
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# Device Analytics

- Smart devices provide the information needed to maximize the value of emerging solutions
  - FactoryTalk<sup>®</sup> Analytics for Devices
  - FactoryTalk Analytics for Machines
  - FactoryTalk TeamOne
  - Information solutions



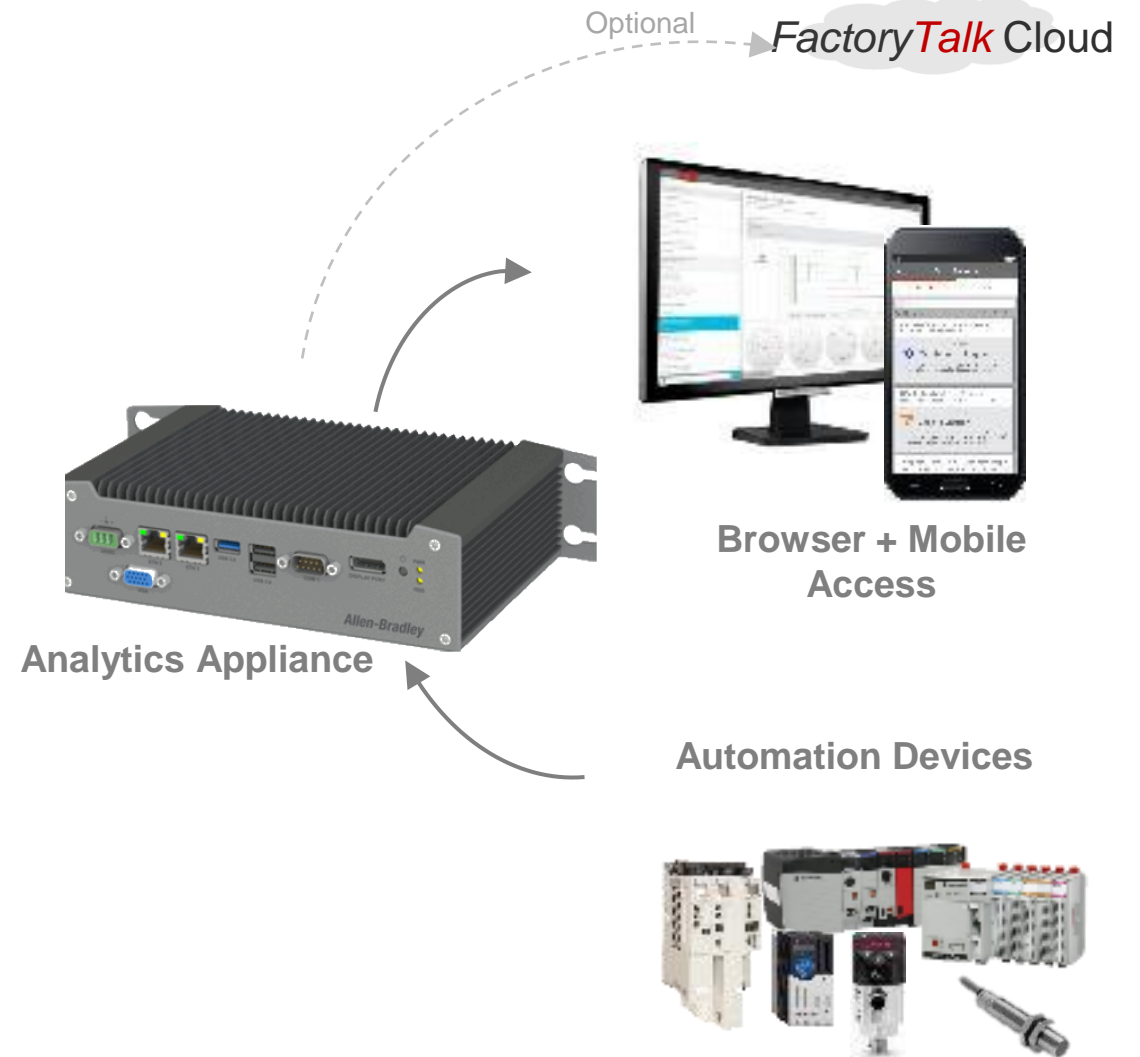
Smart Devices are part of the evolution of industrial analytics and mobile access to information from everywhere



# FactoryTalk Analytics for Devices

What Does It Do?

- Monitors and improves MTTR (Mean Time to Repair)
- Performs analysis on device data
- Provides device issue notifications
- Provides simple and immediate instructions for corrective measures
- Learns what devices are most important/critical
- Performs system level health & diagnostics to solve hard-to-discover issues



# FactoryTalk<sup>®</sup> Analytics for Devices



MONITOR & INTERACT WITH IIoT DEVICES, IMPROVE PLANT HEALTH



**DETECT**  
your smart  
devices,  
automatically



**DIGITIZE** the  
data,  
allowing work  
to be done



**ANALYZE** the  
data perform  
calculations,  
transform the data



**ACT** on  
information, get to  
the right people, on  
the right device

*Immediate value delivered as an Industrial Appliance; Self-contained and FactoryTalk Cloud aggregation options*



# DETECTS

On boot up, the appliance detects devices on the local the local network

- Locates any Ethernet/IP (CIP) devices automatically
- Customizable
  - You can specify ranges or specific IP addresses to include/exclude
- Communicates directly to devices, not thru controller
  - Low network impact, intelligent throttling
- Future: Add different protocols

PowerFlex 755

10.88.16.104 | POWERFLEX 755 AC DRIVE

MAINTENANCE REQUIRED

1769-L36ERM/A LOGIX5336ERM

10.88.16.106 | 1769-L36ERM/A LOGIX5336ERM

MAINTENANCE REQUIRED

PowerFlex 525 1P 110V .50HP

10.88.16.111 | CIP DEVICE

HEALTHY

SoftLogix5800 EtherNet/IP

10.88.18.103 | COMMUNICATIONS ADAPTER

HEALTHY

1756-EN2T/B

10.88.18.15 | CONTROLLOGIX ETHERNET/IP ADAPTER

MAINTENANCE REQUIRED

1756-EN2TR/A

10.88.18.15/1:2 | 1756-EN2TR/C

MAINTENANCE REQUIRED

1756-L64/B LOGIX5564

10.88.18.15/1:4 | CONTROLLOGIX CONTROLLER

MAINTENANCE REQUIRED

1756-EN2TR/B

10.88.18.15/1:7 | 1756-EN2TR/C

MAINTENANCE REQUIRED

PanelView Plus\_6 1500

10.88.18.83 | HUMAN MACHINE INTERFACE

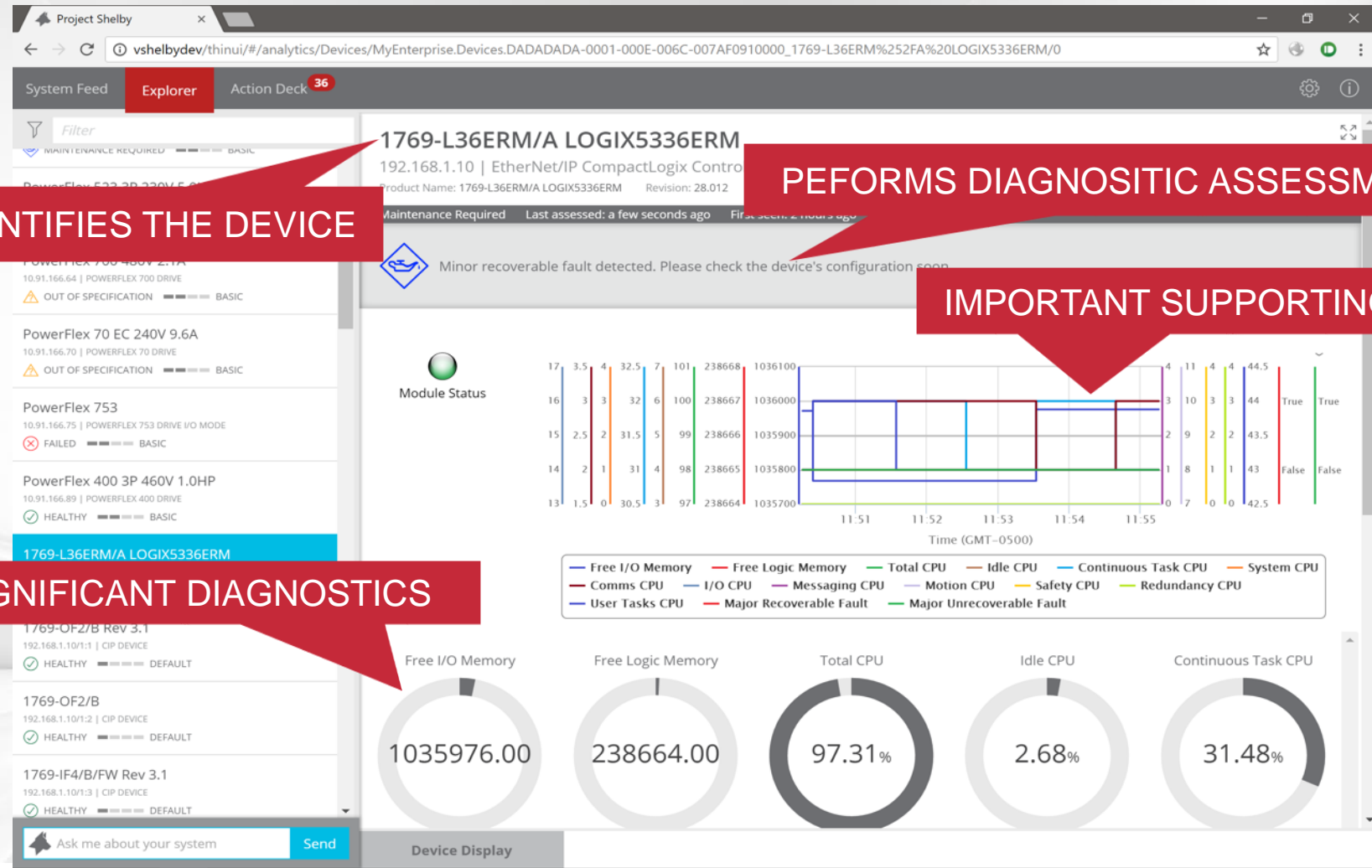
HEALTHY

FactoryTalk<sup>®</sup> Analytics  
for Devices



# ALL DONE AUTOMATICALLY!

# DASHBOARDS



IDENTIFIES THE DEVICE

PERFORMS DIAGNOSTIC ASSESSMENT

IMPORTANT SUPPORTING DATA

SIGNIFICANT DIAGNOSTICS

FactoryTalk<sup>®</sup> Analytics  
for Devices



## WHAT DEVICES ARE SUPPORTED



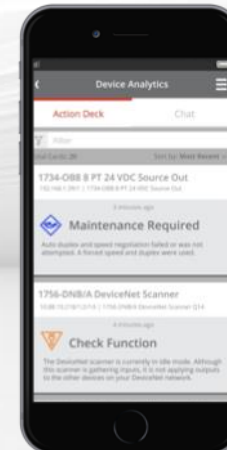
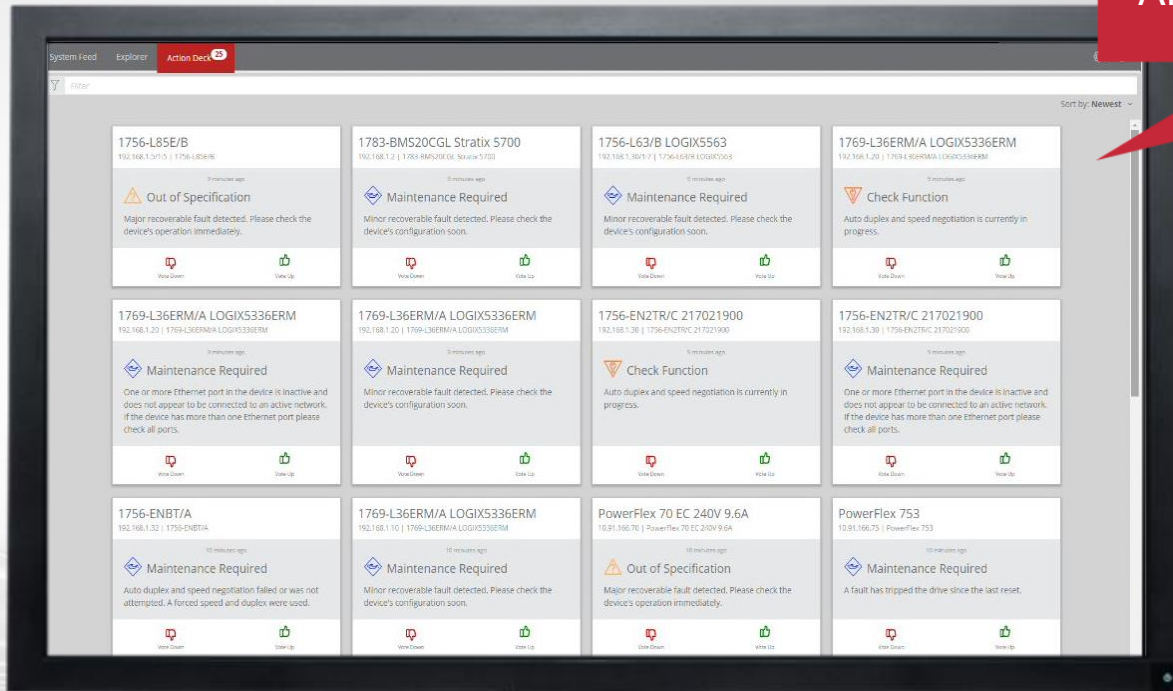
- Any Ethernet/IP device responds with a default diagnostic status
- Over 2,000 devices have specific diagnostics built-in
- Capable of complex analysis based on the data from the devices
- Example: PowerFlex® 755 has over 80 points of data and then an extra 30 created by our analyzers
- Our most popular families will have coverage (Logix, PowerFlex, Kinetix)
- This is an area for future expansion, both in devices supported, 3<sup>rd</sup> party devices supported and customizability
- Diagnostics on **100 devices** per Shelby

**FactoryTalk**® Analytics  
for Devices



# ACTION CARDS

DELIVERED WHEN SOMETHING OCCURS  
AND SYSTEM FEELS ACTION IS REQUIRED



FactoryTalk<sup>®</sup> Analytics  
for Devices

# Smart Devices

### Connected Enterprise Smart Motor Control

Rockwell Automation

The diagram illustrates the 'Connected Enterprise Industry 4.0' architecture for smart motor control. It features a central motor icon connected to various components: Visualization, Design Enhancement, Information Software, and Logic Programmable Automation Controller. Below these are three main functional areas: Fixed Speed, Variable Speed, and Motion Control. Each area is supported by EtherNet/IP and EtherCAT protocols. A green checkmark icon is labeled 'Benefits of Intelligent Motor Control'. A 'Mobility' icon shows a hand holding a tablet displaying a control interface.

COMPANY CONFIDENTIAL

### Connected Enterprise Smart Sensor Devices

Rockwell Automation

The diagram illustrates the 'Connected Enterprise Industry 4.0' architecture for smart sensor devices. It features a central sensor icon connected to various components: Visualization, Design Enhancement, Information Software, and Logic Programmable Automation Controller. Below these are four main sensor types: Proximity Sensor, Photoelectric Sensor, Ultrasonic Sensor, and Pressure Sensor. Each type is supported by EtherNet/IP and EtherCAT protocols. A black checkmark icon is labeled 'Benefits of Smart Sensors'. A 'Mobility' icon shows a hand holding a tablet displaying a control interface.

COMPANY CONFIDENTIAL

### Connected Enterprise Smart Safety Devices

Rockwell Automation

The diagram illustrates the 'Connected Enterprise Industry 4.0' architecture for smart safety devices. It features a central safety icon connected to various components: Visualization, Design Enhancement, Information Software, and Logic Programmable Automation Controller. Below these are five main safety devices: Emergency Stop, Non-contact Switches, Guard Locking, Key Interlock, and Cable pull. Each device is supported by EtherNet/IP and EtherCAT protocols. A red checkmark icon is labeled 'Benefits of Smart Safety'. A 'Mobility' icon shows a hand holding a tablet displaying a control interface.

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For more information visit:  
[rok.auto/smartdevices](http://rok.auto/smartdevices)



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Automation**

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# Innovation & Technology Forum

# Thank you

 Contact me via LinkedIn! – Peter Madarasz