

# The HART Connectivity Ecosystem

Jonas Berge, Emerson





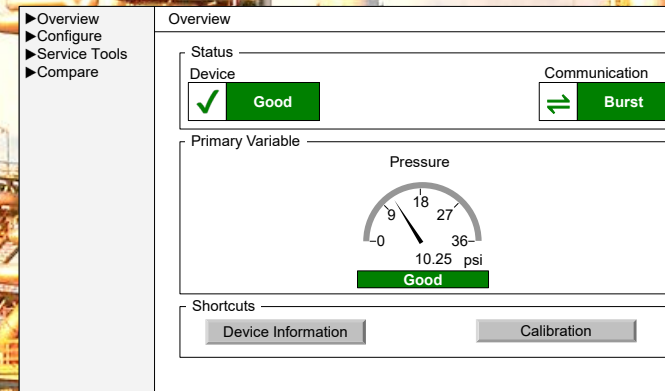
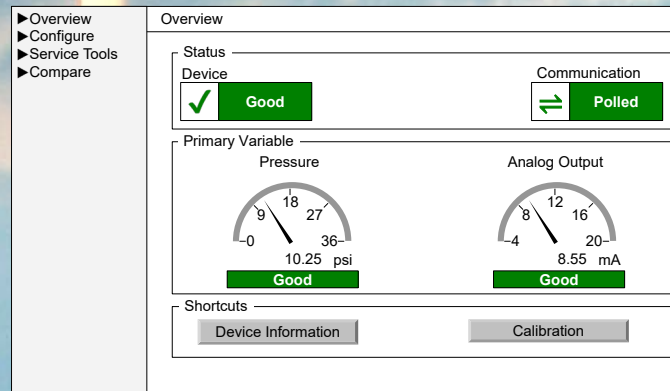
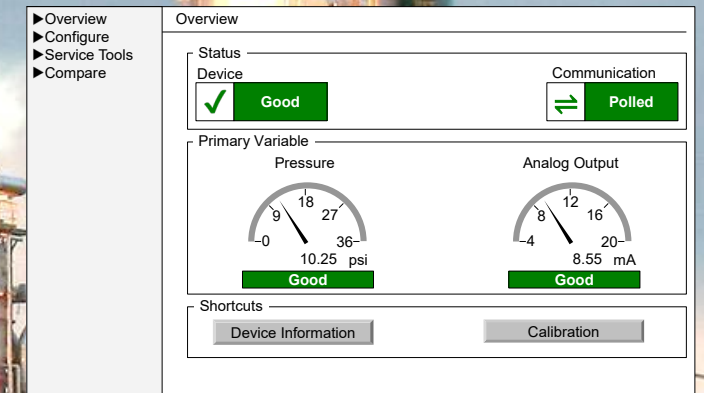
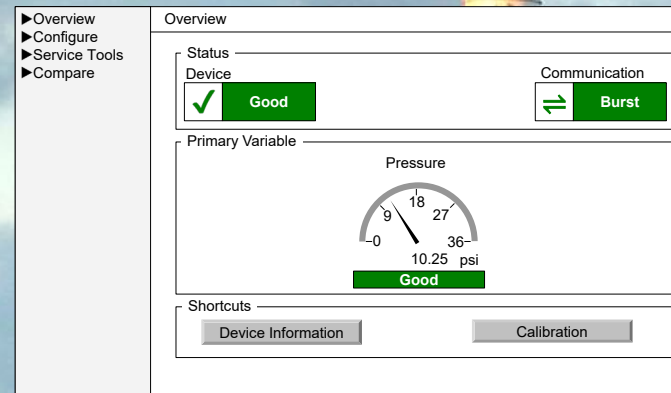
# Connectivity Ecosystem

## 4-20 mA

## Wireless

## Ethernet

## Bluetooth



# 'HART

# over

# Bluetooth'

• HART • Wireless HART • HART-IP



# The Familiar HART Protocol Ecosystem for All Process Instrumentation Needs

## 4-20 mA

- Configuration, calibration, and diagnostics
- Products:
  - Field instruments
  - Handheld communicator
  - Control & safety systems
  - Multiplexers

## Wireless

- IO, configuration, calibration, and diagnostics
- Products:
  - Field instruments
  - Gateways

## Ethernet

- IO, configuration, calibration, and diagnostics
- Products:
  - Software
  - Gateways
  - Multiplexers
  - Control and safety systems
  - Field instruments

## Bluetooth

- Configuration, calibration, and diagnostics
- Products:
  - Field instruments
  - Apps: phones, tablets, laptops



# Instrument Protocol. Not PLC Protocol.

- Designed specifically for instrumentation
- Easy:
  - Configuration
  - Diagnostics
  - Calibration
  - Auxiliary variables
  - Identification
- Not a PLC protocol

HART Command	Function
Device Specific	<ul style="list-style-type: none"> <li>• Vibration spectrum and waveform</li> <li>• Valve signature</li> <li>• Plugged impulse line</li> </ul>
Device Family	<ul style="list-style-type: none"> <li>• Temperature sensor type</li> <li>• Temperature sensor connection</li> </ul>
Common Practice	<ul style="list-style-type: none"> <li>• Units</li> <li>• Transfer function</li> <li>• Range*</li> <li>• Damping</li> <li>• Simulation</li> <li>• Setpoint</li> <li>• NE107 status flags</li> <li>• MV sensor limits</li> <li>• Trim*</li> <li>• PubSub links</li> </ul>
Universal	<ul style="list-style-type: none"> <li>• Tag</li> <li>• Process value</li> <li>• Auxiliary measurements</li> <li>• Multi-variable (MV) measurements</li> <li>• Sensor limits</li> <li>• Serial number</li> <li>• Configuration change counter</li> <li>• Diagnostics</li> <li>• Write protection status</li> </ul>



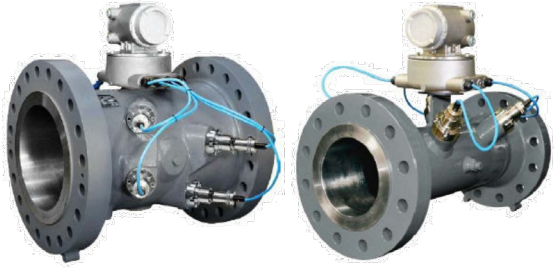










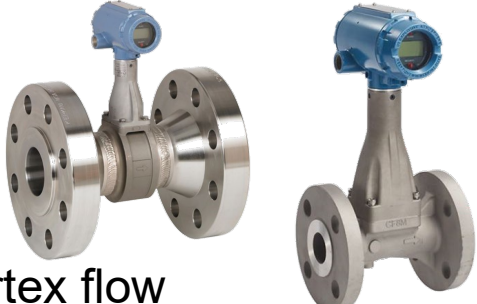








Separate presentation available with HART details

Workshop for smart plant automation modernization available



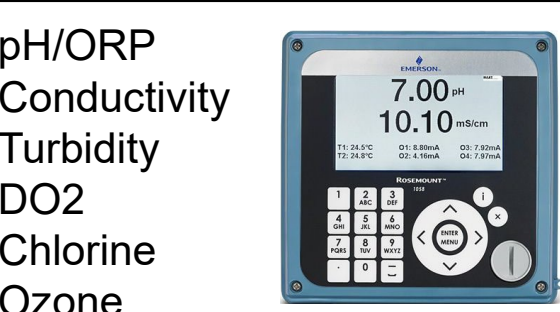






**4-20 mA/HART**

# 4-20 mA/HART Sensors







 <p>Position</p>	 <p>Coriolis mass flow</p>	 <p>Ultrasonic flow (inline)</p>	 <p>Viscosity</p>	 <p>Guided wave radar level</p>
 <p>Level switch</p>	 <p>Magnetic flow</p>	 <p>Hydrostatic level</p>	 <p>Amperometric (DO<sub>2</sub>, chlorine, ozone)</p>	 <p>Pressure and Differential Pressure (DP)</p>
 <p>Radar level</p>	 <p>Temperature</p>	 <p>Ultrasonic gas leak</p>	 <p>Vortex flow</p>	 <p>Displacer level</p>
 <p>Open path gas detector (combustible)</p>	 <p>DP flow</p>	 <p>Refractometer (concentration)</p>	 <p>Conductivity (contacting or toroidal)</p>	 <p>pH/ORP</p>



# 4-20 mA/HART Sensors (Continued)

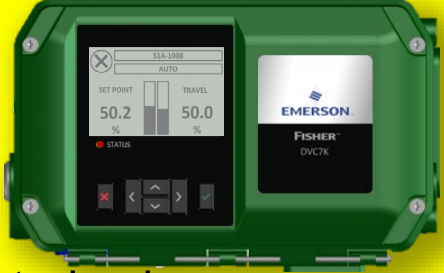



 <p>Density</p>	 <p>Ultrasonic flow (clamp-on)</p>	 <p>pH/ORP Conductivity Turbidity DO2 Chlorine Ozone</p>	 <p>Magnetostrictive level</p>	 <p>Flame</p>
 <p>Flue gas oxygen</p>	 <p>Gas concentration</p>	 <p>Flue gas combustibles and oxygen</p>	 <p>Open path gas detector (combustible)</p>	

# 4-20 mA/HART Systems

 <p>Field communicator</p>	 <p>DCS IO</p>	 <p>DCS IO</p>	 <p>SIS IO</p>	 <p>Controller</p>
 <p>Signal converter</p>				



# 4-20 mA/HART Valves

 <p>Control valve</p>	 <p>On-off valve controller</p>	 <p>Electric actuator / MOV</p>	 <p>ESD valve PST</p>	

Separate presentation available with WirelessHART details

Workshop for digital transformation available

# WirelessHART

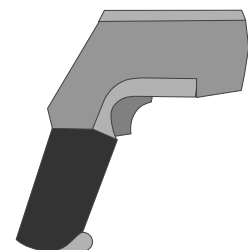
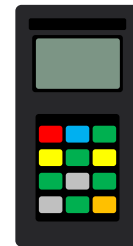
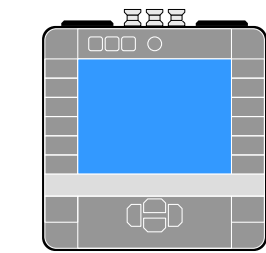
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# Automatic Data Collection Feeds AI: WirelessHART Takes the Place of Portable Testers and Mechanical Gauges

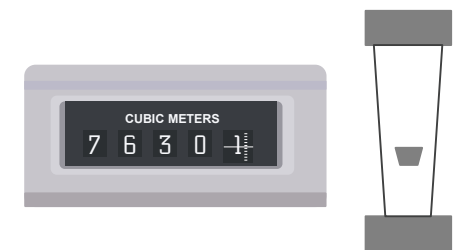
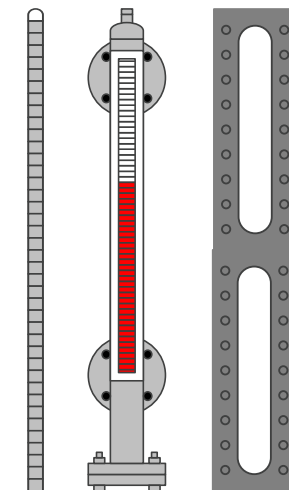
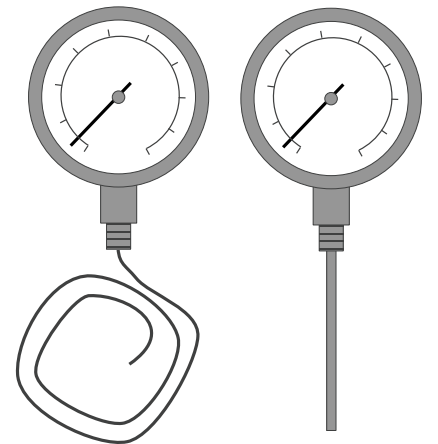
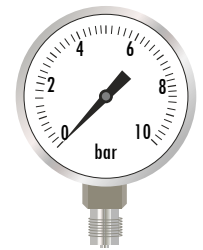
## Portable Testers

- Vibration
  - Rotating equipment failing
- Ultrasonic thickness
  - Corrosion and erosion
- Acoustic noise (leak)
  - Steam traps
  - Flare reduction (PRV)
- Temperature
  - Equipment fouling
  - Equipment failing
- ...



## Mechanical Gauges








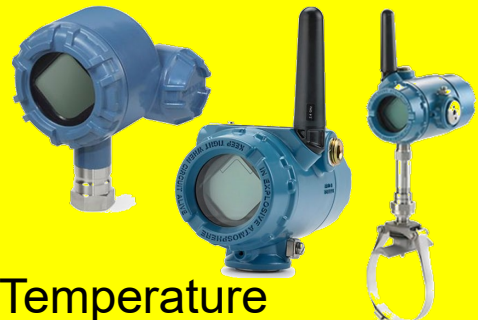




- Pressure
- Temperature
- Level
- Flow
- ...







# WirelessHART Sensors



 <p>DP flow</p>	 <p>Multi-temperature</p>	 <p>Pressure and Differential Pressure (DP)</p>	 <p>Gas concentration</p>	 <p>Turbine flow (pulse)</p>
 <p>Acoustic noise (leak)</p>	 <p>Level switch</p>	 <p>Temperature</p>	 <p>Ultrasonic thickness (UT) (corrosion and erosion)</p>	 <p>Vibration</p>
 <p>Pressure gauge</p>	 <p>Guided wave radar level</p>			



# WirelessHART Systems & Software



 <p>Wireless gateway</p>	 <p>Wireless adapter</p>			

# WirelessHART Valves



 Discrete IO (2 channel)	 Discrete IO (8 channel)			



Separate  
presentation  
available with  
HART-IP  
details

# HART-IP

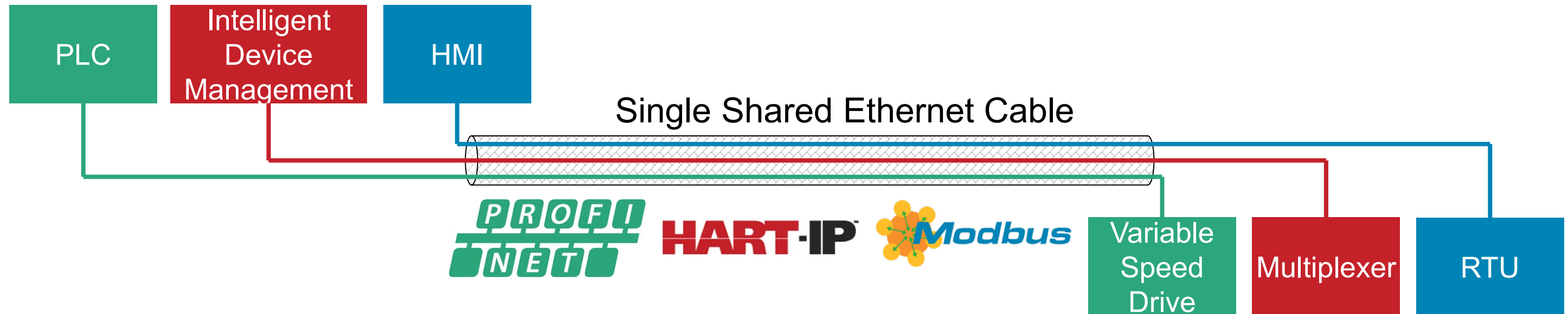
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**HART-IP**



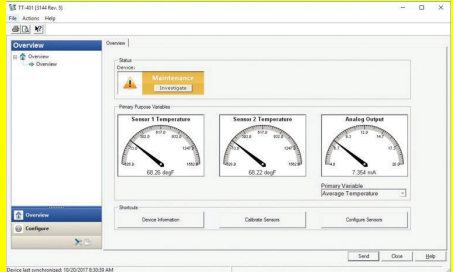



## Ethernet is Multi-Protocol

- IP and Ethernet support multiple protocols
- HART-IP for instrumentation
- Other protocols for other functions



## HART-IP Systems & Software

 <p>Wireless gateway</p>	 <p>Supervisory</p>	 <p>Device Management</p>	 <p>Asset Monitoring</p>	



## HART-IP Valves



Controller (valve-mount)

Controller (valve-mount)				

Separate  
presentation  
available with  
Bluetooth  
details

# ‘HART over Bluetooth’

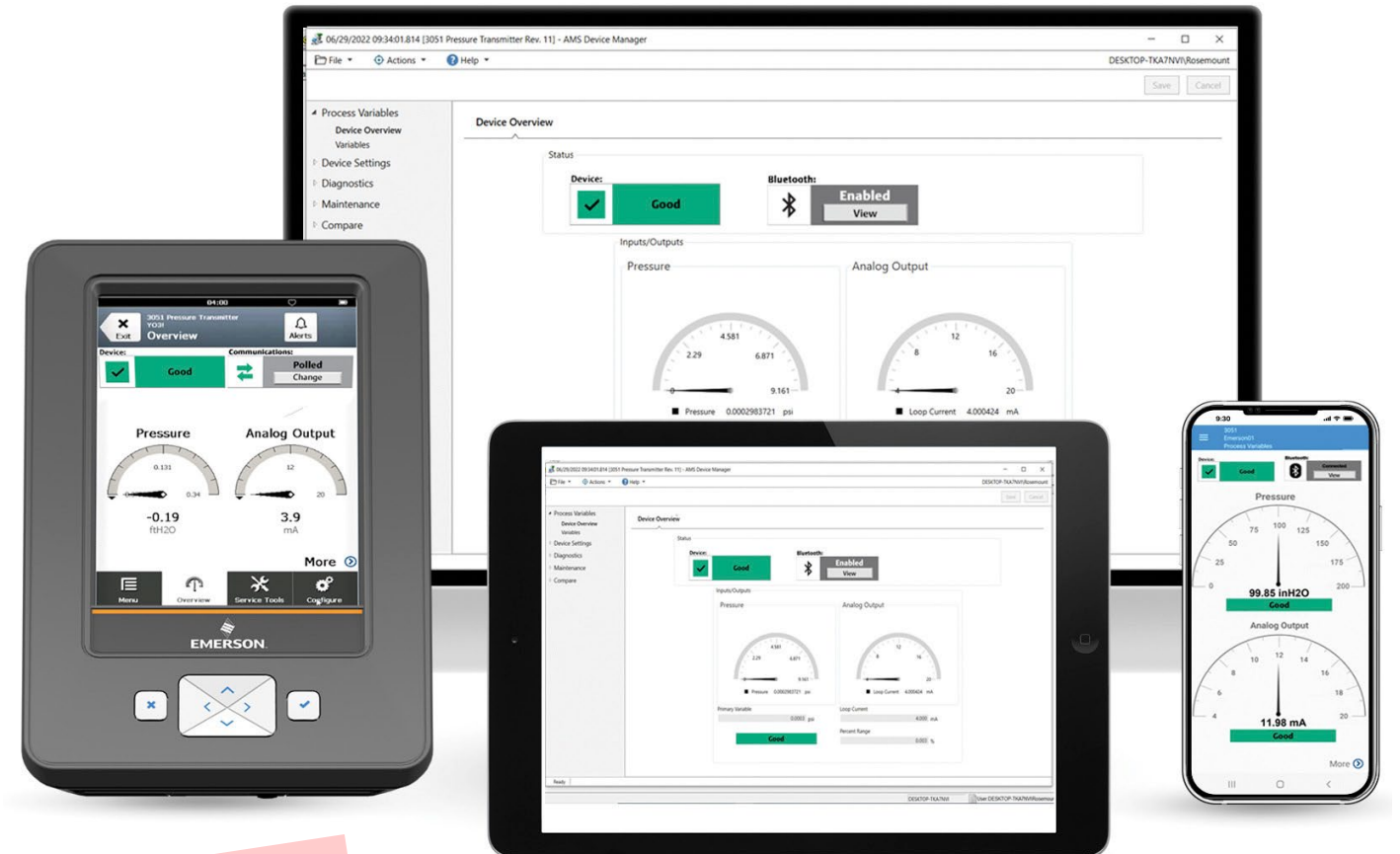
\*FCG specification not published yet



# Technology Solution: Bluetooth – for Plants



- No wires to connect
- No modem required
- No opening the device; no moisture ingress
- No working at heights; 15 m range
- Over-the-air (OTA) firmware updates; 10X faster
- Same look and feel as wired tools; familiar
- Same EDDL and FDI packages
- Security includes encryption and pin



Does not take the place of WirelessHART for wireless sensors

Intrinsically safe phones and tablets are available

## Instrument Commissioning

- ✓ Configuration
- ✓ Diagnostics
- ✓ Calibration status
- ✓ Auxiliary variables
- ✓ Identification





EDDL™






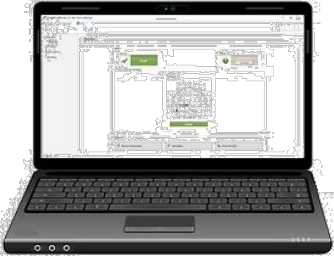

# Sensors with Bluetooth



 <p>Pressure</p>	  <p>Radar level</p>	 <p>Coriolis mass flow</p>		

# Systems & Software with Bluetooth



 <p>Field communicator</p>	 <p>Device configuration</p>	 <p>Mobile device configuration</p>		

# Valves with Bluetooth



Valve positioner


# HART Connectivity Ecosystem

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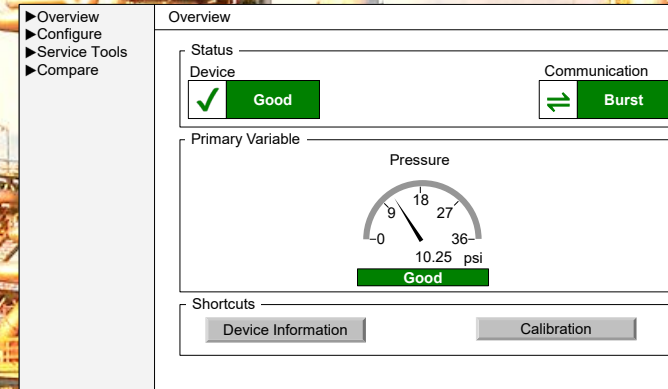
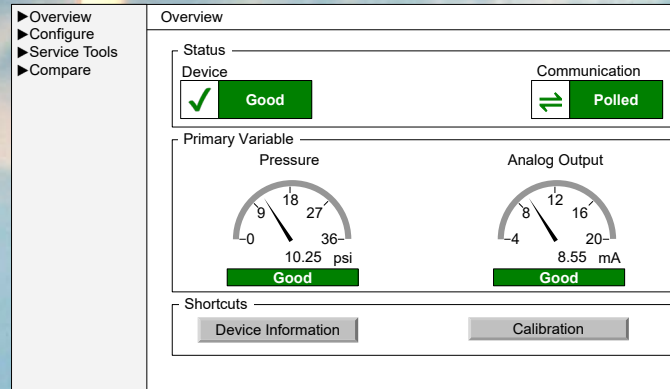
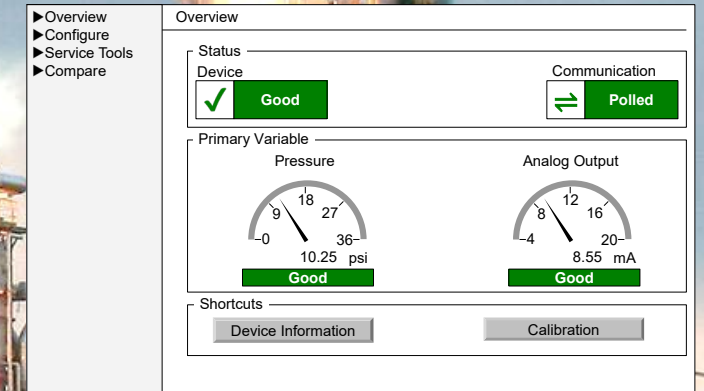
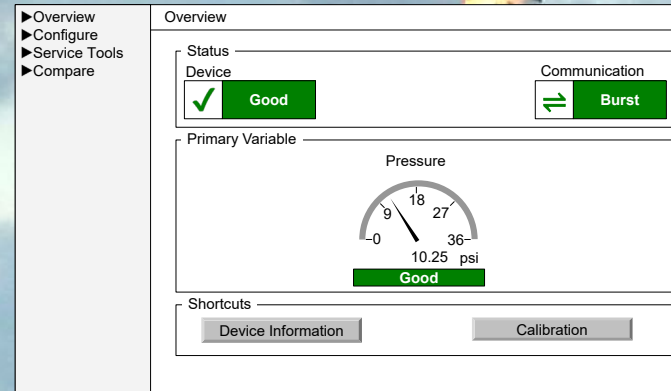
# Connectivity Ecosystem

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# The Most Realistic Smart Plant Experience - The Emerson Solutions Center in Singapore

Digital plant visioning, Mobile notifications, KPI dashboards on mobile devices



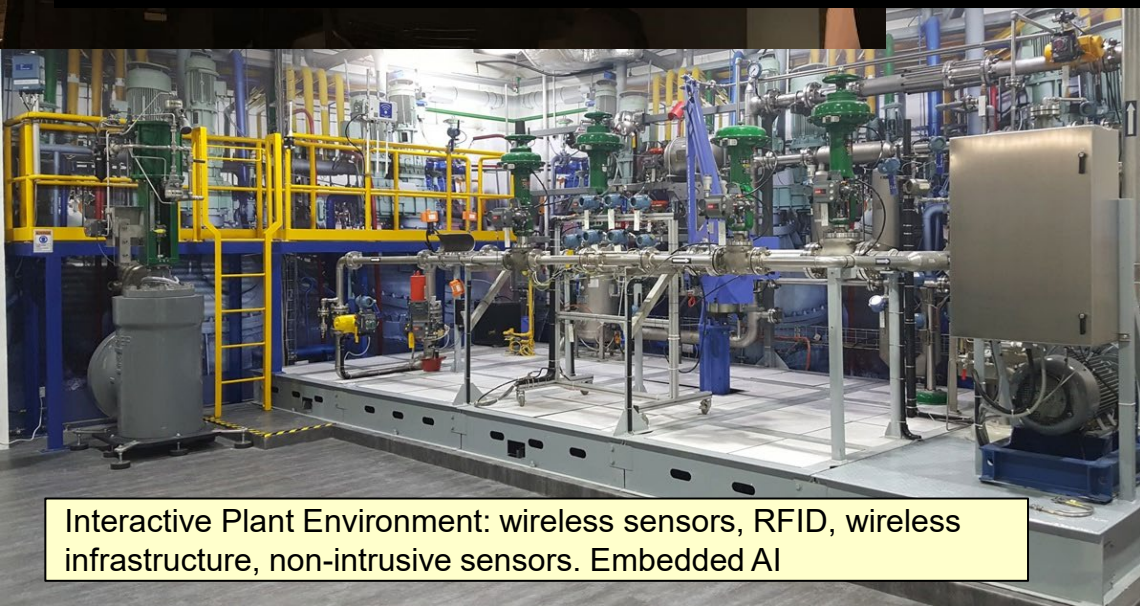
Industrial Internet of Things (IIoT), integrated operations (iOps), fleet management, expert support, cloud, AI equipment performance monitoring, integrity management, energy management, AI predictive equipment condition monitoring, big data management, multivariate analysis (MVA), machine learning, process modelling & simulation



Digital twin, AI batch monitoring



<https://www.youtube.com/watch?v=Boy0fuNEgZQ>



Interactive Plant Environment: wireless sensors, RFID, wireless infrastructure, non-intrusive sensors. Embedded AI



Digital twin, Virtual Reality (VR)



Workshops, discovery sessions



## I'm Listening...

- Jonas Berge

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Linked ®

<http://www.linkedin.com/in/smartdigital>



# SEE TABLETOP DEMO OUTSIDE

