How to integrate IoT & motors

Presented by: Jake Wysocki & Nicole George



Housekeeping

 Today's webinar is being recorded and will be available next week at <u>pumpsandsystems.com/webinars</u>.

 The presentation will last about 45 minutes, and there will be a short question and answer session at the end.

 Enter your questions in the chat feature at the lower left side of your screen.





IoT & pumping system definitions

IoT architecture

Use cases by user type

Questions & answers



Poll question

- What type of organization do you represent?
 - Manufacturer
 - Consulting engineer
 - Distributor
 - Contractor
 - Systems integrator
 - Service provider
 - End user
 - Other



Definitions of IoT pumping systems





Internet of Things (IoT)

Network-connected devices that can produce, analyze and exchange data

Pumping system

• Pump, motor, starter and controls



Consumer examples

Follow the Leaf.

Change the temperature to save energy and you'll be rewarded with a Leaf. The Leaf learns how to help you save, so it appears at different temperatures for different families.

75



()



Poll question

- According to a Gartner study, how many connected devices will be installed in 2020?
 - 3 billion
 - 12 billion
 - 26 billion
 - 54 billion



IoT architecture







Hardware Data collection





()











Cloud Data analysis + storage





User interface



T	MODEL -	UNIT	PRICE +		STOCK *
V	 Model S 700 (79 kWh Battery) 	859	500		~
	 Model S 85D (85 kWh Battery) 	\$65	500		~
1000	Range	Acceleration	Torque	Top Speed	Motor Power
LOGIN	270 miles	42 seconds 0.60 mph	455 lb ft	155 mph	259 hp front and rear
mane	90 kWh upgrade adds 6%				417 hp *
	 Model S PBSD (85 kWh Battery) 	587	800		×
	 Model X P90D (90 kWh Battery) 	\$59	500		×
LOG IN	 Model X 900 (90 kWh Battery) 	201	800		×
	 Model X 700 (70 kWh Bettery) 	500	500		~
Furget password?	 Model X-700 (73 kWh Eartery) CANCEL 	SAVE	Libel	enalgdor	
Pargot peerword?	Model X700 (/3 kWh Barbary) CANCEL BELETE	SAVE RDIT	Label Edit	emalijidor emalijidor	nain.com
Farget passworth	- Model X-TO (73 KH Balley) CAMCEL BELETE Toggle Acts	SAVE EDIT N2ct Active	Label Edit Colordar	emaligidor emaligidor Dec 6,5	Tain.com
Parget password?	Mod X TO (73 KW Barry) CANCEL BELETE Toggle Aex Checker Z	SAVE EDIT Nici Action	Label Edit Calendar	emalgidor emalgidor Dec 6, 5	win.com win.com 015 - Dec 22, 2215
Pargat personal? Ny Polisi e Polisi	- Madel X 120 (25 with Samp) CANCC. BLATY Toggle Add Chester ? Digotion Queen	500 SAVE 10/T Not Active ine. v	Label Edit Collender	emai@don emai@don Dec.6,5 4 De Men. Tark 90 25 27 2	Nah.com Nah.com D15-Dec 22,2315 Cerebar 2015 • D16 Tw / F & BA D Tw / F & BA D Tw / F & BA
Paget personal? Try Polid at meld we Field	Linder X TO (75 WH Reny) CANCEL CANCEL Togle Auto Constant Quent Quen	SAVE LOIT 0 Nicl Action 1 100	Label Edit Collender	emal@dor emal@dor Dec 6,5 4 Dec Marx Tate 40 25 27 2 8 4 1	Nah.com Noh.com 515-Dec 22,2315 017-075 58 0 Thi Fr 561 Dec 22 50 5 2 5 5 2 5 6 7 8 9
Paget personnell ny 71463 et raide LOO IN	- Made X XTO (25 WH Kenny) CANCEL Taggie Consten Chenter Chenter Consten Const	500 5AVE 10H 10 10 10 10 10 10 10 10 10 10 10 10 10	Label Edit Calendar	emal@dor emal@dor Dec.6,3 4 De Mon Tac 40 25 27 2 8 4 1 10 11 1 17 18 1	with Learn with Learn total - One 20, 2015 011 - One 20, 2015



 \bigcirc





50

Poll question

- How would you describe your organization's engagement with IoT?
 - Our pumping systems are IoT enabled
 - We see the value of IoT but haven't installed devices onto our system yet
 - We need to learn more about IoT
 - We don't clearly see the value or business justification of IoT



Use cases by user type



Equipment manufacturers Value



Remote troubleshooting & diagnosis

Data analytics & product development

Enable downstream value chain



Equipment manufacturers Architecture

Traditional systems

- Irrigation pump
- Operator discovers failure
- Calls OEM for troubleshooting support
- Orders parts
- Drives back to pump for installation
- Operator installs parts

3 days, 8 labor hours

Connected systems

- Irrigation pump
- Data analytics predict potential failure
- System alerts OEM as part of premium technical support
- OEM proactively advises preventative
- maintenance and sends replacement parts
- Operator receives parts and installs

0 days, 1 labor hour





Equipment distributors Value

Replacement parts

Predictive



©2018 Eaton. All Rights Reserved

Get the

at the right

time

right parts 🚍

Equipment distributors Architecture

Traditional systems

- Distributor sells VFD pump system
- System begins to run poorly
- Operator discovers failure
- Calls OEM for troubleshooting support
- Services finds broken seal
- Sends PO to distributor
- Distributor orders
 replacement parts

2 days, 6 labor hours

Connected systems

- Distributor sells connected
 VFD pump system
- VFD auto detects decline in system performance
- VFD predicts seal failure based on data analytics
- Error note is sent to user
- PO is sent to distributor automatically

0 days, 0 labor hours





Service providers

Remote monitoring

Predictive diagnostics

Solve problem in one trip



©2018 Eaton. All Rights Reserved

3/2

Service providers Architecture

Traditional system

- SP performs startup and commissioning on system
- Cooling fan nearing end of life begins to cause system to slowly deteriorate
- System fails causing unscheduled downtime
- User calls SP to get them on site
- SP travels to site to find a failed cooling fan after hours of troubleshooting
- Drives to distributor to pick up replacement part
- Drives back to user to install part and get user running again

1 day, 12 labor hours

Connected system

- SP performs startup and commissioning on system
- Cooling fan nearing end of life begins to cause system to slowly deteriorate
- Connected VFD sends alert to SP
 notifying them of system performance
- SP remotely monitors system to determine severity
- System automatically orders
 replacement part
- SP gets planned downtime schedule from user
- SP installs replacement cooling fan on one visit and without unplanned downtime







System integrators



Startup & commissioning

Troubleshooting



3

Labor

savings

System integrators Architecture

Traditional system

- New booster pump system arrives at commercial high-rise building
- Field engineer arrives for startup & commissioning
- System checks fail and field engineer pulls up VFD, pump, motor and sensor manuals to troubleshoot
- Field engineer finds loose wire and restarts system checks

1 day, 8 labor hours

Connected system

- New booster pump system arrives at commercial high-rise building
- Field engineer arrives for startup & commissioning
- Connected HMI performs
 system check when powered on
- Connected HMI detects loose connection between pressure gage and VFD
- Field engineer corrects wiring and completes startup

0 days, 1 labor hour





End users Value

Predictive diagnostics (downtime)

System optimization (efficiency)



©2018 Eaton. All Rights Reserved

Reduce

total cost

of

ownership

End users Architecture

Traditional system

- Water treatment facility
 has 10 VFDs installed on critical
 pumps
- 3 VFDs continue to display faults
- Electricians work to troubleshoot and find root cause through trial and error
- Faults cleared and reset but VFDs continue to fault

10+ days, 40+ labor hours

Connected system

U

- Water treatment facility has 10
 VFDs installed on critical pumps
- Connected VFDs with health & wellness algorithms send data to server for analytics
- Data analytics identify cavitation
 as potential failure mode
- System alerts electrician with recommended preventative maintenance

0 days, 1 labor hour





Poll question

- Where do you see the most value for IoT in pumping?
 - Collecting performance data for analytics
 - Alarming and notifications of system status
 - Predictive diagnostics and failure prevention
 - Startup and commissioning
 - Remote troubleshooting
 - Artificial intelligence and machine learning



The Eaton solution



Eaton solutions

PowerXL[™] VFD family

- Active Energy Control[™]
- Single-phase applications
- Multi-pump control
- Flying start
- Built-in communications
- Dual PID control
- Expandable I/O



Advancing your pumping system

The PowerXL[™] drives family is engineered to provide a complete solution for your demanding pumping applications. The PowerXL DE1, DC1, DA1 and DG1 provide the reliable performance you need while also generating the energy savings you want. With advanced yet easy-to-use features, precise system control and dedicated product support, the PowerXL drives are designed to optimize your pumping systems.

dedicated product support, the PowerXL drives designed to optimize your pumping systems.



DEI

DG1

Eaton solutions

CPX9000 Clean Power VFD

- 40 to 800 hp @ 480 V, 50 / 60 Hz
- 18-pulse low harmonics VFD
- 0.1 to 400 Hz frequency range
- Smallest footprint in the industry
- Guarantees IEEE[®] 519 compliance < 5%THD
- Customizable power and control options







IoT & pumping system definitions

IoT architecture

Use cases by user type

Questions & answers



