

### Compressed Air System Optimization

Smart Technology - Powered by GE's Industrial Internet



#### Benefits

- ✓ **Fault Detection & Diagnosis that REDUCE RISK & LOWER OPERATING COSTS!**
- ✓ **Real Time Probable Causes and Corrective Actions**
- ✓ **Energy and Maintenance Consultation with Experts!**
- ✓ **Mobile Visualization and Alerts... Anytime, Anywhere**
- ✓ **Quicker Time to Resolution – 40% INCREASE IN OPERATIONAL EFFICIENCY!**
- ✓ **Enhanced Decision Making through Collaboration, Notes and Tasks**
- ✓ **Cloud Based means No Hardware or Maintenance Costs - Lowest Total Cost of Ownership in the Industry**

**Compressed Air Systems** are often referred to “The 4<sup>th</sup> Utility”, because they are one of the largest consumers of electricity across major facilities. Therefore, improving and maintaining peak system performance can pay enormous dividends as it relates to both energy savings and operational efficiency.

With **FacilityConneX (FCX) Reasoners**, we can transform your compressed air equipment into a smart system that identifies potential problems, alerts you to critical faults, and recommends the corrective actions that will save you time and money!

#### What is Smart Monitoring?

Smart Monitoring is the next generation of equipment connection and visualization technology, designed to transform machine data into real operational intelligence that end users can act on. This insight is available anytime, anywhere, so you can get out into the field... and get working on the issues that matter most.

#### What is Smart System Optimization?

A modern industrial compressed air system is composed of several major sub-systems and many sub-components (see below). Therefore, improving and maintaining peak compressed air system performance requires understanding and addressing faults at both the supply side and the demand sides of the system. The FCX fault detection analytics are designed to continuously monitor the critical operational parameters to recognize patterns, identify issues, and determine the specific causes for these faults.

The **FCX Compressed Air Reasoner Pack** delivers sophisticated analytics to detect faults, improve efficiency, identify energy cost savings opportunities, and prevent maintenance problems from happening... before they occur!

#### GE Industrial Cloud Secure

We provide a highly-secure private VPN type connection that is used solely for the transmission of this data to FCX Cloud. Our one-way connection is Encrypted and Encoded between trusted servers on either end.

In addition, our Hosted/SaaS model works delivers all the functionality of the platform without the headaches, time or cost it takes to upgrade and maintain any HW/SW in your own environment. The FCX Cloud service takes care of this for you.

#### A Smart System = Better Results

We've seen energy savings from system improvements on compressed air systems that can range from **25 to 50 percent of their electrical consumption**. For many facilities this is equivalent to hundreds of thousands of dollars in potential annual savings. Not only that, but a properly managed compressed air system can reduce maintenance costs, decrease downtime, increase production throughput, and improve overall product quality.

**“You can save 25% - 50% in kWh with a Compressed Air Continuous Fault Detection System!”**

Paul Banks, Principal  
B2Q Associates

**You Can Resolve Issues Faster!**

Advanced notifications through FCX will alert your end-users to a current state anomalies or predictive issues that require immediate attention. These alarms and alerts will drive be prioritized based on their potential impact to your systems and include detailed information on its severity and the probably causes to help you drive a quick resolution

**Looking Deeper into your Air Systems**

FCX can keep an eye on many different types of Compressed Air systems, including; Positive-Displacement (Reciprocating and Rotary) and Dynamic (both Centrifugal and Axial). Depending on your type of Compressed Air System some of the subsystems that we continuously analyzed are:

- Prime Movers or Motors
- Air System Controls
- Supply and Demand Analysis
- Air Inlet Filters
- Separators
- Cooling and Intercooling
- Dryers
- Compressed Air Filtration
- Heat Recovery
- Pressure and Flow Controllers
- Air Distribution Systems
- Leakage



**What Does FDD Do For You?**

- ✓ Analyze Operations and Energy Consumption and Economics
- ✓ Improve Equipment Uptime/Availability
- ✓ Maintain Peak Efficiency at any Part Load
- ✓ Reduce Operating Costs including Electricity and Maintenance
- ✓ Maintain Air Quality

**SAVE UP TO 50%!!**

**Any Many More ...** 100s of checks are done continuously across your compressed air systems.

**Agnostic and Secure Connections**

We detect and predict issues based on the equipment type, not the manufacturer. As long as there are sensors and data to be gathered from the machine, controller, or the building management system (BMS), we can "connect and detect". FCX supports over 200+ protocols and 100s of equipment types, and our connections use advanced VPN technology from General Electric, all built for the Industrial Internet.

**FDD Examples**

- ✗ Blow-off (bypass) valve is open before the inlet guide vanes (inlet butterfly valve) reach minimum position.
- ✗ Compressor using capacity modulation when it should be operating in a load/unload sequence for best efficiency.
- ✗ Multiple compressors are operating when fewer are needed.
- ✗ Dryer is currently operating on a timed schedule and could be improved by implanting dew-point temperature control.
- ✗ Differential pressure across the air filter section is too high for efficient operation.

**Intelligence at Hand**

GE's patented GEO-Intelligence technology is designed to automatically navigate and provide information based on user location, role, and equipment condition and context. This situational awareness technology combines asset critically with location and proximity, to ensure that the user has key information they need on the equipment close by.

**ECONOMICS: The Cost of a Leak?**

**Leaks** can be a significant source of wasted energy in an industrial compressed air system, sometimes wasting 20 to 30 percent of a compressor's output.

A typical plant that has not been well maintained will likely have a leak rate equal to 20 percent of total compressed air production capacity.

Diameter of air leak	CFM of air lost at 100 psig	x 60 = cubic ft. lost per hour	x 24 = cubic ft. lost per day	x 365 = cubic ft. lost per year	Annual cost at \$0.18 per 1,000 cu. ft. *	Annual cost at \$0.32 per 1,000 cu. ft. *
1/32"	1.62	97.2	2,332.8	851,472	\$153	\$272
1/16"	6.49	389.4	9,345.6	3,411,144	\$614	\$1,091
1/8"	26	1,560	37,440	13,665,600	\$2,459	\$4,372
1/4"	104	6,240	149,760	54,662,400	\$9,839	\$17,491
3/8"	234	14,040	336,960	122,990,400	\$22,138	\$39,356
1/2"	415	24,900	597,600	218,124,000	\$39,262	\$69,799
3/4"	934	56,040	1,344,960	490,910,400	\$88,363	\$157,091

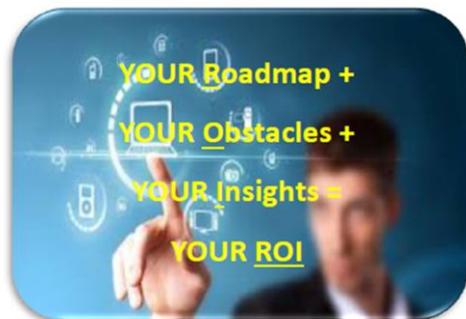
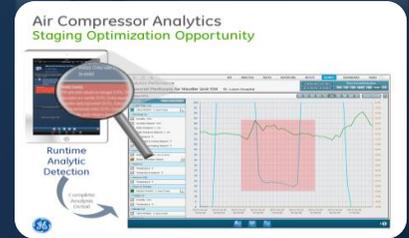
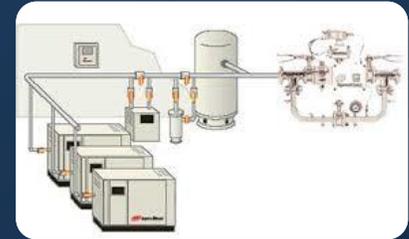
\* According to Compressed Air Challenge of the U.S. Department of Energy's Office of Industrial Technologies, the total cost of 100 psig compressed air has been Calculated to be in the general range of 18 to 32 cent

## Fault Detection Input Requirements

Compressor Subsystem	Input Criteria
Blow-off Value	Value Position Present Value
Bypass Value	Value Position Present Value
Cooling Water Supply	Temperature Present Value Temperature Setpoint
Discharge Air	Pressure Present Value Pressure Setpoint Pressure Loaded Setpoint Pressure Unloaded Setpoint Actual Cubic Feet Per Minute Present Value Standard Cubic Feet Per Minute Present Value
Dry	Discharge Air Dewpoint Present Value
Dryer	Heater Amp Preset Value Heater Status Present Value Purge Status Present Value Differential Pressure Present Value Entering Air Present Value Leaving Air Present Value
Filter	Differential Pressure Preset Value Entering Air Present Value Leaving Air Present Value
Flow	Actual Cubic Feet Per Minute Present Value Standard Cubic Feet Per Minute Present Value
Inlet Value	Valve Position Present Value
Inlet Butterfly Value	Value Position Present Value
Inlet Guide Value	Value Position Present Value
Line	Pressure Present Value
Load	Status Present Value
Motor	AMP Present Value kW Present Value Speed Present Value Status Present Value
Oil	Temperature Present Value

Only with continuous system monitoring can you rest assured that you will identify issue before they become mission critical.

FacilityConneX goes well beyond examining the just the performance of an individual component... instead, we examine how all components on both the supply and demand sides of interact with one another to drive true system optimization.



changes, and review of critical alarms and system findings. We consult with you on energy savings opportunities and equipment optimization findings that FCX has identified to help you prioritize and make the corrections to the equipment performing inefficiently, out of specification, or in failure. Our Engineers will review the system findings every month, leveraging the real-time FCX fault detections and data trends to target specific areas requiring the most attention.

### FCXperience Software 'with' Services

As part of your software subscription, monthly consultations are conducted by our customer experience team. These discussions include time allocated for training, fine-tuning of equipment and system analytics, implementation

We work closely with you to understand where you're headed, and what challenges you've faced getting there. And together we design and implement a continuous commissioning program that delivers sustainable cost savings

The team approach integrates the power of the technology, analytics, and expert "hands on" consulting to drive savings in operational efficiency and energy costs.

**That way, you focus on working on the things that matter most to your team!**

