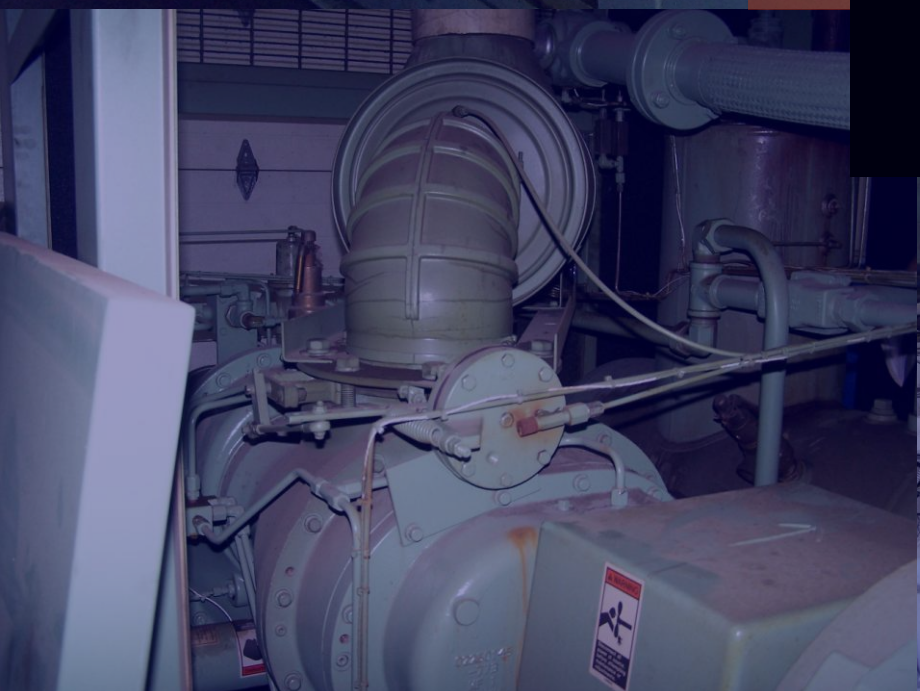
PLANT AIR CONTROL SYSTEMS

CONTROL SOLUTIONS DESIGNED TO FIT RIGHT IN

Maximizing your plant's efficiency with plant air control systems built to fit your needs – *exactly*.

Energy Control Technologies

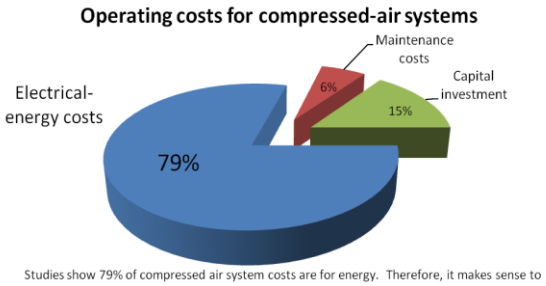


Energy Control Technologies (ECT) provides the latest in plant air control solutions designed to maximize your plant's efficiency. ECT delivers high value control solutions for plant air systems with screw, reciprocating and centrifugal compressors.

Historically, these solutions have been available only in proprietary hardware. ECT now delivers these controls in an open platform using Rockwell Automation hardware and software. Most importantly, payback for an ECT improved plant air control system is typically one year.

High Return on Investment

The air compressors in your plant are one of your highest energy consumers. Many manufacturers ignore the costs of producing air, even when an average of 79 percent of operating costs can be related to energy consumption.



Studies show 79% of compressed air system costs are for energy. Therefore, it makes sense to pay special attention to the proper use of compressed air.
Machine Design April 2007

ECT plant air control systems can lower your energy costs by as much as 25 percent.

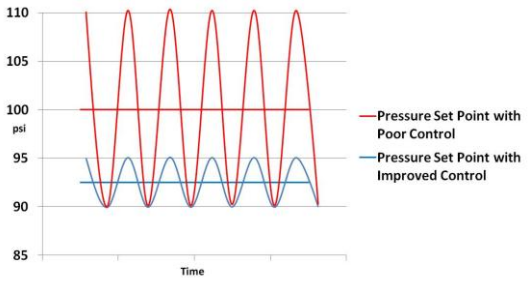
The original control system supplied with a compressor ignores the compressor network, focusing only on the single unit. A flow-pressure regulator is used to control the header pressure rather than controlling the compressors directly in an integrated manner. Because of the pressure loss across the pressure regulating valve, most compressed air systems operate at a higher pressure than required. Frequently, the air system header pressure is operated 10 to 15 psi higher than needed.

Excessive storage capacity in the form of air receivers is also commonly used to buffer the pressure swings. This is necessary since the original system *individually* loads and unloads compressors on the network to prevent short-cycling issues. The result is larger-than-needed swings in pressure at the compressor discharge and higher power consumption.

Centrifugal compressors present the following challenges:

- Surge protection of compressor
- Efficient distribution of flow among parallel operating compressors - especially for a mix of screw and centrifugal compressor combinations
- Unnecessary blow-off of compressed air to atmosphere at lower plant demands

ECT's AirPAC® air compressor control system coordinates all compressors on the network using advanced feed-forward and model predictive algorithms. Because of this, ECT's systems minimize pressure swings, allowing a reduction in header pressure – saving you energy.



Determining Critical Pressure establishes Savings Potential

Critical pressure of the plant air system is often unknown. But its determination is essential to calculating potential energy savings for your plant.

Critical pressure is established by finding the lowest header pressure the system can operate at, without disrupting your manufacturing process. Knowing this pressure, along with knowing the current operating pressure, determines the savings ECT's AirPAC control system can provide.

Energy savings related to Pressure Reduction

High pressure air is more expensive to produce and deliver than low pressure air.

From the *Compressed Air Source Book – Section 2, Compressed Air System Controls*[1]*:*

- For systems in the 100 psig range, a 2 psi increase in discharge pressure will increase energy consumption by approximately 1 percent at full output flow.

- For systems in the 100 psig range with 30 to 50 percent unregulated usage, a 2 psi increase in header pressure will increase energy consumption by about another 0.6 to 1.0 percent because of the additional unregulated air being consumed.

This results in a minimum of 1.6 percent decrease in energy costs for every 2 psi reduction in header pressure.

Calculating the Cost of Compressed Air

To estimate the cost of compressed air, use this calculation:

> Annual Electricity Costs =
> (motor full-load horsepower) x
> (0.746kW/hp) x (1/0.9) x
> (annual hours of operation) x
> (electricity cost in $/kwh)

Energy Savings Demonstrated

The following case study demonstrates how ECT control system savings were determined for one plant:
A manufacturing plant has five 200-horsepower compressors operating year round with electricity costs at $0.05/kWh.

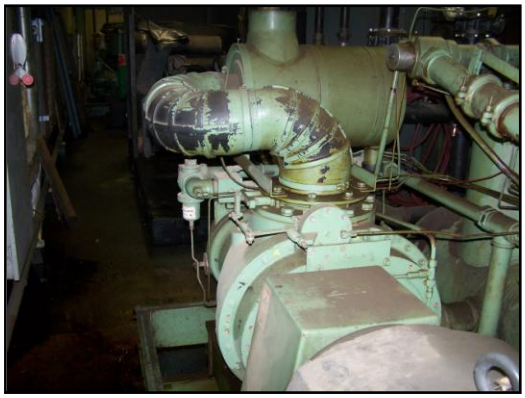
Annual Electricity Costs =
(5 machines) x (200 horsepower/ machine) x (0.746kW/hp) x (1/0.9) x (8760 hours/year) x ($0.05/kWh) = $363,053.33/year

If the current header pressure operates at 105 psi and the critical pressure is 85 psi, then it can be assumed with better controls, the set point can be lowered to 90 psi.
Energy Savings = Annual Electricity Costs

x (Reduction in Set Point in psi) x (1.6%/2 psi reduction)

Energy Savings = $363,053.33 x (15 psi) x (1.6%/2psi) = $43,466.

Additional savings from idling or shutting down unnecessary compressors usually result in an additional 25-50 percent savings resulting in a total savings of $54,458 - $65,200 per year.



Older compressors are excellent sources of energy savings when retrofitted with ECT's AirPAC plant air compressor control system.

Plant Air Compressor Control

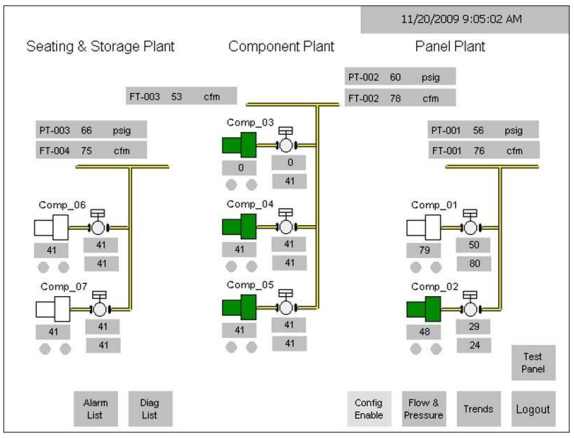
Plant Air Compressor Control is a challenging application requiring sophisticated control algorithms to operate the compressors efficiently. ECT's AirPAC® Advanced Plant Air Automation Control System effectively solves the following control challenges:

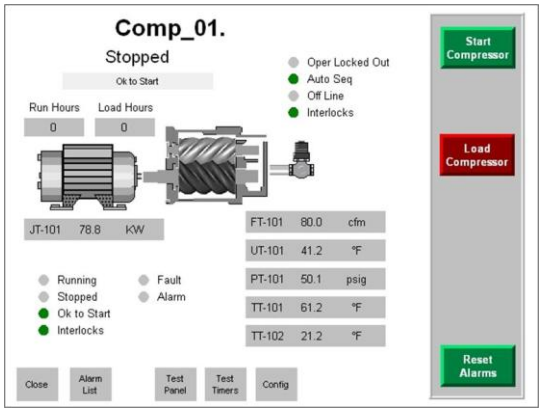
- Compressor start/stop and load/unload
- Compressor interface for modulate control
- Compressor network load distribution for different brands of compressors
- Interfacing to remote compressors via network communications

Traditional systems often use a control strategy known as *cascading set points*. Individual compressor pressure set points were set to add or subtract capacity to meet demand. This strategy leads to a large pressure range and higher operating discharge pressures than required.

The objective of the control system is to match demand with compressor production at maximum compressor efficiencies.

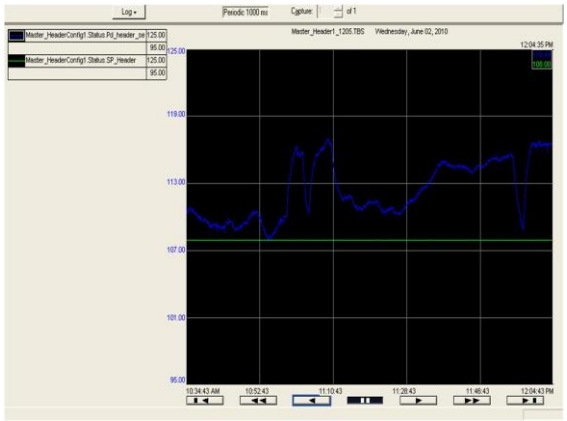
Many plant air systems utilize screw compressors, which are excellent candidates for ECT AirPAC® control system retrofits.



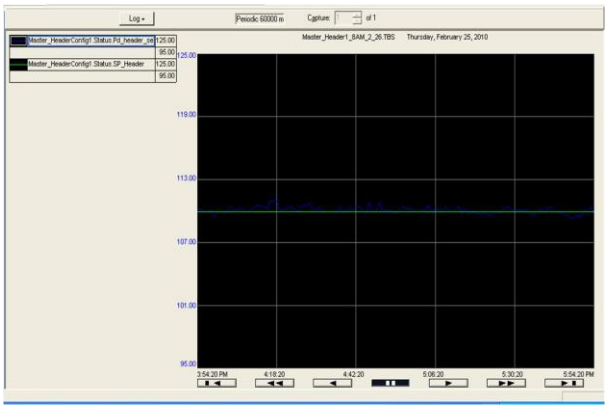


ECT's AirPAC® Plant Air Automation Control System *(shown above)* matches the supply to the demand by:

- Lowering the discharge header pressure set point but keep operating pressure above critical pressure
- Operating the most efficient compressors
- Idling or stopping less efficient compressors
- Maintaining tight header pressure control
- Efficiently distribute the load among different types and capacities of air compressors operating in a network



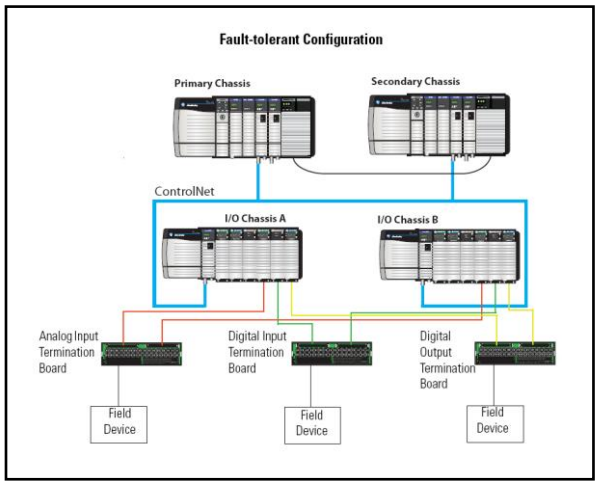
Poor pressure control with existing OEM system



ECT's AirPAC® improved pressure control

FAULT TOLERANCE

ECT can provide a fully redundant control system to provide the ability for a customer to use the existing OEM control as a backup. In addition, ECT's Fault Tolerant Action keeps your system running even with failures of hardware, non-redundant transmitter inputs, or loss of network communications.
In addition, the new system can be backed up by the existing system, should maintenance be required it.



ECT AirPAC® Benefits

- Operate at the lowest possible pressure
- Fewer number of compressors on line
- System redundancy
- Open system using Rockwell Automation Logix platform
- Compressed Air Energy Management system
  - Performance monitoring
  - Capture inefficiencies
- Reduced operating costs
- Provides the highest ROI to customers

Retrofit Project Services

ECT supports its customers' projects with expertise which ranges from control system development through system commissioning:

- Applications engineering and consulting
- Site surveys
- Economic justifications
- Project engineering
- Factory acceptance tests
- Field service and commissioning
- Installation supervision
- Simulations
- Training
- Service contracts

ECT provides full field service support, from checkout to commissioning and remote support for system troubleshooting.

Put ECT to Work for You

ECT is ready to survey your plant's compressed air system to calculate your potential energy savings.

If a control system retrofit is likely to meet your investment criteria, ECT will provide a proposal outlining the control system solution specifically designed for your system.

Contact ECT today at:

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Energy Control Technologies