



Corporate Capabilities

CONTROL SOLUTIONS DESIGNED TO FIT RIGHT IN

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

Energy Control 
Technologies



Energy Control Technologies (ECT) provides the latest in control solutions designed to maximize your plant's production and efficiency. ECT engineers high value control solutions for turbomachinery, positive displacement compressors, and centrifuges (*historically available only in proprietary hardware*) and delivers them in an open platform using Rockwell Automation hardware and software.

ECT provides control solutions for centrifugal & axial compressors

- surge control
- performance control
- Interaction Control®
- optimum load distribution of compressor networks

Steam & gas turbines

- speed control
- extraction control
- electronic overspeed trip
- fuel control
- turbine logic

Plant air compressors for all types of compressors (screws, recips, centrifugals)

- header pressure control
- automatic sequencing
- PrePAC pressure drop prevention

Refrigeration systems

- ammonia compressors
- chillers
- condensers/cooling towers
- fans
- pumps

Centrifuges

- flow control
- power limiting
- speed limiting

- vibration monitoring
- CIP control
- partial & full discharge control

HIGH RETURN ON INVESTMENT

Turbomachinery, compressors, and centrifuges are the heart of many processes. If they're down, your process is down, costing you revenue and profit. In addition, these machines are high energy users. This combination creates control system retrofit opportunities with high ROIs justified by production increases, fewer trips, energy savings, and lower maintenance.

Common problems that result in high ROIs:

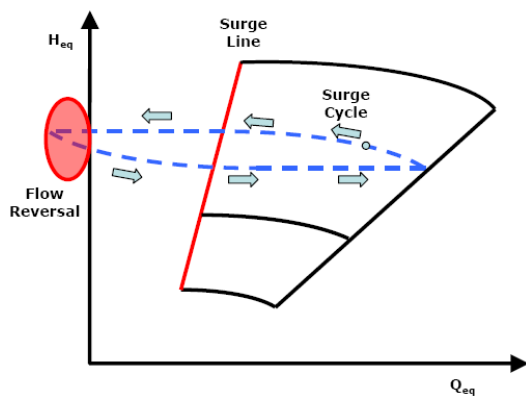
- Machine trips
- Compressor recycle or blow-off
- Unstable pressure control
- Controllers in manual
- Base loading of parallel or series operating compressors
- Multiple partially loaded compressors
- Over cooling and improper load balancing of refrigeration system
- Too frequent centrifuge CIP and partial and full discharges

TURBOCOMPRESSOR CONTROL

Turbocompressor control is a challenging application requiring sophisticated control algorithms to operate the compressor and process safely and efficiently. ECT's TurboPAC® Turbomachinery Process Automation Control System for turbocompressors effectively solves the following control challenges:

- Accurate calculation of the distance between the operating point and surge line
- Surge control, prevention, detection, and stopping
- Control loop interaction
- Compressor network load distribution

Compressor surge is a common problem in turbocompressors that can lead to machine trips and damage. Compressors can surge in as little as 40ms with a complete surge cycle occurring in as little as one second.

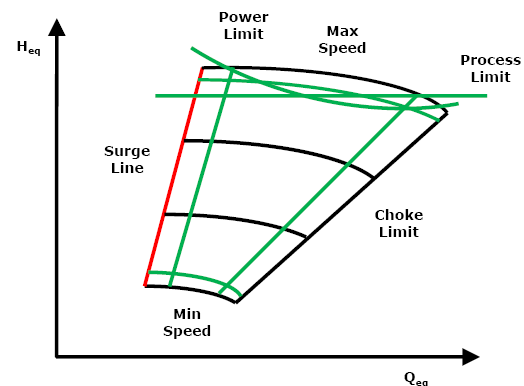


Repetitive surging can lead to seal, bearing, and rotor damage and can lead to trips based on vibration, temperature, over-speed, and exceeding process limits.

EQUIVALENT MAP MODELS

ECT has developed a library of Equivalent Map Models to effectively deal with changing compressor inlet conditions. Our comprehensive models compensate for suction temperature, suction pressure, molecular weight, compressibility, and gas composition.

Our engineers select the models to maximize your compressor operating envelope. With this accurate compressor mapping, you'll see increases in production and energy savings through reduced recycle.



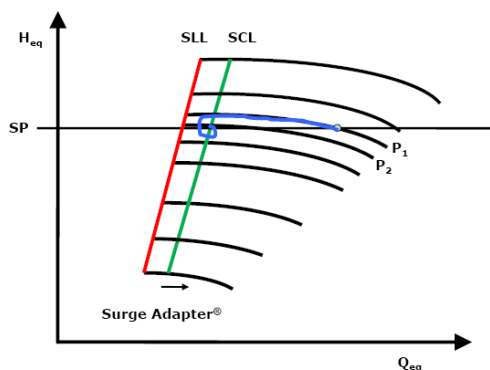
SURGE CONTROL

ECT's SurgePAC® Surge Controller uses three specialized algorithms to prevent surge in your compressor:

- Surge Adapter®
- Surge Preventer®
- Surge Stopper®

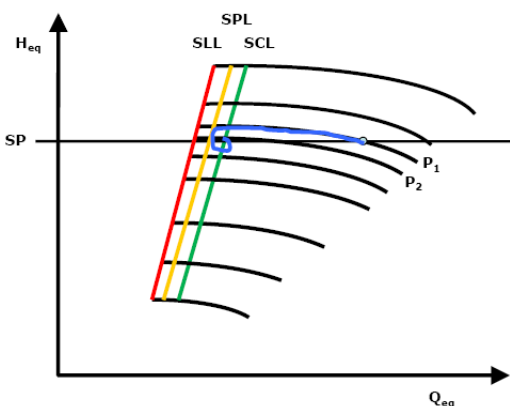
SURGE ADAPTER®

Surge Adapter® safely controls the compressor operating point during larger disturbances by temporarily widening the control margin, then reducing the margin during steady state conditions, minimizing the required recycle when operating at reduced throughput.

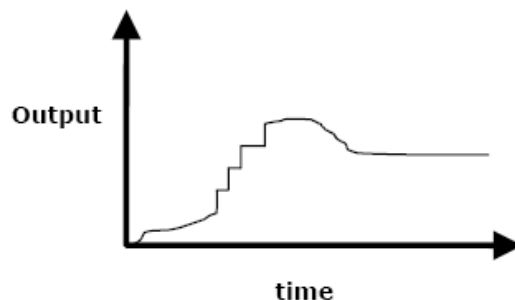


SURGE PREVENTER®

During very large process upsets, Surge Adapter® may not be able to prevent the operating point from moving close to the Surge Limit Line (SLL). ECT's Surge Preventer® responds when the operating point crosses the Surge Preventer Line (SPL). It opens the valve quickly using Fast Response, customized to prevent surge while minimizing the process disturbance at the same time.

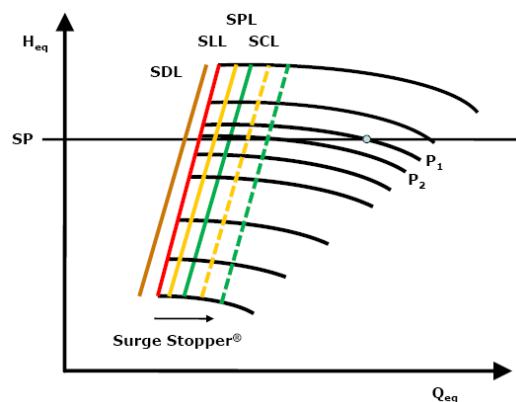


Fast Response is highly adaptable and easy to tune in the field resulting in maximum protection and quick process recovery.



SURGE DETECTION AND SURGE STOPPER®

If a compressor goes into surge, surge will be detected when the operating point crosses the Surge Detection Line (SDL). ECT's powerful Surge Stopper® control algorithm breaks the surge cycle immediately and prevents surge from occurring again.



PERFORMANCE CONTROL

ECT's PerformancePAC® Process Controller controls your plant's main process variable while limiting up to five additional process, performance, and mechanical constraints. The PerformancePAC® Controller can control your turbocompressor using one or more of the following control elements:

- Inlet throttling valve
- Inlet guide vanes
- Turbine speed control
- Variable speed electric drive

INTERACTION CONTROL®

Control loop interaction can be a significant problem when controlling turbocompressors. The interaction between process and surge controllers starts at the worst time, when the operating point is close to surge where the recycle valve starts to open.

Conventional systems can't cope with this problem unless they are detuned or some of the loops are switched to manual. This action results in poor process control and compromised machine protection.

ECT's Interaction Control® Algorithms eliminate control loop interactions resulting in improved process and surge control stability while keeping all controllers in automatic.

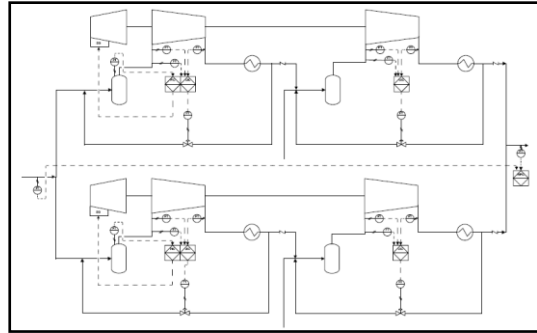
COMPRESSOR NETWORKS

One of the more challenging applications in controlling compressors is load distribution of compressors operating in parallel or series.

ECT's NetPAC® Network Control System includes a Supervisor Function and Distribution Function.

The Supervisor Function is designed to control the main network process variable, usually suction header pressure, discharge header pressure, or system mass flow. The Distribution Function distributes the load among the compressors in the network to maximize compressor network

production, efficiency, protection, and stability.



ECT's Network Control System operating two parallel – two section compressor trains

STEAM AND GAS TURBINE CONTROL

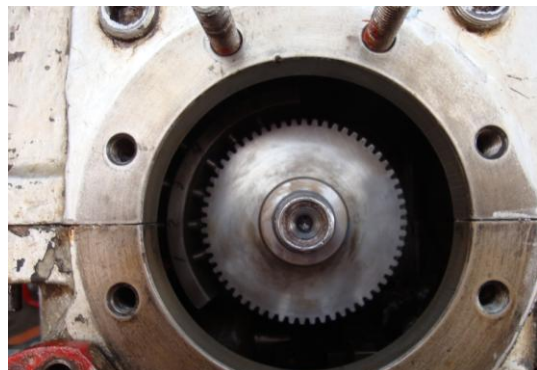
ECT supplies low cost simplex and redundant speed control systems for your turbines driving compressors, generators and pumps. Functions included:

Steam Turbines

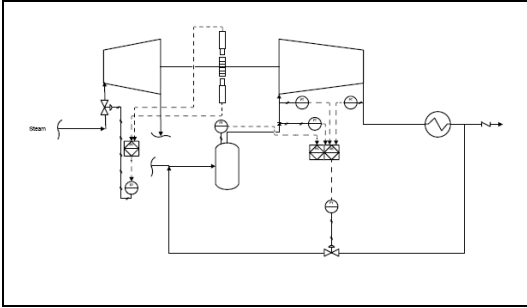
- Startup/shutdown sequencing
- Critical speed avoidance
- Extraction control
- Mechanical retrofit kits

Gas Turbines

- Startup/shutdown sequencing
- Accel/decel limiting control
- CDP, EGT, GG, and PT limiting control
- Mechanical retrofit kits

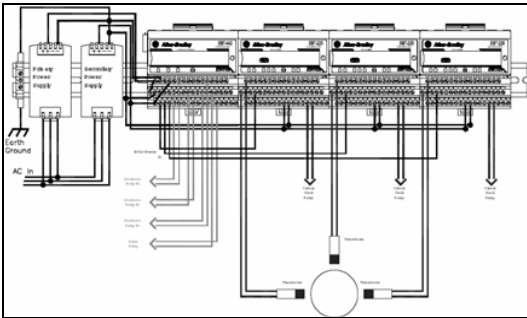


Speed sensing magnetic pickup and gear installation for ECT speed control and overspeed trip system



ECT's Steam Turbine Speed Control on a Compressor Drive

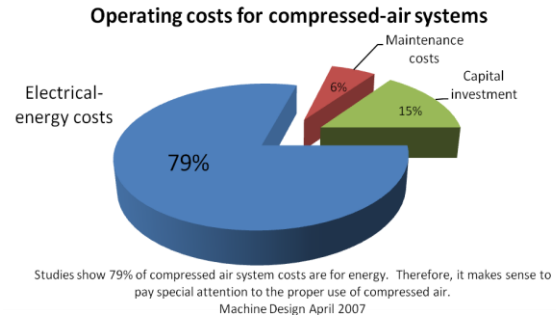
ECT delivers Electronic Overspeed Trip Systems to replace your mechanical system using standard Rockwell Automation hardware meeting API 670 specifications.



ECT's Electronic Overspeed Trip System

PLANT AIR CONTROL

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 costs can be related to energy consumption.

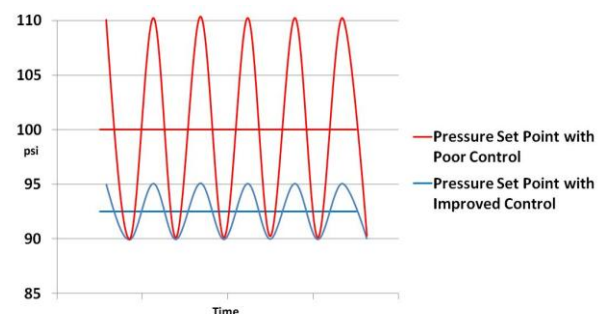


ECT plant air control systems can lower your energy costs by as much as 25 percent.

The original control system supplied with a machine ignores the compressor network, focusing only on the single unit. Because of this, most compressed air systems operate at a higher pressure than required.

Frequently, air system header pressure is operated 10 to 15 psi higher than needed. This is because of the way the original system *individually* loads and unloads compressors on the network. The result is larger-than-needed swings in pressure.

ECT's control system coordinates all compressors on the network. Because of this, ECT's systems minimize pressure swings, allowing a reduction in header pressure – saving you energy.



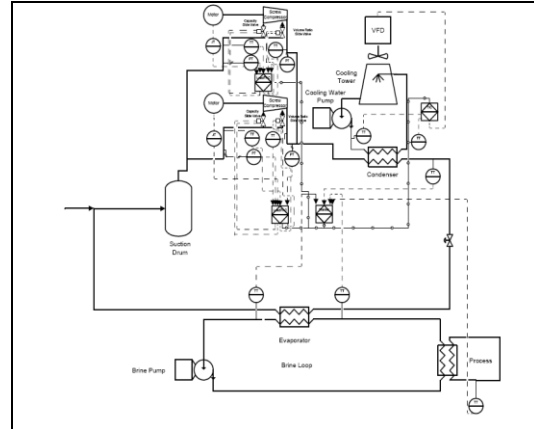


DON'T INSTALL STORAGE TANKS AND PRESSURE/FLOW STATIONS

ECT's AirPAC® control system provides the most energy savings of any system because the AirPAC® system doesn't use a flow/pressure control station which forces some or all of your compressors to operate at a much higher pressure - wasting energy.

REFRIGERATION CONTROL SYSTEMS

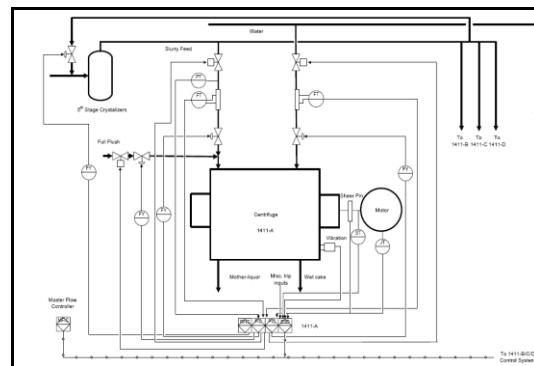
- ECT's refrigeration control system can save up to 15% in energy by eliminating the following problems
- Multiple partially loaded compressors
- Extended idling of compressors without shutting down
- Conservative brine temperature in the chillers
- High condenser temperature due to lack of integration of cooling tower with compressors
- Constant speed fans and pumps
- Compressor trips due to motor overload, high temperature and pressure



CENTRIFUGE CONTROL

ECT's centrifuge control system provides the following functionality:

- Solids build-up detection – through high vibration, torque, and motor amp monitoring
- Seal leak
- Separation efficiency
- Flow and load imbalance among parallel operating centrifuges
- Lube oil low flow trips



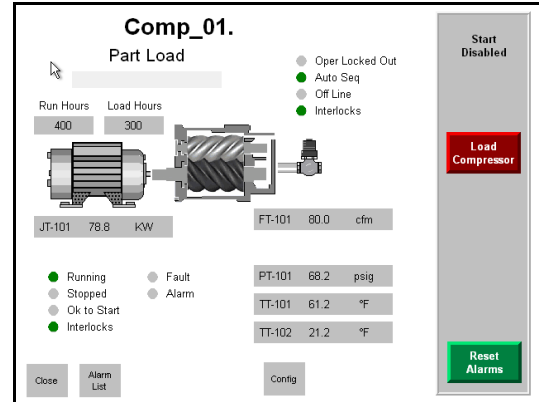
ECT's centrifuge control system

PACVIEW®

ECT's PACView® is your window into your plant enhancing operation, maintenance, and monitoring functions.

With high resolution data recording capability, PACView® can capture critical data that you can replay for troubleshooting purposes. Our engineers customize your PACView® with the following features:

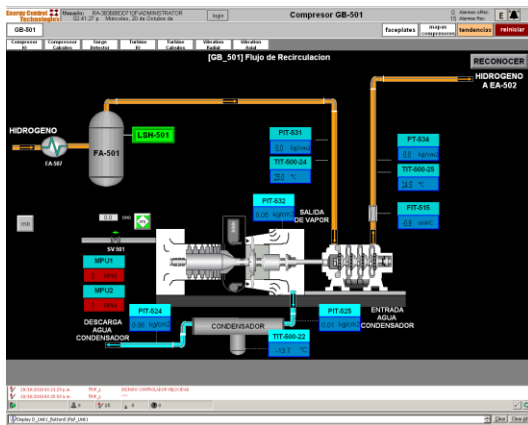
- Process and equipment diagram
- Dynamic machine data
- Controller faceplates
- High speed trending
- Event-driven fast archiving
- Alarms and events



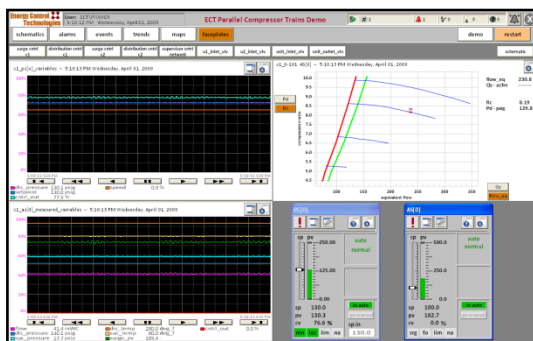
ECT's AirPAC Screw Compressor Operator Display

FAULT TOLERANCE

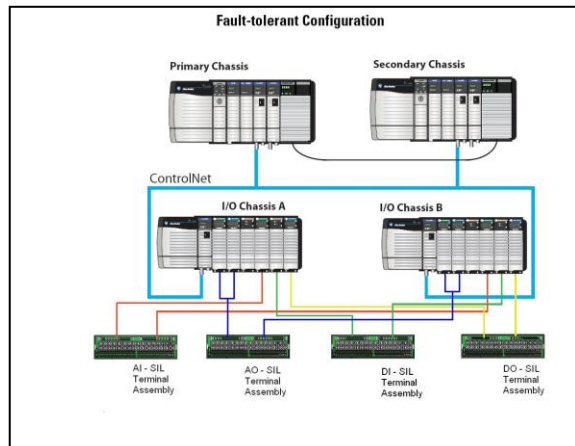
ECT provides a fully redundant control system that is SIL 2 compliant. In addition, ECT's Fault Tolerant Control Action keeps your system running even with failures of non redundant transmitter inputs.



ECT's turbomachinery diagram



ECT's trends, dynamic compressor map and controller face plates



NEW CONSTRUCTION AND RETROFIT PROJECT SERVICES

ECT supports our customers' projects with expertise, from pre-feed control system development to system commissioning, through:

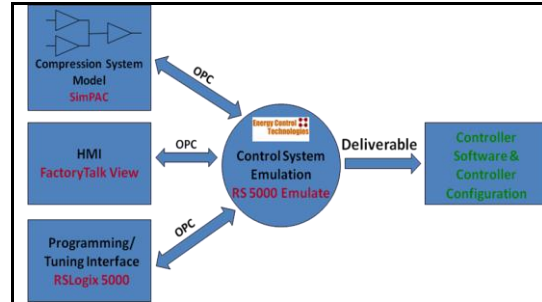
- Applications engineering and consulting
- Site surveys
- Economic justifications
- Project engineering
- Factory acceptance tests
- Field service and commissioning
- Installation supervision
- Simulations
- Training
- Service contracts



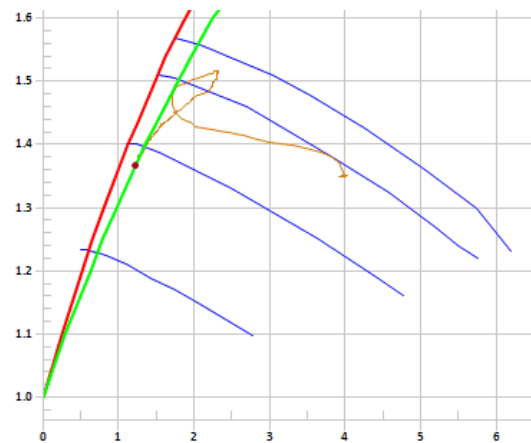
ECT's engineers review field-mounted devices for optimum control system performance.

ECT provides site surveys and economic justifications on retrofits and upgrades to justify customer investments in new control systems.

ECT supports our customers during the engineering phase of the project eliminating the guess work on valve sizing, transmitter selection and locations, process equipment sizing and piping layout through high-fidelity simulations.



ECT's SimPAC™ compressor process simulation capabilities eliminates design errors during the project engineering phase



ECT provides full field service support from system checkout to commissioning including onsite surge testing and tuning of your system. ECT also has the capability to provide remote field support using the latest technology.



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

PUT ECT TO WORK FOR YOU

Whether it's a site survey to calculate an ROI for a retrofit or to help you with important decisions on piping layout and vessel locations on a new project, ECT is ready to support you on your next turbomachinery control system project.

Contact ECT today at:

Energy Control Technologies
2751 99th Street
Urbandale, IA 50322
515 223-1635

contactus@energycontroltechnologies.com

Or visit us on the web at:

www.energycontroltechnologies.com



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