AUTOVAC
Industrial
Vacuum & Air Systems

VACUUM IQ™

Intelligent Vacuum Controller

US Patent Pending

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What is Vacuum IQ™?

Vacuum IQ™ is an electronic motor control and software program designed for motor-driven centrifugal vacuum and pump systems that automatically adjusts motor speed to changing load requirements.

The result is equipment that "thinks" for itself and matches production to demand at any given time. The most significant benefit Vacuum IQ™ offers is dramatic energy savings. Vacuum IQ™ also extends equipment life, reduces maintenance and downtime costs, and often increases productivity.

Vacuum IQ™ combines the technology of a variable frequency drive (VFD) with AutoVac's proprietary computer programming that is customized for each industrial application. Its Windows based operating platform can be interfaced with existing equipment and allows for comprehensive motor control and easy data retrieval.

Software Features

- View and modify drive data with a simple user interface
- Download and save data to a drive or file
- Ability to save parameter or graph data as comma separated variable (.csv) file for use with other software applications such as Microsoft EXCEL
- Online monitoring for troubleshooting and diagnostic purposes
- Fault history of drive
- Digital scope feature for graphing drive data
- Basic online control of the drive to test parameter adjustments, simulate events, and to perform motor auto-tunes
- Cost savings calculator tracks exact savings

How does it work?

Once Vacuum IQ™ is installed and programmed for a specific application, the operating speed of the connected motor is varied by changing the frequency of the motor supply voltage. This allows continuous airflow speed control within the parameters of your specific application. Motor-driven systems are often designed to handle peak loads that have a safety factor. This often leads to energy inefficiency in systems that operate for extended periods at reduced load. The ability to adjust motor speed enables closer matching of motor output to load and results in tremendous energy savings.

Many motor-driven centrifugal vacuum and pump systems operate for extended periods at reduced load with airflow restricted or throttled. In these centrifugal machines, energy consumption is proportional to the cube of the flow rate. Even small reductions in speed and flow can result in significant energy savings. Vacuum IQ™ can offer significant energy and cost savings by reducing the operating speed when the airflow requirements are lower.

Vacuum IQ™ can also increase productivity, improve product quality and process control, and reduce maintenance and downtime.

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How Much Will I Save?

Table 1. Potential Energy Savings from Installing Vacuum IQ™

Airflow Volume (percent of maximum)	Daily Operating Time (hours)	Energy Consumed Without Using Vacuum IQ™ (kWh/year)	Energy Consumed Using Vacuum IQ™ (kWh/year)	Difference in Energy Consumption (kWh/year)
50%	1	7,679	1,992	5,687
60%	1.5	12,160	4,067	8,093
70%	3	25,606	11,122	14,484
80%	3	26,270	14,899	11,371
90%	2	18,343	13,529	4,814
100%	1.5	14,193	14,608	–415
Total	**12**	**104,251**	**60,217**	**44,033**

The potential energy savings from using Vacuum IQ™ is illustrated in the following example. Here, a 30 hp motor is used in a central vacuum system with 12 hoses. The system operates 365 days a year with the load/time profile shown in Table 1. The estimated annual energy savings realized from using Vacuum IQ™ is also shown in Table 1. Refer to the Vacuum IQ™ Cost Savings Calculator at www.VacuumIQ.com to determine your exact savings.

The above example shows a possible electrical energy saving of 44,033 kWh per year, resulting from the installation of Vacuum IQ™. At energy rates of $0.100/kWh, annual savings are $4,403.

Benefits of Using Vacuum IQ™

Vacuum IQ™ provides cost savings on many levels.

- Dramatically lower electric bills through reduced energy consumption
- Extended equipment life since lower operating speeds result in longer life for bearings and motors
- Lower maintenance costs and downtime
- Simplified equipment – there is no need for throttle valves, dampers, and soft start controls
- Improved airflow control
- Rebates offered by most energy suppliers
- Return on investment is short and savings continue year after year
- Controlled ramp-up speed can eliminate vacuum or air surges
- Protect driven equipment by limiting torque to a user-selected level that cannot tolerate excessive torque
- Control process temperature, pressure or flow without the use of a separate controller
- Built-in bypass control
- Increased productivity and improved product quality and process control

Applications

Vacuum IQ™ is the ideal tool to: improve the efficiency of motor-driven equipment by matching speed to changing load requirements; or allow accurate and continuous airflow control over a wide range of speeds.

Because Vacuum IQ™ operates with most motor-driven centrifugal vacuums, exhausters, pumps, fans and blowers, the applications are virtually unlimited.

- Industrial Manufacturing Process
- Aerospace Manufacturing Process
- Production Assembly Lines Clean Up
- Dustless Sanding
- Carwash Central Vacuum Systems
- Carwash Tunnel Blowers/ Dryers
- Medical Vacuum Systems
- Clean Room Technologies
- Many More Applications - Consult Factory

Vacuum IQ™ in a NEMA 3R Enclosure

For more information consult your AutoVac Company Professional today.
Toll Free 1-888-628-8682 or website: www.autovacinc.com

The Science Behind It

Induction motors, the workhorses of industry, rotate at a fixed speed that is determined by the frequency of the supply voltage. Alternating current applied to the stator windings produces a magnetic field that rotates at synchronous speed. This speed may be calculated by dividing line frequency by the number of magnetic pole pairs in the motor winding. A two-pole motor, for example, has one pole pair, and therefore the magnetic field will rotate 60 Hz / 1 = 60 revolutions per second, or 3600 rpm. The rotor of an induction motor will attempt to follow this rotating magnetic field, and, under load, the rotor speed "slips" slightly behind the rotating field. This small slip in speed generates an induced current, and the resulting magnetic field in the rotor produces torque.

Since an induction motor rotates near synchronous speed, the most effective and energy-efficient way to change the motor speed is to change the frequency of the applied voltage. Vacuum IQ™ converts the fixed-frequency supply voltage to a continuously variable frequency, thereby allowing adjustable motor speed. Vacuum IQ™'s proprietary software allows you to determine the parameters to meet your application.

Features

- User-friendly software interface
- Digital keypad for easy manual input
- RJ-45 style digital connector
- 24V DC control logic for sourcing or synching outputs
- UL CUL and CE listed
- MTBF exceeds 28 years
- Compatible with most vacuum systems
- Input/output bypass connectors
- 24 hour service and support

Options

- NEMA 12 4X or 3R enclosures
- Enclosure cooling systems
- Remote digital operator kit
- Ethernet card for remote monitoring TCP/IP
- Custom software for any application
- Logic controller and PLC interface kit

Power Laws

$Q \propto Speed$	$P \propto Speed^2$	$KW \propto Speed^3$
Q = Flow	P = Pressure	KW = Power

Flow in a system is determined by the speed of its pump or fan (in this case a centrifugal vacuum producer). The pressure delivered varies as the square of the speed. So, as you double the speed you deliver four times the pressure. The power required consequently, varies as the cube of the speed -- which means if you double the speed you need eight times as much power. On the flip side, if you half the speed you half the flow but you only need **one-eighth** of the power.

1/2 speed = 1/2 flow = 1/8 power

Energy savings made possible by reducing airflow are exponential – so are the cost savings in real dollars.

AutoVac offers a complete line of motor controls and intelligent vacuum systems.

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