

## Trend In Air-Conditioning Industry - Modulation Technology

The air-conditioning industry first began to explore modulated scroll compressor technology in the 1980s. While the concept of modulation is not necessarily new, changes in equipment technologies, industry regulations, and consumer preferences over the years have created a need for new ways to modulate cooling systems. The end goal is to design a cooling system capable of continuously adapting its capacity to meet changes in ambient conditions and ultimately deliver greater comfort, energy cost savings, and improved reliability.

There is potential to improve and simplify modulation technology by integrating it with scroll compressors. For this reason, development is underway on several different modulation techniques featuring scroll technology. Each type of scroll modulation is suited to specific a/c or refrigeration applications.

In residential a/c equipment below 4 SEER (equivalent to 3.6 based on EER calculations), fixed-speed technology delivers the best system value and has proven to be reliable and easy to maintain. However, stepped modulation is a good approach for today's ultra-high-efficiency residential a/c units. In equipment above 4 SEER, two-step modulated scroll is the best choice for system performance, simplicity, and value. The compressor embodies solenoid-operated bypass ports that allow the scroll to operate at either 100% or 65% capacity without changing motor speed or motor direction.

## Scroll Solutions

Several key scroll solutions are available for modulating commercial a/c and refrigeration equipment. Tandems and multiple refrigerant circuits installed inside a single system is one way to modulate refrigerant flow in commercial systems. In this case, two or more compressors can operate alone or together, delivering several discreet capacity steps, as needed.

**Copeland Digital Scroll™** compressors are a new addition to the modulated product line, offering commercial users modulated compression technology for variable capacity control. Copeland Digital Scroll™ provides a single-compressor solution for broad capacity modulation. This digital technology allows a compressor to run at any capacity between 10% and 100%, making infinite adjustments along the way. An external solenoid valve controls the loading and unloading of the scrolls through system signaling based on system capacity demand. Digital scroll achieves capacity modulation by averaging the two states of loaded vs. unloaded operation over time.

Digital scroll is a good choice for modulation anywhere multi-evaporator systems or precise temperature control is employed. In air conditioning, we have found a need for digital scroll in large commercial applications as well as in precision cooling, such as computer rooms and telecommunications. For commercial refrigeration, this approach can be used in storage cases in convenience stores, restaurants and other food service applications.

## Benefits

Regardless of the application, the benefits remain the same. When you compare digital scroll with other technologies - even with other modulating solutions - there are advantages. For starters, digital scroll is easy to apply and service; there is no need for an inverter or associated controls. Modulation technology prevents wide temperature swings and provides dehumidification control. Commercial users will also benefit from lower applied and operating costs. Because the system is not starting and stopping every time the environment in a room or inside a cooler changes, it runs more efficiently, driving operating costs even lower. Digital scroll products are being field tested currently in the United States. (In the future, Copeland's digital scroll compressor line will span from 2.5 to 25 hp and include condensing units for refrigeration ranging from 2 to 6 hp.) Copeland Digital Scroll™ compressors are now selling in China, Korea, Thailand, and other Asia Pacific markets.

With two-step modulation for residential air conditioning applications, and tandem or digital modulation for use in commercial systems, there are a variety of advanced scroll modulation solutions for today's air conditioning and refrigeration equipment. With increased flexibility in choosing the type of modulation to meet system needs, end users everywhere can benefit from greater comfort, or environmental control, and better system value.