

# Copeland Scroll Digital™

The simple refrigeration solution  
for capacity modulation



**COPELAND SCROLL™**

  
**EMERSON™**

# Copeland Scroll Digital™ simple modulation for precise control

On many refrigeration systems the load will vary over a wide range, thus requiring the use of compressor capacity control. Traditional schemes of modulation include variable speed drives, unloaders, hot gas bypass or paralleling. Some of these solutions lead to various problems, as they are often complicated, don't allow a quick and easy integration into existing equipment or imply reliability concerns. Some require a high level of technical skills or an unaffordable first cost investment. Others do not provide the efficiency level or system stability originally promised. Now all these issues belong to the past.

## Innovation

Based on the unique Copeland Compliant Scroll™ design, the digital modulation operates on a simple mechanism. Capacity control is achieved by separating the scroll sets axially over a small period of time. It is a simple mechanical solution allowing precise temperature control and system efficiency.

## Simplicity

Copeland Scroll Digital technology is a modulation solution that can be easily and quickly implemented into any existing system design as no other components are required. To make the design process even simpler, Emerson has developed a series of controllers that operate the Copeland Scroll Digital compressor.

## Control precision and efficiency

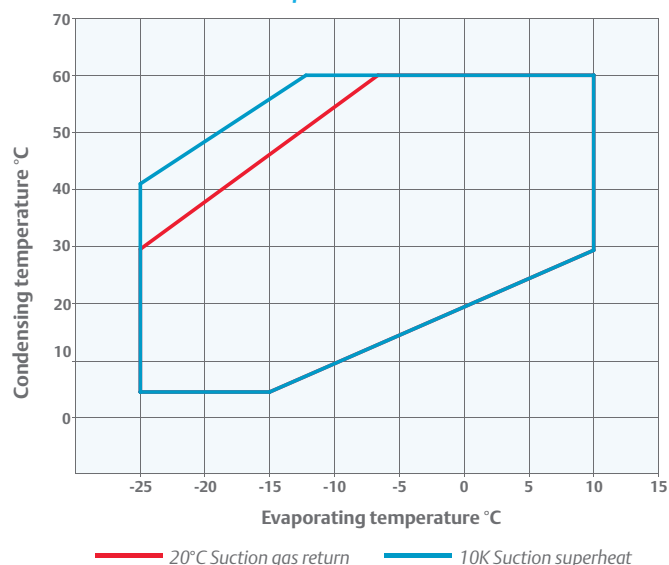
Copeland Scroll Digital technology provides continuous, stepless modulation from 10% to 100% with no operating envelope restriction. As a result, system pressures and temperatures are tightly controlled. Tests showed a temperature variation of +/- 0.5K in the display cases. More stable evaporating temperatures result in less dehumidification of the food, reduction of weight loss and preservation of food quality. Compressor cycling is reduced to a minimum, ensuring optimum system efficiency and longer life expectancy of the equipment. Low condensing capability down to 10°C also ensures the best seasonal efficiencies on the market.

## Reliability

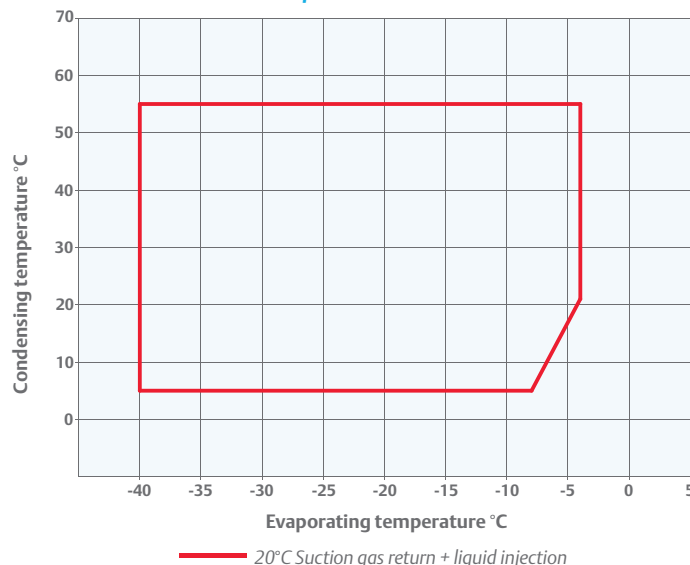
The refrigerant flow back to a Copeland Scroll Digital compressor is identical to a standard scroll compressor, even at low capacity. The Copeland Scroll Digital compressor runs at full speed at all times, never slowing the oil flow to the compressor. Its reliability level is as high as in standard compressors. It does not cause motor overheating or resonance vibrations in the plant.

## Operating envelope

R448A/R449A - ZBD Scroll



R448A/R449A - ZFD Scroll





## Digital mechanism

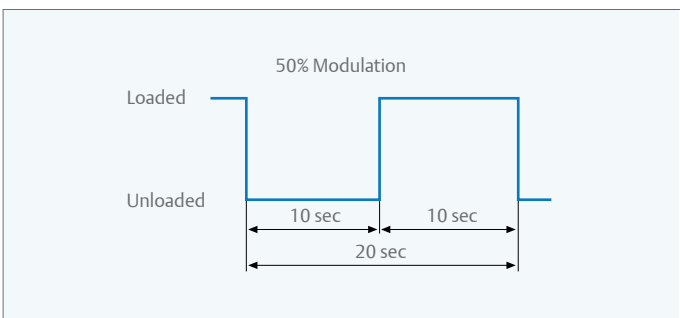
The modulation is achieved with a cycle time based on PWM (Pulse Width Modulation) control of a solenoid valve that operates a piston fitted rigidly to the upper scroll. This piston is actuated by gas pressure. The solenoid opens to allow the modulation chamber to communicate with suction via the external tube. Discharge pressure on the lower side of the piston forces it upwards, bringing with it the upper scroll – there is no compression. When the solenoid closes, pressure builds up in the modulation chamber. A small bleed hole speeds the pressure build up in the chamber. The upper scroll moves down to its normal contact position – compression resumes.

## Cycle time

The compressor capacity is controlled by modulating the solenoid valve input over time.

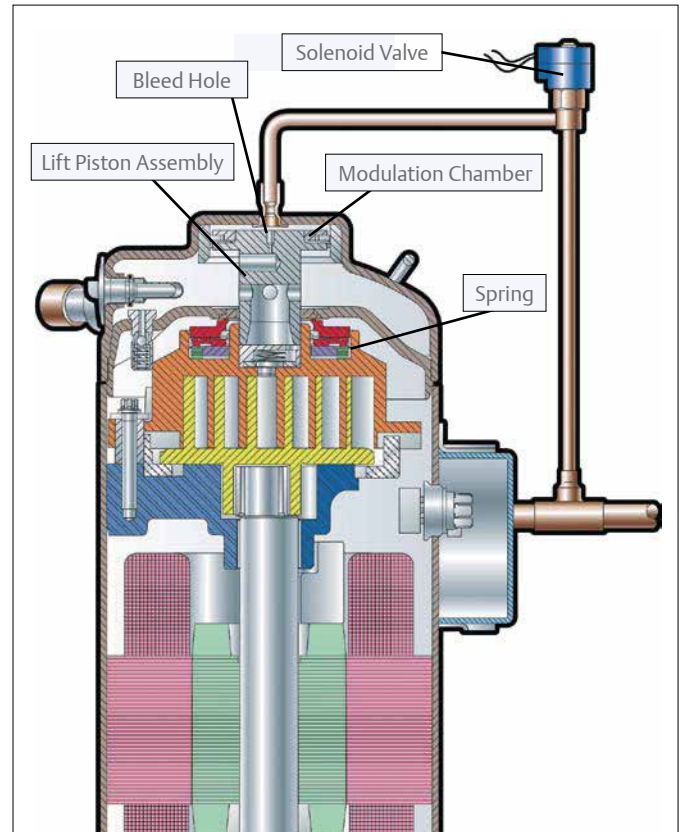
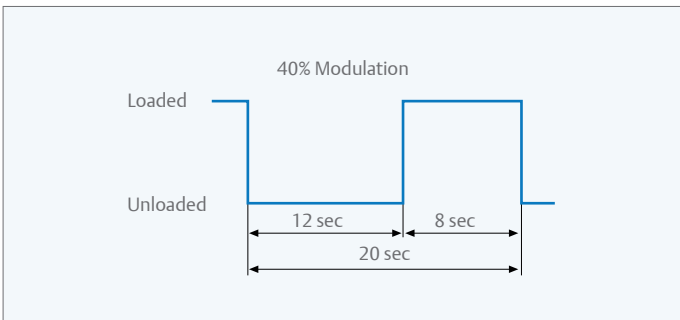
### Example 1:

Cycle time: 20 sec                      Valve active/open: 10 sec  
 Valve inactive/ closed: 10 sec      Resulting capacity: 50%



### Example 2:

Cycle time: 20 sec                      Valve active/open: 12 sec  
 Valve inactive/ closed: 8 sec        Resulting capacity: 40%



## Features and benefits

With Copeland Scroll Digital technology you can offer your customers (manufacturers, contractors, end-users):

- Simple, stepless, continuous modulation for precise temperature control
- One model for multi-refrigerants (R407A/F/C, R448A, R449A, R450, R513A, R404A and R134a)
- Reduced energy consumption
- Highly flexible load matching from 10% to 100%
- An economical and reliable alternative to variable speed drive
- Longer lasting refrigeration equipment due to fewer compressor cycling

With 10% to 100% digital modulation, the higher the number of evaporators in a refrigeration system, the more benefits you are able to offer to your customers.



## Technical overview

Models	Nominal hp	Displacement (m <sup>3</sup> /h)	Cooling capacity (kW)		Rotalock suction (inch)	Rotalock discharge (inch)	Oil quantity (l)	Length/width/height (mm)	Net weight (kg)	Motor version/code	Maximum operating current (A)	Locked rotor current (A)	Sound pressure @ 1m (dBA) **
			R448A/R449A	R407A									
<b>Medium temperature</b>													
ZBD21KCE	3.0	8.3	5.0	4.9	1 1/4	1	1.2	243/243/432	30.2	TFD	6.7	40.0	62.0
ZBD29KCE	4.0	11.4	6.7	6.4	1 1/4	1	1.4	245/243/463	32.7	TFD	7.9	48.0	58.0
ZBD38KCE	5.0	17.1	8.5	8.5	1 1/4	1	1.9	246/250/481	38.1	TFD	11.3	64.0	67.0
ZBD45KCE	6.0	17.1	10.0	9.4	1 1/4	1	1.9	241/246/481	39.9	TFD	12.3	74.0	61.0
ZBD57KCE	7.5	21.4	12.9	12.9	1 1/4	1 1/4	1.9	246/257/481	43.1	TFD	15.9	102.0	68.0
ZBD76K5E	10.0	28.8	17.6	17.1	1 3/4	1 1/4	3.4	299/280/534	61.2	TFD	24.0	118.0	66.0
ZBD114K5E	15.0	43.3	25.5	24.1	1 3/4	1 1/4	3.4	299/280/552	68.9	TFD	33.3	174.0	71.0
<b>Low temperature</b>													
ZFD13KVE EVI	4.0	11.7	3.2	3.2	1 1/4	1	1.9	246/250/481	38.6	TFD	9.0	64.0	65.0
ZFD18KVE EVI	6.0	17.1	4.9	4.9	1 1/4	1	1.9	300/299/481	43.1	TFD	13.8	74.0	67.0
ZFD25KVE EVI	7.5	21.4	6.2	6.1	1 1/4	1 1/4	1.9	246/250/481	43.1	TFD	16.0	102.0	70.0
ZFD41K5E	10.0	35.3	7.4	7.3	1 3/4	1 1/4	3.4	363/312/534	66.2	TFD	20.4	118.0	73.0
ZFD41K5E EVI	13.0	35.3	9.9	10.1	1 3/4	1 1/4	3.4	310/280/534	66.2	TFD	20.4	118.0	72.0

\* 3 Ph: 380-420V/ 50Hz



\*\* @ 1m: sound pressure level at 1m distance from the compressor, free field condition

Conditions for ZBD: Evaporating -10°C, condensing 45°C, suction gas return 20°C, subcooling 0K

Conditions for ZFD: Evaporating -35°C, condensing 40°C, suction gas return 20°C, subcooling 0K

## A complete package: Copeland Scroll Digital compressor is ready to be controlled by a series of controls

Emerson offers a series of controllers and drivers that can control the Copeland Scroll Digital compressor in a refrigeration equipment. All controllers have TCP/IP networking capabilities and web server function.

<b>XEV02D</b> - Digital compressor driver. Receives an input signal from an existing system controller (0-10V, 4...20mA) and activates Copeland Scroll Digital solenoid valve	
<b>XC645D*</b> - Controls condensing units including fan speed, using up to two compressors, of which one can be a Copeland Scroll Digital	
<b>XC660D* + XEV02D</b> - Controls racks using up to 6 compressors/ fans of which one can be a Copeland Scroll Digital and can be matched with XEV02D for digital applications	

\* Each relay is configurable and can operate to manage compressor or blocked suction valve.

## For more details, see [climate.emerson.com/en-gb](http://climate.emerson.com/en-gb)

### Emerson Commercial & Residential Solutions

Emerson Climate Technologies GmbH - European Headquarters - Pascalstrasse 65 - 52076 Aachen, Germany

Tel. +49 (0) 2408 929 0 - Fax: +49 (0) 2408 929 570 - Internet: [climate.emerson.com/en-gb](http://climate.emerson.com/en-gb)

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