

Variable capacity, Copeland, Digital compressors and Controls Application Bulletin

General:

1. The capacity variation is achieved using a pulse to load and unload the compressor. It is a 2 to 20 second run of a 20 second cycle. This unloading can vary from 10% to 100% of the total capacity. This pulse help the oil return in the system since you get full refrigerant flow for a period of time.
2. The refrigerant piping must be properly designed to make sure that you have a constant oil movement, especially during very low load. Special coil circuiting, double risers, traps and piping slope must be done following the best industry standard.
3. When a Digital compressor is used in combination with other compressors in a common suction/discharge refrigeration rack, the Emerson CPC control send a 0/10V signal to the Digital controller to modulate the compressor capacity. This stabilize the suction pressure and reduce compressor cycling.
4. If it is used for an HVAC system in standard AC mode, in a process glycol chiller or in a make-up air system, then the external/internal control must be defined. The following chapters will describe how to set those controls.
5. For a Digital compressor matched with one evaporator, an Emerson EEV with the digital controller must be supplied and/or installed. If the evaporator is not supplied by RefPlus we will supply the EEV since we have to program the EEV model in the Digital controller. The Digital controller has an algorithm to modulate the EEV for a safe and precise superheat and capacity control.
6. The Digital controller will be programed to the actual job specifications. It is the responsibility of the installing contractor to fine tune the control system. The actual programming details will be supplied with the equipment.
7. When operating controls are supplied they will be preprogrammed to the job specifications.
8. The Digital controller cannot be installed outdoor, the minimum operating ambient is 32F/0C. We provide a remote control box with a display/keypad. This box must be installed inside the building and close to the EEV. Control wiring to the Digital compressor solenoid is field installed.
9. For outdoor, packaged process chiller, we will provide a factory installed, heated Digital control box.
10. When applied to an outdoor air cooled condensing unit, it must have a fan cycling and speed control for moderate minimum ambient (20F) or/and a flooding valve to maintain a proper condensing pressure to ensure a smooth operating system.



System with a remote BAS or PLC system. All signal are by others: No supplied operating controls

1. Two external signals are required:
 - a. Compressor Enable.
 - i. This is like the first stage of cooling, it is a dry contact.
 - ii. For a two circuit system, each Digital circuit needs a signal, it is similar to a two stage thermostat.
 - iii. Same applies to a Tandem compressor with one digital compressor and one On/Off.
 - iv. When dual tandem compressors are supplied the digital compressor of each tandem are stage 1 and 2, stage 3 and 4 are for the fix capacity compressor.
 - v. Two tandem system needs 4 stages of controls.
 - b. Compressor Capacity.
 - i. An external 0 to 10 V signal for each Digital compressor must be programmed to match a cooling demand. The Digital controller will be programmed for all the other standard functions.
 - ii. Each controller will be provided with a display/keypad to do fine tuning and reprogram any special operation parameter.
 - c. The display can be programmed to show different information.
 - d. The 0 to 10V signal will tell the controller the length of the loaded time.
 - i. 0 to 0.99V compressor capacity at 10% and 1V to 10 V: 10% to 100%.
 - ii. The control can be programmed for other minimum capacity.
 - e. Example: if you program the controller for 25% minimum and the compressor is enable, from 0V to 2.5V compressor capacity will be 25% and from 2.51V to 10V: 25.1% to 100% capacity.
 - f. Kit description: Digital Kit, with or without EEV, all operating controls by others.



System with a remote Room thermostat or BAS system. Cooling signal only: On/Off control only

1. This applies to system that has a room thermostat and/or BAS. The only signal, is to start compressors on building demand. The modulation requirement is either for a variable CFM system or a combined Economizer and compressor cooling.
 - a. Compressor Enable.
 - i. This is like the first stage of cooling, it is a dry contact.
 - ii. For a two circuit system, each Digital circuit needs a signal similar to a two stage thermostat.
 - iii. Same applies to a Tandem compressor with one digital compressor and one On/Off.
 - iv. When dual tandem compressors are supplied the digital compressor of each tandem are stage 1 and 2, stage 3 and 4 are for the fix capacity compressor.
 - v. Two tandem system needs 4 stages of controls.
 - b. Compressor Capacity.
 - i. The 0 to 10 V signal is from a supplied proportional control with a suction pressure transducer. This system stabilize the suction pressure/temperature. The suction pressure and differential is set according to the job requirements.
 - ii. The leaving air temperature is always very close to the suction temperature. This control will be preprogrammed to the job requirement. The Digital controller will also be programmed for all the other standard functions.
 - iii. The Digital controller will be provided with a display/keypad to do fine tuning and reprogram any special operation parameter.
 - c. The display can be programmed for show different information.
 - d. The 0 to 10V signal will tell the controller the length of the loaded time.
 - i. 0 to 0.99V compressor capacity at 10% and 1V to 10 V: 10% to 100%.
 - ii. The control can be programmed for other minimum capacity.
 - e. Example: if you program the controller for 25% minimum and the compressor is enable, from 0V to 2.5V compressor capacity will be 25% and from 2.51V to 10V: 25.1% to 100% capacity.
 - f. Kit description: Digital Kit, with or without EEV, enable controls by others, supplied suction pressure actuated capacity modulation.



System without any external controls: Supplied On/Off and modulating control

1. This applies to system that has no external controls. A programmable thermostat for the compressor On/Off and a proportional control with a suction pressure transducer controls the modulation. The sensor can be a return air or wall mounted (standard AC application) or a supply air sensor (make-up air application). For precise air temperature special duct mounted air sensors are available.
 - a. Compressor Enable from the supplied thermostat.
 - i. This is like the first stage of cooling, it is a dry contact.
 - ii. For a two circuit system, each Digital circuit needs a signal. The supplied thermostat will be two stage when applied to two circuit or two compressors.
 - iii. When dual tandem compressors are supplied the digital compressor of each tandem are stage 1 and 2, stage 3 and 4 are for the fix capacity compressor.
 - iv. In the case of two tandem compressors, we will supply 4 stages of cooling.
 - b. Compressor Capacity.
 - i. The 0 to 10 V signal is from a supplied proportional control with a suction pressure transducer. This system stabilize the suction pressure/temperature. The suction pressure and differential is set according to the job requirements.
 - ii. The leaving air temperature is always very close to the suction temperature. This control will be preprogrammed to the job requirement. The Digital controller will also be programmed for all the other standard functions.
 - iii. The Digital controller will be provided with a display/keypad to do fine tuning and to reprogram any special operation parameter.
 - c. The display can be programmed for show different information.
 - d. The 0 to 10V signal will tell the controller the length of the loaded time.
 - i. 0 to 0.99V compressor capacity at 10% and 1V to 10 V: 10% to 100%.
 - ii. The control can be programmed for other minimum capacity.
 - e. Example: if you program the controller for 25% minimum and the compressor is enable, from 0V to 2.5V compressor capacity will be 25% and from 2.51V to 10V: 25.1% to 100% capacity.
 - f. Kit description: Digital Kit, with or without EEV, Supplied thermostatic enable controls and suction pressure actuated capacity modulation.



Process Chillers: Supplied On/Off and modulating control

1. This applies to process chillers that has no external controls. A programmable thermostat for the compressor On/Off and a proportional control with a suction pressure transducer controls the modulation. The water sensor will be in the return water piping.
 - a. Compressor Enable from the supplied water thermostat.
 - i. This is like the first stage of cooling, it is a dry contact.
 - ii. For a two circuit system, each Digital circuit needs a signal. The supplied thermostat will be two stage when applied to two circuit or two compressors.
 - iii. In the case of two tandem compressors, we will supply 4 stages of cooling.
 - b. Compressor Capacity.
 - i. The 0 to 10 V signal is from a supplied proportional control with a suction pressure transducer. This system stabilize the suction pressure/temperature. The suction pressure and differential is set according to the job requirements.
 - ii. The leaving water temperature is always very close to the suction temperature using high efficiency plate heat exchangers. This control will be preprogrammed to the job requirement. The Digital controller will also be programmed for all the other standard functions.
 - iii. The Digital controller will be provided with a display/keypad to do fine tuning and to reprogram any special operation parameter.
 - c. The display can be programmed for show different information.
 - d. The 0 to 10V signal will tell the controller the length of the loaded time.
 - i. 0 to 0.99V compressor capacity at 10% and 1V to 10 V: 10% to 100%.
 - ii. The control can be programmed for other minimum capacity.
 - e. Example: if you program the controller for 25% minimum and the compressor is enable, from 0V to 2.5V compressor capacity will be 25% and from 2.51V to 10V: 25.1% to 100% capacity.
 - f. Kit description: Chiller Digital Kit, with EEV, supplied water thermostat enable controls and suction pressure actuated capacity modulation.

