# Digital Compressor Controller


Copeland® brand products

EMERSON™ Climate Technologies

# Copeland Scroll Digital Controller

- Simple Controller That Enables OEM's To Use Digital Scrolls

- Relieves OEM From Developing Special Controllers
  - Faster Time To Market

- Copeland Controller Functions

  **Controls**

  - Compressor Contactor
  - Capacity Modulation Solenoid

  **Protection**

  - Excessive Discharge Temperature
  - Low Flow Conditions
  - Operation Under Fault Conditions

  **Diagnostics**

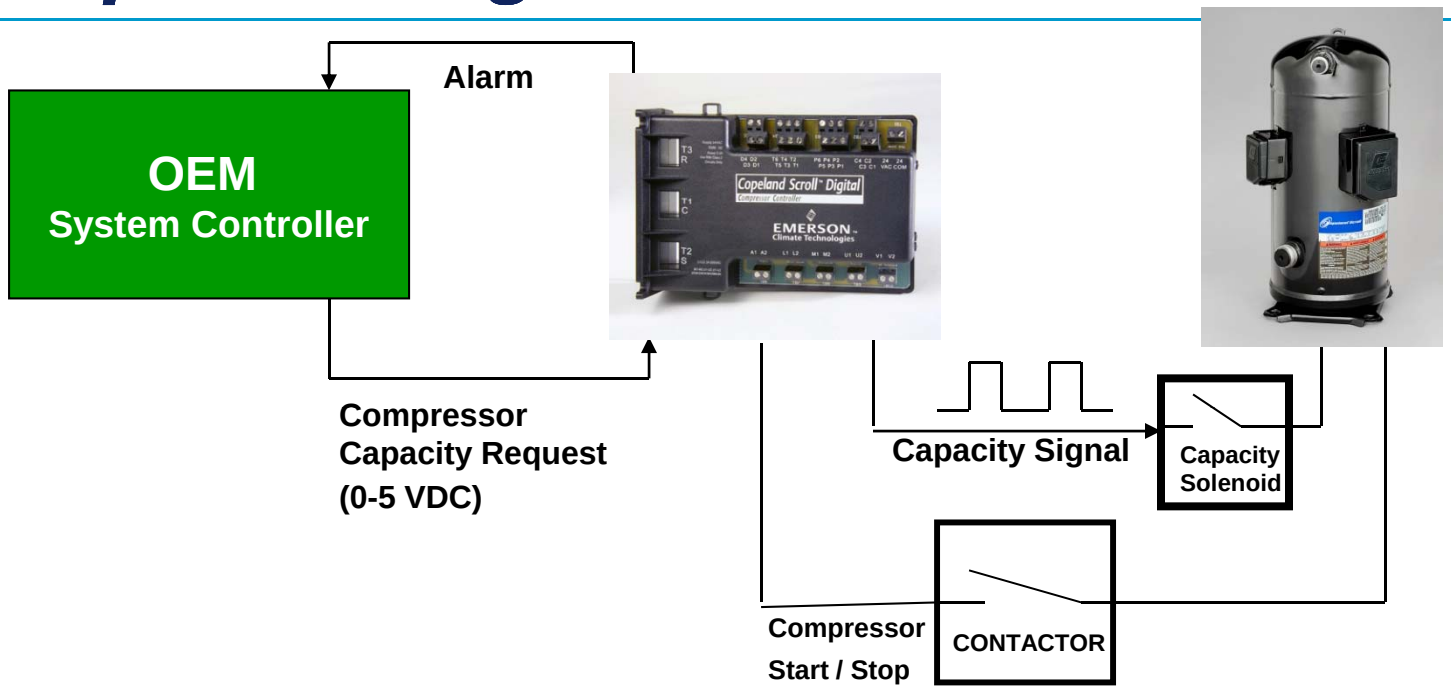
  - 8 Codes Indicating Faults


- Module Is Installed In System Cabinet

# Copeland Scroll™ Digital Compressor Diagnostics

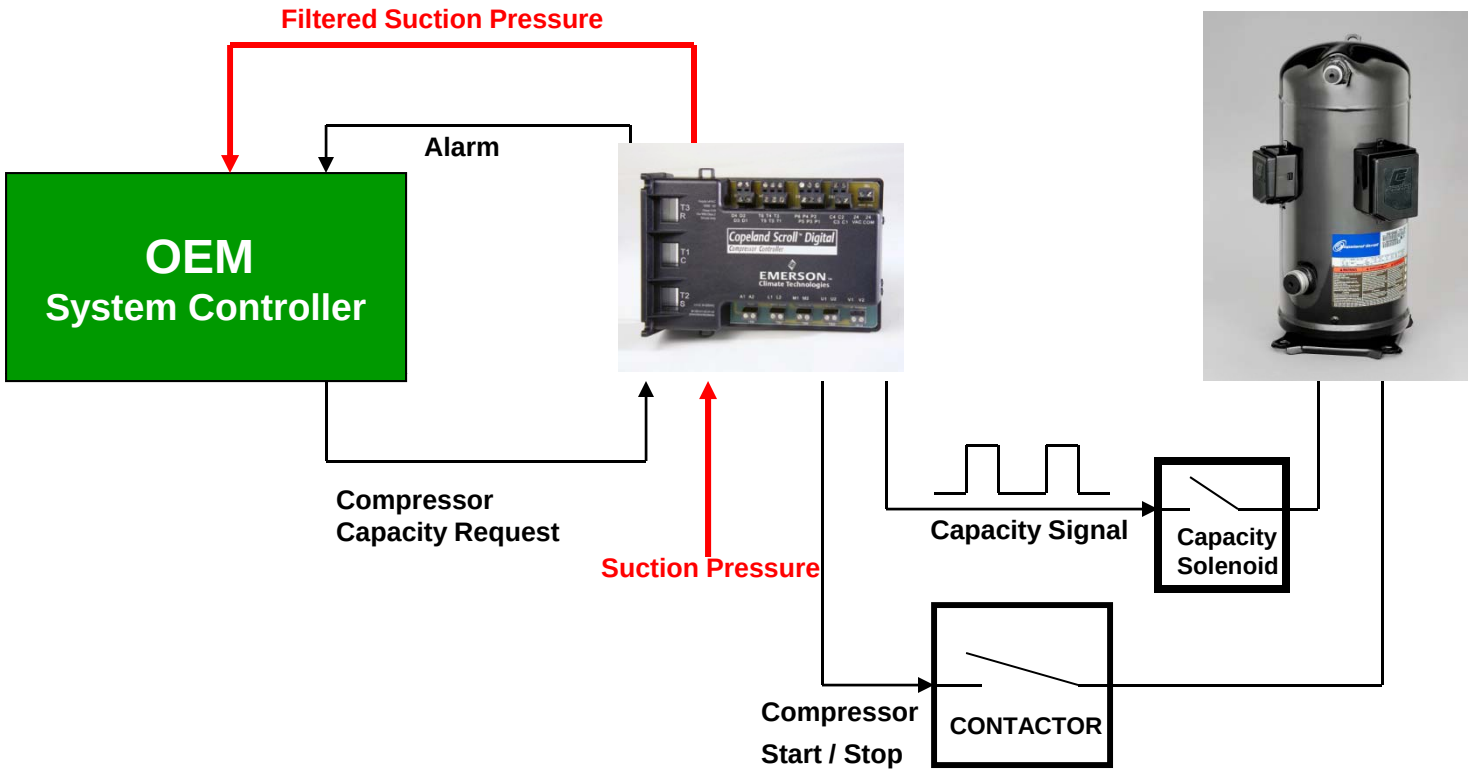
- Patented Copeland Diagnostics
- Green “POWER” LED
  - 24VAC Indicator
  - Flashes During Anti-Short Cycle Timer
- Yellow “UNLOADER” LED
  - Indicates Solenoid Is Energized
- Red “ALERT” LED
  - Flash Code Indicating Which ALERT Code Is Active
  - Code Interpreted By Counting Number Of Flashes (1-9)

# Copeland Digital Scroll Controller



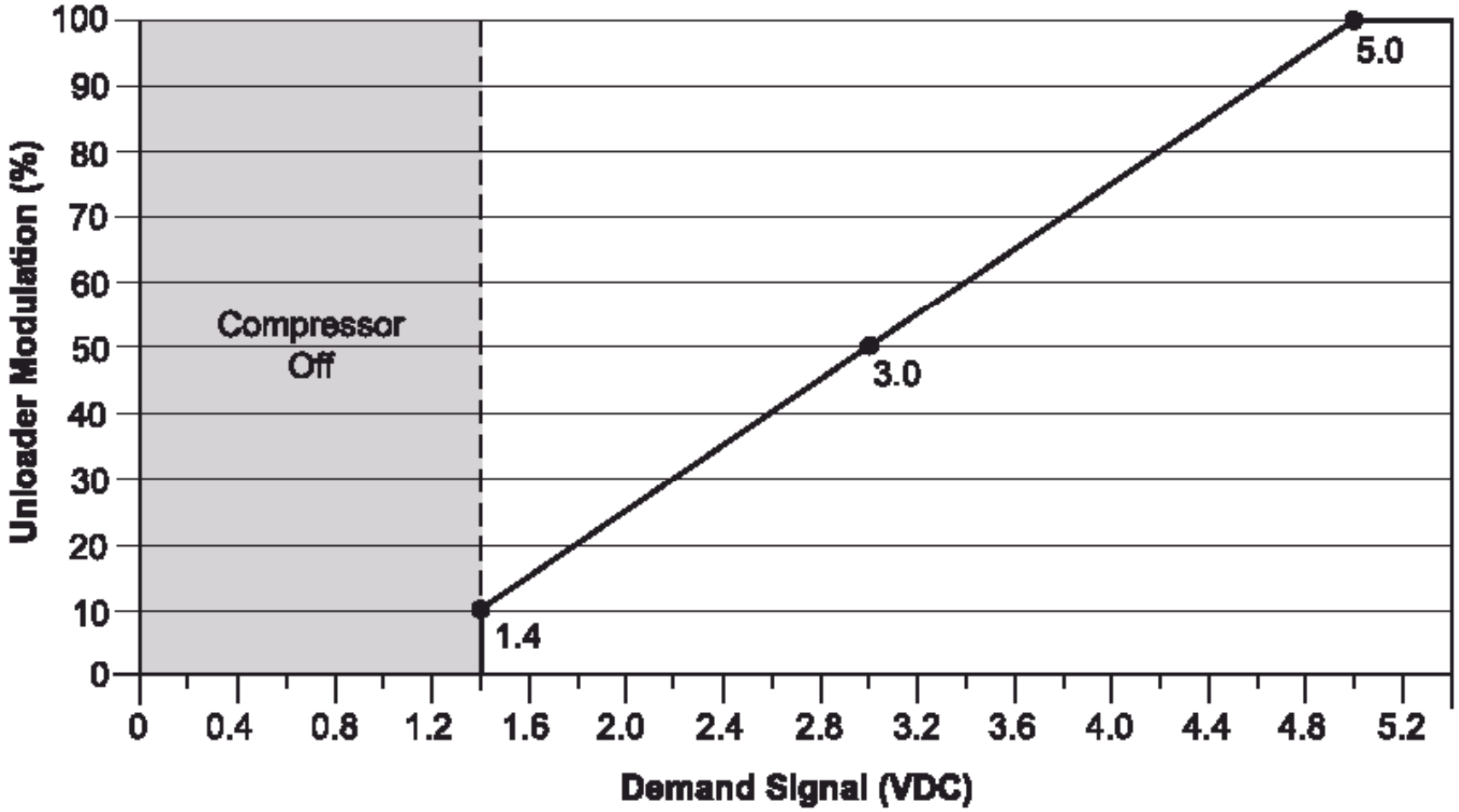

- **Capacity Solenoid Control**
  - **Controller "Modulates" Solenoid Based On Capacity Demand**
  - **Demand Is Read Once Every 20 Seconds**
- **Minor Alert ➔ Display Appropriate Alarm**
- **Major Alert ➔ De-energize Contactor To Lock Out Compressor**

# Copeland Digital Scroll Controller
## Optional Pressure Signal Filtering




- **Digital Controller Can Provide Suction Pressure Feedback**
  - **5 VDC Suction Pressure Transducer Required**
  - **Algorithm “Filters” Suction Pressure Swings**

# Copeland Scroll™ Digital – Demand Signal vs. Modulation



# *Copeland Scroll Digital Controller – Key Specifications*

- **Size**
  - **Depth 6” x Height 4” x Width 2”**
  - **Designed To Minimize Footprint In System Electrical Panel**

- **Voltages**
  - **Controller Supply: 19-28VAC, 48-62Hz, 2VA Max**
  - **Pilot Voltage Capability: AC Voltages 24, 120, 240**

- **Inputs**
  - **Minimum: Capacity Signal 1-5VDC, Discharge Thermistor (100K NTC)**
  - **Optional : Suction Pressure Sensor (Controller Will Source 5VDC To Sensor)**

- **Outputs**
  - **Minimum: Digital Solenoid, Compressor Contactor**
  - **Optional : Suction Pressure, Alarm, Vapor Injection**

- **Operator Interface**
  - **3 LED’s : Green Indicating Module Health**
    **Amber Indicating Digital Solenoid Operation**
    **Red - Up To 8 Flash Codes Indicating Operation Status**

# *Copeland Scroll Digital Controller – Key Operational Features*

## Operation Rules

- Digital duty cycle of 15 seconds
- Min Capacity limited to 10%
- Scrolls unloaded for 0.5 sec on start up
- Scrolls unloaded for 1 sec on shut down to prevent reverse rotation
- 2 Min anti short cycle enforced on all shutdown
- 30 minute “no start” enforced on all high temperature shutdown
- Digital solenoid turned OFF on protector trip

## Status Codes

| | | |
|---|---|---|
| 1 | Future | |
| 2 | High Discharge Temperature | Td >268F,Reset Td<250, Lockout on 5th |
| 3 | Compressor Protector Tripped | Detect using current |
| 4 | Locked Rotor | Lockout on 4th successive locked rotor trip |
| 5 | Demand Signal Loss | Capacity Req < 0.5VDC, shut down |
| 6 | Discharge Thermistor Fault | Wires broken, Capacity forced to max 50% |
| 7 | Future | |
| 8 | Welded Contactor | Detect using current |
| 9 | Low Supply Voltage | Supply voltage < 19VAC, shut down |

# *Copeland Scroll™ Digital Fault Codes*

- **"Alert" Light Blinks When Any Of 7 Harmful System Conditions Is Detected**

| Alert Code | System Condition | Diagnostic Alert Light | Action |
|---|---|---|---|
| Code 2 | High Discharge Temp Trip | Blinks 2 Times | Lockout |
| Code 3 | Compressor Protector Trip | Blinks 3 Times | Lockout |
| Code 4 | Locked Rotor | Blinks 4 Times | Lockout |
| Code 5 | Demand Signal Loss | Blinks 5 Times | Lockout |
| Code 6 | Discharge Thermistor Fault | Blinks 6 Times | Reduce Capacity |
| Code 7 | Future | N/A | N/A |
| Code 8 | Welded Contactor | Blinks 8 Times | Unload Compressor |
| Code 9 | Low Voltage | Blinks 9 Times | Trip Compressor |

**Protective Faults That Require Manual Reset**

# *Code 2 – High Discharge Temperature Trip*

- **Event Trigger**
  - **Discharge temperature is above 268°F OR discharge thermistor input is short circuited**
- **Action**
  - **Deenergize compressor contactor ➔ Take Compressor Offline**
  - **Close alarm relay contacts ➔ Display Code 2 Alert**
  - **Unloader solenoid deenergized**
- **Event Reset For Restarting Compressor**
  - **30 minute cool down timer AND discharge temperature below 250°F**
- **Flash Code Clear/Alarm Relay Contact Open**
  - **Compressor must have 60 non-interrupted, ALERT free minutes of run time**

# *Code 2 – High Discharge Temperature Lockout*

- **Event Trigger**
  - **5 High Discharge Temperature trips within 4 hours**
- **Action**
  - **Deenergize compressor contactor ➔ Take Compressor Offline**
  - **Close alarm relay contacts ➔ Display Code 2 Alert**
  - **Unloader solenoid deenergized**
- **Event Reset For Restarting Compressor**
  - **Controller 24VAC power must be cycled on and off**
- **Flash Code Clear/Alarm Relay Contact Open**
  - **Controller 24VAC power must be cycled on and off**

# *Code 3 – Compressor Protector Trip*

- **Event Trigger**
  - **Demand 1.4VDC or higher AND**
  - **Compressor internal overload protector open OR**
  - **Power disconnected to compressor (fuse, breaker, loose wire)**
- **Action**
  - **Deenergize compressor contactor ➔ Take Compressor Offline**
  - **Close alarm relay contacts ➔ Display Code 3 Alert**
  - **Unloader solenoid deenergized**
- **Event Reset For Restarting Compressor**
  - **Wait anti-short cycle timer delay (2 minutes)**
- **Flash Code Clear/Alarm Relay Contact Open**
  - **Demand 1.4VDC or higher AND compressor current detected**

# *Code 4 – Locked Rotor*

- **Event Trigger**
  - **Controller senses a locked rotor condition in compressor**
- **Action**
  - **Deenergize compressor contactor ➔ Take Compressor Offline**
  - **Close alarm relay contacts ➔ Display Code 4 Alert**
  - **Unloader solenoid deenergized**
- **Event Reset For Restarting Compressor**
  - **Controller 24VAC power must be cycled on and off**
- **Flash Code Clear/Alarm Relay Contact Open**
  - **Controller 24VAC power must be cycled on and off**

# *Code 5 – Demand Signal Loss*

- **Event Trigger**
  - **Demand signal below 0.5VDC**
- **Action**
  - **Deenergize compressor contactor ➔ Take Compressor Offline**
  - **Close alarm relay contacts ➔ Display Code 5 Alert**
  - **Unloader solenoid deenergized**
- **Event Reset For Restarting Compressor**
  - **Demand signal above 0.5VDC AND anti-short cycle timer complete**
- **Flash Code Clear/Alarm Relay Contact Open**
  - **Demand signal above 0.5VDC**

# *Code 6 – Discharge Thermistor Fault*

- **Event Trigger**
  - **Discharge thermistor is not connected to Compressor Controller**
- **Action**
  - **Limit maximum capacity of compressor to 50% unloader modulation**
  - **Close alarm relay contacts ➔ Display Code 6 Alert**
- **Event Reset For Restarting Compressor**
  - **Thermistor reconnected**
- **Flash Code Clear/Alarm Relay Contact Open**
  - **Thermistor reconnected**

# *Code 8 – Compressor Contactor Fault*

- **Event Trigger**
  - **Compressor current is detected when demand is below 1.4VDC**
- **Action**
  - **Reenergizes compressor contactor**
  - **Close alarm relay contacts ➔ Displays Code 8 Alert**
  - **Unloader solenoid energized**
    - **Net effect is to run compressor unloaded until demand rises above 1.4VDC again**
- **Event Reset For Restarting Compressor**
  - **Compressor continues to run**
- **Flash Code Clear/Alarm Relay Contact Open**
  - **Demand above 1.4VDC OR no compressor current detected**

# *Code 9 – Low 24VAC Supply*

- **Event Trigger**
  - **Compressor Controller 24VAC supply below 18.5VAC**
- **Action**
  - **Trip compressor**
  - **Close alarm relay contacts ➔ Display Code 9 Alert**
- **Event Reset For Restarting Compressor**
  - **24VAC supply above 19.5VAC AND anti-short cycle timer complete**
- **Flash Code Clear/Alarm Relay Contact Open**
  - **24VAC supply above 19.5VAC AND anti-short cycle timer complete**