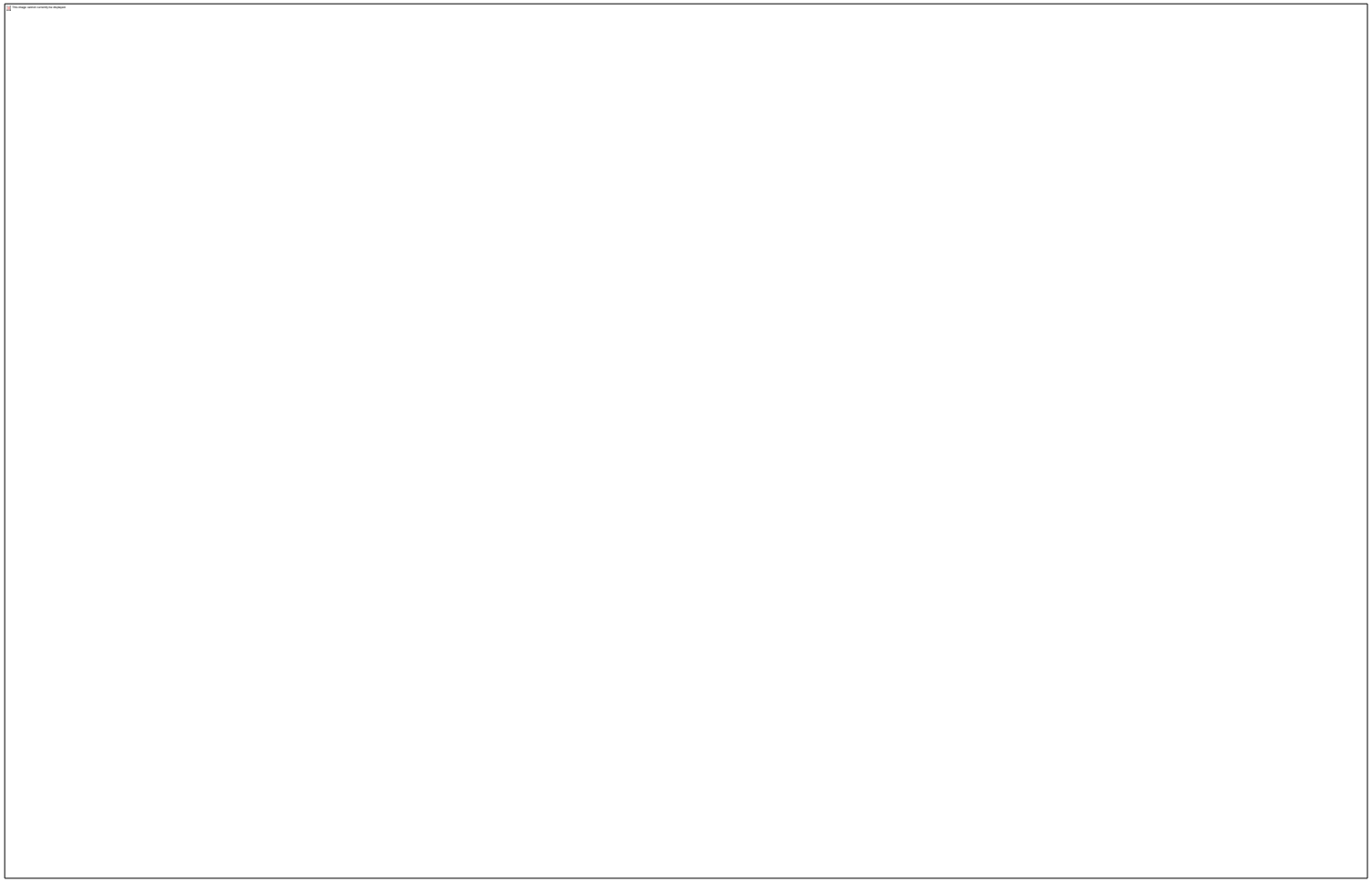
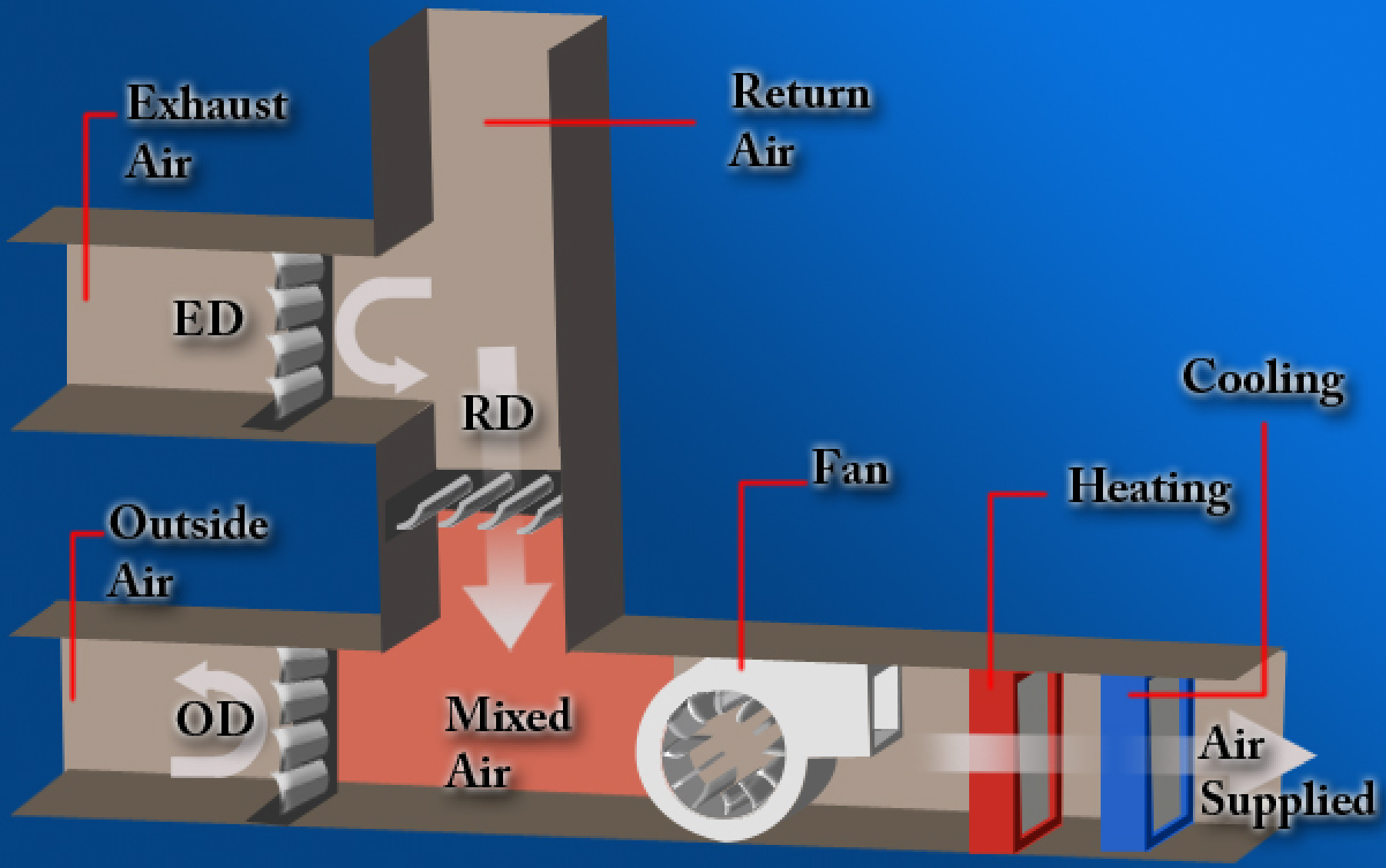
Economizers

Economizers

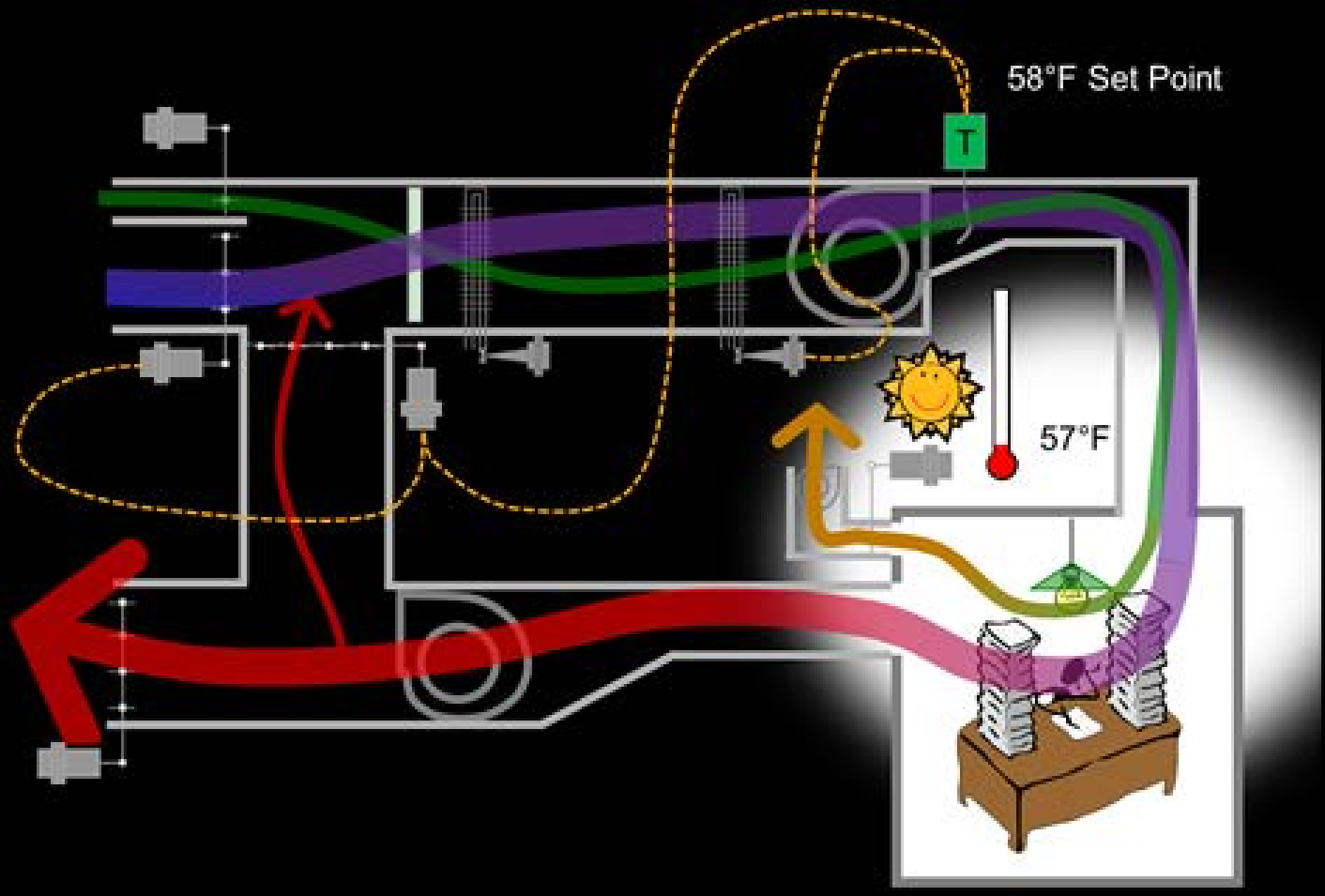



Exhaust Air
Return Air
ED
RD
Cooling
Fan
Heating
Outside Air
OD
Mixed Air
Air Supplied

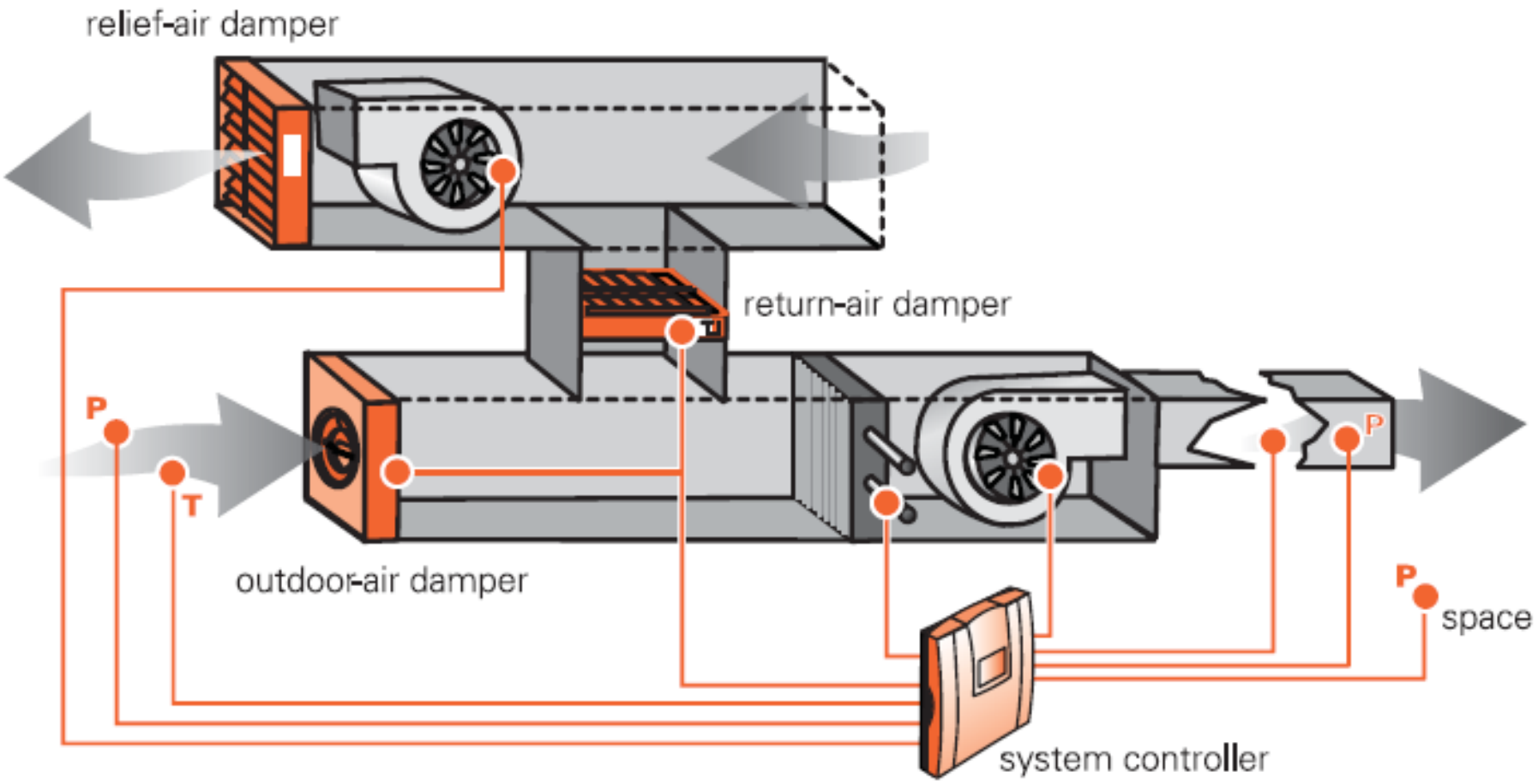
Exhaust or relief damper

- Used when more than minimum outdoor air enters the building during the economizer cooling modes, more than minimum relief air must leave the building

Space Control



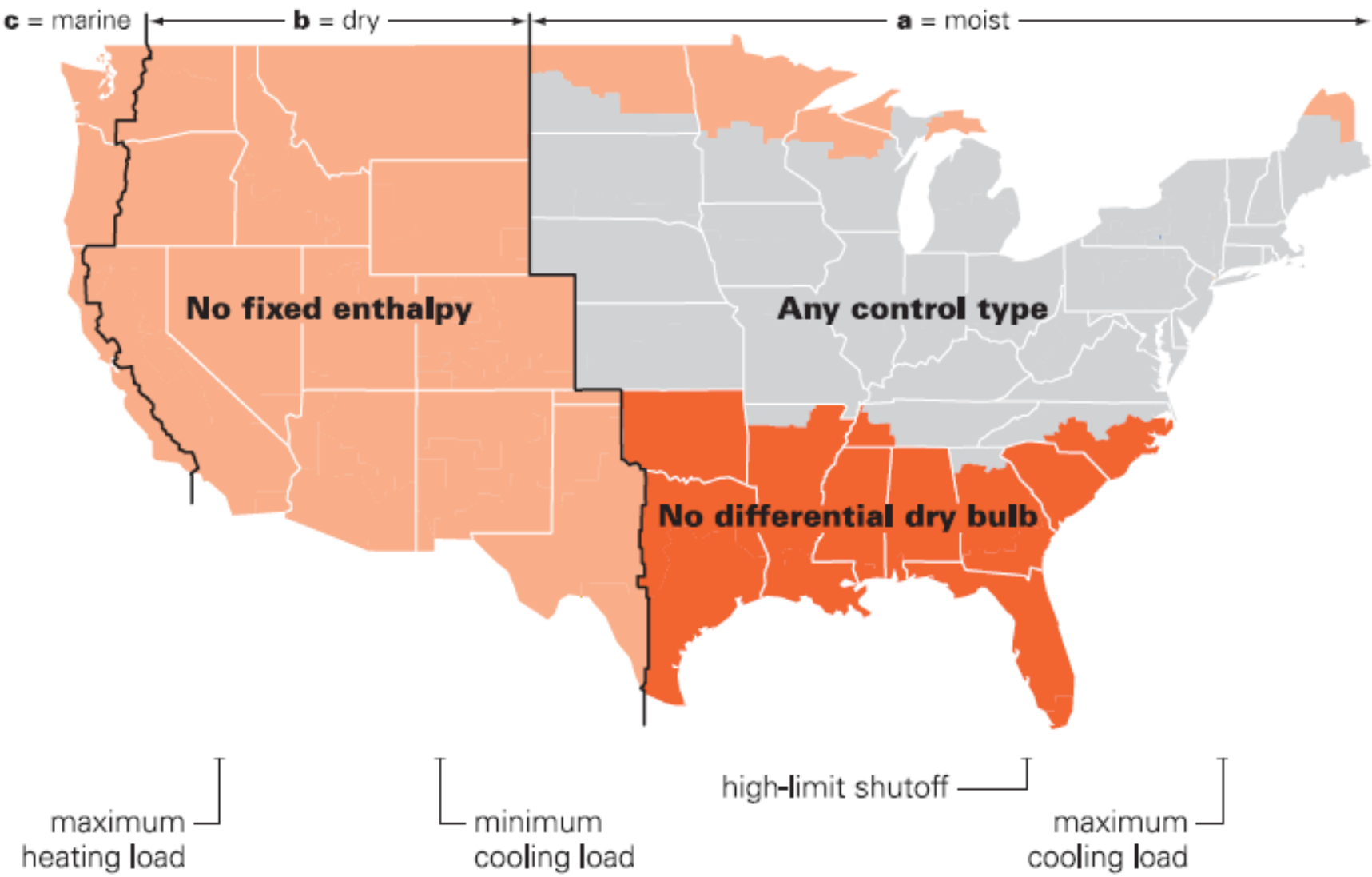
Control


relief-air damper
return-air damper
T
P
T
outdoor-air damper
P
P
space
system controller

Control Types

1. Fixed dry-bulb temperature
2. Differential (or duel) dry-bulb temperature
3. Fixed enthalpy
4. Differential (or duel) Enthalpy
5. Dew point and dry bulb
6. Combination of each of the other four

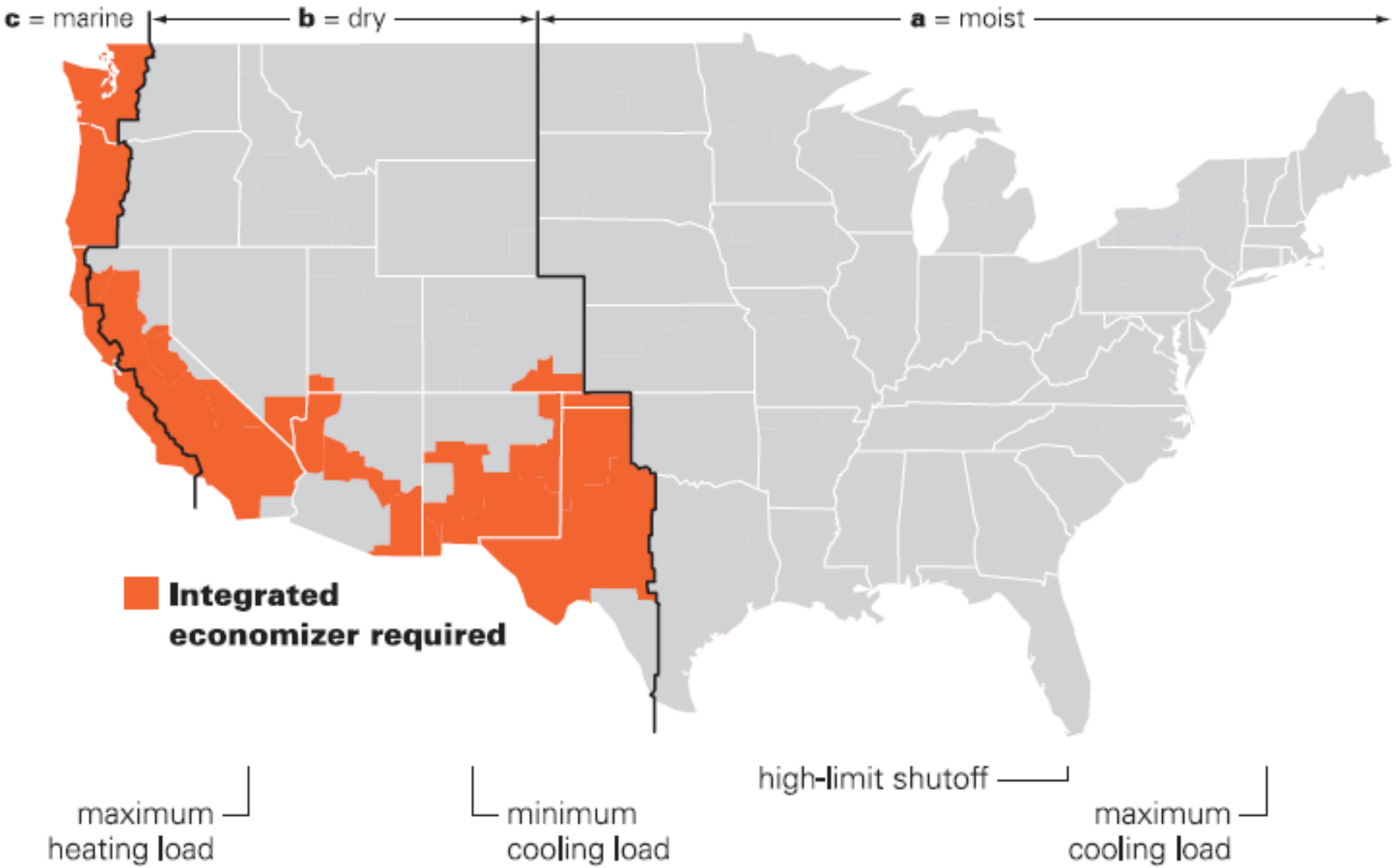
Standard 90's regional limitations for economizer control types



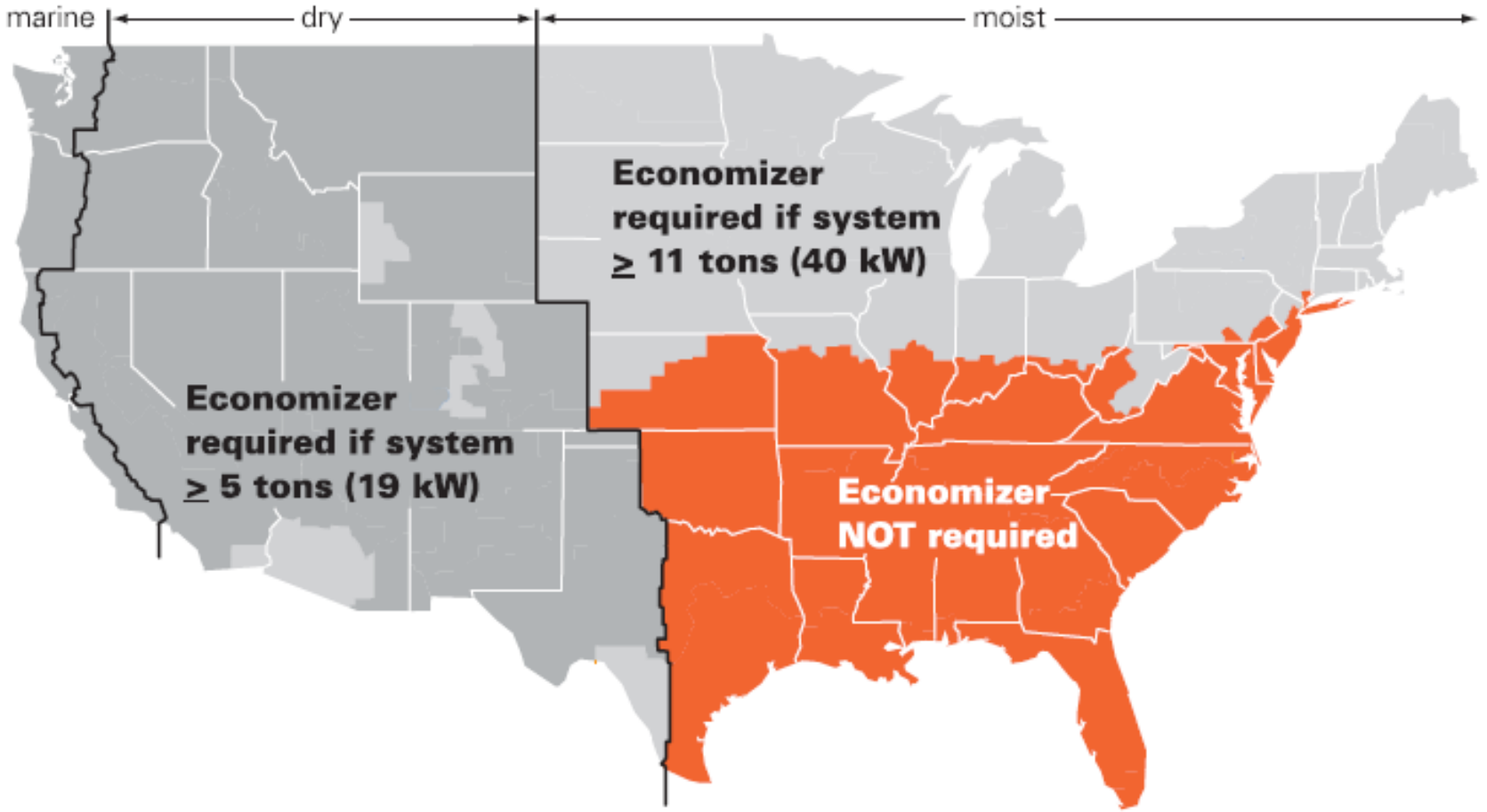
Integrated economizer control

- To comply with Standard 90 economizer operation must be integrated with mechanical cooling cycle

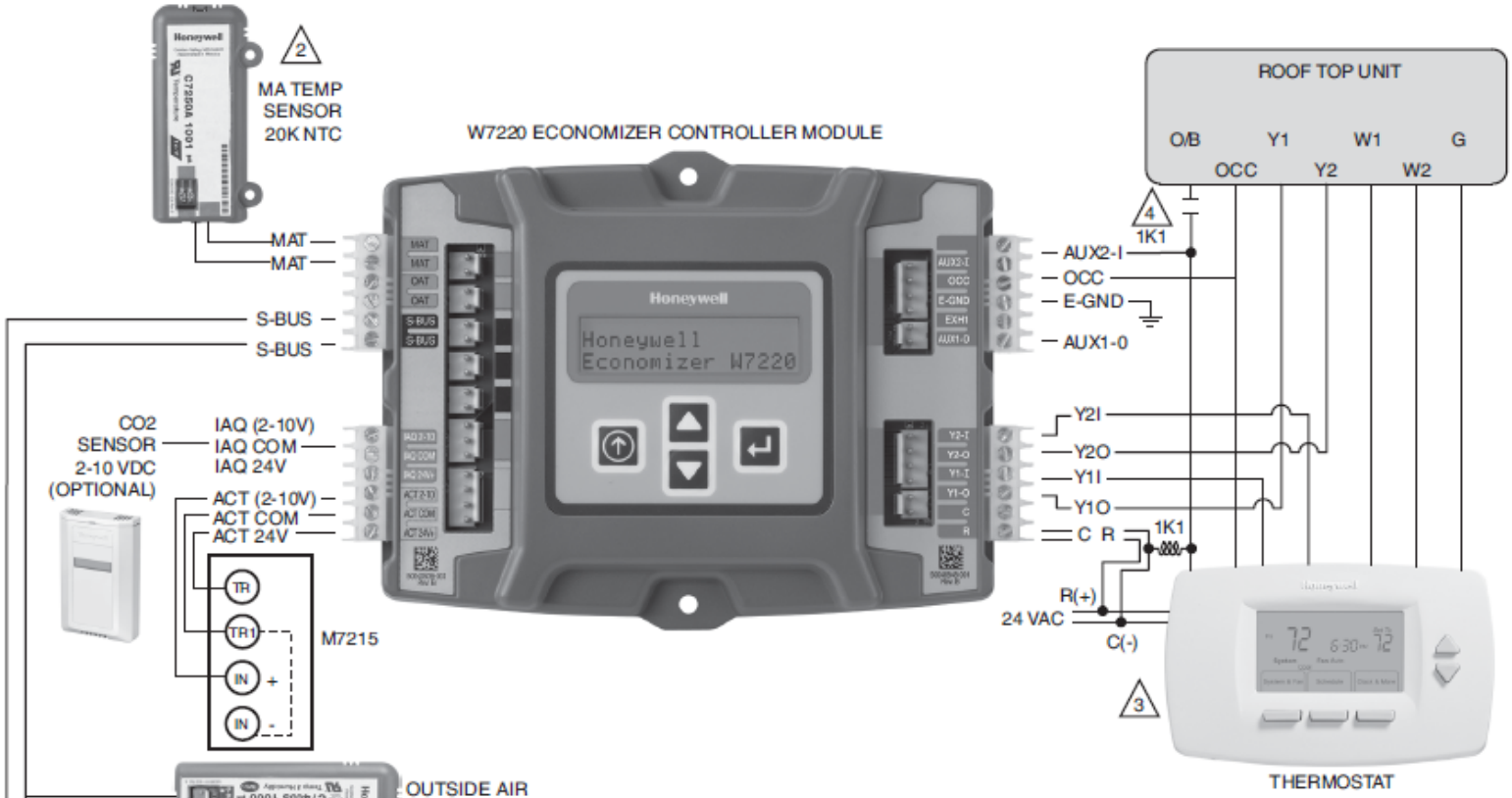
Standard 90's requirement for integrated economizer operation



Standard 90's regional economizer requirements based on cooling system capacity



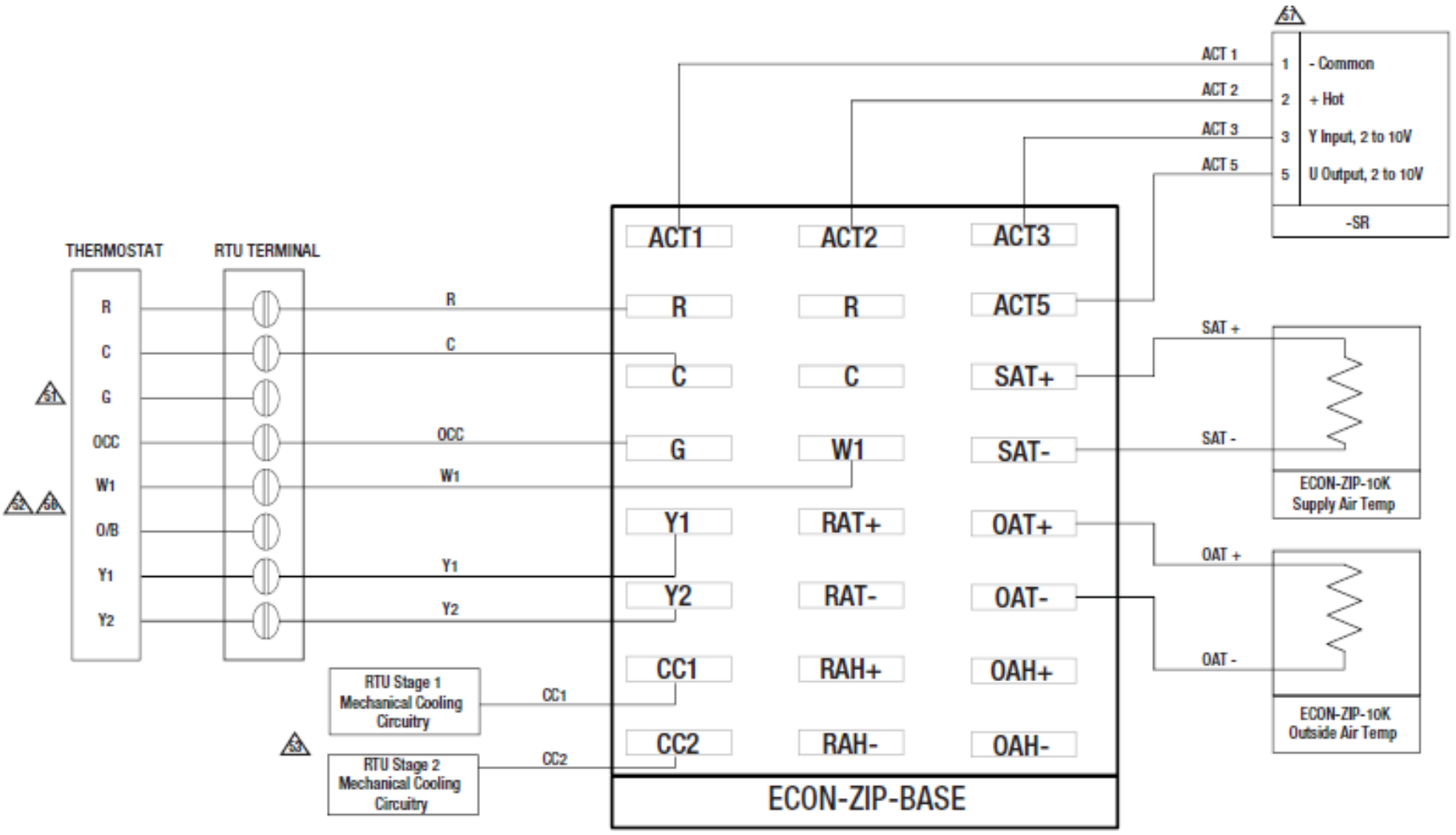
Honeywell Jade

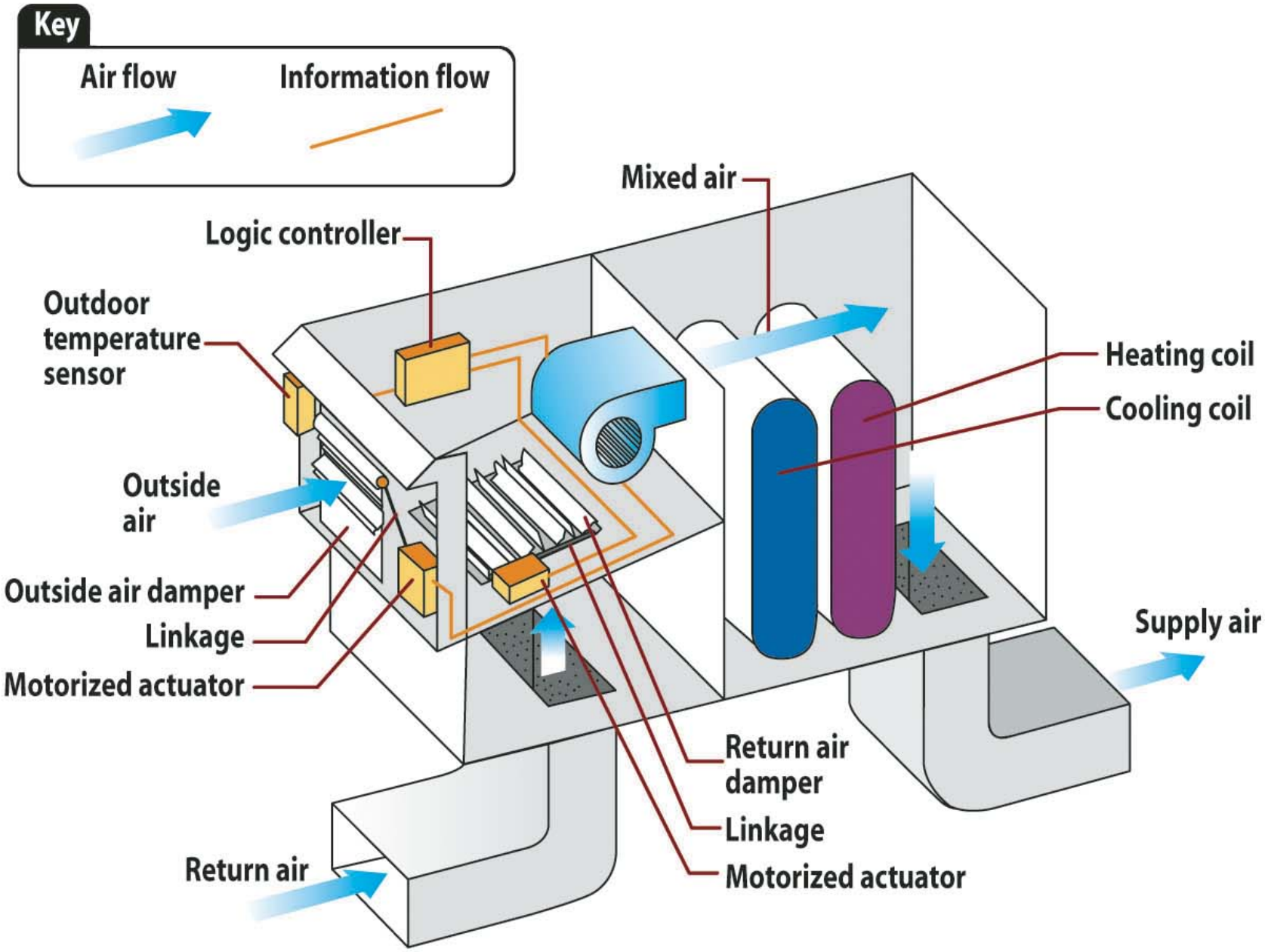


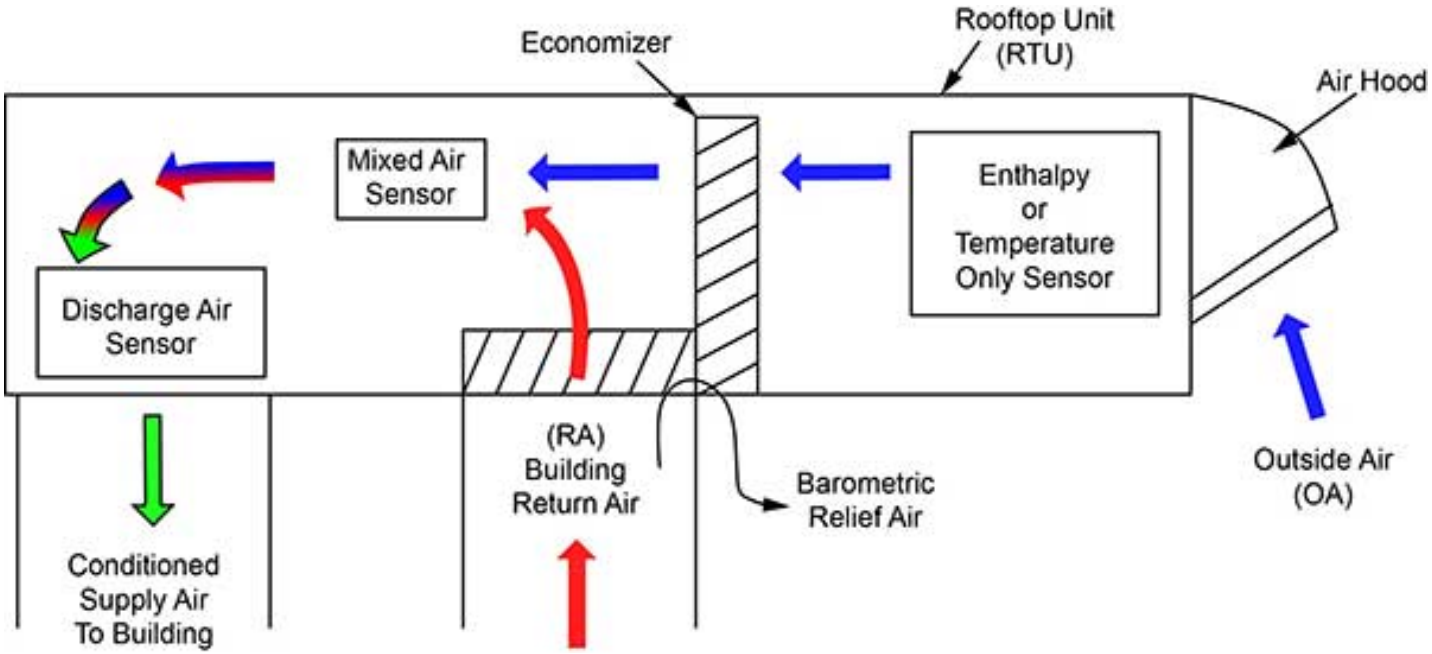
1. IN THIS CONFIGURATION, AN OPTIONAL DISCHARGE AIR TEMP/HUMIDITY (ENTHALPY) SYLKBUS SENSOR CAN BE ADDED FOR ADVANCED CONTROL AS SHOWN IN THE LOWER LEFT OF THIS FIGURE.
2. DO NOT USE THE C7250 20K NTC SENSOR WITH THE OA TERMINAL IN THIS CONFIGURATION.
3. WHEN USING A HEAT PUMP THERMOSTAT, THERMOSTAT TERMINALS MAY DIFFER: W1 MAY BE LABELED O OR B AND W2 MAY BE LABELED W.
4. WHEN USING A HEAT PUMP WITH DEFROST FEEDBACK, ADD AN ISOLATION RELAY BETWEEN O AND C.

M32565D

BELIMO
Power
Test
Alarm
i
esc
OK
TFB24-SR
BELIMO
ECON-ZIF-TH
BELIMO


THERMOSTAT
RTU TERMINAL
R
C
G
OCC
W1
O/B
Y1
Y2
S1
S2
S6
R
C
OCC
W1
Y1
Y2
RTU Stage 1 Mechanical Cooling Circuitry
CC1
S3
RTU Stage 2 Mechanical Cooling Circuitry
CC2
ACT1
ACT2
ACT3
R
R
ACT5
C
C
SAT+
G
W1
SAT-
Y1
RAT+
OAT+
Y2
RAT-
OAT-
CC1
RAH+
OAH+
CC2
RAH-
OAH-
ECON-ZIP-BASE
S7
ACT 1
ACT 2
ACT 3
ACT 5
1 - Common
2 + Hot
3 Y Input, 2 to 10V
5 U Output, 2 to 10V
-SR
SAT +
SAT -
ECON-ZIP-10K Supply Air Temp
OAT +
OAT -
ECON-ZIP-10K Outside Air Temp

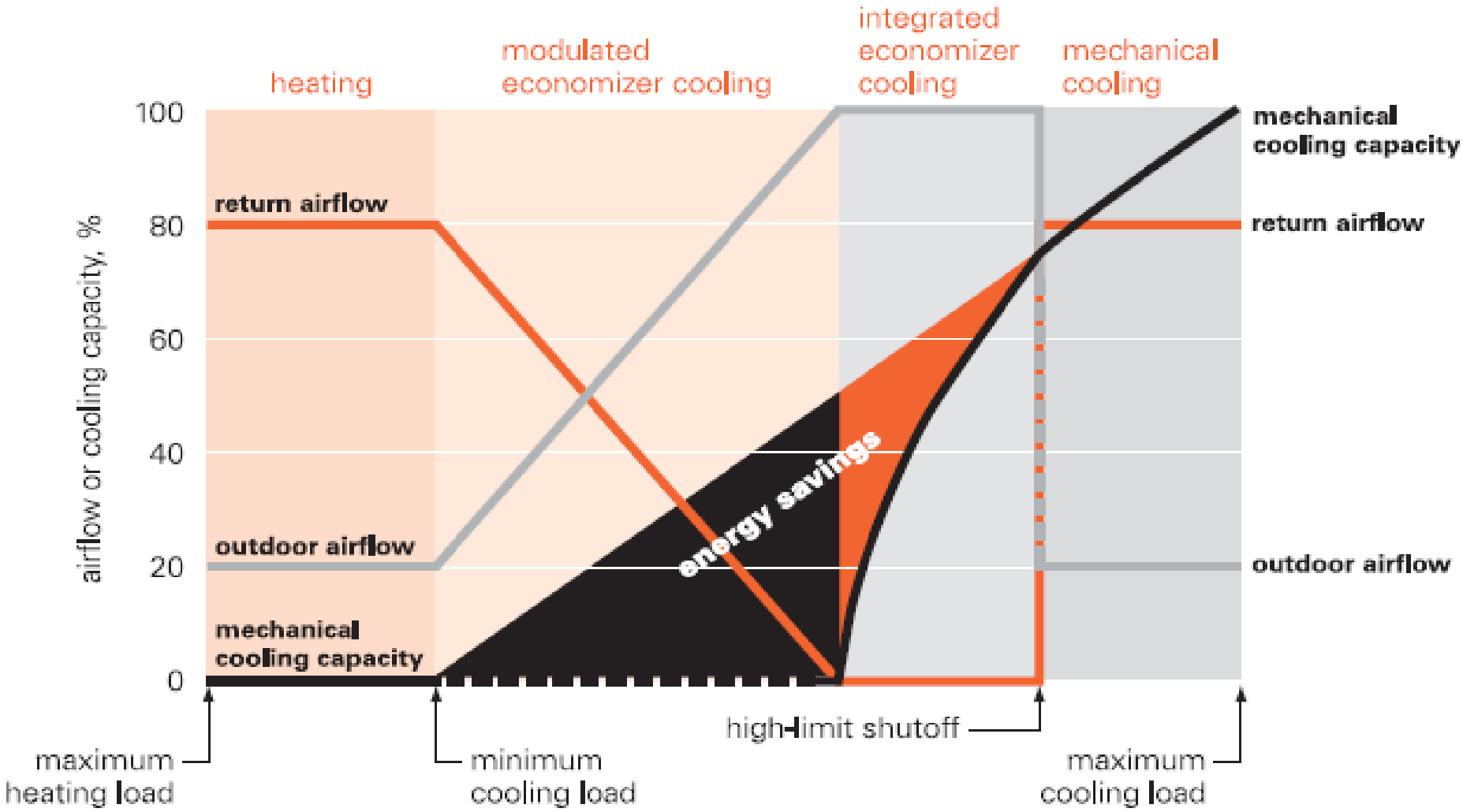

Key
Air flow
Information flow
Mixed air
Logic controller
Outdoor temperature sensor
Heating coil
Cooling coil
Outside air
Outside air damper
Linkage
Motorized actuator
Supply air
Return air damper
Linkage
Motorized actuator
Return air


Economizer
Rooftop Unit
(RTU)
Air Hood
Mixed Air
Sensor
Enthalpy
or
Temperature
Only Sensor
Discharge Air
Sensor
(RA)
Building
Return Air
Barometric
Relief Air
Outside Air
(OA)
Conditioned
Supply Air
To Building

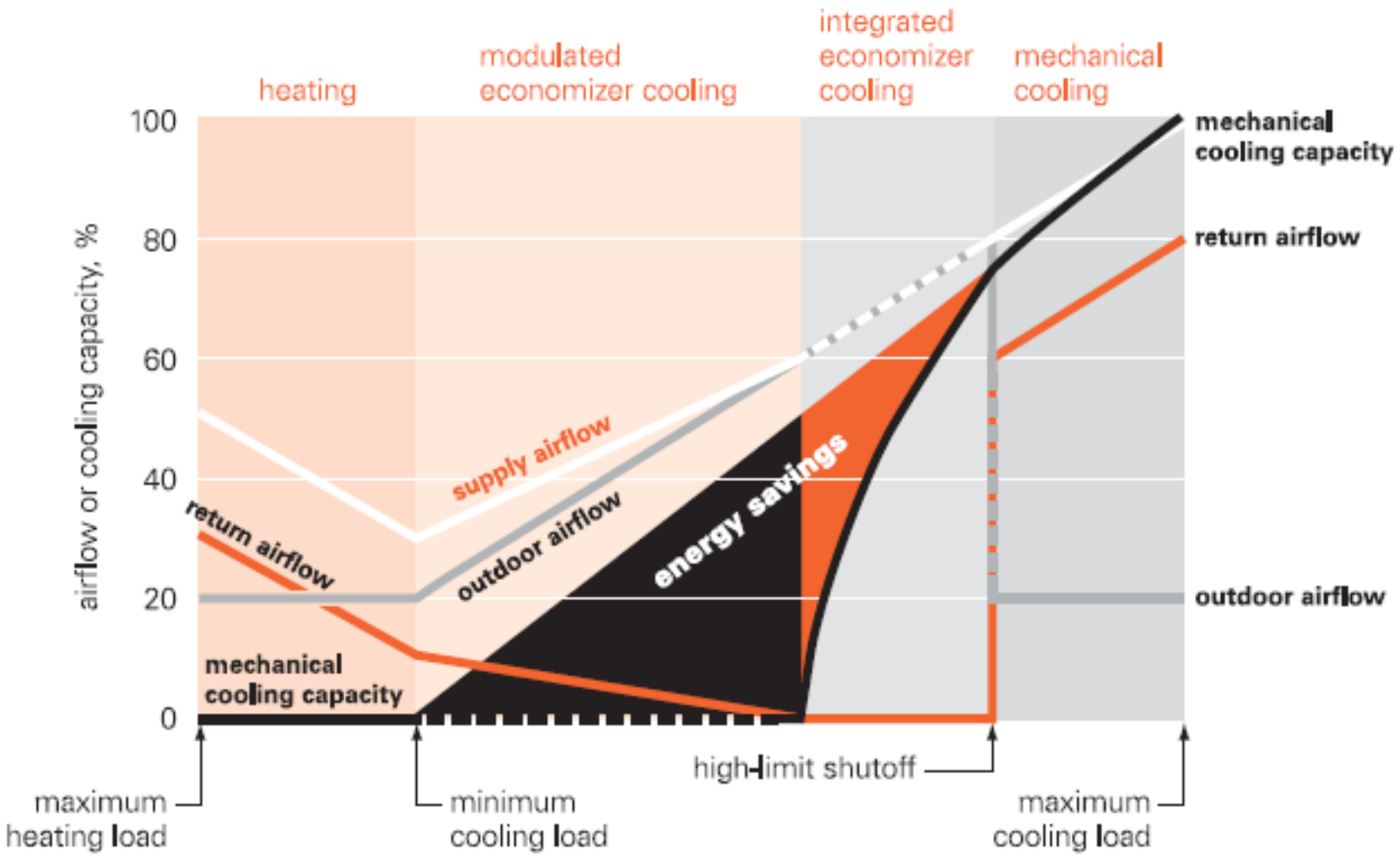
High Limit Shutoff

- The out door damper must be closed during a prescribed high-limit condition.
- High Limit Condition
  - Depends on location
  - Depends on limit type

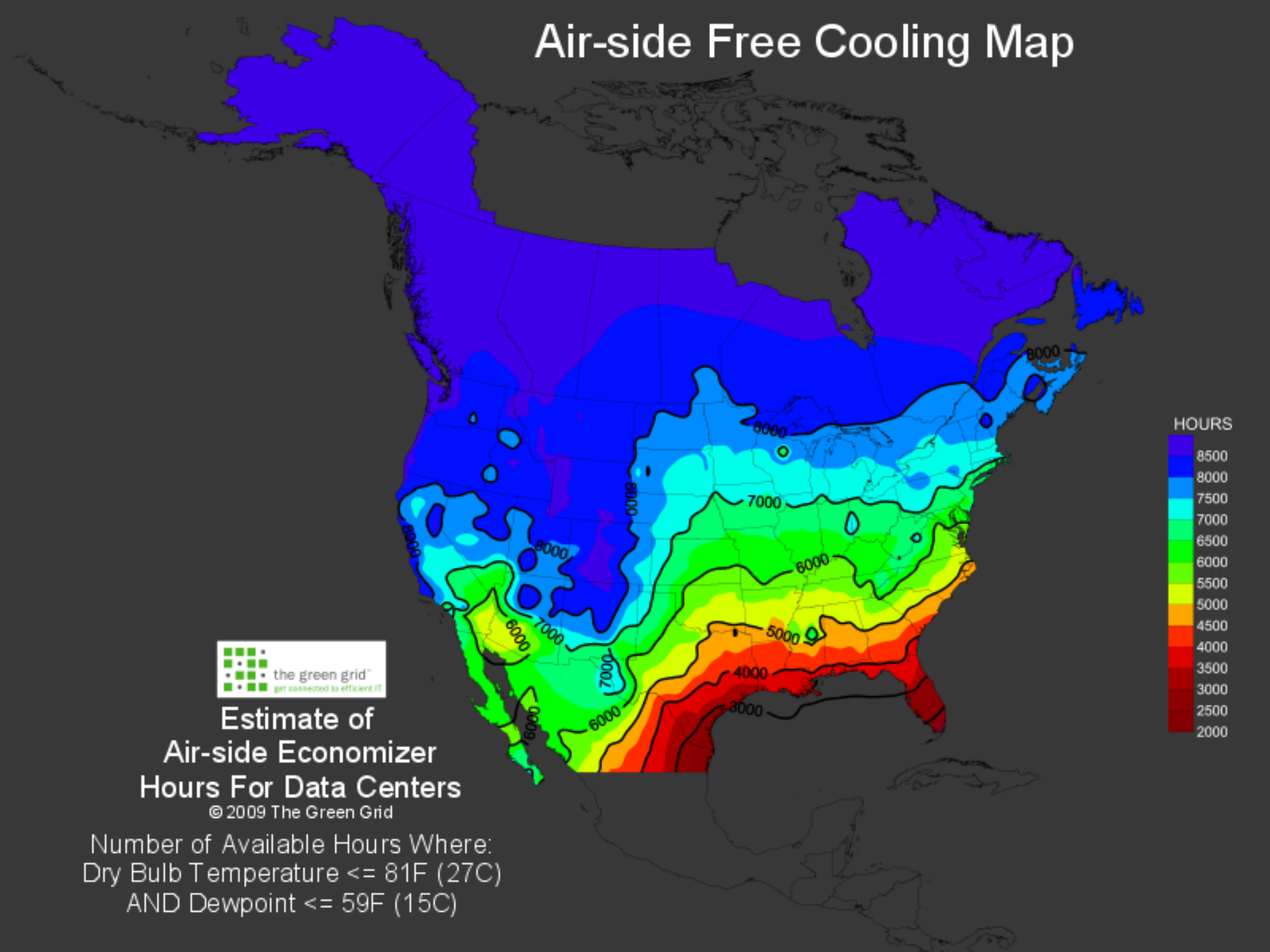
Economizer Sequence
Constant volume systems



VAV SYSTEMS


heating
modulated economizer cooling
integrated economizer cooling
mechanical cooling
airflow or cooling capacity, %
100
80
60
40
20
0
supply airflow
return airflow
outdoor airflow
energy savings
mechanical cooling capacity
mechanical cooling capacity
return airflow
outdoor airflow
maximum heating load
minimum cooling load
high-limit shutoff
maximum cooling load

Air-side Free Cooling Map



the green grid
get connected to efficient IT

Estimate of Air-side Economizer Hours For Data Centers

© 2009 The Green Grid

Number of Available Hours Where:
Dry Bulb Temperature <= 81F (27C)
AND Dewpoint <= 59F (15C)

Economizer control in heating

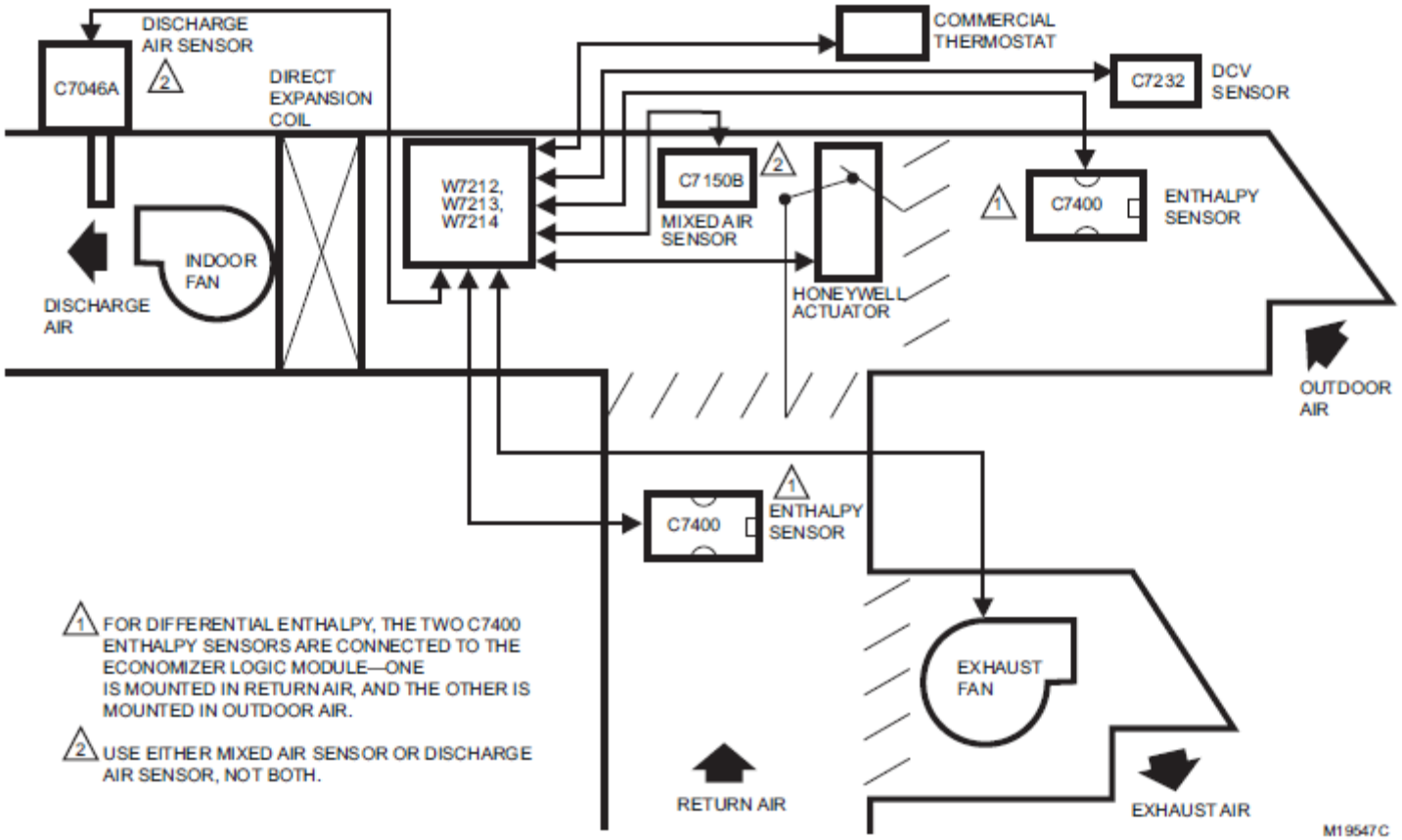
- Economizer system must not result in increased building heating load.

Modes

- Modulated Economizer
  - Space temp meet by OSA (30^{o}-55^{o})
- Integrated Economizer Mode
  - (55^{o}-75^{o}) Cooling and OSA
- Mechanical Cooling Mode
  - Economizer Disabled
- Standard 90
  - Economizer cooling systems used in all cooling systems!

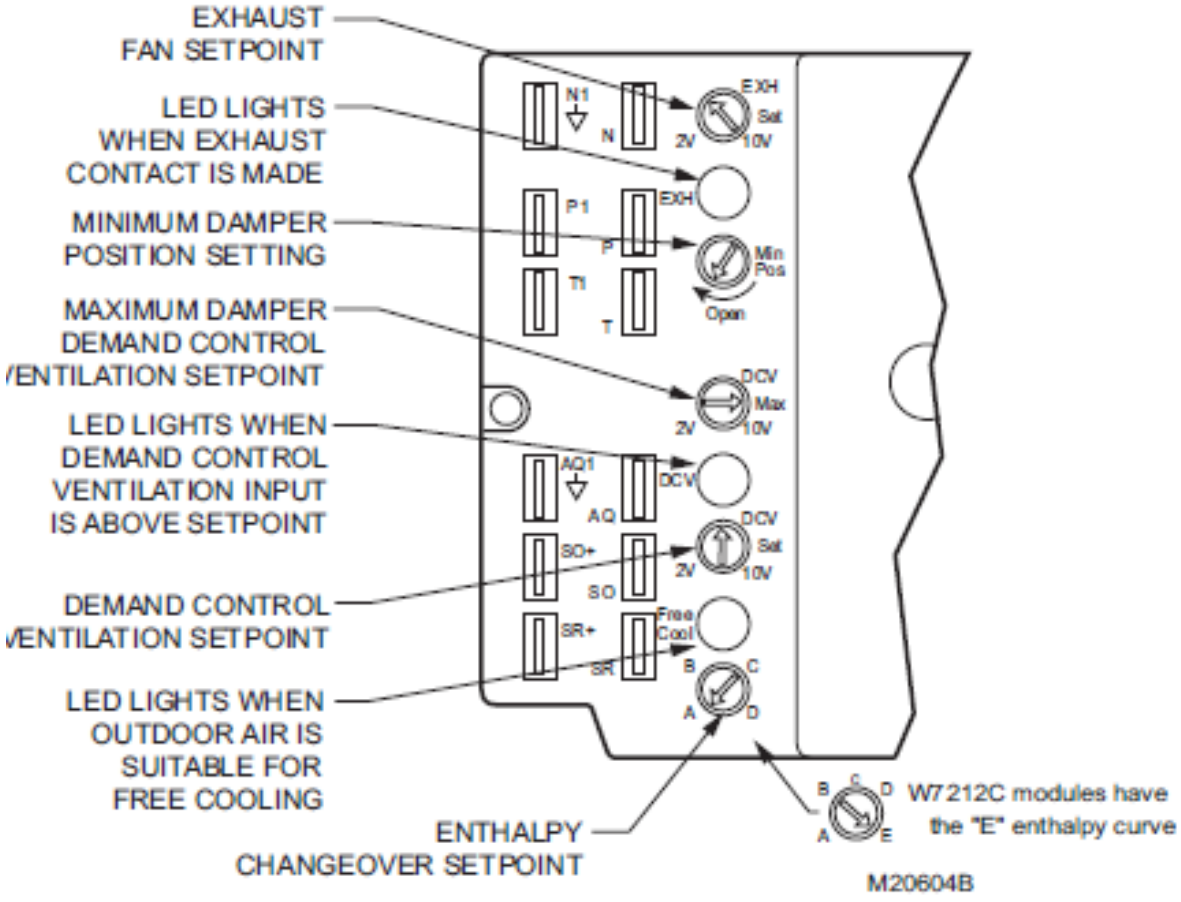
Savings

- Intel IT conducted a proof-of-concept test that used an air-side economizer to cool servers with 100% outside air at temperatures of up to 90°F. Intel estimates that a 500kW facility will save $144,000 annually and that a 10MW facility will save $2.87 million annually. Also, the company found no significant difference between failure rates using outside air and an HVAC system.[38]
- A San Jose, California, data center estimates it can reduce its cooling costs by 60% through air-side economization. A Sacramento, California, data center projects a 30% savings over conventional data centers.[39]

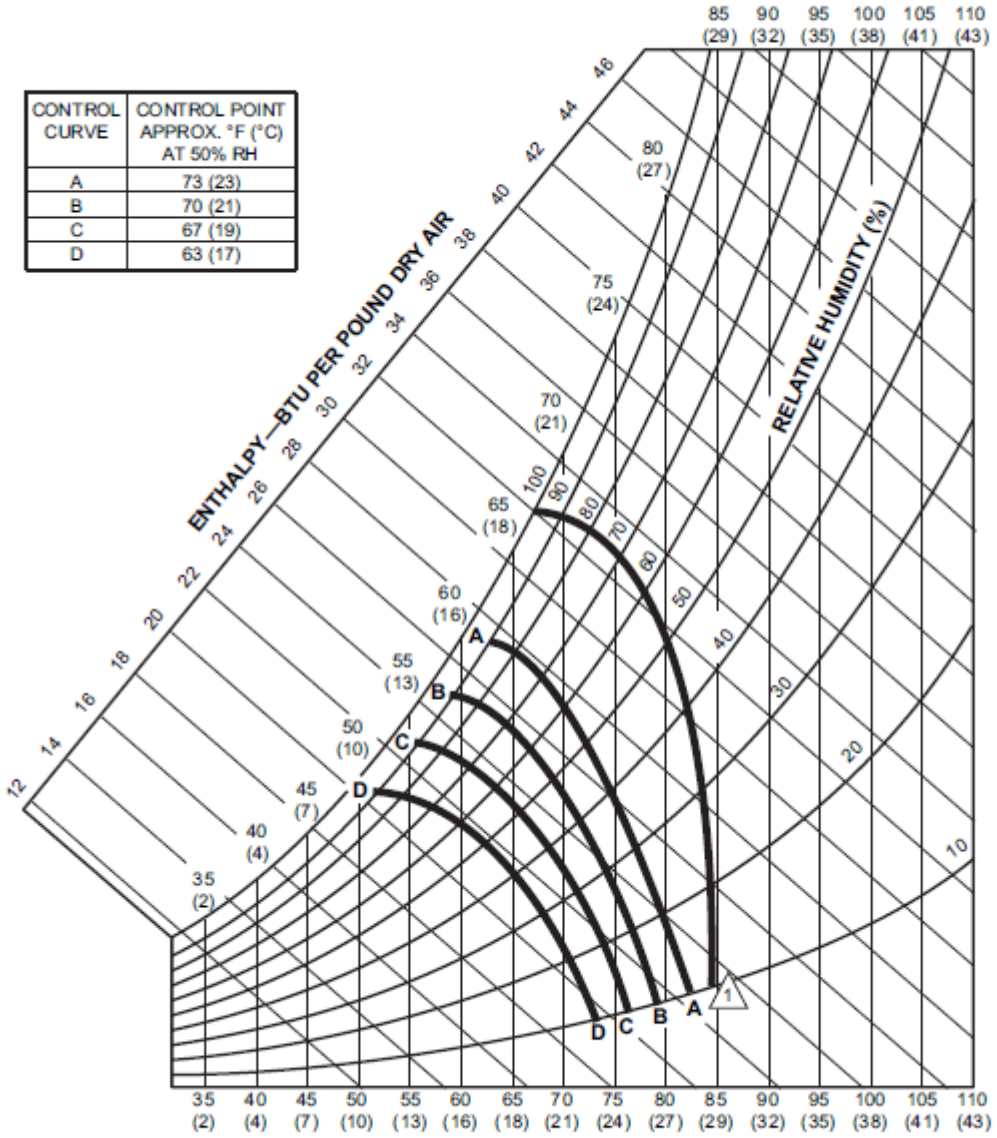


1 FOR DIFFERENTIAL ENTHALPY, THE TWO C7400 ENTHALPY SENSORS ARE CONNECTED TO THE ECONOMIZER LOGIC MODULE—ONE IS MOUNTED IN RETURN AIR, AND THE OTHER IS MOUNTED IN OUTDOOR AIR.

2 USE EITHER MIXED AIR SENSOR OR DISCHARGE AIR SENSOR, NOT BOTH.

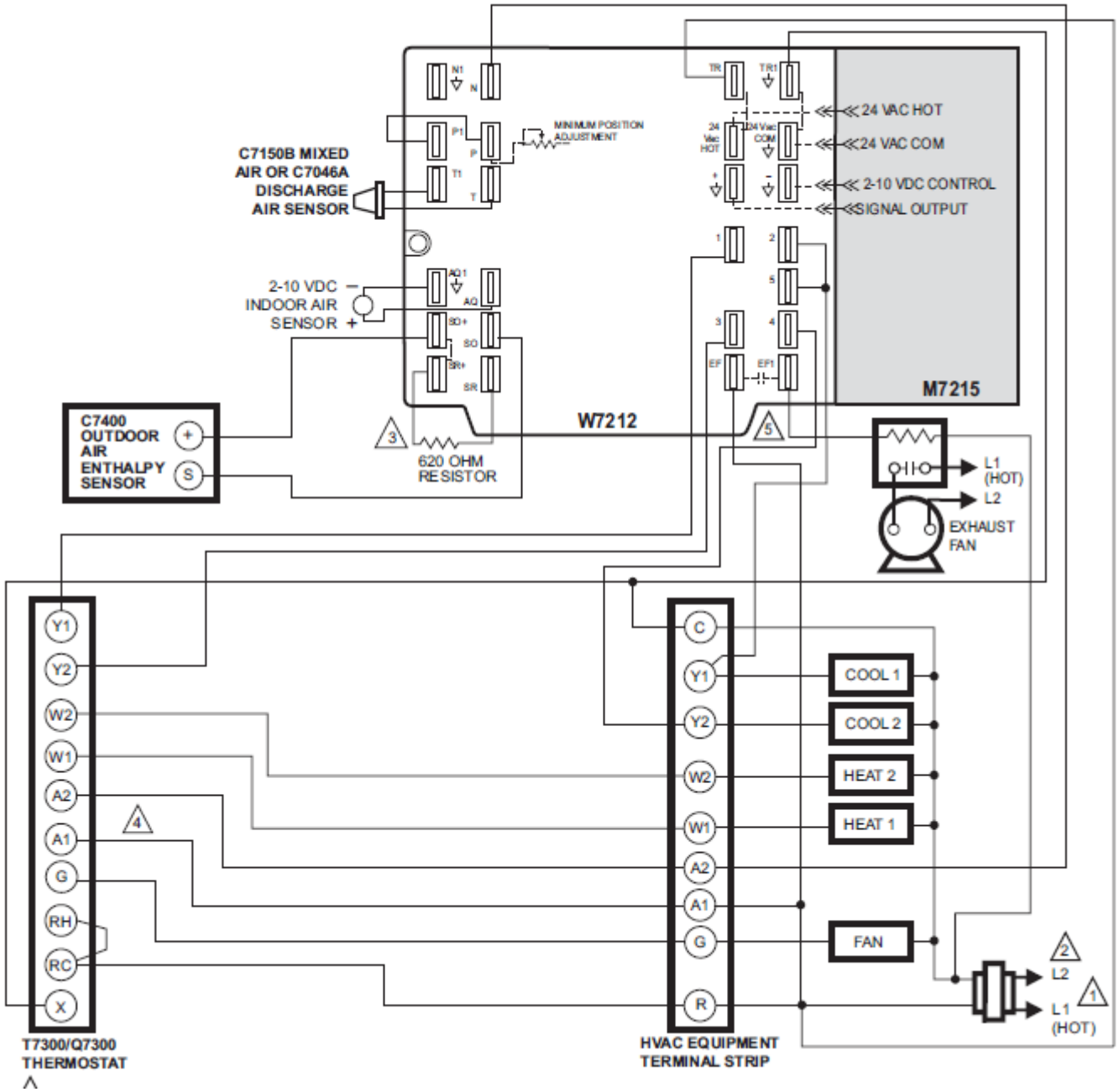

EXHAUST FAN SETPOINT
LED LIGHTS WHEN EXHAUST CONTACT IS MADE
MINIMUM DAMPER POSITION SETTING
MAXIMUM DAMPER DEMAND CONTROL VENTILATION SETPOINT
LED LIGHTS WHEN DEMAND CONTROL VENTILATION INPUT IS ABOVE SETPOINT
DEMAND CONTROL VENTILATION SETPOINT
LED LIGHTS WHEN OUTDOOR AIR IS SUITABLE FOR FREE COOLING
ENTHALPY CHANGEOVER SETPOINT
N1
N
EXH
Set
2V
10V
P1
P
T1
T
Min Pos
Open
DCV
Max
AQ1
AQ
SO+
SO
Free Cool
SR+
SR
A
B
C
D
E
W7212C modules have the "E" enthalpy curve
M20604B

CONTROL CURVE	CONTROL POINT APPROX. °F (°C) AT 50% RH
A	73 (23)
B	70 (21)
C	67 (19)
D	63 (17)



1 HIGH LIMIT CURVE FOR W7210D, W7212, W7213, W7214, W7340B.

M11160C


C7150B MIXED AIR OR C7046A DISCHARGE AIR SENSOR
MINIMUM POSITION ADJUSTMENT
2-10 VDC INDOOR AIR SENSOR
C7400 OUTDOOR AIR ENTHALPY SENSOR
620 OHM RESISTOR
W7212
M7215
24 VAC HOT
24 VAC COM
2-10 VDC CONTROL
SIGNAL OUTPUT
L1 (HOT)
L2
EXHAUST FAN
COOL 1
COOL 2
HEAT 2
HEAT 1
FAN
L2
L1 (HOT)
T7300/Q7300 THERMOSTAT
HVAC EQUIPMENT TERMINAL STRIP