

Honeywell TC500A

Programmable Commercial

Thermostat

For Multistage Conventional and Heat Pump Systems

General

A. Overview: The contractor shall furnish, install, and place in operating condition an HVAC control system described herein. All units shall be located in accordance with the plans.

B. System Requirements:

1. Control up to 3H/3C for conventional gas or electric heat, and up to 5H/3C for heat pump applications
2. Auxiliary heating type may be staged or modulating
3. Modulating heat may be configured with programmable minimum threshold setting
4. Fan speed options: single, two-speed, or variable speed (0-10VDC, modulating/auxiliary heat or staged heating/cooling with up to 6 speeds)
5. Integral temperature and humidity sensor
6. BTL listed BACnet device capable of IP over Wi-Fi and MS/TP via wired networking
7. Remote thermostat cloud-based connectivity via Wi-Fi connection and mobile app to monitor temperature, change set-points, or manage scheduling for up to 20 thermostats
8. Daily schedule copy feature to multiple days of week
9. 365-day schedule with up to 20 holidays/special events
10. Purge function with individually scheduled purge events
11. Enhanced purge function for external economizer using either binary or DCV output
12. BACnet system scheduling and holiday configuration
13. Real-time Clock with 72-hour retention during power loss
14. Up to four occupied or standby periods per day
15. Automatic heat/cool changeover with 2°F (1°C) minimum dead band
16. Unoccupied override for a 0 to 18-hour configurable period, with 3-hour default
17. Temporary override setpoint adjustment of up to +/-30°F (+/-16.5°C)
18. Pre-occupancy purge using standby mode to enable economizer and provide suitable ventilation
19. Configurable heating and cooling parameters including minimum operating cycle time, throttling range, and cycles per hour
20. Configurable recovery ramps for heating and cooling
21. Discharge air temperature cooling/heating lockout (optional sensor)
22. Outdoor air temperature cooling/heating lockout (optional sensor)
23. Display or control room temperature in °F or °C
24. Integration with multiple remote temperature sensors (2-wire bus or analog) with configurable weighted averaging (optional)
25. Packaged economizer integration output economizer
26. Integral economizer function to perform direct economizer control

27. Ventilation control based on external CO2 sensor supporting output 0/2-10VDC for demand control ventilation (DCV)

28. Provide four levels of user management – installer, admin, basic user, and visitor

29. Remote occupancy sensor input for Standby mode

30. Thermostat reset option to restore factory default settings

31. On/Off humidification function

32. On/Off and reheat dehumidification functions

33. Power-up delay after power failure (0- 300 seconds)

34. 20-30 Vac operational voltage range

35. Auto sleep display to reduce energy consumption without user interaction after time-out

36. Display activates via near proximity sensor or screen touch detection

37. Edge to edge glass display for easy cleaning

38. 4" Diagonal capacitive color touch screen LCD display (480x480 pixel)

39. Three color LED indicator to show the operational status (heat, cool, fan, and active - pulsing) when display enters sleep mode

40. Service mode to manually command the outputs to test the operation of mechanical equipment

41. System status screen showing device information, live status, and sensor readings

42. Delta-T diagnostic feature to measure temperature rise or drop across coil to alert user of equipment failure.

C. Codes and Standards: The system shall comply with applicable provisions of ASHRAE 90-75. These specifications are based on equipment from Honeywell to set a standard for design and quality.

D. Wiring: All wiring shall meet National Electrical Codes and local electrical codes.

E. Testing Guarantee Service: Prior to installation, the contractor shall provide copies of submittals. The contractor is responsible for assuring that conduit and wire quantity, size, and type are suitable for the equipment supplied. Upon completion of thermostat installation, the contractor shall conduct a total system test for the owner and engineer.

Warranty service shall be performed by the contractor.

Sequence of Operations

The heating and cooling setpoints shall be individually adjustable for both the occupied, unoccupied, and standby periods. The thermostat shall have a minimum deadband of 2°F (1°C) (no mechanical heating or cooling shall operate within this deadband). Space temperature deviation above the cooling setpoint or below the heating setpoint shall generate a demand signal to control the system as follows:

A. Heating: The thermostat shall control the heating output based on space temperature deviation (proportional gain), the duration of that temperature deviation (integral gain), and the rate of change of the deviation (derivative gain). The thermostat shall energize heating equipment when space temperature falls below heating setpoint.

B. Cooling: The thermostat shall control the cooling output based on space temperature deviation (proportional gain), the duration of that temperature deviation (integral gain), and the rate of change of the deviation (derivative gain). The thermostat shall energize cooling equipment when space temperature exceeds cooling setpoint.

C. Economizer: The thermostat shall be configurable to control the economizer function (Internal Economizer) or interface with an external economizer controller (External Economizer). When configured for Internal Economizer, the thermostat shall determine if outside air is suitable for

free cooling using fixed dry-bulb, differential dry-bulb, fixed enthalpy or differential enthalpy using the connected sensors. When the outdoor air is suitable for cooling the thermostat shall modulate the economizer damper actuator to maintain mixed air temperature and stage mechanical cooling if outdoor air alone does not meet demand. When configured for External Economizer the thermostat shall enable the economizer via digital output (relay contact) whenever the thermostat is in occupied status (Occupied or Standby Mode). The thermostat shall have the option to interface with the economizer module for alarm status, CO2 reading for demand control ventilation and purge functions.

D. Ventilation: The thermostat shall control ventilation as part of the Internal Economizer function.

The ventilation function shall support Demand Control Ventilation (DCV) using a CO2 sensor connected to the thermostat. The DCV function shall increase the ventilation rate upon rise in CO2 level above the programmed CO2 setpoint. The thermostat shall trigger an alarm if CO2 exceeds a programmable limit. The ventilation rate shall be maintained across multiple fan speeds using six (6) programmable damper positions.

Thermostat when connected to external economizer control shall provide equivalent DCV output signal 0/2-10VDC when connected directly to external CO2 sensor utilizing Syk bus or analog input.

E. Purge: The thermostat shall incorporate a purge function for either internal or external economizer integration allowing the user to program purge events into the schedule.

For internal economizer function during the purge event the thermostat shall provide enhanced purge control by directly opening the damper to a pre-programmed position.

When thermostat is connected to external economizer control using DCV control and a CO2 sensor is connected to thermostat it shall provide enhanced purge function either via analog output (DCV) or digital output. When using analog output (0/2-10VDC) as DCV input of economizer control to demand maximum DCV damper opening setting via 10VDC signal. Alternatively, thermostat may supply digital output when connected to external economizer control equipped with digital input for purge function.

F. Delta-T Diagnostics: The thermostat shall incorporate a diagnostic tool that measures the temperature rise or drop across the equipment coils using connected Discharge Air and Mixed Air sensors. The thermostat shall have separate user programmable limits for each stage of heating or cooling. An alarm shall be generated after a programmable time delay when the equipment is running outside the limits to alert the user of equipment issues. There shall be programmable limits to suppress the alerts during extreme conditions. Delta-T function is possible in systems where thermostat is configured for internal economizer control. **Delta T function is not supported in external economizer applications.**

G. Heating Setback and Cooling Setup: Initiation of heating setback or cooling setup for each of 7 days or holidays, special events shall be provided by a programmed time schedule entered into the thermostat, mobile app, and/or building automation system.

H. Setpoint Recovery from Unoccupied to Occupied: The thermostat shall incorporate a programmable ramping feature for both heating and cooling that gradually changes the space setpoints with settings for both min. and max. setpoint recovery in degrees per hour. During recovery operation, the setpoint changes at a rate in degrees per hour

I. Fan Operation: Fan operation shall be selectable as follows:

- a. Continuous: Fan operates continuously in occupied mode, and during standby modes, and during a call for heating or cooling.
 - b. Auto: Fan is energized with calls for heating and cooling.
- J. Minimum Stage Operation Time:** Adjustable for Heating or Cooling:
 - a. Minimum On: 0 – 5 minutes
 - b. Minimum Off: 0 – 5 minutes
- K. Power Interruption:**
 - a. On loss of power, the thermostat shall maintain programmed times and temperatures indefinitely
 - b. Clock and day information shall be retained for a minimum of 72 hours.
- L. Temporary Override:**
 - a. Temporary Override may be used when the thermostat is in Unoccupied or Standby mode. It shall switch to the Occupied mode for an installer-configured number of hours. The default shall be three hours.
 - b. Selecting Temporary Override shall cancel the overrides and return to the programmed schedule

Features and Specifications

TC500A Thermostat Features

- A. Color Touch Screen Interface—** Three main informational screens
 - 1. Home Screen: operational status, current temperature, occupancy, humidity, WiFi, alerts and setpoint
 - 2. Outdoor/Indoor Conditions: temperature, humidity, CO2 (optional)
 - 3. Settings Menu: scheduling, Override, setpoints, configuration, alarms, backlight brightness, contractor info., °F/°C
- B. Wired or Wireless Control—**WiFi + Mobile App, BACnet IP, BACnet MS/TP
- C. Flexible Installation—**RTU/AHU – up to 3H/3C (conventional) 5H/3C (heat pump), 8 digital outputs, (2) UI's, (2) UIO's, RS485, 2-wire bus
- D. User Mobile App—**Remote Setpoint, schedule, current operating modes, and alerts
- E. Contractor Mobile App—**Localized commissioning via Bluetooth connection for full configuration of thermostat plus cloning of multiple thermostats based on saved configuration
- F. Multi-Level user types—**Visitor, Basic, Admin, Installer
- G. Scalable control—**Upgradable to provide advanced energy savings analytics for multi-site
- H. 365-day schedule with up to 20 holidays/special events and individually scheduled purge events**
- I. Configurable fan speeds**
- J. Humidification and Dehumidification functions**
- K. Economizer, Ventilation and Purge functions**
- L. Remote Sensor support: Space Temperature & Averaging, Outdoor Air (Temperature and Humidity), Return Air (Temperature and Humidity), Mixed Air (Temperature and Humidity), Discharge Air (Temperature and Humidity), Indoor Humidity, Occupancy, CO2**
- M. Sylk sensor support**
- N. Tamper-proof housing**
- O. Auto-changeover**
- P. Configurable alarms**
- Q. 5-year warranty**

Power Characteristics

- A. Power Supply Rated voltage: 24VAC 50/60Hz,
- B. Working voltage range: 20-30VAC, UL listed class-2 transformer or IEC 61558 listed transformer.
- C. Power Consumption (Display ON) Max. 8.5VA @ 24VAC (355mA @ 24VAC)
- D. Min. Load 4VA (all Digital Outputs OFF, No Sylk sensor)
- E. Max. Load 96VA (all Digital Outputs ON)

Electrical Characteristics

- A. Rated Impulse Voltage: 500 V
- B. Construction of Control: Independently Mounted Control
- C. Operation Method: Type 1 Action
- D. Pollution Degree: 2
- E. Purpose of Control: Operating Control

Display

- A. Display Type 24 BPP TFT display with CTP
- B. Resolutions 480x480 pixel
- C. Active Display Area 4" diagonally
- D. Backlight LCD (Dimmable)

Operating Environment

- A. Ambient Operating Temperature 32 to 122 °F (0 to +50°C)
- B. Ambient Operating Humidity 10 to 90% relative humidity (noncondensing)
- C. Storage Temperature -40 to 150 °F (-40 to 65.5°C)
- D. Protection Class IP20

I/O Characteristics

UIO x 2	<ul style="list-style-type: none">• Resistive Temperature Sensor Input<ul style="list-style-type: none">– 10K NTC type II, C7021 series (Not for space temp. sensing)– 20K NTC, TR21 and C7041 series. (Space temp sensing)• Temperature Accuracy<ul style="list-style-type: none">– $\pm 0.5^{\circ}\text{C}$ ($\pm 1^{\circ}\text{F}$) at 10 – 32°C (50 – 90°F)– $\pm 1.1^{\circ}\text{C}$ ($\pm 2^{\circ}\text{F}$) at -1.1 – 50°C (30 – 122°F)• Voltage Input, SELV<ul style="list-style-type: none">– 0-10V, $\pm 5\%$ of full scale• Digital Input<ul style="list-style-type: none">– Dry contact closure– Open circuit ($\geq 100\text{ kOhms}$)– Closed circuit ($\leq 100\text{ Ohms}$)• Voltage Output<ul style="list-style-type: none">– 0-10V, $\pm 3\%$ of full scale @2K ohms
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UI x 2	<ul style="list-style-type: none"> • Resistive Temperature Sensor Input <ul style="list-style-type: none"> – 10K NTC type II, C7021 series (Not for space temp. sensing) – 20K NTC, TR21 and C7041 series (Space temp sensing) • Temperature Accuracy <ul style="list-style-type: none"> – $\pm 0.5^{\circ}\text{C}$ ($\pm 1^{\circ}\text{F}$) at $10 - 32^{\circ}\text{C}$ ($50 - 90^{\circ}\text{F}$) – $\pm 1.1^{\circ}\text{C}$ ($\pm 2^{\circ}\text{F}$) at $-1.1 - 50^{\circ}\text{C}$ ($30 - 122^{\circ}\text{F}$) • Voltage Input, SELV <ul style="list-style-type: none"> – 0-10V, $\pm 5\%$ of full scale • Digital Input <ul style="list-style-type: none"> – Dry contact closure – Open circuit ($\geq 100 \text{ kOhms}$) – Closed circuit ($\leq 100 \text{ Ohms}$)
DO (G, Y1,Y2,Y3,W1,W2,W3)	<ul style="list-style-type: none"> • Relay Output <ul style="list-style-type: none"> – 1 Amps Max. at 24VAC
DO (AUX)	<ul style="list-style-type: none"> • Relay Dry Contact <ul style="list-style-type: none"> – 1 Amps Max. at 24VAC/DC

Supported Sensors and Devices

Sensors	Options	Part Numbers
Occupancy Sensor	Direct (Normally Open) Reverse (Normally Closed)	Dry contact occupancy sensor
Dirty Filter Sensor	Direct (Normally Open) Reverse (Normally Closed)	DPS200, DPS400, DPS1000 (Dry contact differential pressure switch)
Proof of Air Flow Sensor	Direct (Normally Open) Reverse (Normally Closed)	DPS200, DPS400, DPS1000 (Dry contact airflow switch)
Shutdown Sensor	Direct (Normally Open) Reverse (Normally Closed)	Dry contact shutdown switch
Mixed Air Temperature Sensor	NTC 20K NTC 10K, Type II Sylk	C7250A, C7041 series C7021 series C7400S
Outdoor Air Sensor	NTC 20K NTC 10K, Type II Sylk	C7250A, C7041 series C7021 series C7400S (Temperature and Humidity)
Discharge Air Sensor	NTC 10K, Type II NTC 20K Sylk	C7021 series C7041 series C7400S (Temperature and Humidity)
CO2 sensor (analog)	0-10 VDC Sylk	C7232 TR40-CO2
Proof of waterflow	Digital Input	Dry contact waterflow switch
Space Temperature Sensors	NTC 20K Sylk	TR21, TR21-A (Averaging) TR40 (max 4), TR75/TR120 (max 1)
Fan or Compressor Current Switch	Direct (Normally Open) Reverse (Normally Closed)	Coming 2022

Communication Technologies and Standards

BACnet IP	Over Wi-Fi
Wi-Fi	802.11 b/g/n Supported security levels OPEN, WPA, WPA2-AES, WPA2-TKIP, WPA3
Bluetooth	BLE 4.2 with 1 Mbps Classic Bluetooth with max. 3 Mbps
Sylk™	Honeywell Sylk™

Certifications and Standards

- CE
- FCC Title 47 part 15 subpart B, Title 47 part 15 subpart C
- ICES-003
- UL/cUL- UL60730-1, UL60730-2-9
- RoHs
- REACH
- California Title 24 (Coming Soon)
- California Prop 65
- EN 60730-1, EN 60730-2-9, EN 301489-1, EN 301489-17, EN 300328, EN 301893, EN 62479
- RSS 210
- BACnet BTL