TCAF Series

Digital Fan Coil Thermostats with 0(2)-10 VDC Fan Output

Features

- Ultra slim wall-mount unit to match any décor
- Large easy-to-read Liquid Crystal Display (LCD), with LED backlight
- A stylish bi-directional rotating dial and two compact touch keys to provide ease of operation
- Choice of constant display of ambient temperature or temperature set point value
- Output relays employed for direct connection of valve actuators for 2-wire on-off and 3-wire floating control
- Configurable operating parameters
- 2-wire on-off, 3-wire on-off/ floating and 0(2)-10 VDC output models available
- 0(2)-10 VDC fan output in a maximum of 7 steps plus auto mode
- Adjustable proportional band for proportional/3-wire floating models
- Adjustable integral time for 0(2) -10 VDC and 3-wire floating output models
- Choice of valve stroke time for 3-wire floating output models
- Field adjustable high and low occupied set point limit settings
- Choice to retain last entered settings on power resumption
- Dual-output models with auto cooling/heating changeover (deadband operation) and manual override
- Adjustable 1 to 5 K deadband for dual-output models
- Choice of operating sequence for dual-output models
- Unoccupied mode capability with field adjustable cooling and heating set points, for energy savings
- Choice of unoccupied mode activation in operating mode only or in both standby and operating modes
- Choice of fan action in unoccupied mode
- Field recalibration capability of measured temperature
- Continuous or auto fan operation
- External and seasonal changeover temperature sensor capability
- Window mode operation
- Optional infra-red remote control unit
- Optional special faceplate color available on request

General

The TCAF Series digital room thermostats are available in 8 basic models for 2-wire on-off, 3-wire on-off/floating and 0(2)-10 VDC control of valves and 0(2)-10 VDC control of fan motors in fan coil units for commercial, industrial and residential installations.

The 0(2)-10 VDC and 3-wire floating thermostats adopt true proportional-integral (PI) control algorithm. The microprocessor combines a proportional plus integral (PI) algorithm with advanced adaptive control logic. The proportional component of the algorithm adjusts the control output in response to changes in the measured temperature. The integral component of the algorithm adjusts the control output to eliminate offset (difference between the set point and the actual temperature). This provides precise and stable control under various system capacity and varying load conditions without the need for tuning or calibrating the control algorithm in the field. The digital display of ambient temperature, set point and operating mode provides the user with an attractive and functional thermostat that is easy to use.

A fan-speed control touch key allows control of a variable-speed fan in the form of step outputs in 0(2)-10 VDC values. The speed control key has a maximum of 8 positions: “Steps 1 to 7 plus Auto”. In the step positions, the fan runs continuously at a speed corresponding to the selected fixed voltage output. In the “Auto” mode, the fan speed is temperature dependent and controlled automatically in 3 steps from lowest to highest speed. Through the parameter setup menu, the default number of steps as well as default fan output range can be changed from 3 to 7 and from 0-10 to 2-10 VDC respectively.

When operating in auto fan mode, the ambient temperature controls both the valve output and fan output simultaneously but uses different algorithms.

A bi-directional rotating dial allows change of settings such as temperature set point values.

Ordering

To order, specify complete model numbers.

Specifications

Product model numbers	See Fig.2: TCAF Series Model Number Selection Guide	
Power requirements	110-230 V, +10% and -15%, 50/60 Hz	
Operating temperature differential (for both 2-wire and 3-wire on-off models)	Fixed at 1 K for both cooling and heating modes	
0-10 VDC output impedance	Minimum 10,000 Ω	
Temperature display range	5-35°C in 0.5 K increments: accuracy ±1 K (41-95ºF in 0.5 R increments, accuracy ±1 R)	
Temperature set point range	5-35°C in 0.5 K increments, initial factory setting at 22°C (41-95ºF in 0.5 R increments)	
Offset adjustment of temperature indication (field recalibration)	+2, +1, 0, -1 and -2 K (+2, +1, 0, -1 and -2 R) throughout the range, factory setting 0	
Deadband of dual-output models	Adjustable 1 to 5 K between cooling Mode and heating Mode, factory set at 3 K(3 R)	
Valve stroke time for 3-wire floating models	Accumulatively 10 to 240 s maximum in one direction, in steps of 10 s; factory setting 120 s	
Proportional band for PI control	Adjustable 1 to 10 K in 1 K increments, factory setting 5 K	
Integral time for PI control	Adjustable 0 to 30 minutes in 1 minute increments, factory setting 15 minutes. Setting = 0 means integral time being turned off.	
Auto fan temperature differential	Fan step output changes at 2 K increments from lowest to highest speed, only Steps 2, 4 and 7 are available in auto fan mode; auto fan operation in heating mode depends on choice of auto fan action.	
Sensing element	NTC thermistor, 10 kΩ@25ºC; accuracy ±0.5 K@25ºC	
Unoccupied mode	Input signal from external voltage-free contact; choice of unoccupied mode activation: in operating mode only or in both standby and operating	
Unoccupied temperature set point range	Field adjustable 5-35ºC in 1 K increments, separately for cooling and heating; Factory settings: 16ºC for heating and 26ºC for cooling	
Enclosure	Material: Self-extinguishing, molded ABS	
	Finish: Off white housing and dark grey faceplate	
Electrical ratings	Valve output relays	110-230 V, 3 A resistive, 1 A inductive, 50/60 Hz
	Total rating	110-230 V, 5 A maximum, 50/60 Hz
Ambient/Storage temperature limits	0 to 50 °C / -30 to 50 °C, 10% to 90% RH non-condensing	
Connectors	Non-removable line-voltage terminal blocks and removable low-voltage wire plugs	
Power wires	Wire size 1 mm^2 or 18 AWG solid copper recommended	
Sensor wires	22 AWG twisted shielded pair double-insulated cable	
Accessories and options	See Figure 8: Optional Accessories	
Agency approval	CE Mark compliant to EMC and Low Voltage Directives pending	
Shipping weight	0.2 kg (0.44 lb)	
Dimensions	See Figure 7: Dimensions in mm	

The performance specifications above are nominal and subject to tolerances and application variables of generally acceptable industry standards. The Manufacturer shall not be liable for damages resulting from misapplication or misuse of its products.

Figure 1: Display Control Unit and LCD Layout

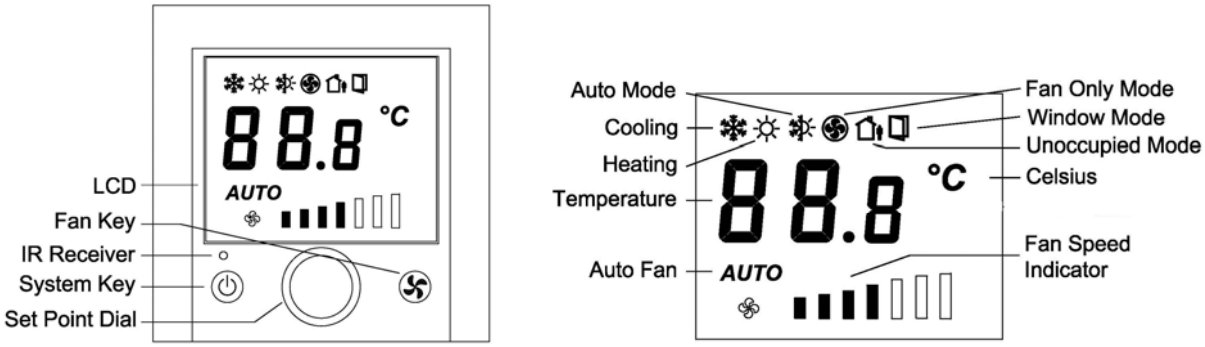


Figure 2: TCAF Series Digital Room Thermostat Model Number Selection Guide

TCAF	–	1	R
Product Type	Separator	Control Type	Options
TCAF = TCAF Series Digital Room Thermostats		**1** = Single 2-wire on-off output, cool only or heat only **1M** = Single 2-wire on-off output, manual cool/heat changeover **1A** = Single 0-10 VDC output, cool only or heat only **1AM** = Single 0-10 VDC output, manual cool/heat changeover **1F** = Single 3-wire floating output, cool only or heat only **1FM** = Single 3-wire floating output, manual cool/heat changeover **2** = Dual 2-wire on-off outputs, manual or Auto cool/heat changeover **2AH** = 0-10 VDC cooling output and 2-wire on-off output, manual or Auto cool/heat changeover	**R** = with infra-red receiver for RCU-1 **B** = without buzzer for key touch sounding **W =** with white color faceplate

Figure 3: Jumper Settings

The models TCAF-2 can be re-configured in the field to various model numbers by a qualified servicing agent, if necessary, by changing the jumper positions of JP2 and JP3. The locations of these jumpers can be found after removing the thermostat cover from its baseplate.

Model Number	Jumper Settings of JP2 and JP3	
	JP2	JP3
TCAF-1	Cut	Cut
TCAF-2	Uncut	Uncut
TCAF-1F	Cut	Uncut
TCAF-1A	Uncut	Cut

Jumper Settings of JP1 and JP4		
Jumper	Cut	Uncut
JP1	With External Sensor	With Built-in Sensor
JP4	For 2-10 VDC Output	For 0-10 VDC Output
Note: JP4 is available in 0-10 VDC/2-10 VDC output models only. Factory setting is 0-10 VDC.		

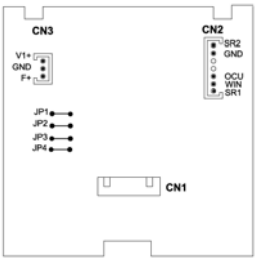


Figure 4: 0(2)-10 VDC Fan Output Table

Step	Output Value for 0-10 VDC Range (VDC)	Output Value for 2-10 VDC Range (VDC)
0	0	2
1	1.43	3.15
2	2.86	4.29
3	4.29	5.43
4	5.72	6.57
5	7.15	7.71
6	8.58	8.85
7	10	10
Auto	**In auto mode, the fan will run in only 3 steps, i.e. Steps 2 , 4 and 7 as default. Number of steps can be changed via parameter setup menu.**	

Figure 5: Thermostat Errors Reporting

When the following errors are reported on the LED display unit, these errors will prevent the thermostat from normal operation and all thermostat functions will be locked out:

E-1 EEPROM read/write error
E-2* Temperature sensor open-circuited
E-3 Temperature sensor short-circuited

* If jumper JP1 is cut open and external sensor is used, E-2 means the external sensor may have been disconnected from Terminals SR1 and GND. Check the external sensor's connectivity and resistive value. If E-2 error is still reported, return the thermostat to the manufacturer for repair.

When the error E-1 or E-3 is reported or when the error E-2 is reported without jumper JP1 being cut and external sensor being installed, return the thermostat to the manufacturer for repair.

Figure 6: Wiring Diagrams and Application Notes

Wiring and Application Notes

- Cut jumper JP1 open if an external sensor is wired to SR1 and GND. Run the wiring away from any electrical motors or power wiring. Failure to do so may result in poor thermostat performance due to electrical noise.
- Cut jumper JP4 open if 2-10 VDC proportional output is required.
- 22 or 24 AWG twisted shielded pair double-insulated cable is recommended as remote sensor wiring and its length must not exceed 25 m.
- Do not bundle and run power wiring and remote sensor wiring in the same conduit.
- The seasonal changeover sensor should be wrapped around the supply water pipe when associated with a water system. When the changeover sensor temperature exceeds 30 ºC, the thermostat enters into heating mode.
- External seasonal changeover sensor or switch is applicable to heat only or cool only 2-pipe models only.
- Unoccupied contact closure activates unoccupied mode.
- Window contact closure activates thermostat lockout mode.
- Hidden-line wiring for Terminal 4 of CN6 is applicable to dual on-off output models only.
- The thermostat outputs are designed for controlling zone valves. If used for controlling electric heaters, external contactors must be used.

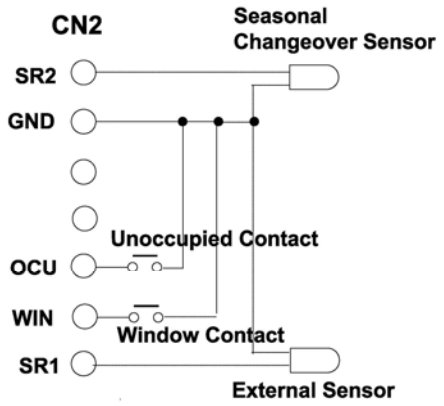
WARNING

Incorrect wiring connection may cause permanent equipment damages to the thermostat.

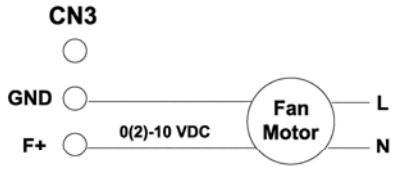
Piping Notes:

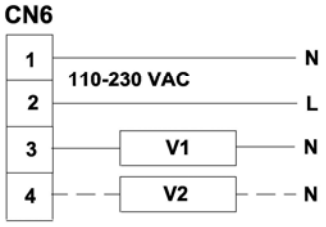
1. On a single on-off output unit, V1 can be either a 2-wire spring-return cooling or heating valve.
2. On a dual on-off output unit, V1 must be a 2-wire spring-return cooling valve and V2 a 2-wire spring-return heating valve.
3. V3 must be a 3-wire floating valve. In cooling mode, Terminal 3 output opens valve on temperature rise and Terminal 4 output closes valve on temperature drop. The action in heating mode is reversed.
4. On a single 0(2)-10 VDC output unit, V1+ can be either a 0(2)-10 VDC cooling or heating valve.
5. On a dual 0-10 VDC plus on-off output unit, V1+ must be a 0-10 VDC cooling valve and H an electric heating contactor.

Connections of Sensors and Contacts



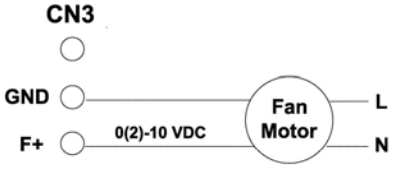
Wiring Diagram for Single and Dual 2-Wire On-Off Valve Outputs

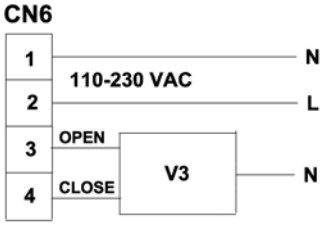




V1 and V2 are 2-wire on-off spring-return valves

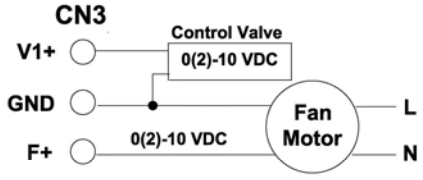
Wiring Diagram for Single 3-Wire Floating Valve Output

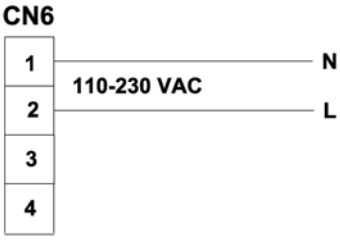




V3 is a 3-wire floating valve

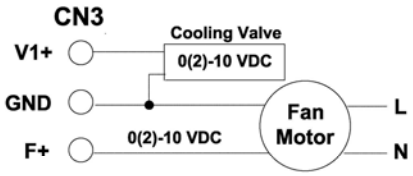
Wiring Diagram for Single 0(2)-10 VDC Valve Output

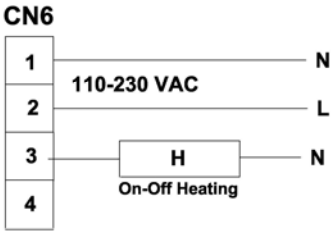




V1+ is a 0(2)-10 VDC valve

Wiring Diagram for Dual 0(2)10 VDC Cooling Valve Output and Line-Voltage Heating Output





V1+ is a 0(2)-10 VDC valve and V2 is an electric heating contactor

Figure 7: Dimensions in mm

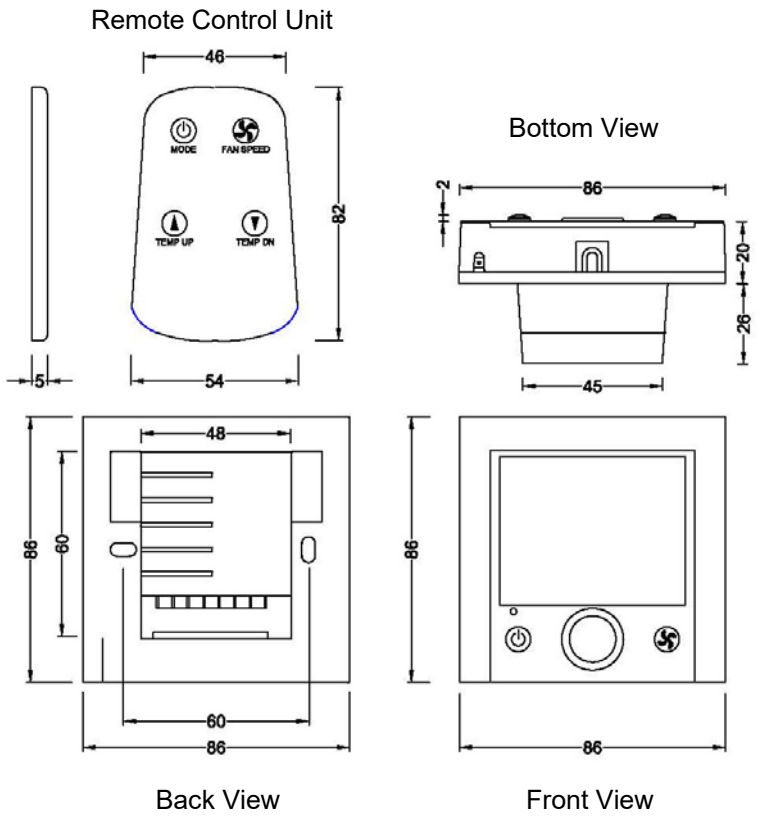
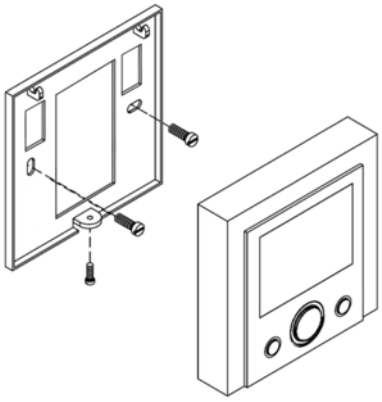


Figure 8: Optional Accessories

Description	Part No.
Remote control unit	RCU-1
Probe temperature sensor	TE10-1
Duct temperature sensor	TE10-2
With infra-red receiver capability	TCAF-xxR
Without buzzer capability	TCAF-xxB
With white-color faceplate	TCAF-xxW

Figure 3: Mounting Details



Mounting

The thermostat can be flush mounted or secured to a standard European 75 x 75 x 47 mm (strongly recommended) electrical box. Two mounting screws are included.

Operation Notes

User Operating Mode

- LCD shows ambient temperature constantly except when set point adjustment is being made.
- Press the system key Φ to enter into the desired operating mode: Cool or Heat-Auto-Fan Only-Off, etc.
- Press the fan key to change the fan speed mode: 1-2-3-4-5-6-7-Auto, etc.
- Increase or decrease temperature set point by rotating the adjustment dial clockwise or counter-clockwise. When the dial is rotated, the LCD shows the existing set point setting.
- In unoccupied mode, the factory temperature set points are 26 °C for cooling and 16 °C for heating. In heating mode, the fan speed can be set at “Off” or “Step 2”, depending on setup menu setting, when temperature is satisfied.
- Unoccupied mode can be activated in the following manner when the unoccupied contact closes:

  For Models “1”, “1A” and “1F”, the unoccupied cooling or heating mode is determined by the status of the SR2 seasonal changeover sensor and the valve output is activated according to the measured temperature.

  For Models “1M”, “1AM” and “1FM”, while in unoccupied mode, the valve output is never activated.

  For Model “2” and “2AH”, the unoccupied cooling or heating mode is always determined by the measured temperature and valve output is also activated according to the measured temperature.

  Unoccupied mode activation in operating mode only or in both standby and operating mode will be determined by activation setting in setup menu.

  When unoccupied mode is activated, all keys are locked out and no settings can be entered.
- When the window contact is closed, the window function enabled mode is activated and locks out all thermostat functions and displays the window icon on the LCD. This function has a higher priority than the unoccupied mode.

Parameter Setup Mode

- The thermostat allows authorized service agent to change a number of operating parameters in the field. Refer to the parameter setup manual for details.

Error reporting

- All valve and fan outputs will be shut down when error is reported.

Mega Controls Limited
Room 1521A, Star House,
3 Salisbury Road, Tsimshatsui, Kowloon, Hong Kong
Phone: +852 6281 1320 Fax: +852 3741 7084 E-mail: sales@megacontrols.com Website: www.megacontrols.com