

## BACnet® MS/TP Networked Full Configurable PI Modulating with On/Off Heating/ Cooling Control

DATA SHEET



The TBB700 series are BACnet Master-Slave/Token-Passing (MS/ TP), full configurable, open protocol networked digital thermostats. They are suitable for 2-pipe or 4-pipe Fan-coil HVAC system of modulating and/or floating controls.

The thermostat measures temperature of a room or distant space and then output 0(2)-10Vdc signal by proportional-integral algorithm to control cooling/heating devices and use relays to switch fan speeds and extra on/off devices in the HVAC system to maintain the room space near a desired temperature set point. The 1- or 3-fan speed can be operated in the mode of auto changeover or manual selected continuous mode.

This series has a big LCD screen showing room temperature or set point, and related status. And it also has optional digital inputs for detection device such as room occupied/unoccupied detector to enhance energy savings.

### FEATURES

- BACnet MS/ TP, RS-485 open protocol communication with complete baud rate selections
- Effective run time accumulation for system reading/ resetting
- The fan speed can be operated in the mode of auto changeover or manual selected continuous mode.
- Room temperature or setpoint temperature selectable for normal display
- Full configurable parameters such as switching differential, cycle time, and etc.
- Proportional plus integral (PI) algorithm applied to modulating control and/or floating control
- 0(2) to 10 Vdc or 10 to 0(2) Vdc control signal output selectable for direct / reverse acting output
- Optional multi-stage on/off control outputs
- Minimum Cycle/ On/ Off time settable
- Optional Remote sensor (RS) input interface for connecting to remote temperature sensor
- Optional Energy Saving input (ESI) interface for connecting to hotel card key , occupied/unoccupied sensor or lighting interlock signal
- Optional extra digital input for Window/ Door open detection to save energy
- Adjustable unoccupied setpoints for heating and cooling mode control
- Optional settable countdown Timer (0 to 24 hours) function to stop control output when time expires
- Optional sleep mode function for raising 2°C temperature setpoint in 2 hours
- Non-volatile memory (EEPROM) retains user settings during power loss
- User's buttons and Energy Saving lockable
- °C or °F display, no fluctuation sensing algorithm
- Control off output when system at "OFF" status
- Maximum and minimum set-point limits settable

# AX-TBB700

BACnet Thermostat - Heat & Cool



## SPECIFICATIONS

### Supply Voltage :

24Vac (+/-10%), 50/60 Hz

### BACnet Communication :

BACnet Application Specific Controller(B-ASC)  
Support B-ASC plus DS-RPM-B BIBBs  
RS485, 2/ 3 wires connection  
BACnet MS/ TP open protocol, support 9.6/ 19.2/  
38.4/ 57.6/ 76.8 kbps baud rate selections  
N81 data format(BACnet Standard)

### Display Range :

-30 to 120.0 °C (-22.0 to 248.0 °F) with suitable sensor

### Display Temperature Unit and Resolution:

0.1 °C/°F

### Indication Accuracy :

+/-1.0 °C (1.8 °F) at 25 °C and output off

### Set-point Range:

0~50 °C / 32~122 °F (default-10~30 °C /50~86 °F,  
adjustable), 0.5 °C/°F per setting step

### Set-point Adjust :

By up and down arrows buttons or BACnet  
communication

### Analog Output Signal :

0(2) to 10 Vdc or 10 to 0(2) Vdc  
Maximum 3mA

### Relay Output for On/ Off stage Control :

Up to 2 SPST or 2 SPDT relays for on/off devices  
control

### Relay Output for Fan Control :

Up to 3 SPST relays for 1- or 3-Fan speed control

### Relay Output for Interlock Control :

1 SPST relay for Interlock control

### Electrical Rating :

SPDT relay -- 1.2A/ 250Vac, inductive load  
SPST relay -- 2A/ 250Vac, inductive load

### Remote Sensor ( RS ) Input Interface :

For connecting to external NTC Thermistor 3K ohm

### Energy Savings Input ( ESI ) Interface :

For saving energy by entering into unoccupied mode  
when ESI is triggered by Normally open (N.O.) or  
normally close (N.C.) dry contact

### Extra Digital Input ( DI ) Interface :

For saving energy by stop cooling/heating and Fan  
control outputs when DI is triggered by Normally open  
(N.O.) or normally close (N.C.) dry contact

### Control action for modulation outputs :

Selectable direct or reverse control action of cooling and  
heating. Both are direct action by default.

#### a. Cooling Control Action

Control Action	Output Signal
Direct	0(2) to 10 Vdc
Reverse	10 to 0(2) Vdc

#### b. Heating Control Action

Control Action	Output Signal
Direct	0(2) to 10 Vdc
Reverse	10 to 0(2) Vdc

### Control Performance :

Proportional plus integral (PI) adaptive control

### Countdown timer Function (optional):

1~24 hours settable countdown timer to turn off control  
outputs when enable

### Sleep mode Function (optional):

For raising 2°C temperature set-point in 2 hours when  
enable

### Operating Environment :

0 ~ 50°C, 5 ~ 95% RH (non-condensing)

### Wiring :

Up to 19 Screw-in terminals, each terminal capable of  
accepting 14 to 22 AWG wires or 1.5 mm<sup>2</sup> wires

### Dimensions :

94×118×34 mm (W × H × D)

### Mounting :

Mounts directly onto wall, panel, standard 65×65 mm  
junction box (hole pitch 60 mm) or standard 2×4 inch  
vertical junction box (hole pitch 83.5 mm)

# AX-TBB700

BACNet Thermostat - Heat & Cool



## PRODUCT ORDERING INFORMATION

TBB7    -      -      -

(1) (2) (3) - (4) (5) (6) (7) (8) - (9) (10)(11)(12) (13) - (14)

### MODEL: TBB7

Item	CODE	Cooling Control Outputs*
<b>(1)</b>	0	None
	1~6	No. of stages for On/Off digital output (DO)
	7	1- floating output
	8	1- 0(2) to 10 VDC Modulating output
	9	1- 0(2) to 10 VDC Modulating with 1 extra On/Off digital output
	A	1- 0(2) to 10 VDC Modulating with 2 extra On/Off digital output
	B	1- 0(2) to 10 VDC Modulating with 3 extra On/Off digital output
	X	Specified

Item	CODE	Heating Control Outputs*
<b>(2)</b>	0	None
	1~6	No. of stages for On/Off digital output (DO)
	7	1- floating output
	8	1- 0(2) to 10 VDC Modulating output
	9	1- 0(2) to 10 VDC Modulating with 1 extra On/Off digital output
	A	1- 0(2) to 10 VDC Modulating with 2 extra On/Off digital output
	B	1- 0(2) to 10 VDC Modulating with 3 extra On/Off digital output
	X	Specified

Item	CODE	Application
<b>(3)</b>	A	2-Pipe Cooling only
	B	4-Pipe Heating or Cooling (Manual Selectable)
	C	4-Pipe Heating and Cooling (Auto Changeover)
	D	2-Pipe Heating only
	E	2-Pipe Heating or Cooling (Manual Selectable)
	X	Specified

Item	CODE	FAN Control *
<b>(4)</b>	0	None
	1~3	No. of speeds of FAN control

Item	CODE	Power of Thermostat, DO1, FAN – refer to wiring diagram for details
<b>(5)</b>	0	24Vac, 24Vac, None
	1	24Vac, External power, External power
	2	24Vac, 24Vac, External power
	3	24Vac, 24Vac, 24Vac
	4	Reserved
	5	Reserved
	6	Reserved
	7	Reserved
	8	Reserved
	9	Reserved

# AX-TBB700

## BACNet Thermostat - Heat & Cool



	A	Reserved
	B	Reserved
	C	24Vac, None, None
	D	24Vac, External power, None
	E	24Vac, None, External power
	F	24Vac, None, 24Vac
	X	Specified

Item	CODE	Wiring for an On/Off Valve/actuator
<b>(6)</b>	0	None
	2	2 Wires
	3	3 Wires
	4	3+2 Wires

Item	CODE	Color for Plastic Case
<b>(7)</b>	1	Pure White
	2	Reserved

Item	CODE	Color of LCD Backlit
<b>(8)</b>	0	None
	1	Reserved
	2	White

Item	CODE	No. of input interfaces for Remote Temperature Sensor (RS) or/and analog input (AI)
<b>(9)</b>	0	None
	1	1 RS input
	X	Reserved

Item	CODE	No. of input interfaces for Energy Saving Input (ESI) or/and Digital inputs (DI)
<b>(10)</b>	0	None
	1	1 ESI input
	2	1 ESI input and 1 extra Digital input

Item	CODE	Function of sleep mode
<b>(11)</b>	0	None
	1	With Sleep mode function

Item	CODE	Function of Timer mode
<b>(12)</b>	0	None
	1	With Timer mode function

Item	CODE	No. of Interlock Contact (ILC) signal outputs*
<b>(13)</b>	0	None
	1	1 ILC

# AX-TBB700

BACNet Thermostat - Heat & Cool



Item	CODE	BACnet Baud Rate(Kbps)
<b>(14)</b>	0	9.6
	1	19.2
	2	38.4
	3	57.6
	4	76.8
	5	115.2

Example: TBB788C-3E010-11000-2: 1 modulating cooling, 1 modulating heating, Cooling & Heating auto changeover, 3-speed of FAN control, 230Vac Fan power, no On/Off valve/actuator, Pure white color for case, no LCD backlit, 1 RS, 1 ESI, No sleep mode function, No Timer function, No ILC, 38.4 Kbps.

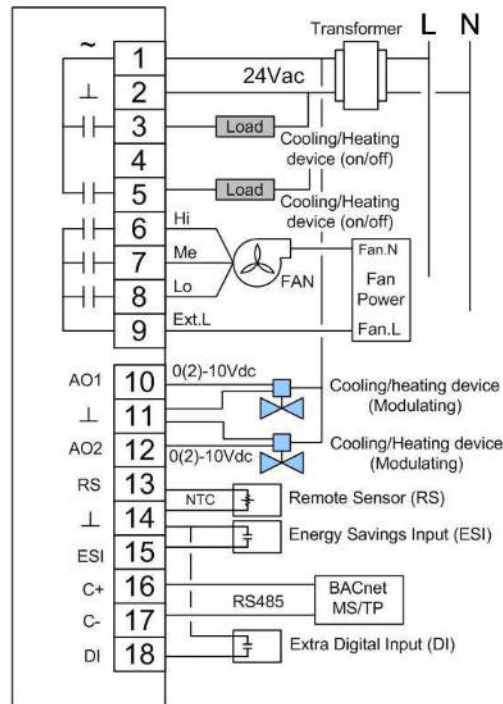
\* **Note:** Total number of cooling plus heating on/off stages and fan control and Interlock contact shall be within four.

# AX-TBB700

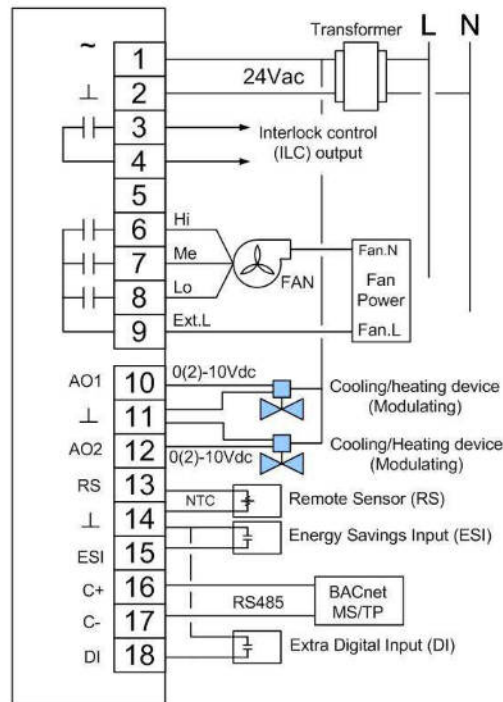
BACnet Thermostat - Heat & Cool



## WIRING EXAMPLES



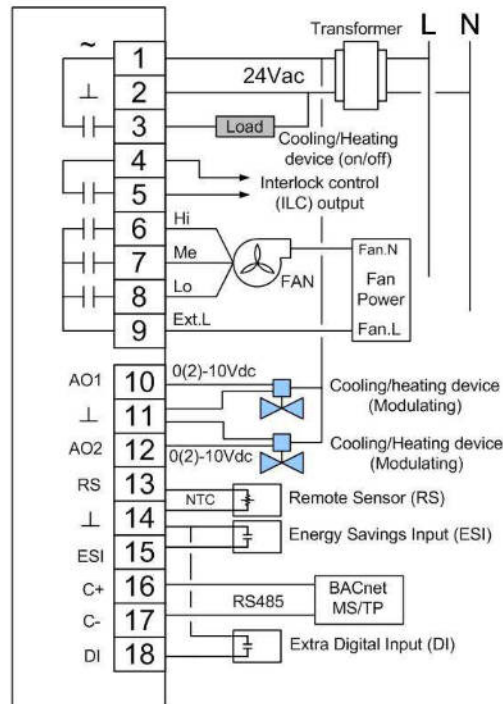
### Modulating with On/Off Device and FAN Control Type



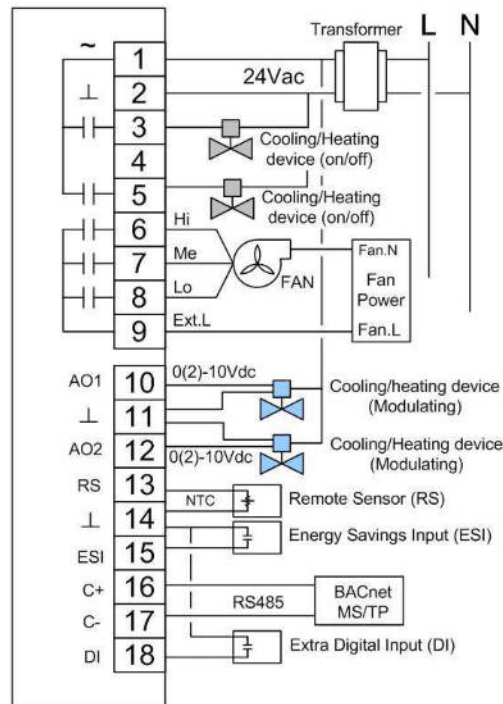
### Modulating with ILC and FAN Control Type

# AX-TBB700

BACNet Thermostat - Heat & Cool



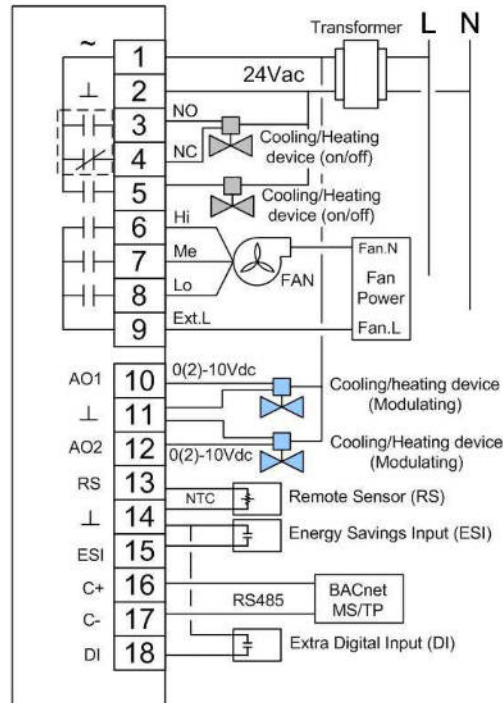
**Modulating with On/Off Device, ILC, and FAN Control Type**



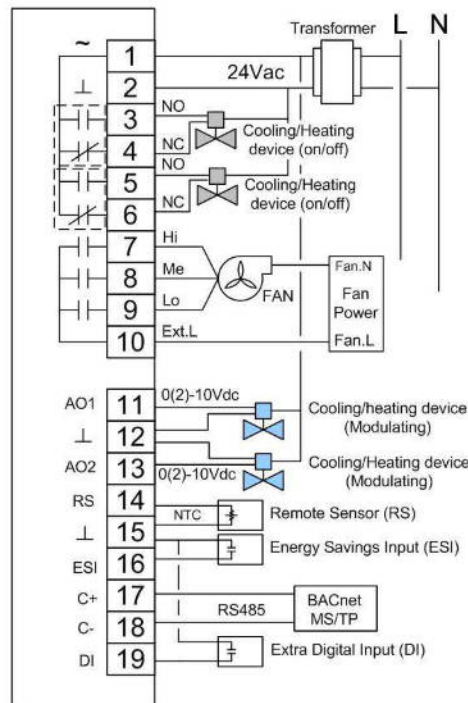
**Modulating with 4-pipe 2-wire On/Off Valves and FAN Control Type**

# AX-TBB700

BACNet Thermostat - Heat & Cool



## Modulating with 3+2-wire On/Off Valves and FAN Control Type



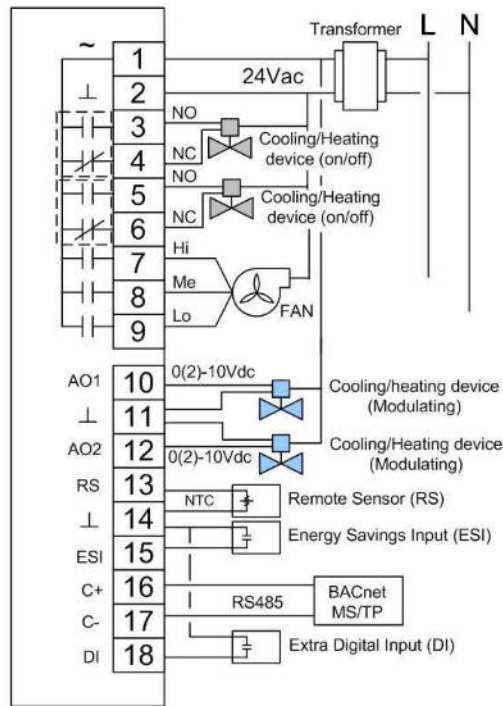
## Modulating with 3+2-wire On/Off Valves and FAN Control Type

**( External Fan Power )**



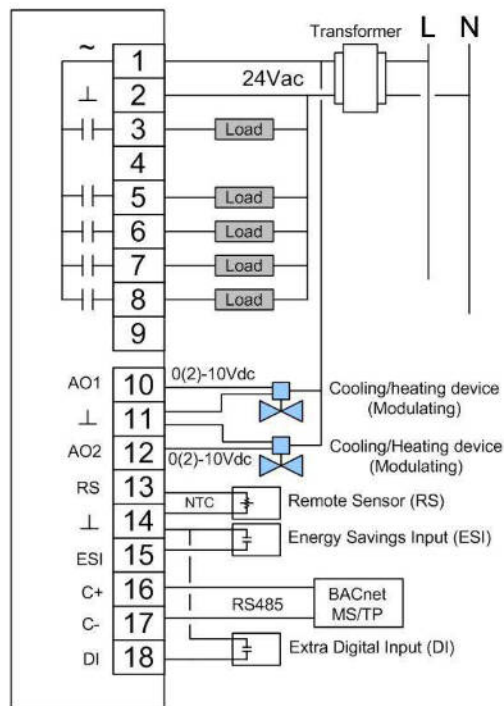
# AX-TBB700

BACNet Thermostat - Heat & Cool



## Modulating with 3+2-wire On/Off Valves and FAN Control Type

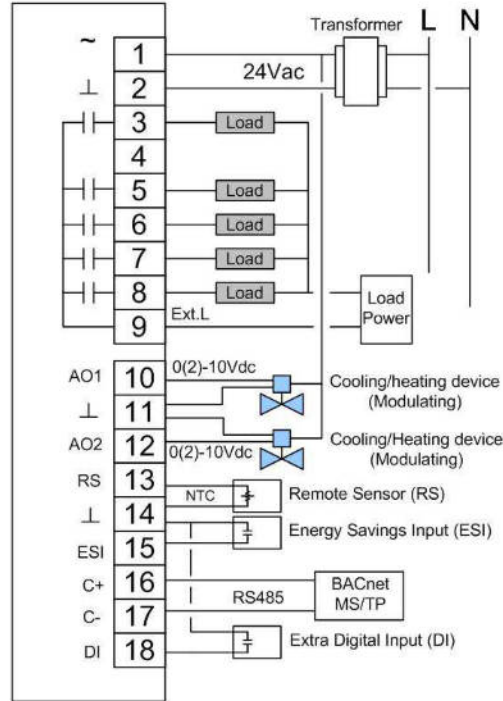
( Internal Fan Power )



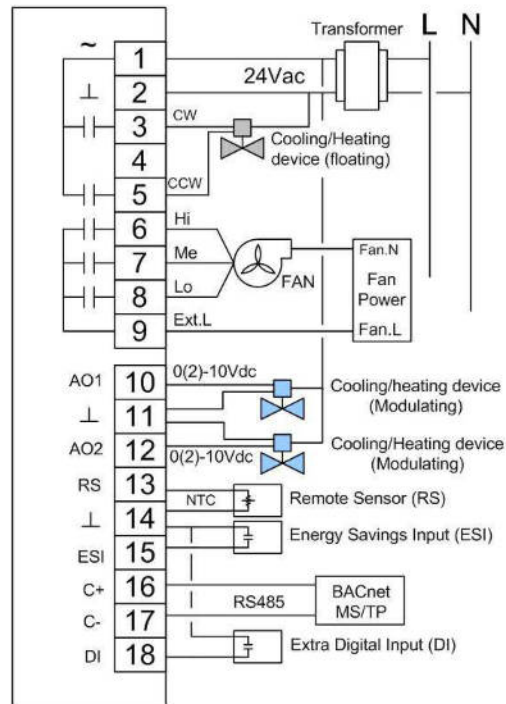
## Modulating with Multi-stage On/Off LOADs Control Type (int. power)

# AX-TBB700

BACnet Thermostat - Heat & Cool



## Modulating with Multi-stage On/Off LOADs Control Type (ext. power)



## Modulating with Floating Control Type

# AX-TBB700

## BACNet Thermostat - Heat & Cool



The modulating and on/off terminal assignment shall be referred to the following tables according to the number of modulating and on/off of Cooling and Heating.

### Models for Modulating with On-Off Device and 3-speed Fan Control Outputs

Model NO.	Analog Terminal Designation		ON-OFF Terminal Designation			
	AO 1	AO 2	Terminal 3	Terminal 6	Terminal 7	Terminal 8
TBB710A			Cool 1 (On/Off)	FAN Hi	FAN Med	FAN Low
TBB701D			Heat 1 (On/Off)	FAN Hi	FAN Med	FAN Low
TBB711E			Cool 1/ Heat 1 (On/Off)	FAN Hi	FAN Med	FAN Low
TBB780A	Cool 1 (Modulating)			FAN Hi	FAN Med	FAN Low
TBB788B	Cool 1 (Modulating)	Heat 1 (Modulating)		FAN Hi	FAN Med	FAN Low
TBB788C	Cool 1 (Modulating)	Heat 1 (Modulating)		FAN Hi	FAN Med	FAN Low
TBB708D	Heat 1 (Modulating)			FAN Hi	FAN Med	FAN Low
TBB788E	Cool 1/ Heat 1 (Modulating)			FAN Hi	FAN Med	FAN Low
TBB781B	Cool 1 (Modulating)		Heat 1 (On/Off)	FAN Hi	FAN Med	FAN Low
TBB781C	Cool 1 (Modulating)		Heat 1 (On/Off)	FAN Hi	FAN Med	FAN Low
TBB718B	Heat 1 (Modulating)		Cool 1 (On/Off)	FAN Hi	FAN Med	FAN Low
TBB718C	Heat 1 (Modulating)		Cool 1 (On/Off)	FAN Hi	FAN Med	FAN Low
TBB790A	Cool 1 (Modulating)		Cool 2 (On/Off)	FAN Hi	FAN Med	FAN Low
TBB709D	Heat 1 (Modulating)		Heat 2 (On/Off)	FAN Hi	FAN Med	FAN Low

To be continued ...

### Models for Modulating with Multi-stage On/Off Control Outputs

Model NO.	Analog Terminal Designation		ON-OFF Terminal Designation				
	AO 1	AO 2	Terminal 3	Terminal 5	Terminal 6	Terminal 7	Terminal 8
TBB780A	Cool 1 (Modulating)						
TBB788B	Cool 1 (Modulating)	Heat 1 (Modulating)					
TBB788C	Cool 1 (Modulating)	Heat 1 (Modulating)					
TBB708D	Heat 1 (Modulating)						
TBB788E	Cool 1/ Heat 1 (Modulating)						
TBB781B	Cool 1 (Modulating)		Heat 1 (On/Off)				
TBB781C	Cool 1 (Modulating)		Heat 1 (On/Off)				
TBB718B	Heat 1 (Modulating)		Cool 1 (On/Off)				
TBB718C	Heat 1 (Modulating)		Cool 1 (On/Off)				
TBB790A	Cool 1 (Modulating)		Cool 2 (On/Off)				
TBB799B	Cool 1 (Modulating)	Heat 1 (Modulating)	Cool 2 (On/Off)	Heat 2 (On/Off)			
TBB799C	Cool 1 (Modulating)	Heat 1 (Modulating)	Cool 2 (On/Off)	Heat 2 (On/Off)			
TBB709D	Heat 1 (Modulating)		Heat 2 (On/Off)				
TBB799E	Cool 1/ Heat 1 (Modulating)		Cool 2/ Heat 2 (On/Off)				
TBB791B	Cool 1 (Modulating)		Cool 2 (On/Off)	Heat 1 (On/Off)			
TBB791C	Cool 1 (Modulating)		Cool 2 (On/Off)	Heat 1 (On/Off)			
TBB719B	Heat 1 (Modulating)		Cool 1 (On/Off)	Heat 2 (On/Off)			
TBB719C	Heat 1 (Modulating)		Cool 1 (On/Off)	Heat 2 (On/Off)			

To be continued ...

# AX-TBB700

BACNet Thermostat - Heat & Cool



TBB7A0A	Cool 1 (Modulating)		Cool 2 (On/Off)	Cool 3 (On/Off)			
TBB7AAB	Cool 1 (Modulating)	Heat 1 (Modulating)	Cool 2 (On/Off)	Cool 3 (On/Off)	Heat 2 (On/Off)	Heat 3 (On/Off)	
TBB7AAC	Cool 1 (Modulating)	Heat 1 (Modulating)	Cool 2 (On/Off)	Cool 3 (On/Off)	Heat 2 (On/Off)	Heat 3 (On/Off)	
TBB70AD	Heat 1 (Modulating)		Heat 2 (On/Off)	Heat 3 (On/Off)			
TBB7AAE	Cool 1/ Heat 1 (Modulating)		Cool 2/ Heat 2 (On/Off)	Cool 3/ Heat 3 (On/Off)			
TBB7A1B	Cool 1 (Modulating)		Cool 2 (On/Off)	Cool 3 (On/Off)	Heat 1 (On/Off)		
TBB7A1C	Cool 1 (Modulating)		Cool 2 (On/Off)	Cool 3 (On/Off)	Heat 1 (On/Off)		
TBB71AB	Heat 1 (Modulating)		Cool 1 (On/Off)	Heat 2 (On/Off)	Heat 3 (On/Off)		
TBB71AC	Heat 1 (Modulating)		Cool 1 (On/Off)	Heat 2 (On/Off)	Heat 3 (On/Off)		
TBB7B0A	Cool 1 (Modulating)		Cool 2 (On/Off)	Cool 3 (On/Off)	Cool 4 (On/Off)		
TBB70BD	Heat 1 (Modulating)		Heat 2 (On/Off)	Heat 3 (On/Off)	Heat 4 (On/Off)		
TBB7BBE	Cool 1/ Heat 1 (Modulating)		Cool 2/ Heat 2 (On/Off)	Cool 3/ Heat 3 (On/Off)	Cool 4/ Heat 4 (On/Off)		
TBB7B1B	Cool 1 (Modulating)		Cool 2 (On/Off)	Cool 3 (On/Off)	Cool 4 (On/Off)	Heat 1 (On/Off)	
TBB7B1C	Cool 1 (Modulating)		Cool 2 (On/Off)	Cool 3 (On/Off)	Cool 4 (On/Off)	Heat 1 (On/Off)	
TBB71BB	Heat 1 (Modulating)		Cool 1 (On/Off)	Heat 2 (On/Off)	Heat 3 (On/Off)	Heat 4 (On/Off)	
TBB71BC	Heat 1 (Modulating)		Cool 1 (On/Off)	Heat 2 (On/Off)	Heat 3 (On/Off)	Heat 4 (On/Off)	

## Models for Other Control Outputs

Model NO.	Analog Terminal Designation		ON-OFF Terminal Designation			
	AO 1	AO 2	Terminal 3/4	Terminal 6	Terminal 7	Terminal 8
TBB780A-3-ILC	Cool 1 (Modulating)		ILC (Interlock Contact)	FAN Hi	FAN Med	FAN Low
TBB788B-3-ILC	Cool 1 (Modulating)	Heat 1 (Modulating)	ILC (Interlock Contact)	FAN Hi	FAN Med	FAN Low
TBB787C-3						

Model NO.	Analog Terminal Designation		ON-OFF Terminal Designation				
	AO 1	AO 2	Terminal 3	Terminal 5	Terminal 6	Terminal 7	Terminal 8
TBB778C-3	Heat 1 (Modulating)		Cool 1 CW (Floating)	Cool 1 CCW (Floating)	FAN Hi	FAN Med	FAN Low
TBB787C-3	Cool 1 (Modulating)		Heat 1 CW (Floating)	Heat 1 CCW (Floating)	FAN Hi	FAN Med	FAN Low

## SYSTEM CONNECTION

