Smart Temp

SMT-150
Installer Manual

3 Stage Digital HVAC Controller
With Modbus RTU communications
Version 1.2

AUSTRALIAN OWNED & OPERATED

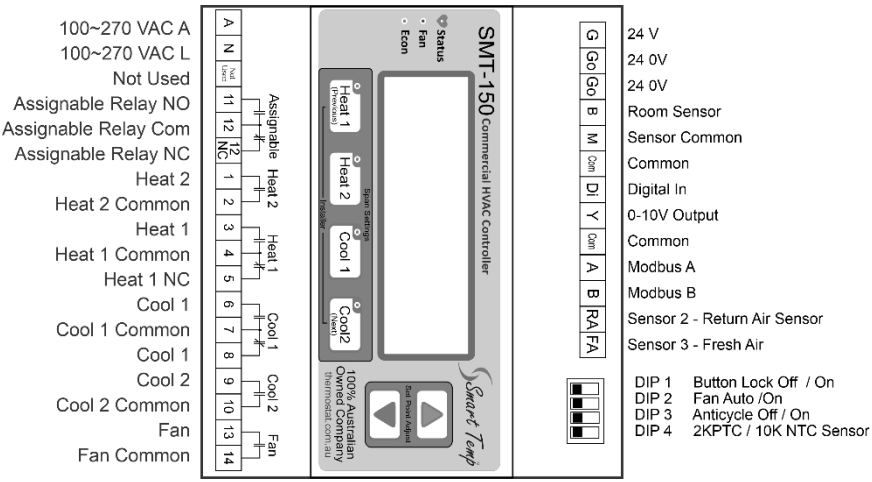
Version History	
Jan 2019	Version 1 - Original Document
Jan 2019	Ver 1.1 – Firmware Ver 3.5 Added installer option 19, Dead band adjustment.
Sept 2020	Ver 1.2 - Firmware Ver 6.1 Added Modbus RTU hardware and firmware (inc support for temperzone communications protocol including fan speed control).

Thank you for your purchase of this premier product. Please take the time to read and understand this manual to ensure the installation runs smoothly and you gain maximum benefit from the features and functions found in this HVAC controller.

The Smart Temp SMT-150 has been designed as a reliable and intuitive HVAC controller with the ability to control conventional Heat Pump and Heat Cool systems with up to 3 compressors. It can also provide basic economy control that compares inside temperature with outside temperature to confirm outside air suitability for cooling. The SMT-150 has also been designed to be a replacement device for other competitive brands currently on the market produced by Regulator®, Siemens® and HEVAC® etc.

Wiring Overview

The SMT-150 is a compact yet powerful HVAC control device. The diagram below shows the available inputs and outputs on theSMT-150.



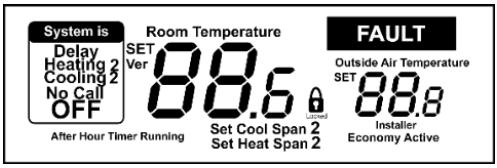
LED Indicators

The SMT-150 has a backlit LCD with LED indicators that provide you with current running status. The LED's

	Status	Fan	Economy	Heat or Cool
Off	No power	Fan is OFF	Econ not running	Heat / Cool not needed
On		Fan running	Fresh air being used	Heat / Cool is running
Blinking	SMT-150 is Running (Heartbeat)		Setpoint and room temp too far apart for econ	Heat / Cool Span being adjusted

LCD

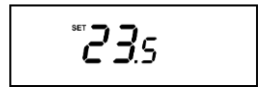
The SMT-150 backlit LCD will display relevant information when appropriate. Some of this information will be duplicated by the LED indicators as described above. It also permits you to visually set "Digitally Accurate" room setpoints, equipment control parameters (such as heating and cooling span settings) as well as adjust installer parameters simply and accurately.

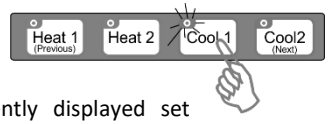


Upon powering up, the LCD will show all segments then the firmware version currently installed in the SMT-150 before showing a normal display.

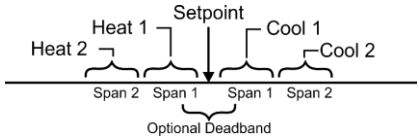
Adjusting Comfort Levels

Press the SMT-150 setpoint up or down buttons to set your desired room temperature. The normal range of adjustment is between 5°C and 35°C but can be extended to -10°C to +70°C within the installer menu range limit adjustment options if desired. *(See High and Low Setpoint Limits on page 12 of this manual)*. Setpoint is adjustable at 0.1°C increments (below zero in 1.0°C steps). Pressing and holding the up or down button will cause the SMT-150 to change setpoint more rapidly. When your desired setpoint is shown simply take your finger off the button to use the currently displayed set temperature.





Set the stage span simply by pressing the relevant button and adjust this displayed value with the setpoint up and down buttons. The range of adjustment is from 0.3°C to 5.0°C per stage.



DIP Switches

4 DIP switches are provided to permit simple setup of the SMT-150. The factory default settings for the DIP switches are all OFF as shown in bold below.

Switch	Function	Off	On
1	Button Lock	**Off**	All Buttons Locked
2	Fan Mode	**Run Continuously**	Cycle with Heat and Cool
3	Anti-Cycle Delay	**5 Minutes**	1Minute
4	Sensor Type	**10K NTC (RS1/2)**	2K PTC

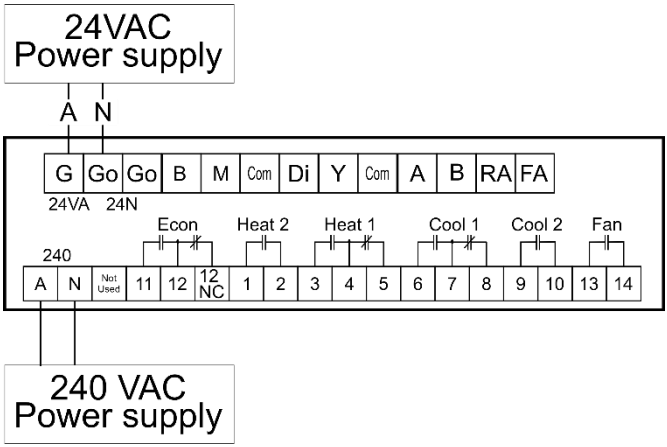
Typical Wiring Examples

Several typical wiring diagrams are provided below as well as some examples of replacing competitive devices that may be found on existing jobs with the SMT-150. Not all wiring examples can be provided here given the extensive capabilities of the SMT-150, therefore should you require additional information on these installations please contact Smart Temp or an authorised distributor.

In most cases you will not need to enter the SMT-150 installer menu to control a multistage heating and cooling system. The installer menu simply provides additional control options for those 1% of projects where the standard configuration will not do.

Powering the SMT-150

Your SMT-150 can be powered from either line voltage (typically 240V) or from 24VAC. The diagrams provided elsewhere in this manual assume you have powered the SMT-150 in accordance with this diagram.

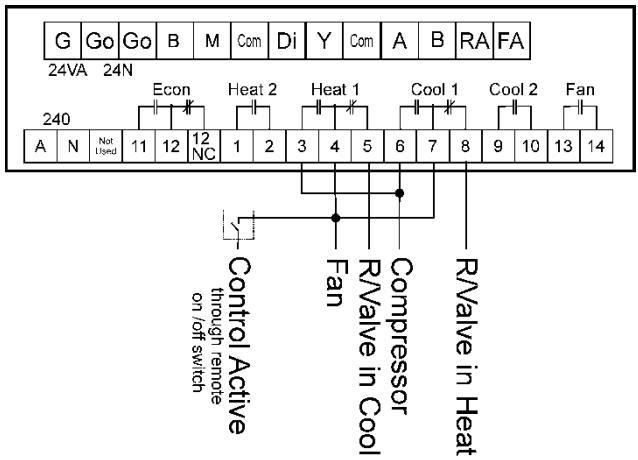


Use one input only.

All SMT-150 relays are volt free. The voltage inputs can be looped to relay inputs if desired.

Single Stage Heat Pump (replacing HEVAC® Brand HTC2 / HTC4)

This diagram shows the SMT-150 in its most basic configuration, being a single stage Heat Pump. No Fan Control. Simply apply 240V to the A & N Terminals OR 24V to the G & Go terminals and install the room temperature sensor.



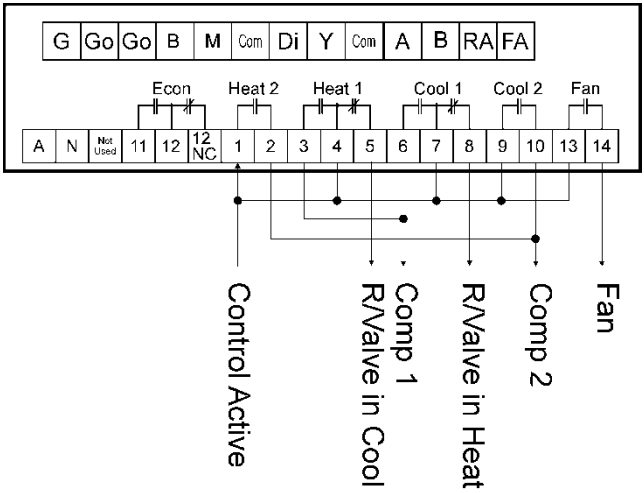
Terminal 5 for RV in cool terminal 8 for RV in heat **Use one reversing valve option only, NOT both.**

Typical 2 Stage Heat Pump Method 1 (No Installer Menu Changes Required)

In this example you are provided with 2 reversing valve wiring options, those being reversing valve On in heat or On in cool.

Terminal 5 for RV in cool
Terminal 8 for RV in heat

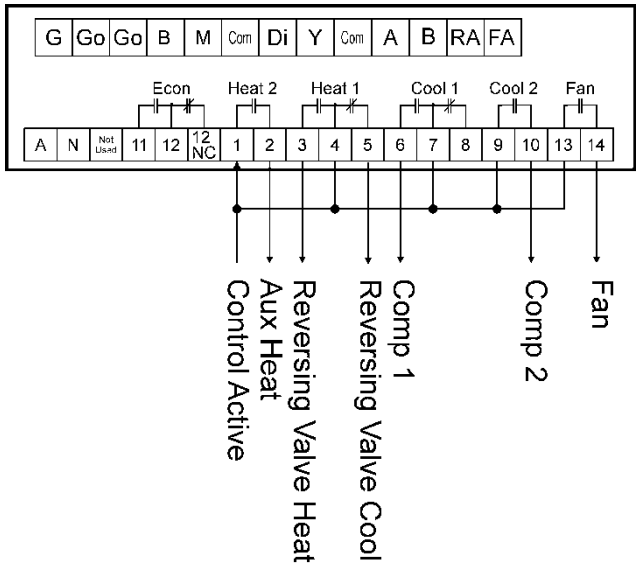
Use one reversing valve option only, NOT both.



Typical 2 Stage Heat Pump (with Aux Heat) Method 2 (Installer Menu Change Required)

The SMT-150 can also behave as a conventional Heat Pump controller whereby it will energise compressors for both heating and cooling and a separate output for reversing valve control.

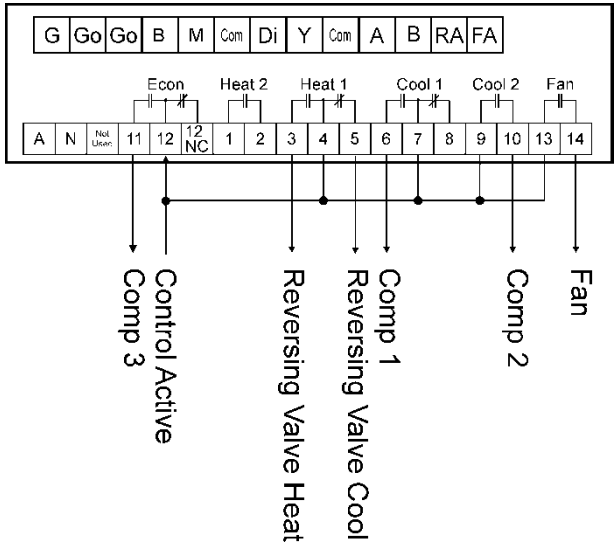
Enter the installer menu as (shown on page 13) and set option number 7 (Heat 1 Relay Function) to 1 (Heat Pump Mode).

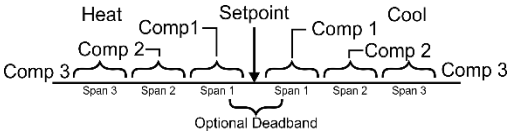


Typical 3 Stage Heat Pump - (Installer Menu Change Required)

The SMT-150 capabilities can be easily enhanced to control a 3 stage Heat Pump system, or 3 Heat 2 Cool systems or 3 Cool 2 Heat systems when required. The example provided here is a typical 3 stage Heat Pump system.

Enter the installer menu and set option number 7 (Heat 1 Relay function) to 1 (Heat 1 relay used for R/V) and option 15 (Auxiliary Relay Options) to 3 (3rd Stage Compressor).



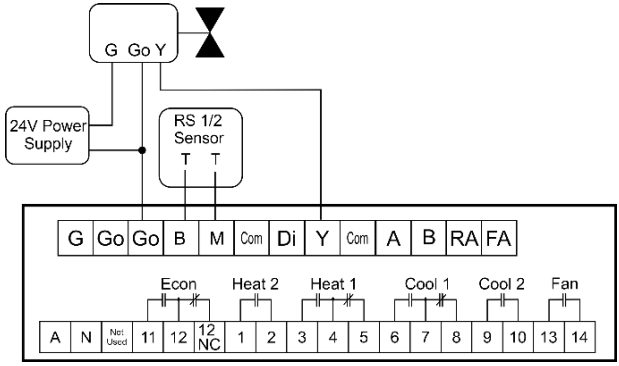


Note: Compressor 3 Span will use Stage 2 setting.

For a Heat Cool system, you can define the Aux Relay for 3rd stage heat or 3rd stage cool if required. *(See Auxiliary Relay Options on page 14 of this manual)*

Typical Modulating Valve Control (Installer Menu Change Required)

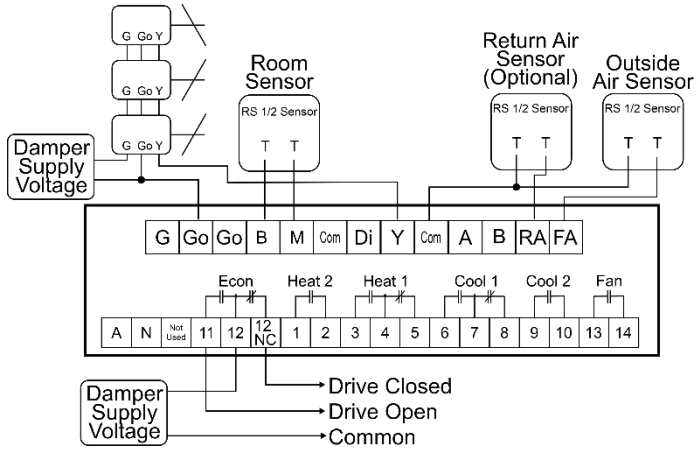
The SMT-150 has a 0-10V output that can be used for several functions such as a modulating heating or cooling valve control. The diagram right shows a typical 24V modulating valve. 240V valves can also be used if necessary.



Enter the installer menu and set option number 17 (0-10V Output Options) to 1 (Heat Valve) or 2 (Cool Valve).

Economy Wiring

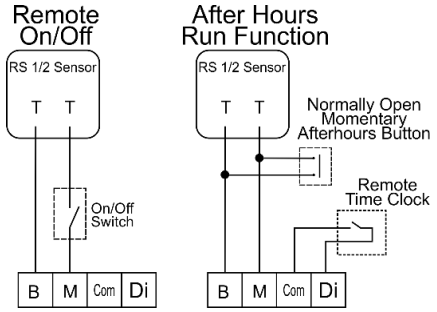
To enable the SMT-150's economy function, simply wire the outside air sensor to the FA (Fresh Air) and Com terminals. Once the SMT-150 detects this sensor, the SMT-150 will display the outside air temperature and the economy function is then automatically enabled.



By default, the SMT-150 provides economy output for both drive open/closed and modulating (0-10V) actuators. The diagram below shows both methods, however only one type of actuator is needed for a typical economy cycle.

The SMT-150 will compare the outside air temperature with the room temperature (or return air temperature if a sensor is fitted). If the outside air temperature is 3°C cooler than the inside air temperature, the economy cycle will introduce outside air into the building for free cooling. The point where compressors are called will be temporarily moved 0.5°C warmer to permit outside air to provide cooling before electric cooling is called.

Turning the SMT-150 ON or OFF with the Room Sensor
Using the After Hours Run Function with the Room Sensor (Installer Menu Change Required)



The SMT-150 actively monitors all sensor inputs and will automatically detect a connected sensor. If the room sensor is removed or shorted the SMT-150 will detect this condition and shut down the HVAC system to prevent a runaway heating or cooling situation.

To turn the SMT-150 OFF with the room temperature sensor, place a switch in the room temperature sensor wiring as shown in the diagram left. The SMT-150 will display the text "OFF" with the room temperature shown as " - - "when the switch is open. **Enter the installer menu and set option 15 (Digital Input Options) to 1 (Run).**

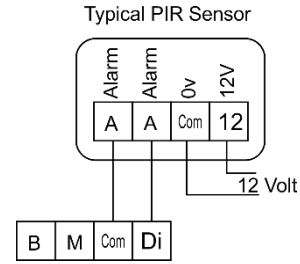
If the SMT-150 is set up to run on a remote time clock input, pressing the Normally Open (NO) switch will start or cancel the Run Timer whenever the clock input is open. The SMT-150 will display "After Hours Timer Running".

(The After-Hours Timer function is not available on 2KPTC sensors)

Occupancy Detection Using a PIR (Installer Menu Change Required)

The SMT-150 can be connected directly to an occupancy or PIR sensor as shown in the diagram to the right.

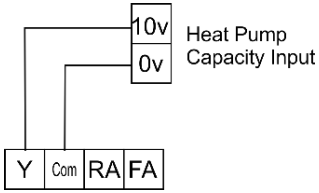
Enter the installer menu and set option number 15 (Digital Input Options) to 3 (Digital Input Used as PIR Sensor).



If the SMT-150 is off when the input changes state for the first time the SMT-150 will turn the HVAC system on and start a 30-minute internal countdown timer. Every time movement is detected by the movement sensor the internal 30-minute countdown timer will reset back to 30 minutes. When the countdown timer eventually reaches 0, the SMT-150 will turn off.

Note: Multiple movement sensors wired with alarm contacts wired in series can be used to cover a larger area if needed. (An open circuit resets the counter)

SMT-150 on Digital Compressor (Installer Menu Change Required)

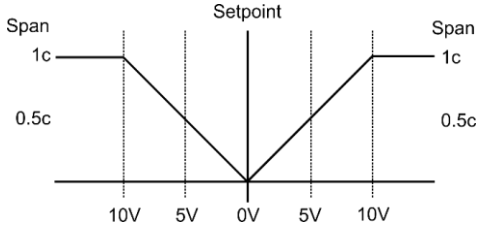


The SMT-150 can provide a demand capacity call for Digital Scroll Compressor systems for example.

Enter the installer menu and set Option 17 (0-10V Output Options) to 3 (Heat & Cool - Capacity).

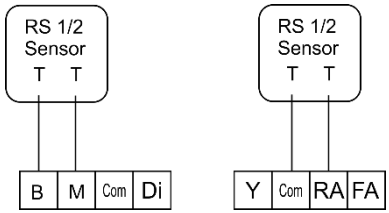
By default, when the room temperature is at 1°C (or greater) the 0-10V output will be at 10V. This value can be adjusted if necessary.

As room temperature approaches setpoint, the 0-10V output will reduce to 0V at setpoint. *(See 0-10V Output Options on page 13 of this manual)*



Remote Sensor Options

The SMT-150 can use the room sensors in several ways based on the project needs. The SMT-150 has two room temperature sensor inputs. The B & M sensor terminals are the primary room temperature sensor terminals however you can add a room temperature sensor to the RA & Com terminals as well. The

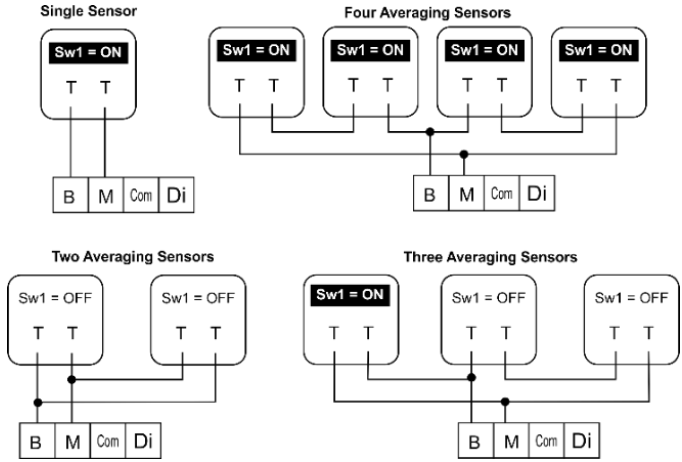


function of these sensors is shown in the installer menu under option 13 (Return Air Sensor Functions).

Economy	The SMT-150 will use the return air sensor for economy comparison.
Average	The SMT-150 will display and control to the average of the two sensors values.
High Select	When cooling, the SMT-150 will use the highest of the two sensor's temperatures as the room temperature.
Low Select	When heating the SMT-150 will use the lowest of the two sensor's temperatures as the room temperature.

Multiple SMT-150 Sensors

Multiple RS1/2 temperature sensors can be used with the SMT-150 to provide an average temperature measurement over a larger area if required.



Take note of the Mode switch in the RS1/2 sensor and ensure it matches the configuration shown in the diagrams above.

For clarity, switches that should be ON are shown Highlighted.

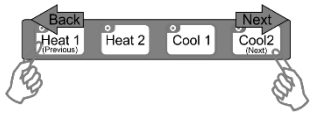
Replacing Competitor Brand Controllers with the SMT-150

Provided below is a table showing how to replace some alternative manufactured devices with the SMT-150. Not all examples can be provided here. Please contact Smart Temp or an authorised distributor for additional wiring support if necessary.

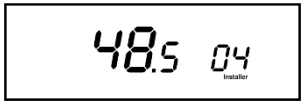
Function	Smart Temp SMT-150 (HP Method 1)	Regulator ET45	HEVAC HTC-2	Siemens RWD xx
Room Sensor	B	1	B	X1
Sensor Com.	M	2	M	M
240VA (24V A)	A (G)	17	A (G)	A (G)
240VN (24V N)	N (Go)	18	N (Go)	N (Go)
Control Active	Loop 1, 4, 7, 9	Loop 19, 22, 27, 30	Loop 4 & 7	Loop 11, 21, 31, 41
Heat 1 NO (NC)	3 (5)	20 (21)	3 (5)	24 (22)
Heat 2 NO (NC)	2 (--)	23 (24)		11
Cool 1 NO (NC)	6 (8)	28 (29)	6 (8)	34 (32)
Cool 2 NO (NC)	10 (--)	31 (32)		44

Installer Menu

The SMT-150 can be easily configured to perform additional functions or to fine tune the performance of the standard functions.



To enter the installer menu press and hold Heat 1 Span and Cool 2 Span buttons simultaneously for 1 second.



Pressing “Cool 2” steps you forward through the menu options.
Pressing “Heat 1” steps you backwards through the menu options.
Use the “Up” or “Down” buttons to scroll through and select the various options.
Pressing “Heat 2” “Cool 1” exits you from the menu. (Or wait 2 minutes)

As you change values in the installer menu the SMT-150 will store the new settings and use the new values or functions. Settings are stored in permanent memory, there is no battery back up required to save the settings. Even if the SMT-150 is powered down for extended periods (many years) all settings will be retained.

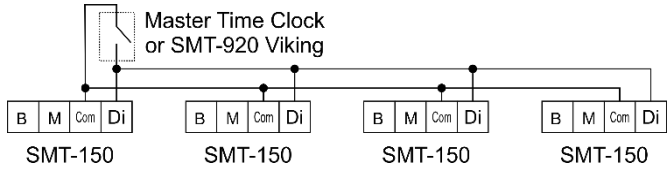
#	Function	Function
1	High Temp Limit	Default = 35^{o}C Defines the highest value that can be set with the Up/Down buttons (Range -10^{o}C to 70^{o}C)
2	Low Temp Limit	Default = 5^{o}C Defines the lowest value that can be set with the Up/Down buttons (Range -10^{o}C to 70^{o}C)

3	Heat Setback Temp	When using the digital input to turn the SMT-150 on or off, you can set a heat setback temperature that will apply when the SMT-150 displays "OFF" (Range is Off to 50°C) *(Only functions when option 15 below is set to 2)*
4	Cool Setback Temp	When using the digital input to turn the SMT-150 on or off, you can set a cool setback temperature that will apply when the SMT-150 displays "OFF" (Range is 50°C to Off) *(Only functions when option 15 below is set to 2)*
5	Fan Mode	0 = Heat Electric (Fan runs in heating) (Default) 1 = Heat Gas (Fan does not run in heating)
6	After Hours Period	Sets the after hours run period Default is 2 hours Range is Off to 12 hours *(Requires the use of the RS1/2 Smart Temp sensor which has after hours run button fitted)*
7	Heat 1 Relay Function	Sets Heat 1 relay to control reversing valve 0 = Heat 1 relay is heat / cool mode (Default) 1 = Heat 1 relay used for reversing valve (Heat Pump)
8	Sensor Response Speed	Determines the speed of response to temperature changes of the room (and the supply air) sensor(s). 1 = Extremely Fast to 5 = Slow (Default = 3)
9	Calibrate Room Sensor	Permits the calibration of the room sensor. Range is -4.5°C to +4.5°C in 0.1°C increments (Default 0)
10	Calibrate Return Air Sensor	Permits the calibration of the return air sensor. Range is --- -4.5°C to +4.5°C in 0.1°C increments (Default 0)
11	Calibrate Outside Air Sensor	Permits the calibration of the outside air sensor. Range is – -4.5°C to +5°C in 0.1°C increments (Default 0)
12	C/F Display	Celsius (Default) or Fahrenheit
13	Return Air Sensor Function	0 = Return air - Used for Econ Function(Default) 1 = Average between room and return air temp 2 = High select between room and return air temp 3 = Low select between room and return air temp
14	0-10V Output Span	Sets the range of the 0-10V output Range from 0.3°C to 5°C (Default 1.0°C)
15	Digital Input Options	0 = Not used. The SMT-150 will run when powered 1 = Run - SMT-150 will run when input closed *(Random time delay start)* 2 = Fault - SMT-150 stops when input closed 3 = PIR input *(Connect the SMT-150 to standard PIR sensor and the SMT-150 will run for 30 minutes after last movement is detected)*

16	Auxiliary Relay Options	0 = Economy output (Default) 1 = 3rd Stage heat 2 = 3rd Stage cool 3 = 3rd Stage compressor (only when option 7 = 1) 4 = Temperature alarm (0.5c Hysteresis) 5 = CWP (Relay closes on heat or cool call -Fault Ignored) 6 = Run (Relay closes when SMT-150 is running)
17	0-10V Output	0 = Economy (Default) 1 = Heat valve 2 = Cool valve 3 = Heat and Cool (Capacity control for digital)
18	Alarm Threshold	Auxiliary relay alarm threshold (Default is 10) (Used when option 16 above = 4 – Temp Alarm) Range -20°C to 50°C
19	Dead band	0.0 to 5.0c. Adds a dead band to either side of the setpoint where there will be no heating or cooling. (Default = 0.0) The LCD Text "**No Call**" will indicate dead band is holding heating or cooling off off. *(Note – Economy function ignores the dead band value)*
20	Fan Speed	If connecting to temperzone ® air conditioning system, setting permits you to set the fan speed the temperzone air conditioner will use when running. 1 = Low fan speed (default) 2 = Medium fan speed 3 = High Fan speed 4 = Auto Fan speed
21	Modbus Address	This sets the individual address for the SMT-150. All devices on the same node should have a unique address. (Address zero not supported) default is address 7
22	Modbus Speed	This sets the communication speed. All devices on the ModBus node must use the same communications speed. 1 = 2.4k 2 = 4.8k 3 = 9.6k 4 = 19.2k
23	Modbus Parity	This sets the communication speed. All devices on the ModBus node must use the same communications speed N = None O = Odd E = Even (default)
r	Factory Reset	Use the Temp Up button to change 0 to1 and then exit with the Heat 2 or Cool 1 Span button.

Wiring multiple SMT-150 to a Master Timeclock

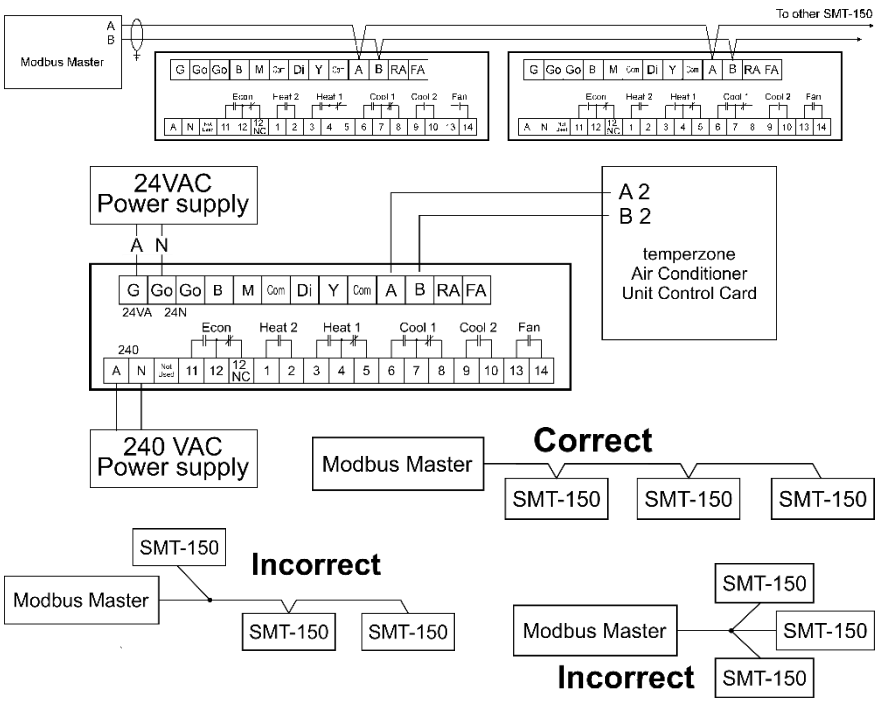
Multiple SMT-150s can be controlled by a single central time clock by simply wiring all the digital inputs to the clock's volt free contacts as shown above.



Once the clock output is closed the SMT-150 will pick a random period between 0 and 90 seconds to start. This is done to prevent excessive building start up electrical loads.

Enter the installer menu and set option 15 (Digital Input Options) to 1 (Run) on each SMT-150.

Modbus Wiring



The SMT-150 has ModBus RTU communications so that it can be controlled by a central building management systems or other SCADA or connect directly to a temperzone ® air conditioning system and control it without the need to wiring to the relays by simply using the ModBus terminals.

(use one power supply only)

It is important that all devices in a ModBus network all share the same speed and parity and that no two devices have the same ModBus network address.

Wiring must be in series with no “T” branches or star wiring permitted.

Modbus Data for the SMT-150 is available in a separate document, The SMT-150 Modbus addendum document is available from our website, smarttemp.com.au

Specifications

Model Number	SMT-150
Designer & Manufacturer	Smart Temp Australia Pty Ltd
Input Voltage	24VAC / 110 VAC / 240 VAC 50-60 Hz
Operating Temperature	0 - 50°C (32°F to 122°F)
Operating RH	0 - 95% (Non-Condensing)
Storage Temperature	0 - 65°C (32°F to 150°F)
Size	110mm x 110mm x 65mm (110 x 180 x 65mm with Terminal Covers Fitted)
Control Range	-10^{o}C to 70°C
Maximum Equipment Stages	3 Compressors (HC Mode = 2 Heat 2 Cool+1)
Anti-Cycle Timer	1 or 5 Minutes (Upstage delay of 30 seconds)
Minimum Run Timer	90 seconds
Auto Upstage Timer	30 Minutes Per Stage
Auto Downstaging	0.2^{o}C Per Stage
After Hours Timer	Off to 12 Hours (Installer Adjustable)
Change Over Protection	+0.3^{o}C When Opposite Mode is Called
Memory Type	Non Volatile 64K
Relays	5A Volt Free (Clean Contact)
0 - 10V Output	15mA Max
Room & Outside Air Sensor	10K NTC Type II or 2KPTC (2 Wire Screened)
Warranty	2 Year RTB

Great care and attention have been used in the manufacturing of this product. If you experience any difficulty installing or using the SMT-150 please contact Smart Temp Australia for assistance.

Due to ongoing product development, specifications of the Smart Temp SMT-150 are subject to change without notice.

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