



# T8078C

## LOW VOLTAGE MODULATING CONTROLLER

### PRODUCT SPECIFICATION SHEET



## APPLICATIONS

The T8078C digital electronic controller is designed for individual zone control of terminal units in fan coil and air conditioning systems.

The controller provides position control of valves or dampers (for airside control), and is capable of mounting on a switching sub-base for manual control of the fan speed.

T8078C has great applications flexibility built-in – all applications and control modes can be selected simply by setting a bank of switches inside the product. Control parameters are also adjusted by means of on-board switches.

T8078C also supports a number of features that enhance the applications capability. These include remote sensing, energy savings mode (activated from an external input), remote setpoint adjustment, and heat/cool changeover.

Installation and commissioning are assisted by a special fast commissioning checkout sequence, internal valve synchronisation, simple user diagnostic LED indication and the provision of a diagnostic output.

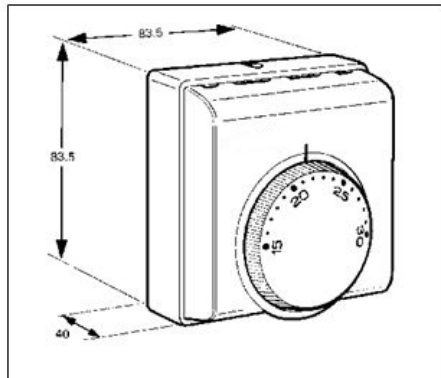
## FEATURES

- Modern styling makes T8078C ideal for locating in the occupied space, particularly in offices and hotels.
- Proportional + Integral (P+I) control form ensures close temperature control under all operating conditions.
- Control modes and applications configured by on-board switches.
- Choice of control Modes:
  - 3-position modulating
  - thermal predictive modulating (TPM)
  - On/off
- Choice of Applications Systems:
  - 2-pipe fan-coil cooling
  - 2-pipe fan-coil heating
  - 2-pipe fan-coil cooling +2-stage on/off heating
  - 2-pipe fan-coil heating +2-stage on/off cooling
  - 2-pipe fan-coil heat/cool changeover
  - 4-pipe fan-coil heat + cool in sequence
- Choice of control parameters:
  - 1, 2, or 4 K for the Proportional Band
  - 2, 4 K for the Zero Energy Band
- Automatic heat/cool changeover is achieved by using a remote switch, or a pipe thermostat (S4390A1004) on the supply water pipe.
- Control setpoint can be remotely adjusted by  $\pm 5$  K.
- Energy Savings Input - a contact closure input will switch T8078C to Energy Savings Mode, where the cooling and heating setpoints will change to pre-defined setup and setback temperatures, enabling maximum energy efficiency. Setup/setback values can be set 2-8K by means of an on-board potentiometer.
- Sensor options: On-board or external (Wall mounted or Remote/return air). The connection of an external sensor is detected automatically.
- Valve commissioning sequence for fast system check.
- Periodic valve exercise and synchronisation.
- Simple user diagnostics capability – by means of a flashing LED mounted inside the thermostat cover.
- Diagnostic output – for communication of diagnostic system information to a PC tool.
- Extra wide Input Voltage Specification: 18 – 30 Vac.
- Automatic calibration offset over full voltage range.
- Suitable for mounting either on the terminal unit or on the wall (surface or wall-box mounting).
- Wiring access from the rear, and surface wiring knockouts at the top and sides.
- Locking front cover.

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# SPECIFICATIONS



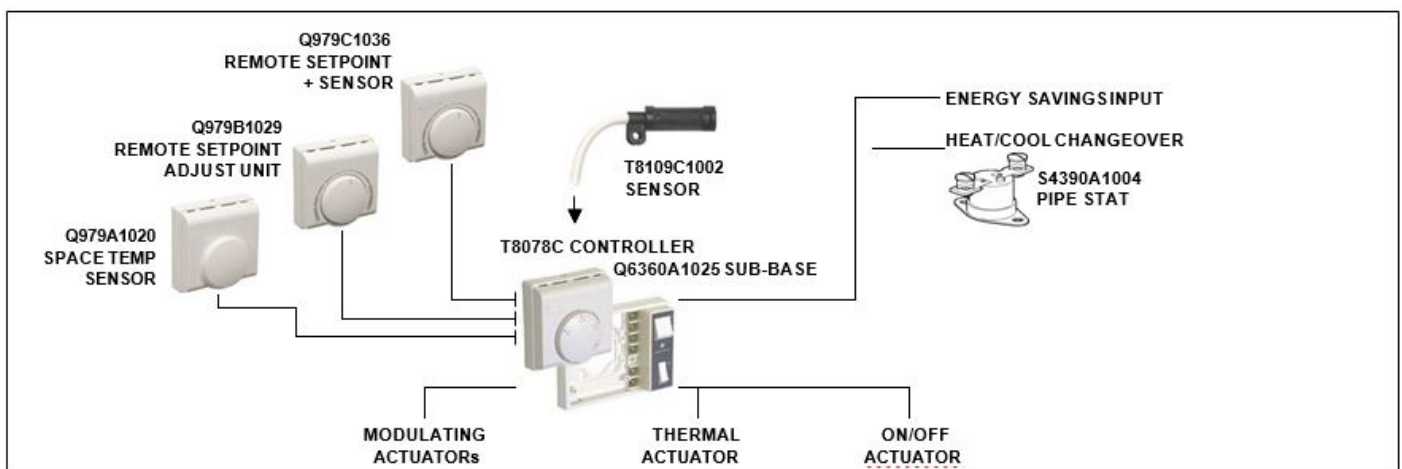
<b>Power Supply:</b>	24 Vac nominal 50/60Hz, operating range 18 – 30 Vac
<b>Power Consumption:</b>	1.2 VA nominal (electronics only)
<b>Output Load Rating:</b>	0.3 A (maximum) for all outputs at 24 Vac, with solid state switching
<b>Setpoint Range:</b>	15 to 30 °C
<b>Configuration/System Selection:</b>	Made via a bank of 6 on-board dip switches
<b>Control Modes:</b>	3 different Control Modes :- Modulating : 3-position modulating P+I control, based on adjustable proportional Band (Xp), and 150sec valve run-time
	On/Off : Primary stage control is P+I on/off output based on adjustable Proportional Band (Xp) and a fixed cycle rate (6 cycles/hour Cooling, 6 cycles/hour heating) : Secondary stage control is P+I on/off output based on a fixed
	Proportional Band of 1K and a fixed cycle rate (6 cycles/hour Cooling, 12 cycles/hour heating)
	TPM : Special on/off control mode for thermo-electric actuators
<b>Applications Systems:</b>	6 different Applications System types :- <ul style="list-style-type: none"> <li>• Heat / Cool Changeover</li> <li>• Cooling Only</li> <li>• Cooling + optional 2-stage On/off Heating</li> <li>• Heating Only</li> <li>• Heating + optional 2-stage On/off Cooling</li> <li>• Heating + Cooling Sequence Control</li> </ul>
<b>Proportional Band (Xp):</b>	1K, 2K, or 4K (depending on system) selected using DIP switches 1K for secondary 2-stage Heating or Cooling stage control
<b>Zero Energy Band (ZEB):</b>	2K or 4K selected using DIP switches
<b>Interstage Differential (ID):</b>	Fixed at 1K, for Systems with secondary 2-stage Heating or Cooling
<b>Control Point Stability:</b>	±0.5K at 20°C
<b>Ambient Temperature Range:</b>	Operating range 0 to 40 °C
<b>Storage Temperature Range:</b>	-20 to 55 °C
<b>Relative Humidity:</b>	10 to 90%, non condensing
<b>Remote Setpoint Adjustment:</b>	±5K by remote unit, resistance input (Q979B1029, Q979C1036)
<b>Energy Savings (Setup/Setback):</b>	2 to 8K setup/setback possible, by means of external contact closure input Value set by potentiometer on T8078C Contact closure can be local or central, to control a group of T8078C (up to 50 max)
<b>Heat/Cool Changeover:</b>	Automatic changeover by means of external contact closure input Input can be local (from aquastat) or central from switch/relay (controls up to 50 max)
<b>Mounting:</b>	Directly onto wall or wall-box (65x65mm junction box with 60mm screw pitch) or inside terminal unit or fan-coil Also mounts on fan speed subbase Q6360A1025
<b>Wiring:</b>	14 x screw terminals capable of accepting up to 1.5mm <sup>2</sup> stranded cable Max length of wiring to actuators is 100m @ 1.0mm <sup>2</sup> , 150m @ 1.5mm <sup>2</sup>
<b>Enclosure:</b>	Flame retardant plastic housing
<b>Dimensions:</b>	83.5 x 83.5 x 40 mm
<b>Protection Class:</b>	IP30 (IEC144)
<b>Approvals:</b>	The T8078C controller is CE, RoHs and WEEE compliant. For regulatory information, DoC / CoC number D1018 is available on request. Product must be wired as shown for CE compliance.
<b>Sensors:</b>	On-board sensor , type NTC100K Remote sensor T8109C1002 (1.5m cable) auto detected on power-up Maximum sensor extension is 20m (using screened cable)

## PRODUCT APPLICATIONS

Basic Application	Controlled Device	Control Mode – details of application	Application No.
2-pipe fan-coil	Valve control	Modulating cooling	1
		Modulating heating	2
		On/off cooling	7
		On/off heating	8
		TPM cooling (thermo-electric actuator)	13
		TPM heating (thermo-electric actuator)	14
	Airside control (damper)	Modulating cooling	1
		Modulating heating	2
Terminal unit	Damper control	Modulating cooling	1
		Modulating heating	2
2-pipe fan-coil with auxillary electric heat (1 or 2-stage electric heating elements)	Valve control	Modulating cooling + 1or 2-stage on/off heating	3
		On/off cooling + 1or 2-stage on/off heating	9
		TPM cooling + 1or 2-stage on/off heating	15
	Airside control (damper)	Modulating cooling + 1or 2-stage on/off heating	3
2-pipe fan-coil with auxillary cooling (1 or 2-stage chillers)	Valve control	Modulating heating + 1or 2-stage on/off cooling	4
		On/off heating+ 1or 2-stage on/off cooling	10
		TPM heating + 1or 2-stage on/off cooling	16
	Airside control (damper)	Modulating heating + 1or 2-stage on/off cooling	4
2-pipe fan-coil with heat/cool changeover	Valve control	Modulating heat/cool changeover	5
		On/off heat/cool changeover	11
		TPM (thermo-electric actuator) heat/cool changeover	17
4-pipe fan-coil	Valve control	Modulating cooling + heating in sequence	6
		On/off cooling + heating in sequence	12
		TPM cooling + heating in sequence	18
	Airside control (damper)	Modulating cooling + heating in sequence	1 or 2

## SYSTEM ARCHITECTURE

A diagram of compatible T8078C system components is shown below.



# OPERATION

## Control Modes

T8078C gives a choice of 3 different output control modes, to suit a range of different actuators and system requirements.

### Modulating Control

3-position modulating control is a control form that exactly positions the control valve in order to satisfy the cooling or heating demand.

For each valve actuator there are 2 control outputs, one to drive the valve open, and another to drive the valve closed. The controller can send out control pulses to each of these outputs to move the valve to any position between fully closed and 100% open. The required valve position is calculated using a P+I algorithm, with an adjustable Proportional Band (Xp), and valve actuator run-time of 150seconds.

This type of control gives optimum performance over a wide range of conditions.

### On/Off Control (with P+I input)

The on/off control form used by T8078C is one where the output is cycled on and off with a fixed cycled period. The on-time is adjusted by a P+I algorithm so the heating or cooling demand is met and the space is controlled to setpoint.

The cycle rate is 6cycles/hour for cooling and heating.

For the primary control stage, the Proportional Band (Xp) can be selected to be either 1, 2, or 4K, depending on the system.

For the secondary control stages, the Proportional Band is fixed at 1K and the cycle rate is 6cycles/hour for cooling, 12cycles/hour for heating.

This type of on/off control ensures closer control to setpoint than conventional on/off control based on a temperature differential.

### TPM Control (for Thermo-Electric Actuators)

Thermo-electric (or thermal) actuators are very cost effective devices, but they present particular difficulties to control because of the time-lags in their response to control inputs.

Therefore T8078C uses a special Thermal Predictive Modulating (TPM) control to operate thermal actuators in the optimum way.

This type of on/off control ensures closer control performance when using thermal actuators than conventional on/off control or pulse-width modulating control.

## Operating Modes

T8078C has 2 main operating modes, *Comfort Mode* and *Energy Savings Mode*, and also has a *Startup / Commissioning Mode* which is entered immediately on power-up.

### Comfort Mode

This is the normal operating mode, where T8078C controls to the setpoint selected by the user.

### Energy Savings Mode

T8078C has an Energy Management System, where the detection of an external input signal will cause the cooling and heating setpoints to change to pre-defined setup and setback temperatures, enabling maximum energy efficiency. This input signal must be in the form of a contact closure, connected to terminals 10 and 11.

### Energy Savings Mode – continued

In Energy Savings Mode the Setup/Setback values can be set between 2-8K by means of an on-board potentiometer. In cooling only systems (1, 7, 13) the setpoint will be increased (setup) by the set value fixed by the potentiometer. In heating only systems (2, 8, 14) the setpoint will be decreased (setback).

In heat/cool changeover systems (5, 11, 17) the heating setpoint will be decreased in heating mode, and the cooling setpoint will be increased in cooling mode.

In cooling + heating systems (any system with a Zero Energy Band) the cooling setpoint will be increased by the set value and the heating setpoint will be decreased by the same amount. The setpoint remains the same, but the effect is to widen the Zero Energy Band.

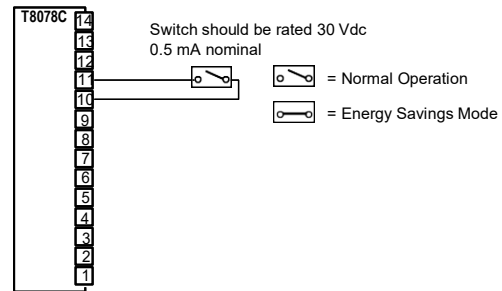
### Energy Savings - From Central Location

A group of T8078C units can be switched to Energy Savings mode using a central switch. A maximum of 50 units can be switched this way, but extreme care must be taken to ensure the polarity of wiring connections is correct.

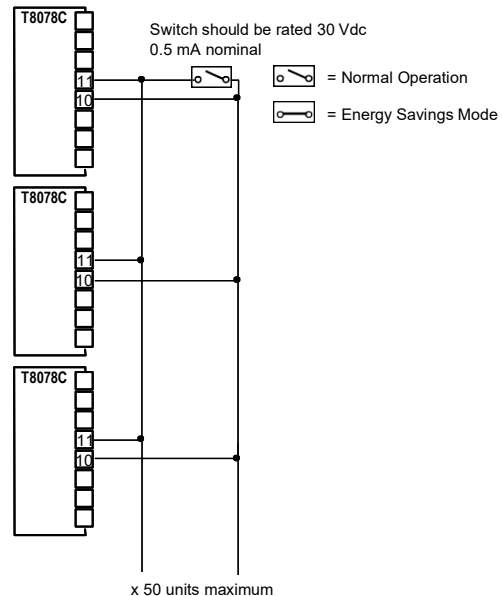
Each T8078C controller will switch to its own pre-defined setback values, as set by its on-board potentiometer.

#### Input Wiring Connections

##### Single Unit Energy Savings



##### Central Energy Savings



Take care to always observe polarity of connection

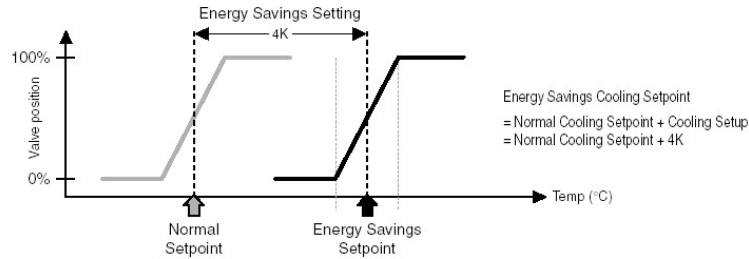
## Energy Savings Mode - Examples

### (1) Modulating Cooling

Energy Savings Potentiometer



Example:  
Setup value = 4k

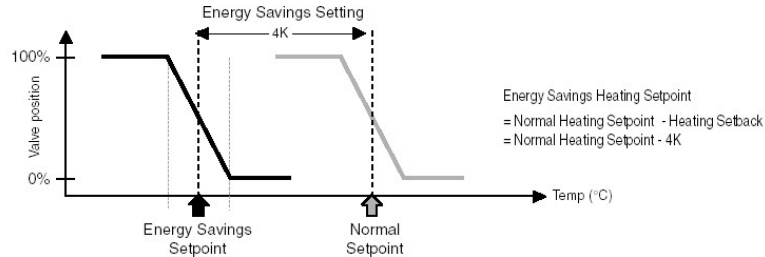


### (2) Modulating Heating

Energy Savings Potentiometer



Example:  
Setback value = 4k

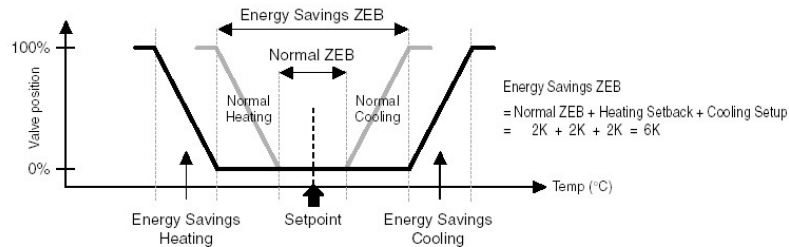


### (6) Modulating Cooling + Heating Sequence

Energy Savings Potentiometer



Example:  
Setup/setback value = 2k



## Startup & Commissioning

On power up, T8078C will immediately undergo a test and synchronisation sequence to enable Installers and Commissioning Engineers to test that the system is wired correctly.

### Test Sequence

For all control modes, the test sequence will last 60 seconds, and will consist of switching the 4 control outputs on and off in the sequence illustrated. The outputs are connected to terminals 3, 4, 6, and 7.

If it is necessary to repeat the sequence the power supply can be switched off and then back on again.

### Valve Synchronisation

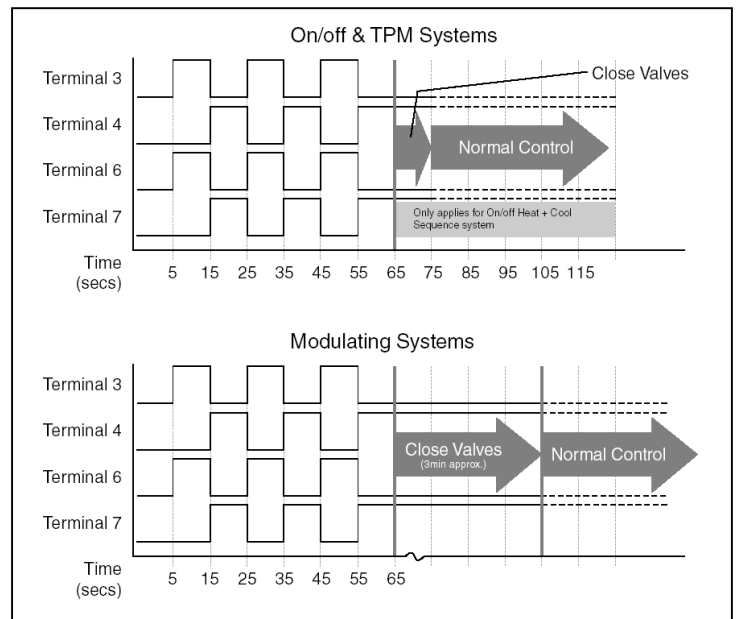
The synchronisation sequence will depend on what type of *Control Mode* has been selected.

For modulating systems, the test sequence will be followed by a 3 minute valve synchronisation, where the valves will be driven to the closed position in order to establish a baseline control reference.

For on/off and TPM control systems, the valve closure sequence will last 10 seconds.

The synchronisation sequence will be repeated 12 hours after power up, and thereafter every 24 hours. This is designed to ensure there will be no disturbance to temperature control during normal hours of building occupancy.

The Diagnostic LED will pulse on and off in the sequence illustrated for Terminal 3 if no faults are detected (see Section entitled 'Diagnostics & Fault Indication' for a complete description).

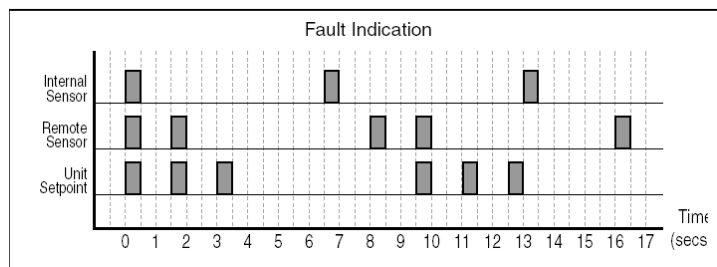


## Diagnostics & Fault Indication

T8078C provides simple user diagnostics and fault indication using an LED, positioned at the bottom right side of the printed wiring board. The T8078C cover must be removed to view the LED correctly.

By pulsing the LED on and off in predefined sequences, T8078C is able to indicate valve position, heating or cooling demand, or whether a fault has been detected.

The tables and graphs opposite give details of the how to interpret the LED outputs.



### Fault Indication

If a fault is detected, this will be indicated as highest priority. Faults are indicated by 1, 2, or 3 LED pulses, followed by a 6 second delay, then a repeat of the pulse sequence.

Most detectable faults are due to errors in reading sensor or setpoint values. In the unlikely event of an internal sensor or unit setpoint fault, the controller must be replaced. If a remote sensor fault is indicated, it is likely to be a bad connection, so all wiring connections should be checked.

Fault	Suggested Action
Internal Sensor out of range	Replace controller
Remote Sensor out of range	Check sensor connections
Faulty setpoint measurement	Replace controller

### Valve Position / Cooling or Heating Demand

Valve position or cooling/heating demands are indicated by an initial code sequence of pulses, followed by the position or demand data, and this is repeated on a fixed cycle rate. The duration of the data pulse provides the important information, for example:

#### Valve position

The LED is switched on for a duration proportional to the valve position, where 10s on = valve fully open

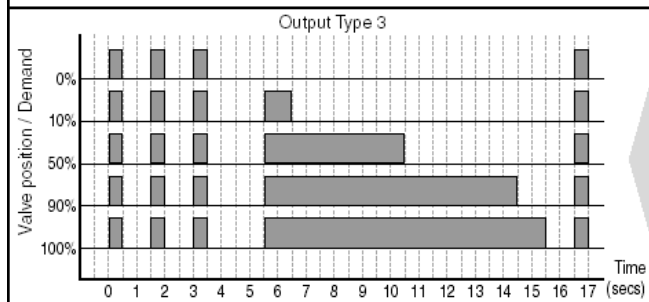
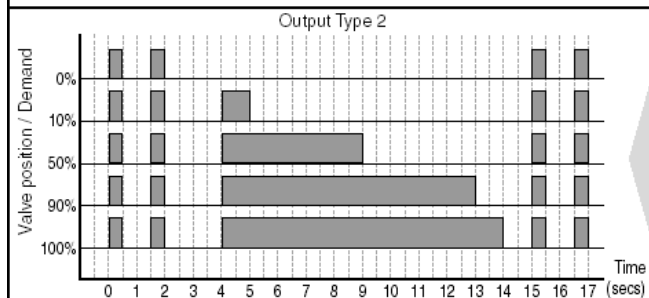
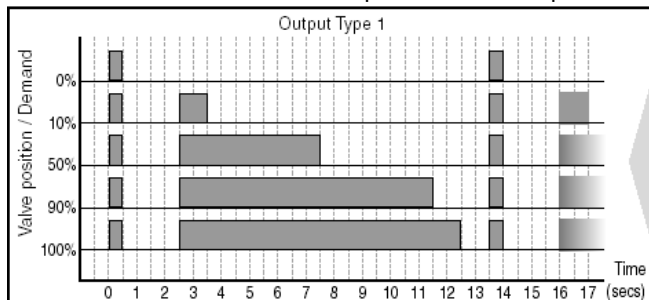
#### On/off or TPM demand

The LED is switched on for an amount proportional to the on-period of the cycle, where 10s on = 100% demand.

T8078C will only provide demand or position data on the current operating output, and this will be indicated by the initial pulse sequence of 1, 2, or 3 pulses.

The table below shows how to determine current operating mode & demand for each of the 18 possible control options.

Modulating Control						On/off Control						TPM Control					
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Modulating Cooling	Modulating Heating	Modulating Cooling+ On/off Heating	Modulating Heating+ On/off Cooling	Modulating Heat / Cool Changeover	Modulating Cool + Heat Sequence	On/off Cooling	On/off Heating	On/off Cooling+ 2-Stage On/off Heating	On/off Heating+ 2-Stage On/off Cooling	On/off Heat / Cool Changeover	On/off Cool + Heat Sequence	TPM Cooling	TPM Heating	TPM Cooling+ 2-Stage On/off Heating	TPM Heating+ 2-Stage On/off Cooling	TPM Heat / Cool Changeover	TPM Cool + Heat Sequence
Valve Position	Valve Position	Valve Position	Valve Position	Valve Position (Heating Operation)	Position of Heating Valve	Valve Demand	Valve Demand	Valve Demand	Valve Demand	Valve Demand (Heating Operation)	Heating Valve Demand	Valve Demand	Valve Demand	Valve Demand	Valve Demand	Valve Demand (Heating Operation)	Heating Valve Demand
Valve closed	Valve closed	1st Stage On/off Heating demand	1st Stage On/off Cooling demand	Valve Position (Cooling Operation)	Position of Cooling Valve	Valve closed	Valve closed	1st Stage On/off Heating demand	1st Stage On/off Cooling demand	Valve Demand (Cooling Operation)	Cooling Valve Demand	Valve closed	Valve closed	1st Stage On/off Heating demand	1st Stage On/off Cooling demand	Valve Demand (Cooling Operation)	Cooling Valve Demand
Valve closed	Valve closed	2nd Stage On/off Heating demand	2nd Stage On/off Cooling demand	Valves closed	Valves closed	Valve closed	Valve closed	2nd Stage On/off Heating demand	2nd Stage On/off Cooling demand	Valves closed	Valves closed	Valve closed	Valve closed	2nd Stage On/off Heating demand	2nd Stage On/off Cooling demand	Valves closed	Valves closed



# ORDERING INFORMATION

**T8078C1009** : Controller

## Accessory Products

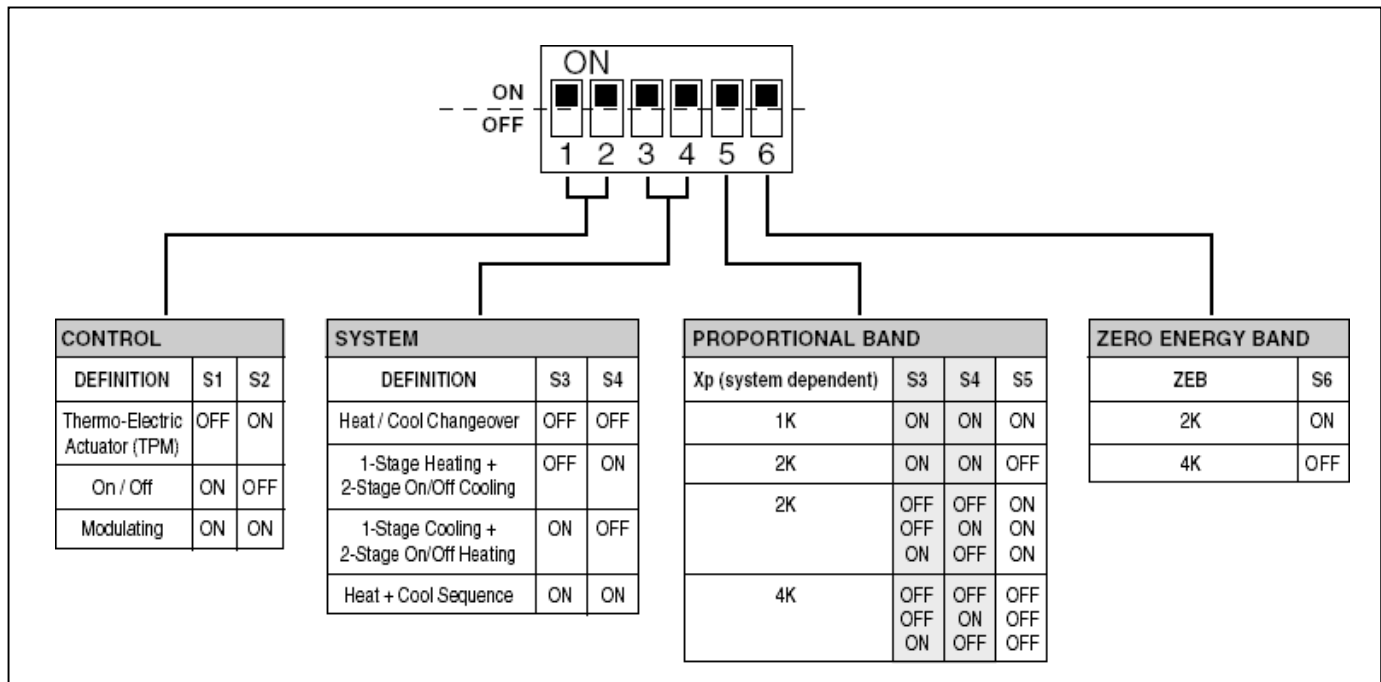
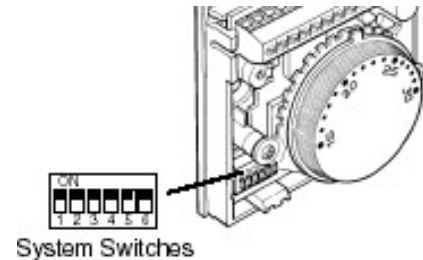
<b>Q979A1020</b>	: Wall-mounted Remote Sensor
<b>Q979B1029</b>	: Remote Setpoint Adjustment Unit ( $\pm 5K$ )
<b>Q979C1036</b>	: Remote Sensor + Setpoint Adjust Unit
<b>T8109C1002</b>	: Remote Sensor (1.5m cable)
<b>S4390A1004</b>	: Pipe-mounted Changeover Thermostat
<b>Q6360A1025</b>	: Fan Speed Switching Sub-base
<b>F42006646-001</b>	: Range-stops (20 per pack, enough for 10 controllers)

## SYSTEM & PARAMETER SELECTION SWITCHES

T8078C uses a bank of 6 switches to enable configuration of the Control MODE, the Applications SYSTEM, and appropriate Control Parameters, such as PROPORTIONAL BAND ( $X_p$ ) and ZERO ENERGY BAND (ZEB).

These switches are located on the wiring board underneath the cover, on the bottom left hand side.

See the diagram below for an explanation of the switch settings.



## How to Configure T8078C

### (1) Select Control Type, using switches S1 and S2

The choices are :

- TPM (optimised for thermal actuator control)
- On/off
- Modulating (3-position control) – sometimes also known as 'Floating' control.

### (2) Select System Type, using switches S3 and S4

The choices are :

- 1-stage cooling (+ optional 2-stage on/off heating)
- 1-stage heating (+ optional 2-stage on/off cooling)
- 1-stage heat/cool changeover (activated by external input signal)
- heat + cool sequence control

### (3) Select Control Parameters, using switches S5 and S6

- Proportional Band  $X_p$  = 1K, 2K or 4K (also dependant on system type)
- Zero Energy Band ZEB = 2K or 4K



# INSTALLATION

## Location

T8078C may be located on the wall in the space to be controlled, or on the body of the terminal unit.

### With In-built Temperature Sensor

T8078C is supplied with a built-in temperature sensor. If this is to be used, then T8078C is the critical temperature control element in the air-conditioning system, and must be located about 1.5m above the floor in a position with good air circulation at room temperature.

### With Remote Temperature Sensor

T8078C supports remote temperature sensing from a range of remote sensors or modules. In this case it is the position of the sensor that is critical:

- for return air sensing the remote sensor must be positioned within the terminal unit, duct, or plenum, in the return air stream where it is not affected by other influences
- for room temperature sensing the remote sensor or module must be located as for a T8078C with in-built sensor.

Please note:

1. The maximum cable run between T8078C and remote sensor is 20m, and screened cable must be used.
2. T8078C uses its in-built sensor, unless it automatically detects the presence of the remote sensor at power-up. So the T8078C must be powered down then back up again after a remote sensor is connected.

## Mounting T8078C

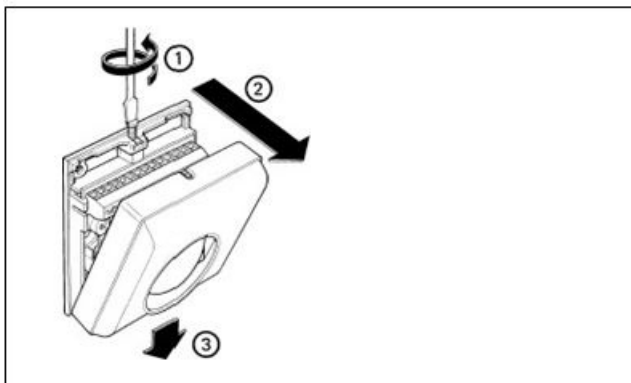
T8078C can be mounted directly on the wall or on a suitable junction box of dimension 65 x 65mm maximum. Mounting screws are supplied (2 x 25mm No. 6 woodscrews, 2 x 25mm M3.5 screws) and there are 4 mounting hole locations on the controller that can be used.

### IMPORTANT!

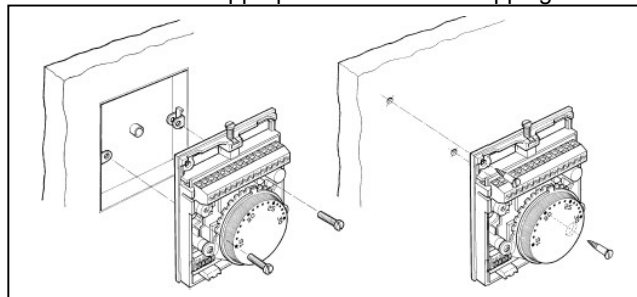
*The Installer must be a trained service engineer.*

*Isolate the power supply before commencing installation.*

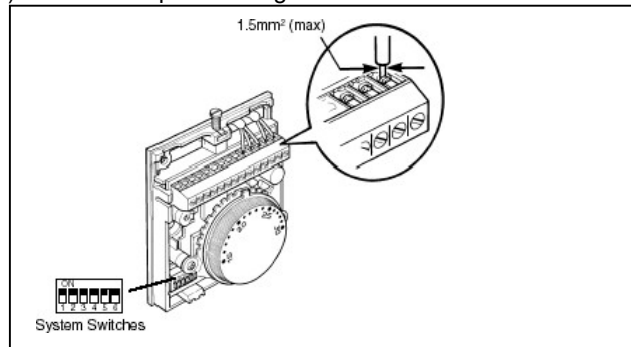
- (1) Unscrew the cover locking screw and remove the cover.



- (2) Mount T8078C to the surface using the mounting screws provided. If it is to be mounted onto a terminal unit, the installer should use appropriate bolts or self-tapping screws.



- (3) Make the required wiring connections



- (4) Re-attach the cover and tighten the locking screw to complete the installation.

## Wiring

The standard wiring access is through a hole at the top and back of T8078B, but there are 4 wiring breakouts in the cover to allow surface wiring, if necessary.

T8078C has 14 wiring terminals – all are suitable for the connection of up to 1.5mm² stranded cable.

Take care not to over-tighten the terminal screws during installation, as this can damage the joints.

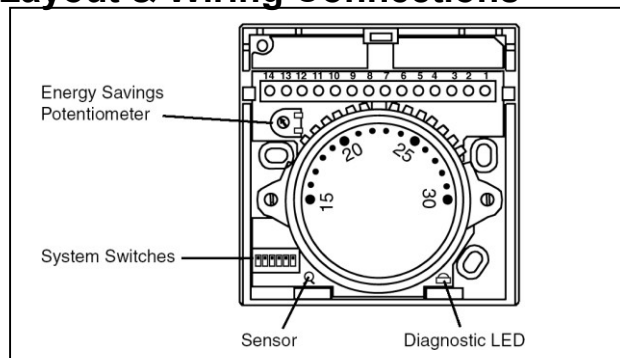
Refer to **Applications** pages for details of all wiring schematics.

### Mounting on Q6360A1025 Fan Speed Sub-base

Where 230Vac fan-speed switching is required, T8078C can be mounted on the Q6360A1025 switching sub-base, using the screws supplied with Q6360.

All line voltage wiring connections should be made to the sub-base before the controller is installed or wired. Line voltage sub-base wiring and low voltage controller wiring should be clearly separated and must comply with all relevant local electrical codes.

## Layout & Wiring Connections

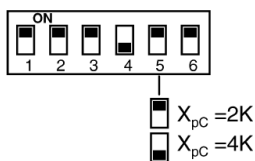
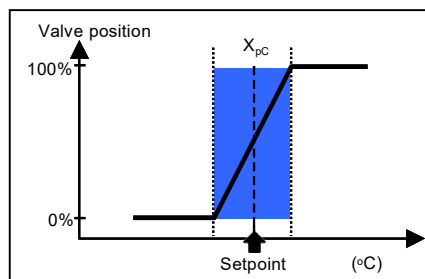


### Terminals

1. 24 volt supply
2. 24 volt supply (0v)
3. Valve 1 open
4. Valve 1 close
5. Valve common
6. Valve 2 open / stage 1 on/off control (applications 3,4,9,10,15,16)
7. Valve 2 close / stage 2 on/off control (applications 3,4,9,10,15,16)
8. Heat / Cool changeover input
9. Heat / Cool changeover input
10. Energy savings input
11. Energy savings input
12. Remote sensor input
13. Remote common (for remote sensor / setpoint inputs)
14. Remote setpoint input

# APPLICATIONS – MODULATING CONTROL

## (1) MODULATING COOLING



### Applications

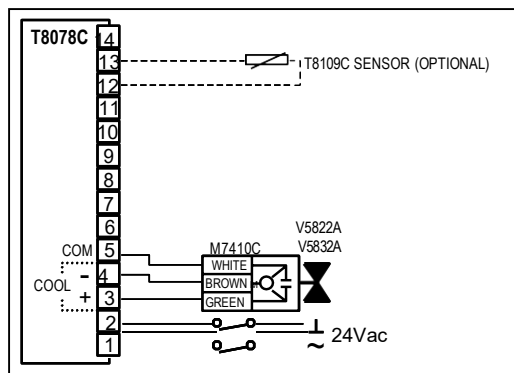
- 2-pipe fcu valve control
- terminal unit damper control
- 2-pipe fcu airside control
- 4-pipe fcu airside control

### Notes

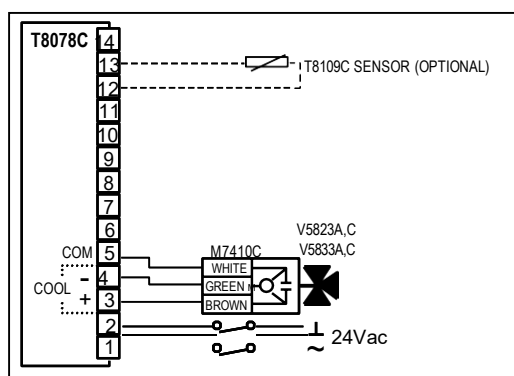
- 1) Proportional Band  $X_{pc} = 2K$  or  $4K$ .
- 2) Use  $4K$  Prop Band for 4-pipe airside control, and wire damper motor as for actuator shown.

## Wiring Schematics

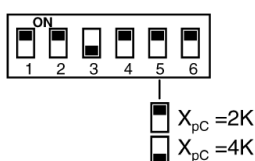
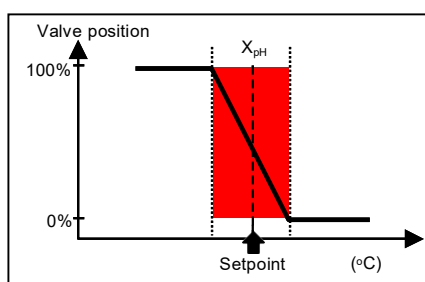
### 2-port valves



### 3-port valves



## (2) MODULATING HEATING



### Applications

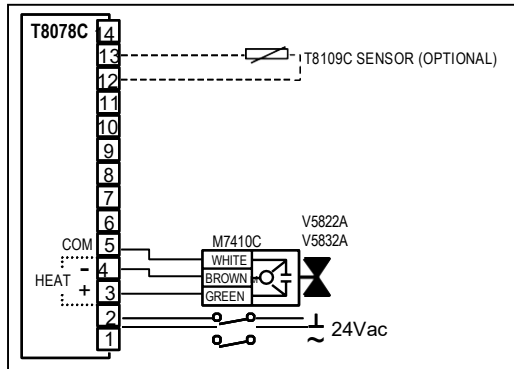
- 2-pipe fcu valve control
- terminal unit damper control
- 2-pipe fcu airside control
- 4-pipe fcu airside control

### Notes

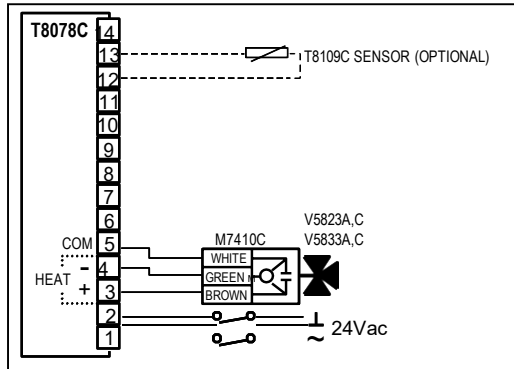
- 1) Proportional Band  $X_{ph} = 2K$  or  $4K$ .
- 2) Use  $4K$  Prop Band for 4-pipe airside control, and wire damper motor as for actuator shown.

## Wiring Schematics

### 2-port valves

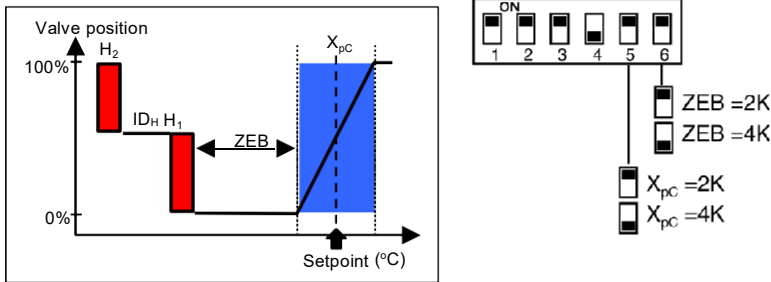


### 3-port valves



# APPLICATIONS – MODULATING CONTROL

## (3) MODULATING COOLING + 2-STAGE ON/OFF HEATING



### Applications

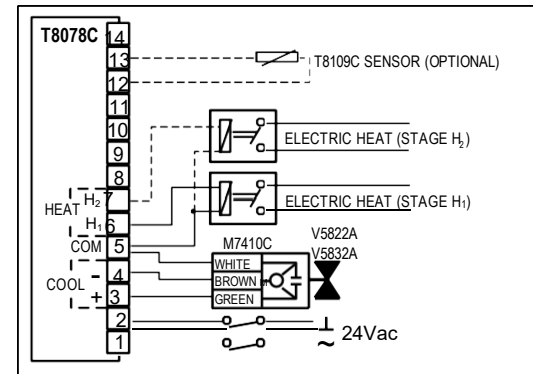
- 2-pipe fcu valve control with 1 or 2 stage electric heat
- 2-pipe fcu airside control with 1 or 2 stage electric heat

### Notes

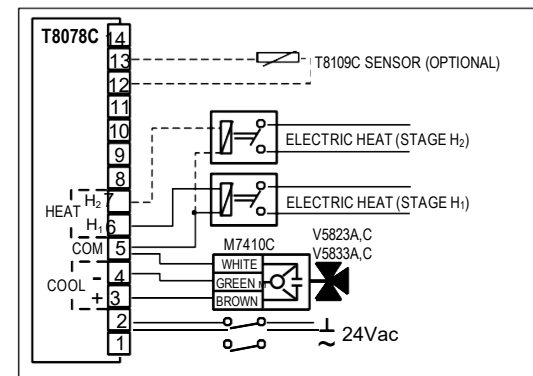
- 1) Proportional Band  $X_{pC}$  = 2K or 4K.
- 2) Zero Energy Band ZEB = 2K or 4K.
- 3) Valve must be closed before heating comes on.
- 4) Heating stages  $H_1$  &  $H_2$  are P+I on/off control with 1K prop. Band.
- 5)  $H_1$  &  $H_2$  = 1K (fixed).
- 6) Heating stages cycle rate = 12c/hour (fixed).
- 7) Interstage Differential  $ID_H$  = 1K (fixed).
- 8) Stages  $H_1$  &  $H_2$  do not switch together -20s delay.
- 9) For airside control, wire damper motor as for actuator shown.

## Wiring Schematics

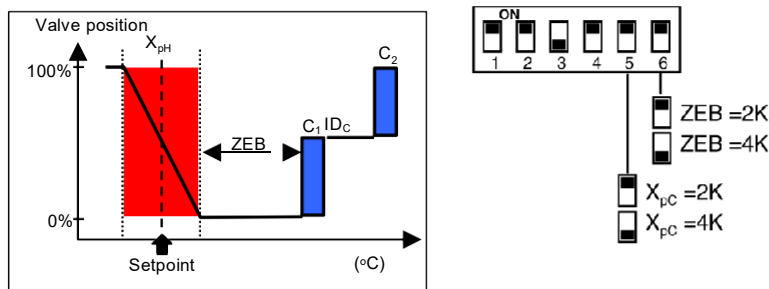
### 2-port valves



### 3-port valves



## (4) MODULATING HEATING + 2-STAGE ON/OFF COOLING



### Applications

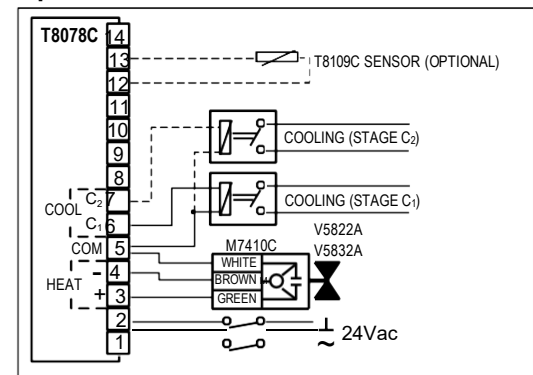
- 2-pipe fcu valve control with 1 or 2 stage chiller
- 2-pipe fcu airside control with 1 or 2 stage chiller

### Notes

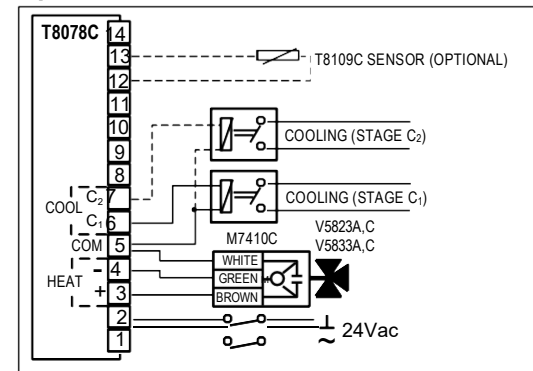
- 1) Proportional Band  $X_{pH}$  = 2K or 4K.
- 2) Zero Energy Band ZEB = 2K or 4K.
- 3) Valve must be closed before cooling comes on.
- 4) Cooling stages  $C_1$  &  $C_2$  are P+I on/off control with 1K prop. Band.
- 5)  $C_1$  &  $C_2$  = 1K (fixed).
- 6) Cooling stages cycle rate = 6c/hour (fixed).
- 7) Interstage Differential  $ID_c$  = 1K (fixed).
- 8) Stages  $C_1$  &  $C_2$  do not switch together -20s delay.
- 9) For airside control, wire damper motor as for actuator shown.

## Wiring Schematics

### 2-port valves

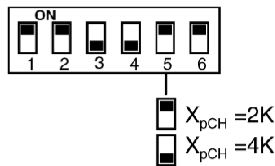
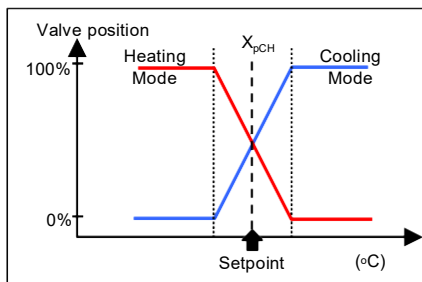


### 3-port valves



# APPLICATIONS – MODULATING CONTROL

## (5) MODULATING HEAT / COOL CHANGEOVER



### Applications

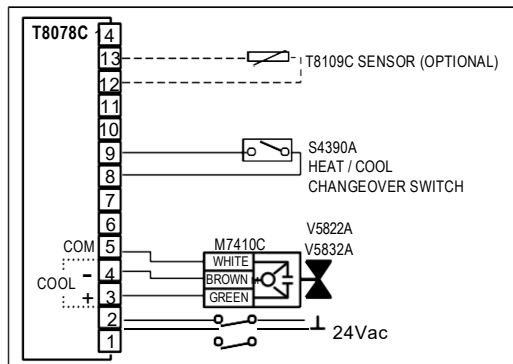
- 2-pipe fcu valve control with input signal for automatic changeover

### Notes

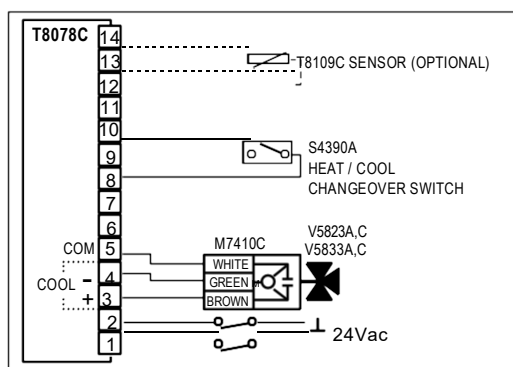
- 1) Proportional Band  $X_{pCH} = 2K$  or  $4K$ .
- 2) Wire as for Cooling control.
- 3) External input signal changes operating mode from cooling to heating.
- 4) Contact closure signal from single aquastat.
- 5) Contact closure signal from central control switch – ensure correct polarity of connection to all T8078C units.

## Wiring Schematics

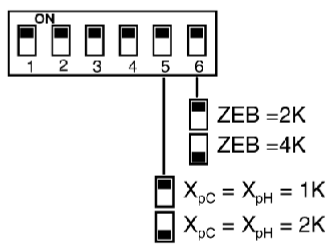
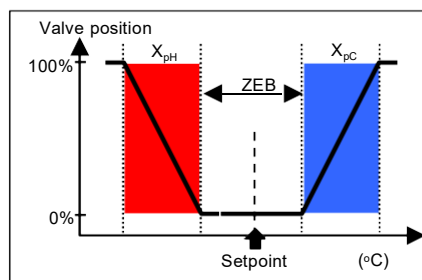
### 2-port valves



### 3-port valves



## (6) MODULATING COOLING + HEATING SEQUENCE



### Applications

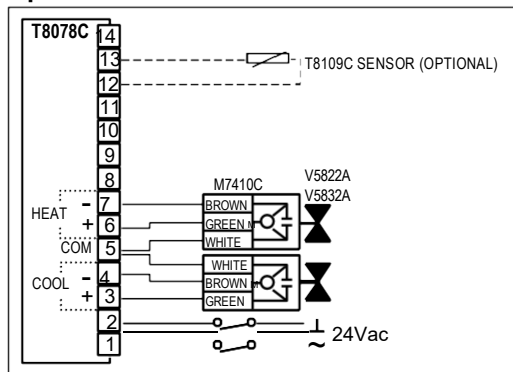
- 4-pipe fcu valve control

### Notes

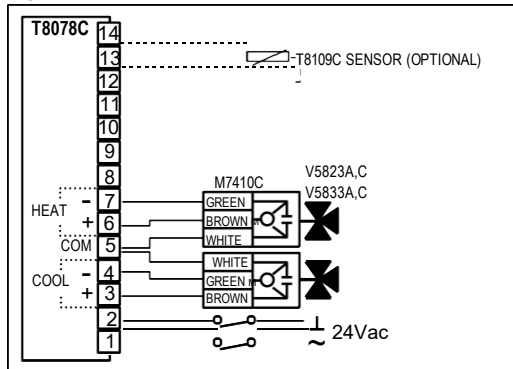
- 1) Both Proportional Bands  $X_{pC}$  &  $X_{pH} = 1K$  or  $2K$ .
- 2) Zero Energy Band ZEB =  $2K$  or  $4K$ .
- 3) Heat valve is closed before cooling valve opens.
- 4) Cool valve is closed before heating valve opens.

## Wiring Schematics

### 2-port valves

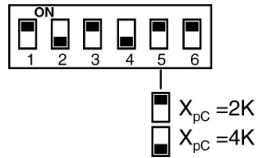
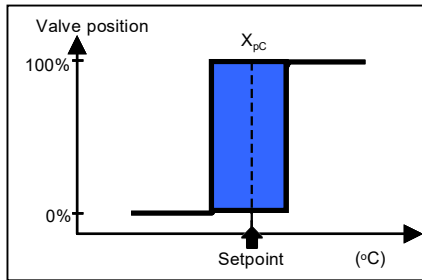


### 3-port valves



# APPLICATIONS – ON / OFF CONTROL

## (7) ON/OFF COOLING



### Applications

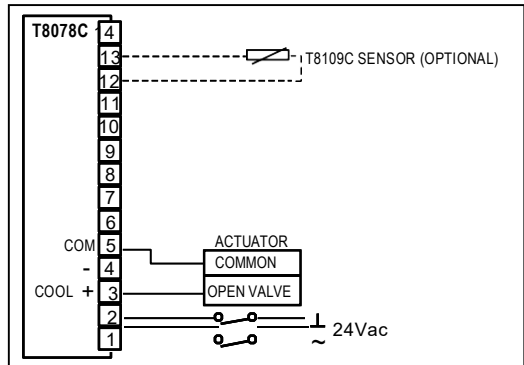
- 2-pipe fcu valve control

### Notes

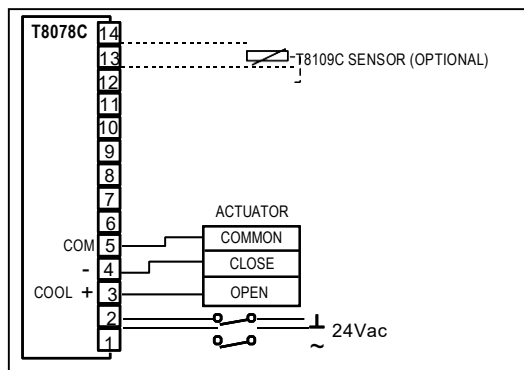
- 1) Control is P+I on/off.
- 2) Cycle rate is 6c/hour (fixed).
- 3) Proportional Band  $X_{pc} = 2K$  or  $4K$ .
- 4) Can use valves that require only to be driven in one direction (for example, with thermal actuators) or valves that require to be driven open, then driven closed.
- 5) Normally closed valves: use output from (+) terminal to drive open.
- 6) Normally open valves: use output from (-) terminal to drive closed.

## Wiring Schematics

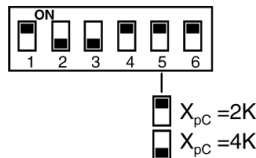
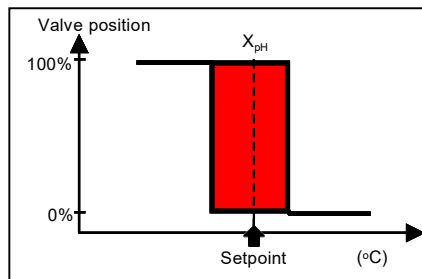
### Drive open valves



### Drive open / drive closed valves



## (8) ON/OFF HEATING



### Applications

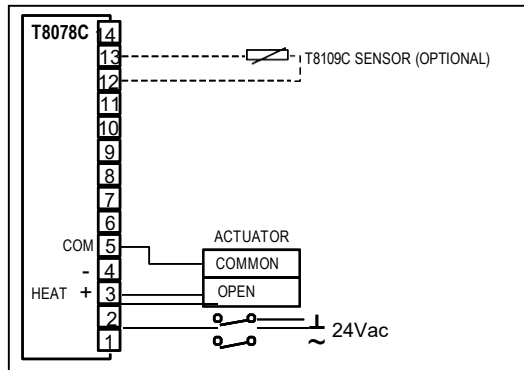
- 2-pipe fcu valve control

### Notes

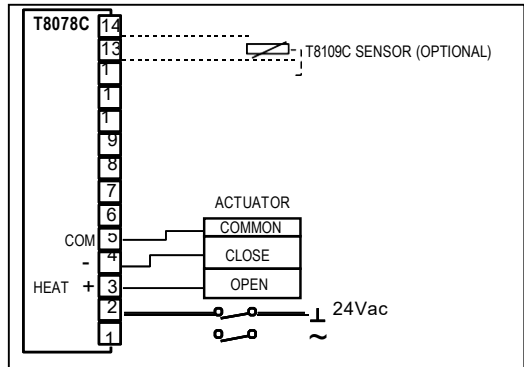
- 1) Control is P+I on/off.
- 2) Cycle rate is 6c/hour (fixed).
- 3) Proportional Band  $X_{ph} = 2K$  or  $4K$ .
- 4) Can use valves that require only to be driven in one direction (for example, with thermal actuators) or valves that require to be driven open, then driven closed.
- 5) Normally closed valves: use output from (+) terminal to drive open.
- 6) Normally open valves: use output from (-) terminal to drive closed.

## Wiring Schematics

### Drive open valves

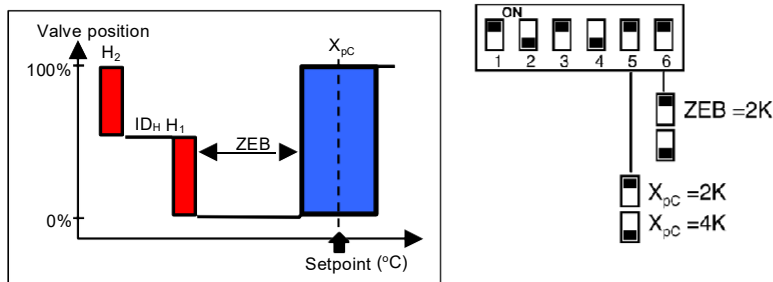


### Drive open / drive closed valves



# APPLICATIONS – ON / OFF CONTROL

## (9) ON/OFF COOLING + 2-STAGE ON/OFF HEATING



### Applications

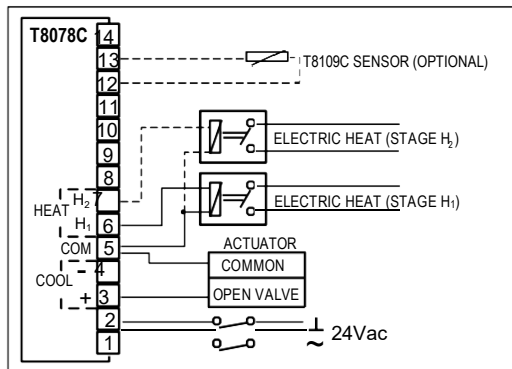
- 2-pipe fcu valve control with 1 or 2 stage electric heat

### Notes

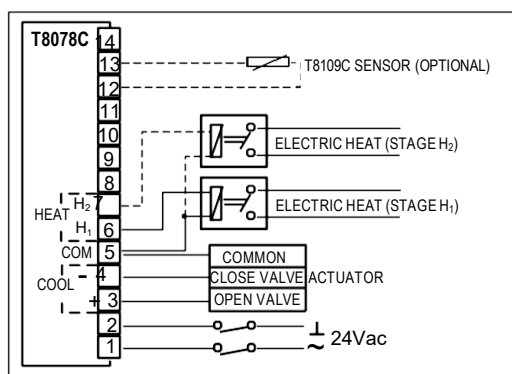
- 1) Cooling control is P+I form, with 6c/hour cyclerate.
- 2) Cooling Proportional Band  $X_{pC}$  = 2K or 4K.
- 3) Zero Energy Band ZEB=2K or 4K.
- 4) Cooling valve must be closed before heating comes on.
- 5) Heating stages  $H_1$  &  $H_2$  are P+I on/off control with 1K Prop. Band.
- 6)  $H_1$  &  $H_2$  = 1K (fixed).
- 7) Heating stages cycle rate=12c/hour (fixed).
- 8) Interstage Differential  $ID_H$  = 1K (fixed).
- 9) Stages  $H_1$  &  $H_2$  do not switch together -20s delay.

## Wiring Schematics

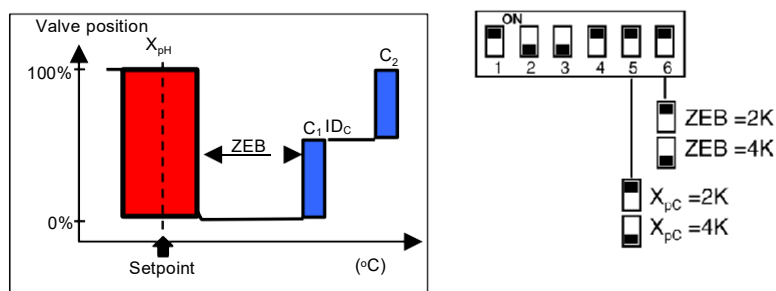
### Drive open valves



### Drive open / drive closed valves



## (10) ON/OFF HEATING + 2-STAGE ON/OFF COOLING



### Applications

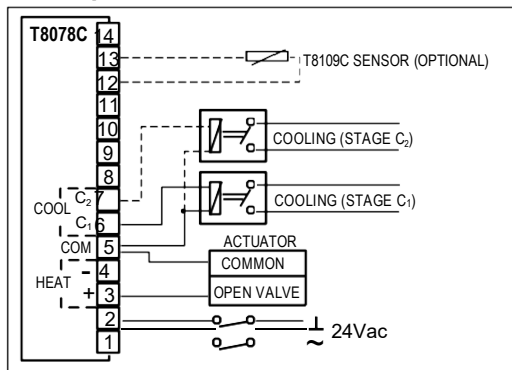
- 2-pipe fcu valve control with 1 or 2 stage chiller

### Notes

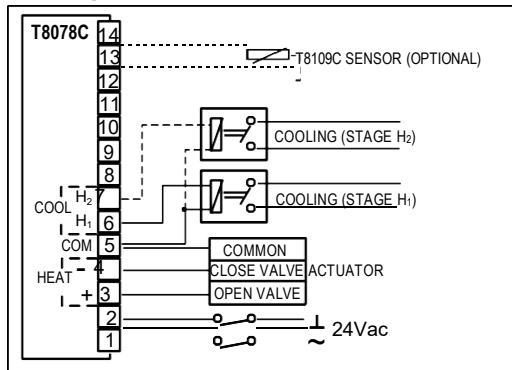
- 1) Heating control is P+I form, with 6c/hour cycle rate.
- 2) Heating Proportional Band  $X_{pH}$  = 2K or 4K.
- 3) Zero Energy Band ZEB=2K or 4K.
- 4) Heating valve must be closed before cooling comes on.
- 5) Cooling stages  $C_1$  &  $C_2$  are P+I on/off control with 1K Prop. Band.
- 6)  $C_1$  &  $C_2$  = 1K (fixed).
- 7) Cooling stages cycle rate=6c/hour (fixed).
- 8) Interstage Differential  $ID_C$  = 1K (fixed).
- 9) Stages  $C_1$  &  $C_2$  do not switch together -20s delay.

## Wiring Schematics

### Drive open valves

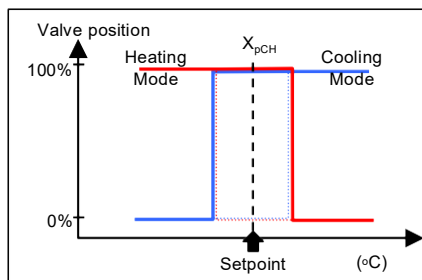


### Drive open / drive closed valves



# APPLICATIONS – ON / OFF CONTROL

## (11) ON/OFF HEAT / COOL CHANGEOVER



### Applications

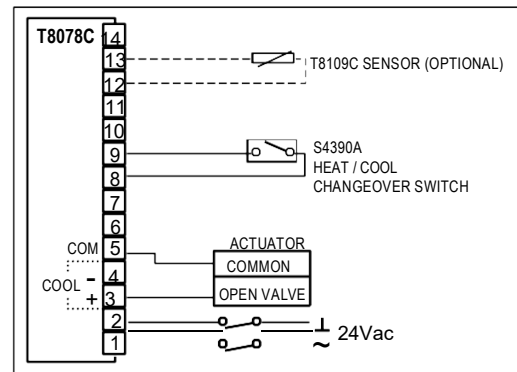
- 2-pipe fcu valve control with input signal for automatic changeover

### Notes

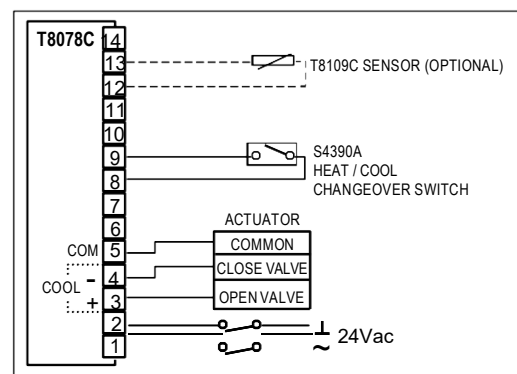
- 1) Control is P+I form, with 6c/hour cycle rate (heating or cooling).
- 2) Proportional Band  $X_{pCH} = 2K$  or  $4K$ .
- 3) Wire as for Cooling control.
- 4) External input signal changes operating mode from cooling to heating.
- 5) Contact closure signal from single aquastat.
- 6) Contact closure signal from central control switch – ensure correct polarity of connection to all T8078C units.

## Wiring Schematics

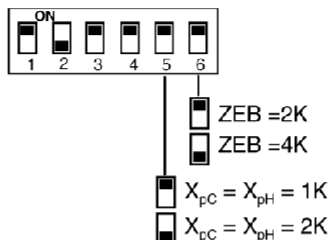
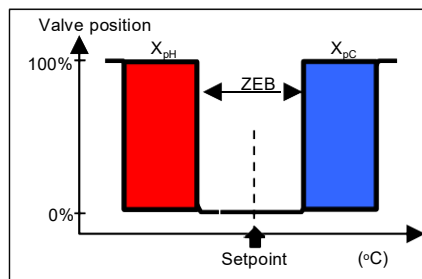
### Drive open valves



### Drive open / drive closed valves



## (12) ON/OFF COOLING + HEATING SEQUENCE



### Applications

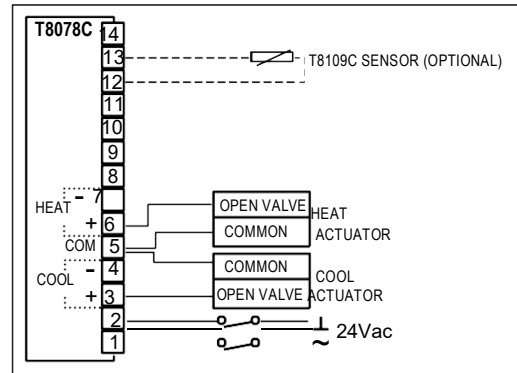
- 4-pipe fcu valve control

### Notes

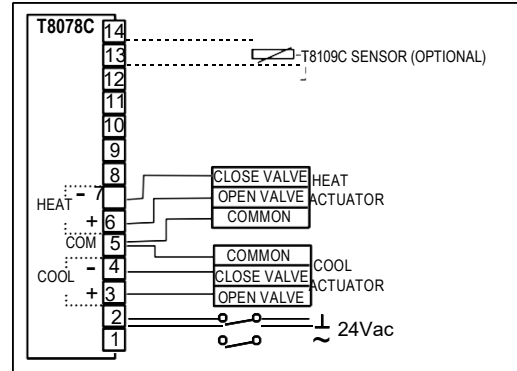
- 1) Both stages are P+I on/off control, with 6c/hour cycle rate.
- 2) Both Proportional Bands  $X_{pC}$  &  $X_{pH} = 1K$  or  $2K$ .
- 3) Zero Energy Band ZEB=2K or 4K.
- 4) Heat valve is closed before cooling valve opens.
- 5) Cool valve is closed before heating valve opens.

## Wiring Schematics

### Drive open valves

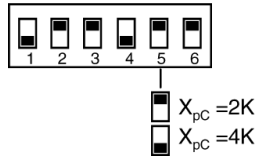
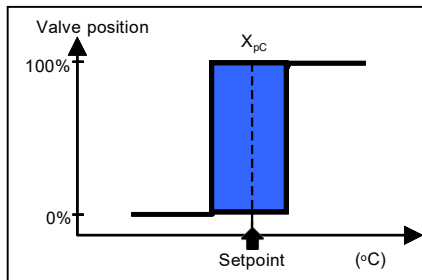


### Drive open / drive closed valves



# APPLICATIONS – TPM CONTROL (THERMO-ELECTRIC ACTUATORS)

## 13) TPM COOLING



### Applications

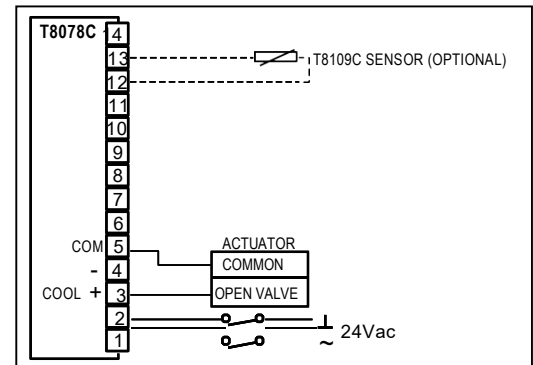
- 2-pipe fcu valve control (with thermal actuator)

### Notes

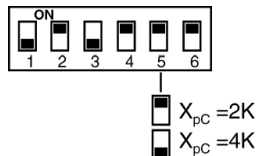
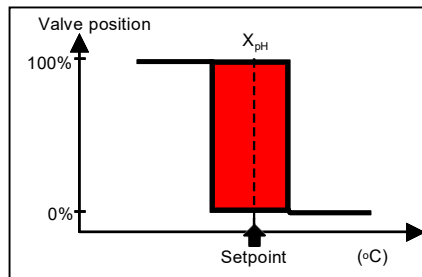
- 1) Special algorithm for thermal actuators.
- 2) Proportional Band  $X_{pC} = 2K$  or  $4K$ .
- 3) Only suitable for normally closed valves: where actuator is powered to drive valve open.

## Wiring Schematic

For normally closed valve – drive to open



## 14) TPM HEATING



### Applications

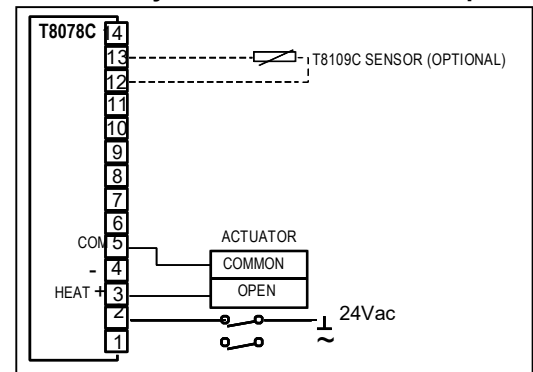
- 2-pipe fcu valve control (with thermal actuator)

### Notes

- 1) Special algorithm for thermal actuators.
- 2) Proportional Band  $X_{pH} = 2K$  or  $4K$ .
- 3) Only suitable for normally closed valves: where actuator is powered to drive valve open.

## Wiring Schematic

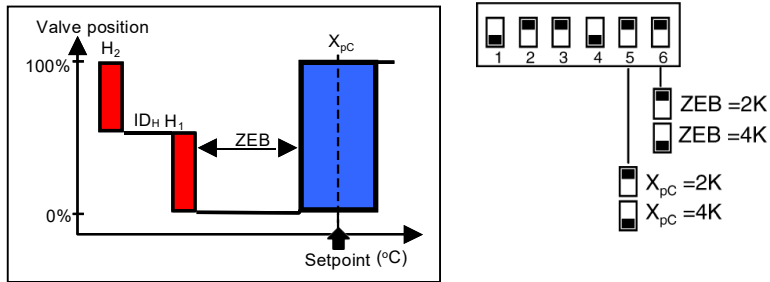
For normally closed valve – drive to open





# APPLICATIONS – TPM CONTROL (THERMO-ELECTRIC ACTUATORS)

## (15) TPM COOLING + 2-STAGE ON/OFF HEATING



### Applications

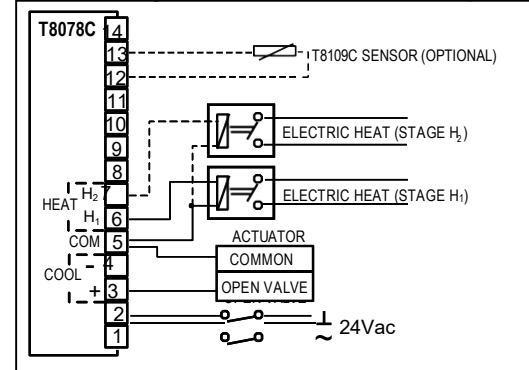
- 2-pipe fcu valve control with 1 or 2 stage electric heat

### Notes

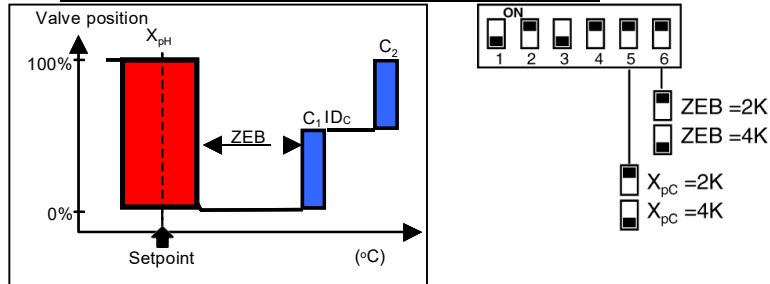
- 1) Cooling control is special algorithm for thermal actuators.
- 2) Only suitable for normally closed valves: where actuator is powered to drive valve open.
- 3) Cooling Proportional Band  $X_{pc}$  = 2K or 4K.
- 4) Zero Energy Band ZEB = 2K or 4K.
- 5) Heating stages H<sub>1</sub> & H<sub>2</sub> are P+I on/off control with 1K Prop. Band.
- 6) H<sub>1</sub> & H<sub>2</sub> = 1K (fixed).
- 7) Heating stages cycle rate = 12c/hour (fixed).
- 8) Interstage Differential ID<sub>H</sub> = 1K (fixed).
- 9) Stages H<sub>1</sub> & H<sub>2</sub> do not switch together -20s delay.

### Wiring Schematic

For normally closed valve – drive to open



## (16) TPM HEATING + 2-STAGE ON/OFF COOLING



### Applications

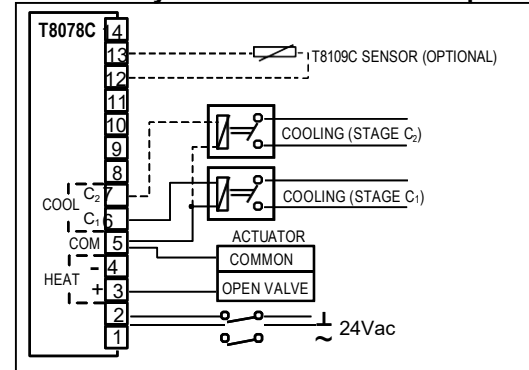
- 2-pipe fcu valve control with 1 or 2 stage chiller

### Notes

- 1) Heating control is special algorithm for thermal actuators.
- 2) Only suitable for normally closed valves: where actuator is powered to drive valve open.
- 3) Heating Proportional Band  $X_{ph}$  = 2K or 4K.
- 4) Zero Energy Band ZEB = 2K or 4K.
- 5) Cooling stages C<sub>1</sub> & C<sub>2</sub> are P+I on/off control with 1K Prop. Band.
- 6) C<sub>1</sub> & C<sub>2</sub> = 1K (fixed).
- 7) Cooling stages cycle rate = 6c/hour (fixed).
- 8) Interstage Differential ID<sub>C</sub> = 1K (fixed).
- 9) Stages C<sub>1</sub> & C<sub>2</sub> do not switch together -20s delay.

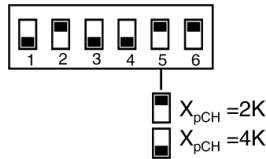
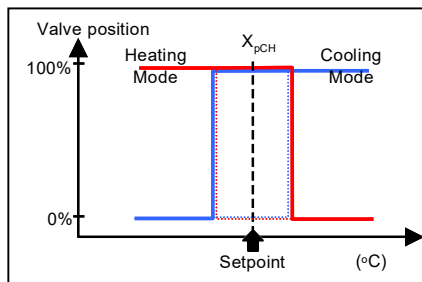
### Wiring Schematic

For normally closed valve – drive to open



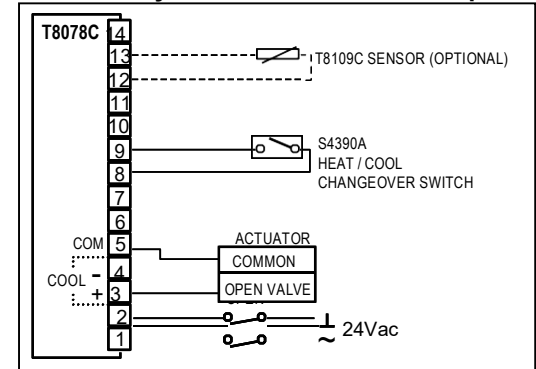
# APPLICATIONS – TPM CONTROL (THERMO-ELECTRIC ACTUATORS)

## (17) TPM HEAT / COOL CHANGEOVER



## Wiring Schematic

For normally closed valve – drive to open



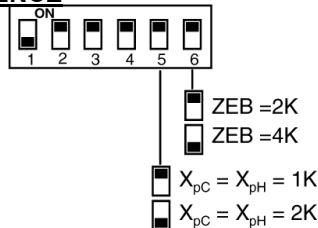
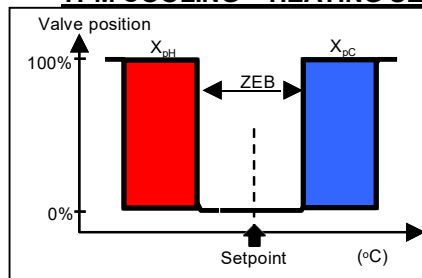
## Applications

- 2-pipe fcu valve control with input signal for automatic changeover

## Notes

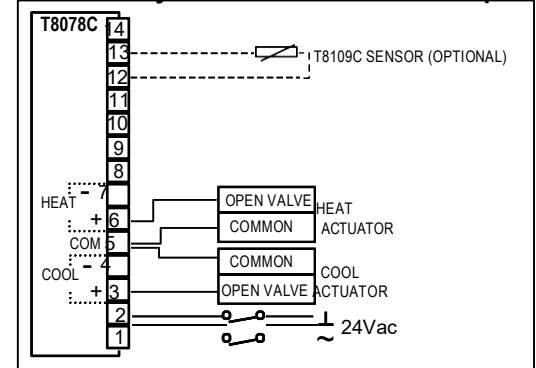
- 1) Control is special algorithm for thermal actuators.
- 2) Only suitable for normally closed valves: where actuator is powered to drive valve open.
- 3) Proportional Band  $X_{pCH} = 2K$  or  $4K$ .
- 4) Wire as for Cooling control.
- 5) External input signal changes operating mode from cooling to heating.
- 6) Contact closure signal from single aquastat.
- 7) Contact closure signal from central control switch – ensure correct polarity of connection to all T8078C units.

## (18) TPM COOLING + HEATING SEQUENCE



## Wiring Schematic

For normally closed valves – drive to open



## Applications

- 4-pipe fcu valve control

## Notes

- 1) Control is special algorithm for thermal actuators.
- 2) Only suitable for normally closed valves: where actuator is powered to drive valve open.
- 3) Both Proportional Bands  $X_{pC}$  &  $X_{pH} = 1K$  or  $2K$ .
- 4) Zero Energy Band  $ZEB = 2K$  or  $4K$ .

## ADDITIONAL FEATURES

### Automatic Heat / Cool Changeover

T8078C is suitable for automatic or central Heat / Cool Changeover, if configured for this Mode of operation. This is applicable only for 2-pipe fan-coil systems, where the changeover is made on a seasonal demand basis.

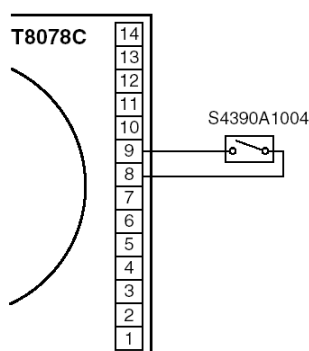
Configuration is done by setting System switches S3 and S4 to 1 and 0 respectively.

Automatic changeover is initiated by a thermostat positioned on the water flow pipe, detecting the presence of heated or chilled water, and sending the appropriate signal to the controller. A suitable product is the S4390A1004 pipe-thermostat.

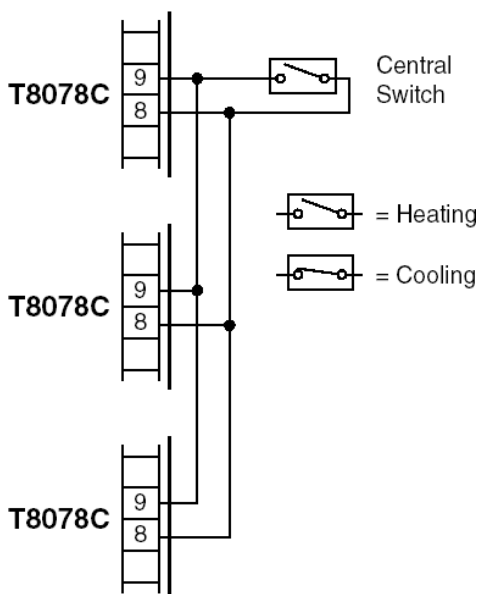
Central changeover is initiated by a switch, and can be used to centrally switch a group of connected T8078C controllers from Heating to Cooling operation.

See wiring schematics for connection details.

#### Automatic Heat / Cool Changeover



#### Central Heat / Cool Changeover



Note: x 50 units maximum

Take care to always observe polarity of connection

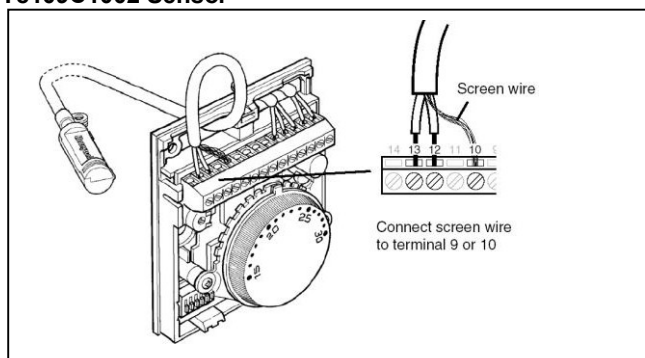
### Remote Temperature Sensor

T8078C is supplied with an on-board temperature sensor. If remote temperature sensing is required (for example in return air sensing applications), then a suitable Honeywell Home Remote Sensor can be connected to terminals 12 and 13 as shown in the wiring schematic.

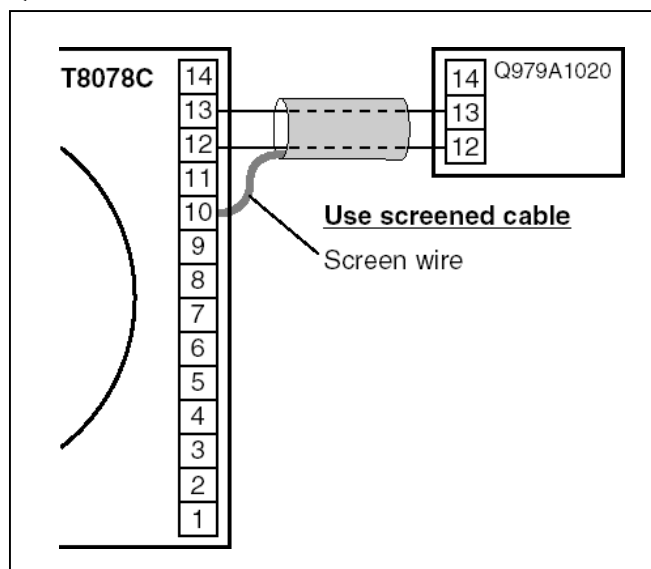
T8078C will auto detect the presence of the Remote Sensor on power up, and will use the Remote Sensor measurement in preference to its internal sensor. So if a Remote Sensor is to be connected, the power must be switched off then on again for it to be detected.

Remote Sensors are available as wall-mounted or airflow (return air) models. Both Q979A1020 and Q979C1036 contain the sensor in wall-mounted form, whereas T8109C1002 is an airflow sensor supplied with 1.5 m cable. If this cable is to be extended then the maximum cable run will be 20m, and the extension must use screened cable. Polarity of connection is not important, but the screen wire must be connected to terminal 9 or 10, as shown.

#### T8109C1002 Sensor



#### Q979A1020 Wall-mounted Sensor



## Remote Setpoint Adjustment

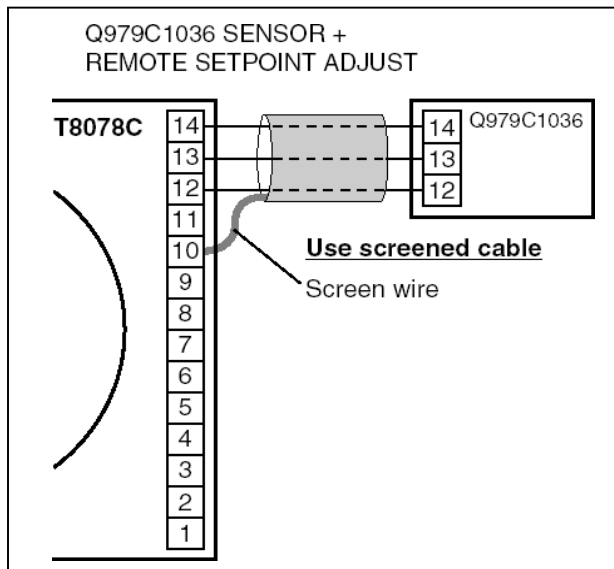
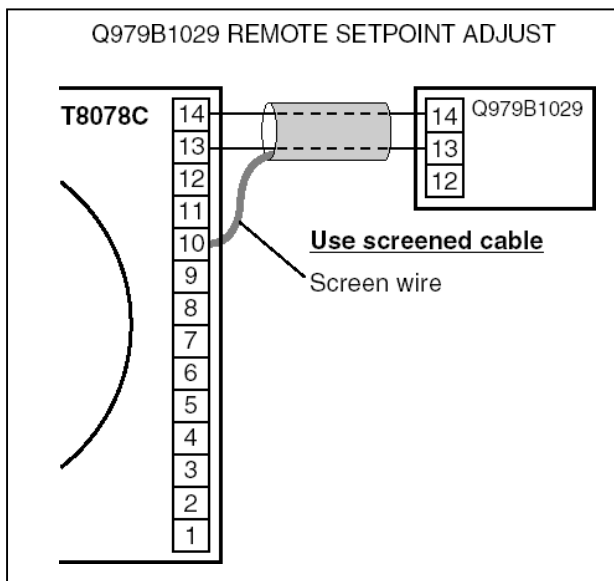
T8078C allows its setpoint to be adjusted remotely by up to  $\pm 5K$ . This is achieved by the connection of a Remote Setpoint Adjustment module to terminals 13 and 14, as shown in the wiring schematic.

Suitable modules are:  
Q979B1029 (Remote Setpoint Adjust) and  
Q979C1036 (Sensor + Remote Setpoint Adjust).

Note – the polarity of connection is not important as the input is purely resistive.

To ensure measurement stability when wiring these modules, use screened cable and connect the screen wire to terminal 9 or 10 of T8078C as shown.

The maximum cable run will be 20m.



## Suitable Valves & Actuators

T8078C is compatible with a wide range of Honeywell Home valves and actuators. See relevant product Specification Sheets for more details.

<b>Valve Actuators</b>	<b>Suitable Valves</b>
<b>M6410C</b> <b>M7410C</b> Modulating 3-pos, 24V~  Max of 10 actuators (0.7VA each) to be connected to any T8078C output	<u>Conical Sealing</u> <b>V5822A</b> 2-way <b>V5823A</b> 3-way <b>V5823C</b> 3-way+bypass <u>Flat Sealing</u> <b>V5832A</b> 2-way <b>V5833A</b> 3-way <b>V5833C</b> 3-way+bypass
<b>M8450A1000</b> Thermo-electric, 24V~ Stroke 8mm  Max of 2 actuators (3VA each) to be connected to any T8078C output	<u>Conical Sealing</u> <b>V5822A</b> 2-way <b>V5823A</b> 3-way <b>V5823C</b> 3-way+bypass <u>Flat Sealing</u> <b>V5832A</b> 2-way <b>V5833A</b> 3-way <b>V5833C</b> 3-way+bypass
<b>M100</b> Thermo-electric, 24V~ Stroke 2.5mm <b>Z100</b> Thermo-electric, 24V~ Stroke 4mm  Max of 2 actuators (3VA each) to be connected to any T8078C output	<u>Conical Sealing</u> <b>V5822A4xxx</b> 2-way <b>V5823A4xxx</b> 3-way <b>V5823C4xxx</b> 3-way+bypass <u>Flat Sealing</u> <b>V5832A4xxx</b> 2-way <b>V5833A4xxx</b> 3-way <b>V5833C4xxx</b> 3-way+bypass
<b>Damper Actuators</b> Modulating 3-pos, 24V~  4Nm <b>ML6161B2024</b>  5Nm <b>ML6161E</b>  10Nm <b>ML6174E</b>  20Nm <b>N2024</b>  34Nm <b>N3424</b>	<b>Max no. to be connected to each T8078C output</b>  Max of 3 actuators (2VA each)  Max of 2 actuators (4VA each)  Max of 2 actuators (4VA each)  Max of 1 actuator (6VA each)  Max of 1 actuator (7VA each)

## Optional Accessories

Optional accessories are available for use with T8078C:

<b>F42006646-001</b>	Range stops (pack of 20)
<b>Q6360A1025</b>	Fan Speed Switching Subbase
<b>Q979A1020</b>	Wall mounted Remote Sensor
<b>Q979B1029</b>	Remote Setpoint Adjust Unit ( $\pm 5K$ )
<b>Q979C1036</b>	Sensor + Remote Setpoint Unit ( $\pm 5K$ )
<b>T8109C1002</b>	Return Air Sensor (1.5m cable)
<b>S4390A1004</b>	Pipe-mounted Changeover Thermostat