



## **PRODUCT STANDARD FEATURES**

### **Safety Controls:**

All components of the Heat Pump operation are controlled for maximum efficiency and safety both hardware and software based. Optional LED controller module records and demonstrates system state for easy diagnosis

### **System Fans:**

3 settings (high/low/off) with large blades results in very quiet operation

### **Modular Design**

EAS Series can dock with an existing boiler or can be supplied with an Ecotec hot water system cylinder in Stainless Steel from 200 – 20,000 litres. Multiple units in sequence will meet most customer requirements

### **Compressor:**

Sanyo Scroll compressors are state of the art, very durable, extremely efficient and vibration free, we guarantee them for 5 years

### **Condensers:**

Ecotec's patented heat exchangers are designed to eliminate the cross-contamination of potable water from system gas and compressor oils. Efficiency of co-axial (not plate) design allows for 20% faster heating while maintaining industry leading COP ratings

### **Evaporators:**

Available in epoxy coated aluminium, 100% copper or copper/nickel alloys depending on application and required resistance to salt-spray or salt water applications

### **Frame and Body:**

Powder Coated Epoxy, Marine Grade 316 Stainless Steel and optional Zinc-Alum Panels will resist salt-spray corrosion for up to 15 years

## **PRODUCT OVERVIEW**

### **SAFETY COMPONENTS OF ECOTEC HEAT PUMPS**

#### **HARDWARE**

- High Pressure Switch with Manual Re-Set
- Low Pressure Switch with Auto Re-Set
- Two manually adjustable Pressure Controllers (which control the Fan Speeds) i.e. Hi Speed, Low Speed, Off mode: these fan speeds are all controlled by Suction Pressure
- Circuit Breaker on Control Circuit
- Mains Power Isolating Switch

#### **SOFTWARE**

Sensors are installed to monitor:

- Discharge Gas Temperature
- Suction Gas Temperature
- Evaporator Coil Temperature (Low Temp. Defrost)
- Water Temperature Sensor
- All other critical functions as per specific product specifications



# MICRO PROCESSOR CONTROLLER

## Specifications for Heat Pumps

### **1.0 SCOPE OF ENTITY**

*This is a micro-processor based digital controller, which has associated peripherals for driving power devices and sensory functions. The boundary of the unit is the terminals, sensors and the user interfaces specific to the controller only.*

### **2.0 HARDWARE SETTING**

*This section describes the options that can be set through either wire jumper or jumper header.*

*A) TS – SHORT = TIME SHORTENING MODE*

*B) TS – OPEN = NORMAL MODE*

#### **2.1 Last Memory Setting**

*The following setting will be memorised on to a non-volatile memory and upon power on; the controller will run based on these setting.*

- a. Operation mode*
- b. ON/OFF status*
- c. Compressor On/Off status*
- d. Temperature setting*
- e. Preset Compressor On/Off Delay*
- f. Maximum Defrost Cycle*
- g. Temperature Offset*

#### **2.2 Time Shortening Mode**

*This mode provides a faster way for production testing. Under this feature, the user will make the programme run in time shortening mode by special design routine. The internal clock will run in 1/60 sec.*

#### **2.3 Default**

- 1. Temperature setting = 12 °C*
- 2. Offset value = 0 (ADC Sampling Step)*
- 3. Maximum Defrost Cycle = 10 minutes*
- 4. Compressor On Delay = 3 minutes*
- 5. Compressor Off Delay = 2 minutes*
- 6. Operation mode = Cool Mode*
- 7. Timer = Off*
- 8. Compressor Differential Temperature 1°C*

### 3.0 SOFTWARE OPERATION

This section will describe the software operation.

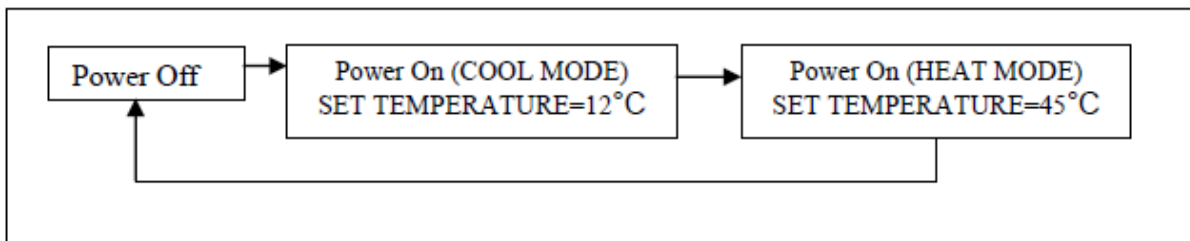
#### 3.1 Unit ON/OFF

There are 2 ways to turn on or off the system:

- 1) By ON/OFF switch.
- 2) By Timer On/Off

##### ON/OFF Switch

ON/OFF triggering can be achieved by pressing ON/OFF button on the unit to turn on/off the unit. The operating mode can be changed by pressing the ON/OFF button in the following sequences.



Power off Power on (COOL MODE)

SET TEMPERATURE=12°C

Power on (HEAT MODE)

SET TEMPERATURE=45°C

ON/OFF Timer

After the unit runs for preset timer delay, the unit is turned itself from ON mode to OFF mode or from OFF mode to ON mode automatically.

#### 3.2 Reset Triggering

When the cause of freeze (cooling) or over temp of hot gas pipe are solved and work normally, pressing the reset button will reset the unit back to normal operation.

#### 3.3 Up button

Press this button will increase the Set Temperature value in Normal Mode Display as well as increase the value of setting parameters in Programming Mode Display.

Range of Set Temperature: 0°C to 80°C

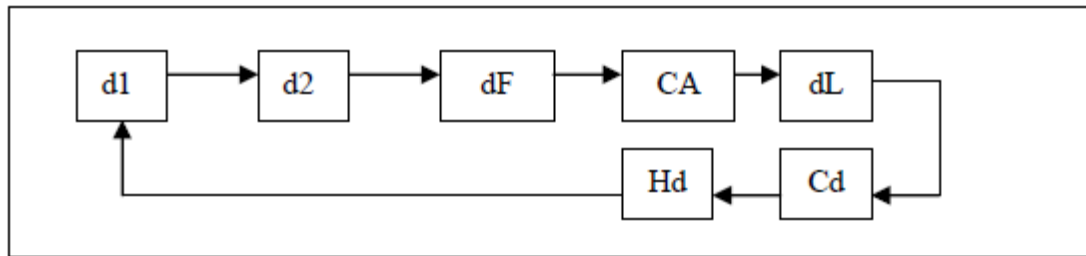
#### 3.4 Down button

Press this button will have the same functions as Up button except to decrease a value.

#### 3.5 Set button

Press this button in normal mode display will switch the Set Temperature value back to actual reading temperature value display.

In the Programming mode display, pressing the Set button can browse through the parameters setting in sequences.



Key Press Sequence

Note:

**A) d1 – Compressor Off Delay**

**B) d2 – Compressor On Delay**

**C) dF – Maximum Defrost Cycle (heat pump only)**

**D) CA – Temperature Offset value**

**E) dL – Timer ON/OFF**

**F) Cd - Compressor Differential Temperature in COOL Mode**

**G) Hd - Compressor Differential Temperature in HEAT Mode**

Hold the Set button for 5 seconds can switch the Normal mode display into Programming mode display.

The Programming mode display can switch back to Normal by holding the Set button for 5 seconds. Not pressing the Set button or Up & Down button for 10 seconds, the display may change back into the Normal mode.

Once the Set button or Up & Down button is pressed, the key delay timer may reset.

### **3.6 Parameters Description**

#### **a) Compressor Off Delay (d1)**

Minimum time delay to turn off the compressor. **Range: 0 Minute to 15 Minutes**

#### **b) Compressor On Delay (d2)**

Minimum time delay to turn on the compressor **Range: 0 Minute to 15 Minutes**

#### **c) Defrost Cycle (dF) (heat pump only)**

The time period for a defrost mode. **Range: 0 minute to 90 minutes**  
**(Recommend not less than 10 minutes)**

**d) Offset value(CA)**

Allow the actual reading temperature value to be calibrated or adjusted for more accuracy. The value shown is the ADC sampling step value and each step is almost equal to 0.038 °C.

Range: -30 to 30 ADC sampling steps

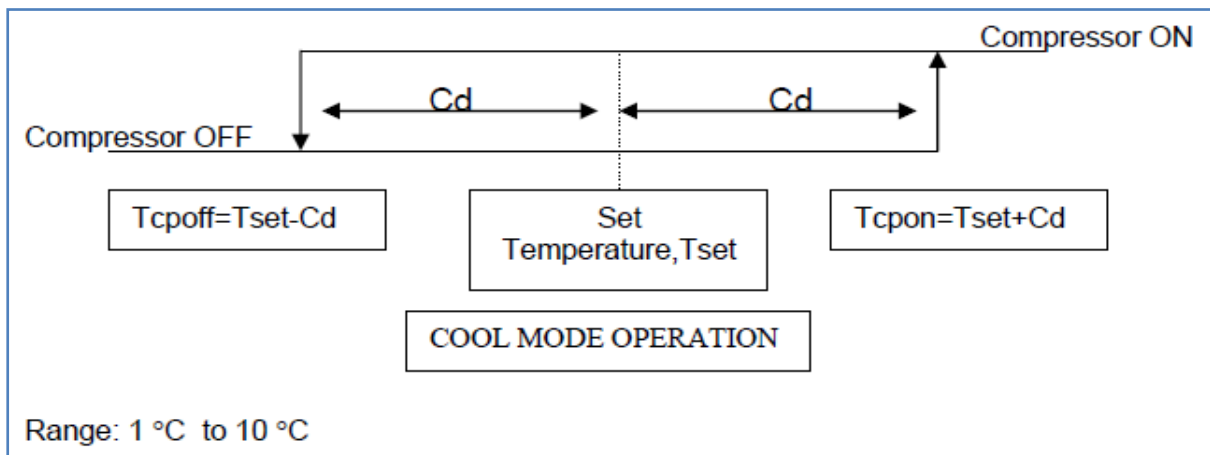
**e) Timer ON/OFF (dL)**

The time for the unit to run in ON mode or OFF mode. **Range: 0 hour to 24 hours**

**f) Compressor Differential Temperature In COOL Mode (Cd)**

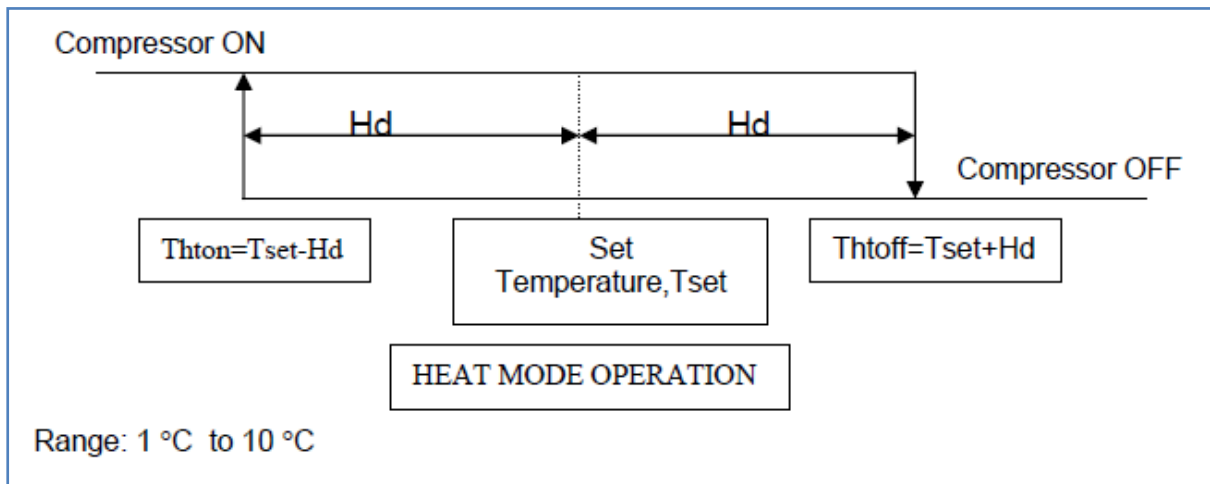
In cool mode, compressor runs with fan on if water temperature is higher than set temperature for 'Cd' degree temperature.

The compressor stops running if water temperature is lower than set temperature for 'Cd' degree temperature.



**g) Compressor Differential Temperature In HEAT Mode (Hd)**

In heat mode, compressor runs with fan & 4wv on if water temperature is lower than set temperature for 'Hd' degree temperature. The compressor stops running if water temperature is higher than set temperature for 'Hd' degree temperature.



### **3.7 Modes**

#### **a) COOL MODE**

If actual reading temperature is higher than set temperature for certain preset degree differential temperature (Cd), compressor and fan will operate while 4way valve OFF. The compressor and fan will 'off' if actual temperature is lower than certain preset degree differential temperature (Cd).

The compressor is switched on/off in the cool mode according to the Compressor Off Delay (d1), Compressor On Delay (d2) and Compressor Differential Temperature (Cd).

#### **b) HEAT MODE**

If actual water temperature is lower than set temperature for certain preset degree differential temperature (Hd), 4way valve with fan and compressor will operate.

The compressor and fan will switch off if actual temperature is higher than certain preset degree differential temperature (Hd) while 4way valve will always on in Heat mode.

The compressor is switched on/off in the HEAT mode according to the Compressor Off Delay (d1), Compressor On Delay (d2) and Compressor Differential Temperature (Hd).

##### **b.1) 4-way Valve Changing**

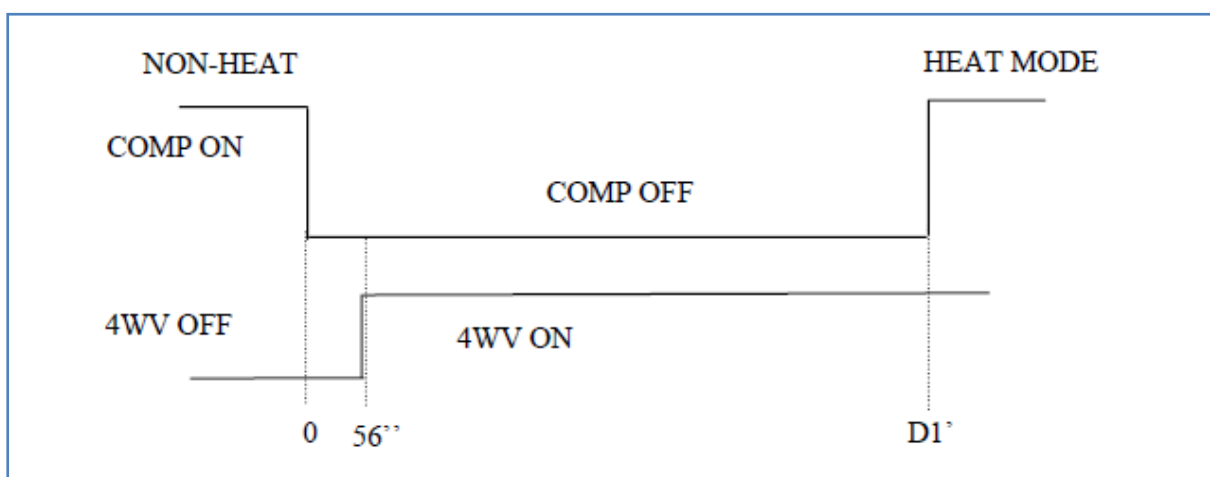
Before compressor cut in, if the 4-way valve is off, then the 4-way valve changing sequence must be affected to change the cool circuit to that of heat pump circuit. The 4-way valve can only turn on in heat mode. Upon return to non-heat mode, the 4-way valve must change to OFF position.

**The 4-way valve can only be changed 56 seconds after the compressor has been cut out.**

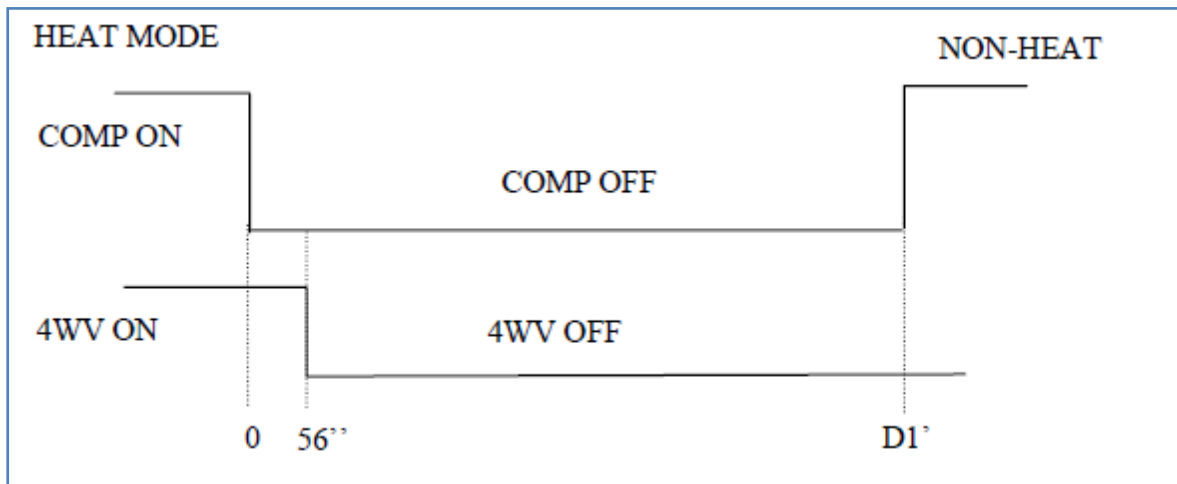
The compressor will cut in again by the time set on the compressor off delay (d1) less 56 seconds. When the 4-way valve has been changed and the compressor has not been switched on, the 4-way valve may still be changed again immediately.

The change stages are as follows:

**From "OFF" to "ON"**



**From "ON" to "OFF"**

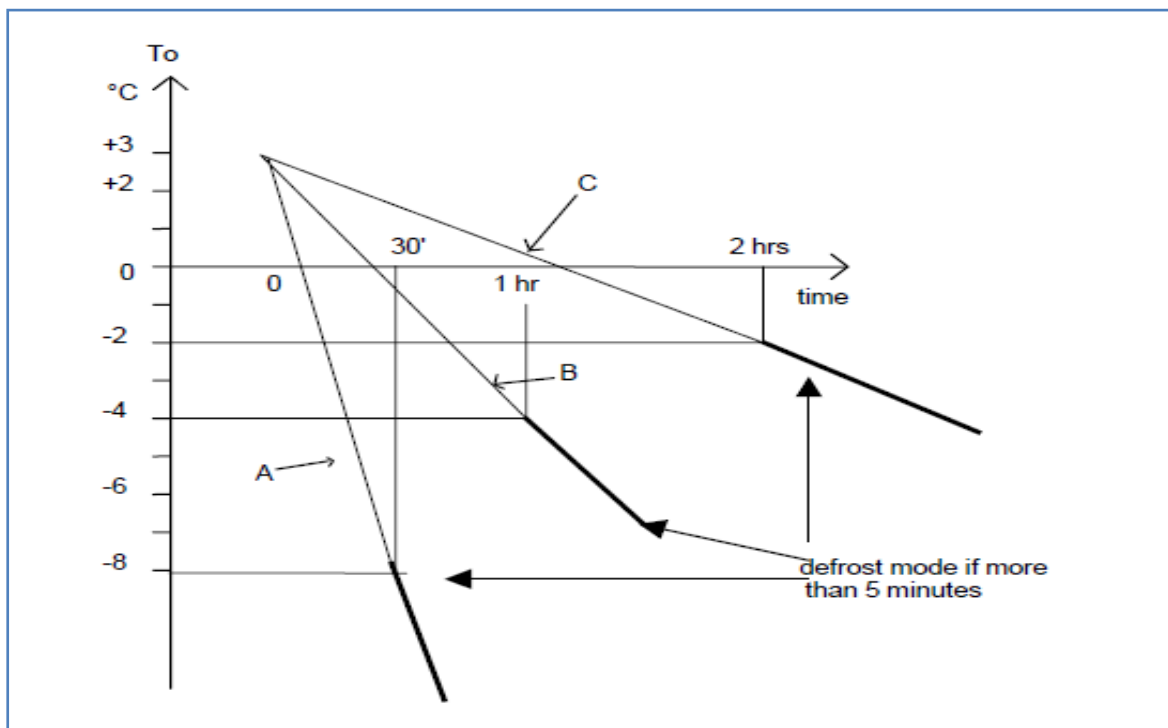


**c) DEFROST MODE**

Defrost mode can only be activated from heat mode (not selectable by user). Ice is assumed to form if the Outdoor Coil temperature is below  $-2^{\circ}\text{C}$ .

A defrost timer will start counting when the outdoor heat exchange thermistor is below  $+3^{\circ}\text{C}$ . Upon crossing over this point ( $+3^{\circ}\text{C}$ ) to a higher temperature for more than 2 minutes, the timer will be reset (this timer is also reset after the defrost mode). Note that, the temperature sensing (for Outdoor Coil) could only be done when the compressor is on for more than 5 minutes (except for defrost termination).

The likelihood of ice frosting at the outdoor coil is characterized by 3 gradients of outdoor coil temperature shown in the chart below:



Defrost mode will be activated if:

**i) 30 minutes to 1 hour from +3°C reference point**

At this point, if the outdoor coil temperature is  $\leq -8^{\circ}\text{C}$  for more than 5 minutes (provided the compressor is on), ice is then assumed to be sufficiently formed at the outdoor coil, and defrost mode is started.

**ii) 1 hour to 2 hours from +3°C reference point**

At this point, if the outdoor coil temperature is  $\leq -4^{\circ}\text{C}$  for more than 5 minutes (provided the compressor is on), ice is then assumed to be sufficiently formed at the outdoor coil, and defrost mode is started.

**iii) more than 2 hours from +3°C reference point**

At this point, if the outdoor coil temperature is  $\leq -2^{\circ}\text{C}$  for more than 5 minutes (provided the compressor is on), ice is then assumed to be sufficiently formed at the outdoor coil, and defrost mode is started.

**Defrost cycle**

Defrost cycle operates the circuit as a cool circuit without both indoor and outdoor fans running. Only ON/OFF trigger will be acknowledged (all other modes and functions cannot be activated) and when the unit is on, the LED will blink to show the defrost status.

At start, the outdoor fan must be cut out, then the 4-way valve changes state to cool circuit.

The compressor then must run with both indoor and outdoor fans off until temperature of outdoor coil exceeds  $+10^{\circ}\text{C}$  or a maximum of (maximum defrost cycle)  $d_f$  minutes compressor run time is achieved, and the Defrost cycle is completed.

Then the 4-way valve changes state to Heat circuit where the Heat cycle can continue to run.

**Note Recommend  $d_f$  value not less than 10 minutes.**

**d) FREEZE SENSOR & HOT GAS SENSOR ERRORS (Factory preset value)**

Freeze sensor is preset at  $-2^{\circ}\text{C}$ . If the sensed temperature at the freeze sensor is  $-2^{\circ}\text{C}$  or below, the unit will shut down.

Hot gas sensor is preset at  $100^{\circ}\text{C}$ , If the sensed temperature at the hot gas sensor is  $100^{\circ}\text{C}$  or above, the unit will shut down.

The only way to turn on the unit after shut down by freeze sensor or hot gas sensor is when sensed temperature at both sensors are within the limit and pressing the reset button.



#### **4.0 Display**

*In Normal mode display, the 7-segment LED displays the water temperature. It shows set temperature once the UP/DOWN button is pressed*

*In Programming mode display, the 7-segment LED displays the parameter symbols for certain period and shows the blinking parameter value for a period too.*

**Power LED:** Turn on when unit is switched ON.

**Defrost LED:** Blink when unit runs in defrost mode.(heat pump only)

**Timer LED:** Blink when Timer On/Off is running.

**CP LED:** Turn on when compressor runs.

**HEAT LED:** Turn on when Heat Mode is activated.

**COOL LED:** Turn on when Cool Mode is activated.

**Sensors Error LED:** Blink when

**Freeze Sensor** sense temperature under limit.

OR - **Hot gas sensor** sense temperature over limit

#### **Self-Diagnostic**

*If certain error or abnormal condition occurs, the special LED indication will appear as stated below:*

- a) The 7-segment LED blinks 'S2' if Freeze Sensor sense temp under limit.*
- b) The 7-segment LED blinks 'S1' if Hot Gas Sensor senses temp over limit.*
- c) The 7-segment LED displays 'E1' if Water inlet thermistor is in error.*
- d) The 7-segment LED displays 'E2' if Outdoor coil thermistor is in error.*
- e) The 7-segment LED displays 'E3' if Water inlet & Outdoor coil thermistor are in error.*