TILI—Control System Specifications, and Operating Manual

Name: Geothermal and Water Source System Controller

Model No. TE004DK006

Edition: 1.1

* * For safety and operational information, please **read** this manual thoroughly before installation and prior to use * *

TILI ELECTRICAL CO., LTD.
BURNABY BC
TEL: 604-430-8496
WWW.TILI-NORTHAMERICA.COM

FEATURES:

1) This controller is a communicating device designed for use with Tili single compressor Geothermal and Water Source Heat Pumps

2) Functions include: Heating, Cooling, De-Humidification, Manual or Automatic Fan operation, Auxiliary Heat and System Diagnostic Read Out

3) Equipped with a Large LCD Screen and back lit Display for easy night time operation

4) Auto re-start Memory in the event of a power loss

5) Anti-Interference with other electronic devices

6) Sleep Mode for comfort and Energy Savings

7) Temperature Display in Celcius or Fahrenheit

DIAGNOSTICS CAPABILITIES:

* **Water Flow Fault Detection**
* **Low Pressure Fault Detection**
* **High Pressure Fault Detection**
* **Temperature Sensor Fault Detection**
* **Air Coil Temperature Monotoring in real time**
* **Loop Entering Water Temperature monitoring in real time**
* **Loop Leaving Water Temperature monitoring in real time**
* **Automatic Refrigerant Leak Detection**
* **Air Coil High Temperature Protection**
* **Communication System Monotoring**

Installer Set-up

1. Default Settings:

The heat pump operational set point range is from 60℉ to 86℉.

The Main control board is equipped with a set of dip switches that are factory set for Geothermal Heat Pumps. The settings are as follows:

1#	2#	3#	4#	Main Board Function	Remarks
on	off	x	off	Water source heat pump	No auxiliary heat
on	off	x	on	Geothermal heat pump	With auxiliary heat
on	on	x	off	Water cooling and cooling only	No auxiliary heat

on	on	x	on	Water cooling and cooling only	With auxiliary heat
x	x	x	x	Error setting	No.

Note: Switch positions indicated by an "x" can be ignored.

2. Sleep Function: Zzz

★ **In "cooling" mode:**

30 minutes after having set to "sleep mode", the set-point temperature will increase 1℉. After one hour, the set-point temperature will increase by 2℉: then after two hours, the set-point temperature will increase by 3℉, and the set-point temperature will not change after this time.

★ **In "heating" mode:**

30 minutes after setting to "sleep" mode the set-point temperature will decrease by 1℉; then after one hour, the set-point temperature will decrease by 2℉: then after two hours, the set-point temperature will decrease by 3℉, and the temperature will not change after this time.

When the sleep mode is turned off and the unit starts its next heating cycle, the temperature will return to it's original setting.

In the event of a power failure, the system turns on when power is restored or may remain off for 2 hours and then turn on, which means a cold reset. In the event of a cold reset, the set-point temperature will decrease 4℉ from the original base set point in the cooling mode, or increase by 4℉ from the original set-point in the heating mode. A cold reset is not usual and may happen when the power supply is not restored smoothly. This feature will protect major components of your heat pump from severe damage.

3: Compressor Protection:

a. There is a built in 3 minute time delay before the compressor is allowed to re-start after a power failure.

The compressor will continue to run for approximately 90 seconds after a heating or cooling call has been satisfied.

b. High temperature protection

In heating mode, the system will shut down the compressor and display error code # 9 on the controller if the temperature at the air coil "U" tube exceeds 68*C (154℉)

c. High Pressure Switch

The high pressure switch is a normally closed switch that will open if the refrigerant pressure exceeds the pressure rating of the switch. If the switch opens and stays open for more than 1 second, the compressor will shut down and the system will go into a lockout condition. Once the cause has been determined, the heat pump must be manually re-started by turning off the power at the controller and then turning it back on. Error code # 3 will be displayed on the controller when a high pressure fault occurs.

d. Low Pressure Switch

The low pressure switch on TILI Geothermal heat pumps is continually monitored by the micro-computer and the system will evaluate whether or not the system should be shut down or that it is normal based on the conditions and it can continue to operate.

On a call for heating or cooling, the low pressure switch is monitored after a time lag of 7 seconds. If the low pressure switch opens after that time and remains open for 10 seconds, the compressor will shut down. After two minutes the heat pump will re-start. If the pressure switch closes within 10 seconds after the 7 second time lag has elapsed, it is considered to be normal and the system will continue to operate. If the switch remains open longer than 10 seconds and the condition occurs 3 times within one hour, the heat pump will shut down and error code # 02 will be displayed on the controller. Once the problem is corrected, the unit can be manually re-started by turning on the power at the controller.

e. Water Flow Switch (when applicable)

The Water Flow Switch will shut down the compressor if it opens for longer than 2 seconds. It will reset automatically. Error code # 01 will be displayed on the controller if this condition occurs.

Sensors

TILI Geothermal heat pumps are equipped with 4 primary sensors. If any sensor fails, the compressor will shut down and an error code will be displayed on the controller identifying the specific sensor that needs to be replaced. When problem is resolved, the unit will reset itself automatically.

Refrigerant Leak Detection

In the event of a refrigerant leak, the unit is equipped with an automatic leak detection system and will shut the unit down.

In cooling mode, if the compressor runs for more than 30 minutes, and the air side coil temperature exceeds 25*C (77°F) for more than 5 minutes, the compressor will shut off and error code # 08 will be displayed on the controller. This confirms a loss of refrigerant.

In heating mode, if the compressor runs for more than 30 minutes, and the coil temperature is below 17*C (63°F) for more than 5 minutes, the compressor will shut off and error code # 08 will be displayed on the controller. This confirms a loss of refrigerant.

Leaving Water Temperature Sensor

In the heating mode, if the leaving water temperature is below -10C (14°F) or in cooling mode, the leaving water temperature is above 52*C (126°F) the system will shut off and error code # 13 will be displayed on the controller. The system will also shut down and display error code # 13 on the controller when the difference between the entering and leaving water temperatures on the ground loop side of the system is above 14C (25°F).

COOLING MODE:

When the room temperature is ½*C (1°F) above the temperature setting on the controller, the compressor will turn on.

When the room temperature is 1*C (2°F) lower than the setting on the controller, the compressor will turn off.

Air Coil Freeze Protection:

During the cooling mode, when the compressor runs for 10 minutes continuously, and the air coil temperature drops below 0*C (32°F) for more than 2 minutes, the compressor will shut off and the fan speed will increase to "high" speed regardless of any pre-selected setting. The compressor will re-start when the air coil temperature exceeds 12*C (54°F) for more than 1 minute.

● DEHUMIDIFYING MODE:

If the de-humidification mode is entered, the de-humidifying mode only works during a call for cooling. The fan will operate at different speeds based on the conditions in the home for a period of 12 minutes or until the house temperature is 1*C (2°F) lower than the set-point temperature and the call for cooling is satisfied.

● HEATING MODE:

When the room temperature is 1*C (2*F) lower than the set-point temperature on the controller, the compressor will turn on.

When the room temperature is 1*C (2*F) higher than the set-point temperature on the controller, the compressor will shut off,

Anti-cool draft and fan operation in heating mode;

When the temperature is rising:

If the air coil temperature is below 20*C (68*F), the blower is off unless a fan speed other than the automatic mode has been selected on the controller.

On a call for heat, if the fan is not already running, it will start on the low speed when the air coil temperature rises above 25*C (77℉).
When the air coil temperature reaches 30*C (86*F), the fan will change to the medium speed and when the coil temperature reaches 35*C (95℉), the fan will change to the high speed.

★ **When the temperature is falling:**

When the coil temperature drops below 30*C (86℉), the blower will operate on medium speed.

When the coil temperature drops below 25*C (77℉), the blower will operate on low speed.

If the coil temperature is drops below 20*C (68℉), the blower will shut off.

AUXILIARY HEAT

Auxiliary heat will only turn on if all of the following conditions are met:

- ★ In heating mode, the auxiliary heat button is set to the on position. The Electric heating LCD symbol flashes indicating the auxiliary heat mode is enabled. A solid light indicates that the auxiliary heat is on.
- ★ The air coil temperature is lower than 50*C (122°F)
- ★ The house or return air temperature is lower than 23*C (73°F)
- ★ Set-point temperature on the controller is 2*C (3.6*F) higher than sensed at the controller

Auxiliary heat will shut off if any of the following occur:

- ★ The heat mode is deactivated.
- ★ The auxiliary heat button has been switched to the off position.
- ★ The air Coil temperature is higher than 50*C (122°F).
- ★ The house or return air temperature is higher than 25*C (77°F).

  The house or return air temperature is 1*C (2°F) higher than the controller set–point temperature.

The blower must be energized for the auxiliary heat to operate. If the blower is de-energized, the auxiliary heat contact will open 60 seconds later.

1. **Reversing Valve Operation**

The Four Way Reversing Valve is energized in the heating mode. On a call for heating, the reversing valve is energized 10 seconds before the compressor is allowed to start and at the end of the heating call, the reversing valve will de-energize 55 seconds after the compressor has turned off to allow for refrigerant pressure equalization.

2. **High or Low water temperature protection**
(Refer to water temperature protection setting instructions)

★ **In Cooling or Dehumidifying modes,**

If the leaving water temperature is lower than T1-5℉ (23℉-5℉=18℉) or higher than T2-5℉ (104℉-5℉=99℉) the compressor will not turn on and error code # 11 will be displayed on the controller. If this occurs and lasts longer than 20 seconds after the compressor has been turned on and the water temperature is higher than T2 (104℉) or when the units water temperature is lower than T1 (23℉) after 3 minutes, the compressor will shut off. The compressor will turn on again in 2 minutes if the water temperature is above T1-5℉ (18℉) and below T2-5℉(99℉).

★ **In heating mode,**

★ If the entering water temperature is lower than T3+5℉(23℉+5℉=28℉) or higher than T4+5℉ (86℉+5℉=91℉) , the compressor will not start. If this occurs and lasts longer than 20 seconds after the compressor has been turned on and the water temperature is lower than T3 (23℉) or when the units water temperature is higher than T4 (86℉) , after 3 minutes, the compressor will shut off. The compressor will turn on again in 2 minutes if the water temperature is between T3+5℉ (28℉) and T4+5℉(91℉). Showing failure code No.: 11

★ **If high-or-low temperature protection happens 3 times within 30 minutes, then the system will lock out and needs to be reset manually . Showing failure code No.: 10**

T1	(Snow flake symbol on , ice-cube symbol blinks) Minimum entering water temperature in cooling,	setting range: 23℉---68℉	Factory Setting 23 ℉
T2	(Snow flake symbol on, flame symbol blinks) Maximum entering water temperature in cooling,	setting range: 86℉---122℉	104 ℉
T3	(Sun symbol on, ice-cube symbol blinks) Minimum entering water temperature in heating ,	setting range: 14℉---45℉	23 ℉
T4	(Sun symbol on, spark symbol blinks) Maximum entering water temperature in heating,	setting range: 77℉---104℉	86 ℉
T5	(water droplet symbol blinks) Minimum leaving water temperature in heating,	setting range: 5℉---41℉	14 ℉
T6	(fan symbol blinks) Maximum leaving water temperature in cooling,	setting range: 113℉---131℉	126 ℉
T7	(sun symbol blinks) Lag time before low pressure monitoring,	setting range: 20s---199s	90 sec

● FAN OPERATION (While in Heating or Cooling mode)

3. Fan speeds can be set to high, medium, low and automatic on the controller. When set to automatic, the fan speed will automatically adjust itself based on the house temperature and set point on the controller and the air coil refrigerant temperature.

FAN MODE

If set to "fan" mode, only high, medium and low fan speeds can be selected. When in the Fan Mode, the heat pump will not operate in the heating or cooling modes. The fan mode is used when fan only operation is desired without the need for heating or cooling.

The fan mode can also be used for emergency heat by pressing the auxiliary heat button. The auxiliary heat will turn on until the ambient air temperature measured at the controller is 25*C (77°F), then the auxiliary heat will shut off. This feature can be used in the event that the heat pump malfunctions.

The fan can be configured to operate continuously on low speed if desired or to shut down completely once a heating or cooling cycle is complete. To access this feature, press and hold the fan button on the controller for approximately 5 seconds. The no fan option is identified by a melting ice cube displayed on the controller. The continuous fan selection will remove the ice cube.

● AUTOMATIC MODE:

When set to "automatic", the unit will work in heating or cooling modes based on the temperature in your home.

★ If the system is in heating mode an the house temperature is more than 3.5*C (6°F) above the controller set point temperature, the compressor will shut off for 10 minutes and automatically switch to the cooling mode.

★ If the unit is in cooling mode and the house temperature is more than 3.5*C (6*F) below the controller set point temperature, the compressor will shut off for ten minutes and automatically switch to the heating mode.

***Note: The blower start up will be delayed if the return air or room temperature is below 68°F to prevent a cool draft situation on start up and allows the air coil to attain a higher surface temperature before the blower is energized. This is the anti-cold draft feature.

● Diagnostic Error Codes:

1	Water Flow Switch (if equipped)	**01**
2	Low pressure switch	**02**
3	High Pressure Switch	**03**
4	Room temperature probe short-circuit or open-circuit	**04**
5	Air coil Refrigerant temperature probe short-circuit or open-circuit	**05**
6	Entering water temperature probe short-circuit or open-circuit	**06**
7	Leaving water temperature probe short-circuit or open-circuit	**07**
8	Refrigerant leak detected	**08**
9	Air Coil refrigerant temperature exceeds 154°F	**09**
10	Abnormal entering water temperature has occurred 3 times in a thirty minute period	**10**
11	Abnormal entering water temperature	**11**
12	Abnormal leaving water temperature	**13**
13	Communication Fault	**31**

CONTROLER KEY IDENTIFICATION

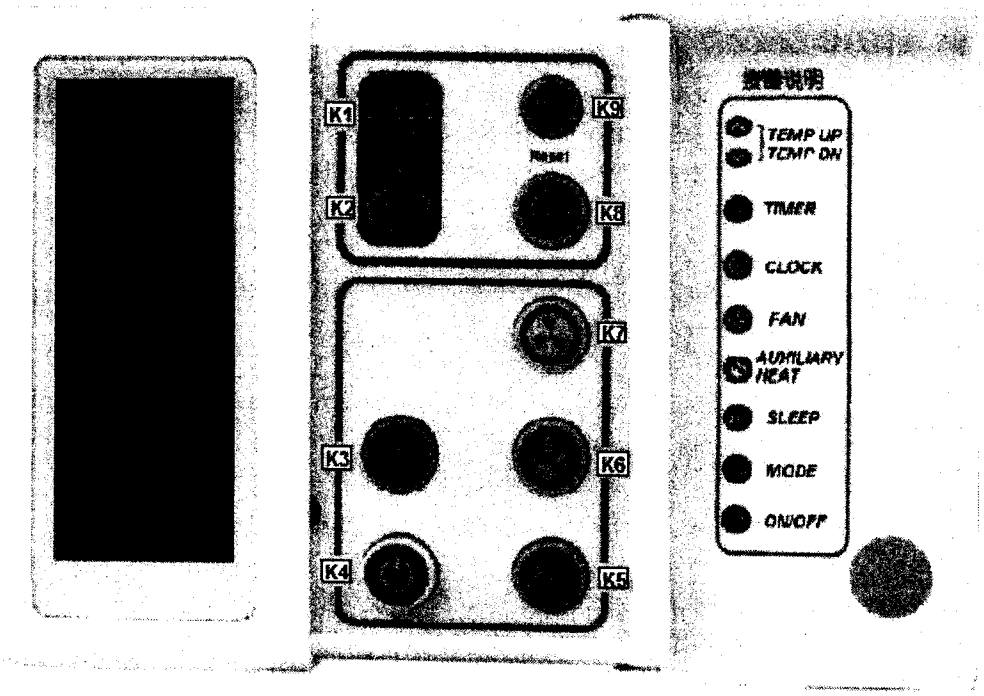
1. Main controller key identification:

K1 **Raise temperature**
K2 **Lower temperature**
K3 **MODE ------ mode change**
K4 **ON/OFF ------ system on/off**
K5 **Z z z ------ sleep mode**
K6 **Auxiliary/Emergency heat**
K7 **Fan speed setting,**
K8 **Adjusting clock**
K9 **Timer setting**

DISPLAY

To change the display form Fahrenheit to Celsius, press and hold the auxiliary heat button (K6) for approximately 5 seconds. Press and hold again to return to Fahrenheit.

Controller:



1. Setting the Clock

Press the K8 (clock symbol) button, the minute display will blink. Press the K8 button again to adjust the minutes. Press and hold down the K8 button for over 3 seconds to advance the minutes rapidly, when the minute display twinkles, press down the "MODE" key to adjust the hours. The hours will blink, then press down K8 again to adjust the hour

2. **Timer function:** (Turn the Controller off for this function)

Press down the "TIMER" button (K9), the timer "ON" time blinks and can be changed by pressing the K8 button. Then press the "TIMER" button again and the time "OFF" time blinks, then adjust the "OFF" time by pressing the K8 button. When finished, the LCD screen will show "TIME ON" or "TIME OFF" depending on which function you've selected. When the desired time is reached, the heat pump will automatically turn on or off. The Timer function can be re-adjusted at any time by depressing the timer button.

4. Real Time temperature verification:

Turn heat pump on and press and hold the "Z z z" button (K5), This action will open the temperature verification interface, press the temperature up (K1) or temperature down (K2) to scroll through the various relevant temperatures, the details are as follows:

Cooling pattern symbol – snowflake – blinking: displays the temperature sensed at the Controller

Dehumidification symbol – dripping water – blinking: displays the temperature measures at the air coil "U" tube. (refrigerant temperature)

Fan symbol – fan – blinking: displays the loop entering water temperature.

Heating symbol – sun – blinking: displays the loop leaving water temperature.

*Note: Program will exit automatically if no buttons are depressed for 5 seconds.

IMPORTANT!

This section should only be used by Certified Technicians who are thoroughly familiar and trained in geothermal systems. Improper settings could severely and/or permanently damage the heat pump. Any heat pump damaged as a result of improper settings in the setting interface will result in the warranty being null and void. If there is any doubt in adjusting the settings, please call TILI and ask for technical support.

Water temperature protection set point adjustments:

To enter the setting interface, the controller must be turned to the off position. Once the settings are entered, they are burnt into the memory and will remain in effect permanently. The settings can be changed at any time through the installer set up procedure.

With the controller turned off, press and hold the "SLEEP" button for 5 seconds to enter the setting interface. The settings are made to the desired function based on the symbol displayed on the LCD , the details are as follows:

Press down the "MODE" key to choose the setting you wish to modify. Press the temperature up" or "temperature down" key to adjust the set points.
If no keys are depressed for 5 seconds, the controller will automatically exit the set-up mode.

INSTALLER SET-UP INTERFACE

When entering into the setting interface, the LCD will display the following symbols to identify the setting functions:

T1	(snowflake does not blink, ice-cube blinks) Minimum entering water temperature set point in the cooling mode: 23℉---68℉
T2	(snowflake doesn't blink, fire symbol blinks) Maximum entering water temperature in the cooling mode: 86℉---122℉
T3	(Sun does not blink, ice-cube blinks) Minimum entering water temperature in the heating mode: 14℉---45℉
T4	(Sun does not blink, spark blinks) Maximum entering water temperature in the heating mode 77℉---104℉
T5	(water droplet blinks) Minimum leaving water temperature in any mode: 5℉---41℉
T6	(fan symbol blinks) Maximum leaving water temperature in any mode: 113℉---131℉.
T7	(sun blinks) Low pressure switch monitoring time (in seconds) before fault indication occurs: 20s---199s
	Remarks: the above temperatures No.1—4 are the temperatures set when the compressor starts. If the compressor does not start the temperature settings will increase by 5℉ from the above settings in the heating mode and decrease by 5℉ from the set point during the cooling mode.

Note: When the temperature displayed is over 99℉, the LCD numeric display will blink.
Example: if "12" is flashing on the LCD, the value is actually "112".

FACTORY SETTINGS

T1	(Snow flake symbol on , ice-cube symbol blinks) Minimum entering water temperature in cooling,	setting range: 23℉---68℉	Factory Setting 23 ℉
T2	(Snow flake symbol on, flame symbol blinks) Maximum entering water temperature in cooling,	setting range: 86℉---122℉	104 ℉
T3	(Sun symbol on, ice-cube symbol blinks) Minimum entering water temperature in heating ,	setting range: 14℉---45℉	23 ℉
T4	(Sun symbol on, spark symbol blinks) Maximum entering water temperature in heating,	setting range: 77℉---104℉	86 ℉
T5	(water droplet symbol blinks) Minimum leaving water temperature in heating,	setting range: 5℉---41℉	14 ℉
T6	(fan symbol blinks) Maximum leaving water temperature in cooling,	setting range: 113℉---131℉	126 ℉
T7	(sun symbol blinks) Lag time before low pressure monitoring,	setting range: 20s---199s	90 sec
T8	Set at 00		

CIRCUIT BOARD LAYOUT & TERMINAL IDENTIFICATION