TC-102

STORAGE TANK TEMPERATURE CONTROL

1. APPLICATION

TC-102 is a 24-volt two stage temperature control for maintaining the water temperature in a storage tank. Operating mode can be selected by an input signal. An auxiliary relay for controlling a fan or pump is also provided. One NTC type temperature sensor can be provided with the control as an option. TC-102 can also work with any general purpose 10K NTC sensor.

2. FEATURES

2.1 Programming mode

2.1a Heat Setting

- Press and hold SET button for 3 seconds, the display will change from showing the sensed temperature to show the P01 program number.
- Press ▲ or ▼ button to select P01 to P05 program numbers.
- Press SET again to show the selected program parameter setting.
- Press ▲ or ▼ button to change the selected parameter setting.
- Press SET to confirm and show the next program number.
- Repeat for P02 through P05.

2.1b Cool Setting

- Press & hold ❄ button for 3 seconds, the display will change from showing the sensed temperature to show the P06 program number.
- Press ▲ or ▼ button to select P06 to P10 program numbers.
- Press ❄ again to show the selected program parameter setting.
- Press ▲ or ▼ button to change the selected parameter setting.
- Press ❄ to confirm and show the next program number.
- Repeat for P07 through P10.

Note : 1. If no button is pressed within 10 seconds, unit will automatically exit from programming

mode and go to normal run mode.

2. Restore default setting by pressing & holding ▲ and ▼ buttons for 3 seconds within 10 seconds of power-up.
3. Refer to the programming section for changing parameters P01 to P10.

2.2 Stage-1 relay operation

- **Heat mode**

  In Heat mode, the stage-1 relay will be turned on if:

  Temp of Tank (T) <= Stage 1 Heat Setpoint – Stage 1 Differential Temp.

  and it will be turned off when:

  Temp of Tank (T) > Stage 1 Heat Setpoint

- **Cool mode**

  In Cool mode, the stage-1 relay will be turned on if:

  Temp of Tank (T) >= Stage 1 Cool Setpoint + Stage 1 Differential Temp.

  and it will be turned off when:

  Temp of Tank (T) < Stage 1 Cool Setpoint

2.3 Stage-2 relay operation

There is a selectable time delay between stage 1 and stage 2 outputs. Once the time delay is satisfied, stage-2 relay will operate as per the stage 2 setpoint chosen. Stage 2 can only be on if Stage 1 is on.

- **Heat mode**

  In Heat mode,the stage-2 relay will be turned on if:

  Temp of Tank (T) <= Stage 2 Heat Setpoint – Stage 2 Differential Temp.

  and it will be turned off when:

  Temp of Tank (T) > Stage 2 Heat Setpoint

- **Cool mode**

  In Cool mode,the stage-2 relay will be turned on if:

  Temp of Tank (T) >= Stage 2 Cool Setpoint + Stage 2 Differential Temp.

  and it will be turned off when:

  Temp of Tank (T) < Stage 2 Cool Setpoint

2.4 Auxiliary Relay operation

There is an auxiliary relay for control of fan or pump. It will operate as below

Stage relay operation.	Auxiliary relay operation.
Stage-1 or Stage-2 relay is turned on	Terminal 6 (R) will be connected to Terminal (A1)
Stage-1 and Stage-2 relay are turned off	Terminal 6 (R) will be connected to Terminal (A2)

2.5 Key Lock/Unlock

Press & hold ▲ and ▼ buttons for 3 seconds to lock keyboard. If any key is pressed while keys are locked, the 7-segment display will show "LOC" for 2 seconds and then return to show the temperature of the tank. This facility is to prevent an unauthorized person from changing any setting. To unlock keyboard, press & hold ▲ and ▼ for 3 seconds again.

3. SYSTEM FEATURE

3.1 Watch dog

There is a watchdog circuit to reset the MCU if it malfunctions due to voltage fluctuation or other abnormality.

3.2 Non-volatile memory

All setting parameters are kept in non-volatile memory. If there is a power-interruption, the control will resume normal operation automatically.

3.3 Sensor error

When the temperature sensor has failed (open/short circuit), the stage-1 relay and the stage-2 relay will be turned off.

The display will blink error code as "E1"

3.4 Mode selection

- TC-102 will operate in Heat or Cool mode as below :
- TC-102 will operate in Cool mode, if 24 VAC is applied to terminal 9(O).
- TC-102 has no function specific for Terminal 10(B) on this model.
- TC-102 will operate in Heat mode, if nothing is applied to terminal 9. So, default mode is Heat mode.

3.5 Front panel LEDs & 7-segment

- 7-segment will display the temperature of tank in Fahrenheit in normal operation.
- Status LED is lit if stage-1 or 2 relay is ON.
- Heat LED is lit when the control is in Heat mode (default).
- Cool LED is lit when the control is in Cool mode.

3.6 Momentary Power Interruptions

- TC-102 control will reset after a short momentary power interruption.

4. PROGRAMMING PARAMETERS

The following parameters can be programmed by the user.

Program	Parameter Description	Default setting from factory	Resolution (step adjust)	Minimum setting	Maximum setting
P01	Stage 1 Heat Setpoint	120 ºF	1 ºF	60 ºF	140 ºF
P02	Stage 1 Heat Differential	20 ºF	1 ºF	5 ºF	20 ºF
P03	Time delay between Heat stage 1 and stage 2	5 minutes	1 minute	2 minutes	10 minutes
P04	Stage 2 Heat Setpoint	110 ºF	1 ºF	60 ºF	140 ºF
P05	Stage 2 Heat Differential	20 ºF	1 ºF	5 ºF	20 ºF
P06	Stage 1 Cool Setpoint	40 ºF	1 ºF	34 ºF	60 ºF
P07	Stage 1 Cool Differential	10ºF	1 ºF	5 ºF	20 ºF
P08	Time delay between Cool stage 1 and stage 2	5 minutes	1 minute	2 minutes	10 minutes
P09	Stage 2 Cool Setpoint	45 ºF	1 ºF	34 ºF	60 ºF
P10	Stage 2 Cool Differential	10 ºF	1 ºF	5 ºF	20 ºF

5. SPECIFICATION

Power	
Power Supply	24 Vac nominal, 18-30 Vac, 50/60 Hz.
Electrical Rating	
Stage-1 Relay rating	Maximum 2 A continuous
Stage-2 Relay rating	Maximum 2 A continuous
Auxiliary Relay N.O. contact rating	Maximum 2 A continuous
Auxiliary Relay N.C. contact rating	Maximum 1 A continuous
Ambient Operating Rating	
Operating Temperature	32ºF to +158ºF (0ºC to +70ºC)
Storage Temperature	-22ºF to +185ºF (-30ºC to +85ºC)
Operating Humidity	20-85% non condensing
Accuracy	
Sensor Accuracy @ 50ºF	± 1.3ºF
Sensor Accuracy @ 110ºF	± 1.6ºF
Control Accuracy	± 2ºF
Temperature Sensor (optional)	Copper tube probe
Sensor Type	10.74K NTC
Length	Standard length of 1.5 m. (4.9 feet) (can be extended to 3 m. in field installation)

6. TERMINAL

Terminal	Name	Description
1	R	Not used on this model.
2	A1	Auxiliary Relay N.O. contact Closed if Stage 1 or 2 is on
3	A2	Auxiliary Relay N.C. contact Open if Stage 1 or 2 is on
4	Y	STAGE 1 Relay N.O. contact (power from Terminal 6)
5	Y2	STAGE 2 Relay N.O. contact (power from Terminal 6)
6	R	24 VAC hot from external transformer
7	C	24 VAC common from external transformer
8	O	Internally connected to Terminal 9
9	O	24 VAC input for Cool mode selection
10	B	Not used on this model.
11	Ts	Temp Sensor
12	Ts	Temp Sensor

7. DIMENSION