

Installation, Operation and Maintenance Manual

CEMLINE CORPORATION

T775 Electronic Temperature Controller

The T775 Electronic Temperature Controller is used to provide high limit safety shutdown on Cemline steam- and boiler-fired water heaters. It also provides a digital readout of the water heater operating temperature. Specifications are as follows:

CONTACT RATINGS:

- ½hp; 9.8 FLA, 58.8 LRA at 120 Vac.
- ½hp; 4.9 FLA, 29.4 LRA at 240 Vac.
- 125 VA pilot duty at 120/240 Vac.
- 10A at 24 Vac (resistive).

SENSOR: Positive coefficient platinum type, 4.8 ohms/°F, 1000 ft. maximum distance between sensor and solid state controller (requires calibration over 400 ft.). To maintain NEMA 4X rating, use environmental proof cable and sensor.

TEMPERATURE ACCURACY: $\pm 1^\circ\text{F}$ (at nominal voltage in 77°F [25°C] ambient, nominal sensor value). Accuracy may vary based on deviation from nominal values of input voltage, operating ambient and sensor ambient.

DISPLAY RESOLUTION: Sensed temperature and other operating parameters are displayed via a liquid crystal display (LCD) with a resolution of 1°F or 1°C .

SETPOINT ADJUSTMENT RANGE:
 -40° to 220°F (-40° to 104°C).

OPERATING AMBIENT TEMPERATURE:
 One and Two Stage units: -30° to 140°F .
 Three and Four Stage units: -30° to 125°F .

OPERATING HUMIDITY: 5% to 95% relative humidity (RH) noncondensing.

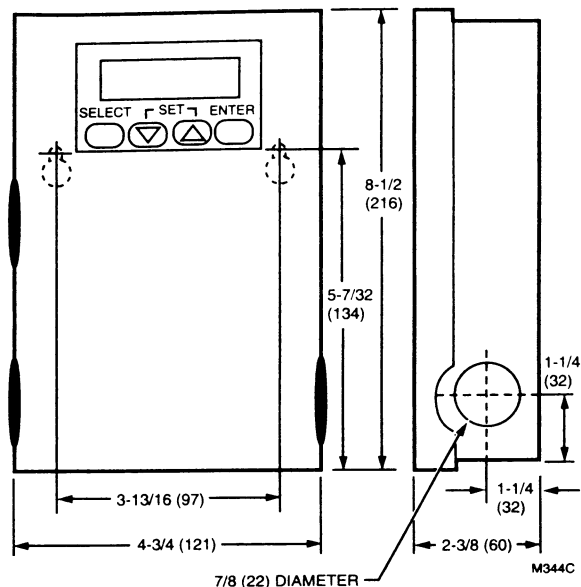
APPROVALS:

Underwriters Laboratories Inc.
 Listed: File no. E4436.

Canadian Standards Assoc. certified:
 File no. LR47125.

MOUNTING: Mounts on any suitable horizontal or vertical surface.

Fig. 1—Approximate dimensions of T775A,B in in. (mm).



OPERATION & MAINTENANCE:

▷ **WARNING!** Disconnect power before opening panel to prevent electrical shock or equipment damage.

SENSOR:

The sensor is mounted in a well in the vessel.

CONTROLLER:

The controller is designed to operate on 120 volts AC. The electrical connections are inside the cover. Be sure that the 120 volts is connected to the terminals marked "COM" and "120V AC."

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CONTROL ALGORITHM:

The thermostat is designed to be a high limit only. The operating control is the pneumatic controller on air-operated systems and the pilot on pilot-operated systems and dial control on electronic systems. As a limit control, this thermostat should be set at a temperature above the operating temperature.

TEMPERATURE LIMIT:

In every case, this controller will operate an electric solenoid valve.

PNEUMATIC (AIR OPERATED) SYSTEMS:

If the heater has an air-operated valve, the solenoid is a 3-way valve. This valve is energized during normal operation. On high temperature condition the 3-way solenoid will be de-energized. This will close the flow of air to the control valve and bleed the air in the control valve to atmosphere on high temperature condition. **CAUTION:** Do not plug the vent port, port #3 (top port) on the 3-way solenoid valve. This port must be open to atmosphere at all times.

PILOT-OPERATED SYSTEMS:

On pilot-operated systems, there is a normally closed solenoid in the pilot line which will be held open by this controller. On an over temperature condition the limit controller will open the internal relay and the pilot solenoid will close, thus causing the pilot-operated valve to close.

ELECTRONIC SYSTEMS:

This thermostat will disconnect electric power to the electronic valve on over temperature condition, causing the valve to close.

NOTE:

The control valve will not operate on loss of power. If the operation of this heater is critical, arrangements should be made to connect the heater to an emergency power supply. The load for the solenoid and controller is 5 amps; check the amp rating of the pump for total power required.

WATER DUMP VALVE:

Some units are furnished with a second solenoid (water dump valve) which is connected to the hot water outlet. On these units the water dump valve will open at a set point, normally higher than the limit temperature, and dump the hot water in the heater to drain. Be sure to pipe the outlet from this solenoid to drain.

NORMAL SETTINGS:

Heaters normally come from the factory set to operate at 140 deg. F. and this limit control is designed to shut the heater off at 150 deg. F. and (if furnished) to open the water solenoid at 160 deg. F. This gives a 10 deg. F. differential between the set point and limit control and a 20 deg. F. differential between operating temperature and water dump (if furnished).

OPERATION OF THE CONTROLLER:

There is a liquid crystal display (LCD) on the front of the unit which displays sensed temperature and other parameters. There are 4 key buttons on the front of the unit. They are marked SELECT, SET DOWN (▽), SET UP (△) and ENTER. The functions of these buttons are as follows:

SELECT: This button is used to prompt the user about what parameter is being displayed. The parameters are

1. **SENSOR.** This is the temperature at which the water heater is operating.
2. **SETPOINT.** This is the setpoint at which the limit control relays will operate.
3. **DIFFERENTIAL.** This is the differential between the setpoint and relay output (see page 3).
4. In the lower right of the LCD is the number 1 or 2. This displays which relay output is being displayed. ▷ **NOTE:** RELAY 1 is used for the limit control; RELAY 2 is used for the dump valve.
5. **HEAT OR COOL.** For Stage 1 (limit control), HEAT should be displayed. For Stage 2 (dump valve), COOL should be displayed. It should not be necessary to change modes. However, to change mode, push SELECT and ENTER simultaneously and then push the up arrow (△) to change to HEAT or the down arrow (▽) to change to COOL. Push ENTER after a heat or cool mode change is made to enter into memory.

▷ **NOTE:** Once power is applied or restored to the limit controller, the display will count down from 210 seconds to 0 seconds, during which time outputs will be de-energized. To avoid viewing the entire countdown, press SELECT and the LCD display will show normal SENSOR display.

SETTING/OPERATION:

In normal operation, this is what should be displayed. The LCD should read

	°F
SENSOR	
HEAT	
STAGE 1 ENERGIZED	

Push the SELECT button once and the LCD should read

	°F
SETPOINT	
SENSOR	
HEAT	1

This is the setpoint at which this controller will close the control valve. This setpoint can be changed by pushing the SET UP (Δ) or SET DOWN (∇) buttons. Normal setting is 5 to 10 degrees above the operating temperature. ▷NOTE: After changing the setpoint you must push the ENTER button to place the new value in memory.

Push the SELECT button a second time and the LCD should read

	°F
SENSOR	
HEAT	
DIFFERENTIAL	1

The temperature displayed is the differential between the limit setpoint temperature and the temperature at which the limit control relay will close.

HEATING MODE OPERATION (TEMPERATURE LIMIT)

- Relay output is energized at the temperature setpoint minus the differential value.
- Relay output is de-energized at the temperature setting.

COOLING MODE OPERATION (DUMP VALVE TEMPERATURE)

- Relay outputs are energized at the temperature setpoint plus differential value.
- Relay outputs are de-energized at the temperature setpoint value.

▷NOTE: Normal differential setting is 2 deg. F.

For units without dump valve, push the SELECT button a third time and return the LDC to the original display.

FOR UNITS WITH DUMP VALVE ONLY:

Push the SELECT button a third time and the LCD should read

	°F
SETPOINT	
SENSOR	
COOL	2

This is the temperature at which the dump valve will open. Pushing the SET UP (Δ) or SET DOWN (∇) buttons will change this setting. Normal setting is 15 to 20 deg. F. above the operating temperature.

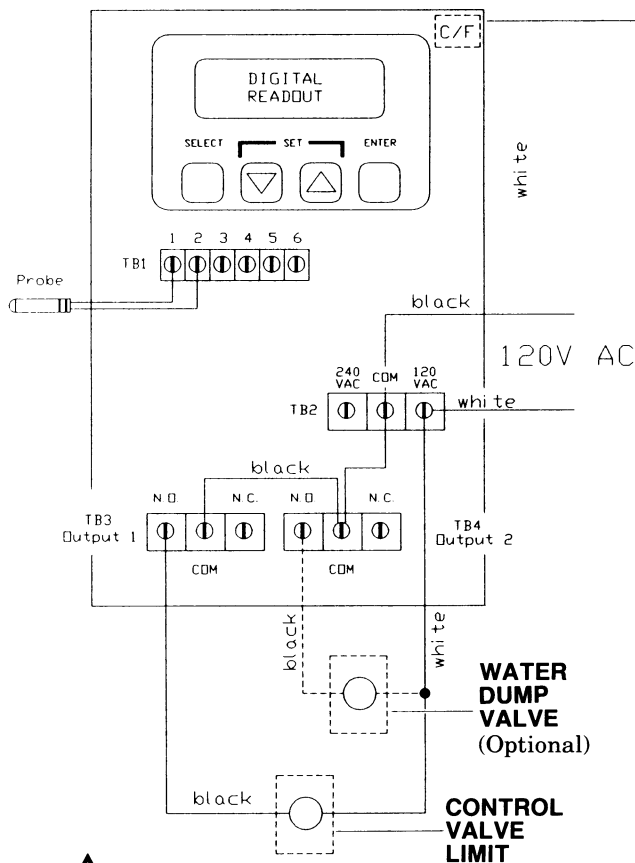
Push the SELECT button a fourth time and the LCD should read

	°F
SENSOR	
COOL	
DIFFERENTIAL	2

This is the differential as described above.

Pushing the SELECT button a fifth time will return the LCD to the original display.

**Fig. 2—Two-stage control, 120 Vac input;
120 Vac load.**



°F/°C SELECTION

A single jumper plug controls °F/°C indication of the displayed temperature value. The unit is shipped with the jumper installed in the °F mode. To operate the device in the °C mode, remove the jumper. Replacing the jumper will reinstate the °F mode.

ERROR MESSAGES

There are seven error messages that can be displayed in response to software or hardware problems with the T775. The error Codes flashing on the display are:

SF — Sensor Failure

If the display shows a flashing SF, this indicates an out-of-range or defective sensor. Make sure that the sensor is connected properly. For T775A, all loads will be de-energized when this error message is flashing. **▷ NOTE:** Sensor values below -40°F or above 220°F will be out-of-range.

EF — EEPROM Failure

The values read back from the EEPROM are not the same as written into the EEPROM. This error cannot be field repaired. Replace the device. The EEPROM is not intended to be field repaired.

CF — Calibration Failure

A calibration resistor reading was not within the range of the Analog to Digital converter. This error cannot be field repaired. Replace the device.

OF — Stray Interrupt Failure

An unused interrupt occurred. This error cannot be field repaired. Replace the device.

CE — Configuration Error

The device hardware was configured to a nonexistent device. This error cannot be field repaired. Replace the device.

OE — ROM Error

The internal Read Only Memory (ROM) of the microprocessor is defective. This error cannot be field repaired. Replace the device.

AE — RAM Error

The internal Random Access Memory (RAM) of the microprocessor is defective. This error cannot be field repaired. Replace the device.



CAUTION

The T775 will not allow the user to program for both heating and cooling loads to be energized at the same time.

If this situation results, cooling loads will be energized and heating loads will be prevented from also energizing. The number (1, 2, 3, 4) of these non-energized loads will flash along with the word HEAT to indicate a call for both heating and cooling loads controlled by one sensor has occurred and to alert the user to reprogram the affected control values.

▷ IMPORTANT: For the T775A: After initial programming, altering the setpoints for Stage 1 up or down will result in a change in setpoint 2, by the same number of degrees and in the same direction. If increasing or decreasing the setpoint for Stage 1 results in exceeding the control limits (-40° to +220°F [-40° to +104°C]) for subsequent stages, the control will not allow the user to enter a value for Stage 1 higher or lower than this limit. This will allow for easy sequential output staging to be modified while keeping the margin intact between setpoints.