OptiCHEM By CHEMGLASS

CG-15001 Series Temperature Controller

OPERATIONS MANUAL

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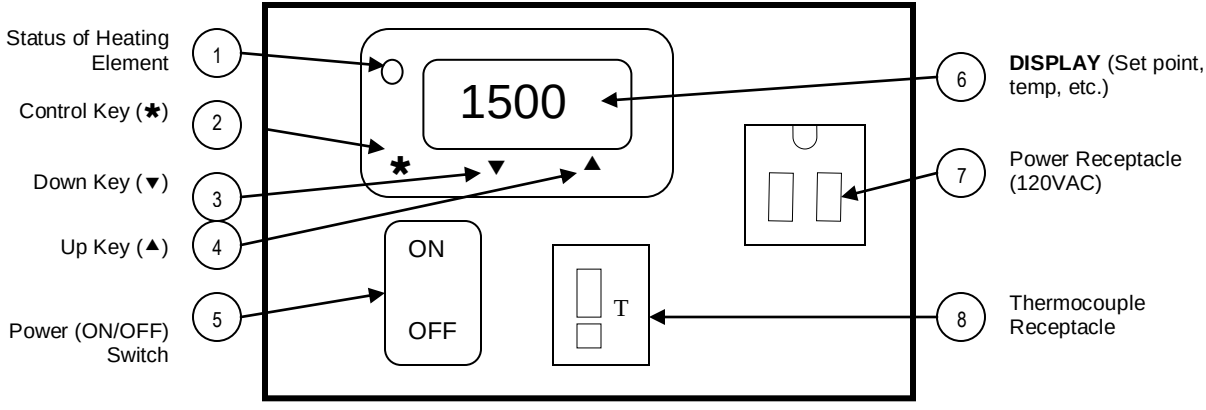
QUICK SET-UP

**This unit has been factory tuned for use with Heating Mantles sized 1L to 12L.*

1) Ensure that the Power Switch (On/Off switch) on the Controller is in the OFF position.
2) Plug Power cord of Chemglass 15001 Series Controller into a 120VAC receptacle.
3) Plug the Heating Device Cord into the 120VAC power receptacle on the Controller.
4) Insert the correct Thermocouple Plug into the Thermocouple Receptacle on Chemglass 15001 Series Controller. NOTE: Color of Thermocouple Plug must be the same color as the Thermocouple Receptacle.
5) Place Thermocouple Probe into medium. NOTE: Probe should not be in contact with bottom or sides of heating vessel, and should be submerged 2/3rds of medium content.
6) Turn Power Switch "ON", and then enter the desired temperature set point via the Controller's keypad. Press and hold the ✱ key, then press ▲ key to increase or, press ▼ key to decrease set point. Once set, the Controller will display the actual temperature of the medium being measured. The set point can be displayed at anytime by pressing the ✱ key.

FRONT PANEL VIEW



TUNING

Tuning is the process that matches the control characteristics of the controller to the heating characteristics of the heater. The controller is said to be tuned to the heater when its memory is programmed with values telling it how fast the heater warms up, cools off, and how efficiently it transfers heat.

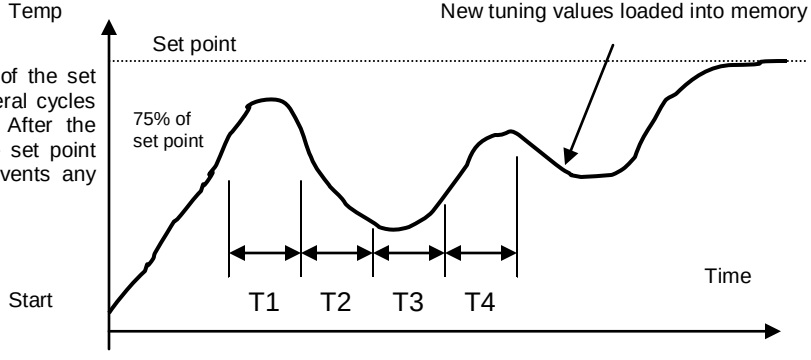
For example, consider the difference between a heat lamp and a heating mantle. When electricity is applied to a heat lamp it begins to heat instantaneously, and when it's turned off it stops heating instantaneously. In contrast, a heating mantle may take several minutes to begin heating when electricity is applied and even longer to start cooling when electricity is turned off. Your controller can typically regulate both a heat lamp and a heating mantle to +/- 1 °C.
The Controller must be programmed with the time constants, which control how fast the heater heats when electricity is turned on, and how fast it begins to cool when it is turned off. These time constants are called the *tuning parameter*s. Every type of heater has its own unique set of tuning parameters. For the controller to heat with stability, it must be programmed with the tuning parameters for the heater currently being used. Tuning parameters for Heating Mantles were programmed into the controller at the factory to maximize heating performance.
Tuning is regulated by five (5) of the temperature controller's user programmable functions. The correct value for these five (5) functions can be calculated and loaded by the user manually, or the controller can do it automatically with its autotune feature.

Auto Tuning

1. Set up the equipment in the exact configuration it will be used. For example, to tune to a vacuum oven, place the thermocouple in the room temperature oven and plug the oven cord into the controller's 120VAC power receptacle. NOTE: If the oven (or heater) has its own thermostat or power control, turn both to the highest limit.
2. Turn the controller and heater on, and enter the desired set point temperature. Press and hold the ✱ key, then press ▲ key to increase or, press ▼ key to decrease set point.
3. Press and hold in the ▲ and ▼ keys on the Controller until "**tunE**" is displayed then release both keys.
4. Press the ▲ key (5 times) until "**CyC.t**" is displayed.
5. Press and hold the ✱ key, simultaneously press the ▼ key. Hold both keys in until the display reads "**A--** ", or "**A**##" where "##" is some number.

6. Press the ▼ until "**tunE**" is shown on the display.
7. Press and hold the ✱ key and "**tunE**" will change to "**off**" to indicate that the autotune is currently off.
8. While holding in the ✱ key, press the ▲ key to change the display to read "**on**", and then release both keys.
9. Press and hold the ▲ and ▼ keys until the measured temperature appears on the display. The Controller is now in Autotune Mode. While in autotune the display alternates between "tunE" and the process temperature. When the autotune process is complete, which may take in excess of an hour, the Controller will only display the process temperature. The autotune procedure can be stopped at any time by repeating steps 3, 8, and 9 – except in step 8 press the ▼ key until "**off**" is displayed. NOTE: If "**tunE**" and "**FAiL**" alternate on the display, then the Autotune process has failed. See trouble shooting notes.

During autotune the controller heats to 75% of the set point temperature, where it oscillates for several cycles before loading the new tuning parameters. After the tuning parameters are loaded it heats to the set point temperature. Tuning below the set point prevents any damage that might occur from overheating.



During T1 – T4, the Controller measures rates of heating and cooling, as well as heating delays to determine tuning values.

Manual Tuning

Note: Manual Tuning should only be done when the following five (5) tuning parameters are known – Proportional Band “bAnd”, Integral Time “int.t”, Derivative Time “dEr.t”, Derivative Approach Control “dAC”, and Cycle Time “CyC.t”. For this sequence, we are using the values that represent a standard Heating Mantle.

1. Press and hold in both the ▲ and ▼ keys on the Controller until the display reads “**tunE**” then release both keys.
2. Press the ▲ key once and the letters “**bAnd**” are displayed.
3. While holding in the ✱ key, press the ▲ or ▼ key until the value “**10**” appears in the display.
4. Press the ▲ key once and the letters “**int.t**” are displayed.
5. While holding in the ✱ key, press the ▲ or ▼ key until the value “**10**” appears in the display.
6. Press the ▲ key once and the letters “**dEr.t**” are displayed.
7. While holding in the ✱ key, press the ▲ or ▼ key until the value “**50**” appears in the display.
8. Press the ▲ key once and the letters “**dAC**” are displayed.
9. While holding in the ✱ key, press the ▲ or ▼ key until the value “**5.0**” appears in the display.
10. Press the ▲ key once and the letters “**CyC.t**” are displayed.
11. While holding in the ✱ key, press the ▲ or ▼ key until the value “**30**” appears in the display.
12. Press and hold in both the ▲ and ▼ keys until the temperature appears in the display, then release both keys.

Modes of Operation

The Chemglass Digital Temperature Controller can heat in either of two (2) Operating Modes, PID (Proportional, Integral, and Derivative) or On/Off Mode. The difference between them is how they supply power to the heater.

In On/Off Mode, the Controller supplies power (ON) to the heater when the measured temperature is below the set point, and does not supply power (OFF) to the heater when the measured temperature is above the set point. Very simply, it turns "on" when below and "off" when above. The problem or disadvantage with this mode is that depending on the Heating Element used, the process temperature may overshoot the set point by a significant margin (>30°). For example, if using a heating block, due to the mass of the block, it will maintain heat and the temperature will continue to rise after the set point has been reached. Therefore, the medium may be above temperature for an unacceptable period of time. In contrast, a Heat Lamp will begin to cool instantaneously, so the overshoot margin would be minimal and may be acceptable. The On/Off Mode requires no tuning.

In the PID Mode the Controller monitors the rise in temperature during initial warm up and decreases power to the heater before the set point is reached so that there is minimal overshoot. PID mode also adjusts the percent of time the heater is on so that the set point is maintained accurately. The advantage of PID is that it delivers stable temperature control for virtually any heater type. The disadvantage is that the Controller must be properly tuned to the parameters of the heater.

ON/OFF Mode of Operation

The Controller is configured in the PID Mode at the factory. However, it can be changed to run in the ON/OFF Mode. Use the following sequence to set the Controller to run in the ON/OFF Mode.

1. Press and hold in both the ▲ and ▼ keys until the word "**tunE**" appears in the display, then release both keys.
2. Press the ▲ key until the letters "**CyC.t**" appear in the display.
3. While holding in the ✱ key, press the ▼ key until the letters "**on.of**" appear in the display. Note: if the letter "A" is displayed when the ✱ is pressed, then press the ▲ key until "**on.of**" is displayed then release both keys.
4. Press the ▼ key until the word "**bAnd**" is displayed.
5. While holding in the ✱ key, press the ▼ key until the value "**0.1**" appears in the display, then release both keys.

6. Press and hold in both the ▲ and ▼ keys until the temperature is displayed, then release both keys.

PID Mode of Operation

The Controller can be set back to the PID Mode by using the following sequence.

1. Press and hold in both the ▲ and ▼ keys until the word "**tunE**" appears in the display, then release both keys.
2. Press the ▲ key until the letters "**CyC.t**" appear in the display.
3. While holding in the ✱ key, press the ▲ or ▼ key until the value "**30**" appears in the display.
4. Press the ▼ key until the word "**bAnd**" is displayed.
5. While holding in the ✱ key, press the ▼ key until the value "**10**" is displayed, then release both keys.
6. Press and hold in both the ▲ and ▼ keys until the temperature is displayed, then release both keys.

Quick Tips

1) To reset alarms and error messages: Press ▼ and ▲ keys together briefly and release.
2) The temperature set point can be displayed at anytime by pressing the ✱ key.
3) To exit from a programming mode and return to normal operations: Press and hold both ▲ and ▼ keys for three (3) seconds or allow the auto-exit program to take effect after 60 seconds of inactivity.

Safety – Heater Restrictions

- Use only resistive loads that are safely operated at 120VAC and require less than 10 amps or damage to the Controller and a safety hazard may result.
- Do not use the Controller to regulate an exothermic process.

CAUTION: PARAMETER SETTINGS IN LEVEL 3 AFFECT THE FAIL SAFE STATE

Over-Temperature Protection Circuit

The Chemglass Digital Temperature Controller is equipped with an over-temperature protection circuit that turns OFF heating whenever the temperature of the medium rises 10°C above the set point. When the medium temperature falls below 10°C above the set point, the circuit is reset and the controller begins to operate normally. A flashing "-**AL**-" on the Display indicates an over-temperature condition.
If needed, use the following sequence to change the over-temperature value, which is factory set to 10°C.

1. Press and hold both the ▲ and ▼ keys until the word "**tunE**" appears in the display, then release both keys.
2. Press the ▲ key until the characters "**SEt.2**" appear in the display.
3. While holding in the ✱ key, press the ▲ or ▼ key until the desired value, i.e. "**15**", "**20**", "**30**" appears in the display. Then release all keys.
4. To return to normal temperature display, press and hold both the ▲ and ▼ keys until the temperature is displayed, then release both keys.

CAUTION: PARAMETER SETTINGS IN LEVEL 3 AFFECT THE FAIL SAFE STATE

Troubleshooting Guide

Problem	Possible Cause	Corrective Action
Large overshoot of the set point (>4°C)	Controller is not tuned for process being heated.	Tune the Controller. See Autotune section, pg. 4.
Unstable temperature control	Controller is not tuned for process. Heater is too large for process.	Tune the Controller. See Autotune section, pg. 4. Replace Heater – contact Chemglass' Technical Service
Controller comes on, but does not heat.	Heater has malfunctioned.	To verify that the controller is functioning, enter a set point of 100°C. Plug a light into the outlet of the controller; wait

		one minute, if the light comes on the controller is functioning properly.
"**inPt**" "**FAiL**" flashes	Temperature sensor is unplugged, corroded, or broken	Ensure Temperature sensor is plugged in. Clean or replace.
"**-AL-**" flashes	The process temperature is higher (+10°C) than the set point	See Over-Temp Protection section, pg. 9.
"**PArk**" flashes	Controller has been placed in 'Park' mode	1. Press and hold both the ▲ and ▼ keys until "**tunE**" is displayed. 2. While holding the ✱ key, press the ▼ key until "**oFF**" appears. 3. Press and hold the ▲ and ▼ keys until the temperature is displayed.
"**tunE**" "**FAiL**" flashes	Autotune routine has failed	Turn off Controller for 10 seconds and retry. If problem persists, call Chemglass' Technical Service.

Warranty

Chemglass, Inc. warranties this unit against defects in material and workmanship for a period of one year from the date of sale. If the unit should malfunction it must be returned for evaluation. If the unit is determined to have a defect in materials or workmanship then it will be repaired or replaced at no charge. Tampering or damage resulting from excessive current, heat, moisture, vibration, corrosive materials, or misuse will void this warranty. Programming changes or reconfigurations are not covered under warranty. To return this item under warranty, advise Chemglass technical service department of the situation and they will provide you with a return authorization number. The unit will be evaluated and repaired as required in accordance to the warranty.

Please contact the Chemglass technical service department for thermocouples and accessories along with warranty repair information.

Chemglass technical service department:
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