Instruction Manual

HP-150 Instruction Manual

Version 1.1 (Feb, 2021)

1. Specification

Controller	
Operating voltage	12VDC
Maximum current	8 Amp
Input power connection	Barrel Connector 5.5 mm OD, 2.1 mm Pin. Center Positive
Heating pad connection	Mini XLR 4 Pin
Dimension	3.1 x 1.2 x 4.2 inch, (80 x 30 x 107 mm).
Temperature resolution	0.1 °C
Temperature accuracy	+/- 0.1°C
Mini. Control Temperature	5 °C above ambient
Max. Control Temperature	50.0°C

2. Front Panel

① AL- Alarm indicator.
② Temperature increment.
③ Temperature decrement.
④ Digit shift / Alarm mute
⑤ Set/confirm.
⑥ OUT- Indicator of power output.
⑦ LED display window. During operation, it displays the temperature of the heating pad. When flashing (by pressing the ▲ or ▼ key once), it displays the target temperature.
⑧ Power switch

Figure 1. Front Panel.

3. System Setup

3.1 Connecting the heating pad

To connect the heating pad, align the Mini XLR connector slot on the controller with Mini XLR connector tab on the heating pad cable, and then push it in. To disconnect it, press the tab on the female connector and pull the connector out.

3.2 Power On/Off

The power switch is on the back panel of the controller. Press “ON” to turn it on. When it is on, this power switch will lid; the LED display at the front will lit and temperature is going to rise. Press the side with “OFF” to turn it off.
The temperature has been set at 37 °C. The built-in alarm is preset to 45.0°C. It will be activated when reading temperature is over 45.0°F. When hearing the buzzing, you can press shift key to mute or power it off. To change this limit, please refer section 4.1.

4. Parameter Setting

4.1. Temperature setting and Alarm setting (accessed by code 0001)

Table 1. Temperature and alarm parameters

Symbol		Description	Range	Initial	Note
Su	SV	Target temperature	Arbitrary value within the measuring range	37.0	Note 1
AH1	AH1	Alarm 1 on temperature		45.0	Note 2
AL1	AL1	Alarm 1 off temperature		44.9	
AH2	AH2	Alarm 2 on temperature		25.0	
AL2	AL2	Alarm 2 off temperature		25.0	
End	END	Exit			

Note 1. Set Temperature.

There are two ways to set the target temperature.
a. During the normal operation mode, press Λ or V once to switch the display from process value (PV) to set value (SV, or target temperature). The display will start to blink. Press Λ or V again to increase or decrease the SV. When finished, wait 8 seconds and the settings will take effect automatically (the display will stop blinking).
b. Press SET key once. Use >, Λ and V keys to enter code 0001. Press SET key to confirm, then the display would be SV (Su). Press SET key again to display the SV setting. Use >, Λ and V keys to enter the new SV value and press SET to confirm. Press V key to change the display to END. Then, press SET to exit. You can also ignore the steps after confirmation of SV. The controller will return to normal operation mode automatically if no key is pressed for 1 minute. The flow chart below shows how to set the SV and alarms in details.

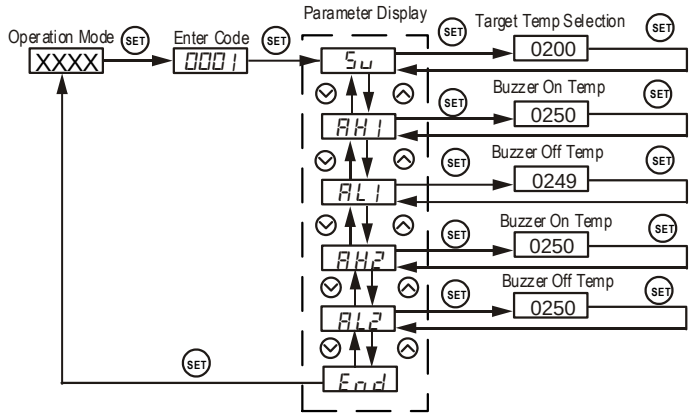

Figure 2. Flow chart for how to set target temperature and alarm.

Note 2. Set alarm

The controller offers two alarms that can be set to turn on the buzzer at specific temperatures. The first alarm is controlled by parameters AH1 and AL1. The initial setting will turn on the buzzer at 45.0°C and off when temperature drops below 49.9°C. The second alarm is controlled by parameters AH2 and AL2. The second alarm is initially deactivated.

AH1 and AH2 are the temperatures to turn buzzer on; AL1 and AL2 are the temperatures to turn buzzer off. When AH1(2) >AL1(2), the alarm is set for absolute high alarm as shown in Figure 3 below. When AH1(2) <AL1(2), the alarm is set for absolute low alarm as shown in Figure 4 below. When AH1(2)=AL1(2), the alarm is deactivated.

Example, if AH1=25.0, AL1=24.9, when the temperature goes up to 25.0°C, the buzzer will be on; when the temperature drops down to 24.9°C, the buzzer will be off.

User can press the shift key (>) to temporarily mute the buzzer sound. The alarm will buzz again if the alarm set temperature is reached again. To permanently deactivate the alarm, set AH1=AL1 or AH2=AL2. Please see flow chart in Figure 2 on how to set the value.

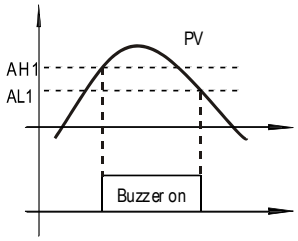

Figure 3. Absolute high alarm

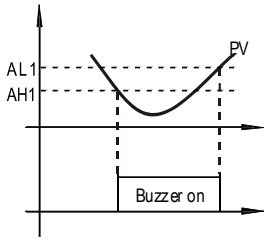

Figure 4. Absolute low alarm

The contents below are for reference and advanced applications. Most users do not need to read beyond this point.

4.2 PID parameter setting (accessed by code 0036)

The values of P, I and D parameters are critical for good response time, accuracy and stability of the system. The values of the PID parameters have been optimized for heating pad. User should not change it unless the result is not satisfactory.

Setting PID parameters is similar to the setting of the Temperature and Alarm Parameter as shown in the flow chart of Figure 2. The difference is that these parameters are accessed by enter code 0036 instead of 0001.

Table 2. PID and relevant parameters

Symbol		Description	Range	Initial	Note
P	p	Proportional Constant	0.1~99.9(%)	0.5	Note 3
I	I	Integral Constant	2~1999(Sec)	80	Note 4
d	d	Derivative Constant	0-399(Sec)	20	Note 5
SouF	SouF	Damp Constant	0.1~1.0	0.4	Note 6
ot	ot	Cycle Rate	2~199(Sec)	2	Note 7
FILE	FILt	Digital Filter Strength	0~3	0	Note 8
End	End	Exit			

Note 3. Proportional Constant (P): When P increases, the system is more stable. When P decreases, the system is less stable. If the P is too small, the system would be oscillatory or even non-convergent.

Note 4. Integral time (I): Brings the system up to the set value by adding a constant to the output that is proportional to how far the process value (PV) is from the set value (SV) and how long it has been there. When I decreases, the response speed is faster but the system is less stable. When I increases, the respond speed is slower, but the system is more stable. When I is 0, then it turns to be PD control.

Note 5. Derivative time (d): Responds to the rate of PV change, so that the controller can compensate in advance before |SV-PV| gets too big. A larger number increases its action. Setting d-value too small or too large would decrease system stability, cause oscillation or even non- convergence.

Note 6. Damp constant (SouF): The parameter is controlled by the artificial intelligence of the controller. This constant helps the PID control quality. When its value is too high, the system will be over damped. When its value is too low, the system may overshoot.

Note 7. Cycle rate (ot): It is the time period that the controller uses to calculate its output. The initial value is set to 2. Short time causes the fan to pulse at higher frequency. Longer time may reduce the quality of control.

Note 8. Digital Filter (Filt): can be set as 0, 1, 2, 3. Filt=0, filter disabled; Filt=3, strongest filtering effect. Stronger filtering increases the stability of readout display, but causes more delay in the response to changes in temperature.

4.3 System Configuration Parameters (accessed by code 0089)

Table 3. System configuration parameter setting

Symbol		Description	Range	Initial	Note
InTY	Inty	Not applicable		P 10.0	
ouTY	Outy	Not applicable		2	
HY	Hy	Not applicable		3	
AdtU	Adtu	Not applicable		0	
PSb	Psb	Input Offset	-99.9 ~ 100.0	0	Note 9
rd	Rd	Not applicable		0	
CorF	Corf	Display Unit	0: °C 1:°F	0	Note 10
End	End	Exit			

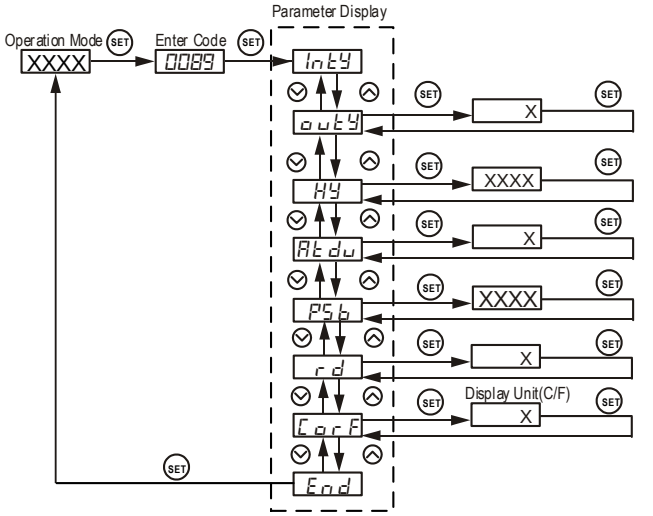

Figure 6. The system setup flow chart

Note 9. Input offset, PSb is used to set an input offset to compensate the error produced by the sensor. For example, if the meter displays 5ºC when probe is in ice/water mixture, setting PSb = -5.0 will make the controller display 0ºC. To set negative value, shift to the very left digit, press down key until it shows "-".

Note 10. Display unit selection CorF: 0 for Celsius (°C); 1 for Fahrenheit (°F). By default, CorF is set to 1 (Fahrenheit). For Celsius display, you need to set CorF to 0 and divide your original P value by 1.8.

For example, assuming your original P value is 2.0. To change to Celsius display, you need to set CorF=0 and P = 1.1 (2.0/1.8=1.11).