

TLC16 ENVIRONMENTAL CONTROLLER BY GREEN LEAF CONTROLLERS (GLC)



**Based in North Carolina
Serving the Planet**

TLC16 (GLC)

Environmental Control Unit (ECU) Version 20.04.13.01

OPERATIONS MANUAL

Congratulations on purchasing the TLC16 Environmental Control Unit, an important step toward a profitable greenhouse operation. This Controller provides 2 zones of heating control, 5 zones of cooling control, humidity control, 8 zones of irrigation control (by time, by Vapor Pressure Deficit (VPD), or both), and an alert alarm.

The unit includes sensors that measures temperature, humidity, and sunlight to give you the data you need to control the environment in your greenhouse. So let's get started!

Installation

Installation instructions are located in this Manual beginning on Page 11. If you have just received your unit, turn to that section to begin installation.

Environmental Sensors

The system uses environmental sensors for temperature, relative humidity, and light. The output of these sensors is read by the microprocessor's software. Temperature can be measured in degrees Fahrenheit in the range of 32-122F. Relative humidity is measured from 0-100%. Light is measure in Klux from 0-40 Klux. For installation and mounting the sensors, please refer to the installation guide. Keep the Temperature & Humidity sensor as dry as possible never place this sensor in direct sun light but preferably somewhere in the plant foliage. Keep the top of the Light Sensor as clean as possible and exposed to direct sunlight.

Portable Android Tablet Interface

The system includes an Android Tablet with a portable touch screen for accessing the system. The device is connecting to the controller via WIFI. The controller works as a WIFI hot spot. The hot spot does have a security code or password. The security passcode/password is located on a stick on label on the inside bottom section of the enclosure door. The included tablet has already been loaded with this password. To connect to the system, simply turn on the touch screen (refer to the manual if needed).

If the included tablet is a “fire 7” then power up the table by pushing the power button on the right hand top side of the tablet. After the table boots up slide the screen from bottom to top to get to the home screen. Then tap on the Silk Icon on the middle left side of the home screen. In the My Favorites section tap the GLC Controller Icon and the browser will open to the controller home page. The portable touch screen comes with a power supply and battery.

For all other tablets there will be a TLC16 icon pre-installed on the home screen when the table powers up. Touch on the icon and the browser will open to the controller home page. The portable touch screen comes with a power supply and battery.

WIFI Hot Spot Interface

Because the controller is a WIFI hot spot, you can use any WIFI enabled device such as a smart phone, tablet, etc. to connect to the system. Your device will be connecting to the controller via WIFI. The hot spot does have a security code or password. The password is located on the card located in the bottom area of the clear plastic door. The hotspot is not connected in any way to the internet, and will show up in your wifi screen as (TLC16). Once you have connected to the hot spot on your device, open a browser, and type in the IP address located on your controller (It will be a number in the form of 192.168.0.199). The home page of the controller should open. Set a bookmark to this address for future access.

Relays

As stated in the installation guide, ***DO NOT EXCEED the 3AMP*** limit on the internal relays. The relays are set up to deliver 24 Volts and can operate any equipment or devices designed to switch with 24 volts. Irrigation relays and heaters usually use a 24 volt switching signal. For all other applications using 110 volt, 220 volts, or other voltage you will need external relays. Because Green Leaf Controllers’ cannot predict what relays you may need for your specific application, these external relays have not been included. We can help you configure this part of your installation and supply the relays upon request. Give us a call!

Getting Started

Make sure your Humidity/Temperature and Light Sensors are all plugged in to the Environmental Control Unit (ECU). Open the ECU Cover and flip the power switch to ON. You will hear the click of the relays and notice the processor powering up, this is indicated by the flashing LED’s located on the processor board. **Wait a minimum of two minute as the unit powers up** before trying to access the system menus. Power up the Android Tablet. Touch the TLC16 Icon on the Android Tablet screen. The “System Log In” screen will open.

The factory User ID is set to **admin**. The factory password is set to **password**.

Type those into the User ID and password fields and click on the Submit. The “System Admin” page will open.

At this point you have successfully logged into the system and can begin running the system and Customizing the system to your preferences.

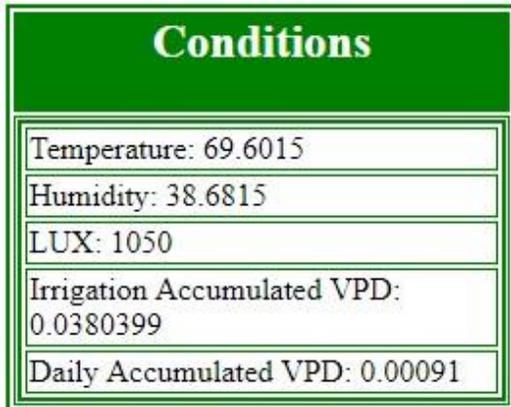
The first step at this point is to set the system time. Please refer to page 16 on setting the controller internal clock to do this. **The internal system clock will need to be set every time the controller has been shut down and restarted or powered back up.**

To run the system, click on the “**Controller Admin**” button. This displays the TLC16 Controller Admin page. Scroll down to the bottom and click on the “Run System” button. The system will start sensing conditions and turning relays on and off based on the growing parameters you set.

Conditions

When the controller is in the Run system mode, the real time environmental conditions are displayed. **This page does not automatically refresh.** Each time **you refresh** the page, the most current conditions are displayed. This is a very useful tool to know what is going on in the growing environment.

To refresh the page, simply place your finger at the top of the page and drag it down towards the bottom you will be prompted with a conformation page to let you know that the page will be refreshed. You must tap the continue button for the page to refresh. Once refreshed the most current data will be displayed.



Conditions
Temperature: 69.6015
Humidity: 38.6815
LUX: 1050
Irrigation Accumulated VPD: 0.0380399
Daily Accumulated VPD: 0.00091

Controls

The status of each of the controls is displayed in real time. When a control is **ON**, it is highlighted in **yellow**. Refresh the browser to get the most up to date status of your equipment.

As of: 15:07:58 06/09/2020

Conditions
Temperature: 73.3853
Humidity: 38.5518
LUX: 3642
Irrigation Accumulated VPD: 0.088008
Daily Accumulated VPD: 0.09797

Controls
Alarm: OFF
Heater 1: OFF
Heater 2: OFF
Cooling 1: OFF
Cooling 2: OFF
Cooling 3: OFF
Cooling 4: OFF
Dehumidify: OFF
Irrigation
Zone 1: OFF
Zone 2: OFF
Zone 3: OFF
Zone 4: OFF
Zone 5: OFF
Zone 6: OFF
Zone 7: OFF
Zone 8: OFF
Irrigate Now

System Status: Stopped

Run System

Edit Settings

System Admin

POWER DOWN

As of: 17:21:54 06/09/2020

Conditions
Temperature: 73.3853
Humidity: 38.5518
LUX: 3648
Irrigation Accumulated VPD: 0.112857
Daily Accumulated VPD: 0.12555

Controls
Alarm: ON
Heater 1: OFF
Heater 2: OFF
Cooling 1: ON
Cooling 2: OFF
Cooling 3: OFF
Cooling 4: OFF
Dehumidify: ON
Irrigation
Irrigating
Zone 1: ON
Zone 2: OFF
Zone 3: OFF
Zone 4: OFF
Zone 5: OFF
Zone 6: OFF
Zone 7: OFF
Zone 8: OFF

System Status: Running

Stop System

Edit Settings

System Admin

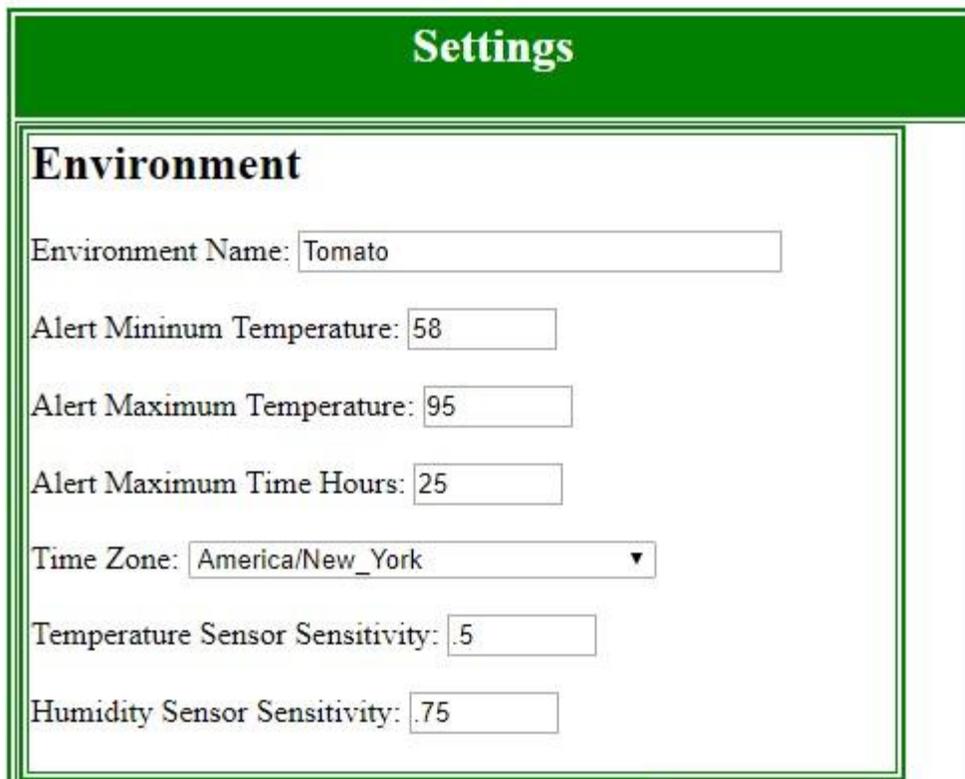
(View of System Stopped Controls Menu) (View of System Running Controls Menu)

Note: When the System is not running the **POWER DOWN** button appears in order to power down system

TLC16 Controller Settings

The controller settings can be easily accessed and changed. The settings are saved even if you power down the controller. To make changes to the growing parameter settings access the Controller Admin page from the System Admin page. Scroll down to the bottom of the page and click on the “**Edit Settings**” button. This will open up another page with all the growing parameters. In this section of the page, all of the environment’s settings can be viewed and updated. Adjust the settings to your liking and then click on the “Submit” button on the bottom of the page. Wait about 5 to 10 seconds and then click on the “Next” button. Your changes are now operational.

NOTE: Changes to growing parameter settings can be made with the controller in either the **RUN** or **STOPPED** mode.



The screenshot shows a web interface titled "Settings" with a green header. Below the header is a section titled "Environment" with a double-line border. Inside this section, there are several input fields and a dropdown menu:

- Environment Name:
- Alert Minimum Temperature:
- Alert Maximum Temperature:
- Alert Maximum Time Hours:
- Time Zone: (dropdown menu)
- Temperature Sensor Sensitivity:
- Humidity Sensor Sensitivity:

Specify a name for your new **Environment**. This is a maximum of 25 characters.

The **Alert Temperature** set points are the temperatures at which the Alarm turns on. This is useful for an onsite “freeze” alarm. The controller checks this set point every second.

The **Alert Maximum Time Hours** is the maximum time in hours since the last Irrigation Cycle. If the Current Irrigation Cycle is past this amount of time in hours, the Alarm turns on until the next irrigation cycle.

Time Zone this should be set to your current time zone.

Temperature Sensor Sensitivity allows fine adjustments to be made to how the system reacts to temperature changes. If heaters or cooling equipment are turning on and off abruptly with only small temperature changes, increase this number. If the controls are not responding quickly enough to temperature changes, decrease this number.

Humidity Sensor Sensitivity allows fine adjustments to be made to how the system reacts to humidity changes. If dehumidification equipment is turning on and off frequently, increase this number. If the controls are not responding quickly enough to RH changes, decrease this number.

Settings – Heating & Cooling

-----Heater 1-----	
Heater 1 Set Point 1 Hour:	<input type="text" value="0"/>
Heater 1 Set Point 1 Minute:	<input type="text" value="0"/>
Heater 1 Set Point 1 Temperature:	<input type="text" value="65"/>
Heater 1 Set Point 2 Hour:	<input type="text" value="8"/>
Heater 1 Set Point 2 Minute:	<input type="text" value="0"/>
Heater 1 Set Point 2 Temperature:	<input type="text" value="65"/>
Heater 1 Set Point 3 Hour:	<input type="text" value="10"/>
Heater 1 Set Point 3 Minute:	<input type="text" value="0"/>
Heater 1 Set Point 3 Temperature:	<input type="text" value="65"/>
Heater 1 Set Point 4 Hour:	<input type="text" value="12"/>
Heater 1 Set Point 4 Minute:	<input type="text" value="0"/>
Heater 1 Set Point 4 Temperature:	<input type="text" value="65"/>
-----Heater 2-----	
Heater 2 Set Point 1 Hour:	<input type="text" value="0"/>
Heater 2 Set Point 1 Minute:	<input type="text" value="0"/>
Heater 2 Set Point 1 Temperature:	<input type="text" value="64"/>
Heater 2 Set Point 2 Hour:	<input type="text" value="8"/>

Version 20.04.13.01 provides for 2 heating stages for heating. The heating differential specifies the desired fluctuation in temperature. For example, if Heater 1 is set to 66° with a 1° differential, the heater will go on when the greenhouse is at or below 65 degrees. The controller will keep the heater on until the temperatures reaches 66° in the greenhouse.

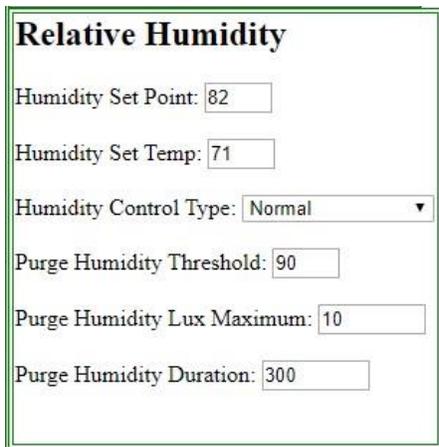
Version 20.04.13.01 provides 5 stages of cooling with a user defined differential. For example, if Cooling 1 is set to 68° with a differential of 1°, the controller will turn on Cooling 1 when the greenhouse is at or above 69° and turn off the Cooling 1 at 68°.

Please Note that the first actual stage of cooling is controlled in the Humidity settings and uses the Humidity control fan. This setting is referred to as the “**Humidity Set Temp**” and uses the same temperature defined differential as the other cooling stages this temperature should then be set at a lower temperature than Cooling 1. When this temp setting is on it will be indicated by the **Dehumidify: ON** in the Humidity control section. And this setting will just be either on or off different daily set points are not provided for this setting.

With the exception of the Humidity Set Temp, the system provides up to 4 different daily set points for both heating and cooling.

*Note: The time for the first set point MUST be set to 0 hour and 0 minute. The second hour set point must be a greater number (that is an hour number greater than 0) than the first hour set point. The third hour set point must be a greater number than the second hour set point. The fourth hour set point must a greater number than the third hour set point. The fourth hour set point will be valid until 23:59:59 (1 millisecond before midnight). All hour values must be between 0 and 23. All minute values must be between 0 and 59. When inputting these numbers into the settings fields be very sure that you use only numbers and not an “o” instead of a “0”. Also in the Hours and Minutes Fields be sure not to use a decimal. Correct example for hours would be (0, 8, 12 ,14 **and not 0.0, 8.0, 12.0 or 14.0**). The same holds true for the minute’s fields. Correct examples for minutes would be (5, 10, 20, 45, 50 **and not 5.0, 10.0, 20.0, 45.0, 50.0**)*

Settings – Relative Humidity



Relative Humidity	
Humidity Set Point:	<input type="text" value="82"/>
Humidity Set Temp:	<input type="text" value="71"/>
Humidity Control Type:	<input type="text" value="Normal"/>
Purge Humidity Threshold:	<input type="text" value="90"/>
Purge Humidity Lux Maximum:	<input type="text" value="10"/>
Purge Humidity Duration:	<input type="text" value="300"/>

Dehumidification Normal Control

TLC16 systems provide two modes types of dehumidification logic. The normal mode provides equipment control of dehumidification equipment such as small motorized vents. The humidity set point is used most of the time for reducing humidity. Set this value to the RH percentage that will turn on your dehumidification equipment. Select the Humidity Control Type to Normal for this type of set up.

Dehumidification Purge Control

The purge mode provides additional logic to minimize the possibility of high humidity and the risks associated with prolonged high RH (Relative Humidity).

The Purge Humidity Threshold is the RH percentage that you want to define for a purge cycle to begin. In the above diagram, at 90% RH a purge cycle will begin as long as the light (Lux) is below the maximum Lux set point.

The Purge Humidity Lux Maximum allows you to define whether a purge can happen anytime, just on cloudy days, or just at night. To allow a purge to happen anytime, set this value to 40000. To allow a purge to happen during the night or on cloudy days, set this value between 4000 to 8000. To limit a purge cycle to happen only at night, set this value to 10.

The Purge Humidity Duration defines the length of the purge cycle in seconds. This value also defines how long the system will wait until it tries another purge cycle. The logic uses 2x this value to determine how long after a purge cycle completes to wait to try to purge the high RH again.

Let's take an example with set points of 90 for the target humidity, 10 for the light level, and 300 (5 minutes) for the purge duration. When the humidity exceeds 90% and it is dark (<10 lux), the purge logic will, (a.) close all vents, (b.) turn the heaters on regardless of temperature for 5 minutes then, (c.) turn on/open cooling1 and cooling2 for 5 minutes then, (d.) close cooling1 & cooling2 and turn the heater back until the normal set point temperature is reached (say 65), (e.) wait for 10 minutes. If after 10 minutes (2x the 5 minute set point) the humidity is still above the set point of 90, then the process will repeat.

Note: While a Purge Cycle is occurring, the Control Display will show Dehumidify: PURGING

Caution: A Purge Cycle will typically produce a large temperature change within a short period of time in the environment. Experiment with your equipment setup to determine the best settings to knock down high humidity. The goal is to heat the moist air up, then purge it out, then heat it back up again. The purge duration for heating, cooling, then heating again defines the temperature swing. Use caution so that your equipment does not create prolonged temperature extremes that stress your plants. Diverters for the incoming air should be placed in front of the louvers or Polly Vent to force the incoming air from a purge cycle to go up and mix with warmer air in the top of the greenhouse, and not to be directed directly onto your plants. Plants have been killed in the winter during a purge cycle from the extreme outside air temperatures. You may also have to change your temperature alert alarm settings to eliminate false alarms.

Humidification Control (To Add Humidity)

The humidity set point is used most of the time for reducing humidity. However, if the requirement is for humidification, use the **normally closed** position on your external relay. Set the set point according to when the equipment stops humidifying. Set the Humidity Control type to Normal and do not use the Purge logic with this type of set up. The Controller will turn on

your misters when the humidity is low or drops below the Humidity set point, and will turn them off when the humidity reaches the Humidity set point.

Settings – Irrigation

Irrigation By VPD

There are three choices for irrigation: **By VPD, By Time, or By VPD and Time.**

Vapor Pressure Deficient (**VPD**) is based on accumulated light, the temperature, and relative humidity. It is a much more precise way of providing irrigation. Irrigation can be more closely tied to plant needs. This results in less fertilizer waste and happier root zones. On cloudy days, there will be fewer irrigation cycles. On sunny, hot, dry days, there will be many more irrigation cycles. The Accumulated Moles set point is user defined. It can be changed as the maturity of the crop changes. Each crop will be different and each area will be different. Watch the plants and adjust this parameter accordingly.

Irrigation By Accumulated VPD Set Point

This set point determines when an irrigation will occur when the Irrigation type is set to either **VPD** or **Both VPD and Time**. As the VPD moles accumulate over time, the controller will initiate an irrigation cycle when the accumulated moles equals your accumulated VPD set point. This value depends on many factors including the growing media, the age of the crop, the orientation of the greenhouse, and more. The best approach is to estimate how many irrigation cycles you would like to have on a normal dry warm sunny day and divide that by the total accumulated VPD for the day. So if you are targeting 6 watering's and the total VPD for the day is 24, you would set this value to 4.0. Most growers start with a higher value at the beginning of the crop and decrease this 4 to 5 times during the life cycle of the crop.

Irrigation By Time

Irrigation by time uses the daily cycle set points. Version 20.04.13.01 provides for 8 daily cycles. Specify the start time for each cycle from hours 0 to 23 and minutes from 00 to 59. If you do not wish to use a cycle, put an hour number greater than 24 (for example 25). The controller will turn on the irrigation relays each day at the specified time.

Irrigation Programming (A Suggested Starting Point using VPD and Time)

A suggested starting point for watering using **VPD** is to set the “Irrigation By” setting to “**VPD and Time**”. This is found in Edit Settings at the bottom of the Controller Administration Page as you scroll down through Heating Cooling, Relative Humidity, then Irrigation. You will want to also **set one timed watering** cycle by going to Irrigate By Time and setting Cycle 1 to water shortly after sunrise when the plant starts to photosynthesize. A good year round time is 8:00am.

Once you have set “Irrigation By” to “**VPD and Time**” then scroll down the page to VPD Sensitivity. As a starting point use the value of 1.0 to start. For most crops and conditions this

should water more than needed. At the end of the day, at sunset, go to the **Controller Administration Page** and record the **Daily Accumulated VPD**. This number should be in the range on 4.0 – 6.0. What this number tells you is the total accumulated light for that day. Assuming you wanted to water 6 times and at the end of the day the Daily Accumulated VPD was 6, and the VPD Sensitivity was set on 1, you should have watered 6 times. Obviously you will need to fine tune the “**Accumulated VPD Set Point**” number over several days, lowering the number to get more irrigations per day, raising the number for less irrigations per day. You should be monitoring the plants with some method of overflow so you can determine that they are getting the water they need. A good rule of thumb is to have a total overflow per day of 12-15 oz. in each Irrigation zone. To increase the water amount to a Zone increase that Zone’s “On Time (Seconds)” and also to decrease the amount of water a Zone gets decrease that Zone’s “On Time (Seconds)”. A good starting point for this time might be 70 seconds. Once you have set the VPD Sensitivity to your particular crops needs, it will automatically adjust the number of watering cycles per day for the amount of sunlight each day. As day length increases, the number of watering cycles per day will increase. On cloudy days it will significantly reduce the number of watering cycles per day. This is the value of having this unit for irrigation – the plant gets precisely the amount of fertilization when it needs it saving you fertilizer and solving the problem of excessive fertilizer runoff. If you are not using a Zone you may reduce the zone on time to 5 seconds, because of data statistical recorded by this process **do not set this value below 5 seconds**, the processor needs this time to be able to keep up with data statistical recording in the database.

Master Valve Delay (Seconds)

This is the amount of time you may need to pressurize you Irrigation Zone lines downstream of your Master Valve. This setting is the amount of time that your Master Valve is on before the First Irrigation Zone turns on. The setting is in seconds and can be set as low as 0. Not all Irrigation systems are installed with a Master Valve. However you may want to keep this in mind; if you have a zone valve to fail in the open condition without a Master Valve in line, that zone will continue to irrigate until you discover that its irrigation valve has failed. This condition often results in the loss of plants in that irrigation zone from over watering. Also you may have mixing pumps that could fail as well from pumping out all the fertilizer and operating in a dry condition.

Time Between Zones

This is the time is seconds between zones. If your well or pump needs time to build pressure back up between zones, increase this value. Do not set this value below 1 sec.

Zone On Times

Each zone will be on for the number of specified seconds. For example, 300 seconds is 5 minutes. Version 20.04.13.01 provides for 8 zones of irrigation. Each zone can have a different on time. A good starting point for this setting maybe 70 seconds, and should be adjusted up or down based on the amount of overflow that occurs from an irrigation cycle. Most growers find that the outer rows or zones need more irrigation than inner rows or zones in a grow area, and southern rows or zones require more than northern rows or zones. The amount of sunlight a zone

gets is normally the key to how much a zone will require compared to another zone. Adjust your zones according to the amount of overflow measured in each zone.

Irrigation by both Time and Vapor Pressure Deficient (VPD) is useful for watering once or twice during the night when the night time temperatures are very warm. This is also used to start each morning with moist media.

Note: When an irrigation cycle starts, relay 16 turns on. This relay can be used to control a master solenoid or pump (don't exceed 3 amps on the relay). After all the zones are complete, relay 16 will turn off.

Alarm

Version 20.04.13.01 of the controller has an alarm output at the top of the **Controls** Menu. When the Alarm is active it will show in the **Controls** menu as Yellow and on **Alarm: On**. The four Alarm conditions are listed below.

- 1.) If the Alert Minimum Temperature is reached
- 2.) If the Alert Maximum Temperature is reached
- 3.) If the Alert Maximum Time Hours is reached (hours since last irrigation)
- 4.) If the auxiliary dry contacts become closed or made. (connections are located on the right side terminal strip #11 & #12)

Note:

Item #3 Alert Maximum Time Hours should be set greater than the time perceived as the last time the system will irrigate in the evening or afternoon until it will again irrigate the next morning. Unit will ship with this time set as 25 hours and maybe reduced to the needed setting.

Item #4 can be used or wired to a pressure switch to indicate the lack of water pressure. Contacts must open as pressure builds and close on low pressure, a standard well pump on off control can easily be used. It can also be used with any device that will provide a closed dry contact for a warning signal. Connections may be made on the right side terminal strip terminals #11 & #12.

Controller Data Logging and Exporting

Version 20.04.13.01 provides data logging of *both* conditions and controls. From the System Admin page, click on the history or export buttons. You can use this information as a very valuable tool to gain insight into how your equipment is working, energy consumption, number of irrigation cycles per day, and more!

Powering Down &Turning the System Off

It is very important that the system is in the STOPPED mode before removing the 12v power from the controller. Removing or losing power when the system is in the RUN mode may cause unpredictable results, one of these maybe database corruption. To power down and turn the system off, first place the system in the STOPPED mode found in the Controller Admin Page.

When the system status is in STOPPED mode, click on the POWER DOWN button at the bottom of the Controller Admin page. Wait at least 10 seconds and then turn the power switch off.

If the system is powered off by a power failure, the system will reboot automatically when the power returns or comes back on; however, when the system comes back up it will come up running, but the clock will be wrong and will need to be set. Refer to step 7.) In the setup procedure page 16 of this document to set the clock.

Please note if you are rebooting or shutting down and restarting your system as at times maybe required, when you power back up the system, do not jump into a saved menu such as the **Controller Admin** Screen but close your browser window and login back into to the system as you would do in a normal startup. Then continue to “**Update System Time**” menu to set the current time before proceeding to the **Controller Admin** screen to restart the system.

Recommended Operational Practices

The following are some best practices to ensure long term success with your system:

1) Redundancy – Green Leaf Controllers strongly recommends using an inexpensive backup thermostat for both heating and cooling. In the event that any part of the system fails, this will protect your crop from extreme conditions or even a complete loss. Set the set points for this thermostat at least 3 degrees away from the heating and cooling set points defined within the Controller. For example, if the lowest set point for heat is 65 degrees in the ECU, set the manual thermostat at 62.

Note: GLC nor any of its suppliers are liable for any losses due to any part of this system failing.

2) Manual Override Option – Wire equipment such as fans and irrigation solenoid valves such that in the event of a failure, they can be simply “plugged in” with direct power. Ideally, all 110v equipment would have a standard electrical plug. This plug is plugged into the power circuit that is switched by the relays. If any part of the relay circuit fails, the equipment can be unplugged from the relay circuit and plugged into a direct power source to turn the equipment on manually.

3) Emergency Power backup – The Controller should be connected to an uninterrupted power supply (UPS). Even if the power goes out in the environment, power will remain on for the controller. A standard one that is designed to be used with a home computer will work fine for this purpose.

4) Use a Firewall - any computers connected to the internet should be firewall protected

5) Stay Close to your Crop – this controller is a powerful growing tool, but it is only a tool, and having tools is only part of successful growing.

Support

To receive support from GLC for TLC16 Controllers call us at (828)-393-5884 Between the hours of 8:00am and 8:00 pm EST, Sunday Through Thursday and 8:00am till 4:00pm on Fridays.

INSTALLATION INSTRUCTIONS FOR ECU

Version 20.04.13.01

READ ALL Documentation (End User License, Installation Instructions, Owner's Manual) BEFORE using your system.

Thank you for choosing the TLC16 Controller (GLC). This guide will take you through the steps necessary to get the Controller running in your environment.

This installation guide provides instructions for installing version 19.04.28.01 This version provides 2 zones of heating control, 5 zones of cooling control, humidity control, 8 zones of irrigation control (by time, by Vapor Pressure Deficit (VPD), or both), and an alert alarm. The system includes a temperature & humidity sensor and a light sensor.

Step 1: Verify Shipping Contents

This system is shipped with an Owner's Manual, the ECU controller enclosure (microprocessor, relay board, WIFI hotspot), an Android portable touch screen tablet, a temperature & humidity sensor (1 sensor that has both) with cable, a light sensor with cable, and a power supply with 110v input.

Step 2: TEST Run the System for 24 Hours

It is important to conduct a test or "bench" run of the system prior to mounting or installing the enclosure. This establishes a base line for future trouble shooting, verifies the system was not damaged during shipping, and allows you to become familiar with the operation of the system prior to actually having anything hooked up.

Bench Testing Setup Installation Steps

Follow the steps below to bench test your system:

- 1) Unpack the contents.
- 2) Connect the Temperature/Humidity Sensor and Light Sensor into the proper jacks on the enclosure
- 3) Connect the power cable into an 110v electric receptacle. Move Power Switch on the right-hand side of the Controller enclosure to "On", you should hear the relays open and close rapidly as the system powers up.
- 4) Turn the power to the Touch Screen Tablet ON (refer to the device instructions if needed)
- 5) Touch on the TLC16 icon on the main Screen of the Tablet. The Controller Log In page will open
- 6) The factory User ID is set to **admin**. The factory password is set to **password**. Type those into the User ID and password fields and click on the Submit. The "**System Admin**" page will open.

7) Click on the “**Update System Time**” button. Adjust the date and time using the proper formats as shown next to each box.

Example:

Date: (yyyymmdd format): 20180909 for September 09, 2018

Time: (hh:mm:ss format): 14:16:00 for 2:16:00 pm

Once you have completed both fields click the “Submit” button, then “Submit” again on the next page.

Note: each time you power cycle the controller, or there is a power failure you will need to set again the correct time according to the procedure above.

8) Click on the Controller Admin button.

At this point you have successfully logged into the system and can begin running the system and Customizing the system to your preferences.

To run the system, click on the “Controller Admin” button. This displays the ECU Controller Admin page. Scroll down to the bottom and click on the “Run System” button. The system will start sensing conditions and turning relays on and off based on the growing parameter settings. Run the system “on the bench” for 24 hours.

IMPORTANT: DO NOT UNPLUG the power to the controller in the Run Mode. The proper way to power down the system is to put it in the STOPPED mode on the Controller Admin page, then at the bottom of the Controller Admin page, click on the POWER DOWN button, wait 20 sec. before turning off the power by the switch.

Step 3: Determine Locations

Choose a location for your controller. Ideally, the controller should be easy to access, be close to your electrical service area for the growing environment, installed vertically not horizontally, and located inside the growing environment. The preferred location for the controller enclosure should be out of direct sunlight and in as cool, dry as possible area in your growing environment.

On the north side, facing north, behind equipment for shading (such as heaters) is optimal for the controller. If this is not possible, east (morning sun) is better than west (afternoon sun) – preferably shaded by some other equipment.

While some industry professionals may recommend putting temperature & humidity sensors “in the middle” of the growing environment, (GLC) has found the best area is actually on the north end for several reasons. During the heating season with the blowers blowing south, the air goes around and comes back to the north side as the coolest part of the environment – the sensor will sense the coolest part of the environment. During the cooling season, the hottest air is drawn through the environment to the north side -the sensor will sense the hottest part of the

environment. The temperature & humidity sensor should be located on the opposite end of the greenhouse from the vents, slightly behind the heater blowers, between the 2 exhaust fans. The level of the sensor is a grower preference. Some prefer “at fruit/flowering” level while others prefer a higher “at cross brace/ purlin” level. **However the sensor should never be located in direct sunlight as the sunlight will heat up the sensor housing and the unit will miss report the temperature and humidity. We have found that the unit seems to report the most accurate information when it is actually located in the foliage of the plants screen side facing down.**

The light sensor should be mounted with the eye of the sensor pointing straight up. Mounting the box flat is acceptable. If the box is going to be mounted at a slight angle, incline the box so it faces south. High on top of an unshaded cross brace or purlin is ideal. Be sure to place the sensor in a low traffic area so when personnel work with the plants they don't disturb the sensor.

Step 4: Mount and Install the Controller Enclosure

Mounting brackets and screws are provided for mounting the enclosure. Mount the controller enclosure as per recommendations in step 3.

Step 5: Connect the Sensors

Make sure the power cord is unplugged for the controller before connecting or disconnecting sensors. All sensors ship with the cable attached to the sensor and a connector on the opposite end. The temperature & humidity sensor, and the light sensor both use a 4 pin connector. Plug the connector into a matting connector on the bottom right hand side of the controller enclosure. These sensors have no designated mate and either sensor maybe plugged into either matting connector port, as they both connect to a common bus. They will only mate or slide together at one location. Tighten the locking ring and this will complete this part of the installation.

Step 6: Connect Relay Switches

Relay switches and anything electrical related should be set up by a certified electrical technician. Electricians will know how to wire the system so that it complies with all state and local building codes. Green Leaf Controllers is simply providing switches and assumes no liability for installation, damages, or losses from electrical malfunctions.

Mount and Connect Manual Relay Switches (Not Included)

Danger: Risk of Electrical shock - Make sure all power is off to the sensors, controllers, and electrically controlled equipment before connecting any relay switches to any electrically powered device.

Install and Connect Irrigation Solenoid Valves (Not Included)

Danger: Risk of Electrical shock - Make sure all power is off to the sensors, controllers, and electrically controlled equipment before connecting any relay switches to any electrically powered device.

The controller is acting solely as a switching mechanism.

A 24vac power transformer is included in the Controller enclosure capable of a total continuous 4 amp output as an accumulated total.

The relays on the controller will provide 24vac to any device, solenoid or relay you wish to activate.

Wiring 24vac Solenoids (Not Included)

Power for the irrigation solenoids comes from a 24v transformer located in the Controller enclosure. The irrigation solenoid should not be rated above 3 amps.

Note: There is no backup for irrigation valves within the system. Best practices dictate that you have a means of visually monitoring irrigation amounts each day. Green Leaf Controllers recommends having an extra emitter on each zone that fills into a measured catch container. Monitor this container periodically to make sure the proper amount of irrigation occurs for each zone. A normal overflow amount is 12-15oz. for each zone.

Manual Override

Wire irrigation solenoid valves such that in the event of a relay failure, they can be simply turned on manually. Ideally, all equipment would have a standard electrical plug. This plug is plugged into the power circuit that is switched by the relays. If any part of the relay circuit fails, the equipment can be unplugged from the relay circuit and plugged into a direct power source to turn the equipment on manually.

DO NOT EXCEED the 3 amp limit on the relays! For electrical devices that require more than 3 amps, GLC recommends using additional 10, 20 or 30 amp relays. ***Fans or other high powered equipment WILL require a separate power relay (not included). The TLC 16 will be able to provide control voltage for these relays provided you have one that has a 24vac control coil installed in it.***

Connect TLC16 Relay Switches

Danger: Risk of Electrical shock - Make sure all power is off to the sensors, controllers, and electrically controlled equipment before connecting any relay switches to any electrically powered device.

The TLC16 relays are found inside the controller enclosure. Relays are hardwired to the terminal strips located on the left and right sides of the enclosure. Relays 1-8 are found on the left side with relay 1 being on the top. Relays 9-16 are found on the right side with relay 9 being on the bottom closest to the microprocessor. Each relay has a 24 Volt output and is wired normally open. For most applications, you will use the relays as normally open. Each relay has one

connector for wires located on the terminal strips on the left and right side of the enclosure and each terminal strip has a common neutral terminal.

Exceptions to this rule are with relays, #3 (Cooling 1 to be used with a Polly vent), and # 7 (Humidity control relay to be used with misters to add humidity to the green house) on the left side. These two relays also have a wire brought to the terminal strip for their N.C. contacts as well as the N.O. The N.C. connection for these relays directly follow after their N.O. connection. Please note this in the Terminal Strip Description on page 19.

Terminal Strip Connections are shown on the enclosure side by the terminal. Below this also is listed.

Left Side Terminal Strip (Top to Bottom)	Right Side Terminal Strip (Top to Bottom)
1 – Ground Connection	1 – Neutral Connection
2 – Neutral Connection	2 – I8 Irrigation Zone 8 N.O. Contact
3 – H1 Heater #1	3 – I7 Irrigation Zone 7 N.O. Contact
4 – H2 Heater #2	4 – I6 Irrigation Zone 6 N.O. Contact
5 – Cooling #1 N.O. Contact	5 – I5 Irrigation Zone 5 N.O. Contact
6 – Cooling #1 N.C. Contact	6 – I4 Irrigation Zone 4 N.O. Contact
7 – Cooling #2 N.O. Contact	7 – I3 Irrigation Zone 3 N.O. Contact
8 – Cooling #3 N.O. Contact	8 – I2 Irrigation Zone 2 N.O. Contact
9 – Cooling #4 N.O. Contact	9 – I1 Irrigation Zone 1 N.O. Contact
10 – HU Humidity Control N.O. Contact	10 – No Connection
11 – HU Humidity Control N.C. Contact	11 – Dry Alarm Contact #2
12 – MA Master Valve N.O. Contact	12 – Dry Alarm Contact #2

Main Relay Board Mappings for GLC Version 20.04.13.01 Controller

Relay #

1-Heater 1	16-Irrigation Zone 8
2-Heater 2	15-Irrigation Zone 7
3-Cooling 1	14-Irrigation Zone 6
4-Cooling 2	13-Irrigation Zone 5
5-Cooling 3	12-Irrigation Zone 4
6-Cooling 4	11-Irrigation Zone 3
7-Humidity	10-Irrigation Zone 2
8- On During Irrigation Cycle (Master Valve)	09-Irrigation Zone 1

Step 7: Relay Switch Test

Recommended: POWER UP SEQUENCE

- 1st) ECU Controller power on
- 2nd) Controller in the STOPPED system status
- 3rd) Power (breakers) to equipment on

Set the irrigation zone on times to a very small amount of time. You can test the irrigation zone valves by clicking on the “Irrigate Now” button. The label turns to yellow the irrigation cycle starts.

Your system is now operational. You may modify the set points to suite your growing conditions.

If you experience any problems, feel free to contact us at (828)-393-5884 between the hours of 8:00am and 8:00 pm EST, Monday Through Thursday and 8:00am till 4:00pm on Fridays.

Step 9: Run/Control the Environment

Using your Android Tablet browser, click on the RUN button at the bottom of the Controller Admin page. It normally takes 5 to 10 seconds for the system to perform start up tests and start running. Once all the relays are controlling the equipment properly, you can adjust the user defined settings to your growing preferences. Refer to the Owner’s Manual for more details on settings. Your system is now installed and complete!

We at Green Leaf Controllers would like to thank you for your purchase.

LIMITED WARRANTY

All Green Leaf Controllers (GLC) products and services have a 1 year unlimited warranty starting from the day of delivery. During the 1 year warranty period, if any part of the system does not work properly, GLC will replace the component for free. NOTE: ANY user MODIFICATIONS to the enclosures, microprocessors, cables, sensors or any other part of the system voids all support and warranty coverage.

Green Leaf Controllers (GLC) warrants that (a) the SOFTWARE PRODUCT will perform substantially in accordance with the accompanying written materials for a period of 1 Year from the date of receipt, and (b) any Support Services provided by GLC shall be substantially as described in applicable written materials provided to you by GLC, and GLC support engineers will make commercially reasonable efforts to solve any problem issues. Some states and jurisdictions do not allow limitations on duration of an implied warranty, so the above limitation may not apply to you. To the extent allowed by applicable law, implied warranties on the SOFTWARE PRODUCT, if any, are limited to 1 Year. GLC does not warrant that this SOFTWARE PRODUCT works in all types of environments all the time.

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