LSC Greenhouse Manual

Written by Paul Logue

Edited by David Althoff

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Overview

The LSC Greenhouse is composed of two wings, research wing and teaching wing. The research wing is suitable for the growing of transgenic plants. In addition, there is a set of double doors at the end of the research wing to help shield the rest of the greenhouse room for researchers needing to conduct experiments with insects in the greenhouse.

All environmental functions of the greenhouse are controlled by a dedicated computer in room 500 LSC using Argus software (now a subsidiary of Conviron). Each room of the greenhouse and hallway sections south of the main 5th floor hallway have a control box dedicated to the room. These control boxes act as an interface to the main computer and store the room parameter settings in case of computer failure. The switches inside these control boxes will override the computer in room 500. These are locked and should only be opened by the greenhouse manager as there is a risk of electrical shock.

The computer in room 500 LSC is on both emergency backup power and has a USP to bridge the gap between a power failure and the emergency generator going on line. All critical functions of the greenhouse (vents, A/C blower motors, heating and cooling valves and boost pumps are on emergency power as well. Supplemental lighting for the greenhouse and the evaporative cooling for the teaching wing are not on emergency power.

Greenhouse computer

All parameters of the environmental conditions for the greenhouse growth rooms and Katie Becklin's growth chambers are made through the computer in LSC 501. The Argus software is a logic based software program and is set up in layers like an onion. Because of this there are multiple ways to get the same changes. Always double check that your setting changes do as requested in the greenhouse room..

The best way to learn the system is to sit at the computer and explore the layers without making any changes. There is an Argus manual that you can start with but it Is fairly limited in coverage.

> **CAUTION Before making any parameter changes double check you are on the correct room and then write down the setting value and what layer of the program you are in before making any changes. It is easy to make a change and then forget what you did.**
>
> **CAUTION DO NOT SHUTDOWN THE ARGUS SYSTEM <u>EVER</u>. Only do so as instructed by Argus.**
>
> **CAUTION Only one person should make changes in the greenhouse settings.**

The computer is only on the internal Syracuse intranet. Dennis Wenthen is the A&S computer person assigned to the computer. In the event that you need remote access to the computer, either because you are going to be away or Argus needs to help you fix software issues, you will need to plug in the Ethernet cord to the back of the computer. You can use TeamViewer to access the computer remotely to make changes to greenhouse parameters. Launch TeamViewer and write down the IP address and password to get access.

In addition, Argus can use this to upgrade and troubleshoot problems with you. Argus does not have admin access so you will have to sit at the computer and enter the password when they need to install new software.

Room control cabinets

Each room and hallway south of the main hallway has a control cabinet associated with it. All room parameters put in through the computer are stored in the main control board in each cabinet. The control board is specific to each cabinet and the board has an ID key printed on a label. If board replacement is, needed the new key must be entered into the Argus set up software. You will need to contact Argus to have them walk you through this procedure. The number is: 1-888-667-2091 Ext. 115 is Vincent Marcos.

On occasion, I have had control boards fail (Rare) and a few output boards fail (again rare)

> **CAUTION** opening and working inside the control panels exposes you to both 115 and 208 Volts. Everything on the right side of the cabinet is active high voltage. Everything on the left side is active 24 Volts AC. Any mistakes on the right side with skin contact or conductive tool will get you shocked. Any contact on the left side with a conductive tool will probably damage the electronics. Be sure you know what you are doing and know how to safely work around live wires before trying to make repairs!

Repairs and troubleshooting to diagnose a problem and find where the problem lies you need a digital multi-meter. One (yellow) is in room 500 LSC. The output boards are plugged into the control boards and held in place by a small square drive screw. If a shade, vent or light is not working you need to first see if the output board is getting power. Each output board has a ground wire (black) and a 24V AC wire (red) going to each outer edge of the board. See if you have 24 volts AC. If not a fuse is probably blown. (Did Physical Plant recently replace a 4-way valve?) If you have power to the board, you then need to see if the output board is functioning properly. The output is controlled two ways. Manually with the toggle or rotary switch. This will override the computer settings. Activate the switch/dial and see if the shade, vent or lights work. If the shade, vent or light does not work, you then need to see if you are getting 24 volts AC out of the board. If you do not get voltage then the output board is probably bad. Some spares are in room 512 (potting shed) in a large box on the wire shelves.

The output board may work manually through the switches on the board but not electronically through the micro switches on the board. To test for this and you have gotten voltage out via the manual switches you need to make sure the computer in 500 is set to activate the function. If you are getting voltage out then the problem is either in the relays on the right side of the cabinet or the actual motor or limit switches within the motor housing. Activating the function and if you are getting voltage out you should see and hear the relay clicking. If there is no relay, activity and you can switch voltage output on and off the problem is in the relay. If you are getting relay activity then the problem is in the motor or the limit switches inside the motor housing.

> **CAUTION** do not manually activate the relays for more than a very short moment. You can override the limit switches and damage the motor and or the mechanical shades, vents. All the boards and relays are labeled. Some of the labels you need to look carefully for.
>
> **CAUTION** if one of the roof vents is stuck open you cannot leave for the day until it is closed. If a storm come up at night or in winter if you have a cold snap, it can destroy the research in the room and cause severe damage to the greenhouse.

Room Heating

Both the teaching wing and the research wing are heated by upper and lower (perimeter) hot water heating coils. The flow of hot water is controlled by 4-way valves in the hallway outside the rooms and boost pumps for each loop. The lower heating coil is used mostly for raising the room temperature and the upper coil is mostly for humidity control and snow melt during winter months.

Known problems-- the heating 4-way valves are prone to binding up and they seem to fail more often in the open position resulting in room overheating.

Problem diagnosis-- you can cycle the valve and boost pump and monitor the supply and return temperatures of the heating coil. To do so click on the room. You will have a display of all the room parameters and on the left side you will see the upper and lower supply and return water temperatures. If the valve is stuck these will not change quickly when the valve and pump are cycled. Time is needed to let the pipes cool down when they are hot. When cold the temperatures should begin to rise quickly.

Repairs Contact Physical Plant to have the valves or boost pumps replaced or repaired. The link is here: https://bfas.syr.edu/facilities/service-requests/?redirect

Room cooling

Teaching wing

The teaching wing is cooled via evaporative cooling (swamp coolers) these units are maintained by Biology. The coolers consist of a primary screen, secondary screen of very fine mesh and a 12" thick honeycomb section that is wetted by a circulation pump. Airflow over this section evaporates water and cools the incoming air. The blower is driven by a 1.5 hp. 115 Volt motor and each cooler has a primary electrical disconnect.

> **CAUTION** When working on a cooling unit turn the disconnect off. Sudden startup of the blower can cause injury.

Known problems the wetted membrane is served by a sump pump. These pumps have a life span of about 18-24 months and constant monitoring and replacement is needed. Spare pumps are in room 500 LSC. To replace the pump you need to cut the plug end of the electrical cord off near the plug and strip .5" of insulation off the end of each wire. Make sure the electrical disconnect is OFF before removing the old pump and installing the new one.

The water level in the sumps is controlled by a "toilet tank" type valve. These valves wear and need adjusting or replacement from time to time. Spare valves are in room 500 LSC.

Maintenance In the spring you will need to turn the water supply on. There are two ball valves in rooms D1 and D2. Valves are in the southeast corner and southwest corner respectively. Turn the upper ball valve to close and the lower valve to open. At this point water will begin to flow. Go outside and close the two drain ball valves at each end of the main 1.5" copper pipe and the two knob valves on each of the evaporative coolers. Open the access panel on the side of the cooler and make sure you see flow of water, which should be wetting the honeycomb membrane. The circulation pumps must be set to manual on at the computer for each room. If the pump does not work, it must be replaced.

Spring water turn on this is a judgement call depending on the type of weather and depends if you have an early or late spring. I usually turn the water on in late April.

Fall water turn off Depending on the weather and type of fall you will need to "winterize" the coolers. To do so you need to turn off the supply (lower ball valve in D1 southeast corner of room and open top ball valve. Southwest corner of D2. Open all four ball valves on the main 1.5" copper lines outside and then open the two knob valves on each of the coolers. At the computer, turn the circulation pumps to manual off for each room. I usually winterize the coolers in mid-late Oct.

Yearly maintenance-- Each cooler needs to be greased. There are two Zerk fittings on the water supply side of the cooler. Each fitting gets two pumps of grease. Grease gun is in the small mechanical room (504 LSC) along with spare grease tubes.

The screens (both inner and outer) need to be cleaned. Use the pressure washer in room 500 to do this. The inner fine mesh screens need to be clean. It takes about three slow passes at a distance of 4". Both sides of the screen need three passes. The inner screens are directional with arrows on the frame for direction of airflow. Start cleaning from the inside of the screen so the bulk of the dirt is blown out and not into the screen.

Blower drive belts need to be replaced yearly and properly adjusted. Physical Plant can order new belts. To replace the belts you need to turn off the electrical disconnect, remove the side access cover and the top cover (4 Phillips screws at each corner) Lift the cover up and slide it towards the building. It will rest at an angle. Loosen the four bolts on the motor to frame mounting plate and move the motor to loosen the belt. The new belt should be snug but not tight and the pulleys should be in line and parallel.

> **CAUTION** The metal edges of the cooler housing are VERY SHARP! You can get a serious cut if you are not careful!

In years with very heavy Cottonwood tree fluff, you may need to clean the outer screens twice. Once in early spring and again after the Cottonwood fluff is finished.

Research wing

The research wing is cooled by chilled water A/C units with blowers. The A/C units are below the two narrower benches in the large rooms and below the one narrow bench in the smaller rooms. Each bank (room) of the A/C units is supplied with chiller water from either SU's steam plant during the summer months or the LSC building large chiller unit located in mechanical room 123. The chilled water is controlled by the same type of 4-way valve the heating uses however; the valves are less prone to failure. The chilled water also uses boost pumps for circulation. These units are serviced by Physical Plant.

Known problems the chilled water lines have in-line screens to prevent clogging of the cooling coils in the A/C units. These screens are clogged often in the spring when SU's Steam Plant switches over to chilled water. This usually is in late April-early May of each year. This is due to rust chunks in the nearly 100-year-old pipes that run throughout the campus.

Diagnosis of problems if a screen is clogged you can check the flow by cycling the valve and watching the chilled water supply temperatures. This is only for the research wing. Click on a room on the computer. Under "Air Handling Unit", turn the turn the chiller valve and pump to manual on. In the left side of the screen, watch the chilled water supply temperature. It should begin to drop and go down in the 50's F range. On extremely hot days when the entire University is demanding chilled water the temperatures may only get down to the low 60's.

Repairs Contact Physical Plant. https://bfas.syr.edu/facilities/service-requests/?redirect if this is an emergency; you should phone Energy Management 315-443-1535.

Room Venting

The roof and side venting are used to control both temperature and humidity and in emergency overheating, it is the last resort to prevent severe overheating.

The vents are controlled via a motor that has both open and close position limit switches. These switches prevent over load of the motors and damage to the motor and mechanical frames. The position of the vent opening is registered by a 10 turn variable resistor (Potentiometer) inside the motor housing unit. The turning of the potentiometer shaft causes a change in the resistance, which is then sensed by the control panel, and this reading is sent to the main computer in room 500 LSC.

Known issues

The insect screens on the roof vents are at the end of their life and need to be replaced. This is an enormous job in scale and cost and can only be done through the Office of Design and Construction. The screen stays (vertical metal rods attached to the screens) keep the screens from billowing in the wind. These also need to be replaced by heavier rods. I have new heavier rods in room 500.

The roof vent actuator rod to frame attachment points are failing. This is due to the wind loads constantly pushing down and lifting up on the vent panels. Over time, the sheet metal screws that screw into the thin Aluminum frame have loosened and have started to rip out. When this happens the actuator rod will punch through the glass panel and brake the glass. This is also a problem the Office of Design and Construction needs to fix.

The 10-turn potentiometer within the motor housing are prone to failure. They usually fail by giving a very high resistance, which the computer detects and shows as a silent alarm. This is not an emergency, as the limit switches inside the housing will prevent damage.

Replacement of potentiometers To replace the potentiometer the vent must be closed manually by turning the side or roof vent switch to close and once the vent is closed turn the switch to off. This is inside the white control panel in the hallway outside the greenhouse room. The keys for the control panel are []. The side vent motors can be reached using a stepladder. Four screws hold the cover. You will need to unsolder the old potentiometer and remove it. Change over the plastic gear to the new potentiometer and you will need to set the turns on the new potentiometer to where there are on the old one. In the closed vent, position the turns on the old one should be close to an end of the 10 turns. New one should be set the same. Solder in the new potentiometer and remount it. You will need to then calibrate the new potentiometer with the computer. To do so, click on the room and in the lower left of the window click on IO module 1. You should see a list of sensors and one will be the vent you are working on. You will see about mid screen an area to put the **output scaling** in the left box put the value of the current reading. (Raw input reading) This is the maximum resistance when the vent is in the closed position. You now need to manually open the vent. You can do this by either backing out of the program and change the setting to fill open or change the setting using the switch in the control panel outside the room. You then need to go back into the program and insert the new “raw input reading” into the second output scaling box (to the right of the first box you just put the other value in) this value is usually lower than the first value you entered. Replace the cover on the motor housing and reset all the controls back to automatic.

> **CAUTION Never open the roof vents during high wind conditions**. The program on the computer is set to close the vents during high wind and limit the opening during rain. Do not mess with these settings. In high wind, a vent can be torn off the roof of the greenhouse. This could kill someone and most certainly do tremendous damage to the greenhouse.

CAUTION When working on the roof vent, you will need the 20' extension ladder. Be very careful of the lights and cables above you. The overhead shades should be locked in the open position. When up high in the roof vent area be very careful you do not slip and watch what you step on. Support yourself only on the structural framing and not on the electrical conduit or guywires.

Shades

There are no known problems with these shades. They should be cleaned with the pressure washer whenever the growth room gets a wash down. The overhead shades cannot really be cleaned. Side shades can be pressure washed by closing the shade (fully extended) and going over them with the pressure washer. Do not get closer than 18" or you can damage the shade. Reattach any clips that have come undone. Occasionally, a cable will come undone from the wind up spool or detached from the shade rail. You will need to rewind it on the spool or reattach it to the rail.

Irrigation and flood benches

The irrigation (drip lines) and flood benches are on different programs. In the lower left of the home screen you will see "irrigation controls" and "ebb and flood controls" The ebb and flood are the flood benches, the irrigation are the drip lines and the misting benches. There are two misting benches. One in teaching in E-1 and one in research in B-2.

Flood benches the plastic inserts on top of some of the benches are quite fragile. Never stand or drop anything on them. There are two spare kits in the autoclave room 508 LSC behind the autoclave in a wooden crate. You will need to order the glue in order to fuse the sheets together.

The flood benches have a sump full of water under the bench. A pump inside the sump pumps water up and into the flood bench. There is a water level sensor (pressure sensor) in the sump as well. When the water level gets low in the sump, the pressure sensor senses the drop in water pressure and turns the pump off. The water then flows back down into the sump until it switches the pump back on again. This will continue until the program tells the system to shut off. The pump (and pressure witch) is plugged into a 115 volt outlet which is controlled by the computer. There is an outlet box right next to the controlled outlet that is always active. The controlled outlets are marked by a black plastic plate. When a bench is not in use the easiest way to shut off the flood bench is just to unplug the plug from the controlled outlet rather than going into the program and stopping the flood cycle.

Known issues these are quite reliable. I have replaced all the original pumps as the old have failed and the new pumps have had few problems. One may fail in time and you just need to swap out with a new pump. You will need to order a new one if one fails.

Irrigation the irrigation lines are controlled by a 24-volt AC solenoid attached to the grey PVC line.

Known problems the only issue I have had with the solenoid valves is when Physical Plant changes out a 4-way valve for heating or cooling. If they do not set the valve to off and they go to rewire the new valve and short the leads together, it will blow the fuse to the 24-volt line. This fuse also supplies power to the irrigation solenoid. The fuse is in the white control cabinet outside the growth room and is the

four Amp 24 volt fuse. This fuse output is daisy chained to several output boards inside the control cabinet. It is important to have the 4-way valve switched off when Physical Plant works on the valve.

Floor drains

Each growth room has a floor drain. One drain in the small rooms, two drains in the large rooms. These should be kept clean by the room user. These drains and the drains in the wing hallways drain down into two large sediment tanks in room 400 (mechanical room). The floor drains should have water put down them on occasion (once a month) to keep the traps full. This keeps any insects from getting between the growth rooms. When the growth room is given a pressure wash between uses the floor drain should get a good blasting as well to remove built up dirt in the drain. No large quantities of soil should be flushed down the drain!

Supplemental lighting

Both the teaching wing and research wing of the greenhouse have high-pressure sodium vapor lights to supplement natural sunlight. The research wing has twice the lighting density than that of the teaching wing. The lights are not on emergency standby power. The lighting is controlled through the Argus software. The software can be set to have two lighting time windows and the lighting in rooms A-1 and A-2 can be divides into every other row lighting. I have made a map of the lights and which circuit breaker controls what light so the lighting can be further customized for researchers. The mapping sheets are in the doors of the circuit breaker boxes in the main hallway on the fifth floor of LSC.

The lights can be programmed to be full on for a specified period or programmed to turn off after a specific natural sunlight intensity is reached or turned off after a specified total sunlight threshold has been reached.

The lights should be turned off if a greenhouse room is not in use. Each lamp is 600 watts and uses a lot of energy and the sodium bulbs are about $100 each.

Known issues none. Occasionally a bulb will burn out and must be replaced. I have had to replace two ballasts and one igniter in the past 12 years. The lights are very heavy and if removal of the unit is needed for, repair two people are needed. One person needs to support the light using a pulley and the other person needs to be on a ladder to unhook the light and unplug it. These are very expensive lights and should be treated with care. The pulley and spare bulbs are in room 500 LSC on top of the file cabinet next to the door.

Roof weather station

There is a weather station on the top of the A-2 growth room. This weather station consists of a weather vane, thermistor for outside temperature, a rain-sensing ring and heater and a photo detection sensor for measuring ambient light.

Operational function the weather station is used by the software to determine heating requirements, dehumidification requirements, lighting functions if your lighting settings are based on intensity or total accumulation of sunlight, it is also used to melt the snow on the roof during snowstorms.

Known problems there have been only two problems I have had with the weather station. One was due to a lightning strike close by and the electronic board had to be replaced. The other is over time the rain sensor rings, which are brass and build up oxidation. This increases the resistance between the concentric rings and at a point, the resistance become so high it is outside the limits of the rain resistance and the computer never senses it is raining. The fix for this is to take a pad of Scotch bright pad and get up on the roof and wet the pad and gently rub over the top of the sensor. Then wipe off with a clean rag. This removes the oxidation on the brass rings and restores function. The hard part is you need to get up on the upper roof with a tall (12') ladder that you have to haul up through the hatch. The hatch is behind the door on the landing of the stairway next to room 500.

> **CAUTION** do not attempt to get on the roof on a windy day or if it is raining and especially if there is a thunderstorm nearby. Also, do not go out on the roof during spring April-May when the Red Tail Hawk is nesting next door. Great care should be exercised when up on the roof on the ladder servicing the weather station.

Side note there is a second temperature and rain sensor on the wall outside the door leading to the outside roof greenhouse area. This is used by Energy Management to tell if it is snowing. When it snows the roof area alone the banks of evaporative coolers is heated to melt the snow. This is because the cooler while not using water for cooling are still used to bring in cold air to cool the rooms. The snowmelt prevents snow build up and clogging the intakes to the coolers. If you see buildup of snow contact Physical Plant.

Outside roof area

The roof greenhouse area is used by researchers and students throughout the year. Even in winter. The area is about 80' up and the wind can become very intense at times. Nothing light should be put out on the roof. It can be blown off and could kill someone on the ground or cause damage. I have seen the empty benched be moved by the wind. No chairs, tables etc. should be left out on the roof unless they are anchored or chained down!

Students are responsible for keeping the area clean. If a student makes a mess and leaves it, you need to contact them and tell them to clean it up. If they do not then contact their faculty member and tell them. Cleanliness out on the roof is just as important as it is inside the growth rooms.

General upkeep and cleaning

Upkeep it is important to make sure repairs to equipment is done promptly. Do not let stuff slide because things will snowball and become unmanageable in short order. If you have put in work orders to Physical Plant, https://bfas.syr.edu/facilities/service-requests/?redirect and they have not responded in a reasonable amount of time you should contact Seth Enders swenders@syr.edu

Some things like general heating and cooling you can submit a repair order. Other things that are specific to the greenhouse are billed services. In the fields that are for requisition and chart string, you should type, “put on Biology standing order”

The greenhouse growth rooms, sterilizer room and potting shed should be kept clean at all times. The students and researchers are responsible for the cleaning up after themselves. You are not responsible for cleaning up after people. You are responsible to make sure the people that make the mess clean up after themselves. You are also responsible for getting custodial to clean the main hallway floors regularly. Annette Statum astatum@syr.edu is the supervisor for custodial. She is the one you contact about getting trash bins empty and the main hallway floor cleaned. Custodians do not go past the hallway doors for the teaching and research wing.

Growth chamber room

Overview room 401 contains nine growth chambers. They are numbered 1-6 and 8-10. There are several different vintages/models of growth chambers in the room.

Two of the oldest ~35+ years, units 3 & 4, are E-15 early electronic control with water-cooled condensers. These two chambers are in OK condition as I rebuilt much of the electronics and rewired the lighting/ballasts inside them to get them up and running. They have been mostly problem free for the past 10 years.

Two newer E-15 units # 1 & 2 are ~30 years old. These are water-cooled and early computer controlled. These two units are not owned by Dave Althoff and Kari Segraves but they have first refusal of use. These two units have had some problems with the drivers for the triacs that powers the lights and heaters. I have replaced both unit control computers. They have also had refrigerant leaks. These units should be watched when in use. SU’s Physical Plant will service the refrigeration part of the units as a billed service.

Two units # 7 & 8 are ATC26 ~20 years old. These are air-cooled condensers; have humidification fed by R/O water to misting nozzles. These are newer computer controlled. These units are owned by Ramesh Raina. There have been several problems with these units. The misting nozzles become clogged once in a while. The air cooled units need to have the condenser coils cleaned yearly. One unit I replaced the computer controller.

There are two new (less than 5 years old) #’S 9 & 10 owned by Katie Becklin. The one unit #10 has had a couple of issues, which I traced to a poor supply wiring. The wiring feeding the unit was not tight causing intermittent power loss. This problem has been fixed.

All the above growth chambers are Conviron units. Conviron is somewhat difficult to deal with and their service reps are local contractors. Some are good, some not so good.

The final unit, # 6 is a Puffer Hubbard brand growth chamber. It is very old. The unit is mechanically controlled. The timer for the incandescent lights needs to be replaced as it runs slow and will get out of

sync with the time of day. The lighting/ballasts have been replaced and the compressor, which is air-cooled, is in running condition. It is the least technical unit of them all.

Walk-in growth chamber

Overview This is a walk-in growth chamber (Rm 281) and the controls are separate from the unit as is the water-cooled compressor. The compressor resides under the large black box you will see when you walk into the room. The chamber is humidity controlled using a rotary misting humidifier controlled by the computer and supplied by the buildings R/O water. The system is controlled by a basic programmable computer and augmented by a standalone desktop computer. Manuals are in the cabinet below the breaker box. This is a departmental growth chamber.

Known problems there are two problem areas. The biggest is the evaporation coils used for cooling the chamber use a hot gas bypass valve to shunt hot compressed refrigeration gas back to the cooling coils to defrost them. This valve is located near the large compressor. The vibration from the compressor destroys the valve over a period of ~18-24 months. I have tried to get Physical Plant to relocate the valve farther downstream so the vibration does not ruin it. They have refused to move the valve. In June 2021, watch for problems with heating and cooling in this chamber. Physical Plant needs to do the work on the compressor and bypass valve. The second issue is the fuses for the auxiliary heat coils. These fuses have burned out twice. The cover to the large black box on the wall must be removed to access these fuses and replace them.

Argus Software

Overview the software interface is similar to a browser window that contains “hyperlinks”. When you left click on it, it takes you to the next window. On the top left tools you can toggle back and forth from current window to pervious window. The software is logic based. By this I mean much of the program is based on AND, OR logic found in primary level digital electronic components.

Home screen this displays a basic layout of the green house and the room designations A-1 through E-3. It also displays the current temporary set points (high/low) and current room temps.

A word of caution until you know the system and are comfortable in the programs use I suggest you double check you are on the correct room and before making any changes you know what layer of the program you are on and what the pre-change value is before making any changes. It is easy to get lost in the layers and forget where you made a change in the event you have to undo what you changed.

For Argus remote support

In order for Argus to go in and work on the green house computer, two things need to be done. 1) The Ethernet cable in the back of the computer needs to be plugged in. It should be unplugged all the time except when remote log on is to be done! 2) You need to > on the Team Viewer and have it running. This take a moment for it to connect with Team Viewer and give an ID# and password. The ID # does not change. The password will change daily or with each Team Viewer session. The ID # and password

must be given to the person you wish to log on and work on the software. My contact for Argus is Vincent Marcos jira@conviron.com or 1-888-667-2091 Ext. 115.

Making changes

For simplicity I will use ">" to denote clicking on a field.

Setting room parameters it is easiest to set the room parameters by going into the "big picture" To do so > the room you wish to change. To the mid-lower left you will see "diurnal set points" > on this. > Big overview. You now can enter new values into the fields by > on the field.

NOTE the program is designed with a ramp up and ramp down period where the room is in transition. You need to allow 1-2 hrs. between day settings and night settings. If you wanted to have a day period of 6 am to 10 pm, you would enter 600 in the day period start field and 2200 in the day end field. You would then need to adjust the night field allowing for a ramp. For this, you would enter 2300 for the start field and 500 for the end field. In some cases, you will hear a faint beeping for a short time until you have the proper time settings set. If the beeping continues, you probably have to extend the ramp time by shortening the nighttime window. These time settings have no bearing on the supplemental lighting times. Supplemental lighting is controlled through the HID lighting control.

Supplemental lighting > on a room you wish to adjust the lighting in. You will see about mid screen HID lighting control. You can either turn the lights on, off or set them to automatic to have the computer control the lights. To set up a lighting time > on HID lighting control. Depending on what room you > on, you will see HID lighting 1 or HID lighting one & HID lighting two. Only rooms A-1 and A-2 have two choices. These two choices allow you to set different lighting times by every other row of lights.

Time settings for HID lighting > on the room you wish to change > HID lighting control > HID lighting 1 (or 2) Under BLOCK 1 EQUATIONS you have "time window 1" > time window 1 In the lower half of the window you will see "equation management" In this area you can enter the times you wish the lights to be on. You can also use time window 2 to set up an evening lighting period and have the lights off during the daytime. Use the time window 1 for morning and time window 2 for evening lighting.

Using sensor based lighting in the previous window above, under "Block 1 equations" Next to "sensor based operation" (equation 3) to the left you can toggle between disable and enable.

Accumulation lighting You can also turn the lights off based on total solar accumulation (equation 4)

Watering schedule changes

Overview The drip lines and flood benches are quite versatile in length of watering/flooding and times of use. Setting these up can be a little tricky and confusing because you need to have all the logic switches set up right for it to work.

Irrigation There are eight "valves" per room in the Argus program. Physically there are six junction boxes along each room outer wall. Each of these boxes can control a solenoid water valve. Not all boxes are wired to valves. The solenoid valves are the black valves attached to the ¾" grey PVC pipe on the wall opposite the room door. These valves can either be triggered by the program or manually

opened. **DO NOT FORCE THESE VALVES CLOSED BY overtightening them!** Just a light tightening is all that is needed. In addition to these solenoid valves, there is a ball valve that must be on in order to have water flow. These solenoid valves are activated by a 24 Volt A/ C output inside the rooms control cabinet outside the room. This 24 Volt A/C supply also serves the overhead 4-way valves that control the room heating. I have had Physical Plant replace the 4-way valve and not turn off the valve power and they short the wires that blow the four Amp fuse. If you are not getting signal (24 Volts A/C) to the solenoid valve check that you have 24 Volt A/C to the small control board that supplies the solenoid. Black and red wire on each outer edge of the small board.

Irrigation time set up on the home screen > on "irrigation control" To the left you will see a long list of valves starting with valve A1-1. You need to know which valve you are working with. The boxes in each room are 1-6 with # 1 being closest to the main hallway that the wings come off of. The valve must be set to automatic. In the upper mid screen, you will see the zone schedules. Two rooms have two schedules. (A2 and D2) > on a schedule (say A1) To set up a time clock watering you must have the time clock watering set to enable. > On "time clock watering" Under "watering settings" you can set up the duration of the watering. It is set up for Hrs. min, sec. 00:05:00 would be 5 minutes of watering.

Under "Time window", you can set the days of the week you wish to water. This can be set for a one-week cycle or every other day continuous by using the two-week cycle.

Under "watering times", you can set the time you wish to start watering. You can have 24 different watering intervals per day. You can enter 600 in the first block and 1500 in the second. All the rest being zero. This will give you a watering at 6 am and 3 pm.

You must be sure that the "time clock watering" is enabled (top right of window)

Manual watering > irrigation control > choose the zone. In the upper window top right > on initiate a manual watering. A window will pop up. > OK. This will initiate a watering for a time determined by the previous window.

Warning in order for the system to work you need to make sure the zone and valve is in the schedule. To do so: From home screen > irrigation control Make sure the specific valve in the room you want to water in is set to automatic. (Left column) > The zone. In the upper right > on "zones to water" This will show you a list of valves that will be activated when the program triggers. Any valve in this list will trigger as long as the valve is set to automatic (see above) You can add or remove valves in this list by > "irrigation zones to water" **BE CAREFUL.** You have the entire list of valves for the entire green house. Find the exact valve you want on the left and > add. You can also remove valves on the list at the right by clicking remove.

Flood bench watering (ebb and flood)

Overview The flood benches are controlled by activating the 115 Volt outlets along the rooms outer wall. These outlets are marked with a black plaque. Black sumps below the benches must be clean and filled with fresh water and the pump and the pressure sensor must be at the bottom of the sump. When the pump is active, it will begin to fill the flood bench until the pressure sensor detects low water level and shuts the pump off. When the pump shuts off the water drains back into the sump until the pressure switch turns on again. This will continue as long as the program has power going to the outlet. The outlets are marked with #1 being closest to the main corridor the wings come off.

The flood benches take time to fill. It takes between 30-45 minutes to fill the bench and the same to drain. If you have the program, set for 30 minutes the effective watering time will be around 45-55 minutes. You cannot do a flood watering in 10 minutes. Not enough water will be pumped up to water all the plants.

Scheduling the flooding

1 & 2 day cycles from the home screen > Ebb & flood control. In the upper middle column, be sure the outlet is set to automatic. In the left column you can choose the room and bench you wish to set up the time of flooding. > a room and bench. > Time clock watering. You can now set the duration of watering, the days of the week and times of day the same as you did for the irrigation section. Back out two screens to the irrigation status window. > The corresponding bench in the middle column. At the top of this window you need to make sure the "watering for this zone is" ENABLED."

3 day cycles from the home screen > ebb and flood. In the lower half of the screen, you will see five columns. In order to water every 3 days you must disable the fifth column (time clock control) that corresponds to the room you are working on. In the first column, you need to enable the room you are working on. In the second column, you need to set the duration of the flood cycle.

Argus Graphing Function

The graphing function now is working after the controllers were reset and is handy to see room temps and other functions and for diagnostic function to help pinpoint a software or hardware problem.

To use the graphing you need to right click on a blank part of the Argus window. Anywhere in the grey area below the "Conviron chamber" block to the right of the window will do. The dropdown menu will have create data graph. Select this. Then go to the fields you want to graph. For example, room A-1 current temp. Right click on this field. In the dropdown menu choose Display temporary graph. You can go back in time, shrink or expand both the X and Y axis. To exit the graph function click the X box at the top right. You will be asked if you want to save the graph. Clicking no just closes the graph.

You can graph in any screen layer. i.e. home screen or deeper down in the rooms. You can also graph multiple fields by right clicking on the grey empty field, choose create data graph then hit and hold the control key while right clicking to select all the fields then release the control key and right click on the highlighted field and select display temporary graph. All fields selected will be graphed.