

iGrow 1600™

INTELLIGENT ENVIRONMENTAL CONTROLLER



Installation and User's Guide

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Introduction

Welcome to iGrow 1600™, Link4's Intelligent Greenhouse Environmental Controller. The iGrow 1600™ represents the latest in greenhouse environmental control automation. iGrow 1600™ enables you to control and integrate a variety of equipment in your greenhouse. Your heating, cooling, venting, shading, humidity, CO₂ lighting, misting and irrigation needs are linked together into one flexible, easy-to-use system.

Link4 can offer reliable service because we are staffed by the designer and engineers that developed the iGrow 1600™. In designing the iGrow 1600™ it was our purpose to design a controller specifically for the demands and cost concerns for small to mid size growers and no other controller has a better feature to price ratio than iGrow 1600™. Your greenhouse control system should improve the quality and efficiency of your operation. iGrow 1600™ offers quick installation, and dynamic programming flexibility for easier and more accurate greenhouse management giving you the freedom for you to focus on plants and profits.

The reason why we stand out from others is because of our Link4 Promise: Our passion is to provide growers with intelligent control solutions. We understand controlling your growing environment is critical to your success. Therefore, our commitment is to build outstanding controllers and to provide excellent support so that you can know with confidence that the iGrow 1600™ system is right for you.

Customer Service

Link4 has a well-trained customer support staff that is ready to help. Our customer service center is committed to your greenhouse business 24/7 through our website or service line for access to solutions for your controller needs. Before you contact us, please write down the model number and serial number located inside the iGrow 1600™ enclosure so that we can serve you better.

Contact Us

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Warranty

Link4 warrants that the goods sold under this contract will be free from defects in material and workmanship for a period of 12 months after the date of purchase. This warranty will be limited to the repair and replacement of parts and the necessary labor and services required to repair the goods. IT IS EXPRESSLY AGREED THAT THIS WARRANTY WILL BE IN LIEU OF ALL WARRANTIES OF FITNESS AND IN LIEU OF THE WARRANTY OF MERCHANTABILITY.

Moreover, any description of the goods contained in this contract is for the sole purpose of identifying them, is not part of the basis of the bargain, and does not constitute a *warranty* that the goods will conform to that description. The use of any sample or model in connection with this contract is for illustrative purposes only, is not part of the basis of the bargain, and is not to be construed as a *warranty* that the goods will conform to the sample or model. No affirmation of fact or promise made by Link4, whether or not in this contract, will constitute a *warranty* that the goods will conform to the affirmation or promise.

Link4 shall not be responsible for replacement(s) or repair(s), which become defective from user negligence, modification, abuse and/or any types of improper usage. Nonconformance to any of the specifications in the product manual will void the warranty. Furthermore, our liability to the goods sold, whether on warranty, contract, or negligence, will be released upon the expiration of the warranty period when all such liability shall terminate.

Link4 shall not be responsible for any loss or claims due to consequential damages afford by the Buyer. Link4 also reserves the right to make any necessary changes to features and specifications to condition or warranty.

Returns

Merchandise cannot be returned without a Return Merchandise Authorization (RMA) number from Link4. Requests for permission to return defective items must be made within (14) fourteen days after receipt of shipment. A Link4 RMA # for approved returns must appear on both the customer's shipping carton and the related receipt memo. Parts under warranty will be repaired at no charge. Other returned items will be subjected to the following restocking charges: 20% for no value added items, 40% for value added items, and 75% for custom designed or built to specification items.

Repairs

A repair order must also have a Link4 Return Merchandise Authorization (RMA) number. Repairs that are not covered by the warranty will be billed on a material and labor basis. Items returned for repair must be sent to Link4 with prepaid return transportation Link4 will not be responsible for damage(s) due to improper packaging or shipping and delivery of items returned for repair.

Additional Costs

It is expressly agreed that Buyer will reimburse Link4 for any additional costs attributable to changes in the specifications, directions, or design of the items furnished which are requested or approved by Buyer at Link4's listed retail prices in effect at the time such changes are ordered.

Governing Law

The validity of this contract and of any of its terms or provisions, as well as the rights and duties of the parties under this contract, shall be construed pursuant to and in accordance with the law of California. The parties specifically agree to submit to the jurisdiction of the courts of California.

Support

In order to offer you the best support, we request that you register your product with us online at www.link4corp.com. You will find the Register selection under the Support tab of the website.

Before you Begin

Temperature Control

With the iGrow 1600™ you can program a cooling temperature target called a “Cool Setpoint” and a heating temperature target called a “Heat Setpoint”. The temperature range between these two targets is called the “Normal” temperature range. If the greenhouse temperature is within the Normal temperature band usually none of the cooling or heating equipment is on. However, some circulation fans (often called horizontal air flow (HAF) fans) may be active to maintain air movement within the greenhouse environment.

Whenever the temperature within the greenhouse moves above the cool setpoint, or below the heat setpoint (falls outside the *Normal* temperature range) the iGrow 1600™ will enter cooling or heating stages to bring it back in line. With the iGrow 1600™ you can program up to six cooling and six heating stages. These stages go from Cool 1 to Cool 6 and Heat 1 to Heat 6. Cool 1 and Heat 1 are the least aggressive with Cool 6 and Heat 6 the most aggressive. In your program you will determine what equipment you want to be active in each of the stages. Of course, you do not need to use all the stages

When the air temperature in the greenhouse rises above the Cool Setpoint, the system enters the first stage of cooling, referred to as Cool 1. If the temperature continues to rise, the system will enter the second stage, Cool 2, then the third stage, Cool 3 and so forth. At each increasing cooling stage, more cooling will be brought to attempt to bring the air temperature below the cool setpoint and within the target “Normal” temperature range. Heating works the same way.

In considering the difference between each heating and cooling stage there is a variable increment in the program which is the number of degrees between each heating and cooling stage called the “Stage Separation” or “Stage Width”. Whenever the temperature rises 1 degree above the cool setpoint (70^o) then the iGrow 1600™ will activate the appropriate equipment to bring the greenhouse to the normal temperature range. If the temperature rises 2 degrees above the cool setpoint then the controller will be active in C2 cooling stage. The same goes for the heating stage when the temperature drops below the heating setpoints. In Figure 2.1, there is an example with four cooling stages and two heating stages.

Deadbands

If the temperature is below the cool setpoint and rises into the first stage of cooling, some cooling equipment will be turned on. This may then lower the temperature and bring it into the normal range. In order to keep the equipment from oscillating, a “Deadband” is employed when the temperature is between stages. In Figure 2.1 the dead band is set at 1 degree so that when the greenhouse is attempting to return to Normal temperature from C4 to C3 the controller will use a deadband of 1 degree to keep the equipment from oscillating off and on. Now, when the temperature drops below the cool setpoint, the system remains in the Cool 1 stage until the temperature drops below the Cool Deadband. The concepts that we described for cooling operate in the same manner for heating.

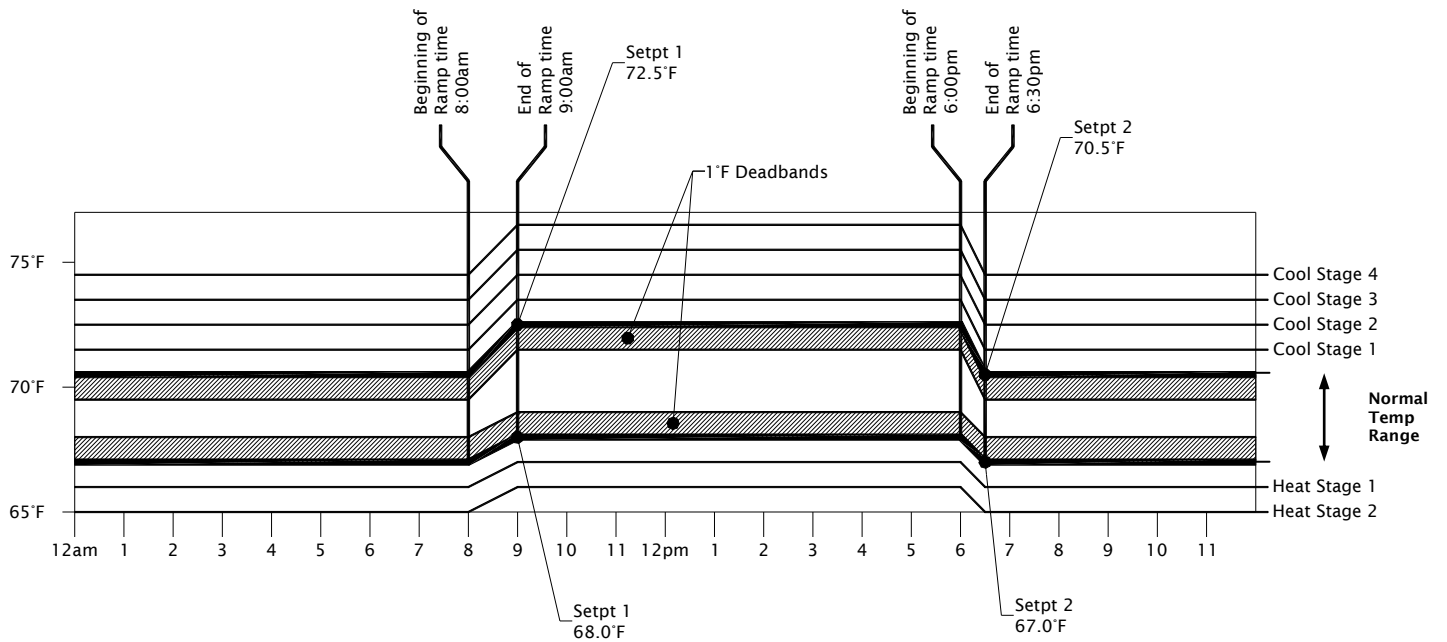
Setpoint

You will be able to use up to 4 setpoints in a 24 hour time period. Within each day Setpoints are based on time and temperature to produce an ideal environment. By placing setpoints during different times of the day you can regulate the temperature within a range for target temperatures and humidity. When a setpoint is in affect at a certain time length the controller will activate the necessary equipment in heating and cool stages to bring the environment back to Norm. The same applies when the humidity rises or falls beyond the target low/high setpoint. When one or more setpoints are used the second or subsequent setpoints will become the active setpoint at the start time and the previous setpoint will end.

Ramping

In addition, you have the option of a temperature **ramp** between the setpoints. Each setpoint time period ends with a Ramp time. The benefit of ramping allows for you to make smooth transitions within the greenhouse so that the plants don't experience temperature shock. Ramping also saves energy, which translates directly into lower operating costs.

In the example below, the start time is 8:00a with a 30-minute ramp time. The ramp time enables a smooth transition of the target temperatures between the setpoint time periods. Of course, the ramp times can be set to 0 and in this case there will be an immediate step transition in the set points. This is best explained by the illustration shown below.



in this Example:

Setpoint 1 is set to 9:00am with a 30minute Ramp, Temp is set as 68 to 72.5°F

Setpoint 2 is set to 6:30pm with a 60minute Ramp, Temp is set as 67 to 70.5°F

Figure 2.1 Example of Setpoints, Staging, & Deadbands

Control Strategy

Prior to installing and programming the iGrow 1600™ it is important to determine an overall strategy to control the environment in the greenhouse. The iGrow 1600™ is an extremely flexible and powerful device, thus additional care and planning are required.

In order to aid you with the process, Link4 has provided several worksheets in the following pages. It is assumed that you already possess a general understanding of greenhouse controls. If not, please review this section carefully.

It is recommended that you make copies of these sheets before using them. They will be useful in the future should your control need change.

The first worksheet is for temperature and humidity controls. It should be completed as thoroughly as possible, depending on your needs.

The second worksheet is for CO₂ controls. Skip this worksheet if you don't plan on regulating the amount of CO₂ in your greenhouse.

The next 3 worksheets are for Irrigation. The iGrow 1600™ supports up to 4 different modes of irrigation. Please see the Programming Section of this manual for additional information for these modes. These modes are supported on a per channel basis, so any combination of them can be used depending on your irrigation needs. If there are no plans for irrigation or misting controls with the iGrow 1600™ then these worksheets can be skipped.

Setpoint and Staging Worksheets

SET POINTS	START TIME	TEMPERATURE		RAMP TIME (min)	HUMIDITY	
		Low Set Pt. (°F/°C)	High Set Pt. (°F/°C)		Low Set Pt. (%)	High Set Pt. (%)
1						
2						
3						
4						

OUTPUTS	EQUIPMENT NAME	FOR ON/OFF & VENT ONLY														DEHUMIDIFICATION			HUMIDIFICATION
		HEATING STAGES							N	COOLING STAGES									
		H6	H5	H4	H3	H2	H1			C1	C2	C3	C4	C5	C6	DH1	DH2	DHLT	H
1																			
2																			
3																			
4																			
5																			
6																			
7																			
8																			
9																			
10																			
11																			
12																			

1 = ON 0 = OFF % = GO TO % -- = NOT AFFECTED

Figure 3.1 Setpoint & Staging Worksheets

For more information on Staging, see the **Cool/Heat Stages** portion of this Manual. For more information on Setpoints, see the **Setpoint/Timeperiod** portion of this manual.

Note: Curtains are not tied to staging (i.e. Inside Temp), they are controlled by light, outside temperature and overrides only.

Mix Valves are also not tied to staging, they independently adjust based on Indoor temperature, Outdoor temperature, and water temperature.

CO₂ Worksheet

OUTPUTS	EQUIPMENT NAME	CO ₂					
		START TIME (hh:mm)	END TIME (hh:mm)	MINIMUM CO ₂ LEVEL (ppm)	MAXIMUM CO ₂ LEVEL (ppm)	CO ₂ ENABLED STAGE	MINIMUM LIGHT LEVEL (W/m ²)
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							

Figure 3.2 CO₂ Worksheet

For more information on CO₂ control, see the CO₂ Equipment portion of this manual.

Accumulated Light Worksheet for Irrigation

OUTPUTS	EQUIPMENT NAME	ON TIME (hh:mm:ss)	ACCUMULATED LIGHT MODE						
			START TIME (hh:mm)	END TIME (hh:mm)	ACCUMULATED LIGHT LEVEL LOW TEMP (W/m2h)	LOW TEMP (°F/°C)	ACCUMULATED LIGHT LEVEL ELEVATED TEMP (W/m2h)	ELEVATED TEMP (°F/°C)	MAX OFF TIME (hh:mm)
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									

For more information on Accumulated Light mode irrigation, see the **Irrigation** portion of this manual.

Figure 3.3 Accumulated Light Worksheet for Irrigation

Cycle & Trigger Worksheet for Irrigation

OUTPUTS	EQUIPMENT NAME	ON TIME (hh:mm:ss)	CYCLE MODE			TRIGGER MODE	
			START TIME (hh:mm)	END TIME (hh:mm)	CYCLE TIME (hh:mm)	START TIME (hh:mm)	END TIME (hh:mm)
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							

For more information on Cycle & Trigger mode irrigation, see the **Irrigation** portion of this manual.

Figure 3.4 Cycle & Trigger Mode Worksheet for Irrigation

Schedule Worksheet for Irrigation

OUTPUTS	EQUIPMENT NAME	ON TIME (hh:mm:ss)	SCHEDULED MODE																						
			START TIME (hh:mm)						SCHEDULED IRRIGATION DAYS																
			T1	T2	T3	T4	T5	T6	Su	M	T	W	Th	F	Sa	Su	M	T	W	Th	F	Sa			
1																									
2																									
3																									
4																									
5																									
6																									
7																									
8																									
9																									
10																									
11																									
12																									

For more information on Schedule mode irrigation, see the **Irrigation** portion of this manual.

Figure 3.5 Schedule Mode Worksheet for Irrigation

Installation

Content Inspection

It's always a good idea to check to make sure your iGrow1600 came with all items listed below.

Additional accessories such as outside temperature sensor, light sensor, wind and rain sensors, and CO2 monitors can be purchased and added at any time.

Make sure you have all items, all associated hardware, and necessary tools before you begin installation. If there is any visible damage or missing parts, please contact our customer service at support@Link4corp.com or 1-866-755-LINK or fax us at 714.854-7244.

1. iGrow 1600™ unit
2. 12 VDC external Power Supply
3. Temp/Humidity Sensor with 50ft. cable
4. 4 pcs – 3/8" Drive, Hex Head Self Drilling Screws
5. 8 pcs – 1/4" Washers
6. 4 pcs – 1/4 -20 x 1" Hex Bolts
7. 4 pcs – 1/4 –20 Hex Nut
8. 1pc – small screwdriver (for tightening wire terminals).

Recommended Tools

1. Drill
2. 3/8" socket drive drill bit with 3" extender
3. Adjustable Wrench
4. 1/8" high speed steel drill bit
5. 7/16" socket drive with 3" extender
6. Level (optional)
7. Pencil

Mounting the iGrow 1600™

1. First, find a secure location to mount the iGrow 1600™ controller. The area should be away from direct sunlight, condensing humidity, rain, and extreme temperatures. It should be mounted in an easily accessible location at the user's eye level.
2. Since the iGrow 1600™ is equipped with a hinged door and a hinged access panel for easy service and installation, make sure there is adequate workspace. The recommended area is as diagrammed in Figure 4.1.

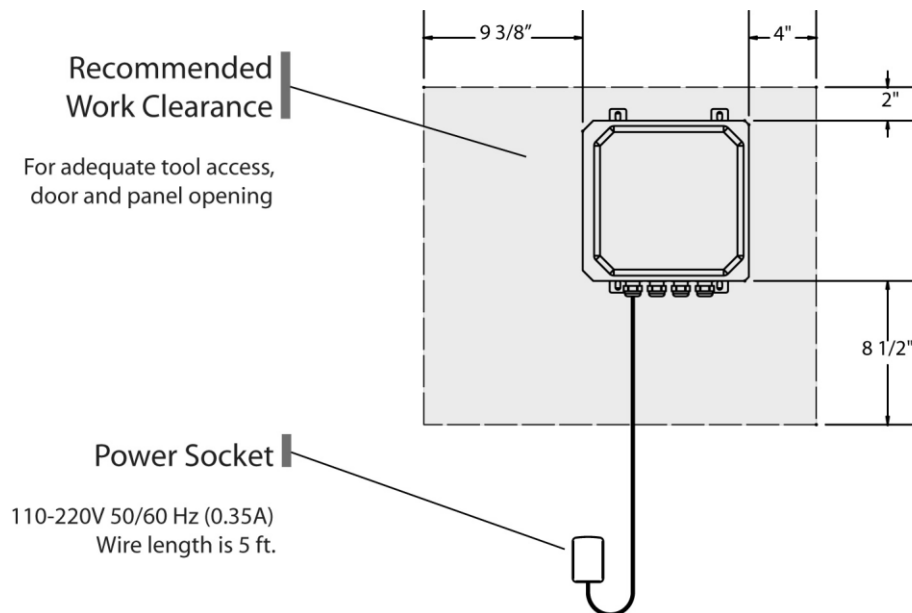


Figure 4.1 Mounting Clearance for iGrow1600™

3. The iGrow 1600™ comes with a 12V DC wall mount power supply. Make sure there is a power outlet within approximately 6 feet. It is recommended that the outlet is not switched and is on a circuit that is independent of any noisy, high power equipment. The use of a sealed outlet is recommended if the power output is exposed to moisture.
4. There are 4 mounting feet on the backside of the iGrow 1600. For shipping reasons, they have been rotated inward so they don't protrude from the sides of the iGrow 1600. Using the Drill with #2 Phillips drive, loosen the four feet and re-align them outward. Gently, but firmly, retighten the screws holding the feet in place. The brass inserts can strip out so be careful to not over-tighten.
5. Next, you will want to identify what type of surface you will be mounting the iGrow 1600™ to. Included are 4 self-drilling screws and washers for mounting to beam or wood panel. Also included are 4 pieces 1/4 - 20 x 1in. Hex Bolts and 4 pieces of 1/4 - 20 Hex Nuts for mounting to a slotted beam. If you are using the Hex Bolts, make sure that you pre-drill a small pilot hole.
6. Using the appropriate tools depending on your surface, mount the iGrow 1600™. Refer to figure 4.2 for a visual picture.

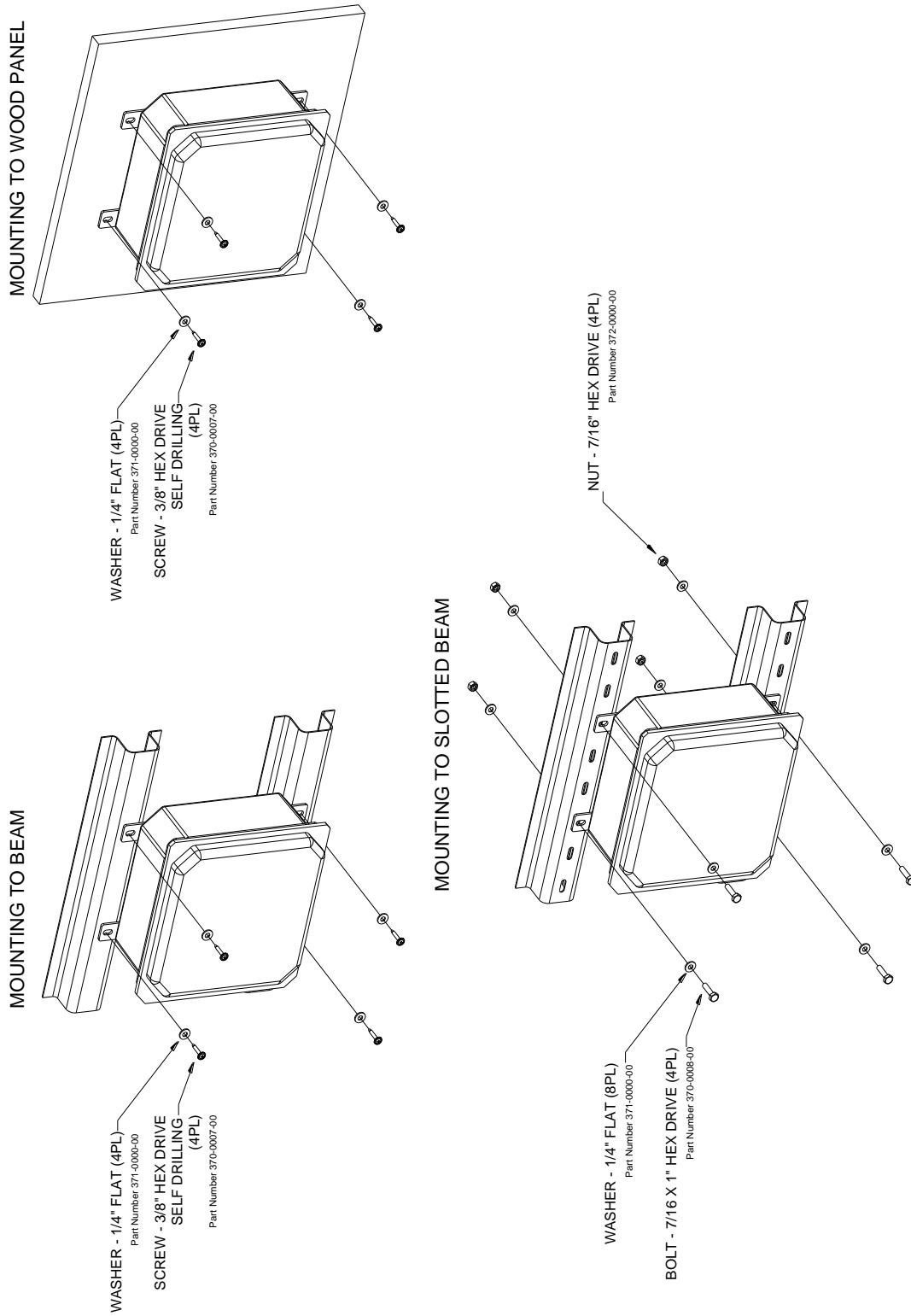


Figure 4.2 iGrow1600™ Installation Instructions

iGrow 1600™ Overview

Now that the iGrow1600™ has been mounted, take some time to look over the front panel. The iGrow1600™ has many features to help give you the growing advantage. Figure 4.3 below gives an overview of the main components that the iGrow1600™ has to offer.

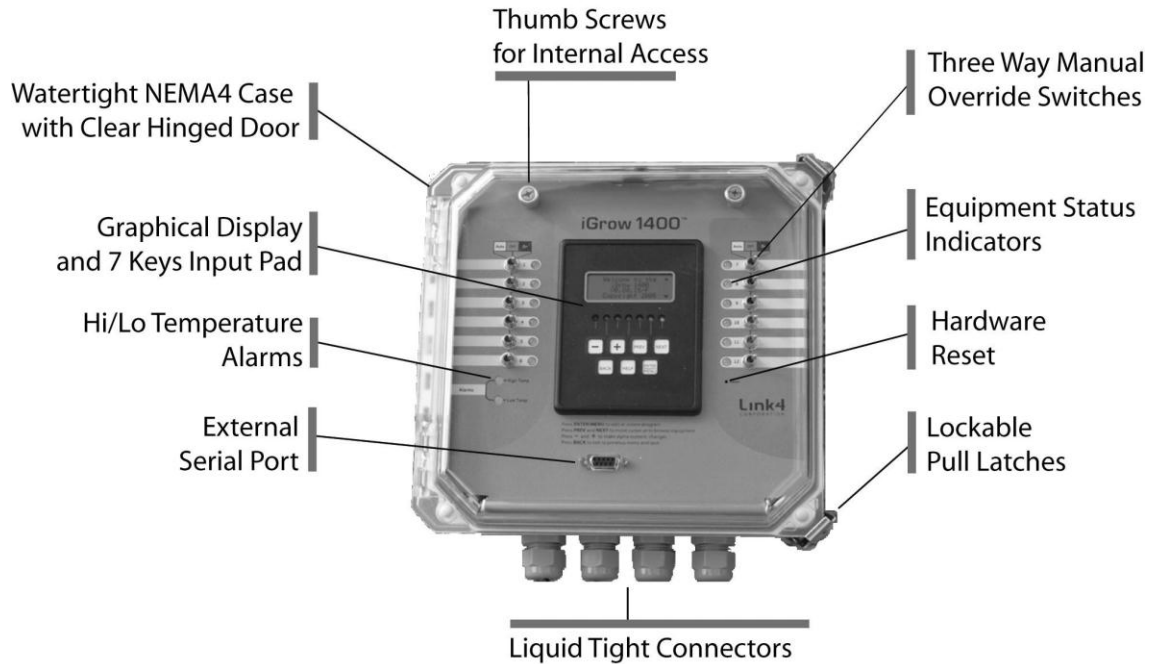


Figure 4.3 Front View of iGrow 1600™

Note: There are convenient white spaces provided next to each of the switches to allow for easy equipment labeling.

Opening the iGrow 1600™

1. First, open the clear hinged door by unlatching the two pull latches.
2. Now, loosen the two thumb screws until the iGrow 1600™ 's front panel comes out.
3. The front panel has a unique design that allows it to swing downward. It can be stopped at two positions: fully downward 180 deg or at 90 deg. using the front panel support cable. This cable should always be tucked away when it is not being used. The hinged design allows for easy accessibility to the inside of the iGrow 1600™ for service and installation procedures and a kink free cable management when the panel is closed (see Figure 4.4 and Figure 4.5).

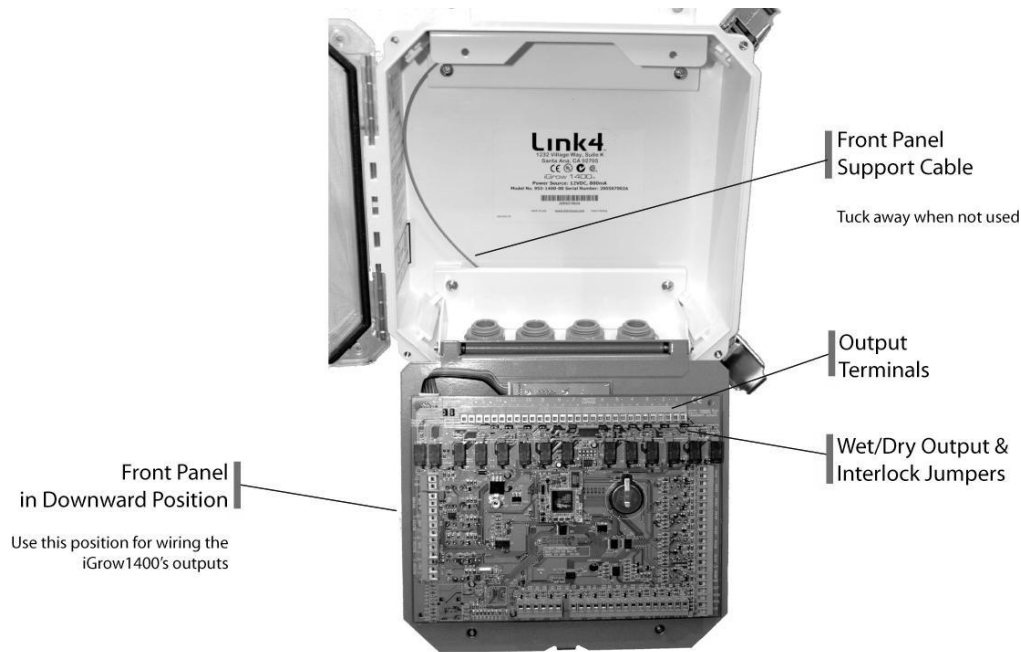


Figure 4.4 Full Open View of iGrow 1600™

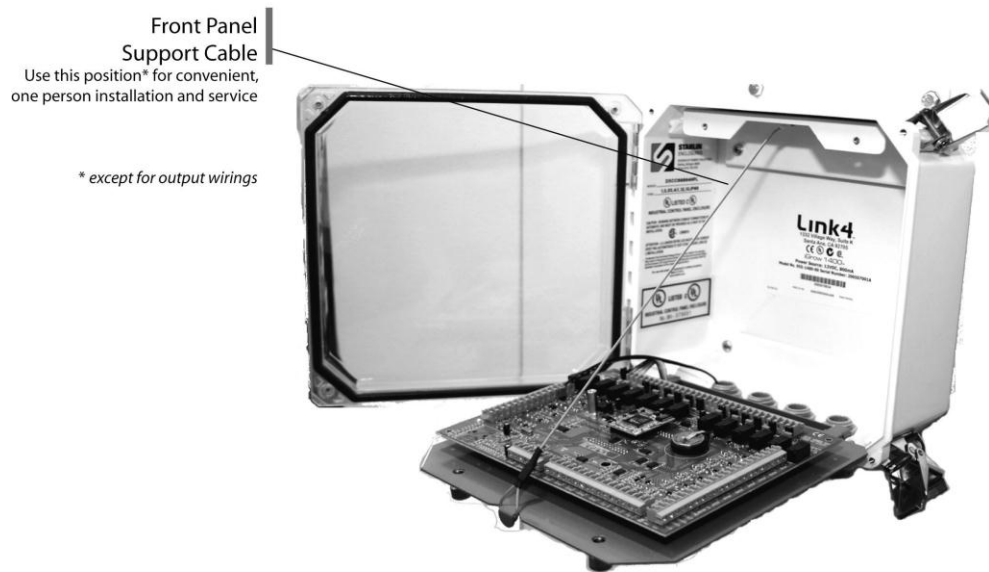


Figure 4.5 Front Panel, in the 90 deg. position

Internal Layout

Figure 4.6 shows how the iGrow 1600™ looks on the inside. Take notice of the board and familiarize yourself with the internal layout before beginning the wiring process.

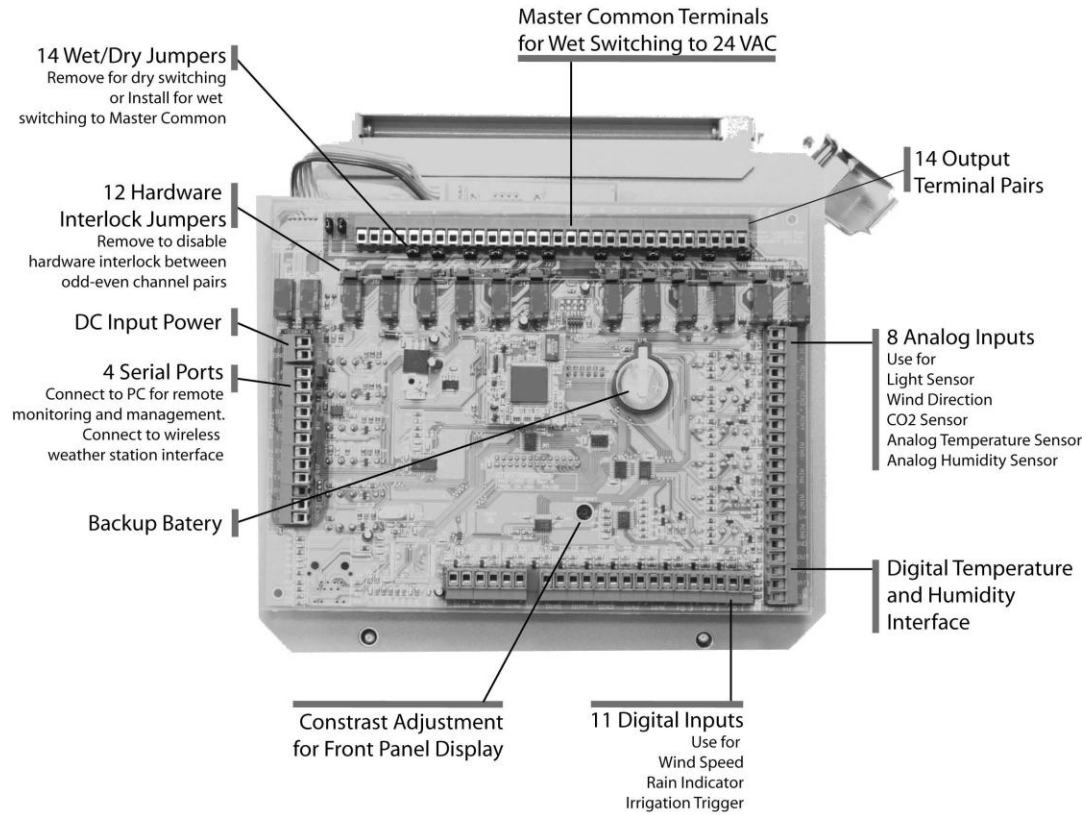


Figure 4.6 Internal Layout of the iGrow 1600™ PCB

Wiring the iGrow 1600™

Warning: Do Not Plug-in the Power in while wiring the iGrow 1600™ and keep all toggle switches in the OFF position.

It is recommended that all connections be made through the 4 liquid tight connectors at the bottom of the iGrow 1600™ since the glands compress around the cables to form a watertight seal. Making any additional holes in the top, sides, or back of the enclosure can result in water condensation inside the unit, causing damage to the controller. Failure to install to Link4's specification will void the warranty.

In preparation for the control wiring you should decide the iGrow 1600™ output assignments and control strategy. For more information on output assignment and control strategies, please refer to the Control Strategy section and the appropriate worksheets for this manual.

Power Supply Installation

1. If you want to navigate through the iGrow 1600™ to see some of the features and to familiarize yourself with how it works, begin by installing the power supply. Make sure the power supply is NOT plugged while installing any other outputs or inputs.
2. Begin the power installation by measuring the distance between where the iGrow 1600™ is mounted and the power socket. There needs to be about 6 feet between the two. If the power supply is too short, then use a power extension cord.
3. Make sure all 12 manual toggle switches are in the OFF position (center).
4. Lower the front panel to the 90 deg position by using the tucked away front panel support cable. See figure 4.5.
5. Take the open end (the two stripped and tinned leads) of the power supply. The RED lead is the 12V power and the BLACK lead is the GND (ground). Route the power lead through the left most liquid tight connector. Remember not to plug in the power supply at this time
6. Locate the DC Input Power terminal along the left edge of the PCB. See Figure 4.6 and Figure 4.7.
7. Connect the Ground lead (BLACK) to the GND terminal using a #0 screwdriver. Make sure that when screwing to make it a snug fit. Be careful not to over tighten the connection.
8. Do the same and connect the 12V power lead (RED) to the 12 V terminal using a #0 flat drive screwdriver.
9. Now, if you want you can plug in the power to navigate through the iGrow 1600™ or you can continue to install different outputs or inputs, but if you continue, remember to keep the power supply unplugged.
10. Power supply must be plugged into a water resistant outlet that is sourced from a clean 120V/60Hz circuit.

Part Number 551-0000-00

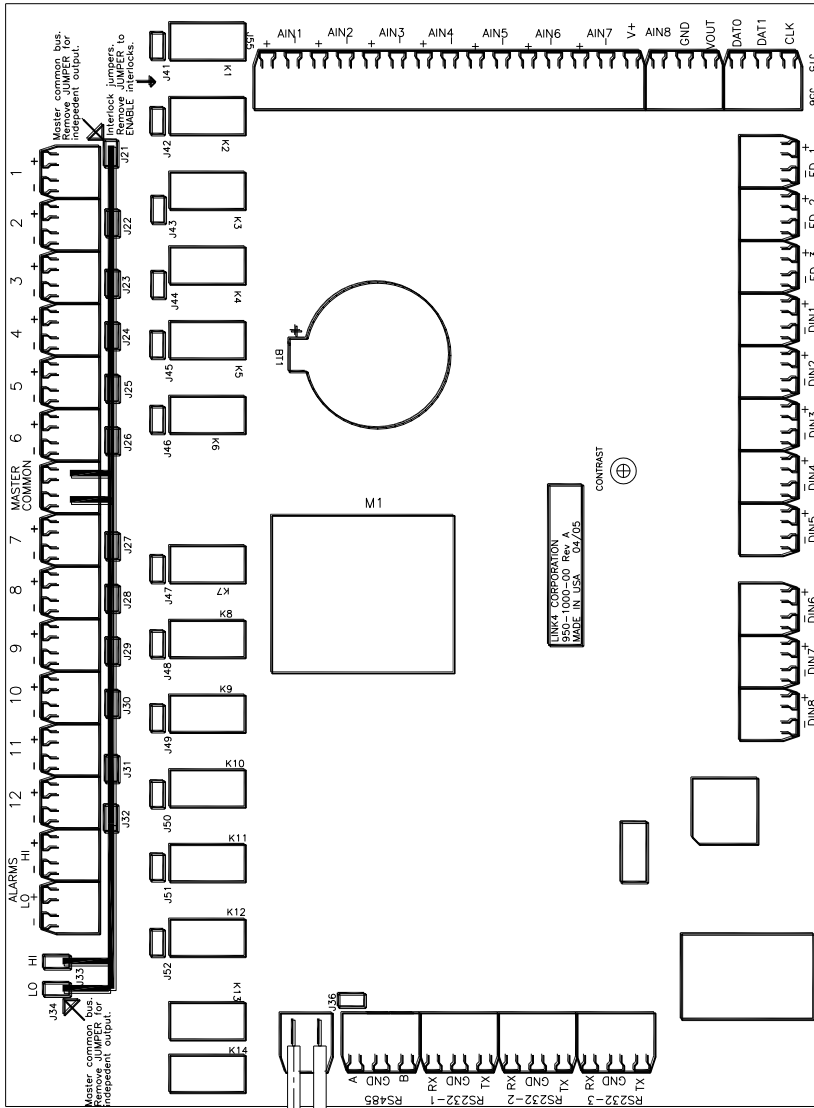
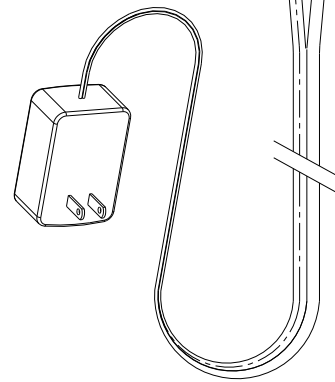


Figure 4.7 Wiring the Power Supply

Output Installation

The general installation strategy for this section is to install the output equipment in the greenhouse first and then the inputs to keep the cables organized in the iGrow 1600™. It is assumed that at this point you have already planned the channel assignment. If not, please refer back to the previous section on Control Strategy.

All cables coming into and out of the iGrow 1600™ should go through the 4 liquid tight connectors at the bottom of the enclosure. In order to minimize interference, it is also recommended that the sensor input wires not be routed through the same connector as the power wires. For best results, route all sensor wires through the right most liquid tight connector and then move toward the left. The power wires and non-sensor wires are routed through the left most connector, and if needed, the next connector over.

Control Relays & Contactors

Your iGrow 1600™ has twelve output relays that come set up with “wetted” contacts. The black terminal jumpers come set, from the factory, so that you can bring in a Master common 24 VAC.

When wiring this way, as wetted, the line current on the master common should not exceed 7 amps. If you remove a black jumper, its associated relay is then wired as a “dry” contact. See Figure 4.8 and Figure 4.9.

The board mounted relays are intended as “pilot” relays. For most loads you will want the iGrow 1600™ outputs to control a load relay or contactor that is connected to the motor. However, in some cases such as irrigation valves that are 24 VAC, you can drive them directly assuming that you are wiring only one or two valves per relay. The maximum run current recommended for each of the iGrow1600 relays is 1 amp. There are voltage suppressors on each output to protect the iGrow1600 from excessive inductive spikes. Additional protection should be used in the contactor panel if there are large inductive loads.

“Wet” and “Dry” Contact Design

A wet output switches the output to a shared 24VAC source. There is one terminal for each output (+) and a shared terminal for the 24VAC (master common)

A Dry output closes a switch. There are two terminals for each output (+) and (-).

“Wet” contact installation design is used when connecting one power wire to the master common 24 VAC source for multiple equipment such as irrigation and then a single wire to the appropriate channel. “Wet” design installation is utilized to minimize the amount of wires and fewer transformers. By default the black terminal jumpers are set in place. It is not necessary to remove the black terminal jumpers when using a “wet” contact installation.

Note: Both of the MASTER COMMON terminals and the channel terminals are the same and provide a maximum capacity of 7 amps. See Figure 4.8 for an example of a “wet” contact installation.

“Dry” contact installation design is used when a user wants to isolate equipment and use transformers for every piece of equipment. In this case, put both the wires in the appropriate channel and then remove the black terminal jumper for each channel wired as a dry contact. (you may replace the black terminal back on only ONE pin for safe keeping). See Figure 4.9 for an example of a “dry” contact installation.

It is also possible to utilize both “wet” and “dry” contact installations at the same time. Refer to the “wet” contact section to install a “wet” setup and refer to the “dry” contact section to install a “dry” contact. Remember when installing a “dry” contact to remove the black terminal jumper for each channel wired as a “dry” contact only. See Figure 4.10 to view an example of output wiring a combination of “wet” and “dry” contacts.

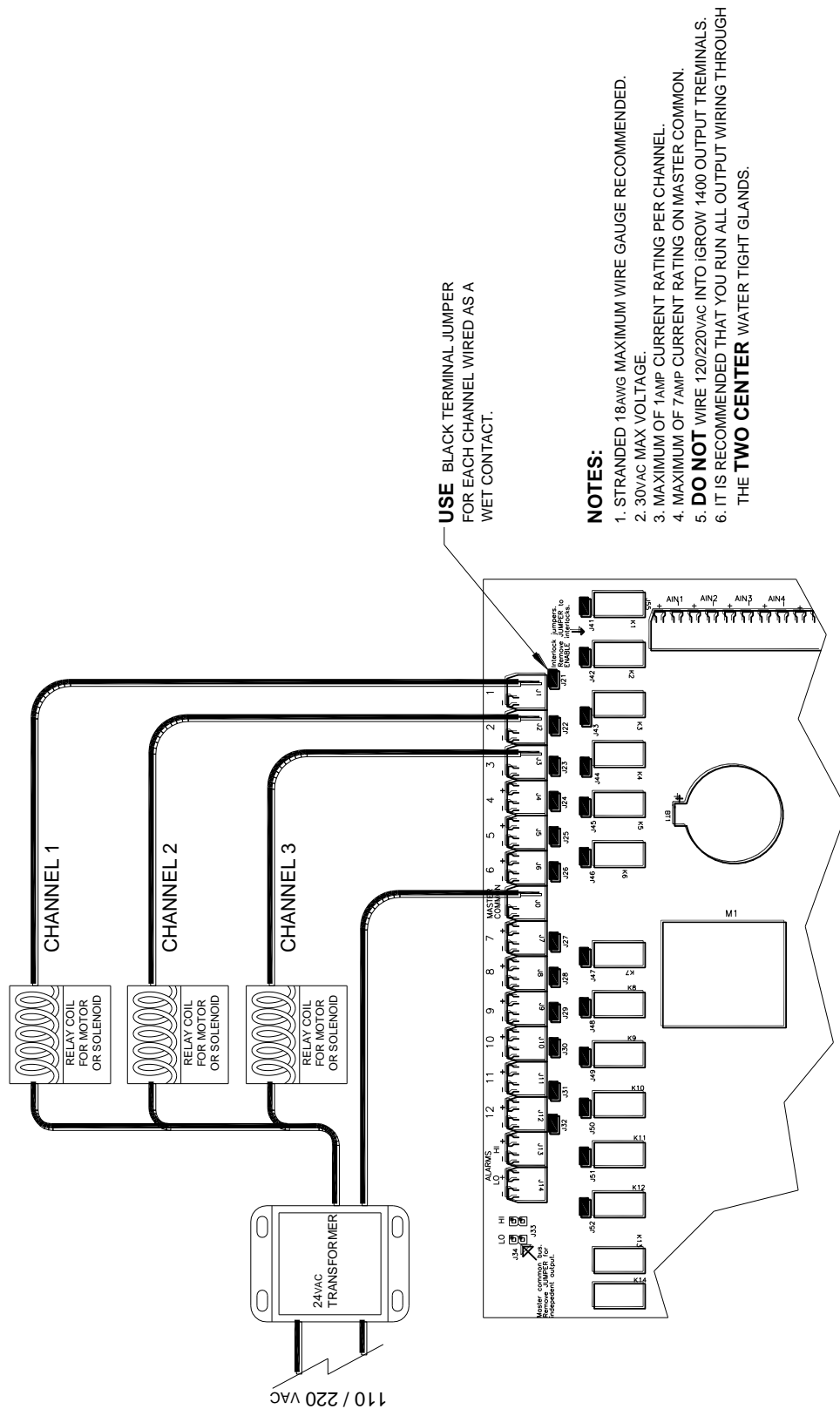


Figure 4.8 Output Wiring Example, Wet Contact

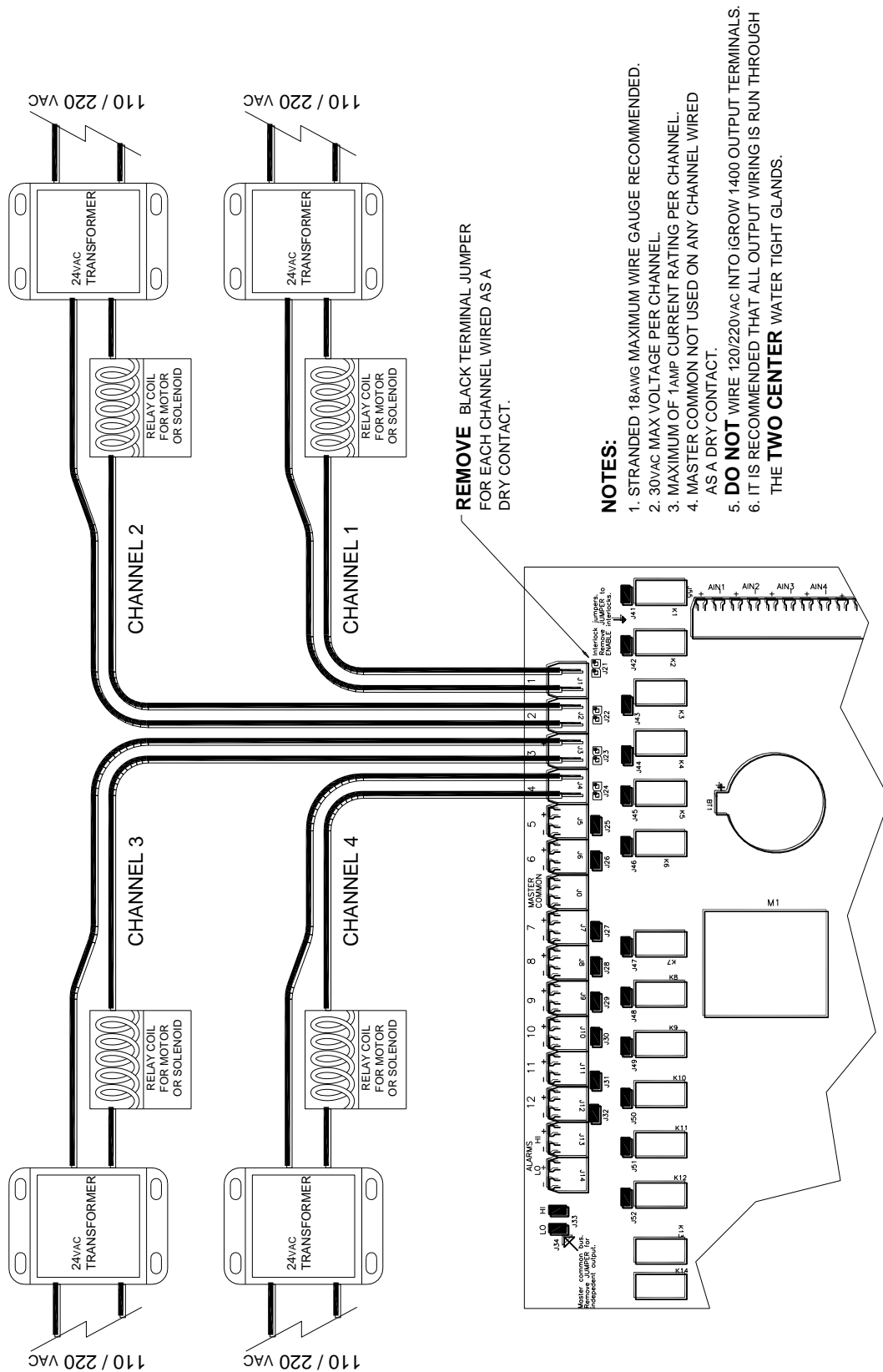


Figure 4.9 Output Wiring Example, Dry Contact

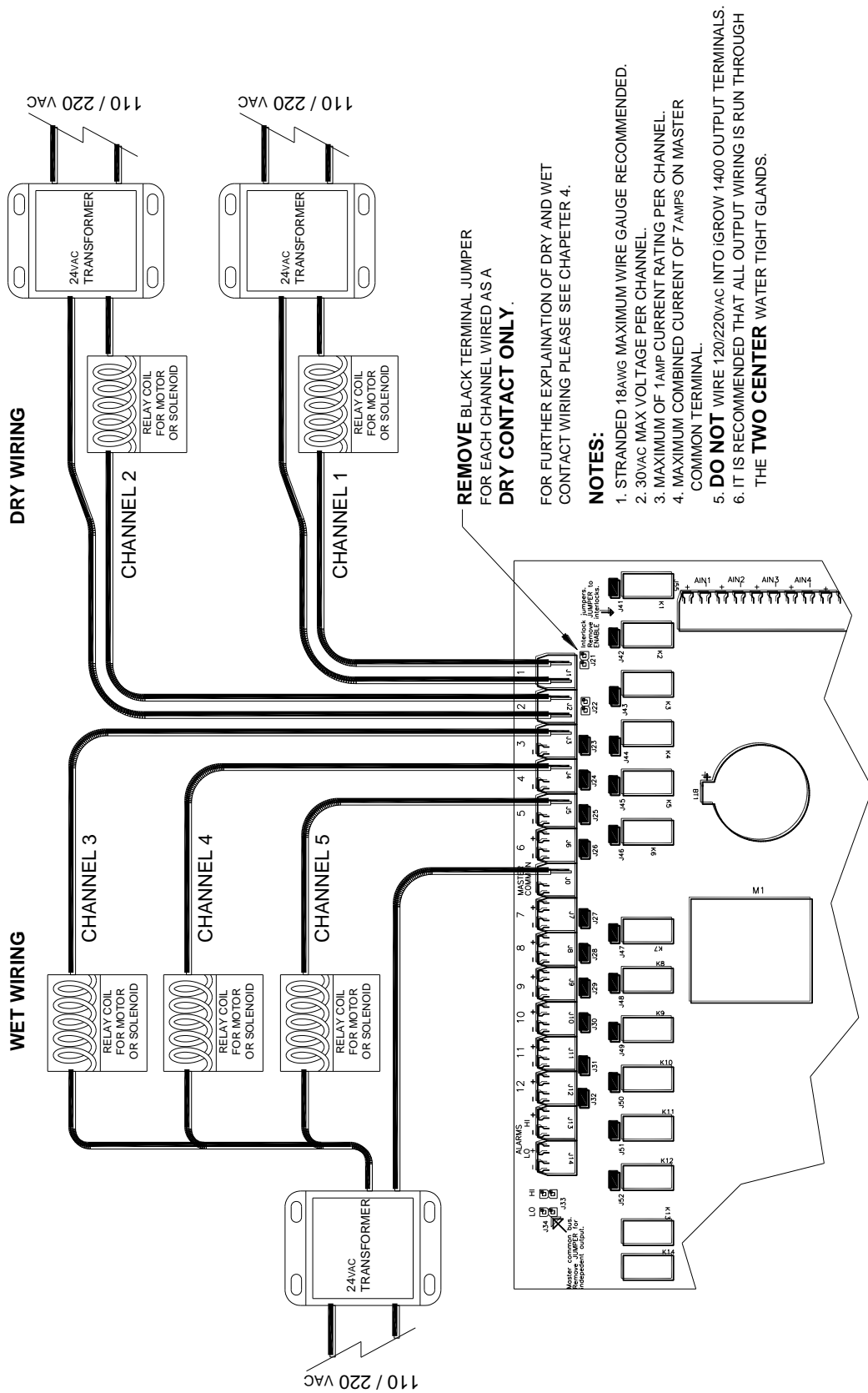


Figure 4.10 Output Wiring Example, Combination Wet and Dry Contact

Hardware Interlock Jumpers

Hardware Interlock is a protective mechanical mechanism that prevents two adjacent outputs (1&2, 3&4, etc.) from coming on at the same time. It is useful for such equipments such as reversible motors and two speed motors, where it is vital that only one output be turned on at a time

The iGrow 1600™ is shipped with all the hardware interlocks disabled. Removing both jumpers for each curtain, vent or two speed fans enables interlock jumpers. It is important to remove the paired set of red jumpers with these types of equipment to prevent the possibility of a short in the event the open and close switches are turned on at the same time. Usually, the contractors in the relay panel have mechanical interlocks to prevent this from happening and the iGrow interlocks act as a backup. Simply remove the paired set of red terminal jumpers that are associated with each channel wired as an interlock contact. See Figure 4.11 and Figure 4.12 to view an example of “wet” and “dry” interlocked diagrams.

Note: When a paired set of red interlock terminal jumpers is removed, the corresponding front panel switches will affect the manual override switches. Manual toggle switches can be used to override, unless the motor or device is already active or in motion. If you want to manually override a vent, curtain or two speed fan, put both switches in the Off position prior to switching On one of the switches.

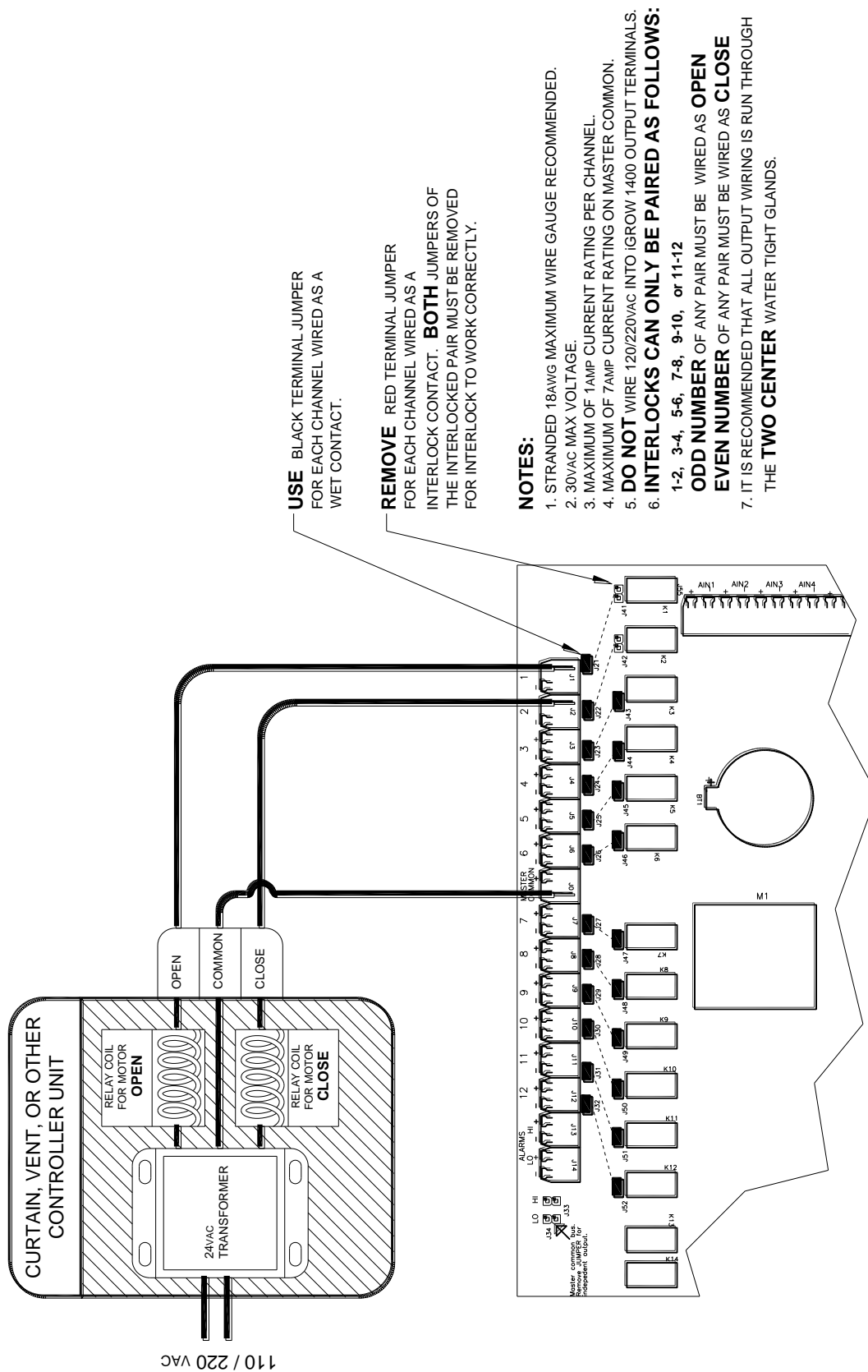


Figure 4.11 Output Wiring Example, Wet Interlocked Pair

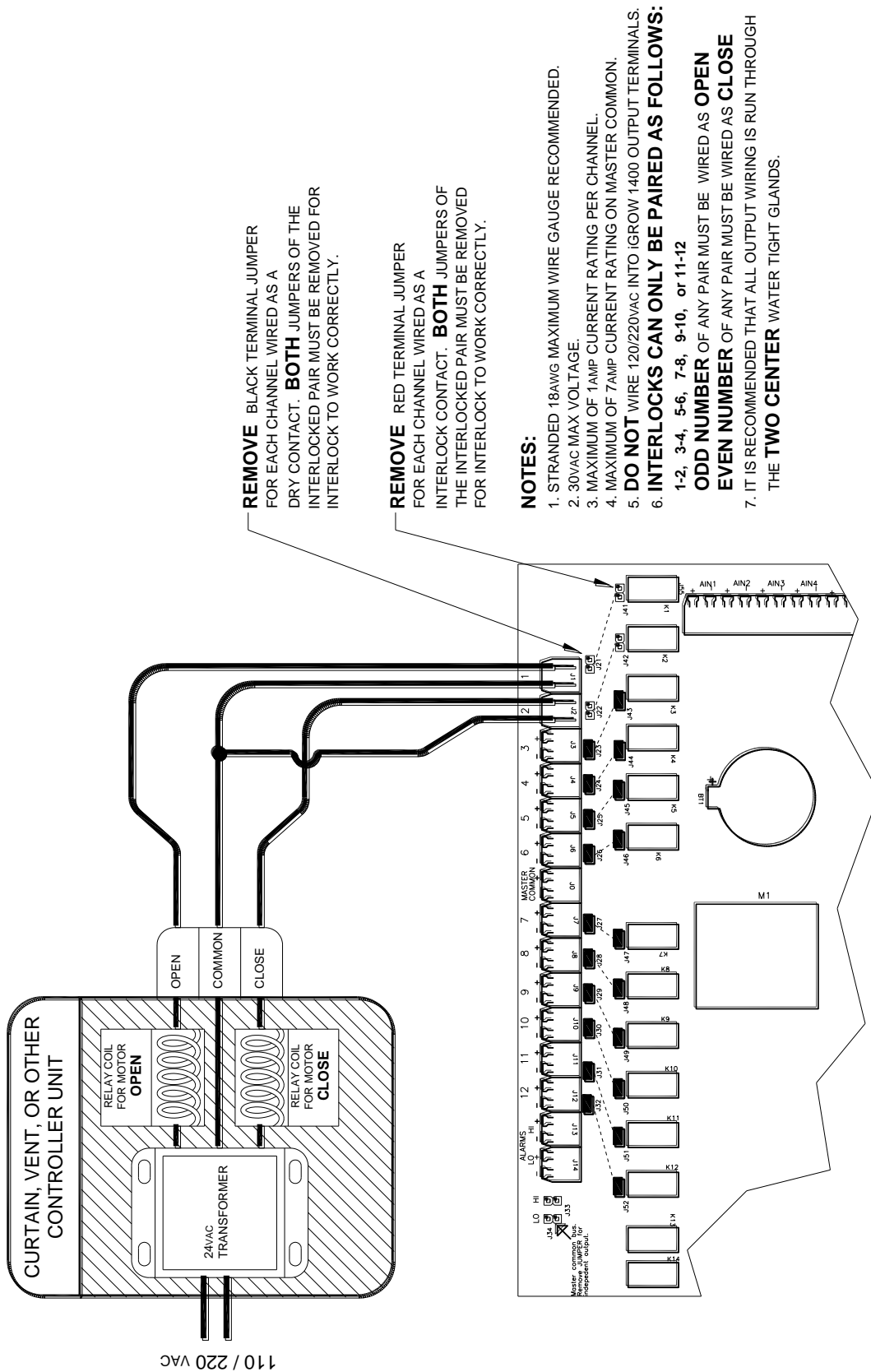


Figure 4.12 Output Wiring Example, Dry Interlocked Pair

Input and Sensor Installation

The iGrow 1600™ utilizes a variety of different sensors. In this section you will be shown how to install indoor/outdoor temperature and humidity, light, wind direction and speed, rain and CO₂ sensors and a Sensaphone.

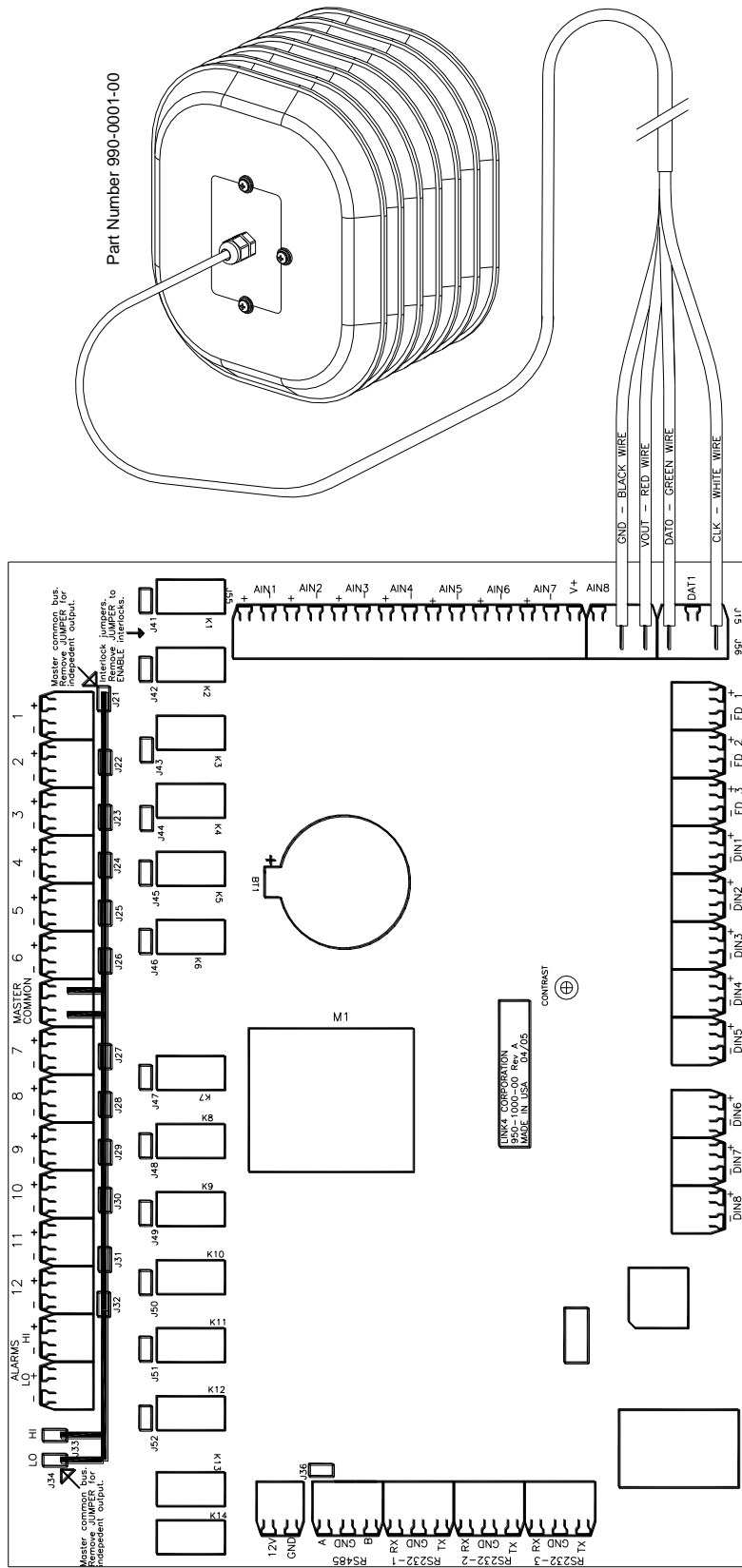
Indoor Air Temperature and Humidity Sensor

The iGrow 1600™ ships with a temperature/humidity sensor in a radiation shield to ensure accurate air temperature readings in direct sunlight. The sensor includes a 50-foot sensor cable. Normally you will want to hang the sensor near the crop level close to the center of the controlled environment. It is important to keep the sensor away from irrigation emitters, unit heaters, etc. that will effect the accuracy of the sensor.

1. First, open up the front panel to the 90 deg. position, as shown in Figure 4.5. Make sure the cable supports the front panel securely.
2. Find a central location in the greenhouse and let it hang relatively close to the height of where the plants will be.
3. Run the free end of the sensor cable to the controller unit.
4. You may extend the sensor cable as needed, but make sure to use an adapter and wire approved by Link4 to make any extensions (the wire and adapter can be purchased from Link4). Any extension wire must be shielded and stranded 24AWG type wire.
5. Carefully insert the cable through the right most watertight fitting at the bottom of the enclosure. It is easy to strip insulation and/or break wires when pulling cable. If you want to bundle wires tighter, use UV protected "tie wraps" (typically blue or black), and do not over-tighten.

<p>Note: If any splices are needed to extend cable length, make certain they are WATERTIGHT. Water or fertilizer infiltration WILL cause unstable sensor readings.</p>

6. Connect the wires as shown in Figure 4.13.
7. Keep sensor cables away from interference sources, including high voltage power wiring, inverters, motor controllers, mercury arc, or sodium lamp circuits. Placing sensor cable near such wiring may cause erratic sensor readings.
8. After installing the sensor, it is recommended that sensors be checked by plugging in the power supply and testing under various conditions before moving on in order to make sure the sensor works properly and accurately. Test the temperature by changing the indoor temperature to see if it is reading properly. After testing remember to unplug the unit to continue installing other sensors.



Part Number 990-0001-00

NOTES:

1. WHEN BOTH INDOOR AND OUTDOOR SENSORS ARE WIRED, **GND, VOUT, AND CLK** TERMINALS ARE SHARED BY BOTH SENSORS.
2. IT IS RECOMMENDED TO RUN ALL SENSOR WIRES THROUGH THE WATER TIGHT GLAND ON THE FAR **RIGHT** SIDE OF THE iGROW 1400. THIS CONSERVES THE TWO MIDDLE GLANDS FOR OUTPUT WIRING.
3. THIS DRAWING IS NOT TO SCALE.
4. **SOFTWARE SETTINGS:** USING THE iGROW1400s KEYPAD, GO TO *Setup Inputs*, AND ADJUST *InT* to *Serial/Sens1*. ALSO SET *RelHum* TO *SerialSens1*.

Figure 4.13 Wiring Indoor Temp/Humidity Sensor

Light Sensor

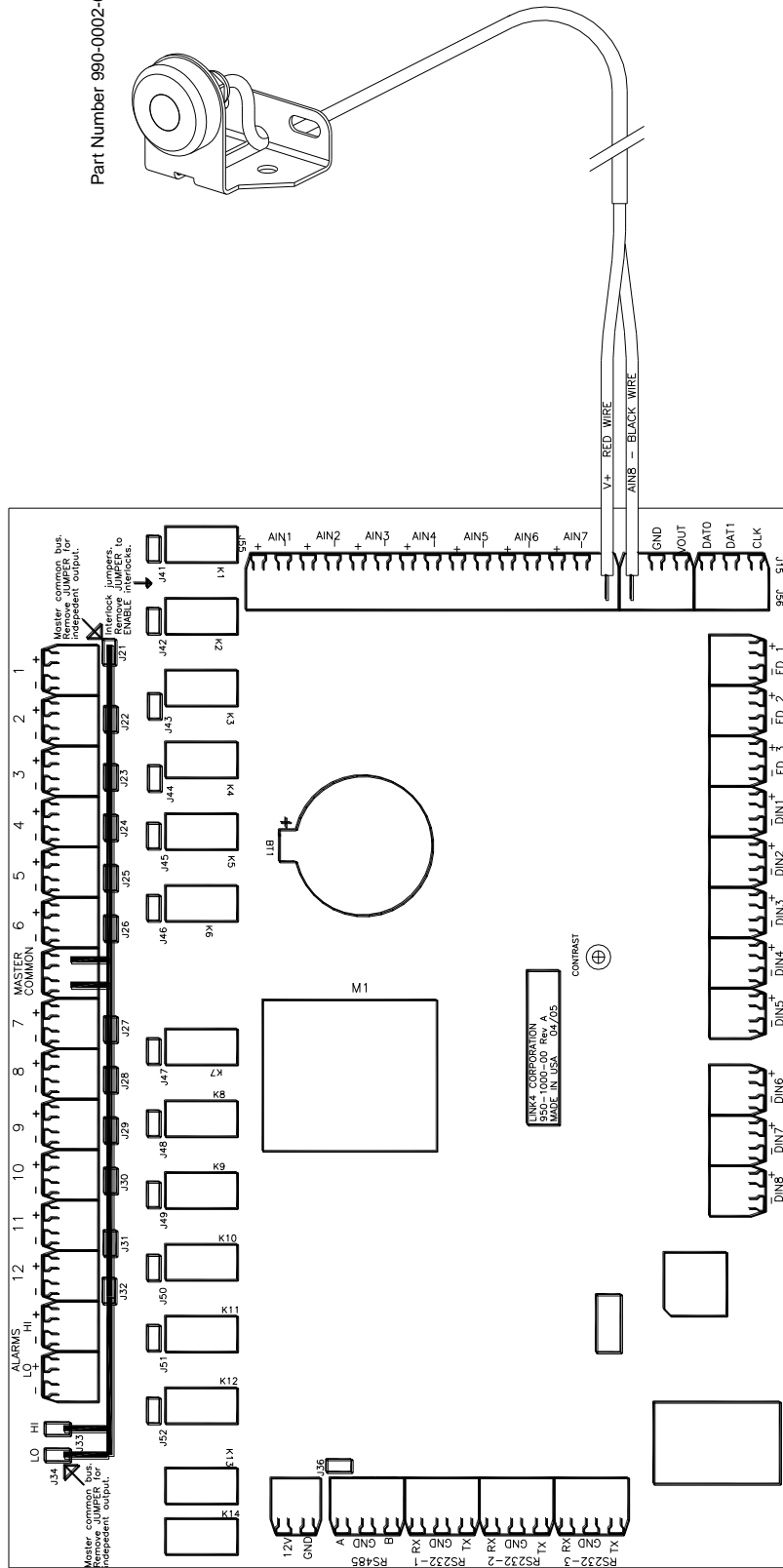
Link4 Offers two types of light sensors; Solar and Quantum. The Solar Light Sensor is sensitive to the visible light spectrum, whereas the Quantum version limits the light measurement to the 400 to 700 nanometer band where photosynthesis takes place (PAR). Whichever type you've chosen, the installation only varies slightly.

1. Open up the front panel to the 90 deg. position, as shown in Figure 4.5. Make sure the cable supports the front panel securely.
2. Find a location that is open and free from obstructions for the sensor to be exposed to light from all necessary angles.
3. Run the free end of the sensor cable to the controller unit.
4. You may extend the sensor cable as needed, but make sure to use an adapter and wire approved by Link4 to make any extensions (the wire and adapter can be purchased from Link4).
5. Carefully insert the cable through the right most watertight fittings at the bottom of the enclosure. It is easy to strip insulation and/or break wires when pulling cable. If you want to bundle wires tighter, use UV protected "tie wraps" (typically blue or black), and do not over-tighten.

<p>Note: If any splices are needed to extend cable length, make certain they are WATERTIGHT. Water or fertilizer infiltration WILL cause unstable sensor readings.</p>

6. Keep sensor cables away from interference sources, including high voltage power wiring, inverters, motor controllers, mercury arc, or sodium lamp circuits. Placing sensor cable near such wiring may cause erratic sensor readings.
 - a. Connect the wires as shown in Figure 4.14a for Solar, and Figure 4.14b for Quantum light Sensor.
7. After installing the sensor, it is recommended that sensors be checked by plugging in the power supply and testing under various conditions before moving on in order to make sure the sensor works properly and accurately. Test the light sensor by giving it light or covering to see different readings. After testing remember to unplug the unit to continue installing other sensors.

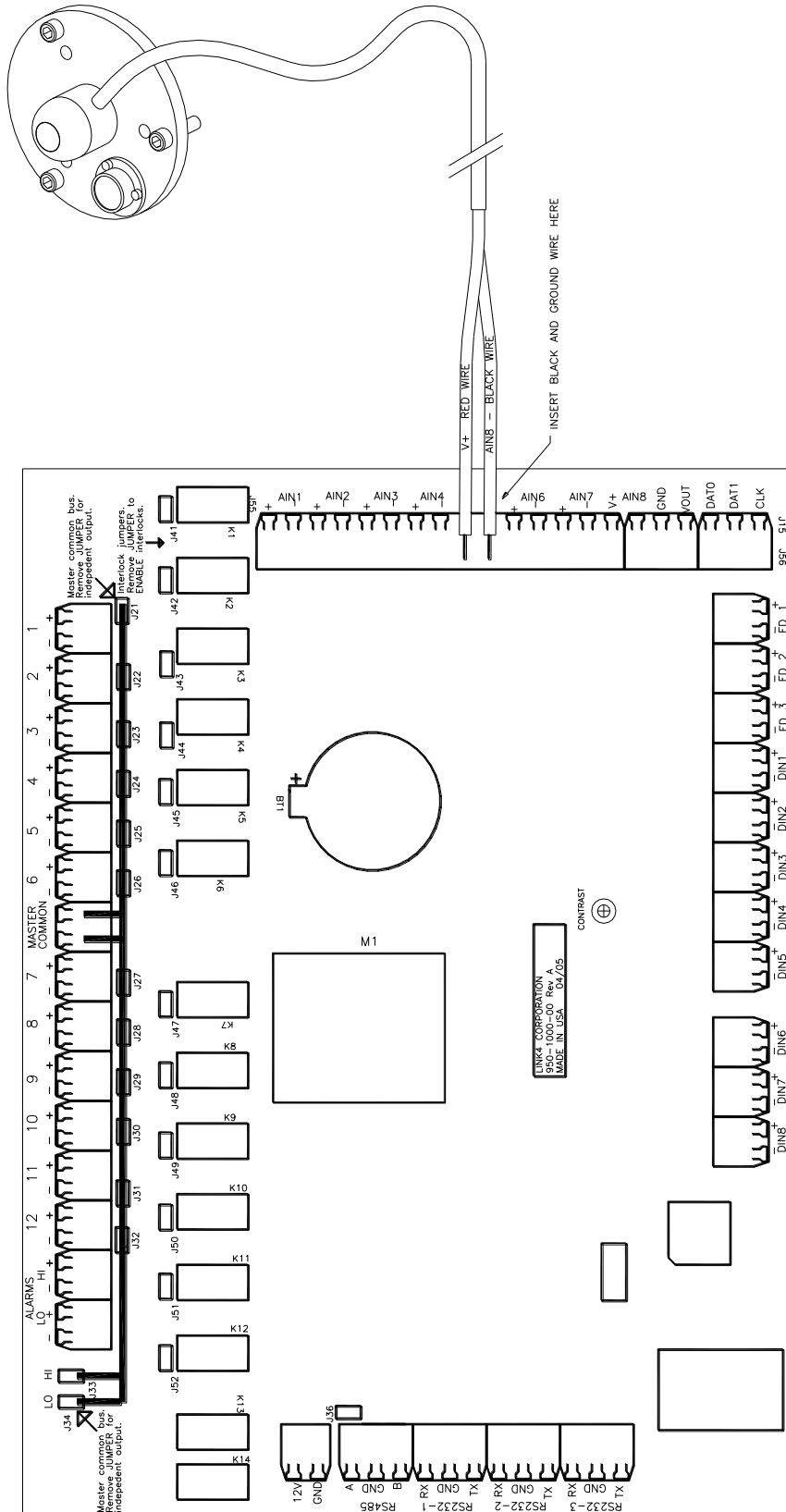
Part Number 990-0002-00



NOTES:

1. IT IS RECOMMENDED TO RUN ALL SENSOR WIRES THROUGH THE WATER TIGHT GLAND ON THE FAR **RIGHT** SIDE OF THE iGROW 1400. THIS CONSERVES THE TWO MIDDLE GLANDS FOR OUTPUT WIRING.
2. THIS DRAWING IS NOT TO SCALE.
3. **SOFTWARE SETTINGS:** USING THE iGROW1400s KEYPAD, GO TO *Setup Inputs*, AND ADJUST *Light* to *Solar*.

Figure 4.14a Wiring Solar Light Sensor



NOTES:

1. IT IS RECOMMENDED TO RUN ALL SENSOR WIRES THROUGH THE WATER TIGHT GLAND ON THE FAR **RIGHT** SIDE OF THE iGROW 1400. THIS CONSERVES THE TWO MIDDLE GLANDS FOR OUTPUT WIRING.
2. THIS DRAWING IS NOT TO SCALE.
3. **SOFTWARE SETTINGS:** USING THE iGROW1400s KEYPAD, GO TO *Setup Inputs*, AND ADJUST *Light* to *Quantum*.

Figure 4.14b Wiring Quantum Light Sensor

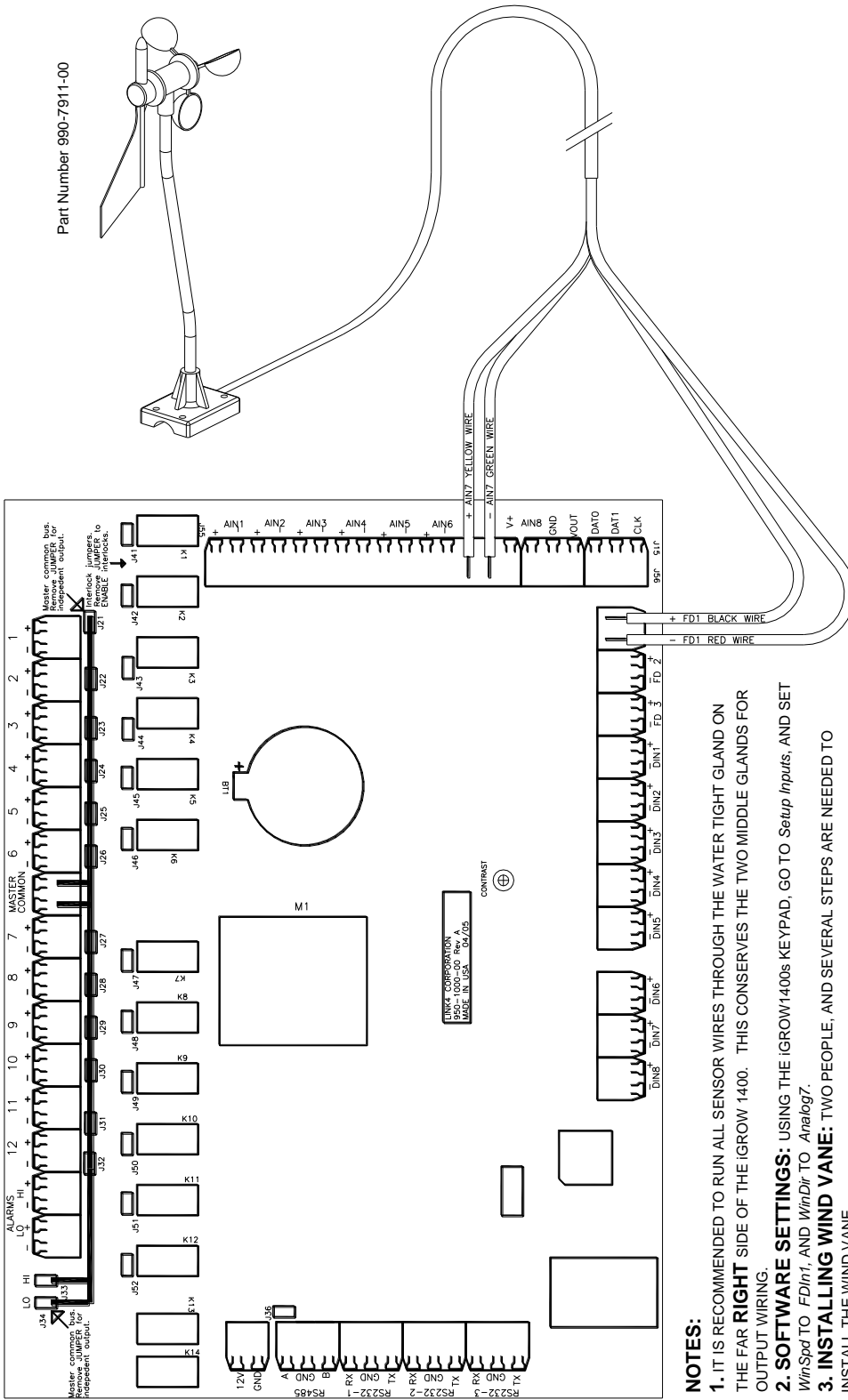
Wind Direction and Wind Speed (Anemometer)

1. Open up the front panel to the 90 deg. position, as shown in Figure 4.5. Make sure the cable supports the front panel securely.
2. Find a location that is open and free from obstructions. Mount the mast at the end of the greenhouse or other building structure, with the top of the mast extending at least 3 feet above the top of the building.
3. Run the free end of the sensor cable to the controller unit.
4. You may extend the sensor cable to a maximum length of 150, but make sure to use an adapter and wire approved by Link4 to make any extensions (the wire and adapter can be purchased from Link4).
5. Carefully insert the cable through the right most watertight fittings at the bottom of the enclosure. It is easy to strip insulation and/or break wires when pulling cable. If you want to bundle wires tighter, use UV protected "tie wraps" (typically blue or black), and do not over-tighten.

Note: If any splices are needed to extend cable length, make certain they are WATERTIGHT. Water or fertilizer infiltration WILL cause unstable sensor readings.

6. Keep sensor cables away from interference sources, including high voltage power wiring, inverters, motor controllers, mercury arc, or sodium lamp circuits. Placing sensor cable near such wiring may cause erratic sensor readings.
7. Connect the wires as shown in Figure 4.15.
8. After installing the sensor, it is recommended that sensors be checked by plugging in the power supply and testing under various conditions before moving on in order to make sure the sensor works properly and accurately. After testing remember to unplug the unit to continue installing other sensors.
9. If necessary, refer to the Anemometer installation instructions that are shipped with the unit for more installation details.

Part Number 990-7911-00



NOTES:

1. IT IS RECOMMENDED TO RUN ALL SENSOR WIRES THROUGH THE WATER TIGHT GLAND ON THE FAR **RIGHT** SIDE OF THE iGROW 1400. THIS CONSERVES THE TWO MIDDLE GLANDS FOR OUTPUT WIRING.
2. **SOFTWARE SETTINGS:** USING THE iGROW1400s KEYPAD, GO TO *Setup Inputs*, AND SET *WinSpd* TO *FD/m1*, AND *WinDir* TO *Analog7*.
3. **INSTALLING WIND VANE:** TWO PEOPLE, AND SEVERAL STEPS ARE NEEDED TO INSTALL THE WIND VANE.
 - a. REFERENCING THE DAVIS INSTALLATION MANUAL (pages 3-7), INSTALL ANEMOMETER BASE & ARM (BUT NOT THE WIND VANE YET).
 - b. CONNECT WIND DIRECTION WIRES TO THE iGROW1400, AND TURN ON iGROW1400.
 - c. ON THE iGROW1400 STATUS SCREEN, FIND THE READING FOR WIND DIRECTION.
 - d. HAVE SECOND PERSON CLIMB LADDER, AND SLOWLY ROTATE THE WIND VANE MOUNTING SHAFT UNTIL THE iGROW1400 READS DUE **NORTH**. HINT: ROTATE THE MOUNTING SHAFT IN SMALL INCREMENTS THEN WAIT ABOUT 8 SECONDS BEFORE READING THE WIND DIRECTION ON THE iGROW1400.
 - e. USING A COMPASS, HAVE THE PERSON ON LADDER HOLD THE WIND VANE SO THAT IT IS POINTING NORTH, THEN VERY CAREFULLY SLIDE IT ONTO THE MOUNTING SHAFT.
 - f. GENTLY TIGHTEN THE WIND VANE SET SCREW.
 - g. WIND VANE INSTALLATION IS NOW COMPLETE. BUT DOUBLE CHECK THE INSTALLATION BY ROTATING VANE TO POINT SOUTH, THEN AFTER 8 SECONDS VERIFY THAT THE iGROW1400 IS READING SOUTH.
4. THIS DRAWING IS NOT TO SCALE.

Figure 4.15 Wiring Wind Direction and Wind Speed

Rain Sensor (Tipping Bucket)

1. Open up the front panel to the 90 deg. position, as shown in Figure 4.5. Make sure the cable supports the front panel securely.
2. Find a location that is open and free from obstructions.
3. Run the free end of the sensor cable to the controller unit.
4. You may extend the sensor cable as needed, but make sure to use an adapter and wire approved by Link4 to make any extensions (the wire and adapter can be purchased from Link4).
5. Carefully insert the cable through the right most watertight fittings at the bottom of the enclosure. It is easy to strip insulation and/or break wires when pulling cable. If you want to bundle wires tighter, use UV protected "tie wraps" (typically blue or black), and do not over-tighten.

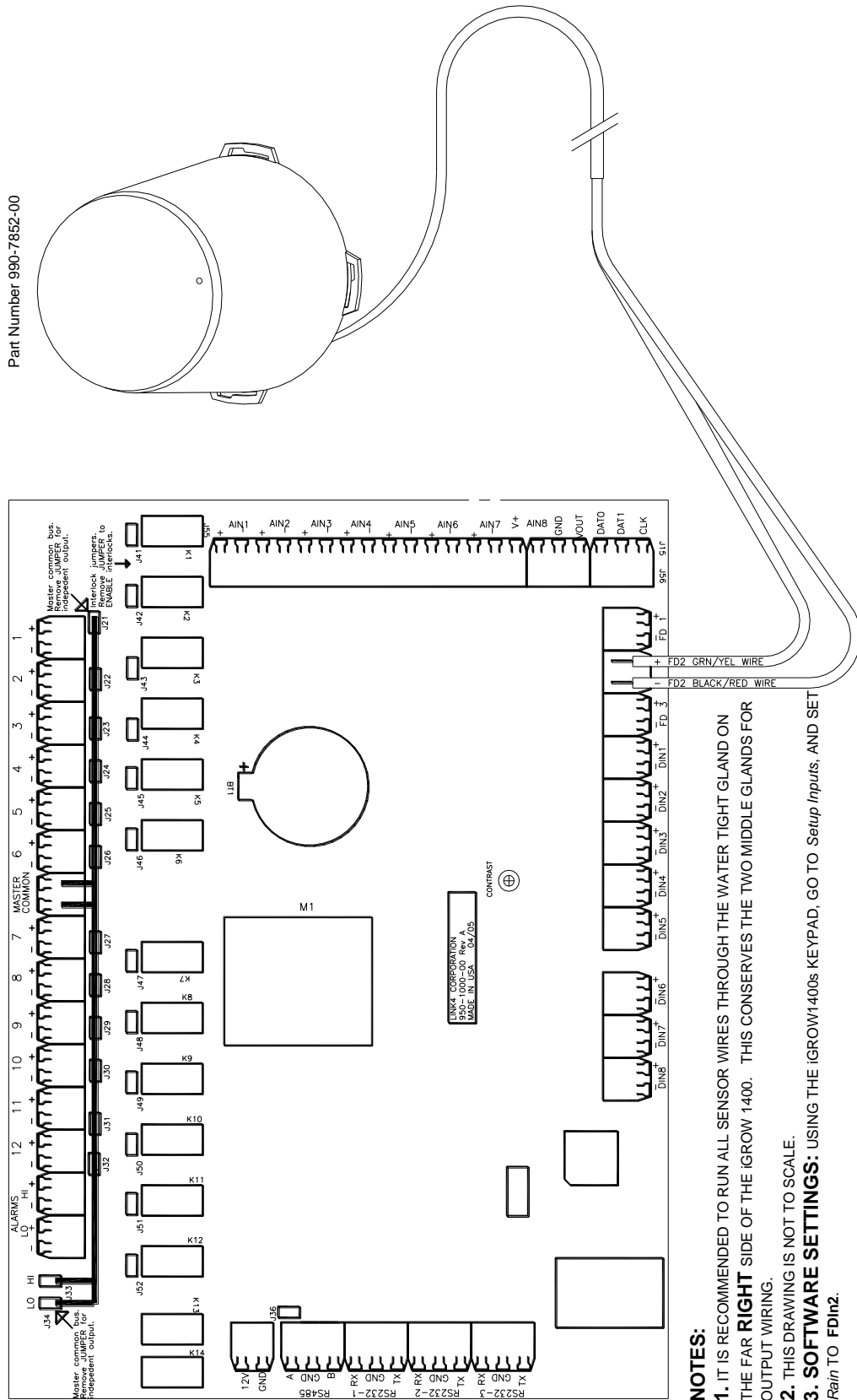
Note: If any splices are needed to extend cable length, make certain they are WATERTIGHT. Water or fertilizer infiltration WILL cause unstable sensor readings.

6. Keep sensor cables away from interference sources, including high voltage power wiring, inverters, motor controllers, mercury arc, or sodium lamp circuits. Placing sensor cable near such wiring may cause erratic sensor readings.
7. Connect the wires as shown in Figure 4.16.
8. After installing the sensor, it is recommended that sensors be checked by plugging in the power supply and testing under various conditions before moving on in order to make sure the sensor works properly and accurately. Make sure you test the rain sensor by pouring some water in it as though it were raining to see if it senses rain. After testing remember to unplug the unit to continue installing other sensors.

Note: For shipping purposes, the rain sensor has a plastic zip tie that must be cut before it will work properly.

9. Refer to the Rain sensor installation instructions that are shipped with the unit for more installation details.

Part Number 990-7852-00



NOTES:

1. IT IS RECOMMENDED TO RUN ALL SENSOR WIRES THROUGH THE WATER TIGHT GLAND ON THE FAR **RIGHT** SIDE OF THE iGROW 1400. THIS CONSERVES THE TWO MIDDLE GLANDS FOR OUTPUT WIRING.
2. THIS DRAWING IS NOT TO SCALE.
3. **SOFTWARE SETTINGS:** USING THE iGROW1400s KEYPAD, GO TO *Setup Inputs*, AND SET Rain TO *FDIn2*.

Figure 4.16 Wiring Rain Sensor

Precipitation Sensor (Fast Response)

1. Open up the front panel to the 90 deg. position, as shown in Figure 4.5. Make sure the cable supports the front panel securely.
2. Find a location that is open and free from obstructions.
3. Run the free end of the sensor cable to the controller unit.
4. You may extend the sensor cable as needed, but make sure to use an adapter and wire approved by Link4 to make any extensions (the wire and adapter can be purchased from Link4).
5. Carefully insert the cable through the right most watertight fittings at the bottom of the enclosure. It is easy to strip insulation and/or break wires when pulling cable. If you want to bundle wires tighter, use UV protected "tie wraps" (typically blue or black), and do not over-tighten.

Note: If any splices are needed to extend cable length, make certain they are WATERTIGHT. Water or fertilizer infiltration WILL cause unstable sensor readings.

6. Keep sensor cables away from interference sources, including high voltage power wiring, inverters, motor controllers, mercury arc, or sodium lamp circuits. Placing sensor cable near such wiring may cause erratic sensor readings.
7. Connect the wires as shown in Figure 4.16a.
8. After installing the sensor, it is recommended that sensors be checked by plugging in the power supply and testing under various conditions before moving on in order to make sure the sensor works properly and accurately. Make sure you test the precipitation sensor by sprinkling some water on it as though it were raining to see if it senses rain. After testing remember to unplug the unit to continue installing other sensors.

NOTES:

- 1. IT IS RECOMMENDED TO RUN ALL SENSOR WIRES THROUGH THE WATER TIGHT GLAND ON THE FAR RIGHT SIDE OF THE iGrow 1400. THIS CONSERVES THE TWO MIDDLE GLANDS FOR OUTPUT WIRING.
- 2. THIS DRAWING IS NOT TO SCALE.
- 3. **SOFTWARE SETTINGS:** USING THE iGrowV1400s KEYPAD, GO TO Setup Inputs, AND SET Rain TO FDIin2.

WIRING INSIDE RAIN SENSOR

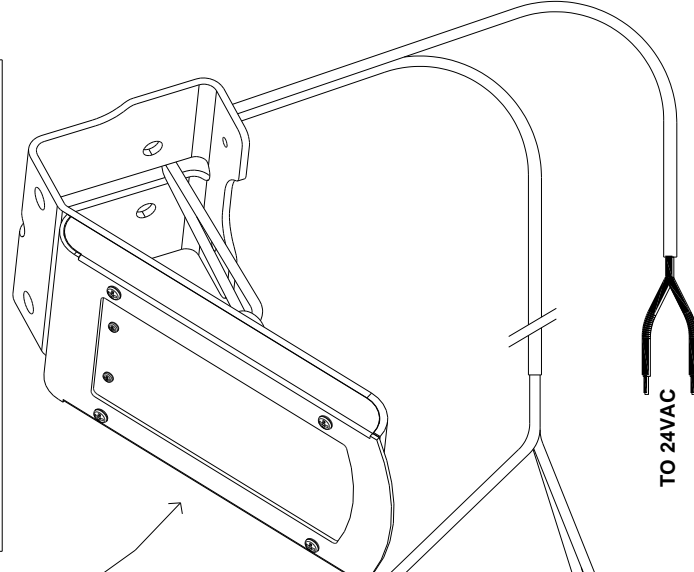
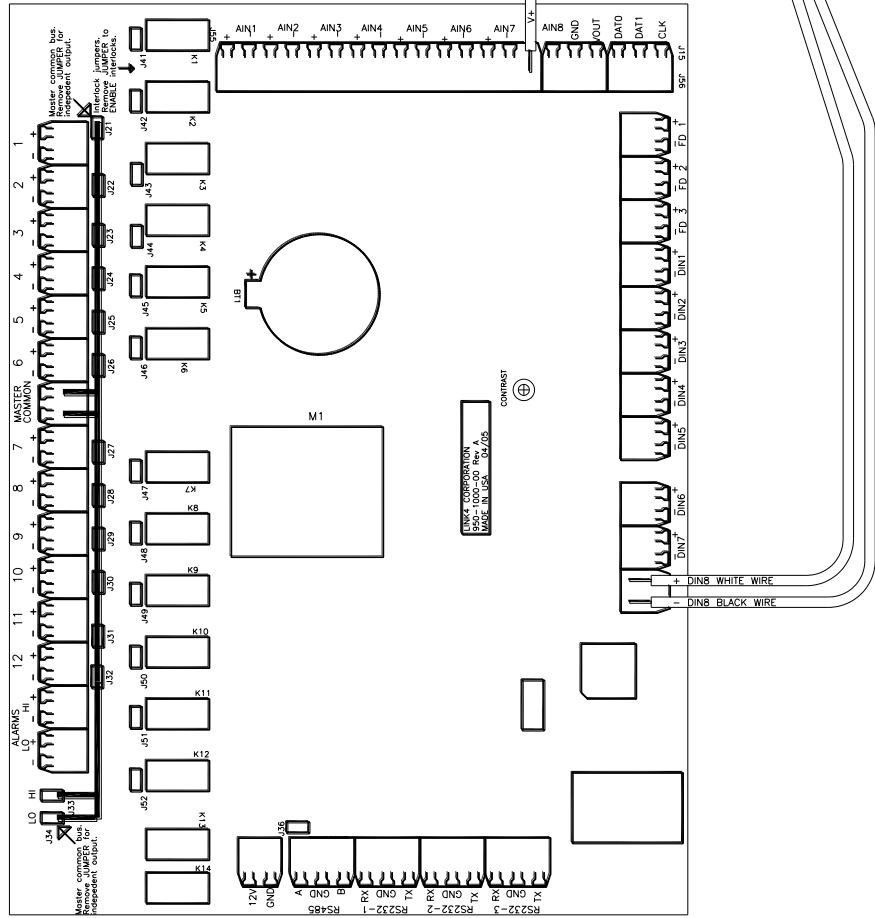
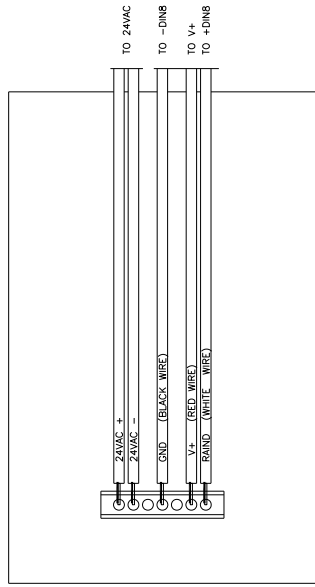


Figure 4.16a Wiring Precipitation Sensor

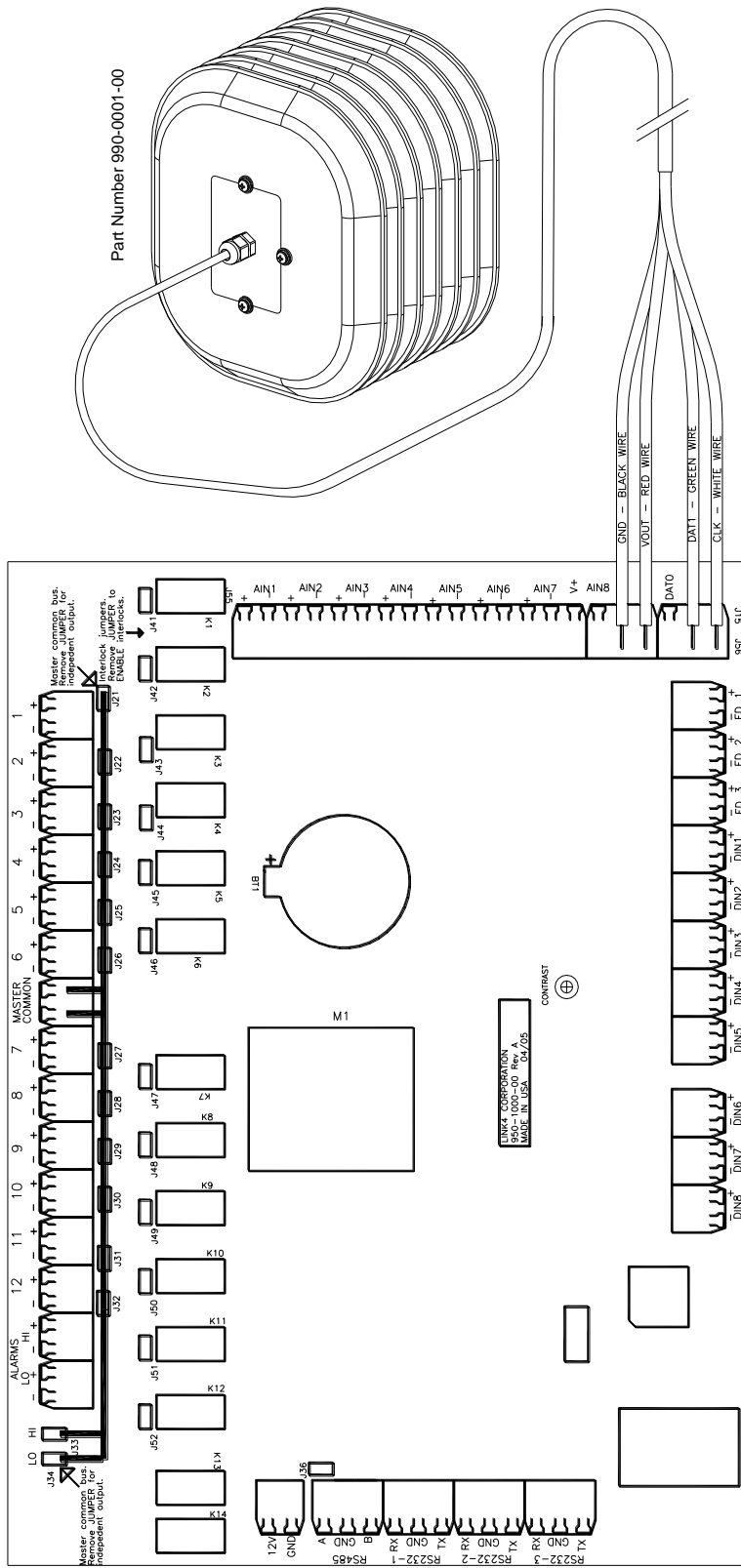
Outdoor Air Temperature sensor

Instead of a weather station, you may simply be mounting an outdoor air temperature sensor.

1. Open up the front panel to the 90 deg. position, as shown in Figure 4.5. Make sure the cable supports the front panel securely.
2. Find a location that is open and free from obstructions such as anything that might cast a shadow.
3. Run the free end of the sensor cable to the controller unit.
4. You may extend the sensor cable as needed, but make sure to use an adapter and wire approved by Link4 to make any extensions (the wire and adapter can be purchased from Link4).
5. Carefully insert the cable through the right most watertight fittings at the bottom of the enclosure. It is easy to strip insulation and/or break wires when pulling cable. If you want to bundle wires tighter, use UV protected "tie wraps" (typically blue or black), and do not over-tighten.

<p>Note: If any splices are needed to extend cable length, make certain they are WATERTIGHT. Water or fertilizer infiltration WILL cause unstable sensor readings.</p>

6. Keep sensor cables away from interference sources, including high voltage power wiring, inverters, motor controllers, mercury arc, or sodium lamp circuits. Placing sensor cable near such wiring may cause erratic sensor readings.
7. Connect the wires as shown in Figure 4.17.
8. After installing the sensor, it is recommended that sensors be checked by plugging in the power supply and testing under various conditions before moving on in order to make sure the sensor works properly and accurately. Make sure you test the sensor by changing the temperature around it with a fan, heating or anything that will change the temperature reading. After testing remember to unplug the unit to continue installing other sensors.



NOTES:

1. WHEN BOTH INDOOR AND OUTDOOR SENSORS ARE WIRED, **GND, VOUT, AND CLK** TERMINALS ARE SHARED BY BOTH SENSORS.
2. IT IS RECOMMENDED TO RUN ALL SENSOR WIRES THROUGH THE WATER TIGHT GLAND ON THE FAR **RIGHT** SIDE OF THE iGrow 1400. THIS CONSERVES THE TWO MIDDLE GLANDS FOR OUTPUT WIRING.
3. THIS DRAWING IS NOT TO SCALE.
4. WHEN CHOOSING LOCATION FOR INSTALLING OUTDOOR TEMP/HUM SENSOR, TEMP ACCURACY CAN BE SLIGHTLY IMPROVED IF IT'S IN A SHADED AREA.
5. **SOFTWARE SETTINGS:** USING THE iGrow1400s KEYPAD, GO TO *Setup Inputs, AND ADJUST OutT to SerialSens2.*

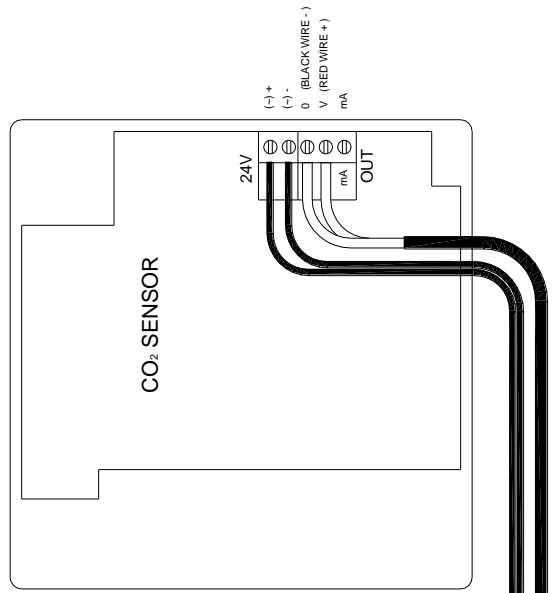
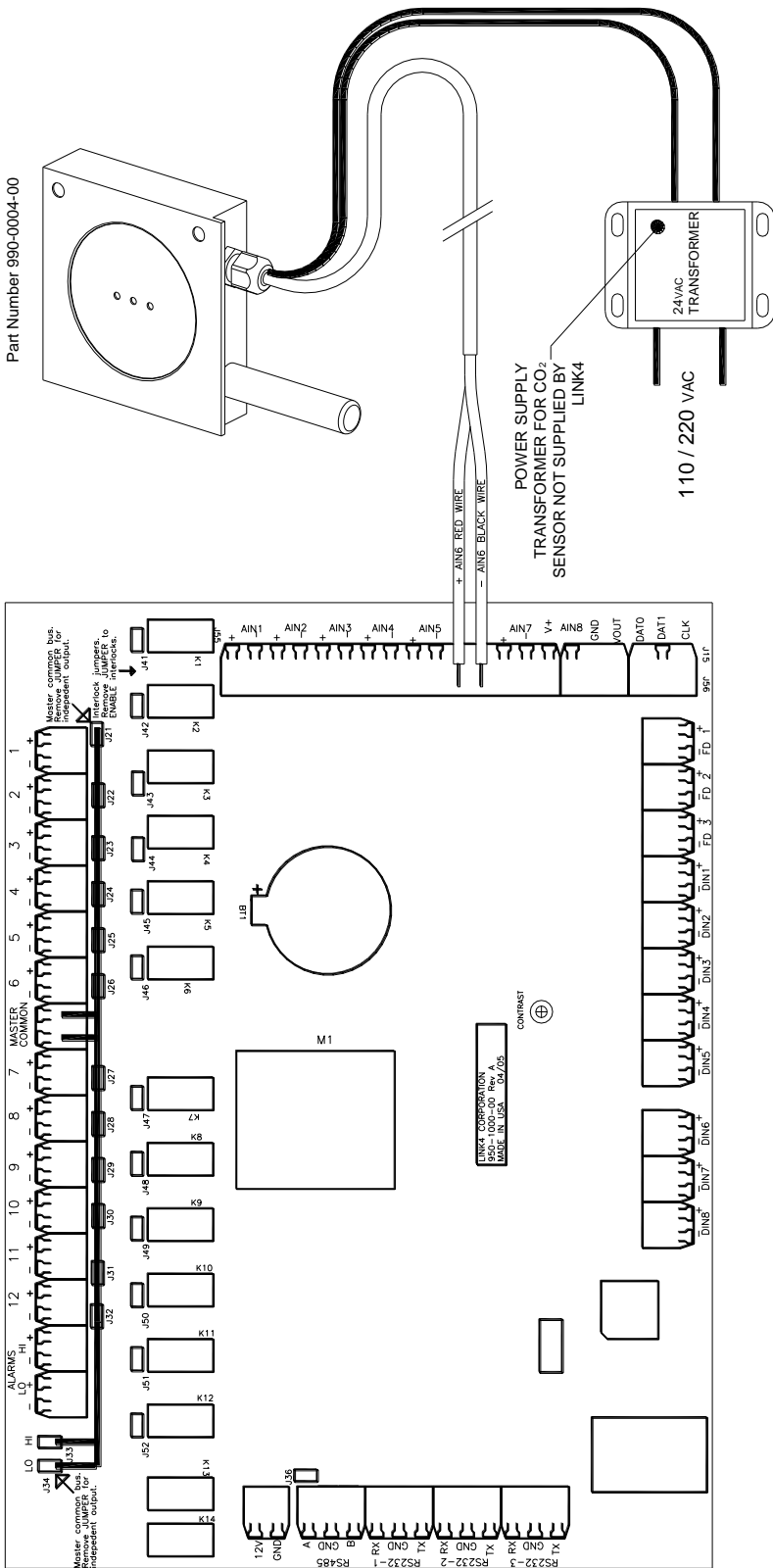
Figure 4.17 Wiring Outdoor Temp/Humidity Sensor

CO₂ Sensor

1. Open up the front panel to the 90 deg. position, as shown in Figure 4.5. Make sure the cable supports the front panel securely.
2. Find a location that is inside the greenhouse and also free from obstructions.
3. Run the free end of the sensor cable to the controller unit.
4. You may extend the sensor cable as needed, but make sure to use an adapter and wire approved by Link4 to make any extensions (the wire and adapter can be purchased from Link4).
5. Carefully insert the cable through the right most watertight fittings at the bottom of the enclosure. It is easy to strip insulation and/or break wires when pulling cable. If you want to bundle wires tighter, use UV protected "tie wraps" (typically blue or black), and do not over-tighten.

Note: If any splices are needed to extend cable length, make certain they are WATERTIGHT. Water or fertilizer infiltration WILL cause unstable sensor readings.

6. Keep sensor cables away from interference sources, including high voltage power wiring, inverters, motor controllers, mercury arc, or sodium lamp circuits. Placing sensor cable near such wiring may cause erratic sensor readings.
7. Connect the wires as shown in Figure 4.18.
8. After installing the sensor, it is recommended that sensor be checked by plugging in the power supply and testing under various conditions before moving on in order to make sure the sensor works properly and accurately. You can perform this test by having one person breath on the CO₂ sensor element (long cylinder protruding from the CO₂ enclosure) while the other person views the CO₂ reading on the iGrow1600. After testing remember to unplug the unit to continue installing other sensors.
9. Refer to the CO₂ installation instructions that are shipped with the unit for more installation details.



- NOTES:**
1. CO₂ SENSOR **MUST** BE CONNECTED TO ANALOG INPUT 6 TERMINALS (+AIN6 and -AIN6) OR THE iGROW1400™ WILL NOT BE ABLE TO READ DATA FROM IT.
 2. IT IS RECOMMENDED TO RUN ALL SENSOR WIRES THROUGH THE WATER TIGHT GLAND ON THE FAR **RIGHT** SIDE OF THE iGROW 1400. THIS CONSERVES THE TWO MIDDLE GLANDS FOR OUTPUT WIRING.
 3. **SOFTWARE SETTINGS:** USING THE iGROW1400s KEYPAD, GO TO *Setup Inputs*, AND ADJUST CO₂ TO *AnalogIn6*.
 4. WIRING FOR CO₂ SENSOR IS NOT INCLUDED, BUT CAN BE PURCHASED FROM LINK4 CORP. IF NEEDED.
 5. AFTER INSTALLATION, CO₂ SENSOR MAY NEED UP TO 30 MINUTES TO STABILIZE ITS READING.
 6. **CAUTION:** DURING INSTALLATION, CO₂ SENSOR IS SUSCEPTIBLE TO DAMAGE BY STATIC ELECTRICITY. BE SURE YOU ARE WELL GROUNDED DURING INSTALLATION.
 7. THIS DRAWING IS NOT TO SCALE.

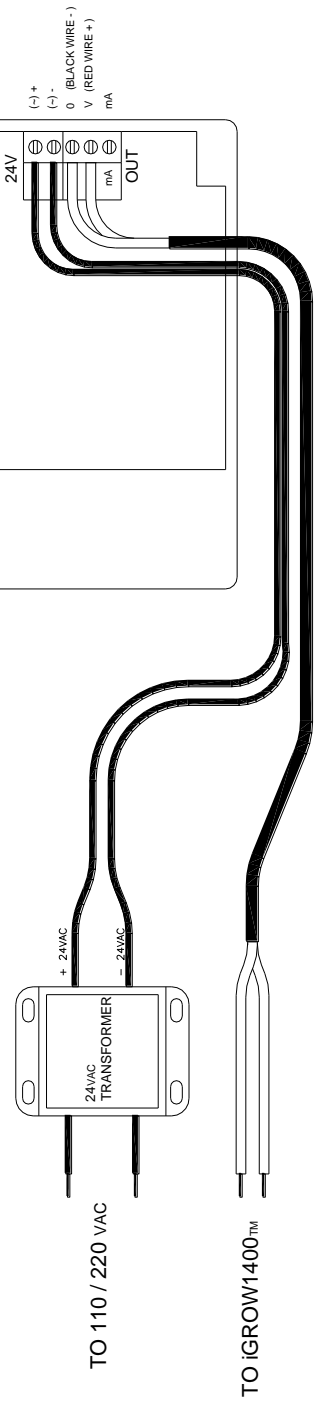


Figure 4.18 Wiring CO₂ Sensor

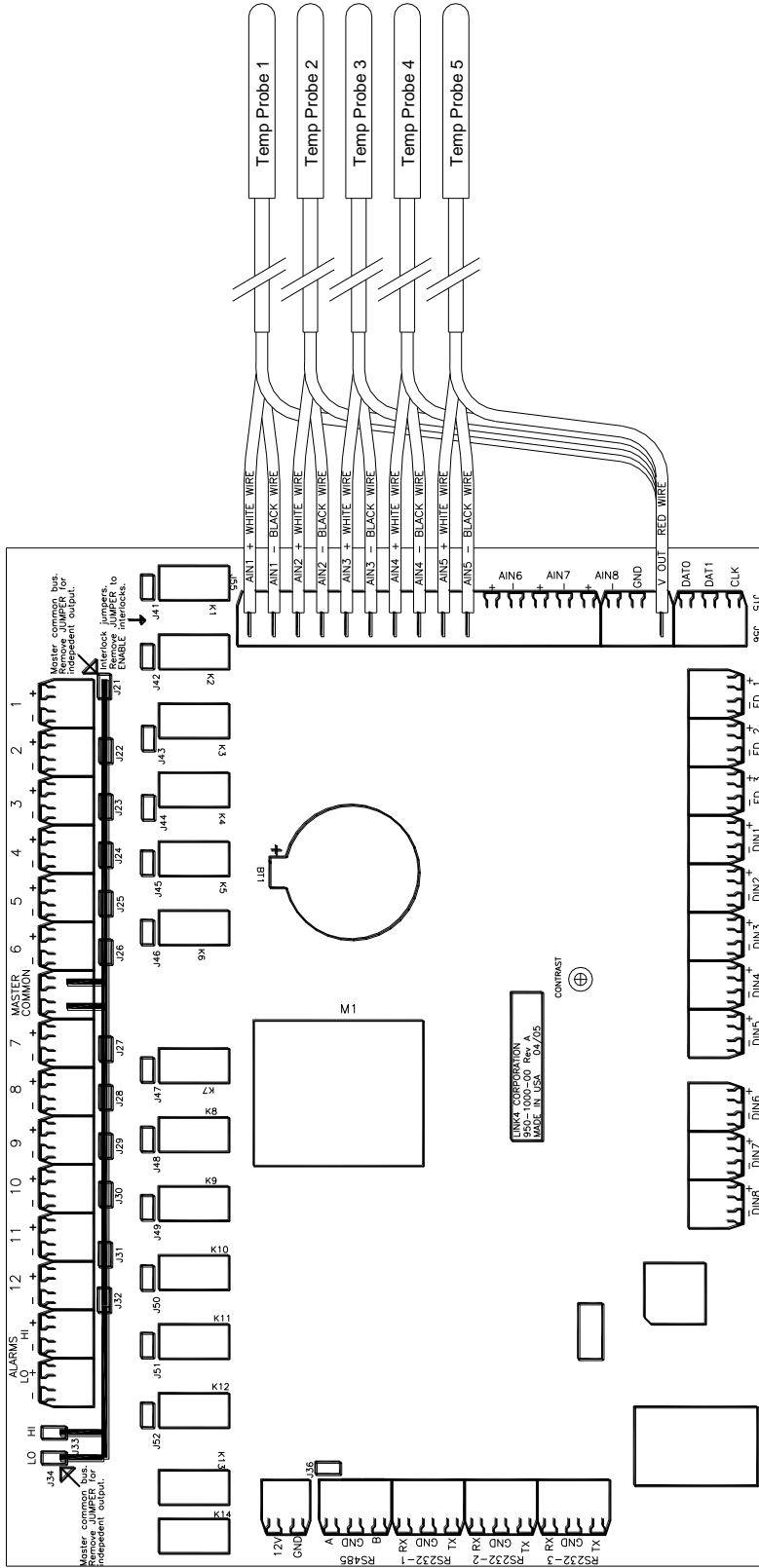
Bottom Heat Probes

Your iGrow1600 can support up to 5 temperature probes. The probes can be connected to any Analog Inputs between 1 to 5 (labeled as AIN1, AIN2, AIN3, on the circuit board)

1. Open up the front panel to the 90 deg. Position, as shown in Figure 4.5. Make sure the cable supports the front panel securely.
2. Mount or hang your probes in the desired locations.
3. Run the free end of the sensor cable to the controller unit.
4. You may extend the sensor cable as needed, but make sure to use an adapter and wire approved by Link4 to make any extensions (the wire and adapter can be purchased from Link4).
5. Carefully insert the cable through the right most watertight fittings at the bottom of the enclosure. It is easy to strip insulation and/or break wires when pulling cable. If you want to bundle wires tighter, use UV protected "tie wraps" (typically blue or black), and do not over-tighten.

<p>Note: If any splices are needed to extend cable length, make certain they are WATERTIGHT. Water or fertilizer infiltration WILL cause unstable sensor readings.</p>

6. Keep sensor cables away from interference sources, including high voltage power wiring, inverters, motor controllers, mercury arc, or sodium lamp circuits. Placing sensor cable near such wiring may cause erratic sensor readings.
7. Connect the wires as shown in Figure 4.19.
8. After installing the sensor, it is recommended that sensors be checked by plugging in the power supply and testing under various conditions before moving on in order to make sure the sensor works properly and accurately. Make sure you test the sensor by changing the temperature around it with a fan, heating or anything that will change the temperature reading. After testing remember to unplug the unit to continue installing other sensors.



NOTES:

1. IT IS RECOMMENDED TO RUN ALL SENSOR WIRES THROUGH THE WATER TIGHT GLAND ON THE FAR **RIGHT** SIDE OF THE iGROW 1400. THIS CONSERVES THE TWO MIDDLE GLANDS FOR OUTPUT WIRING.
2. THIS DRAWING IS NOT TO SCALE.
3. **SOFTWARE SETTINGS:** USING THE iGROW1400s KEYPAD, GO TO *Setup Inputs*, AND ADJUST *Temp1* to *AnalogIn1*, *Temp2* to *Analog2*, *Temp3* to *Analog3* etc. THIS SENSOR CAN BE CONNECTED TO ANALOG INPUTS 1 THRU 5. SIMPLY ADJUST THE SOFTWARE SETTINGS TO MATCH WHICHEVER ANALOG INPUT TERMINAL YOU'VE CONNECTED THE SENSOR TO.

Figure 4.19 Wiring Bottom Heat Probe

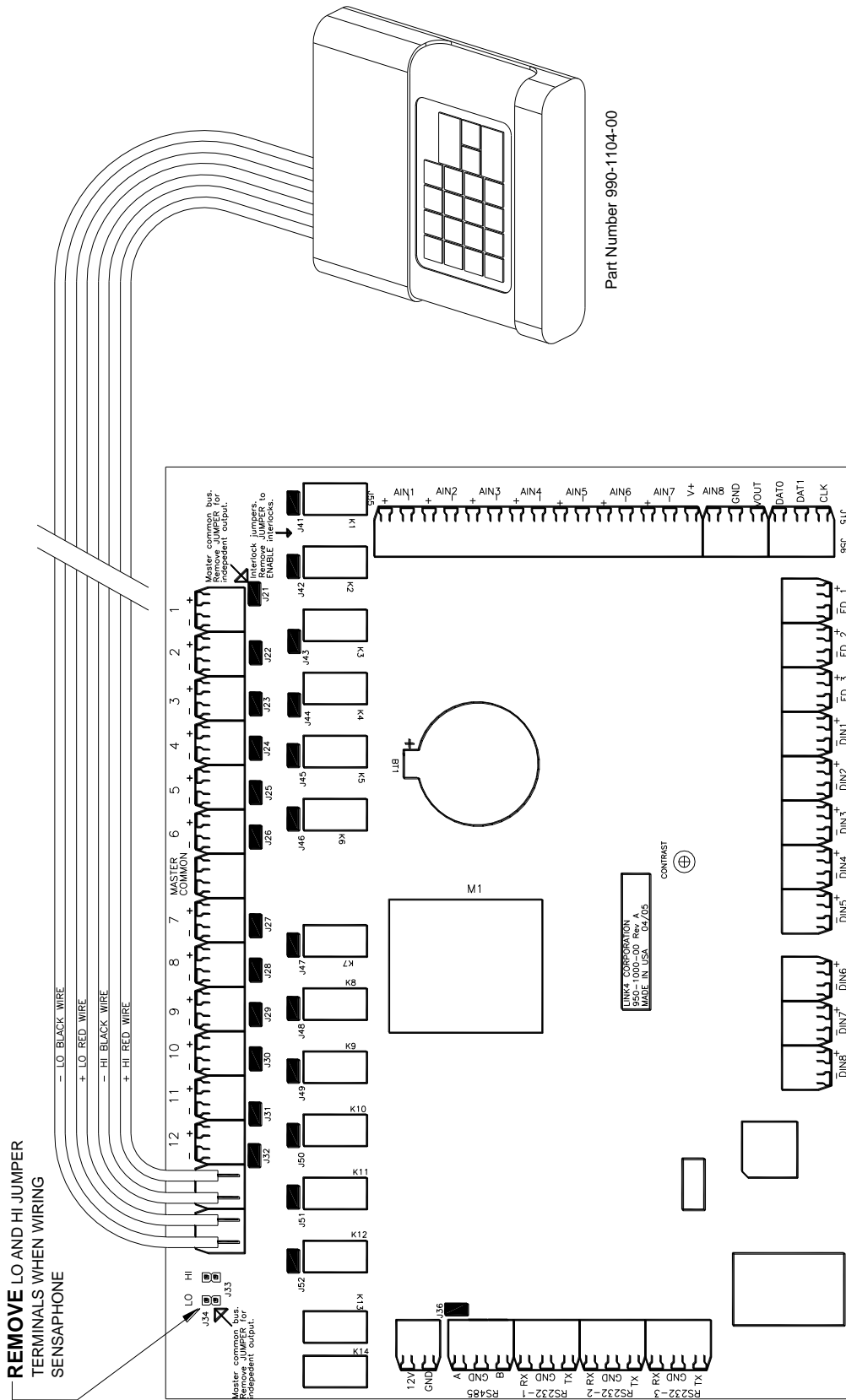
Wiring Sensaphone

A Sensaphone is used to notify the user via telephone, cell phone, or pager whenever the sensors reach the user programmed temperature alarm limits.

1. Open up the front panel to the 90 deg. position, as shown in Figure 4.5. Make sure the cable supports the front panel securely.
2. Find a location that is near the controller.
3. Run the free end of the cable to the controller unit.
4. You may extend the cable as needed, but make sure to use an adapter and wire approved by Link4 to make any extensions (the wire and adapter can be purchased from Link4).
5. Carefully insert the cable through the left most watertight fittings at the bottom of the enclosure. It is easy to strip insulation and/or break wires when pulling cable. Use UV protected "tie wraps" (typically blue or black), and do not over-tighten.

<p>Note: If any splices are needed to extend cable length, make certain they are WATERTIGHT. Water or fertilizer infiltration WILL cause unstable sensor readings.</p>

6. Keep cables away from interference sources, including high voltage power wiring, inverters, motor controllers, mercury arc, or sodium lamp circuits.
7. Connect the wires as shown in Figure 4.20.
8. Make sure you test the Sensaphone by programming a high and low limit and then make the alarms go off to see if the Sensaphone will contact the right number. After testing remember to unplug the iGrow 1600 before continuing to install other sensors.
9. Refer to the Sensaphone installation instructions for programming the unit.



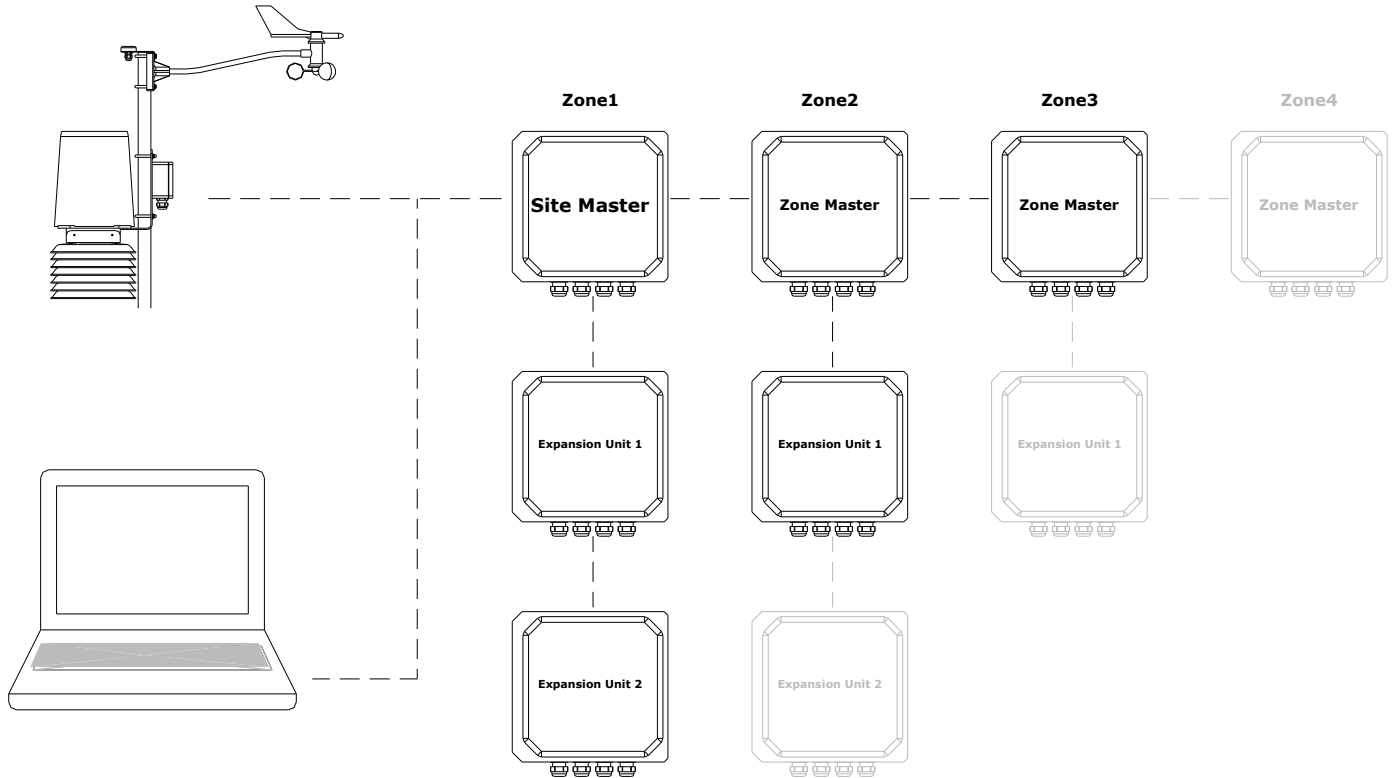
Part Number 990-1104-00

REMOVE LO AND HI JUMPER TERMINALS WHEN WIRING SENSAPHONE

- NOTES:**
1. IT IS RECOMMENDED TO RUN THESE CABLES THROUGH THE WATER TIGHT GLAND ON THE FAR LEFT SIDE OF THE IGROW 1400. THIS CONSERVES THE TWO MIDDLE GLANDS FOR OUTPUT WIRING.
 2. THIS DRAWING NO TO SCALE.

Figure 4.20 Wiring Sensaphone

Expansion Units & Multi-Zone Network



Whether you need to setup multiple zones, add expansion units, or both, creating a network of iGrow1600™'s is simple. However, there are a few important details to note. The cornerstone to connecting multiple iGrow1600s™ together is choosing one unit to be setup as the **Site Master**.

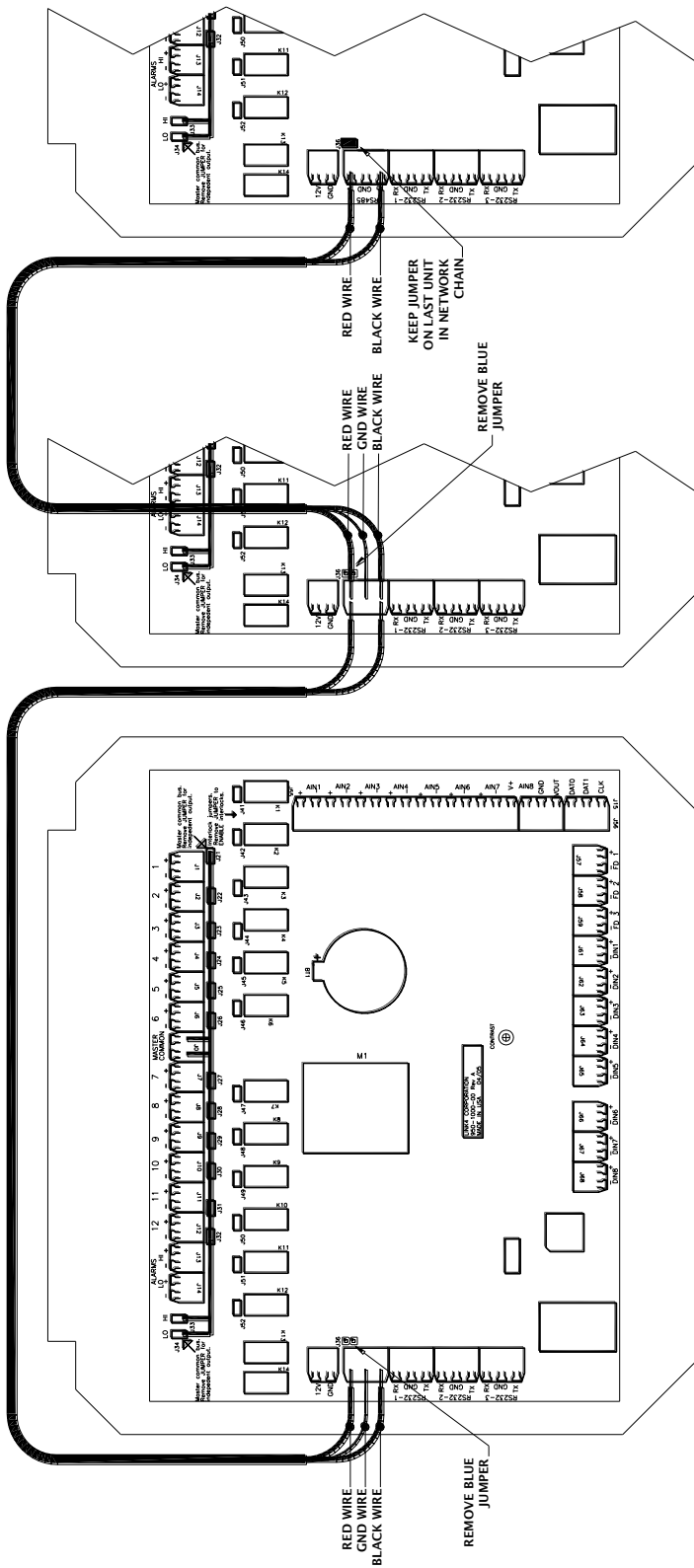
The Site Master performs several important tasks:

- It Controls all communications within the network
- It is the only unit that can broadcast Weather Station data to other iGrow1600™'s
- It is the only iGrow1600™ in the network that can be connected to a computer for remote management.
- It sets the time & date for all iGrow1600s in the network

Wiring - Plan for the first installed iGrow1600™ to be the Site Master. Once all units are installed in their proper locations and all sensors tested, you are ready to connect the serial cable. Regardless of which units will be Zone Masters or Expansion units, all units must be wired together in a serial fashion as shown in figure 4.21.

Jumper Settings - Make sure to remove the blue jumper on the Site Master and any following controllers, except for the last controller in the serial network chain. On the last unit of the network chain, the blue jumper must remain installed, or the network won't function properly. If you're only connecting two iGrow1600s™ together, remove the jumper from the first Site Master unit and leave it installed on the second unit.

Programming - The last step in setting up the network is programming each unit to be a Site Master, Zone Master, or Slave (Slave units are also called Expansion units). Zone Masters and Slaves also need to know which data to pull down from the network (such as weather station, temp probes, and zone setpoints). For instructions on how to do this, please refer to "COMMUNICATIONS (Network Programming)" section of this manual.



Site Master

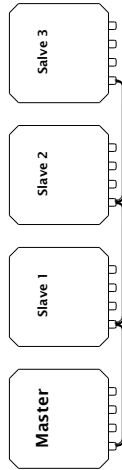
Expansion Unit #1

Expansion Unit #2

Figure 4.21 Wiring Serial Network

Correct

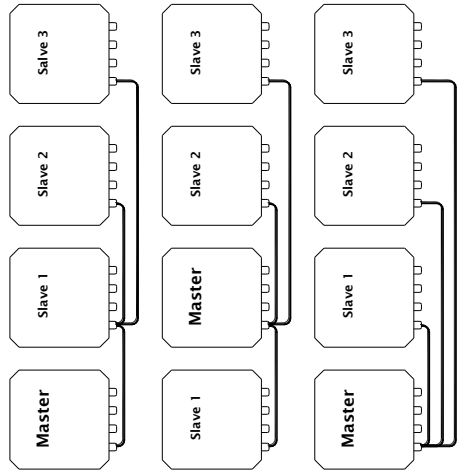
Master/Expansion wiring configuration



It is essential to connect networked iGrow1400s in a serial fashion (as shown above). Any other configuration will prevent the network from functioning properly.

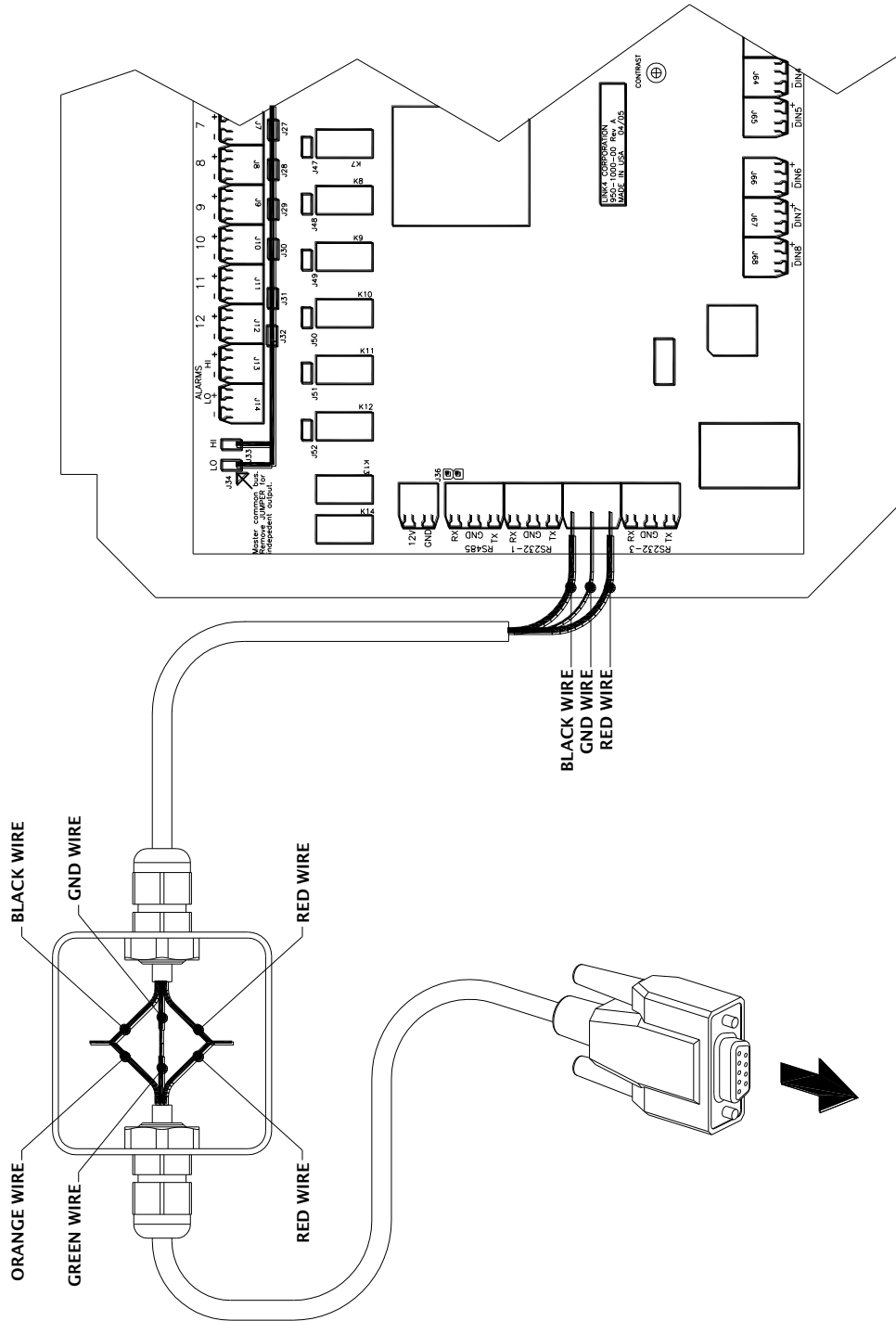
Incorrect

Master/Expansion wiring configurations



Connecting to a PC

To connect your iGrow1600 to a PC, please see Figure 4.22



- NOTES:**
1. IF SEVERAL iGROW 1400™s ARE NETWORKED TOGETHER, THE PC **MUST** BE CONNECTED TO THE MASTER UNIT ONLY.
 2. ONCE THE iGROW 1400™ IS WIRED TO THE PC, INSTALL THE REMOTE MANAGEMENT SOFTWARE ON THE PC. PLEASE REFER TO THE INSTALLATION GUIDE PROVIDED WITH YOUR REMOTE MANAGEMENT SOFTWARE TO COMPLETE THE SOFTWARE INSTALLATION.

CONNECT TO SERIAL PORT ON YOUR PC, OR SERIAL TO USB ADAPTOR CABLE

Figure 4.22 Connecting to a PC

Programming your iGrow1600

Before You Begin Programming

Before the iGrow 1600™ is programmed, it is recommended that the following steps are followed:

Hardware is properly installed and tested with manual switches.

All toggle switches have been restored back to the OFF state.

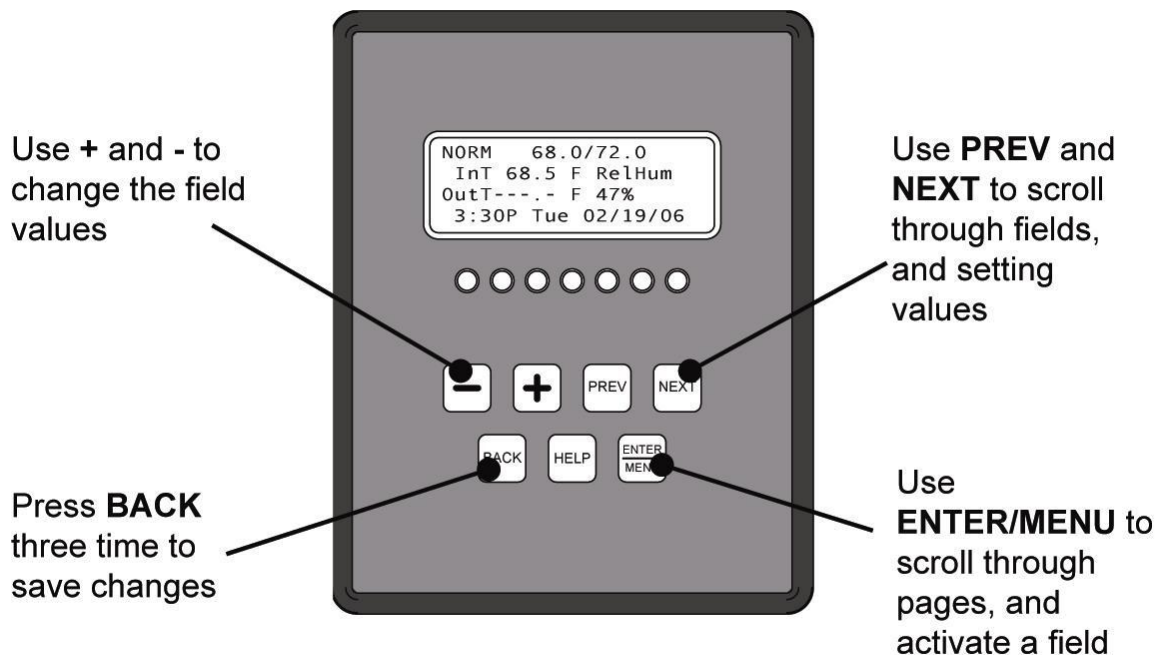
All the templates from Chapter 3: Control Strategies that are relevant to your application are understood and are completely filled out.

Navigation

The iGrow 1600™ has a 7 button keypad. The behaviors of the keys are:

- Used to edit (decrement) alphanumeric parameters. See also Browse Mode.
- + Used to edit (increment) alphanumeric parameters. See also Browse Mode.
- Prev** Used to move backward from screen to screen in browser mode or to the previous entry in the “edit” mode.
- Next** Used to move forward from screen to screen in browser mode or to the next entry in the “edit” mode.
- Back** Used to move back up one menu level and save any changes that have been made.
- Help** Pressing Help will give you hints for whatever page you happen to be on.
- Enter/** Pressing this key initially goes to the menu screen and after that it is used to enter.
- MENU** subsequent highlighted screens. See also Browse Mode.

Note: When browsing through the menu, **highlighted** text signifies that it can be modified.



Status Screens and Programming Screens

When operating the iGrow1600 you will use Status Screens and Programming Screens.

Status screens show:

- Sensor readings (Inside Temp, Weather Station, Temp Probes, CO2)
- Equipment status
- Daily averages, etc.

Programming screens are where you setup and adjust:

- Equipment
- Setpoints
- Overrides
- Other settings important related to your greenhouse

The Navigation Menu Map on the following page shows all the primary screens.

Status Screens

Welcome Screen

Upon power up or a hardware reset (see Reset Controller for more information), the iGrow 1600™ will briefly display the Welcome screen below. After 5 seconds, the iGrow 1600™ will automatically display the Main Status screen.



```
Welcome to the  
iGrow 1600  
V1.03.20  
Copyright 2007
```

Main Status Screen

```
COOL2 SetPt 72.0+  
InT 75.0°F RelHum  
OutT 95.3°F 42% dh1  
12:34P Tue 07/05/05
```

The main status screen displays the current status of your greenhouse zone. The numbers shown are only sample numbers and will differ for each user, but a description for each display will be explained.

Note: Use the **NEXT** and **BACK** buttons to scroll through Status Screens.

Cool 2

This is the current temperature stage. It can go from Cool 6, to Normal, to Heat 6.

SetPt

This is the current setpoint for cooling, or if it's in a heat stage, it will be the heat setpoint. For the Normal stage both the lower and upper setpoints are shown, respectively.

Note: A + sign after the SetPt reading (72.0+) indicates Heat Boost condition. Please refer to the Dehumidification/Humidification section for a description on Heat Boost.

InT

This is the current indoor temperature reading from the indoor temperature sensor.

OutT

This is the current outdoor temperature reading, if you have an outdoor temperature sensor.

RelHum

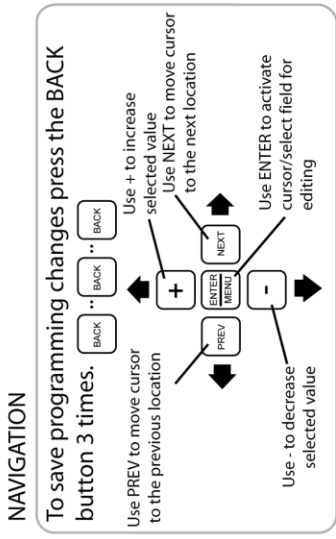
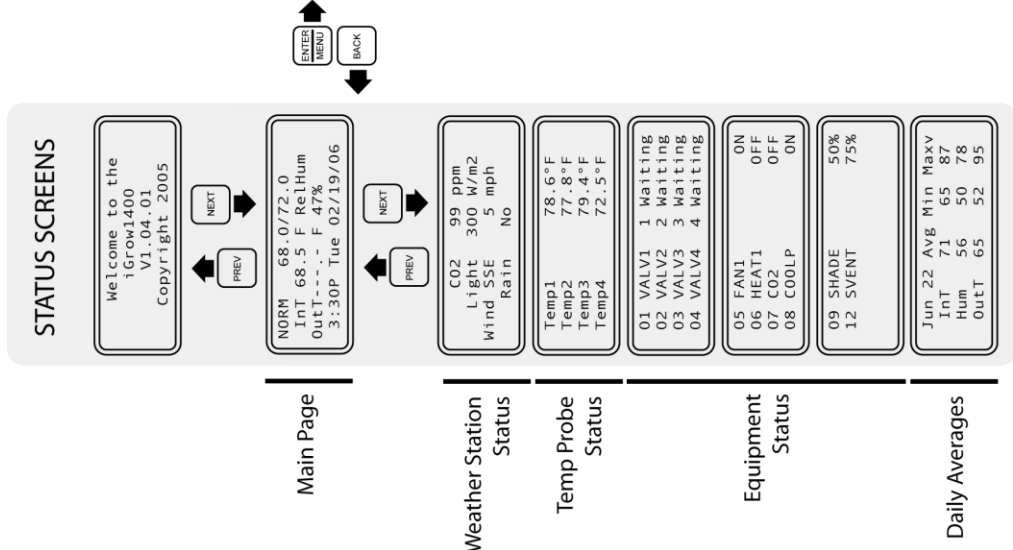
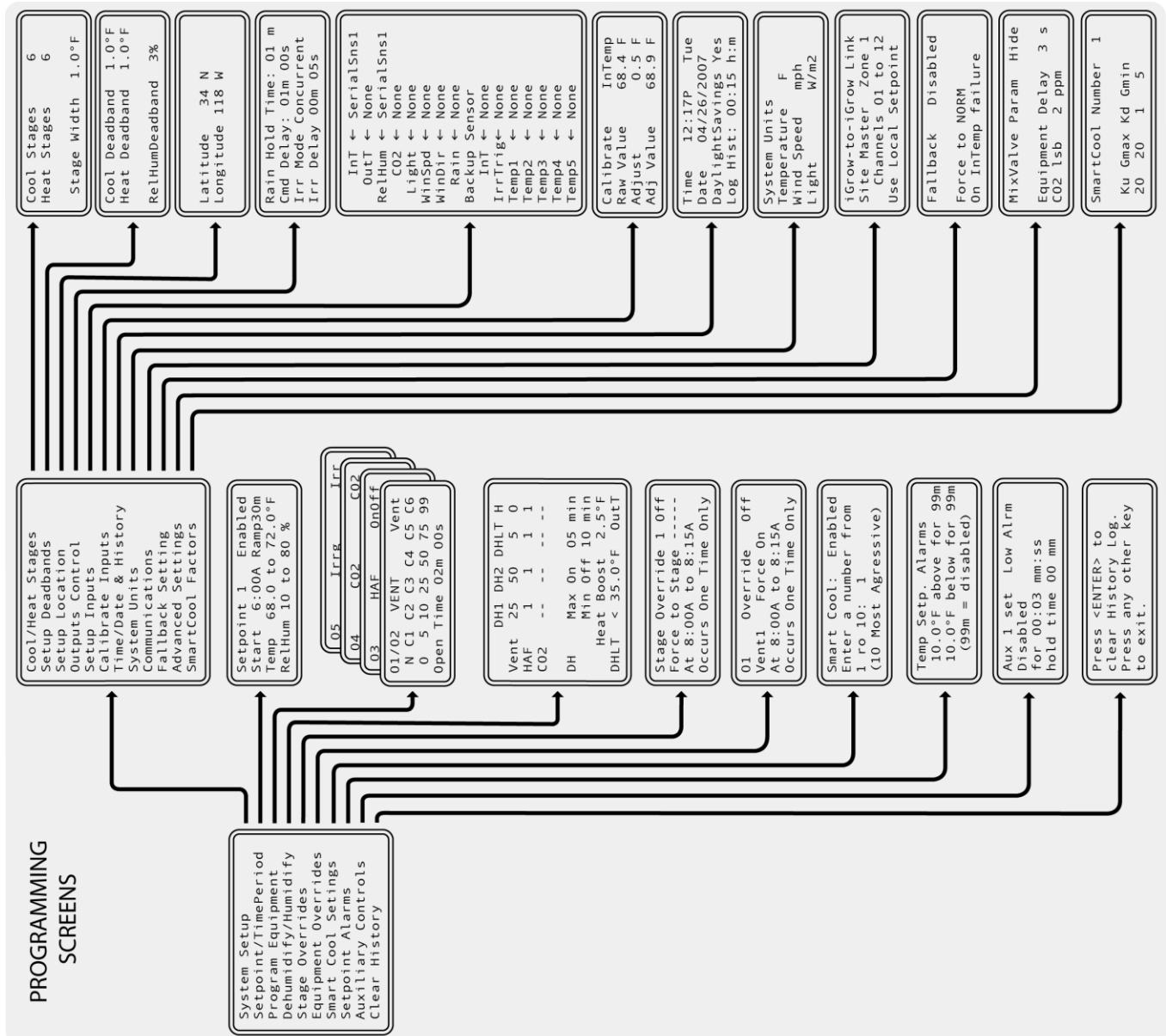
This is the current humidity reading in the zone

dh1

This is the current dehumidification stage. The possible entries are (dh1, DH1, dh2, DH2, dhlt, DHLT, h, H, and blank). Blank means that the humidity level is acceptable. If this field is highlighted, it means that the iGrow 1600™ is in the dehumidification override mode.

Since the dehumidification control can be programmed to cycle on and off (See Dehumidification/Humidification Section), the DH1 status indicator can cycle between DH1 and dh1, indicating that the dehumidification process is on and off, respectively.

The last line displays the current **time, day of the week and date** at the bottom of the screen.



Sensor Status Display

CO2	1000	ppm
Light	1000	W/m ²
Wind	SSE	15 mph
Rain	No	
Temp1	77.0	°F
Temp2	79.4	°F
Temp3	69.8	°F
Temp4	71.2	°F
Temp5	70.5	°F

The Sensor Status Display screen(s) will show you readings for whichever sensors you have attached.

CO₂

Current CO₂ reading, in ppm.

Light

Current **light** reading. The light sensor is typically installed outdoors with a maximum reading of 2000 Watts/meter squared OR in Klux with a maximum of 120Klux.

Wind

This wind **speed** reading is displayed in miles per hour or kilometers/hour, along with the wind **direction** display with one of 8 possible directions: N, NE, E, SE, S, SW, W, NW

Rain

The **rain detector** indication is either "Yes"-there is rain or "No"-there is no rain.

Temp Probe Number

You can have up to 5 temperature probes attached to your iGrow1600. By mapping your Input Settings, you can assign each probe to whichever Temp Probe Reading (Temp1, Temp2, etc.) that you want.

Equipment Status

01	Irr1	6	Waiting
02	Irr2	2	46
03	Irr3	3	3:00p
04	Irr4	39	58

05	C02		Off
07	Vent1		99%
09	Curt1		40%
12	Heater		Off

Pressing the **Next** key again will display the status for each piece of equipment assigned to the various output channels, up to 4 equipment status' can be displayed simultaneously. The **Next/Prev** key allows you to page back and forth between the programmed equipment status screens. An example follows:

These screens display the current status of the equipment outputs.

First column

This first column is the Channel number. Keep in mind that for Vents and Curtains, two channels are taken up. In the example above, 7/8 are vent outputs and 9/10 are curtain outputs. Note that equipment #11 is not used, thus it is not displayed.

Second column

The second column is the Equipment name assigned to that channel. Names are limited to 5 alphanumeric characters.

Third column

The third column is the number of times that the respective output has been triggered in irrigation mode.

Fourth column

The fourth column is the current status reading of the equipment. **Waiting** indicates that the Irrigation output configured in triggered mode is waiting for a trigger. In Accumulated light mode, the Irrigation output will display the current accumulated light level. In scheduled mode, the Irrigation output will display the next scheduled start time. In cycle mode, the Irrigation output will display the amount of time remaining (in minutes) until the next irrigation cycle.

Note: When the text on the status screen is highlighted, this means the equipment is being overridden. See the Equipment Override Section.

Yesterday's Averages Status

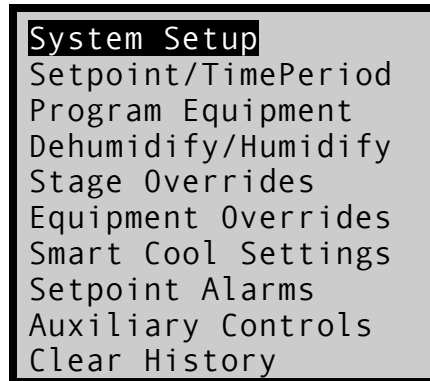
Jun 21	Avg	Min	Max
InT	78	74	84
Hum	50	41	61
OutT	78	74	83

This screen displays the average, min, and max of InT (Inside Temperature), Hum (Humidity), and OutT (Outdoor Temp) from yesterday. Yesterday is defined as 5:00AM (yesterday) to 4:59AM (today).

Programming Screens

Begin Programming

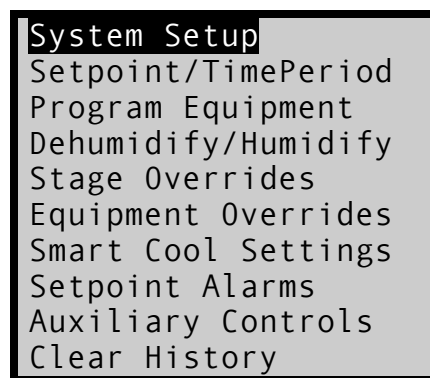
From any Status Screen, press the **ENTER/MENU** key to enter programming mode. Press NEXT and PREV to scroll up and down in this screen. To make changes to any of the items in the screen below, press ENTER.



System Setup (installation settings)

If you're setting up your iGrow1600 for the first time, then the first task is to program all applicable items found under System Setup.

If the **ENTER/MENU** key is pressed while the **System Setup** field is highlighted, then the iGrow 1600™ will display the Menu selection for the System Setup section of the iGrow 1600™.



```
Cool/Heat Stages
Setup Deadbands
Setup Location
Outputs Control
Setup Inputs
Calibrate Inputs
Time/Date & History
System Units
Communications
Fallback Settings
Advanced Settings
Smart Cool Factors
```

Cool/Heating Stages

```
Cool Stages 6
Heat Stages 6

Stage Width 1.0°F
```

On this screen you will select the maximum number of **cooling and heating stages** that you intend to use. The up and down arrow keys are used to increase or decrease the amount of stages for cooling and heating. If, for example, you select 2 heating stages, then in the remainder of the programming only 2 heating stages will be displayed. The third selection is the **Stage Width**. This is the number of degrees between each of your stages, sometimes referred to as "Stage Separation". Typically, users select either 1 or 2 degrees.

Setup Deadbands

```
Cool Deadband 1.0°F
Heat Deadband 1.0°F

RelHumDeadband 3%
```

Deadband
this is sometimes called "hysteresis" band. For *cooling*, it is the number of degrees the temperature needs to drop from the lower boundary of its current stage before it switches to the lower stage. Without Deadbands, equipment tends to cycle frequently & constantly change stages when the temperature approaches the set points. When a large value is used, setpoints may not be maintained. Typical values might be 1 to 2 degrees F. For *heating* it is the number of degrees the temperature needs to rise above the temperature boundary before it switches to a lower heating stage.

RelHum Deadband
This is the RH% the humidity must drop below the dehumidification threshold before exiting the dehumidification state. It also is the RH% the humidity must rise above the humidification threshold before exiting the humidification threshold.

Bheat Deadband

This is the number of degrees that the bottom heat temperature must rise above the bottom heat temperature setpoint or threshold before the heat valve switches off. Typical values might be 1 degree F or less.

Setup Location

```
Latitude 34 N
Longitude 118 W
```

The iGrow 1600™ has an internal astronomical clock. By knowing the actual coordinates, sunrise and sunset times can be precisely calculated. Go to www.heavens-above.com to find coordinates for your precise location. If a **negative** longitude is given you are west, and if a **negative** latitude is given you are south.

Outputs Control

```
Rain Hold Time: 01 m
Cmd Delay: 01 m 00 s
Irr Mode Concurrent
Irr Delay 00 m 05 s
```

Rain Hold Time

Rain Hold Time is a parameter that lets you choose how long you want the rain override condition to persist after the rain status goes from Yes to No. This is to keep intermittent rain from causing the vents to keep opening and closing.

Cmd Delay

Cmd Delay is the time between commands to change the equipments' states. It is the shortest time permitted for switching equipments. Typical update times are from 1 to 2 minutes. This parameter is used to minimize the cycling of the equipment.

Irr Mode

Irr Mode is either **Concurrent** or **Sequential**. You can choose between the two options by pressing the + or - key. These options apply if you program more than one irrigation valve to trigger based on accumulated light or a dry contact switch closure, or if you select the cycling (misting) option. If you select Concurrent, then the valves will turn on immediately when requested regardless of how many are already on. If you select Sequential, then the first one will turn on but if other valves are to come on, they will wait in queue and each one will come on in succession. (Also see Jumper section to make sure your settings are correct).

Irr Delay

Irr Delay forces a user definable delay between the valves. In other words, when the current On valve goes Off, the next valve in the queue will wait the selected min and sec before it turns On.

Setup Inputs (sensor mapping)

```
InT ⇐ SerialSns1
OutT ⇐ SerialSns2
RelHum ⇐ SerialSns1
  CO2 ⇐ AnalogIn6
  Light ⇐ Solar
WinSpd ⇐ FDIIn1
WinDir ⇐ AnalogIn7
  Rain ⇐ FDIIn2
Backup Sensor
  InT ⇐ SerialSns2
IrrTrig⇐ DigitalIn1
Temp1  ⇐ AnalogIn1
Temp2  ⇐ AnalogIn2
Temp3  ⇐ AnalogIn3
Temp4  ⇐ AnalogIn4
Temp5  ⇐ AnalogIn5
VPos1  ⇐ AnalogIn1
VPos2  ⇐ AnalogIn2
VPos3  ⇐ AnalogIn3
VPos4  ⇐ AnalogIn4
VPos5  ⇐ AnalogIn5
      pH1 ⇐ AnaIn1
      pH2 ⇐ AnaIn2
      5uS EC3 ⇐ AnaIn3
      500uS EC4 ⇐ AnaIn4
      5k uS ECT5 ⇐ AnaIn5
```

Setup Inputs is where you tell your iGrow1600™ what sensors you are using (this is also called sensor mapping). The screen above shows the typical sensor mapping for each sensor. If you don't have a particular sensor then leave the setting as **None**.

Note: For Zone Master and Slave units, you should set all weather station sensors (OutT, Light, WindSpd, WindDir, and Rain to **Remote**. Setting the weather station sensors to Remote means the Slave unit or Zone Master will get their weather station data remotely from the Site Master.

PREV and **NEXT** keys move the cursor from one input selection to the next. Using the **+** and **-** keys you can select which one of the input channels to assign to your sensors. Note that the allowable choices vary from one type of sensor to another. If any given sensor is not present, **None** should be selected. The **Software** choice is

useful for testing and debugging if you just want to force the reading to a particular value. The software value can be modified through the Calibration Inputs screen below.

The **Backup Sensor** is an optional way to tell the iGrow 1600™ which sensor it should default to in the case of a failure on the InTemp temperature sensor.

Note: For the Backup Sensor to be used, to must be Enabled. See also **Fallback Settings** below to Enable the Backup Sensor.

Calibrate Inputs

Calibrate	
Raw Value	73.6°F
Adjust	0.5°F
Adj Value	74.1°F

Calibrate

To calibrate an input you must first select the sensor you want to calibrate. Press the + or - keys to cycle through the various sensors. Once you have selected your sensor, press enter and it will take you to the adjustment line.

Raw Value

Raw Value is the direct reading from the sensor. Using the + or - keys will add a positive or negative adjustment to the raw reading giving you an adjusted value.

Adj Value

Adj Value is what will be reflected on the front status screen.

Time/Date & History

Time	12:17P
Date	04/26/2005 Tue
DaylightSavings	Yes
Log Hist:	00:01 h:m

Time

Time adjusts the current time by highlighting the field and pressing either the + or - keys. This will allow you to scroll through the entire 24 hours.

Date

Do the same for the date. Press Enter to go from field to field and adjust the correct date.

Daylight Savings

If you want the program to automatically adjust itself for Daylight savings time, select YES. If not, select NO.

Log History

This option lets you choose how often the controller will log sensor and equipment history information. In this case it saves log history every minute, but can be changed to different lengths of time. If you put 00:00, then it will save information every second.

Note: In the United States and Canada Daylight Saving Time begins on the second Sunday in March and reverts back to standard time on the first Sunday in November.

System Units

System Units	
Temperature	°F
Wind Speed	mph
Light	W/m ²

Temperature

Choose either degrees Fahrenheit (°F) or degrees Centigrade (°C).

Wind Speed

Choose either miles per hour (mph) or kilometers per hour (km/h).

Light

Choose either Watts/meter² or klux.

Communications (Network Programming)

Once multiple iGrow controllers are wired together (as shown in Figure 4.21), you will need to set up each iGrow1600's program settings for proper communications. Note that the most important iGrow1600 in the network is the one you choose to be the Site Master. The Site Master controls all network communications and is the only unit that a Weather Station and PC can be connected to.

Site Master

To setup your Site Master press Enter/Menu → System Setup → Communications. Under the “Communications” screen you’ll find several editable fields. By default the text **Disabled** will be highlighted. Use the + and - buttons to change this setting to Site Master. Now press the **BACK** button three times (or until you see the Main Status screen) to save your changes. That is all that’s necessary to setup the Site Master. Your Site Master is now ready to communicate with you network and PC.

iGrow-to-iGrow Link
████████████████████ Zone 1
Channels 01 to 12
Use Local Setpoint

Zone Master

To add a Zone, simply set a unit to **Zone Master**, You can set the Zone number, and choose to use it’s own “**Local setpoints**” or the Site Masters “**Remote setpoints**”. Now press the **BACK** button three times (or until you see the Main Status screen) to save your changes.

- Local setpoints are the setpoints on the Zone Master itself
- Remote setpoints are the setpoints of the Site Master Unit

```
iGrow-to-iGrow Link
██████████ Zone 2
Channels 01 to 12
Use Local Setpoint
```

Note: Be sure that ZoneMaster Units are set up in sequential order. For Example, if you have three Zone Masters, set their zone number to be in order i.e. 2,3,4. DO NOT jump over one such as 2,4,5. The iControl software will not function properly.

Slave Unit

For Slave Units (also called Expansion Units), set to **Slave Unit**. Then set which zone the unit will be an expansion unit to, i.e. Site Master Zone 1, or some other Zone Master. Since each zone can have up to 3 Expansion Units you must also decide which expansion unit it is.

- Expansion Unit Outputs 13-24
- Expansion Unit Outputs 25-36
- Expansion Unit Outputs 37-48

Note: Be sure that Expansion Units are set up in sequential order. For Example, if you have only two expansion units be sure to set one as 13-24 and the other to 25-36. DO NOT jump over one such as 13-24 and 37-48. The iControl software will not function properly.

```
iGrow-to-iGrow Link
██████████ Zone 1
Channels 13 to 24
Use Remote Setpoint
```

Similar to a Zone Master, you can choose to use **Local** or **Remote** Setpoints. But in this case, if you choose **Remote** setpoints, the Expansion unit will use the Zone Master's setpoints **NOT** the Site Master's setpoints.

Now press the **BACK** button three times (or until you see the Main Status screen) to save your changes.

Note: Once you setup the Site Master, Zone Master(s) and Expansion Unit(s), you should label the front panel on each unit for easier reference in the future.

Fallback Settings

```
Fallback
Sensor Enabled
High Alarm Disabled
Force to NORM
```

Sensor

This feature is used if there is an InTemp sensor failure and you want the controller to fallback into utilizing the backup **Sensor** (OutTemp, or other temp sensor you have defined in the **Setup Inputs** section). By choosing the fallback option to Enabled mode, the controller will automatically detect an InTemp sensor failure and fall back to the backup Sensor. If Fallback is Disabled, then there is no action to utilize a backup sensor and the iGrow 1600 will engage the **Force to** condition.

High Alarm

If you enable the High Alarm, the iGrow will trigger an alarm upon temp sensor failure.

Force to

In case of a **Fallback** failure scenario, or if Fallback is Disabled, the third level of safety is to force the iGrow 1600 into any stage automatically. In the example screen above, the iGrow 1600 would engage whatever equipment you have assigned to be ON under NORM conditions.

Advanced Settings

```
MixValve Param Hide
Equipment Delay 3 s
CO2 lsb 2 ppm
Comm Diag Scrn Hide
Curtain Energy Mode
Light Hyst 50%
Temp Hyst + 5°F
Heat Demand Show
Cool Demand Show
Heat Offset 5.0 F
Cool Offset 5.0 F
Bump ENABLED
Bump Hold 5m
AutoDetect ON RESET
Reset Error Hide
Pass Mode Enabled
Rst Stack Enabled
```

Advanced

If you wish to use PID Mix Valve operation then the **MixValve Param** option must be set to from Hide to **Show**. This will activate two additional menu screens located under the MixV equipment type menu. Use the + and - keys to change setting from Hide to Show.

Equipment Delay

Time the iGrow1600 will wait to switch from one equipment to the next.

CO2 lsb

Tuning range for a CO2 sensor (modifies the ranging of a CO2 sensor) 2 means the CO2 range will be 0-2000ppm, a value of 3 would set the range to be 0-3000ppm.

Comm Diag Scrn

By toggling this field to Show, a status screen will become visible that allows you to see if this iGrow is communicating with other iGrows on the network

Light Hyst

Light Hysteresis only applies to curtains in Energy Mode. Once a curtain closes, for it to reopen due to light, the new light reading must be higher than the close value by: Close Value times Hyst value plus the Close Value.

For example, let's say the Hyst Value is 50%. If the curtain closes at 100W/m², then to reopen it the light level must reach 150 W/m² (or 100x50% + 100).

Temp Hyst

Temp Hysteresis is similar to Light Hysteresis, and only applies to curtains in Energy Mode. Once a curtain closes, for it to reopen due to temperature, the new temperature reading must be higher than the close value by: Close Value plus the Temp Hysteresis value.

For example, let's say the Hyst Value is +5°F. If the curtain closes at 70°F, then to reopen it the temperature level must reach 75°F (or 70+ 5).

Note: Regardless of what causes a curtain to close, during energy mode either Light Hyst or Temp Hyst can reopen it.

Heat Demand

Toggling this field to Show makes the Heat Demand visible in the status screens

Cool Demand

Toggling this field to Show makes the Cool Demand visible in the status screens

Heat Offset

Heat Offset is a calibration factor for your heat demand

Cool Offset

Cool Offset is a calibration factor for your cool demand

Bump

To ensure that proportional devices don't drift, or become mis-calibrated, bump turns all proportional devices in the same direction that they last moved for a specific period of time.

Bump Hold

This is the time period that the bump feature turns on for

AutoDetect

When you have multiple iGrow controllers connected together, you can set how often the Master controller checks the network to see if another controller has been added, or if one is lost.

Reset Error

This feature is used for testing & troubleshooting. If you are having communication problems, turning this to Show will display error messages in the status screens.

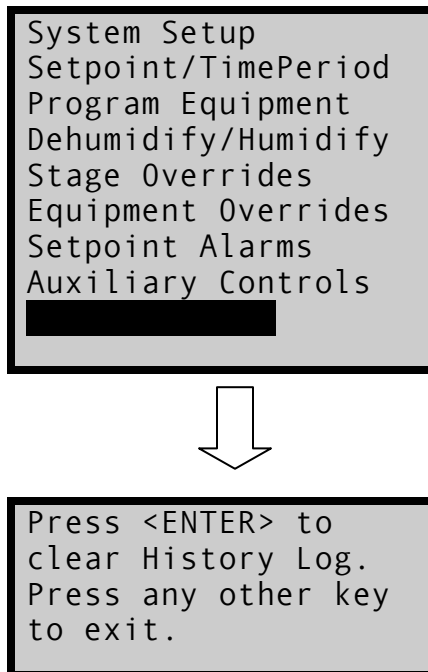
Pass Mode

This feature is used by field technicians for troubleshooting

Rst Stack

This feature is used by field technicians for troubleshooting

Clear History



Clear History

The Clear History option is made available to erase any previous history log that is undesirable. Press Enter to clear history log and then press the Back key to save and exit.

Resetting the Controller

Hard Reset- If your controller ever freezes, use a long pin to press the reset button (though the small hole on the front panel labeled **Reset**). This will refresh the controller. This is a safe operation and will not cause you to lose any programming or configurations.

Factory Default Reset- if ever wanted, or is necessary, you can reset the iGrow 1600™ to its factory default settings. To do this, unplug or press the reset button, then immediately press and hold the “Back” and “Enter” buttons simultaneously while the unit restarts. After doing so, the controller will say “iGrow 1600 Restoring Default Configurations.....” It is suggested that if you have the iGrow Remote Management Utility (RMU) software, use it to save your configurations before making a factory default reset. Then, you can use it to quickly restore all your settings.

Warning: You will lose all configuration data if a Factory Default Reset is performed.

SmartCool Factors

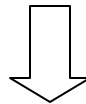
```
SmartCool Number 1
Ku Gmax Kd Gmin
20 20 1 5
```

Smart Cool uses the outside temperature and light data to assist in making intelligent cool staging decisions for the most efficient control of your greenhouse. In the first level of screens, there is a similarly named panel called **Smart Cool Settings**. **SmartCool Factors** and **Smart Cool Settings** panels are related to each other. In the Smart Cool Settings panel there are 10 possible settings you can choose from, each one determining how aggressively your iGrow will respond to changing weather conditions. SmartCool Factors are the detailed settings for each of the 1-10 Smart Cool Settings.

Note: Smart Cool Factors are settings related to how quickly your greenhouse heats up and cools down. The iGrow1600 allows you to adjust the Smart Cool Factors, but it is **NOT RECOMMENDED TO CHANGE THE DEFAULT SETTINGS**. To use Smart Cool, you should only adjust the 1-10 values found in the Smart Cool Settings panel. For further information on Smart Cool, please contact Link4.

Setpoint/Time Period Programming

```
System Setup
██████████
Program Equipment
Dehumidify/Humidify
Stage Overrides
Equipment Overrides
Setpoint Alarms
```



```
Setpoint 1 Enabled
Start 6:00A Ramp30m
Temp 68.0 to 72.0°F
RelHum 10 to 80 %
```

Start Times

You have up to 4 setpoint start times available to use within a 24 hour time period. You can cycle through each of the four start times with the + or - keys.

Pressing Enter takes you to the **Enabled** or **Disabled** option. Setpoint 1 is always enabled. Setpoint's 2-4 are disabled. You may enable them by use of the + key.

Note: If you only have day and night setpoints, you will only use Setpoint 1 and Setpoint 2, the other two will remain disabled

The **Start** time is when the heat and cool temperature setpoints temperatures are engaged. The start time is either a fixed time or it can vary daily based on the increase or decrease in day length. This day length is an **Astronomic Adjustment** based on the latitude and longitude entries that you made as shown in the **Setup Location** portion of this manual.

By pressing the **+** key at the Start Time entry, you will get the following:

Press **+** once = SRise

Press **+** twice = SSet

You would use the Srise option for the setpoint that you program at the beginning of the day. Similarly, you would use the Sset option for the end of the day setpoint. The adjustment will be made each midnight and so everyday you will see a change in the “Start Time”.

Ramp Time

The ramp time enables a smooth transition of the target temperatures between the time periods. If the ramp time is set to 0 there will be an immediate step transition in the set points from the previous from the current setpoint to the following time period. If the ramp time is not zero, the ramping begins at the end of the time period (see Fig 2.1 for reference).

Heat and Cool Setpoints

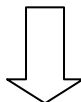
The third line is where you enter the heat and the cool setpoints, that is, the low temperature and the high temperature targets.

Humidity Setpoints

The humidity range is shown on the fourth line. If the humidity is below the lower value, you enter the humidification stage. If humidity is above the higher number you go into the dehumidification stage.

Programming Equipment

```
System Setup
Setpoint/TimePeriod
Program Equipment
Dehumidify/Humidify
Stage Overrides
Equipment Overrides
Alarm Limits
Clear History
```



```
01      Name1  None

This channel has no
selected equipment.
```

To setup or change equipments press the **ENTER/MENU** button, use the + and – buttons to find **Program Equipment** selection, then press **ENTER/MENU** again. You will then see the right screen above. To select the output channel that you want to edit press **ENTER/MENU** one more time and the **CH01 01** in the upper left corner will highlight. Use the + and – buttons to select the channel you want to edit. Once the channel is selected, the next two steps are to name the channel (usually named by the equipment type it's controlling), and to set what kind of equipment it is.

For un-programmed equipment, there are two editable choices: the name field and the equipment type field. The names are restricted to 5 alphanumeric characters. The equipment type field is restricted to the following equipment types:

- On/Off** – On/Off may be programmed on any channel
- Irrig** – Irrig may be programmed on any channel
- CO2** – CO2 may be programmed on any channel
- Light** – Light may be programmed on any channel
- Pump** - Pump may be programmed on any channel
- MZone** – MZone (or Microzone) is an On/Off type device with its own setpoints and temp sensor (temp probe only). It is an independent thermostat output with Day/Night settings. It can be programmed on any Channel.
- Vent** – Vent may only be programmed on any two consecutive channels, the first channel being an odd number and the second it's neighboring even number (for example: channels 1&2 or 3&4 are acceptable pairs, but 2&3, or 8&9 are not)
- Curtain** – Curtain may only be programmed on any two consecutive channels, the first channel being an odd number and the second it's neighboring even number (for example: channels 1&2 or 3&4 are acceptable pairs, but 2&3, or 8&9 are not)
- MixV** – MixV may only be programmed on any two consecutive channels, the first channel being an odd number and the second it's neighboring even number (for example: channels 1&2 or 3&4 are acceptable pairs, but 2&3, or 8&9 are not)
- PZone** – PZone is a special purpose Mixvalve, and is a proportional controlled MicroZone. It may only be programmed on any two consecutive channels, the first channel being an odd number and the second it's neighboring even number (for example: channels 1&2 or 3&4 are acceptable pairs, but 2&3, or 8&9 are not) It is an independent thermostat output that can control modulating heat valves.
- VOut** – VOut is a variable voltage or current output for equipments such as variable speed fans. This option only appears if you have installed the optional iMOD (Multi-Output Device) expansion board.

ON/OFF Equipment

```
02    ExFan    OnOff
      Heat     Cool
      654321 N 123456
      000000 0 011111
```

The iGrow 1600™ supports On/Off devices with up to 6 heating and 6 cooling stages. 1 to turn equipment ON and 0 to turn it OFF. Use the + or – keys to toggle the On/Off condition for a particular stage.

In the above example, we have the exhaust fan coming on beginning with the second stage of cooling and then continuing on in the remaining six cooling stages.

Note: If in the Cooling/Heating Stage setup you selected fewer than 6 stages, then only the number of stages that you selected will appear for the On/Off devices and Vents (Refer to Cool/Heating Stages Setup to set how many stages are desirable).

Irrigation Programming

```
01      Valve1 Irr
Mode:    Scheduled
          Hr mm ss
OnTime:  00:00:00
```

Each channel programmed for Irr (irrigation) can be programmed independently. The first selection is the **Mode**. Pressing the + or – keys cycles you through the mode choices. There are four choices defined as follows:

Scheduled

This mode is like a time clock where you set the start time, run time and days of the week.

Accumulated Light

In this mode the irrigation cycle is triggered when the accumulated light or “light sum” reaches a threshold or when the off time limit is reached.

Cycle

With this option, the irrigation valve is cycled continuously during the time window with an On time and an Off time that you get to select.

Trigger

This option lets you trigger the irrigation based on an external input. This input could be a wall switch, a moisture sensor, a weighing scale or any on/off input.

Scheduled Irrigation

```
01      Irr01  Irr
Mode:   Scheduled
        hr mm ss
```

```
01      Irr01  Irr
7:00A   8:00A  12:30P
4:00P   Off    Off
```

```
01      Irr01  Irr
SMTWTFS SMTWTFS
1010101 0101010
```

Scheduled mode allows the iGrow 1600™ to turn the Irrigation channel on for a duration equal to OnTime at up to **six** start times per day. Use Off to indicate unused time slot. The third screen allows for enabling or disabling scheduled irrigation for an entire day. A “1” indicates that irrigation is enabled for that particular day, and a “0” means irrigation is disabled for that day. Two weeks are given, so that the iGrow 1600™ can be configured to irrigate every other day.

In the above example, the equipment, named Irr01, is scheduled to turn on for 2 minutes, every other day of the week, at 7a.m., 8a.m., 12:30p.m., and 4p.m.

Note: These times are not astronomically adjusted.

Accumulated Light Irrigation

```
02      Irr02  Irr
Mode:   Accum Light
        hr mm ss
```

Accumulated light mode allows the iGrow 1600™ to turn the Irrigation channel on for a duration equal to the OnTime.

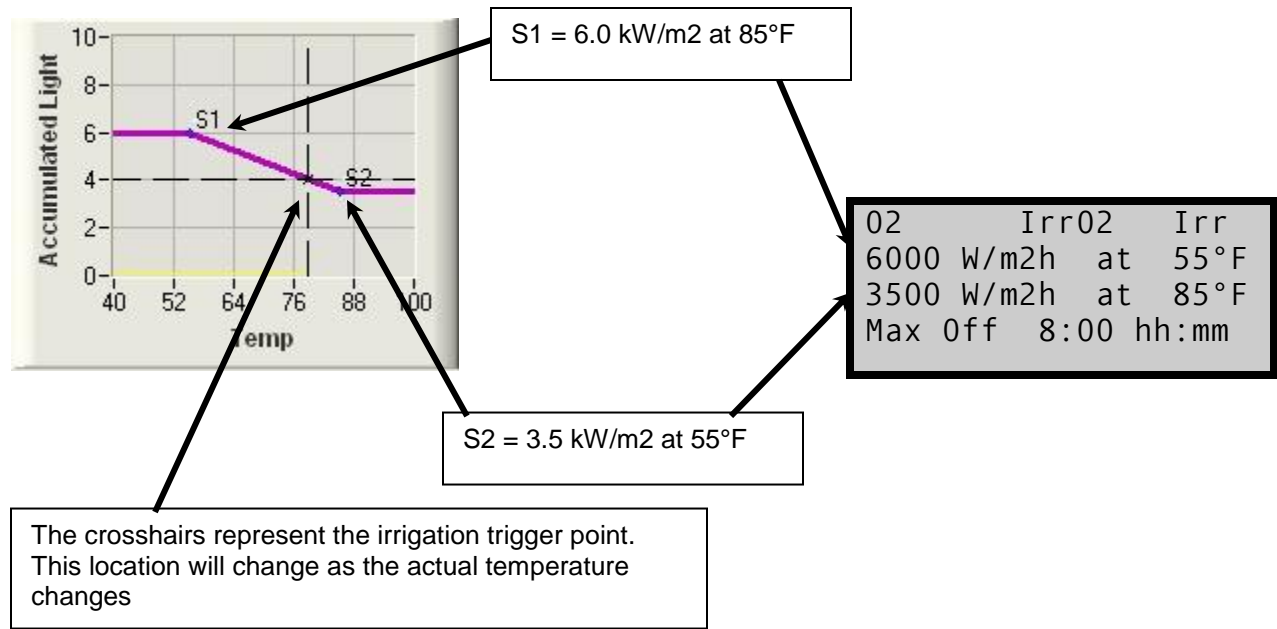
```
02      Irr02  Irr
Start   SRise  07:00A
End     at    07:30P
Accum Light
```

The irrigation valve will only turn on between the Start time and End time and will only do so when the appropriate amount of light has been accumulated. Both of the start and end times can be astronomically

adjusted to vary with respect to either sunrise or sunset. Please note that if the accumulation does not reach the threshold at the end of the time window the accumulation will still continue, however, if the threshold is reached outside the time window, irrigation will not take place until the beginning of the next active time window.

```
02      Irr02  Irr
6000 W/m2h at 55°F
3500 W/m2h at 85°F
Max Off 8:00 hh:mm
```

In the third screen you will need to set the accumulated light threshold. You have the option of setting it as a function of the air temperature. For example, you might have a threshold of 6000 w/m2-hr at a temperature of 70 °F and a threshold of 5550 w/m2-hr at an air temperature of 80 °F. The threshold will then be a straight line interpolation between the two temperature thresholds. Note: If you don't want it set as a function of temperature, then simply make the two accumulated light entries the same.



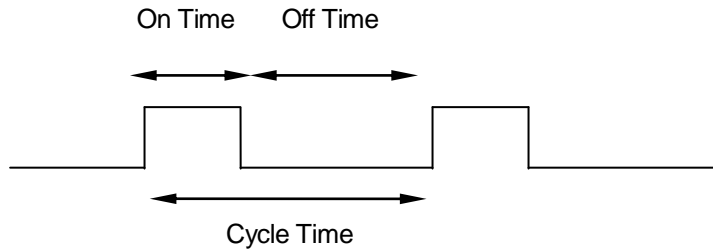
The last entry is the **Max off** time. This is similar to a safety net. In the event that the accumulated light is below the threshold when the maximum off time is reached, irrigation will take place anyway and the accumulator will be reset.

Note: In order to use this feature properly, there has to be a light sensor attached to the iGrow 1600™ and it must be mapped correctly in the Setup Input screen.

Cycling Irrigation

```
03      Irr03  Irr
Mode: Cycle
      hr mm ss
```

When you select this option you will get the following screen: The cycling option is for turning on and off a valve at some repetition rate during a time window. As with the other options, your first entry is the OnTime for the valve.



```

03      Irr03      Irr
Start  at          09:00A
End    at          07:00P
    
```

In the second screen you will set the time window with **Start** and **End** times. The start and end times can be fixed or they can be related to **Sunrise** or **Sunset**, if you like. You can cycle through the three options by pressing the + key when the cursor is over the **at**.

The **Cycle Time** is the combination of the On time and the Off time added together.

Trigger Irrigation

```

04      Irr04      Irr
Mode: Trigger
      hr mm ss
    
```

The external trigger option is designed to turn on your irrigation valve(s) from an external switch such as a momentary wall switch or a soil moisture sensor. The external trigger input should already be assigned in the Setup Inputs screens. See Setup Inputs Section for more details.

Note: The iGrow 1600™ digital input has an internal 10K pull up resistor to +3.3V. If the external trigger input is pulled low by an external device for more than 50 msec then the input is deemed **valid**.

```

04      Irr04      Irr
Start  at          09:00A
End    at          07:00P
Trigger
    
```

The iGrow 1600™ enables the external trigger only between the **Start** and **End** times. These two time values can be astronomically adjusted with respect to either sunrise or sunset.

CO₂ Equipment

```
05      CO2      CO2
Start   at       09:00A
End     at       07:00P
```

The iGrow 1600™ can also be used to regulate the amount of CO₂ inside the greenhouse by controlling CO₂ pumps or injectors. This mode is active between the **Start** and **End** times. You have the option of controlling the **Start** and **End** times based on a fixed time window or a relative time window. The latter is relative to the sunrise and sunset times. When the cursor is over the **at** position and you press the **+** or **-** keys, you will cycle through the three options: **SRise**, **SnSet**, and **at**.

When you set the parameters up for the first time as shown in the above screen, the Start and End times will be adjusted every day thereafter, at 2 AM, to track the shortening and lengthening of the days.

Note: It does not mean that the Start is exactly at the sunrise time, or the End at exactly at the sunset times. You can select any time window. What it means is that the daily adjustment is per the change in the sunrise and sunset time amounts. When the days get longer, the sunrise rise time will be earlier each day and the sunset time will be later.

```
05      CO2      CO2
Min CO2  0 ppm
Max CO2  0 <=HEAT6
Min Light  0 W/m2
```

Within the active time period, the iGrow 1600™ will inject CO₂ to the **Min CO₂ Level**, which is the minimum CO₂ level.

The iGrow 1600™ will also inject CO₂ to the **Max CO₂ Level**, within the active time period, if both of the following conditions are met:

1. The current cooling/heating stage is less than or equal to the indicated stage, where $H6 < H5 \dots < N < C1 < \dots < C6$. This means that the iGrow 1600™ will not inject CO₂ up to the **Max CO₂ Level** for cooling stages above the indicated stage. This can be used to prevent excessive loss of CO₂ due to high fans and opened vents.

AND

2. The current light level must be above the programmed Min Light limit.

Note: This mode requires the installation of the optional CO₂ sensor and CO₂ pump. If there is no light sensor present, the iGrow 1600™ will inject the CO₂ to the **Max CO₂ Level** assuming the condition (1) above is satisfied.

Light (HID) Equipment

The iGrow 1600™ can be used to control lights (typically HID) in the greenhouse. There are two operational modes that you can program. One is called Supplemental and the other Scheduled.

```
06    HID    Light
Select Operational
Mode:  Supplemental
```

You can press the enter key and highlight the Mode: With the plus key you can toggle between the Supplemental and the Scheduled options.

Supplemental HID control

```
06    HID    Light
Start  at    09:00A
End    at    07:00P
Use LightSensor? No
```

Supplemental mode is active between the Start and End times. You have the option of controlling the Start and End times based on a fixed time window or a relative time window. The latter is relative to the sunrise and sunset times. When the cursor is over the **at** position and you press the **+** or **-** keys, you will cycle through the three options: SRise, SnSet, and at.

When you set the parameters up for the first time as shown in the above screen, the Start and End times will be adjusted every day thereafter, at 2 AM, to track the shortening and lengthening of the days.

Note: When you select SRise or SnSet, It does not mean that the Start is exactly at the sunrise time, or the End at exactly at the sunset times. You can select any time window. What it means is that the daily adjustment is per the change in the sunrise and sunset time amounts. When the days get longer, the sunrise rise time will be earlier each day and the sunset time will be later.

If you do not have a light sensor, then the output functions as a time clock with the optional astronomical adjustment.

If you **do** have a light sensor, then you can program the following screen:

```
06    HID    Light
Turn ON < 500 W/m2
Turn OFF > 600 W/m2
Time Delay 20 Min
```

First you will program the light level below which the lights will be turned ON. Then you will program the level at which they will be turned off. The final parameter is the Time Delay. If the sun were to appear momentarily, you probably don't want the lights go off and then on again. To avoid this potential cycling problem, you can set a Time Delay in minutes where the light level must be above the turn off threshold continuously before the lights will be turned OFF.

Scheduled HID control

```
06   HID   Light
Select Operational
Mode:  Scheduled
```

If you select **Scheduled** mode, the following screens have the following format.

```
06   HID   Light
o 6:00p o 7:30p
n 9:00p f 10:45p
 12:00a f 12:00a
```

On this screen you can see that you have up to three time periods per day to program an ON and OFF time for your lights. Just press the **Next** or **Prev** keys to navigate to the time entry you want to modify and then use the **+** or **-** key to adjust the time. The next screen lets you select the days of the week for enabling your lights. This is on a two week schedule.

```
06   HID   Light
SMTWTFS SMTWTFS
0111110 0111110
Scheduled Days
```

A "0" means the lights won't come on for that entire day, a "1" means they will. Once you've pressed the **Enter** button, move the cursor with the **Next** or **Prev** keys. You toggle between the 0 and the 1 with the **+** key.

MZone (Micro-Zone) for ON/OFF Equipment

The iGrow 1600™ can be used to monitor and control up to five (5) independent heating or cooling “Micro-Zones”. What is a Micro-Zone? A Micro-Zone is a region or compartment within a greenhouse that has a different temperature setpoint. Typical uses for Micro-Zones would be bench heating, corridor heating, or any other area in the greenhouse with separate heating or cooling equipment. Any of the iGrow1600’s 12 outputs can be programmed as an M-Zone. An MZone output is basically an independent thermostat with both a day and night setting.

Note: MZones only control On/Off type equipments. For control of proportional type see Pzone.

The first option for MZones is setting it to control either a heating device or a cooling one. The next setting is telling the iGrow1600™ which temperature probe to use. The iGrow 1600™ has five temperature probe sensor inputs, so it’s important to set the iGrow1600™ to read the correct one for the MZone.

```
07      BHeat  MZone
Mode    Heat
Sensor  Temp1
```

```
07      BHeat  MZone
Day     72.0°F  Enabled
Start   at     6:00A
Lockout >= Cool1
```

Two target temperatures can be set, one for **Day** and the other **Nite**. Either can be **Enabled** or **Disabled**. The Day temperature target begins with the **Start** time. The start can be astronomically adjusted by pressing the + key when the cursor is positioned over **at**.

```
07      BHeat  MZone
Nite    65.0°F  Enabled
Start   at     8:00P
Lockout >= Cool1
```

The iGrow 1600™ will keep the device on so long as the following two conditions are met:

1. The current cooling/heating stage is less than or equal to the indicated stage, where H6<H5...<N<C1<...C6.
2. The temperature is above/below the target temperature plus the deadband.

Note: The Deadband is set under the “System Setup” menu and then selecting the “Setup Deadbands” option. The BHeat deadband is one used for MZones.

The Nite target is set exactly the same as the day. If only one temperature setpoint is desired for the 24 hour period, then you can simply select the **Disabled** option for the second one.

In the example screen above, iGrow1600™ output 7 is controlling a Bench Heater. From 6am to 8pm the heater will turn on if the MZone temperature goes below 72°F. Additionally, it will shut off, or **Lockout**, if the main greenhouse enters Cool1-Cool6. This way you’re not trying to heat and cool your greenhouse at the same time. From 8pm to 6am the setpoint lowers to 65°F and will also Lockout if the greenhouse enters Cool1-Cool6.

Pump Control

The iGrow offers two types of pump control. Supply pumps are used for hot or cold water temperature control systems while peristolic pumps are used for nutrient injection systems.

```
05      Pump2  Pump
Select Pump Type:
      Supply
```

Choose the type of pump you are controlling, **Supply** or **Peristolic**

Supply Pump

When you have a mixvalve type heating system, it is often necessary for the controller to manage the system pump(s). The iGrow1600™ can control up to 5 Pumps, each one being activated when the mixvalve tied to it opens beyond the Minimum threshold. To “tie” a pump to a specific mixvalve you must specify, in the mixvalve’s settings, which pump you want it to control. For more details on this see the **Programming / Mix Valve** section of this manual.

```
05      Pump2  Pump
Pump    2
Supply Mixv's with
minimum 5% open
```

In the example screen above, the pump will turn on when the mixvalve that it's tied to opens at or above 5%.

Peristolic Pump

When you have a nutrient injection system, it is often necessary for the controller to manage the system pump(s). The iGrow1600™ can control up to 5 Pumps, each one being activated when the corresponding sensor passes the threshold you define below.

```
05      Pump2  Pump
Probe: 500uS ECT1
ON to: Decrease uS
```

Probe

Depending on what type of probe you have connected and configured (pH or EC), you can select which one the pump will be controlled by.

Note: Configuration of the probe (pH or EC) is done in Input Settings, and this should be done before programming a Peristolic Pump.

ON to

This pump can be used to either increase nutrient or decrease nutrient per a setpoint you define.

```
05      Pump2  Pump
Setpoint 0.0uS
Deadband 0.0uS
```

Setpoint

Setpoint is the ideal value that you want to keep your nutrient at.

Deadband

When the nutrient level falls off the setpoint the pump will be activated. The deadband forces the pump to stay on for a while past the setpoint. The purpose of deadbands are to keep the pump from constantly turning the pump on and off again to maintain the setpoint.

```
05      Pump2  Pump
If Light > 0W/m2
Drive to 0.0 uS
```

If Light - then Drive to

In order to optimize your growing conditions, the iGrow1600 offers a light override. If a high light level occurs you can temporarily modify your nutrient setpoint.

```
05      Pump2  Pump
If Temp1 > 0.0 F
Drive to 0.0 uS
```

If Temp - then Drive to

Similar to the Light override, you can also override the nutrient setpoint if the greenhouse temperature goes above the threshold you set.

```
05      Pump2  Pump
ON TIME 0sec
OFF TIME 5sec
```

ON/OFF TIME

When the pump is activated to maintain the desired setpoint it will pulse on and off. It pulses in order to not overshoot the setpoint.

Vent (Proportional) Programming

Note: This equipment type requires 2 consecutive output channels 1&2, 3&4, etc. The first channel (odd numbered) **must** be wired to OPEN the vent, and the other (even numbered) to CLOSE it.

```
07/08   Top V   Vent
  N  C1 C2 C3 C4 C5 C6
10 20 40 80 40  0  0
Open Time 01m 35s
```

The vent opening is defined in percentage terms where 0% is vent closed and 99% is where the vent is fully open. NORM is the normal stage when neither heating nor cooling is usually required. C1 is the lowest stage of cooling, and C6 is the highest (or maximum) cooling stage. Enter your desired vent opening percentage for each of the stages.

The **Open Time** is the time in minutes and seconds that it takes for the vent to go from its full closed to full open position or vice versa.

Note: to determine the vent open time turn manual toggle switch on, and using a clock or stopwatch, time the vent as it goes from its closed to open position.

```
07/08   Top V   Vent
Dir  N   Min Max
WindWd   15 30mph
LeeWd   15 40mph
```

Wind Overrides

Wind overrides limits are important for safe and effective vent operation. Of course, a weather station (or Link4 anemometer) must already be installed to use this feature. First you have to set **Dir**, which is the direction that the vent faces when open. You have eight choices. N, NE, E, SE, S, SW, W, NW.

Next, you will need to set a **Min and Max** vent opening for the case with the wind blowing into the vent (Windward) and similarly for the case where the wind is blowing across or over the vent (Leeward). The program calculates an average wind speed. This is a running average over approximately 5 seconds. Once the average wind speed exceeds the **Min** value the vent begins to close. As the wind speed increases and approaches the **Max** value, the vent will go to the full close position.

The third vent screen is shown below.

```
07/08   Top V   Vent
Wind Ovr Hold    2m
If Rain MaxOpen  5%
```

The **Wind Ovr Hold** parameter is the length of time in minutes that the vent will remain in its override position once the wind speed is below the minimum threshold. This is to keep short wind gusts from causing the vents to constantly open & close.

The **Rain MaxOpen** percent is the maximum vent position once rain is detected.

EXAMPLE:

The wind override has higher priority than rain. Suppose the vent is open 50% and it begins to rain. From the entry in the above screen, the vent will close down to 5%. Now assume that the wind picks up and exceeds 30 mph with the wind blowing into the vent. The vent will then go to a full close.

The fourth screen below is for insuring that the vent does not open beyond a preset percentage if the outside temperature is below a user defined threshold.

```
07/08 Top V Vent
LOW OTEMP OVERRIDE
Vent MaxOpen 0%
If Otemp < 40 °F
```

The **Vent MaxOpen** is the max that the vent will go open if the **Otemp** is less than the number of degrees that you enter. In any case, wind and rain overrides will have precedence.

In the fifth and final screen, the vent can be programmed to go to a minimum opening if the outdoor temperature exceeds a plus or minus value relative to the cool temperature setpoint. This override is anticipatory and is particularly useful for the open roof vent configuration or the side roll up vents. It is also useful, if one wants to minimize the vent movements, by just leaving the vent in a fixed position as long as the outside temperature exceeds some offset from the cool setpoint temperature.

```
07/08 Top V Vent
Vent Min Open 99%
If Outside Temp >
Cool Setp - 3 °F
```

The **Vent Min Open** is the minimum position for the vent when the **Otemp** exceeds the **CoolSetP** plus an **offset** temperature. This feature helps improve efficiency by using outside air to cool the greenhouse rather than fans or Pads. As with the previous screen, wind and rain overrides will have precedence.

EXAMPLE:

Suppose you have an open roof vent and you want to it go to its maximum position when the outside temperature is 3 degrees below the cool setpoint which during the day is 70 degrees. You will then enter 99 for the Min Open value and -3 for the offset value. Once the outside temperature exceeds 67 degrees, the roof vent will, in this example, go to 99% or full open.

```
07/08 Top V Vent
PositionSensor Input
Position Sensor 1
```

Position Sensor Input

The iGrow1600 offers the ability to read true vent position if you've wired a vent position sensor to your iGrow1600. This field sets which Position Sensor to look at (that you have defined in your Menu Mapping).

Curtain Programming

Shade Control

Note: This equipment type requires 2 consecutive channels 1&2, 3&4, etc. The first channel (odd numbered) **must** be wired to OPEN the valve, and the other (even numbered) to CLOSE it.

In programming your curtain for shading you will first set a close and open time. It is during this window of time that you permit or enable the curtain to be controlled for shading purposes.

```
09/10  H1Top  Curt
SHADING
Close  at  7:00A
Open   at  6:00P
```

You have the option of controlling the close and open times based on a fixed time window or a relative time window. The latter is relative to the sunrise and sunset times. When the cursor is over the **at** position and you press the **+** or **-** keys, you will cycle through the three options: **SRise**, **SnSet**, and **at**.

When you set the parameters up for the first time as shown in the above screen, the close and open times will be adjusted every day thereafter, at 2 AM, to track the shortening and lengthening of the days.

Note: It does not mean that the Close is exactly at neither the sunrise time, nor the Open at exactly at the sunset times. You can select any time window. What it means is that the daily adjustment is per the change in the sunrise and sunset time amounts. When the days get longer, the sunrise rise time will be earlier each day and the sunset time will be later.

In the following screen you have more parameters to set. The first is the **MaxClose** position. This is important if you are dependent on ridge vents for cooling. In this case you may not want to close the curtain completely in order to let hot air escape through the overhead vent. In this event, a typical MaxClose might be 90% or 95%.

```
09/10  H1Top  Curt
SHADE  MaxClose 99%
Close  Above 800W/m2
or if OutT > 100°F
```

If you have a light sensor, you may want the curtain to shade only when the light exceeds a threshold. Therefore, you have a **Close Above** light intensity value you can select. Also, if you have an outside temperature sensor, you may want to close the curtain to the MaxClose position, when the **OutT** exceeds a temperature threshold. If you have neither of these sensors, then your shade control is solely dependent upon the close and open times that you set in the first screen above.

The next screen is the last one for shading control. Here you set the light threshold where the curtain will open after it was closed. Light levels can vary suddenly and sometimes only for a few minutes, therefore, you will typically keep this **Open Below** value in the range of 50 to 100 W/m² below the **Close Above** setting on the previous screen.

```
09/10  H1Top  Curt
SHADE
Open Below  700W/m2
Open Delay  20 min
```

To further reduce the curtain movement, you can set an **Open Delay** time. This means that the light level must be continuously below the **Open below** threshold for the selected time in minutes before the curtain will open.

Energy Control

Note: This equipment type requires 2 consecutive channels 1&2, 3&4, etc. The first channel (odd numbered) **must** be wired to OPEN the valve, and the other (even numbered) to CLOSE it.

Curtains are often used as a thermal blanket during the night. We call this energy control. On the first screen you set the **Close** and **Open** time window. As above, you have the option of adjusting the Close and Open times for Sunset and Sunrise.

```
09/10  H1Top  Curt
ENERGY CONTROL 1
Close   at    7:00P
Open   at    8:00A
```

If you have a light sensor and/or an outside temperature sensor, you can make the energy blanket subject to certain conditions as shown in the following screen

```
09/10  H1Top  Curt
ENERGY CONTROL 2
Open Above  200W/m2
OR  OutT > 75 °F
```

You can set a light threshold and an outside temperature threshold above which the curtain will not close. Either of these two parameters will keep the curtain open.

The final curtain screen has a few more options. The first is that you can select a heating or cooling stage above which the curtain will be closed to a maximum %. For example, in the above case, the curtain will close to 95%, if the stage is at or above Cool 5.

```
09/10  H1Top  Curt
MaxClose 95%  COOL5
ShockProtect  40°F
Close Time 01m 00s
```

The next is **Shock Protection**. In the morning when the curtain is scheduled to open and it is cold above the curtain, it may not be desirable to open the curtain all at once. This option lets you select an outside temperature below that the curtain will open in four steps. It will open 5% and then pause for five minutes. It will do this for four times and then open to 0% without stopping. If the system does not have an outdoor temperature sensor, this option is not enabled.

The final item is **Close Time**. This is the time in minutes and seconds it takes for the curtain to go from its full open position to its full close position. Just as with the vents, this is an important entry since it establishes the run time for the curtain so that it will go correctly to the close positions that you program.

Mixing Valves

Note: This equipment type requires 2 consecutive channels 1&2, 3&4, 5&6, etc. The first channel (odd numbered) **must** be wired to OPEN the valve, and the other (even numbered) to CLOSE it.

```
01/02 Valve1 MixV
Temp1   Min 70.0 °F
        Max 90.0 °F
Open Time 1 m 30 s
```

Temp

The Temp1 setting tells the iGrow1600™ which temp probe is being used to measure the hot water supply to the greenhouse. Since you can have up to 5 temp probes connected to your iGrow1600 be sure to set this to the correct one. Use the + or – buttons to select the correct probe.

Min

Min is the minimum water temperature of the supply pipe. If the supply water temperature ever goes below this value the mixvalve will adjust increase the supply water temperature. Use the + or – buttons to select the correct temperature.

ax

Max is the Maximum temperature that the supply water should ever become. If the supply water temperature ever approaches this value, the mixvalve will adjust low the supply water temperature. This is especially important when PVC pipes are being used. Use the + or – buttons to select the correct temperature.

Open Time

Open Time is the time it takes for the Mixvalve to go from fully opened to fully closed. Measure this time with a watch, add a few seconds, and then enter it into Open Time field.

```
01/02 Valve1 MixV
Heating Delay
  01 h 15 m 00 s
Use Pump1
```

Heat Turn On Delay

Heat Turn On Delay is the estimated time it takes for the heating system to affect the greenhouse temperature. This is determined by taking a temperature reading with all heating & cooling equipment off and the mix valve closed, then manually switching the mix valve open. Measure the time it takes for the ambient temperature within the greenhouse to rise 2 deg.

Use Pump

If you want the iGrow1600 to control a pump associated with the mixvalve system, this is where you select which pump to control. You must use one Output Channel to control the pump. For more information on how to setup the pump, see the Pump Control section of this manual.


```
01/02 Valve1 MixV
Shock Prot: No
if Temp3 < 105.0°F
limit to 5% open
```

Shock Protect

Setting Shock Protect to **Yes** forces the Mixvalve to open slowly, preventing an inrush of cold water into your boiler system. Shock Protect will work two different ways depending on whether or not you have a return temp sensor assigned below. Without a Temp sensor the iGrow1600™ will still protect your boiler by adjusting how quickly the valve opens based on how long it's been since the valve was opened last. The longer the time, the slower it will open. If you do assign a temperature probe, then the iGrow1600™ follows the “if Temp(1) is less than some temp then only open some percentage”.

if Temp(3) < 140°F limit to 5% open

If you have a temperature probe, assigned as Temp1 in the example above, then these are the settings for the return water supply to the Mixvalve. In this example, if the return water temperature is below 105°F then the mixvalve will only open 5% until the return temperature reaches the low temperature setpoint of the supply water temperature.

```
01/02 Valve1 MixV
Valve Type Heat
Tune Range 40.0 F
```

Valve Type

This field defines the device to be either for Heating or Cooling

Tune Range

Tune Range is the allowable temperature range that the Mix Valve PID controller can change the water temperature setpoint from the setpoint set by the heat/cool demand.

For PID control of the Mix Valve the two following pages must be activated. To activate these pages go to the Advanced Settings menu and set MixValve Param from Hide to Show. For further information on activating these screens see page 60.

```
01/02 Valve1 MixV
Water Temp P 2.00
I 0.05
D 0.00
```

```
01/02 Valve1 MixV
Inside Temp P 1.00
I 0.40
Disable No D 0.40
```

P, I, and D values

These parameters determine the reaction times of the valve as related to the difference between the target temperature and the actual temperature.

The **P** value is a proportional number. The larger the value for **P**, the faster the valve will move when the temperature differs from the desired value. The downside to increasing **P** is that it can result in increased overshoot.

The **I** value makes adjustments to the valve position to reduce the temperature overshooting. The larger the value, the less the temperature will overshoot the target. The downside is that the larger the **I** value, the slower the reaction time as the temperature gets close to its target. Also, never adjust **I** to be zero as it will generate errors.

The **D** value looks at the rate of change of the difference between the target and the desired temperature.. The higher the number, the more the valve will move when the temperature differs from its target. Be very careful when increasing this number.

Disable

Disable stops the zone feedback loop used by the PID control.

Note: The iGrow1600's default settings for **PID** should be suitable for most any installation, and therefore should not be modified without a good understanding of **PID** controls. If you feel a change is necessary and are not sure how to proceed contact your local distributor, or Link4 directly, for assistance.

Note: You can also disable the zone temperature control loop. This is useful if you want to set a fixed water temperature. Set the Min and Max water temperature to the same number and disable the zone temperature loop.

PZone (Micro-Zone) for Proportional Equipment

PZones (Proportional Device Micro-Zones) are special purpose mixvalves that control Micro-Zones (changes made). A Micro-Zone is a region or compartment within a greenhouse that has a different temperature setpoint, and is controlled by a hot water mixvalve heating system. In this system the iGrow1600 measures the Micro-Zone air temperature, and the hot water supply temperature. The iGrow 1600™ can be used to monitor and control up to two (2) independent heating PZones.

Note: This equipment type requires 2 consecutive channels 1&2, 3&4, 5&6, etc. The first channel (odd numbered) **must** be wired to OPEN the valve, and the other (even numbered) to CLOSE it.

```
07/08 Valve1 PZone
Temp1 Min 45.0 °F
      Max 120.0 °F
Open Time 00 m 00 s
```

Settings on the first screen are for the Supply water coming from the MixValve to the Micro-Zone area.

Temp

The Temp1 setting tells the iGrow1600™ which temp probe is being used to measure the hot water supply to the greenhouse. Since you can have up to 5 temp probes connected to your iGrow1600 be sure to set this to the correct one. Use the + or – buttons to select the correct probe.

Min

Min is the minimum water temperature of the supply pipe. If the supply water temperature ever goes below this value the mixvalve will adjust increase the supply water temperature. Use the + or – buttons to select the correct temperature.

Max

Max is the Maximum temperature that the supply water should ever become. If the supply water temperature ever approaches this value, the mixvalve will adjust low the supply water temperature. This is especially important when PVC pipes are being used. Use the + or – buttons to select the correct temperature.

Open Time

Open Time is the time it takes for the Mixvalve to go from fully opened to fully closed. Measure this time with a watch, add a few seconds, and then enter it into Open Time field.

```
07/08 Valve1 PZone
Heat Turn On Delay
  00 h  00 m  15 s
Use Pump1
```

The second screen are general settings.

Heat Turn On Delay

Heat Turn On Delay is the estimated time it takes for the heating system to affect the greenhouse temperature. This is determined by taking a temperature reading with all heating & cooling equipment off and the mix valve closed, then manually switching the mix valve open. Measure the time it takes for the ambient temperature within the greenhouse to rise 2 deg.

Use Pump

If you want the iGrow1600 to control a pump associated with the mixvalve system, this is where you select which pump to control. You must use one Output Channel to control the pump. For more information on how to setup the pump, see the Pump Control section of this manual.

```
07/08 Valve1 PZone
MicroZone Air Temp:
Sensor   Temp2
Temp 68.0 to 72.0°F
```

The third screen is for setting up the Micro-Zone air temp.

Sensor

The Temp(2) setting tells the iGrow1600™ which temp probe is being used to measure the Micro-Zone air temperature. Since you can have up to 5 temp probes connected to your iGrow1600 be sure to set this to the correct one. Use + or – to select the correct sensor.

Temp

Temp refers to the setpoint temperatures for the Micro-Zone. Use + or – to set each value.

```
07/08 Valve1 PZone
Shock Prot:   No
if Temp3 < 105.0°F
limit to 5% open
```

The fourth screen is settings for shock protection in your boiler system.

Shock Protect

Setting Shock Protect to **Yes** forces the Mixvalve to open slowly, preventing an inrush of cold water into your boiler system. Shock Protect will work two different ways depending on whether or not you have a return temp

sensor assigned below. Without a Temp sensor the iGrow1600™ will still protect your boiler by adjusting how quickly the valve opens based on how long it's been since the valve was opened last. The longer the time, the slower it will open. If you do assign a temperature probe, then the iGrow1600™ follows the “if Temp(1) is less than some temp then only open some percentage”.

if Temp(3) < 140°F limit to 5% open

If you have a temperature probe, assigned as Temp1 in the example above, then these are the settings for the return water supply to the Mixvalve. In this example, if the return water temperature is below 105°F then the mixvalve will only open 5% until the return temperature reaches the low temperature setpoint of the supply water temperature.

```
07/08 Valve1 MZon2
Valve Type Heat
Tune Range 40.0 F
```

Valve Type

This field defines the device to be either for Heating or Cooling

Tune Range

Tune Range is the allowable temperature range that the Mix Valve PID controller can change the water temperature setpoint from the setpoint set by the heat/cool demand.

For PID control of the PZone the two following pages must be activated. To activate these pages go to the Advanced Settings menu and set MixValve Param from Hide to Show.

```
01/02 Valve1 MixV
Water Temp P 2.00
I 0.05
D 0.00
```

```
01/02 Valve1 MixV
Inside Temp P 1.00
I 0.40
Disable No D 0.40
```

P, I, and D values

These parameters determine the reaction times of the valve as related to the difference between the target temperature and the actual temperature.

The **P** value is a proportional number. The larger the value for **P**, the faster the valve will move when the temperature differs from the desired value. The downside to increasing **P** is that it can result in increased overshoot.

The **I** value makes adjustments to the valve position to reduce the temperature overshooting. The larger the value, the less the temperature will overshoot the target. The downside is that the larger the **I** value, the slower the reaction time as the temperature gets close to its target. Also, never adjust **I** to be zero as it will generate errors.

The **D** value looks at the rate of change of the difference between the target and the desired temperature.. The higher the number, the more the valve will move when the temperature differs from its target. Be very careful when increasing this number.

Note: The iGrow1600's default settings for **PID** should be suitable for most any installation, and therefore should not be modified without a good understanding of **PID** controls. If you feel a change is necessary and are not sure how to proceed contact your local distributor, or Link4 directly, for assistance.

VOut Variable Voltage/Current Output

VOut devices will only appear as an equipment type if you have purchased the optional iMOD expansion module

Note: If you have installed the iMOD expansion module but don't see VOut as an equipment option, you must **Enable** "Expansion Settings" before it will appear as available equipment.

Variable Current Outputs

For outputs that you have configured in Expansion Settings as Variable Current devices, the following screens appear.

```
15      VFan1  VOut
Current varies with
          Ht Dem
```

Ht Dem

This field determines whether the equipment connected to this output is for heating or cooling. **Ht Dem** is for heating and **Cl Dem** is for cooling.

```
15      VFan1  VOut
          Ht Dem  mAmps
Max     0       20.00
Min     0       20.00
```

max

max is the heat demand percentage that you want the maximum output level to occur at. The value to the right of **max** sets the current output that occurs at the **max** percentage.

min

min is the heat demand percentage that you want the minimum output level to occur at. The value to the right of **min** sets the current output that occurs at the **min** percentage.

```
15      VFan1  VOut
Offset Cal    0.00
Gain   Cal    1.00
```

Offset Cal

Gain Cal

Variable Voltage Outputs

For outputs that you have configured in Expansion Settings as Variable Voltage devices, the following screens appear.

15	VFan1	VOut
Voltage varies with Ht Dem		

Ht Dem

This field determines whether the equipment connected to this output is for heating or cooling. **Ht Dem** is for heating and **Cl Dem** is for cooling.

15	VFan1	VOut
	Ht Dem	Volts
Max	0	0.00
Min	0	0.00

max

max is the heat demand percentage that you want the maximum output level to occur at. The value to the right of **max** sets the voltage output that occurs at the **max** percentage.

min

min is the heat demand percentage that you want the minimum output level to occur at. The value to the right of **min** sets the voltage output that occurs at the **min** percentage.

15	VFan1	VOut
Offset	Cal	0.00
Gain	Cal	1.00

Offset Cal

Gain Cal

Dehumidify/Humidify

```
System Setup
Setpoint/TimePeriod
Program Equipment
Dehumidify/Humidify
Stage Overrides
Equipment Overrides
Alarm Limits
```



	DH1	DH2	DHLT	H
Fan1	1	1	0	0
Heat	--	0	1	--
Vent1	5	15	00	00



```
DH    Max On  05 min
      Min Off 10 min
Heat Boost 2.5°F
DHLT < 35.0°F OutT
```

When you select the dehumidify/humidify option it takes you to a screen that lets you program the equipment you want to use in each of the four humidity override states. See upper right figure above. The four states are:

DH1 is engaged when the zone's humidity reading is immediately above the 'High' humidity setpoint. In the example, Fan1 will go on and Vent1 will go to 5%.

DH2 is engaged when the zone's humidity reading is above the setpoint by 5%

DHLT is the dehumidification state that is engaged when the outside temperature is below a user set value on the next screen.

H or humidify stage is engaged when zone's humidity is below the 'Low' Humidity Setpoint

Note: For On/Off equipment, a "1" indicates that the equipment is to be turned On in the override state. A "0" would indicate that it is to go Off. The -- indicate that the equipment is not to be subject to the override. For proportional devices, a percentage open for vents and a percentage closed for curtains would be entered for the override.

For vents, the percentage open is a "minimum" value. For example, if the vent is open to 30% because of cooling, then when the dehumidification state is active, the vent will stay at 30%. However, if the vent were closed, and the DH1 state becomes active, the vent will go to 5% according to our example.

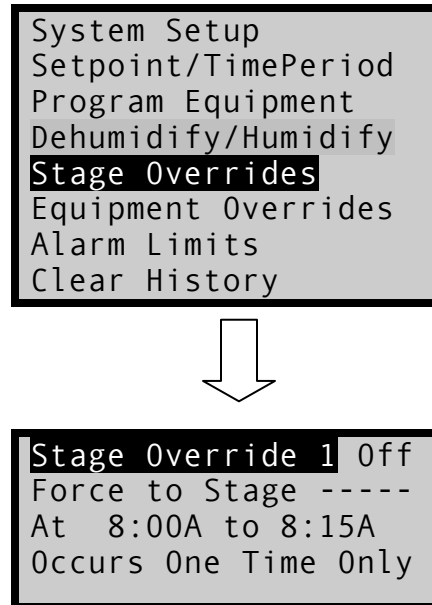
By pressing the "next" button to scroll to the next screen down lets you program some additional features for humidity control.

When in a dehumidify override state you have the option of cycling the dehumidification state. In the example, a **Max On** for 5 minutes and a **Min Off** for 10 minutes is programmed. This means that if the humidity is above the target, the dehumidify state will cycle on for 5 minutes and off for ten. If during the On time, the humidity drops below the target, the dehumidification state will end and the equipment will return to normal temperature control.

The **Heat Boost** is another means of reducing the humidity. You can automatically increase the setpoint by the amount entered. This adjustment is subject to the On/Off cycling. If you want to turn off the dehum cycling, then just set the Min Off to 0.

The final entry is the DHLT outside temperature below which the low temp dehum stage is enabled. From the example, when the outside temperature is less than 35 °F, the exhaust fan will be turned off and Vent1 will go to a minimum of 5 % open.

Stage Overrides



Stage overrides are useful for testing purposes, where you can force the iGrow1600 into any of the heating or cooling stages. They are also useful for fumigation, where there are spraying cycles that require everything to be closed and then exhaust cycle where air exchange takes place.

It is possible to override one, to four, of the setpoint settings by forcing the zone into one of the cooling, heating or normal stages for a selected time period. There are **four** possible stage override programs. When you go to the stage override screen, the first highlighted segment is the **Stage Override #**. Use of the **+ or -** keys selects one of the 4 setpoints you wish to override. The next field is used to enable the override. This is done by toggling the field from **Off** to **On**.

Select Stage Override Number

When Stage Override 1 is highlighted press the + or – buttons to select which of the 4 Stage Overrides you want to set.

Force to Stage -----

With the use of the **+ or -**, you can select the stage that you want to force the zone into.

Time Start and Stop

Enter the times of day you want the overrides condition to begin and end.

One Time Only or Daily

Choices for this field are **Daily** or **One Time Only**. If “One Time Only” is selected, once the override is completed, it will not occur again without being reset to On. If Daily is selected, the override will occur every day during the time window.

Equipment Overrides

```
System Setup
Setpoint/TimePeriod
Program Equipment
Dehumidify/Humidify
Stage Overrides
Equipment Overrides
Alarm Limits
Clear History
```



```
01      Override Off
Vent1   Force On
At 8:00A to 8:15A
Occurs One Time Only
```

This programming feature allows you to manually override your greenhouse equipment for specified periods of time, either once or daily.

Select the Channel

Pressing the + or - to find the Channel you wish to override.

Force

With the use of the + or -, you can select whether you want to force the digital equipment either **On** or **Off** and the proportional equipment to a particular position.

Start and End Times

Now use the + or - buttons to enter the times to Start and Stop the override.

One Time Only or Daily

Enter the times of day you want the overrides condition to begin and end. Choices for this field are **Daily** or **One Time Only**. If "One Time Only" is selected, once the override is completed, it will not occur again without being reset to On. If Daily is selected, the override will occur every day during the time window.

Smart Cool Settings

```
Smart Cool: Disable  
Enter a number from  
1 to 10: 6  
(10 Most Aggressive)
```

What is Smart Cool? It is an innovative program that uses the outside temperature and light data to assist in making intelligent cool staging decisions for the most efficient control of your greenhouse. The 1-10 Smart Cool setting is a thermal efficiency rating that your iGrow1600 uses to determine how quickly your greenhouse heats up and cools down. Knowing these parameters, the iGrow1600 can predict how aggressively it should cool your greenhouse.

Enable/Disable

Pressing the + key when the upper right hand field is highlighted, toggles you between the “Enable” and “Disable” Smart Cool option. If you toggle to the “Enable” option your greenhouse will now function under “Smart Cool”.

Smart Cool Setting (1 to 10)

Your next step is to set the thermal efficiency of your greenhouse. The aggressiveness that you select will need to match the type of greenhouse that you are controlling. For example, the temperature can change very rapidly in a small glass greenhouse. However, the reverse might be true for a large poly house with a shading system. To get it right may take some experimenting or “tuning”. When you look at the historical data, you can see what kind of changes you need to make to get a better response. So select a number from 1 to 10 with 1 being the least aggressive and 10 the most aggressive use of “Smart Cool”. The default number is 6 which should be a good starting point. Use the + or – buttons to adjust this number.

Important! Smart cool can be used whether or not you have an outside light and temperature sensor. However, it will function most efficiently, if you have both these sensors.

Smart Cool Operating Examples:

Case I: No outside light or temperature sensors:

For this case, Smart Cool operates as follows:

When the inside temperature rises above your cool setpoint temperature, your system will immediately go to Cool1 or higher. If your greenhouse remains in this stage for a certain length of time without dropping the temperature, it will automatically go to the next higher cooling state and reset the timer. This process will continue until the greenhouse temperature is at or below the cool setpoint. Once this condition is satisfied, no further stage change is made until one of the following three conditions occurs.

Condition I: Zone temperature goes above the cool setpoint – in this case the cool stage is increased by one and the above process is resumed.

Condition II: Zone temperature drops below the midpoint of the cool and heat setpoints. As soon as the temperature drops below the midpoint, the cooling state is reduced by one. Hopefully, this will raise the zone temperature above the midpoint. If after a certain time, this does not happen, the cool stage will again be lowered by one. This down-staging continues until the temperature rises to the “cool deadband”.

Condition III: Zone’s temperature drops to within 0.2 degrees above the heat setpoint. If this occurs, the system will immediately revert to the Normal stage. Of course, if the temperature continues to drop, the system will go into its heating mode.

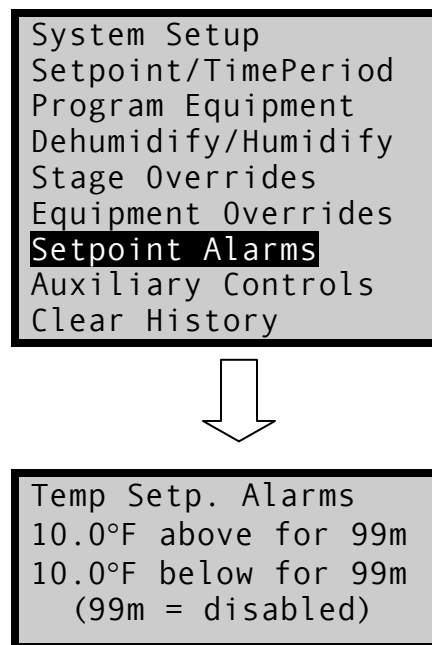
Least aggressive to most aggressive:

The aggressiveness setting (1 to 10) has to do with how fast the system will increase its cooling stages (upstage) or lower its cooling stages (downstage). If the greenhouse is one where the temperature inside can change rapidly, then it is important to be more aggressive on the upstaging and less aggressive on the downstaging. For example, if 6 is selected, the upstaging timer is set to 4 minutes and the downstaging timer is 6 minutes. If 10 is selected, the upstage timer is 1 minute and the downstage timer is 9 minutes. If 1 is selected, the upstage timer is 10 minutes and the downstage timer is 1 minute.

Case II: Light and/or outside temperature sensors:

With a light and/or outside temperature sensor, the system uses a proprietary algorithm to modify the upstage and downstage times as a function of the sensor readings. Assume an aggressiveness number of 6 is selected. As noted above, the upstage timer is 4 minutes and the downstage timer is 6 minutes if the outside temperature is close to the inside setpoint temperature and the light level is low. As the light level increases, the upstage time will be shortened and the downstage time will be increased. This change will occur gradually. Similarly, as the outside temperature goes above the inside setpoint temperature, the upstage time is reduced and the downstage time is increased.

Setpoint Alarms



Set Temperature

The Setpoint Alarm screen lets you set a high temperature and a low temperature alarm relative to the Set Point. For example, if your Set Point temperature is 70 degrees, and you want the alarm to trigger 10 degrees above this value you will enter the 10 as shown above.

Time Value

The Time Value that must be met in order to trigger the alarm. A value of 99 disables the alarm. If the value is zero, then the alarm will occur immediately when the temp setting is met.

Note: It is highly recommended you use the optional Link4 Sensaphone to call your user preset phone numbers in case of an alarm being triggered.

Note: If both alarm lights go on, this is an indicator that the temperature sensor for inside temperature has malfunctioned.

Auxiliary Controls

```
Aux 1 set Channel 3
Temp2 < 59°F
For 00:30 mm:ss,
Hold time 10 mm
```

Auxiliary Controls (also known as Aux Control) are a cross between an Equipment Control and an Alarm Control. Aux Controls allows you to control any Equipment or Alarm Output based on a specified environmental condition. Aux Controls are often used as a flexible Alarm control, as they can turn on an Output if an alarm type condition occurs. Another way to look at Aux Controls is as a Conditional Equipment Control. Meaning, if some specific condition occurs in your greenhouse, then activate certain Equipment.

Aux (1)

You can have up to 8 Aux Controls. Use the + or – buttons to set which Aux Control you want to setup.

Channel (3)

You can assign Aux Control to control any Output Channel (1-12 and either or both Alarm Output(s)). Aux Control can operate as an override to an equipment such as:

Example 1

Channel 1 is a single channel device (ON/OFF, CO2, Light, etc) - if channel 1 passes some threshold then activate channel 5

Example 2

Channel 1 is set as a two channel, proportional, device (Vent, Mixvalve, Curtain) – if channel 1 goes above 50% then de-activate channel 7

Select the conditional Control

To select the conditions, adjust the sensor input, greater than or less than, and the value under which the condition will trigger at. Use the + or – buttons to choose adjust these values.

Select Condition Time

The specified condition must occur for the specified time in order to activate the Output Channel.

Hold Time

Once the condition is no longer met, the Hold Time will keep the channel active for the specified amount of time.

In the example screen above, if the Temp2 (Temp Probe 2) measures a temperature below 59°F for 30sec then Output Channel 3 will turn on. Channel 3 will then remain active for 10 minutes or until the temperature rises above 59°F. This is useful to prevent cycling of equipment.

Expansion Settings

```
Expansion Settings
Enabled
CH15 Voltage
CH16 Voltage
```

With the iGrow1600 you have the ability to add the iMOD (Multi Output Device) Expansion Module. The iMOD module adds 2 relay outputs to your iGrow1600 controller (Channels 13 and 14) plus two variable voltage outputs, or variable current outputs (Channels 15 and 16).

Enabled

The Enable/Disabled field simply switches communications with the expansion iMOD expansion board on or off.

CH15 Voltage/Current

This setting configures Output Channel 15 to output either 0 to 10V, or 4 to 20mA

CH16 Voltage/Current

This setting configures Output Channel 16 to output either 0 to 10V, or 4 to 20mA

Heat Demand

One of the iGrow1600's advanced features is Heat Demand, predictive control. This feature helps you optimize the efficiency of your greenhouse while reducing equipment usage by changing more gradually rather than by waiting until conditions have already changed.

Heating Demand	
Design Delta	45.0 F
Max Light	1200W/m2
Max Wind	80mph

Design Delta

The Design Delta is maximum difference between the outside temperature and heating setpoint that the heating system can maintain.

Max Light

Max Light is the maximum light level typically experienced by the greenhouse. This value is used to calculate heat demand based on light. 1200W/m2 is a good approximation for North America.

Max Wind

Max Wind is the maximum wind speed experienced by the greenhouse. This is used to calculate heat demand based on wind speed.

Heating Demand	
Light Factor	0%
Wind Factor	0%

Light Factor

Light Factor is a percentage of light's influence on determining heat demand. 0% represents no influence, while 100% represents maximum influence.

Wind Factor

Wind Factor is a percentage of wind's influence on determining heat demand. 0% represents no influence, while 100% represents maximum influence

If you adjust either one of these, does it automatically affect the other such that the combination of the two never exceeds 100%?

Cool Demand

```
Cooling Demand
Design Delta 45.0 F
Max Light 1200W/m2
Light Factor 0%
```

Design Delta

The Design Delta is maximum difference between the outside temperature and cooling setpoint that the cooling system can maintain.

Max Light

Max Light is the maximum light level typically experienced by the greenhouse. This value is used to calculate cool demand based on light. 1200W/m2 is a good approximation for North America.

Light Factor

Light Factor is a percentage of light's influence on determining cool demand. 0% represents no influence, while 100% represents maximum influence.

```
Cooling Demand
Active Cool Disabled
Passive Lock
Stage NORM
```

Active Cool

When Active Cool is Disabled, the controller will operate only in stage based cooling (6 stages of cooling). However when Active Cool is Enabled, fixed stage based control is turned off, and chilled water mix valves will begin modulating to whatever percentages the demand requires above the Active threshold.

Passive Lock Stage

When Active Cooling is Enabled, Passive Lock Stage forces all stage based equipment the specified stage so they don't fight each other.

```
Cooling Demand
Demand
Active > 75%
Passive < 25%
```

Active

When the Cool Demand rises above this percentage, the greenhouse will enter Active Cooling

Passive

When Cool Demand fall below this percentage, the greenhouse will enter passive cooling.

Note - When the iGrow first starts, if cool demand is less than the active cool setting, the greenhouse will be in passive cooling.