Greenhouse Control Systems

SOLAR INNOVATIONS®
ARCHITECTURAL GLAZING SYSTEMS

Greenhouse automation can occur from as simple of a setup as placing an inexpensive timer with a valve on your water supply or as complex as a unit that has multiple inputs and outputs, operating accessories such as heating and cooling systems, vents, fans, and irrigation, and receiving data from a weather station and/or various other sensors.

Simple Timer for Irrigation Systems

Rain Bird 1ZEHTMR: Electronic Garden Hose Watering Timer
When you only need to program the water on/off for a hose connection, a simple, inexpensive timer is all that is needed. This timer connects directly at the faucet to your hose and operates on two AA batteries. It only controls one zone (wherever the hose leads) and allows for up to two start times for each day of the week with manual watering and temporary shutoff controls.

More Advanced Timer for Irrigation Systems

Rain Bird ESP4ME3: Indoor/Outdoor 120V Irrigation Controller
When you need to control an irrigation system with multiple zones using electronic solenoids, and you're not controlling any other devices, a dedicated irrigation controller should fulfill your needs. This timer plugs into a wall outlet and independently controls up to four zones with the unit itself, or up to 22 zones through expansion modules. Each zone can have up to six start times and durations for each time. To prevent watering when it rains, a rain sensor can also be added. Manual on/off overrides are also included.

Full Greenhouse Control

Link4 iGrow 800 Greenhouse Controller System
When your greenhouse control needs go beyond just watering, a more advanced control system is needed. The iGrow 800 Greenhouse Controller System has eight built-in outputs (expandable to 32) with manual overrides, eight analog inputs and two digital inputs. Data can be analyzed on a PC and settings can be controlled via Wi-Fi on your smartphone. When controlling a wide array of devices, managing wires, transformers and relays can quickly become unwieldy and potentially unsafe. Incorporating an integrated relay contactor panel contains all the wiring connections in a water-tight compartment with direct connection to the iGrow 800.

Professional Greenhouse Control

Link4 iGrow 1800 Greenhouse Controller System
When you require the maximum amount of control for your greenhouse or the iGrow 800 has an inadequate number of inputs or outputs, a professional series greenhouse controller is needed. The iGrow 1800 Greenhouse Controller System has 12 built-in outputs (expandable to 144) with manual overrides, eight analog inputs and 11 digital inputs. The iGrow 1800 enables you to control certain devices and systems that the iGrow 800 does not support, such as the iDoser and Vapor Pressure Deficit Irrigation. Just like the iGrow 800, an integrated relay contactor panel centralizes all of the wiring connections into one organized, water-tight compartment and be connected to a PC or be controlled via Wi-Fi on your smartphone.

The Logic Behind Link4 Greenhouse Controllers

Though Link4 Greenhouse Controllers are sophisticated devices that greatly reduce the manual intervention in controlling greenhouse devices, the logic behind them is pretty simple. They essentially take inputs, either programmed directly into the device, or delivered through a sensor, and when a condition is met, such as temperature, instruct devices to turn on or off. (i.e. open the ridge vent when the temperature rises above 78°). The controllers are low-voltage devices that send signals over low-voltage wires to relays, which are essentially switches, that allow high voltage to flow to the device. When a second condition is met, such as temperature or time interval, the controller closes the relay, halting the electricity flow to the device. The exception to this logic are low-voltage devices, such as irrigation solenoids. With these devices the controller is wired directly to the solenoid, eliminating the need for a relay.

Typical Inputs (Link4 Sensors)

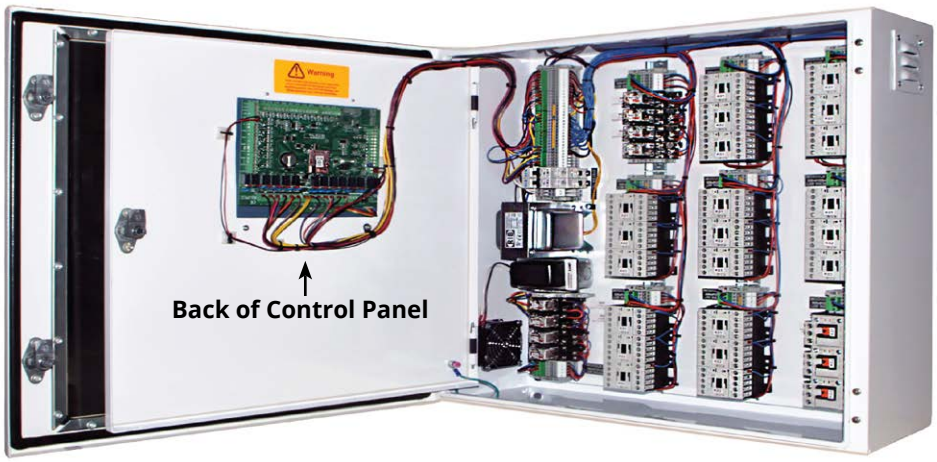
- Advanced Digital Integrated Sensor Module
- Weather Station
- Anemometer
- Solar Light Sensor
- 100 Series Temperature Probe
- EC/Temperature Sensor
- pH Sensor
- Digital Temperature and Humidity Sensor
- Digital Integrated Sensor Module
- Room Pressure Sensor
- Quantum (Par) Light Sensor

Typical Outputs (Third Party Devices)

- Circulation Fans
- Exhaust Fans
- Foggers/Humidifiers with or without oscillators
- Heaters
- Evaporative Coolers
- Ridge Vents
- Eave Vents
- Misting Irrigation System
- Drip Irrigation System
- Grow Lights
- Motorized Shades or Blinds

Integrated Relay Contactor Panel

Link4 offers an excellent solution to safely organize and contain all of the wiring connections in a greenhouse in one watertight container. The Integrated Relay Contactor Panel is a hinged box that directly integrates the iGrow 800 or 1800 controller with all of the necessary relays that control all of the devices in the greenhouse (except low-voltage devices). This unit requires only one 110V power source that will power the controller as well as all the devices. The panel includes a receptacle for the controller, cooling fan, relays, and punch outs for water-tight conduit fittings. The panel also allows for the inclusion of Expansion Modules. Because each device draws specific amperage, the correct relays need to be installed to properly service each device. Link4 offers several standard configurations or a Link4 representative can custom-tailor the panel, based on the electrical requirements for all of the devices in the greenhouse. When this service is selected, the panel is delivered pre-wired and tested, ensuring a worry-free installation; only the power source and lines to each device need to be connected.



Typical Greenhouse Control System Diagram

Equipment shown may vary based on greenhouse design. Some accessories may require independent power supplies.

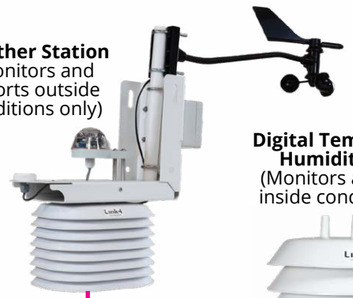
- 12V DC
- 24V AC/DC
- 110V AC

Circulation Fans

Variable Speed Controllers

This configuration allows you to independently control the speed of each fan or turn off power

Weather Station (Monitors and reports outside conditions only)



Digital Temperature & Humidity Sensor (Monitors and reports inside conditions only)

Inside Temp. & Humidity Data

Light, Wind Speed, Wind Direction, Outside Temp., & Rain Data

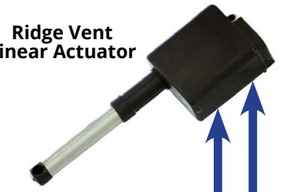
Power Source: 110V AC

Only one power source is required to run multiple devices

WindowMaster Chain Actuator (Awning window/ cold frame control)

24V DC connected directly to controller

Ridge Vent Linear Actuator



OPEN
CLOSE

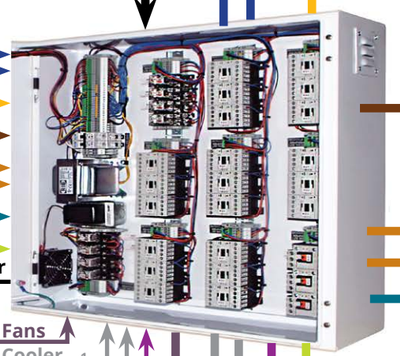
Tubular Motor for Shades

Motorized Intake Louvre

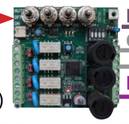
Exhaust Fan

Integrated Relay Contactor Panel

- Ridge Vent — OPEN / CLOSE
- Shade
- Louvre/Exhaust Fan
- Eave Vent — OPEN / CLOSE
- Heater
- Fogger/Oscill./Solenoid
- Power to Controller
- Expansion Module
- Fans
- Cooler 1 2
- Lights



Expansion Module (Installed Inside Panel)



Eave Vent Linear Actuator

OPEN
CLOSE

Gas Heater

Fogger Oscillator

This configuration oscillates fogger as it runs

Fogger/ Humidifier

Water Flow Solenoid for Fogger

Water Supply

Low voltage devices do not need relays and connect directly to controller

24V AC

24V AC

Drip System Solenoid

Water Supply

Misting System Solenoid

Two-Stage Evaporative Cooler

STAGE 1

STAGE 2

Water Supply

Grow Lights

One output can control multiple lights; all will turn on/off at same time

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Greenhouse Accessories (Inputs/Link4 Sensors)

WEATHER STATIONS

For reading of outdoor weather conditions only, the Link4 Weather Station is specially designed for iGrow controllers. It measures light, wind speed, wind direction, outside temperature, humidity, and rain data. The Weather Station is protected against solar radiation and reflected heat, and detects minute changes in the weather and relays that information to the iGrow controller. Its 12V wiring is configured to perfectly marry to the inputs within the controller.

Sensor	Range	Repeatability	Resolution	Accuracy
Rain	-40° to 185° F	—	—	—
Light	0 50 3,000 W/m²	0 ± 1%	—	—
Wind Direction	0° to 360°	—	1 degree	—
Wind Speed	1 to 175 mph	—	1 mph	± 3 mph
Temperature	-40° to 150° F	—	—	± 0.9° F, from 50° to 104° F
Humidity	0% to 100%	—	—	± 2%, from 10% to 90%

DIGITAL TEMPERATURE & HUMIDITY SENSORS

This indoor digital sensor integrates temperature and humidity into one single chip sensor. Constructed with a protective shield that safeguards against radiation and reflected heat, the Digital Temperature & Humidity Sensor offers high precision for relative humidity and temperature readings. The unit has no moving parts (which often get damaged), keeps power consumption low, gives fast response times of less than 4 seconds, and reports accurate readings. Its 12V wiring is configured to perfectly marry to the inputs within the controller. Note: There are two sensor models, each respectively designed for the iGrow 800 and iGrow 1800.

ADVANCED DIGITAL INTEGRATED SENSOR MODULES (ADISM)

The ADISM indoor sensor gives you monitoring control with a differential pressure to provide accurate readings for temperature, humidity, CO2, and solar light. Its intuitive programming allows for easy setup and day-to-day use. Compatible with Link4's iGrow 1800 Series controller, the ADISM is a powerful companion tool to monitor and control a greenhouse.

Sensor	Resolution	Accuracy	Operating Range	Operating Temp	Span Accuracy
Temperature	0.01 C	0.3 C	-40° to 254.9° F	—	—
Humidity	0.05% RH	0.3 C	—	—	—
CO2	—	100 PPM, 5% of measuring value	1to10,000 PPM	—	—
Light	—	—	Up to -2000 W/m^2	-40° to 257° F	—
Differential Pressure	—	—	-125 Pa to +125 PA, 0.5 in	—	3% of reading

ANEMOMETERS

This wind speed and wind direction system is strong enough to withstand hurricane-force winds, yet sensitive enough to detect the lightest breeze. Hand-balanced for optimal stability and accuracy, this precision instrument is sealed with stainless steel ball bearings for a long life.

Wind Speed Range	Wind Speed Accuracy	Wind Direction Precision	Dimensions	Weight
3 to 175 mph	± 5%	± 2%	21" x 10" x 5½"	—

SOLAR LIGHT SENSORS
The Solar Light Sensor offers light sensing in the visible spectrum to control shades, blinds, irrigation, lighting, and CO2. This control assists in maximizing the iGrow's predictive control feature accuracy. The sensor is capable of measuring light in the spectral range of 420-675 nm. The Solar Light Sensor is constructed from top-grade materials and is designed for easy installation and long life.

1000 SERIES TEMPERATURE PROBES
These stainless-steel Temperature Probes are specially designed to work with iGrow 1800 Controllers. Whether you are measuring bottom heat, a mixing valve system, soil temperature, or any other zone, these durable probes will do the job. The iGrow1800 Controller can use up to five Temperature Probes in addition to indoor and outdoor Temperature Sensors. These rugged sensors are conveniently small so, they can be placed almost anywhere in your greenhouse.

EC/TEMPERATURE SENSORS
In any hydroponic grow system, the health of your solution determines the health of your plants. EC sensor monitors your solution's electrical conductivity and sends out a signal if there is a potential problem. It works with the Link4 iDoser. It also has a convenient and portable design with smart sensors that simplify calibration.

Material	Cell Constant K	Temp. Range	Pressure Range
Epoxy Body, Graphite Tip	1.0	32° to 158° F	0 to 100 PSIG

PH FLAT-TIP SENSORS
Link4's pH Sensor helps you accurately keep track of pH levels, constantly analyzing for changes that could affect yield. Plus, it easily interfaces with the Link4 iDoser for simplicity of use. The durable body is guaranteed to last for up to a year with a low-maintenance sealed gel design to prevent contamination.

Reference Solution	Junction Number	Junction Material	Body Material	Temp. Range	Strain Relief	BNC Boot	Bulb Protection
3.5 M KCl/AgCl/KNO_3	Double	Pellon	Ultem	32° to 176° F	No	Yes	Teeth

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DIGITAL INTEGRATED SENSOR MODULES (DISM)
The (DISM) sensor provides sensing for CO2, temperature, humidity, and light to get the most out of greenhouse operation.

ROOM PRESSURE SENSORS
The Room Pressure Sensor provides monitoring and controlling of the positive pressure cooling system in a greenhouse.

QUANTUM (PAR) LIGHT SENSORS

The Par Light Sensor records the exact amount of light plants are getting. Calibrated for sunlight, this self-powered sensor measures Photosynthetic Photon Flux Density (PPFD). Its quantum sensors can also measure Photo-synthetically Active Radiation (PAR) in an aquaponics setup. Its rugged and self-cleaning design makes it a reliable and long-lasting solution.

Sensitivity	Calibration Factor	Calibration Uncertainty	Calibrated Output Range	Measurement Repeatability	Non-Stability	Non-Linearity
0.2 mV per µmol m-2 s-1	5 µmol m-2 s-1 per mV	± 5%	0 to 800 mV	< 0.5%	< 2 %/year	< 1 %

Response Time	Field of View	Spectral Range	Spectral Sensitivity	Directional Response	Temp. Response	Operating Environment
< 1 ms	180°	410 nm to 655 nm	< 10% from 469 to 653 nm	± 5% at 75° zenith angle	0.06 ± 0.06% per C	-40° to 158° F , 0 to 100% humidity

Greenhouse Accessories (Outputs)

CIRCULATION FANS

Circulation Fans eliminates stagnant air, which breeds diseases, while also reducing the spread of fungi and pests. Moist leaves combined with warm temperatures will promote disease growth. They help dry plants quicker and reduce pests. A Circulation Fan can also help eliminate pockets of hot and cold air in a greenhouse. Two fans are typically used in a greenhouse and placed in opposite corners.

FEATURES

- Fully enclosed motors
- Hanging mount
- Framework built for greenhouses & high moisture environments
- Optional variable speed controllers
- White frame

Model	Diameter	Performance	Weight (lbs.)	Volts	Amps
VK8	8″	448 CFM*	8	115	0.6
VK12	12″	1,554 CFM	18	115/230	1.3/0.65
VK20	20″	4,000-4,800 CFM	37	115/230	3.8/1.9
VK24	24″	5,000-6,000 CFM	46	115/230	4.8/2.4
SI Dram	24″	5,000-6,000 CFM	NA	NA	NA

* Cubic feet per minute

VARIABLE SPEED CONTROLLERS

An in-line variable speed controller allows the user to control the speed in which a circulation fan operates from 1% to 100% with the option of manually turning the fan off, overriding any control system.

Model	Phase	Dimensions (LxWxH)	Weight (lbs.)	Volts	Amps
H115	1	6¾″ x 3″ x 3¾″	1	115	6

WINDOWMASTER CHAIN ACTUATORS

WindowMaster Chain Actuators are capable of lifting up to 450 pounds and can be synced with other WindowMaster actuators. They offer the highest moisture resistance and can automated with rain or temperature sensors. The actuators can be set to open from 1″ to 10″ in ⅜″ increments. This unit operates at 24 V DC and is connected directly to the iGrow Controller, bypassing the Contactor Panel.

Size (W x H x D)	Weight	Min. Window Width	Min. Window Height
13½″ x 1 3/16″ x 1⅝″	2.2 lbs.	14⅜″	15¾″

LINEAR ACTUATORS

These durable motors can be paired with rain and temperature sensors for automated operation. They are designed to open vents that span multiple bays and are used in both ridge and eave configurations.

These actuators require two dedicated outputs when connected to an iGrow controller — one to open, and one to close the actuator.

Horsepower	Volts	Amps	Full Load Thrust	Pin to Pin Retracted Length	Stroke Distance
1/10	115	1.15 no load/1.40 full load	600 lbs.	17⅛”	7” to 12”

EVAPORATIVE COOLERS

A greenhouse has the potential to get too hot in the summer, even with ventilation. In order to preserve the plants, a cooling system needs to be incorporated, that both cools and adds humidity to the space. The Evaporative Cooler draws air over a wet pad, by way of a fan. As the water passes over the pads, it evaporates and takes heat with it. The air then passes into the greenhouse and can be up to 30°cooler. Evaporative Coolers consume ¼ less energy than traditional air conditioners. Evaporative Coolers exchange air; rather than re-circulating stagnant air; a benefit for greenhouses which need fresh air to combat pests and disease.

These coolers require two dedicated outputs when connected to an iGrow controller — one for Stage 1 and the other for Stage 2.

PORTABLE EVAPORATIVE COOLERS

Portable evaporative coolers provide a low-cost, environmentally-friendly means of keeping spaces cool. Water and forced air are combined to reduce air temperatures by as much as 26°F. These coolers have a computer-programmed control panel with LCD display, and come with a convenient remote control.

Model	Dimensions (H x W)	Draft Direction	CFMs	HP	Weight (lbs)	Volts	Amps
3000SD	33 7/16" x 28⅛"	Side Draft	3,000	1/3	193	115	7.2
N30S	33 7/16" x 28⅛"	Side Draft	2,077	1/3	193	115	NA
N40/45S	34½" x 34⅛"	Side Draft	4,000-4,800	1/3 or 1/2	269	115	NA
N55/65	42 7/16" x 39"	Side Draft	5,000-6,000	1/2 or 3/4	357	115	NA
30" Portable	59" x 44"	Front	10,500	3/4	110	115	NA

IRRIGATION SYSTEM SOLENOID VALVES

These electric valves open and close via a 24 V AC connection. They come in ¾” and 1” NPT fitting sizes. They are connected directly to the iGrow Controller, bypassing the Contactor Panel.

FULL-SPECTRUM LED LIGHT
A Full-Spectrum LED Light delivers a highly efficient 330 watts and covers a 3′ x 5′ area for vegetation and 2′ x 4′ area for flowers. They are dimmable with an optional controller and can operate in wet environments.

METAL HALIDE LIGHT
A metal halide grow light emits more light in the blue wavelength spectrum to promote vegetative plant growth. Plants grown under this type of light are typically taller and bushier.

Volts	Amps	Watts
277	1.2	330

Volts	Amps	Watts
120/240	3.0/1.5	315

TUBULAR MOTORS FOR SHADES
Tubular motors are designed to expand and retract roller shades as well as gravity fed (Roman) shades. One motor can simultaneously operate multiple shades for each bay or one shade over multiple bays.

Diameter	Min. Width	Max. Width	Volts	Amps	RPM	Lift	Lift Speed	Turns
1.81″	18″	120″†	120	1.7	30	88 lbs.	3.2 sec./ft.	21 to 32*

* Available with a 230 V motor.
† The width may exceed 120″ with the implementation of an intermediate bracket and roller assembly, but the weight limit remains at 88 lbs.

MOTORIZED INTAKE LOUVRES
Motorized Intake Louvres work in conjunction with Exhaust Fans so that each will operate simultaneously, drawing fresh outside air in the structure while stagnant air is exhausted out. The shutters are constructed of exterior-grade PVC.

Model	Rough-In Dimensions	Weight	Opening Area	Volts	Amps	CFM* (@0.05″)	CFM* Range (Free Air)
MIT-1200	12⅝″ x 12⅝″	7 lbs.	1 sq. ft.	115	0.5	800	<1,000
MIT-1600	16½″ x 16½″	8 lbs.	1.77 sq. ft.	115	0.5	1,420	1,001 to 2,500
MIT-2200	22⅝″ x 22⅝″	12 lbs.	3.36 sq. ft.	115	0.5	2,690	2,501 to 5,000

*Cubic feet per minute

EXHAUST FANS
Exhaust fans pull hot air out of a structure and prevent it from becoming trapped at the ridge. They help circulate air within a structure and maintain a constant temperature. They are constructed with a PVC shell and should be placed on the opposing side of the structure from the intake louvre.

Model	Diameter	HP	RPM	Performance	Motorized intake pairing	Weight	Volts	Amps
SFT-1200-1	12"	1/30	1,550	760 CFM*	MIT-1600 16”	12 lbs.	115	0.9
SFT-1600-1	16"	1/10	1,725	1,250 CFM	MIT-2000 20"	21 lbs.	115/230	1.3/0.65
SFT-2000-1	20"	1/3	1,725	3,122 CFM	MIT-2200 22"	31 lbs.	115/230	3.8/1.9

*Cubic feet per minute

INTERIOR-MOUNT GAS HEATERS
A Gas Heater requires an external fuel source, either gas or propane and is mounted on the interior of a structure. An internal fan circulates the warm air throughout the greenhouse.

INTERIOR-MOUNT ELECTRIC HEATERS
An Electric Heater does not require an external fuel source and is mounted on the interior of a structure. The heat is generate through electric coils and an internal fan circulates the warm air throughout the greenhouse.

EXTERIOR-MOUNT HEATERS
Exterior-mount heaters should be mounted at floor level and work in conjunction with a louvered vent installed at the ridge and opposite of the heater.

Manufacturer	Model	BTU output	Dimensions (LxHxD)	Entering Airflow (CFM*)	Heat Throw (ft) at Max Height	Volts	Amps	Fuel
Modine Hot Dawg	HD30	24,000	26¾"x12¼"x22"	505	25	115	3.7	Gas
Modine Hot Dawg	HD45	36,000	26¾"x12¼"x22"	720	27	115	3.7	Gas
Modine Hot Dawg	HD60	48,000	26¾"x18"x25"	990	36	115	2.5	Gas
Modine Hot Dawg	HD75	60,000	26¾"x18"x25"	1,160	38	115	2.5	Gas
Modine Hot Dawg	HD100	80,000	35½"x20½"x31"	1,490	42	115	4.7	Gas
Modine Hot Dawg	HD125	100,000	35½"x20½"x31"	1,490	42	115	4.2	Gas
Modine Electric	HER50	17,100	14¼”x17½”x12¼”	380	12	208	24.5	Electric
Empire	DV20E	20,000	37"x26"x15¾"	350	25	115	5	Gas
Empire	DV40E	40,000	37"x26"x15¾"	350	35	115	5	Gas
Empire	DV55E	55,000	37"x26"x15¾"	400	50	115	5	Gas
Markel Electric	492296	25,000	NA	375	25	NA	NA	Electric
Markel Electric	492290	11,200	NA	375	20	NA	NA	Electric

*Cubic feet per minute

HUMIDIFIERS/FOGGERS, OSCILLATORS, & SOLENOIDS

Humidifiers, or foggers, are utilized to control moisture levels in the air for optimal plant growth. When humidity drops below a predetermined level, a sensor triggers the humidifier to activate, blowing a fine mist throughout the space. For more advanced applications, high pressure foggers and oscillators are available.

TURBO XE500 & XE1000

- Used on mid-sized greenhouses; Models available for larger greenhouses
- XE500 propels water up to 25’
- XE1000 propels water up to 30’
- Quiet & noise free operation
- Withstands salt, lime, & acid exposure
- Withstands 100% relative humidity
- No filters or special pumps required

HYDRO SS700

- Used on smaller greenhouses
- Direct feed hanging units receive liquid through a visual flow meter control panel
- Equipped with a 5 GPH flow meter panel & 12’ condensation drainage line
- Propels water up to 20’
- No filters or special pumps required
- All hardware is stainless steel

OSCILLATOR

- Oscillates fogger for greater fog dispersement up to 70 ft. in diameter and uniform displacement
- Can be tied into iGrow controller with same wiring
- Waterproof container
- Compatible with XE model foggers
- 96 settings, in 3.75° increments
- 360° rotation in two minutes

WATER SOLENOID

- Can be tied into iGrow controller with same wiring
- ⅜” OD tube connection
- Shuts off water supply in the event of a power outage

Model	Misting	HP	CFM	Dimensions (W x H)	Weight	Volts	Amps
Turbo XE500	11 GPH	½	2,160	17½" x 22½"	46 lbs.	115/230	7.4
Turbo XE1000	24 GPH	½	2,730	17½" x 22½"	46 lbs.	115/230	7.4
Hydro SS700	Up to 3.5 GPH	NA	980	15" x 12"	10 lbs.	115	1.5
Turbo Oscillator	NA	NA	NA	9¾"L x 6¼"H x 4"W	NA	115/230	NA
Water Solenoid	NA	NA	NA	NA	NA	115/208	NA