



Climate
Control
Systems

a nebula group company

FERTIGATION MANAGER™

The Most Advance **Feed Management**
and **Irrigation Control System.**



FERTIGATION MANAGER™

The Fertigation Manager™ is a precise fertilizer blending and delivery system that allows the grower to create various fertilizer feeding formulas for all types of crops including hydroponic, aeroponic and traditional growing methods.

- The Fertigation Manager™ delivers the exact amount of irrigation water to each plant, irrespective of the amount of water required or the frequency of the watering
- The Fertigation Manager™ completes mixing and remembers the exact amount of water and nutrients required for each recipe

Growers depend on fertilizer programs to irrigate flower and vegetable crops on a daily basis. The Fertigation Manager™ allows growers to create and distribute different feeding formulas and was the first system to fully integrate to the internet allowing for remote control and monitoring.



The perfect tool for dealing with the difficulties of irrigating plants with a variety of nutrient recipes.



MODES OF OPERATION

The Fertigation program allows growers to control each fertilizer solution injected into the pressurized irrigation water line by (1) EC and pH control or (2) proportional to water flow control.

- The EC control program injects fertilizer in the irrigation water until the set EC level is reached, then the injectors slow down to maintain the EC level and pH level.
- The Fertigation Program allow you to pre schedule up to 20 Fertilizer recipe programs and can be assigned to specific irrigation zones.

A MANAGER FOR EVERY CROP

Save money on fertilizer and water usage by treating and recycling waste irrigation water. This water recycling program includes a special strategy for treating collected irrigation water.

The program conditions water for desired EC and pH before it is sent to the Fertigation Manager™ for further treatment.

The Fertigation Manager™ control program is a powerful tool for fertigation management, water recycling and climate control for any sized indoor grow operation. These smart controllers are accessible via the Internet. Technical support is available from anywhere the Internet is accessible.

EPIC Fertigation Manager -- Nutrient PPM Analysis

PPM Calculation Mode: Static (Recipe) / Dynamic (LIVE)

Fertilizer Name >>

Nitric Acid	Plant Prod MJ Boost	Calcium Nitrate	Magnesium Sulfate	Plant Prod MJ Spike	Micro Nutrients
Fertilizer Mix (Solute): 55,000 kg	10,000 kg	10,000 kg	70,000 kg	10,000 kg	2,000 kg
Tank Size (Solvent): 500 Liters	500 Liters	453 Liters	500 Liters	500 Liters	500 Liters
Mix Ratio: 110.00 (g/L)	20.00 (g/L)	22.07 (g/L)	140.00 (g/L)	20.00 (g/L)	4.00 (g/L)
Solubility: 1.20 (1-x)	1.00 (1-x)	1.00 (1-x)	1.00 (1-x)	1.00 (1-x)	1.00 (1-x)

Water Analysis ppm

Nutrients	ppm	TOTAL ppm	TARGET ppm	Diff +/-
1 Nitrogen N	0.00	242.70	191.00	51.70 ↓
2 Phosphorus P	0.00	105.90	50.00	55.90 ↓
3 Potassium K	0.00	87.85	370.00	282.15 ↑
4 Calcium Ca	10.00	22.24	190.00	167.76 ↑
5 Magnesium Mg	0.00	46.20	65.00	-18.80 ↓
9 Sulfur S	5.00	65.67	0.00	65.67 ↑
7 Ammonia NH4	0.00	0.00	30.00	-30.00 ↓
8 Manganese Mn	3.00	91.91	1.00	89.91 ↑
9 Copper Cu	0.00	0.10	5.00	-4.90 ↓
10 Molybdenum Mo	0.00	0.00	0.00	0.00
11 Zinc Z	0.00	0.10	0.00	0.10 ↑
12 Iron Fe	0.00	0.20	0.00	0.20 ↑
13 Boron B	0.00	0.04	0.00	0.04 ↑
14 Sodium Na	0.00	0.00	0.00	0.00
16 Chloride Cl	0.00	0.00	0.00	0.00
16 Cobalt Co	0.00	74.67	0.00	74.67 ↑
17 Silicon Si	0.00	0.00	0.00	0.00
18 Selenium Se	0.00	0.00	0.00	0.00
19 Nutrient19 Xx	0.00	0.00	0.00	0.00
20 Nutrient20 Yy	0.00	0.00	0.00	0.00

pH Control

#0	#1	#2	#3	#4	#5
% ppm ppm	% ppm ppm	% ppm ppm	% ppm ppm	% ppm ppm	% ppm ppm
15.00 16.500 156.75	15.00 3.000 30.25	15.00 3.310 10.20	0.00 0.00 0.00	15.00 3.000 20.00	0.00 0.00 0.00

Program Running: 0

Recipe # 1 Early Flower

EC-Out: 2.300 uS
pH-Out: 5.50
Temp: 21.0 °C

Liters Pumped: 12.6

Water Source: RO Water

EC-In: 1.250 uS **Water Pressure: 44.00 PSI**

Recipe Pulse Rate: 30.0 LPM

Injection Rate:	50.00 Strokes / min (25.00 Actual)	55.00 Strokes / min (27.50 Actual)	22.00 Strokes / min (11.00 Actual)	25.00 Strokes / min (11.50 Actual)	40.00 Strokes / min (20.00 Actual)	24.00 Strokes / min (12.00 Actual)
Injection Rate:	285.00 mL / min	302.50 mL / min	92.40 mL / min	100.00 mL / min	200.00 mL / min	52.80 mL / min

Tank Level

Tank Level	Tank Level	Tank Level	Tank Level	Tank Level	Tank Level
233.20 Liters (46.4%)	97.00 Liters (19.2%)	45.97 Liters (10.1%)	95.93 Liters (19.1%)	53.79 Liters (10.6%)	120.04 Liters (24.0%)

Mixing Tank (10 Liters)

SIMPLE/EASY TO USE SOFTWARE

The program works with up to 12 injectors and up to 128 irrigation valves. Various feed formulas can be pre-programmed to satisfy various vegetable and flower crops.

Climate Control Systems offers a unique measurement and control instrumentation for EC, pH and water flow meters that have field programmable features to help growers manage the production of crops.

Irrigation Program

Program: Start Sunday Monday Tuesday Wednesday Thursday Friday Saturday

Valve Group: Edit

Recipe: Edit

Auxiliary: Clear

Water Content

1.	0	Avg.
2.	0	0
3.	0	

WC Alarm: 0

#	Schedule Recipe Name	Start Date (yyyy-mm-dd)	End Date (yyyy-mm-dd)	Days	Begin (hh.mm)	End (hh.mm)	Rest (mm.ss)	Trigger (mm.ss)	Solar D.L.I.	WC (%)	DB +/-	EC - 2 Set Point
1.	Early FLower	2023-01-01	2023-01-15	14	7.00	19.00	45.00	60.00	0.00	25	5.0	0
2.	Early FLower (2)	2023-01-16	2023-02-01	16	8.00	18.50	15.00	60.00	0.00	25	0.0	0
3.	Cucs	2023-02-28	2023-03-30	30	8.30	18.30	15.00	60.00	0.00	25	0.0	0
4.	Recipe #5	2023-04-01	2023-04-14	13	0.00	0.00	0.00	0.00	0.00	0	0.0	0
5.				0	0.00	0.00	0.00	0.00	0.00	0	0.0	0

Current Time (hh.mm): 13.05 Active Values: 0 s 3,210 s 0.00 0

Fertigation Scheduler Save Cancel

There are 20 irrigation programs where one can assign specific irrigation valves. Schedule irrigation based on time intervals, live solar conditions set in u/Moles, by substrate/soil moisture sensors or by external trigger.

- The timer counts down in seconds to indicate seconds left until the next irrigation start cycle
- The Solar Sensor provides accumulated solar levels in μ moles to trigger irrigation on set solar levels

	Program Name	Timer	Solar	WC		Program Name	Timer	Solar	WC
1.	Room #1	0	0.00		11.	Program #11			
2.	Program #2	0	0.00		12.	Program #12			
3.	Pod Group 3	0	0.00		13.	Program #13			
4.	Program #4	0	0.00		14.	Program #14			
5.	Program #5				15.	Program #15			
6.	Program #6				16.	Program #16			
7.	Program #7				17.	Program #17			
8.	Program #8				18.	Program #18			
9.	Program #9				19.	Program #19			
10.	Program #10				20.	Program #20			

MANAGE WATER AND FERTILIZER

The Fertigation Manager™ is a key component in this engineered water recycling system in conjunction with the Ozone Pro water sterilization system.

System Parameters		Auto Mode Delay	15.00 Sec
Injector On Time	0.25 Sec	PH Alarm Delay	15.00 Sec
Injector Off Time	0.25 Sec	EC Refresh Delay	5.00 Sec
		Mix Valve Delay	10.00 Sec
Alarm Setpoints		EC-out High Alarm	5,000 EC
pH High Alarm	8.0 pH	EC-out Low Alarm	0 EC
pH Low Alarm	4.0 pH	EC-in High Alarm	10,000 EC
		EC-in Low Alarm	-5,000 EC
Pressure High Alarm	99.00 psi	EC Alarm Delay	15.00 Sec
Pressure Low Alarm	0.00 psi	Temp. High Alarm	99.00 °C
Pressure Alarm Delay	60.00 Sec	Temp. Low Alarm	0.00 °C
		Temp. Alarm Delay	0.00 Sec
Flow High Alarm	100.00 LPM	Pump Delay	0.00 Sec
Flow Low Alarm	2.00 LPM	External Delay	1.00 Sec
Flow Alarm Delay	15.00 Sec		

- Complete turn-key water collection and recirculation system
- Saves the grower up to 40% on water and fertilizer costs
- Recycles 100% of the fertilized irrigation wastewater

ONE CENTRAL MACHINE FOR MULTIPLE RECIPES

The Fertigation Manager™ uses anywhere from **3 to 12 fertilizer tanks** to create many different fertilizer formulas required for different crops.

The software program allows you to automatically mix many different feeding recipes and send them directly to the irrigation zone.

PPM Target Setpoints		Injector Setpoints	
Nutrients	ppm	Injector#	Name
1 Nitrogen	N 191.00	1.	Nitric Acid
2 Phosphorous	P 50.00	2.	Plant Prod MJ Boost
3 Potassium	K 370.00	3.	Calcium Nitrate
4 Calcium	Ca 190.00	4.	Magnesium Sulfate
5 Magnesium	Mg 65.00	5.	Monopotassium Phosphate
6 Sulfur	S 0.00	6.	Micro Nutrients
7 Ammonia	NH4 30.00	7.	Ammonium Nitrate
8 Manganese	Mn 1.00	8.	Calcium Nitrate
9 Copper	Cu 5.00	9.	Iron Chelate
10 Molybdenum	Mo 0.00	10.	Micro Nutrients
11 Zinc	Z 0.00	11.	
12 Iron	Fe 0.80	12.	Plant Prod MJ Grow
13 Boron	B 0.00		
14 Sodium	Na 0.00		
15 Chloride	Cl 0.00		
16 Cobalt	Co 0.00		
17 Silicon	Si 0.00		
18 Selenium	Se 0.00		
19 Nutrient19	Xx 0.00		
20 Nutrient20	Yy 0.00		

Pulses / 30 LPM

Save Targets

THE EVOLUTION OF FERTIGATION

OUR NEW PRECISION FERTIGATION MANAGER PRO

The Fertigation Manager™ Pro offers true multi-layered precision control of fertilizer feeding formulas at a previously unheard levels, allowing growers to explicitly set variables at a PPM basis to ensure crops have exactly the nutrients they require at the targeted time they require them.

With the capability to specify up to 100 grow zones, and 100 feed formula schedules within each, the Fertigation Manager Pro has the potential to sustain 100 individually monitored crops in each grow zone.



TRULY REMOTE CONTROL

Securely access your system remotely from anywhere in the world, and monitor or make changes with an easy to navigate GUI interface.

ADVANCED WATER ANALYSIS

The Fertigation Manager Pro has the ability to record the nutrient levels in the water from up to 25 different sources. Following lab testing, growers can enter the ppm of current nutrients in individual water sources, and the Fertigation Manager Pro can automatically calculate what additives are needed in combination with any pre-existing elements, in order to certify that the precise PPM feed formula is delivered to the individual grow zones as directed by the grower.

The screenshot shows the 'ppm Edit WaterData' window. It displays a table of 'Water Analysis Data #0' for '- RO Water -'. The table lists 20 nutrients with their respective ppm values.

Nutrients	ppm
1 Nitrogen N	0.00
2 Phosphorous P	0.00
3 Potassium K	0.00
4 Calcium Ca	10.00
5 Magnesium Mg	0.00
6 Sulfur S	5.00
7 Ammonia NH4	0.00
8 Manganese Mn	3.00
9 Copper Cu	0.00
10 Molybdenum Mo	0.00
11 Zinc Z	0.00
12 Iron Fe	0.00
13 Boron B	0.00
14 Sodium Na	0.00
15 Chloride Cl	0.00
16 Cobalt Co	0.00
17 Silicon Si	0.00
18 Selenium Se	0.00
19 Nutrient19 Xx	0.00
20 Nutrient20 Yy	0.00

The screenshot shows the 'Water Source' window. It displays a list of water sources with a 'Select Water Source: OK' button at the top. The list includes 10 different water sources.

Select Water Source: OK
1. RO Water
2. City Water
3. Well Water
4. Pond Water
5. Rain Water
6. Leachate-1
7. Leachate-2
8. Leachate 25%
9. Leachate 50%
10. Leachate 75%

At the bottom of the window, there is an 'Edit Water Analysis data' button.

CUSTOMIZABLE FEED FORMULAS

PPM Targets

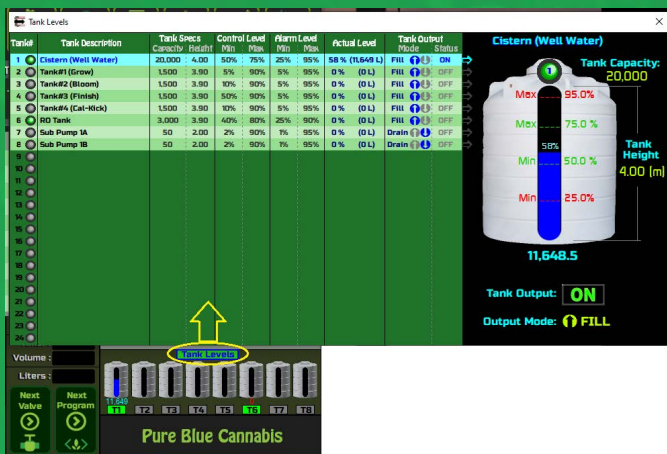
Recipe #: 1 Description: Early FLower

PPM Target Setpoints			Injector Setpoints		
Nutrients	ppm		Injector#	Name	Pulses / 30 LPM
1 Nitrogen	N	191.00	1.	Nitric Acid	50.000
2 Phosphorous	P	50.00	2.	Plant Prod MJ Boost	55.000
3 Potassium	K	370.00	3.	Calcium Nitrate	22.000
4 Calcium	Ca	190.00	4.	Magnesium Sulfate	25.000
5 Magnesium	Mg	65.00	5.	Monopotassium Phosphate	40.000
6 Sulfur	S	0.00	6.	Micro Nutrients	24.000
7 Ammonia	NH4	30.00	7.	Ammonium Nitrate	20.000
8 Manganese	Mn	1.00	8.	Calcium Nitrate	20.000
9 Copper	Cu	5.00	9.	Iron Chelate	20.000
10 Molybdenum	Mo	0.00	10.	Micro Nutrients	20.000
11 Zinc	Z	0.00	11.		0.000
12 Iron	Fe	0.80	12.	Plant Prod MJ Grow	0.000
13 Boron	B	0.00			
14 Sodium	Na	0.00			
15 Chloride	Cl	0.00			
16 Cobalt	Co	0.00			
17 Silicon	Si	0.00			
18 Selenium	Se	0.00			
19 Nutrient19	Xx	0.00			
20 Nutrient20	Yy	0.00			

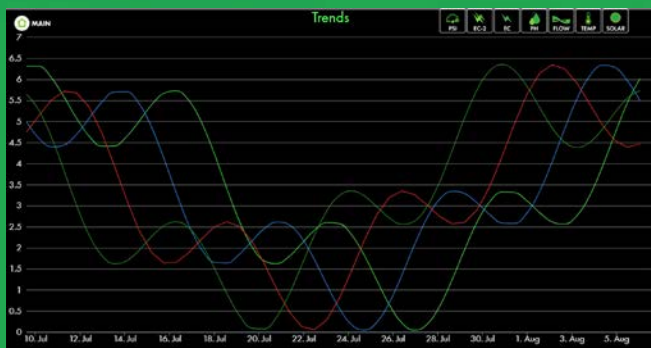
Save Targets

Get unprecedented control by specifying up to 150 different Feed Formulas, on 150 different schedules, controlling up to 150 valve groups, with EC control feed formulas for specific targeting. All formulas are based off of PPM measurements for more accurate formula integration, and feature integrated manual testing option before actioning them within a grow zone, ensuring accuracy for your formulas and schedules.

REAL TIME MONITORING AND DATA COLLECTION



Tank levels are consistently visible while the system is running, in order to ensure that levels of all nutrients are being tracked. The Fertigation Manager Pro further offers the ability not only to monitor nutrient tanks, but also solutions within each tank. Changes can be easily configured to change levels per stroke, capacity, and alarm setpoints (based on percentage).



Monitor the Pressure, EC, pH, Flow, Temperature, and Solar of your growing operation with realtime trends per second, and evaluate historical data by week, day, or overall. The Fertigation Manager Pro also offers the ability to download trend data in Excel format.

EPIC CONTROLLER



The Groov Epic is the next generation of fertigation control programs. It offers real time readings in custom graphics programs, data collection, and graphs for all monitored conditions for:

- EC
- pH
- Water flow
- Water temperature
- Root zone temperature
- Solar levels
- Substrate EC levels
- Substrate moisture levels
- And much, much more!

Any alarm conditions or customized event triggers can be texted or emailed to your personal device. The Epic controller software supports all web browsers on smart phones, tablets, laptops, and desktop computers.

System Parameters		Auto Mode Delay	15.00 Sec
Injector On Time	0.25 Sec	PH Alarm Delay	15.00 Sec
Injector Off Time	0.25 Sec	EC Refresh Delay	5.00 Sec
		Mix Valve Delay	10.00 Sec
Alarm Setpoints		EC-out High Alarm	5,000 EC
pH High Alarm	8.0 pH	EC-out Low Alarm	0 EC
pH Low Alarm	4.0 pH	EC-in High Alarm	10,000 EC
		EC-in Low Alarm	-5,000 EC
Pressure High Alarm	99.00 psi	EC Alarm Delay	15.00 Sec
Pressure Low Alarm	0.00 psi	Temp. High Alarm	99.00 °C
Pressure Alarm Delay	60.00 Sec	Temp. Low Alarm	0.00 °C
Flow High Alarm	100.00 LPM	Temp. Alarm Delay	0.00 Sec
Flow Low Alarm	2.00 LPM	Pump Delay	0.00 Sec
Flow Alarm Delay	15.00 Sec	External Delay	1.00 Sec

EPIC CONTROLLER

EXPANDABLE • CUSTOMIZABLE • ACCESSIBLE

Powering a web-based app, the EPIC controller provides instant access, anywhere to the Fertigation Manager.™ With more power, comes more possibilities... The EPIC controller serves as the ideal platform for expandability, so your Fertigation Manager can be truly customized to supply you with the data you need to optimize your growth.



INSTANT ACCESS • ANYWHERE • ANY DEVICE



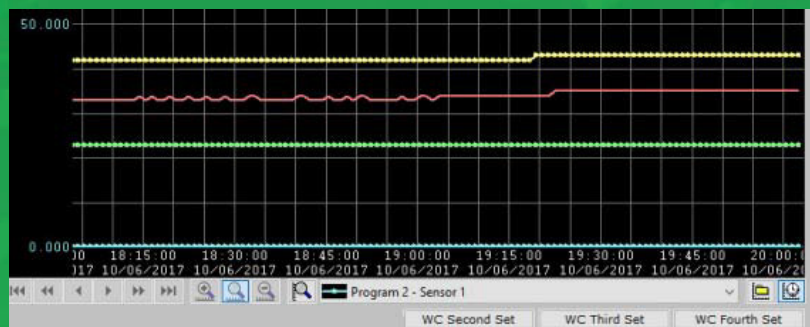
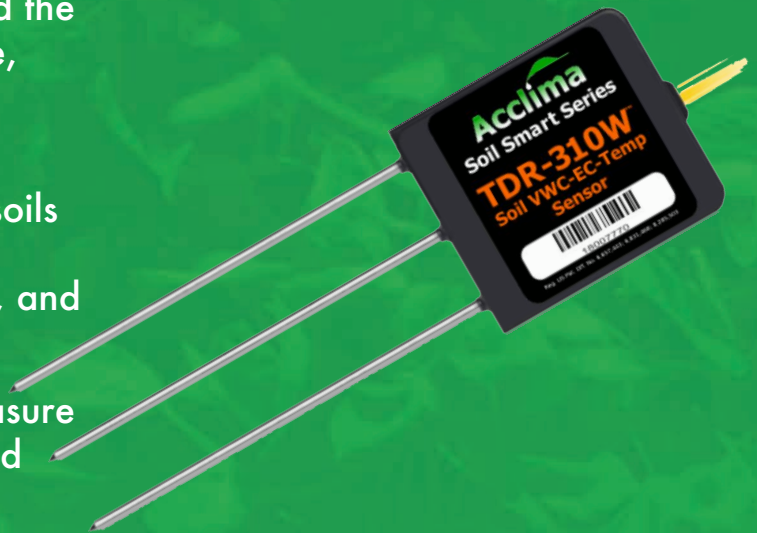
SOIL-SUBSTRATE MOISTURE SENSOR WITH EC & TEMPERATURE MONITORING

Climate Control Systems has added the new Acclima TDR-310 soil moisture, temperature, and EC sensor to the Fertigation Manager system.

The TDR sensor is used in mineral soils and soil-less substrates such as Rockwool, potting soil, Co-co peat, and perlite.

You can use the TDR sensor to measure the temperature, water content, and electrical conductivity within the growing medium.

Its stainless steel probes with an extended surface area to optimize EC measurements and minimize substrate disturbance during insertion. We have integrated the sensor into our software to gain greater control over measuring the substrate moisture, temperature and EC level within the growing media.



Prog.	Description	Volts	Temp (C)	EC	WC (%)	Temp (C)	EC	WC (%)	Temp (C)	EC	WC (%)	Avg. WC	Updated
1.													
2.	Lemon	4.16	19.40	930	35	18.33	2,060	24	12.20	1,140	25	28	20:50:39
3.	Rosemary	4.13	19.30	1,970	28	19.40	0	10	18.60	2,010	35	24	20:50:21

The CCS-3 measures moisture content, temperature, and EC independently. Its unique design minimizes salinity and textural effects, making it accurate in most soil or soilless media.

The stainless steel needles have an extended surface area, which when inserted into the growing media are able to optimize EC measurements, while minimizing substrate disturbance during insertion. The temperature of the growing media is measured with an onboard thermistor, and the electrical conductivity is measured using a stainless steel electrode array.

TDR-310W SOIL-SUBSTRATE SENSOR

Accuracy

VWC: Using a generic calibration: $\pm 0.03 \text{ m}^3 / \text{m}^3 (\pm 3\% \text{ VWC})$ typical in mineral soils that have solution electrical conductivity less than 10 dS/m ; Using medium specific calibration, $\pm 0.01 - 0.02 \text{ m}^3 / \text{m}^3 (\pm 1-2\% \text{ VWC})$ in any porous medium. Electrical Conductivity: $\pm 10\%$ from 0 to 10 dS/m , user calibration required above 10 dS/m Temperature: $\pm 1^\circ\text{C}$

Resolution

Using Topp equation: $\pm 0.03 \text{ m}^3 / \text{m}^3 (\pm 3\% \text{ VWC})$ typical in mineral soils that have solution electrical conductivity less than 10 dS/m . Using medium specific calibration, $\pm 0.02 \text{ m}^3 / \text{m}^3 (\pm 2\% \text{ VWC})$ in any porous medium.

Sensor Type

VWC: Frequency domain, EC: Two probe design, Temperature: Thermistor

Operating Temperature Range

-40°C to 60°C

Measurement Range

VWC: 0 – 100% EC: 0 – 23 dS/m (bulk)

Dimensions

9.3 cm x 2.4 cm x 6.5 cm

Cable Length

5 m standard, custom cable lengths available upon request

Measure Cycle Time

150 ms (milliseconds)

Power requirements

3.6 – 15 VDC, 0.3 mA quiescent, 25 mA during 150 ms measurement

Connector Type

3.5mm stereo plug

Output Type

Serial TTL, 3.6 Volt Levels or SDI-1

Creating consistent growing environments for **healthy crop growth and quality control.**



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Climate Control Systems Inc. has been manufacturing greenhouse automation systems around the globe since 1985.

Our greenhouse automation software and solutions work around the clock to optimize greenhouse climate, increase crop yields and reduce water, energy and fertilizer costs.

We provide complete solutions for your growing operations. Our solutions help achieve a better crop while saving you precious time and overhead costs.

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Nebula Group's primary mission is to profitably expand leadership in food production and safety in a localized manner through the decentralization of the food supply chain via sustainable resources, modernized technology systems, and self-sufficient processes. Learn more at nebulagroup.co.

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