aessensefresh

Ætrium-2.1 SmartFarm

Data Sheet 4/2022

The Ætrium-2.1 SmartFarm

The AEtrium-2.1 Smartfarm is our premiere vertical aeroponic system for growing leafy greens, herbs, and much more.

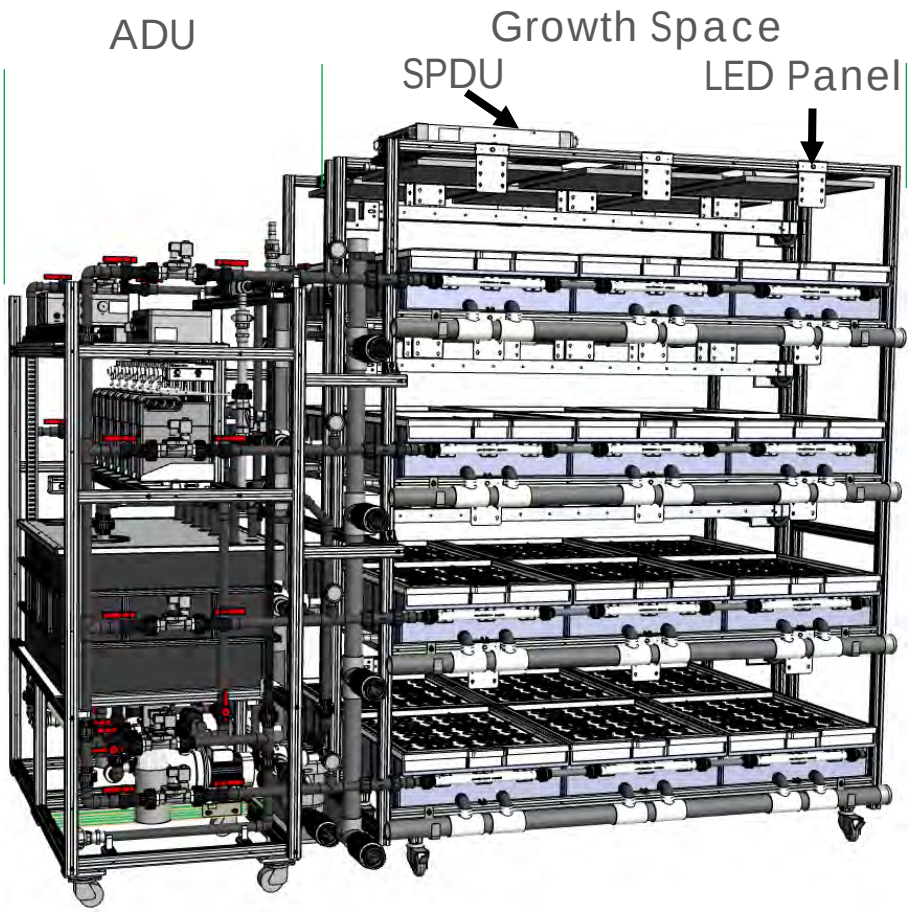
Ætrium-2.1 SmartFarm Components

The Ætrium Dosing Unit (ADU) is the main engine of the Ætrium-2.1 SmartFarm. Using our Guardian Grow Manager (GGM) as its main interface, it controls all water, air, and electrical operations.

Plants are cultivated in the Growth Space. This is where the growth trays with the spray manifold system are located. The Growth Space can be configured to have 24, 48 or 72 growth trays. Each tray can support up to 63 clone or seed cups.

Each growth tray is illuminated by one LED Panel.

The DC LED Panels are powered by the Sectional Power Distribution Units (SPDUs).

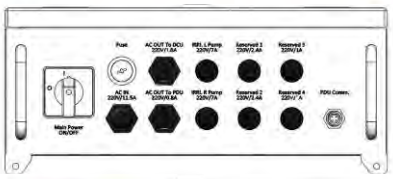


Power Distribution Unit (PDU)

The PDU links the AEtrium Dosing Unit (ADU) either wirelessly via an Access Point or via an ethernet connection to the server that runs the GGM. It directly controls the Dosing Module, the ACU, the DCU, the WSE, the ASD, and the SPDUs in the Growth Space.

AC Relay Controller (ACU)

The ACU contains all AC relays that enable the Irrigation Pumps and Return Water Pump.



DC Relay Controller (DCU)

The DCU contains all DC relays that enable the 24V Valves.

Irrigation Pumps

The two Irrigation Pumps move water from the Reservoir through the pipes to the manifold spray heads in the Growth Space. They alternate their duty cycle and provide complete redundancy in case of failure. Each pump has a Sediment Filter attached to it.

Return Water Pump

The Return Water Pump moves water from the grow trays in the Growth Space back to the Reservoir.

Dosing Module

Driven by GGM the Dosing Module adds a grower determined ratio of fertilizer and amendments to the water in the Reservoir. It consists of Dosing Bottles and Peristaltic Doser Pumps controlled by Stepper Motor (doser) Controllers (SMC).

Reservoir

The Reservoir is the storage tank for nutrient rich water circulated through the Growth Space. To maintain optimal conditions of the nutrient solution to support healthy roots, a chiller is recommended to manage and control temperature. A separate mechanical chiller or an optional stainless steel loop of chilled water is recommended (part number 300-00188-03, including stainless steel cooling loop, solenoid valve and connections). Reservoir chilling can be controlled by the GGM.

Valves

The automatically controlled 24 volt DC valves enable individual irrigation patterns for each layer in the Growth Space. The Pressure Relief Valves (PRV) are manually adjustable diaphragm valves for fine tuning pressure under the growth trays. The Manual Valves can be used to shut off water to certain parts of the Growth Space during servicing.

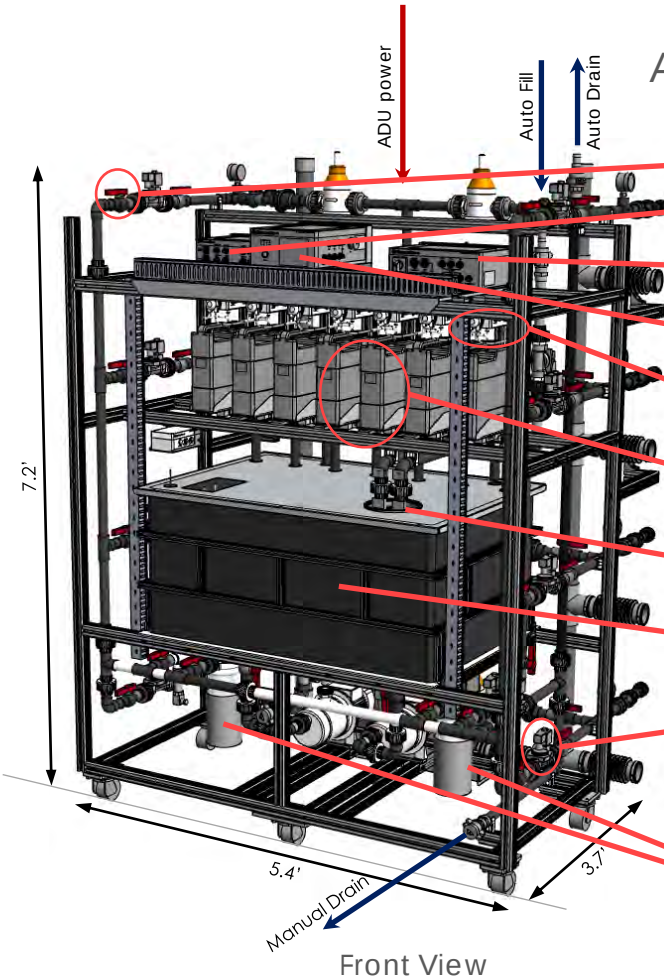
Sensors

The Water Pressure Sensors (WTP), the Water Sensing Module (WSE), and the AEtrium System Detector (ASD) provide accurate feedback to the GGM on water pressure, level, pH, water temperature, electrical conductivity, air temperature, relative humidity, CO_2 level, and light intensity (ON/OFF).

Backup Power

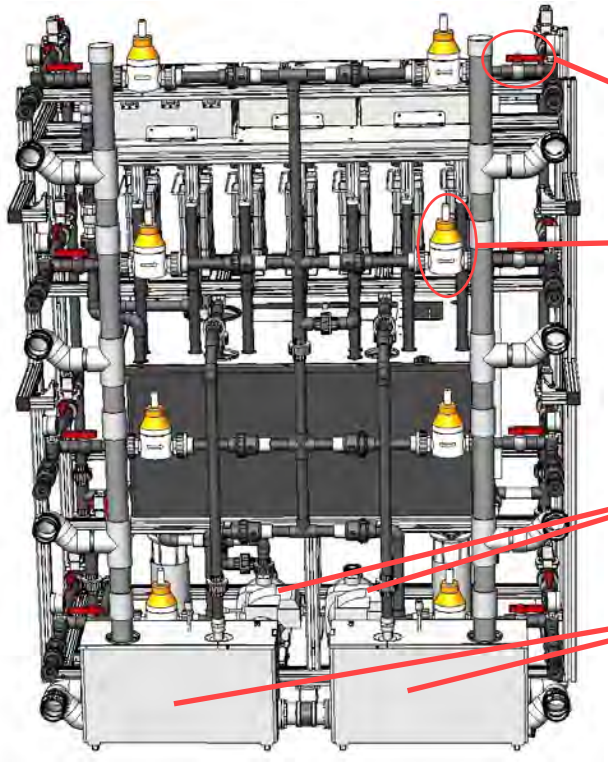
In areas where one could suffer from loss of mains power it is highly recommended that the ADU be supplied with power from a backup source to assure that the plants continue to get fertigated. The control network, and its components, should also be on backup power.

Ætrium-2.1 ADU Components



Manual shutoff valve
DCU
ACU
PDU
SMC and Peristaltic Doser Pump
Dosing Bottle with weight scale
Return Water Filter
Reservoir
24V Valve
Sediment Filters

Front View



Manual Valve
Adjustable PRV
Irrigation Pumps
Return Water Reservoirs with pumps inside

Rear View from Behind

Ætrium-2.1 ADU Specs

Description	Min	Typical	Max
ADU input voltage	100 V_{AC}	–	240 V_{AC}
ADU input frequency	47 Hz	–	63 Hz
ADU power draw	–	15A	–
Operating temperature	34 °F (1 °C)	–	104 °F (40 °C)
Storage temperature	-22 °F (-30 °C)	–	176 °F (80 °C)
UL/CSA Certification		reference E491725	
CE Certificate Number		8227170919	

Description	Value
Water temperature	Range: 32-122°F (0-50°C) Resolution: 1°F (0.1°C)
Water pH	Range: 0-14 pH Resolution: 0.01 pH
Water Electrical Conductivity (EC)	Range: 2–20,000 µS/cm
Supplied water (EC)[1]	<250µS/cm[3]
Irrigation Pump max flow rate	15.8 gal/min (60 lpm)
# of Irrigation Pumps	2
Return Water Pump max flow rate	18 gal/min (68 lpm)
# of Return Water Pumps	2
# of Dosing Pumps	7
Sediment Filters (2)	
Material	Polypropylene frame 304 Stainless mesh
Size	80 mesh (0.18mm)
Sediment Filter dimensions (L x W x H)	7.1" x 7.1" x 32.3" (180 mm x 180 mm x 820 mm)
Return Water Filter	
Material:	Polypropylene frame Polyamide mesh
Size	60 mesh (0.25mm)

Description	Value
Automatic Drain pump: the ADU can automatically complete a change out of the fertigation solution	
Max. drain pumping height	14.7' (4.5 m)
Flow rate	15.8 gal/min (59.8 lpm)
Connection Hose Barb (uses 5/8" garden hose)	5/8" OD (16mm OD)
Automatic Water Fill: the ADU automatically senses water level and will add water using a provided solenoid when water levels slip below allowable levels[1]	
Input Flow/pressure	30-50psi @2.2gpm (2-3bar, 8.3lpm)
Connection Hose Barb (uses 5/8" garden hose)	5/8" OD (16mm OD)
Reservoir Capacity	80 gal (302 L)
OPTIONAL Reservoir Cooling Coil (PN 300-00188-03): the optional cooling coil can help to control reservoir temperature below the room temperature. User must supply chilled liquid	
Coil Material	304 Stainless Steel
Coil Length	37.4' (11400mm)
Coil Diameter	1/2" (12.7mm)
Coil Connection Hose Barb	5/8" OD (16mm OD)
Chilled water supply	<45°F (7°C)
Flow rate	2.6-3.2 gal/min (10-12 lpm)
Connection Hose Barb (uses 5/8" garden hose)	5/8" OD (16mm OD)
Heat Generated	2,750 BTU/hr for a 24 tray 5,500 BTU/hr for a 48 tray 8,250 BTU/hr for a 72 tray
Dosing Bottle capacity	1.06 gal (4 L)
# of Dosing Bottles/Peristaltic Pumps	7
Maximum pH up solution	30% potassium hydride (KOH) or equivalent
Maximum pH down solution	10% nitric acid (HNO_3) or equivalent
ADU dimensions (L x W x H)	43.6" x 63.9" x 86.1" (1105 mm x 1622 mm x 2185 mm)
ADU dry weight	574 lbs (260 kg)

1. It is highly recommended that one do a complete analysis of the supplied water prior to commencing cultivation. One may need to condition the water to reduce the conductivity of it for best cultivation results.

Ætrium-2.1 Shared Specs

Description	Min	Typ	Max
Grow tray grow sites (May be customized by using caps to block unused holes)		63 	
Grow tray size		22" x 27" (559 mm x 686 mm)	
Grow tray area		4.13 ft² (0.38M²)	
Hole Spacing		3" hole center to hole center, 1" hole edge to edge	
Recommended Ceiling Height	9' (2743mm)	10' (3048mm)	Unlimited
Offset from walls (front back sides)	30" (762mm)	36" (914mm)	Unlimited
Floor Slope		Floor must not be more than ¼" out of level over 10'	

24-Tray Ætrium-2.1 Specs

Description	Min	Typ	Max
Average daytime wattage [1,2]	–	3,550 W	–
Peak hourly heat output [1,2]	–	12,100 BTU/h	–
Total daily energy consumption [1,2,3]	–	73 kWh	–
Total daily heat generation [1,2,3]	–	250,000 BTU	–
Average daily water consumption (0.2-0.3 gal./day/tray[5])	4.8 gal. (18L)	7.2 gal. (27L)	
Square Feet of Canopy		101 ft2 (9.4M²)	
# of SPDUs		2	
# of LED Panels		24	
Ætrium-2.1 dimensions (L x W x H)		9' 11" x 5' 4" x 8' 4" (3012 mm x 1622 mm x 2539 mm)	
Ætrium-2.1 dry weight		1,720 lbs (780 kg)	
Recommended mechanical chiller (an optional liquid loop chiller can be controlled by the GGM)		½ HP	

48-Tray Ætrium-2.1 Specs

Description	Min	Typ	Max
Average daytime wattage [1,2]	–	5,660 W	–
Peak hourly heat output [1,2]	–	19,300 BTU/h	–
Total daily energy consumption [1,2,3]	–	111 kWh	–
Total daily heat generation [1,2,3]	–	379,000 BTU	–
Average daily water consumption (0.2-0.3 gal./day/tray[5])	9.6 gal. (36L)	14.4 gal. (55L)	
Square Feet of Canopy		202 ft² (18.7 M²)	
# of SPDUs		4	
# of LED Panels		48	
Ætrium-2.1 dimensions (L x W x H)		16' 6" x 5' 4" x 8' 4" (5017 mm x 1622 mm x 2539 mm)	
Ætrium-2.1 dry weight		2,867 lbs (1300 kg)	
Recommended mechanical chiller (an optional liquid loop chiller can be controlled by the GGM)		1 HP	

72-Tray Ætrium-2.1 Specs

Description	Min	Typ	Max
Average daytime wattage [1,2]	–	7,780 W	–
Peak hourly heat output [1,2]	–	26,500 BTU/h	–
Total daily energy consumption [3,4]	–	149 kWh	–
Total daily heat generation [1,2,3]	–	508,000 BTU	–
Average daily water consumption (0.2-0.3 gal./day/tray[5])	14.4 gal. (55L)	21.6 gal. (82L)	
Square Feet of Canopy		302 ft² (28.1 M²)	
# of SPDUs		6	
# of LED Panels		72	
Ætrium-2.1 dimensions (L x W x H)		23' 1" x 5' 4" x 8' 4" (7022 mm x 1622 mm x 2539 mm)	
Ætrium-2.1 dry weight		4,013 lbs (1820 kg)	
Recommended mechanical chiller (an optional liquid loop chiller can be controlled by the GGM)		1 HP	

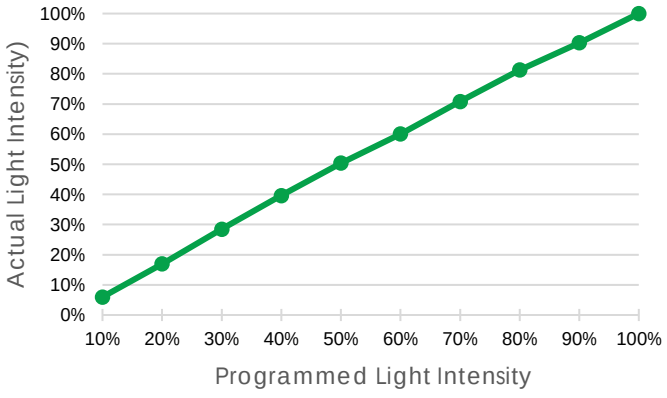
1. @ 100% light intensity with all fans running
2. ADU and SPDU @ 208 V_{AC},
3. All 4 layers irrigated in a round robin manner without pause, fans on 24 hours, lights on 18 hours, lights off 6 hours, 208 V_{AC} input to ADU and SPDUs, 110 V_{AC} input to Return Water Pump
4. Average Photosynthetically Active Photon Flux Density (PPFD) over each 24"x30" grow tray at 100% intensity
5. Dependent on the crop, density, cultural practices, and environmental conditions

Ætrium-2.1 LED Specs

Description	Min	Typ	Max
SPDU input voltage	100 V_{AC}	–	120 V_{AC}
SPDU input frequency	47 Hz	–	63 Hz
SPDU AC power draw each (2 on 24 tray, 4 on 48 tray, 6 on 72 tray)		1,260 W [1, 2]	
LED panel voltage	–	33.3 V [1]	38.5 V
Continuous dimming range	10%	–	100%
Fan channel voltage	–	24 V [2]	27 V

Description	Value
LED Panel PPF	120 µmol/s [1]
Average PPFD 4" above tray [1]	300 µmol/m^2/s
Average PPFD 8" above tray [1]	380 µmol/m^2/s
SPDU dimensions (L x W x H)	24.4" x 16.9" x 2.4" (620 mm x 428 mm x 60 mm)
SPDU weight	23.2 lbs. (10.5 kg)
LED Panel dimensions (L x W x H)	24.8" x 20.5" x 1" (630 mm x 520 mm x 25 mm)
LED Panel weight	9.8 lbs. (4.4 kg)

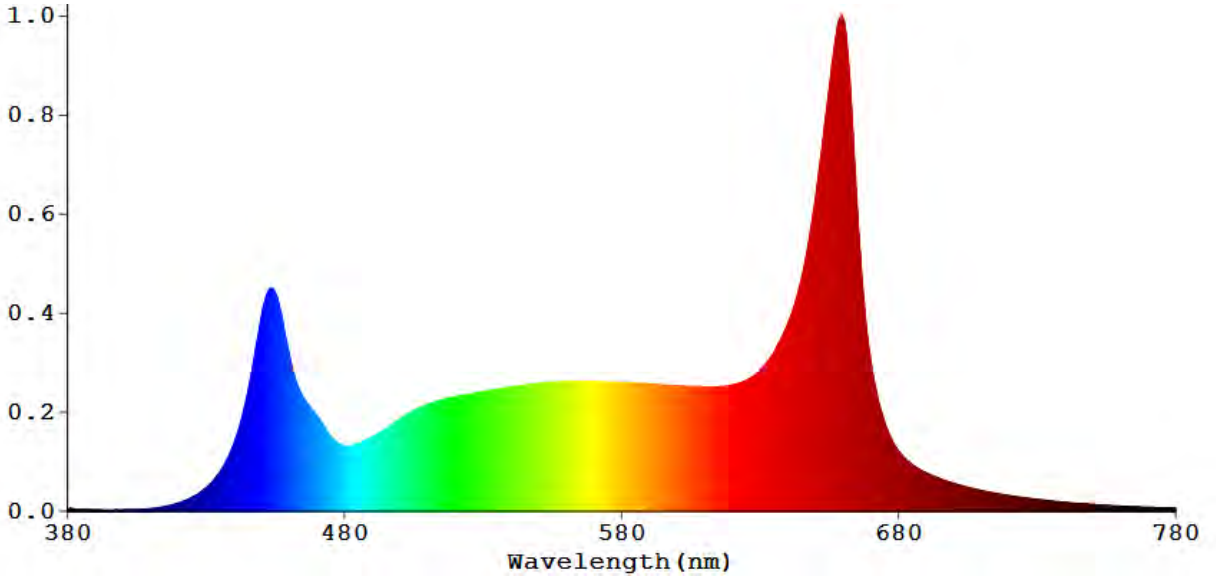
LED Lighting Dimming Curve



LED Panel

SPDU

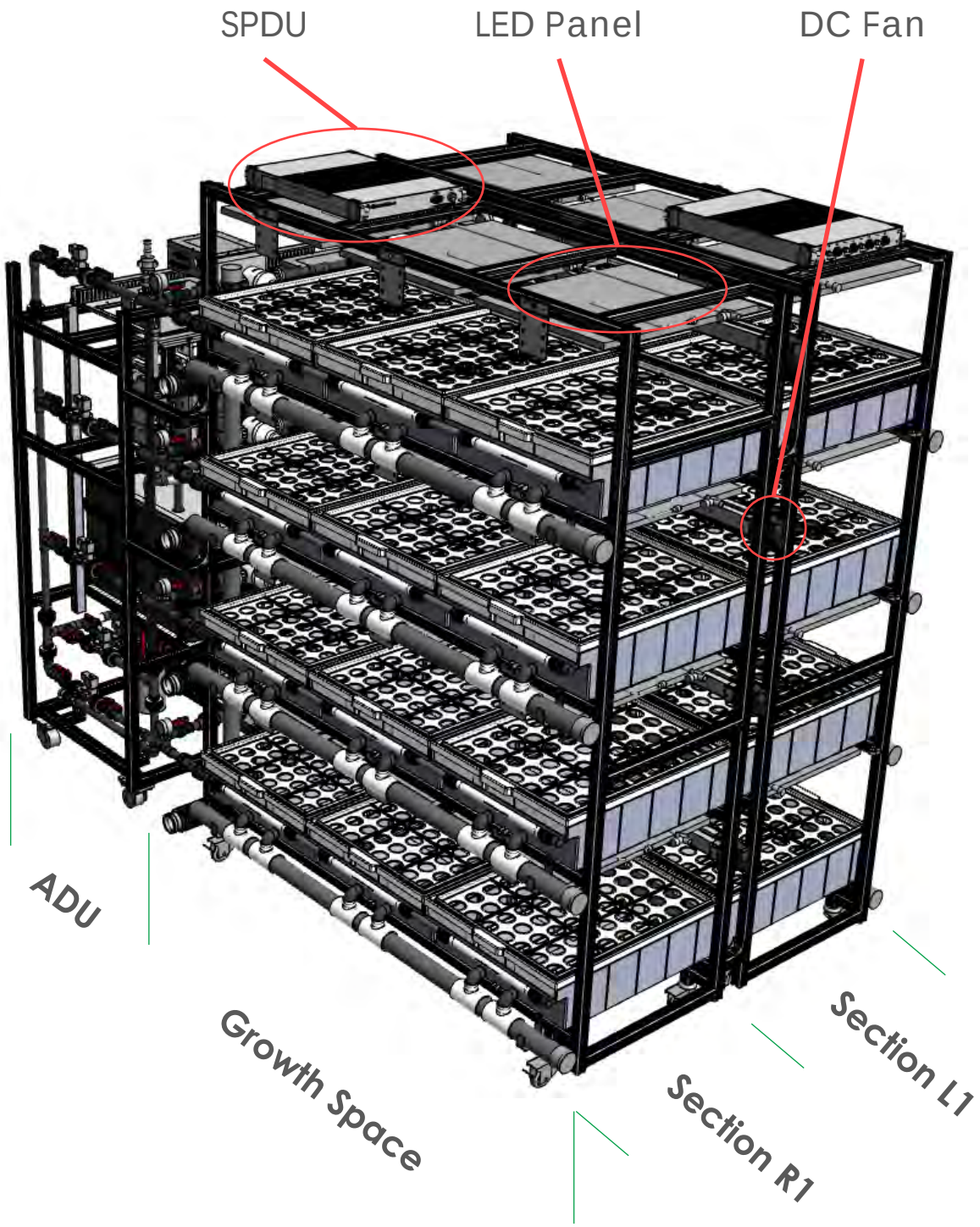
LED Lighting Spectrum



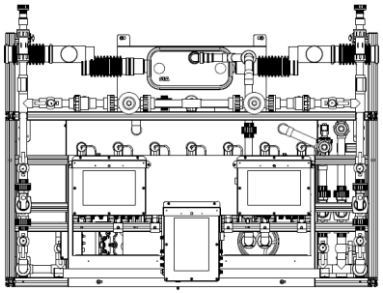
1. @ 100% light intensity in the Ætrium-2.1
2. With all fans running in the Ætrium-2.1

SmartFarm LED Lights in the Ætrium-2.1

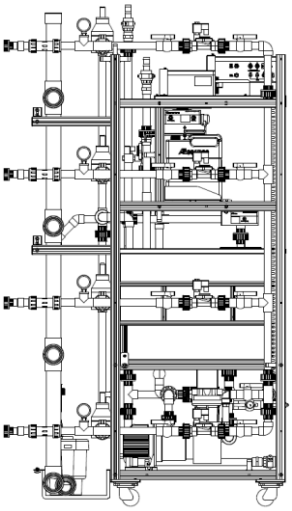
Each SmartFarm sectional grow space contains one Sectional Power Distribution Unit (SPDU) and 12 LED panels. The SPDUs are able to drive 12 LED lists and four 24V DC fans. Each SmartFarm LED light serves one Ætrium-2.1 tray.



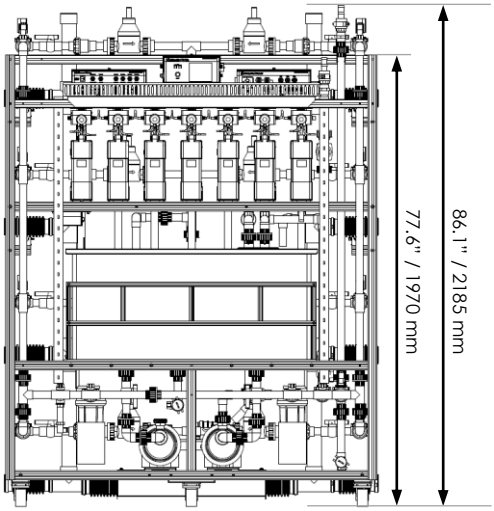
Ætrium-2.1 ADU Mechanical Design



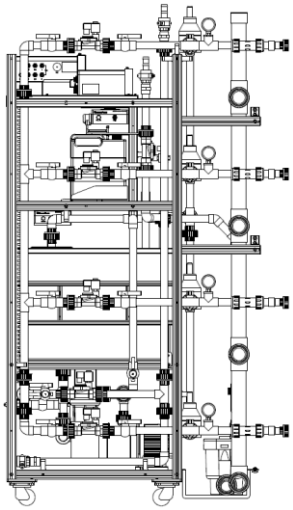
Top View



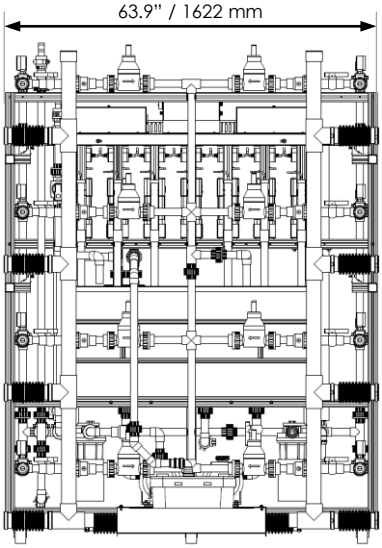
Left Side View



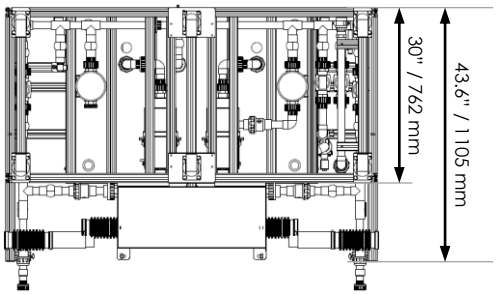
Front View



Right Side View

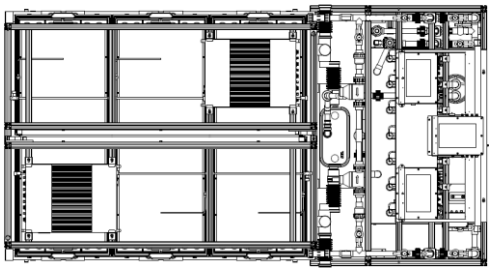


Rear View

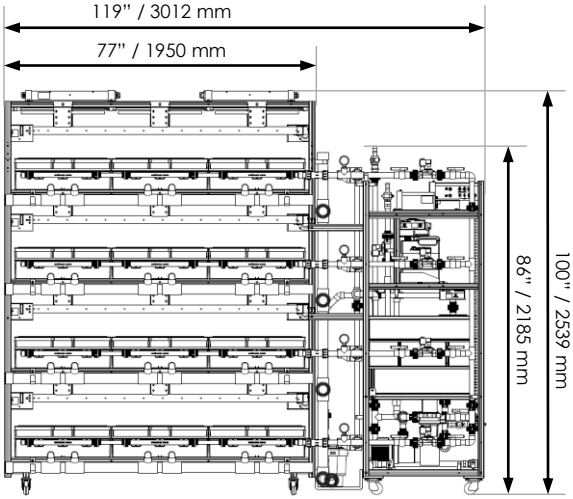


Bottom View

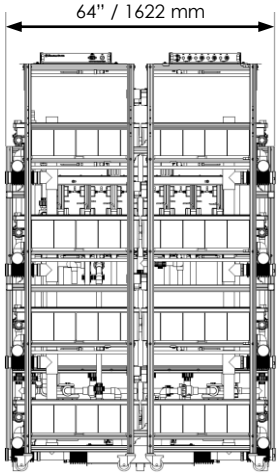
24-Tray Ætrium-2.1 Mechanical Design



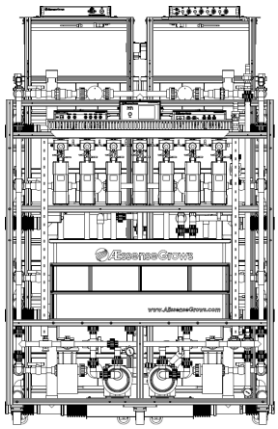
Top View



Side View

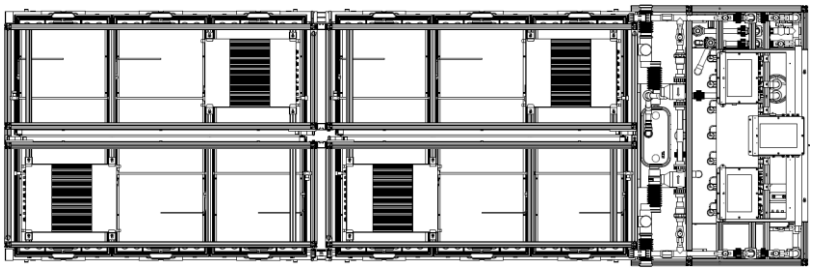


Rear View

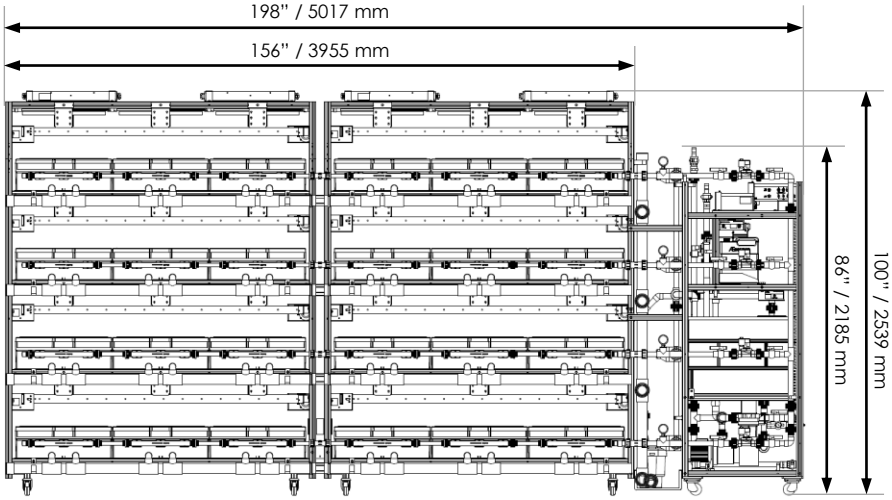


Front View

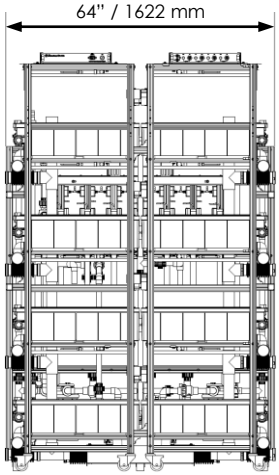
48-Tray Ætrium-2.1 Mechanical Design



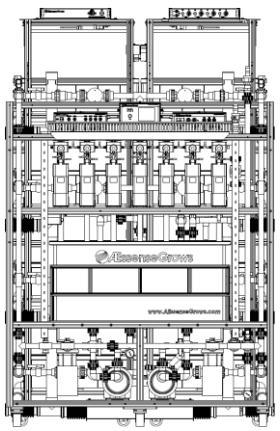
Top View



Side View

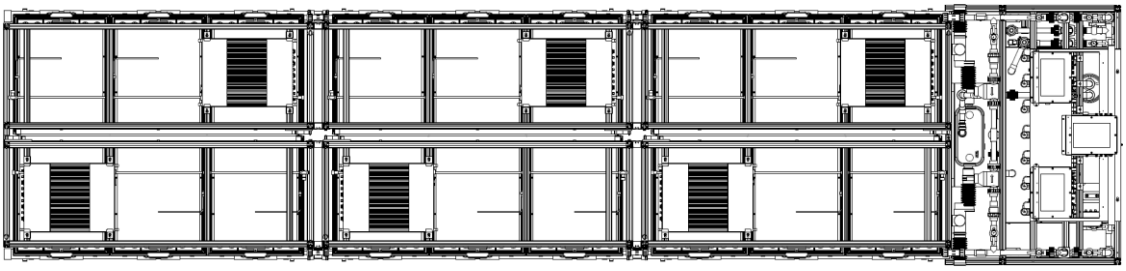


Rear View

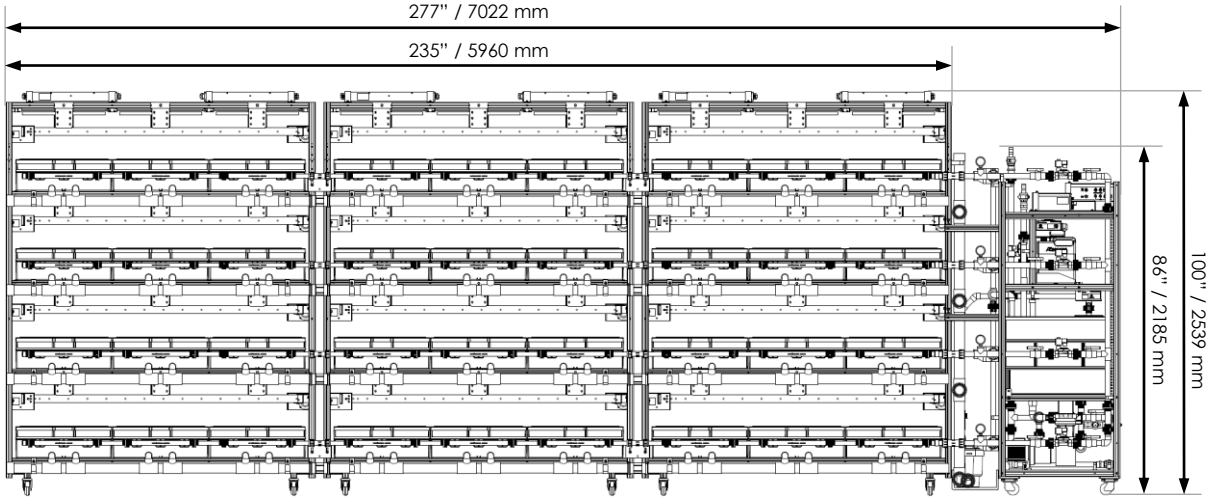


Front View

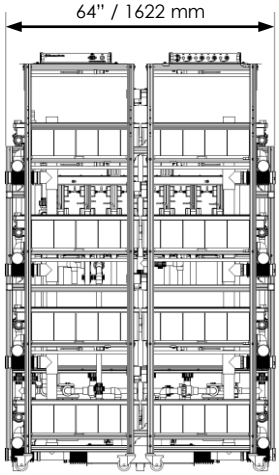
72-Tray Ætrium-2.1 Mechanical Design



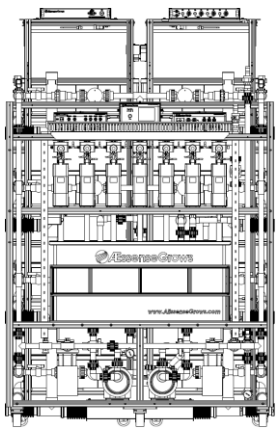
Top View



Side View

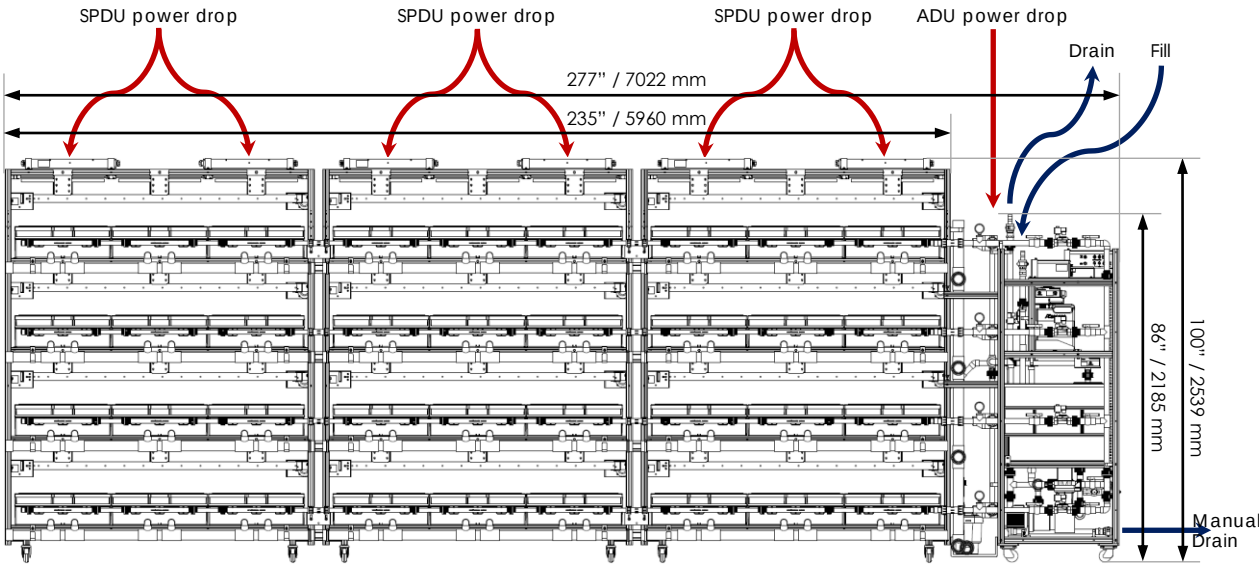


Rear View

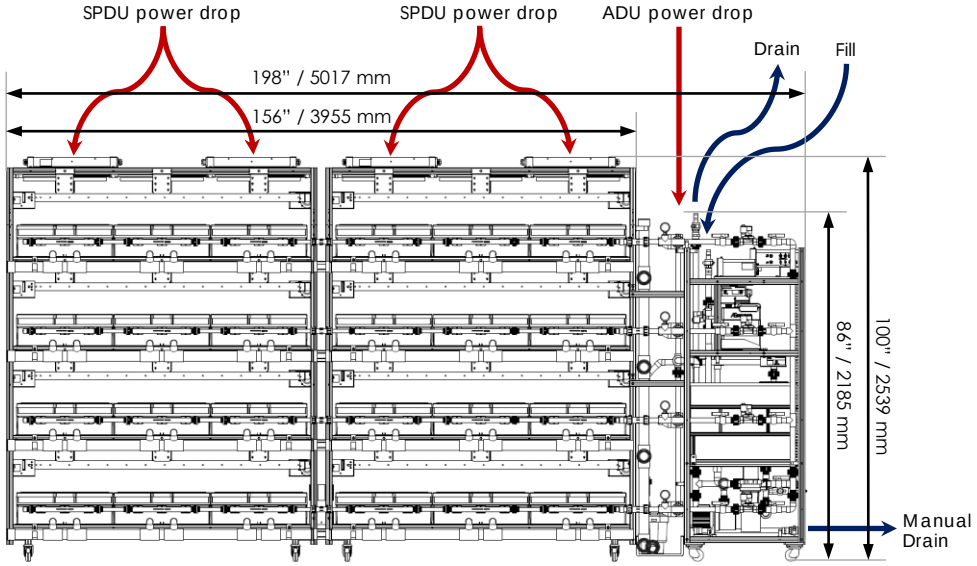


Front View

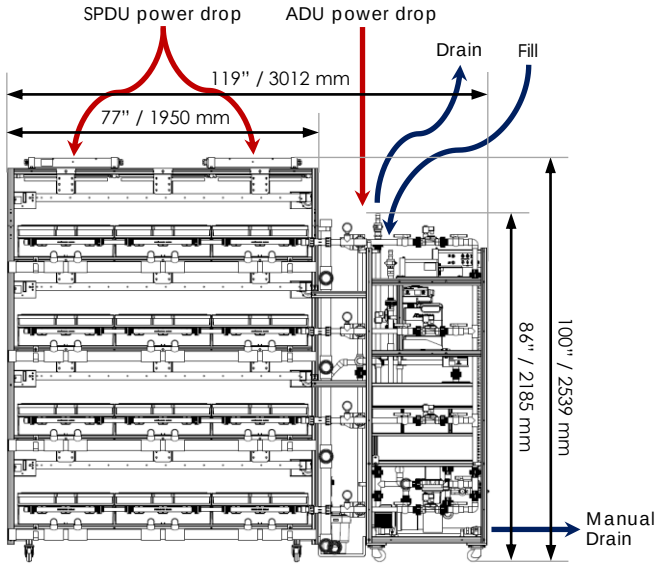
72-Tray Ætrium-2.1



48-Tray Ætrium-2.1



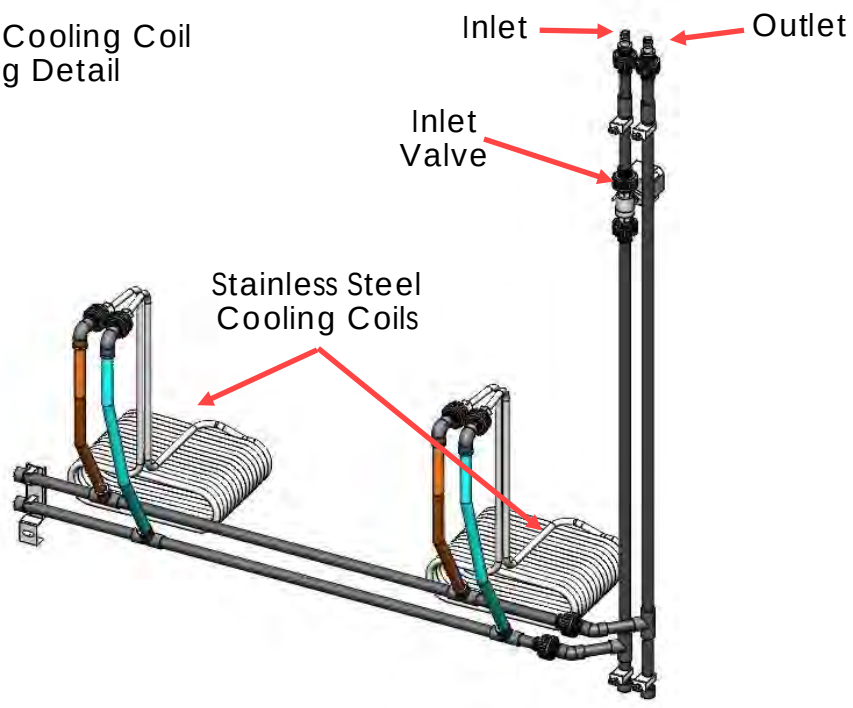
24-Tray Ætrium-2.1



Ætrium-2.1 Liquid Line Connections

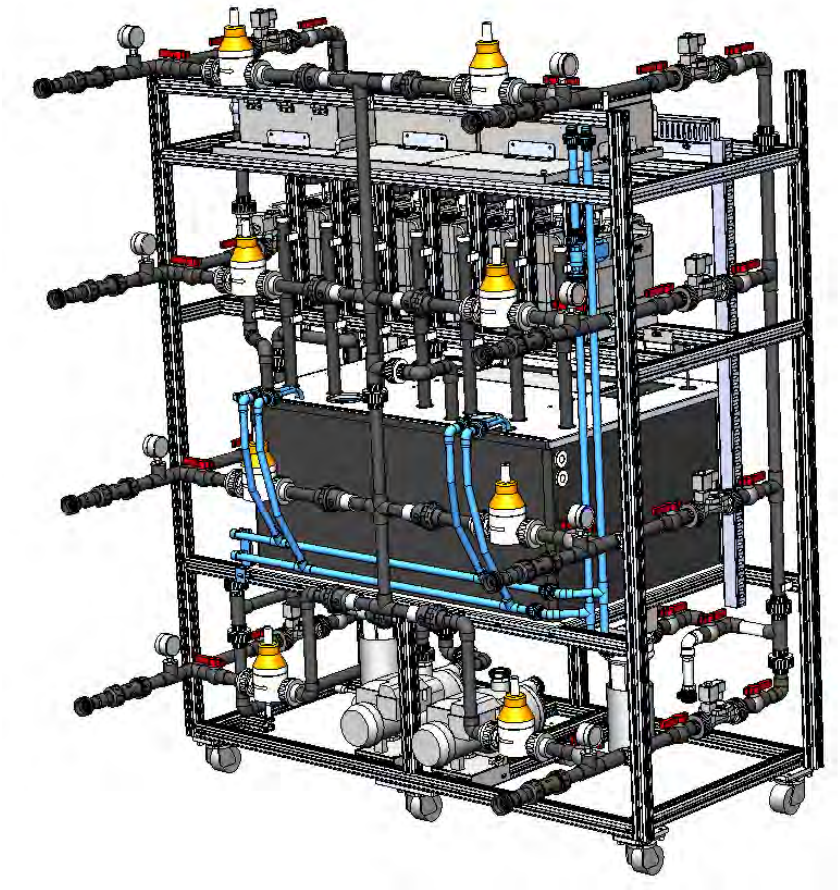
- Flexible lines allow the AEtrium-2.1 rows to move

Optional Cooling Coil Piping Detail



Rear View of ADU and Reservoir

(cooling coil pipes in blue)



Typical Ætrium-2.1 Shipping Configuration

Major Ætrium-2.1 components	Dimensions (L x W x H)	Weight
ADU on pallet	64.5" x 31.25" x 83.5" (1638 x 794 x 2121mm)	525 lbs (238 kg)
ADU off of pallet (shipping configuration)	64.5" x 31.25" x 77.5" (1638 x 794 x 1969mm)	
Growth Space Module (with top layer broken down) on pallet	78.25" x 31" x 88.5" (1988 x 787 x 2247mm)	705 lbs (320 kg)
Growth Space Module (with top layer broken down) off pallet	78.25" x 31" x 83" (1988 x 787 x 2108mm)	
Wood Crate of Parts on pallet	50" x 36" x 54" (1270 x 914 x 1372mm)	655 lbs (297 kg)

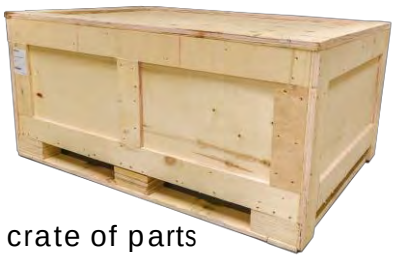
Ætrium-2.1 Shipping and installation

The ADU ships on a pallet and each of the Growth Space modules ship on a pallet. A 24 tray unit ships on 3 pallets and a 48 tray units ships on 5 pallets. It is recommended to unload the AEtrium-2.1 components from their pallets using a forklift. Once unloaded from the pallets the ADU and growth space modules will roll on pre-installed casters. The Growth Space modules are shipped with the top layer broken down so that they are not too tall to fit in shipping containers. It's easily lifted to its final position using two people during assembly.

- Door size for installation: Grow room doors are recommended to be at least 84'' x 36'' (2286 x 914mm) to accommodate moving in the AEtrium-2.1 when it is depalletized.

ADU on pallet

One Growth Space Module on pallet



Wood crate of parts

Emergency Box

Should the ADU suffer a complete failure, the emergency box allows one to fertigate the multiple levels automatically for two minutes each (period is not changeable). Disconnect the fertigation solenoids from the ADU and hook them up to the emergency box to allow fertigation to take place until the ADU is repaired. The same emergency box can be used on both the AEtrium-2.1 and AEtrium-4 Double-Deck. One recommended per facility.

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