

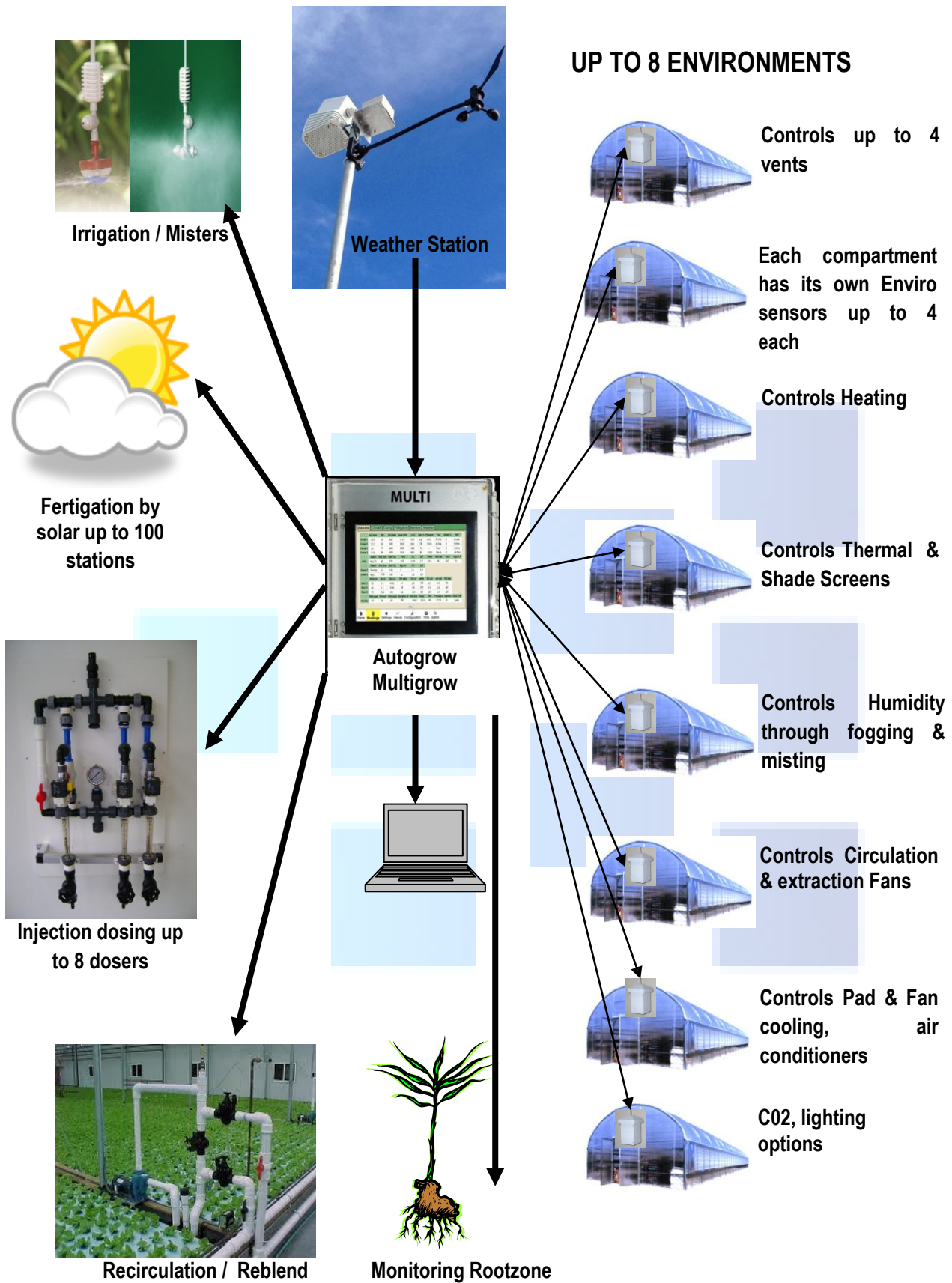
Autogrow MULTIGROW

A new modular system from Autogrow Systems Ltd which caters to all levels of grower requirements:-

- **Climate control**
- **Fertigation control**
- **Hydroponic dosing**
- **Simple to advanced**
- **Single or multi compartment**
- **Serves web pages to PC LAN or WIFI tablet**
- **Uses ultra-reliable CANfree™ technology**



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What it can do

By adding appropriate peripheral devices and software modules the system can be configured to provide climate, fertigation, dosing, batching, irrigation and monitoring functions up to the following limits:-

- **Up to 8 Climate compartments (three styles (i) vented, (ii) fan/pad and (iii) aircon)**
- **Up to 8 Dosing and batching systems**
- **1 Fertigation + re-blend**
- **Up to 8 Root-Zone monitoring and analysis systems**

The hardware modules and software modules are sold separately so that a user with large complex requirements will pay appropriately more than a small user with simple requirements.

Key Features

A low cost multi-compartment system with Fertigation

Pay for what you use. This is a very smart and expandable system. By adding hardware expansion modules and firmware modules you can build a system that is a perfect fit for your needs. Expensive customization is **NOT** needed to do this.

System designed for maximum reliability

For example, communication busses are extensively protected against voltage spikes and in the event of a module failure it will remove itself from the bus using CANfree™ to prevent any interference with remaining modules. The controller will detect this and even though the system may continue to operate satisfactorily, a warning alarm will be set.

System designed for ease of use

Although this system has some very advanced features we have made every effort to keep the user interface as easy to use as possible.

Systems designed for ease of service

Should a system component ever require servicing all parts are designed for ease of replacement.

Systems designed for ease of upgrade

As the controllers have Ethernet ports to connect them to a PC it is very easy to re-flash the controller with updated software or to apply upgrades to the functionality. This provides reassurance to the grower that if their needs ever change, it is easy to add new functions.

Output modules use true overrides. Unlike many other systems the output modules have override switches that provide **TRUE** overrides by connecting the power supply directly to the output without the need for any electronics. In addition, **every output is monitored** so that the controller can track the output even when on manual. This means that vents and screens will not get out of synch when manually operated.

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Examples of Smart Features

Sunrise and sunset may be user set by time-of-day or else derived from an astronomical clock using longitude and latitude that takes into account seasonal changes. Time zones and irrigation start stop times may be set as offsets from these times.

Smart vents use PID algorithms to position quickly and eliminate error. Vents have influences for humidity and solar radiation. When closed in cold conditions a proportional minimum crack is applied for humidity. Multi-stage wind and rain overrides protect crop and structure protection.

Smart pipe temperature. With hydroponic heating the minimum pipe temperature is influenced by humidity, solar radiation and outside heat-loss factor and uses PID control for accurate and fast positioning.

Irrigation start and stop times may be set as offsets from sunrise and sunset and may even take into account accumulated solar radiation to automatically adjust these critical times thus ensuring optimal root zone conditions.

Irrigation EC can be automatically adjusted according to suit solar radiation to help ensure root zone EC is maintained at levels that suit the climatic conditions.

The self-learning fertigation system continually learns the best injection rate for each zone to ensure minimal error in EC and pH at all times.

Smart screens automatically adjust to keep internal levels within set targets. After a cold night they will open in small steps to avoid shock from spilling cold air onto the crop. They also have a proportional crack response to high humidity conditions.

Smart negative pressure evaporative cooling. The system can be set up to automatically adjust vents and fans to generate a targeted negative air pressure to use in conjunction with fogging and air exhaust.

Smart Auto switch over from passive cooling (air vents) to active cooling (evaporative or heat pump)

Smart error detection, reporting and fail safe operation. Where possible slightly imperfect operation is detected and reported. If a total failure occurs smart fail safe routines kick into action to reduce the impact and alarms are activated immediately. If a GSM modem is fitted the system will send informative TXT messages to the grower, also a web based system may be used to alert alarms via the local wifi network. As an example of fail safe operation we will assume that the controller loses contact with all temperature/humidity sensors in a compartment. The system can be set so when this is detected it mimics the operation of a similar compartment. Where this is not possible it uses the outside conditions to generate a best guess at suitable vent and heater settings.

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HARDWARE

Multi function controller with 12" touch screen or P.C./tablet options

- **Enviro sensor mini** (Temp/RH/Solar watts) (maximum of 16 per controller)
OR Enviro sensor maxi (Temp/RH/Press/CO2 – external light PAR and W)
- **Remote EC/pH/Temp/moisture module** (maximum of 16 per controller)
- **Weather station (1 or 2)**
 - with wind spd/dir, Temp, RH, solar PAR and Watts, rain sense, optional pluviometer
- **Output expander with DIRECT manual override and FEEDBACK** for 10 outputs.
(Direct override means that it does not rely on any electronics and feedback means that when operated on manual the vents/screens do not lose synchronisation so the reported position is always correct)
 - triac single outputs, - relay single outputs, - relay 4 bi-directional + 2 single
- **Analogue** hardware module (4 IN, 4 OUT) – used for interfacing to third party sensors and variable speed (0..10V) fans etc



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SOFTWARE MODULES

MULTI-OPERATING SYSTEM - required for all system that have multiple compartments or Climate + Dosing or Fertigation)

Climate

Each compartment
PC comms module CLIMATE (web server) for each compartment
Vent manager - SIMPLE (Temp proportional + Rain, wind overrides) per compartment
Vent manager - SMART (PID with Influences for RH, solar) per compartment
Vent module for each vent
Heating on/off
Heating hydronic (each compartment)
Heating hydronic ring main control
Fogging - pump and trigger
Fogging - each zone valve
Each sprinkler zone - 1..4 outputs timed or solar integrated - individual set
HAF fans
Each smart screen (humidity var crack, stepped opening, inside / outside)
Extraction fans each bank simple switching temp offset On/Off
Extraction fans 3 speed (prop to error from target)
Extraction fans var speed (0..10V)
Pad vent and water control (smart water control between RH limits)
Autochange negative pressure - fan control and vent adjust
Autochange vent to fan pad
CO2 simple
CO2 burner
Heat pump switch over and control
Lighting control timed each bank
Lighting control supplemental

Fertigation

PC comms module FERTI
Channels A,B,C,D,pH,Chem
trigger groups
Irrig zones
Filter flush timed OR Filter flush pressure
Calendar schedule

DOSE/batch

Each dosing system
PC comms module DOSE
Channels A,B,C Acid, alk
Tank batch and irrig pump control
Irrig zones
heat pump control
Calendar schedule

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System Limits

1 or 2 Weather Stations (2nd one provides fail safe operation)

8 Climate Compartments

- 4 enviro sensors per compartment (max of 16 per system)
- I/O expanders (max 16 per system = 160 outputs)
- 6 vents per compartment , 32 per system
- 2 screens (max 8 per system) (inside or out)
- 4 fog zones (max 16 per system)
- 2 ON/OFF heaters (max 8 per system)
- 1 hydronic heating (max 8 per system)
- 1 heat pump (max 8 per system)
- 1 CO2 (max 8 per system)
- 2 banks lighting (max 8 per system)

1 Fertigation system

- Solar integrated trigger with timer override (10 groups)
- smart (solar and time based) start and stop times
- EC auto adjust based on solar
- 10 channels with variable ration (eg 50%A, 70%B, 80%C etc)
- 10 start groups
- 300 irrig zones
- blender option for recirculation
- 3 EC/Ph/moist sensors maximum 1 input, 2 output
- smart alarms
- 2 pumps
- pump protection (no flow or low pressure)
- water meter input

8 Dosers

- channels A,B,C... 8max (variable ratio)
- proportional or timed dosing
- batch function
- irrig zones 100 total

4 Monitoring systems (MINDERS)

Each has

- 2 moisture sensors
- 2 temperature sensors
- 2 EC and pH probes
- 2 pulse water quantity inputs

The above can be combined in any combination providing the following are not exceeded

Peripheral maximum

Enviro sensors 16

(mini enviro sensor with built-in light and/or maxi with CO2, pressure and external light)

EC/pH/moisture 16

Pipe temp/ general purpose temperature sensor 16

Outputs total 160 (320 with special hardware)

Analogue 64 in, 64 out

Weather stations 1 is normal but 2 possible to provide backup.

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System Overview

The Autogrow MULTIGROW system is a particularly flexible system that can be configured to perform Climate Control, Fertigation, Dosing, Batching, Irrigation and system monitoring.

When fully configured the controller can support a system with up to 8 Climate compartments PLUS up to 8 Dosing/batching/irrigation systems PLUS a full function Fertigation system with built-in re-blend and calendar scheduling. On top of all this it can incorporate an advanced monitoring system for root-zone, drain water and aerial environment.

Although the system has some very advanced features it is also very simple to operate and is available in a range of languages. By connecting via Ethernet onto a local PC network or WIFI hub the controller can serve user friendly interactive web pages to any computer or tablet on the network. In addition, any future firmware upgrades can be easily downloaded from the internet by the user and will self-install. The original firmware will be retained and if the new operation is not as expected, the user may revert to the original. In fact, restore points may be set at any time and may also be set to automatically save a restore point periodically – perhaps once per month.

There are 3 possible ways of viewing and adjusting the controller :

1. 12" Touch screen with interface in a waterproof box. This is a robust industrial grade touch screen in full colour.
2. Screenless controller that is viewed by a LCD computer screen attached via VGA, and controller by a wireless keyboard and mouse which attaches via a USB cord. This saves about \$1250 from option 1 but the cost of screen, keyboard and mouse are extra.
3. Screenless controller viewed and adjusted using a tablet such as an iPad or Android tablet. It is configured best for a 10" screen but will work down to the size of a Smartphone. A wireless hub needs to be created when using a tablet so the cost of the router is extra.

Having a WIFI tablet computer close to the controller as well as a PC in the central office provides the best possible access to the system.

The controller has 10 outputs built-in making it immediately suitable for simple applications without any expansion. However, by adding Output Expansion Modules the outputs can be increased in steps of 10 to a maximum of 160 outputs. Similarly, by adding input modules (environment sensors, dosing sensors, analogue I/O etc) the input capability can be expanded, virtually, at will. The output expanders also provide TRUE overrides to the outputs and these switches are monitored and fed back to the controller so that even when vents or screens have been manually moved the controller can keep track of their position.

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The communication busses

The Autogrow MULTIGROW controller has three communications busses as follows:-

- Ethernet port to connect to a computer network. The controller serves web pages to any PC on the network which only required a standard web browser. This will be structured to allow the use of a 7" or 10" tablet.
- One CAN bus connects to the one or two weather stations. This CAN bus may be connected to multiple controllers if desired but if all controllers are Ethernet connected then this is not strictly necessary as any controller accessing weather information will re-broadcast it over the network. The CAN bus is well protected against voltage spikes and, in the controller, is connected via an easily replaced daughter board in case it is ever damaged by a lightning event.
- A second CAN bus connects each controller with its local peripherals such as aspirated environment sensor boxes (temp/RH/solar/CO2/pressure), dosing sensors (EC/pH/moisture), output expansion modules (with true overrides), analogue I/O modules etc. The controller has a smart method of switching over between the two CAN daughter boards should one ever fail and all devices on the bus have a fail-safe CANfree™ circuit which detaches them from the bus in the event of a failure thus freeing the bus to continue working with remaining devices.

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