

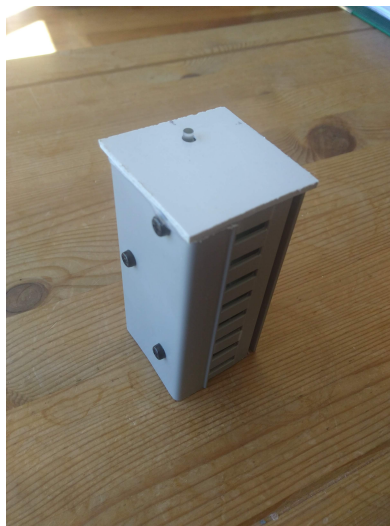
Ystumtec Ltd.

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## GH1: Wireless Greenhouse Monitor user guide (V0.1)

Pant y chwarel, Ystumtuen, Ceredigion, SY23 3AF, UK

July 8, 2018



### 1 Overview

This low-cost and simple to use greenhouse monitoring system senses air temperature, relative humidity and light level at multiple locations using standalone modules and relays the data wirelessly to a central logging station. Each module has a serial number marked on the outside of the case and the data that it transmits will be labelled accordingly. The data is stored in a CSV file on the uSD card in the logging station, and is also output using TTL level serial signals for use by a computer, microcontroller or other system if required. A single logging station can log data from up to 254

modules. Multiple logging stations (using different radio channels) can operate in the same area if required. Each module also has the ability to read two additional sensors that can be plugged into the PCB by popping open the case (see instructions below). These are intended to be compatible with a Dallas 1Wire DS18B20 temperature sensor for soil/water temperature monitoring and a vegetronix VH400 soil moisture probe. These sensors can be purchased separately. Data is transmitted approximately once per minute by each module. Under normal circumstances data transmission is very reliable, but if large numbers of modules are in use and/or the environment is very obstructed by metallic obstacles then some data may not be received by the logging station. You may wish to experiment with the positioning of the modules and logging station in order to obtain the desired performance.

Each module is powered from an internal NiMH battery which will need recharging after 6-12 months of operation. The battery voltage in each sensor is transmitted along with the sensor data, so that the charge state can be monitored and recharging can be undertaken only when required.

In order to use the system the following steps are required:

1. Decide where you want to place the logging station. Plug in the power supply to the mains outlet for the logging station, connect the power cable to the logging station and turn it on. Ideally a location that has a line-of-sight view of all of the monitors in use should be selected, although some experimentation will show if any monitors are failing to communicate and allow an appropriate position to be selected. The logging station uses a GPS module to obtain the date and time, so requires sufficient view of the sky for it to receive signals from GPS satellites. Because the GPS is not used for positioning the view of the sky can simply be through a window or other aperture. It will take several minutes for the logging station to obtain the date and time after being powered on: data collected prior to this will not have the correct date and time stamp.
2. Decide where you wish to place the sensing modules and attach them using double-sided tape or string, or simply stand them where required. Ensure that you note where each sensor has been placed for future reference. Try not to select locations that are very close to metallic structures, and try to ensure that they have a relatively clear line-of-sight view of the position of the logging station. Foliage does not block the signal under normal circumstances unless it is very dense and/or many 10s of metres from the logging station.
3. Allow the system to run for at least five minutes and examine the data that has been collected (pop out the uSD card and insert it into a laptop or other device to view the CSV file "LOG.TXT" to see which modules have successfully transmitted data.

We recommend experimenting with the sensor module locations: variations of temperature, humidity and light level within a greenhouse can be extreme.

The sensor module housings are designed to resist water that drips vertically (or at angles of 15° maximum), and high humidity, but should not be placed where they are likely to be sprayed horizontally or from beneath. If the sensors are operated for long periods in very humid conditions (>90% RH such as in a "tropical" glasshouse for more than 1 month) then they should be taken out of service once every six months, have their battery disconnected and the module should be placed in



an 80°C <15% humidity environment for 12 hours. This will allow the humidity sensor to recover its calibration and reduce/remove any offset that has accumulated.

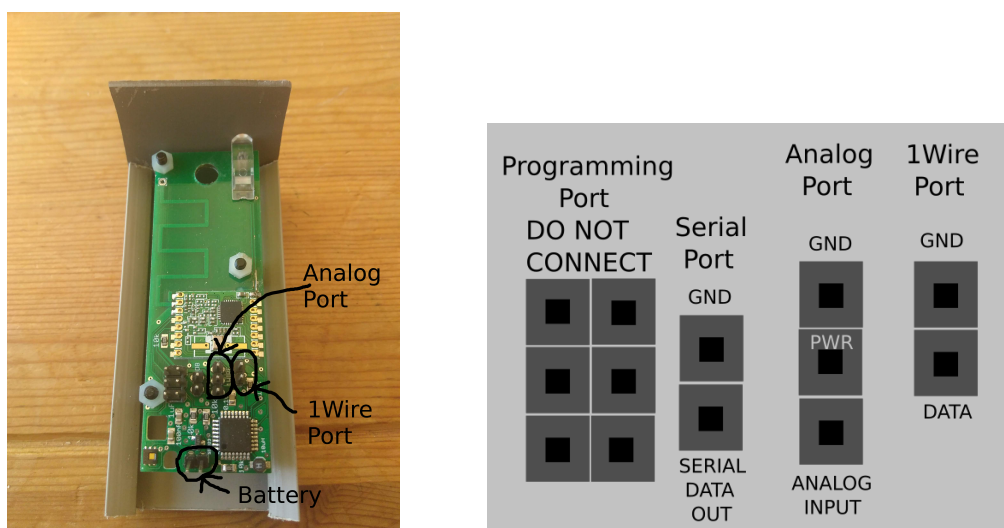


Figure 1: Unclip the front of the housing to reveal the PCB and connection ports. Do not connect anything to the 6 pin programming header as it may damage the module. The ports for connection of a VH400 (analog port) and DS18B20 (1Wire) port can be seen in the image.

## 2 Physical Considerations

The modules are not intended for outdoor use and are rated as IP22. This means that they will withstand near-vertical water drops, and will withstand gentle impacts from large, blunt instruments. They are inherently delicate. The electronics are coated in a waterproof layer and are intended to withstand high humidity. When batteries are disconnected and reconnected for recharging you will notice that they are slightly “greasy”, this is because the contacts have been coated lightly in Vaseline. When you connect or disconnect batteries or sensors you should apply a light smear of Vaseline to all connectors to help prevent corrosion.

## 3 File format

When working correctly the uSD card in the logging station should contain 1 file in the root folder. Any other files and folders will be ignored.

**LOG.TXT** which will contain the readings that have been made by the modules from which data is being received. Each line contains the ID of the module, the date and time, the light levels (three values for the red, green and blue bands: arbitrary values), the overall light level (in lux), the air temperature (in Centigrade), the relative humidity (in %), the reading from the

DS18B20 soil temperature probe, if fitted(in Centigrade) and the reading from the soil moisture probe, if fitted (as volumetric water content). These are all separated by commas as in this example that has two monitors, neither of which is fitted with a VH400 or DS18B20:

```
3, 13/5/18, 13:45:28, 4C7, 7F4, 3FE, 23024, 23.76, 56.7, -99, 0  
2, 13/5/18, 13:45:47, 2F2, 5DA, 23A, 13184, 21.53, 62.8, -99, 0  
3, 13/5/18, 13:46:29, 3F7, 701, 29A, 19340, 22.50, 56.4, -99, 0  
2, 13/5/18, 13:46:48, 3A2, 6D4, 21F, 15154, 21.82, 63.5, -99, 0
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