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ARGUS ADVISOR

Information for Argus Control System Owners

We usually focus on controlling processes to optimize performance and efficiency, but in this edition of the Argus advisor we look at the other side: What happens when we encounter equipment limitations that prevent us from achieving your objectives?

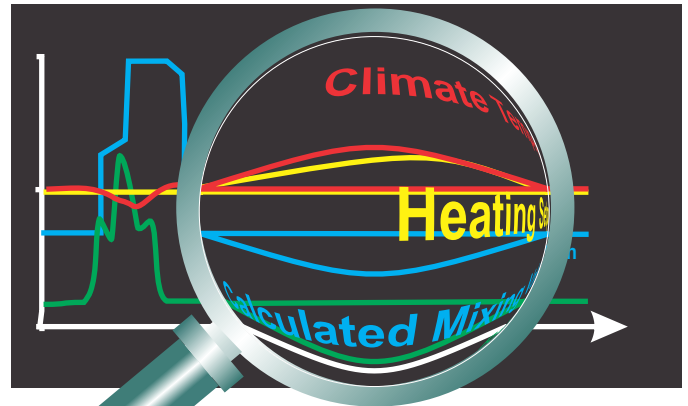
Sometimes the most important control decisions are made when you select your equipment. While we can 'work around' some limitations, a much better solution is proper system design and equipment selection in the first place. Other performance limitations are imposed by fundamental relationships such as those described in a psychrometric chart. You can't change these rules, but you can learn to work within them.

On a separate topic, over the last year or two we have noted increasing interest in extracting summary management information from the Argus control system. In this issue we offer some ideas to help you to collect and report useful management information.

Best wishes to all for the coming New Year.

Alec Mackenzie

Using Your Argus System for Management Reporting



There are many ways to use the power of your Argus system to provide valuable management information. The large amount of data collected by your system contains all sorts of useful information for keeping track of everything from energy costs, equipment wear, and crop development. Argus provides several powerful tools to help you 'mine' this data.

You can use your Argus system to calculate values related to direct growth management such as **DLI** (Daily Light Integrals), **ADT** (Average Daily Temperatures), and all sorts of other custom calculations and tabulations based on controller data. You can also perform highly selective data filtering tasks such as only accumulating light values during designated time windows, or only when the light levels exceed a certain threshold.

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Take Control With Argus

Management Information cont'd...

Calculated values developed in the controllers can be treated the same as any other system parameter. You can record them for graphical and tabular analysis, accumulate them over time, and set management alarms to let you know when designated thresholds have been reached. You can even use them in direct control applications such as irrigation, heating, or lighting decisions.

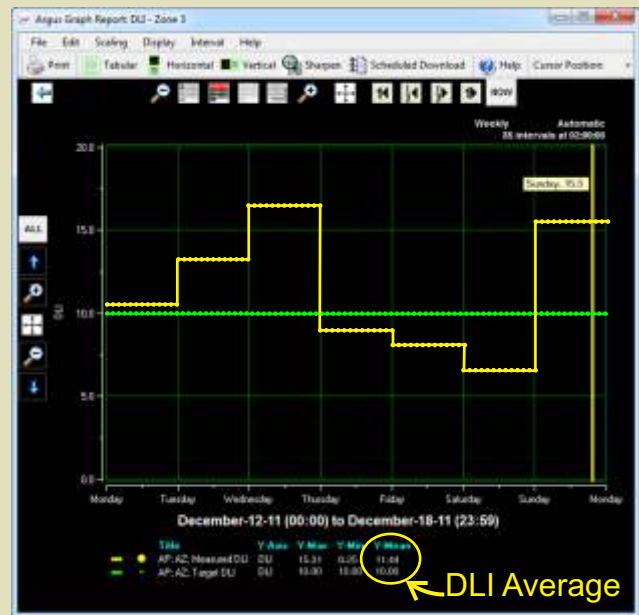
Instead of offering just a few 'canned' reports, Argus provides a highly flexible graphing program and a powerful set of tools for collecting, summarizing, and mathematically manipulating any parameters on your control system to suit your purposes. For example, you can track how many minutes per day your exhaust fans are operating or the daily amounts of water used. You can also use optional math functions to make energy or cost extrapolations based on equipment running times, flow rates, on/off cycles, etc.

For quick data analysis, try using the **Argus Graph** program to calculate and display average values for the selected time periods. Pan or zoom the displayed graph to align with a time period of interest and then read the average, maximum, and minimum values from the legend.

Your ability to collect, summarize, and extrapolate management information from your Argus system is mainly limited by your system configuration. Some values can be directly calculated from your control applications, while others may require additional inputs and sensors. For example, it is often possible to use the firing time of unit heaters to approximate relative fuel use over time. While not as accurate as direct fuel measurement, this type of information can be extremely useful for tracking energy use and for detecting potential problems early.

As with all information calculated and recorded in the controllers, you can export data sets for additional use in your own custom spreadsheets and other management information programs.

Daily Light Integral (mol·m⁻²·d⁻¹)



Calculated **DLI** (Daily Light Integral) is just one example of the valuable information that you can extract from your Argus system. DLI is typically calculated from the daily accumulation of PAR light levels measured at the top of the crop canopy. It can be very useful for estimating crop timing, yields, and evaluating the need for supplemental lighting. Alternatively, your HID lighting control application could also be programmed to maintain a minimum DLI.

The above example shows that over a seven day period the recorded DLI (the yellow line) fell below the 10 mol·m⁻²·d⁻¹ target (the green line) on three of those days. However, the average DLI for the week (11.44) as calculated by the **Argus Graph** program is above the minimum DLI target level.

Note for Argus Classic System Owners:

Even though the Argus Titan system contains many enhanced data collection and data manipulation features compared to Argus Classic systems, the basic Graphing, Event Recording, and Math functions are essentially the same. The major difference is in the number of items that can be recorded, the sampling resolution, and the ability to further manipulate and filter calculated values. Call Argus for more information on available upgrades and options.

Design Limitations and Control Expectations

Every facility has limits imposed by:

- The design of the structure
- The selected equipment
- External climate variables

These physical constraints determine the limits of control. For example, you cannot use air exchange alone to cool your greenhouse below the current outdoor temperature. To achieve this, you need some help from the plants (transpiration), supplementary evaporative cooling (mist, fog, or pad & fan systems), or mechanical refrigeration.

Likewise, your Argus system can't get any more heat out of your boiler than it is capable of providing. Commercial greenhouses are seldom outfitted or sized with the equipment necessary to maintain all the desired climate targets under all circumstances. This is because the additional capital investment and the cost of the energy required would exceed the potential benefit.

It's important to stress that these are not control limitations. There is no limit to the amount of cooling or heating that could be controlled by the Argus system if it were available.

While the physical limitations of your heating and cooling equipment are easy enough to understand and separate from control issues, there are other limitations that are not as obvious. For example, despite having ample amounts of fog or mist available, you may still have problems maintaining high humidities at times of the year when it is very cold. There are at least three reasons for this:

1. **Your greenhouse is working against you.**

Despite your best efforts, the cold greenhouse glazing surface acts as a giant condenser, changing large quantities of water vapor back into liquid water. This same principle is used for dehumidification in air conditioner chiller coils!

2. **Air leaks** - even with the tightest greenhouses, there is always some infiltration of outside air. Since cold air

cannot hold as much water vapor as warm air, it will tend to lower the relative humidity when it mixes with the greenhouse air.

3. **Diminishing returns** - the closer you get to the saturation point of air, the harder it is to make more water evaporate into it. Consequently, even though you may be introducing plenty of water droplets into the environment, most of them will not completely evaporate. They will just float about as liquid water drops until they come in contact with plant and greenhouse surfaces. In such cases, more mist does not actually produce higher humidity. It certainly does result in a wetter greenhouse!

Again, these limits are not imposed by your control system or even your mist equipment - they are caused by the greenhouse structure, the weather circumstances, and complex air/water relationships known as **psychrometrics**. Even if you operate your mist or fog system continuously, you may never achieve the highest humidities under such circumstances. You'll probably still need to install additional poly screens or tenting to help mitigate the effects of cold glazing and air infiltration.

Psychrometry and the Psychrometric Chart

Air/water relationships are complex and your first look at any psychrometric chart may well scare you enough to never want to know more. However, the chart actually makes it easier to understand how air pressure, air temperature, and moisture content are related. Your Argus system uses the underlying mathematical relationships of psychrometry to calculate the current dewpoint temperature, VPD, and relative humidity.

You can learn more about using a psychrometric chart here:

<http://www.abe.psu.edu/extension/factsheets/g/G83.pdf>

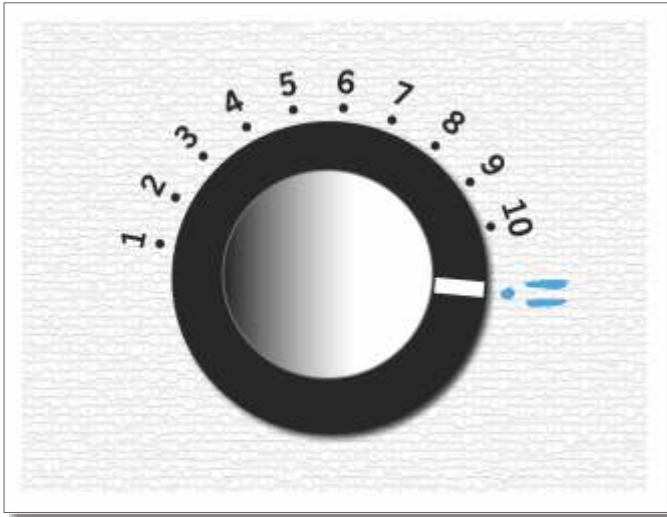
We recommend you print this document so you can see the chart in its proper orientation (it is displayed sideways in the document). There are also some free interactive psychrometric chart programs you can download from the Internet, including one from the Trane Corporation:

<http://www.trane.com/Commercial/Dna/View.aspx?i=1250>

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Control expectations cont'd...

Getting '110 Percent' From Your Facility



Your Argus system can't really provide any more than 100% of equipment capability but it can often appear to achieve the impossible by spreading out loads, starting early to 'get the jump on things', and temporarily cutting back on non-essential activities. It even anticipates these sorts of issues with settings like priority service for boiler heating systems, where less essential zones are limited whenever necessary in favor of more critical ones.

The Argus system can also execute a variety of 'Plan B' compromise strategies such as closing thermal curtains during the day, or turning on HID lighting for extra heat when light is otherwise not needed.

Sadly, much as we would like it to, your Argus system cannot perform magic. It cannot produce any effect that your facility is incapable of providing. If you are presently contending with an unmanageable or economically important limitation, your only recourse is to invest in additional equipment capacity or structural enhancements.

Argus Customer Wins International Grower of the Year



Congratulations to **Bylands Nurseries** for winning the 3rd annual **International Grower of the Year Award!**

Located in the Okanagan region of British Columbia, Canada, Bylands was recognized for playing a leading role in innovation, including their development of novel plants suitable to cold climates, new methods for transporting plants, and a strong marketing strategy that focuses on the entire horticulture chain.

The International Grower of the Year contest is organized by the International Association of Horticultural Producers (AIPH) in collaboration with FloraCulture International. The recent awards were handed out on September 27, 2011 during China's International Horticultural Exhibition in the city of Xi'an.