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## ARGUS ADVISOR

News for Argus Control System Owners

We continue to push envelopes at Argus, and this month's issue of the Argus Advisor is dedicated to our latest advancements in nutrient control applications. Over the past several years we have continually refined both our hardware and our control software for nutrient injection control applications.

Our two-pronged approach has been in response to two quite different problems. The first problem is one of accuracy, and it applies to all injection systems, particularly for in-line applications requiring high turn down ratios. To solve this we designed our Multi-Feed systems around a high reliability dual venturi manifold. This design can be easily scaled from a few gallons to thousands of gallons per minute, and the number of injection ports is variable. It also uses very few moving parts for increased reliability and ease of service.

The second problem was to develop control software powerful enough to match the capabilities and possibilities of the Multi-Feed system, yet still flexible enough to adapt to a customer's existing injection equipment. We also wanted growers to have the option of specifying nutrient recipes as either ratios of concentrate to water, or in absolute parts per million to match their style of nutrient management.

With the Titan system, we can automate any style of nutrient control application, including in-line injection, multiplexed dilute tanks, and recirculating systems. Please feel free to give us a call anytime to discuss your nutrient control requirements.

Alec Mackenzie

### Multi-Feed System at OARDC



Landscape Nursery Poplar Trials at the OARDC.

Argus partnered with the OARDC (Ohio Agricultural Research and Development Center) for testing and refinement of an Argus single-element Multi-Feed dosing system and associated Titan control components. The system is currently being used for nutrient and plant growth studies.

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### See Us at Horti Fair 2009

Once again, we will be showcasing our products and services at the annual Horti Fair in Amsterdam. If you are planning to attend, please drop by and see us Oct 13 - 16th, Hall 6, Booth 06.0101

# Take Control With Argus

The Argus single-element dosing system makes it possible for plant researchers to create nearly any fertilizer formula 'on-the-fly' provided an appropriate set of dissolved stock ingredients is used. The system features very high turndown ratios and a low resident volume allowing for quick feed changes with minimal cross-contamination and line purging.

System operators simply enter and save recipes either in elemental parts per million or as ratios of one constituent to another. These recipes are then specified in the irrigation regimes for each watered zone. This makes it possible to use a single irrigation system to supply many zones, each with their own unique fertilizer recipe.

Argus is currently installing and commissioning several new Multi-Feed systems at other research and commercial production facilities. Systems can be custom-sized for low volumes typical of research applications to very high volume commercial installations. A variety of configurations can support A+B style or single-element dosing applications.



Multi-Feed Injection setup at the OARDC

For additional information on water quality, plant nutrients, and liquid fertilizer formulations Argus has produced a [Nutrient Dosing Handbook](#). It is available for download from our web site: [www.arguscontrols.com](http://www.arguscontrols.com)

For more information on our Multi-Feed nutrient injection systems and control options please contact Argus.

## Titan Under Test

As part of the OARDC project, the Titan system was submitted to rigorous performance testing including comparisons of Titan I/O module sensor inputs against the Ohio State electronics laboratory's high accuracy Fluke 5720 NIST certified calibration standard and other calibrated instrumentation.

Test results indicate that the measured accuracy and resolution of analog inputs on Titan I/O modules is about 100 times more sensitive than many competing systems. This, combined with an extremely low noise floor makes it possible to directly connect instruments with extremely low output voltages such as light sensors and thermocouples.

In a poster presented at GreenSys 2009 by researchers from the OARDC, and OSU's Department of Food Agricultural & Biological Engineering, the system evaluators made the following conclusions:

*"The delivery volume of the unit tested works well for university or industry small scale research and development plots. The results of the evaluation proves that the Titan System is a stable and reliable state-of-the-art Nutrient Delivery System"*



Electronics Test Laboratory at Ohio State University

## Titan Multi-Feed Nutrient Control

Advanced nutrient control applications are one of the outstanding features of the new Argus Titan system. When matched with an Argus **Multi-Feed** nutrient injection system, the Titan system is capable of managing any type of automated nutrient dosing application ranging from A+B style injection to complete single element dosing.

Titan Multi-Feed systems can be configured to inject anywhere from 2 to 14 separate materials plus an acid or base. Although few customers may ever need to adjust the relative ratios of every plant nutrient, there are instances where it can be very useful to manipulate the ratios of some elements to satisfy the needs of different crops or the changing needs of a single crop. Varying the proportions of certain fertilizer ions such as the ratio of ammonium to nitrate nitrogen can also be useful for managing growth.

Multi-Feed systems are designed to provide the widest variety of different liquid feed formulations through a single multiplexed injection apparatus. For example, you can use or combine several A and B formulations as illustrated in **Figure 1**. **Figure 2** shows an example of a single element dosing setup capable of varying all of the major elements plus iron from a selection of basic stock ingredients. These are just two examples of the many possible ways that Multi-Feed systems can be configured.

## How Single Element Dosing Works

Although you certainly don't need single element dosing to make good use of a Multi-Feed nutrient injection system, we thought we'd tell you a bit more about it since the technique is still relatively limited in commercial horticulture. While there have been some experimental and commercial systems in the past, the equipment required was highly specialized and complex.

By contrast, the Argus Multi-Feed injection system is an industrial quality injection system that is capable of all types of nutrient injection tasks *including* single element dosing. You can even combine A+B style and single element dosing applications on the same system!

With a suitable selection of basic stock fertilizer salts such as calcium nitrate, potassium nitrate, magnesium sulfate etc., each located in separate stock tanks, the Titan Multi-Feed system can prepare nearly any fertilizer recipe.

Since most fertilizer materials are salts consisting of two or more elements, calculating the relative amounts of each material to use can be quite complex, particularly if you are trying to avoid using excessive amounts of certain ions such as ammonium nitrogen, chloride, or sodium. If you have ever tried doing this on paper you'll appreciate how complicated this can get. The good news is the Argus system does all the math for you!

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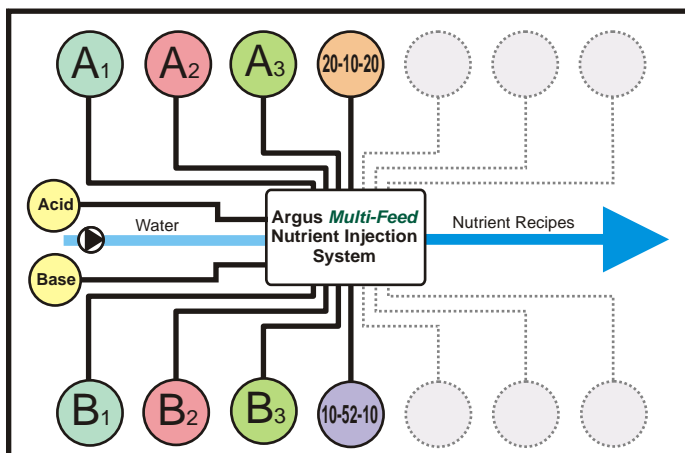


Figure 1: An example using 8 stock tanks consisting of 3 different A+B formulations plus 2 general purpose liquid fertilizers.

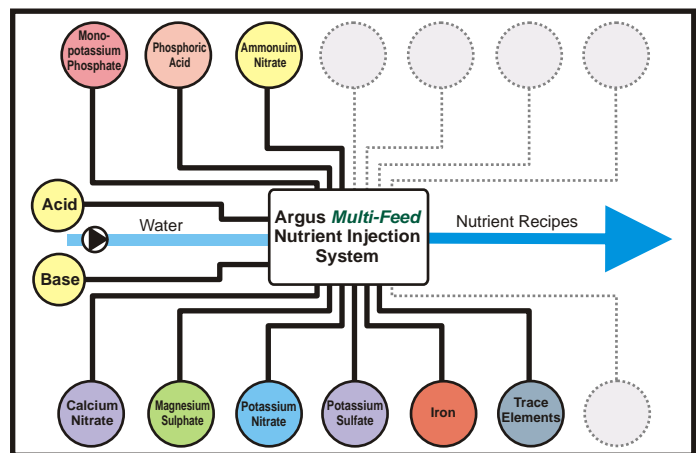


Figure 2: A single element dosing application using 9 stock tanks capable of varying all of the major elements plus iron.

## Using Single Element Dosing

To use Titan single element dosing with automatic recipe calculation, you enter recipes in parts per million for each fertilizer element that you wish to control. You can also have the system track materials that you might need to limit such as chloride and sodium. While you are entering each recipe, the system automatically scans the contents in each available stock tank and calculates how much it will need to inject. You can select which tanks can and cannot be used in automatic recipe calculations. You can even specify the order that the system scans the tanks to ensure that the least costly materials or the fertilizers most preferred for growth management are selected first.

Most growers that would have a use for single element dosing don't need to vary all elements individually. For example, if you don't need individual control over the trace elements, then a single concentrate tank containing all of them is fine. Any configuration that matches your needs is possible.

### Where's the Catch?

OK, as cool as single element dosing sounds, it does have some drawbacks. Along with all of this flexibility, there are more places for failures to occur. This can include

mechanical problems or mixing errors when dissolving the concentrates, as well as mistakes in the operator settings. The setup is more complex, and there are more components to maintain. Also, unlike A+B systems, the stock tanks are not drawn down at equal rates making quick visual confirmation of proper operation more difficult. To help you in this regard the system does keep track of how much it doses from each stock tank so you can compare these amounts to the actual stock tank volumes.

### Need for Routine Lab Analysis

While regular lab testing of nutrient solutions is always a good idea, it's particularly important for single element dosing applications. It not only confirms proper operation of the injection equipment, but helps verify that the correct materials have been placed in the concentrate tanks at the declared concentrations.

Most customers purchase our Multi-Feed systems for tried and true A+B style nutrient injection techniques, and the Titan system provides plenty of options for automatically manipulating nutrient levels using this injection style. However, should you ever need it, with the flexible design of our Multi-Feed systems we can engineer a custom system to your specifications.

## Reasons For and Against Single Element Dosing:

### For:

- Maximum nutrient recipe flexibility
- Vary your nutrient ratios dynamically according to local conditions
- Save money on fertilizers by purchasing only the basic constituents

### Against:

- Quality Control - fertilizer manufacturers go to a lot of expense and effort to make sure their blends are safe and consistent. With on-site blending that responsibility falls to you.
- Complexity - with single element dosing there are more settings, more tanks, more equipment and more potential failure points. Increased management and vigilance is essential.
- Higher Initial Costs - when compared to other injection methods

