

Application Case Study: Liquid Level Control in Dry Fog Disinfection



Introduction

Have you ever heard of “dry fog”? When we think of fog, we imagine the type of thick, wet fog that hugs the horizon on a cool winter morning – the type that brings traffic to a crawl and makes us late getting our kids to school. This type of fog coats everything it touches with water droplets, so we’d hardly call that “dry”. As it turns out, there’s a different type of fog made up of water molecules so small that they evaporate into the air without leaving any sign of moisture behind at all. Dry fog, as it’s known, is a man-made invention used to deliver suspended fluids

through the air in many industrial, commercial, and scientific applications. We learned all of this after being contacted by a startup manufacturer of Dry Fog Disinfection systems designed for commercial cleaning uses. The client needed help protecting their system against running out of cleaning chemicals, and that sure sounded like a solvable fluid sensor challenge to us!

About Us

As a veteran-owned small business, Whitman Controls is dedicated to supplying premium quality, reliable, technologically advanced instrumentation for use in nearly any application. Our Bristol, CT manufacturing facility embodies over 40 years of engineering, fabrication, and customer service expertise, serving both end-user and manufacturing customers nationwide through direct and distribution channels.

Application Summary

Disinfecting large areas of human-occupied buildings has traditionally required tedious manual cleaning using harsh chemicals, high temperatures, and lots of disposable materials. Even with such effort, manual cleaning can only go so far, often missing hard-to-reach spots and leaving moisture behind where contaminants can grow. To address these issues, dry fog disinfection has entered the commercial cleaning world as a means of sterilizing all surfaces in large spaces automatically without introducing moisture. Vapor droplets less than 10 microns are defined as dry fog, which when made up of sterile water and a disinfectant chemical, can treat entire rooms and buildings without leaving a trace of moisture behind.

Dry fog disinfection is an increasingly popular cleaning process because it can be pushed into every nook and cranny where the likes of E. coli, listeria, influenza, human coronavirus, norovirus, and many more harmful pathogens can hide. Dry fog systems can be mobile, stationary, or built into building infrastructure, offering options for large scale disinfection. Common applications include hygienic manufacturing, hospitals, healthcare facilities, gyms, laboratories, and cleanrooms. In addition, dry fog systems can also be used for surficial treatment applications such as in greenhouses and insectaries.

Challenge

As a startup OEM, our client had just cleared the development stage and had produced a successful portable atomizer prototype. This system was able to achieve all the key criteria

needed out of a large-area fogger, from droplet size to concentration, and now needed additional features to enhance the system's overall reliability. Since our client was targeting medical, institutional, and hygienic manufacturing customers, their objective was nothing less than complete customer confidence.

This concern is what brought them to Whitman Controls, specifically for help in developing a solution against running the system with insufficient disinfectant volumes. Our client's system contained two liquid tanks - one for purified water and one for disinfectant. If either tank were to run out of liquid during a disinfection cycle, fog could be generated that did not contain the right mix of liquid components and lead to failed cleaning. Since the entire point of our client's system was to provide unattended reliable sterilization of critical environments, running dry was simply not an option.

With this understanding, we quickly broke down our client's challenge into three elements:

- **Permissive Start** – the atomizer needed an interlock that would only allow the system to start a disinfection cycle when liquid was verifiably present in both water and disinfectant tanks. If liquid volume was insufficient, the system would not be permitted to start.
- **Automatic Stop** – in the event that either tank ran dry during a disinfection cycle, the system needed to automatically stop the current cycle and remain idle until the stop condition was addressed by an operator.
- **Alarm & Notification** – since these systems were designed for commercial use that may include rental and minimally-trained operator use, it was very important that the system clearly display its alarm and notification states to operators.

“Commercial cleaning is not a high-skill job or market, and our [disinfection] systems have to be operatable by pretty much anybody. Any tiny inconvenience like running a tank empty and not knowing why the system stopped could make our customers stop using [our systems], so adding the level sensors and display lights really helps.” - Sales Manager, Confidential Dry Fog Disinfection System Manufacturer

Solution

Seeing the application's discrete challenges spread out before us, it became immediately apparent that a point level solution was all that would be needed. A single point level sensor installed at the lower sidewall of each liquid tank would provide all condition reporting needed, which we could use to control the overall system in the following ways:

- **Low Tank Level Interlock** – using a single pole point level switch, the switch's normally-open contact would be run back through the system's start relay such that when liquid was above a low-level setpoint, the contact would switch closed and complete the run circuit. Whenever liquid fell below the low-level setpoint, the contact would switch open and interrupt the run circuit, initiating a soft system stop and alerting the operator to investigate the issue.
- **Start Enable** – using this same wiring and relay circuit, the system would not be allowed to start at any time that liquid level was below the low-level setpoint.
- **Alarm LEDs** – using separate LED lights on the operator panel, the system's control board would clearly inform users of separate conditions stemming from each tank's level sensor. One LED would convey "Low Tank Level" whenever the level sensor was switched below setpoint, and another LED would convey "Incomplete Cycle" to indicate that a disinfection cycle had ended prematurely.

We presented these recommendations to our client, who approved the concept as meeting all of their needs. Next, we needed to select a sensor to fit the bill. Reliability, cleanliness, and ease of maintenance were the main factors we targeted in our selection, ultimately landing on the [Whitman L20 Series Side-Mounted Stainless Steel Liquid Level Switch](#) based on the below features:

- Simple Point Level Switch functionality
- Most Commonly Used with Potable Water, Hot Water, Acids, and Solvents
- 316 / 316L Stainless Steel materials
- Low Weight 5-7 ounces
- Fully Potted Wiring Leads
- SPST switch, Rated for 50 vA
- 1/2" NPT Threaded Bulkhead side mounting
- Wide Temperature Range -40°F to 300°F
- Minimum Liquid Gravity 0.85

- Pressure Rated to 500 PSI

Results

Dry fog disinfection has risen in popularity over the last several years, and after implementing our suggested level control solution, our client on this project was able to launch their systems just in time to catch the wave. While the L20 level sensor's stainless steel material option has performed very well with the originally requested chemical makeup, we are currently helping our client look at alternative materials that may help them reduce costs and support alternative chemistry profiles.

Data Bullets

- **99.999%** pathogen disinfection using our client's dry fog system
- **4** million square feet of disinfection capacity per cycle
- **1** day's lead time on in-stock OEM sensor models
- **2** micron dry fog droplet size, four times smaller than a single red blood cell

Here at Whitman Controls, our values drive us to provide the highest level of servant partnership that you can find. To discuss your applications or to learn more about our capabilities, please contact us at (800) 233-4401, via email at info@whitmancontrols.com, or online at www.whitmancontrols.com