

# ULTRADOSER<sup>®</sup> 500S

## LN<sub>2</sub> Dosing System

### USER MANUAL



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## Introduction

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Thank you for your purchase of the Chart Inc. (Chart) UltraDoser<sup>®</sup> 500S LN<sub>2</sub> Dosing System. Chart has designed and fabricated your system with attention to detail and utilizing the leading cryogenic technologies to ensure a high efficient and reliable system.

Please contact us with any questions or comments that you may have. If after reading this manual you are not confident in carrying out any task, please call Chart's service team at +1 408.371.4932.

### ☐ Service

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Chart's UltraDoser 500S Dosing System has been designed for years of safe and dependable operation. In the event service is required, please contact Chart at:

Chart Inc.  
46441 Landing Parkway  
Fremont, CA 94538 USA  
www.chartdosers.com  
+1 408.371.4932

### ☐ Manufacturer

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The UltraDoser 500S Dosing System is designed and manufactured by:

Chart Inc.  
46441 Landing Parkway  
Fremont, CA 94538 USA  
www.chartdosers.com  
+1 800.371.3303

### ☐ Design Modification

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**DO NOT** use this product in a manner not consistent with the instruction outlined in this manual.

**NEVER** alter the design, or perform service that is not consistent with the instructions outlined in this manual without prior written approval of Chart.

### ☐ Additional Copies

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Additional copies of this manual are available by contacting Chart:

Chart Inc.  
46441 Landing Parkway  
Fremont, CA 94538 USA  
www.chartdosers.com  
+1 800.371.3303

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Chart Inc.

This manual is intended for use by Chart UltraDoser<sup>®</sup> 500S LN<sub>2</sub> Dosing System customers. It is important to read and understand the information in this manual before installing or operating the system. This manual is provided by Chart to its customers as a courtesy and, except as expressly provided in this manual, **CHART MAKES NO WARRANTIES, EXPRESS OR IMPLIED, REGARDING THE CONTENTS IN THIS MANUAL. CHART ASSUMES NO RESPONSIBILITY FOR ANY OUTCOMES AS A RESULT OF USING THIS MANUAL.**


## SAFETY FIRST!

Liquid nitrogen must be handled properly. Without proper handling, severe frost bite, cryogenic burning, oxygen deprivation, and bursting of sealed bottles (or containers) can result.

During this process, you may need:

- Safety glasses with side shields and/or protective face shield
- Insulated gloves for cryogenic service

Symbols and statements used throughout this text and their meaning are as follows:

 Text following this symbol needs extra attention.

**IMPORTANT:** Text like this is extra information helpful to the situation

**CAUTION:** Text like this is information to help avoid personal injury and/or property damage.

 **WARNING!** Text like this is information to help avoid serious personal injury or death and/or property damage.

## Safety

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**⚠ WARNING! Your UltraDoser® 500S LN<sub>2</sub> Dosing System may be fed by a vacuum insulated pipe system designed to contain pressurized, ultra-cold cryogenic liquids. These systems should only be worked on by trained personnel to avoid serious injuries such as freezing, oxygen deficient atmosphere and extremely high pressures.**

**⚠ WARNING! Any configuration which allows a trapped volume of cryogenic liquid or cold gas must be protected by a pressure relief valve. As the cold liquid/gas gains heat, the contents will expand and increase in pressure. A section not protected by an over-pressure relief valve will experience extremely high pressures and significant safety concerns.**

**⚠ WARNING! Over pressurization of bottles (or containers) can occur while using Chart's UltraDoser 500S system potentially bursting the bottles (or containers). Proper calibration of the UltraDoser 500S ensures optimum nitrogen doses to avoid over pressurization. Be sure to remove any bottles (or containers) that receive more than its proper LN<sub>2</sub> doses before sealing.**

**⚠ WARNING! If you are at all unsure of how to safely work on this system, STOP and contact Chart immediately at +1 408.371.4932.**

**CAUTION:** As with any cryogenic system, it should be observed that any non-insulated piping can get extremely cold and should not be touched by exposed skin. If the system requires maintenance, it should be shutdown and allowed to warm up.


**Strict compliance with proper safety and handling practices is necessary when using a cryogenic system.** We recommend that all our customers re-emphasize safety and safe handling practices to all their employees and customers. While every possible safety feature has been designed into the system and safe operations are anticipated, it is essential that the user of the cryogenic system carefully read to fully understand all WARNINGS and CAUTION notes listed in this safety summary and enumerated below. Also read the information provided in the Safety Bulletin for Inert Gases following this Safety Summary. Periodic review of the Safety Summary is recommended.

**⚠ WARNING! Nitrogen vapors in air may dilute the concentration of oxygen necessary to support or sustain life.**

Exposure to such an oxygen deficient atmosphere can lead to unconsciousness and serious injury, including death.

**CAUTION:** Before removing parts or loosening fittings, empty the UltraDoser 500S system of liquid and release any vapor pressure in a safe manner.

External valves and fittings can become extremely cold and may cause painful burns to personnel unless properly protected. Personnel must wear protective gloves and eye protection whenever removing parts or loosening fittings. Failure to do so may result in personal injury due to the extreme cold and pressure in the system.

 **WARNING! Accidental contact of liquid gases with skin or eyes may cause a freezing injury similar to a burn.**

Handle liquid so that it will not splash or spill. Protect your eyes and cover skin where the possibility of contact with liquid, cold pipes and equipment, or cold gas exists. Safety goggles or a face shield should be worn if liquid ejection or splashing may occur or cold gas may exit forcefully from equipment. Clean, insulated gloves that can be easily removed and long sleeves are recommended for arm and hand protection. Cuff less trousers should be worn over the shoes to shed spilled liquid.

## ☐ Safety Bulletin

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Portions of the following information are extracted from Safety Bulletin SB-2 from the Compressed Gas Association, Inc. (CGA). For the full text of Safety Bulletin SB-2 and for more information about oxygen atmospheres, refer to Safety Bulletin SB-2 from the Compressed Gas Association, Inc. (CGA) at [www.cganet.com](http://www.cganet.com). Additional information on nitrogen and liquid cylinders is available in CGA Pamphlet P-9. Write to the Compressed Gas Association, Inc., 1235 Jefferson Davis Highway, Arlington, VA 22202 or visit their website at [www.cganet.com](http://www.cganet.com).

### **Oxygen Deficient Atmospheres**

The normal oxygen content of air is approximately 21%. Depletion of oxygen content in air, either by combustion or by displacement with inert gas, is a potential hazard. Users should exercise suitable precautions.

One aspect of this possible hazard is the response of humans when exposed to an atmosphere containing only 8 to 12% oxygen. In this environment unconsciousness can be immediate with virtually no warning.

When the oxygen content of air is reduced to approximately 15 or 16%, the flame of ordinary combustible materials, including those commonly used as fuel for heat or light, may be extinguished. Somewhat below this concentration, an individual breathing the air is mentally incapable of diagnosing the situation. The onset of symptoms such as sleepiness, fatigue, lassitude, loss of coordination, errors in judgment and confusion can be masked by a state of "euphoria," leaving the victim with a false sense of security and well being.

Human exposure to atmosphere containing 12% or less oxygen leads to rapid unconsciousness. Unconsciousness can occur so rapidly that the user is rendered helpless. This can occur if the condition is reached by immediate change of environment, or through the gradual depletion of oxygen.

Most individuals working in or around oxygen deficient atmospheres rely on the "buddy system" for protection - obviously, the "buddy" is equally susceptible to asphyxiation if he or she enters the area to assist an unconscious partner unless equipped with a portable air supply. Best protection is obtainable by equipping all individuals with a portable supply of respiratory air. Lifelines are acceptable only if the area is essentially free of obstructions and individuals can assist one another without constraint.

If oxygen deficient atmosphere is suspected or known to exist:

1. Use the "buddy system." Use more than one "buddy" if necessary to move a fellow worker in an emergency.
2. Both the worker and "buddy" should be equipped with self-contained or airline breathing equipment.

## **Nitrogen**

Nitrogen (an inert gas) is a simple asphyxiate. It will not support or sustain life and can produce immediate hazardous conditions through the displacement of oxygen. Under high pressure these gases may produce unconsciousness even though an adequate oxygen supply, sufficient for life, is detected.

Nitrogen vapors in air dilute the concentration of oxygen necessary to support or sustain life. Inhalation of high concentrations of this gas can cause anoxia, resulting in dizziness, nausea, vomiting, or unconsciousness and possibly death. Individuals should be prohibited from entering areas where the oxygen content is below 19% unless equipped with a self-contained breathing apparatus. Unconsciousness and death may occur with virtually no warning if the oxygen concentration is below approximately 8%. Contact with cold nitrogen gas or liquid can cause cryogenic (extreme low temperature) burns and freeze body tissue.

Persons suffering from lack of oxygen should be immediately moved to areas with normal atmospheres. SELF CONTAINED BREATHING APPARATUS MAY BE REQUIRED TO PREVENT ASPHYXIATION OF RESCUE WORKERS. Assisted respiration and supplemental oxygen should be given if the victim is not breathing. If cryogenic liquid or cold boil-off gas contacts a worker's skin or eyes, the affected tissues should be promptly flooded or soaked with tepid water (105-115°F; 41-46°C). DO NOT USE HOT WATER. Cryogenic burns, which result in blistering or deeper tissue freezing, should be examined promptly by a physician.

## Receiving Your UltraDoser® 500S LN<sub>2</sub> Dosing System

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The UltraDoser 500S system is designed for variable speed filling lines up to 500 bottles (or containers) per minute. If set up properly, the UltraDoser 500S system will accommodate for any changes in line speed up to 500 bottlers (or containers).

### ☐ Unpacking the UltraDoser 500S System

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The UltraDoser 500S system will arrive in a specially designed shipping crate. If the unit is intended to be moved from one location to another, storing the crate for future use is ideal.

Upon arrival of the UltraDoser 500S system, it is advised to immediately inspect for any signs of damage. If any damage occurred in shipping, claims must be filed with the shipping carrier immediately prior to unpacking the UltraDoser 500S system.

While unpacking the crate, all contents should be carefully inspected. Things to check for upon arrival include:

- ✓ Dents in the UltraDoser unit
- ✓ Male and female bayonets should be protected.
- ✓ Proper number of bayonet clamps/flanges and o-rings (one set for every female bayonet).
- ✓ Any other components that were defined to ship loose

If there are any pieces listed on the Pack Slip and/or Materials List not in the shipping crate please contact Chart immediately at +1 800.371.3303.

**CAUTION:** When removing the UltraDoser unit from the crate, gently set it on the ground. Do not drop the UltraDoser unit! When transporting the UltraDoser unit through the facility, be sure to carry with care. Take care not to run into walls or drag the UltraDoser unit on the ground.

Prior to installation the UltraDoser 500S system should be stored in a location that will prevent dirt, water or other debris from getting inside the system. Similarly, it should be stored in a place that is generally out of the way of frequent traffic to reduce the risk of damage. Chart recommends storing the system in the crate when not in service.



## UltraDoser<sup>®</sup> 500S LN<sub>2</sub> Dosing System Overview and Utilities

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### ☐ Product Specifications

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<b>UltraDoser Body Dimensions:</b>	Reservoir height: 18" (457mm) Hexagonal: 6" (197mm) Arm reach : 12" or 18" (305mm or 457mm) from stand dependent on mounting bracket location
<b>UltraDoser Dosing Head:</b>	2"W x 9.5"H (51mm x 241mm)
<b>Total Weight (w/electronics):</b>	UltraDoser: 32 lbs (14.5kg) 500S Controller: 10.5 lbs (4.8kg)
<b>Dosing Range:</b>	0.01 – 14 grams/dose
<b>Dosing Accuracy:</b>	+/- 5% of dose value
<b>Timing Range:</b>	15 ms – 1000 ms (in 1 ms intervals)
<b>Control Voltage:</b>	24 VDC
<b>Materials:</b>	Stainless steel construction Built to food and beverage industry standards
<b>Crate Dimensions:</b>	59"L x 29"W x 21"H (1499mm x 737mm x 533mm) 225 lbs (102kg) with support stand 140 lbs (64kg) without support stand

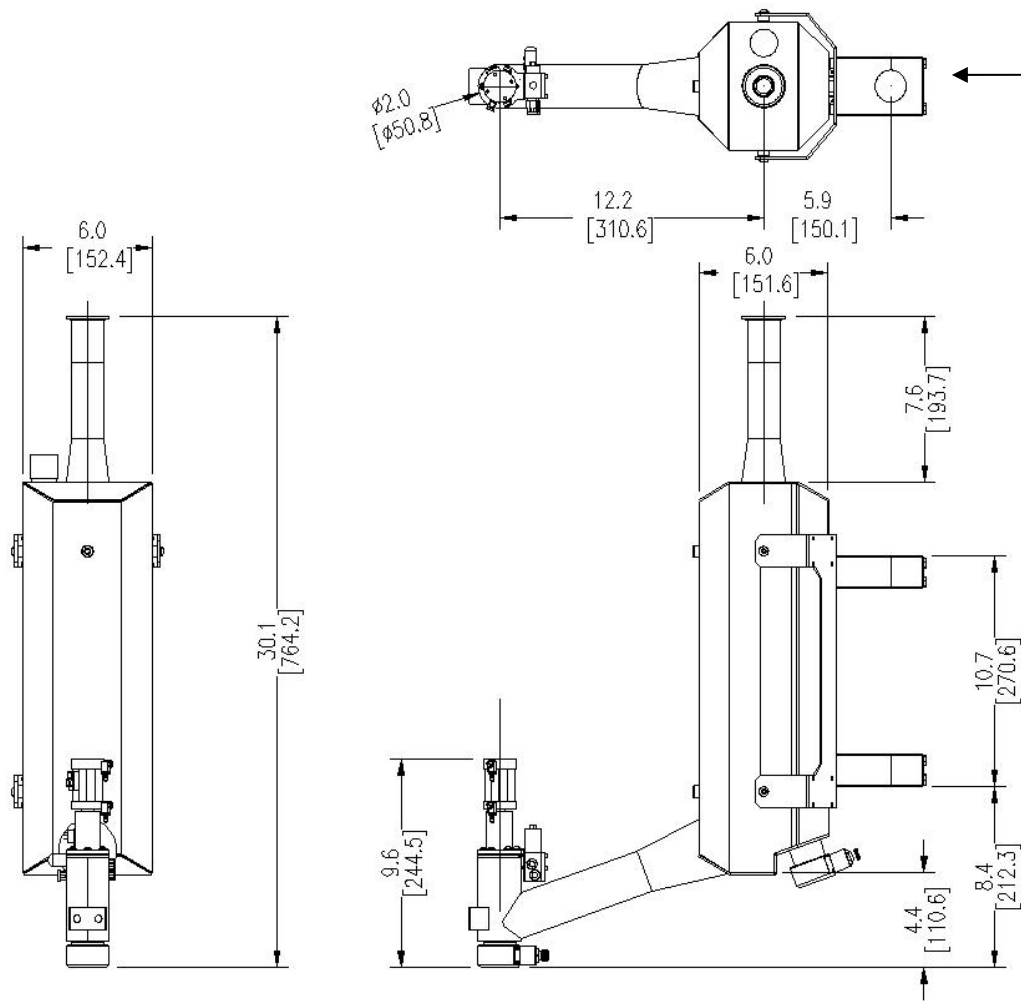
### ☐ Utility Requirements

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<b>Electrical Supply:</b>	100-240 VAC 50-60Hz 110 W
<b>Liquid Nitrogen:</b>	Portable Dura-Cyl <sup>®</sup> Liquid Cylinder – 22 psi (1.5 bar) House System (with Chart Phase Separator) – 100 psi (6.9 bar) Maximum flow rate 15 gallons (56 liters) per hour
<b>Gaseous Nitrogen:</b>	60 to 100 psi (4.1 to 6.9 bar) 10 SCFH gas per 100 bottles (or containers) per minute

# UltraDoser® LN<sub>2</sub> Dosing System Body Dimensions

Note: Mounting bracket can be mounted at 90° intervals around the central axis of the UltraDoser body. See page 16 for additional information.



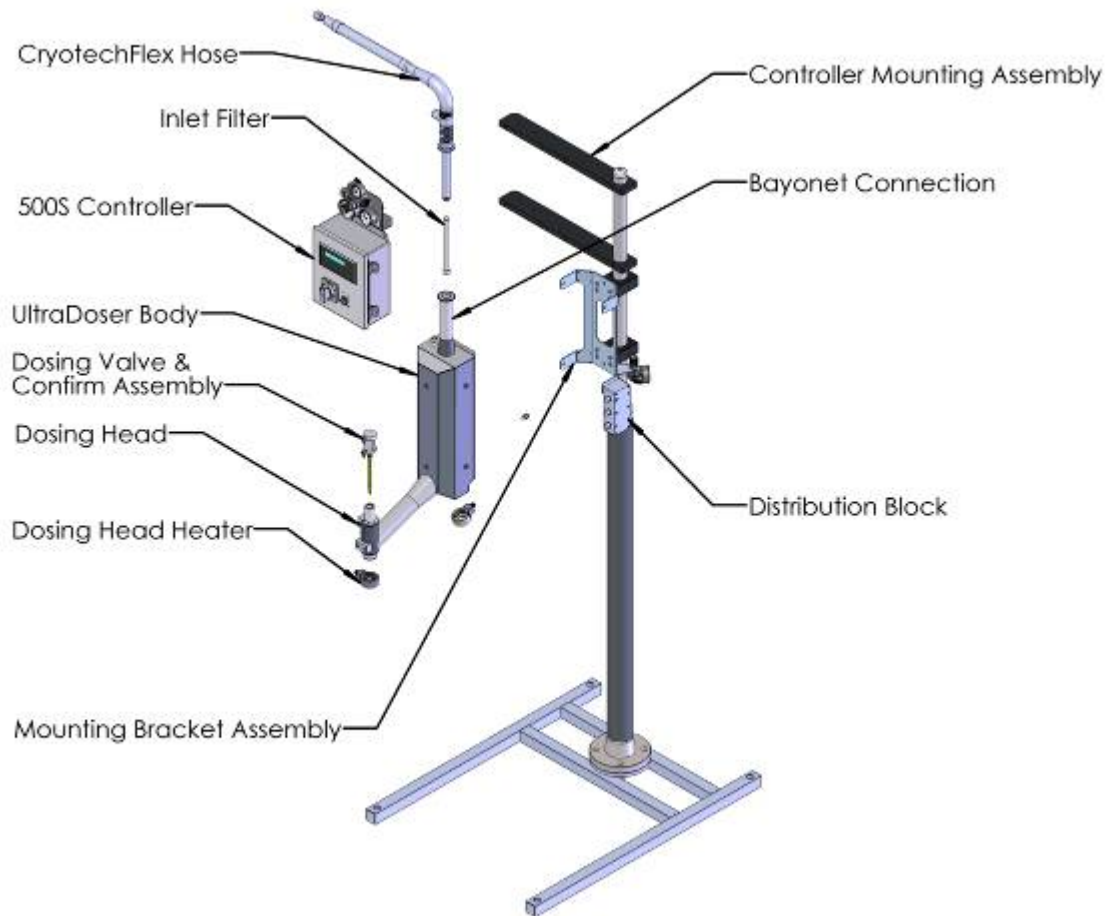
\*Shown with Standard Head

# UltraDoser® 500S LN<sub>2</sub> Dosing System Components

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## □ Standard Components (Front View)

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### UltraDoser Body

The stainless steel vacuum insulated reservoir provides a working supply of LN<sub>2</sub> for dosing operations from your liquid nitrogen supply.

### Dosing Valve Assembly

The dosing valve assembly contains the solenoid coil, the electromagnetic core with the valve stem, the return spring and the sealed valve housing.

### Valve Confirm Assembly

The valve confirm assembly is attached to the pneumatic cylinder. The sensor confirms that the valve stem was lifted and that dosing occurred. Failure of the sensor to detect the lifted valve stem may result in an alarm within the controller.

### Dosing Head

The dosing head delivers the dose of LN<sub>2</sub>.

### **Dosing Head Heater**

The UltraDoser<sup>®</sup> 500S LN<sub>2</sub> Dosing System unit has a self-regulating dosing head heater. The maximum temperature of the dosing head heater is 150°F (65°C) and prevents frost or ice formation at the dosing head area. The heater is held in place by a set of o-rings. If needed, the dosing head heater can be removed by slipping it off of the dosing head.

The dosing head heater has a built-in splash guard to minimize the dosing nozzle's exposure to splashed product or LN<sub>2</sub>.

### **Mounting Bracket Assembly**

The UltraDoser unit is supplied with a mounting bracket assembly. The assembly consists of the bracket attaching to the UltraDoser unit and two clamps. These clamps are designed to fit on Chart's support stand or 1-1/2" stainless steel rod. The bracket can be mounted in 3 positions. See page 16 for additional information.

### **Distribution Block**

The distribution block houses the electrical connectors and wiring interface between the operating parts of the UltraDoser unit and the 500S controller.

### **Bayonet Connection**

The bayonet connection allows a completely vacuum insulated, warm, and frost-free connection between the CryotechFlex hose and the UltraDoser unit.

### **Controller Mounting Assembly**

The 500S controller is supplied with a mounting assembly. The assembly consists of the bracket attaching to the controller gauge assembly and two clamps. These clamps are designed to fit on Chart's support stand or 1-1/2" stainless steel rod.

### **Inlet Filter**

A 10 micron stainless steel inlet filter is provided. The filter needs to be installed inside the male bayonet inserted into the UltraDoser unit.

### **500S Controller**

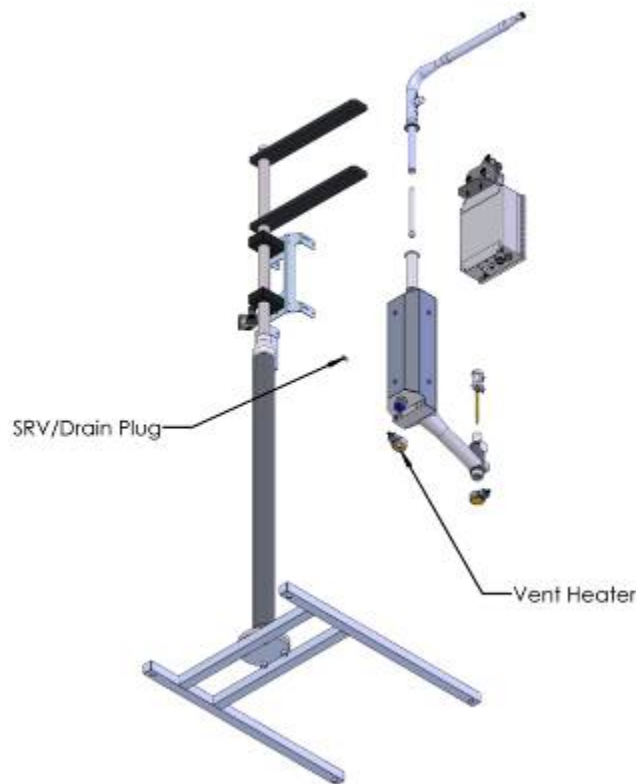
500S controller dictates the dosing operation of the system.

### **Dosing Nozzle (not shown)**

The size of the dosing nozzle directly affects the amount of LN<sub>2</sub> dosed. 0.040" ID, 0.050" ID, and a 0.060" ID nozzles ship loose with the LN<sub>2</sub> Dosing System. Custom sizes may be ordered from Chart.

## □ Standard Components (Back View)

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### **SRV / Drain Plug**

A 50 psi SRV / drain plug are located on the back of the UltraDoser<sup>®</sup> LN<sub>2</sub> Dosing System unit. When removed, this allows the LN<sub>2</sub> to drain from the UltraDoser body.

The 50 psi safety relief valve (SRV) is provided to protect the unit against over pressurization. If the pressure inside the unit reaches 50 psi or greater, the safety relief valve will vent excess pressure. Under normal operating conditions, the SRV should not vent.

### **Vent Heater**

The UltraDoser unit has a self-regulating vent heater. The maximum temperature of the vent heater is 150°F (65°C) and prevents frost or ice formation at the vent area. The heater is held in place by a set of o-rings. If needed, the vent heater can be removed by slipping it off of the vent area.

## □ Optional Components

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### **ElectroPneumatic (EP) Actuated Valve**

If ordered, the UltraDoser system has an ElectroPneumatic actuated dosing valve. The valve is driven by a pneumatic cylinder. Gas pressure to the cylinder is controlled by a 24 volt solenoid valve.

### **CryotechFlex Hose**

A vacuum insulated hose that provides a connection between the UltraDoser unit and the LN<sub>2</sub> supply.

## Principles of Liquid Nitrogen (LN<sub>2</sub>) Dosing

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To ensure consistent dosing results, an accurate dose must be delivered to each bottle (or container) AND each bottle (or container) must be processed in the same manner.

Chart's UltraDoser<sup>®</sup> 500S LN<sub>2</sub> Dosing System guarantees that a precise, accurate dose of LN<sub>2</sub> is delivered. The UltraDoser 500S system meets the following fundamental dosing conditions.

### Pure Liquid at the Dosing Head

Pure liquid (i.e. liquid with no gas pockets) must be instantaneously available at the dosing head. Chart has a unique internal design that ensures the continual availability of pure liquid at the dosing head.

### Constant Pressure

Constant pressure at the dosing head is a critical requirement for reproducible dose size. The unit utilizes a float valve that allows for a stable liquid level. This allows the pressure at the dosing head to remain constant during operation.

### Dose Duration

The dose duration is tightly controlled by the 500S controller's electronics. Dose duration is measured in milliseconds.

**IMPORTANT:** The following production conditions must be controlled to ensure consistent dosing results:

1. Product bottle (or container) fill levels must be consistent.
2. Product bottle (or container) fill temperatures must be consistent.
3. Capping techniques must be consistent.
4. Product may not be spilled or splashed out of bottles (or containers) following dose.

**IMPORTANT:** Enough time must be allowed for specific dosing operations. When using the UltraDoser 500S system for inerting purposes (removal of oxygen) time must be allowed between dosing and complete capping of the bottle (or container). See "Inerting", page 15, for additional information.

# Installation

## □ Application Evaluation

The UltraDoser<sup>®</sup> 500S LN<sub>2</sub> Dosing System can be used for both inerting and pressurization applications. The application must be evaluated to determine the ideal location of the dosing head on the filling line.

**Inerting** – Inerting is the process of removing oxygen (O<sub>2</sub>) from a bottle (or container) by dosing a relatively large amount of LN<sub>2</sub> in the bottle (or container) to inert. The liquid dose quickly converts into gas displacing air and oxygen from the bottle (or container). The ideal location for the UltraDoser unit must allow for enough time between dosing and capping so that the liquid dose is converted into a gas.

**Pressurization** – Pressurization occurs by dosing a relatively small amount of LN<sub>2</sub> into a bottle (or container). The liquid dose quickly converts into gas and the bottle (or container) is then capped or sealed to capture the expanding gas. The UltraDoser unit should be installed as close to the capper as possible.

## □ Support Stand Location

The UltraDoser unit is supplied with a mounting bracket assembly. The assembly consists of the bracket attaching to the UltraDoser body and two clamps designed to fit on 1½” stainless steel rod. Chart can supply a prefabricated stand to accommodate the mounting bracket assembly. This stand can be utilized in almost all installations. If the Chart stand cannot be used in your installation, fabricating one with 1½” diameter rod or round bar will make installation of the UltraDoser 500S system simpler. The following instructions will assume installation of Chart’s prefabricated support stand (Figure 4).

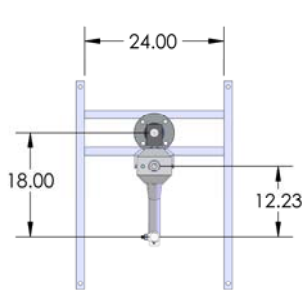


Figure 1

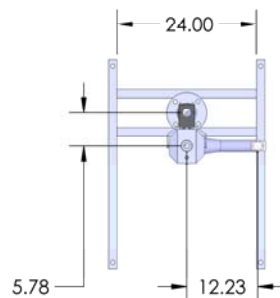


Figure 2

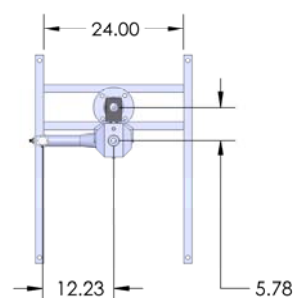


Figure 3

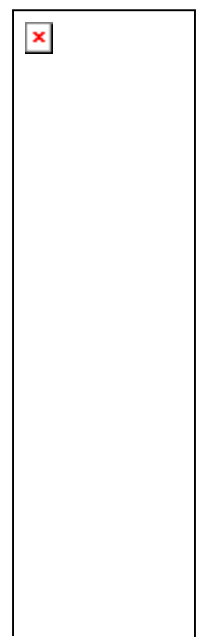


Figure 4

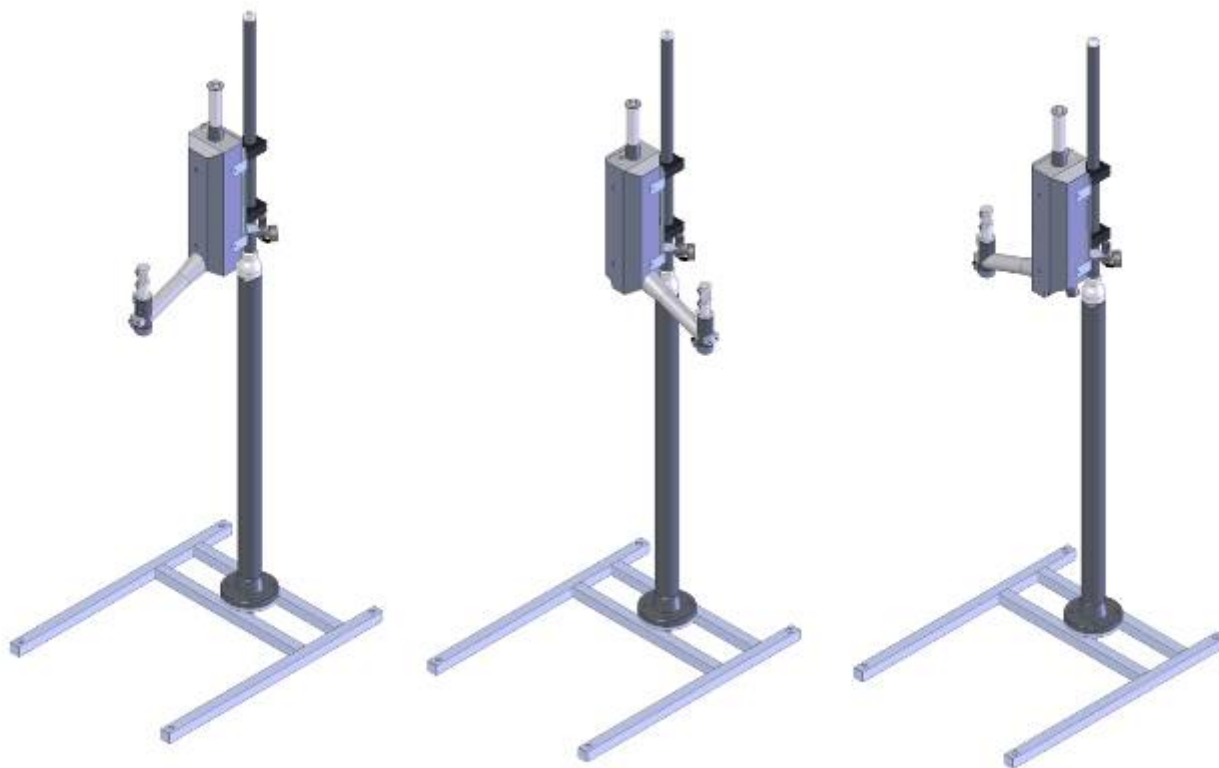
1. The UltraDoser unit can be installed on either side of a production line. Select the side that best suits the workplace. The mounting bracket assembly is installed straight back opposite to the arm from the factory. However, the UltraDoser body can be mounted in the mounting bracket such that the support stand is located on either side perpendicular to the arm (Figure 1-3).
2. Measure the appropriate distance depending on the UltraDoser system configuration. This is the location for the installation of the support stand.
3. Mark the location of the stand and install the four (4) 5/8” bolts included with the support stand in the proper locations.

## ☐ Mounting the UltraDoser<sup>®</sup> LN<sub>2</sub> Dosing System Unit

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Once the stand is installed, mount the UltraDoser unit on the stand using the supplied mounting bracket.

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## □ Connecting the Distribution Block

The distribution block houses the electrical connectors and wiring interface between the operating parts of the UltraDoser<sup>®</sup> LN<sub>2</sub> Dosing System unit and the 500S controller. There are five connections on the distribution block:



Not used.

### **Vent Heater (D-1)**

Provides +24VDC power to the vent heater. A green light on the cable connector indicates that power is being made available to the vent heater.

### **Nozzle Heater (D-2)**

Provides +24VDC power to the dosing head heater. A green light on the cable connector indicates that power is being made available to the dosing head heater.

### **Timing/Container Sensor (D-3)**

Provides +24VDC power to the timing/container sensor and indicates sensor activity. A green light on the cable connector indicates that power is being supplied to the sensor. A yellow light will flash when a container is detected.

### **Dose Solenoid (D-4)**

Provides +24VDC power to the solenoid valve assembly located on the dosing head. A green light on the cable connector indicates that power is being supplied to the solenoid valve. A yellow light will appear when the solenoid valve has been activated.

### **Confirm Sensor (D-5)**

Provides +24VDC power to the confirm sensor assembly located on the dosing head. A green light on the cable connector indicates that power is being supplied to the confirm sensor. A yellow light will appear when the pneumatic cylinder has lifted the valve stem. Simultaneously, a yellow indicator will illuminate on the confirm sensor body.

### **Aux (D-6)**

## □ Installing the Nozzle

Three nozzles are supplied with the UltraDoser<sup>®</sup> 500S LN<sub>2</sub> Dosing System – 0.040”, 0.050”, and 0.060”. Custom sizes may be ordered from Chart.

1. Remove the dosing head heater.
2. Select a nozzle.
3. Insert the nozzle into the nozzle tool, threads out (Image 1).
4. Thread the nozzle into the dosing head area in a clockwise direction (Image 2 & 3). Do not over torque.
5. Re-apply the dosing head heater.



**Image 1**



**Image 2**

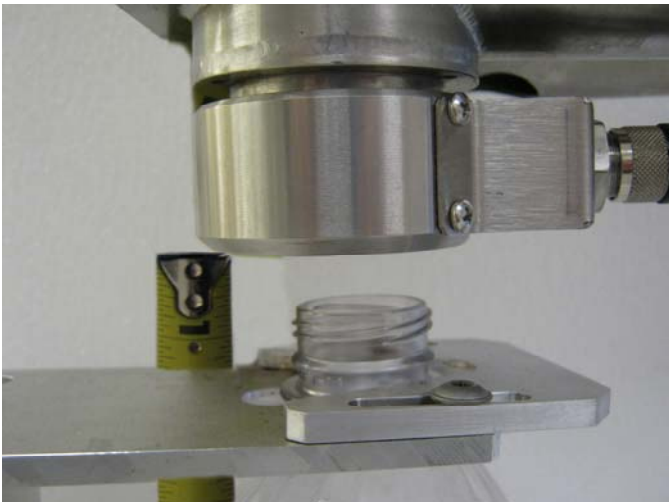


**Image 3**

**CAUTION:** Never use an ice-pick, screwdriver, torch, or similar devices on the dosing head (Image 2). The ribs of the internal bellows are a thin walled metal and the hole on the outer ring of the dosing head is a positive pressure port to help keep moisture out and ice from forming. High heat and puncture holes will destroy the vacuum insulation and VOID WARRANTY.

## □ Positioning the Dosing Head

The dosing head should be directly over the bottle (or container) opening. The dosing head is typically installed 1/2” - 3/4” above the bottle (or container) opening. The UltraDoser unit must be manually adjusted to accommodate different sized bottles (or containers) running on the same production line.



## ☐ Installing the Container Sensor

---

The container sensor must be a PNP type sensor and is used to detect if containers are present on the line. Chart provides a PNP 18mm ultrasonic sensor with the UltraDoser® 500S LN<sub>2</sub> Dosing System. Ideal container sensor placement is about four (4) to six (6) pockets from the dosing head.



## ☐ Installing the Speed Sensor (optional)

---

The speed sensor is installed to detect filling line speed and must be installed for the UltraDoser 500S system to operate properly. Chart provides a PNP 12mm inductive proximity sensor with the UltraDoser 500S system. Ideal speed sensor placement is on a shaft or gear, like a worm shaft, that provides at least a 1:1 pulses per container ratio; the more pulses the better the resolution and accuracy.



## □ Installing the 500S Controller

Locate the ideal location for the 500S controller. Brackets can be supplied to mount the controller on the Chart prefabricated support stand or 1½” diameter rod or round bar. If Chart’s prefabricated brackets are not utilized, the controller’s mounting tabs can be utilized.

The front of the 500S controller (image below) displays the system status.



The gauge assembly on the top of the 500S controller provides the following information:

### **Dosing Head Pressure**

The dosing head pressure gauge measures the head pressure of the liquid nitrogen in the reservoir and acts as a liquid level indicator. The pressure gauge should read between 0.4 – 0.5 psi when the reservoir is full.

### **Gas Regulator Pressure (preset to 60psi)**

The regulator controls the pressure of the gaseous nitrogen to the dosing head valve. If necessary, on-site adjustments can be made. Only gaseous nitrogen should be used in this application. Air, even if it is dry compressed air, should NEVER be used as an alternative.

### **Source Pressure**

This gauge measures the pressure of the liquid nitrogen source. This pressure reading should read between 3-22psi depending on the source of liquid nitrogen (house system or Dura-Cyl<sup>®</sup> Liquid Cylinder fed).

The bottom of the 500S controller (image below) is the electrical “hub”.



### **Input Power (J-1)**

The 500S controller power cable (6ft) is connected to the 500S controller at port J-1.

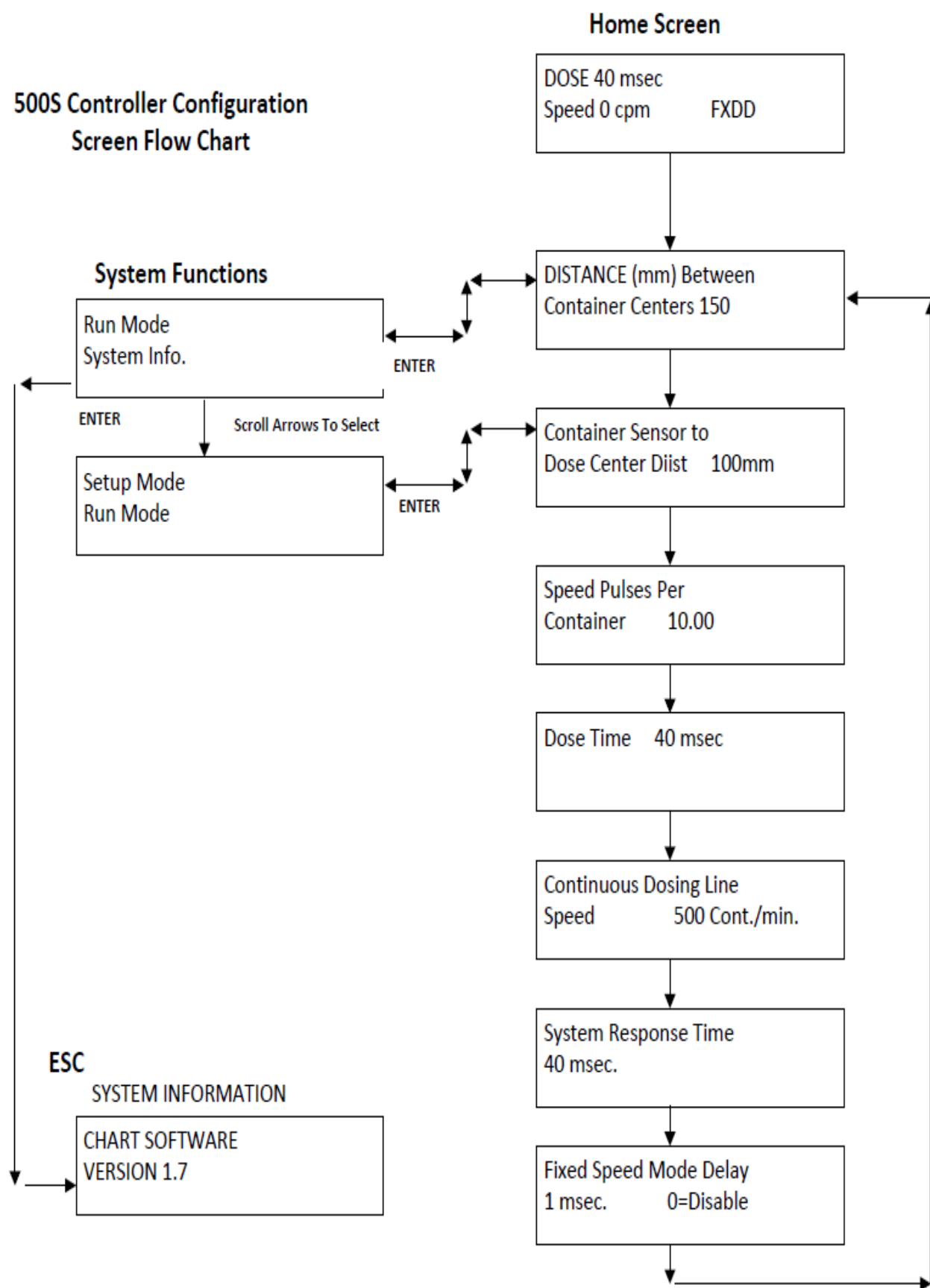
### **Interface Connection (J-2)**

The 500S controller I/O (input/output) cable, a component of the distribution block, is connected to the 500S controller at port J-2.

### **Speed Sensor (J-3)**

A PNP 12mm proximity speed sensor provides the 500S controller with pulses that are used to calculate the line speed.

## 500S Controller Configuration Screen Flow Chart





## 500S Controller Adjustments

The 500S controller dictates the dosing operation of the system. The controller allows the system to operate in either a “Fixed Delay” or a “Speed Compensation” mode.

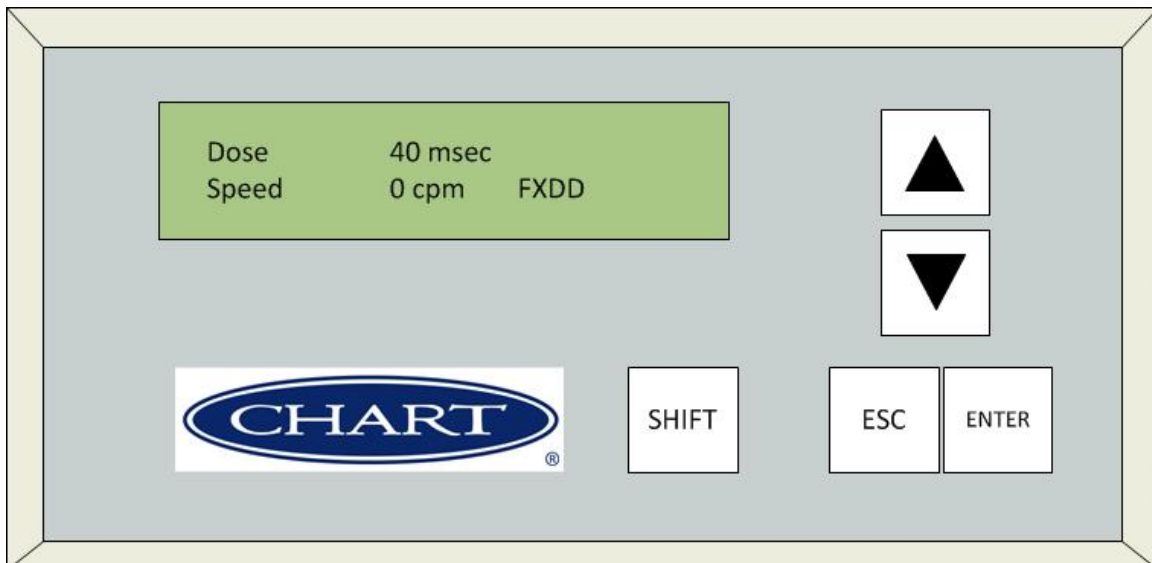
In Fixed Delay mode, the operator inputs the “Dose Time” and the “Fixed Speed Mode Delay”. When the system detects a bottle (or container), the UltraDoser will dose per the dose time after the fixed speed mode delay time passes. In this mode the system only requires a container sensor to detect bottles (or containers).

In Speed Compensation mode, the 500S controller automatically adjusts the time delay from the time the UltraDoser<sup>®</sup> LN<sub>2</sub> Dosing System senses the bottle (or container) to when it doses based on the speed of the line. The operator must enter several parameters and install a container sensor and a speed sensor (see page 19 for additional information). The 500S controller will automatically change to continuous dosing at 500 containers per minute (cont/min).

**IMPORTANT:** The default unit of measure for the 500S controller is metric. To change to imperial unit of measure, the wire into IO.4 must be removed.

### □ Home Screen

From the Home screen (image below), the operator can navigate to other screens and functions. The Home screen shows current dose duration (in milliseconds) and filler line speed (in containers per minute).



**IMPORTANT:** The 500S controller defaults to the home screen at power up. After one (1) minute, other screens will default back to the home screen.

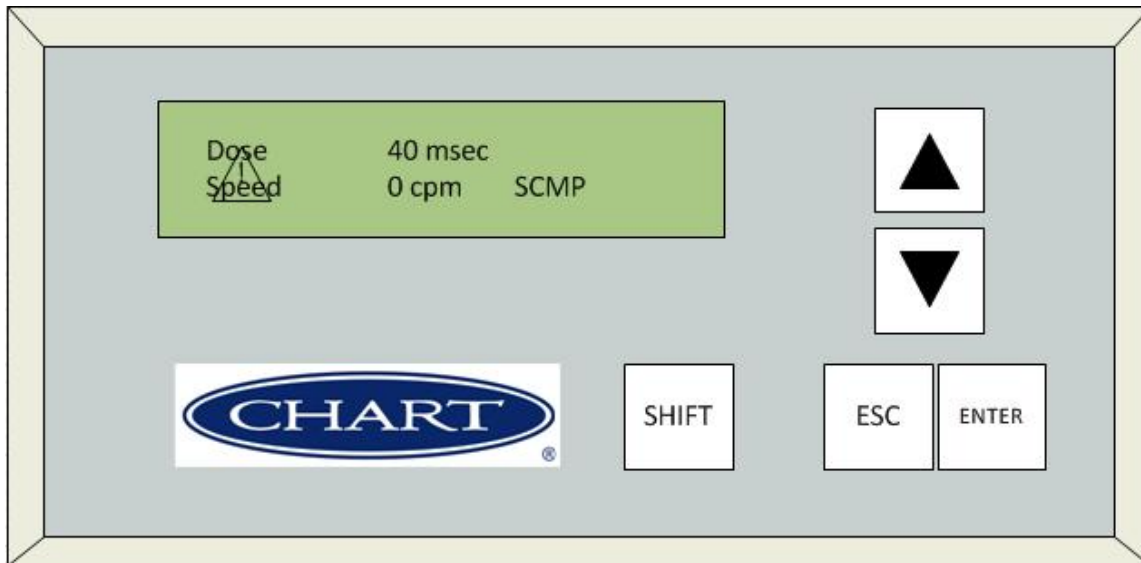
## □ Alarm Screen

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The software alerts the user for the following reasons:

1. If it detects speed sensor failure after a container has been detected (if in Speed Compensated mode).
2. The dosing valve has not been activated after a container has been detected.

The alert will appear as a flashing triangle on the Home screen (image below). The flashing triangle will disappear once the alarm condition has been resolved.





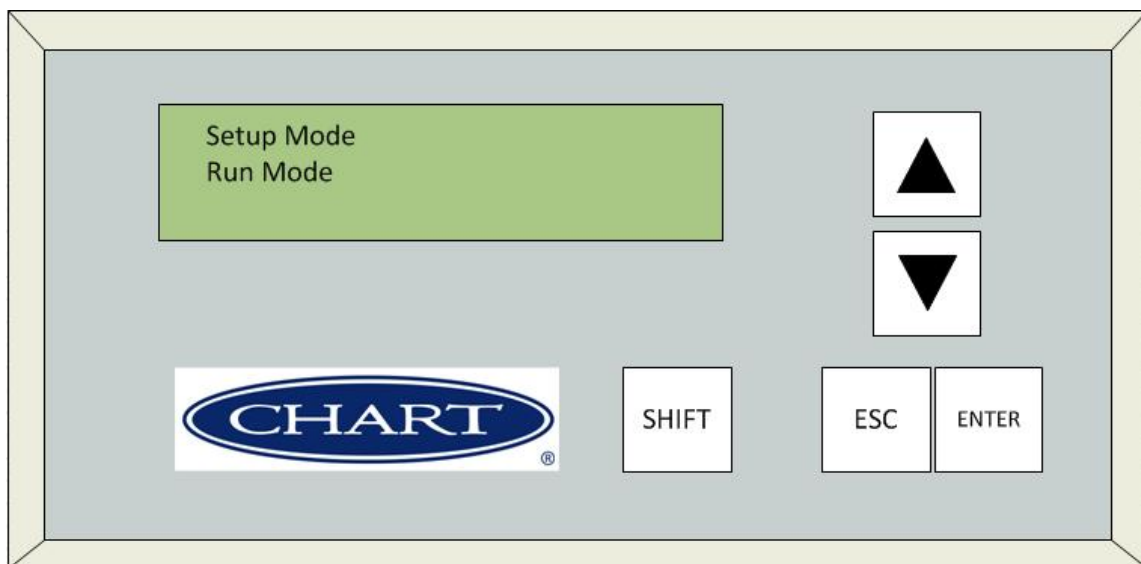
## □ Fixed Delay Mode (FXDD)

---

In Fixed Delay mode, the operator inputs the “Dose Time” and the “Fixed Speed Mode Delay”. When the system detects a bottle (or container), the UltraDoser will dose per the dose time after the fixed speed mode delay time passes. In this mode the system only requires a container sensor to detect bottles (or containers).

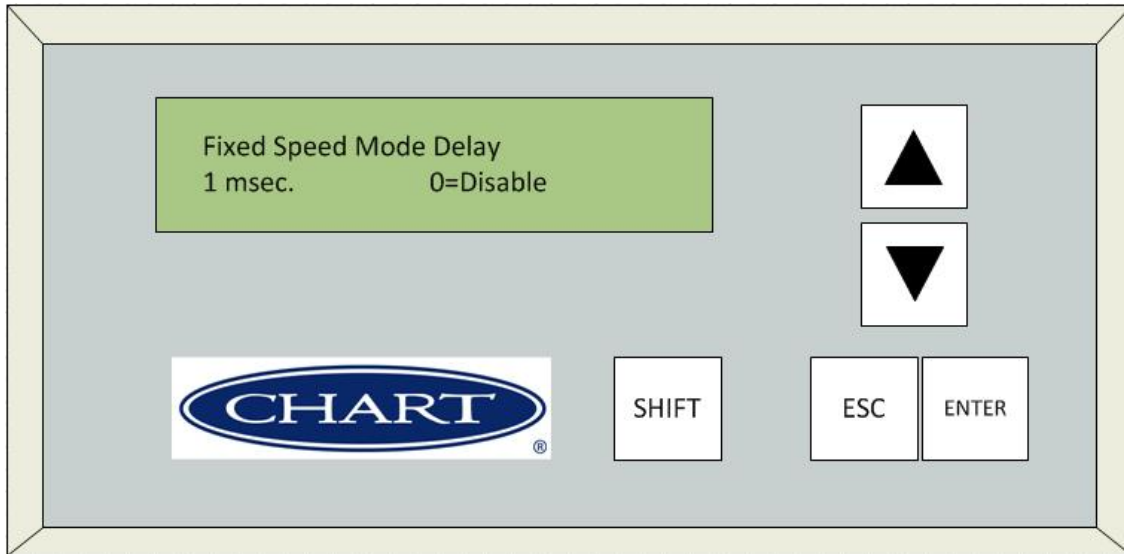
The 500S controller is preset at the factory to run in Fixed Delay mode; 1 millisecond (msec) dose delay with 40 millisecond (msec) dose duration.

1. Turn the 500S controller ON.
2. On the front of the 500S controller box, place the Dose Enable switch in the disable mode (0).
3. From the Home screen press ESC to go to the System Functions screen (image below).



4. Use the arrow key ▲ or ▼ to highlight Setup Mode. Press ENTER to select.

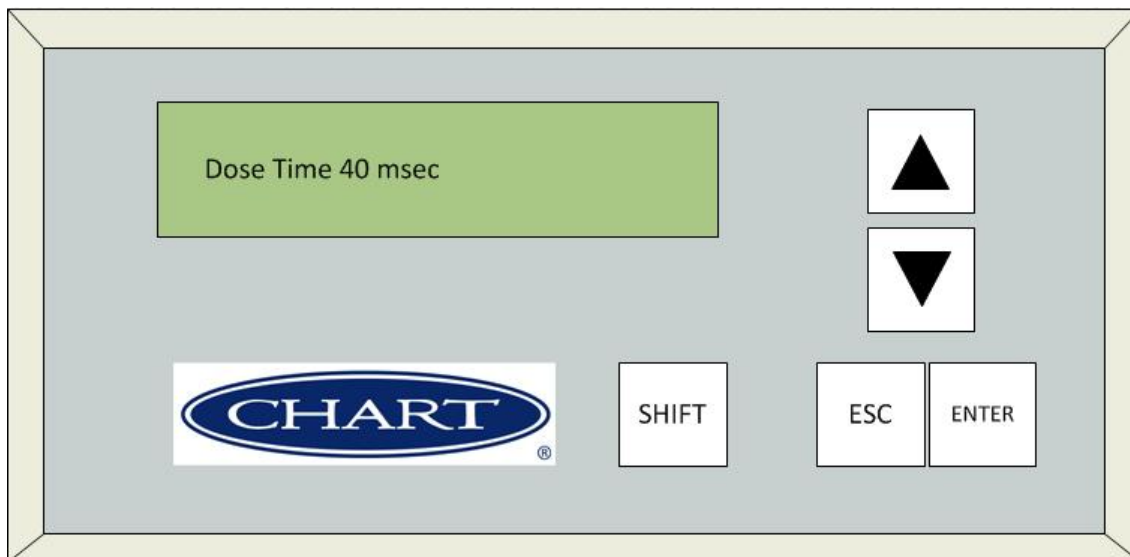
5. Use the arrow key ▲ to go to the Fixed Speed Mode Delay screen (image below). Press ENTER to highlight the digit before ‘msec’.



6. Use the arrow key ▲ or ▼ to change the value. Press ENTER when the desired value is shown; range is 1 to 5000 milliseconds. The fixed speed mode delay time is now set.

**IMPORTANT:** A value other than ‘0’ in this field means the system will run in Fixed Delay Mode. When this value is greater than 0, it is the delay (in milliseconds) between the time a bottle (or container) is detected to when the UltraDoser™ dosing system doses. The closer the container sensor is to the dosing head, the shorter the time delay.

7. Use the arrow key ▲ or ▼ to go to the Dose Time screen (image below). Press ENTER to highlight the value.



**IMPORTANT:** The Dose Time setting controls the amount of time (in milliseconds) that the UltraDoser system dispenses liquid nitrogen. The amount of liquid nitrogen inside a container depends on many variables including the position of the dosing head relative to the capper, the size of the dosing nozzle, the temperature of the container contents, fill levels and head space. Therefore, the time setting for each filling operation must be evaluated.

8. Use the arrow key ▲ or ▼ to change the value. Press ENTER when the desired value is shown; range is 15 to 1000 milliseconds. The dose time is now set.
9. On the front of the 500S controller box, place the Dose Enable switch in the enable mode 'I'.

#### ☐ 500S Controller Set-up Verification

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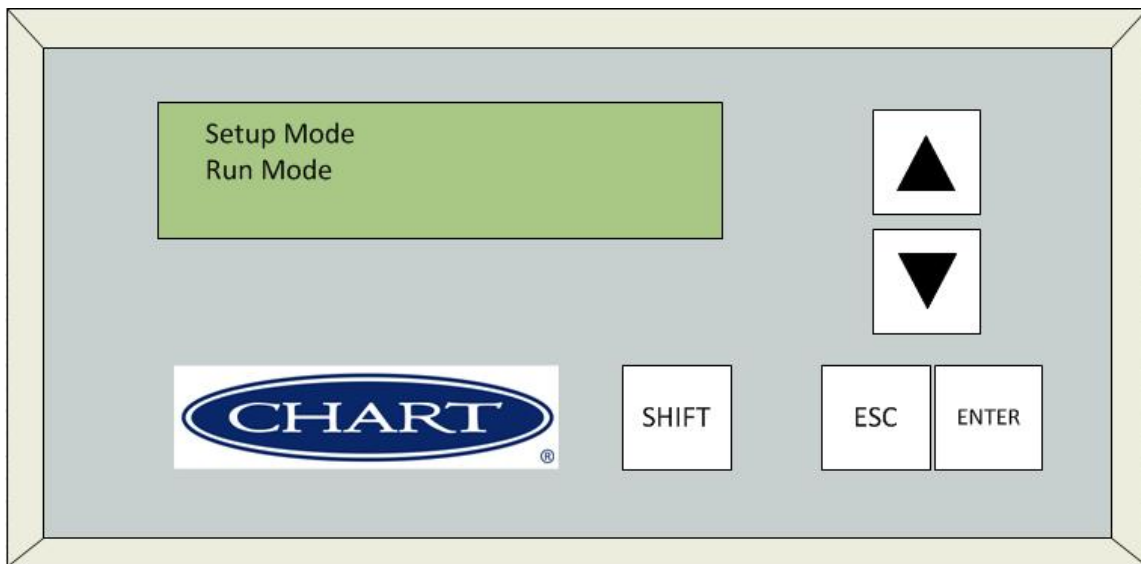
Send a bottle (or container) down the filling line. Note if the dose is dispensed before, in, or after the bottle (or container). If the dose is dispensed BEFORE the bottle (or container) reaches the dosing head, INCREASE the dose delay until the dose is dispensed into the bottle (or container). If the dose is dispensed AFTER the bottle (or container) reaches the dosing head, REDUCE the dose delay.

<p><b>IMPORTANT:</b> In Fixed Delay Mode, the UltraDoser<sup>®</sup> 500S LN<sub>2</sub> Dosing System dispenses liquid nitrogen at the user defined millisecond setting REGARDLESS of line speed.</p>
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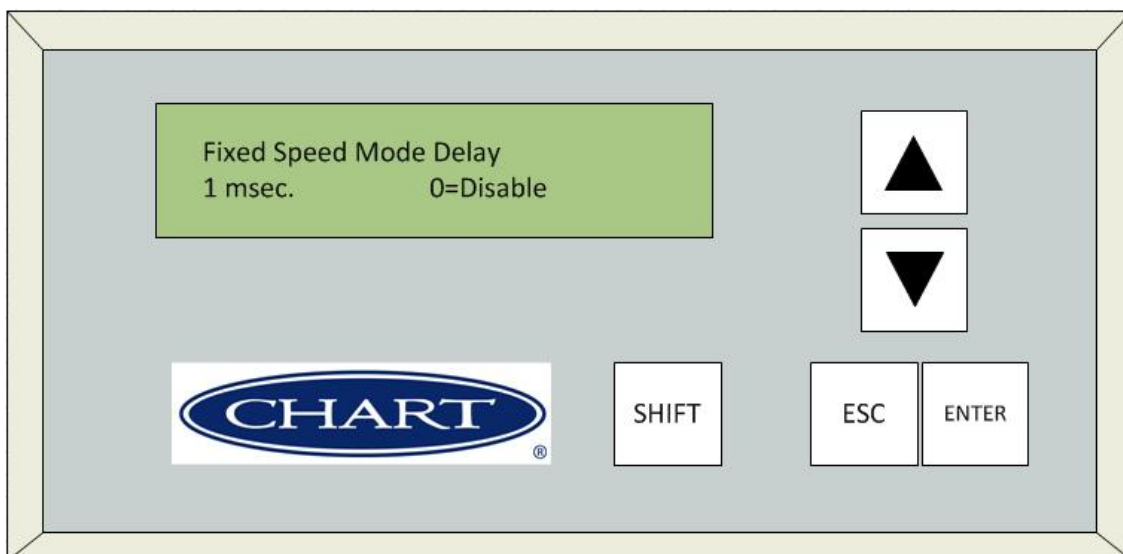
## □ Speed Compensated Mode (SCMP)

In Speed Compensation mode, the 500S controller automatically adjusts the time delay from the time the UltraDoser<sup>®</sup> LN<sub>2</sub> Dosing System senses the bottle (or container) to when it doses based on the speed of the line. The operator must enter several parameters and install a container sensor and a speed sensor (see page 19 for additional information). The 500S controller will automatically change to continuous dosing at 500 containers per minute (cont/min).

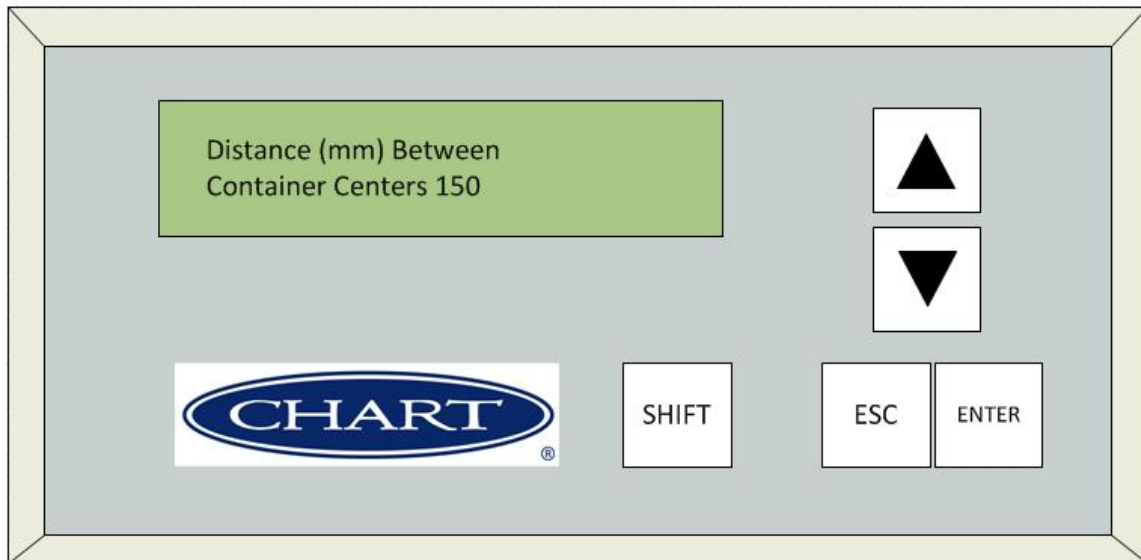
1. Turn the 500S controller ON.
2. On the front of the 500S controller box, place the Dose Enable switch in the disable mode (0).
3. From the Main screen press ESC to go to the System Functions screen (image below).



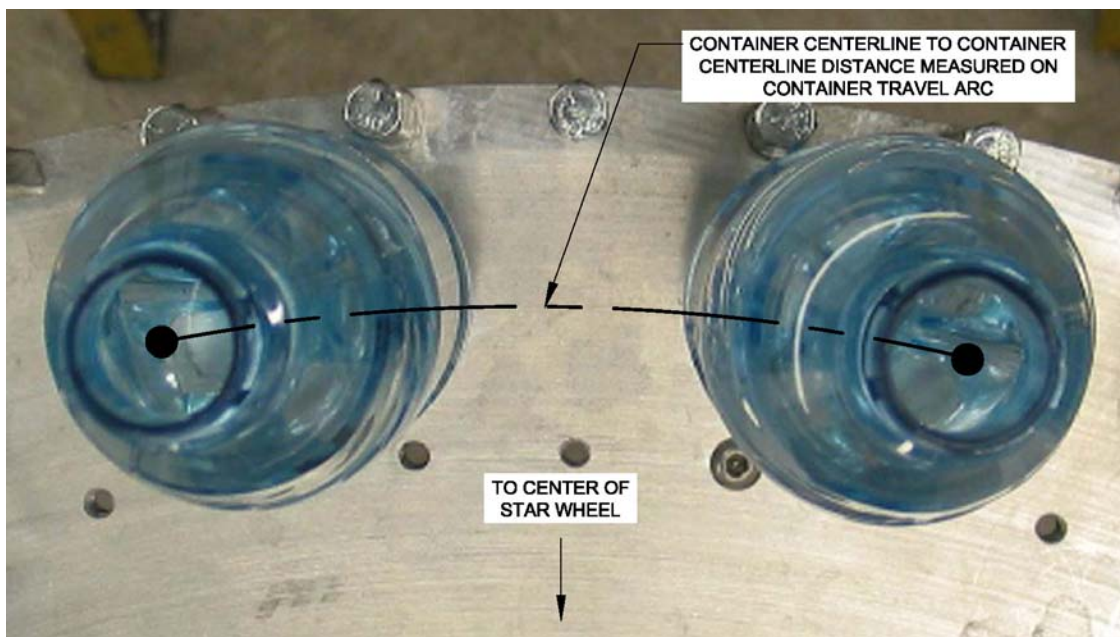
4. Use the arrow key ▲ or ▼ to highlight Setup Mode. Press ENTER to select.
5. Use the arrow key ▲ to go to the Fixed Speed Mode Delay screen (image below). Press ENTER to highlight the digit before 'msec'.



6. Use the arrow key ▲ or ▼ to change the value to '0'.
7. Use the arrow key ▲ or ▼ to go to the Distance Between Container Centers screen (image below). Press ENTER to highlight the value.

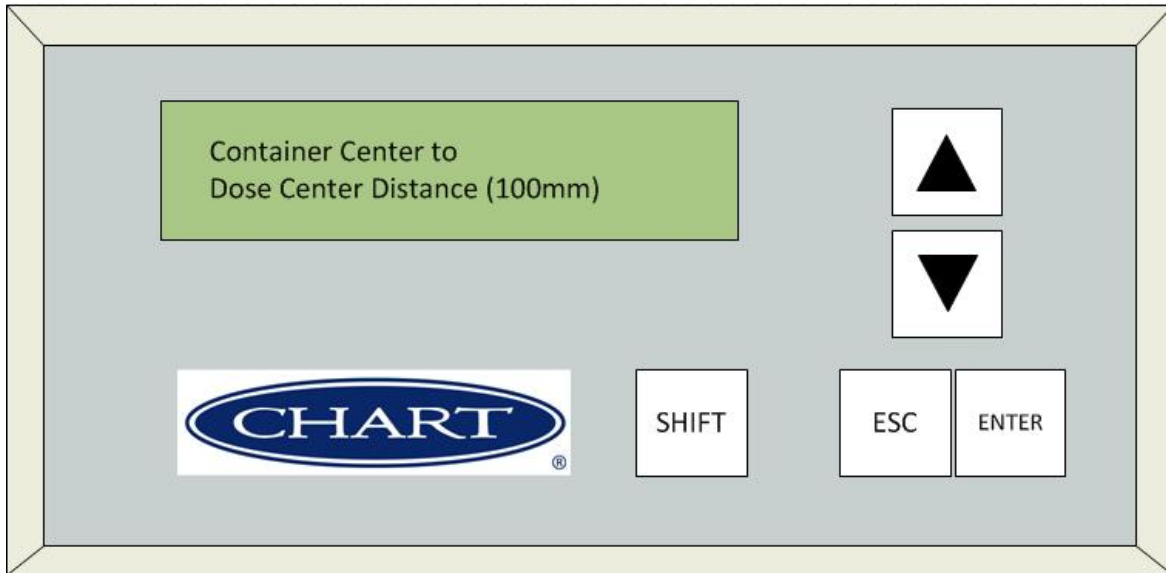


**IMPORTANT:** This measurement is the distance between containers centerline to container centerline (in mm or in).

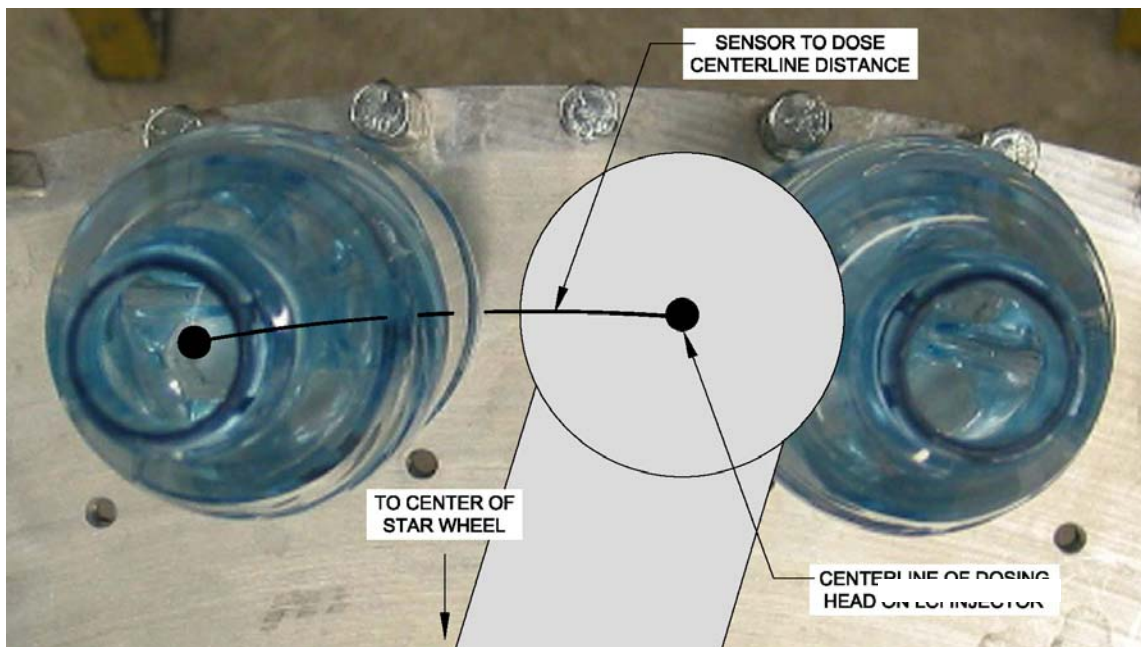


8. Use the arrow key ▲ or ▼ to change the value. Press ENTER when the desired value is shown; range is 50 to 500 millimeters (mm) or 2 to 20 inches (in). The distance between container centers is now set.

9. Use the arrow key ▲ or ▼ to go to the Container Center to Dose Center Distance screen (image below). Press ENTER to highlight the value.

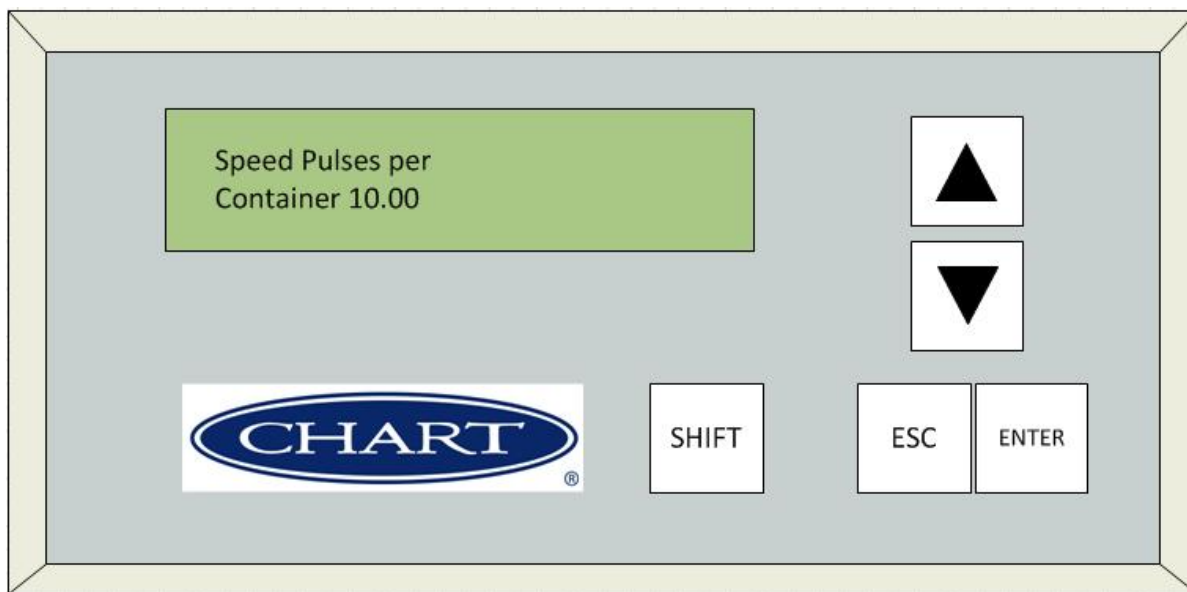


**IMPORTANT:** This measurement is the distance between the container sensor and the dosing head nozzle (in mm or in).



10. Use the arrow key ▲ or ▼ to change the value. Press ENTER when the desired value is shown; range is 0 to 500 millimeters (mm) or 0 to 20 inches (in). The container center to dose center distance is now set.

11. Use the arrow key ▲ or ▼ to go to the Speed Pulses per Container screen (image below). Press ENTER to highlight the value.



**IMPORTANT:** This is a critical parameter of the system and care should be taken to input the correct value. The number of pulses does not have to be a whole number.

#### **Determining Speed Pulses per Container**

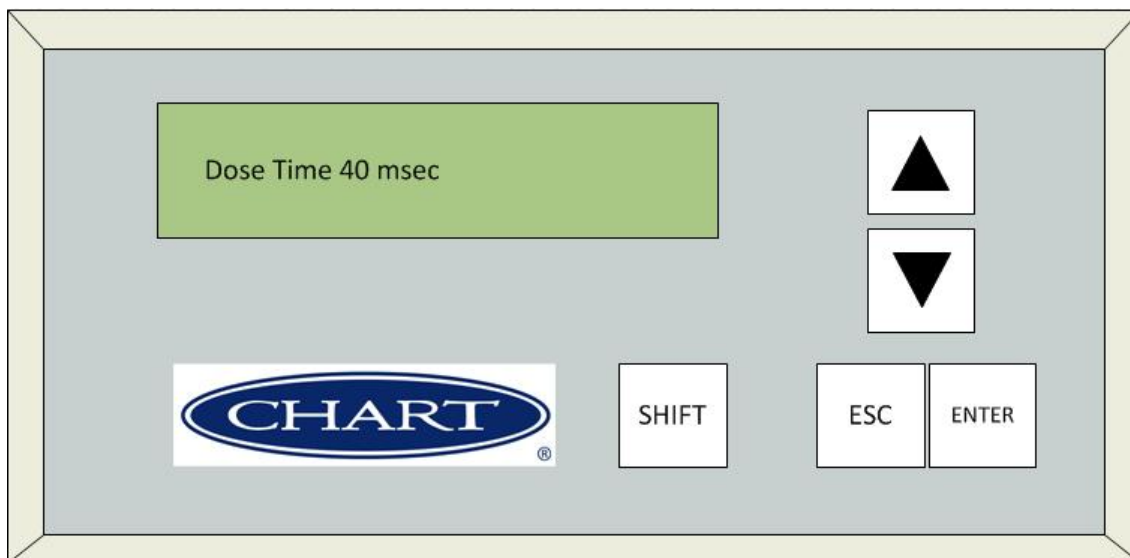
Speed pulses per container can be determined by observing the light pulses on both the container and speed sensors. If there are three speed light pulses per container pulse, the speed pulses per container is 3.

In cases where the lights on the container and speed sensors are not visible, the 500S controller can be opened and light pulses on inputs IO.1 (Speed Sensor) and IO.2 (Container Sensor) can be counted.

12. Use the arrow key ▲ or ▼ to change the value. Press ENTER when the desired value is shown; range is 1 to 12. The speed pulse is now set.

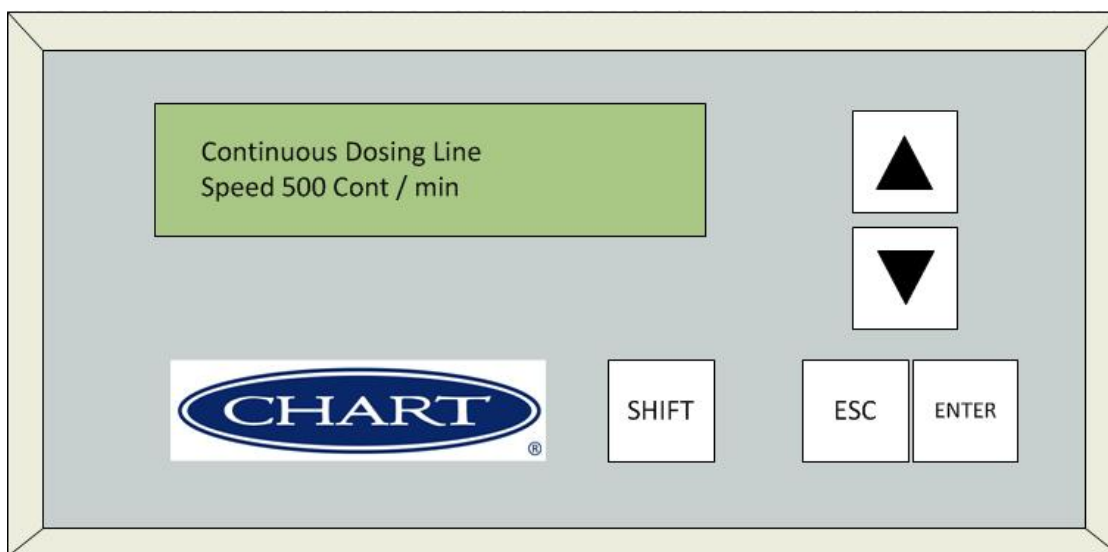


13. Use the arrow key ▲ or ▼ to go to the Dose Time screen (image below). Press ENTER to highlight the value.



**IMPORTANT:** The Dose Time setting controls the amount of time (in milliseconds) that the UltraDoser<sup>®</sup> LN<sub>2</sub> Dosing System dispenses liquid nitrogen. The amount of liquid nitrogen inside a container depends on many variables including the position of the dosing head relative to the capper, the size of the dosing nozzle, the temperature of the container contents, fill levels and head space. Therefore, the time setting for each filling operation must be evaluated.

14. Use the arrow key ▲ or ▼ to change the value. Press ENTER when the desired value is shown; range is 15 to 1000 milliseconds. The dose time is now set.
15. Use the arrow key ▲ or ▼ to go to the Continuous Dosing Line Speed screen (image below). Press ENTER to highlight the value.



**IMPORTANT:** The Continuous Dosing Time Speed is the line speed at which the 500S controller will change from discrete to continuous dosing. This is preset at the factory to 500 cont/min.



16. Use the arrow key ▲ or ▼ to change the value. Press ENTER when the desired value is shown; range is 100 to 500 containers per minute (cont/min). The continuous dosing line speed is now set.

**IMPORTANT:** The 500S controller has a speed “buffer” of +/- 10 containers per minute (cpm) before it changes from continuous back to discrete dosing.

**CAUTION:** Nitrogen that misses the bottle and hits the floor other machinery may cause ice to form in the area.

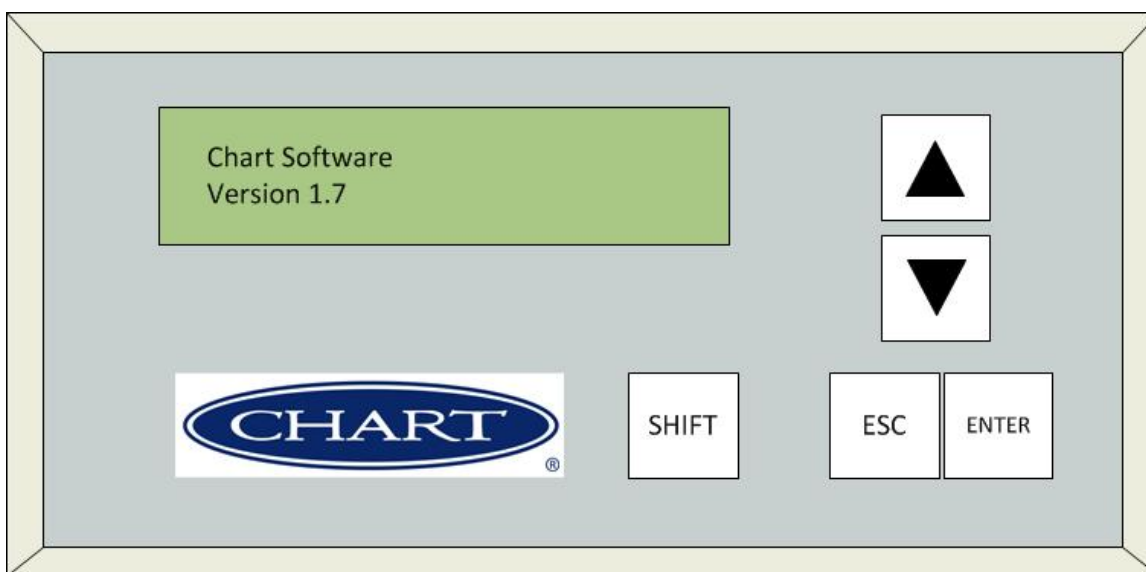
17. On the front of the 500S controller box, place the Dose Enable switch in the enable mode ‘I’.

### ☐ 500S Controller Set-up Verification

Send a bottle (or container) down the filling line. Note if the dose is dispensed before, in, or after the bottle (or container). If the dose is dispensed BEFORE the bottle (or container) reaches the dosing head, INCREASE the dose delay until the dose is dispensed into the bottle (or container). If the dose is dispensed AFTER the bottle (or container) reaches the dosing head, REDUCE the dose delay.

### ☐ System Information Screen

This System Information screen (image below) shows the 500S controller’s software version. This screen would only be accessed for upgrade or troubleshooting purposes. Contact Chart service at +1 408.371.4932 if access to this screen is necessary.

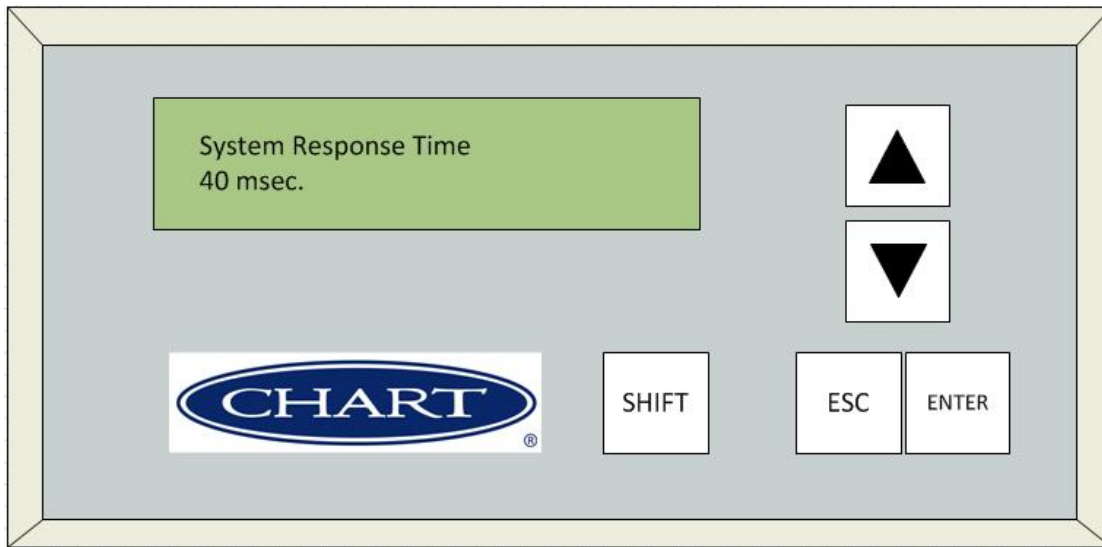


## □ Advanced Settings (System Response Time)

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The System Response Time is an adjustment that is used to make small adjustments to valve timing. It may be required when the normal setup does not correctly dose bottles (or containers). This feature is intended to compensate when the dosing head is greater than 3/4 inch from the bottle (or container) or if the pneumatic pressure (GN<sub>2</sub>) is near the operational limits of the system. The initial value is set at the factory and does not normally need to be adjusted.

1. Use the arrow key ▲ or ▼ to go to the System Response Time screen (image below). Press ENTER to highlight the value.

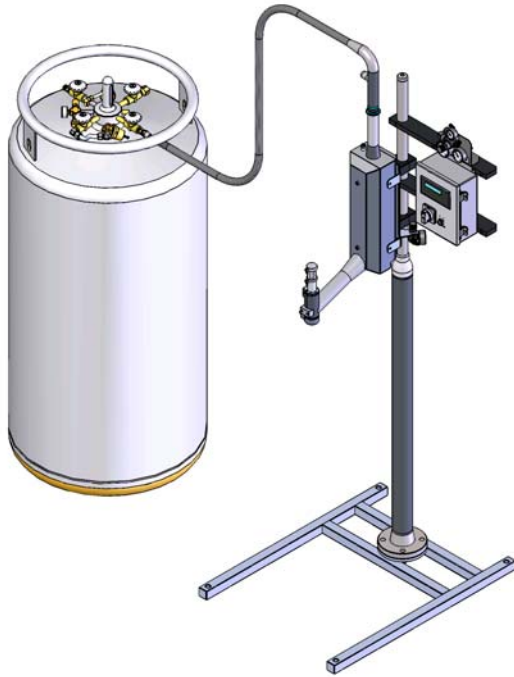


2. Use the arrow key ▲ or ▼ to change the value. Press ENTER when the desired value is shown; range is 20 to 60 milliseconds (msec). The system response time is now set.

## Daily Operating Procedures

The UltraDoser<sup>®</sup> 500S LN<sub>2</sub> Dosing System unit can be fed by either a portable Dura-Cyl<sup>®</sup> Liquid Cylinder or a house liquid nitrogen system. Most UltraDoser 500S system installations will utilize portable Dura-Cyl cylinders.

### ☐ Dura-Cyl Liquid Cylinder Fed System



**Typical Dura-Cyl cylinder Installation Set-Up**

**IMPORTANT:** LN<sub>2</sub> is -320°F (-196°C). Any water and/or moisture can cause ice which will affect the performance of the UltraDoser 500S system. Providing a positive pressure of GN<sub>2</sub> (also known as purging) to the UltraDoser unit before introducing LN<sub>2</sub> into the body will eliminate many performance interruptions.

### **Purging with Gaseous Nitrogen**

The UltraDoser unit must only be purged with gaseous nitrogen. Chart recommends the UltraDoser unit be purged when not in use. However, this may not be practical for all operators. At a minimum, the UltraDoser unit should be purged to eliminate any water that may be inside the unit after installation and prior to startup. The UltraDoser reservoir may also require purging when there is liquid nitrogen flowing out of the vent. The UltraDoser reservoir must also be purged when the nozzle becomes frozen shut.

1. Attach the CryotechFlex hose (½" female flare side) to the house GN<sub>2</sub> system or portable GN<sub>2</sub> cylinder.  
\*\*Note: this step will require additional fittings such as ½" male flare fitting and compression fittings.
2. Flow GN<sub>2</sub> (20 psi; 1.38 bar) through the UltraDoser body for approximately ten (10) minutes before system start up.

**IMPORTANT:** When purging the UltraDoser unit, it will vent heavily and there will be a steady stream of "fog" from the vent. This "fog" will be cold to the touch if the internal temperature of the UltraDoser unit is still at or near LN<sub>2</sub> temperatures (-320 °F; -196 °C). Once the UltraDoser unit is at or near ambient temperature, the "fog" will warm up.

## System Start Up

1. Remove the CryotechFlex hose from the GN<sub>2</sub> outlet with a 7/8" open end wrench or adjustable crescent wrench.
2. Insert the supplied 10 micron filter into the male bayonet on the supplied 10 foot CryotechFlex hose using a 1/8" allen wrench.
3. Attach the CryotechFlex hose (male bayonet side) to the UltraDoser<sup>®</sup> LN<sub>2</sub> Dosing System unit with the supplied bayonet clamp and gasket.
4. Attach the CryotechFlex hose (female flare fitting side) to the 22psi LN<sub>2</sub> Dura-Cyl<sup>®</sup> Liquid Cylinder.
5. Open the liquid valve (counter-clockwise direction) on the Dura-Cyl liquid cylinder.
6. Wait until the UltraDoser unit is filled with liquid nitrogen, approximately 10 minutes.
7. Turn the controller "ON". The front panel will show the Home screen if the controller is functioning correctly.
8. Place the DOSE ENABLE switch on the controller to the "0" position. This will prevent the UltraDoser system from dosing until the operator is ready.
9. Adjust the dosing parameters. See "500S Controller Adjustments" on page 23 for additional information.
10. Place the DOSE ENABLE switch on the controller to the "I" position. This will allow the unit to begin dosing.

**IMPORTANT:** When the UltraDoser unit is filling, it will vent heavily and there will be a steady stream of "fog" from the vent. Once the UltraDoser unit is filled, there will be a "wisp" of fog coming from the vent. If the UltraDoser unit overfills and liquid nitrogen starts dripping out the vent, close the liquid valve on the Dura-Cyl cylinder and call Chart service at +1 408.371.4932.

## System Shut Down

1. Place the DOSE ENABLE switch on the controller to the "0" position. This will stop the machine from dosing nitrogen.
2. Shut the liquid valve (clockwise direction) on the Dura-Cyl cylinder.
3. If possible, purge with GN<sub>2</sub> until next use. See "Purging with Gaseous Nitrogen" on page 34 for additional information.

**IMPORTANT:** Turn the Dose Enable switch to the off "0" position if the system will not be used for a period of time; example an 8 hour shift. This will disable the dosing function but allow the system to continue to supply power to the dosing and vent heaters to prevent ice build-up.

## Dura-Cyl cylinder (22psi) Change Out Procedure

The Dura-Cyl cylinder will need to be changed out from time to time. The operator should visually check the gauges on the Dura-Cyl cylinder to monitor the internal liquid level. When the gauges read low levels, it must be swapped with a full Dura-Cyl cylinder.

1. Shut the liquid valve (counter-clockwise direction) on the Dura-Cyl cylinder.
2. Disconnect the CryotechFlex hose from the Dura-Cyl cylinder using a 7/8" open end wrench or adjustable crescent wrench.
3. Connect the CryotechFlex hose to the liquid outlet on the full Dura-Cyl cylinder using a 7/8" open end wrench or adjustable crescent wrench.

**IMPORTANT:** The UltraDoser 500S system will continue to dose properly until the liquid level inside the UltraDoser unit runs low. This feature gives the operator a reasonable window in which to change out the Dura-Cyl cylinder without disrupting the production operation.

# UltraDoser® LN<sub>2</sub> Dosing System Service and Maintenance

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## □ Nozzle Change Out Procedure

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1. Remove the dosing head heater.
2. Insert the nozzle tool into the nozzle area until the tool connects with the nozzle (Image 1).
3. Remove the nozzle with the driver in a counter-clockwise direction. Remove.
4. Once the nozzle is removed, place the new nozzle or cleaned nozzle into the nozzle tool and insert in a clockwise direction (Image 2).



**Image 1**



**Image 2**

**CAUTION:** The dosing head heater may still be in operation. Do not expose skin to prolonged contact with the dosing head heater. The maximum temperature of the dosing head heater is 150°F (65°C).

**IMPORTANT:** Always perform nozzle change out procedures before introducing LN<sub>2</sub> into the UltraDoser unit. Failure to do so may cause the nozzle to unthread and fall out.

**IMPORTANT:** If the nozzle does not loosen easily, drain the UltraDoser unit through the SRV / drain plug and warm up nozzle with a low voltage heat gun.

## □ Nozzle Cleaning Procedure

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1. Remove the nozzle from the UltraDoser. See “Nozzle Change Out Procedure” on page 36.
2. Clean the nozzle opening with a very thin wire and blow dry nitrogen through it.
3. Thoroughly dry the nozzle with dry nitrogen gas before re-installing.

**IMPORTANT:** Any moisture left on the nozzle will immediately freeze up when the nozzle is re-installed which may cause the nozzle to unthread and fall out.

## □ Purging the UltraDoser<sup>®</sup> LN<sub>2</sub> Dosing System with Gaseous Nitrogen

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The UltraDoser unit must only be purged with gaseous nitrogen. Chart recommends the UltraDoser unit be purged when not in use. However, this may not be practical for all operators. At a minimum, the UltraDoser unit should be purged to eliminate any water that may be inside the unit after installation and prior to startup. The UltraDoser reservoir may also require purging when there is liquid nitrogen flowing out of the vent. The UltraDoser reservoir must also be purged when the nozzle becomes frozen shut.

1. Attach the CryotechFlex hose (½” female flare side) to the house GN<sub>2</sub> system or portable GN<sub>2</sub> cylinder.  
\*\*Note: this step will require additional fittings such as ½” male flare fitting and compression fittings.
2. Flow GN<sub>2</sub> (20 psi; 1.38 bar) through the UltraDoser body for approximately ten (10) minutes before system start up.

**IMPORTANT:** When purging the UltraDoser unit, it will vent heavily and there will be a steady stream of “fog” from the vent. This “fog” will be cold to the touch if the internal temperature of the UltraDoser unit is still at or near LN<sub>2</sub> temperatures (-320 °F; -196 °C). Once the UltraDoser unit is at or near ambient temperature, the “fog” will warm up.

## UltraDoser® 500S LN<sub>2</sub> Dosing System Replacement Parts

Refer to page 11 and 13 for location of most replacement parts on the UltraDoser 500S system.

Part Description	Part Number
Injection Unit Spare Parts Kit (Standard Head) Includes PNs: 102, 103, 104, 105C, 106C, 141, 362, and 535	567
Injection Unit Spare Parts Kit (EP Head) Includes PNs: 102, 103, 104, 105C, 106C, 362, 670.38, and 670.42	2772
0.040" Nozzle	102
0.050" Nozzle	103
0.060" Nozzle	104
Nozzle Tool – 4mm Hex Nut Driver	362
Vent Heater Assembly (no cable included)	105C
Vent Heater Cable	105C.01
Dosing Head Heater (no cable included)	106C
Nozzle (Dosing Head) Heater Cable	1411
10 Micron Inlet Filter	108
10' CryotechFlex Fill Hose	123
EP Head Assembly	1005
Dosing Stem (Valve) Assembly (Standard Head)	141
Dosing Stem (Valve) Assembly (EP Head)	670.38
Solenoid Valve Spare Assembly (Standard Head)	535
Solenoid Valve Spare Assembly (EP Head)	670.42
Dose Solenoid Cable (Standard Head)	2045
Dose Solenoid Cable (EP Head)	323
Confirm Sensor and Cable (Standard Head)	1201
Confirm Sensor Cable (EP Head)	323
Distribution Block	571
Distribution Block Cable	577
18mm Sensor Support Hardware (mount to PN 1422)	694
Complete Sensor Bracket Assembly	1422
18mm Ultrasonic Sensor (Bottle Detect)	643
Timing/Container Sensor Cable	2440.16
12mm Inductive Proximity Sensor (Speed Sensor)	2807
Speed Sensor Support Hardware	2779
Controller Assembly – 500S	CR_2810A
Controller Gauge Assembly	133
Controller Mounting Assembly	2384
Controller Power Cord Assembly	410
User Manual, UltraDoser 500S	15920
UltraDoser Body	15171

## General Troubleshooting

Below are a few general troubleshooting guidelines. If after reading this section, the condition does not change or the condition is not covered in this section, please contact Chart's service team at +1 408.371.4932.

<b>Condition: The safety relief valve is venting.</b>	
<b>Possible Causes</b>	<b>Actions</b>
<ul style="list-style-type: none"><li>The pressure of the LN<sub>2</sub> supply is greater than 50 psi (3.44 bar).</li></ul>	<ul style="list-style-type: none"><li>Check the pressure of the LN<sub>2</sub> supply. If the supply pressure is greater than 50 psi (3.44 bar), reduce the supply pressure.  **Note: A cylinder can be vented to reduce the pressure.</li></ul>
<ul style="list-style-type: none"><li>The vent is obstructed.</li></ul>	<ul style="list-style-type: none"><li>Check the UltraDoser unit vent. If the vent is obstructed, clear the obstruction.  If the vent is obstructed with ice, contact Chart's service team at +1 408.371.4932.</li></ul>

<b>Condition: Liquid is coming out of the vent.</b>	
<b>Possible Causes</b>	<b>Actions</b>
<ul style="list-style-type: none"><li>The LN<sub>2</sub> supply pressure is too high.</li></ul>	<ul style="list-style-type: none"><li>Lower LN<sub>2</sub> supply pressure to 22 psi (1.5 bar) or lower.</li></ul>
<ul style="list-style-type: none"><li>Ice has developed inside the unit, causing the internal float valve to malfunction.</li></ul>	<ul style="list-style-type: none"><li>The UltraDoser unit must be drained of liquid, allowed to warm up over a minimum of 24 hours with a continuous purge of warm nitrogen gas.  Contact Chart's service team at +1 408.371.4932 for a detailed procedure.</li></ul>

<b>Condition: Liquid is coming out of the dosing head even though the valve is shut close.</b>	
<b>Possible Causes</b>	<b>Actions</b>
<ul style="list-style-type: none"><li>The LN<sub>2</sub> supply pressure is too high.</li></ul>	<ul style="list-style-type: none"><li>Reduce the LN<sub>2</sub> supply pressure.</li></ul>
<ul style="list-style-type: none"><li>The valve seat is contaminated (ice or particles).</li></ul>	<ul style="list-style-type: none"><li>The UltraDoser unit must be drained of LN<sub>2</sub>. The dosing valve assembly must be removed and cleaned.  Contact Chart's service team at +1 408.371.4932 for a detailed procedure.</li></ul>



<b>Condition: No liquid from the dosing head.</b>	
<b>Possible Causes</b>	<b>Actions</b>
<ul style="list-style-type: none"> <li>There is insufficient liquid inside the UltraDoser unit.</li> </ul>	<ul style="list-style-type: none"> <li>Open the valve (counter-clockwise direction) on the Dura-Cyl<sup>®</sup> Liquid Cylinder.</li> </ul>
<ul style="list-style-type: none"> <li>The unit is disabled.</li> </ul>	<ul style="list-style-type: none"> <li>Switch the Dose Enable switch to the “I” position.</li> </ul>
<ul style="list-style-type: none"> <li>The nozzle is frozen shut.</li> </ul>	<ul style="list-style-type: none"> <li>Remove, clean, and re-install the nozzle (see page 36).</li> </ul>
<ul style="list-style-type: none"> <li>There is insufficient GN<sub>2</sub> to the dosing head valve.</li> </ul>	<ul style="list-style-type: none"> <li>Check the level of GN<sub>2</sub> at the source. If the level is empty or low, replace.</li> </ul>
<ul style="list-style-type: none"> <li>The speed sensor is not functioning</li> </ul>	<ul style="list-style-type: none"> <li>Check the speed sensor is operating correctly and is sending a signal to the controller.</li> <li></li> </ul>

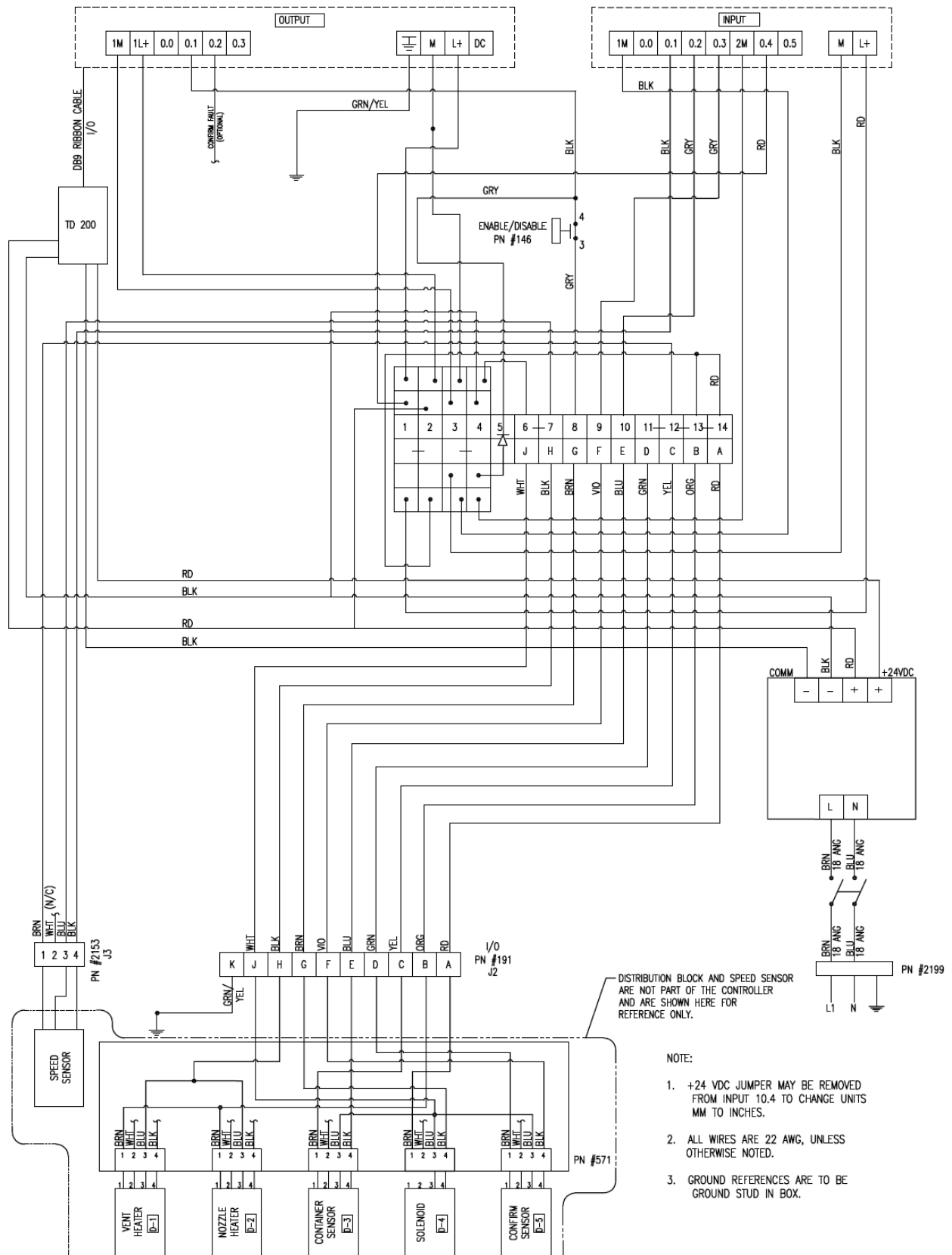
<b>5. Condition: The dosing valve alarm is displayed.</b>	
<b>Possible Causes</b>	<b>Actions</b>
<ul style="list-style-type: none"> <li>The dosing valve assembly is not moving.</li> </ul>	<ul style="list-style-type: none"> <li>Check the pneumatic pressure There must be more than 60 psi (4.14 bar) to have the dosing valve function correctly.</li> <li>Check the confirm sensor for correct placement.</li> </ul>

<b>6. Condition: The speed sensor alarm is displayed.</b>	
<b>Possible Causes</b>	<b>Actions</b>
<ul style="list-style-type: none"> <li>The speed sensor has been dislodged.</li> </ul>	<ul style="list-style-type: none"> <li>Check speed sensor connections.</li> </ul>
<ul style="list-style-type: none"> <li>The speed sensor has malfunctioned.</li> </ul>	<ul style="list-style-type: none"> <li>Replace speed sensor.</li> </ul>

<b>7. Condition: The system is in speed compensated mode but is missing bottles.</b>	
<b>Possible Causes</b>	<b>Actions</b>
<ul style="list-style-type: none"> <li>The container sensor is not detecting a container.</li> </ul>	<ul style="list-style-type: none"> <li>Check sensor connections. If necessary, replace sensor.</li> </ul>
<ul style="list-style-type: none"> <li>The speed sensor has been dislodged.</li> </ul>	<ul style="list-style-type: none"> <li>Check speed sensor connections.</li> </ul>
<ul style="list-style-type: none"> <li>The speed sensor has malfunctioned.</li> </ul>	<ul style="list-style-type: none"> <li>Replace speed sensor.</li> </ul>

**\*\*Note: The UltraDoser system will continue to dose even if there is a speed sensor fault. The 500S controller displays the last known speed and compensates per that speed.**

# 500S Controller Wiring Diagram



## Warranty

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All sales of Liquid Nitrogen Dosing Systems ("LN<sub>2</sub> Dosing Systems") from Chart Inc. ("Chart") to the purchaser are subject to all applicable Chart standard terms and conditions in effect at the time of sale, unless otherwise agreed in writing by an authorized representative of Chart. In addition to the warranty stated in Chart's Standard Terms and Conditions of Sale, Chart warrants to the original purchaser of Chart manufactured LN<sub>2</sub> Dosing Systems that for one (1) year after the date of shipment to the original purchaser said Chart manufactured LN<sub>2</sub> Dosing System will maintain all vacuum and performance standards for said LN<sub>2</sub> Dosing System as published by Chart on the date of invoice.

Purchaser agrees that as a pre-condition to any Chart warranty obligation hereunder, purchaser shall fully inspect the LN<sub>2</sub> Dosing System immediately upon delivery to purchaser and shall give Chart written notice of any claim or purported defect within ten (10) days after receipt of the LN<sub>2</sub> Dosing System. As a further pre-condition to any Chart warranty obligation hereunder, purchaser shall return said purportedly defective LN<sub>2</sub> Dosing System, freight prepaid, to the plant of the manufacturer within thirty (30) days after receipt of the LN<sub>2</sub> Dosing System. Chart shall inspect the returned LN<sub>2</sub> Dosing System, and, if said LN<sub>2</sub> Dosing System is found defective, shall, at Chart's option as purchaser's sole and exclusive remedy, either (i) repair or replace such LN<sub>2</sub> Dosing System or any defective component or part thereof which proves to be defective, or (ii) refund the net purchase price paid by the original purchaser. Alterations or repairs by others or operation of such LN<sub>2</sub> Dosing System in a manner inconsistent with Chart accepted practices and all operating instructions, unless preauthorized in writing by Chart, shall void this warranty. This warranty does not extend to defects caused by the effects of normal wear and tear, erosion, corrosion, fire, or explosion.

Chart's sole and exclusive liability under this Warranty is to the original purchaser and shall not exceed the lesser of the cost of repair, cost of replacement, or refund of the net purchase price paid of the LN<sub>2</sub> Dosing System by the original purchaser. Chart is not liable for any other losses, damages, or costs of delays, including incidental or consequential damages. CHART SPECIFICALLY MAKES NO WARRANTIES OR GUARANTEES, EXPRESS OR IMPLIED, INCLUDING THE WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR USE, OTHER THAN OR WHICH EXTEND THOSE WARRANTIES EXPRESSED HEREIN. The original purchaser shall indemnify, defend and hold Chart harmless from any third party claims as a result of the use, sale, or lease of the LN<sub>2</sub> Dosing System.