



# *Product Manual*

## *CryoDoser Flex™ Liquid Nitrogen Dosing System*



**Designed and Built by:**

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# Contents

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Revision Log . . . . .	iv
<b>Preface . . . . .</b>	<b>1</b>
General . . . . .	1
Features . . . . .	1
Key Benefits . . . . .	1
Product Manual . . . . .	1
Terms . . . . .	2
Acronyms / Abbreviations. . . . .	2
<b>Safety . . . . .</b>	<b>3</b>
General . . . . .	3
Safety Bulletin. . . . .	4
Oxygen Deficient Atmospheres . . . . .	4
Nitrogen . . . . .	4
<b>Installation. . . . .</b>	<b>5</b>
Receiving . . . . .	5
Unpacking . . . . .	5
Installation. . . . .	5
Application Evaluation . . . . .	5
Support Stand and Base Location . . . . .	5
Mounting the Dosing Body. . . . .	6
Mounting the Control and Interface Boxes. . . . .	6
Top Tube Connections . . . . .	6
Electro-Mechanical Connections. . . . .	7
Installing the Nozzle . . . . .	7
Positioning the Dosing Head . . . . .	9
Installing the Container Detect Sensor . . . . .	9
Installing the Timing Sensor . . . . .	9
Installing the Encoder . . . . .	10
Installing the FleX Controller . . . . .	11
Completed Assembly . . . . .	11
<b>Daily Operating Procedures . . . . .</b>	<b>13</b>
Dura-Cyl® Liquid Cylinder Fed System. . . . .	13
Dura-Cyl Cylinder Change Out Procedure . . . . .	13
Bulk Tank (House Fed) System . . . . .	14
Purging with Gaseous Nitrogen . . . . .	14
System Start Up. . . . .	14
System Shut Down . . . . .	15
Best Practices for Superb Operation . . . . .	15
Minimize the entry of moisture into the dosing system . . . . .	15
Nozzle use . . . . .	15
Sensors . . . . .	15
How much LN <sub>2</sub> is needed? . . . . .	16
<b>Service and Maintenance. . . . .</b>	<b>17</b>
Activating Insta-Purge. . . . .	17
Nozzle Change Out . . . . .	17
Nozzle Cleaning. . . . .	17
Purging with Gaseous Nitrogen . . . . .	18
Troubleshooting . . . . .	18

**Specifications . . . . . 19**  
CryoDoser Flex Technical Specifications. . . . . 19  
CryoDoser Flex Components. . . . . 20  
    Standard Components . . . . . 20  
    Optional Components. . . . . 20  
Common Replacement Parts . . . . . 21  
Sensor Positioning. . . . . 22  
Craft Custom Control Box Schematic. . . . . 23  
Craft Custom Interface Box Schematic . . . . . 24  
**Warranty . . . . . 25**

**Revision Log**

Revision Level	Date	Description
A	08/30/2017	Original



## Preface

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### General

The CryoDoser Flex™ LN<sub>2</sub> Dosing System is the first doser with the ability to serve every dosing application within one unit. Chart Inc. has designed a brand new dosing system that can be used from the slowest production lines to the fastest. The CryoDoser Flex line features two distinct controller systems but keeps the look and feel of each very similar. The Craft Custom system includes the capability of changing dose duration and dose delays for up to ten containers. The Pack Premier system is capable of speeds in excess of 2000 cpm with superb accuracy.

With two premium controller options, more standard functions than any other doser offered before, and a brand new all-around design, the CryoDoser Flex system is ready to change the market.

### Features

- Compact Size - enables installation in limited spaces
- Discrete Dosing - Craft Custom (750 cpm) and Pack Premier (2000+ cpm)
- SoftDose™ Compatible - Chart's proven technology for hot fill, powder and granular applications.
- MicroDose™ Standard - the Pack Premier has a controller function that allows dosing pressure adjustments
- RemoteDose™ Standard\* - monitor, troubleshoot and make adjustments while connected to your VPN\*\*
- ExacTrack™ - with the new EDS (Electric Dosing System), supreme accuracy is achieved. Proportionally control the amount the actuator opens and make dosing duration changes in increments of 0.1 ms.
- Warranty - four (4) year vacuum warranty; highest in the industry; one (1) year controller warranty

*\*Results achieved at Chart laboratory conditions.*

*\*\*Access to the internal network is necessary for this function.*

### Key Benefits

- Lightweight PET - reduce the weight of PET for cost and environmental savings
- Glass to PET Transition - eliminate glass safety hazards and weight of containers

- Container Rigidity - maintain container shape even with lighter weight containers
- Eliminate Paneling - increase the internal pressure to offset paneling issues
- Oxygen Reduction - create an inert environment to preserve product freshness
- Extend Shelf Life - minimize oxygen levels
- Ease of Labeling - consistent container rigidity creates an efficient labeling process
- Reduce Nitrogen Consumption - measurable and repeatable liquid doses
- Maximize Warehouse Storage Space - increasing product stackability utilizes less square footage
- Stabilize Organic Products - extend shelf life without preservatives

### Product Manual

This manual is designed to be used in conjunction with the CryoDoser Flex Liquid Nitrogen Dosing System provided by Chart. Chart makes no warranties, express or implied, regarding the content in this manual. Chart assumes no responsibility for any outcomes as a result of using this manual. If after reading this manual you are not confident in carrying out any task, please contact Chart's service team at 1-408-371-4932.

The safety requirements for operating the CryoDoser Flex system and handling or transporting extremely cold liquid products are shown in the Safety section. Use this safety section as a "Safety Checklist" each time the equipment is being used.

In the Installation section there are illustrations for proper connections.

The Controller Adjustments and Daily Operations Section will give information on getting the system up and running smoothly.

The remaining sections provide information on Service, Troubleshooting, Specifications and the Warranty provided by Chart.

## Terms

Throughout this manual safety precautions will be designated as follows:



**Warning!** *Description of a condition that can result in personal injury or death.*



**Caution!** *Description of a condition that can result in equipment or component damage.*



**Note:** *A statement that contains information that is important enough to emphasize or repeat.*

## Acronyms / Abbreviations

The following acronyms / abbreviations are used throughout this manual:

BAR	Pressure (Metric)
CPM	Containers Per Minute
GN <sub>2</sub>	Gaseous Nitrogen
HMI	Human Machine Interface
Kg	Kilogram
LN <sub>2</sub>	Liquid Nitrogen
mS	Milliseconds
O <sub>2</sub>	Oxygen
PET	Polyethylene Terephthalate
PLC	Programmable Logic Controller
PN	Part Number
PNP	Positive-Negative-Positive
PSI	Pounds per Square Inch

## Safety

### General

Thank you for your purchase of Chart Inc.'s CryDoser Flex™ Liquid Nitrogen Dosing System. Chart has designed and fabricated your system with attention to detail utilizing the leading cryogenic technologies to ensure a highly efficient and reliable system.

**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 from Chart.

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!** *Your CryDoser Flex 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.*

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.



**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.*



**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 containers can occur while using Chart's CryDoser Flex doser potentially bursting the containers. Proper calibration of the CryDoser Flex system ensures optimum nitrogen doses to avoid over pressurization. Be sure to remove any containers that receive more than the proper LN<sub>2</sub> doses before sealing.*



**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.*



**Caution!** Before removing parts or loosening fittings, empty the CryDoser FleX system of liquid and release any vapor pressure in a safe manner.

## Safety Bulletin

Portions of the following information are extracted from Safety Bulletin SB-2 from the Compressed Gas Association, Inc. at [www.cganet.com](http://www.cganet.com). Additional information on oxygen, nitrogen, and cryogenics is available in CGA Pamphlet P-9. Write to the Compressed Gas Association, Inc., 1235 Jefferson Davis Highway, Arlington, VA 22202..

## Oxygen Deficient Atmospheres



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

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 and 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 to 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 because 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 essentially helpless. This can occur if the condition is reached by an 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 the unconscious partner unless equipped with a portable air supply. Best protection is obtainable by equipping all individuals with a portable supply of respirable air. Life lines are acceptable only if the area is essentially free of obstructions and individuals can assist one another without constraint.

If an 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 this gas may produce unconsciousness even though an adequate oxygen supply sufficient for life is present.

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 worker’s skin or eyes, the affected tissue should be flooded or soaked with tepid water (105-115°F or 41-46°C). DO NOT USE HOT WATER. Cryogenic burns that result in blistering or deeper tissue freezing should be examined promptly by a physician.



## Installation

### Receiving

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

Upon arrival of the CryoDoser Flex 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.

### Unpacking

All contents should be carefully inspected while unpacking the unit. Things to check for upon arrival include:

- Dents in the CryoDoser Flex 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 packing slip and/or materials list not in the shipping crate, please contact Chart immediately at 1-800-371-3303.



**Caution!** When removing the CryoDoser Flex unit from the crate, gently set it on the ground. **DO NOT drop the CryoDoser Flex unit!** When transporting the unit through the facility be sure to carry with care. Take care not to run into walls or drag the CryoDoser Flex unit on the ground.

If not installed immediately, the CryoDoser Flex system should be stored in a location that is out of the way of frequent traffic and will prevent dirt, water, or other debris from getting inside the system. Chart recommends storing the system in the crate when not in service.

### Installation

#### Application Evaluation

The CryoDoser Flex 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 container by dosing a relatively large amount of LN<sub>2</sub> in the container to inert. The liquid dose quickly converts into gas displacing air and oxygen from the container. The ideal location for the CryoDoser Flex 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 container. The liquid dose quickly converts into gas and the container is then capped or sealed to capture the expanding gas. The CryoDoser Flex unit should be installed as close to the capper as possible.

#### Support Stand and Base Location



Image 1

The CryoDoser Flex unit is supplied with a mounting bracket assembly. The assembly consists of the bracket attaching to the CryoDoser Flex body and two clamps designed to fit on a 1½” stainless steel rod. Chart can supply a prefabricated stand (and stand base) 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 a 1½” diameter rod or round bar will make installation of the CryoDoser Flex system simpler. The instructions below will assume installation of Chart’s prefabricated support stand (Image 2).

1. The CryoDoser Flex unit can be installed on either side of a production line. Select the side that best suits the workplace.
2. Place the base on a level surface and position the bottom half of the stand aligning the holes in the stand to those on the base.
3. Measure 27-1/2” (when a long arm is used or 20-1/2” when a short arm is used) back from the dosing head location. This is the distance from the center of the support stand to the farthest point on the dosing head.
4. Mark the location of the stand and install the four 5/8” bolts included with the support stand in the proper location.

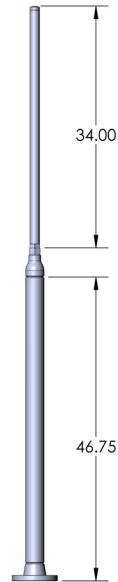


Image 2

### Mounting the Dosing Body

Image 3 depicts the dosing body with various parts not included for clarity. The dosing body will come completely assembled on the bracket. Loosen the 8 bolts on the black Delrin blocks to ensure they will slip over the 1-1/2” round bar. It is beneficial if two people perform this task, one to hold the body in the approximately position and the other to tighten the bolts.

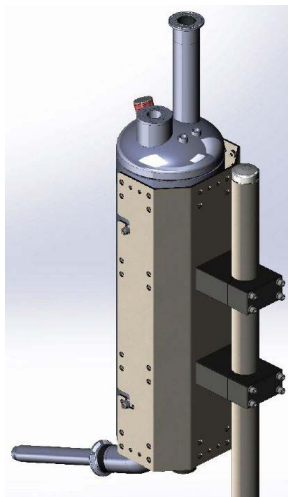


Image 3

**Note:** Do not remove the bolts completely. Doing so could cause the bracket to separate from the clamps.

### Mounting the Control and Interface Boxes

Secure the Control Box and the Interface Box on to the top section of the stand.

**Note:** The Control box is mounted to the two Delrin “arms”.

The Interface box slips over the top of the round bar. Loosen the clamps of each to allow for mounting.

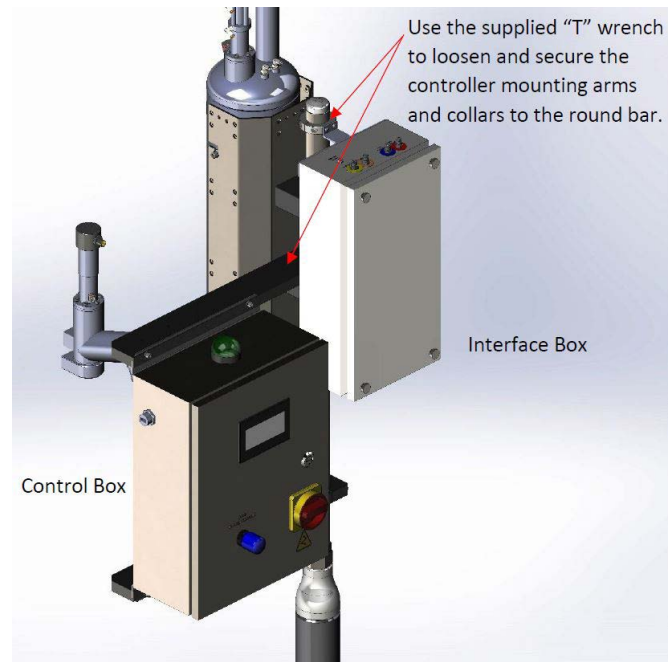


Image 4

### Top Tube Connections

The inlet and pressure tubes will generally come already secured to the dosing body. Color and/or labeling may be used to identify each connection. Push the end of each corresponding tube to the location marked or shown on the Interface box.

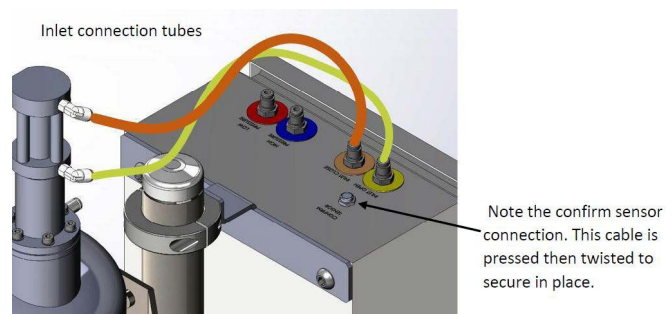


Image 5

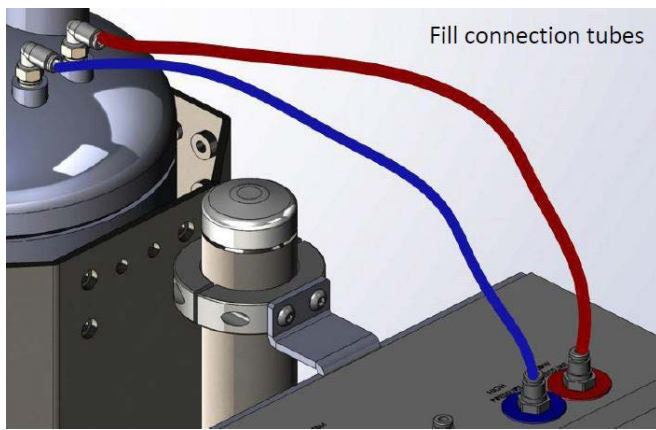


Image 6

### Electro-Mechanical Connections

The bottom of the Control and Interface boxes are provided with connectors and fittings for communication, power, and gaseous nitrogen feed. Depending on system configuration, not all connectors will be utilized.

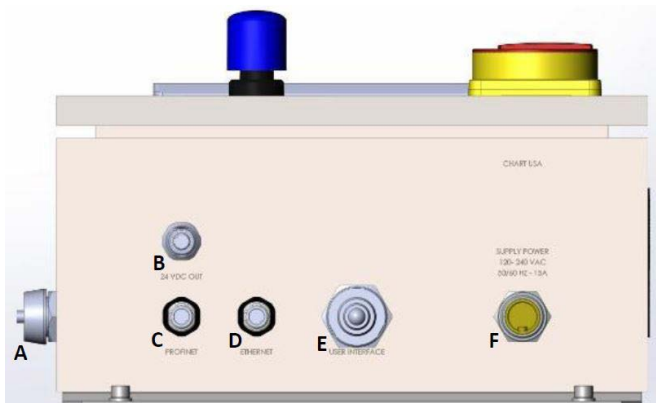


Image 7

- A. **USB Port Connector** - Use this port with a USB memory stick to load any future software changes/upgrades.
- B. **24 VDC Out Connector** - DC power from the Control box to Interface box. Connect the DC power cable.
- C. **Profinet Connector** - Industrial Ethernet. Connect the Green Ethernet cable to the Ethernet port of the Interface Box.
- D. **Ethernet Connector** - Used only when external communication is to be used.
- E. **User Interface Connector** - High end applications when I/O signals will be exchanged between the dosing system and filling lines.
- F. **AC Power Connector** - Connect the AC power cord to a 110VAC Outlet.

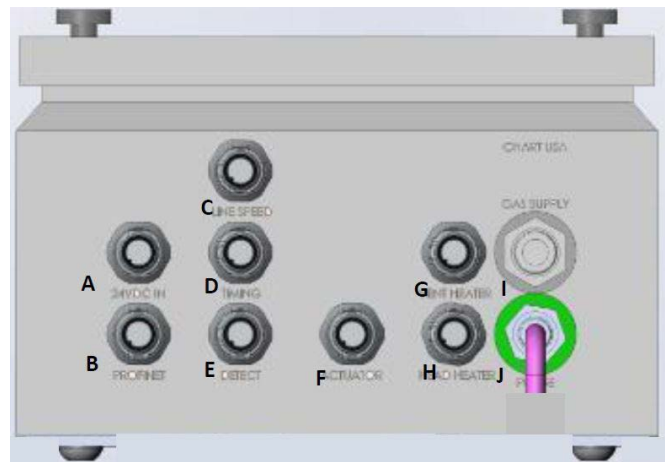


Image 8

- A. **24VDC IN Connector** - Connect DC cable from the control box to this connector.
- B. **Profinet Connector** - Connect the green Ethernet cable from the control box to this connector.
- C. **Line Speed Connector** - For systems that will be using either an encoder or speed sensor, connect the encoder or speed sensor cable to this connector.
- D. **Timing Connector** - All systems will use this connector to detect a container or container pocket (all Craft Custom users, connect the container sensor cable to this connector).
- E. **Container Detect Connector** - For Pack Premier users, connect the container detect cable to this connector.
- F. **Actuator Connector** - Connect either the EDS or EASE actuator cable to this connector.
- G. **Vent Heater Connector** - The short heater cable connects to this connector.
- H. **Head Heater Connector** - The longer heater cable connects to this connector.
- I. **Gas Supply Fitting** - Main gas inlet. Connect the black polytube.
- J. **Purge Fitting** - Connect the polytube to the fitting on the actuator.

### Installing the Nozzle

Three nozzles are supplied with the CryDoser Flex system (0.040 inch, 0.050 inch, and 0.060 inch). 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 (see Image 9).
4. Thread the nozzle into the dosing head area in a clockwise direction (Image 10 & 11). Do not over torque.
5. Re-apply the dosing head heater.



Image 9



Image 11



Image 10



**Caution!** Never use any sharp or pointed object such as an ice-pick, screwdriver, torch or similar device on the dosing head (Image 10). 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 container opening. The dosing head is typically installed 1/2" - 3/4" above the container opening. The CryDoser Flex unit must be manually adjusted to accommodate different sized containers running on the same production line.

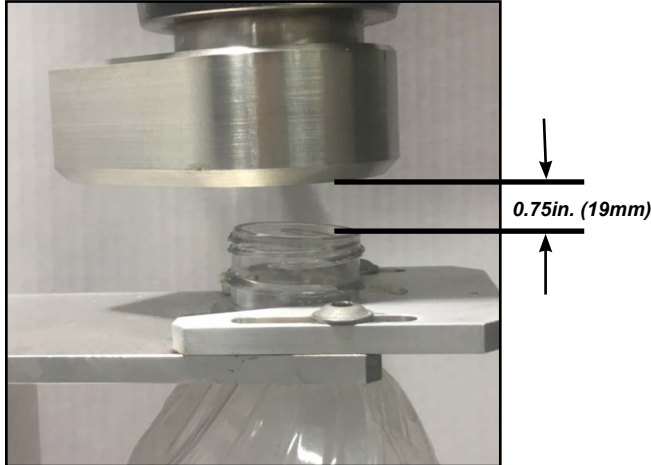


Image 12

### Installing the Container Detect Sensor

The container detect sensor must be a PNP type sensor and is used to detect if containers are present on the line. Chart provides a container detect sensor with the CryDoser Flex system (Image 13). Ideal sensor placement is about four to six pockets from the dosing head. If the sensor does not detect a container for the user defined number of seconds, the CryDoser Flex unit will stop dosing. See the Inputs/Outputs and Container Sensor sections for additional information.



Image 13

The diagram below shows three different ways of positioning the sensor.

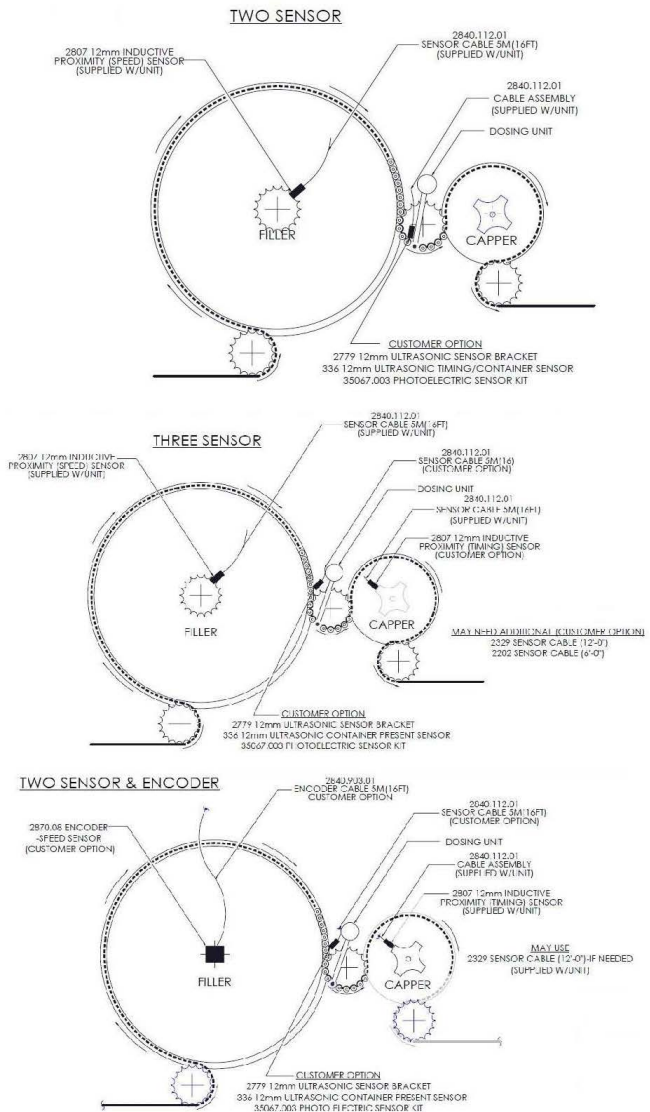


Image 14

### Installing the Timing Sensor

The timing sensor is installed to identify container location and must be installed for the CryDoser Flex system to operate properly. Chart provides a PNP 12mm inductive proximity sensor with the CryDoser Flex system. Ideal sensor placement must provide a one-to-one signal.



Image 15

The speed sensor is installed to detect filling line speed and must be installed for the CryoDoser Flex system to operate properly. Chart provides an additional PNP 12mm inductive proximity sensor that may be used with the CryoDoser Flex system.

### Installing the Encoder

For high speed lines where extreme accuracy is required an encoder (Image 16) must be installed to increase the resolution of the speed output for better performance of the CryoDoser Flex at higher line speeds. The encoder provided by Chart comes from the factory preset to 500 pulses per revolution.



Image 16



**Note:** Only one channel is used to provide necessary pulses for the CryoDoser Flex system. For correct encoder functionality, shielded cabling must be used. The encoder should be grounded, either thru the mounting bracket or separate ground wire.

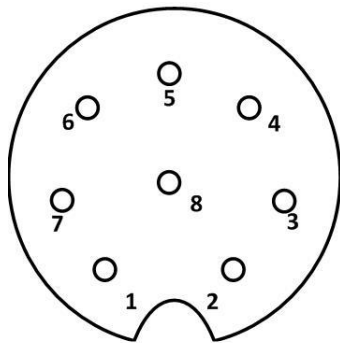


Image 17 - Encoder Cable Connections

Encoder Pin No.	Function	Wire Color
1	Not Used	N/A
2	Not Used	N/A
3	Not Used	N/A
4	CH B Output	Pink
5	Not Used	N/A
6	Not Used	N/A
7	Return (-24Vdc)	Blue
8	Supply Voltage (+24Vdc)	Red
Shield		

The encoder location should be accessible for installation and maintenance. The location may be a spindle to spindle connection where the encoder spindle may be integrated with the filler/capper spindle.

### Encoder Mounting Information

Ensure encoder is properly mounted and securely affixed so it will perform at its optimum capability. Follow the drawing below and mount with suitable hardware. Grounding is achieved by proper mounting of the encoder case. Ensure good electrical contact is made from the mounting flanges to an earthed bracket or other grounded mounting means.

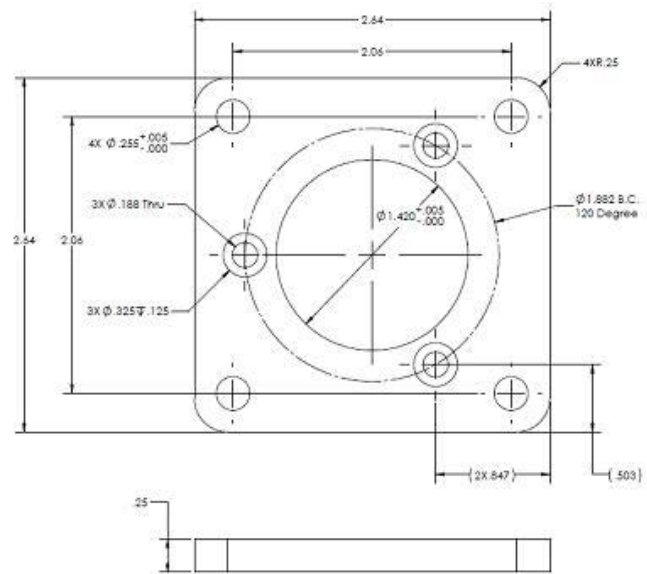


Image 18

## Installing the FleX Controller

Locate the ideal location for the FleX controller. Brackets are supplied to mount the controller on the Chart prefabricated support stand or 1-1/2" diameter rod or round bar. If Chart's prefabricated brackets are not utilized, the controller's mounting tabs can be utilized.

The following images show both Pack Premier and Craft Custom controllers for reference.



Image 19



Image 20

- On/Off Switch - Main power switch for the FleX controller
- Dose Disable Button - Manual dose enable/disable button to disable dosing
- Light Tower Status - The indicator light provides a visual display of the operating status of the CryoDoser FleX system
- Green - Normal operation
- Amber (solid) - Warning condition; see "Alarms" section for additional information
- Red - Fault condition; see "Alarms" section for additional information
- For more detailed information pertaining to the controllers please reference the Pack Premier Controller or Craft Custom Controller Quick Start Guides.

## Completed Assembly

When fully assembled, the CryoDoser FleX will generally take the form shown here.

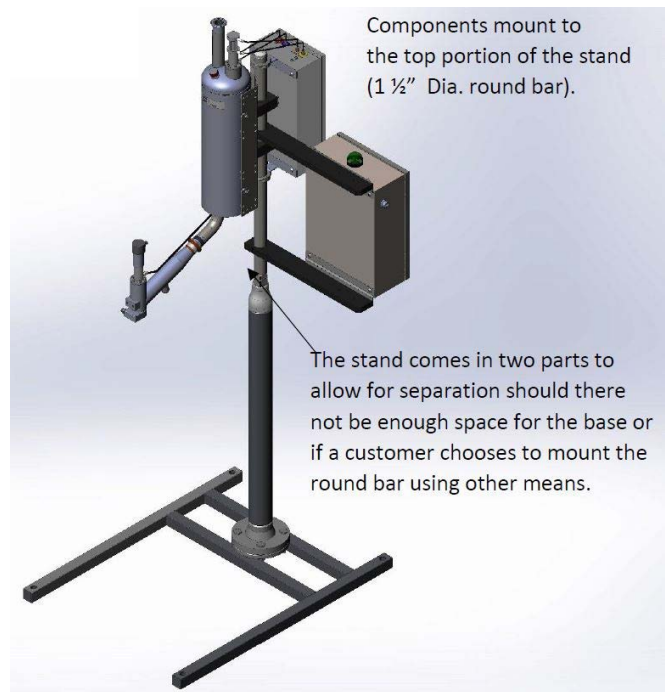


Image 21





## Daily Operating Procedures

The CryDoser Flex system can be fed by either a portable Dura-Cyl® Liquid Cylinder or a bulk tank (house fed) liquid nitrogen system.

### Dura-Cyl® Liquid Cylinder Fed System



**Note:** LN<sub>2</sub> is -320°F (-196°C). Any water and/or moisture can cause ice which will affect the performance of the CryDoser Flex system. Providing a positive pressure

of GN<sub>2</sub> (also known as purging) to the CryDoser Flex unit before introducing LN<sub>2</sub> into the body will eliminate many performance interruptions.

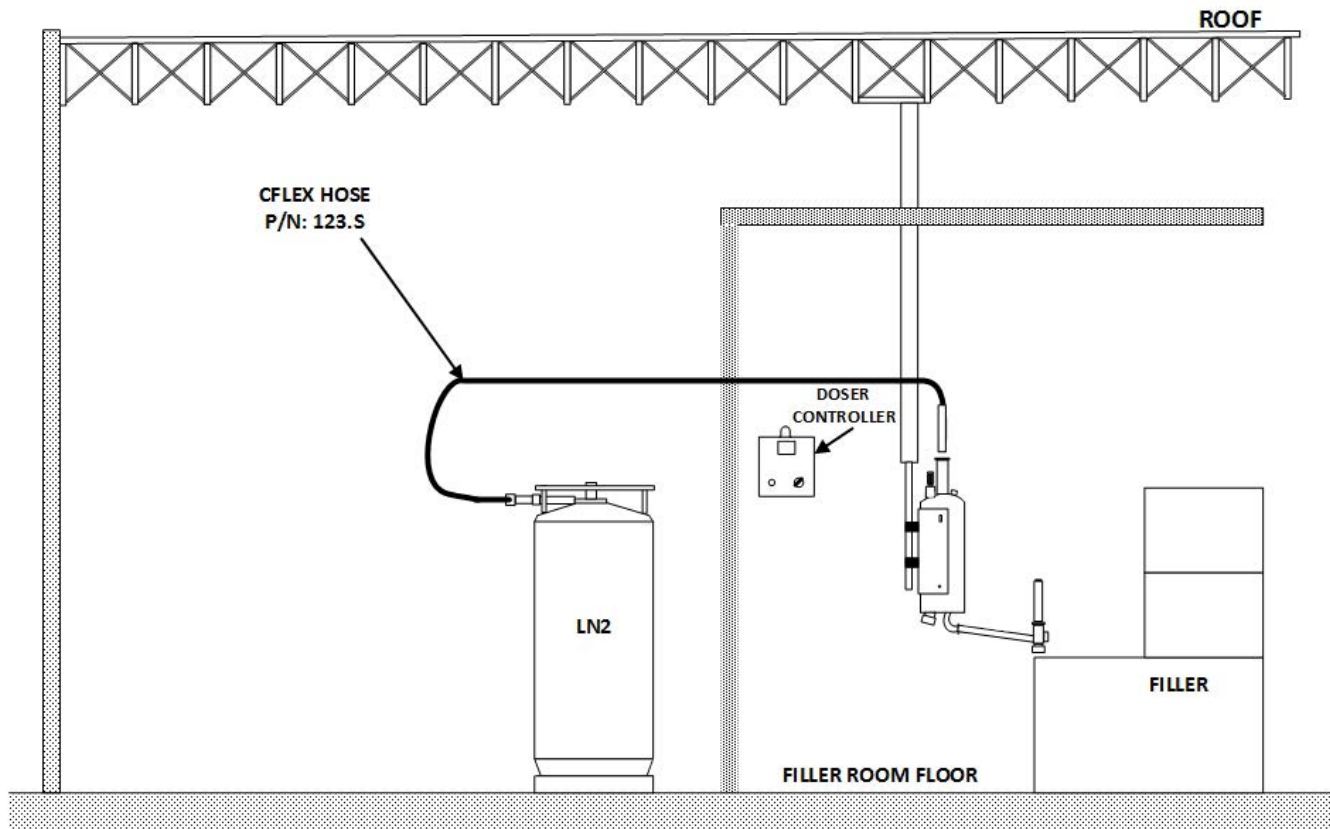


Image 22

### Dura-Cyl Cylinder 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. Chart recommends a cylinder pressure of 60 psi and above.

1. Close the liquid valve (clockwise direction) on the Dura-Cyl cylinder.
2. Disconnect the C-Flex hose from the Dura-Cyl cylinder using a 7/8" open end wrench or adjustable crescent wrench.

3. Connect the C-Flex hose to the liquid outlet on the full Dura-Cyl cylinder using a 7/8" open end wrench or adjustable crescent wrench.



**Note:** The CryDoser Flex unit will continue to dose properly until the liquid level inside the CryDoser Flex 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.

## Bulk Tank (House Fed) System



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

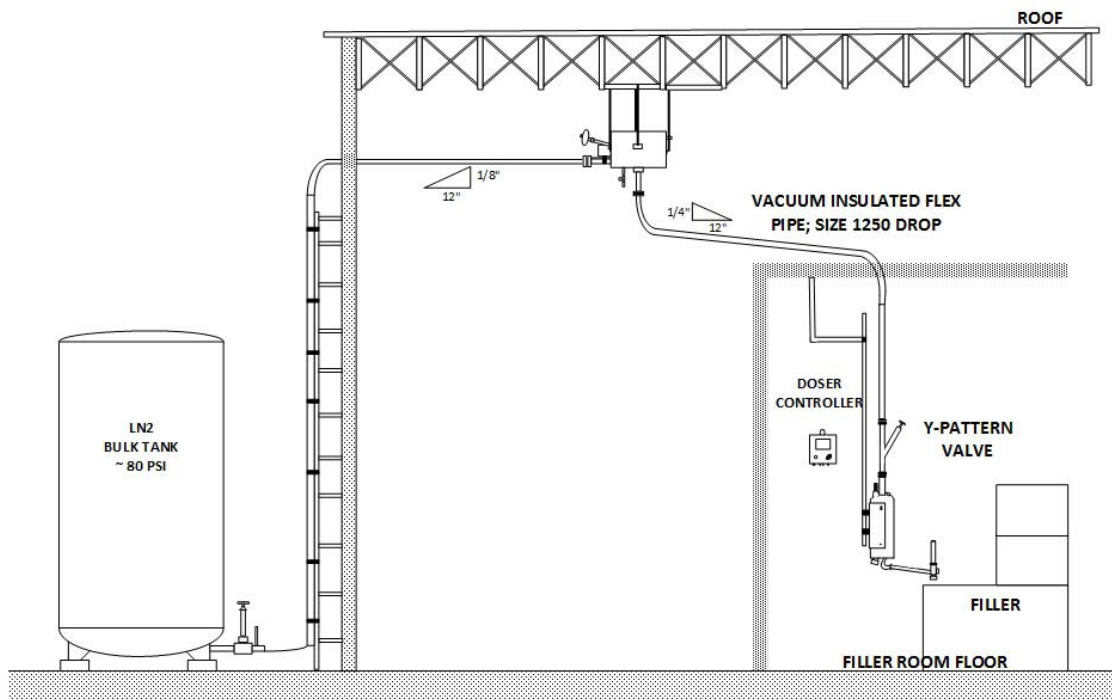


Image 23

### Purging with Gaseous Nitrogen

Purging is the process of introducing nitrogen gas into the CryoDoser FleX body to minimize and/or eliminate ice that may have formed within the system. Ice may form whenever there is an introduction of a liquid substance into the CryoDoser FleX body. This may be because of product splashing, steam from CIP, or just an intake of moisture from the environment.

Freeze-ups may result in delays - some extreme if the ice within the body has occurred deep inside the vessel.

With the CryoDoser FleX system, Chart has taken steps to ensure freeze-ups are minimized. Each system is provided with integral purging capabilities including an option to provide heated gas. Heating the gas accelerates the removal of ice so as to bring the down time to a minimum.

For additional information about purging please refer to the Controller Quick Start Guide.



**Caution!** When purging the CryoDoser FleX 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 CryoDoser FleX unit is still at or near LN<sub>2</sub> temperatures (-320°F; -196°C). Once the CryoDoser FleX unit is at or near ambient temperature, the “fog” will warm up.

### System Start Up

There are two primary methods for delivering liquid nitrogen to the CryoDoser FleX system; phase separator through a Y-pattern valve and Chart Dura-Cyl® Liquid Cylinder or similar dewar through a Chart flexible “123” hose.

If the CryoDoser FleX system is being fed liquid nitrogen via a phase separator, ensure the phase separator has been

properly set up prior to set up of the CryDoser FleX. Refer to the Phase Separator Product Manual for specific instructions.

If the CryDoser FleX system is being fed liquid nitrogen from the Chart Dura-Cyl cylinder, ensure the connection hose to the CryDoser FleX has been properly connected including the installation of a safety relief device as part of the hose installation, that the stainless steel filter has been installed in the end of the hose bayonet, and that the bayonet connection to the CryDoser FleX has been properly installed and secured.

Manually open (counter clockwise) the blue handle valve on the Dura-Cyl liquid cylinder.

Refer to the CryDoser FleX Controller Quick Start Guide for additional information.

## System Shut Down

1. Manually close (clockwise) the Y-Pattern valve (blue handle).
2. Manually open (clockwise) the ball valve (yellow handle) on the Purge Kit.



**Note:** The supply pressure reading on the FleX controller may read  $12 \pm \text{psi}$  due to the added GN<sub>2</sub> pressure.

Also, refer to the phase separator product manual for instructions regarding shutting down of the phase separator if applicable.

If your CryDoser FleX system is being fed off of a Chart Dura-Cyl liquid cylinder close (clockwise) the valve of the cylinder.

## Best Practices for Superb Operation

### Minimize the entry of moisture into the dosing system

1. Moisture turns into ice when subjected to cryogenic temperatures. Ice causes blockages and can lead to tremendous down time. Moisture can inadvertently enter the dosing system in various ways including splashing product, system cleaning, or from the environment. It is extremely important to be aware of this and prevent moisture from entering or accumulating in the dosing system.
2. How can moisture be prevented from entering the dosing system?

- a. When not in use, or being cleaned, cap the vent and the dosing head area.
- b. If the system will not be used for a short period of time it is helpful to keep some liquid in the dosing body to provide positive pressure at the vent preventing moisture from creeping in.

## Nozzle use

Standard nozzles are single opening devices with diameters ranging from 0.020" to 0.110" in 0.005" increments. In addition to these devices, Chart provides a range of specialty nozzles in our "Soft Dose" packages. These nozzles include: Ventilator, Regar, Diverging, Converging, Angle and Hot Chute.

- Where to use - There is no set standard that identifies a specific nozzle for a product. Each product, product line, and requirement will lead towards defining the type of nozzle(s) used. In general, standard single opening nozzles are used in the vast majority of liquids; such as water, teas, coffees and beers. They are also used with dry goods such as peanuts and almonds. The same nozzles can be used for both pressurization or inerting (oxygen reduction).
- Soft dose nozzles may also be used for pressurization or inerting. The use of these nozzles may provide added benefits such as less spray for products that can tend to be ejected from their container if a single hole nozzle is used. Powder or granulated products such as ground spices, ground coffee, teas, or even baby formula are examples of susceptible products.
- Soft dose nozzles such as the "Regar" nozzle have a shower head spray pattern that can be used to diffuse slightly to minimize product ejection. In addition, this particular nozzle has a wide spray pattern making it suitable for larger opening containers.
- The Hot Chute is a unique soft dose product. This device utilizes a standard nozzle but also incorporates a set of heating elements and nose extension allowing access to some locations where a standard dosing head may not be able to reach into a small space. The added heating elements diffuse the nitrogen stream causing it to become more of a mist which also minimizes product expulsion.

## Sensors

The Chart dosing systems typically utilize three sensors for high speed operation. Lower speed lines or manual operated lines can operate on just one sensor.

- Sensors provided for Chart dosing systems are as follows:

Timing  
Container detect  
Encoder

- Timing - typically an inductive proximity device. This sensor will provide a pulse identifying a start time where a container has been detected until it reaches the dosing head. This sensor is suitable for detecting on any metal object such as a gear tooth or shaft collar bolt. This sensor is typically a barrel type and comes in three different diameters: 13mm, 18mm and 30mm. Sensing distances are approximately as follows:

13mm dia. = 2mm (0.08 in.)

18mm dia. = 4mm (0.2 in.)

30mm dia. = 7-8mm (0.3 in.)

- Container detect - Typically a photo-electric device. This sensor will provide a signal identifying an approaching container. It is capable of detecting virtually any type of object that is placed within its sensing distance, therefore good for cans, bottles, pouches of all shapes, sizes and colors. The sensing distance may vary based upon the manufacturer of the sensor but it typically has a range of approximately 4 inches (10cm).

The sensor is typically a barrel type and is provided in an 18mm diameter.

The sensor is typically placed at or near the dosing head. It also serves the purpose of nozzle cooling when placed at some short distance in front of the dosing head. This feature can be very important when the filler tends to sit idle with no containers passing for short periods of time.

As the system sits without dosing, the dosing head heats up which results in the next dose (or couple of doses) being slightly warmer and therefore more gaseous. This will result in lower pressure in the first few containers.

- Encoder - this device does provide an input to the control box but unlike the other two sensing devices that provide one pulse each time it is triggered, this device provides hundreds or even thousands of pulses. The device can be programmed to output up to the maximum capability of the device (65,000 pulses per shaft revolution). Considering the standard pulses necessary for high speed dosing is about 500 pulses per container, this encoder is capable of many more than needed to perform optimally.

## How much LN<sub>2</sub> is needed?

Identifying the right amount of liquid can be challenging. Some trial and error is commonplace. However, there are a couple of ways to minimize the number of trial and error situations.

- Use the largest nozzle and lower the dose duration. It is much easier to punch a button rather than removing a nozzle so the fewer number of times a nozzle is to be removed, the better. Start with a larger nozzle size than you think is necessary and run a shorter dose duration than what is probably needed. Test to see what the pressure or oxygen level is and increase the duration until a desirable result is achieved.
- Use a continuous stream as a starting point. Targeting a small opening can also be challenging. However, if a continuous stream is used initially it can then be reasoned that the nozzle size is correct. The second half of this test is to then “shorten” the stream. In other words target the stream to start and stop within the opening.
- Semi-continuous stream - a trick to use when targeting is more difficult due to erratic conveyor movement, environment issues, poor sensing or sensor susceptibility is to start and stop the stream before and after each container. Set the dose early (starting just before the container gets under the dosing head) and end it just after the container has passed.
- How do you know if you’re hitting the target? Two simple techniques:
  - Look for the “smoke” out of the container
  - Feel test

Is the smoke good enough? Depending on your specification and/or requirement more or less nitrogen may be needed. Once smoke is seen, a measurement is taken (pressure or oxygen levels). That measurement can then be used to determine whether more or less nitrogen is needed. Increase the dose duration. If the pressure goes up, the initial target was fairly accurate. If it stays the same, then the initial target was a bit late and the added dose duration just placed nitrogen into the space after the container has passed. In this case move the targeting sensor so it triggers sooner.

What about oxygen content? This will require an oxygen meter or tester. Oxygen measurements can be even trickier.

## Service and Maintenance

### Activating Insta-Purge

The CryDoser Flex unit has a purge feature that minimizes downtime for maintenance and/or nozzle change out without draining or shutting down the main LN<sub>2</sub> supply line.

### Nozzle Change Out

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

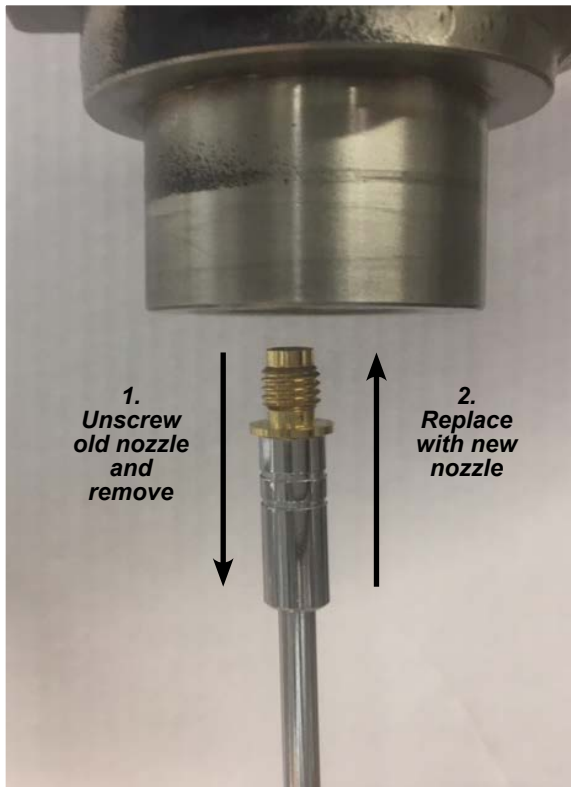


Image 24



**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).



**Caution!** If possible, always perform nozzle change out procedures before introducing LN<sub>2</sub> into the CryDoser Flex unit. Failure to do so may cause the nozzle to unthread and fall out.



**Note:** If the nozzle does not loosen easily, a low voltage heat gun may be used to heat the end of the nozzle tool. The tool can then be placed over the nozzle to slowly melt any ice allowing removal of the nozzle. Repeat this process if the nozzle remains stuck.

### Nozzle Cleaning

1. Remove the nozzle from the CryDoser Flex unit.
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.



**Caution!** 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 with Gaseous Nitrogen

The CryoDoser FleX™ unit must only be purged with gaseous nitrogen. Chart recommends the CryoDoser FleX unit be purged when not in use. However, this may not be practical for all operators. At a minimum, the CryoDoser FleX unit should be purged after installation and prior to startup to eliminate any water that may be inside the unit. The CryoDoser FleX reservoir may also require purging

when there is liquid nitrogen flowing out of the vent. The CryoDoser FleX reservoir must also be purged when the nozzle becomes frozen shut.

See the Dura-Cyl® Liquid Cylinder Fed System and Bulk Tank (House Fed) System sections for additional information.

## Troubleshooting

Refer to the table below for troubleshooting procedures. The table is arranged in a Symptom/Possible Cause/Solution format. Note that possible causes for specific symptoms are listed in descending order of significance. That is, check out the first cause listed before proceeding to the next. If you need further assistance please contact Chart's service team at 1-408-371-4932.

Symptom	Possible Cause	Solution
Liquid is coming out of the vent.	The LN <sub>2</sub> supply pressure is too high.  Ice has developed inside the unit, causing the inlet valve to malfunction.	Lower LN <sub>2</sub> supply pressure to 120 psi (8.3 bar) or lower.  The CryoDoser FleX unit must be drained of liquid, allowed to warm with a continuous purge of warm nitrogen gas. Contact Chart's service team at 1-408-371-4932 for a detailed procedure.
Liquid is coming out of the dosing head even though the valve is closed.	The valve seat is contaminated (ice or particles).	The CryoDoser FleX 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.
No liquid from the dosing head.	There is insufficient liquid inside the CryoDoser FleX unit.  The unit is disabled.  The nozzle is frozen shut.  The container detect sensor is not detecting a container.	Check the level of LN <sub>2</sub> . If the level is empty or low, open the supply valve.  Pull out the Dose Enable switch to enable mode (ensure switch is not lit).  Run Insta-Purge to thaw nozzle. Remove, clean, and re-install the nozzle (see Nozzle Change Out section for additional information).  Check sensor connections. Ensure the sensor is correctly positioned to detect points (gear tooth or the like). If necessary, replace sensor, cable or both.

## Specifications

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### CryoDoser FleX Technical Specifications

Materials	Stainless Steel Series 316L
Weight	38 lbs (17 kg)
Body Dimensions	28.5"H x 6"W (724mm x 152 mm)
Dosing Head Dimensions	13.5"H x 2"W (338mm x 50.8mm)
Arm Reach Short - 20-1/2" Long - 27-1/2"	20-1/2" to 27-1/2" (521mm to 699mm)
Head Pressure	Variable
Nozzles	Ships with 0.040", 0.050", 0.060"  0.020" - 0.100" available (0.005" increments)
System Utilities	Liquid Nitrogen: 3-120 psi (0.2-8.3 bar)  Gaseous Nitrogen: 60-80 psi (4.1-5.5 bar)  Electricity: 110-240V AC; 50/60Hz, 110W
Steady State Consumption	0.04 gal (0.15 liter) / hour
Purge Feature	Yes
Vacuum Insulated	Yes
Arm	Yes
SoftDose™ Compatible	Yes

## CryoDoser Flex Components

### Standard Components

#### CryoDoser Flex Body

The stainless steel vacuum insulated reservoir provides a ready supply of LN<sub>2</sub> for dosing operations.

#### Controller

Controller dictates the dosing operation of the system.

#### Inlet Filter

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

#### Bayonet Connection

The bayonet connection allows the C-Flex hose or vacuum insulated pipe to connect to the CryoDoser Flex unit. Bayonets are vacuum insulated and provide a warm, frost-free connection.

#### Mounting Bracket Assembly

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

#### Dosing Head

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

#### Dosing Head Heater

The CryoDoser Flex 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>.

#### Dosing Nozzle(s)

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

#### Vent Heater

The CryoDoser Flex 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

#### C-Flex Hose

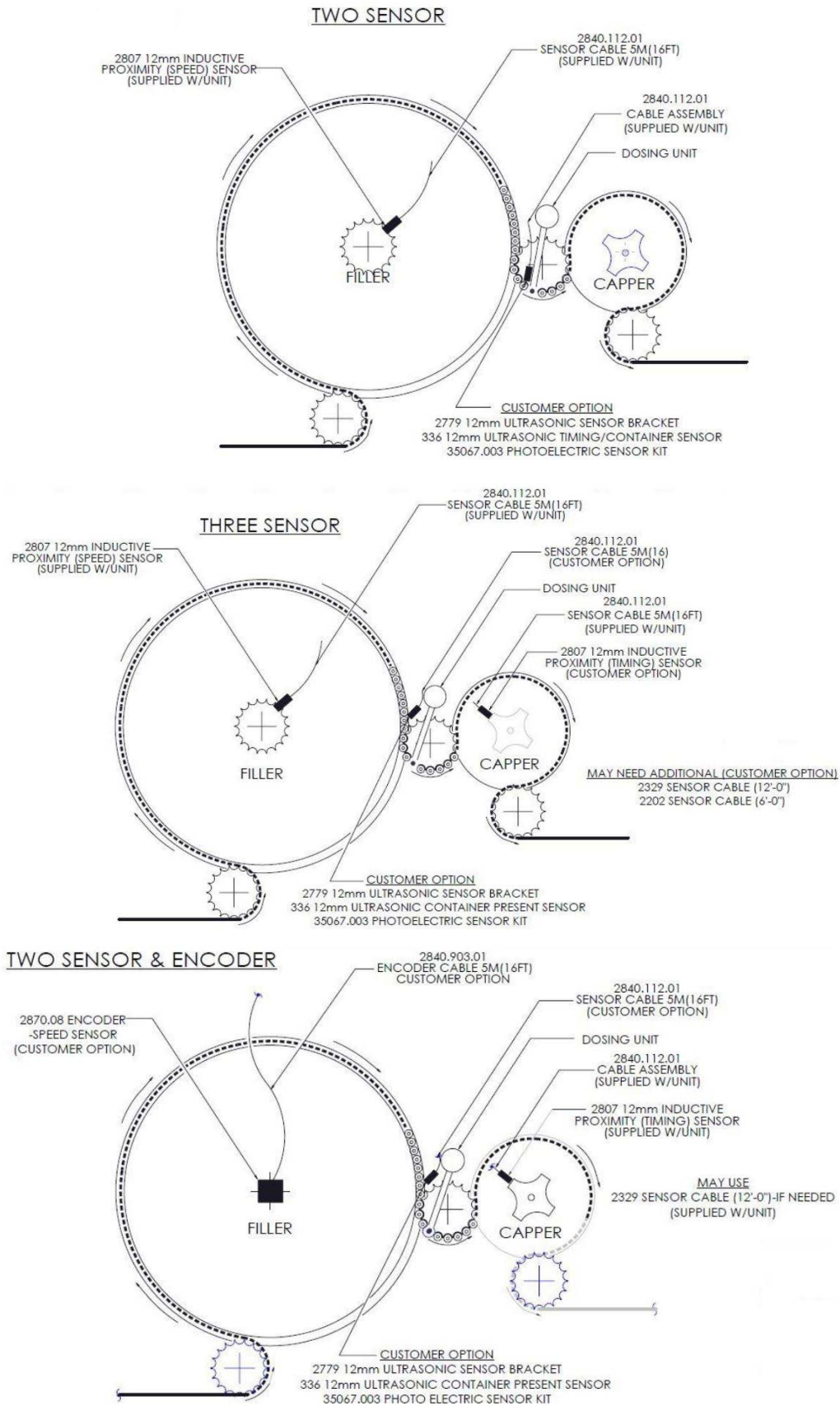
A vacuum insulated hose that provides a connection between the CryoDoser Flex unit and the LN<sub>2</sub> supply.



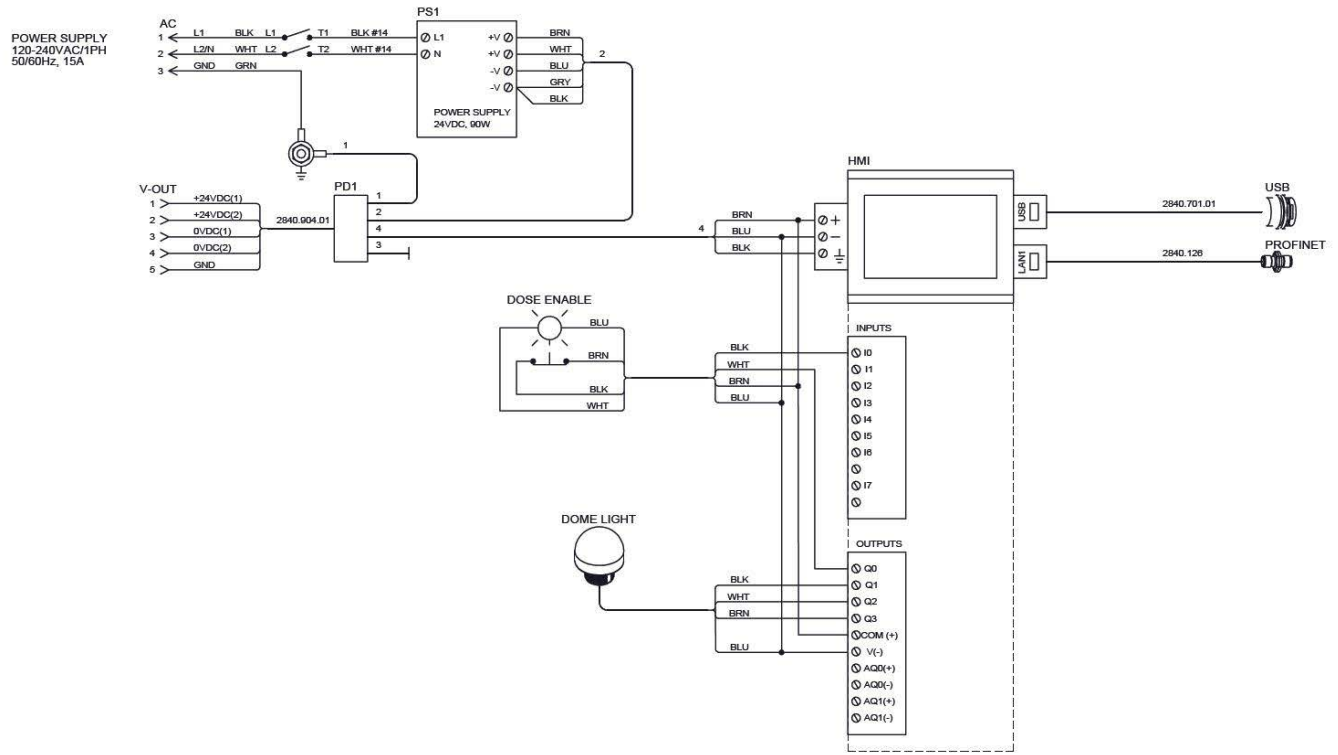
## Common Replacement Parts

Item Number	Part Description	Part Number
1	CryoDoser Flex Body	35000
2	Short Arm	35050
3	Long Arm	35051 / 35061
4	EDS Electric Actuator	35053
5	EASE Electric Actuator	35058
6	Long Arm Support	35060
7	CryoDoser Flex Body Mounting Bracket	35054
8	Vent Heater Assy	35056
8a	10W Vent Heater Cartridge	35055.03
9	Dosing Head Heater Assy	35055
9a	6W Dosing Head Heater Cartridge	35055.01
10	Inlet Valve Assy	35057
11	Inductive Prox. Sensor Assy (Timing)	35067.004
12	Photoelectric Sensor Assy (Container)	35067.003
13	Encoder Assy	35067.002
14	Control Box Assy CC	35065
14a	Control Box Assy PP	35063
15	Interface Box Assy CC	35064
15a	Interface Box Assy PP	35066
16	Doser Stand	119K
17	Doser Base	326A
18	Y-Pattern Valve	S6OMYCD
19	123 Fill Hose	123.S
20	10 Micron Filter	CR_108
21	AC Power Cord	410
22	Ethernet Cable	2840.122
23	DC Power Interconnect Cord	2840.108
24	PolyTube - Black	334
25	Thermopurge Assy	35062
26	30mm Inductive Proximity Sensor Assy	35067.005
27	Sensor Cable(s)	2840.112.01
28	Encoder Cable	2840.903.01
29	Vent Heater Cable	2840.113.01
30	Dosing Head Heater Cable	2840.113.02
31	EDS Electric Actuator Cable	2840.901.01
32	EASE Electric Actuator Cable	2840.902.01

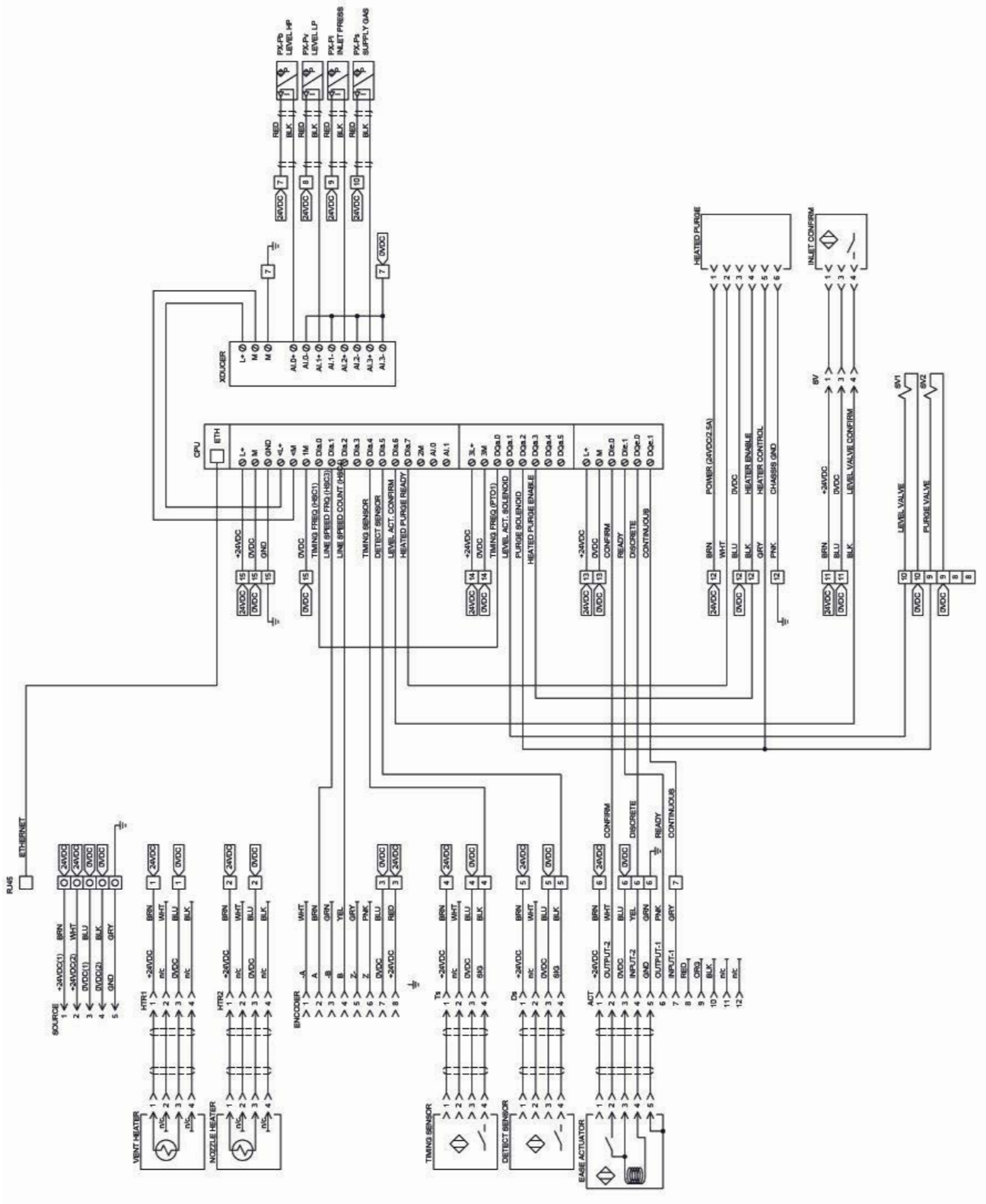
## Sensor Positioning



## Craft Custom Control Box Schematic



# Craft Custom Interface Box Schematic



## 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 two (2) years after the date of shipment to the original purchaser said Chart manufactured LN<sub>2</sub> Dosing Systems will maintain all performance standards for said LN<sub>2</sub> Dosing Systems as published by Chart on the date of invoice. Warranty replacements due to vacuum loss will also follow the same warranty period and regulations.

Purchaser agrees that as a pre-condition to any Chart warranty obligation hereunder, purchaser shall fully inspect the LN<sub>2</sub> Dosing Systems 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 Systems. As a further pre-condition to any Chart warranty obligation hereunder, purchaser shall return said purportedly defective LN<sub>2</sub> Dosing Systems, freight prepaid, to the plant of the manufacturer within thirty (30) days after receipt of the LN<sub>2</sub> Dosing Systems. Chart shall inspect the returned LN<sub>2</sub> Dosing Systems, and, if said LN<sub>2</sub> Dosing Systems 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 Systems 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 Systems 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 Systems 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 Systems.



