



Product Manual
CryoDoser® 2K
Liquid Nitrogen Dosing System



Designed and Built by:

Chart Inc.

***46441 Landing Parkway
Fremont, CA 94538 USA
(800) 371-3303***



Contents

Revision Log	iv
Preface	1
General	1
Features	1
Key Benefits	1
Product Manual	1
Terms	2
Acronyms / Abbreviations.	2
Safety	3
General	3
Safety Bulletin.	4
Oxygen Deficient Atmospheres	4
Nitrogen	4
Installation.	5
Receiving	5
Unpacking	5
Installation.	5
Application Evaluation	5
Support Stand Location.	6
Mounting the CryoDoser Unit	6
Connecting the Gas Manifold Assembly	6
Connecting the Distribution Block	7
Installing the Nozzle.	8
Positioning the Dosing Head	9
Installing the Bottle Detect Sensor	9
Installing the Timing Sensor	10
Installing the Encoder	10
Installing the 2K Controller	11
Controller Adjustments.	13
Home Screen	13
Color Coding	13
Home Screen Overview and Meanings.	13
About Screen	13
Languages	14
Setup Button.	14
Access and Passwords.	14
System Settings	14
Calibration	15
Recipes	17
Creating a Recipe.	17
Creating Additional Recipes	17
Activating a Recipe.	17
Maintenance	18
Maintenance Modes	18
Dosing Valve Disabled	18
Dosing Valve Enabled	18
Graphs	18
Timing Analysis Graph	19
Dose Delay Bar Graph	19
Inputs/Outputs.	19
Tower Light - troubleshoot the tower lights	19
Liquid Level - calibrate and set alarm threshold for liquid level.	20

Inlet Pressure - calibrate and set alarm threshold for inlet pressure 20

Bottle Sensor - set the functions of the bottle detect sensor 20

Distribution Block - troubleshoot the distribution block sensors/connections 21

Alarms 21

 Warning Level Alarms 22

Daily Operating Procedures 23

 Dura-Cyl Liquid Cylinder Fed System 23

 Purging with Gaseous Nitrogen 24

 System Start Up. 25

 System Shut Down 25

 Dura-Cyl® Liquid Cylinder (22 psi) Change Out Procedure 25

 Bulk Tank (House Fed) System 26

 Purging with Gaseous Nitrogen 26

 System Start Up. 27

 System Shut Down 27

Service and Maintenance. 29

 Activating Quick Service 29

 Nozzle Change Out 29

 Nozzle Cleaning. 30

 Purging with Gaseous Nitrogen 30

 Troubleshooting 30

Specifications 33

 CryoDoser Technical Specifications. 33

 Controller Technical Specifications 33

 CryoDoser 2K Components 34

 Standard Components 34

 Optional Components. 34

 Common Replacement Parts 35

 Sensor Positioning. 40

Warranty 41

Appendix 43

Revision Log

Revision Level	Date	Description
B	10/07/2014	Reformat with new layout
C	10/9/2014	Add 'Creating Additional Recipes' section
D	02/06/2015	Replace Distribution Block photo in Installation section
E	03/16/2015	Increase warranty to 2 years
F	05/10/2016	Update address to Fremont, CA, update alarm levels on pages 21 & 22, update encoder figure 4 on page 10.



Preface

General

The CryoDoser® 2K system is the premier liquid nitrogen (LN₂) dosing system utilizing advanced cryogenic technology and PLC programming. Three sensors detecting line speed, timing, and bottle presence allow the system to detect all lines speeds, including high speeds, to dispense a precise dose of LN₂ into every container every time. The LN₂ gasifies and is either trapped in the container to add rigidity or escapes with oxygen to inert the headspace.

LN₂ is supplied to the CryoDoser system by a vacuum insulated hose and flows into the dosing head. A sensor detects the speed of the line (encoder compatible); a second sensor detects the presence of a container. When a container is detected, the dosing head opens and dispenses an exact amount of pure LN₂. A PLC (Programmable Logic Controller) is the brains behind integrating the sensors, controls and human interface via a touch-screen HMI (Human Machine Interface) display.

Features

- Flexible Dosing Arm - allows the dosing head to be installed at any angle
- Quick Service Automatic Defrost - eliminates most freeze ups in less than ten minutes
- IntelliDose™ Capable - automatic dose adjustments at any line speed between low/high points as defined by user
- RemoteDose™ Capable - monitor and troubleshoot the system remotely thereby minimizing or eliminating system downtime**
- MicroDose™ Technology - designed specifically for tight pressure specifications
- Discrete Dosing - up to 2000* containers per minute
- Discrete or Continuous Dosing - change over defined by user
- SoftDose™ Compatible - Chart's proven technology for hot fill, powder and granular applications

*Results obtained under specific 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
- Bottle Rigidity - maintain bottle 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 bottle 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 2K 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.

Additional copies of this manual are available by contacting Chart at 1-800-371-3303.

The safety requirements for operating the CryoDoser 2K 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 ₂	Gaseous Nitrogen
HMI	Human Machine Interface
Kg	Kilogram
LN ₂	Liquid Nitrogen
mS	Milliseconds
O ₂	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 (Chart) CryDoser 2K 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 2K 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 bottles (or containers) can occur while using Chart's CryDoser 2K doser potentially bursting the bottles (or containers). Proper calibration of the CryDoser 2K system ensures optimum nitrogen doses to avoid over pressurization. Be sure to remove any bottles (or containers) that receive more than the proper LN₂ 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 CryoDoser 2K 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. 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 2K doser is designed for variable speed filling lines up to 2000 bottles (or containers) per minute (under specific conditions). It will compensate for changes in line speed, ramp up, and ramp down conditions.

Unpacking

The CryoDoser 2K 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 2K 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.

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

- Dents in the CryoDoser 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 unit from the crate, gently set it on the ground. DO NOT drop the CryoDoser 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 unit on the ground.*

If not installed immediately, the CryoDoser 2K 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 2K 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 (O₂) from a bottle (or container) by dosing a relatively large amount of LN₂ 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 CryoDoser 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 LN₂ 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 CryoDoser unit should be installed as close to the capper as possible.

Support Stand Location

The CryoDoser unit is supplied with a mounting bracket assembly. The assembly consists of the bracket attaching to the CryoDoser body and two clamps designed to fit on 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 1½” diameter rod or round bar will make installation of the CryoDoser 2K system simpler. The instructions below will assume installation of Chart’s prefabricated support stand (Figure 1).

1. The CryoDoser unit can be installed on either side of a production line. Select the side that best suits the workplace.
2. Measure 32.5” (825mm) 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.
3. Mark the location of the stand and install the four 5/8” bolts included with the support stand in the proper location.

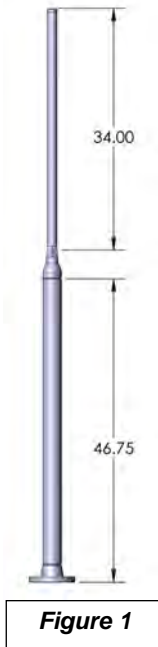


Figure 1

Mounting the CryoDoser Unit

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

Connecting the Gas Manifold Assembly

The gas manifold assembly is a secondary “hub” to gather and transfer information from the CryoDoser unit to the 2K controller. The manifold is installed on a mounting bracket that can be installed on the Chart prefabricated stand (1-1/2” diameter rod or round bar). Each tube inlet has a designated function.



- Tube 1 - GN₂ source inlet. Includes a pressure gauge to provide source pressure information.
- Tube 2 - not used.
- Tube 3 - connects to the 2K controller liquid level transducer.
- Tube 4 - connects to the 2K controller supply pressure transducer.
- Tube 5 - connects to the solenoid valve to actuate the dosing mechanism. Includes a pressure gauge and regulator to regulate GN₂ pressure to 65 psi to the solenoid valve.
- Tube 6 - connects to the CryoDoser unit’s inner vessel via the bottom of the CryoDoser unit at Tube #6 connection to provide LN₂ supply pressure reading on the 2K controller.
- Tube 7 - connects to the CryoDoser unit’s inner vessel via the bottom of the CryoDoser unit at Tube #7 connection to provide LN₂ liquid level. This psi reading correlates the “fullness” of the CryoDoser reservoir. A 50 psi pressure relief valve is included in line with tube 7.
- Tube 8 - connects to the CryoDoser unit’s inner vessel via the bottom of the CryoDoser unit at Tube #8 and is used to drain the CryoDoser unit. Tube 8 also includes a three-way solenoid valve to change gas flow while in Quick Service mode.
- Tube 9 - not used.
- Tube 10 - connects to the CryoDoser unit’s inner vessel via the bottom of the CryoDoser unit at Tube #10 and is used to provide a constant gas purge at the CryoDoser dosing head.

Connecting the Distribution Block

The distribution block houses the electrical connectors and wiring interface between the operating parts of the CryDoser unit and the 2K controller.



There are five connections on the distribution block:

- 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) - not used.

Installing the Nozzle

Three nozzles are supplied with the CryoDoser 2K 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 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.

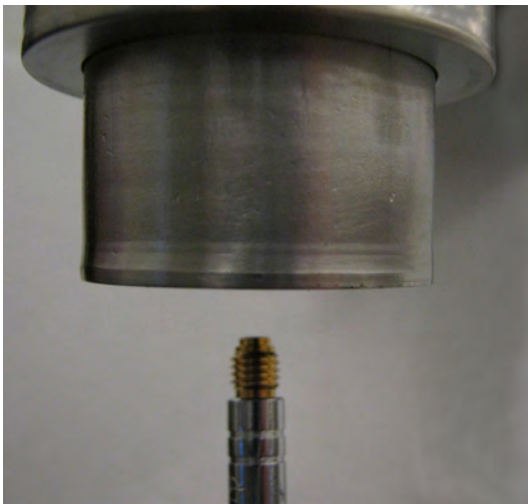


Image 1



Image 2

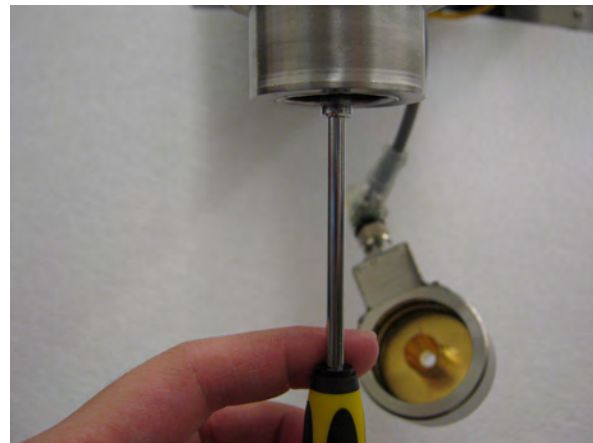


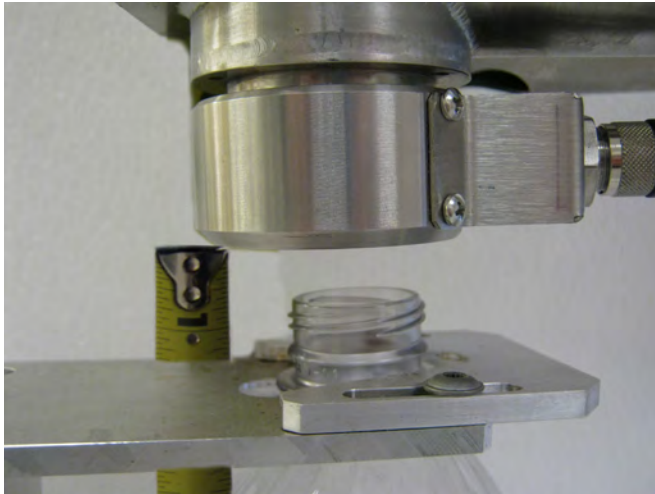
Image 3



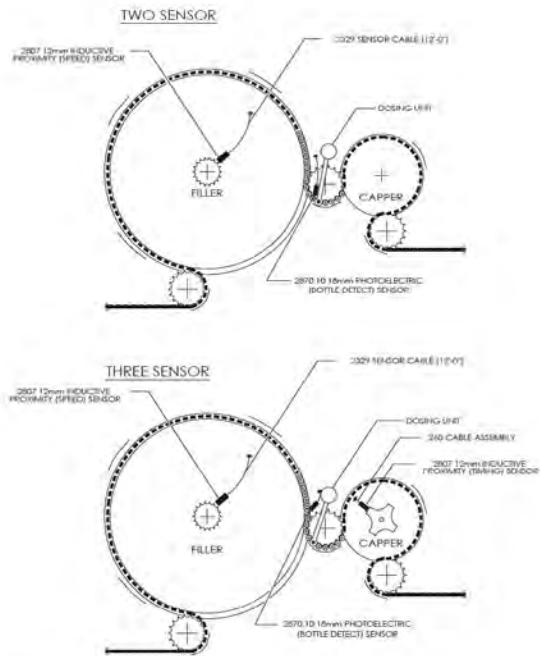
Caution! *Never use an ice-pick, screwdriver, torch or similar devices on the dosing head (Image 2). The ribs of the internal bellows are a thin walled metal and the hole on the outer ring of the dosing head is a positive pressure port to help keep moisture out and ice from forming. High heat and puncture 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 CryDoser unit must be manually adjusted to accommodate different sized bottles (or containers) running on the same production line.

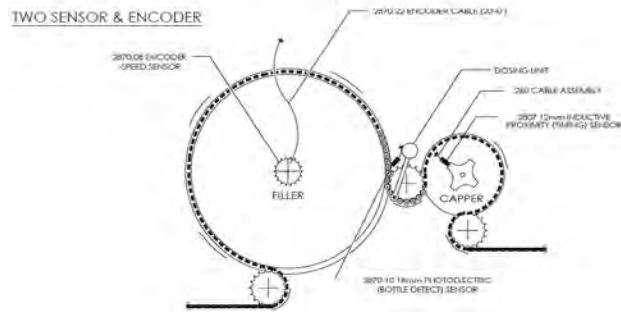


The diagram below shows three different ways of positioning the sensor.



Installing the Bottle Detect Sensor

The bottle detect 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 CryDoser 2K system. 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 unit will stop dosing. See the Inputs/Outputs and Bottle Sensor sections for additional information.



Installing the Timing Sensor

The timing sensor is installed to detect filling line speed and must be installed for the CryoDoser 2K system to operate properly. Chart provides a PNP 12mm inductive proximity sensor with the CryoDoser 2K system. Ideal sensor placement should provide a one-to-one signal and will vary for each filling line.

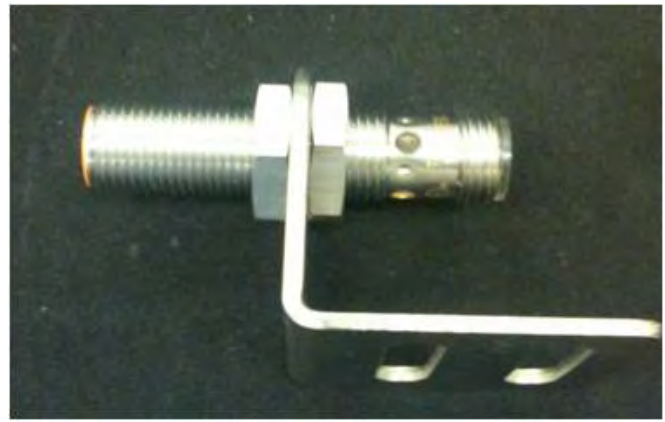
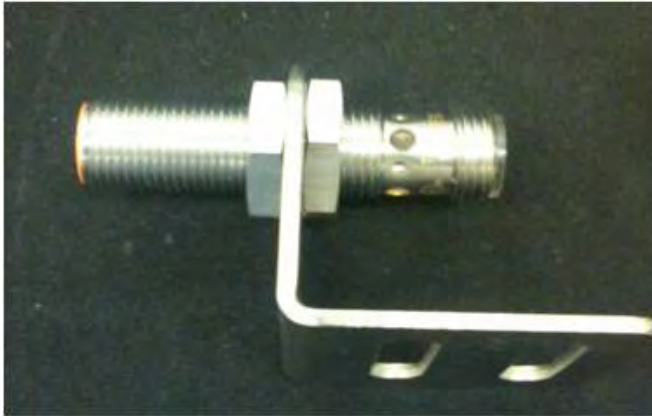


Image 5 - 12mm Inductive Proximity Sensor



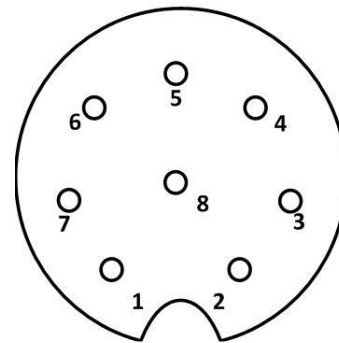
Note: Only one channel is used to provide necessary pulse for the CryoDoser 2K system. For correct encoder functionality, shielded cabling must be used. The encoder should be grounded, either thru the mounting bracket or separate ground wire.

Installing the Encoder

The speed sensor is installed to detect filling line speed and must be installed for the CryoDoser 2K system to operate properly. Chart provides a PNP 12mm inductive proximity sensor (Image 5) with the CryoDoser 2K system. Chart highly recommends a SICK encoder (Image 4) be installed in lieu of a PNP sensor to increase the resolution of the speed output for better performance of the CryoDoser 2K at higher line speeds. The SICK encoder provided by Chart comes from the factory preset to 500 pulses per container.



Image 4: SICK Encoder



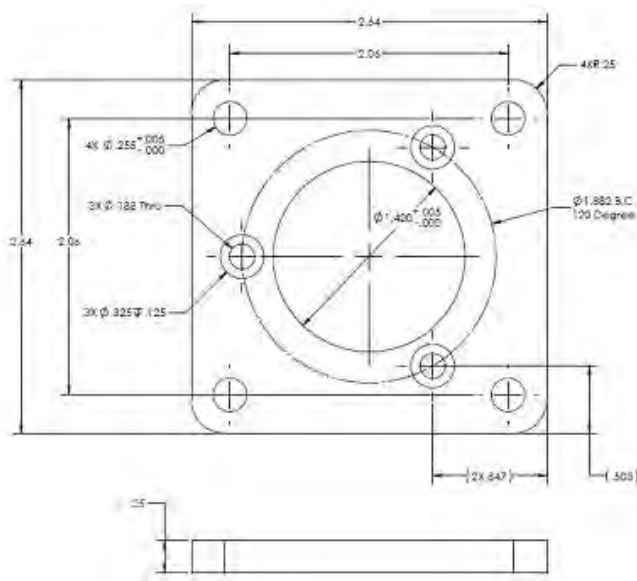
Encoder Cable Connections

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. If a gear is chosen which is not one-to-one with the container pockets the appropriate gearing ratios must be provided to ensure optimum dosing results.

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.



Installing the 2K Controller

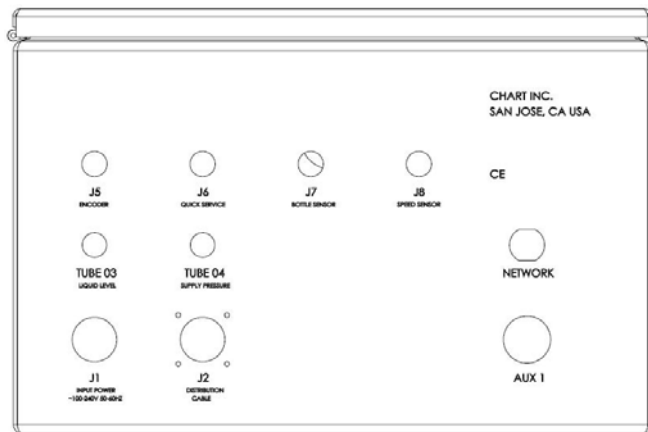
Locate the ideal location for the 2K controller. Brackets are supplied to mount the controller on the Chart prefabricated support stand or 1-1/2" diameter rod or round bar. If Chart's prefabricated brackets are not utilized, the controller's mounting tabs can be utilized.



- On/Off Switch - Main power switch for the 2K controller
- Dose Disable Button - Manual dose disable button to disable dosing
- Light Tower Status - The indicator light provides a visual display of the operating status of the CryDoser 2K system
- Green - Normal operation
- Amber (solid) - Warning condition; see "Alarms" section for additional information
- Red - Fault condition; see "Alarms" section for additional information



Note: Upon pushing the manual dose enabling button, a pop up confirm window will display on the Home screen (next page). Push Yes/No to confirm.



- Input Power (J1) - The 2K controller power cable (6ft) is connected to the 2K controller at port J1.
- Distribution Cable (J2) - The 2K controller I/O (input/output) cable, a component of the distribution block, is connected to the 2K controller at port J2.
- Tube 03 - CryoDoser Liquid Level from the Gas Manifold Assembly is connected to the 2K controller at Tube 03.
- Tube 04 - CryoDoser Supply Pressure from the Gas Manifold Assembly is connected to the 2K controller at Tube 04.
- Encoder (J5) - An encoder must be used to provide approximately 500 24v pulses per container. A PNP 12mm proximity speed sensor is provided as a back up to provide the 2K controller with minimal pulses that are used to calculate the line speed. The encoder (if proximity sensor, if used) is connected to the 2K controller at J5.
- Quick Service (J6) - The quick service solenoid valve located on the gas manifold assembly is connected to the 2K controller at port J6.
- Bottle Sensor (J7) - A PNP bottle detect sensor connected to the 2K controller at port J7.
- Network - An industrial Ethernet connection (8 pin M12) is provided to connect to the network for remote access to the HMI display.

Controller Adjustments

Home Screen

The Home screen displays pertinent information and actual parameters currently running. The Home screen is a “read-only” screen; any changes need to be made on the respective screens. The only active buttons are located in the top left portion of the screen: the Chart logo and the country flag (see languages section for additional information). From the “Home” screen, the operator can navigate to other screens functions using the navigation buttons on the bottom of the screen.



- Dose Duration (mS) - The Dose Duration should be a steady number proportionally between ‘Dose Duration Calibration’ points High and Low.
- Pulses (container to container) - This is the pulse count between timing sensors. A low number indicates a low resolution and a high number indicates the possibility of exceeding 20,000 pulses per second.
- Line Speed (CPM) - This number indicates the bottles per minute and should be steady.
- LN₂ Level - This is the calculated liquid nitrogen level from the level sensor.
- Inlet Pressure - This is the calculated inlet pressure from the inlet pressure sensor.

About Screen

On the Home screen, pressing the Chart logo will show the ‘About’ screen. Chart’s contact information as well as the CryoDoser 2K controller’s PLC and HMI version and default IP address will be available on this screen.



Color Coding

In general, the color of the field’s backfill dictates the functionality.

- Black = Read only
- Blue = PLC calculated value
- Yellow = User entered value
- Red/Green = Toggle feature

Home Screen Overview and Meanings

- Dose Mode - This is the Dose Delay Mode, either ‘Fixed’ or ‘Auto’.
- Dose Delay (mS) - The Dose Delay should be a steady number proportionally between ‘Distance Delay Calibration’ points #1 and #2.

Languages

On the Home screen, pressing the flag will show the 'Languages' sub-screen. Select the desired language setting from this screen.



Flag	Language
USA	English
Mexico	Spanish
Brazil	Portuguese
UK	English
Spain	Spanish
Portugal	Portuguese
China	Simplified Chinese
Poland	Polish
Italy	Italian

Note: Selecting a language automatically determines all settings including the date, pressure measurements, and distance measurements. All flag selections, except for USA, default to metric settings.

Setup Button

Selecting the 'Setup' navigation button will prompt two sub-navigation buttons: 'System Settings' and 'Calibration'. Access to these screens will require log-in with user ID and password.



Access and Passwords

Changing any parameters on any screen requires a user ID and password. When accessing the changeable boxes a log-on dialog box will appear requesting a user ID and password. The CryoDoser 2K controller has been programmed to a default user and password as described below.

User Name: A

Password: A

Note: Once logged in, any and all user information is changeable. Care must be taken when entering user and password information to prevent locking out personnel.

Note: User may be prompted to re-enter user ID and password information if the 2K controller is idle for more than five minutes.



System Settings

From 'Setup' select 'System Settings' to change system settings such as date/time, reset batch actuations, and hide/show the alarm banner.




System Settings overview and meanings:

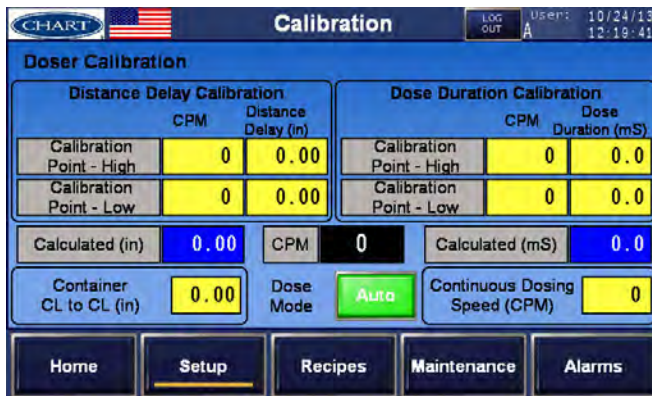
- Date/Time Set - The factory will program and set the current date and time. Any changes can be made at the 'Set Date' or 'Set Time' field.
- Dosing Head Actuations - Displays the total number of actuations and the batch number of actuations. Total will show the life of the system while batch can be reset.
- Alarm Banner - If the banner is hidden, a small colored circle will display next to the flag on the Home screen. If the alarm is shown, the alarm condition will display and cover the first 0.5" (12.7mm) of the top of each screen.
- Security - Another way to log in/out to change user programmable parameters.

Calibration

To set up the dosing parameters push the 'Setup' button then select 'Calibration.' Determine the desired Dose Mode: Auto or Fixed. 'Auto' Dose Mode compensates for any changes in line speed by auto-adjusting the distance delay and dose duration. 'Fixed' Dose Mode does not compensate for any changes in line speed. The distance delay will remain unchanged but the dose duration can be set up to auto-adjust.

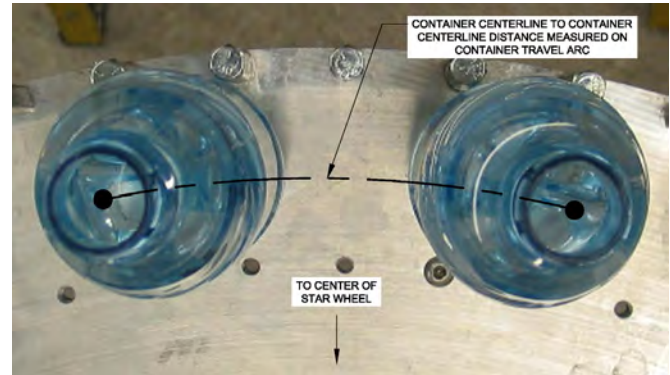
 **Note:** Proper setup of the 'Calibration' screen is essential to the successful operation of the CryoDoser 2K system. If after reading this section you are still unsure, please contact Chart's service group at 1-408-371-9313.

Auto Dose Mode




Entering Setup Parameters for Auto Dose Mode:

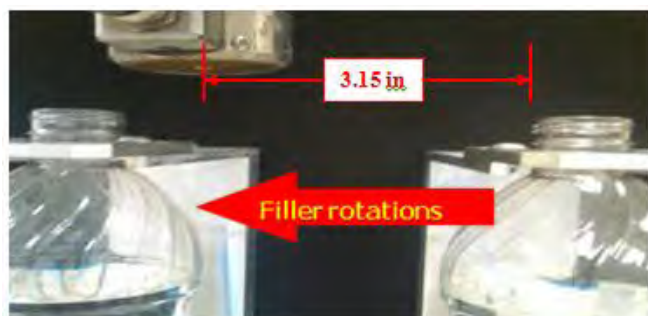
1. Measure and enter the centerline to centerline distance between two containers in the 'Container CL to CL' field (see image for additional information in determining this value).



2. Enter the 'Continuous Dosing Speed (CPM).' This is the maximum speed at which the CryoDoser 2K will dose in discrete (pulse) mode. If the line speed exceeds the user entered value, the CryoDoser 2K will dose in continuous (stream) mode.
3. Distance Delay Calibration Point High CPM - Enter the CPM of the fastest operating line speed.
4. Distance Delay Calibration Point High Distance Delay (mm) - Enter 10% of the 'Container CL to CL' value as a starting point and verify with a high speed camera or similar. Adjust accordingly.

 **Note:** Measurement for Distance Delay Calibration Point High can only be verified by high speed camera. Dose too early = increase delay, dose too late = decrease delay.

5. Distance Delay Calibration Point Low CPM - Enter the CPM of the slowest operating line speed.
6. Distance Delay Calibration Point Low Distance Delay (mm) - Jog the filler until timing sensor is activated (distribution block D-3 cable, yellow light). Measure the distance from the center of the dosing head to the leading edge of the bottle. See images on next page for additional information in determining this value. This value is ~75% of the 'Container CL to CL' value. Verify with a high speed camera or similar. Adjust accordingly.



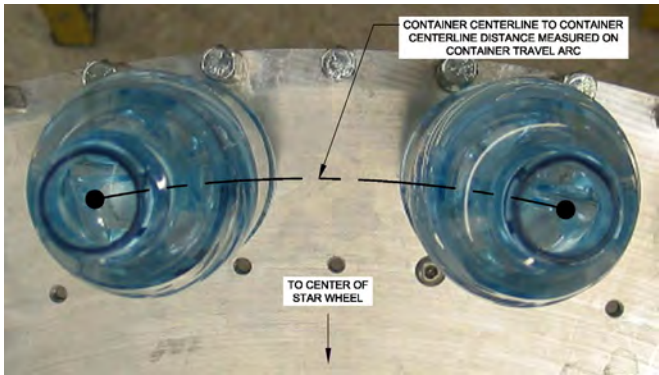
Note: The system will automatically adjust for speed changes within the high/low calibration points. This system calculated value is shown in the 'Calculated' blue field.

7. Dose Duration Calibration Point High CPM - Enter the CPM of the fastest operating line speed.
8. Dose Duration Calibration Point High Dose Duration (mS) - Enter the distance delay for the fastest operating line speed.
9. Dose Duration Calibration Point Low CPM - Enter the CPM of the slowest operating line speed.
10. Dose Duration Calibration Point Low Dose Duration (mS) - Enter the distance delay for the slowest operating line speed.
11. The calculated Dose Duration (mS) is displayed in the blue box under the Distance Delay Calibration Setup.

Fixed Dose Mode



Enter Setup Parameters for Fixed Dose Mode:

1. Measure the centerline to centerline distance between two containers and enter in the 'Container CL to CL' field. See image below for additional information in determining this value.
- 
2. Enter the 'Continuous Dosing Speed (CPM).' This is the maximum speed at which the CryoDoser 2K system will dose in discrete (pulse) mode. If the line speed exceeds this user entered value, the CryoDoser 2K system will dose in continuous (stream) mode.
 3. Enter the 'Fixed Time Delay.' This is the amount of time the system will wait (in milliseconds) after the bottle detect sensor has been detected until the dose duration (in milliseconds) begins.
 4. Dose Duration Calibration Point High CPM - Enter the CPM of the fastest operating line speed.
 5. Dose Duration Calibration Point High Dose Duration (mS) - Enter the distance delay for the fastest operating line speed.
 6. Dose Duration Calibration Point Low CPM - Enter the CPM of the slowest operating line speed.
 7. Dose Duration Calibration Point Low Dose Duration (mS) - Enter the distance delay for the slowest operating line speed.
 8. The calculated Dose Duration (mS) is displayed in the blue box under the Distance Delay Calibration setup.

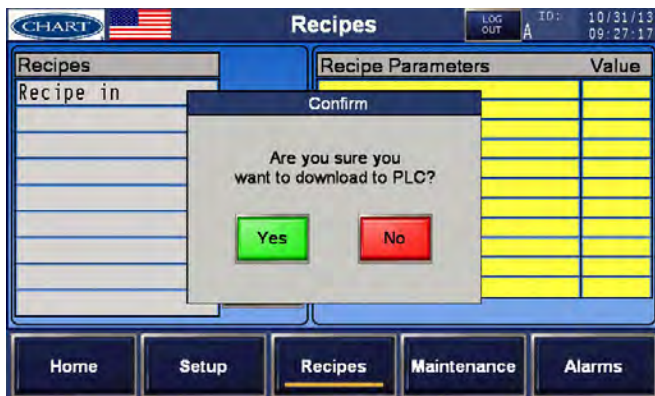
Recipes

Creating a Recipe


- From the 'Recipes' screen press 'Transfer' then 'Upload from PLC' to upload the dosing parameters from the 'Calibration' screen. The "Recipe Parameters" should auto populate.



- Press 'Yes/No' to confirm the action.



- Name the recipes in the "Recipe Name" value.

 **Note:** The "Recipes Name" value will be used to identify recipes on the 'Home' screen.



- Press 'Save.' This name will appear on the 'Home' screen when the recipe is downloaded to the PLC (as opposed to the name under "Recipe").

Creating Additional Recipes

- From the 'Recipes' screen, select a previously saved recipe.
- Press 'Edit' then 'Copy'. "Recipe-1" should now be displayed.
- Press 'Save'.
- Go to 'Setup' then 'Calibration' and input new parameters.
- Go to the 'Recipes' screen, press 'Transfer' then 'Upload from PLC' to upload the dosing parameters from the 'Calibration' screen. The "Recipe Parameters" should auto populate.
- Press 'Yes/No' to confirm the action.
- Name the recipe in the "Recipe Name" value.
- Press 'Save'. This name will appear on the 'Home' screen when the recipe is downloaded to the PLC (as opposed to the name under 'Recipe').

Activating a Recipe



1. Select and highlight the recipe you would like to use.
2. Press 'Transfer' then 'Download to PLC' to activate the recipe.
3. Verify that the recipe has been activated. The "Recipes Name Value" should appear on the 'Home' screen.



Note: *If any changes are made to the 'Calibration' settings of an activated recipe, the recipe will become deactivated and the current settings will take precedence. Verification of this can be seen on the 'Home' screen at the 'Recipe' field; a '-' will appear instead of the recipe name.*

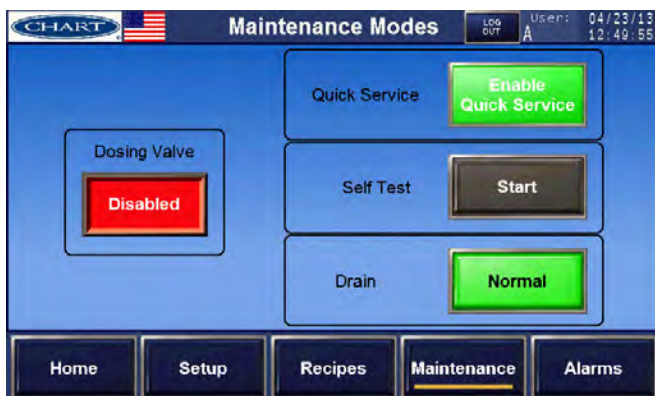
Maintenance

Selecting the 'Maintenance' navigation button will prompt three sub-navigation buttons: 'Maintenance Modes,' 'Graphs' and 'Inputs/Outputs.' Access to these screens will require log in with user ID and password. See Access and Passwords section for additional information.



Maintenance Modes

From 'Maintenance' select 'Maintenance Modes' to select and activate maintenance related features.



Dosing Valve Disabled

When the dosing valve is disabled, the maintenance modes become visible.

Quick Service - the quick service button engages a solenoid which routes gaseous nitrogen (GN₂) through the body to the dosing head. This is typically used to purge the system to ensure a clean pathway for liquid to flow. If a system has been left off for some time or exposed to air, moisture may have accumulated which could result in ice formation causing a blockage in the system. Purging by sending gaseous nitrogen will "dry-out" the system.



Note: *Press and HOLD 'Enable Quick Service' to activate.*

Self Test - used to test the firing of the dosing solenoid. Pressing self test activates the solenoid for five pulses.

Drain - used to drain liquid nitrogen from the body of the CryoDoser system through the dosing head.



Note: *Press and HOLD 'Normal' to activate.*

Dosing Valve Enabled

When the dosing valve is enabled, the maintenance modes become invisible.



Graphs

From 'Maintenance' select 'Graphs.' This view serves as the location for activation of the system once all the parameters have been set.

Timing Analysis Graph

This circular graph is updated left to right every few seconds with current CPM data. The graph shows the CPM timing of the last 250 containers. The important characteristic to watch is the consistency of the data. There should not be large spikes in data (inconsistent speed or spacing) or sine waves (line speed wobble).



Note: This graph shows the steadiness of the filler's line speed. Variation in the line speed will cause variation in the dosing.



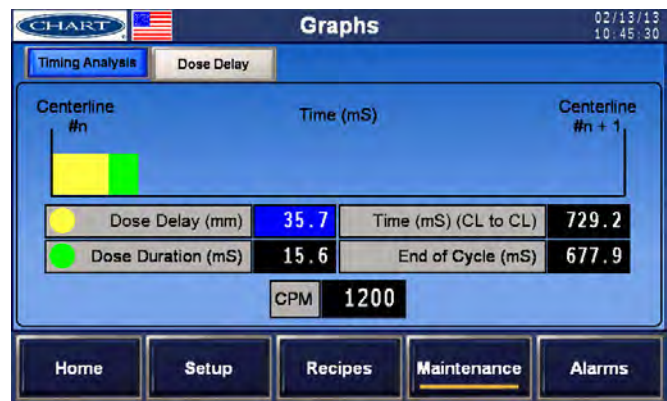
Dose Delay Bar Graph

The graph starts at the left with the sensing of a container by the timing sensor and ends at the right with the sensing of the next timing sensor. This is the time between timing sensors and is the total time allocated for the Dosing Delay and the Dosing Duration.

- Dosing Delay (mS) - The yellow bar graph is the Dosing Delay time.
- Dosing Duration (mS) - The green bar graph is the Dosing Duration or the time the LN₂ valve is actuated.
- Realtime - The graph updates in realtime showing continuous doses.
- End of Cycle (mS) - This is the time after the LN₂ valve is turned off before the next timing sensor will arrive.



Note: The graph should be consistent and not come close to the next timing sensor line or the Dose Delay may be too long, the Dose Duration may be too long, or the CPM may be too fast.



Inputs/Outputs

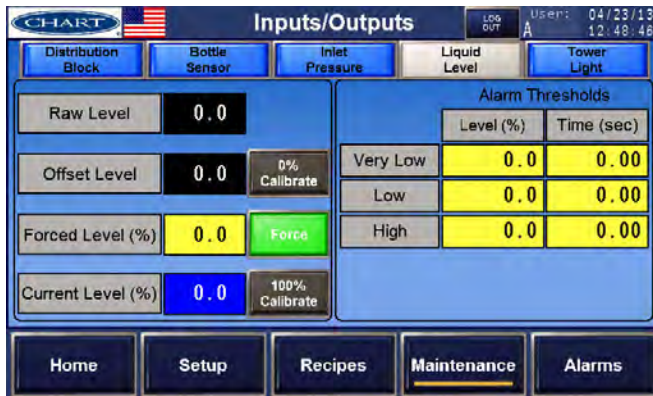
Tower Light - troubleshoot the tower lights



These are the three colored lights on top of the 2K controller:

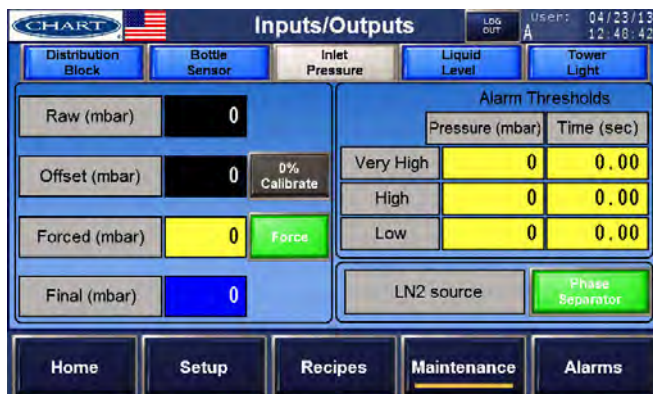
- Green Light - press the 'Force On' button to turn the green light on. Press the 'Force Off' button to turn the green light off. The force action is enabled when the button is red. Disable both forces to return the green light to normal operation.
- Red Light - press the 'Force On' button to turn the red light on. Press the 'Force Off' button to turn the red light off. The force action is enabled when the button is red. Disable both forces to return the red light to normal operation.
- Yellow Light - press the 'Force On' button to turn the yellow light on. Press the 'Force Off' button to turn the yellow light off. The force action is enabled when the button is red. Disable both forces to return the yellow light to normal operation.

Liquid Level - calibrate and set alarm threshold for liquid level



- Raw Level - this is the raw reading from the PLC analog input.
- 0% Calibrate - push this button when calibrating at the zero liquid level.
- Offset Level - after calibrating the liquid level at zero level by pushing the '0% Calibrate' button the raw reading will become the offset level.
- 100% Calibrate - push this button when calibrating at the 100% liquid level.
- Current Level % - the blue box indicates the current liquid level.
- Forced Level % - you can force a liquid level by typing a value in the yellow input box and pressing the 'Force' toggle.
- Alarm Thresholds - the thresholds low and high liquid level alarms can be set by typing an alarm threshold % value and associated time before the alarm occurs into the yellow input box.

Inlet Pressure - calibrate and set alarm threshold for inlet pressure



- Raw Inlet Pressure - this is the raw reading from the PLC analog input.
- Offset Inlet Pressure - after calibrating the inlet pressure at zero level by pushing the 'Offset' button the raw reading will become the inlet pressure offset.
- Final Inlet Pressure % - the blue box indicates the current inlet pressure.
- Forced Inlet Pressure % - You can force an inlet pressure by typing a value in the yellow input box and pressing the 'Force' button.
- Alarm Thresholds - the thresholds low and high inlet pressure alarms can be set by typing an alarm threshold % value and associated time before the alarm occurs into the yellow input box.
- LN₂ Source - press the 'LN₂ Source' button to choose the source of liquid nitrogen.

Bottle Sensor - set the functions of the bottle detect sensor



The bottle sensor is used to detect bottles moving under the dosing head.

- Result - this is the current status of the Bottle Sensor. When illuminated green bottles are being sensed, either from the sensor or the 'Force' button.
- Force Button - When pushed, the 'Force' function will turn the Bottle Sensor on, even if there is no sensor or no bottles.
- No Bottles (sec) - this sets the time (seconds) that will keep the Bottle Sensor on when not currently detecting bottles. This will normally occur in-between bottle detections as the bottles pass the sensor.

Distribution Block - troubleshoot the distribution block sensors/connections



These digital inputs and outputs replicate the lights on the Distribution Block.

- Speed Sensor (digital input) - usually this is the status of the encoder pulses.
- Timing Sensor (digital input) - this is the status of the one per bottle sensor.
- Valve Confirm (digital input) - this is the status of the LN₂ valve actuator sensor.
- Bottle Detect (digital input) - this is the status of the bottle sensor.
- Dose Disable (digital input) - this is the status of the Dose Disable.
- Quick Service (digital output) - this is the status of the Quick Service function.
- Dose Solenoid (digital output) - this is the status of the Dose Solenoid LN₂ valve actuator.

Alarms

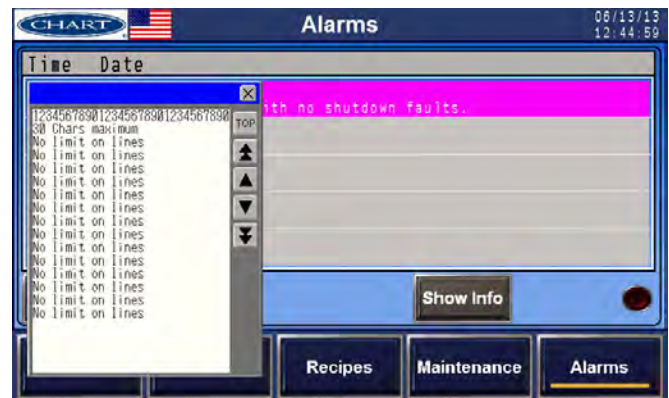
Two alarm screens are provided: Alarms and Alarm History. Alarms are displayed on the 'Alarms' screen when they are currently active and are retentively displayed on the 'Alarm History' screen.



Note: Alarm conditions do not stop liquid nitrogen dosing.



Note: Alarm conditions are shown on the 'Alarms' screen. Information to resolve the alarm can be found by highlighting the alarm condition and pressing 'More Info.'



Warning Level Alarms

		Manual	Allen-Bradley		Siemens		Dosing D = Disabled
			HMI	PLC	HMI	PLC	
B9:0/1	WARN #1 - Started Dosing with no shutdown faults. (green)	X	X	X	X	X	E
B9:0/2	WARN #2 - Dosing is Disabled.	X	X	X	X	X	D
B9:0/3	WARN #3 - Conitnuous Dosing CPM threshold was exceeded.	X	X	X	X	X	E
B9:0/4	WARN #4 - Liquid Level was too low.	X	X	X	X	X	E
B9:0/5	WARN #5 - Liquid Level was too high.	X	X	X	X	X	E
B9:0/6	WARN #6 - Inlet Pressure was too low.	X	X	X	X	X	E
B9:0/7	WARN #7 - Inlet Pressure was too high.	X	X	X	X	X	E
B9:0/8	WARN #8 - Dose Delay was too long.	X	X	X	X	X	E
B9:0/9	WARN #9 - Too few Sensor Pulses counted.						E
B3:2/2	WARN #9 - LN2 Valve Disabled		X	X	X	X	E*
B9:1/7	WARN #23 - Bottle Present Sensor is not seen on input #12.	X	X	X	X	X	E
B9:1/4	FAULT #20 - Speed Sensor Pulses were seen not on input #0.	X	X	X	X	X	D
B9:1/5	FAULT #21 - Speed Sensor Pulses were seen not on input #4.	X	X	X	X	X	D
B9:1/6	FAULT #22 - Pocket Sensor Pulses were not seen on input #1.	X	X	X	X	X	D
B9:1/7	FAULT #23 - Bottle Present Sensor is not seen on input #12.						n/a
B9:1/8	FALUT #24 - Valve Confirm Sensor Pulses were not seen on input	X	X	X	X	X	D
B9:1/9	FAULT #25 - Liquid Level was very low.	X	X	X	X	X	D
B9:1/10	FAULT #26 - Inlet Pressure was too high.	X	X	X	X	X	D
B9:2/0	FAULT #32 - PWM Pulses were not seen on input #2.	X	X	X	X	X	D
B9:2/1	FAULT #33 - PWM Pulses were not seen on input #6.	X	X	X	X	X	D
B9:2/2	FAULT #34 - PWM Pulses were not seen on input #8.	X	X	X	X	X	D
B9:2/3	FAULT #35 - PWM Pulses were not seen on input #10.	X	X	X	X	X	D
B9:3/2	FAULT #50 - Estop PB is not seen on input #14.	X	X	X	X	X	D
B9:3/3	FAULT #51 - Remote Disable is on.	X	X	X	X	X	D
B9:3/4	FAULT #53 - Bottle Sensor Pulses seen too fast.	X	X	X	X	X	D

* NOTE: For the purposes of using OUT8 (AB), or DQb.0 (Siemens) output to control or send a signal to other machines, this warning applies to the physical dose disable switch which is not tied to these outputs. Therefore, the output will not change state even if the button is engaged.



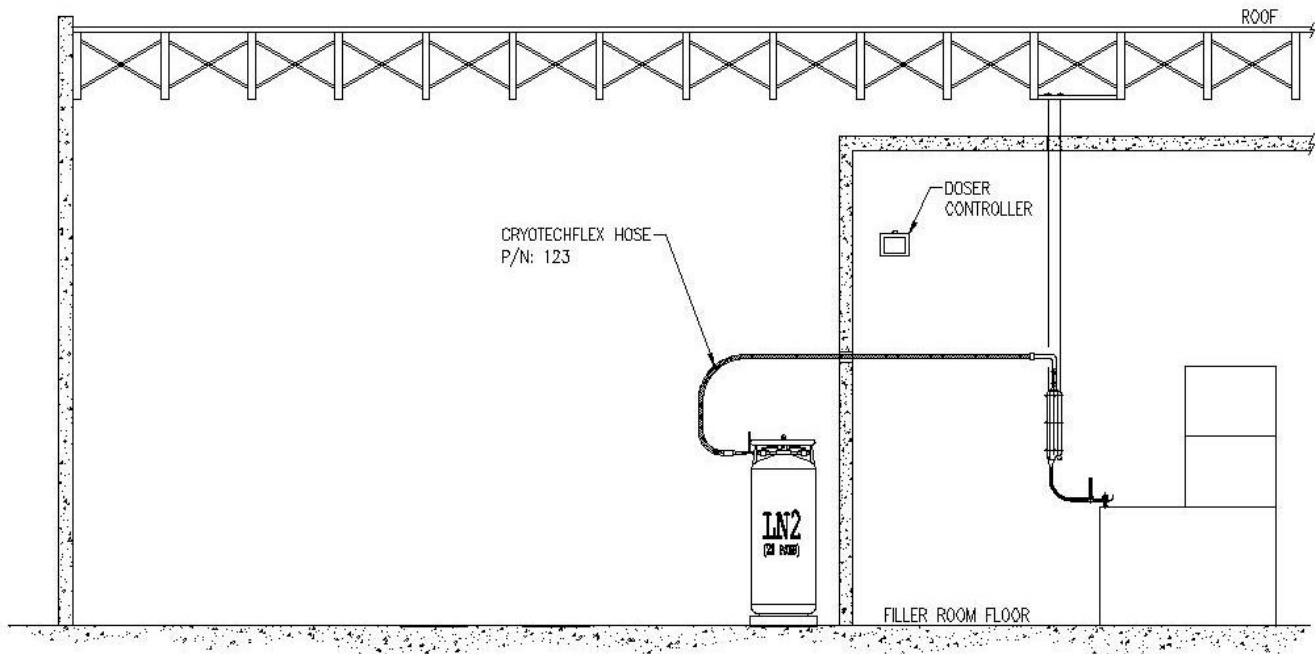
Daily Operating Procedures

The CryoDoser 2K 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

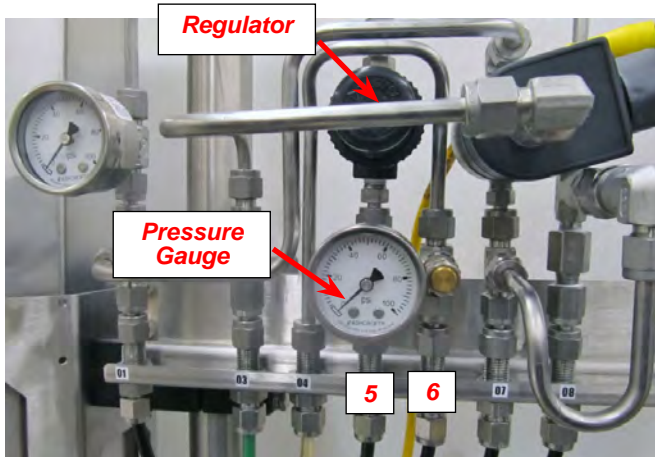


Note: LN₂ is -320°F (-196°C). Any water and/or moisture can cause ice which will affect the performance of the CryoDoser 2K system. Providing a positive pressure of GN₂ (also known as purging) to the CryoDoser unit before introducing LN₂ into the body will eliminate many performance interruptions.



Purging with Gaseous Nitrogen

The CryoDoser 2K unit must only be purged with gaseous nitrogen. Chart recommends the CryoDoser unit be purged when not in use. However, this may not be practical for all operators. At a minimum, the CryoDoser unit should be purged to eliminate any water that may be inside the unit after installation and prior to startup. The CryoDoser reservoir may also require purging when there is liquid nitrogen flowing out of the vent. The CryoDoser reservoir must also be purged when the nozzle becomes frozen shut. Purging can be performed through the gas manifold assembly.



1. Set the regulator on the gas manifold assembly to 0 psi (confirm setting on the pressure gauge).
2. Disconnect, swap, and re-connect tube 5 and tube 6 at the gas manifold assembly; tube 5 will be in position 6 and tube 6 will be in position 5. This will direct gaseous nitrogen to the top of the CryoDoser unit.
3. Set the regulator on the gas manifold assembly to 20 psi (confirm setting on the pressure gauge).
4. Purge until ambient gas is vented out of the CryoDoser unit; it may take more than 4 hours to purge properly.
5. When purging is complete, set the regulator on the gas manifold assembly to 0 psi (confirm setting on the pressure gauge).

6. Disconnect, swap, and re-connect tube 5 and tube 6 at the gas manifold assembly; tube 5 will be in position 5 and tube 6 will be in position 6.
7. Set the regulator on the gas manifold assembly to 60 psi (confirm setting on the pressure gauge).



Note: The supply pressure reading on the 2K controller may read $12 \pm \text{psi}$ due to the added GN₂ pressure.



Caution! When purging the CryoDoser unit, it will vent heavily and there may be a steady stream of “fog” from the vent. This “fog” will be cold to the touch if the internal temperature of the CryoDoser unit is still at or near LN₂ temperatures (-320°F; -196°C). Once the CryoDoser unit is at or near ambient temperature, the “fog” will warm up.

System Start Up

1. Place the On/Off switch on the 2K controller in the “On” position. Ensure the ‘Dosing Disable’ button is pushed to disable dosing.
2. Insert the supplied 10 micron filter into the male bayonet on the supplied C-Flex hose using a 1/8” Allen wrench.
3. Attach the C-Flex hose (male bayonet side) to the CryoDoser unit with the supplied bayonet clamp and gasket.
4. Attach the C-Flex hose (female flare fitting side) to the 22 psi LN₂ Dura-Cyl® Liquid Cylinder.
5. Open the liquid valve (counter-clockwise direction) on the Dura-Cyl liquid cylinder.
6. Wait until the CryoDoser unit is filled with liquid nitrogen, approximately 10 minutes.
7. Adjust the dosing parameters. See Controller Adjustments section for additional information.
8. Pull out the “Dosing Disable” button to enable dosing.



Caution! *When the CryoDoser unit is filling, it will vent heavily and there will be a steady stream of “fog” from the vent. Once the CryoDoser unit is filled, there will be a “wisp” of fog coming from the vent. If the CryoDoser unit overfills and liquid nitrogen starts dripping out the vent, close the liquid valve on the Dura-Cyl liquid cylinder and call Chart service at 1-408-371-4932.*

System Shut Down

1. Place the On/Off switch on the 2K controller in the “Off” position.
2. Shut the liquid valve (clockwise direction) on the Dura-Cyl cylinder.
3. If possible, purge with GN₂ until next use. See Purging with Gaseous Nitrogen section for additional information.



Note: *The supply pressure reading on the 2K controller may read $12 \pm$ psi due to the added GN₂ pressure.*

Dura-Cyl® Liquid Cylinder (22 psi) 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. 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.

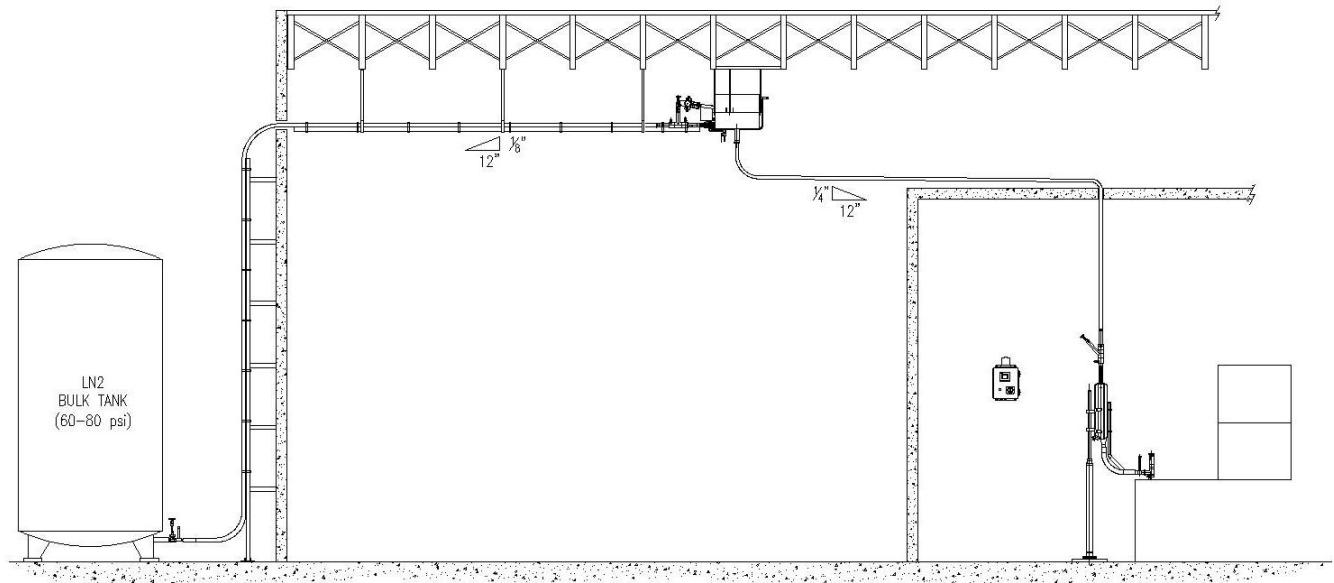


Note: *The CryoDoser 2K will continue to dose properly until the liquid level inside the CryoDoser unit runs low. This feature gives the operator a reasonable window in which to change out the Dura-Cyl cylinder without disrupting the production operation.*

Bulk Tank (House Fed) System



Note: LN₂ is -320°F (-196°C). Any water and/or moisture can cause ice which will affect the performance of the CryoDoser 2K system. Providing a positive pressure of GN₂ (also known as purging) to the CryoDoser unit before introducing LN₂ into the body will eliminate many performance interruptions.

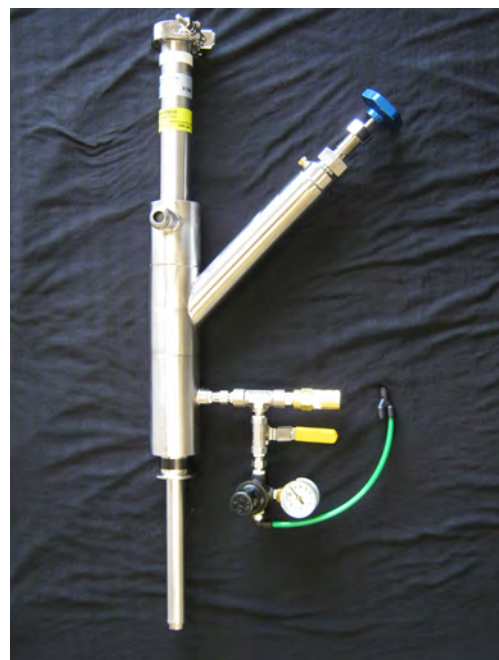


Purging with Gaseous Nitrogen

The CryoDoser 2K unit must only be purged with gaseous nitrogen. Chart recommends the CryoDoser unit be purged when not in use. However, this may not be practical for all operators. At a minimum, the CryoDoser unit should be purged to eliminate any water that may be inside the unit after installation and prior to startup. The CryoDoser reservoir may also require purging when there is liquid nitrogen flowing out of the vent. The CryoDoser reservoir must also be purged when the nozzle becomes frozen shut.

This section assumes a Y-Pattern valve and Purge Kit are installed upstream of the CryoDoser unit. Chart highly recommends each CryoDoser 2K unit be installed with a Y-Pattern valve and Purge Kit to isolate the CryoDoser unit from the LN₂ source and to purge the CryoDoser unit to eliminate performance interruptions.

A dedicated GN₂ source is required to purge the CryoDoser unit. Chart recommends a dedicated GN₂ source from the facility or tapping into the GN₂ source used on the CryoDoser Gas Manifold Assembly at Tube 1. See Connecting to the Gas Manifold Assembly section for additional information.



Y-Pattern Valve with Purge Kit Assembly

1. Manually close (clockwise) the Y-Pattern valve (blue handle).
2. Manually open (clockwise) the ball valve (yellow handle) on the Purge Kit.
3. On the 2K controller, go to 'Maintenance' then Maintenance Modes (see the Maintenance section for additional information) "Disable" the dosing valve.
4. Manually close (clockwise) the valve (silver nut) on the CryoDoser arm and power "Off" the 2K controller.



Note: The supply pressure reading on the 2K controller may read $12 \pm \text{psi}$ due to the added GN₂ pressure.



Caution! When purging the CryoDoser 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 unit is still at or near LN₂ temperatures (-320°F; -196°C). Once the CryoDoser unit is at or near ambient temperature, the "fog" will warm up.

System Start Up

This section assumes the Chart Phase Separator is full of liquid nitrogen. If this is not the case, ample time is needed to fill the Chart Phase Separator with liquid nitrogen before the CryoDoser 2K system can start up.

1. Manually close (counter-clockwise) the ball valve (yellow handle) on the Purge Kit.
2. Manually open (counter-clockwise) the Y-Pattern valve (blue handle)
3. As the CryoDoser system fills, remove the dosing head heater and nozzle. Clean and dry both before reinstalling. See Nozzle Cleaning Procedure for additional information.
4. Manually open (counter-clockwise) the valve (silver nut) on the CryoDoser arm.
5. Wait until the CryoDoser unit is filled with liquid nitrogen, approximately 10 minutes, before dosing.



Caution! When the CryoDoser unit is filling, it will vent heavily and there will be a steady stream of "fog" from the vent. Once the CryoDoser unit is filled, there will be a "wisp" of fog coming from the vent. If the CryoDoser unit overfills and liquid nitrogen starts dripping out the vent, close the Y-Pattern valve and call Chart service at 1-408-371-4932.

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 2K controller may read $12 \pm \text{psi}$ due to the added GN₂ pressure.

3. On the 2K controller, go to "Maintenance" then Maintenance Modes (see Maintenance section for additional information) "Disable" the dosing valve.
4. Manually close (clockwise) the valve (silver nut) on the CryoDoser arm and power "Off" the 2K controller.



Caution! When purging the CryoDoser 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 unit is still at or near LN₂ temperatures (-320°F; -196°C). Once the CryoDoser unit is at or near ambient temperature, the "fog" will warm up.

Service and Maintenance

Activating Quick Service

The CryoDoser unit has a “Quick Service” feature that minimizes downtime for maintenance and/or nozzle change out without draining or shutting down the main LN₂ supply line.

1. Manually close (clockwise) the valve (silver nut) on the CryoDoser arm.
2. On the 2K controller, go to “Maintenance” then Maintenance Modes (see Maintenance section for additional information). Press and HOLD “Activate” Quick Service.
3. Press “Deactivate” Quick Service when ready.
4. Perform any service or maintenance at the dosing head.
5. Manually open (counter-clockwise) the valve (silver nut) on the CryoDoser arm.

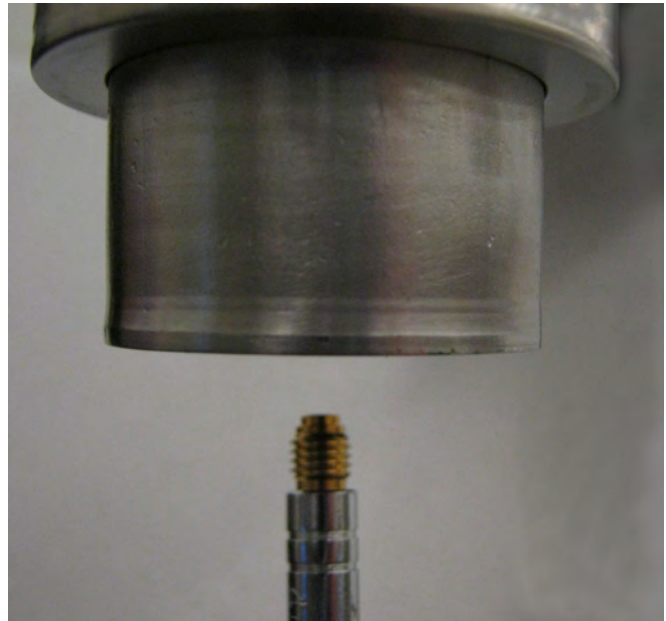


Image 2

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 (image 1).
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 2).

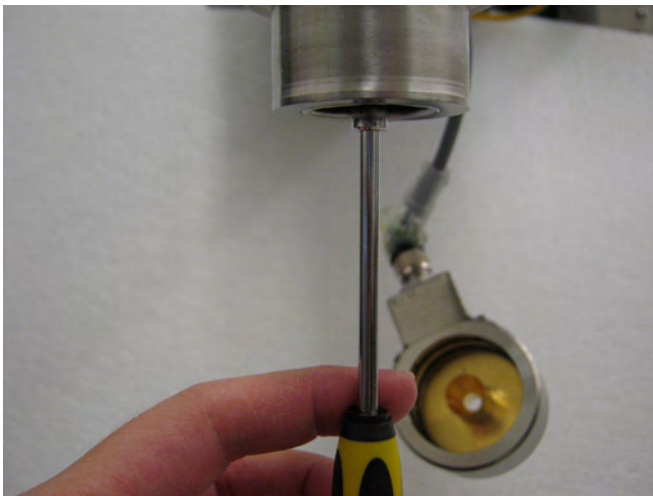


Image 1



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! Always perform nozzle change out procedures before introducing LN₂ into the CryoDoser unit. Failure to do so may cause the nozzle to unthread and fall out.



Note: If the nozzle does not loosen easily, drain the CryoDoser unit through the drain plug and warm up nozzle with a low voltage heat gun.

Nozzle Cleaning

1. Remove the nozzle from the CryoDoser 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 unit must only be purged with gaseous nitrogen. Chart recommends the CryoDoser unit be purged when not in use. However, this may not be practical for all operators. At a minimum, the CryoDoser unit should be purged after installation and prior to startup to eliminate any water that may be inside the unit. The CryoDoser reservoir may also require purging when there is liquid nitrogen flowing out of the vent. The CryoDoser 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
The safety relief valve is venting.	The pressure of the LN ₂ supply is greater than 50 psi (3.44 bar). The vent is obstructed.	Check the pressure of the LN ₂ supply. If the supply pressure is greater than 50 psi (3.44 bar), reduce the supply pressure. **Note: A dewar can be vented to reduce the pressure. Check the CryoDoser 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.
Liquid is coming out of the vent.	The LN ₂ supply pressure is too high. Ice has developed inside the unit, causing the internal float valve to malfunction.	Lower LN ₂ supply pressure to 22 psi (1.5 bar) or lower. The CryoDoser 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.
Liquid is coming out of the dosing head even though the valve is closed.	The LN ₂ supply pressure is too high. The valve seat is contaminated (ice or particles). Air supplied to the solenoid is reversed.	Reduce the LN ₂ supply pressure. The CryoDoser unit must be drained of LN ₂ . The dosing valve assembly must be removed and cleaned. Contact Chart's service team at 1-408-371-4932 for a detailed procedure. Reverse the LN ₂ lines that supply and vent to the solenoid.

<i>Symptom</i>	<i>Possible Cause</i>	<i>Solution</i>
No liquid from the dosing head.	<p>There is insufficient liquid inside the CryoDoser unit.</p> <p>The unit is disabled.</p> <p>The nozzle is frozen shut.</p> <p>The bottle detect sensor is not detecting a container.</p> <p>The speed sensor/encoder is not functioning.</p>	<p>Check the level of LN₂. If the level is empty or low, open the supply valve.</p> <p>Pull out the Dose Enable switch to enable mode (ensure switch is not lit).</p> <p>Run Quick Service to thaw nozzle. Remove, clean, and re-install the nozzle (see Nozzle Change Out section for additional information).</p> <p>Check sensor connections. Ensure the sensor is correctly positioned to detect points (gear tooth or the like). If necessary, replace sensor.</p> <p>Check the speed sensor/encoder is operating correctly and is sending a signal to the 2K controller.</p>
The dosing valve fault error is displayed on the 2K Controller.	The dosing valve assembly is not moving.	Check the pneumatic pressure. There must be approximately 60-70 psi (4.13-4.82 bar) for the dosing valve to function correctly.
The speed sensor fault error is displayed on the 2K Controller.	<p>The speed sensor (or encoder) has been dislodged.</p> <p>The speed sensor (or encoder) has malfunctioned.</p>	<p>Check speed sensor (or encoder) connections.</p> <p>Replace speed sensor (or encoder).</p>

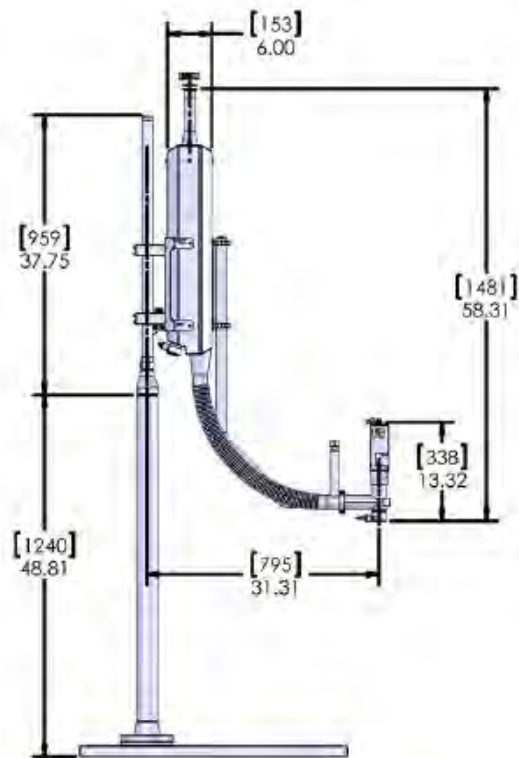


Specifications

CryoDoser Technical Specifications

Materials	Stainless Steel Series 300*
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	24" to 30" (609.6mm to 762mm)
Head Pressure	0.9 psi (0.06 bar)
Nozzles	Ships with 0.040", 0.050", 0.060" 0.020" - 0.100" available (0.005" increments)
System Utilities	Liquid Nitrogen: 3-22 psi (0.2-1.5 bar) Gaseous Nitrogen: 60-100 psi (4.1-6.9 bar) Electricity: 110-240V AC; 50/60Hz, 110W
Steady State Consumption	0.04 gal (0.15 liter) / hour
Quick Service Feature	Yes
Vacuum Insulated	Yes
Flexible Arm	Yes
SoftDose™ Compatible	Yes

*304 standard, 316L available upon request



Controller Technical Specifications

PLC Platform	Allen-Bradley ML1400 or Siemens S7-1200
Display	7" (178mm) TFT Color LCD Touch Screen
Dose Duration	5.5 to 1000 mS (0.1 mS intervals)
Dose Volume	0.002 to 14 grams/dose
Encoder Compatible	Yes
Maximum Discrete Dosing (cpm/cph)	2000*/120,000
MicroDose™ Technology	Yes
Line Speed Auto Detect	Yes
Electronic Dose Targeting	Yes
Fixed Delay Mode	Yes
Speed Compensated Mode	Yes
Accuracy	± 2% of dose weight
Multiple Languages	Yes
RemoteDose™ Capable	Yes
IntelliDose™ Capable	Yes
Recipe Storage	Yes
Certifications	CE, NEMA, 4X

*Results obtained under specific conditions.

CryoDoser 2K Components

Standard Components

CryoDoser Body

The stainless steel vacuum insulated reservoir provides a ready supply of LN₂ for dosing operations.

Distribution Block

Houses the electrical connectors and wiring interface between the operating parts of the CryoDoser unit and the 2K controller.

2K Controller

2K 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 unit.

Bayonet Connection

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

Mounting Bracket Assembly

The CryoDoser unit is supplied with a mounting bracket assembly. The assembly consists of the bracket attaching to the CryoDoser 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 LN₂.

Electro-Pneumatic Actuator (EP Head)

The Electro-Pneumatic Actuator assembly contains the dosing stem, solenoid valve and Bimba-cylinder all within a self-contained water-tight housing. The main benefit is ease of use during Clean-In-Place (CIP) operations. The solenoid valve rests on the pneumatic cylinder. The cold GN₂ running through the valve has a cooling effect on the cylinder offsetting some of the heat generated by the opening and closing of the actuator.

Dosing Head Heater

The CryoDoser 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 LN₂.

Dosing Nozzle(s)

The size of the dosing nozzle directly affects the amount of LN₂ dosed. 0.040", 0.050", and 0.060" nozzles ship loose with the CryoDoser 2K system. Custom sizes may be ordered from Chart.

Drain Plug

A drain plug is located on the back on the CryoDoser unit. When removed, this allows LN₂ to drain from the CryoDoser body.

Vent Heater

The CryoDoser 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.

Gas Manifold Assembly

The gas manifold assembly is a secondary "hub" to gather and transfer information from the CryoDoser unit to the 2K controller.

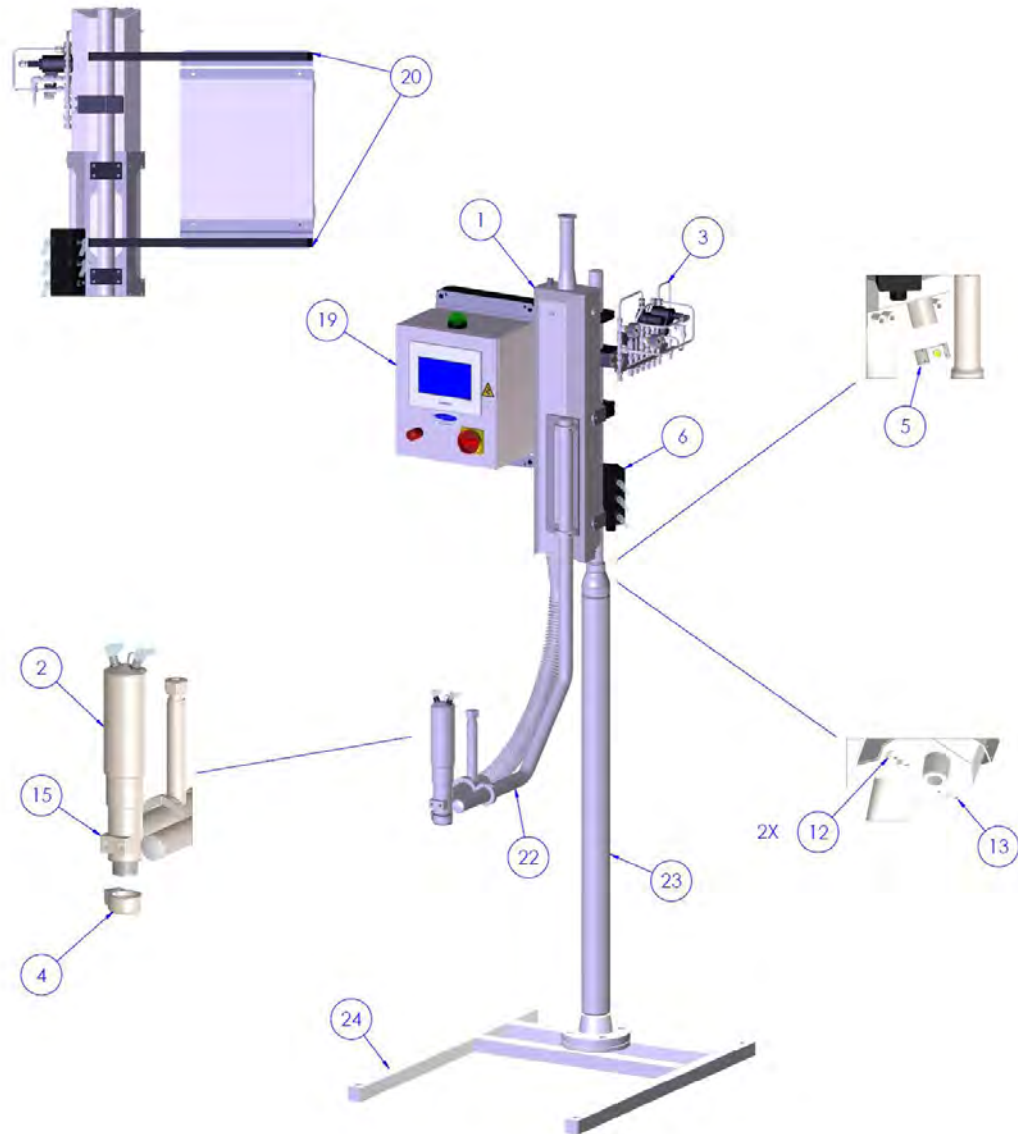
Optional Components

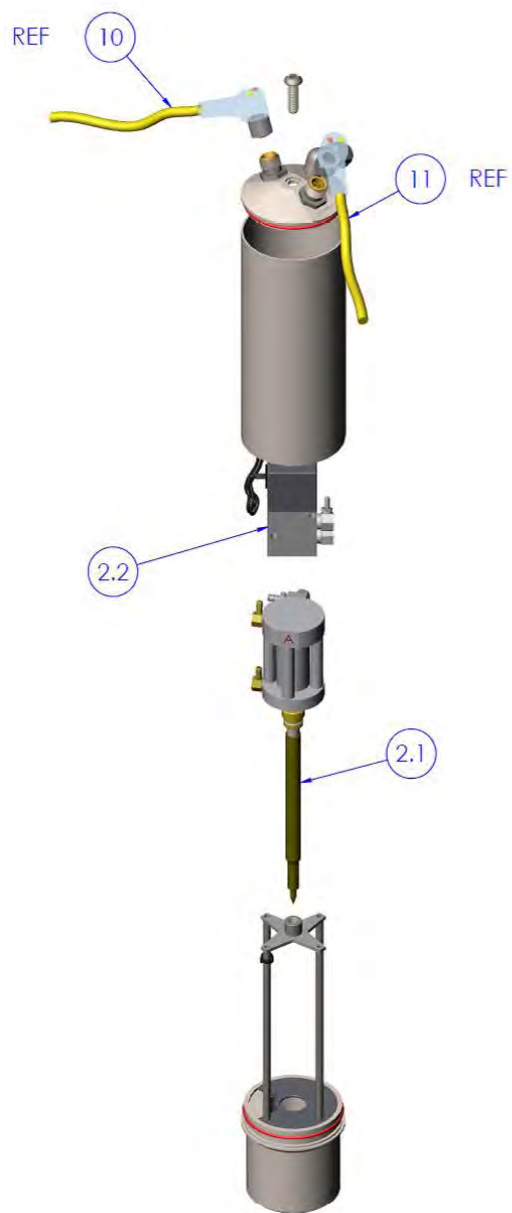
C-Flex Hose

A vacuum insulated hose that provides a connection between the CryoDoser unit and the LN₂ supply.

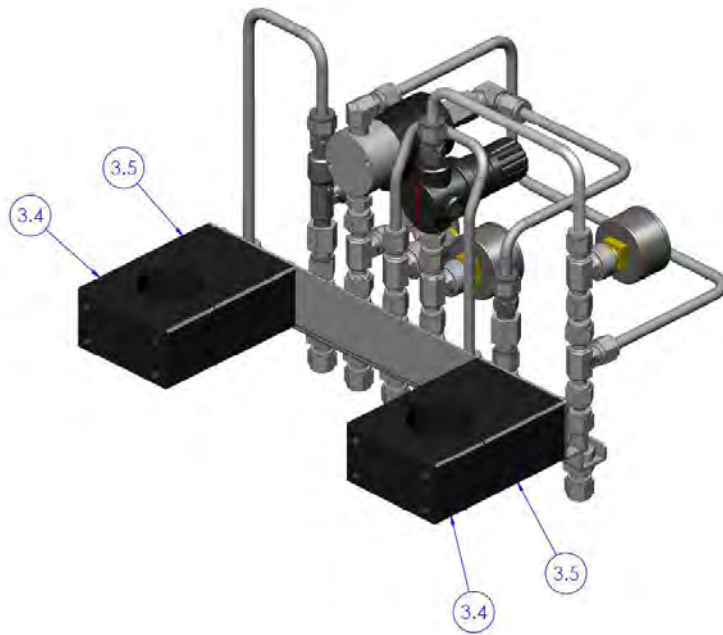
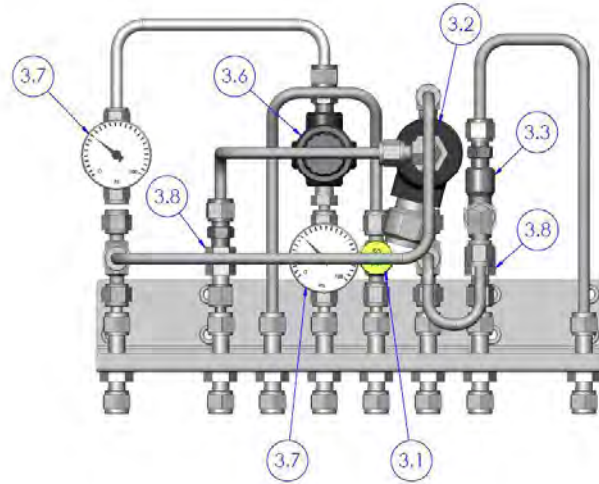
Common Replacement Parts

Item Number	Part Description	Part Number
CryoDoser Parts		
1	CryoDoser Body	15170
2	EP Head Assembly	2450.09
2.1	Dosing Stem (Valve) Assembly	670.38
2.2	Solenoid Valve Spare Assembly	2450.16
3	Gas Manifold Assembly	CR_2250
3.1	SRV, 50 psi	211
3.2	3-Way Solenoid Valve	CR_2256
3.3	Check Valve	CR_2263
3.4	Clamp Secondary	361A
3.5	Clamp Primary	360A
3.6	Nitrogen Regulator	2320
3.7	0-100 psi gauge	2321
3.8	2-5 Micron, 1/8" M x F Snubber	159
4	Dosing Head Heater (no cable included)	106C
5	Vent Heater Assembly (no cable included)	105C
6	Distribution Block	571
7	Vent Heater Cable - 4mt (D-1)	105C.01
8	Nozzle (Dosing Head) Heater Cable - 1.2mt (D-2)	2450.15
9	Timing / Container Sensor Cable Assembly - 2mt (D-3)	2440.16
10	Dose Solenoid Cable - 1.5mt (D-4 for EP Head)	366
11	Confirm Sensor Cable - 1.5mt (D-5 for EP Head)	366
12	75 Micron, 1/8" M x F Snubber	160
13	2-5 Micron, 1/8" M x F Snubber	159
14	Distribution Block Cable - 5mt	577
Sensors		
15	Complete Sensor Bracket Assembly (install at CryoDoser head)	1422
16	12mm Inductive Proximity Sensor (Speed & Timing Sensor)	2807
17	Encoder Assy. w/33' cable and brackets	2870.25
18	Encoder Cable - 20 ft	2870.22
Not Shown	SICK Encoder Programmer	2870.35
Not Shown	18mm Photoelectric Sensor (default Bottle Detect Sensor)	2870.10
Not Shown	18mm Sensor Support Hardware (use with PN 1422)	694
2K Controller Parts		
19	Controller Assembly - 2KS (Siemens)	2880
19	Controller Assembly - 2KA (Allen Bradley)	2870
20	Controller Mounting Assembly	2384
21	Controller Power Cord Assembly - 4mt	410
MISC Parts		
22	Arm Support	2450.07
23	Doser Stand	119
24	Stand Base	326A
Not Shown	C-Flex Fill Hose - 10 ft	123.S
Not Shown	Y-Pattern Manual Globe Valve	S6OMYCD
Not Shown	Purge Kit Assy for Y-Pattern Valve	6111

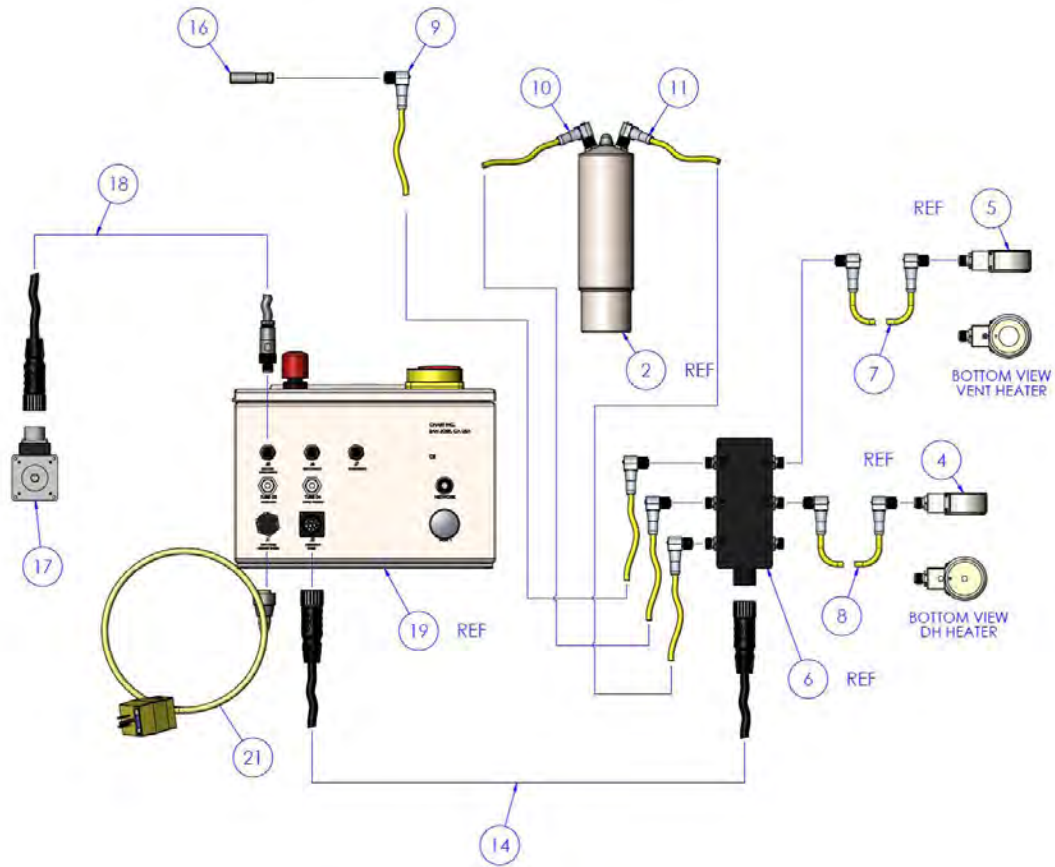




② EP HEAD ASSEMBLY

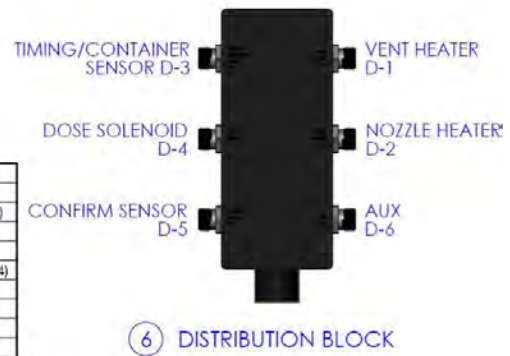


③ GAS MANIFOLD ASSEMBLY



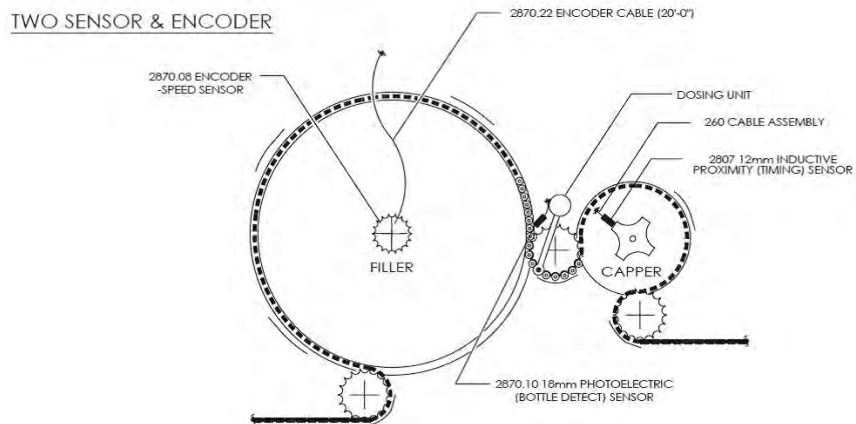
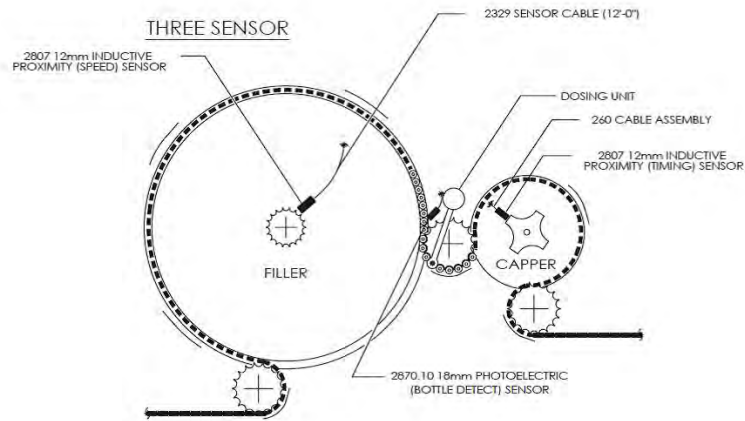
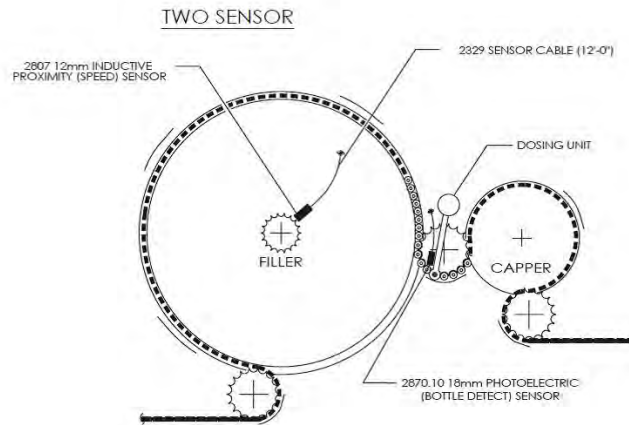
2K CONTROLLER CABLE LAYOUT

	SOURCE	CABLE ITEM NO.	DESTINATION
CONTROLLER (ITEM 19)	J1 - INPUT POWER	21	AC POWER
	J2 - DISTRIBUTION CABLE	14	DISTRIBUTION BLOCK (ITEM 6)
	J5 - ENCODER/SPEED SENSOR	18	ENCODER (ITEM 17)
DISTRIBUTION BLOCK (ITEM 6)	D1 - VENT HEATER	7	VENT HEATER (ITEM 5)
	D2 - NOZZLE HEATER	8	DOSING HEAD HEATER (ITEM 4)
	D3 - TIMING/CONTAINER SENSOR	9	TIMING SENSOR (ITEM 16)
	D4 - DOSE SOLENOID	10	EP HEAD - DOSE (ITEM 2)
	D5 - CONFIRM SENSOR	11	EP HEAD - CONFIRM (ITEM 2)
	D6 - AUX		NOT USED



6 DISTRIBUTION BLOCK

Sensor Positioning



Warranty

All sales of Liquid Nitrogen Dosing Systems (“LN₂ 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 LN₂ Dosing Systems that for two (2) years after the date of shipment to the original purchaser said Chart manufactured LN₂ Dosing Systems will maintain all performance standards for said LN₂ Dosing Systems 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 LN₂ 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 LN₂ Dosing Systems. As a further pre-condition to any Chart warranty obligation hereunder, purchaser shall return said purportedly defective LN₂ Dosing Systems, freight prepaid, to the plant of the manufacturer within thirty (30) days after receipt of the LN₂ Dosing Systems. Chart shall inspect the returned LN₂ Dosing Systems, and, if said LN₂ Dosing Systems is found defective, shall, at Chart’s option as purchaser’s sole and exclusive remedy, either (i) repair

or replace such LN₂ 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 LN₂ 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.

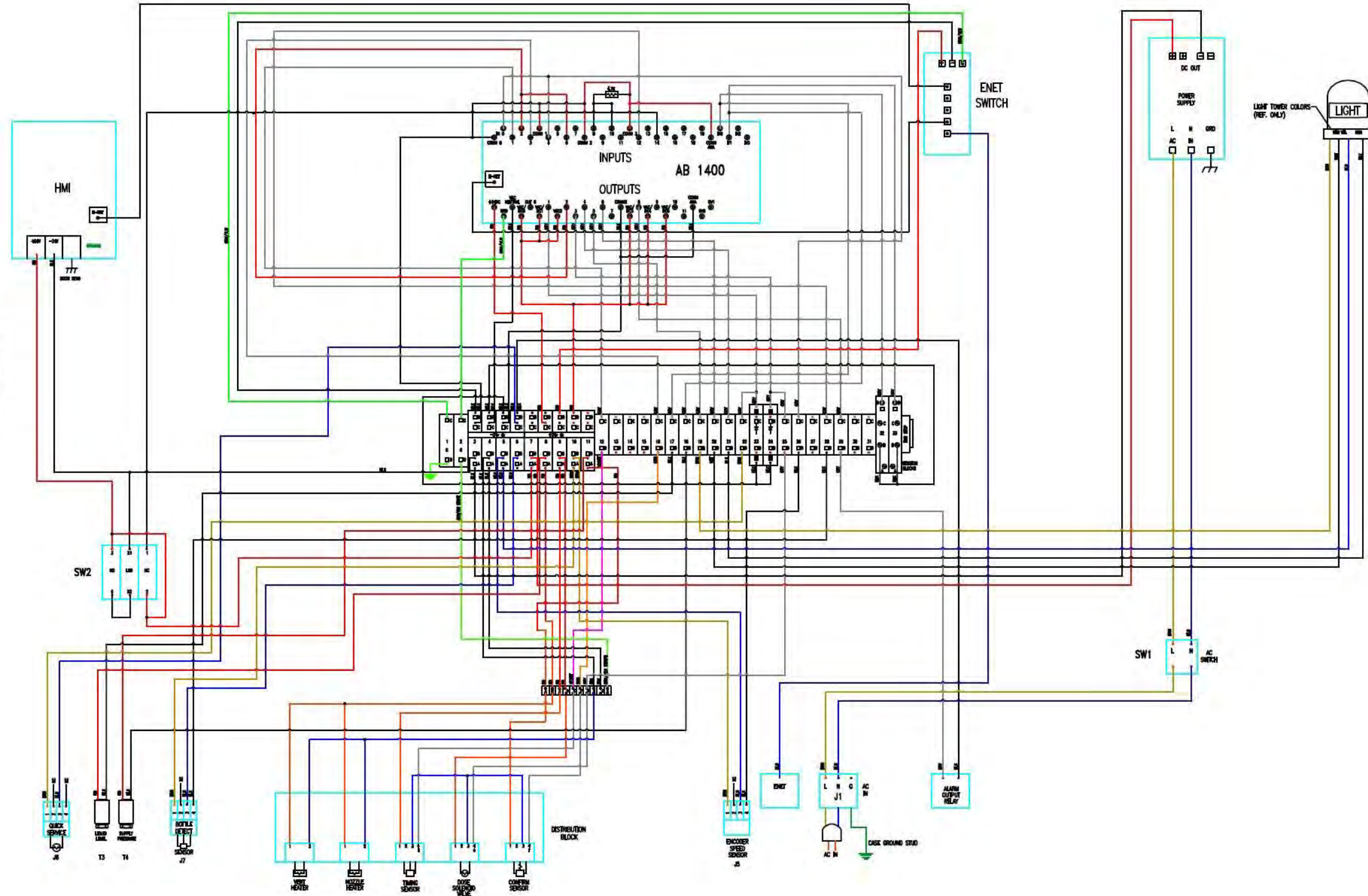
Chart’s sole and exclusive liability under this Warranty is to the original purchaser and shall not exceed the lesser of the cost of repair, cost of replacement, or refund of the net purchase price paid of the LN₂ Dosing Systems by the original purchaser. Chart is not liable for any other losses, damages, 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 LN₂ Dosing Systems.



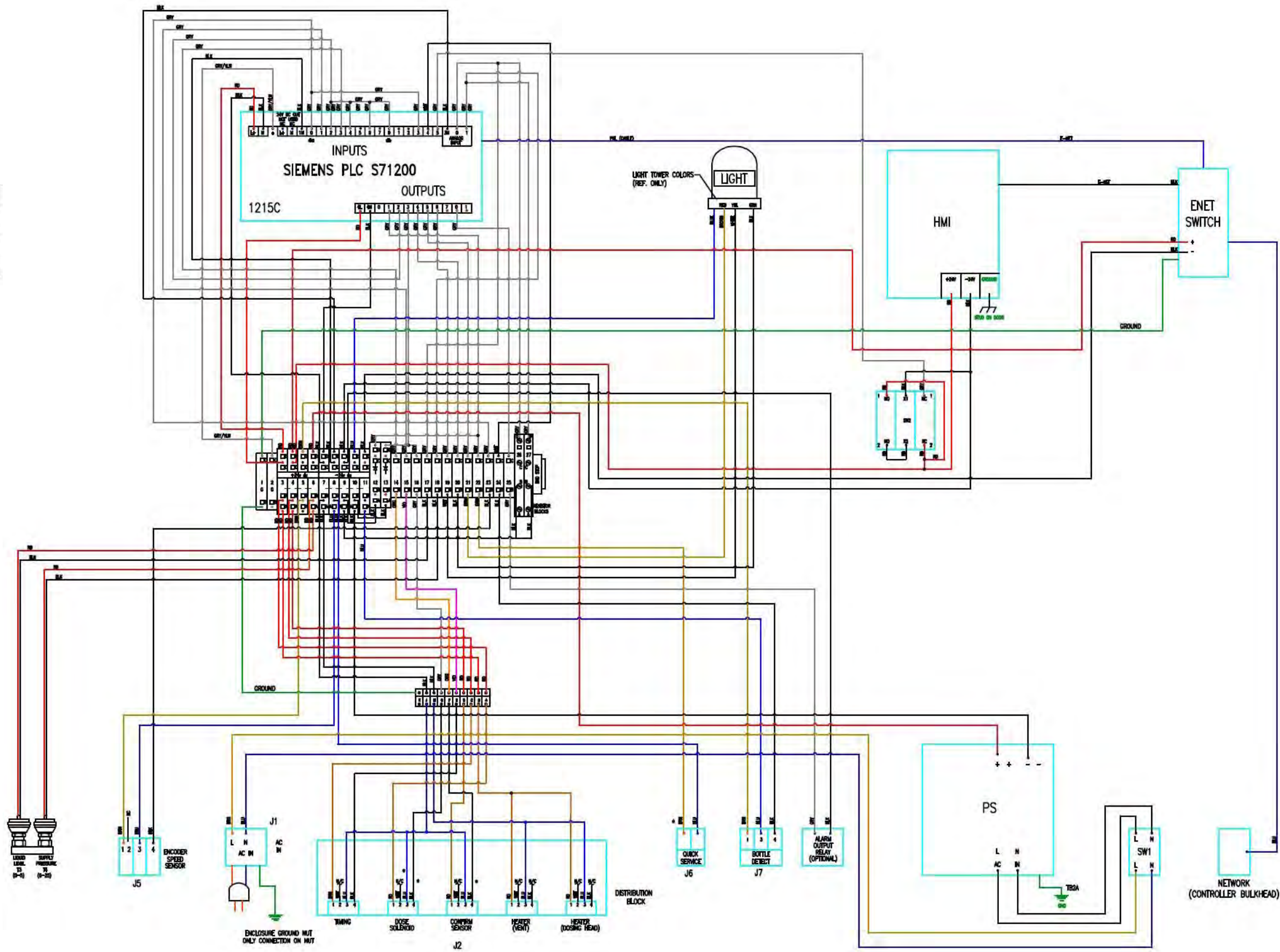
Appendix

The following wiring diagrams are the 2KA (Allen Bradley) Controller Wiring Diagram and the 2KS (Siemens) Controller Wiring Diagram respectively.

I/O FUNCTIONS	
DIGITAL INPUT	ANALOG INPUT
1. TB 28 - I.2 BOTTLE DETECT	TB 17C - NO LIQUID LEVEL
2. TB 12 - I.1 TUNING SENSOR	TB 18C - I.1 SUPPLY PRESSURE
3. TB 16 - I.3 CONFIRM SENSOR	
4. TB 26 - I.0 ENCODER/SPEED SENSOR	
OUTPUTS	
1. TB 22 - O.1 QUICK SERVICE	
2. TB 25 - O.3 DOSING VALUE	
3. TB 19 - O.5 LIGHT TOWER RED	
4. TB 20 - O.6 LIGHT TOWER YELLOW	
5. TB 21 - O.4 LIGHT TOWER GREEN	
6. TB 29 - O.8 ALARM OUTPUT RELAY	



I/O FUNCTIONS	
DIGITAL INPUT	ANALOG INPUT
TB 15 - Di.1 TIMING SENSOR	TB 17C - AI0 LIQUID LEVEL
TB 14 - Di.3 CONFIRM SENSOR	TB 18C - AI1 SUPPLY PRESSURE
TB 23 - Di.0 ENCODER/ SPEED SENSOR	
OUTPUTS	
TB 25 - DQ.0 ALARM OUTPUT RELAY	
TB 22 - DQ.1 QUICK SERVICE	
TB 16 - DQ.3 DOSING VALUE	
TB 20 - DQ.4 LIGHT TOWER GREEN	
TB 21 - DQ.5 LIGHT TOWER RED	
TB 19 - DQ.8 LIGHT TOWER YELLOW	



NOTE:
ALL CABELING 22 GA. (UNLESS NOTED)