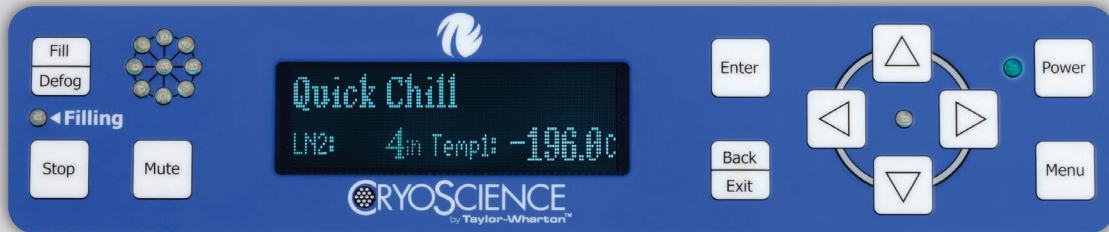


CS SERIES Control System

CS200 OPERATION & MAINTENANCE INSTRUCTIONS



CAUTION - SAFETY FIRST!

- REVIEW AND UNDERSTAND ALL SAFETY PROCEDURES IN THE "HANDLE WITH CARE" BOOKLET FORM # TW-10 P/N 7950-8052 BEFORE ATTEMPTING TO INSTALL, OPERATE OR PERFORM MAINTENANCE ON THIS LN₂ CONTROLLER.
- DO NOT ATTEMPT TO USE OR MAINTAIN ANY LIQUID NITROGEN FREEZER UNTIL YOU READ AND UNDERSTAND THESE INSTRUCTIONS.
- DO NOT PERMIT UNTRAINED PERSONS TO USE OR MAINTAIN THIS UNIT.
- IF YOU DO NOT FULLY UNDERSTAND THESE INSTRUCTIONS, CONTACT YOUR SUPPLIER FOR FURTHER INFORMATION.
- BEFORE ATTEMPTING TO OPERATE THIS CONTROLLER WITH ANY CRYOSCIENCE BY TAYLOR-WHARTON™ LABS & K SERIES UNITS, YOU MUST READ THE SEPARATE OPERATING AND SAFETY MANUAL PROVIDED WITH THAT TAYLOR-WHARTON UNIT.



Taylor-Wharton

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SAFETY PRECAUTIONS

Liquid Nitrogen

Nitrogen is an inert, colorless, odorless, and tasteless gas making up four-fifths of the air you breathe – and can be **very dangerous**. Air is roughly one-fifth oxygen. Liquid nitrogen is at a temperature of -196°C (-320°F) under normal atmospheric pressure. Cryogenic freezers are used in LN_2 service only.

Extreme Cold - Cautionary Statement

Accidental contact of liquid nitrogen or cold issuing gas with the skin or eyes may cause a freezing injury similar to frostbite. Handle the liquid so it won't splash or spill. Protect your eyes and cover the skin where the possibility of contact with the liquid, cold pipes and equipment, or cold gas exists. Safety goggles or a face shield should be worn when operating this equipment. Insulated gloves that can be easily removed and long sleeves are recommended for arm protection. Trousers without cuffs should be worn outside boots or over the shoes to shed spilled liquid.

Keep Equipment Area Well Ventilated

Although nitrogen is non-toxic and non-flammable, it can cause asphyxiation in a confined area without adequate ventilation. Any atmosphere not containing enough oxygen for breathing can cause dizziness, unconsciousness, or even death. Nitrogen, a colorless, odorless, and tasteless gas that cannot be detected by the human senses, will be inhaled normally as if it were air. One (1) liter of liquid nitrogen is equivalent to 696 liters of nitrogen gas. Without adequate ventilation, the expanding nitrogen will displace the normal air resulting in death.

Liquid Nitrogen System

The liquid nitrogen supply pressure at the inlet to the refrigerator should be in the range of 10 psig (0.7 bar/69 kPa) to 20 psig (1.4 bar/138 kPa) for optimum performance. Higher operating pressures will increase transfer losses and create excessive turbulence of the liquid in the refrigerator, which can generate false signals to the liquid level controller causing the refrigerator to under-fill. In "liquid phase" storage applications, excessive turbulence can cause splashing which could result in personal injury and/or damage to the refrigerator. When installing piping or fill hose assemblies, make certain a suitable safety relief valve is installed in each section of plumbing between any two isolation points. Trapped liquefied gas will expand greatly as it warms and may burst hoses or piping causing damage or personal injury. A relief valve is installed in the refrigerator plumbing to protect the line between the customer supplied shut-off valve and the refrigerator solenoid valve. Relief valves can be piped to the outside of the building.

Electrical

- This product is not intended for a life support function.
- This product is intended to be used in hospitals and clinics.
- This product has no Radio Transmitter (Intentional Radiator) functions.
- This product is not intended for electromagnetic shielded rooms only.
- This product does not intentionally apply RF energy for its function.
- This product does not intentionally receive RF energy for its function.

The liquid level controllers used with these refrigerators operate from 12 VDC. Disconnect the electrical power cord from the outlet before attempting any service.

WARNING:
The following safety precautions are for your protection. Before installing, operating, or maintaining this unit read and follow all safety precautions in this section and in reference publications. Failure to observe all safety precautions can result in property damage, personal injury, or possibly death.

WARNING:
Maintain adequate ventilation to prevent asphyxiation hazard (see Safety Precautions).

Caution:
When installing field fabricated piping, make certain a suitable safety relief valve is installed in each section of piping between any two isolation points.

WARNING:
Inlet pressure should not exceed 22 psig (1.5 bar/152 kPa). Higher pressures could result in damage to equipment.

WARNING:
Electrical shock can kill. Do not attempt any service on these units without first disconnecting the electrical power cord.

For more detailed information concerning safety precautions and safe practices to be observed when handling cryogenic liquids consult CGA publication P-12 "Safe Handling of Cryogenic Liquids" available from the Compressed Gas Association: CGA website: www.cganet.com; CGA customer service +1.703.788.2700; or email customerservice@cganet.com.

GENERAL INFORMATION

The CS SERIES Control System can monitor and control both the liquid nitrogen level and the vapor temperature range in the cryostorage unit you have selected. CS SERIES Control Systems are designed to work with Taylor-Wharton LABS Cryostorage Systems. The features are designed to provide a safe environment for samples while at the same time tracking all relevant information associated with the freezer. This control provides a complete historical record of the environment in your unit and therefore, the environment in which your samples have been stored in this system. This controller features a vacuum fluorescent display. The addition of a liquid nitrogen supply and inventory control racks for systematic retrieval of stored product completes the total Cryostorage System.

Taylor-Wharton LABS Cryostorage Systems are designed for applications where extremely low temperature storage of biological products is required. They are also appropriate for industrial or other applications where liquid nitrogen temperatures and high capacity are needed.

Before beginning installation or operation of this CS SERIES Control System, make sure that you read and understand this manual as well as the operating and safety instructions for the cryostorage unit you will be using with this controller.

CS SERIES Control System Specifications

Control Type:	LN ₂ Level Control & Temperature Control
Level Measurement Sensor Type:	8-Thermistor Fixed 4-Thermistor Adjustable Range: 8 inch range (8-Thermistor) Low, Normal, High (4-Thermistor) Redundancy Multiple discrete points
Temperature Measurement:	Sensor Type: Type T Thermocouples Accuracy of 1.5% with Resolution of 0.1°C Number of Channels: 2 Temperature Display Units: °C, F, K, R
Electrical:	Input Voltage: 100-240 VAC Input Current (max): 1.75 A Input Current (continuous): 0.5 A Power Consumption (max): 21 W Power Consumption (continuous): 6 W Input Frequency: 50/60 Hz Output: 12 VDC Control Input Voltage: 12 VDC Power Cord: Available for all countries
Battery:	Rating: 12 Volt, 18Ah Type: Absorbent Glass Mat (AGM) Sealed Non-Spillable Short Protection: Installed PCB with thermal fuse Battery Cover: Vinyl Solenoid Valve Input Voltage: 12 VDC Input Current 0.96 amps
Communications:	Protocol: Connectivity Access Network (CAN) Number of Communication Ports: 3 User Interface: Display Type Vacuum Fluorescent Display: (VFD) Buttons: 11 Level, Temperature and Alarm Information "At a Glance" Status LED status wheel Filling 1 LED Menu Access 1 LED Power LED
Control Tests:	Power Up Self Test Control System Check Thermistor Status Battery voltage Control voltages Temperature Circuit
Alarms:	Low Level Alarm: Always enabled High Level Alarm: Always enabled Sensor Error Alarm: Always enabled High Temperature Alarm: (T/C #1, T/C #2) Programmable

Alarms (continued...):	Low Temperature Alarm: (T/C #1, T/C#2) Programmable Thermocouple Calibration: Alarm Always enabled Thermocouple Open Alarm: Always enabled Power Failure (Remote only): Always enabled Low LN ₂ Supply Alarm: Programmable Battery Mode Warning: Always enabled Lid Open Too Long Alarm: Programmable Valve Stuck Open Alarm: Programmable Unauthorized Access Warning: Programmable LN ₂ Usage Warning: Programmable Low Battery Voltage: Always enabled Temperature Alarm Delay: Programmable Audible Alarm: Always enabled Audible Alarm Re-trigger: Programmable Visual Alarm Indicator: Always enabled Remote Alarm Delay: Programmable
Buttons:	Power: Turns power on/off Fill/Defog: Open Solenoid Valve Stop: Close Solenoid Valve Menu: Access Menu Mute: Silence audible Enter: Save a setting or select a menu choice Back/Exit: Leave a setting unchanged or back out of menu Up Arrow: Scroll the menu system or increase a value Down Arrow: Scroll the menu system or decrease a value Left Arrow: Scroll horizontal menu Right Arrow: Scroll horizontal menu
Data Collection:	Temperature Level Alarms Memory: 4 Mb
Dimensions:	Display Width: 9.5 in. (241 mm) Display Height: 2.0 in. (50.8 mm) Display Depth: 1.31 in. (33.3 mm) Display Weight: 0.625 lbs (.28 kg) Main Control Width: 8.875 in. (225.4 mm) Main Control Height: 6.688 in. (169.9 mm) Main Control Depth: 1 in. (25.4 mm) Main Control Weight: 1.0 lbs (.45 kg) Battery Width: 7.25 in. (184.2 mm) Battery Height: 6.375 in. (161.9 mm) Battery Depth: 3.25 in. (82.6 mm) Battery Weight: 12.4 lbs (5.6 kg)



Figure 1.0 Crated LABS 38K

DELIVERY AND RETURNS

Unpacking and Inspection

Inspect shipping containers for external damage. All claims for damage (apparent or concealed) or partial loss of shipment must be made in writing within five (5) days from receipt of goods. If damage or loss is apparent, please notify the appropriate parties as indicated below:

Domestic LTL Shipments – The customer should notify and file the appropriate damage claims with the carrier. All products are shipped FOB Origin.

Domestic UPS Shipments – Any damage should be noted and reported to shipper upon

delivery, and Taylor-Wharton must also be notified. Confirm with Taylor-Wharton Customer Service the filing procedures for any UPS damage claims.

International Shipments – Any damage and/or claims are to be filed with the carrier. Insurance agent(s) and customs' brokers should also be notified.

In all cases, Taylor-Wharton should be notified so we can assist if needed in filing damage claims.

Open the shipping containers; a packing list is included with the system to simplify checking that all components, cables, accessories, and manuals were received. Please use the packing list to check off each item as the system is unpacked. Inspect for damage. Be sure to inventory all components supplied before discarding any shipping materials. If there is damage to the system during transit, be sure to file proper claims promptly. Please advise Taylor-Wharton of such filings. In case of parts or accessory shortages, advise Taylor-Wharton immediately. Taylor-Wharton cannot be responsible for any missing parts unless notified within 10 days of shipment.

Freight Damage Procedures

Any freight damage claims are your responsibility. Cryostorage Systems are delivered to your carrier from Taylor-Wharton's dock in new condition; when you receive our product you may expect it to be in that same condition. For your own protection, take time to visually inspect each shipment in the presence of the carrier's agent before you accept delivery. If any damage is observed, make an appropriate notation on the freight bill. Then, ask the driver to sign the notation before you receive the equipment. You should decline to accept containers that show damage which might affect serviceability.

Repackaging for Shipment

If it is necessary to return any part of the system for repair or replacement, a Material Return Authorization (MRA) number must be obtained from an authorized factory representative before returning the equipment to our service department. Contact your distributor for return authorization. When returning equipment for service, the following information must be provided before obtaining an MRA:

- A. System model and serial number, and controller model and unit, if available.
- B. User's name, company, address, and phone number
- C. Malfunction symptoms

If possible, the original packing material should be retained for reshipment. If not available, consult Taylor-Wharton for shipping and packing instructions. It is the responsibility of the customer to assure that the goods are adequately packaged for return to the factory. *All refrigerators returned to Taylor-Wharton must be clean and sterile before return. Refer to the operating manual of the freezer you are using for cleaning instructions.*

INSTALLATION

Getting Unit into Service

Your Cryostorage System comes with complete instructions for how you should remove the unit from the crate and put it into service. Read both this manual and your Cryostorage System's manual before beginning any installation. Make sure to follow any required procedures and safety guidelines when you are connecting your Liquid Nitrogen source.

The CS SERIES Control System is designed to be operated at normal room temperatures 15° C to 27° C (60° F to 80° F) at a relative humidity level below 50%. The humidity level should be maintained such that the electronics are not exposed to condensation.

The Taylor-Wharton Cryostorage freezer should be positioned such that the all sides of the unit are easily accessible and the user can easily connect/disconnect the power cord from the wall socket.

Proper ventilation MUST BE adequate to sustain life for those working with or maintaining this equipment.

Electrical

The liquid level controllers used with these refrigerators operate at 12 VDC. The external transformer has a 100/240 VAC primary. Disconnect the electrical power cord from the outlet before attempting any service.

Electromagnetic Compatibility (EMC)

Although this equipment conforms to the intent of the 2004/108/EC EMC Directive, all medical equipment may produce electromagnetic interference or be susceptible to electromagnetic interference. The following are guidance and manufacturer's declarations regarding EMC for the CS SERIES Control System.

The CS SERIES Control System needs special precautions regarding EMC and needs to be installed and put into service according to the EMC information provided in the following pages.

Portable and Mobile RF communications equipment can affect the performance of the CS SERIES Control System. Please use the guidelines and recommendations specified in the EN Compliance tables found on pages 43-46.

Other Medical Equipment or Systems can produce electromagnetic emissions and therefore can interfere with the functionality of the CS SERIES Control System. Care should be used when operating the CS SERIES Control System adjacent to or stacked with other equipment. If adjacent or stacked use is necessary, the CS SERIES Control System should initially be observed to verify normal operation in the configuration in which it will be used.

The electrical cables, external power supplies and accessories listed or referenced in this manual have been shown to comply with the test requirements listed in the

CAUTION:

If using a power source other than North American 110/220 VAC, contact Taylor-Wharton Customer Service to make sure you are using the appropriate converter. Use of an unapproved power source converter may cause permanent damage to the unit.

WARNING:

Electrical shock can kill. Do not attempt any service on these units without first disconnecting the electrical power cord.

WARNING:

Maintain adequate ventilation to prevent asphyxiation hazard (see Safety Precautions).

WARNING:

If the fill fails to stop for any reason, quickly close the liquid supply valve to prevent overfilling until the cause of the problem can be determined.

EN Compliance tables found on pages 43-46. Care should be taken to use only manufacturer-recommended cables, power supplies and electrical accessories with the CS SERIES Control System. If a third-party supplier offers cables, external power supplies and electrical accessories for use with the CS SERIES Control System and they are not listed or referenced in this manual, it is the responsibility of that third-party supplier to determine compliance with the standards and tests in the EN Compliance tables found on pages 43-46.

The use of electrical cables and accessories other than those specified in this manual or referenced documents may result in increased electromagnetic emissions from the CS SERIES Control System or decreased electromagnetic immunity of the CS SERIES Control System.

Power Supply Connection

Connect the power supply to your LABS Cryostorage System and then plug the power supply into a surge-protected 110/220 VAC outlet.

Validation

Some organizations require that equipment be validated periodically. If information is needed on the proper techniques to validate this equipment, please contact your supplier.

OPERATION

These instructions are for operators experienced with cryogenic equipment. Before operating the system, become familiar with the safety precautions in this manual and in reference publications. Make certain all applicable provisions set forth in the Installation Section have been followed before placing a system in operation. Study this manual thoroughly. Know the location and function of all system components.

Initial Fill

The Cryostorage System, using the CS SERIES Controller, comes preset from the factory. The liquid nitrogen supply pressure at the inlet to the refrigerator should be in the range of 10 psig (0.7 bar/69 kPa) to 20 psig (1.4 bar/138 kPa) for optimum performance. Higher operating pressures will increase transfer losses and create excessive turbulence of the liquid in the refrigerator which can generate false signals to the liquid level controller causing the refrigerator to under fill. In "liquid phase" storage applications, excessive turbulence can cause splashing which could result in personal injury.

For complete instructions for the initial fill refer the Quick Start Guide that comes with your cryogenic freezer model.

WARNING:
This equipment is intended for use by healthcare professionals. As with all electrical medical equipment, this equipment may cause radio interference or may disrupt the operation of nearby equipment. It may be necessary to take mitigation measures such as re-orienting or relocating the CS SERIES Control System unit or shielding the location.

Control Components

CS SERIES Control System Components

The CS SERIES Control System for the Taylor-Wharton Cryostorage freezer consists of the following components:

- Main Control Module
- VFD (Vacuum Florescent Display) Module
- Shielded Display Cable
- Wiring Harness Assembly
- Power Supply
- Thermocouple Assembly (Optional Second Thermocouple)
- Sensor Assembly
- Cryogenic Solenoid Valve
- Remote Alarm Plug
- Lid Switch Assembly
- 12 Volt, 18aH battery
- Solenoid Valve Assembly with Freezeguard
- Strainer

The CS SERIES Control System is assembled onto the freezer at the factory and completely tested. Refer to the Quick Start Guide for freezer set-up. Start operation of the control system by plugging the power cord into the wall outlet. Press and hold the POWER button for 2 seconds. The CS SERIES Control System will go through a short startup routine and then start operation. Refer to Figure 2.0 below CS200 Controller Display for a description of the controller's navigation buttons.

CS200 Controller Display Guide

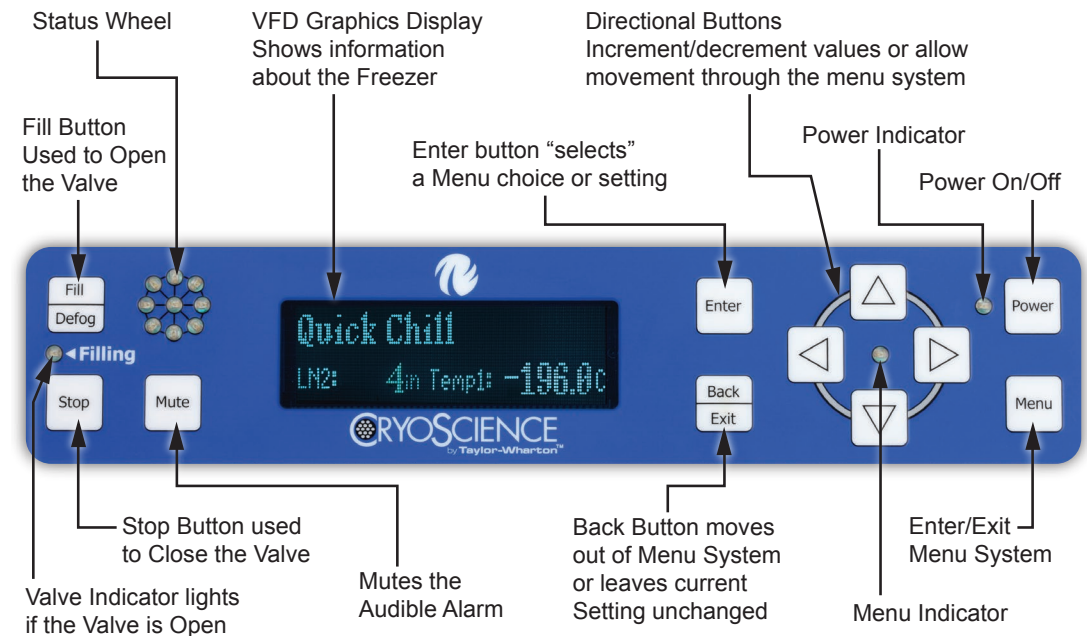


Figure 2.0 CS200 Controller Display

Operational Theory

The CS SERIES Control System automatically maintains the Liquid Nitrogen (LN_2) level and monitors temperature in the Cryogenic freezer. Operational conditions are monitored and any alarm is triggered if necessary. Operations data is stored in memory on the control board.

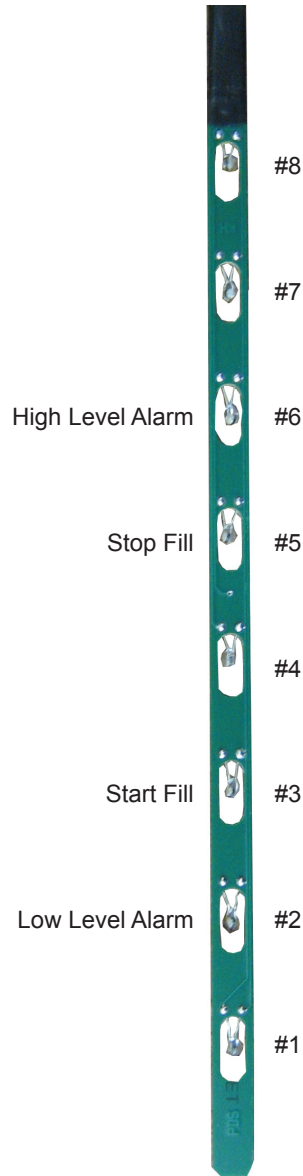


Figure 3.0 Thermister LN_2 Level

The CS CONTROL SYSTEM uses thermistors to measure the LN_2 level within the vessel. A thermistor is a thermal resistor and its resistance changes as the temperature changes. When a thermistor is submerged in LN_2 , its resistance will be significantly greater than its resistance at room temperature. The control can detect this resistance change and determine the level of the LN_2 within the freezer. The CS CONTROL SYSTEM is designed to work with an 8 thermistor assembly. There are four thermistors that can be selected that will maintain the LN_2 level. These selected thermistors correspond to Low Alarm, Start Fill, Stop Fill and High Alarm. When the LN_2 level drops below the Start Fill thermistor, the control opens a solenoid valve allowing LN_2 to enter the vessel. This continues until the Stop Fill thermistor is submerged in LN_2 at which point the solenoid valve is closed preventing the flow of additional LN_2 into the vessel. The Low Alarm, Start Fill, Stop Fill and High Alarm settings can all be changed by the user through the menu system.

The LN₂ level is indicated on the display and is determined by the number of thermistors submerged in LN₂ according to the table below:

Table 1.0 8-Thermistor Sensor (G=NORMAL, L=LN₂ Flow)

#1	#2	#3	#4	#5	#6	#7	#8	Offset	Display	Actions
G	G	G	G	G	G	G	G	θ	θ	Low Alarm, Filling
L	G	G	G	G	G	G	G	θ	1	Low Alarm, Filling
L	L	G	G	G	G	G	G	θ	2	Filling
L	L	L	G	G	G	G	G	θ	3	Normal
L	L	L	L	G	G	G	G	θ	4	Normal
L	L	L	L	L	G	G	G	θ	5	Stop Fill
L	L	L	L	L	L	G	G	θ	6	High Alarm
L	L	L	L	L	L	L	G	θ	7	High Alarm
L	L	L	L	L	L	L	L	θ	8	High Alarm, Valve stuck Open Alarm

Alarm Conditions

The CS SERIES Control System monitors a number of conditions and provides an alarm if a problem is detected. The alarms are listed below:

Table 2.0 Alarm Conditions

ALARM	PROBLEM DETECTED
Low Level Alarm	LN ₂ level is too low. Thermistor #2 on the sensor assembly is not submerged in LN ₂ .
High Level Alarm	LN ₂ level is too high. Thermistor #6 on the sensor assembly is submerged in LN ₂ .
Sensor Error Alarm	A problem exists with the level sensor. The control detects an open sensor circuit meaning that the sensor is unplugged or the sensor assembly has been damaged. A faulty sensor is denoted as "O" for open.
High Temperature Alarm	The temperature detected is warmer than the high temperature alarm setting.
Low Temperature Alarm	The temperature detected is colder than the low temperature alarm setting.
Thermocouple Calibration Alarm	The calibration data is incorrect.
Thermocouple Open Alarm	A problem exists with the temperature sensor (thermocouple). The control detects an open circuit meaning that the sensor is unplugged or the sensor assembly has been damaged.
Power Failure	No Power.
Low LN ₂ Supply Alarm	A problem may exist with the LN ₂ supply connected to the freezer. This alarm occurs if the freezer does not fill within the designated amount of time determined by the setting on the control. Possible reasons include an empty supply cylinder, low head pressure in the supply cylinder or a closed shut off valve.
LN ₂ Use Warning	The consumption of LN ₂ has increased and should be checked.

Note: Please see description of the offset. Level displayed may vary depending on the offset setting.

Table 2.0 Alarm Conditions

ALARM	PROBLEM DETECTED
Operating in Battery Mode Alarm Warning	The power from the power supply has been disrupted and the control system is operating on battery power.
Low Battery Voltage	The voltage on the battery is low.
Lid Open Too Long Alarm	The lid has been opened for a period which is longer than the designated alarm setting.
Valve Stuck Open Alarm	The valve is stuck open.
Unauthorized Access Warning	The lid has been opened and an incorrect or no identification has been entered.
Temp Alarm Delay	This is the amount of time after a warm temperature is detected before the control goes into alarm.
Audible Alarm Retrigger	The audible alarm is retriggered if the error condition that caused it is not corrected. The retrigger time can be adjusted by the user.
Remote Alarm Relay	The control provides a relay to provide an external signal that an alarm condition has occurred. The user can set the remote alarm timer that determines the amount of time an error must be active before the relay is triggered.

All alarms include the following:

- The flashing status wheel flashes to signal an error condition
- An audible tone sounds
- The error detected is displayed and scrolled on the screen
- The remote alarm relay changes state to provide a dry contact output signal

Lid Switch

The LABS Lid Switch (Figure 4.0) is attached to the hinge and determines whether or not the lid is open on the freezer. This also allows the control to determine whether to activate the Auto Defog, Quick Chill or Lid Alarm features.

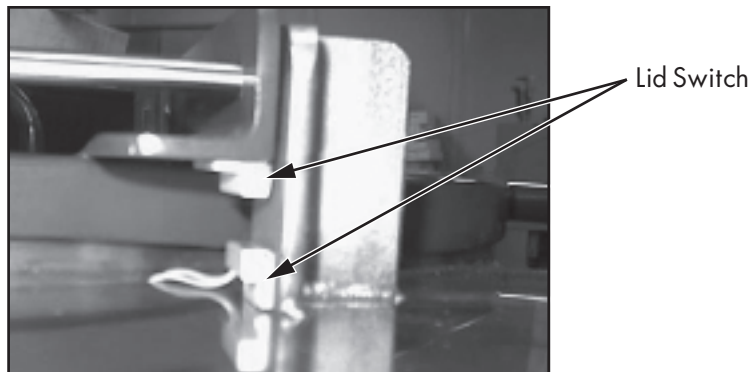


Figure 4.0 LABS Lid Switch

Solenoid Valve

These units are designed to work with 12 VDC solenoid valve (see Figure 17.0 LABS Plumbing Assembly on page 37).

Thermocouples

Type T thermocouples monitor the temperature in the freezer. The user may choose to use NONE, 1 or 2 thermocouples with this control at any time. (The unit comes complete with one Thermocouple)

Power Supply

A 12 VDC power supply is supplied for the CS SERIES Control System. The system is supplied with a transformer compatible with common household (North American) 100/240 VAC. (For other power outlets contact Taylor-Wharton Customer Service.) UL approval for the system as a whole is not required since the control operates on low voltage. If your power source differs, or is subject to disruption or line surges due to other equipment on line, consult your Taylor-Wharton representative.

Remote Alarm

If an error condition occurs after a user defined period of time, a remote alarm can be initiated. This is accomplished by connecting a remote device to the remote alarm jack on the rear electrical panel. The 3-pin jack on the back of the unit provides continuity between pin #2 (common) and pin #3 in the normal condition. Continuity between pin #1 and pin #2 is provided in an error condition.

Remote Alarm Connector



Figure 5.0 Remote Alarm Plug Connection

Operating Parameters

When materials are immersed in liquid nitrogen, they will assume the temperature of the liquid (-196°C/-320°F). When material is stored in the vapor phase over the liquid, the liquid nitrogen is still a very cold refrigerant, but the refrigerator's interior temperature increases as product is stored higher over the liquid. This temperature differential is not significant for many biological storage applications, and is affected by the amount of product stored in the refrigerator, the type size and material of inventory control system, and the liquid level in the unit.

The liquid level in the refrigerator is determined by the position of the of the Thermistor Assembly in the sensor tube. These sensors are set at installation to maintain a specific liquid level. A filling cycle is initiated when the level falls below the Start Fill sensor and is completed when the Stop Fill sensor is reached. This filling cycle repeats when the level fall below the Start Fill sensor. Sensor Probe assignments may be changed on the controller keypad to define new start and stop levels, and these levels may be set independently to vary the liquid level deference between fills. Prior to the initial fill of the refrigerator, a determination should be made whether vapor phase or liquid phase storage will be utilized.

All units are supplied with an eight thermistor assembly and a freeze-guard sensor unless otherwise specified. The LABS factory setting positions will maintain liquid level within a distance of 2 in. (50.8 mm) from the bottom of the operating tray on the LABS 20K, 38K, 40K, 80K units, and 3 in. (76.2 mm) from the bottom of the operating tray on the LABS 94K.

Temperature Monitoring

The CS SERIES Control System uses a type T thermocouple to monitor the temperature in the vessel. The thermocouple is factory-installed near the top of the Taylor-Wharton Cryostorage freezer vapor chamber and the temperatures are measured at that point.

The CS SERIES Control System accommodates a second user-installed thermocouple for temperature measurement at a secondary location. This is also a Type T thermocouple.

The control provides a High Temperature Alarm for each thermocouple which can be selected by the user. If the temperature exceeds the temperature alarm set point, the status wheel flashes and an audible alarm is triggered.

Liquid Phase Storage

Liquid phase storage is normally utilized when -196 is required to maintain stored product viability and the storage medium is adequate for storage in liquid nitrogen.

In a typical liquid phase storage system, the liquid level sensors are positioned to maintain the liquid level at or below the top level of the inventory control system. During operation, the upper levels of the inventory control system will at times become exposed as the liquid level fluctuates.

Care must be taken to ensure that the liquid level remains below the bottom of the refrigerator lid. Exposure to liquid nitrogen may result in physical damage to the lid. Additionally, operating the refrigerator with high liquid levels characteristic of liquid phase storage may result in turbulence during fill cycles. Caution must be exercised if the refrigerator lid is opened during a fill, and appropriate safety equipment should always be worn.

The Taylor-Wharton Cryostorage Systems are set at factory for vapor phase storage.

Maintenance

To insure proper operation and maintain excellent performance of the Taylor-Wharton Cryostorage freezer, an annual maintenance schedule should be followed for the CS SERIES Control System. This would include the following:

Table 3.0 Annual Maintenance Schedule

CS SERIES Control System	Examine for exposure to moisture, wear and tear, connector problems, and cracks or other damages to the faceplate or buttons. In addition, periodic firmware updates may be important.
Harness Assembly	Examine for damage to the cable and damage to connectors.
Battery	Examine connection cable and connector for damage. Examine vinyl cover for damage. Replace every 2 years.
Solenoid Valve	Examine wires and connector for damage. Replace every 3 years.
Lid Switch	Examine lid switch pickup and wires for damage. Replace if necessary.
Level Sensor Assembly	Examine for damage to wires and connector.
Thermocouple Assembly	Examine for damage to wires and connector.
Power Supply	Examine for damage to power supply and power cords.

In addition, inspection and preventive maintenance should also be performed on the freezer and its mechanical parts. Refer to owner's manual for details.

If any intermittent alarm or defect with the Cryo-Storage System is observed or suspected, it should be investigated and remedied immediately even if this falls outside of the normal maintenance schedule.

CONTROLLER OPERATION

This section of the operating manual is for Taylor-Wharton approved equipment that uses the CS SERIES Control System.

Introduction

The CS200 Control System, temperature and LN₂ level controller is designed for easy operation and uninterrupted reliable service. This controller will maintain the selected liquid level range of LN₂ in your refrigerator as well as provide audible and visual alarms for any non conforming conditions that may occur. An Alarm is any condition outside the activated preset limits on the control, such as an open sensor circuit or temperature alarm. "System Events" are lid openings and closings, solenoid valve openings and closing, and operation of the controller's relay for remote alarm indication. System Events, Alarms and Temperature "Data" can be downloaded.

The System should require no additional attention to maintain liquid level if an adequate supply source of liquid nitrogen is maintained. If your protocol calls for you to "top-off" the Cryostorage System at the end of a workday or workweek, press the FILL button. The unit will fill to the upper allowable liquid level and stop automatically. You may choose to manually stop the fill by pressing the STOP button at anytime during the fill.

Operation Data

The CS200 CONTROL SYSTEM stores data related to the operation of the Taylor-Wharton Cryo-Storage freezer. This data includes date, time, LN₂ level, temperature, system events and error conditions. This can be useful for audit purposes, operation analysis and preventive maintenance.

Communications

The CONTROL SYSTEM has been designed with advanced communications capabilities. This allows for the transfer of data out of the control where the data can more easily be used. Please check with your supplier for available protocols and compatible products.

Normal Fill Cycle

When the refrigerator is filled and the controller is operating, the *START FILL* and *LOW ALARM* sensors are immersed in liquid nitrogen. Their resistance values are interpreted by the controller as "in liquid". At the same time, the *STOP FILL* and the *HIGH ALARM* sensors are above the liquid pool, informing the control that these sensors are in vapor. As liquid nitrogen evaporates, the liquid level in the refrigerator drops slowly until the *START FILL* sensor is above the liquid and sends a different signal to the controller. After a delay sufficient to ensure the signal, the controller interprets this condition as low liquid and opens the fill solenoid, admitting more liquid nitrogen from the supply source.

The refrigerator will fill slowly. The fill continues until the *STOP FILL* sensor sends the controller a signal that it is now in liquid. The controller will close the liquid supply valve to stop the fill. As liquid evaporates, the display will indicate the liquid is at a normal level as the cycle begins again.

Control Setting Adjustments






Level

The standard sensor assembly that is installed on a freezer consists of a circuit board with thermistors installed. The assembly has a maximum range of 6 inches (150mm). Thermistor assignments can be changed through the menu system and the operating range can be changed by either raising or lowering the circuit board (offset) within the freezer.

If a wider range is needed between the start fill and stop fill thermistor, please contact your supplier for an alternate sensor assembly.


Features & Settings

Some control settings can be changed through the menu system.

Enter and Exit the menu system by pressing:	
Move down through the menu system by pressing:	
Move up through the menu system by pressing:	
Select a menu choice or lock in a setting by pressing:	
Back out of the menu system by pressing:	

When changing settings, single button presses will increment/decrement a value one step at a time. Pressing and holding a button will allow for rapid change of a setting.

The menu system incorporates icons to show the user settings which can be changed and which are locked.

Locked menu choice:	
Accessible menu choice:	

Also, the menu system includes a scroll bar on the right side of the display. The scroll bar will indicate the current location in the menu system and will indicate if additional menu choices are available with the display of up and down arrows on the scroll bar.

The control will continue to monitor all sensors and conditions while the user accesses the menu system. If no activity is detected for 30 seconds, the control will automatically return to the main operational screen.

View Only

The View Only menu selection allows the user to view settings but will not allow changes to any settings. This restriction is designated with a lock symbol. Refer to Figure 8.1 Menu System - View Only on page 22 to navigate the “View Only” menu.

Change Settings

The Change Settings menu selection allows the user to change operational settings for the control system. Refer to Figure 8.2 Menu System - Change Settings on page 23 to navigate through any changes you need to make.

Below are the Menu Settings that are available in both the “View Only” and “Change Settings” modes.

• TEMPERATURE

- **Thermocouple Select:** Allows the user to turn on/off thermocouples for temperature measurement.
- **Calibrate**
 - **Calibrate Thermocouple 1:** Allows the user to calibrate the control for use with thermocouple #1.
 - **Calibrate Thermocouple 2:** Allows the user to calibrate the control for use with thermocouple #2.
 - **Restore Calibration:** Resets the calibration to the data stored during factory calibration.
 - **Set Ambient:** Ambient temperature is set at the factory and should not be changed in the field.
- **Test Temperature System**
 - **Check Thermocouples:** Gives status of temperature sensors.
 - **Test Temp Alarms:** Allows the user to manually test temperature alarms for the thermocouples.
- **Control by Temperature**
 - **Temp Control On/Off:** Enables/Disables temperature control.
 - **Temp Control Range:** Allows the user to set the range for temperature control.
- **Temperature Alarms**
 - **High Temperature Alarm:** Allows the user to set the high temperature alarm for both thermocouples. Settings [00° C to -1900° C]
 - **Low Temperature Alarm:** Allows the user to set the low temperature alarm for both thermocouples. Settings [00° C to -1900° C]
 - **Time with no Temp alarm:** Displays the time since the last high or low temperature alarm.
- **Temperature Units:** Allows the user to choose the units of measure for temperature.

• LEVEL

- **Thermistor Status:** Gives the user the status for the 8 thermistors on the level sensor assembly and the freeze-guard sensor installed at the valve.
- **Sensor Positions:** Allows the user to assign the thermistors for low level alarm, start fill, stop fill, high level alarm and the sensor offset.
- **Valve Open Duration:** Allows the user to set the fixed times for valve open and valve closed durations.

- **Sensor Type:** Allows the user to set the sensor type as a 4 thermistor sensor or an 8 thermistor sensor. Also allows the user to disable the freezeguard sensor.
- **Level Sensor Alarm**
 - **Sensor Error Mute:** Allows the user to mute the audible alarm for a sensor error.
 - **Freezeguard Error Mute:** Allows the user to mute the audible alarm for a freezeguard sensor error.
- **SYSTEM**
 - **Inch/Metric:** Allow the user to switch between English and Metric level measurement systems.
 - **Date/Time:**
 - **Set Date/Time:** Allows the user to set the date and the time. Use the up/down arrows to change settings. Use the left/right arrows to move between the date and time fields.

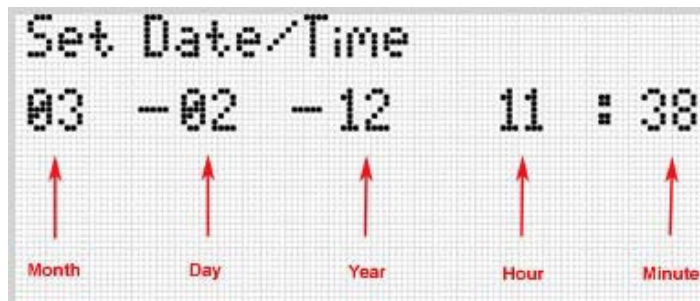


Figure 6.0 Set Date/Time Menu

- **Date Format:** Allows the user to change between U.S. and International format.
- **Lid Functions**
 - **Lid Switch:** Permits the user to enable/disable the lid switch feature.
 - **Quickchill Timer:** Enables the user to set the amount of time that the valve will stay open after the lid is closed.
 - **Manual Defog Timer:** Allows the user to set the amount of time that the valve stays open when the Fill/Defog button is pressed and the LN₂ level is within normal range.
 - **Auto Defog Timer:** Allows the user to set the amount of time that the valve stays open. Triggered by the lid switch when the lid is opened and the LN₂ level is within normal range.
 - **User Access On/Off:** Allows the user to enable/disable this feature.
 - **User ID's:** Allows the user to set user identification for freezer access.
 - **Lid Open Valve Off:** Allows the user to enable this feature which insures that solenoid is closed when the lid is opened.
- **System Alarms**
 - **Test Alarm:** Allows the user to manually check the audible, visual and remote alarm.
 - **LN₂ Supply Alarm Delay:** Allows the user to set the time to wait before an error condition occurs if the freezer does not fill in a timely manner. If this alarm occurs the supply should be checked to insure that the supply valve is turned on, a sufficient supply of LN₂ (at least 10 psi) is available in the supply cylinder. Settings [30, 45, 60, 75, 90 min] or [2, 3, 4 hours]

- **Remote Alarm Delay:** Allows the user to set the time before the remote alarm relay is triggered after an error condition occurs. Settings [Immediate, 30, 60, 90 min] or [2,3, 4, 6 hours]
- **Lid Open Alarm Delay:** Allow the user to set the time before an alarm condition occurs if the lid is opened too long.
- **Valve Stuck Alarm:** Allow the user to enable/disable this feature.
- **Audible Re-trigger:** Allows the user to set the time before the audible alarm is re-triggered after an alarm has been acknowledged. Settings [15, 30, 60, 120, 240, 480 min] or [1 day]
- **Display**
 - **Display Brightness:** Allows the user to adjust brightness for the display. Settings [1 to 15]
 - **Screen Saver Time:** Allows the user to adjust the time before the screen saver starts working. Settings [0 to 60 min]
- **Freezer ID:** Allows the user the capability to change the freezer identification.
- **SCHEDULED EVENTS**
 - **Scheduled Fills**
 - **Set Time:** Allows the user to set the day and time for the next filling operation.
 - **Next Fill:** Displays the next scheduled fill.
 - **LN₂ Supply Reminder**
 - **Set Reminder:** Allows the user to set the day which the control will display a reminder to check the supply of LN₂.
 - **Clear Reminder:** Allows the user to acknowledge that the LN₂ supply has been checked.
 - **Next Reminder:** Displays the next scheduled reminder.

Below are the Menu Settings that are available only in the “Change Settings” mode.

- **SECURITY**
 - **Settings Password:** Allows the user to set a password to allow setting changes.
 - **Power Password:** Allows the user to set the password which secures power button operation.
- **CONTACT SUPPORT**
 - **Distributor:** Contact information for the distributor.
 - **Taylor-Wharton:** Contact information for Taylor-Wharton.
- **SYSTEM INFORMATION**
 - Displays the control serial number, the firmware version and the freezer identification.

Temperature

The temperature in the Cryostorage freezer is measured at the location of the thermocouple. The installation location is different depending on the model of the freezer but usually the thermocouple is positioned level with the top storage box. This may mean that temperatures displayed may be slightly warmer than the temperature experienced by the samples or product stored in the freezer.

Temperature Control

The CS SERIES Control System has the capability to control the vapor temperature at the top of the freezer. The temperature is controlled at the location of thermocouple 1.

To maintain temperature, the CS200 SERIES Control System bubbles N₂ gas through the pool of LN₂ in the bottom of the freezer. The nitrogen gas evaporates some of the LN₂ causing a cooling effect reducing the temperature in the freezer. Since a pool of LN₂ is important in the process of temperature control, an adequate level is always maintained by the control systems and the level control always takes precedence over temperature control. Temperature control will not work if the LN₂ level is above High Level Alarm.

Enabling the temperature control feature will always increase the use of LN₂. The increased consumption will depend on a number of factors including the temperature to be maintained, the range of the controlled temperature, the ambient temperature and the length of supply hose connected to the freezer and the frequency which users open the lid or otherwise introduce heat.

Battery Operation

The CS200 SERIES Control System is designed to operate with or without an optional battery backup system if required. Simply plug the battery into the appropriate connector. The control will recognize that the battery has been connected and will activate the battery backup mode.

LED Status Wheel

The CS SERIES Control System offers an innovative concept called a status wheel. In normal operation, the LED's on the status wheel light to show a slow rotation of the wheel. If an error condition occurs, the control will alert the user with an additional visual alarm from the status wheel. The rotation can be accelerated, flashed or even illuminated in the opposite direction.

Condition	LED Flash Property
Normal	Clockwise pattern, 1 LED per second
General Error	Clockwise pattern, rapid rotation, flash

Figure 7.0 LED Status Wheel Flash Patterns

Lid Switch

The lid switch consists of a magnet and a pickup installed on the lid. The control can determine when the lid is opened because the magnet moves out of range of the pickup and the circuit becomes open. A number of features are associated with the lid switch such as Auto Defog, Quickchill and the Lid Open Too Long Alarm. If the lid switch is deactivated, these features are also disabled.

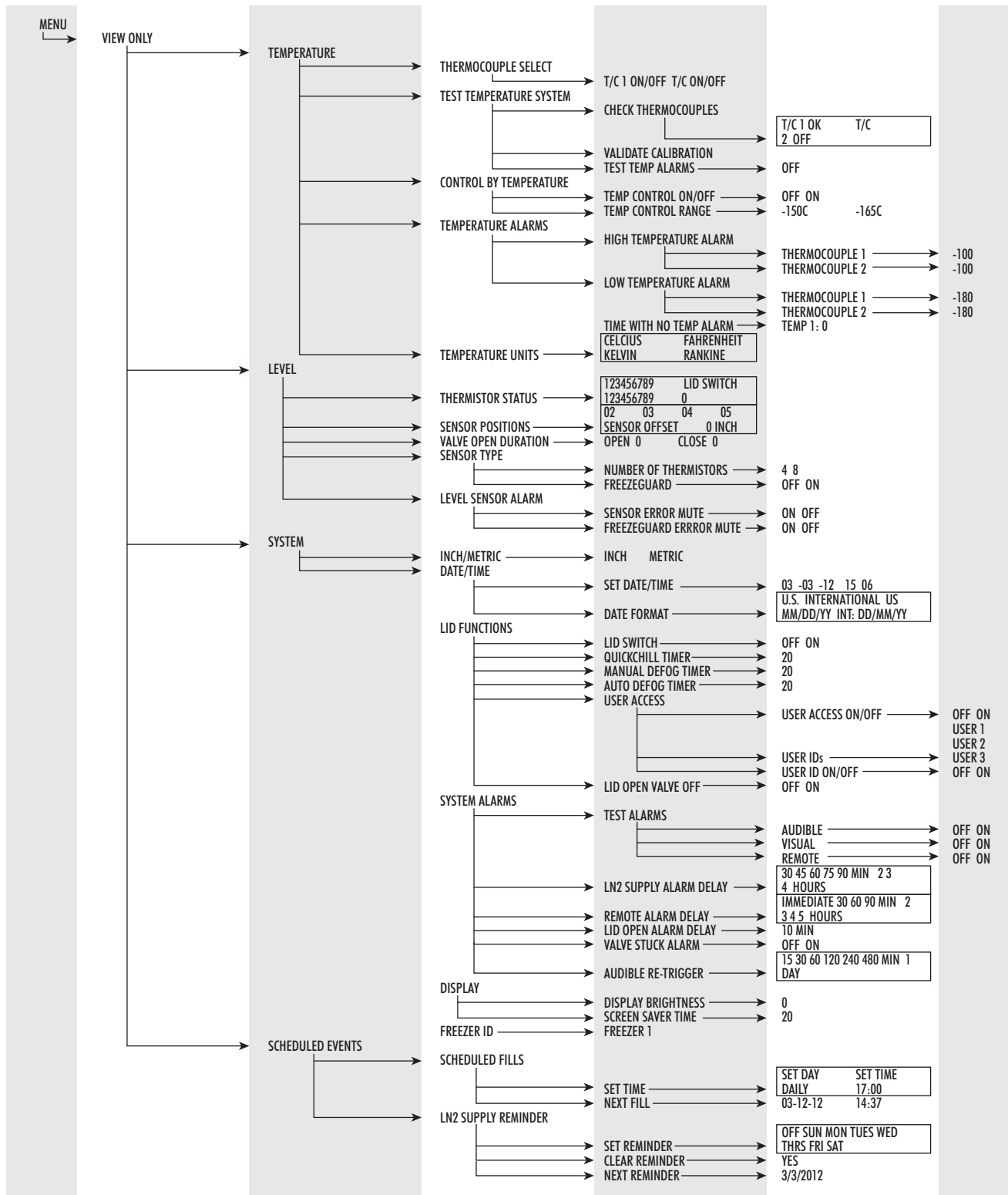


Figure 8.1 Menu System - View Only

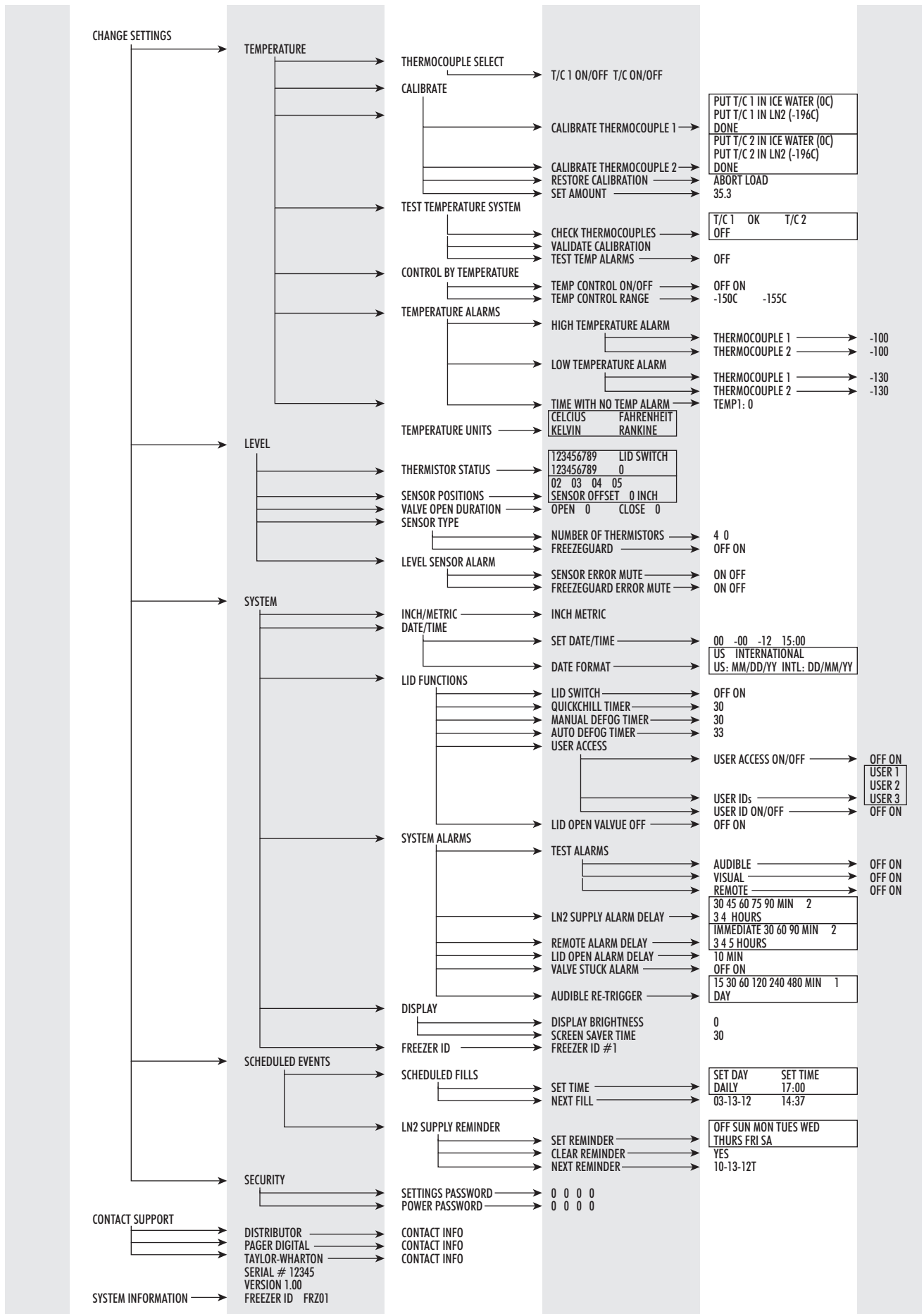


Figure 8.2 Menu System - Change Settings

Factory Defaults

Thermocouple #1	On
Thermocouple #2	Off
Control by Temperature	Off
High Temperature Alarm #1	-100C
High Temperature Alarm #2	-100C
Low Temperature Alarm #1	Off
Low Temperature Alarm #2	Off
Temperature Units	Celsius
Sensor Position	Freezer dependant
Valve Open Duration	Off
Sensor Type	8 thermistor sensor
Freezeguard feature	On
Sensor Error Mute	Off
Freezeguard Error Mute	Off
Level Units of Measure	inch
Date/Time Factory	Set for Eastern Standard Time
Lid Switch	On
Quickchill Timer	30 seconds
Manual Defog Timer	30 seconds
Auto Defog Timer	30 seconds
User Access	Off
Lid Open-Valve Off	Off
LN ₂ Supply Alarm Delay	30 minutes
Remote Alarm Delay	30 minutes
Lid Open Alarm Delay	10 minutes
Valve Stuck Alarm	On
Audible Retrigger	30 minutes
Display Brightness	10
Screen Saver Time	30 minutes
Freezer ID	Not set
Scheduled Fills	Off
LN ₂ Supply Reminder	Off
Settings Password	Off
Power Password	Off

Troubleshooting

If the Taylor-Wharton Cryostorage freezer with the CS200 SERIES Control System installed experiences problems or appears that it is not operating at optimum efficiency, please contact your distributor for assistance. The CS SERIES Control System has incorporated state of the art diagnostic tools to assist in the identification and correction of any issues that may arise.

Interconnection Block Diagram

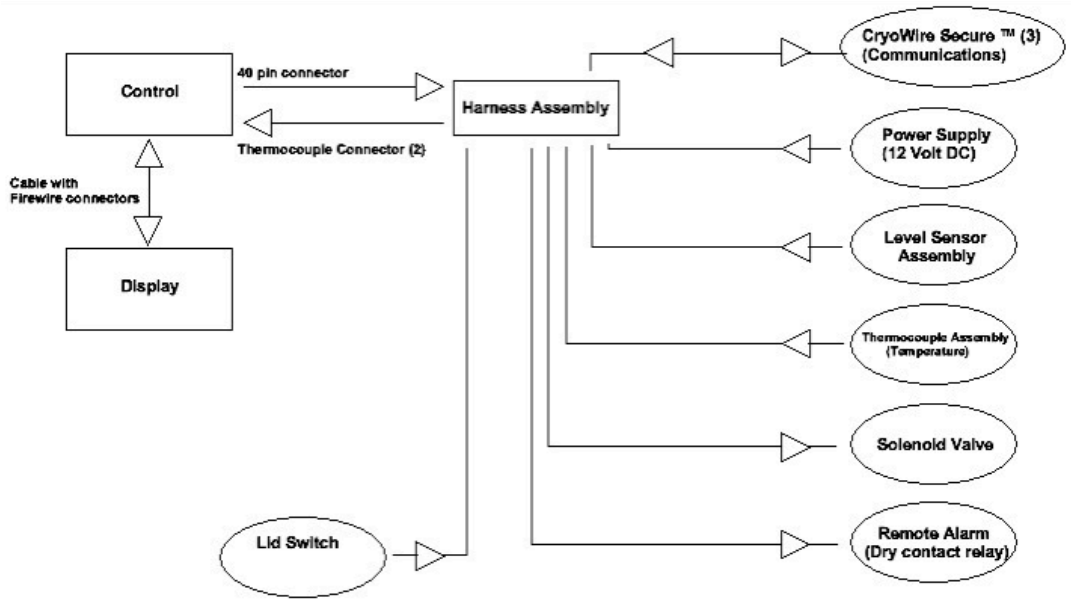


Figure 9.0 Interconnection Block Diagram

Wiring Diagram

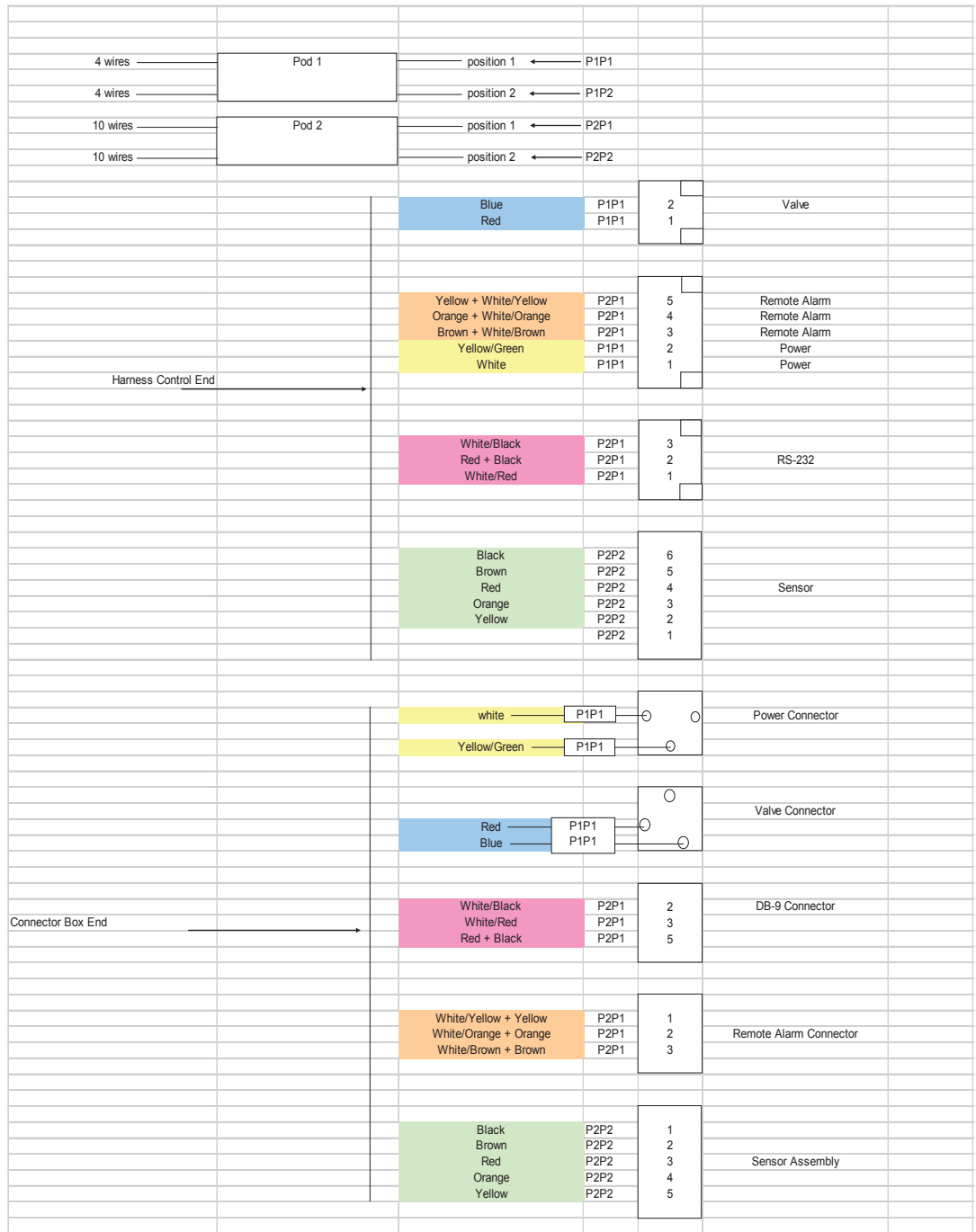


Figure 10.0 CS Series Control System Harness Wiring Diagram

Installation & Setup

The CS SERIES Control System consists of the following components.

- Main Control
- VFD Display Module
- Wiring Harness Assembly
- Power Supply
- Thermocouple Assembly
- Lid Switch Assembly
- Sensor Assembly
- Cryogenic Solenoid Valve
- Remote Alarm Plug
- LN₂
- Plumbing

Connect the wiring harness assembly to the main control. The connector is keyed and can only be plugged in one way.

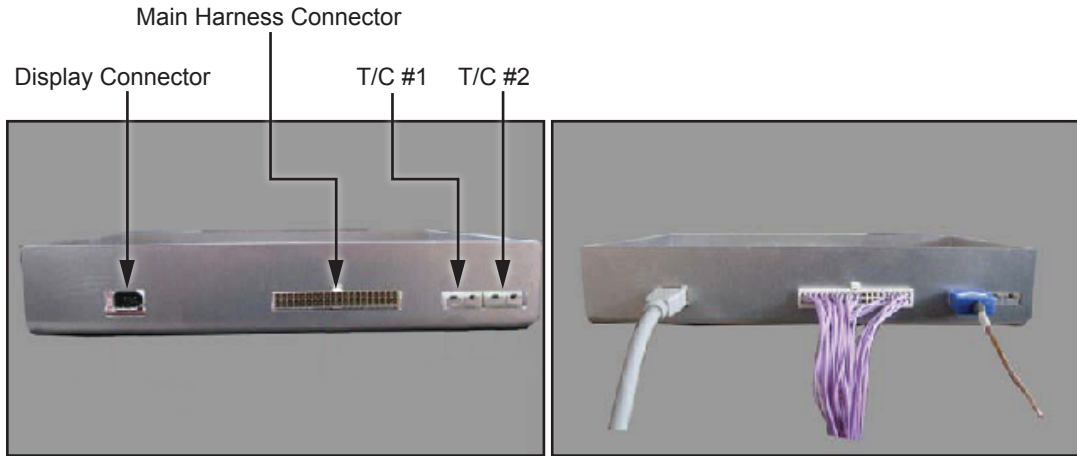


Figure 11.0 Main Control Back Panel

Connect the thermocouple plug of the harness assembly into the control at the thermocouple plug labeled T/C #1. One of the blades on the plug is slightly wider insuring that it is plugged in correctly. The copper blade should plug into copper colored plug. Finally, connect the display cable into the main control and the display.

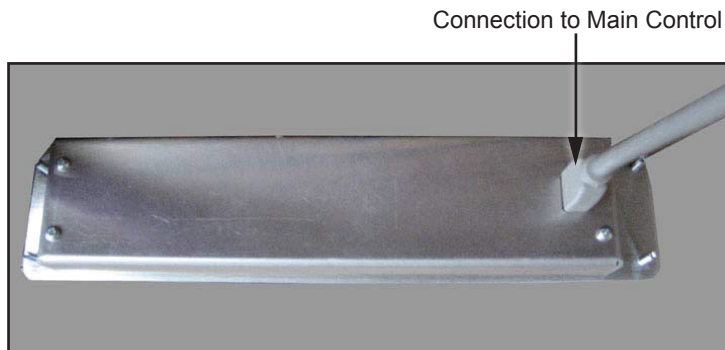


Figure 12.0 Connection to Main Control

Connect the level sensor assembly into the pigtail with the round connector terminating at the control end of the harness assembly. The connector is a round locking connector that is keyed so it can only be plugged in one way.

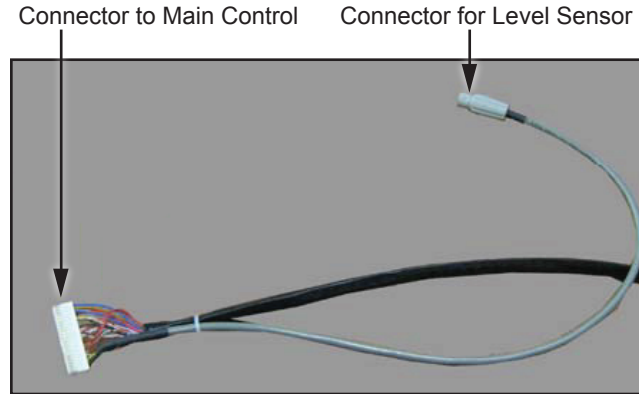


Figure 13.1 Harness Assembly



**Figure 13.2
Sensor Assembly Connector**

Connect the solenoid valve and the lid switch into the appropriate connectors on the connector box. These are located on the circuit board inside the box and are labeled. The solenoid connector is a 6 pin locking connector and the lid switch is a 2 pin locking connector. Each is keyed so they can only be plugged in one way.

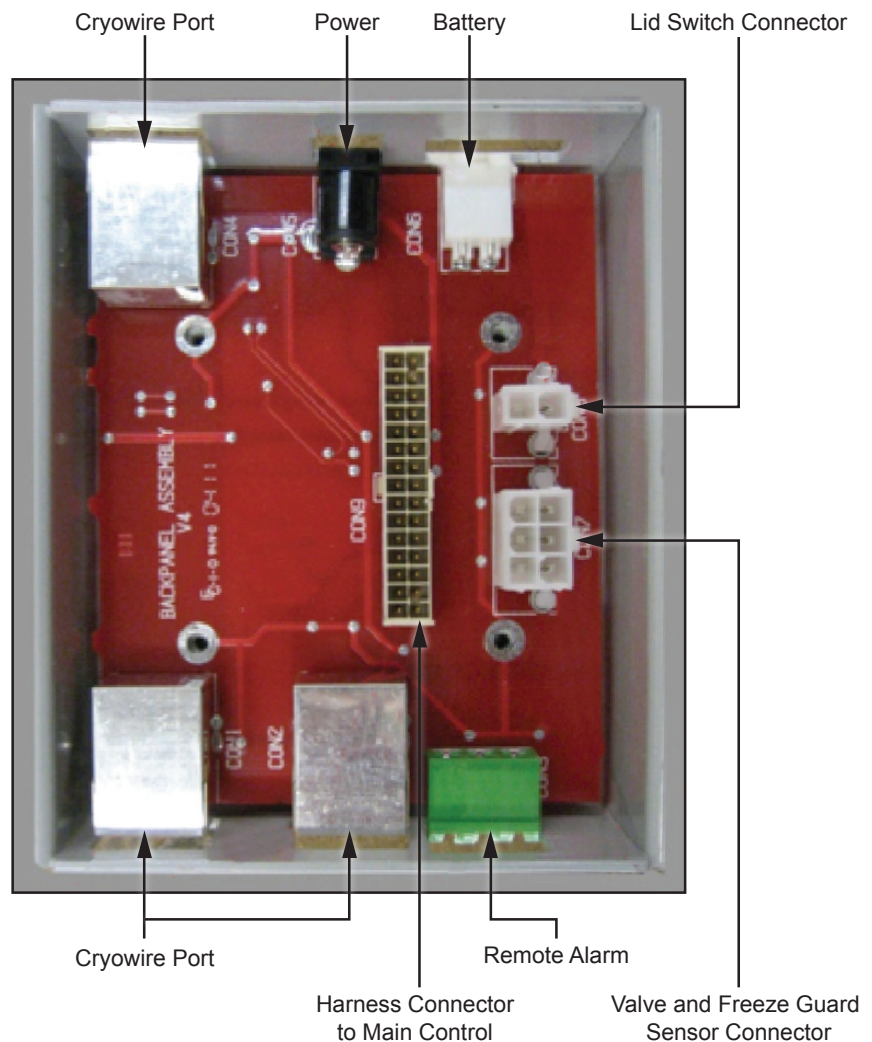


Figure 14.0 Harness Assembly & Back Panel

Connect the Remote Alarm plug into the panel at the end of the wiring harness assembly. This is keyed so that it can only be plugged in one way.

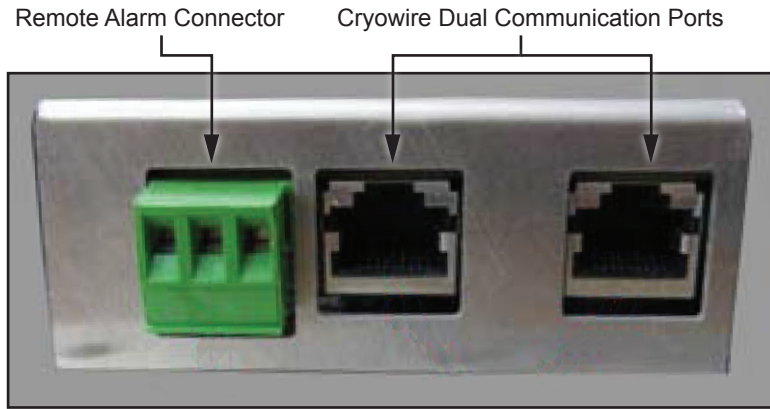


Figure 15.0

Finally, connect the barrel plug of the power supply and the battery into the appropriate receptacles in the connector box.

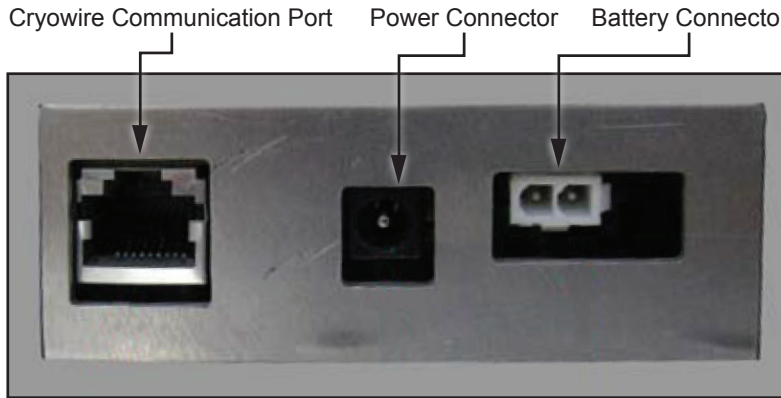


Figure 16.0

Diagnostic Menu

Need diagnostic menu

External Connector Ratings

Designated Use	Max rated voltage/current ratings	Connector type
Power	36 VDC	2.5mm barrel connector
CAN	N/A	Modular shielded jack
Remote Alarm	300 volts	5mm terminal block
Solenoid Valve	600 volts	4.2mm header
Thermocouple	N/A	2 pin thermocouple
Level Sensor	5 amps / contact	Sealed circular connector

LED Status Wheel Flash Patterns

Condition	LED Flash Pattery
Normal	Clockwise pattern, 1 LED per second
General Error	Clockwise pattern, rapid rotation, flash

Temperature Thermocouple Select

The chamber temperature is monitored with 1 or 2 Type T thermocouples. The thermocouple is placed in the chamber to monitor temperature level at the top of the inventory system. Factory installation includes one thermocouple inside of the LABS thermocouple tube or inside of the thermocouple tube at an elevation to match the height of standard racks. A second Type T thermocouple may be added to monitor another location inside the chamber. Both thermocouples can be activated/deactivated through the menu system.

Temperature Calibration

The CS SERIES Control System uses a type T thermocouple to measure temperature within the CryoStorage freezer. The temperature curve for a thermocouple is nonlinear so it is important that the CS SERIES Control System have a good calibration to provide accurate temperature readings. The temperature is traceable to the National Institute of Standards and Technology (NIST) ITS-90 Thermocouple Database.

There are three important reference points needed for calibration:

Ambient Temperature:

Ice Water: 0°C

Liquid Nitrogen (LN₂): -196°C

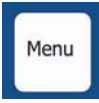






The ambient temperature is the temperature measured inside the control box and is used to provide temperature compensation adjustment. This is calibrated at the factory and should not be adjusted in the field.

Ice water and LN₂ provide the reference points on the temperature curve. If these two points are calibrated correctly then all other points (temperatures) on the curve are correct.

The accuracy of a thermocouple is +/- 1°C or +/- 1.5% of the reading, whichever is greater.

To check a calibration, submerge the thermocouple in ice water slurry and then LN₂. If readings are within accuracy specifications noted above, then the temperature circuit on the control is properly calibrated. If not, follow the steps below to calibrate the temperature.

Table 4.0 Temperature Calibration Instruction

Access the menu by pressing	
Highlight CHANGE SETTINGS and press	
Highlight TEMPERATURE and press	
Highlight CALIBRATE and press	
Highlight CALIBRATE THERMOCOUPLE 1. The display will read Dip the thermocouple into ice water.	
Submerge the thermocouple into an ice water bath. The bar graph will fluctuate. When a good stable reading is obtained, the bar graph will decrease to 1 or 2 bars. At this point, press to lock in the value	
The display will read Dip the thermocouple into LN ₂ .	
Submerge the thermocouple into LN ₂ . The bar graph will fluctuate. When a good stable reading is obtained, the bar graph will decrease to 1 or 2 bars. At this point, press to lock in the value.	
If the calibration values fall within the expected range, DONE! Will be displayed on the screen.	

Test Temperature System

The temperature circuitry can be checked at any time through the menu system. This check will tell if the thermocouples are working or if they are "open" (broken or unplugged). If a thermocouple is not connected to the control it will check as "open." If a thermocouple is "Disabled" through the menu system, it will not show up on the check.

Test Level Sensors

The sensor assembly can be tested through the menu system. The sensor diagnostics indicates the sensor number and the status (whether in liquid or gas). If the control is set for an eight-thermistor it will indicate 9 sensors in the diagnostics. If it is set for a four-sensor assembly, it will indicate 4 sensors. The status is indicated with either an "O" for open, a "G" for gas or an "L" for liquid. This is an easy means to tell if sensors are in or out of liquid or if a new sensor assembly is needed (open or defective sensors).

The sensor type can be set through the menu system. The sensor type selection should match the sensor type that is being used in the system. This is a 4-sensor, a 8-sensor (Freeze-Guard) or an 8-sensor array. If the sensor assembly is unplugged and the main control is still on, the display will indicate that a sensor error has occurred. In addition the level indicated would be 8" on an 8-sensor assembly, or "High Alarm" on a 4-sensor assembly. This occurs because the control cannot differentiate between a very high resistance (when a thermistor is in LN₂) and an infinite resistance (when an open circuit appears in the level sensing circuitry).

Alarms and Error Conditions

The CS SERIES Control System control tracks many different conditions in the freezer and therefore, has a full complement of alarms associated with these different conditions. As alarms occur, they cause an audible beep as well as a flashing red light on the same wheel. A remote alarm relay is also triggered following a user-designated period of time, after the error condition occurs, if it is not corrected. In addition, the error condition is displayed on the top line until the error condition is corrected. When an error does occur, the audible alarm may be muted by pressing the designated button. The audible alarm will then be silent until activated by a new error condition. A red light will continue to flash until all errors are corrected. The remote alarm will be activated if the power is interrupted.

The High Temperature Alarm for Thermocouple #1 can be set through the menu system. This alarm is activated if the temperature rises above the designated temperature. The alarm temperature can range from 0°C to -190°C. It can also be disabled.

High Temperature Alarm for Thermocouple #2 can be set through the menu system. This alarm is activated if the temperature rises above the designated temperature. The alarm temperature can range from 0°C to -190°C and it can also be disabled.

System Alarms

A Low LN₂ Supply Alarm can be set through the menu system. This alarm is activated if the solenoid valve is not closed within a designated time period after a fill starts. The solenoid valve can be closed either automatically (the LN₂ level reaches the STOP FILL sensor) or manually (the stop fill button is pressed). To stop the timer which activates this alarm. The possible choices for this alarm are None, 15, 30, 45, 60 minutes, 2 or 3 hours. This alarm does not correct itself until the fill is stopped (the solenoid closes).

The Sensor Error Alarm can be set through the menu system. This alarm is activated if the control detects a sensor error such as an open sensor. The possible choices are ENABLE or DISABLE. An open sensor can be confirmed through the TEST LEVEL SENSORS option in the menu system.

A Remote Alarm Timer can be set through the menu system. This is the amount of time allowed to pass before the remote alarm relay is triggered if an error condition is not corrected. The possible choices are None, Immediate, 30 minutes, 60 minutes or 2 hours.

Lid Open Too Long Alarm can be set through the menu system. This is the amount of time the lid can be open before it triggers an alarm condition. The possible choices are None, 1, 2, 5 or 10 minutes.

Thermocouple Alarm can be set through the menu system. This alarm is activated if either thermocouple experiences an open circuit. Your choices are ENABLE or DISABLE.

Test Alarms

Audible, visual and remote alarms can be tested at any time by the user through the menu system. Follow the instructions on the display to hear the audible “chirping” indicator of an alarm or to see the red status wheel flash or to trigger an immediate relay closure of the remote alarm.

Logging

On board memory logging function is one of the most powerful and useful features of the CS SERIES Control System control. It provides a historical record for not only your freezer but also a complete record of the environment in which specimens were stored. Four separate logs are kept in the control:

1. System log – System logs are events that occur in the system including lid opening/closing, LN₂ filling, Quick-Chill, Defog.
2. Error log – Error logs are outside the activated preset limits detected by the system.
3. Temperature #1 log and Temperature #2 log (for use with optional thermocouple #2) – The two temperature logs are simply records of the temperatures recorded by the two thermocouples in the system.

The system and the error log each hold 4096 events while the combined temperature logs hold an additional 32,768 temperature events. All the logs are kept in non-volatile memory, meaning that the information is saved regardless of whether the control has power.

When an event (system, error or temperature) occurs, the control does two things with the data:

1. It enters the beginning or the conclusion of an event in the internal memory of the controller.
2. It sends the event data out the serial port of the freezer.

The control consolidates the events in the internal log (combining “start event” / “conclude event” information to provide one event with duration), however, when the data is sent out the serial port no consolidation of data occurs.

As an example, a fill would provide one log entry in the internal log of the control, indicated as follows: **Fill occurred on 01/07/2012 @ 8:07 for 24 minutes**. The same data coming out of the serial port would cause two entries in a computer or printer and would be indicated as follows:

```
Fill Started on 01/07/12 @ 8:07
... (elapsed time)
Fill occurred on 01/07/12 @ 8:07 for 24 minutes
```

Menu Access causes the control to make some decisions on logging an event and they are handled in the following manner: Temperature is immediately logged (if it is enabled) and then a fresh time period is started when the Menu system is exited. System and error logs are placed in a suspended state until the control exits the menu system and timing is started again. Duration of system and error logs then are total time of the event less any time that the user was in the menu system.

When logs are dumped to the serial port, the oldest events are sent first. The control operates on the FIFO (First In First Out) method. If the maximum number of entries is reached, the oldest are lost to make way for the newest entries.

Dump Logs

DUMP SYSTEM LOGS is accessible through the menu system of the control. This option sends data from the system logs out the serial port of the freezer. When this option is chosen, the display reports how many system logs are stored. While the data is being sent to the serial port, it can be paused or completely cancelled through the menu system.

DUMP ERROR LOGS is accessible through the menu system of the control. This option sends data from the error logs to the serial port of the freezer. When this option is chosen, the display reports how many error logs are in the system. While the data is being sent out the serial port, it can be paused or completely cancelled through the menu system.

DUMP TEMP LOG #1 and *TEMP LOG #2* are accessible through the menu system of the control. This option sends data from the temperature logs to the serial port of the freezer. When this option is chosen, the display reports how many temperature logs are in the system. While the data is being sent out the serial port, it can be paused or completely cancelled through the menu system.

Error Logs

SENS. ERR. LOGGING is accessible through the menu system of the control. This menu choice turns on/off the logging of all sensor errors. The choices are ENABLE or DISABLE. Records data in the error log.

LOW LN₂ SUPPLY LOGGING is accessible through the menu system of the control. This menu choice turns on/off the logging of the low LN₂ supply error. The choices are ENABLE or DISABLE. Records data in the error log.

REMOTE ALARM LOGGING is accessible through the menu system of the control. The menu choice turns on/off the logging of the remote alarm activation. The choices are ENABLE OR DISABLE. Records data in the error log.

OPEN THERMOCOUPLE LOGGING is accessible through the menu system of the control. This menu choice turns on/off the logging of the thermocouple open alarm. The choices are ENABLE and DISABLE. Records data in the error log.

HIGH TEMP #1 LOG is accessible through the menu system of the control. This menu choice turns on/off the logging of the high temperature alarm for Thermocouple #1. The choices are ENABLE and DISABLE. Records data in the error log.

HIGH TEMP #2 LOG is accessible through the menu system of the control. This menu choice turns on/off the logging of the high temperature alarm for Thermocouple #2. The choices are ENABLE and DISABLE. Records data in the error log.

System Logs

FILL LOGGING is accessible through the menu system of the control. This menu choice turns on/off the logging of tank filling operations. The choices are ENABLE or DISABLE. Records data in the system log.

LID ACTION LOGGING is accessible through the menu system of the control. This menu choice turns on/off the logging of lid openings and closings. The choices are ENABLE or DISABLE. Records data in the system log.

USER ACCESS LOGGING is accessible through the menu system of the control. This menu choice turns on/off the logging of user access codes, which are requested when the lid is opened. Records data in the system log.

Temperature Logs

Temperature Logging Rates for thermocouple #1 (*T/C #1 LOGGING*) and thermocouple #2 (*T/C #2 LOGGING*) are accessible through the menu system of the control. This menu choice adjusts the rate at which temperatures are logged for the two thermocouples. The possible choices are Disabled, 15, 30 minutes, 1, 2, 4, 6, 12 or 24 hours. Records data in the temperature logs.

Erase Logs

ERASE LOGS is accessible through the menu system of the control. This menu choice erases any of the four logs found in the control. **Please note that once a log has been erased, it is gone forever.**

ERASE SYSTEM LOGS).

ERASE ERROR LOGS.

ERASE TEMPERATURE LOG #1.

ERASE TEMPERATURE LOG #2.

Display Brightness

DISPLAY BRIGHTNESS can be set through the menu system of the control. This option changes the intensity of the display. The possible choices are 25%, 50%, 75% and 100%.

Making Adjustments to the CS SERIES Control System Sensor Assembly

Table 5.0: CS SERIES Control System Sensor Assembly Factory Settings

CRYOSTORAGE SYSTEM	LOW LEVEL ALARM	START FILL	STOP FILL	HIGH LEVEL ALARM
LABS 20K, 38K, 40K, 80K	2 in. (50mm)	3 in. (76mm)	5 in. (127mm) (at carousel)	6 in. (152mm)
LABS 94K	5 in. (127mm)	6 in. (152mm)	9 in. (228mm) (at carousel)	10 in. (254mm)

The sensor assembly is preset at the factory for vapor phase storage. If adjustments need to be made, the following procedure will simplify the process.

The CS SERIES Control System control installed on the Taylor-Wharton Cryostorage units operates with specially designed software to match the design characteristics of your refrigerator. Refer to the chart below to see the versions and their difference.

To make adjustments to a sensor assembly in a refrigerator filled with LN₂, the following procedure can be used:

- Measure the LN₂ liquid level in the refrigerator.
- Take this measured level and subtract the offset to determine how many sensors should be in liquid.
 - a. Remove sensors.
 - b. Fill to correct level and turn off Liquid supply.
 - c. Eg. Level is to be 15 in. (381 mm) and sensor number 6 is currently and will remain the Stop Fill. 15 in. (381 mm) – 6 in. (152.4 mm) = 9 in. (238.6 mm) offset. Set Offset to 9 in (228mm).
- Go to “Test Level Sensor” through the CS SERIES Control System menu. “L” means a sensor is in liquid while “G” means a sensor is in gas.
- Move the sensor up or down so that the appropriate numbers of sensors are in liquid (read “L”).
- Return to the CS SERIES Control System main screen and the level indicated should match the physically measured reading.

The Sensor Offset, the START FILL and the STOP FILL can all be set through the CS SERIES Control System menu system.

Removing/Installing the Solenoid Valve

The LN₂ and power must be turned off before beginning work on the solenoid valve.

For LABS Units

Disconnect only the solenoid valve lead connection from the back of controller board.

To remove the solenoid valve, loosen the compression fitting that connects the plumbing tubing to fill tube. Unscrew the two (2) mounting screws that hold the solenoid valve to the solenoid bracket. Then remove the solenoid valve and its associated plumbing. Disconnect the plumbing from the inlet and outlet side of the solenoid valve.

To install a new solenoid valve, attach the connecting plumbing to the inlet and outlet connections of the valve using Teflon tape on tapered threads (3 wraps). Attach the compression fitting to the fill tube first and then connect the compression fitting to the elbow that is connected to the outlet side of the solenoid valve. Position the solenoid valve onto the solenoid valve bracket and tighten the two (2) mounting screws. Attach the solenoid valve lead connection to the controller board.

Controller Electrical Tests

If a controller is removed from the refrigerator for service, the liquid refrigerant level must be maintained manually to protect stored product. The fill solenoid valve will be inoperative with the controller removed. A flexible fill line terminated with a phase separator may be used periodically through the open refrigerator lid to conduct manual fill operations until automatic operation is restored.

Sensor Probes. The sensor probes used to detect liquid level by Taylor-Wharton controllers are temperature-sensitive resistors called "thermistors." Their resistance to electrical current flow changes greatly with their temperature.

- At Room Temperature2 ohms to 10 ohms
- In Cold Nitrogen Gas8 K ohms to 18 K ohms
- In Liquid Nitrogen 18 K ohms to 35 K ohms

Controller Logic. The liquid level controllers read the values of the sensors as indications of liquid level. The function of a sensor, and its value, are interpreted by the controller to set normal operating, fill, fill termination, and alarm conditions. In addition, the refrigerator temperature is monitored and an alarm is triggered if the temperature raises above a pre-determined point.

- From cold gas to liquid ..Resistance greater than 22K ohms.
- From liquid to cold gas ..Resistance less than 16K ohms.
- Defective SensorResistance greater than 50K ohms, or less that 5 ohms.

Plumbing Assembly

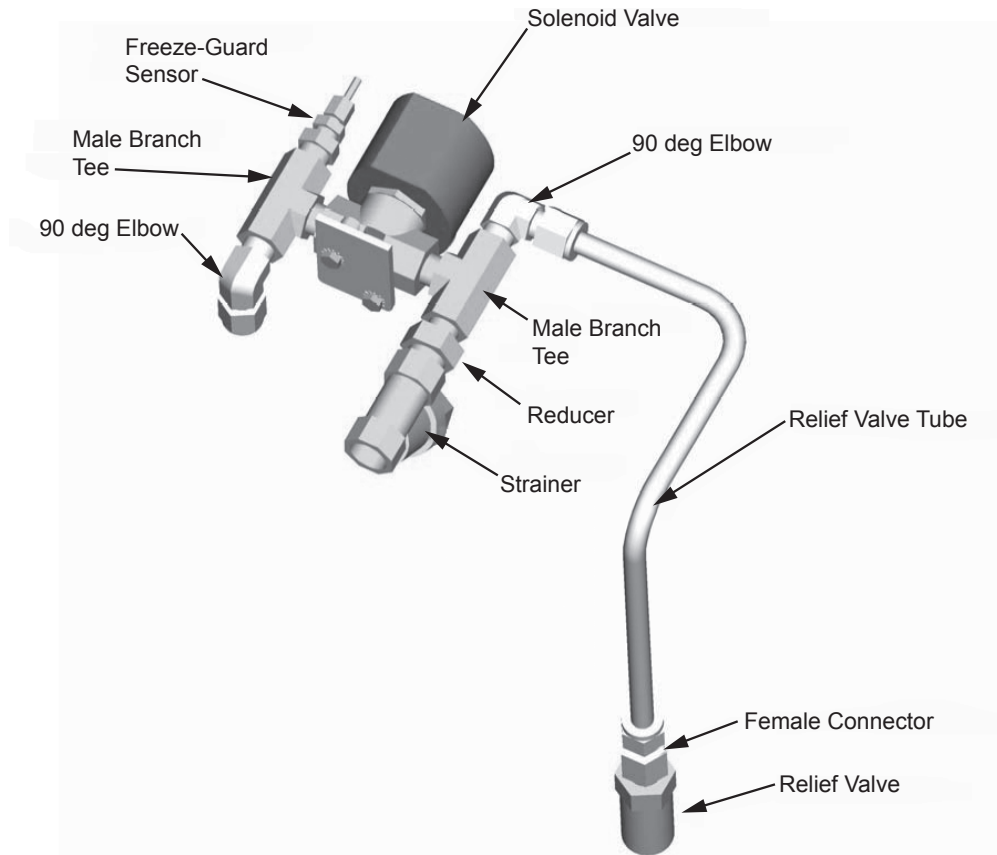


Figure 17.0 LABS Plumbing Assembly

TROUBLESHOOTING

Symptoms

The key to troubleshooting your CS SERIES Control System and your cryostorage system is to determine which component in the system is the source of the problem. Determine if the problem is occurring in any of the following subsystems: Supply Vessel, Transfer Line, Power Source, Temperature, Level Sensing, Security, Lid Switch, Solenoid Valve, Control Display, Alarm System, Communications. After determining which sub-system is having the problem, isolate the problem further by performing sub-system tests. Once the problem is isolated and defined, it will be easier to solve.

Controller Will Not Turn ON

1. Press POWER button. If display is blank and dark go to next step.
2. Check all connections. Start with the connections to the controller. Pay special attention to jacks labeled "POWER". Power cord must be plugged into an outlet providing AC voltage between 100 and 130 to deliver AC voltage 21 to 30 to the back of the freezer. Or the 100-240 50/60Hz European standard.

Indicates High Liquid Level

1. Determine actual liquid level using a dipstick. Select **MENU**, LEVEL SENSING, TEST LEVEL SENSORS. An "L" or "G" will indicate individual thermistor status. "L" meaning that the thermistor is submerged in liquid and "G" indicates that the thermistor is in cold. A fill solenoid valve that freezes (or sticks) open will typically empty the supply cylinder. Replace solenoid valve if it has failed even once.
2. Liquid level is sensed by thermistors located in a sensor tube. If the sensor tube is blocked or iced at the top, the liquid level in the sensor tube may not rise and fall at the same rate as the liquid level in the freezing chamber. Make sure the sensor tube is not obstructed.
3. The pool of LN₂ can become turbulent during a fill. Bubbling and splashing can be amplified by the rack arrangement. The deeper the pool, the more turbulent the surface of the pool will be during a fill. The turbulence of the pool surface can splash on the X-High thermistor and cause a false high alarm. Rearrange the racks to reduce the turbulence and splashing.
4. Confirm that sensor assembly is responding to changing liquid level with a dip-test.
 - Close liquid supply valve at source.
 - Mark the sensor assembly at top of tube to assure back to the original position.
 - Remove sensor assembly from sensor tube. DO NOT FORCE. Fill solenoid valve should open and LOW LEVEL alarm should be activated.
 - Select **MENU**, LEVEL SENSING, TEST LEVEL SENSORS. An "L" or "G" will indicate individual thermistor status (L = Liquid and G = Gas).
 - Dip each thermistor in succession into LN₂. Observe the controller display noting that each thermistor changes from "G" to "L" as each is submerged. Response time may vary.
 - Return to the main menu and submerge the START FILL THERMISTOR IN LIQUID. Note that the low level alarm ceases, fill solenoid valve is still open. Control is flashing FILLING.
 - Manually press STOP button and note that the fill solenoid valve closes.
 - Press FILL button to re-open fill solenoid valve.
 - Continue to lower the sensor until the STOP FILL thermistor is immersed in the LN₂. The fill should stop after a confirming (CHECK) SPLASH GUARD period.
 - Simulate an over fill by lowering the HIGH LEVEL Alarm thermistor into the LN₂. HIGH LEVEL alarm should sound with 10 seconds.
 - Re-install sensor assembly and thermocouple into sensor tube as before. Open supply valve on LN₂ supply.

Indicates Low LN₂ Supply

When the START FILL thermistor is uncovered, the controller calls for the fill solenoid valve to open. If the STOP FILL thermistor is not covered with LN₂ in the pre-determined amount of time, the controller is programmed to interpret this as a LN₂ supply shortage.

1. Check contents gauge and pressure gauge of supply cylinder. Both liquid contents and pressure (15 to 22 psi - 0.7bar/69kPa to 1.4 bar/138 kPa) are required to complete a fill.
2. Confirm that no other transfer hose or apparatus is attached to the supply cylinder. Either could compromise adequate tank pressure required to complete a standard fill in 30 minutes.
 - Check the distance that the LN₂ must travel to reach the freezer. Observe the time it takes for Liquid LN₂ to reach the Freezer through the usual piping conditions (Pipe-Temperature at start fill). Liquid should be entering the chamber within 4 minutes under normal (usual) line temperature conditions.
 - Distances over 6 feet (1.83 m) without a gas by-pass are discouraged due to excessive boil off.
 - A "Keep-Cold" or a "Keep-Full" device are almost always needed on an LN₂ pipeline, whether the pipe is Vacuum Jacketed or Foam Insulated.
3. Confirm that the solenoid valve is open when a fill is called for.
 - If no flow is detected, the solenoid valve is not getting the signal to open, or it is opening and there is a blockage in the line. Check the connections on the leads near the solenoid itself, as well as the connection at the controller.
 - Confirm that the wires have not been pinched, creating a short circuit.
4. If a longer fill time is desired, change the setting by selecting: MENU, SYSTEM ALARMS, LN₂ SUPPLY ALARM.

Indicates Open Sensor

1. Normally, this message is associated with a loose plug or connector. Check all connections.
2. To determine this select: MENU, LEVEL SENSING, TEST LEVEL SENSORS. An "L", "G", or "O" (open) will indicate individual thermistor status.
3. Thermocouple is not repairable. Replace from stock.

Temperature Reading 10 to 20 Degrees Warm

- Prepare an ice water slurry with crushed ice and tap water. Dip or pour LN₂ into a styrofoam cup to prepare an LN₂ bath. Calibrate the controller. Select **MENU**, TEMPERATURE, CALIBRATE TEMPERATURE. Follow the on-screen instructions. Hold the thermocouple in each bath until the control completes its self-calibration.
- Make sure the thermocouple is clean and dry before and after each bath.
- Reposition the thermocouple at the elevation the customer wants to monitor or control.

Fill Solenoid Cycles On and Off

CS SERIES Control System features a timer function whereby the valve open duration is limited, allowed to shut for a short warm-up and then opened again. To confirm or change the valve open duration:

- Select **MENU**, USER OPTIONS, CONTROL OPTIONS, FREEZE-GUARD OPTIONS, VALVE OPEN DURATION.

If the controller Freeze-Guard function detects that the valve is stuck in the open position (i.e., continues to fill after the valve is de-energized), it will attempt to De-Ice the valve by causing a rapid cycling of the valve in an attempt to dislodge the blockage.

- To activate or de-activate this feature: Select **MENU**, USER OPTIONS, CONTROL OPTIONS, FREEZE-GUARD OPTIONS, VALVE DE-ICING.

Repeated cycling of the Solenoid Valve, caused by excessive turbulence, power/low battery, bad connection, or circuit board corrosion, could be attributable to moisture invasion on the controller circuit board.

To troubleshoot proper operation of the fill valve:

1. Check gasket seals.
2. Access control board and allow time to fully dry prior to reinstallation.
3. Confirm the pressure of the supply vessel is less than 22 psi (1.4 bar/138kPa).
4. Watch the interface panel on the controller to verify if the Start and Stop Fill cycles are repeating. You should see and hear each cycle.

Fill Solenoid Makes Excessive Humming Noise

During normal operation, the fill solenoid valve will make a soft humming noise. If the noise is excessively loud, turn the fill valve on and off using the control panel. If a soft humming noise is heard, the valve should continue to operate reliably. If the humming noise is excessive, replace solenoid valve. You should change the solenoid valve every 3 years.

Display = "Check"

The word CHECK will flash during periods of Splash-Guard protection.

Lid Open Alarm

A lid switch is located near the front hinge. The proximity switch should actuate when the hinge is opened and again when it is shut.

- Confirm that there is a ½ in. (12 mm) gap between the sensors."

QCF (Quick Chill Feature) Will Not Operate

See LID OPEN ALARM

To activate or adjust times: Select **MENU**, USER OPTIONS, CONTROL OPTIONS, LID/DEFOG SETTINGS, QUICK CHILL.

Defog Feature Will Not Operate

See LID OPEN ALARM.

To activate or adjust times: Select **MENU**, USER OPTIONS, CONTROL OPTIONS, LID/DEFOG SETTINGS, AUTO DE-FOG.

Push Buttons Will Not Respond

Moisture may have migrated into the sealed faceplate. Call Taylor-Wharton for a Return Authorization. Refer to the Service and Maintenance section of this manual to get the contact information you will need to return any equipment.

Liquid Level Readout is Incorrect

Liquid level is determined by a 8-thermistor assembly inside a protective sensor tube. The user may adjust the desired START FILL elevations and STOP FILL elevations for the pool of nitrogen with the confines of the 5 inches (127mm). START FILL cannot be assigned to thermistor number 1. STOP FILL cannot be assigned to thermistor number 8. The factory installs this eight thermistor assembly all the way to the floor of the sensor tube, which positions thermistor number 1 at 1 in. (25.4 mm) above the floor (i.e.; the first thermistor is offset from the floor zero inches).

If you would like to stop the fill at a depth greater than seven inches from the floor, the sensor assembly must physically be raised inside the sensor tube. The distance that it has been raised becomes the new OFFSET and the controller must be notified of this offset from the floor. The factory settings are START FILL at 3 inches and STOP FILL at 5 inches, with an OFFSET of zero.

Power Failure Alarm

If power is interrupted, a note of the time and duration will be recorded in the log. If the unit is not connected to a battery back-up or an external alarm, then no local alarm will be sounded unless a high temperature is detected after power resumes. A Remote Alarm will be triggered anytime the power is interrupted.

REPLACEMENT PARTS

A complete list of Replacement Parts and Accessories for the LABS Cryostorage Systems is available from the following Taylor Wharton Customer Care Centers:

Europe
+421 (0)55-727-7157

Americas
+251-443-8680

Asia/Australia
+61 (0)2 6040-2533

In U.S. and Canada:
800-898-2657

SERVICE AND MAINTENANCE HISTORY LOG

Fill in top section at installation. Copy this form each time service is required.

Fill bottom section with service notes to keep a complete log of each freezer service and maintenance history.

End User Company Name _____ LOG NO _____

Service Contract/NameCompany _____

Service Contract Phone Number/Fax _____

Cryostorage System Model/Serial Number _____

Controller Serial Number _____

Control Version Number _____

In-service Date _____

Describe Conditions – Actual	Describe Conditions – Controller Reading
Liquid Level – via Dipstick _____	Liquid Level – Per Controller _____
Level Sensor Type ____ FG ____ 8T ____ 4T ____	Liquid Level Setting ____ HIGH ____ LOW
Lid ____ Open ____ Closed	Lid ____ Open ____ Closed
Filling ____ Yes ____ No	Filling ____ Yes ____ No
Temperature _____	Temperature _____
LN ₂ Supply _____ ltr _____ psi	LN ₂ Supply Alarm ____ On ____ Off
Note: Ice Build-up ____ a little ____ a lot	Remote Alarm ____ On ____ Off
Note: Gasket condition ____ Seals ____ Leaks	Audible Alarm ____ On ____ Off
Display Lights ____ On ____ Off	

Taylor-Wharton Technical Services - Phone: In USA & Canada 800-898-2657
Fax: +251-443-2209 USA • +421 (0)55-727-7157 Slovakia • +49 (0)4841-985130 Germany

Service History Log (note date and log number on each service entry)

- Date: _____
- Date: _____
- Date: _____
- Date: _____
- Date: _____
- Date: _____
- Date: _____
- Date: _____
- Date: _____
- Date: _____

NOTE: All Taylor-Wharton Cryostorage Systems must be cleaned and sterilized prior to return to Taylor-Wharton for repair or maintenance and must be accompanied by a written statement to this effect. Any Cryostorage Systems or CS SERIES Control System received without this statement will be returned to the sender, freight collect. Contact Customer Service by telephone: 800-898-2657 In USA & Canada or +421 (0)55-727-7124 Kosice or +49 (0)4841-985139 Husum. Or email: salesandservice@taylorwharton.com.

Appedix

Certifications & Listings

This product complies with the following standards and directives:

- CB Scheme Report and Certificate
- IEC 61010-1
- UL 61010-1
- CAN/CSAC22.2#61010-1
- 93/42/EEC Medical Device Directive for the European Union
- IEC 60601-1-2, 2007 Edition 3.0 (EMC Directive)
- RoHS Directive
- WEEE Directive
- Packaging Directive
- ETL/cETL Listing for North America
- CE marked to the Low Voltage Directive

EN Compliance Tables

Table 6.0

Guidance and Manufacturer's Declaration – Electromagnetic Emissions		
The CS CONTROL SYSTEM is intended for use in the electromagnetic environment specified below. The customer or the end user of the CE1000 should assure that it is used in such an environment.		
Emissions Test	Compliance	Electromagnetic Environment - Guidance
RF Emissions - CISPR 11 (Radiated & Conducted)	Group 1	The CS CONTROL SYSTEM uses RF energy only for its internal function. Therefore, its RF emissions are very low and are not likely to cause any interference in nearby electronic equipment.
RF Emissions - CISPR 11 (Radiated & Conducted)	Class B	The CS CONTROL SYSTEM is suitable for use in all establishments, including domestic establishments and those directly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes.
Harmonic Emissions EN/IEC 61000-3-2	Class A	
Voltage fluctuations/ Flicker Emissions EN/IEC 61000-3-3	Complies	

Table 7.0

Guidance and Manufacturer's Declaration – Electromagnetic Immunity			
The CS CONTROL SYSTEM is intended for use in the electromagnetic environment specified below. The customer or the end user of the CS CONTROL SYSTEM unit should assure it is used only in such an environment.			
Immunity Test	EN/IEC 60601 Test Level	Compliance Level	Intended Electromagnetic Environment
Electromagnetic Discharge (ESD) EN/IEC 61000-4-2	± 6kV contact ± 8kV air	± 6kV contact ± 8kV air	Floors should be wood, concrete or ceramic tile. If floors are covered with synthetic material, the relative humidity should be at least 30%.
Electrical fast transient/burst EN/IEC 61000-4-4	± 2kV for power supply lines ± 1kV for input/output lines	± 2kV for power supply lines ± 1kV for input/output lines	Mains power quality should be that of a typical commercial or hospital environment.
Surge EN/IEC 61000-4-5	± 1kV differential mode (line-line) ± 2kV common mode (line-earth)	± 1kV differential mode (line-line) ± 2kV common mode (line-earth)	Mains power quality should be that of a typical commercial or hospital environment.
Voltage dips, short interruptions and voltage variations on power supply input lines EN/IEC 61000-4-11	<5% UT (>95% dip in UT) for 0.5 cycle 40% UT (60% dip in UT) for 5 cycles 70% UT (30% dip in UT) for 25 cycles <5% UT (>95% dip in UT) for 5 seconds	<5% UT (>95% dip in UT) for 0.5 cycle 40% UT (60% dip in UT) for 5 cycles 70% UT (30% dip in UT) for 25 cycles <5% UT (>95% dip in UT) for 5 seconds	Mains power quality should be that of a typical commercial or hospital environment. If the user of the CS CONTROL SYSTEM requires continued operation during power mains interruptions, it is recommended that the CS CONTROL SYSTEM be powered from an uninterruptible power supply or a battery.
Power frequency (50/60Hz) magnetic field EN/IEC 61000-4-8	3A/m	3A/m	Power frequency magnetic fields should be at levels characteristic of a typical location in a typical commercial or hospital environment.
Note UT is the a.c. mains voltage prior to application of the test level.			

Table 8.0


Guidance and Manufacturer’s Declaration – Electromagnetic Immunity			
The CS CONTROL SYSTEM is intended for use in the electromagnetic environment specified below. The customer or the end user of the CS CONTROL SYSTEM should assure it is used in such an environment.			
Immunity Test	EN/IEC 60601 Test Level	Compliance Level	Intended Electromagnetic Environment
<p>Conducted RF EN/IEC 61000-4-6</p> <p>Radiated RF EN/IEC 61000-4-3</p>	<p>3Vrms 150kHz to 80MHz</p> <p>3V/m 80MHz to 2.5GHz</p>	<p>3Vrms 150kHz to 80MHz</p> <p>3V/m 80MHz to 2.5GHz</p>	<p>Portable and mobile RF communications equipment should be used no closer to any part of the CS CONTROL SYSTEM, including cables, than the recommended separation distance calculated from the equation applicable to the frequency of the transmitter.</p> <p>Recommended separation distance</p> <p>$d = 1.2\sqrt{P}$ $d = 1.2\sqrt{P}$ 80MHz to 800 MHz $d = 2.3\sqrt{P}$ 800MHz to 2.5GHz</p> <p>where P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer and d is the recommended minimum separation distance in meters (m).</p> <p>Field strengths from fixed RF transmitters, as determined by an electromagnetic site survey^a, should be less than the compliance level in each frequency range.^b</p> <p>Interference may occur in the vicinity of equipment marked with the following symbol:</p>  <p>Graphic needed.</p>
NOTE 1: At 80MHz and 800MHz, the higher frequency range applies.			
NOTE 2: These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from objects, structures and people.			
<p>^a Field strengths from fixed transmitters, such as base stations for radio (cellular/cordless) telephones and land mobile radios, amateur radio, AM and FM radio broadcast and TV broadcast cannot be predicted theoretically with accuracy. To assess the electromagnetic environment due to fixed RF transmitters, an electromagnetic site survey should be considered. If the measured field strength in the location in which the CS CONTROL SYSTEM is used exceeds the applicable RF compliance level above, the CS CONTROL SYSTEM should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as reorienting or relocating the CS CONTROL SYSTEM.</p> <p>^b Over the frequency range 150kHz to 80MHz, field strengths should be less than 3V/m.</p>			

Table 9.0

Recommended separation distances between portable and mobile RF communications equipment and the CS CONTROL SYSTEM.			
The CS CONTROL SYSTEM is intended for use in an electromagnetic environment in which radiated RF disturbances are controlled. The customer or the user of the CS CONTROL SYSTEM can help prevent electromagnetic interference by maintaining a minimum distance between the portable and mobile RF communications equipment (transmitters) and the CS CONTROL SYSTEM as recommended below, according to the maximum output power of the communications equipment.			
Rated maximum output power of transmitter in meters (m) power of transmitter in watts (W)	Separation distance according to frequency of transmitter in meters (m)		
	150kHz to 80MHz $d = 1.2\sqrt{P}$	80MHz to 800MHz $d = 1.2\sqrt{P}$	800MHz to 2.5GHz $d = 2.3\sqrt{P}$
0.01	.12	.12	.23
0.1	.38	.38	.73
1.0	1.2	1.2	2.3
10	3.8	3.8	7.3
100	12	12	23
For transmitters rated at a maximum output power not listed above, the recommended separation distance d in meters (m) can be estimated using the equation applicable to the frequency of the transmitter, where P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer.			
NOTE 1: At 80 MHz and 800 MHz, the separation distance for the higher frequency range applies.			
NOTE 2: These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.			

Declaration of Conformity

EC DECLARATION OF CONFORMITY

The undersigned representing the manufacturer

Pacer Digital Systems, Inc.
 Attn: Kevin Oeff
 8658 Castle Park Drive
 Suite 103
 Indianapolis, IN 46256
 USA

Herewith declared that the Product: LN₂ Level Control for Cryostorage System

Model/Type ref.: CS CONTROL SYSTEM

is in conformity with the Essential requirements of the following EC Directives when subject to correct installation, maintenance and use conforming to its(their)intended purpose, to the applicable regulations and standards, to our operation and maintenance manual.

93/42/EEC Medical Device Directive
 2004/108/EC EMC Directive
 2006/95/EC Low Voltage Directive

and that the Standards and/or technical specifications referenced below have been applied:

- EN 60601-1:2006 Edition 3 Medical Electrical Equipment – General Requirements for basic safety and essential performance.
- IEC 60601-1-2: 2007 Edition 3 Medical Electrical Equipment – General Requirements for basic safety and essential performance – Collateral standard : Electromagnetic Compatibility
- IEC/CISPR 11:2009+A1:2010 Radiated & Conducted Emissions.
- IEC61000-3-2:2005+A1:2008+A2:2009. Harmonics
- IEC 61000-3-3:2008. Flicker

Year of CE Marking: 2012

Manufacturer: Pacer Digital Systems, Inc.

Signature: Kevin Oeff Digitally signed by Kevin Oeff

DN: cn=Kevin Oeff, o=Pacer Digital Systems, Inc., ou,
 email=kevinoeff@pacerdigital.com, c=US

Date: 2012.05.24 13:48:04 -04'00'

Position: President

Date: 24 May 2012

Place: Indianapolis, IN USA

Warranty

Taylor-Wharton warrants that each of its electronic control products will be free from defects in material and workmanship, in the normal service for which the product was manufactured, for a period of two years from the date of purchase. Taylor-Wharton at its option will either repair or replace any item covered under this warranty.

This warranty is void if the product is used for any other purpose than that for which it was designed, including but not limited to connection with third party systems.

This warranty is also void if the product is in any way altered or repaired by others. Taylor-Wharton shall not be liable under this warranty, or otherwise, for defects caused by negligence, abuse or misuse of this product, corrosion, fire or the effects of normal wear.

The remedies set forth herein are exclusive. Taylor-Wharton shall not be liable for any indirect or consequential damages including, without limitation, damages relating to lost profits or loss of products, resulting from the delivery, use or failure of the product or for any other cause. By accepting delivery of the product, the purchaser acknowledges that this limitation of remedies is reasonable and enforceable. In no case shall Taylor-Wharton's liability exceed the purchase price for the product.

Labels



Figure 18.1 Main Rating Label

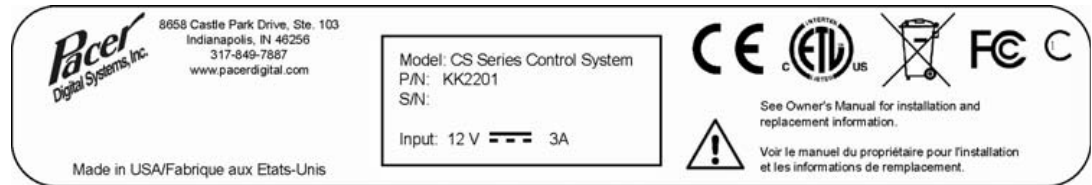


Figure 18.2 Control & Display Label

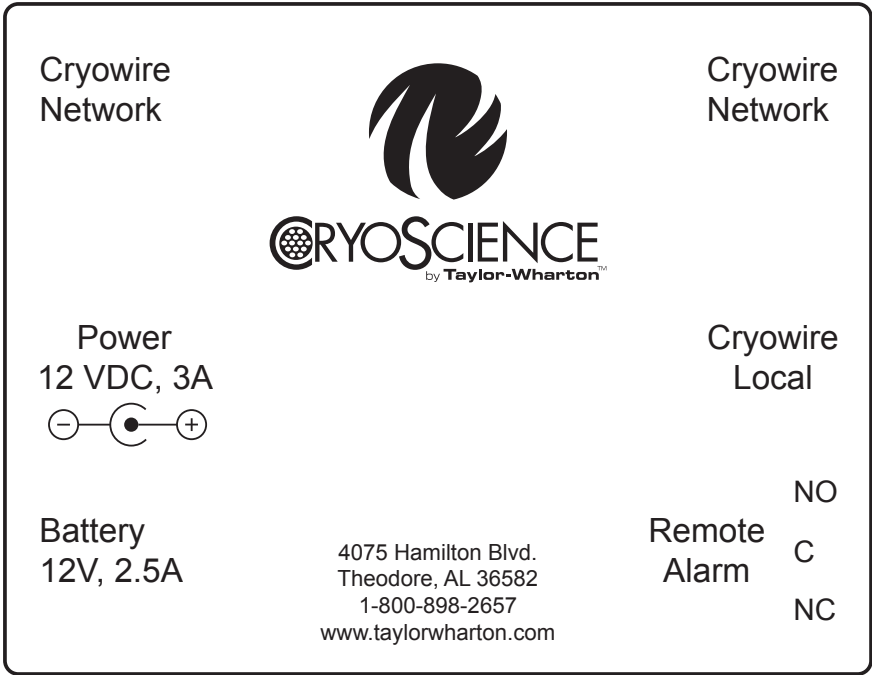


Figure 18.3 Connector Box Label

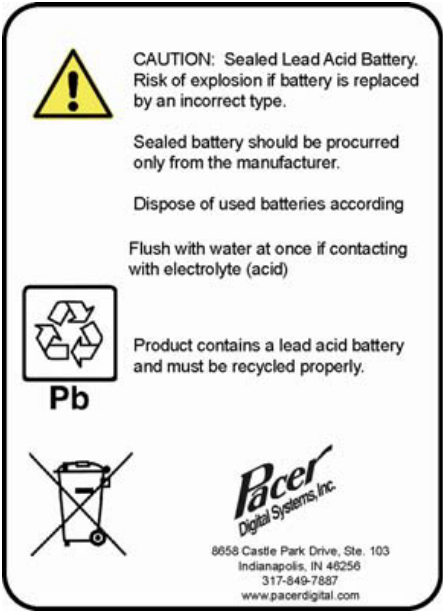


Figure 18.4 Battery Label - (Optional)



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