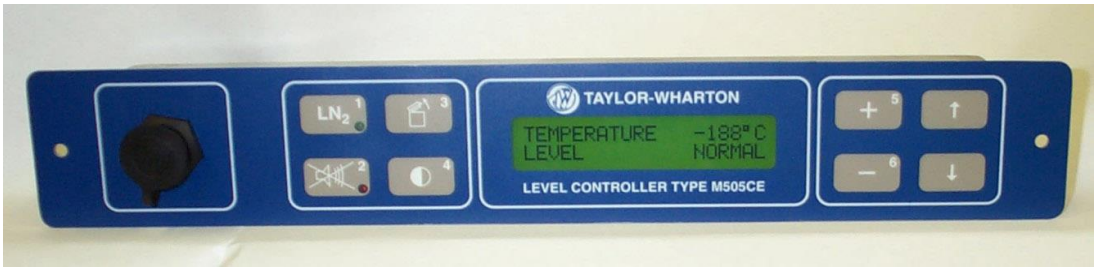
Type M505CE Liquid Nitrogen Level Control System
Installation and operating Instructions

M505K / M505KBox

Version V3.0



REVIEW AND UNDERSTAND ALL SAFETY PROCEDURES BEFORE ATTEMPTING TO INSTALL, OPERATE OR PERFORM MAINTENANCE ON THIS CRYOSTORAGE SYSTEM / CONTROLLER UNIT.
DO NOT ATTEMPT TO USE OR MAINTAIN THIS UNIT 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.

Manufacturer:

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Tel. 0049 - 4841 – 985 – 0
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CE 0044

1. Used symbols

Hazard
Fire and Explosions hazard

Hazard
This symbol is used to pinpoint possible risk of injury or mortal danger for users

Information
This symbol marks additional information or application details

Instruction
Wear face shield

Instruction
Wear protection waterproof gloves

Note
Inert gas, Nitrogen, UN Number 1977

Asphyxiation hazard Special warning special risk of suffocation due to Oxygen depletion

1. Safety Precautions

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.

Safety Precautions for Liquid Nitrogen

Nitrogen is an inert, colourless, odourless, and tasteless gas making up four-fifths of the air you breathe. Liquid nitrogen is obtained by cooling air until it becomes a liquid and then removing the oxygen. Air is roughly one-fifth oxygen. Under normal atmospheric pressure Liquid Nitrogen has a temperature of -196°C

Extreme Cold - Cover Eyes and Exposed Skin

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 that it won't splash or spill. Protect your eyes and cover the skin where the possibility of contact with the liquid, cold pipes and cold 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 colourless, odourless, and tasteless gas, cannot be detected by the human senses and will be inhaled normally as if it were air. Without adequate ventilation the expanding nitrogen will displace the normal air resulting in a non-life-supporting atmosphere.

Liquid Nitrogen System

The liquid nitrogen supply pressure at the inlet to the refrigerator should be in the range of 10 psig (0.7bar/69 kPa) to 20 psig (1,4bar/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 shut-off valves. 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.

CAUTION: When installing field fabricated piping, make certain a suitable safety valve is installed in each section of piping between shut-off valves.

For more detailed information concerning safety precautions and safe practices to be observed when handling cryogenic liquids consult CGA pamphlet P-12 "Handling Cryogenic Liquids" available from the Compressed Gas Association, 1235 Jefferson Davis Highway, Arlington, VA 22202.

Warning: Inlet pressure should not exceed 1,5 bar 22 psig /152 kPa). Higher pressure could result in damage to equipment.

Dispose of Waste Liquid Nitrogen Safely
Dispose of waste liquid nitrogen out-of-doors where its cold temperature cannot damage floors or driveways and where it will evaporate rapidly. An outdoor pit filled with clean sand or gravel will evaporate liquid nitrogen safely and quickly.

Electrical
Electrical Shock Can Kill – the liquid level controllers used with these refrigerators operate from 24VAC. However, the external transformer does have a 230VAC primary. Do not attempt any service on these units without disconnecting the electrical power cord.

Note: Units are supplied with Taylor-Wharton approved controllers. If other liquid level controllers are used, please contact Taylor-Wharton before putting the refrigerator into service.

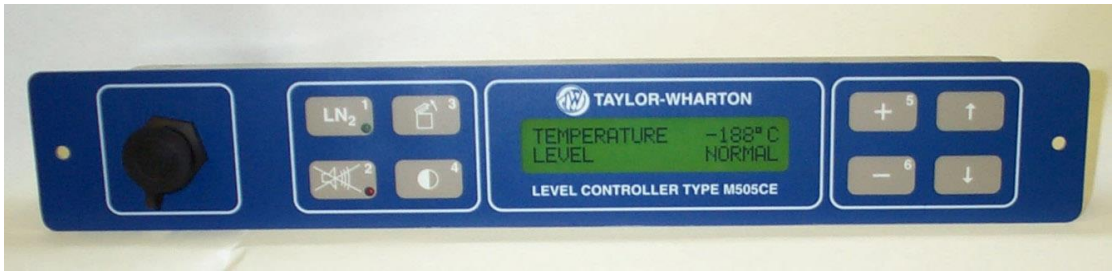
Freight Damage Precautions
Any Freight damage claims are your responsibility. Cryostorage systems and / or controllers are delivered to your carrier from Taylor-Wharton's dock in new condition. When you receive our product you may expect it to be in that same condition. For your own protection, take 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.

Spare Parts Please use only Taylor Wharton approved spare parts for maintenance work.

Type M505CE Liquid Nitrogen Level Control System
Installation and operating Instructions

Revision Status

Rev	Date	Revision Details	By	Checked	Appd
A	20/10/00	For prototypes with V0.3 firmware	GHL	**NM**	**NM**
1	4/4/01	First Production (V1.0 Firmware)	GHL	**NM**	**NM**
2	10/10/02	Update for V1.5 Firmware + additional variants and accessories (F76/1077, F21/1501)	GHL	**NM**	**NM**
3	26/11/02	Minor Corrections	GHL	**NM**	**NM**
4	4/3/04	Printer Output Details added Additional features for V1.9 and V9.0 Firmware. (F76/1090, F21/1554)	GHL	**NM**	**NM**
5	5/4/11	Update for V3.0 Firmware (Draft)	GHL	**NM**	**NM**
6	14/8/12	Additional information for MDD2012 product. D of C updated. (F21/2318)	GHL	**NM**	**NM**



Contents

1. Introduction

The M505CE is a Microprocessor based Liquid Nitrogen Level Control System with the following features and functions:-

* Level monitoring and automatic filling of Freezers.
* Level display High/Normal/Low or cm.
* Temperature monitoring and display.
* Temperature Control
* Generation of local and remote alarms for:

  High Temperature
  High or Low liquid levels
  Sensor faults
  Failure of liquid nitrogen supply
  Lid left open.
  Unauthorised Access
  General Alarm

* Manual filling.
* Timed filling based on elapsed days or day of week.
* Logging of temperature, levels, alarms, fill activity etc.
* Serial ports for output of logged data to a printer or PC.
* Self testing and isolation of sensor faults.
* Simple "daisy chaining" of controllers for simultaneous filling in multiple Installations
* Gas bypass input to disable filling during Gas Venting
* Automatic defogging on lid opening
* Fast temperature recovery on lid closure. ('Quick Chill')
* Password controlled Access for opening lid and/or changing settings
* Optional extra PCBs for:

  RS485 connection to remote PC.
  Analogue Temperature output. (4-20mA and 0 – 10V)
  Individual Alarm Relay Outputs.
  Ethernet/Internet connection to remote PC

* Optional 12 hour battery backup (For temperature logging only).

* Update of operating software is possible using a PC and download cable (USB and Serial cables available)

* PC Software for data download and analysis. (CryoData2)

* PC Software for monitoring of multiple freezers and automatic data collection. (Cryobank Status Monitor).

This manual covers M505CE Control Systems with firmware up to Version

3.0 Description

The M505CE Level Control System is made up from the following components: -

Controller	Mowden Part No. M506CE or M506CE-B
Wall Mounted Connector Box and PSU	Mowden Part No. M507CE
Sensor Assembly	Mowden Part No. M508CE
Connecting Cable	Mowden Part No. M509CE

2.1 Controller (M506CE)

The Controller is available in two versions:

The standard version (M506CE) is designed for fitting to Taylor Wharton 10K and 24K Freezers.

A boxed version (M506CE-B) is designed for fitting to 38K Freezers or wall mounting. It is also suitable for retro-fitting to Freezers supplied by other manufacturers, subject to suitable arrangements for plumbing of the LN2 supply and fitting of the Sensor Assembly.

The standard Controller (Fig 1a) consists of a metal case which houses the microprocessor based electronic controls, and a separate fascia panel. The two are linked by a short cable.

The boxed Controller (Fig 1b) combines the fascia and controller in a single case.

The fascia panel incorporates a 2 line by 20-character Liquid Crystal Display (LCD), eight switches and two LEDs. On the standard version a connector for a PC or printer is fitted to the front panel. On the boxed version this is fitted to the rear panel (Fig 1c).

The LCD is fitted with a back-light to allow viewing in poor lighting conditions.

Four of the switches (+,-,↑ and ↓) in conjunction with the LCD allow the user to program the various settings for timers, alarms etc.
The + and – switches allow adjustment of the back-light intensity.
The + and – switches in conjunction with a contrast switch (number 4) allow the display contrast to be adjusted.
Other switches allow the Fill Solenoid Valve to be turned on and off, and the audible alarm to be muted
Six of the switches are numbered to allow the codes to be entered for access control.

Fig 1a. – M506CE Controller (Standard Version).

Fig 1b – M506CE-B Controller (Boxed Version)

One LED (Red) gives a visual indication of an alarm condition. The other LED (Green) is used to indicate when the Fill Solenoid Valve is energised.

When connected to a PC the Data Log may be downloaded for storage/analysis

A PC may also be connected to upload firmware to the controller allowing updates to be carried out in the field without changing Memory chips or removing the Controller.

Fig 1b M506CE-B Controller – Back view showing Connectors

2.2 Connector Box and PSU (M507CE)

The System Power Supply and terminal blocks for all external connections are housed in a wall mountable steel case (Figs 2 & 3). Overall size (including mounting brackets and cable glands) is 285 x 170 x 80mm.
The built in Safety Isolating transformer provides the power to drive up to two 24V ac Solenoid Valves and also provides a rectified and smoothed 12Vdc to power the Controller electronics. A separate isolated winding provides power for ancillary components requiring an isolated supply.

Screw terminal connectors are provided for:-

- Remote alarm contact
- External Fill (Simultaneous Fill) input/output
- Auxiliary relay contact
- Vent relay input (for connection to Gas Vent System to disable filling during gas venting).

Connectors and mounting points are provided for the following optional boards:-

- Isolated RS232/RS485 PCB for communication to PC.
- Analogue output PCB, 4–20mA /0–10 volts or 0-2V (User Configurable).
- Ethernet/Internet Connection.
- Individual Relay Outputs.

A battery pack may be installed to maintain temperature logging during power failures.

Fig 2 M507CE PSU/ Connection Box.(Lid removed)

Fig 3 M507CE Mains Cord Clamp .

***IMPORTANT**: When fitting the mains cord slacken the clamping screw <u>and</u> the two clamp retaining screws. The plug is a tight fit in the clamp. Ensure it is pushed fully home before re tightening the clamping and retaining screws.*

2.3 Sensor Assembly (M508CE)

This standard sensor assembly contains four thermistors and a thermocouple.

The thermistors are designated: *Extra Low*
Normal
High
Extra High

The level is maintained between the Normal and High Sensors. The Extra Low and Extra High Sensors are used to activate alarms and to drive hardware interlocks.

The distance between the Extra Low and Normal Thermistors is fixed at ~2.5cm. The others may be adjusted relative to each other.

The sensor leads and thermocouple are terminated to a 15 way D connector which also houses electronics which compensate for ambient temperature fluctuations.

2.4 Cable Assembly (M509CE)

A cable is used to link the Controller to the Connector Box/PSU. The cable is fitted with 15 way D type connectors to allow easy disconnection and reconnection for maintenance purposes. The standard cable is 3 metres long. It is supplied with a modified access plate for routing the cable through the rear of the Freezer cabinet. The access plate is not supplied with the M506CE-B.

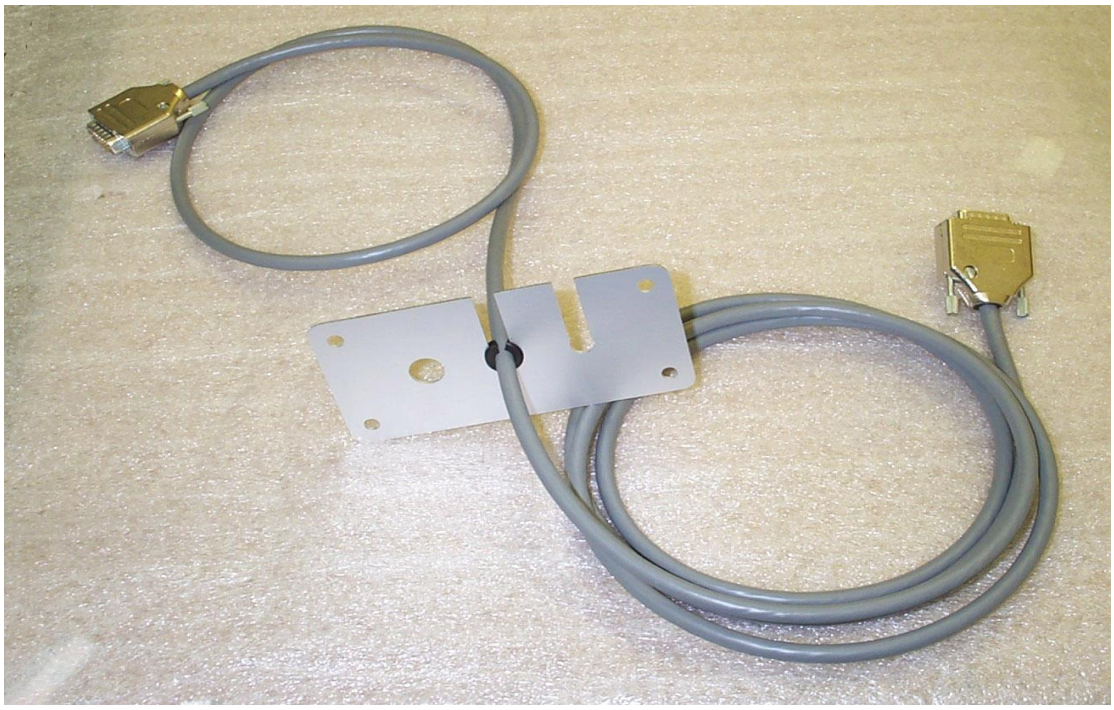


Fig 4 M509CE Cable assembly.
(Note modified access plate and split grommet used to protect cable)

2.5 Optional Accessories.

The following accessories are available as optional extras:

M503CE Mounting Pod. *For fitting Standard M506CE to 38K Freezers*

M510CE Analogue termination kit. For use with M511CE Analogue output PCB (See notes below).

M511CE Analogue Output PCB. *(Note 1)*

M512CE Isolated RS485/RS232 Interface PCB.

M513CE Mounting tray with Cover. Allows fitting of the M507CE to the back of the Freezer as an alternative to wall mounting.
For 38K Freezers a bracket kit is also required. (See below).

M514CE Bracket kit for fastening M513CE Mounting tray to 38K Freezers.

M515CE Printer cable for connection to the M512CE

M516CE PC cable for connection to the M512CE

M517CE Relay Output PCB. Six relays for individual alarm conditions plus Analogue terminals (for use with M511CE)

M518CE Printer Cable for connecting a printer to the socket on the M506CE Fascia panel.

M519CE PC Cable for connecting a PC to the socket on the M506CE Fascia.

M529CE Ethernet/Internet interface PCB.

M531CE Battery pack. Maintains temperature logging during power failures.

M549CE USB – PC cable. (USB version of M519CE).

M507CE-I Enhanced M507CE with Individual Gas Bypass feature plus RS485 Interface.

Notes:

The M511CE is fitted to the main PCB in the M506CE Controller.

The use of some accessories may preclude others being fitted. See appendix J for valid combinations.

3. Installation

The standard M505CE Kit contains all parts for installation into boxed 10K and 24K Freezers.
If installing a standard M506CE Controller onto a 38K Freezer a mounting pod (M503CE) will be required.
For optional accessories see the specific manuals covering their installation and function.

3.1. Installation of M506CE in 10K and 24K Freezers

These notes assume a standard installation, i.e. the M507CE is wall mounted and none of the optional accessories are fitted. They also assume that the required plumbing kit and solenoid valve(s) have been fitted as per the relevant Taylor Wharton manual.

3.1.1 Remove the bezel and blanking plate from the cut-out where the Controller is to be installed. Retain the fixing screws.
Raise the hinged lid of the Freezer and remove the screws securing the lid surround/top moulding. Raise and prop the surround. Do not remove the hinged lid.

3.1.2 Route the 15 way and 25 way cable assemblies (M509CE) through the small access panel at the back of the Freezer cabinet leaving sufficient slack for connection to the Controller. A slotted gland plate and split grommets are provided for this purpose. (Fig. 4).

3.1.3 Fit and position the M508CE Sensor Assembly in the Sensor tube. For information on sensor and thermocouple positioning see appendix A.

3.1.4 Fit the mounting bracket to the M506CE Controller box using 3 off M3x6 screws and shake-proof washers. ***Note: Do not use screws other than those provided. If longer screws are used they could cause damage to the unit.***

3.1.5 Plug the 15 and 25 way Cable Assemblies and M508CE Sensor Assembly into the D type connectors on the Controller. Tighten the jackscrews on both connectors and lower the Controller into position so that the projecting brackets engage in the guides.

3.1.6 Route the Lid switch cable and Solenoid cable(s) through the Freezer body and connect as required. If an extra solenoid valve is to be fitted externally the cable for this should be taken through the spare hole in the gland plate using a cable gland or grommet to protect it.

3.1.7 Refit the lid surround.
Feed the Controller box through the cut-out in the lid surround and fit the fascia panel using the two larger screws retained from the blanking plate.
Refit the bezel using the four self tapping screws.

3.1.8 Mount the M507CE PSU/Connector box on a wall or other vertical surface within 1.5m of the Freezer and close to a 230V power outlet.

3.1.9. If required, Remote Alarm and Simultaneous Fill Connections should be made to the terminal blocks in the M507CE.
For details of Remote alarm Connection see Appendix B.
For details of Simultaneous/Sequential Fill connection see Appendix C

3.1.10 If using the M505CE System in conjunction with the M360 Gas Vent System the Vent terminals of the M507CE should be connected to terminals 1 and 2 of

the M361 Controller (Polarity is not important). There is no need to use a separate M362 Relay Box. For further details see Appendix D
Note that the Simultaneous Fill connection is required for Gas Venting.

3.1.11 Plug the M509CE Cable Assembly (15 way D type) into the connector on the M507CE. Tighten the jackscrews to ensure a secure connection.
If using an optional accessory PCB the 25 way cable plugs into the connector on this. Otherwise stow it neatly behind the freezer.

3.2 Installation of M506CE on 38K Freezers

3.2.1 Feed the M506CE Controller through the opening in the mounting pod and secure it with 3 off M3x6 screws and shake-proof washers.
Note: Do not use screws other than those provided. If longer screws are used they could cause damage to the unit.
Feed the fascia unit into the opening and secure with 2 off M3.5 x 6 screws.

3.2.2 Fit two off mounting brackets to the pod. (M3.5 x 6 countersunk screws)
There are three pairs of threaded bushes for this purpose. (fig 5))
One bracket is fitted to the centre pair of holes. The other is fitted depending on which side of the Freezer the pod is to be located. This can be checked by offering up the pod to the mounting points on the Freezer.

3.2.3 Fasten the pod to the Freezer body using the fixing points provided.

3.2.4 Fit and position the sensor assembly in the Sensor tube. For information on sensor and thermocouple positioning see appendix A.

3.2.5 Plug the M509CE Cable Assembly and M508CE Sensor Assembly into the D type connectors on the Controller. Tighten the jackscrews on both connectors.

3.2.6 Connect the Solenoid and lid switch cables.

The remainder of the installation is the same as 10K and 24K Freezers. See sections 3.1.8 to 3.1.11.

Fig 5 M504CE mounting pod with brackets fitted.

3.3 Installation of M506CE-B on 38K Freezers

3.3.1 Fit two off mounting brackets (same as used on M504CE – see fig 5) to the case using M3.5 x 6 countersunk screws
There are two pairs threaded bushes for this purpose

3.3.2 Fasten the Controller to the Freezer body using the fixing points provided.

3.3.3 Fit and position the sensor assembly in the Sensor tube. For information on sensor and thermocouple positioning see appendix A.

3.3.4 Plug the M509CE Cable Assembly and M508CE Sensor Assembly into the D type connectors on the Controller. Tighten the jackscrews on both connectors.

3.3.5 Connect the Solenoid and lid switch cables.

The remainder of the installation is the same as for 10K and 24K Freezers. See sections 3.1.8 to 3.1.11.

4. Installing Firmware

The M505CE Control System is shipped with a Control Program (Firmware) preloaded at the factory and should be ready to run.

If it is necessary to update to a newer version this can be done using a PC and an M519CE or M549CE PC Interface Cable.

The latest firmware version may be obtained by E-mail

Contact Enquiries@Mowden.co.uk for details of the current version and/or to obtain an update.

Installation instructions will be sent with all updates

5. Initial Start up

Check that the Sensor Assembly and Thermocouple is in the required position.

Plug the M507CE Safety PSU/Connection unit into the mains supply and switch on. After a short delay the display should show level and temperature. E.g.

TEMPERATURE -30 C LEVEL EXTRA LOW

Use the Mute switch (number 2) to silence the audible alarm. Note that pressing the mute switch will cause the various alarms to be displayed. Press the mute switch again to return to the Temperature and Level display.

If the Freezer is empty or the LN2 level is low the Freezer will begin to fill. Further alarms may occur and these may be silenced using the Mute switch. Ignore any alarm messages for the time being.

When the Freezer has finished filling the controller should be set up and calibrated as per section. 6.

Note: It is possible that on initial filling that the Fill timer will time out and switch off the Fill Solenoid. This is indicated by an alarm and slow flashing of the green Fill LED.
If this happens, reset the fill timer and restart filling by pressing the LN2 switch ***twice****.*

6. Setting up and Calibration

There are no internal switches to set on the M506CE Controller. The various timers and options are accessed and set up via two main menus

The main menus are TIMERS/CLOCK and CONFIG/CALIBRATE.

The following options and procedures are accessed via the CONFIG/CALIBRATE menu:-

Language
Thermocouple calibration
Printer/PC connection and mode of operation.
Level Display Mode (High/Low/Normal or cm)
Temperature Control (On/off + timer settings))
Lid Switch Type (NO/NC)
Gas Bypass Setup (on/off)
Valve On/Off (No LN2)
Analogue Output (On/Off + Settings + Calibration check)
Timed Fill On/Off
Timed Fill (Off, 24hr, 48hr, 72hr or select days of week) *(V3.0 on).*
Password protection setup

The following options, timers etc. are accessed and set via the TIMERS/CLOCK menu:-

Alarm Temperature
Maximum Temperature (for temperature control).
Fill Timer
Sim Fill Delay
Remote timer

Remote Alarm for LN2 Supply failure (On/Off)
Lid timer
Auto Defog timer
Quick Chill timer
Extra High Alarm Delay
Gas Bypass Timer Settings (for use with M507CE-I)
Freezer Number
Battery voltage monitor
Clock setting
Day off week setting (For timed fill). *(V3.0 on).*
Timed Fill Setting (Time to switch on)
Log Interval Setting

Certain additional settings are accessible via an Engineers Menu. (See Section 6.4).

Note: At installation and initial set-up it is advisable to clear the data log before proceeding to Setting up and Calibration.
For details see section 11.

6.1 Getting into the Menus

To enter the menus press the ↓ key.
The Firmware Version number and serial numberwill be briefly displayed followed by the menu:-

6.1.1

1: VIEW SETTINGS 2: CHANGE SETTINGS

Press 2 to Change Settings. If password protection is disabled go to 6.1.3 If password protection is enabled the following message will appear:-

6.1.2

ENTER CODE _

If a code is requested and it is not known, the Password will have to be reset.
See section for how to do this and for an explanation of the Security Options.
Use the numbered keys to input the 4 digit code. The ↓ and ↑ keys may be used to move the cursor. Press the ↓ key to finish when the cursor is on the last digit.

If the code is accepted (or not requested) the following menu will appear:-

6.1.3

1: TIMERS/CLOCK
2: CONFIG/CALIBRATE

To set up the clock and/or timers etc press switch 1.
To reconfigure or calibrate the Controller press switch 2 and go to section 6.3. ..
For initial installation set up the required features in 'Config/Calibrate' first and then go to the Timers/Clock menu:-

6.2 Timers and Clock Setting

If option 1 from 6.1.3. is selected the following message (example) will appear:-

6.2.1

ALARM TEMP -130 C
_

If the temperature of the Thermocouple rises above the displayed value an alarm will be activated.

The Alarm temperature setting is adjustable between 0 and –175° C in 5 degree steps.

Use the + and – keys to set the alarm temperature.

Press the ↓ key when finished.

If the Temperature Control Option is enabled (See Config/Calibrate menu) the following message (example) will appear:-

6.2.2

MAX TEMP -150 C
_

If the temperature rises above the set value the Solenoid valve is opened for a short period of time
The disturbance caused by Nitrogen gas bubbling through the liquid causes the temperature to drop rapidly.

If the required temperature is not achieved a further pulse of gas is admitted after a pre-set time interval. The on time and interval are set up via the Config/Calibration menu.

The Maximum temperature setting is adjustable between 0 and –175°C in 5 degree steps.

Use the + and – keys to set the Maximum temperature.

Press the ↓ key when finished. If theLN2 Supply alarm is disabled (Config/Calibrate menu) skip to 6.2.4. Otherwise:-

The following message (example) will appear:-

6.2.3.

FILL TIMER
_ 15 min

If the Solenoid valve is operated for longer than the displayed time an alarm will be activated and the Solenoid valve will be switched off. Switching off the Solenoid Valve reduces the risk of it overheating if the LN2 supply fails.
It is also a safeguard against possible masking of the sensors by a build-up of ice. This situation could cause overfilling of the Freezer.
A time-out during filling is additionally indicated by slow flashing of the green Fill LED.
To cancel the Alarm the LN2 switch must be pressed.

The Fill Timer setting is adjustable between 0 and 90 minutes in 5 minute steps.

Use the + and – keys to set the maximum fill time.

Press the ↓ key when finished.

The following message (example) will appear:-

6.2.4

SIM FILL DELAY
_ 15 min

Simultaneous filling is a method of reducing Nitrogen consumption. If a number of Freezers are connected for Simultaneous Filling . and one Freezer demands LN2 it sends a signal to the others so that they start to fill also.
This reduces the number of times that the common pipework needs to be cooled and hence reduces evaporation losses. For further details on Simultaneous Filling and interconnection of Freezers see Appendix C.

In some installations the LN2 supply pressure may be insufficient to feed all of the connected Freezers simultaneously, resulting in LN2 Supply Alarms.
This may be overcome by staggering the Fill start times by setting a 'Sim Fill Delay'. The Sim Fill delay delays the start of filling following the receipt of a Sim Fill input signal.
By selecting suitable delays the Filling may be sequenced so that not all Freezers call for Nitrogen at the same time.

The Sim Fill Delay setting is adjustable between 0 and 125 minutes in 5 minute steps.

Use the + and – keys to set the Sim Fill Delay.

Press the ↓ key when finished.

The following message (example) will appear:-

6.2.5

REMOTE TIMER
_ 15 min

The Remote timer setting displays the time that will elapse between the occurrence of the first alarm and activation of the Remote Alarm Relay
In the case of an Extra High level alarm the Remote Alarm timer defaults to 5 minutes maximum.

The Remote Timer setting is adjustable between 0 and 90 minutes in 5 minute steps.

Use the + and – keys to set the Remote Timer.

Press the ↓ key when finished.

The following message (example) will appear:-

6.2.6 REMOTE ALARM
(LN2 SUPPLY) ON

If required the Remote Alarm may be disabled for failure of the LN2 supply. This may be useful to avoid unnecessary fault call-outs in situations where the Freezer and its Nitrogen supply are regularly monitored.
It should be used with caution and is not recommended if the Freezer is situated in an unattended location.

Use the + key to set the LN2 Supply Remote alarm ON.

Use the - key to set the LN2 Supply Remote alarm OFF.

Press the ↓ key when finished.

The following message (example) will appear:-

6.2.7

LID TIMER
_ 15 min

The lid timer setting is the maximum length of time that the lid can be left open before an alarm is activated. Note that a lid switch must be fitted to utilise this feature. A closed contact on the lid switch indicates that the lid is open.

The Lid Timer setting is adjustable between 0 and 30 minutes in 5 minute steps.

Use the + and – keys to set the Lid Timer.

Press the ↓ key when finished.

The following message (example) will appear:-

6.2.8

AUTO DEFOG
_ 05 (s)

When the lid is opened Liquid Nitrogen is allowed into the Freezer for the displayed time. This has the effect of dispersing the fog within the vessel.
A lid switch must be fitted if this function is required.

The Auto Defog timer is adjustable between 0 and 90 seconds in 5 second steps.

Use the + and – keys to set the Auto Defog Timer.

Press the ↓ key when finished.

The following message (example) will appear:-

6.2.9.

QUICK CHILL
_ 05 (s)

When the lid is closed Liquid Nitrogen is allowed into the Freezer for the displayed time. This has the effect of rapidly cooling the vessel.
A lid switch must be fitted if this function is required.

The Quick Chill timer is adjustable between 0 and 90 seconds in 5 second steps.

Use the + and – keys to set the Quick Chill Timer.

Press the ↓ key when finished.

The following message (example) will appear:-

6.2.10

Extra High Alarm
Delay 60 (s)

Occasionally during Filling, turbulence caused by Gas entering the Freezer can cause liquid to splash onto the 'Extra High' Sensor. This may give intermittent Level Alarms.
To avoid these nuisance alarms a short delay can be programmed. This allows time for the initial turbulence to subside and for the liquid to evaporate off from the Extra High Sensor. If the Extra High Sensor still detects Liquid at the end of the delay period a Level Alarm is given as normal.

The Extra High Alarm Delay is adjustable between 0 and 90 seconds in 5 second steps. (Increased to 120 seconds from V1.9)

Use the + and – keys to set the Extra High Alarm Delay.

Press the ↓ key when finished. If the Gas Bypass Timer is set to OFF (Config/Calibrate menu) skip to 6.2.13
Otherwise:

The following message (example) will appear:-

6.2.11

Gas Bypass Timer
10 min

The Gas Bypass Timer is only used in conjunction with the M507CE-I. When the Freezer starts to fill the M507CE-I opens a Vent Solenoid Valve and discharges gas from the pipe-work. A thermocouple in the outlet senses when liquid reaches the outlet and switches off the Vent Solenoid Valve allowing the Freezer to start filling. If liquid is not detected within a preset time an Alarm is sounded and the Vent Solenoid Valve is closed. This preset time is controlled by the Gas Bypass Timer.
Further details are contained in a separate manual (IM1017).

The Gas Bypass Timer is adjustable between 0 and 30 minutes in 5 minute steps.

Use the + and – keys to set the Gas Bypass Timer.

Press the ↓ key when finished.

The following message (example) will appear:-

6.2.12

T/couple in Liquid
5 min

The ‘Thermocouple in Liquid’ Timer is only used in conjunction with the M507CE-I. When Liquid is detected by the Thermocouple in the Vent Outlet the timer is started. If liquid is still present after the preset time it is possible that the Valve is stuck open and an alarm is sounded.

The ‘Thermocouple in Liquid’ Timer is adjustable between 0 and 30 minutes in 5 minute steps.

Use the + and – keys to set the ‘Thermocouple in Liquid’ Timer.

Press the ↓ key when finished.

The following message (example) will appear:-

6.2.13

REFRIGERATOR NO. 01

This number will be printed in the page headings of the data log when it is printed out. A unique number should be chosen for each Freezer so that printouts from different Freezers may be identified.
If the Freezer is linked to a PC it will only respond to commands which contain the correct Refrigerator number (unless set to 00).
The Refrigerator Number may be set to any number between 00 and 98.
Use the + and – keys to set the Refrigerator (Freezer) number.

Press the ↓ key when finished.

The following message (example) will appear:-

6.2.14.

Battery = 2.750 V

The real time clock and RAM require a minimum of 2.2V to function correctly and retain their settings when mains power is removed.
If the battery voltage is too low a warning will be displayed and the clock settings should be checked.
A warning will also be given if the battery voltage is too high. This indicates a battery fault (possible open circuit).

Press the ↓ key when finished.
The following message (example) will appear:-

6.2.15.

DATE & TIME 16/05/01 18:51

A cursor will appear under the day of month digits.
Use the + and – keys to set the correct day.
Use the ↓ key to move the cursor to the month digits.

Repeat the adjustment procedure for month, year, hour and minute settings.
The up ↑ key may be used to step the cursor backwards if a mistake is made.

When the correct time setting has been obtained use the ↓ key to advance the cursor to the minutes digits then press it once more to finish.

The following message (example) will appear:- *(V3.0 onwards. Otherwise skip to 6.2.17)*

6.2.16.

TODAY TUES

The day of week setting is required for some of the timed fill options
Use the + and – keys to set the correct day of the week.

Press the ↓ key when finished.
If 'Daily Fill' is set to OFF (Config/Calibrate menu) skip to 6.2.18. Otherwise the following message (example) will appear:-

6.2.17.

Daily Fill 23:59

A cursor will appear under the first digit.
'Daily Fill' allows the Freezer to be refilled at a fixed time each day *(V1.9 & V2.0)* or on selected days, or at 24, 48 or 72 hour intervals *(V3.0 onwards).*

. This may be useful for any of the following reasons:-

Safety - Filling takes place when no staff are likely to be present.

Security – Filling takes place at a time when it can easily be monitored.

Simultaneous Filling – Several Freezers may be filled at the same time without the need for interconnection.

Sequential Filling – By staggering the start times several Freezers may be

filled in sequence without the need for interconnection.

Use the + and – keys to set the correct hour
Use the ↓ key to move the cursor to the minute digits.
Use the + and – keys to set the correct minute

When the correct setting has been obtained use the ↓ key to finish.
The following message (example) will appear:-

6.2.18

LOG INTERVAL
_ 15 min

Use the + and – keys to enter the required logging interval.
Select from 5, 10, 15, 30, 60 mins or 2, 4, 6, 12, 24 hrs or No Logging (------ displayed).

Press the ↓ key when finished.

The following message will appear:-

6.2.19

SAVING SETTINGS

All settings are saved in non-volatile memory
After a few seconds the Temperature and Level display will reappear.

6.3 System Configuration and Thermocouple Calibration

From menu 6.1.3 above select 2 (CONFIG/CALIBRATE)

The following message will appear.

6.3.1

Language English

The available languages are: English
German
French

Use the + and – keys to select the language required.

Press the ↓ key when finished.

User Calibration may be disabled in the ‘Engineering Menu.If this is the case, skip to step 6.3.14, otherwise the following message will appear:-

6.3.2.

1: CALIBRATE TC1
↓: NEXT

Thermocouples are calibrated using melting Ice as a 0°C reference and Liquid Nitrogen to set the gain. Ensure both are to hand and within reach of the Thermocouple tip before proceeding.

To skip over calibration press the ↓ key and proceed to step 6.3.14.
To begin calibration select 1 from the menu. The following Message will appear:-

6.3.3.

Thermocouple in ice?
Press ↓ to continue

Place the thermocouple in the Ice and allow a few seconds for the temperature to stabilise before pressing the ↓ key.

The following message (example) will be displayed for a few seconds.

6.3.4.

Calibration in progress	188

The number in the bottom right of the screen indicates the measurement being taken by the controller. Typically this will be around 180 - 200 when the thermocouple is in ice.

If the ice calibration is successful, after a few seconds the following message will appear:-

6.3.5.

Calibration done

followed by

6.3.6.

Thermocouple in LN2? Press ↓ to continue

Transfer the thermocouple to the Liquid Nitrogen.
Allow at least 10 seconds for the temperature of the thermocouple to stabilise and press the ↓ key.

The following message (example) will appear:-

6.3.7

Gain Calibration in progress 695

The number in the bottom right of the screen indicates the measurement being taken by the controller. Typically it will be around 670 -710 with the thermocouple in LN2.

If the LN2 calibration is successful, after a few seconds the following message will appear:-

6.3.8.

Gain Calibration done

followed by:-

6.3.9.

1: CALIBRATE TC1 ↓: NEXT

Calibration is complete. Press ↓ to proceed to the next step (6.3.10) or ↑ to exit. It is recommended that the calibration is confirmed by checking the temperature display with the Thermocouple in Ice and Liquid Nitrogen.

Note: If the temperature of the thermocouple is not stable during the Ice or LN2 calibration the following message may appear:-

6.3.10.

Calibration Failed!

If the temperature of the thermocouple is out of an acceptable range (e.g. if it is not correctly inserted into the ice or LN2 during calibration) the following messages (examples) may appear:-

6.3.11.

OUT OF RANGE (ICE) 125

or..

6.3.12.

OUT OF RANGE (LN2) 598

Following any of the above messages or successful calibration the calibration routine will return to step 6.3.2 i.e.:-.

6.3.13.

1: CALIBRATE TC1 ↓: NEXT

If calibration was unsuccessful press key 1 to repeat the procedure

Note: If on returning to the Level and Temperature Display the displayed temperature is lower than -197℃ it is possible that the thermocouple temperature did not have time to fully stabilise while in Liquid Nitrogen. If this occurs repeat the calibration ensuring the recommended delay at step 6.3.6 is observed.

Otherwise press the ↓ key

The following message will be displayed:-

6.3.15

Printer/PC mode Printer

The available modes are:	Printer	(Continuous printout of data)
	Printer (NC)	(Print on demand)
	PC RS232	
	PC RS485	

Use the + and – keys to select the mode required.

Press the ↓ key when finished.

If either PC mode is selected proceed to 6.3.17.

If either printer mode is selected the following message will appear:-

6.3.16

Printer Connection M506

The available options are	M506
	M507.

If the M506 option is selected, printer output is routed to the 7 pin plug on the Controller.

If the M507 option is selected, printer output is routed to the M507CE PSU/Connector box via the 25 pin I/O connector on the M506CE. To use this option an M512CE RS232/RS485 Interface PCB must be installed in the M507CE. Connection to the printer is then made at the M512CE terminals. See the M512CE instruction manual (IM1005) for further details.

Note: *If a PC mode is selected, input/output routing defaults to the 25 pin I/O connector on the M506CE. If a PC is plugged into the 7 pin plug on the fascia panel it is automatically detected and the input/output data is re-routed*

Use the + and – keys to select the mode required.

Press the ↓ key when finished.

The following message will be displayed (example):-

6.3.17.

Level Display High/Low/Normal

The M505CE has the facility to display the liquid level in the Freezer in centimetres. This is done by measuring the time taken for the liquid level to fall due to evaporation of Liquid Nitrogen from the high to the low sensor.
If the High and Low sensor positions are known the level may be calculated from the time elapsed since the last fill.

On the initial fill/evaporate cycle a nominal evaporation rate for the Freezer type is assumed. On subsequent cycles the actual rate is computed.

The positions of the High and Normal sensors should be set as shown in Appendix A.

Use the + and – keys to select the mode required.

Press the ↓ key when finished.

If the High/Low/Normal mode has been selected proceed to 6.3.21 otherwise.

The following message will be displayed (example):-

6.3.18

REFRIGERATOR TYPE 10K

The nominal evaporation rate, used to calculate the level in cm, depends on the Freezer (Refrigerator) type.

Use the + and – keys to select the Refrigerator type.

Press the ↓ key when finished.

The following message will be displayed (example):-

6.3.19.

HIGH SENSOR LEVEL 15cm

Use the + and – keys to input the position of the high thermistor. (Upper Liquid Level)

Press the ↓ key when finished.

The following message will be displayed

6.3.20.

NORMAL SENSOR LEVEL 5 cm

Use the + and – keys to input the position of the Normal thermistor. (Lower Liquid Level)
Press the ↓ key when finished.

The following message will be displayed

6.3.21

Temperature Control off

Temperature control, if set to on will attempt to maintain the Freezer temperature below the value set in 6.2.2 by bubbling Nitrogen gas through the liquid pool in the bottom of the Freezer.
The disturbance caused by Nitrogen gas bubbling through the liquid causes the temperature to drop rapidly.

Use the + and – keys to select on or off

If the Temperature Control option is set to Off proceed to 6.3.23.

If the temperature control option is set to On the following message will be displayed (example):-

6.3.22

Valve on time
15 (s)

The Valve on time is the period for which the Solenoid valve is opened during the Temperature Control cycle. The optimum setting will depend upon the length and layout of the pipe-work and is best found by trial and error.

The Valve on timer is adjustable between 0 and 30 seconds in 5 second steps.

Use the + and – keys to set the Valve On Timer.

Press the ↓ key when finished.

The following message will be displayed:

6.3.23

Valve interval
30 (s)

The Valve interval is the period for which the Solenoid valve is closed during the Temperature Control cycle. The optimum setting will depend upon the length and layout of the pipe-work and is best found by trial and error.

The Valve interval timer is adjustable between 0 and 90 seconds in 5 second steps.

Use the + and – keys to set the Valve On Timer.

Press the ↓ key when finished.

The following message will be displayed:

6.3.24

Lid Switch Type Normally Open

Two types of switch are fitted to TW Freezers. Select Normally Open or Normally Closed using the + and – keys. Note that if the wrong type is selected the Lid Open Alarm will sound.

Press the ↓ key when finished.

The following message (example) will be displayed:

6.3.25

Gas Bypass M360/Off

The options are: M360/Off
M507I

If used with the M507CE-I the Controller will monitor the Gas Bypass thermocouple and send a signal to start Venting when Filling is called for.
If the Gas bypass feature is not required or is provided by an M360 system, no action or monitoring is required.

Use the + and – keys to select the required option

Press the ↓ key when finished.

The following message (example) will be displayed:
Note: This function only available by special order (V9.0 firmware). Proceed to 6.3.26

6.3.26

No LN2 Alarm Off

The options are: Alarm Off
Alarm On

The LN2 supply alarm (Fill Timer) may be disabled if required. e.g. to avoid false alarms on systems with long filling times.
If the 'Alarm Off' option is selected the Freezer will fill indefinitely without giving an 'LN2 Supply' alarm.

Use the + and – keys to select the required option

Press the ↓ key when finished.

If the 'Alarm Off' option is selected in 6.3.25 proceed to 6.3.27, otherwise the following message (example) will be displayed:-

6.3.27

No LN2 Valve Off

The options are: Valve Off
Valve On

If a time-out occurs during Filling the Solenoid Valve may be switched off or left on.
Note: *It is recommended that 'Off' is selected, especially when connected to a bulk LN2 tank. The pressurised gas in a large empty tank may cause the Freezer to boil dry if the valve is left open!*

Use the + and – keys to select the required option

Press the ↓ key when finished.
The following message (example) will be displayed:

6.3.28

Analogue Output Off

The options are: Off
0-2V
0-10V & 4-20mA

If an Analogue Output PCB (M511CE) is fitted, its output range may be set to any of the above options. If 'Off' is selected the output is set 0V/4mA.
Further details of the M511CE are contained in the Instruction Manual IM

Use the + and – keys to select the required option

Press the ↓ key when finished.

The following message will be displayed:

6.3.29

1: Check Analogue o/p ↓: Next

This feature allows the Analogue Output PCB to be tested and enables connected equipment to be calibrated for Zero and Full Scale Outputs.

If calibration/checking is required press '1' and proceed to (6.3.29)

If calibration/checking is not required press '↓ ' and proceed to (6.3.30)

If the Analogue Output requires checking ('1' pressed in 6.3.20) the following message will be displayed:

6.3.30

0%

The options are: 0%, 50%, 100% (% of full scale output)

If the 0-2V range was selected (6.3.19) the output will be set to 0V, 1V or 2V depending on the option selected

If the 0-10V/4-20mA range was selected the output will be set to 0V/4mA, 5V/12mA or 10V/20mA depending on the option selected

Use the + and – keys to select the required output Voltage/Current

Press the ↓ key when finished.

The following message (example) will be displayed:

6.3.31

Daily Fill Off

'Daily Fill' allows the Freezer to be refilled at a fixed time each 24 hours (see 6.2.16)

The options are: Off or On or..
Off, 24h, 48h, 72h or 'Select days' *(Firmware V3.0 on)*

If any option other than 'Off' is selected the Fill Start time must be set up in the Timers/Clock Menu (6.2.17).

Use the + and – keys to select the required option

Press the ↓ key when finished.

If the 'Select Days' option has been chosen the following message will appear:-

6.3.32

Mon off

Use the + and – keys to select On or Off for Monday.

Press the ↓ key to step to Tuesday and select On or Off.

Repeat for each day of the week up to Sunday then press ↓ key to finish.

The following message (example) will be displayed:

6.3.33

Password Protection off

Password protection uses a four digit Access Code to prevent unauthorised alterations to the Controller settings, and to monitor access to the Freezer.

There are two priority levels, Supervisor and Operator. If the Security options are enabled the Supervisor (Operator 1) may alter settings (including the Access Codes) and open the lid of the Freezer.
The Operators (2 to 7) may only open the lid of the Freezer. The Supervisor and Operator Access Codes may be used to record which operator has accessed the Freezer and when.
If an invalid code or no code is entered an alarm is sounded and the unauthorised access is recorded in the Data Log.

Settings may be viewed by anyone by selecting *VIEW SETTINGS* from menu 6.1.1.
Use the + and – keys to select the level of protection required.

The available options are: Settings and Access
Settings only
Off

Press the ↓ key when finished.

If the *Settings and Access* or *Settings Only* options have been selected the following Message will appear:-

6.3.34

Code – Operator 01 6666

Operator 01 is the Supervisor.
6666 is the default code, to which Access Codes are reset.
Use the + and - keys to set each code digit and the ↑ and ↓ keys to move the cursor.
Finally press ↓ to move to the next screen:-

The following message will appear:-

6.3.35.

Code – Operator 02 6666

Set the code for Operators 2 to 7 in the same way as for Operator 1
Unused operator codes should be set to the same value as the Operator 01 (Supervisor) code.

When the operator 8 code has been set press ↓.
The following message will appear:-

6.3.36. | SAVING SETTINGS |

All settings are saved in non-volatile memory
After a few seconds the Temperature and Level display will reappear.

6.4. Other Settings (Engineer Menu)

The following additional settings are normally only accessible to the Service Engineer:-

Service Call Indicator	
Show/Hide User Calibration	
Number of Thermocouple inputs, (1 or 2)**	(V2.1)
Aux Relay Function	
Sim Fill Repeat	
PC Software Type	
Fill Timer, Start immediately or after Venting	(V2.2)
Sim Fill Delay, Start immediately or after Venting	(V2.3)
Analog Output 'Polarity'	(V2.4)
Set Memory Size. (8K or 20K records)	
Set Baud rate for serial comms. (9600 or 19200).	

For further details refer to IM1026.

*** Second thermocouple requires hardware modifications*

7. Normal Operation

During normal operation of the unit the LCD Display shows the temperature of the thermocouple and the liquid level relative to the sensors.

Filling takes place automatically to compensate for evaporative losses.

Filling may also be triggered by an External Fill Signal (Simultaneous Fill).

Note*: Once a Simultaneous Fill input signal has been accepted the controller will not respond to another Simultaneous Fill input signal until 30 minutes have elapsed. This is to avoid the possibility that two or more Controllers could interact causing repeated short fill cycles.*
The 30 minute timer may be cleared by restarting the controller as described in section 10.4. This may be useful when testing for correct operation of a system connected for Simultaneous filling.

The LN2 switch may be used to top up the liquid level or for defogging the chamber.

When the Fill solenoid is active a green light above the LN2 switch is illuminated.

The LCD back-light may be adjusted for intensity using the + and – switches.

LCD Contrast may be adjusted by holding the switch with the contrast symbol (switch 4) and pressing either the + or – switch.

8. Access to the Freezer – Security features.

Before opening the lid Switch 3 should be pressed

If the security feature is enabled the operator will be prompted for a code. If no code or an invalid code is entered and the lid is opened the alarm will be activated.
This will be recorded in the data log as an unauthorised access.
The alarm can be muted in the same way as any other alarm but can only be cleared by the Supervisor (Operator 1) entering the correct code.

9. Alarm and Event Reporting

9.1 Temperature, Level, Lid and Sensor Alarms

A list of possible alarms is given in Appendix E.

If an alarm condition occurs the audible alarm will sound and the red alarm lamp will flash.
The audible alarm may be silenced by pressing the Mute switch.

The alarm lamp will continue to flash while an alarm is present.

Pressing the Mute switch also causes an appropriate alarm message to be displayed by the LCD.
If more than one alarm condition has occurred (e.g. High Temperature and Lid Open) the alarm messages will be displayed in sequence.

The Mute switch is used to toggle the display between the Temperature/Level display and Alarm reporting.

If new alarm conditions occur they will reactivate the audible alarm.

After a preset period from the first alarm the Remote Alarm relay will be de-energised and the audible alarm will be reactivated. In the case of an Extra High Level alarm the Remote Alarm time-out period defaults to 5 minutes maximum, irrespective of the timer setting.

Clearing the alarm conditions will switch off the flashing lamp and audible alarm, re-energise the Remote Alarm relay and return the display to Temperature/Level reporting.

9.2 LN2 Supply Alarms

In the case of an LN2 supply alarm the red alarm LED will flash, the alarm will sound and the green Fill LED will flash slowly.

The LN2 Supply Alarm may be cleared by pressing the LN2 switch.

If the LN2 alarm is activated but the Freezer subsequently fills to the High level Sensor the LN2 Supply Alarm is cancelled.
If this happens regularly it probably indicates that the Fill Timer setting is too low.

9.3 General Alarm

If a certain number of alarms (currently set to 25) occur in a 24 hour period a 'General Alarm' is raised.
The System needs to be reset to clear the alarm. Alternatively it will also be cleared at the end of a 24 hour period (Midnight).

The General alarm indicates when multiple intermittent problems are occurring. If the alarms do not persist for long enough to trip the Remote Alarm they might not be noticed for some time.
The purpose of the General alarm is to draw attention to this situation.

If a General Alarm occurs, inspection of the data log should reveal the cause.

9.4. Service Call Indicator

With the Service Call option set, the Controller will prompt when a service becomes due.
When a Service is due a '!' symbol flashes in the left hand corner of the display. Also, on entering the menu the following message is displayed for a couple of seconds:-

Service Due Call TW Agent

The Service Call option (on/off) and Service due date (month and year) are set in the Engineer menu.

9.5 Event reporting

A list of possible 'events' is given in Appendix E.

10. **Data Logging and Retrieval**

10.1 Data Storage

At pre-set intervals the System status is recorded in the Data Memory of the Controller.
If an alarm (e.g. High Temperature) or event (e.g. Fill Start) occurs it is recorded together with its date and time.

By default the Data Memory of the M506CE Controller is divided into 4 sectors, each holding 2048 records giving a maximum of 8192 (8K). When all sectors are full, the sector with the oldest records is erased.

The maximum number of sectors available is 5 and the maximum number of records per sector is 4096 giving a maximum total of >20,000 records (20K).

The default setting of 8K records is for compatibility with older versions of PC software.
The memory size may be altered in the Engineering menu.

10.2 Data Download - Software

The data log may be downloaded to a PC for storage and analysis.
Two variants of PC software are available for this purpose.

CryoData This Software gives the facility for management and storage of downloaded data. Output is available as printed reports, graphs, or in a format suitable for input to spreadsheet programs.
It can also remotely display the Status of the Freezer (Temperatures, Levels, Clock etc) and many of the Timer Settings.

CryoBank Status Monitor. CryoBank Status Monitor Software is designed to remotely monitor the status of, and collect data from a number of Freezers fitted with M305 and/or M505 controllers.
Typically the controllers will be linked together to communicate with a PC using an RS485 network or via a Local Area Network
The Software can be set to continuously scan the connected Controllers and report the status and any alarm conditions for each.
Data may be collected automatically.

For Current Software prices and/or a free Demo Version contact your TW agent..

10.3 Data Download - Printer

For connecting to the front panel socket a printer cable (M518CE) will be required.

For connecting via fixed wiring the M512CE RS232/RS485 Interface PCB must be installed. (See section 2.5 - Optional Accessories)

Five different print options are provided. These are:-

DATA LOG - Time, Date, Temperature and Level for each logging point are listed line by line. Alarms and other events are also listed.

TEMPERATURE LOG - Time and Temperature only are listed for each logging point. The information is arranged into six columns and grouped in days with a new header with date for each day.

ALARM LOG - As DATA LOG but only alarms, resets and power on/off events are listed.

FILL ACTIVITY LOG - As DATA LOG but only Fill On and Fill Off events are listed.

ALL STORED DATA - As DATA LOG but all data in the memory is printed irrespective of whether the data log has been cleared.

10.3.1 Printing the Data Log

Ensure the printer is connected, switched on and has sufficient paper to print all of the expected data.

To start printing press the ↓ key. The following screen will appear (after the introductory screen):-

1: SETTINGS 2: PRINTER

Press key 1. The display will show:-

PRESS + FOR DATA LOG

If a different option is required press the down arrow key. This will step the display to the next option i.e.

PRESS + FOR TEMPERATURE LOG

The down arrow and up arrow keys may be used to move through the available options.

When the required option has been selected press and hold the + key. The audible alarm will sound three times and printing will begin.

The display returns to System Status reporting.

Note: If the + key is not held down for the full three bleeps of the audible alarm no printout will be generated.

If the printer is disconnected, switched off or out of paper the following message will be displayed for a few seconds:

PRINTER NOT READY

If this occurs rectify the problem and try again.

If the printer becomes unavailable while printing is in progress, an alarm will be activated. If this occurs rectify the problem and either restart the printer or stop the printout routine and start again. See 10.4 for Printer Control functions.

10.3.2. Printer Control

Facility is provided to pause, restart and stop printing.
This may be useful for example if the printer runs out of paper or a paper jam occurs.

If printing is in progress and you wish to pause, press the down arrow key.

Display will show:-

PRESS + TO PAUSE PRINTER

Press the + key.

The display will return to normal and printing will be suspended.
Note that the printer may continue for a while until its buffer is empty.

To restart the printer press the down arrow key.

Display will show:-

PRESS + TO RESTART PRINTER

Press the + key.
The display will return to normal and printing will be restarted.

To stop printing altogether first press the down arrow key to obtain the PAUSE or RESTART messages. Then press the down arrow key again.

Display will show:-

PRESS + TO STOP PRINTER

Press the + key.

The display will return to normal and printing will be aborted.

10.3.3. Clearing the Data Log

Once the data log has been successfully printed it may be cleared. Note that clearing the log via the printer menu does not erase any data. It merely sets a pointer in the memory to tell the printer where to start the next printout.
The ALL STORED DATA print option may be used to retrieve data even after it has been cleared.
Data is only lost when the data store is full at which point the oldest records are deleted and overwritten.

To clear the data log:

Use the down arrow key to work through the Printer options until the display reads:-

PRESS + AND - TO CLEAR DATA LOG

Press the + and - keys simultaneously. The controller will bleep once and the display will briefly show:-

DATA LOG CLEARED

The data log is now cleared.

10.4 Resetting the Controller and Clearing the Memory

The RESTART function can be used to force the M505 Controller to go through its Start-up sequence. This can be used for resetting the Controller and clearing the Data Log.
Note: *If the Data Log is cleared using the RESTART function all data will be lost.*

To clear the data log and reset the system:-

Make sure the PC cable is not plugged in.

Press the ↑ key. After a few seconds the following message will appear

10.4.1

RESTARTING

When the 'Restarting' message appears press and hold the ↓ key. The Controller will bleep three times and the following message will appear

10.4.2

Clear Data Log ↓

Press the ↓ key to proceed or ↑ to return to the Temperature/Level Display.

If password protection is enabled following message will appear:-

10.4.3

Enter Code _

Enter the 4 digit supervisors PIN Code then ↓.
If the correct code is entered the following message will appear:-

10.4.4

Delete All Data? Yes ↓ No ↑

If 'No' is selected (↑**)** the data memory is left intact and the controller returns to the Temperature/Level display.
If 'Yes' is selected (↓) the following message will appear:-

10.4.5

Data Log Cleared System Reset

Release the ↓ key. After a few seconds the temperature and Level display should reappear.

Note: If the Controller is Restarted with a PC cable plugged in it will start the Program Loader. If this happens, remove the PC cable and switch off the power to the Controller for a few seconds. Alternatively, wait for a few minutes and the main program will restart.

Do not press any keys while the Program Loader screen is present. It is possible to enter a factory test mode which may result in the loss of data and erasure of the control program.

11. Lost Password Codes

If the password codes are lost or corrupted they may be reset to a default value (6666) using a PC and M519CE PC cable. PC software is available by E-mail for this purpose.
Instructions are supplied with the PC software.

Appendix A – Sensor and Thermocouple Positioning

Sensor Positioning

The position of the sensors in the sensor tube determines the level of Liquid Nitrogen to be maintained.
Sensor position is determined by measuring the distance from the top of the sensor tube to the bottom of the Freezer, then subtracting the desired liquid level.
The result is used to position a split rubber bung on the sensor leads. When correctly installed, the bung will position the sensors at the correct level when the sensor assembly is inserted into its tube.
The bung caps the tube and functions as a sensor retainer.

The longest lead with a single sensor pod is the low level sensor assembly. The upper bead in the pod is the Normal sensor and the lower bead is the Extra Low sensor.

The lead with two pods is the high level sensor assembly, consisting of the High and Extra High sensors.

The Normal and High sensors must be separately positioned to set the liquid levels at which the controller will start and terminate each fill cycle.

Determination of the liquid level to be maintained depends upon the application and the product being stored, and is beyond the scope of this manual.

Position the sensors as shown in Fig A-1.

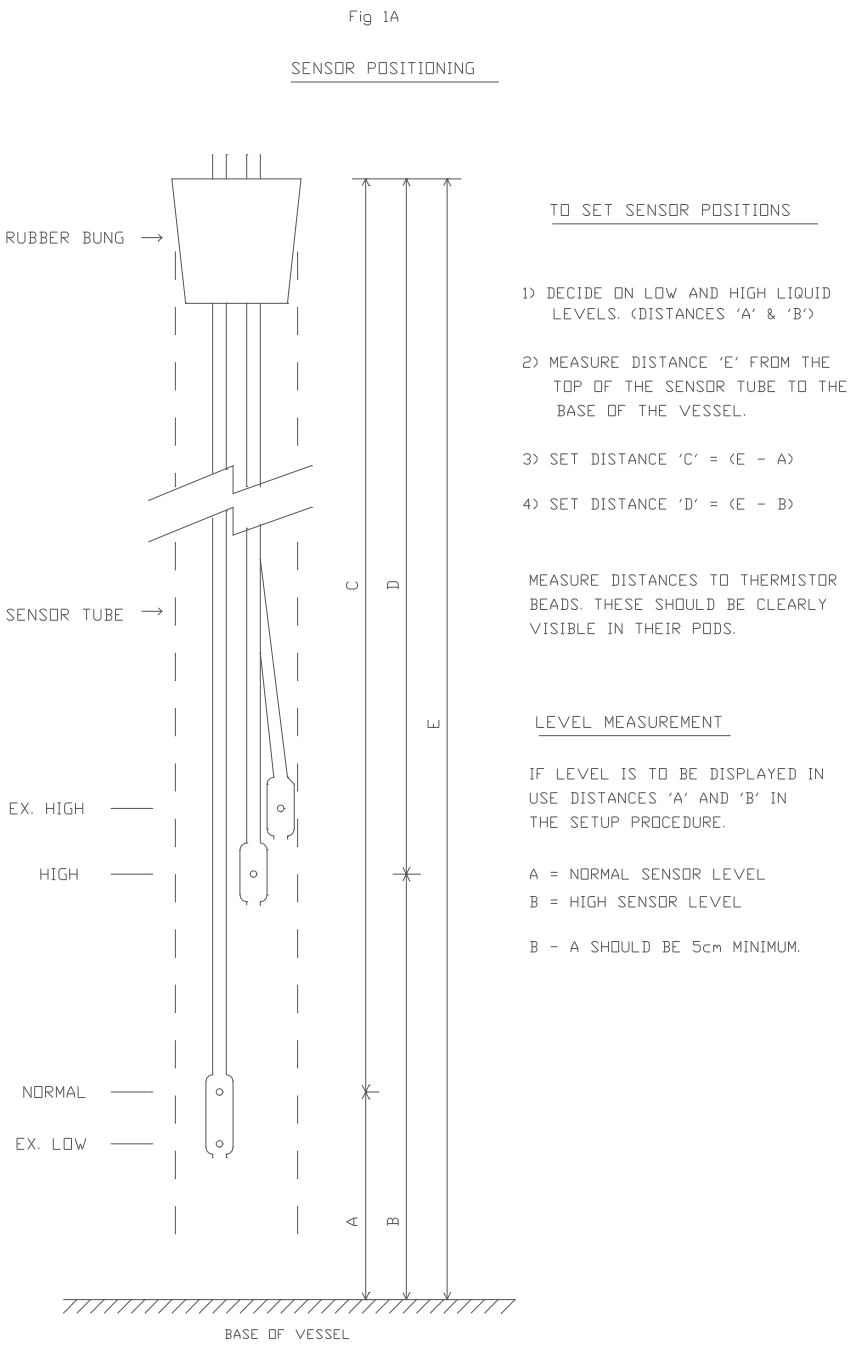


Fig A-1 Sensor Positioning

Thermocouple Position

The thermocouple may be positioned anywhere in the Freezer within the limits of its length.

Typically the product will be stored in vapour phase with about 15-20cm of liquid in the vessel.

The 'worst case' temperature for vapour phase storage is just below the lid of the Freezer and it is suggested that the optimum position for the thermocouple is within the sensor tube and level with either the bottom of the lid or the top of the Inventory Control System. (Fig. A-2).

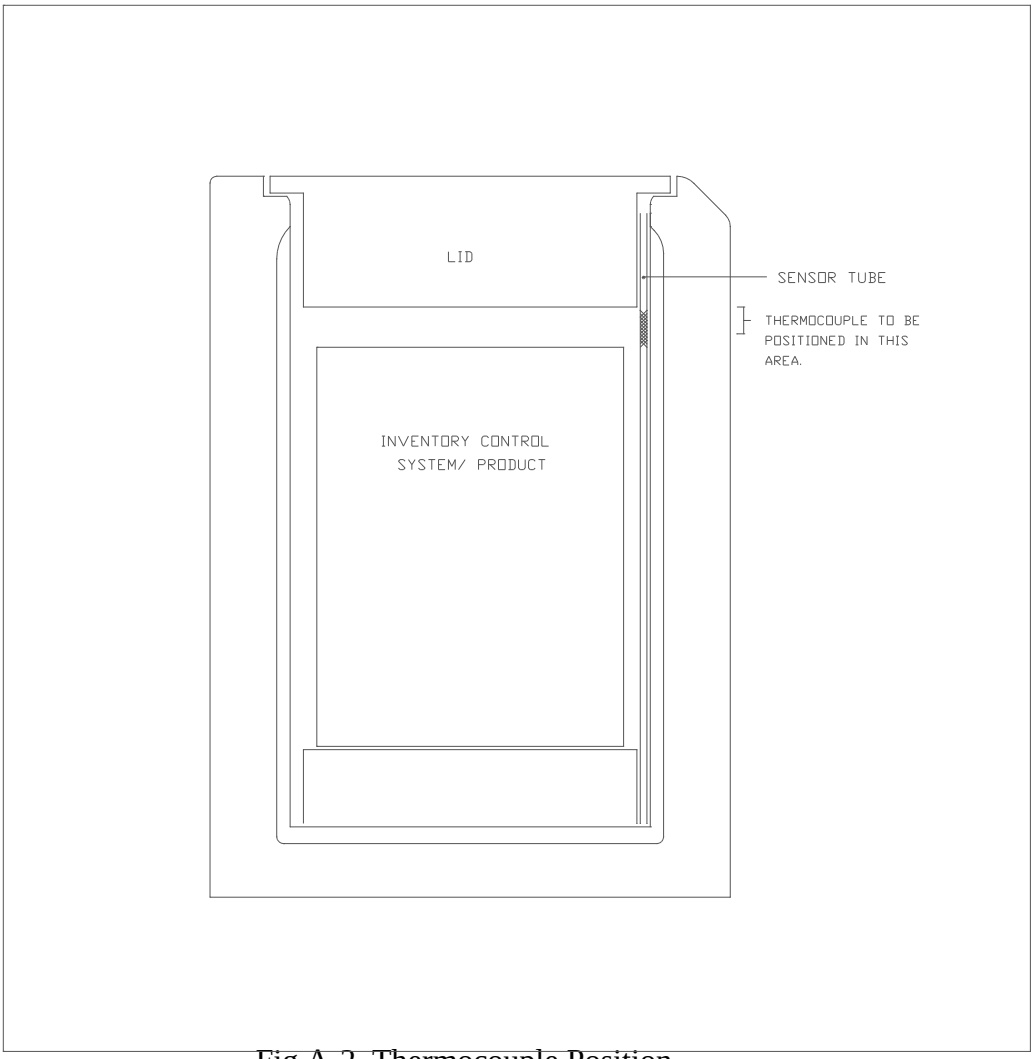


Fig A-2 Thermocouple Position

Thermocouple Accuracy and Sources of Error

The thermocouple should be accurate to within 3 degrees C.
The main source of error has been found to be heat leakage from outside the vessel.
The thermocouple is a type T in which the junction is formed between Copper and Constantin (Copper Nickel alloy) Conductors.
This combination gives good performance at cryogenic temperatures but has high heat conductivity.

If the junction is positioned high in the sensor tube there may be < 20cm of wire between it and the outside of the vessel and may cause measurement errors.

To overcome this problem it is suggested that the thermocouple is formed into a loop as shown in Fig A-3. before insertion into the sensor tube. The loop down into the cold gas acts as a buffer between the measuring junction and ambient temperature.

Note: The tip of the thermocouple is insulated with a plastic sleeve. If this sleeve becomes detached it is possible for the thermocouple to short to the sensor tube.
If the temperature readout is incorrect or erratic check that the insulating sleeve is still in place.

Other Thermocouple Types

Note that the M505CE Controller is optimised for use with type T thermocouples and other types should not be substituted. It may be possible to obtain a calibration in ice and liquid nitrogen but the temperature compensation and linearisation of the controller will not match, resulting in errors.

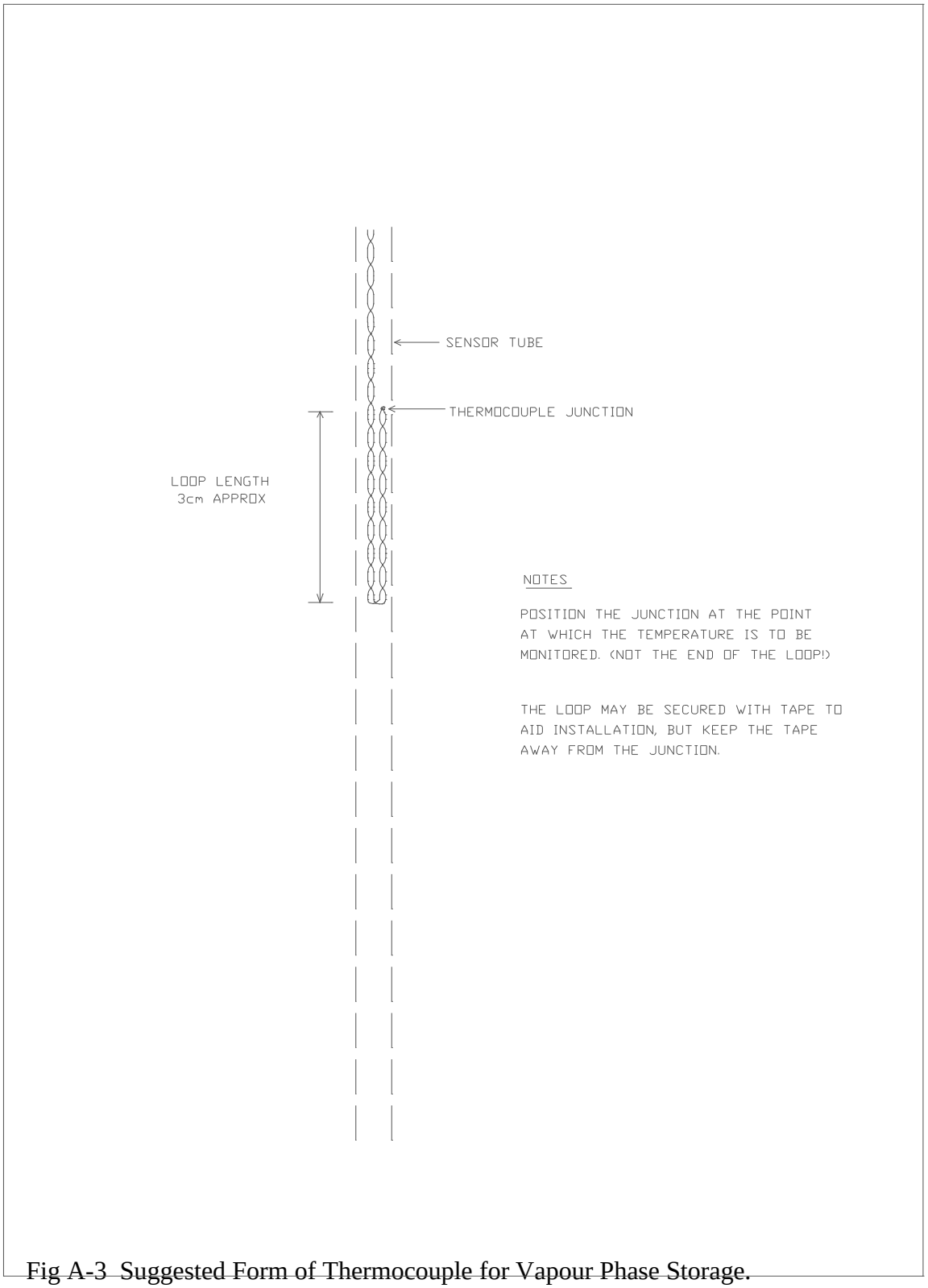


Fig A-3 Suggested Form of Thermocouple for Vapour Phase Storage.

Appendix B – Remote Alarm Connection.

A changeover relay contact is provided (Terminals 12, 13 and 14 of the M507CE) to facilitate reporting of an alarm condition at a point remote from the Freezer.

In the 'good' condition the relay is energised. i.e. The Normally Open (NO) contact is closed and the Normally Closed (NC) contact is open.
If the remote alarm is activated or there is a power failure the relay is released and the contact changes over.

For safety reasons the relay should switch no more than 2 Amps at 50V AC/DC. (Resistive load).

Appendix C - Simultaneous and Sequential Filling

Simultaneous Filling

Where two or more Freezers are connected to the same Liquid Nitrogen supply, economies in the use of Nitrogen may be realised by synchronising the filling of Freezers. This reduces the number of fill cycles required and hence the losses due to nitrogen being trapped in the common supply pipework and vented at the end of a fill cycle.

To use this feature connect the FILL terminals of the M507CEs using 2 core cable, ensuring that + is connected to + and - to -). This is shown in Fig C-1

Whenever a Freezer in the connected group starts to fill a signal is sent to all the others. This causes them to start a fill cycle if they are not already full.

Up to 20 Freezers may be connected together in this way.

Make sure however that the supply pressure is adequate to complete filling in a reasonable time. If not, a supply alarm may be generated by one or more of the controllers.
For large installations it may be better to connect the Freezers in two or more groups. The best groupings will depend upon pipework layout.

Alternatively, 'Delayed Sim Fill' may be used to cause the Freezers to fill in sequence. See 6.2.4. for details.

Sequential Filling

If the LN2 supply pressure is insufficient to fill several Freezers at once it may not be possible to perform Simultaneous Filling.
Sequential Filling may be used to overcome this problem. This feature minimises the number of times the pipework is filled with LN2 by filling the Freezers one after another in sequence.

This should give savings in the use of LN2 similar to those achievable with simultaneous filling.

Wiring details for Sequential Fill are shown in Fig C-2 Operation is as follows:-

The normally open contact of the Auxiliary relay on each Freezer is connected to the External Fill terminals of the next Freezer in the system. The auxiliary relay contact of the last Freezer in the system is connected to the External Fill terminals of the first to form a loop.

When a Freezer requires filling it opens its solenoid valve and fills to the High level sensor. When the liquid reaches the High sensor, filling is terminated and the auxiliary relay is energised for 10 seconds approx. This starts the fill cycle for the next Freezer.
The fill signal is passed on from one Freezer to the next until it reaches the originating Freezer.

To prevent the fill signal from being passed around the loop forever a timer in each controller terminates the sequence if it receives an external fill signal within 10 hours of the previous one.

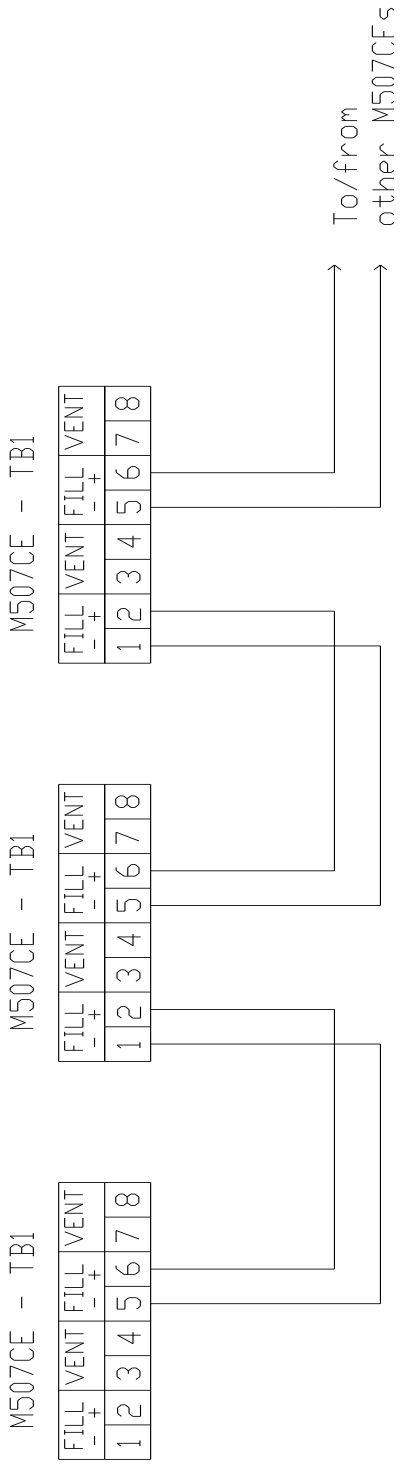


Fig C-1 Connection for Simultaneous Filling

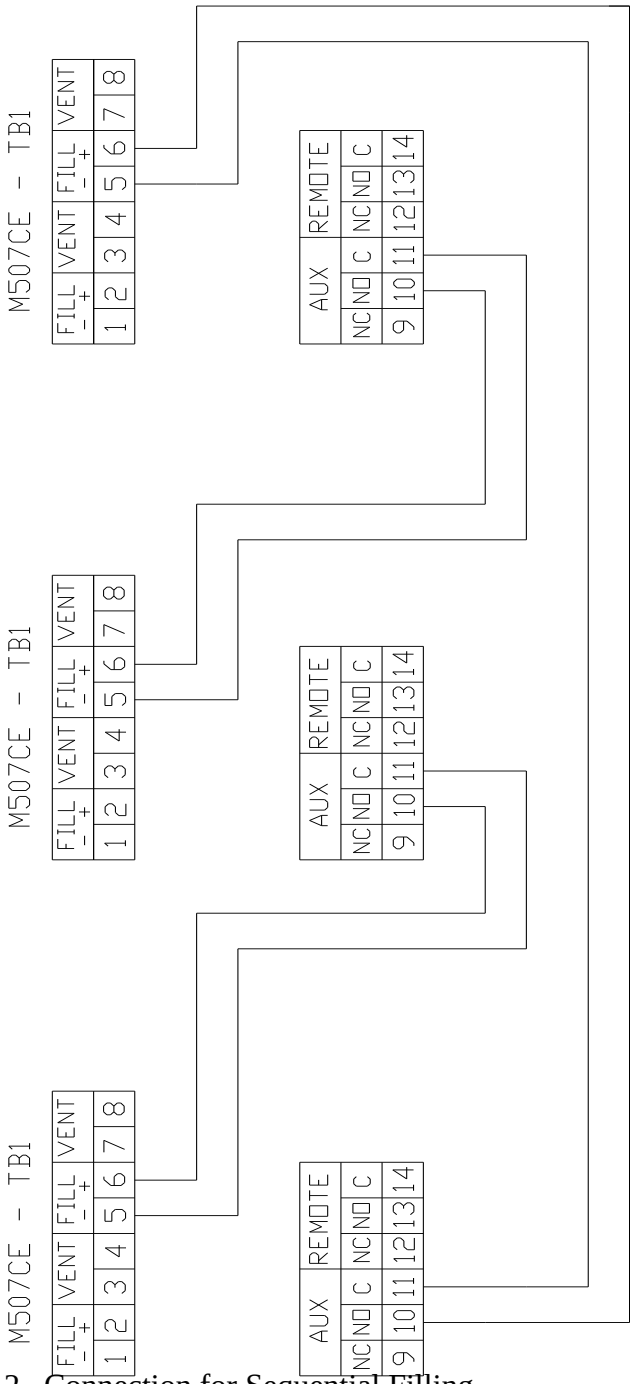
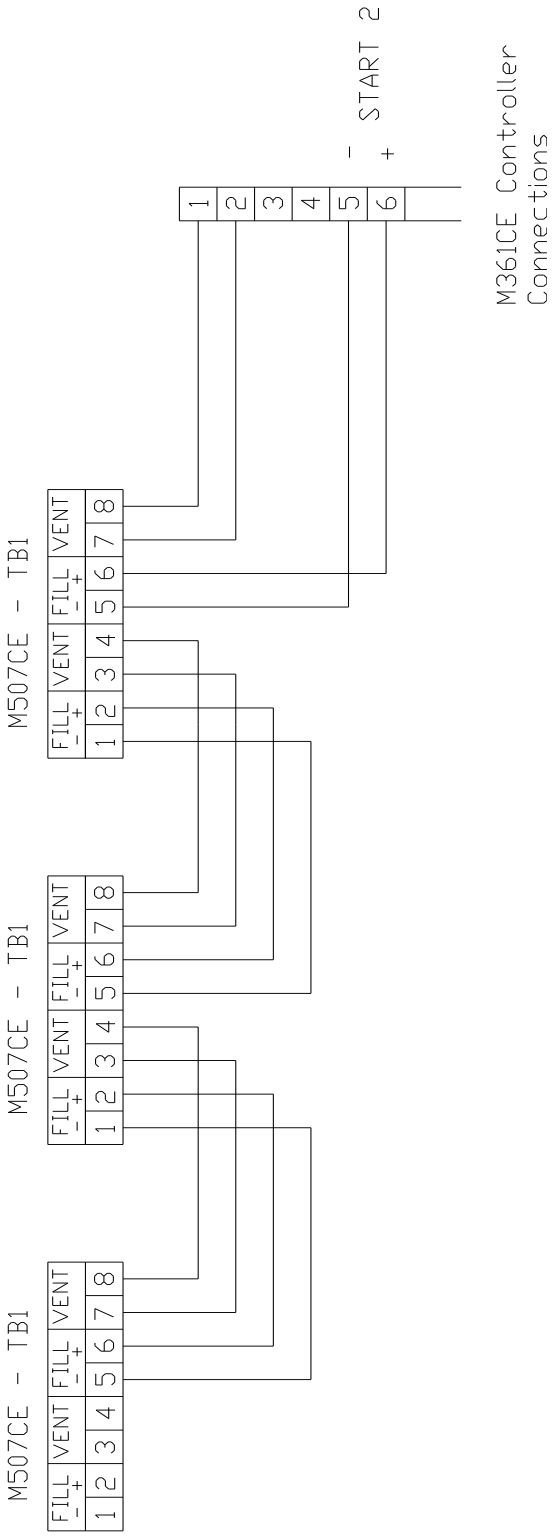


Fig C-2 Connection for Sequential Filling.

Appendix D – Connections for Gas Venting



Appendix E – Alarms and Events

This is a summary of the possible Alarms and Events that can be reported by the M505CE Control System.
The Alarm/Event code is a number which is inserted into the data log to identify the nature of the alarm condition or the event

The following apply to Firmware versions up to V1.9.

Printed/Displayed Text	*Notes*	*Alarm/Event Code (hex)*
*** HIGH TEMPERATURE ***		01
*** LID OPEN ***		02
*** LEVEL EXTRA LOW ***		03
*** LEVEL EXTRA HIGH ***		04
*** SENSOR SHORT (EXTRA LOW) ***		05
*** SENSOR SHORT (NORMAL) ***		06
*** SENSOR SHORT (HIGH) ***		07
*** SENSOR SHORT (EXTRA HIGH) ***		08
*** SENSOR OPEN (EXTRA LOW) ***		09
*** SENSOR OPEN (NORMAL) ***		0A
*** SENSOR OPEN (HIGH) ***		0B
*** SENSOR OPEN (EXTRA HIGH) ***		0C
*** NO LN2 SUPPLY (FILL TIMER) ***		0D
*** WARNING - CHECK PRINTER ***	(1)	0E
*** THERMOCOUPLE OPEN ***"		0F
*** EXTERNAL FILL INPUT S/CCT ***		10
*** UNAUTHORISED ACCESS ***		11
*** GAS BYPASS THERMOCOUPLE FAULT ***	(2)	12
*** NO LN2 (GAS BYPASS TIMER) ***	(2)	13
*** GAS BYPASS FAULT - VALVE OPEN? ***	(2)	14
*** REMOTE ALARM ***		18
* LID OPENED *		19
* LID CLOSED *		1A
* FILL START *		1B
* FILL STOP *		1C
* POWER OFF *"		1D
* POWER ON *		1E
* SYSTEM RESET *		1F
* ALARMS CLEARED *		20
* POINTER ERROR *DATA LOG CLEARED *		21
** LID OPENED BY SUPERVISOR **		29
* LID OPENED - OPERATOR No. 2 *		2A
* LID OPENED - OPERATOR No. 3 *		2B
* LID OPENED - OPERATOR No. 4 *		2C

* LID OPENED - OPERATOR No. 5 *	2D
* LID OPENED - OPERATOR No. 6 *	2E
* LID OPENED - OPERATOR No. 7 *	2F
* LID OPENED - OPERATOR No. 8 *	30

Note 1: *This alarm is displayed but not recorded in the data log. Not used in Version 1.0 Firmware*
Note 2: *From Version 1.5 onwards.*

The following codes were added for Firmware V2.0 onwards.

Printed/Displayed Text	*Notes*	*Alarm/Event Code (hex)*
* FILL START (Manual) *		32
* FILL START (Auto)		33
* FILL START (External)		34
* FILL START (Defog/Chill)		35
* FILL START (Temp Control)		36
* FILL START (PC)		37
* FILL START - Daily Fill		38
* FILL STOP (Manual)		39
* FILL STOP (Auto)		3A
* FILL STOP (Defog/Chill)		3B
* FILL STOP (Temp Control)		3C
* FILL STOP (PC)		3D
* FILL STOP Time out (no LN2)		3E
* TIMER/SETTING CHANGED		

If password protection is enabled, a record is inserted into the data log whenever a setting is changed. In the report this will appear as (e.g):-

Dd/mm/yy hh:mm *Timer/Setting Changed* Fill timer (01) was 15 minutes, now 20 minutes

The following codes were added for Firmware V3.0

Printed/Displayed Text	*Notes*	*Alarm/Event Code (hex)*
Battery Backup		24
Settings Restored from Flash		25
Data recovery		26

From V3.0, message for Event code 38 changed to:-
* Fill Start – (Timed Auto Fill)*

Appendix F – Declaration of Conformity

DECLARATION OF CONFORMITY

Manufacturer: **Mowden Controls Limited**
Northallerton
U.K.
DL6 2YD

Declares that the following product:

Product Description: ***Liquid Nitrogen Level Control System Type M505CE***

Type Nos*:* ***M506CE or M506CE-B (Controller)***

M507CE (PSU/Connector Panel)

M508CE (Sensor Assembly)

***M509CE or M523CE (Cable Assemblies*)**

when installed in accordance with the instructions conforms to the following Directive(s) and Norm(s)

2004/108/EC, 2006/95/EC

EN60601-1-1	**(Electrical Safety – Medical Devices)**
EN60601-1-2	**(EMC – Medical devices)**
EN61326-1	**(EMC – Equipment for measurement, control and laboratory use)**

N Maclean
(Technical Director)

24/8/2011

Appendix G – Additional Technical and Safety Information

Input Power Requirements

230Vac +/- 10%, 1 Amp Maximum.

WARNING: To avoid risk of Electric Shock, this equipment must be connected to a mains supply with protective earth.

Environmental Requirements

To ensure safe and reliable operation the equipment should be operated in the temperature range 0 - 40˚C.
Sufficient ventilation should be allowed so as to avoid persistent condensation.
If the PSU is mounted on the freezer it should be positioned to avoid dripping water.
For K series Freezers a mounting plate and drip cover is available for this purpose.

For transport and storage a temperature range of -10 - +50 ˚C is permissible.

Routine maintenance

It is recommended that this equipment is routinely tested for electrical safety.
Exposed parts may be wiped with a damp cloth for cleaning purposes.
Do not use running water or water jets.

Replacement Fuses

WARNING: The equipment must be completely disconnected from the mains supply before replacing internal fuses.

Equipment Type	Fuse type and rating	Location
M505CE Level Controller	1A(T) HRC Ceramic	M507 PSU (Power inlet)
	1A(T) Glass	M507 PSU, PCB
	3.15A(T) Glass	M507 PSU, PCB
M505CE Level Controller with 'Individual Gas Bypass' (Other fuses as above)	1.6A(T) HRC Ceramic	M507CE-I (Power inlet) *

*Was 1.25A. May be increased to 1.6A if nuisance fusing occurs

Note that ceramic fuses of equivalent rating may be used in place of glass ones but glass fuses should not be used where a ceramic type is specified.

Note for UK equipment only:
Fused Mains Plugs fitted to UK Equipment are fitted with a 3 Amp fuse (1" x ¼)

Appendix H - Controllers with second thermocouple (M506CE-T & M506CE-B-T)

As an optional extra controllers may have a second thermocouple input.
The additional hardware is only fitted to controller types M506CE-2T and M506CE-B-2T.
It is a factory option and cannot be retrofitted.

The second Thermocouple may be enabled and disabled in the Engineering menu. If enabled, both temperatures are shown on the top line of the display and labelled 'T1' and 'T2'.

A separate Temperature Alarm setting for the second Thermocouple is programmed in the Timers/Clock menu

The second thermocouple is for indication only.
It will generate an alarm if the TC2 alarm temperature is exceeded or if an open circuit is detected but there is no logging of Alarms and temperatures for TC2.

Calibration of second thermocouple

If a second thermocouple is fitted the calibration sequence follows on from 6.3.13. and is a repeat of the same steps used for TC1.

Appendix J. - M505CE + Accessories – Valid Combinations

	M510CE	M511CE	M512CE	M517CE	M529CE	Added Function(s)
Standard M505CE or M505CE-B	√	√	x	x	x	Analogue Temperature O/P
	x	√	√	x	x	Analogue Temperature O/P + RS485 + RS232
	x	√	x	√	x	Analogue Temperature O/P +Relay Outputs
	x	x	√	x	x	RS485 + RS232
	x	x	x	√	x	Relay Outputs
	x	x	x	x	√	Ethernet Interface
M505CE or M505CE-B with Individual Gas Bypass (M507CE-I)	x	√	x (Note 1)	x	x	Analogue Temperature O/P

Note 1. RS485 Output (not RS232) is standard for M507CE-I

Appendix K – Additional Notes for MDD Approved Product.

Installation

WARNING: CLASS 1 MEDICAL ELECTRICAL EQUIPMENT

To avoid risk of Electric Shock, this equipment must be connected to a mains supply with protective earth.

No Modification of this Equipment is allowed.

The appliance coupler (Mains cord) is the disconnection device.
The equipment must be positioned so that the disconnection device is easily accessible to the operator.

This equipment must not be operated in an Oxygen rich or potentially flammable environment.

Maintenance

Servicing and repairs are to be undertaken by an authorised service representative only.

Replacement Cord sets must be fully approved and rated for the country of use.

Manufacturer:

Mowden Controls Ltd.
Mount View,
Standard Way
Northallerton.
North Yorkshire
DL6 2YD.
UK

Contact Details for the Responsible Organisation:

Please Contact Taylor Wharton at the address given in the documentation supplied with the Freezer.