MECHATECH SYSTEMS

LyoDry Midi Pro Operator & Maintenance Manual

LyoDry Freeze Dryers & High Vacuum Systems

MechaTech Systems Ltd
Thornbury UK

Revised 2019
Issue no. 1

MechaTech Part No. LSM55P Operator and Maintenance Manual

General Sales and Service Contact Information:

MechaTech Systems Ltd
Unit 9, Brunel Way, Thornbury Industrial Estate,
Thornbury, Bristol BS35 3UR UK
Tel. +44 (0)1454 414723 Fax: +44 (0)1454 414723
Web: www.mechatechsystems.co.uk
Email: enquiries@mechatechsystems.co.uk

For information about our products, please visit our web site.

Table of Contents

1. Introduction

1.1 Who should use this manual?

This Operator's Manual is intended for anyone trained and authorised to operate the MechaTech LyoDry Midi Pro Freeze Dryer

1.2 Scope of this Manual

This manual attempts to cover all the issues that an operator is likely to encounter in normal, daily operation of the system.

1.3 Disclaimer

The purpose of this manual is to provide instructions and guidance for using the LyoDry Midi Pro Freeze Dryer. Nothing contained in this manual constitutes a warranty of any kind in respect of the machine or of the results to be achieved by its use. The only warranties given by MechaTech Systems Ltd in respect of any machine are those expressly given by MechaTech Systems Ltd in the contract under which it sells the machine to its buyer.

The information contained in this manual is believed to be accurate as at the date of publication, but MechaTech Systems Ltd gives no guarantees in this respect. Note that it is the operating company's responsibility to ensure that it complies with such regulatory and other legal requirements as may be from time to time apply to operation of the machine.

1.4 Service and Sales Contact

General Sales and Service Contact Information:

haTech Systems Ltd
9, Brunel Way, Thornbury Industrial Estate
nbury, Bristol BS35 3UR UK
+44 (0)1454 414723 Fax: +44 (0)1454 414723
: www. MechaTechsystems.co.uk

2. Health and Safety

2.1 Safety Warnings in this Manual

Instructions in this manual may require special precautions to ensure the safety of the personnel performing the operations.

Potential safety issues are indicated by this symbol: 

Please read the safety information before performing any operation preceded by this symbol.

There are two levels of safety message: **WARNINGS** and **CAUTIONS**. The distinction between the two is as follows:

WARNING

Failure to observe this warning could result in death or serious injury.

CAUTION

Failure to observe this caution may cause minor injury, or damage to equipment.

2.2 General Safety Precautions

Do not operate the machine until you have read the safety precautions below.

WARNINGS

- Failure to follow safe installation and servicing procedures could result in death or serious injury.
- Only authorised personnel trained by MechaTech Systems Ltd and qualified by experience may perform maintenance on the LyoDry Midi Pro Freeze Dryer.
- Do not make changes to this equipment of any kind without prior consultation with MechaTech Systems Ltd.
- Please note that international regulations and various safety requirements strictly prohibit the modification of this equipment in any way without first being approved by a competent specialist.
- Some protective covers may not be interlocked, as it is not intended for them to be removed during normal use of the machine.
- Do not attempt to override the safety circuit of the machine in any way. The safety circuit exists to ensure that a hazardous situation cannot arise during the operation of the machine.
- The customer is responsible for fitting and using machine safeguards to protect personnel from becoming trapped or crushed by moving parts of the machine. Failure to do so may cause death or serious injury.

2.3 Health and Safety when using this equipment

WARNING

- The LyoDry Midi Pro is heavy. Use suitable lifting equipment to move the LyoDry Midi Pro or get someone to help you move it. Do not attempt to lift the LyoDry Midi Pro Freeze Dryer on your own.
- Observe your Health and Safety at Work information, and wear suitable Personal Protective Equipment where appropriate.

WARNING

Do not interfere with system safeguards, and make sure that you read, understand and comply with the safety instructions in this manual.

3. Installing the LyoDry Midi Pro

3.1 Unpack and inspect

Remove all packing materials and inspect the LyoDry Midi Pro. If the LyoDry Midi Pro is damaged, notify your supplier and the carrier in writing within three days; state the serial number of the LyoDry Midi Pro together with your order number and your supplier's invoice number. Retain all packing materials for inspection. Do not use the LyoDry Midi Pro if it is damaged and notify your supplier within three days.

If the LyoDry Midi Pro is not to be used immediately, replace the protective covers. Store the LyoDry Midi Pro in suitable conditions.

3.2 Locate the LyoDry Midi Pro

The LyoDry Midi Pro is designed for use on a level floor. Locate the LyoDry Midi Pro in its required operating position, ensuring that the floor is adequate to support the equipment, within convenient access to a suitable electrical supply.

We recommend that you leave an air-gap of at least 500mm between all four sides of the LyoDry Midi Pro and any wall or obstruction. If you do not leave a sufficient air gap, poor cooling of the LyoDry Midi Pro may result in poor performance.

When you locate the LyoDry Midi Pro, you should also consider ease of access for maintenance and repair work, when you will need to remove the cover of the LyoDry Midi Pro.

3.3 Connecting the LyoDry Midi Pro to the electrical supply

WARNING

Failure to refit all panels prior to connecting to mains power may result in injury or death to the operator.

WARNING

Ensure that the electrical installation of the LyoDry Midi Pro conforms to your local and national safety requirements. It must be connected to a suitably fused and protected electrical supply and a suitable earth (ground) point.

1. Make sure that the LyoDry Midi Pro is suitable for use with your electrical supply voltage and frequency.
2. Ensure that the main switch (item 2, figure 1) is on the '0' (off) position.

3. The LyoDry Midi Pro is supplied with a two-metre length of 3-core electrical supply cable and a 13A power plug. Connect the plug to the electrical supply.

3.5 Test after installation

CAUTION

Do not attempt to use the LyoDry Midi Pro if it fails the installation test. If you do, poor performance may result in the loss of the product being freeze dried

CAUTION

Never engage the vacuum pump when water is present in the Ice Condenser. The introduction of water directly into the internal mechanism of the vacuum pump will cause significant damage to the pump.

When you have installed the LyoDry Midi Pro, test that it works correctly. Note that the refrigeration system uses a thermostatic expansion valve which contains a spring-loaded needle valve; the expansion valve automatically regulates the amount of refrigeration, according to the load on the refrigeration system. The needle valve is optimised for load conditions and when you test the LyoDry Midi Pro with the chamber empty (that is, with no product in the chamber), the temperature of the chamber can cycle between -40˚C and -55˚C.

Use the following procedure to test the LyoDry Midi Pro:

1. Switch on the electrical supply and then turn the main switch (item 2, figure 1) to the '1' (on) position.
2. The display (item 3, Figure 1) on the front panel should be illuminated.
3. From the Home screen select the Control Screen
4. Enter your Operator user name and password to access the Control screen.
5. From the Control screen tap the Refrigeration switch to start the compressor.
6. Check that 'COOL' is displayed. If 'DEFROST' is displayed tap the Mode switch to cool.
7. Hold an A4 size piece of paper against the grill on the rear of the LyoDry Midi Pro. If the paper is drawn towards the grill then the cooling fan is rotating correctly: continue at Step 10. If the fan is not rotating, continue at Step 14 below.
8. Check that the compressor operates. If it operates, you will hear a low hum: continue at Step 9. If you cannot hear the compressor, continue at Step 13 below.
9. Leave the LyoDry Midi Pro on for approximately 60 minutes, and then check that a temperature of -45˚C or lower is shown on the temperature gauge. If the temperature is correct continue at Step 10 below. If the temperature is not correct, continue at Step 13 below.
10. Attach an empty drying accessory to the accessory flange (item1, Figure 1).
11. From the Control screen witch on the vacuum pump.
12. Leave the pump to operate for at least 30 minutes, then check that a pressure of

1 x 10^{-1} mbar or lower is shown on the pressure gauge. If the pressure is correct, the LyoDry Midi Pro is ready for use. If the pressure is not correct, continue at Step 13.

13. If any of the checks in Steps 7 to 9 above fail, turn the main switch to the '0' (off) position, then switch off the external electrical supply and disconnect the supply from the LyoDry Midi Pro. Contact your supplier for advice. Do not attempt to use the LyoDry Midi Pro.

4. Introduction to the LyoDry Midi Pro

4.1 General description

The LyoDry Midi is the ice condenser section of a freeze drying system. It is suitable for freeze drying biological and pharmaceutical preparations in a laboratory. The LyoDry Midi only requires the attachment of a suitable drying accessory to form a complete freeze drying system. The LyoDry Midi is also suitable for use on other vacuum duties, including evaporation and distillation processes.

The LyoDry Midi has a condenser chamber, a refrigeration system and a control system which includes temperature and pressure indication and user controls. The refrigerant used in the LyoDry Midi is CFC free. All of the LyoDry Midi components are housed in a free-standing cabinet, which is designed to be located alongside standard-height laboratory work surfaces. The cabinet is fitted with casters for ease of locating the required operating position. The components are described in the following sections.

When used with suitable accessories, the LyoDry Midi can be used to freeze dry materials in bulk trays, round-bottomed flasks, vials or ampoules. Alternatively, the LyoDry Midi can be used as a low-temperature vapour trap (or cold trap) that may be attached to an existing evaporation facility. A number of accessories are available from MechaTech Systems; these include vacuum pumps, drying accessories and glassware.

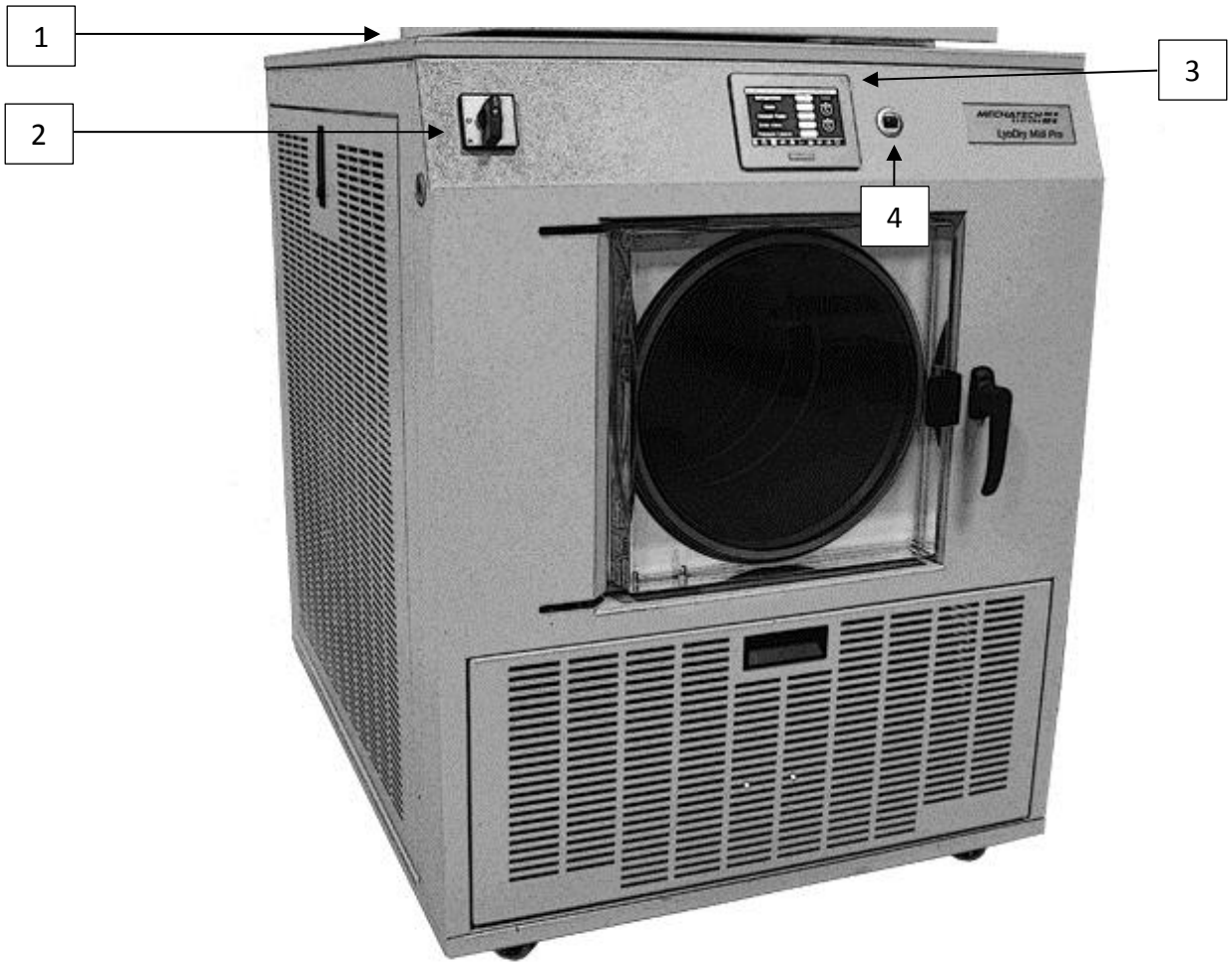


Figure 1 – LyoDry Midi Pro. Front View

1. Condenser Chamber Accessory Flange
2. On/Off Switch
3. USB port
4. Operator Interface

5. Description of LyoDry Midi Pro Main Components

The LyoDry Midi Pro has a condenser chamber, a vacuum pump, a refrigeration system and a control system which includes temperature and pressure indication and user controls. The refrigerant used in the LyoDry Midi Pro is CFC free. All of the LyoDry Midi Pro components are housed in a free-standing cabinet.

The cabinet is fitted with casters for ease of locating the required operating position. The components are described in the following sections.

These are the main components of the LyoDry Midi Pro system.

5.1 Vacuum and Condensing system

5.1.1 Condenser Chamber

The Condenser Chamber can trap up to 18 Kg of ice. It contains a cooling-coil which condenses water vapour, to form ice. The temperature of the cooling-coil under normal operating conditions with no load applied is approximately -55°C.

A large diameter accessory flange, which is compatible with the LyoDry Midi Pro accessory range, is at the top of the condenser chamber. The large top opening allows easy inspection, cleaning and defrosting of the condenser chamber and enables high vacuum-pumping rates to be attained.

A transparent door at the front of the LyoDry Midi freeze dryer allows easy inspection, cleaning and defrosting of the condenser chamber.

There is a valved drain pipe at the base of the condenser chamber; this drain pipe is used to vent system and drain water from the condenser chamber. The drain-pipe and the drain-valve are accessible through the front inspection panel.

A vacuum pipeline connects the chamber to a vacuum pump connector on the front of the LyoDry Midi Pro.

5.1.2 Vacuum Pump

The LyoDry Midi Pro freeze dryer has an Edwards nXDS15i Vacuum Pump mounted inside. The vacuum pump is a dry scroll pump which is ideally suited to freeze drying.

5.1.3 Condensate Drain System

The use of the controls and connections are described in Table 1.

Control/Connection	Use
Touch Screen Interface	The Touch Screen Interface is used to fully operate and monitor the LyoDry Midi Pro. The pressure reading shows the pressure in the condenser chamber. The temperature reading shows the temperature in the condenser chamber.
Data retrieval port	Use this to retrieve logged data files to a USB memory stick
Ethernet port	Used for factory configuration
Vacuum pump connector	Use this to connect your vacuum pump to the LyoDry Midi Pro.
Drain-outlet	This outlet is used to drain water from the LyoDry Midi Pro during defrosting of the condenser chamber and cooling-coil. The outlet is also used to admit air into the vacuum system.

Table 1 – Front Controls and Connections.

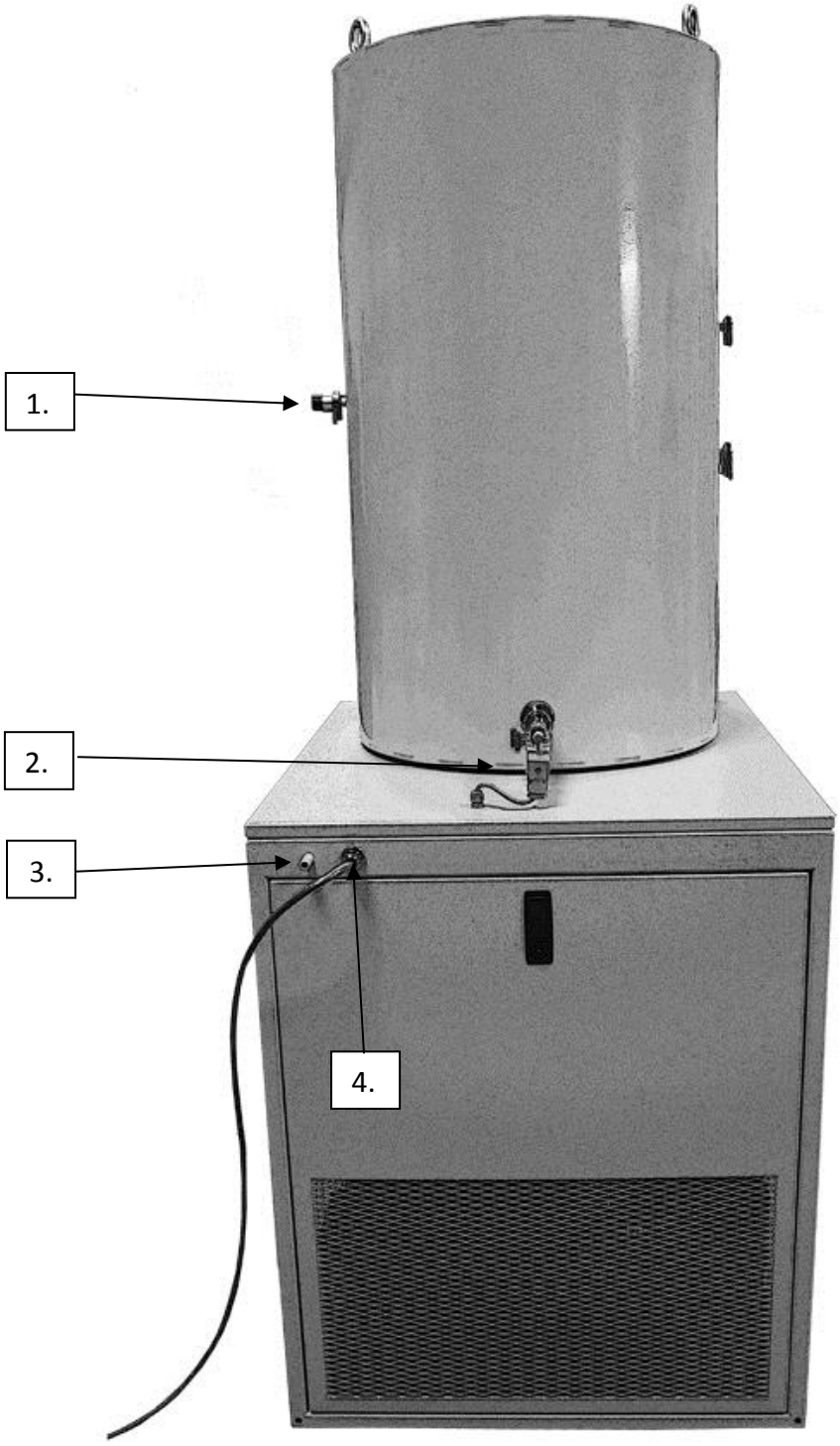


Figure 2 – LyoDry Midi Pro Rear view.

1. Manual vent valve
2. Automatic pressure control valve
3. Vacuum pump exhaust
4. Power cord

6. Applications

6.1 Introduction

If you want to use the LyoDry Midi Pro as a freeze dryer, you must connect it to a two-stage vacuum pump and fit a drying accessory. When you use the LyoDry Midi Pro as part of a freeze drying system, we recommend that you keep accurate records of all operating parameters (that is: load, drying times, and so forth). This data will help you to determine the optimum cycle for efficient operation with various products.

Some factors which affect the freeze drying process are described in the following sections.

6.2 The freezing process

You must pre-freeze the product to be freeze-dried before you place it in (or on) the drying accessory. The thickness of the ice (and hence the product) will affect the length of time needed to dry a given sample. In general, the thickness should be less than 10mm. A range of product containers is available from MechaTech Systems. These include the containers shown in Table 2.

Container	**Method of freezing**
Bulk tray	Use a cabinet freezer to freeze the bulk tray. The maximum recommended depth is 10 mm.
Vials	Use a cabinet freezer to freeze the vials. The maximum recommended depth of fill is 10 mm.
Ampoules	Pre-freeze in a cabinet or use a spin-freeze accessory to dry the ampoules.
Flasks	Use a pre-freeze bath to shell-freeze to a maximum thickness of 10 mm.

Table 2 – Product containers

6.3 The drying process

When the LyoDry Midi Pro condenser temperature is less than -30°C, as shown on the Main screen, the vacuum pump can be switched on. The pressure in the condenser chamber then starts to drop, producing the conditions necessary for freeze drying to occur. The pressure gauge will show the pressure in the condenser chamber.

The time required to dry a product varies and is determined by a number of factors; these include the type of product, its mass and thickness, the type of container used, the temperatures of the product and the condenser and the system performance.

Freeze drying requires an input of heat energy to the product to change the ice into water vapour. When using the LyoDry Midi Pro, this energy may be absorbed solely from the surroundings or, alternatively, a heated accessory may be used to supplement this heat input. If you use a heated accessory, the accessory should not be switched on until the pressure in the condenser chamber has fallen to 1 mbar or lower.

When you decide on the quantity of heat input required, or when you try to optimise the drying cycle for a particular product, it is important to observe the physical appearance of the product whenever possible during the drying process. If the product has been correctly frozen, it will usually appear to be uniform in colour and Midi Pro. If the product is uneven in colour, or if signs of boiling are visible, then the product may have been incorrectly frozen or may have undergone some physical change, possible from the application of too much heat.

A wide range of factors has to be considered when trying to optimise the drying cycle for a given product. To assist in this optimisation, we therefore recommend that you take note of the rate of change of both temperature and pressure within the condenser chamber during the freeze drying process.

6.4 Vapour trapping

When the LyoDry Midi Pro is used as a vapour trap, its function is significantly different to that when it is used in freeze drying applications. In vapour trapping applications, the LyoDry Midi Pro acts solely to protect the rotary pump; in freeze drying applications, it actually pumps the water vapour from the product.

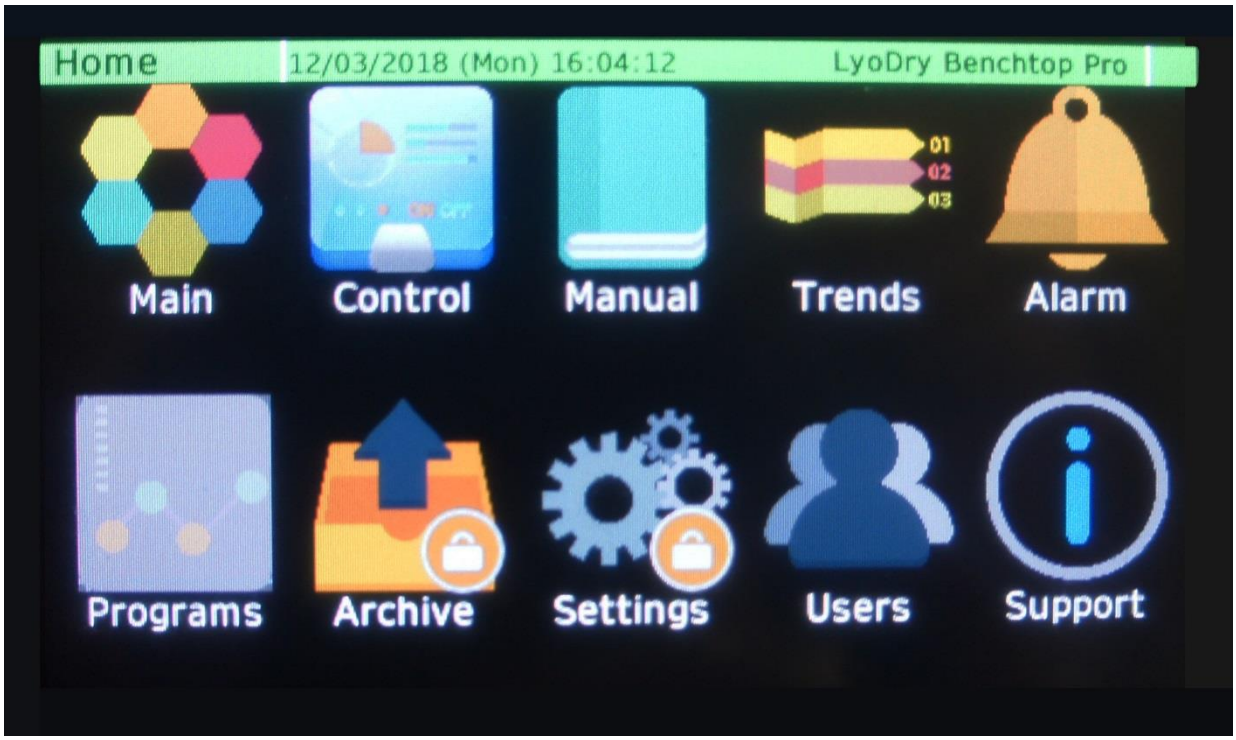
In vapour trapping applications, it is often necessary to limit the vapour flow from the system to the LyoDry Midi Pro by fitting a restrictor between the vapour source and the LyoDry Midi Pro. The size of the restrictor depends on the system.

7. How the LyoDry Midi Pro is controlled

7.1 Operator Interface:

The Operator Interface is a touch screen used to control and monitor the LyoDry Midi Pro.

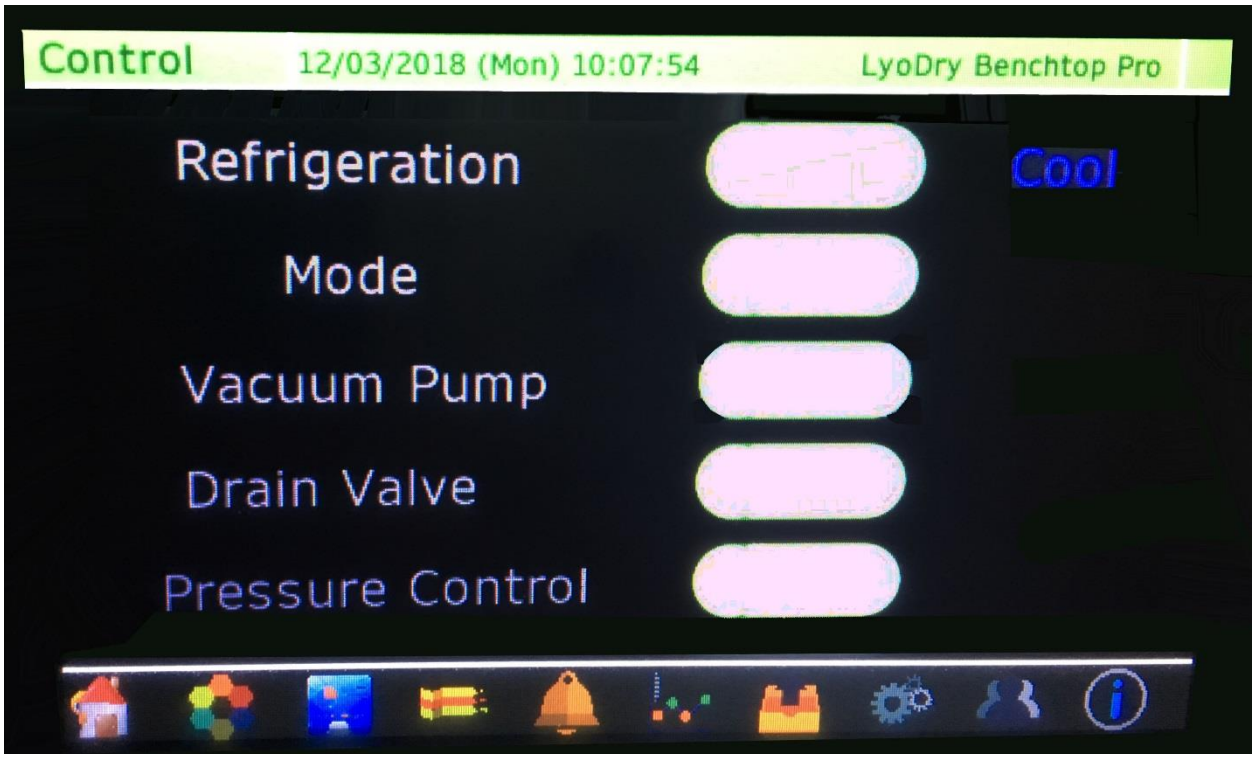
An overview of the main screens follows.



This is the **Home** screen

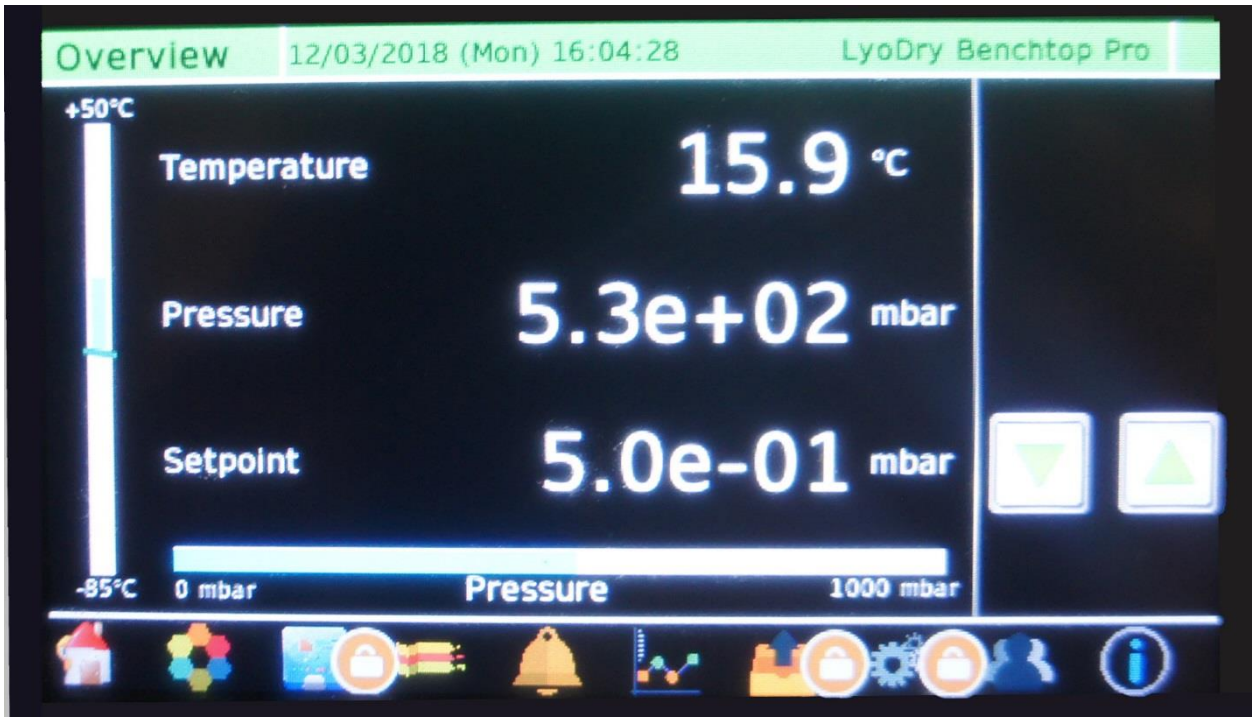
This is the top level Menus screen that appears after the power up sequence.

There are touch icons buttons located on the Home screen. Theses icons are used to navigate through the screens. These icons are repeated along the bottom of the other screens.



This is the **Control** screen

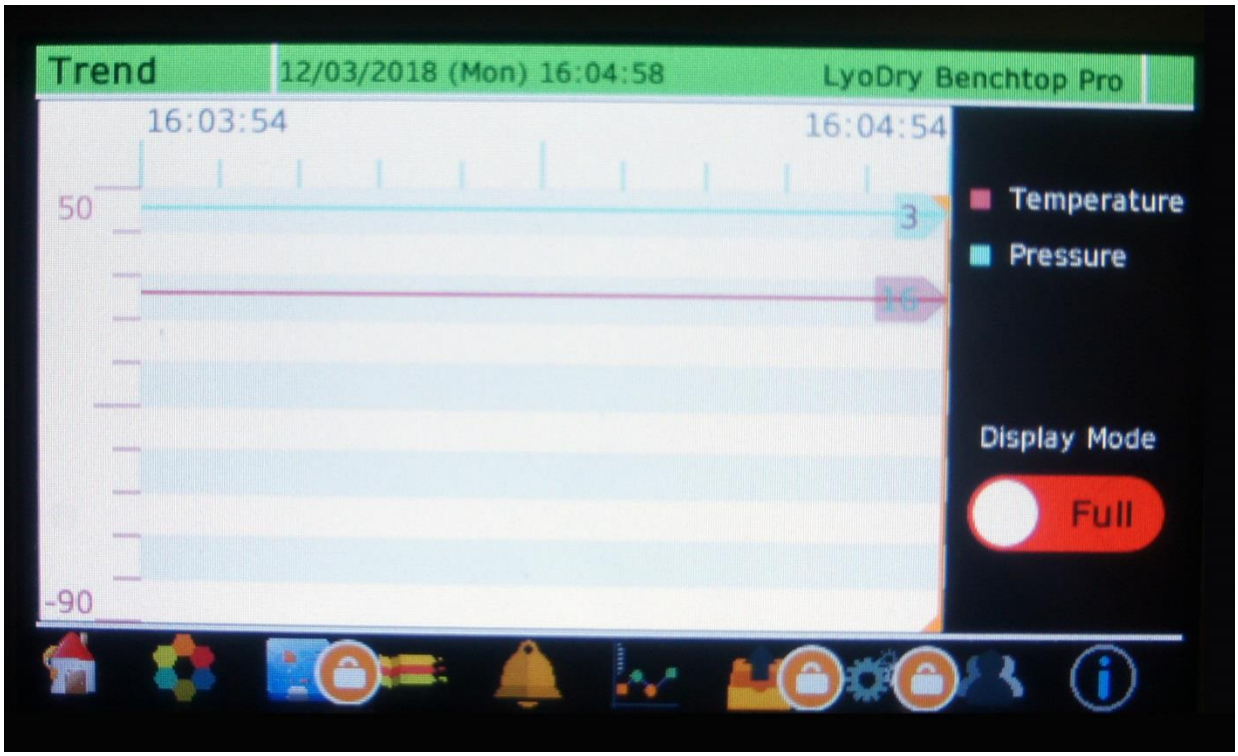
Tap the switches to operate each item



This is the **Overview** screen

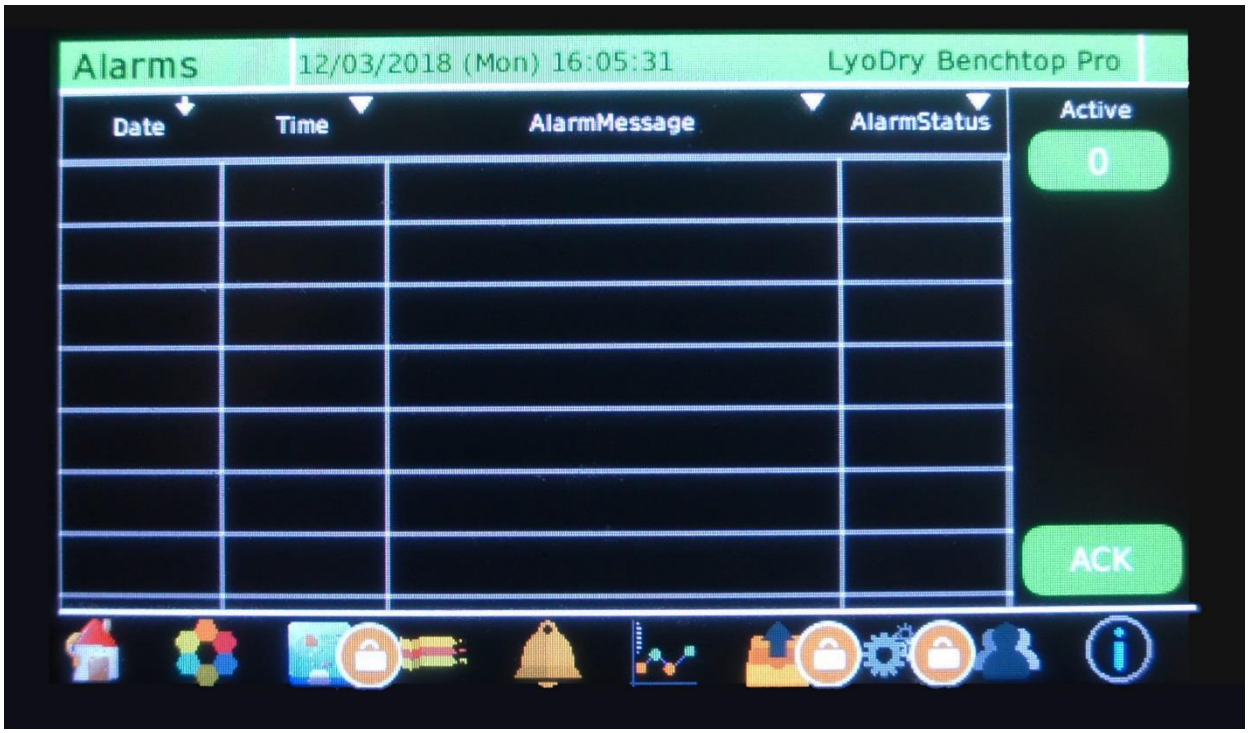
The pressure setpoint can be adjusted within this screen by tapping the up and down arrows

Note: Pressure Control must be selected within the Control screen to activate the setpoint.



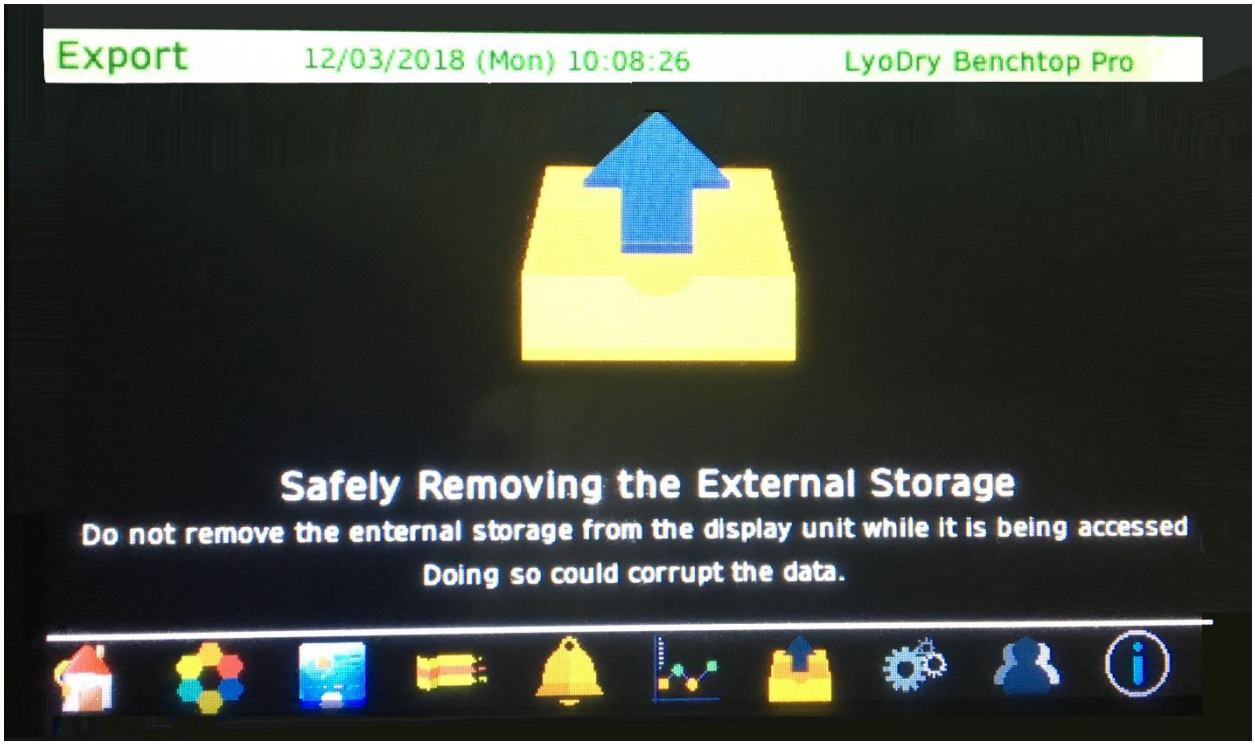
This is the **Trend** screen

Within the Trend screen, the Display Mode switch can be used to scroll toggle between display modes.



This is the **Alarms** screen

The temperature and pressure levels during the process are key to a successful freeze dried product and are therefore monitored continuously during the cycle. Should either the temperature or pressure rise above the permitted level then there will be an alarm. The alarm message will be displayed until the parameter has recovered to normal levels or the alarm is subsequently acknowledged.



This is the **Export** screen

Data is stored continually in the system's internal battery backed memory.

Selecting the Export screen from the Home screen allows a user, with a high enough access level, to archive the recorder history, to a 'memory stick' plugged into the USB port at the front of the unit (item 7, figure 1). The archived data remains in the flash memory of the instrument.

Tap the icon to start achieving process.

CAUTION

The Memory stick must not be removed while archiving is in progress, as to do so may irreparably damage the file system of the memory stick, rendering it unusable.

The text file will be saved to folder **LoggingGroup** which can be opened using Excel.

8. Running a Drying Process

8.1 How to run a Drying Cycle

WARNING

If you intend to freeze dry products which contain sodium azide, make sure that your vacuum pump and pipeline are suitable for freezing these products. If they are not suitable, there is a severe risk of explosion.

Sodium azide is sometimes used as a stabilizing agent in freeze drying processes. Sodium azide is toxic and, when dry, is highly explosive.

If you freeze dry a product that contains Sodium azide, a chemical reaction can occur in the presence of heavy metals such as copper, lead, zinc and cadmium. The result of this reaction is the formation of metallic azides which are highly unstable and explosive.

The LyoDry Midi Pro contains no heavy metals and is suitable for freeze drying products which contain Sodium azide.

If you do not use an Edwards's pump, your vacuum pump and vacuum pipeline may not be suitable for freeze drying products containing Sodium azide. Check with your vacuum pump's manufacturer to determine its suitability if you intend to freeze dry products containing Sodium azide.

8.2 Sequence of operation

Operation of the LyoDry Midi Pro can involve a number of different steps:

- Prepare the LyoDry Midi Pro
- Fit the product container and any other necessary accessory
- Load the products
- Pre-cool the LyoDry Midi Pro
- Dry the product
- Shut down

Before you freeze a product, you must always prepare the LyoDry Midi Pro as described. Always dry the product and shut down the LyoDry Midi Pro as described.

However, the order in which the remaining three steps are carried out depends on the type of product container or other accessory you use and the type of product to be freeze dried.

In some circumstances you will need to pre-cool the LyoDry Midi Pro with the accessory-flange open to atmosphere; in other circumstances, you fit the product container, then pre-cool the LyoDry Midi Pro and then load the product to be freeze dried.

If the correct sequence of operations to follow is not clear to you, refer to the instruction manual supplied with the product container or other accessory which you will use.

8.3 Prepare the LyoDry Midi Pro

CAUTION

Use only mild detergents to clean the condenser chamber, accessories and connecting pipeline. Some of the MechaTech Systems accessories are made from acrylic materials and must not be cleaned with organic solvents.

Before you use the LyoDry Midi Pro, and between freeze-drying cycles, prepare the LyoDry Midi Pro, as follows:

1. Switch on the electrical supply and then turn the power switch (item 1, figure 2) to the '1' (on) position.
2. The display (item 3, Figure 1) on the front panel should be illuminated.
3. From the Home screen select the Control Screen
4. Enter your Operator user name and password to access the Control screen.
5. From the Control screen tap the Drain Valve switch to open it.
6. When the chamber is completely drained, turn off the drain-valve.
7. If acidic or corrosive products have been processed, flush through the condenser chamber and drain-line with clean water.
8. Make sure that the condenser chamber is dry.
9. Make sure that the LyoDry Midi Pro is clean, particularly the accessory-flange. If the flange is not clean, you will not get a good vacuum seal and the performance of the LyoDry Midi Pro will be poor.
10. Select a suitable drying accessory for the product. Wipe clean the sealing-ring of the accessory and check the sealing-ring for damage; if it is damaged, fit a new sealing-ring. The accessory sealing-ring should not need lubricating, but if it is excessively dry, apply a light wipe of high vacuum grease.

8.4 Fit the product container and other accessories

A drying accessory may be connected to the LyoDry Midi Pro accessory flange. Accessories have a rubber sealing-ring to seal the accessory to the LyoDry Midi Pro accessory flange. Once positioned, the weight of the accessory is sufficient to produce an airtight seal under vacuum conditions. If using the LSCC10 there are four securing bolts that secure the accessory to the LyoDry Midi Pro.

8.5 Pre-cool the LyoDry Midi Pro

WARNING

Do not touch any part of the condenser chamber during or immediately after the cooling process. The condenser chamber is at a very low temperature and can cause tissue damage.

Note: *if you cool the LyoDry Midi Pro with no product in the chamber, the condenser temperature will cycle between approximately -50˚C and -55˚C.*

Pre-cool the LyoDry Midi Pro condenser chamber as follows:

1. From the Control screen tap the Refrigeration switch to start the compressor.
2. Check that 'COOL' is displayed. If 'DEFROST' is displayed tap the Mode switch to cool.
3. Wait until the temperature shown on the display reads -45°C or lower. This may take 60 minutes.

8.6 Dry the product

CAUTION

Use gas-ballast on the vacuum pump when drying. If you do not, water may condense in the pump.

1. On RV5 or RV8 pumps, turn the gas-ballast control to position 'I': refer to the pump instruction manual. On other pumps, open the gas-ballast valve: refer to the pump instruction manual.
2. If the vacuum pump is electrically connected to the LyoDry Midi Pro vacuum pump power outlet (Figure 2), from the Control Screen tap the Vacuum Pump switch to turn it on. If the vacuum pump is connected to a separate supply, switch on the pump according to the manufacturer's instructions.

Take note of the following when freeze drying products:

- Only switch on a heated accessory when the pressure is 1 mbar or less.
- When a load is first applied to the LyoDry Midi Pro, the temperature may rise for a few minutes. This is because the evaporation rate from the product is initially high. If the temperature does not fall to -45˚C or below within a few minutes, the LyoDry Midi Pro is overloaded. Reduce the amount of product in the freeze drying system to prevent the product from melting or, when you use the LyoDry Midi Pro as a vapour trap, restrict the flow of vapour to the LyoDry Midi Pro.
- If you wish to dry a number of flasks, first attach one flask, then evacuate the flask until the pressure (shown on the pressure gauge) falls to 1 mbar or less. Then attach and evacuate the remaining flasks in the same way.

If you use this procedure, you can identify any flasks that leak. This procedure also prevents rapid pressure increases, which might cause flasks to fall off of the drying accessory.

- If there appears to be a leak, check that the drain-valve is fully closed and that all seals are clean. If the LyoDry Midi Pro continues to leak, contact your supplier.

8.7 Removing the product

CAUTION

If you use a manifold assembly, do not admit air into the LyoDry Midi Pro through the drain-valve until all flasks have been removed, otherwise the flasks may fall off the manifolds.

Look at the pressure shown on the pressure gauge and the appearance of the product and consult data gathered from previous freeze drying operations to determine when the freeze drying process has finished. Note that the pressure shown on the display will fall significantly when vapour is no longer being released from the product.

Once the process has finished, shut down the LyoDry Midi Pro as follows:

1. If you use a manifold accessory, use the manifold valves to vent each flask in turn. Remove and seal each flask.
2. If using the LSCC10 multi-shelf chamber you can use the manual vent valve located on the right hand side (item 1, figure 2).
3. If the Vacuum Pump is electrically connected to the LyoDry Midi Pro vacuum pump power outlet (Figure 2), from the Control Screen tap the Vacuum Pump switch to turn it off. If the vacuum pump is connected to a separate supply, switch off the pump according to the manufacturer's instructions.

8.8 Defrost the LyoDry Midi Pro

WARNING

Do not touch any part of the condenser chamber during or immediately after the cooling process. The condenser chamber is at a very low temperature and can cause tissue damage.

WARNING

Do not pour water at a temperature greater than 50˚C into the ice condenser when it is cold. This may result in a dangerous rise in pressure in the refrigeration system.

The LyoDry Midi Pro has a hot gas defrosting feature.
Place the drain hose in a suitable container to collect the melted condensate.

1. From the Control Screen tap the Drain Valve switch to open it.
2. From the Control screen tap the Mode switch to select DEFROST.
3. Wait until all the ice has defrosted and finished draining out of the drain hose. If all the ice has melted and the there is no water flowing out of the drain hose tap the Drain Valve switch to close it.

4. From the Control screen tap the Mode switch to select DEFROST.
5. From the Control screen tap the Refrigeration switch to turn off the compressor.
6. Prepare the LyoDry Midi Pro for the next operational cycle as described starting from section 8.3 or shutdown the LyoDry Midi Pro as described in section 8.10.

8.9 Operation with no load

If you operate the LyoDry Midi Pro with no load for several hours, the internal components of the LyoDry Midi Pro get very cold. Atmospheric water vapour will then condense onto the cold surfaces and may drip out of the bottom of the LyoDry Midi Pro. You may therefore see puddles of water under the LyoDry Midi Pro, which give the impression that water is leaking from the condenser chamber.

If you see water dripping out of the LyoDry Midi Pro, inspect the condenser chamber: if there is ice in the chamber, the water is probably not leaking from the chamber, but is dripping from the cold surfaces inside the LyoDry Midi Pro. Always check this carefully before you contact your supplier for advice.

To avoid this problem, we recommend that you shut-down the LyoDry Midi Pro if you will not use it for three or four hours. This is particularly important if the use of the LyoDry Midi Pro is in a high humidity environment.

8.10 Shutdown

1. Following a defrost cycle you can switch off the electrical supply by turning the power switch (item 2, figure 1) to the ‘0’ (off) position.

9. Maintenance

WARNING

Obey the safety instructions below and take note of the appropriate precautions. If you do not you can cause injury to people and damage to equipment.

WARNING

The LyoDry Midi Pro may be contaminated with the process chemicals that have been pumped during operation. If so, ensure that the LyoDry Midi Pro is decontaminated before maintenance and that you take adequate precautions to protect people from the effects of dangerous substances if contamination has occurred.

9.1 Introduction

Note: you must obey the maintenance procedures defined in the instruction manuals supplied with your accessories and vacuum pump.

Note: there are no user-serviceable parts inside the LyoDry Midi Pro refrigeration system.

The following sections describe possible problems and their possible solutions and are intended as a guide to the user and to qualified service engineers. Some of the solutions can be carried out by the user, but others (which are clearly identified) must be carried out only by approved MechaTech Systems service engineers.

9.2 Precautions

- Switch off the LyoDry Midi Pro, isolate it from the electrical supply and defrost it before you start maintenance.
- Do not touch any part of the condenser chamber during or immediately after the cooling process. The condenser chamber is at a very low temperature and can cause tissue damage.
- Do not pour water at a temperature greater than 50 °C into the condenser chamber when it is cold. If you do, this may result in a dangerous pressure rise in the refrigeration system.
- Ensure that you do fault finding in a well-ventilated area.
- After you have rectified a fault, ensure that the electrical installation of the LyoDry Midi Pro conforms to your local and national safety requirements. It must be connected to a suitable fused and protected electrical supply and a suitable earth (ground) point.

9.3 Cleaning

CAUTION

External surfaces of the LyoDry Midi Pro should be cleaned using warm soapy water. Care must be taken with solvent-based cleaning fluids as they may remove important information from the product labels.

CAUTION

Do not pour water at a temperature greater than 50°C into the condenser chamber when it is cold. If you do, this may result in a dangerous pressure rise in the refrigeration system.

9.3.1 Cleaning the Operator Interface screen

Clean the Operator Interface screen as and when required.

CAUTION

- To prevent possible damage to the Nanodac screen, make sure you use a lint-free cloth, moistened if necessary with a weak detergent solution. Do NOT use aggressive cleaning materials such as isopropyl alcohol because they damage the Nanodac screen.
- DO NOT USE ABRASIVE CLEANERS OR INDUSTRIAL SOLVENTS. These may damage the unit beyond repair. This is NOT covered by warranty or hardware maintenance contracts.

1. Have all your cleaning materials ready – a clean, soft, lint-free cloth and weak detergent solution.
2. You can clean the screen when the system is powered ON or OFF.
3. Gently clean the screen. We recommend that you allow it to dry before resuming use, to avoid leaving marks on the surface.

9.3.2 Cleaning the Condenser chamber

WARNING

The Condenser may be contaminated with the process chemicals that have been pumped during operation. If so, follow your specific decontamination procedures before attempting to clean the chamber and take adequate precautions to protect people from the effects of dangerous substances if contamination has occurred.

Clean the Condenser chamber as and when required.

1. Have all your cleaning materials ready – a clean, soft, lint-free cloth and weak detergent solution.
2. Gloves should be worn when working with chemicals.
3. Ensure that the condenser is at atmospheric pressure and ambient temperature.
4. To access the chamber open the condenser door by turning the handle ant-clockwise ninety degrees.
5. The door can now be opened by pulling on the two handle on the right hand side of the door.
6. Check that the surface temperature is within safe limits to touch.
7. Gently clean the internal surface by reaching inside. Do not attempt to put your head into the chamber
8. To close the door after cleaning, swing the door flush against the sealing flange and turn the handle clock-wise ninety degrees. Ensure that the door is not loose.

WARNING

Ensure that the electrical supply is isolated before starting any maintenance work.

9.4 Calibration

It is recommended that the vacuum and temperature gauges fitted to this unit are calibration at least every 12 months. The time interval between services must to be reviewed by the customer during the units operating life.

9.5 Safety

WARNING

Obey the safety instruction given below and take note of appropriate precautions. If you do not, you can cause injury to people and damage to equipment.

9.6 Precautions

- Switch off the LyoDry Midi Pro, isolate it from the electrical supply and defrost it before you start maintenance.
- Do not touch any part of the condenser chamber during or immediately after the cooling process. The condenser chamber is at a very low temperature and can cause tissue damage.
- Do not pour water at a temperature greater than 50°C into the condenser chamber when it is cold. If you do, this may result in a dangerous pressure rise in the refrigeration system.
- Ensure that you do fault finding in a well-ventilated area.
- After you have rectified a fault, ensure that the electrical installation of the LyoDry Midi Pro conforms to your local and national safety requirements. It must be connected to a suitable fused and protected electrical supply and a suitable earth (ground) point.

9.7 Electrical faults

If an electrical fault is suspected, use Table 3 to identify the possible causes and actions to cure the fault. The 'By' column of the table identifies whether the checks and actions can be done by a user (a 'U' entry in the column), or whether they must be done by a qualified service engineer (an 'SE' entry in the column).

If the fault persists after you complete the recommended action, contact your supplier before you use the LyoDry Midi Pro again.

Symptom	Check	Action	By
The external electrical supply is on but the display is off and there is no electrical supply to any components.	Has the fuse in the main switch failed?	If so, identify and rectify the cause of the problem, then replace the fuse. If the fuse fails repeatedly, check the electrical system and rectify any fault found.	U SE
	Has the external fuse in the electrical supply failed?	If so, identify and rectify the cause of the problem, then replace the fuse. If the fuse fails repeatedly, check the electrical system and rectify any fault found.	U SE
The display is on, the Refrigeration in 'COOL' mode but the compressor does not start.	Has the thermal magnetic circuit-breaker tripped?	If so, identify and rectify the cause of the problem, then reset the circuit breaker. If the circuit-breaker trips repeatedly, check the electrical system and rectify any fault found.	U SE
	Is the electrical supply voltage too low?	Use an alternative electrical supply and/or remove any extension cables which can cause small voltage drops.	
	Is there a loose connection?	Inspect the electrical system and repair any loose connection. If there are no loose connections, the compressor may be faulty.	
The compressor starts but only operates for a short time before it stops.	Have the motor windings failed?	Check the windings and replace the compressor is necessary.	SE
The temperature shown on the display does not change or error is displayed.	Is the plug disconnected from or loosely connected to the rear of the display?	Inspect the electrical system and repair any fault found.	SE
	Has the thermocouple failed?	Check and replace the thermocouple.	SE
Incorrect temperatures are shown on the display.	Does the thermocouple need to be calibrated?	Calibrate the thermocouple.	SE
	Is the incorrect type of thermocouple fitted?	Check and replace the thermocouple, if necessary.	SE
The pressure shown on the display does not change or error is displayed.	Does the gauge need to be calibrated?	Calibrate the pressure gauge.	U
	Is the plug disconnected from or loosely connected to the rear of the display?	Inspect the electrical system and repair any fault found.	SE
	Is the gauge head faulty?	Replace the Pirani gauge head.	SE

Table 3 – Electrical Fault Finding

9.7.1 Remove and open the inspection panels

WARNING

Disconnect the LyoDry Midi Pro from the electrical supply before you remove the any panels. If you do not, you may accidentally touch live electrical components.

Note: Each inspection panel has an earth lead attached. You must disconnect the earth lead before you can completely remove an inspection panel.

Use the following procedure to remove the side and rear panels:

1. Switch off the external electrical supply and isolate it from the LyoDry Midi.
2. Press in the top of the catch at the top-centre of the right-hand panel.
3. Lift the lever of the catch to release the locking bar.
4. Pull the top of the panel out and lift the panel upwards to remove it.

Use the following procedure to remove and open the front panel:

1. Pull the handle at the top of the front inspection panel and swing the panel downwards to open it (see Figure 3).

Figure 3. Open the front panel

9.7.2 Refit the inspection panels

WARNING: Ensure that the earth (ground) cable is correctly fitted to the inspection panel. If you do not, there will be a risk of electric shock when you switch on the LyoDry Midi Pro.

1. Place the bottom of the panel onto the two locating pins and push the top of the panel in.
2. Push in the locking bar lever to lock the catch into place.

9.8 Refrigeration faults

9.8.1 Repeat the installation test

If you suspect that there is a fault in the refrigeration system in the LyoDry Midi, then:

1. Defrost the chamber.
2. Repeat the installation tests. Note the results at each step and then contact MechaTech Systems.

9.8.2 Fault diagnosis

Some possible causes of refrigeration faults, together with suggested actions to cure the faults, are shown in Table 4. The 'By' column of the table identifies whether the checks and actions can be done by a user (a 'U' entry in the column), or whether they must be done by a qualified service engineer (an 'SE' entry in the column).

If other symptoms occur, or the cause of the fault cannot be identified, contact your supplier for advice.

9.8.3 Refrigerant leaks

The refrigerant used in the LyoDry Midi is heavier than air and is an asphyxiant by the displacement of oxygen. If a refrigerant leak is suspected, place the LyoDry Midi in a well-ventilated area. Do not allow naked flames or smoking near the LyoDry Midi, as products of combustion of the refrigerant include dangerous fluorides and chlorides.

If refrigerant vapour is inhaled, summon medical help immediately. Take the victim to a well-ventilated, uncontaminated area; if the victim's breathing is weak or has stopped, apply artificial ventilation, preferably using an oxygen resuscitator. Do not use adrenalin or other cardiac stimulants.

Refrigerant in contact with skin or eyes can cause cold burns. If contact has taken place, seek medical help immediately and carry out the following: remove clothing from the

affected area; carefully irrigate the affected area with tepid water for at least 15 minutes; apply a sterile dressing and treat the wound as you would a heat burn.

9.8.4 Leak test the refrigeration system

Leak test the refrigeration system with a halogen leak detector, which is sensitive to all refrigerants. Before you start leak tests, check the operation of the leak tester with refrigerant from the cylinder which you will use to recharge the LyoDry Midi.

The refrigerant used in the LyoDry Midi is heavier than air, so you must check the highest joints in the system first.

9.8.5 Component replacement

Note: The refrigeration system should be left open to atmosphere for as short a time as possible.

Only replace a component when you are sure that it is the cause of the fault. Components (particularly compressors) are often replaced unnecessarily and it is therefore recommended that you recheck your findings before you replace a component.

Use the following procedure to replace a component in the refrigeration system.

1. Recover the refrigerant from the system.
2. Remove the faulty component. You must use suitable pipe cutters if you cut a pipe. If heat has to be applied to a joint, pass an inert gas through the system while you heat the joint, and again while you cool the joint.
3. Replace the component.
4. When repairs on the refrigeration system have been completed, replace the filter-dryer as that is likely to have been contaminated.
5. Dehydrate the system and recharge the LyoDry Midi with refrigerant. Before the unit is completely recharged, check that any new or repaired joints do not leak.

9.8.6 Recharge with refrigerant

If you need to recharge the LyoDry Midi due to a refrigerant leak, locate and repair the leak before you start to recharge the refrigeration system. Use the correct type and quantity of refrigerant to recharge the refrigeration system.

9.8.7 Reset the thermal magnetic breaker

Use the following procedure to reset the thermal magnetic circuit-breaker if it has tripped. Only reset the circuit-breaker once you have identified and rectified the source of the trip.

1. Carry out the procedure in **9.7.1** above

2. Press the reset button to reset the thermal magnetic circuit-breaker.
3. Carry out the procedure in **9.7.2** above
4. Refit the top cover.

Symptom	Check	Action	By
The compressor does not start.	Is there an electrical fault?	Refer to electrical faults section and rectify any fault found.	SE
The compressor starts but the temperature does not reach -45˚C or less after 90 minutes.	Is there sufficient ventilation?	If not, relocate the LyoDry Midi Pro. There must be no restrictions to air-flow to the sides and rear of the LyoDry Midi Pro.	U
	Is there a leak in the refrigeration system?	Find the leak, then repair the leak and recharge the system with refrigerant	SE
The compressor starts but the temperature does not reduce.	Is the thermocouple faulty?	Check the gauge and the thermocouple and replace if necessary.	SE
	Is there a leak in the refrigeration system?	Find the leak, then repair the leak and recharge the system with refrigerant.	SE
The temperature rises to above -45˚C during drying and does not fall to below -45˚C again within a few minutes.	Is the load on the LyoDry Midi Pro too high?	Reduce the amount of product being freeze dried or restrict the vapour load to the LyoDry Midi Pro.	U

Table 4 – Refrigeration fault finding

9.8.8 Recharge with refrigerant

If you need to recharge the LyoDry Midi Pro due to a refrigerant leak, locate and repair the leak before you start to recharge the refrigeration system.

Use the correct type and quantity of refrigerant to recharge the refrigeration system.

10. Storage and disposal

10.1 Storage

Use the following procedure to store the LyoDry Midi Pro

- Power down the LyoDry Midi Pro as described in Section 8.10
- Disconnect the LyoDry Midi Pro from all the services
- Place and secure protective covers over the inlet and outlet interfaces
- Store the LyoDry Midi Pro in cool, dry conditions until required for use. When required, prepare and install the LyoDry Midi Pro as described in Section 3

10.2 Disposal

Dispose of the LyoDry Midi Pro and any components from it safely in accordance with all local and national safety and environmental requirements.

Particular care must be taken with components which have been contaminated with dangerous process substances.

Do not incinerate fluoroelastomer seals and O-rings.

11. Spares and accessories

11.1 Spares and Accessories

Description	Part No	Supplier
Edwards APG100-XM, NW16	D026-01-000	MechaTech Systems Ltd Unit 9 Brunel Way Thornbury Bristol BS35 3UR +44 (0)1454 414723 enquiries@mechatechsystems.co.uk www.mechatechsystems.co.uk
Temperature sensor	LSTC	
Dow Corning silicone high vacuum grease, 50g tube	HVGREASE	
Acrylic drying chamber 350mm x 435mm, lid and 2 x L-gaskets	LSDC	
6-tray drying rack assembly, SS (for use inside acrylic chamber)	LSD6	
Heated tray drying accessory	LSAD6H	
14” L-gasket for acrylic chamber	L-GASKET14	

Table 7: Spare Parts and Accessories

12. Technical Specifications

12.1 System Specification

LyoDry Midi Pro	TECHNICAL SPECIFICATION
Part number and model	LSM555P LyoDry Midi Pro
Maximum condenser chamber capacity	18 litres
Ice removal capacity (in 12 hours)	1.2kg (2.6 lbs)
Ice removal capacity (in 24 hours)	2.3kg (5.1 lbs)
Maximum ice capacity	4.5kg (9.9 lbs)
Operating temperature	~ -55◦C
Temperature display range	+50◦C to -100 ◦C
Pressure display range	0.01 mbar to 1000 mbar
Refrigeration compressor type	1 hp hermetic unit
Dimensions (H x W x D)	945 x 750 x 1000 mm
Weight	230kg (507 lbs)
Power requirements	LSM55P-230: 230VAC/50 Hz, 13.0 A

Table 8: Technical Specification

12.2 Technical Support

12.2.1 Contacting Technical Support

If you suspect a problem with the LyoDry Midi Pro unit, you should first contact your local supervisor or Maintenance Engineer. If they cannot resolve the issue, then please contact MechaTech Systems Ltd.

General Sales and Service Contact Information:

MechaTech Systems Ltd
Unit 9, Brunel Way, Thornbury Industrial Estate,
Thornbury, Bristol BS35 3UR UK
Tel. +44 (0)1454 414723 Fax: +44 (0)1454 414723
Web: www.mechatechsystems.co.uk
Email: enquiries@mechatechsystems.co.uk