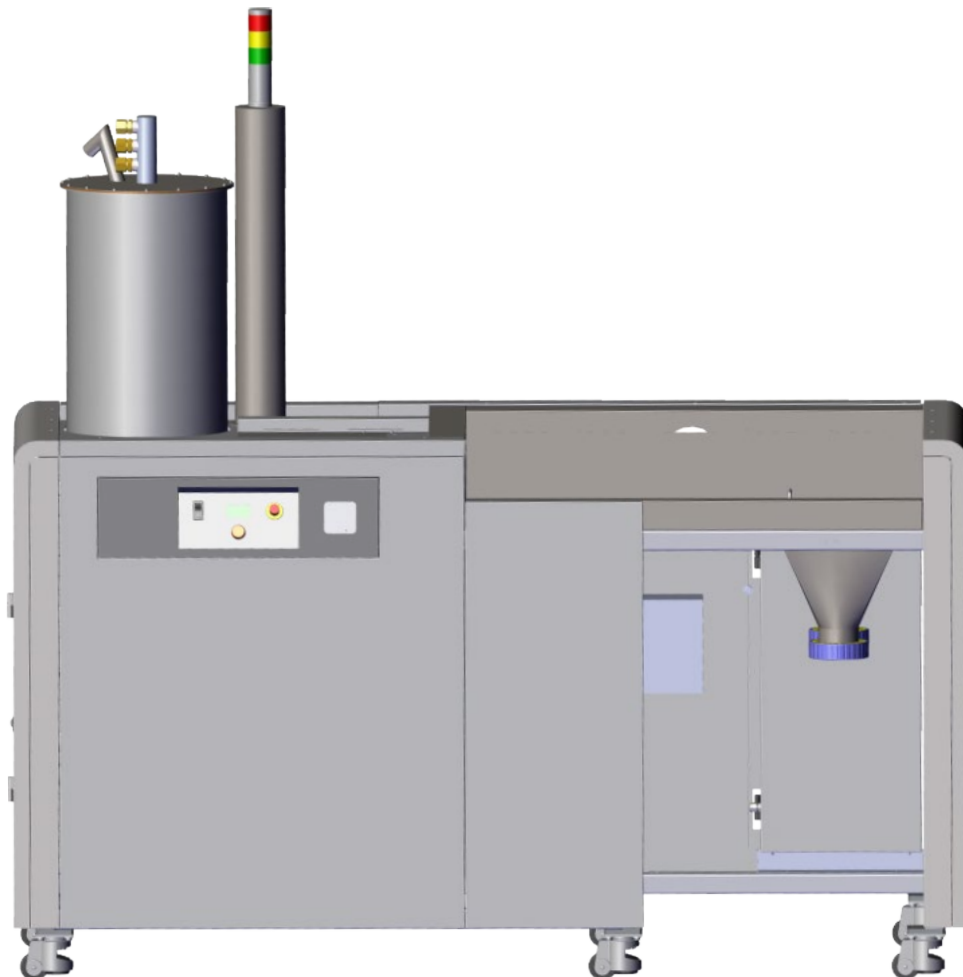


SLS SINGLE USE MQC SYSTEM

User Guide

Original Instructions



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1 INTRODUCTION

Thank you for purchasing the 3D Systems ProX™ MQS (Material Quality Control) 3D Production Printer, auxiliary SLS equipment, and 3D Systems materials! Before you start printing parts with your process facility, please read this guide carefully to enjoy optimum process performance and longer equipment service life .

ABOUT THIS GUIDE

This guide describes how to operate and maintain your ProX® Material Quality Control (MQC) System used for the SLS process . For part printing instructions, refer to the [Material Guide](#) for your specific material.

WHAT'S INSIDE?

MQC System Operations

This section details the operation of the MQC System including part breakout.

Safety Guidelines and Instructions

The Safety section tells you what you need to know to avoid injury or equipment damage. Read this section before you switch on power to any SLS equipment or handle any material.

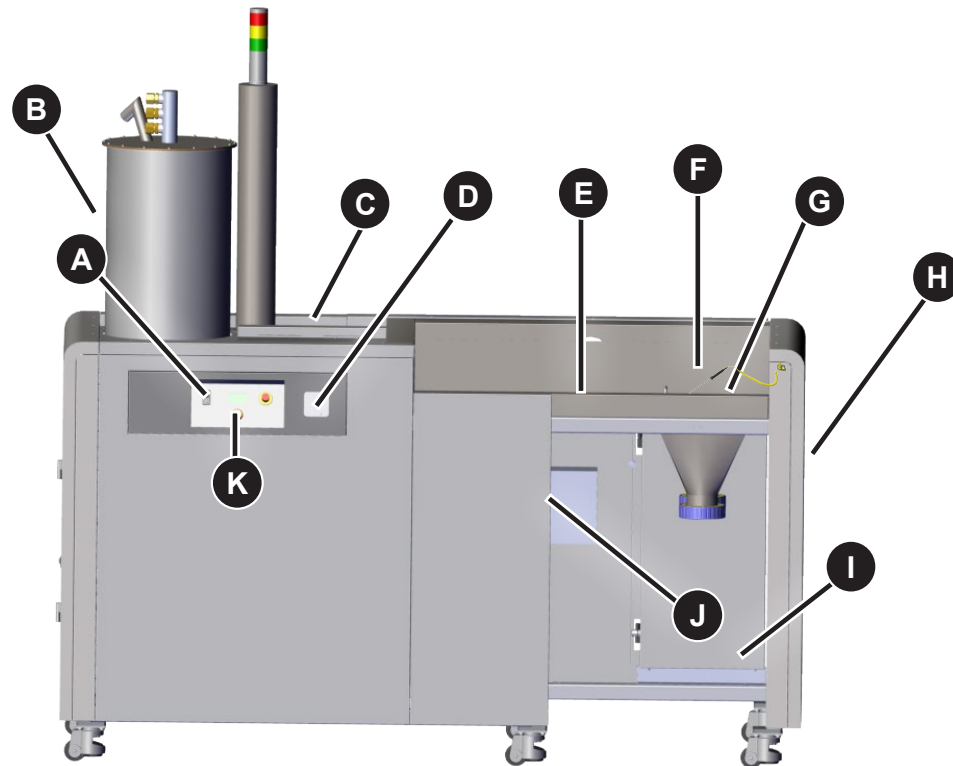
ProX® MQC Single Use System Operations

This section details the operation of the ProX® MQC System including part breakout.

2 INTRODUCTION TO THE MQC

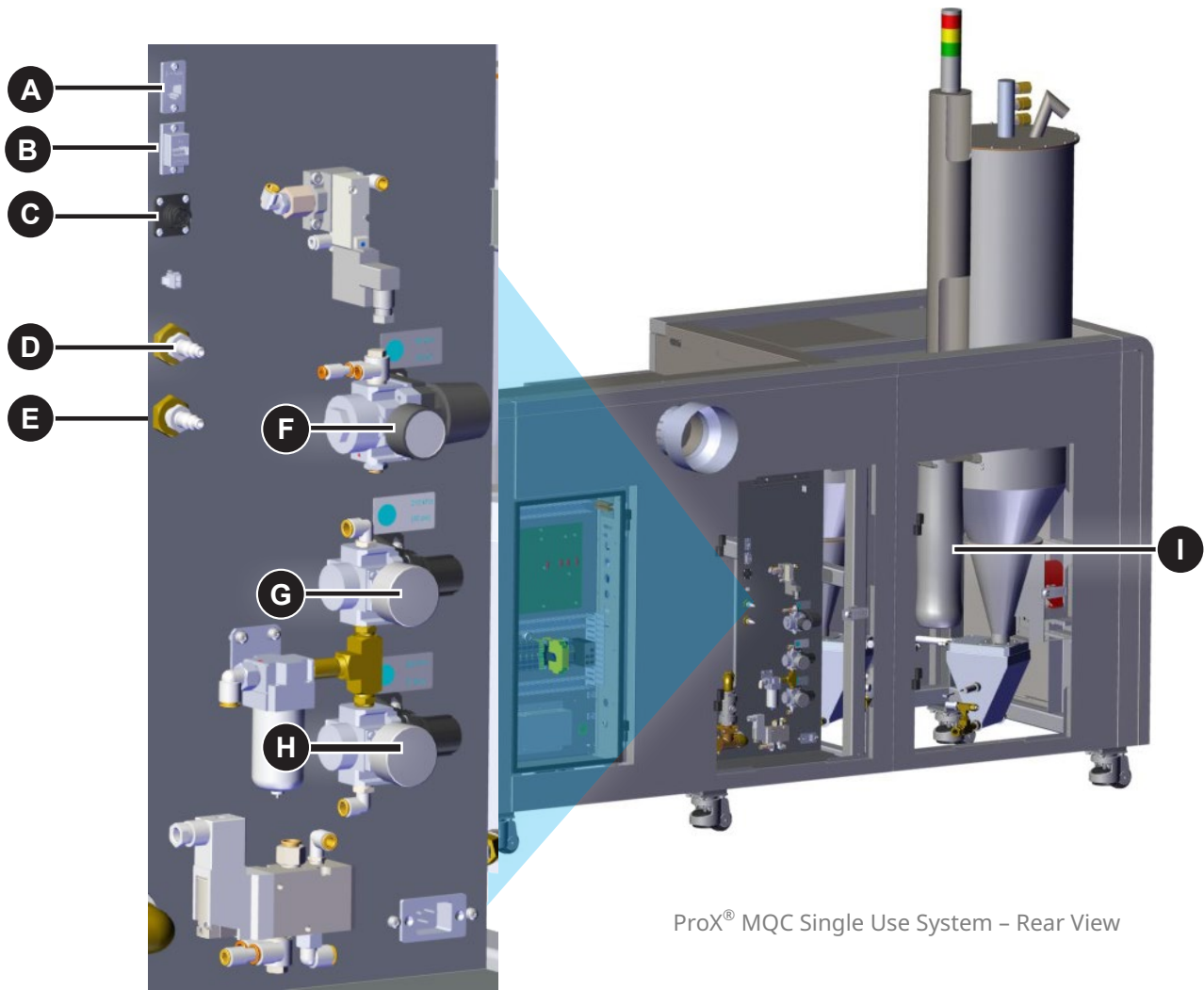
PROX® MATERIAL QUALITY CONTROL (MQC) SYSTEM

The ProX® MQC Single Use System is designed to be used as the material handling unit for the ProX® SLS 6100 SLS line of printers. It is responsible for delivering material to the printer, storing and mixing fresh and used material, and breaking out the SLS parts from the print cake which is produced by the printer.



SLS Single MQC System – Front View

- A Power Switch:** This switch enables and disables power to the ProX® MQC Single User System.
- B Blended Material Bin:** Material which is a combination of used material and fresh material is stored for production use in this hopper. The system handles this automatically.
- C Fresh Material Input:** Fresh material is loaded at this location. The user must scan the RFID tag on the container across the RFID reader.
- D RFID Reader:** The RFID reader is used to scan the RFID tag of the material container. This ensures that the system keeps track of material quantity and fresh-to-new powder ratios. The tag must be scanned to unlock the Fresh Material input doors and add the material to the system.
- E Breakout Area:** The print cake is brought here using the Print Transfer Cart Assembly.
- F Reject Chute:** Spent material (as determined by the user) is loaded into the reject chute.
- G Thermocouples:** Two temperature gauges for the print cake are used to determine whether or not the print cake has cooled sufficiently before breaking out the parts.
- H Nitrogen Blanket:** This lid is placed on top of a filled print cake cylinder to control the cooldown of the print cake using nitrogen.
- I Stowaway Area:** Underneath the breakout area, there is a space which can be used to store part extraction cylinders when they are not in use.
- J Sifter:** The user removes the parts from the print cake in the breakout area and places the material for reuse into the sifter.
- K SLS Single MQC System Operator Controls:** User interface for operation of the SLS Single MQC System.



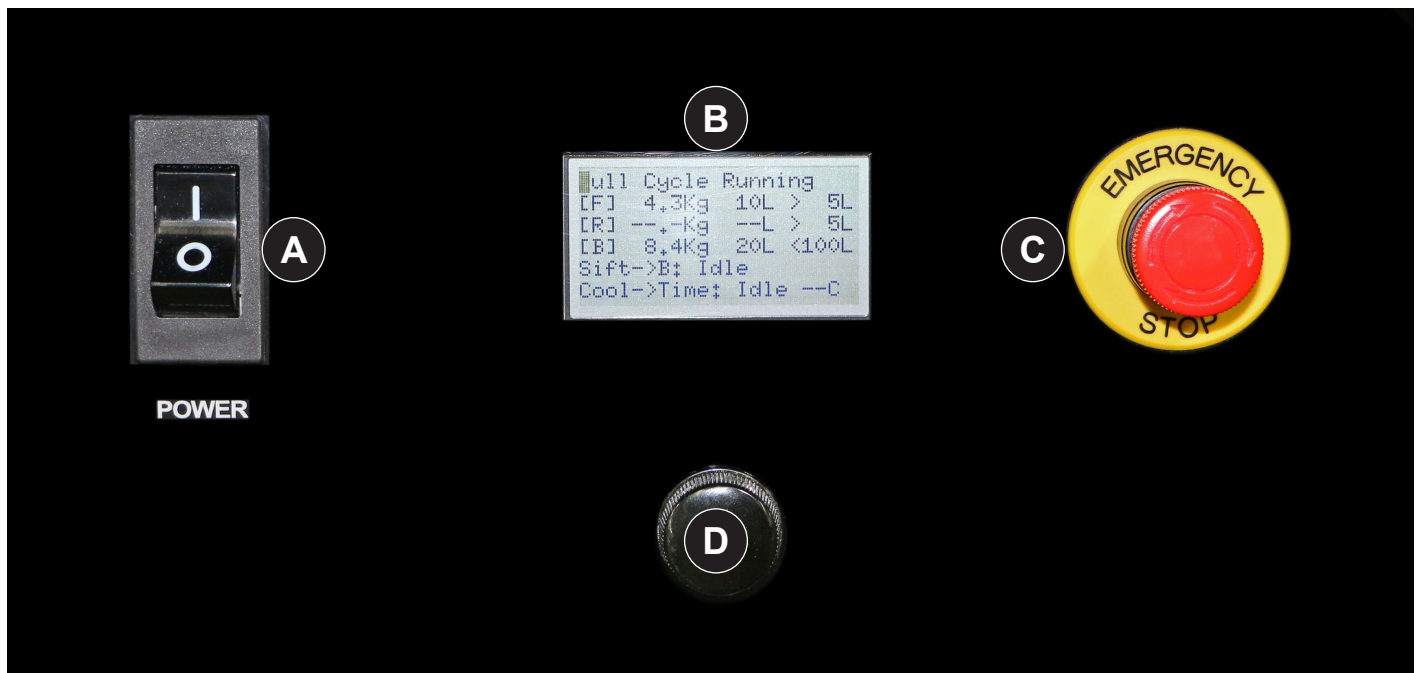
ProX® MQC Single Use System – Rear View

- A** **Ethernet Adaptor (3x):** Network connections to service 1 printer and a laptop (for service personnel only).
- B** **USB Adapter**
- C** **4-Pin Connector for Oxygen Sensor**
- D** **Nitrogen Inlet:** Input for nitrogen supply.
- E** **Quick-Disconnect Air Fitting:** Input for compressed air coming into the MQC System
- F** **Pressure Regulator (Nitrogen)**
- G** **Pressure Regulator (Air)**
- H** **Pressure Regulator (Air)**
- I** **Transport Filter:** The material filter for the ProX® MQC Single Use System.

PROX® MQC SINGLE USE SYSTEM COMPONENTS

ProX® MQC Single Use System User Interface

The User Interface, located on the front panel of the ProX® MQC Single Use System, consists of a dial-operated menu screen that allows the user to access the functionality of the system. An E-Stop control is located to the right of the screen and the system power switch is located to the left.



- A Power Switch:** This switch enables and disables power to the ProX® MQC Single Use System.
- B LED Display:** The display is operated using the Control Dial (see below). It gives the user access to all functionality of the machine.
- C Emergency Stop Button:** Depress the E-Stop button to cut off all power to the machine. This function is usually reserved for situations where the machine cannot be stopped normally.
- D Control Dial:** The user selects functions on the LED Display using this dial control.

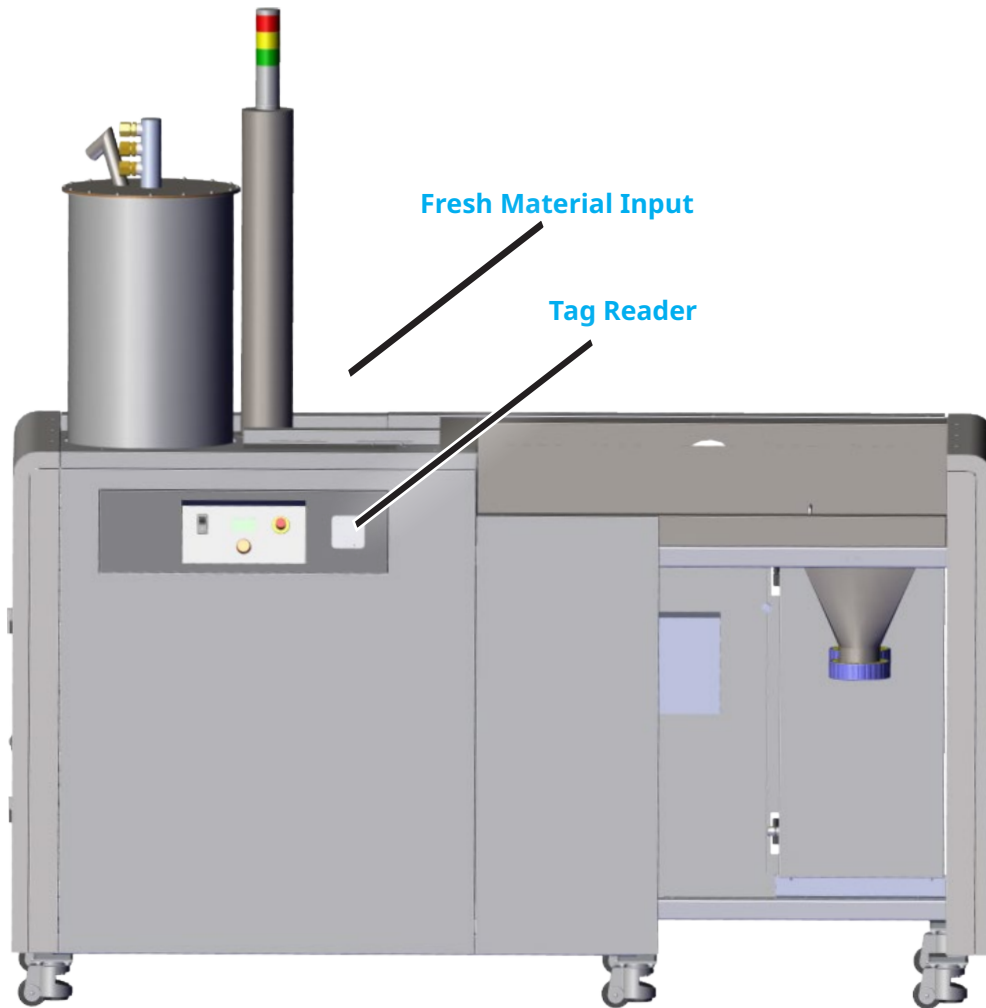
ProX® MQC Single Use System Stack Light Conditions

Light Color	Solid	Flashing	Off
Red	E-Stop condition	System fault active	Normal
Yellow	System is in service mode	System warning active and/or message present on user interface	E-Stop condition or normal
Green	System is active. Printer transports are enabled	System is active. Printer transports are disabled	E-Stop condition or normal



Fresh Material Input

The material input hatch takes fresh material from the user and feeds it to the ProX[®] MQC Single Use System. To unlock the hatch, the user must first swipe the tag of the material container across the tag reader.



3 SAFETY GUIDELINES & INSTRUCTIONS

GENERAL GUIDELINES

Before using your SLS equipment, your company should have a safety program in place. The safety program should:

- Point out hazardous equipment, materials, and procedures.
- Explain what to do in case of an emergency.
- Provide information about the hazards of the equipment and materials in the form of Safety Data Sheets (SDS). The Safety Data Sheets are provided with all materials supplied by 3D Systems.

All SLS equipment is designed with safety in mind. However, improper use, malfunctions, and excessive exposure could cause injury.

TRAINING AND INSTRUCTIONS

Follow these general safety guidelines when operating any SLS equipment:

- Do not operate any SLS equipment before receiving proper training.
- Read and follow all operating instructions.
- Follow all safety rules in this section and heed all hazard warnings in this guide.
- Do not try to perform any equipment maintenance procedures you were not trained to do.
 - **Operators** are trained to operate the system and perform all the necessary tasks to print a part.
 - **Certified service personnel** are those who have completed the 3D Systems service training package and are certified to perform service tasks. Certification may occur at various levels, and servicers should only perform tasks they are authorized and certified to complete.

MACHINE HANDLING

- Do not try to access, service, or adjust any components inside any SLS equipment enclosure.
- Do not try to open any panel or door while a machine is running.
- Do not access any area of the machine near the print chamber during printing.
- Use special caution when handling a heated print cake and when dealing with the heated, inert environment inside the SLS system's print chamber. Take note of all thermal hazard warning labels on the machines.
- Secure electrical cables and coolant hoses to prevent tripping.

MATERIAL HANDLING

- Do not use any material without first reviewing its Safety Data Sheet (SDS).
- To prevent injury and equipment damage, be sure to follow all handling guidelines detailed in the appropriate **Material Guide**.

ALARMS AND WARNINGS

- If you see an error, alarm, or warning message on any SLS equipment display, note the state of that machine's stack light. Clear the alarm, error, or warning message before resuming operation.
- Displayed error, alarm, or warning messages can result from unsafe practices, such as opening an enclosure door or panel when equipment is powered up and running.

SAFETY SYMBOLS AND DEFINITIONS

The following safety labels are posted at various points on the machine to indicate potentially hazardous conditions:



HOT SURFACES HAZARD: There are surfaces and materials in the vicinity that may be hot and could cause severe burns.



ELECTRIC SHOCK HAZARD: High voltage electricity is accessible in the vicinity of this sign or behind the access panel. High voltage can cause severe burns or death. Access panels are for service only and should be opened only by certified service personnel or trained maintenance personnel.



CAUTION: Indicates something may happen that could cause loss of data, damage to equipment, or personal injury.

FIRST AID SECTION – WHAT TO DO



In the case of an accident while using any SLS equipment, seek medical attention immediately. Use the following guidelines for specific safety instances.

Burns

This equipment contains high temperatures and burning laser radiation which could cause 2nd degree burns. Do not attempt to remove any protective panels. There are no user serviceable parts inside.

If a burn occurs, seek first aid and immediate medical attention. Pushing the E-stop button will de-energize the equipment and diffuse the hazardous situation.

Electrocution

The SLS system contains equipment energized at 208 volts, 3-phase delta. Do not attempt to remove protective panels. There are no user serviceable parts inside.

If electrocution occurs, seek first aid and medical attention immediately. Pushing the E-stop button will de-energize the equipment and diffuse the hazardous situation.

Material Inhalation

The part cleaning process may create a choking or air restriction hazard. If someone has difficulty breathing or a “loss of breath” sensation, transport the person to a well-ventilated room or outside of the facility. If the condition persists, seek immediate medical attention.

SLS EQUIPMENT SAFETY FEATURES

A major design goal for all SLS equipment is to provide a safe operating environment. The frame and enclosure designs passively limit hazardous access while the electronics and software actively and automatically sense and react to unsafe conditions when they arise. For example, if the SLS system detects unsafe operating conditions, it will immediately stop operating and, in some cases, shut down completely.



CAUTION: If any SLS equipment safety features fail, your actions may be all that will prevent potentially hazardous operating conditions.

Safety Interlocks

Safety interlock devices on the SLS equipment help prevent accidental laser exposure, electrical shocks, crush injuries, burns, and fires. SLS equipment will not operate unless all safety interlocks are satisfied.



CAUTION: Never try to disable or override any safety interlock device on any SLS equipment. Operating equipment without all safety interlocks enabled can cause equipment damage, injury, or death. If you suspect a safety interlock device is not working properly, do not operate your SLS equipment. Rather, disconnect power from the equipment and contact 3D Systems Customer Support for assistance.

a. Internal panels are for service access only. Several interlocked panels are for customer maintenance: overflow cleanout, blackbody cleaning port, and the filter box located on back of machine.

Limited Access and Barrier Shielding

SLS equipment frame and enclosure designs limit access to the following:

- **Service areas**, such as cabinets and enclosures for electrical power and automation controls. This prevents accidental exposure to electrical shock hazards.
- **Material areas**, such as material feed hoppers, storage bins, and transport tubes. This prevents:
 - burn hazards by minimizing exposure to heated material
 - slip hazards by keeping material from dropping on the floor
 - fire hazards by minimizing airborne dust cloud formation and potential ignition. See SDS for complete material hazard details.

Other Active Safety Features

- The ProX[®] MQC Single Use System, coupled with the **Dust Collector**, removes airborne material during part breakout in accordance with standard industrial ventilation practices.
- An optional room oxygen monitor automatically initiates SLS system shutdown when it detects too little oxygen in the room.
- Software in the SLS system automatically initiates immediate equipment shutdown if certain unsafe conditions are detected during operation.

ELECTRICAL SAFETY

To prevent electrical shock, SLS equipment will not operate unless all external panels are installed and all electrical safety interlock circuits are closed.



ELECTRICAL HAZARD: Hazardous voltage exists inside the enclosures of all SLS equipment. Injury or death from electrical shock can result if you remove external panels or try to defeat safety interlocks. Panels should only be removed, and interlocks should only be defeated, by trained and certified 3D Systems Customer Support personnel.



ELECTRICAL HAZARD: Verify your facility's electrical service ratings before connecting power to any SLS equipment. Power must only be connected by a certified electrician.



ELECTRICAL HAZARD: Do not open the panel behind disconnect switch! Live voltage present. This should only be opened by qualified personnel after power is disconnected from the facility's power circuit/breaker panel.

All SLS equipment was designed to minimize operator exposure to electrical hazards during normal operations. All exposed electrical circuits are inside limited-access cabinets. This is to separate the operator from service and maintenance areas.

When operating any SLS equipment, keep the following electrical safety points in mind:

- Only 3D Systems certified service personnel should operate SLS equipment with access panels or service doors open.
- Heed high voltage warning signs and labels.
- Take common-sense safety precautions when operating any electrical equipment.
- After any change to the electrical wiring, make sure the equipment is properly grounded.

ENVIRONMENTAL ISSUES

The SLS system emits no toxic substances when using materials approved by 3D Systems.

Emissions

Material heating – Analytical testing on 3D Systems materials indicates no detectable emissions outside acceptable limits from the SLS system. (See the materials' SDS.)

Nitrogen – The SLS system uses nitrogen, which is passively vented in the print chamber.



NOTE: Do not install a fan in the exhaust port. The exhaust port in the print chamber must not be blocked. The nitrogen-inert atmosphere in the SLS system print chamber is at higher pressure than the outside atmosphere. The chamber will vent without a fan. Installing a fan in the exhaust port will draw nitrogen-rich air out of the print chamber too fast, raising the oxygen concentration in the chamber. This can keep the SLS system from reaching inert status, or cause an in-process print to abort.

Material Disposal

Refer to the DuraForm ProX® material SDS for disposal information. Follow any applicable local regulations.

MATERIAL SAFETY

All materials certified by 3D Systems are safe during normal operation. However, you should be aware of the following issues:

- Any material, material-like substance, or airborne cloud of material has a remote chance of rapid combustion.
- Breathing some materials may cause certain people to experience respiratory irritation.
- Material safety hazards are minimized by good industrial housekeeping and ventilation practices.
- Spilled material can cause the floor to become very slippery.
- Material should be sifted in a well-ventilated room.

Refer to the SDS's and to 3D Systems material guides for information on specific materials.



CAUTION: Using materials that have not been certified for use in the SLS equipment may cause health or safety hazards and may damage the equipment and void the warranty.

Material Ignition Information

Powdered materials can be flammable and can be ignited by static electricity in a non-inert environment. Refer to each material's SDS for specific information.



CAUTION: The operator must use an approved vacuum cleaner to clean up excess material. 3D Systems recommends an ESD or explosion-proof model. Contact 3D Systems Customer Service for purchasing options.

Finding Material Safety Information

Use the Material Safety Information table to locate references and contacts for information on important material safety topics. Also check the SDS of the material used for the specific precautions to be observed.

Material Safety Information

TOPIC	REFERENCE / CONTACT		
Standard industrial ventilation practices	US: American Conference of Governmental Hygienists, Committee on Industrial Ventilation Europe: Maximale Arbeitsplatz Konzentration, January 1990		
Housecleaning and prevention of accumulation of explosive dust concentrations	US: NFPA 654: Standard for the Prevention of Dust Explosions in the Plastics Industry; National Fire Protection Association, Volume 5 of the National Fire Codes Europe: Maximale Arbeitsplatz Konzentration, January 1990		
Material exposure	US: Code of Federal Regulations, 29 CFR, section 1900.1000, available from Superintendent of Documents, Government Printing Office, Washington, D.C. 20402 Europe: DIN EN 26184 Teil 1 /06.91		
Specific materials	Material Safety Data Sheets (MSDS) from 3D Systems, Inc.		
	US/Canada:		Europe:
	Mfgr. Contact:	3D Systems Corporation 333 Three D Systems Circle Rock Hill, SC 29730 USA	3D Systems GmbH Guerickeweg 9 D-64291 Darmstadt, Germany
	Information	Phone: 803.326.3900 or Toll-free: 800.739.3669	Phone: (+49) 6151 357-0
	Emergency	1.800.262.8200 - Chemtrec	1.703.741.56100 - Chemtrec (U.S.)

Material Handling Precautions

During normal operation of the SLS system using 3D Systems' materials, you are not required to wear a dust mask or special personal protection equipment unless specifically designated. Check the SDS of the material used for the specific precautions you should observe. Use the following table of precautions as a general guide:

Safe Material Handling Guidelines

CATEGORY	PRECAUTION
FIRE/HEAT	<ul style="list-style-type: none"> Never smoke or ignite anything around powdered materials. Maintain proper clearance from materials when using portable heating devices. Store flammable liquids away from materials. After removing a part from the print chamber, allow it to cool to room temperature in a well-ventilated area. Use anti-static mats in front of SLS equipment.
INHALATION	<ul style="list-style-type: none"> Avoid breathing powdered materials; when exposure to dust or fumes is likely, wear a NIOSH-approved respirator appropriate to the airborne concentration. Always provide adequate ventilation.
SHOP SAFETY	<ul style="list-style-type: none"> Train operators in SLS system procedures. Wear safety glasses. Use extreme care with all heated materials. Make sure that the room is well ventilated.
AVOIDING SPILLS	<ul style="list-style-type: none"> Keep containers closed when not in use. Have a fully-grounded internal non-ignition vacuum cleaner ready to use. Have any equipment specified in the SDS ready to use.
SDS	<ul style="list-style-type: none"> Give operators access to the SDS's that apply to materials they will be handling and ensure that they read them. If necessary, translate them. File SDS's in an easily accessible location for immediate reference. Strictly follow all the conditions in each SDS.

NITROGEN/OXYGEN SAFETY

The SLS system uses nitrogen to create an inert atmosphere in the print chamber. The nitrogen inhibits any potential rapid combustion of particulate matter during the SLS process.

The oxygen content of air is approximately 21 percent. Displacement of the normal atmosphere with an inert gas, such as nitrogen, can reduce the oxygen content in a room. In the remote chance that nitrogen leaks into the room during the sintering process, the situation can be hazardous.

Your site must have an oxygen alarm monitor installed in the room containing the SLS system. This monitor will alert you if the oxygen level drops below a designated point. It must be wired to trigger an immediate shutdown of the SLS system and nitrogen generator (if in use).



CAUTION: Exposure to an atmosphere containing 12 percent or less oxygen causes unconsciousness without any warning symptoms. This happens so quickly that you cannot help or protect yourself.

The table of [Oxygen Deprivation Effects and Symptoms](#) explains the potential effects and symptoms that can occur at different concentrations of oxygen in the atmosphere.

When you work in an environment that may become oxygen-deficient, make sure you comply with the following items:

- If, at any time, you feel you are experiencing symptoms of oxygen deprivation, leave the area immediately.
- You have received oxygen/nitrogen safety training.
- The room is well-ventilated; at least 4 air exchanges per hour.
- Self-contained breathing apparatus is available and easily accessible.
- The room oxygen alarm monitor is functioning and audible.
- Leave the SLS system room/area immediately when you hear the oxygen alarm.

Oxygen Deprivation Effects and Symptoms

OXYGEN CONTENT (% BY VOLUME)	EFFECTS AND SYMPTOMS AT ATMOSPHERIC PRESSURE ^a
15 – 19 %	Decreased ability to work strenuously. May impair your coordination or may induce early symptoms in persons with coronary, pulmonary, or circulatory problems.
12 – 14 %	Increases respiration during exertion. Pulse rate goes up. May experience impaired coordination, perception, and judgment.
10 – 12 %	Respiration continues to increase in rate and depth. Lips become blue. May lose consciousness at this point.
8 – 10 %	Mental failure. Fainting and unconsciousness. Face becomes ashen, lips become blue. Nausea and vomiting may occur.
6 – 8 %	100% fatal after 8 minutes of exposure. 50% fatal within 6 minutes. Recovery with treatment within 4 to 5 minutes.
4 – 6 %	Coma within 40 seconds; convulsions, respiration ceases, death occurs.

a. From Safety Bulletin SB-2 - 1983—"1983 by the Compressed Gas Association, Inc. 1235 Jefferson Davis Highway, Arlington, VA 22202

4 PROX® MQC SINGLE USE SYSTEM OPERATIONS

Follow the instructions in this section to use ProX® MQC Single Use System safely. The instructions tell you how to load fresh material, blend material, and breakout parts from the print cake.

HOW THE PROX® MQC SINGLE USE SYSTEM WORKS

The ProX MQC Single Use System regulates the material usage for the ProX® SLS 6100. It stores and mixes fresh, blended, and recycled powder and can supply material for one ProX® SLS 6100 printer. The printer sends a separate refill request to the ProX® MQC Single Use System when its feed hopper is low.

Receiving and Storing Material

Fresh material and blended material are stored in separate bins on the ProX® MQC Single Use System. Recycled powder is reclaimed through the sifter. To feed recycled material into the system, the Sifter Switch must be turned on during breakout.

Fresh bin - receives and stores fresh material input by the user. The fresh material is loaded from the material containers. The container's tag (on top of the lid) must be scanned by the reader on the interface of the ProX® MQC Single Use System before it can be fed into the system.

Blended bin - receives, blends, and stores material from the sifter and fresh bin for use in the printer.

Blending and Sending Material

The ProX MQC Single Use System automatically initiates a blend cycle when the sifter is activated. The amount of recycled and fresh powder required for a blend depends upon the blend ratio



NOTE: A load cell under the bin read the material weight and level. Do not place objects on top of the bin. This will give an incorrect reading of the material weight.

BASIC OPERATIONS

Turning on the ProX® MQC Single Use System:

3D Systems designed the ProX® MQC Single Use System to remain with the power on at all times. You seldom need to power-up the machine. If you ever find the power off, this subsection describes how to turn on the system.

1. Make sure the facility power to the system is turned on.
2. Turn on the dust collector by pressing the power switch.
3. On the user interface, flip the power switch to the ON position.




Power Switch

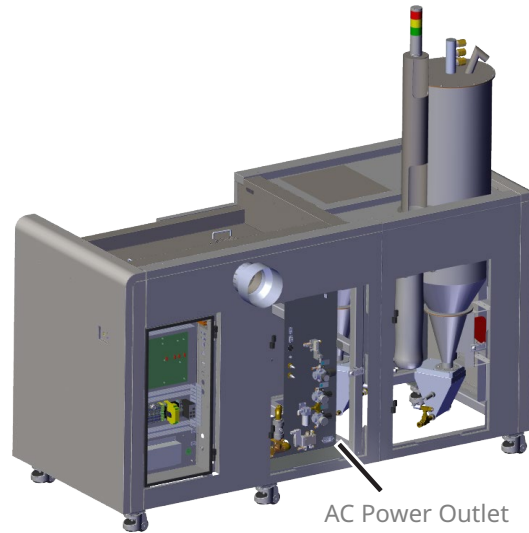
Shutting Down the ProX® MQC Single Use System Completely

3D Systems designed the ProX® MQC Single Use System to remain with the power on at all times. You seldom need to power-down the system, unless:

- You are shutting down the entire system.
- The system requires service.
- The system loses facility power and does not regain it immediately.
- The system will be idle over an extended period of time.

To turn the system off,

1. Check the ProX® MQC Single Use System user interface screen to see what mode it is in.
2. If the cycle is stopped, skip the next step.
3. If the cycle is in **Full** or **Local** mode, navigate to the **Operation Mode** menu, and select **"Stop Cycle."**
4. Navigate to the **Setup/Service** menu and then the **Setup** submenu. Select **"System Shutdown"**.
5. At the operator panel, turn the power switch off.
6. Go to the back side of the ProX® MQC System and open the reject powder door.
7. Pull out the power plug from the AC inlet.  **WARNING (for ATEX): Use socket cap when unplugged.**



Cleaning the ProX® MQC Single Use System Before Breakout

Follow these procedures to clean the system before you print parts with your ProX® SLS 6100 printer.

1. Debris and loose powder from the ProX® MQC Single Use System can be cleaned using a non-ignition vacuum cleaner.
2. A clean, dry cloth can be used to wipe off excess material from any area of the machine where it is present.

Verifying Material Quantity

The approximate amount of powder required for a print job can be found using 3D Sprint Estimate menu.

To verify that there is sufficient material for the print job, you can use either of the two following methods:

1. In **Sinter**, check the **ProX® MQC Single Use window** in the **Man Ops** screen. This displays the MQC Single Use System's status, including the amount of available powder.
2. Check the **ProX® MQC Single Use status** in the **Sinter Status** window which also displays the amount of available powder.

REMOVING THE PRINT CAKE FROM THE PRINT CHAMBER

The print cake can be removed from the print chamber either before or after it has finished cooling.



CAUTION: Do not begin breakout of the parts from the print cake until the cooldown stage is complete. The temperature must be no higher than 85 °C. The print cake can remain extremely hot for hours after a build. To prevent burns, allow sufficient time for cool down (up to 24 hours without the nitrogen lid) before removing parts from the print cake. The temperature of the print cake can be tested using the thermocouples in the breakout area of the ProX® MQC system.

Where to Cool Down the Print Cake

If you cool down the print cake inside the print chamber, wait until the print cake reaches its final cooldown temperature of no more than 85 °C. If you choose to let the print cake cool down outside the print chamber, you can take it to the MQC Single Use System and either let it cool down normally or use the nitrogen lid on the side of the MQC Single Use System.

To use the nitrogen lid, do the following:

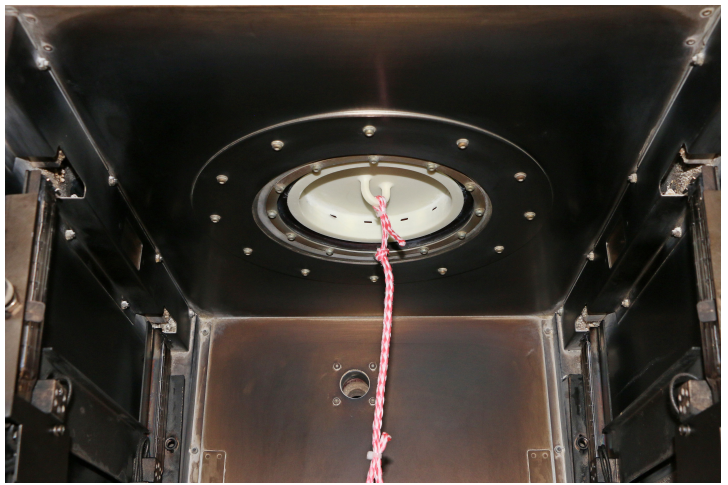
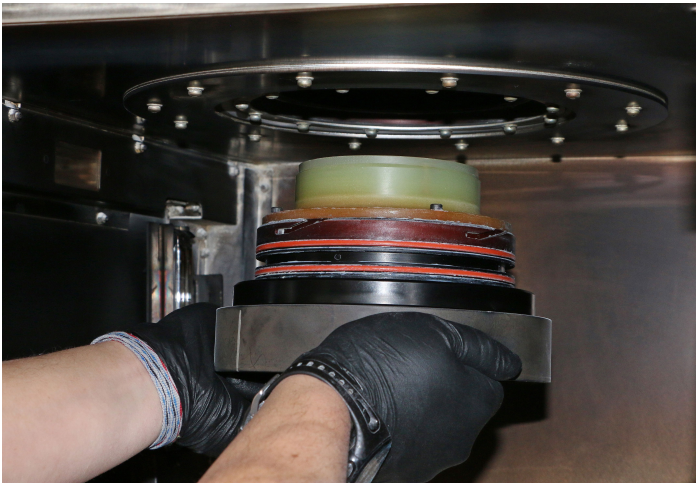
- Immediately after placing the hot print cake in the breakout area of the MQC Single Use System, place the nitrogen lid onto the print cake cylinder. Then...
 - use the lid to do a controlled cooldown for a programmed amount of time (the default is 3 hours), or until a programmed temperature is reached.
 - let the print cake cool down without the nitrogen flow.

Unloading the Print Cake After a Print

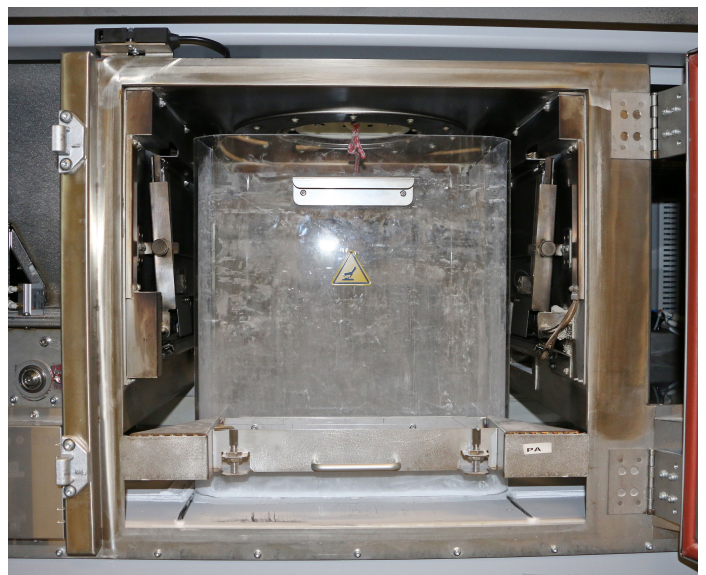
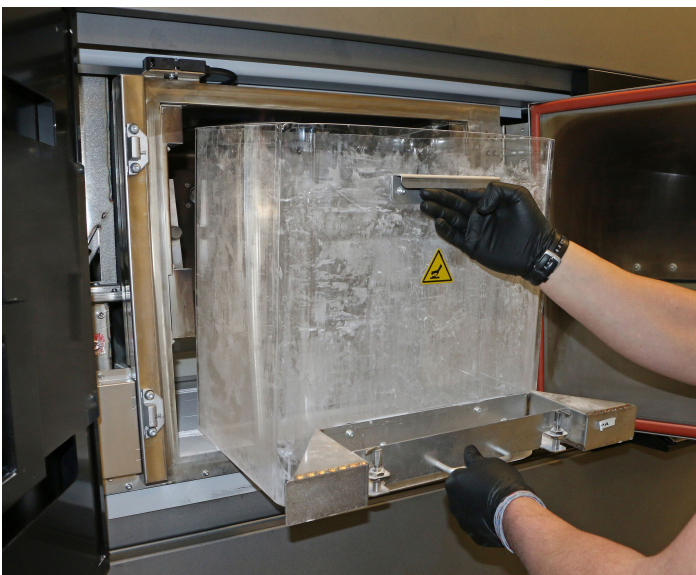
After a print and before part breakout, you must remove the print cake from the print chamber and transport it to the ProX® MQC Single Use System.

To remove the print cake:

1. Turn off the chamber lights.
2. Open the outer door of the print chamber.
3. Unlatch and open the inner print chamber door.
4. Raise heaters.
5. Remove the Laser Window by turning it counterclockwise ¼-turn and pulling it out of the top of the chamber. Put it in a safe, clean location and clean it before reinstalling it into the print chamber.
6. Press the Laser Window Baffle Plug into the top of the chamber (see photo).



7. With the handle facing towards you, fully insert the print cake cylinder into the print chamber, placing it over the print bed.

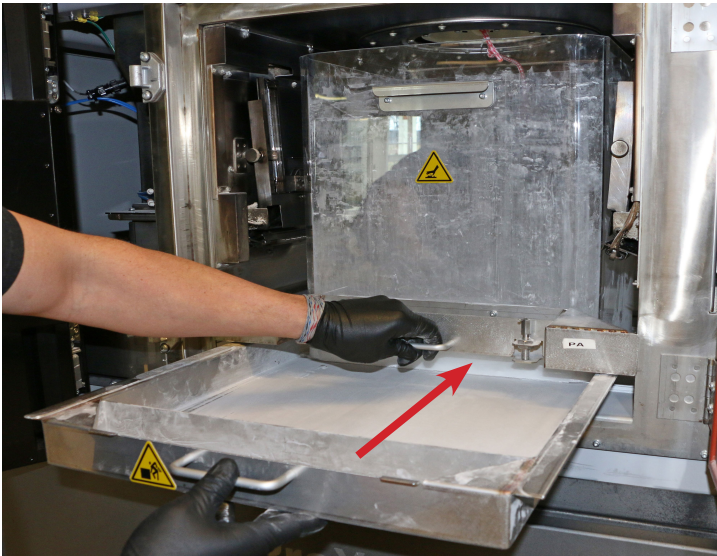


Full insert print cake cylinder into chamber

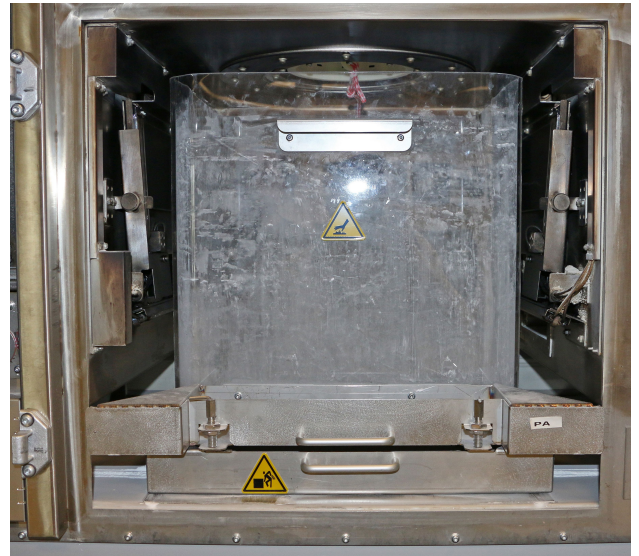


Make sure the outer tabs of the cylinder catch on the rim of the print chamber door.

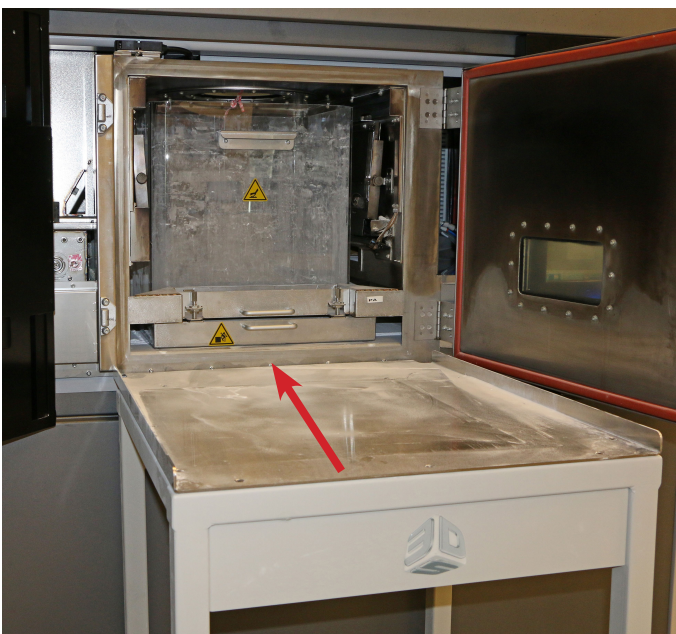
8. Close and latch the inner print chamber door.
9. Close the outer print chamber door.
10. In Build Setup, open the Piston Control and press the Start Piston button to raise the print cake into the cylinder.
11. Once the piston has finished raising the print cake, open the outer and inner print chamber doors.
12. Slide the Print Cake Tray underneath the cylinder, as shown, and latch the tray with the pull pins on the cylinder.



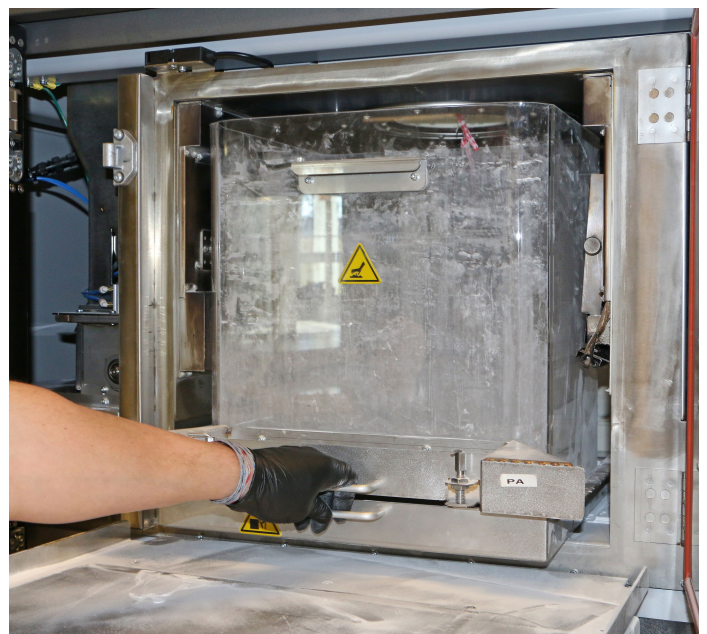
Slide print cake tray underneath cylinder



13. If the print cake is light enough, it can be moved manually to the ProX[®] MQC Single Use System. Otherwise, use the Part Transfer Cart.
14. Move and align the cart to the print chamber.



Align cart with print chamber

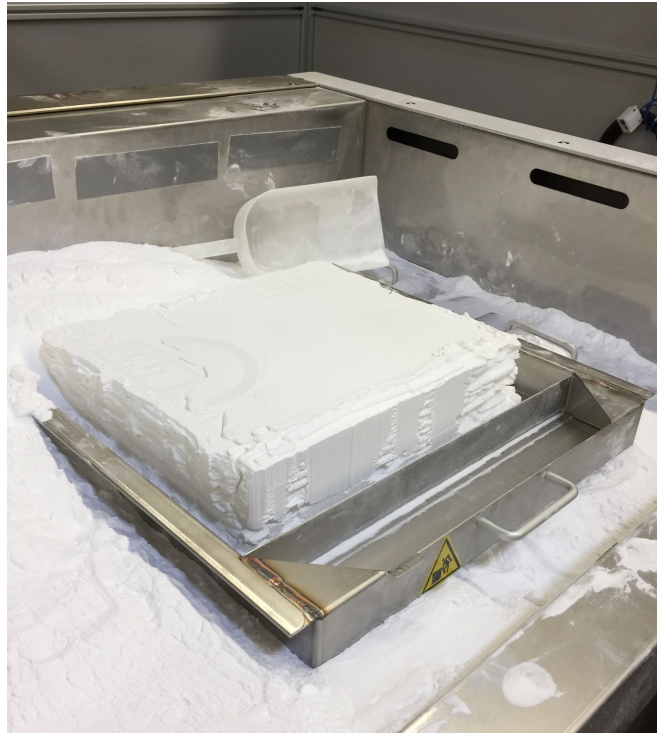


Slide tray and cylinder onto cart

15. Slide the cylinder and tray out of the chamber and onto the cart.
16. Move the transfer cart to the MQC System.

BREAKING OUT PARTS

When a print completes, you need to remove the sintered parts from the print cake and clean them. Removing parts from the print cake is called “breakout.” This section describes the procedures you follow when you break out parts.



NOTE: You can find material-specific information about breaking out and cleaning parts in your Material Guide.

Before breakout, you must:

- Cool down the print cake then remove the part transfer cylinder from the print chamber—or vice-versa.
- Roll the part transfer cart to the ProX[®] MQC Single Use System and unload the print cylinder onto the breakout area.
- Remove the print cylinder.
- Remove the surrounding powder from the outline of the parts with a spatula and brush. Ensure the sifter is running, then brush unsintered print cake powder into the sifter.
- When you can easily grasp a part, carefully lift it. Gently brush off the parts and place them on the breakout area of the ProX[®] MQC Single Use System.

Part Finishing After Breakout



NOTE: Consult your Material Guide for full details on part finishing.

After breakout, remove and dispose of any remaining print cake material from holes and crevices.

Your SLS system ships with a basic set of rough and fine part cleaning tools. You may find it useful to supplement these with other fine tools, picks, and brushes, such as those used for dental and jewelry work.

3D Systems recommends you also purchase a glass bead blaster (pneumatic blast cabinet). A bead blaster makes fine cleaning much easier and faster. See your [Facility Guide](#) for specifications.

Operational Mode Screen

From the **Main Control Screen**, use the dial to highlight the menu item, **Operational mode** and press the dial to select.

This menu allows the user to choose the mode of material handling for the ProX MQC Single Use System.

- **Full Cycle** will allow the ProX MQC Single Use System and printer to control all material handling in fully-automatic mode.
- **Local Cycle** is the same as Full Cycle, except that all printer powder requests are ignored by the ProX MQC Single Use System.
- Choose **Stop Cycle** to turn material handling off.

Main Control

- > Operational mode
- + Load fresh powder
- + Start/stop cool cycle
 - > Setup/Service/Diag
 - + Activate Svc mode
 - Deactivate Svc mode

Operational mode

- + Run Full cycle
- + Run Local Cycle
- + Stop Cycle

System Setup/Service Screen

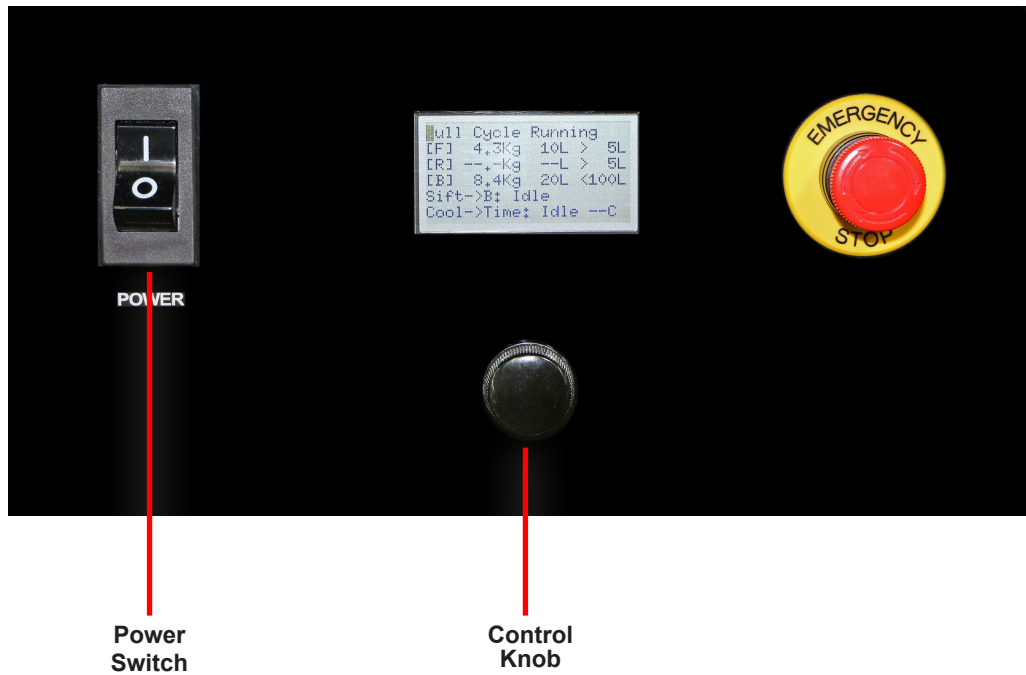
From the **Main Control Screen**, use the dial to highlight the menu item **Setup/service**, and press the dial to select. The **Service** option is for Certified Personnel only and not available to the user.

From this screen, you can:

- Navigate to the **Diagnostics** screen.
- Navigate to the **Setup** screen.
- Navigate to the **Service** screen. This is available to certified personnel only.
- View the **Version information** for the software installed on the ProX MQC Single Use System.

System setup/service

- > Diagnostics
- > Setup
- > Service
- + Version info



PROX MQC SINGLE USE SYSTEM USER INTERFACE SETTINGS

Display Legend

The following information is applicable to all LED Display menu items:

LEGEND

- > Submenu - rotate knob to highlight and select submenu, press knob to enter.
- + Command - press button to start action or edit value.
- (or no symbol) - Output or unavailable command, does not respond to the knob.
- > BACK - Rotate knob to highlight and select, press knob to return to previous menu.

Rotate the knob to switch between items.

Press and hold the knob down to return to **Main Status** screen.

ProX MQC Single Use System Main Status Screen

The **Main Control** screen allows the user to:

- Displays the current operational mode and other status information.
- Shows amount of powder in MQC Single Use System bins (Kg and Liters) and the amount of powder required to begin a powder blend.
 - F - Fresh powder bin
 - B - Blended powder bin
- Sifter status
- Cooling lid status

In opposite screen:

- There are 10 liters in fresh bin
- There are 20 liters in blended powder bin
- The ProX MQC Single Use System will not start another blend cycle unless:
 - The fresh bin level is greater than 5 liters
 - The blended bin level is less than 100 liters
 - There is more than 5 liters of reclaimed powder available. (reclaimed through the sifter from completed print jobs)
- The sifter is idle and but if in use the output would be directed to Blended bin
- The cooling lid is idle but if in use N2 flow duration would be controlled by time

```
Full Cycle Running
[F] 4.3Kg 10L > 5L
[R] --,-Kg --L > 5L
[B] 8.4Kg 20L <100L
Sift->B: Idle
Cool->Time: Idle --C
```

The amount of Fresh and reclaimed powder required to start a blend is based on the current current replenish percentage. If 50%, then equal amounts of powder are required. The screen above shows that for a replenish rate of 50% a minimum of 5 liters of Fresh and reclaimed powder is required.

First line display may change based on MQC current status:

- F B -> B indicates Full Cycle mode and Blended Bin recirculation
- Other possible status messages:
 - B -> PA Blended bin transporting to Printer A

```
F B->B
[F] 4.3Kg 10L > 5L
[R] --,-Kg --L > 5L
[B] 8.4Kg 20L <100L
Sift->B: Idle
Cool->Time: Idle --C
```

```
B->PA
[F] 4.3Kg 10L > 5L
[R] --,-Kg --L > 5L
[B] 8.4Kg 20L <100L
Sift->B: Idle
Cool->Time: Idle --C
```



NOTE: To toggle from Status screen to Main Control screen, quickly press and release control knob.

ProX MQC Single Use System Main Control Screen

- The **Main Control Screen** allows the user to:
- Navigate to the **Operational Mode** screen.
- **Load Fresh Powder** into the system (To do this the user must first scan the material RFID tag on the lid of the material container across the RFID reader on the front panel of the MQC Single Use system. This will unlock the fresh bin access doors. The RFID tag material type must match the material type currently in MQC Single Use System.
- **Start Cool Cycle** - Start the N2 flow to the Nitrogen lid (duration controlled either by temperature or time)
- **Change Sifter Mode** - allows user to select destination of the output from the sifter (reclaimed bin or external barrel or drum)
- **Setup/Service/Diag** - Navigate to submenu. (only the Setup screen is available to general users. Service and Diag screens are only for use by 3D Systems Certified Technicians)
- **Activate Service** - Service RFID tag required
- **Clear Weight Error** - usage by operator for a clear bin weight tag to clear a bin weight error

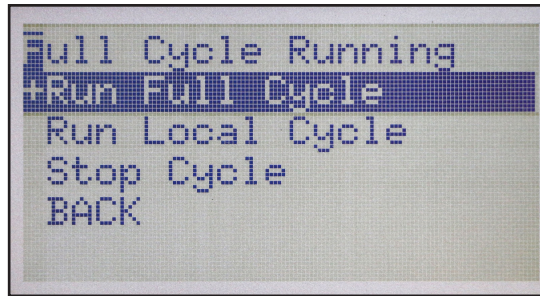
```
Full Cycle Running
>Operational Mode
Load Fresh Powder
Start Cool Cycle
Start Blend
Setup/Service/Diag
```

```
Full Cycle Running
Start Cool Cycle
Start Blend
>Setup/Service/Diag
Activate Service
Clear Weight Error
```

Operational Mode Screen

On the Main Control Screen, rotate the button to highlight Operational Mode.

Quickly press and release knob to display the following screen:



Full Cycle allows the ProX MQC Single Use System to operate in a fully automatic mode.

- The ProX MQC Single Use System will send powder to requesting printer if blended powder is available.
- The ProX MQC Single Use System will blend powder if adequate powder is available in the fresh bin.
- The ProX MQC Single Use System will periodically recirculate the powder in the blended bins.

Local Cycle will allow the ProX MQC Single Use System to operate the same way as Full Cycle mode except that all printer requests for powder are ignored by the ProX MQC Single Use System.

Stop Cycle prevents the ProX MQC Single Use System from blending powder, recirculating powder in Fresh and Reclaimed bins or responding to printer requests for powder.

User should select **Stop Cycle** to:

- Load Fresh Powder
- Enter Setup submenu to:
 - Change replenish percentage for blending
 - Change sifter timeout

To Load Fresh Powder

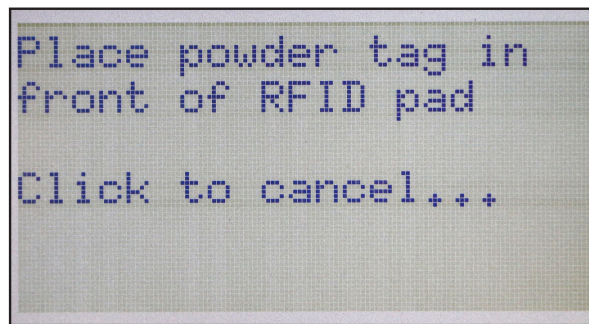
1. After **Stop Cycle** is selected, quickly press and release knob to display the following screen.



2. Rotate knob to select **Load Fresh Powder**.



Quickly press and release knob to display the following screen:



4. Remove lid from powder container. Place the lid against the RFID pad and hold there until you hear the doors to the fresh powder bin unlock.

5. Turn on ProX MQC Single Use System air handler. Open Fresh Bin doors and empty the powder container into Fresh bin, then close doors. You should hear doors relock.



NOTE: If loading multiple powder containers, you must close and lock the Fresh Bin doors between each container.

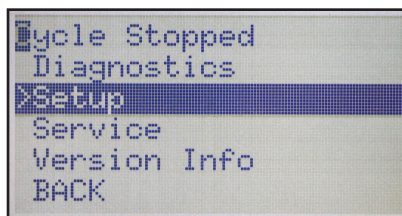
6. When finished with loading powder into the Fresh Bin, return ProX MQC Single Use System to Full Cycle mode to blend powder or continue in Stop mode if you wish to change Replenish percentage or make any other changes to the setup parameters.

To change Replenish percentage:

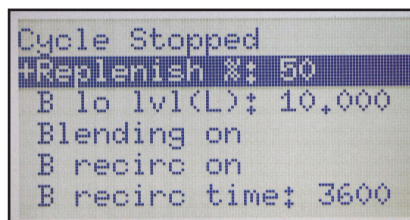
1. Quickly press and release knob to display the following screen:



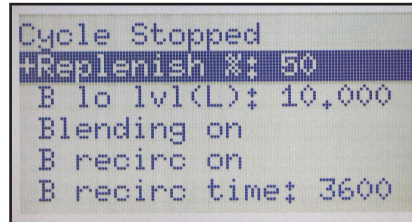
2. Rotate control knob to select **Service/Service/Diag** and quickly press and release knob.



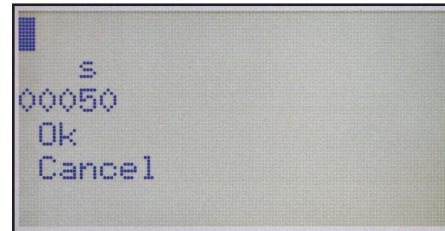
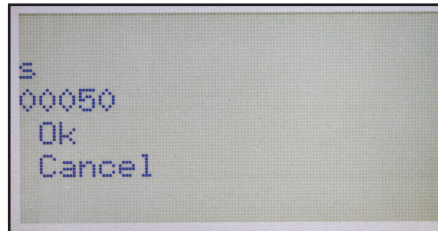
3. Rotate control knob to select **Setup** and quickly press and release knob to display the following screen:



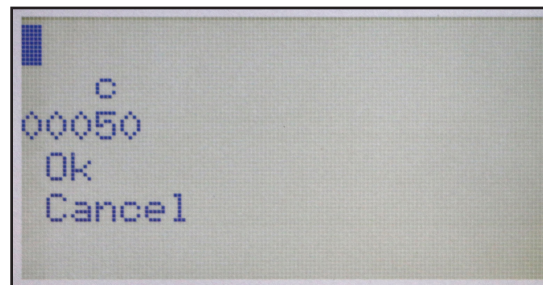
4. Select **Replenish%**.



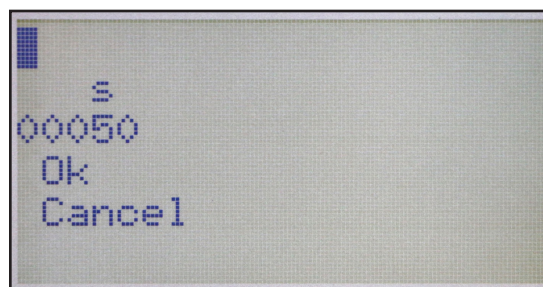
5. Twist knob to position selection cursor.



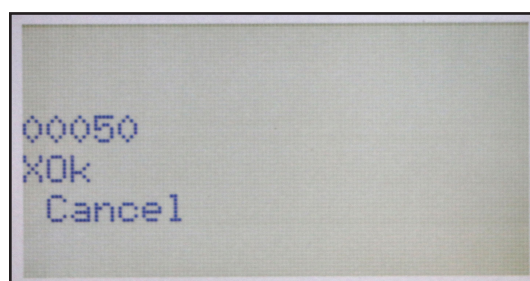
6. Push knob to change cursor from **Select** to **Change** mode and rotate to change value.



7. Push knob again to go back to **Select** mode.



8. Continue to rotate until the selection is adjacent to the OK and push knob again (this will save your changes).



Diagnostics Screen

From the **System setup/service** screen, use the dial to highlight the menu item **Diagnostics**, and press the dial to select.

From this screen, you can navigate to the following diagnostic screens:

- **Material tracking.** This allows you to view details regarding the material that is in the system.
- **Fresh-bin diagnostics.** This allows you to view status details of the components that comprise the handling of fresh material in the system.
- **Blend-bin diagnostics.** This allows you to view status details of the components that comprise the handling of blended material in the system.
- **Sifter diagnostics.** From here you can view the status of components related to the sifting system.
- **Generic I/O diagnostics.** Details related to the stack lights, E-Stop, relays, nitrogen, and temperature can be viewed here.

Diagnostics

- > Material tracking
- > Fresh-bin diag
- > Blend-bin diag
- > Sifter diag
- > Generic I/O diag

Setup Screen

From the **System setup/service** screen, use the dial to highlight the menu item **Setup**, and press the dial to select. This screen is only operational when the system is in **Stop** mode.



NOTE: all times are in seconds except the nitrogen cooldown time, which is in minutes.

This menu provides the following commands:

- Choose the percentage of **fresh powder** in the **blended bin**.
- Choose the **lower level limit** of the **blended bin** in liters.
- Turn the **blending function** on or off.
- Turn the **blended bin recirculation** function on or off.
- Set the **time** for the **blended bin recirculation** (in seconds).
- Set the **minimum weight** threshold for fresh bin (in Kg).
- Set the **length of time for the sifter** to automatically turn off.
- Toggle the **nitrogen** setting between **temperature** and **time**.
- Set the **time that the nitrogen will be used** to cool off the print cake.
- Set the **temperature** of the print cake at which the nitrogen will stop being dispensed.
- Reset the data for the material.
- Shutdown the system.

Setup

- + Replenish %
- + B lo lvl (L)
- + Blending on/off
- + B recirc on/off
- + B recirc time
- + Minimum Fresh Weight

- + Sift timeout
- + Cool by temp/time
- + Cool time (min)
- + Cool temp
- + Reset material data
- + System Shutdown

Material Tracking Screen

From the **Diagnostics** screen, use the dial to highlight the menu item **Material tracking**, and press the dial to select.

This screen displays the following status information:

- **Material Number:** The number associated with the material.
- **Name:** The name of the material.
- **Material Density:** The density of the material.
- **Minimum Fresh Blend Percentage:** The minimum percentage of fresh material that is available for blending.
- **Maximum Fresh Blend Percentage:** The maximum percentage of fresh material that is available for blending.
- **Max Recirculation Period:** The maximum time (in seconds) that recirculation will take place
- **Fresh Consumed:** The amount of fresh material consumed (in Kg).
- **Used Consumed:** The amount of used material consumed (in Kg).

Material Tracking

- Matl #
- Name
- Matl density
- Min Replensish %
- Max Replenish %
- MaxRecircPeriod
- Fresh Consumed
- Used Consumed

Fresh-Bin Diag Screen

From the **Diagnostics** screen, use the dial to highlight the menu item **Fresh-bin diag**, and press the dial to select.

This screen displays the following status information:

- **Door closed/open:** This indicates whether the left door for inputting fresh material is open or closed.
- **Door unlocked/locked:** Indicates whether or not the door for inputting fresh material are locked or unlocked.
- **Gate valve open/closed:** Indicates if the gate valve for the fresh material bin is opened or closed.
- **Transport level full/not full:** Indicates whether or not the transporter for the fresh material is full or not.
- **Fluidizing air on/off:** Indicates whether or not the air responsible for fluidizing the material in the transporter is on or off.
- **Transporter air on/off:** Indicates whether or not the air responsible for transporting the material out of the transporter is on or off.
- **Weight:** Gives the weight (Kg) of the material in the fresh bin.
- **Pressure:** Gives the air pressure (KPa) from the transporter.

Fresh-bin diag

Door closed/open
Door unlocked/locked
Gate valve open/closed
Tport level full/not full
Fluid air on/off
Tport air on/off
Weight Kg
Pressure KPa

Blend-Bin Diag Screen

From the **Diagnostics** screen, use the dial to highlight the menu item **Blend-bin diag**, and press the dial to select.

This screen displays the following status information:

- **Gate valve open/closed:** Indicates if the gate valve for the blended material bin is opened or closed.
- **Transport level full/not full:** Indicates whether or not the transporter for the blended material is full or not.
- **Fluidizing air on/off:** Indicates whether or not the air responsible for fluidizing the material in the transporter is on or off.
- **Transporter air on/off:** Indicates whether or not the air responsible for transporting the material out of the transporter is on or off.
- **Weight:** Gives the weight of the material in the blended bin.
- **Pressure:** Gives the air pressure from the transporter.
- **Current Blend:** Gives the current percentage of blended material in the bin

Blend-bin diag

Gate valve open/closed
Tport level full/not full
Fluid air on/off
Tport air on/off
Pinch B->B closed/open
Pinch B->PA closed/open
Weight Kg
Pressure KPa
Current Blend %

Sifter Diag Screen

From the **Diagnostics** screen, use the dial to highlight the menu item **Sifter diag**, and press the dial to select.

This screen displays the following status information:

- **Gate valve open/closed:** Indicates if the gate valve for the sifter is opened or closed.
- **Transport level full/not full:** Indicates whether or not the transporter for the sifter is full or not.
- **Fluidizing air on/off:** Indicates whether or not the air responsible for fluidizing the material in the sifter transporter is on or off.
- **Transporter air on/off:** Indicates whether or not the air responsible for transporting the material out of the sifter transporter is on or off.
- **Pinch valve sifter to blended bin closed/open:** Indicates whether or not the sifter's blended bin is open or closed.
- **Cycle start active/inactive:** Indicates whether or not the sifter's cycle start is active or inactive.
- **Cycle stop active/inactive:** Indicates whether or not the sifter's cycle stop is active or inactive.
- **Shaker on/off:** Indicates whether or not the sifter's shaker is on or off.
- **Pressure:** Gives the air pressure from the transporter.

Sifter diag

```
Gate valve open/closed
Tport level full/not full
Fluid air on/off
Tport air on/off
Pinch S->B bin closed/open
Cycle start active/inactive
Cycle stop active/inactive
Shaker on/off
Pressure KPa
```

Generic I/O Diag Screen

From the **Diagnostics** screen, use the dial to highlight the menu item **Generic I/O diag**, and press the dial to select.

This screen displays the following status information:

- **E-Stop active/inactive:** Indicates whether or not the E-Stop for the machine has been activated.
- **24V Relay on/off:** Indicates the on/off status of the 24 volt relay.
- **Red light on/off:** Indicates the status of the red stack light.
- **Amber light on/off:** Indicates the status of the amber stack light.
- **Green light on/off:** Indicates the status of the green stack light.
- **Logo backlight on/off:** Indicates the status of the logo backlight.
- **Nitrogen supply valve open/closed:** If the valve for the nitrogen supply is open, nitrogen can be fed to the system.
- **Nitrogen blanket (cooling lid) valve open/closed:** If the valve for the nitrogen supply to the cooling lid is open, the cooling lid can be used.
- **Part Cake 1 (thermocouple) temperature:** Gives the temperature of the first thermocouple used to measure the temperature in the part cake.
- **Part Cake 2 (thermocouple) temperature:** Gives the temperature of the second thermocouple used to measure the temperature in the part cake.
- **Digital Output temperature:** Gives the temperature of the digital output on the controller board of the MQC System.
- **Power Supply temperature:** Gives the temperature of the power supply on the controller board of the MQC System.

Generic I/O diag

```
Estop active/inactive
24V Relay on/off
Red light on/off
Amber light on/off
Green light on/off
Logo backlight on/off
N2 supply v. open/closed
N2 blanket v. open/closed
PC1 temp.
PC2 temp.
DO temp.
PS temp.
```

5 PROX® MQC SINGLE USE SYSTEM MAINTENANCE

MQC – USER MAINTENANCE

- Inspect compressed air condensation/oil trap, empty if needed
- Wipe surfaces, sift, discard unusable powder, as needed
- Disposal container
 - Inspect weekly, empty as needed
- Sifter screen
 - Vacuum after every use
- Sock filter
 - Inspect weekly, clean monthly, replace at 6 months



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