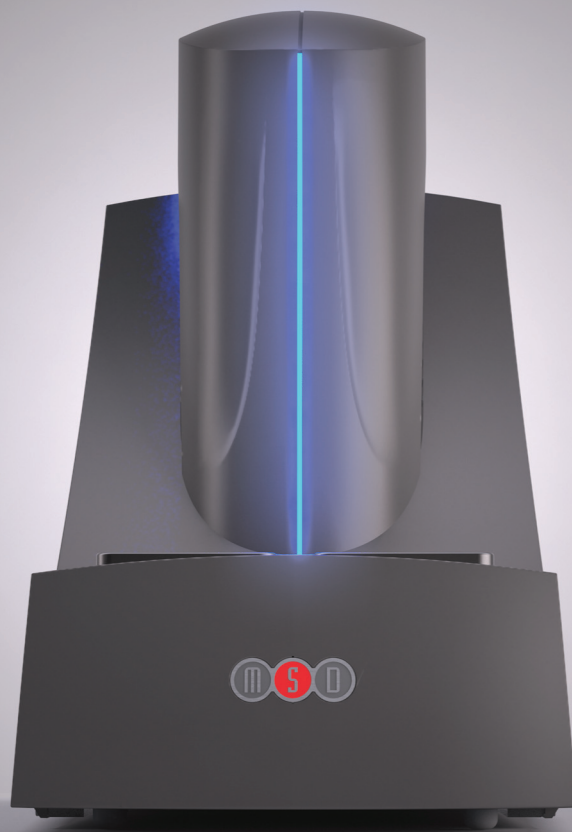




INSTRUMENT MANUAL



MESO™ QuickPlex SQ 120



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Introduction

1 Introduction

MESO SCALE DISCOVERY® (MSD) develops, manufactures, and markets biological assays that provide cost-effective and valuable information to scientists in drug discovery, therapeutic screening, and life science research. MSD's product portfolio is based on MULTI-ARRAY® technology, a proprietary combination of patterned arrays and electrochemiluminescence detection that results in exceptional sensitivity, speed, dynamic range, and convenience.

MSD® develops, manufactures, and markets detection instrument systems as well as a line of assay kits for use with these instruments, a proprietary line of reagents, and custom microplate printing and assay development services. MSD MULTI-ARRAY microplates are available in 96-, 384-, and 1536-well formats with standard or high-binding surfaces. MSD plates may be purchased uncoated or coated with proteins such as streptavidin or avidin, with anti-species antibodies such as goat anti-mouse or goat anti-rabbit, or with antibodies against specific analytes. Custom coatings and surface treatments are available.

MSD MULTI-ARRAY plates are available as single spot (single assay) plates and as MULTI-SPOT® plates with patterned spot arrays in each well. MULTI-SPOT plates measure multiple analytes simultaneously in a single well, increasing throughput and enabling novel assay panels.

For more details and information about applications, please visit the MSD website at www.mesoscale.com.

1.1 Intended Audience

This manual is for users of the MESO QuickPlex SQ 120. Users should have an understanding of general computer and Microsoft® Windows terminology and be familiar with standard laboratory practices.

This manual describes how to operate the MESO QuickPlex SQ 120 and acquire data using both SECTOR® and QUICKPLEX® MULTI-ARRAY and MULTI-SPOT microplates. The analysis of this data is treated in a separate manual: DISCOVERY WORKBENCH® User's Guide.

1.2 How to Use This Manual

This manual is organized by chapters containing main topics and subsections. Use the hyperlinked Table of Contents to find topics of interest quickly. The List of Figures and List of Tables hyperlink to the images and tables that enhance understanding of written information in the manual. The Appendix contains supplemental information on troubleshooting, instrument specifications, regulatory information, and safety symbols and labels.

Tips



Tips provide extra information or details that help users perform functions more efficiently.



Notes

Notes provide supplemental information on the proper use of the QuickPlex SQ 120 and its software.

1.3 Warnings and Caution Symbols


WARNING

General warnings advise operators of potential hazards and highlight the procedures or information necessary to avoid personal injury during use of the QuickPlex SQ 120.

Symbol	Explanation
	Risk exists for a mechanical, chemical, or safety hazard
	Risk exists for an electrical hazard

CAUTION

A caution note highlights procedures or information necessary to avoid damage to equipment, corruption of software, loss of data, or invalid test results.

 **CAUTION:** Carefully read and understand all information in this document. Failure to read, understand, and follow the instructions in this publication may result in damage to the product, injury to operating personnel or poor instrument performance.

1.4 Formatting Information

This guide uses the following formatting conventions:

- Internal hyperlinks are formatted bold/gray. Click to jump instantly to the referenced section or figure.
- Clickstreams are indicated with arrows and always start with a top-level menu item: Select Tools → Plate Data History.
- Information to be entered by the user is shown in italics: Enter *5*.
- When referring to a term as it appears in the software, we capitalize it exactly as it is capitalized on-screen: Select Read from Bar Code from the Plate Type menu.


Important Information

2 Important Information


2.1 General Operation


Once initialized, the QuickPlex SQ 120 imager enters standby mode and maintains the CCD detector at its set temperature. The instrument is ready to read plates at any time. The QuickPlex SQ 120 is designed to run indefinitely in standby mode.

 **WARNING:** The instrument must be operated with all covers in place. If the unit is operated in any manner not specified in this manual, the protection provided by the equipment may be impaired.


 **CAUTION:** Installation of additional software on the computer system used to operate the QuickPlex SQ 120 is not supported. Specifically, updating aspects of the operating system or installing any software that changes parameters of the computer environment could interfere with proper operation of the instrument software.

 **CAUTION:** Running screen-savers, automated maintenance software, network-security software, and other possible software on the QuickPlex SQ 120 computer system could cause conflicts with the operation of the instrument software.

 **CAUTION:** The instrument generates files when running. Virus scanning on the instrument computer can interfere with instrument operation. We suggest that any virus checking software run on the instrument computer be configured to minimize the scanning of newly generated files while the instrument is operating.


 **CAUTION:** Use of operating system power features that disable USB communication, such as Hibernate, will cause the system to stop responding and requires a power off/on cycle of the instrument and PC to restore function.

 **CAUTION:** Additional USB devices should not be connected to the QuickPlex SQ 120's computer system or used while plates are being read.

 **CAUTION:** Changes to the computer clock can cause a system error if the changes are made during a plate read. A system error may also occur if a plate is being read when the time is automatically changed from standard to daylight savings time or vice versa.

NOTE: The QuickPlex SQ 120 should be operated in a dust-free environment with an ambient temperature between 15°C and 32°C, and humidity levels between 10% and 80% (non-condensing). Environments or locations with high levels of vibration should be avoided. See 6.2 [Specifications](#) for complete environmental specifications.

 **CAUTION:** Keep the QuickPlex SQ 120 away from direct sources of heat or cold and direct sunlight. Ensure that the rear cooling vents and the CCD camera tower cooling vents on the QuickPlex SQ 120 are not blocked.

 **CAUTION:** Do not place any objects, materials, or liquid containers on top of the QuickPlex SQ 120.

 **CAUTION:** Falling objects or splashing liquids, including chemically reactive or infectious reagents, can cause damage to the instrumentation or cause injuries. Avoid handling or storing infectious or radioactive materials near the QuickPlex SQ 120.

2.2 Hazards

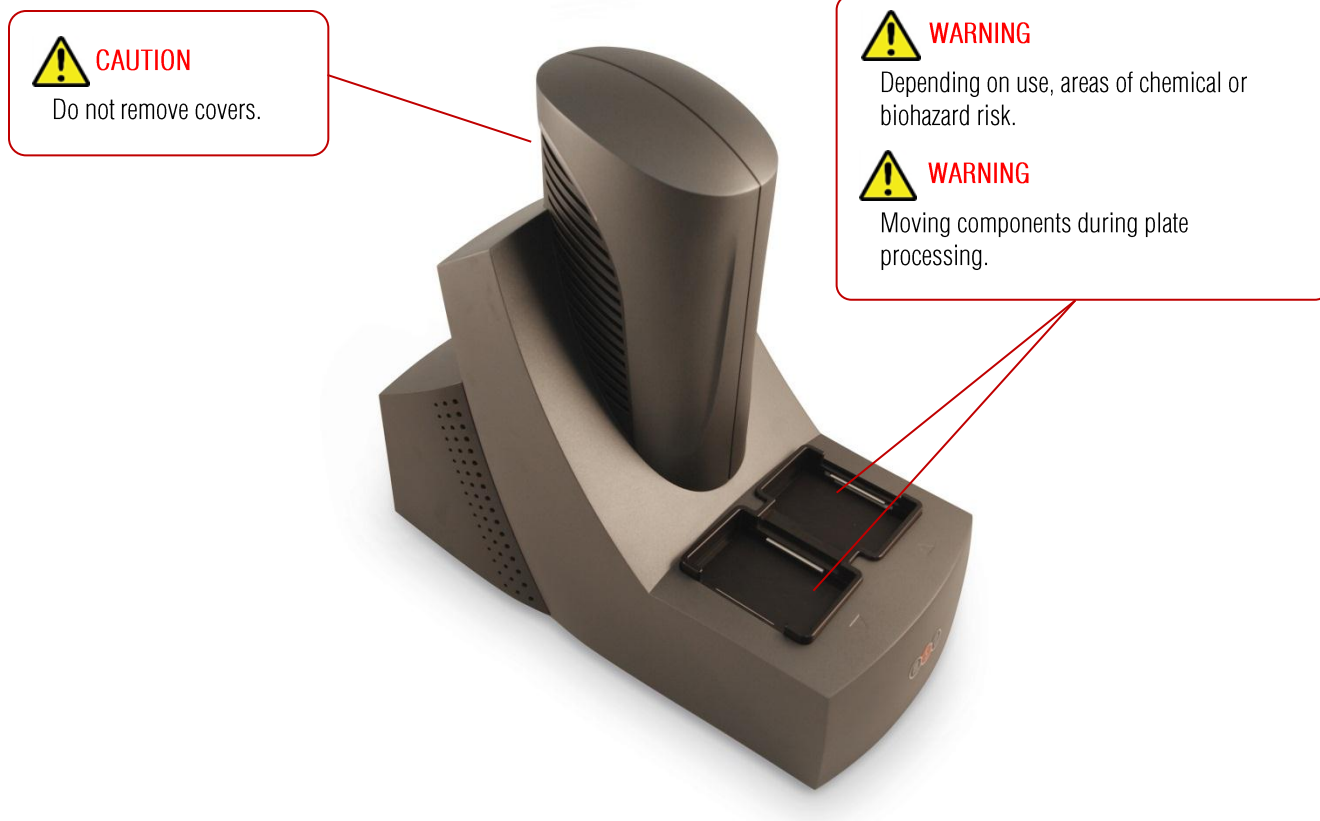
This section contains notices and warnings of hazards and should be read carefully. Before working with the QuickPlex SQ 120, become familiar with all safety precautions and regulations concerning the handling of materials and the instrument's electrical and

mechanical components. Operating this device in a manner not specified by this manual may impair the electrical and thermal protection provided by the equipment.

As with most laboratory instruments, the QuickPlex SQ 120 presents certain hazards for users. There are 5 key types of hazards:

- Electrical
- Chemical and biological
- Visual
- Mechanical
- ESD sensitivity

Figure 2:1 User hazards



2.2.1 Electrical


The QuickPlex SQ 120 has been designed and tested for compliance with appropriate electrical safety standards.


WARNING: For best performance, remove any sample or reagent spillage from the instrument. For safety, the operator should power down the instrument and disconnect the QuickPlex SQ 120's power cable from the wall socket prior to cleaning near moving parts. For significant spills or liquid intrusion into the instrument enclosure (e.g., resulting from a fire protection water sprinkler), contact MSD [Instrument Service](#).

WARNING: The QuickPlex SQ 120 has not been tested regarding intrinsic safety. Accordingly, the QuickPlex SQ 120 must not be operated in hazardous (classified) atmospheres as defined by the National Fire Protection Association and the National Electric Code.

WARNING: Although the QuickPlex SQ 120 uses a 24 volt DC power supply, laboratory personnel should never remove any instrument covers that would expose electrical circuits. Only authorized MSD Service personnel should perform repairs to the interior of the QuickPlex SQ 120.

NOTE: We *strongly* recommend that users of laboratory instruments (such as the QuickPlex SQ 120) follow the Clinical and Laboratory Standards Institute (CLSI) document entitled GP17-A3, Clinical Laboratory Safety; Approved Guideline, Section 19, Instrument Testing.

 **CAUTION:** Grounding and polarity checks should be conducted on all electrical outlets annually, and the results of these tests should be documented. New or incoming equipment should also undergo electrical safety checks before use. Power cords should be inspected annually for integrity.

 **WARNING:** Do not use a two-prong plug or extension cord to connect primary power to the QuickPlex SQ 120. Use of a two-prong adaptor disconnects utility ground, creating a shock hazard. Always connect the system power cord directly to a 3-prong receptacle with a functional ground.

 **WARNING:** Do not replace the supplied detachable mains supply cord of the external power supply with an inadequately rated cord.

2.2.2 Chemical and Biological

Users are responsible for taking all necessary precautions against hazards associated with the use of laboratory chemicals. In the course of preparing assay plates to run on the QuickPlex SQ 120, users may work with potent chemicals, such as acids, bases and solvents, and thus be exposed to chemical hazards. This may also be the case when working with cleaning or disinfecting agents and with some reagents used in assays.

Laboratory regulations and good laboratory practices concerning the use of such chemicals should be followed at all times. Use personal protective equipment recommended by your facility when handling any of these reagents.

Product labels, package inserts and product information sheets with specific usage recommendations are provided for all plates and reagents used with the instrument. Contact MSD **Scientific and Technical Support** to obtain material safety data sheets (MSDS) for MSD plates and reagents.

Samples, user reagents, or controls used in assays may be infectious or biohazardous. By working with these materials, users may be exposed to biological hazards. Laboratory regulations concerning the handling of potentially infectious material should be followed at all times.


Users should avoid breathing reagent fumes or aerosols. Gloves and goggles should be worn when disposing of used plates. If skin comes in contact with reagents, rinse the exposed area with water immediately, and follow appropriate safety protocols as determined by your facility. Dispose of used plates according to federal, state, and local regulations.

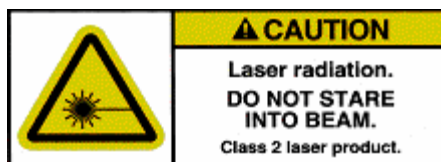
 **WARNING:** Wear appropriate personal protective equipment and avoid skin contact and inhalation when handling plates that contain or have been exposed to hazardous reagents.

 **WARNING:** The plate stacker input and output locations are considered susceptible to contamination during normal use. Use of personal protective equipment and good laboratory practices are strongly suggested when working in these areas.

2.2.3 Visual


The instrument uses a scanning bar code reader with a Class 2 laser rated at a maximum of 1 mW. The laser beam is not visible during normal operation. However, there is risk of exposure if the instrument is operated without the external covers and the internal barcode reader cover.


 **WARNING:** DO NOT STARE INTO THE BEAM. The laser is only directly viewable and accessible by qualified service personnel.




 **WARNING:** Operation of the instrument without external covers and the internal barcode reader cover may result in hazardous radiation exposure.

2.2.4 Mechanical

 **WARNING:** The QuickPlex SQ 120 imager weighs 44.5 lbs. (20.2 kg.). Be careful to use proper technique when lifting it to minimize the risk of injury. Two or more people should lift from beneath the instrument. Please contact MSD [Instrument Service](#) before attempting to move the instrument.

 **WARNING:** The QuickPlex SQ 120 imager presents potential mechanical hazards. To avoid injury, do not touch any part of the instrument while it is in operation. Do not place fingers in the plate stacker or the plate carrier when the instrument is in operation.

 **WARNING:** Moving parts of the QuickPlex SQ 120 imager can be damaged or become misaligned when exposed to strong mechanical force. As with any mechanical instrument, you should take certain precautions when operating the QuickPlex SQ 120, including:

- Do not wear loose garments or jewelry that could catch in moving mechanisms.
- Operate the instrument with the cover intact.
- Keep hands away from pathways of moving parts during operation.
- Do not attempt electrical or mechanical repairs.
- Do not bump into or lean on the QuickPlex SQ 120 or place any objects on top of it.


2.2.5 ESD Sensitivity


The instrument contains sensitive electronics and can be damaged if it is exposed to electrostatic discharges in excess of 4.0 kV. While the instrument complies with electrostatic discharge (ESD) standards for this type of laboratory equipment, MSD recommends standard precautions to minimize ESD. In typical laboratory environments, electrostatic discharge should not be a problem.

2.2.6 Electromagnetic Interference and Susceptibility

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. The equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause interference, in which case users will be required to correct the interference at their own expense.

Changes or modifications not expressly approved by MSD may void the warranty. The operator shall use any special accessories provided with the equipment such as the power supply or shielded cables that are necessary for compliance with FCC standards.

 **CAUTION:** The QuickPlex SQ 120 has been tested for operation in a controlled electromagnetic environment. Transmitters of RF energy such as mobile (cellular) telephones should not be used in close proximity.

 **CAUTION:** To avoid interference from voltage transients, the computer and instrument should be powered by the same electrical circuit. This may be accomplished using an uninterruptible power supply (UPS), power strip of proper electrical rating, or by verifying the power wall outlets. Please contact MSD [Scientific and Technical Support](#) if you have questions or need assistance.

2.3 Software and Operating System Compatibility

 **CAUTION:** Turn off automatic Windows and application updates.

The Microsoft Windows® Update service can affect the operation of the instrument software. When running, the update application can turn off the database services upon which the instrument relies, causing errors and stopping instrument operation. Updates should not be run during instrument use. Run manually or schedule Windows and other software updates when you are sure that the instrument will not be in use.

Occasionally, Windows Update does not restart the database server after it runs. This will cause the instrument software to run incorrectly. Restarting the computer will restart the database service and restore the instrument to full operation.

2.4 Decontamination Prior to Shipping or Servicing

The QuickPlex SQ 120 may have been used to analyze infectious materials or used in an environment where infectious materials were handled. For the protection of future users and service personnel, please follow site safety procedures and the directions of the site safety officer to disinfect the QuickPlex SQ 120 imager. If shipping to MSD, contact MSD **Instrument Service** to determine the level of decontamination required.

 **WARNING:** Follow site safety procedures and the directions of the site safety officer to determine decontamination requirements for the imager before shipping or service.

 **WARNING:** Prior authorization must be obtained before the instrument and/or its accessories are shipped to MSD. Authorization is contingent upon completion of the MSD Instrument Decontamination Certification Form and issuance of a Returned Merchandise Authorization (RMA) number by MSD **Instrument Service**.

System Description

3 System Description

3.1 Intended Use

The MESO QuickPlex SQ 120 is for research use only. The instrument is not for use in diagnostic procedures.

3.2 Specifications Overview

The QuickPlex SQ 120 imager offers high sensitivity and a dynamic range that exceeds 5 logs. The QuickPlex SQ 120 is designed to read both SECTOR and QUICKPLEX plates in 96-well MULTI-ARRAY and MULTI-SPOT formats. The QuickPlex SQ 120 reads SECTOR plates 4 wells at a time (24 sectors per plate). QUICKPLEX plates are read 1 well at a time.

The QuickPlex SQ 120 reads a SECTOR plate in approximately 1 minute, 30 seconds and a QUICKPLEX plate in 2 minutes, 45 seconds. The level of multiplexing does not affect plate read time.

The QuickPlex SQ 120 will distinguish SECTOR and QUICKPLEX plate types by reading the plate's barcode and will automatically read each plate accordingly.

3.3 Plate Compatibility

The QuickPlex SQ 120 is compatible with all 96-well SECTOR and QUICKPLEX plates. PR plates, designed for SECTOR PR plate readers, are not compatible with the QuickPlex SQ 120 imager.

3.4 System Components

A standard QuickPlex SQ 120 system consists of the following:

- MESO QuickPlex SQ 120 imager (Figure 3:1)
- Microsoft Windows-compatible notebook computer (Figure 3:1)
- Notebook computer power supply and AC cord
- MSD DISCOVERY WORKBENCH software (installed)
- MSD DISCOVERY WORKBENCH User's Guide (installed)
- Instrument Manual (installed)
- Quick Start Guide
- Electronic test plate
- USB communication cable
- Instrument 24 volt DC power supply and AC cord
- Uninterruptible power supply (UPS)

Figure 3:1 The QuickPlex SQ 120 imager and computer

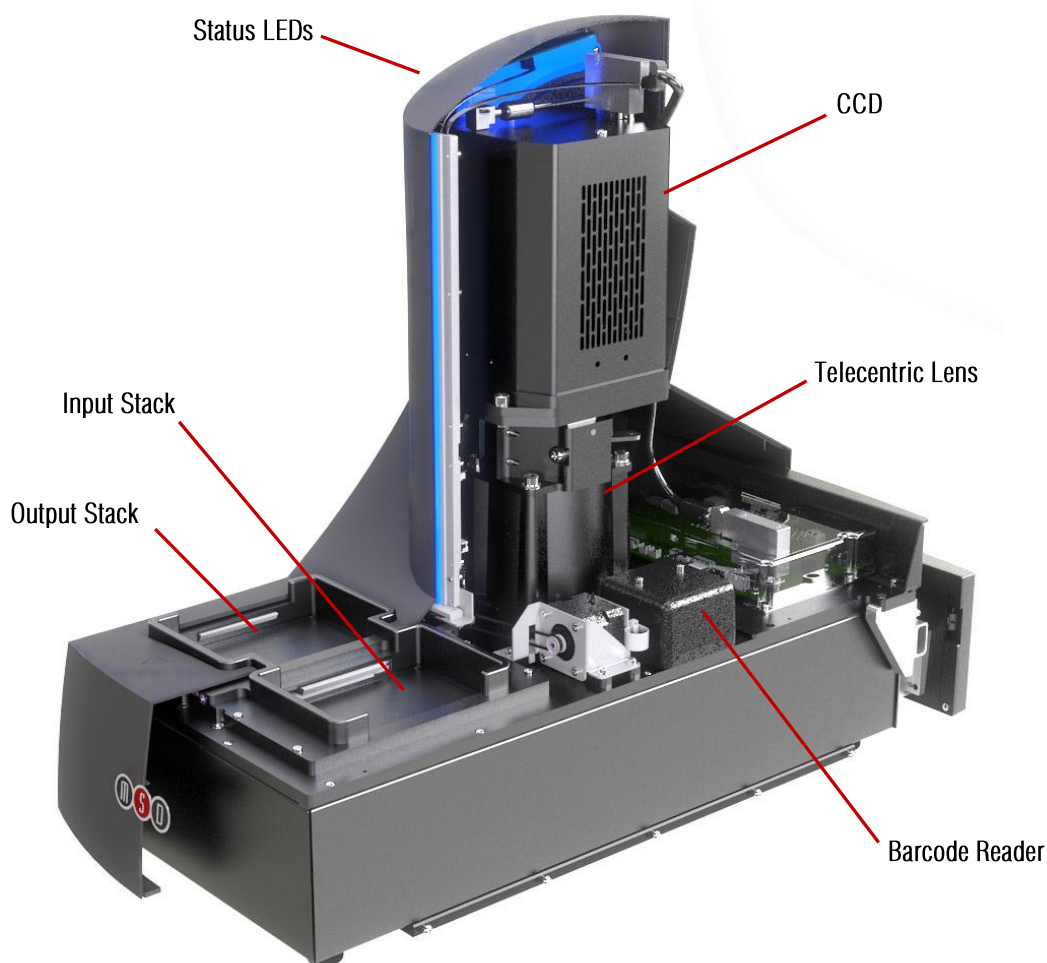


3.5 MESO QuickPlex SQ 120 Imager

The main components of the QuickPlex SQ 120 imager (Figure 3:2) include:

- CCD camera and telecentric lens
- Plate motion control system (not shown)
- Plate barcode reader (long side)
- Integrated assay plate input/output stacks
- Instrument status LEDs
- Power switch and I/O panel (not shown)

Figure 3:2 Cutaway view of the imager



3.5.1 CCD Camera and Telecentric Lens

The instrument uses a very sensitive, high-resolution CCD camera and lens system to detect light emitted from MULTI-ARRAY and MULTI-SPOT plates. The custom-designed lens provides high efficiency and uniform collection of ECL generated light. For optimal sensitivity, the camera sensor is cooled to a temperature of -25°C and maintained at this temperature within a control band of $\pm 2^{\circ}\text{C}$.

3.5.2 Motion Control System

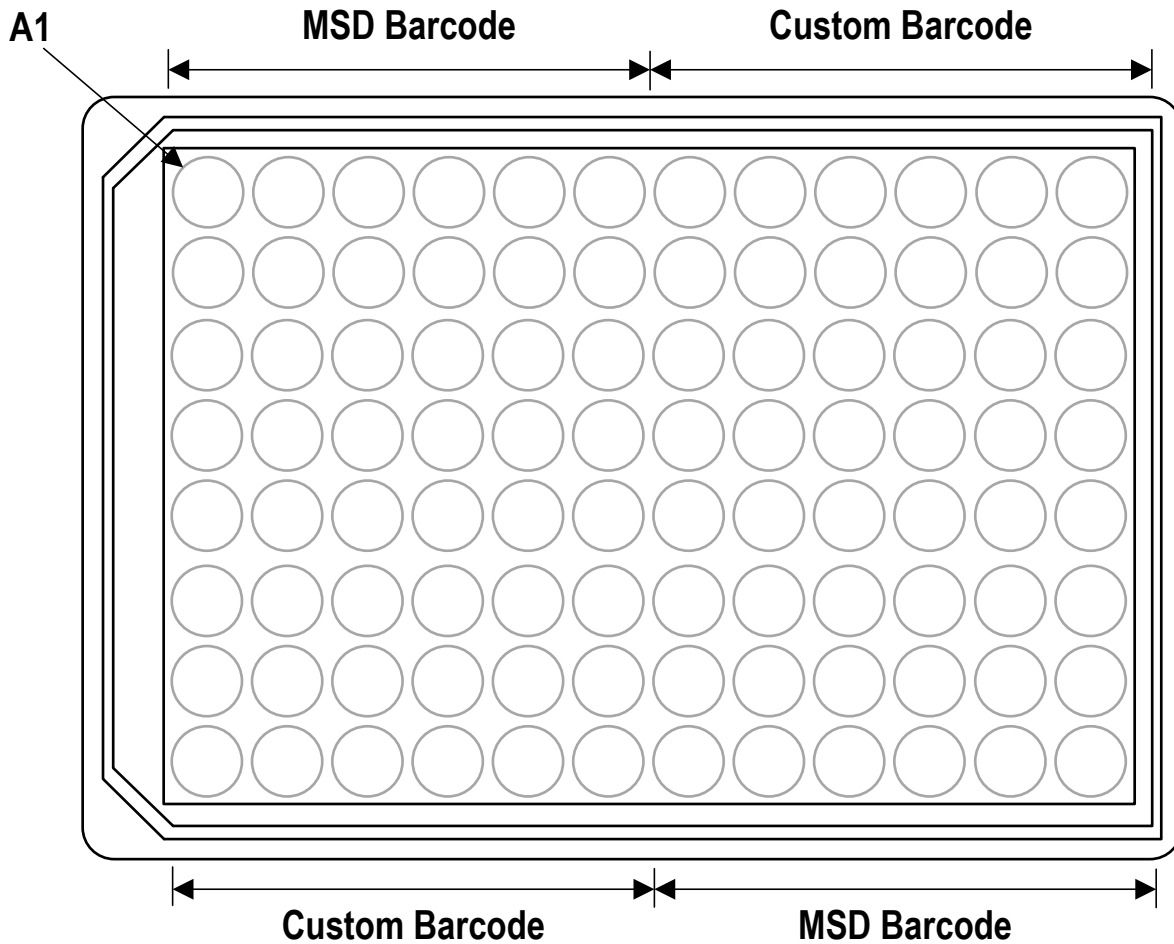
The instrument uses a high-precision mechanism for transporting plates from the input stack, into the CCD camera's viewing area, and back to either the input or output stack, depending on user setup in the DISCOVERY WORKBENCH software. See [4 Installation, Quick Start, and General Use](#) for more information on reading a plate.

3.5.3 Plate Barcode Reader

The imager uses a single, internal barcode reader to identify the plate at the beginning of a plate read. The barcode information allows DISCOVERY WORKBENCH software to identify the plate type and to read and interpret the plate data correctly.

For certain applications, users may be interested in applying custom barcode labels. Custom barcodes may be placed on the side of the plate next to the MSD barcode. [Figure 3:3](#) illustrates where custom barcode labels may be placed. Custom barcodes must be either Code 39 or Code 128, with a minimum line width of 7 mils.

Figure 3:3 MSD and custom barcode label locations



To enable custom bar code reading, open the instrument reader window, navigate to Tools → Instrument Configuration, and select Enable Long-side Custom Bar Code Reader. If you have questions concerning the use of custom bar codes on MSD plates, please contact MSD Scientific and Technical Support.

3.5.4 Integrated Assay Plate Stacker

The QuickPlex SQ 120 imager includes an integrated assay plate stacker for loading and unloading plates. The stacker can process up to 5 plates at a time.



WARNING: The maximum capacity of the input and output stacks is 5 plates. Do not load more than 5 plates into the input stack (right side) at a time and do not allow more than 5 plates to accumulate in the output stack (left side).



WARNING: The stacker contains components that can move at any time. Even though the door automatically retracts if an obstruction is detected, users should never place their fingers into the input or output stacks for any reason unless the instrument is completely powered off.

3.5.5 Status LEDs

The status LEDs built into the camera tower are used to indicate the operational mode of the imager (Figure 3:4).

- **Steady blue:** Imager is in standby mode and is ready to read plates.
- **Blinking blue:** Imager is currently reading a plate.
- **Steady red:** Imager is in error mode or is waiting for plates.

Figure 3:4 Status LEDs

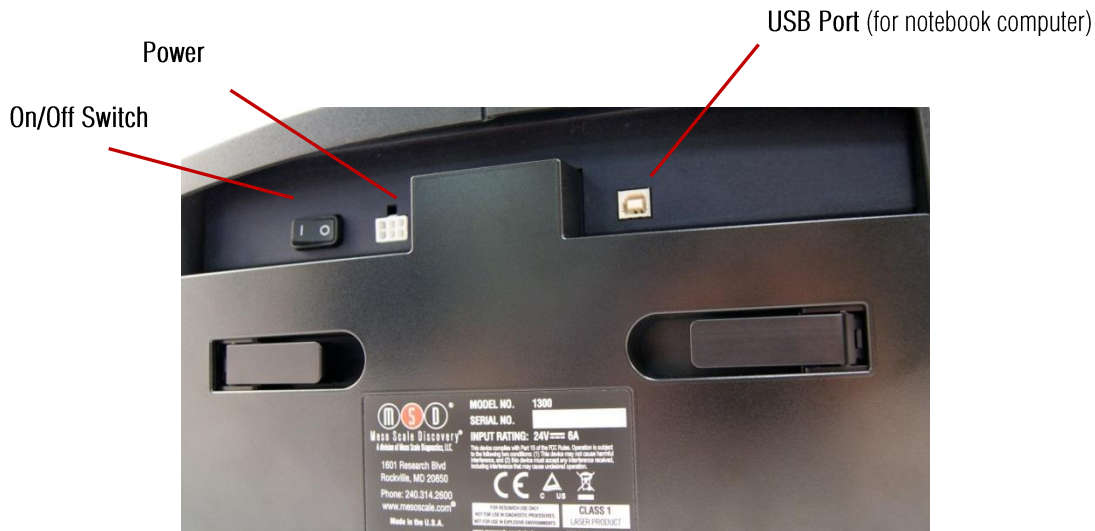


3.5.6 Power Switch and Input/Output (I/O) Panel

The I/O panel, located in the back of the imager unit, includes the on/off switch, the power entry port, and a USB connector for communications between the imager and computer. Typically, the imager should be left powered-on to maintain camera temperature.

NOTE: Only use cables and accessories supplied with the instrument. Use of cables and accessories other than those supplied may degrade instrument performance.

Figure 3:5 Power switch and I/O panel of the instrument



3.6 Microsoft Windows-Compatible Computer

A notebook computer is configured by MSD for use with the imager and comes preloaded with MSD DISCOVERY WORKBENCH Software. The notebook computer and its software are an integral part of the system and should only be modified by an MSD service engineer. The computer is connected to the imager by a single USB cable (Figure 3:6).

Figure 3:6 Notebook computer cable attachments (USB and power)



3.7 MSD DISCOVERY WORKBENCH Software

DISCOVERY WORKBENCH is a Windows application that supports the operation of the instrument, stores both current and historical plate data, and analyzes and presents results. The application has several components: instrument modules, a secure database (the Plate Data History), kit layouts, data integrity features, and data analysis functions. Please refer to the DISCOVERY WORKBENCH User's Guide for additional information.

3.8 Operational Modes

The instrument can be configured as a stand-alone reader or integrated with robotic systems. It has 3 operational modes:

- **The 1-stack mode** uses only the input plate stack for both loading and unloading single plates.
- **The 2-stack mode** uses the input and output plate stacks for loading and unloading multiple plates. Up to 5 plates may be loaded into the input stack at a time. Output stack capacity is also 5 plates.
- **The robotic operational mode** can use either the 1-stack or 2-stack mode with robotic handling of plates. See 4.4 [Robotics Integration](#) for general information on robotic application.

3.9 Image Readout

The QuickPlex SQ 120 uses a CCD camera to obtain images of the plate during readout. One advantage of imaging detection is that the time required to read a plate is independent of the format of the plate (i.e., both singleplex and multiplex plates are read in the same amount of time).

The QuickPlex SQ 120 reads both SECTOR (Figure 3:7) and QUICKPLEX plates. When reading QUICKPLEX plates, the QuickPlex SQ 120 imager reads each well within a sector individually. The wells in each group are read in the following order: upper left, upper right, lower left, lower right. (Figure 3:8).

The QuickPlex SQ 120 imager reads SECTOR plates at a rate of about 1 minute, 30 seconds per plate and reads QUICKPLEX plates 1 well at a time at a rate of 2 minutes, 45 seconds per plate.

Figure 3:7 SECTOR plate showing 24, 4-well sectors

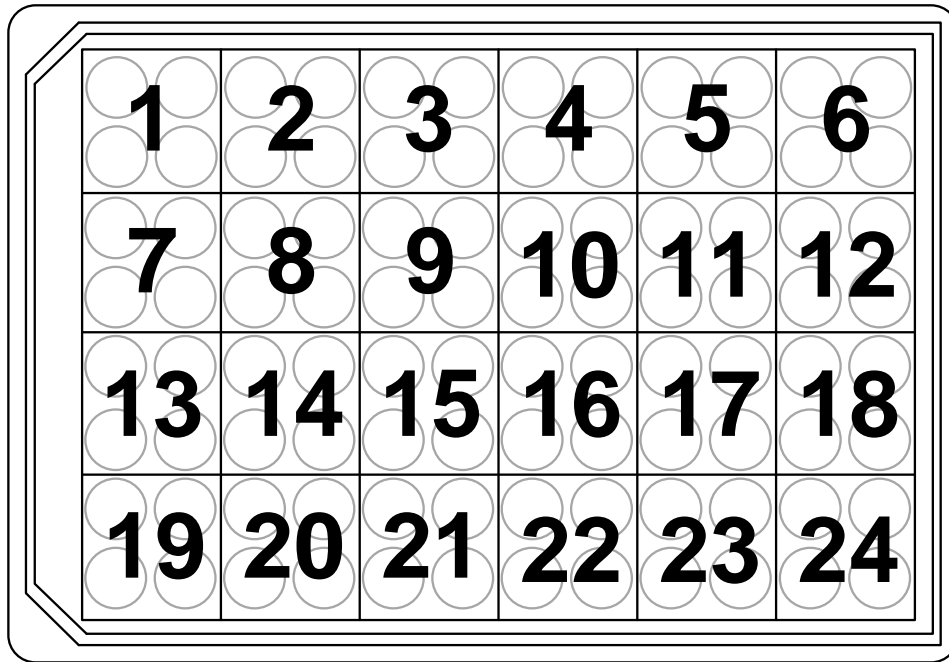
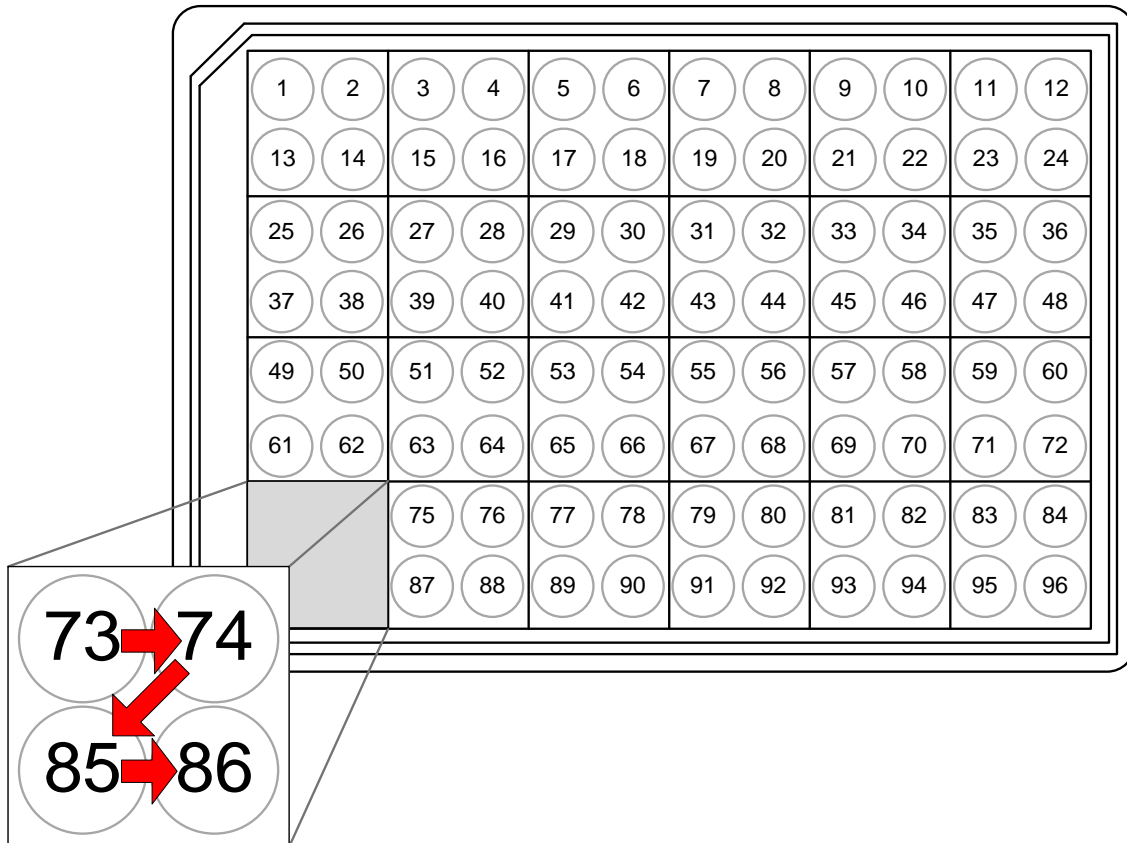


Figure 3:8 Reading QUICKPLEX plates in sectors, 1 well at a time



3.9.1 Reading Partial Plates

The QuickPlex SQ 120 can also be set up to read partial plates. When reading partial plates, the QuickPlex SQ 120 reads both SECTOR and QUICKPLEX plates in sectors (Figure 3:7). You may specify the sectors (not the individual wells) that will be read. Refer to the DISCOVERY WORKBENCH User's Guide for more information on running partial plates.

3.10 Electronic Test Plate

Each QuickPlex SQ 120 system is shipped with an electronic test plate (Figure 3:9). This test plate verifies operation of the system and can be used for operational qualification. It does not verify performance and should not be used for calibration purposes or performance qualification.

The electronic plate consists of an electronic circuit board housed in a plastic carrier in the shape of a standard assay plate. The circuit board for the electronic test plate has 24 separate sectors, simulating the structure of a SECTOR plate (Figure 3:7).

Figure 3:9 The electronic test plate



On the electronic test plate, wells 9, 22, 35, 48, 52, 63, 74, and 85 contain an LED that tests the CCD camera. The remaining sectors include known electronic components for testing the electrical functionality of the instrument across its range of operation. The electronic plate can be used without any chemical reagents to check instrument function at the start of each day or as a tool for demonstrating the instrument and software to new users.

Store the electronic plate in its case when not in use, and keep the electronic plate clean and free of dust and debris.

To use, place the electronic plate in the input stack with the chamfered corners of the plate facing into the instrument (Figure 4:5). This orientation ensures that the bar code reader can read the bar code label. See 4 *Installation, Quick Start, and General Use* for more details.

3.11 Uninterruptible Power Supply

The QuickPlex SQ 120 should be operated with an uninterruptible power supply (UPS) to ensure the integrity of data in the event of power line transients.

The UPS required will depend on the standard operating voltage at your laboratory's location. Please ensure that the proper UPS is employed for the power conditions in your country and local area.

NOTE: Although the instrument has been tested and complies with applicable electrical standards, operation of the system with a UPS is *strongly* encouraged for uninterrupted operation and protection from power line interference.

Installation, Quick Start, and General Use

4 Installation, Quick Start, and General Use

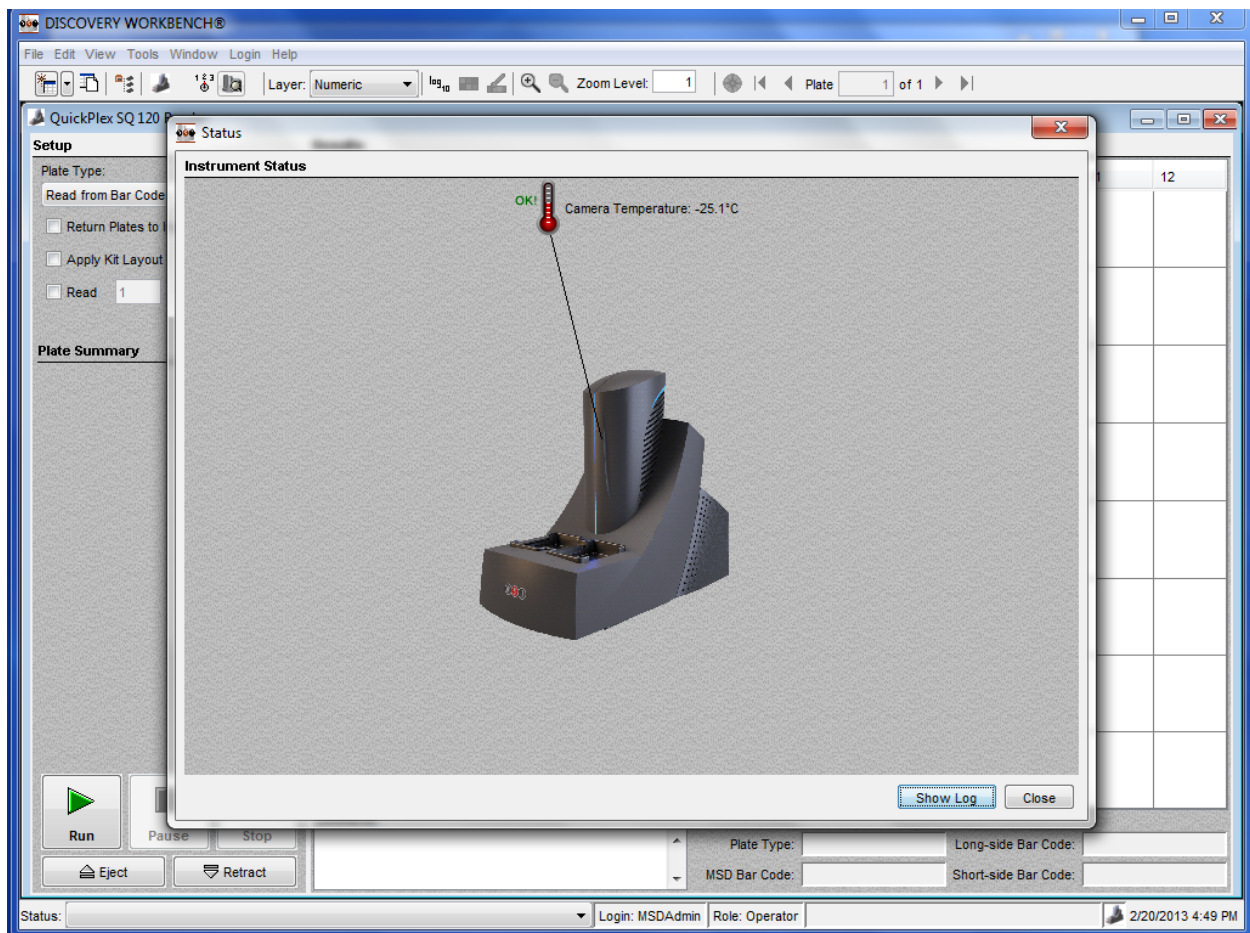
4.1 Installation

A qualified MSD service engineer must install and configure the QuickPlex SQ 120 system before use. Installation includes setup, connection of the instrument to its computer, and verification that the system is functioning properly. Only the computer provided with the instrument and preconfigured by MSD should be used to operate the instrument.

4.2 Quick Start

This chapter explains how to run the electronic test plate on the QuickPlex SQ 120 imager and verify that the instrument acquires data and functions properly. The electronic test plate may be run at the start of each day as a part of standard operation.

Figure 4:1 Status window



4.2.1 Start-up

The QuickPlex SQ 120 imager has a cooled CCD camera that needs to be brought to operating temperature before plates are read. This cooling process can take up to 25 minutes. To initiate the cooling process, turn on the instrument and allow it to cool to -25°C automatically.

You can monitor the cooling progress by viewing the DISCOVERY WORKBENCH software Status window, which displays the temperature of the CCD camera (Figure 4:1). The Status window is accessible by selecting Tools from the menu bar in the DISCOVERY WORKBENCH software. Once the temperature indicator disappears, the instrument is ready for use.

NOTE: We suggest that the instrument be left on so that the CCD camera stays at operating temperature and the instrument is ready to run assay plates at any time.

To start the system:

1. Turn on the QuickPlex SQ 120 imager and the notebook computer connected to it.
2. Log on to the Windows operating system. To do this, enter *MSDAdmin* as the user login name and *Administrator* as the password. (This is the default login shipped with the system; you may change this login/password or add additional Windows user accounts.)
3. The QuickPlex SQ 120 software within DISCOVERY WORKBENCH will automatically start and the QuickPlex SQ 120 splash screen (Figure 4:2) will display while the instrument is initializing.

Figure 4:2 MSD DISCOVERY WORKBENCH splash screen



4. If DISCOVERY WORKBENCH does not start automatically, double-click the MSD DISCOVERY WORKBENCH icon on the Windows desktop (Figure 4:3).

Figure 4:3 MSD DISCOVERY WORKBENCH desktop icon

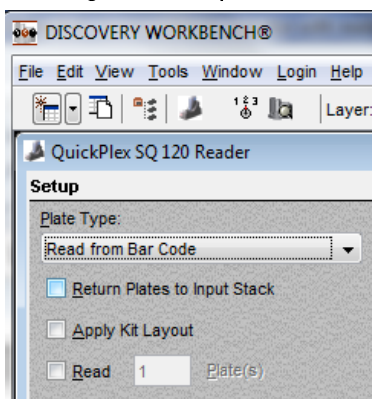


4.2.2 Setup

On the left side of the Instrument window in DISCOVERY WORKBENCH, users can view and edit the Setup selections for reading the electronic test plate (Figure 4:4).

1. Select Read from Bar Code on the Plate Type Menu (Figure 4:4).
2. Leave the Apply Kit Layout box unchecked. This option is covered in the DISCOVERY WORKBENCH User Guide.
3. Check Read and enter 1 in the text field.

Figure 4:4 Setup window



Load the electronic test plate into the input stack (Figure 4:5). Note that if an assay plate is installed backwards, sensors in the instrument will automatically identify the plate orientation and adjust the data acquisition and analysis accordingly.

Figure 4:5 Loading an electronic plate



NOTE: If the instrument is unable to read the barcode on the electronic plate (or if no barcode label is present), the plate will be skipped and ejected from the instrument. Please contact MSD Scientific and Technical Support for assistance.

4.2.3 Run

When the CCD camera reaches proper operating temperature, the Instrument Log (click Show Log in the Status window) will indicate that the temperature is locked. At that point, the instrument is ready.

Click the Run button in the Instrument window. The Run Options dialog window will open (Figure 4:6).

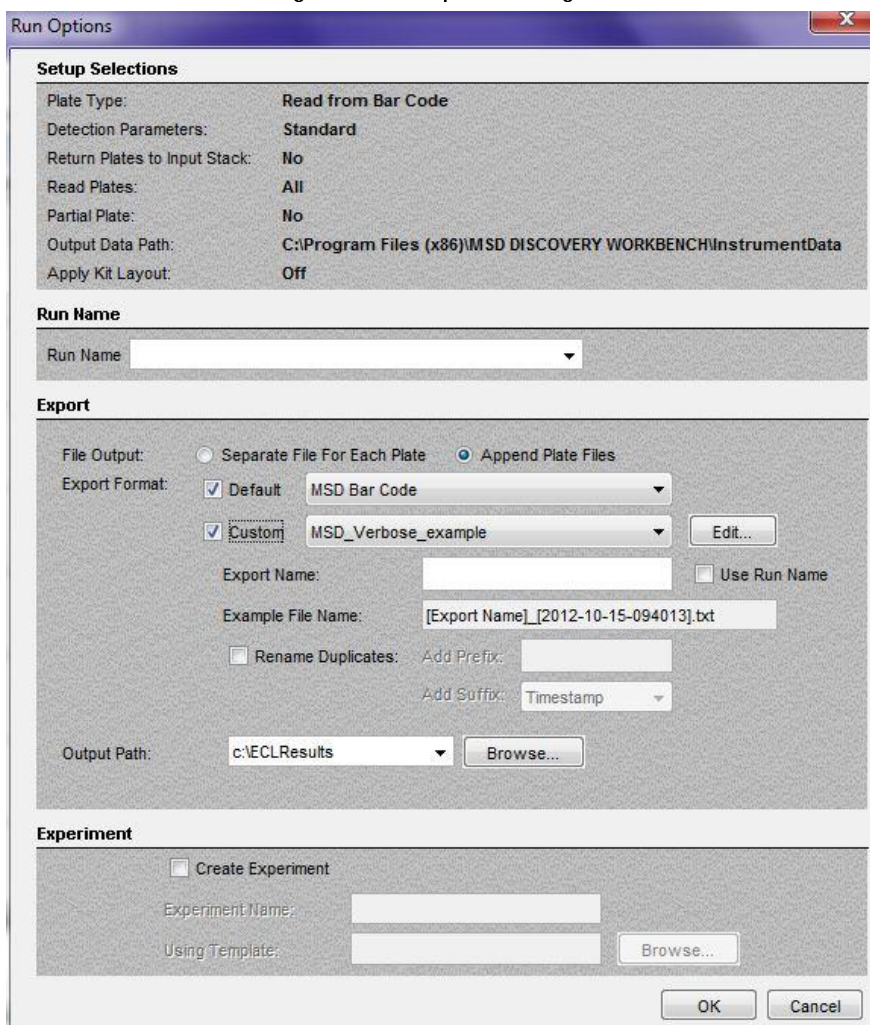
1. Verify Setup Selections. If changes are necessary, click Cancel, make changes to Setup (4.2.2 Setup) and re-verify Setup Selections.
2. Run Name is optional, but can be entered in the second section. The Run Name is useful when a number of plates will all be read together that are part of a single experiment, enabling quick lookup of data from groups of related assay plates.
3. Verify the Export information and make changes if necessary (Refer to the DISCOVERY WORKBENCH User's Guide for additional details.) The export selections control the format and the location of the exported text data file that will be created when the electronic plate is read.
4. Click **OK**. The plate read starts. View the status in the lower left region (Status bar) of the DISCOVERY WORKBENCH software to monitor progress. When the plate read is complete, the electronic plate is ejected to the output stack and **Run** is enabled again.

4.2.3.1 Operations

The Pause, Stop, Eject, and Retract buttons operate the motion control system that moves plates through the instrument.

- **Pause:** Pauses the plate read. Selecting Pause again resumes the read.
- **Stop:** Stops the current run and ejects the plate if it has already been retracted into the instrument.
- **Eject:** Transfers a plate from inside the instrument (if not being read) to the stacker output port where it may be retrieved. This function is disabled during a plate run.
- **Retract.** Moves a plate from the input port into the instrument. No further action is taken without input from the operator. This function is disabled during a plate run.

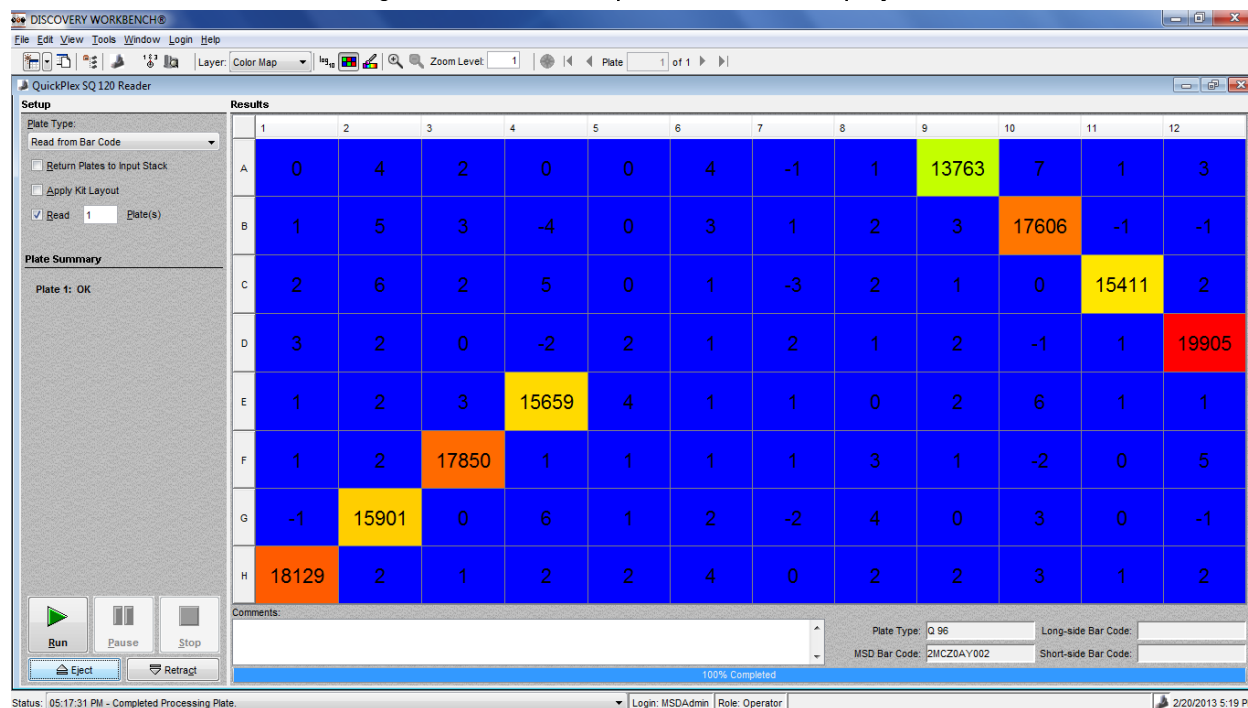
Figure 4:6 Run Options dialog box



4.2.4 Results

The software provides several options for viewing results. Select View → Layer Views from the menu or select a layer from the Layer menu on the toolbar. Refer to the DISCOVERY WORKBENCH User's Guide for details on data viewing options. If you observe the data as it is acquired in Color Map view, bright wells should display numbers above 2000 and dark wells should display numbers below 200.

Figure 4:7 Electronic test plate results, Color Map layer



When using the electronic test plate, wells A9, B10, C11, D12, E4, F3, G2, and H1 should display numbers above 2000, as shown in Figure 4:7. All other wells should have just a background signal.

4.3 Run Multiple Plates

For multi-plate runs, do not select Return Plates to Input Stack. Up to 5 plates may be loaded into the input stacker per run. Loading more than 5 plates is not recommended. Plates will accumulate in the output stack of the instrument and can be removed at any time. Do not allow more than 5 plates to accumulate in the output stack.

4.4 Robotics Integration

The instrument can be integrated with a robotics system for loading and unloading plates using the Remote Instrument Mode, which allows the instrument to be used as a component through its remote interface. A remote instrument manual that provides descriptions of the commands recognized by the MSD software is available upon request. Contact **Scientific and Technical Support** for more information on robotics integration.

Maintenance

5 Maintenance

This chapter provides information on maintenance for the QuickPlex SQ 120 system. The QuickPlex SQ 120 has been designed to require minimal maintenance. A qualified MSD service engineer should perform all maintenance procedures that are not categorized as user maintenance items.

5.1 User Maintenance

User maintenance of the QuickPlex SQ 120 system is minimal and mainly consists of keeping the outside of the instrument clean along with basic maintenance of the QuickPlex SQ 120 computer.

 **WARNING:** Opening the instrument to perform maintenance incurs risk of mechanical, electrical, and laser hazards.

Inspect the instrument before and after each use to ensure that there is no debris (liquid, dirt, plastic items, etc.) on or near the input and output stacks. Clean the instrument when needed as described below.

5.1.1 Computer Maintenance

Please perform periodic system maintenance on the computer when the instrument is not in use in order to maintain high performance. This includes running the defragmentation program included with the operating system on a regular basis, discarding unneeded files, and ensuring that there is adequate disk space on the computer.

5.1.2 Performance Qualification

A Performance Qualification Kit—containing plates, reagents, and a protocol for verifying instrument performance—is available for purchase (MSD catalog # R31QQ-2). MSD [Scientific and Technical Support](#) can provide more details on the performance qualification kit.

5.1.3 Cleaning and Exterior Decontamination

Any of the outside surfaces of the QuickPlex SQ 120 imager, accessible regions of the input and output stacks, and stacker elevator can be cleaned in the event of a fluid spill onto the instrument or for general cleanliness. Power to the instrument must be disconnected before cleaning.

 **WARNING:** The instrument should be turned off and unplugged for all cleaning processes.

Acceptable cleaning solutions include water, 70% ethanol, 1% bleach in water, or a mild detergent. Choose a cleaning solvent that is appropriate for the nature of the spill. Lint-free cleaning wipes are recommended. Please follow all safety protocols for your facility.

If chemical reagents are spilled inside the light-tight enclosure, contact MSD Instrument Service for instructions.

5.2 Preventive Maintenance

The QuickPlex SQ 120 requires annual preventive maintenance. Only MSD service engineers should perform standard preventive maintenance, which includes cleaning and lubricating all appropriate internal components.

Appendix

6 Appendix

6.1 Troubleshooting Guide

Refer to Table 6:1 below to troubleshoot hardware and operating errors. The software version may be found in Help → About Workbench.

Table 6:1 Troubleshooting Guide

Symptom/Error message on screen	Possible Cause	Corrective Action
Instrument or computer does not power on	Loose or disconnected power cable(s)	Ensure that the cables connecting the instrument and/or computer to the external power source are plugged in properly.
	No voltage at outlet	Test the outlet by connecting a different electrical device to the outlet.
	One or more fuses activated	Fuse locations and specifications for the instrument are shown in Table 6:2.
The plate passes through the instrument without being read. The Status window jumps from 1% to 100%.	The instrument was unable to read the barcode on the plate. The bar code may be damaged, smudged, marked, or otherwise unreadable.	Verify a bar code is smoothly affixed to the side of the plate. Then, select the appropriate plate type from the pull-down menu, and read the plate again.
Error 515 General error The instrument failed to read the plate after clicking the Run button.	Windows security settings, networking parameters, or the instrument name has changed.	Click OK to continue. Determine whether your IT department has made any changes to the instrument computer recently.
	Incompatible anti-virus software has been installed on the instrument computer.	Disable the antivirus program temporarily to see if that is the issue. There are several methods: 1) Exclude the file: C:\Program Files (x86)\MSD Discovery Workbench\lib\prefs.properties from scanning. 2) Disable real-time scanning. 3) Uninstall the antivirus program and use a different program.
Error 515 General error The instrument failed to initialize after clicking the instrument icon.	The Windows theme has changed.	Click OK to continue. Restore the default Windows theme. Please check whether your IT department has made any changes to the instrument computer recently. The sysinfo file contains a software log that can be used to diagnose the problem. The log will contain errors such as .JCodeException: Error creating plugin: unknown and CreatePluginAction\$1 doWork:-1 and lifesci.usersrv.ipr.IPRReader\$iprReaderVetoCloseController vetoClose:-1.
Error 515 General error The error was noted while reading a plate or during data analysis.	The Plate Data History (database) is full.	Click OK to continue. Backup and clear the database. For DISCOVERY WORKBENCH v4, instructions on backing up and clearing the database may be found in the DISCOVERY WORKBENCH User's Guide. The software log will contain a message such as: Could not allocate space for object 'PIDTable'in database 'LCPRSchema' because the 'PRIMARY' filegroup is full.

Error 6106 Instrument initialization failed	The instrument or computer has experienced a communications failure.	Perform the following steps: <ol style="list-style-type: none"> 1) Shut down the computer 2) Shut down the QuickPlex SQ 120 imager 3) Restart the computer 4) Restart the QuickPlex SQ 120 imager.
Error 7461 Instrument not ready when starting a plate run.	The camera has not reached the proper temperature for operation. The QuickPlex SQ 120 camera will cool to -25°C before the instrument becomes operational.	Check the camera cooling status (Tools → Status). The temperature should be dropping toward the operating temperature. Wait up to 30 minutes for the camera to stabilize at the correct temperature. This is a normal function of turning on the instrument. Restart the software. Check the temperature again. Contact MSD Scientific and Technical Support if the camera temperature is not dropping.
Error 8704 The MSSQL\$Mesoscale1 or SQL Server (MESOSCALE2) service has not started	The Windows service has not started.	It may take up to 5 minutes for this service to start after the computer is started. If the error is caused because DISCOVERY WORKBENCH was launched before the service started, then restarting the software will resolve it. If the service has been interrupted: <ol style="list-style-type: none"> 1) Right-click My Computer on the desktop and select Manage. In the Computer Management window under Services and Applications, click Services. 2) In the alphabetical list of services, right-click SQL Server (MESOSCALE2) and select Restart.
Error 8906 Invalid Plate Type	A discontinued plate or a plate configuration exclusive to another instrument was used.	Discontinued plates cannot be run. Plates made for SECTOR PR instruments are incompatible with the QuickPlex SQ 120 imager.
Error 9460 Instrument timed out	Communication between the instrument and the computer has been interrupted.	Check the cables attached to the instrument and computer to make sure they are correct and securely seated. Contact Instrument Service. Customers may be asked to provide log files from the folder C:\Program Files (x86)\MSD DISCOVERY WORKBENCH\log
Error 9711 Unable to connect to the instrument server	Loose cables prevent communication between the instrument and computer.	Check the integrity of all cables going into the imager and the desktop computer.
	Communication between the instrument and computer has been interrupted.	Restart the computer. Restart the communication service by navigating in Windows to Control Panel → Administrative Tools → Services. Right-click the service SQL Server (MESOSCALE2) and select either Restart or Start.
Error 9901, 9902 Communications failure	The instrument lost communication with the computer.	Ensure that both the instrument and computer are powered on and all power and communications cables connected and secure. Close DISCOVERY WORKBENCH and restart the computer. If restarting does not correct the problem, then switch the location of the instrument-to-computer USB cable by plugging the USB cable into a different USB port on the instrument computer. <ol style="list-style-type: none"> 1) Turn off the QuickPlex SQ 120 imager. 2) Wait 30 seconds. 3) Turn on the QuickPlex SQ 120 imager. 4) Restart the computer. 5) Wait 5 minutes before starting the MSD DISCOVERY WORKBENCH software. If the problem is not resolved, contact Scientific and Technical Support.

6.2 Specifications

6.2.1 MESO QuickPlex SQ 120 Imager Specifications

All performance information given below, including standard signal levels, detection limits, dynamic range, and instrument noise, is based on 150 μL read volumes in 96-well MULTI-ARRAY plates using standard plate read parameters.

Table 6:2 Specifications

Scientific Performance	
Standard Signal Levels Signals generated by Free TAG, 15,000 Signals generated by MSD Read Buffer T (1X)	12,000–18,000 counts 15–100 counts
Dynamic Range	$>10^5$
Electronic Noise Standard Deviation of Dark Noise (depends on plate type)	0–16 counts
Plate Read Times	
96-well SECTOR Plate (singleplex and multiplex)	1 min, 30 sec
96-well QUICKPLEX plate (singleplex and multiplex)	2 min, 45 sec
Environmental Specifications	
Operational Temperature Range	15° to 32°C (59 to 90°F)
Operational Humidity Range	10% to 80% non-condensing
Storage Temperature Range	-18° to 50°C (0° to 122°F)
Storage Humidity Range	5% to 85% non-condensing
Ambient Light	<2000 lux with no exposure to direct sunlight
Power Requirements	
Voltage	100–240 V~ 50/60 Hz
Current	1.5–0.6 A
Power Consumption	170W
Physical Dimensions	
Size	13 in x 23 in x 21 in (33 cm x 58 cm x 53 cm)
Weight	44.5 lbs (20.2 kg)
Plate Standard Read Volume	
96-well MULTI-ARRAY/MULTI-SPOT Plates	150 μL
Custom Bar Code Compatibility	
Code 39, Code 128	Minimum line width, 7 mils

6.2.2 MSD Plate Specifications

MSD plates are designed to comply with the mechanical dimensions of the proposed standards of the Society of Biomolecular Screening. Contact MSD [Scientific and Technical Support](#) for further details.

MSD plate bar code labels conform to the ANSI/AIM BC1—1995: Uniform Symbology Specification—Code 39 format.

6.3 Regulatory and Safety Certifications

6.3.1 Safety

The MESO QuickPlex SQ 120 has been tested by TUV Rheinland of NA, Inc. for compliance with the second and third editions of IEC 61010-1 and for completion of the CB test report and issuance of its CB test certificate. It carries the cTUVus mark and is CE marked.

6.3.2 Electromagnetic Compatibility

The MESO QuickPlex SQ 120 complies with the radiated and conducted emissions and immunity requirements of EN 61326-1 and CISPR11.

Regarding EN61326 Electrical Equipment for Measurement, Control, and Laboratory Use—EMC Requirements. (EMCD) Annex B:

- The instrument is designed for operation in a controlled electromagnetic environment. Transmitters of RF energy such as mobile (cellular) telephones should not be used in close proximity.

Regarding FCC Rules, Part 15, Subpart B, a Class A digital device:

- This Class A digital apparatus complies with Canadian ICES-003.
- Cet appareil numérique de la Classe A est conforme à la norme NMB-003 du Canada.
- This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. The equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause interference in which case the user will be required to correct the interference at his own expense.

Contact MSD **Scientific and Technical Support** with inquiries about the regulatory compliance of MSD instrumentation.

6.3.3 Laser






The MESO QuickPlex SQ 120 is classified per CFR Title 21 part 1040.10 and part 1040.11 as a Class I laser product with a built-in barcode reader classified as Class II. The QuickPlex SQ 120 is classified as Class I in accordance with IEC 60825-1.

6.3.4 WEEE Compliance

For all inquiries regarding recycling of shipping materials, instrument disposal, and WEEE-related issues, please contact an MSD instrument service specialist at 301-947-2057 or instrumentservice@mesoscale.com.

6.4 Symbols and Labels

Table 6:3 Symbols and labels

Symbol/Label	Description
	Warning message. General warnings advise operators of potential mechanical or other hazards and highlight the procedures or information necessary to avoid personal injury during use of the instrument.
	Caution message. A caution note highlights procedures or information necessary to avoid damage to equipment, corruption of software, loss of data, or invalid test results.
Class I Laser	Class 1 Laser Warning
	Electrostatic Sensitive Device
V	Volts
A	Amps
~	Alternating Current
	On
○	Off
	European Compliance Mark Indicates that the device complies with applicable European Directives
	USB I/O Port Symbol and Reference Designation

Technical Support

7 Technical Support

MSD provides excellent and timely support for all authorized users of the QuickPlex SQ 120. We welcome and carefully consider all bug reports and suggestions for improvements to future versions. We will work with you to resolve any problems you may encounter.

7.1 Bug Reports and Suggestions

Please send comments or feedback on the software—including bug reports, unresolved error codes, feature requests, or design change requests—to an MSD Scientific and Technical Support specialist at scientificsupport@mesoscale.com.

7.2 Problems Running the QuickPlex Imager

If you encounter an error report that you cannot resolve, please provide us with as much of the following information as possible:

- The error code and text in the error dialog box
- What you were doing when the error occurred
- How the error can be reproduced
- If requested by MSD Scientific Support, a copy of the SysInfoOutput.txt file located in C:\sysinfo

To generate the report file, first run the SysInfo.exe diagnostic tool located in (Win7-64 bit)C:\Program Files (x86)\MSD DISCOVERY WORKBENCH\bin.

Email this information to scientificsupport@mesoscale.com. Someone will contact you within two business days. If the error is affecting your work, please mark it URGENT and we will respond as quickly as possible.

7.3 How to Contact Us

Meso Scale Diagnostics, LLC, company headquarters is located at:

1601 Research Boulevard
Rockville, Maryland 20850 USA
+1 240-314-2600

Our website is www.mesoscale.com.

Customer Service

+1 301-947-2085

customerservice@mesoscale.com

Scientific and Technical Support

+1 301-947-2025

scientificsupport@mesoscale.com

Instrument Service

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MESO SCALE DISCOVERY, MESO SCALE DIAGNOSTICS, MSD, DISCOVERY WORKBENCH, MULTI-ARRAY, MULTI-SPOT, QUICKPLEX, SECTOR, SECTOR PR, SECTOR HTS, SULFO-TAG, V-PLEX, STREPTAVIDIN GOLD, MESO, www.mesoscale.com, SMALL SPOT (design), 96 WELL 1, 4, 7, & 10-SPOT (designs), 384 WELL 1 & 4-SPOT (designs), MSD (design), and SPOT THE DIFFERENCE are trademarks and/or service marks of Meso Scale Diagnostics, LLC. ©2013 Meso Scale Diagnostics, LLC. All rights reserved



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