



MIRO·CANVAS™

User Guide

Version 1.3

For research use only. Not for use in diagnostic procedures.

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Revision History

Version	Revisions
1.2	Updated regulatory and legal information
1.3	Updated compatibility table

Contact Information

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Legal

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Section 1 • General Information

INTENDED USE

The Miro Canvas is a benchtop digital microfluidics platform that delivers custom low-throughput workflow automation for academic, research, and pharmaceutical life science laboratories. The Miro Canvas is for Research Use Only (RUO).

Section 2 • Safety and Compliance

SAFETY STANDARDS

Complies to:

- UL STD 61010-1
- UL STD 61010-2-010
- EN 61010-1:2010+A1:2019
- IEC 61010-1:2010/AMD1:2016
- EN 61010-2-081:2020
- IEC 61010-2-081:2019
- EN 61010-2-010:2020
- IEC 61010-2-010:2019

Certified to:

- CSA C22.2 STD # 61010-1-12
- CSA C22.2 STD # 61010-2-010

EMC STANDARDS

The Miro Canvas has been tested and found to be in conformity with:


- IEC/EN 61326-1:2021
- FCC 47 CFR Part 15, Subpart B - Verification
- ICES-003 Issue 7:2020
- FCC 47 CFR Part 15, Subpart C - 15.225
- RSS-210, Issue 10, December 2019
- RSS-Gen, Issue 5, Amendment 1, March 2019
- ETSI EN 300 330 V2.1.1
- ETSI EN 300 328 V2.1.1

SYMBOL TABLE

	European Conformity
	UK Conformity Assessed
	High Voltage
	Warning or Caution

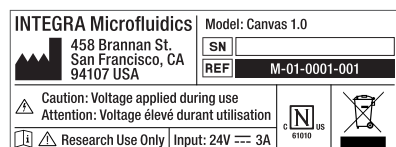
FCC COMPLIANCE (FCC ID: 2A6E7MIROCANVAS10 CONTAINS FCC ID: VVXLM823)

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

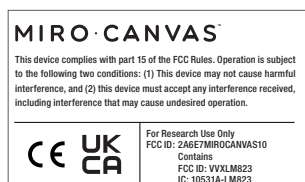
 **CAUTION:** Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

If the device has removable antennas then a list of the antennas that may be used with the device must be included in the user manual. The list should identify the type of antenna, impedance (usually 50 ohms), and the maximum gain in dBi.

INSTRUMENT LABELING




This label is placed on the back of the instrument.



This label is placed on the bottom of the instrument.

OPERATING PRECAUTIONS

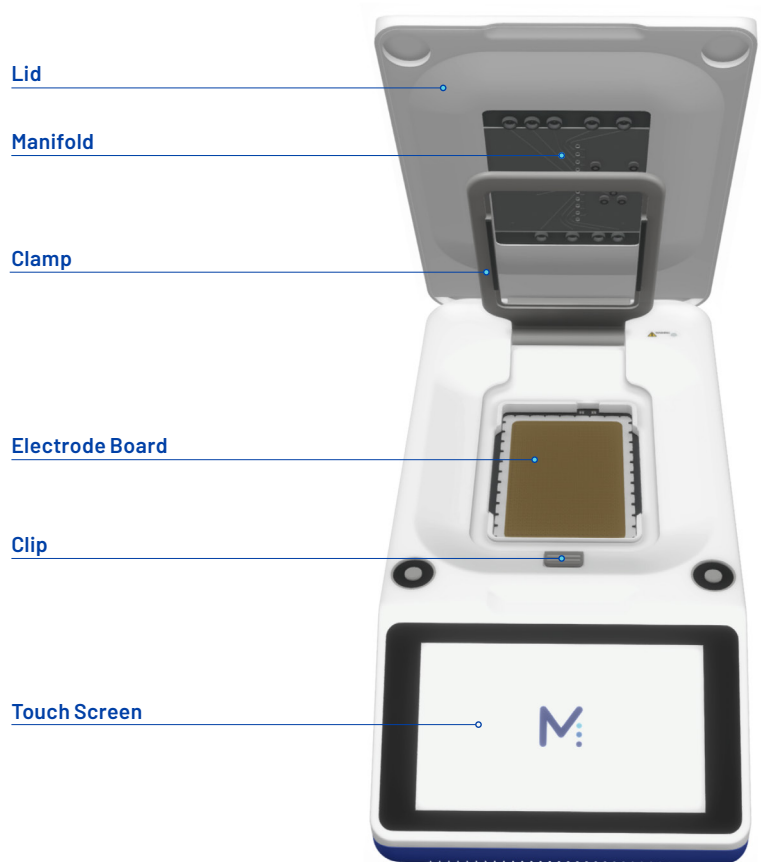
- Instrument is only to be operated by personnel who have read the User Guide in full and are using proper personal protective equipment.
-  Voltage applied during use. Follow all instructions when loading the instrument.
- Use care when loading the cartridge on the instrument electrode board.
- Handle liquids near the instrument with extreme caution.
- Do not overfill reagent reservoirs.
- Use the instrument only within the environmental conditions specified in this document.
- Use only the power supply and cables provided with the instrument.
- Use only the Wi-Fi antenna provided with the instrument.
- Use the instrument in a dry environment, especially if synthetic materials are present (synthetic clothing, carpets, etc. may cause damaging electrostatic discharges).
- Do not use this instrument in close proximity to sources of strong electromagnetic radiation, as these may interfere with proper operation.
- Treat all samples as potentially biohazardous in accordance with your organization's approved procedures.
- Operate the instrument in a clean indoor area free of dust.

- Do not operate the instrument if the internal components have been damaged or exposed to fluids.
- Use only unexpired reagents and consumables.
- Store Miro Dropgloss bottle upright and away from light.
- Do not aliquot Miro Dropgloss. Leave in the original container.
- Only write on cartridges with soft permanent or laboratory markers (Sharpie® or similar). Do not apply pressure to the cartridge or cartridge film/label if annotating with markers.
- Instrument electrode board is vulnerable to scratching. Do not slide the cartridge on the electrode board. Do not wipe the electrode board with any material.
- Be aware of pinch points when opening and closing the instrument lid.

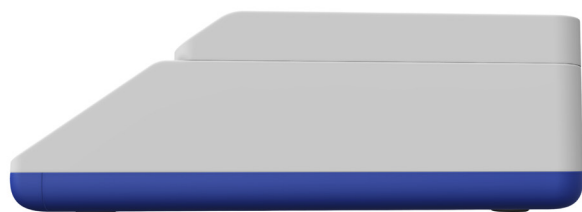
Section 3 • Operating Conditions

ATTRIBUTE	VALUE
Dimensions (lid closed)	20.2 cm W x 40.6 cm D x 17.6 cm H 8 in W x 16 in D x 7 in H
Weight	13.2 lb 6 kg
Nominal Input Voltage	100 - 240V AC
Nominal Input Frequency	50 - 60 Hz
Input Current	4A @ 115V AC, 2A @ 230V AC
Operating Temperature	19 - 25 °C
Relative Humidity	20 - 80%, non-condensing
Atmospheric Pressure	78 - 107 kPa
Space Requirements	Minimum 30 cm W x 45 cm D on a stable surface
Pollution Degree	Pollution Degree 2

Section 4 • Components



INSTRUMENT AND ELECTRODE BOARD



INSTRUMENT (SIDE)



INSTRUMENT (FRONT)

Section 5 • Installation

1. INFRASTRUCTURE REQUIREMENTS

- 120V 3-prong outlet
- Networked computer with Google Chrome (browser version 75.x or later)
- Local area network connectivity supporting a speed of 100 Mb/s via RJ-45 shielded Ethernet cable or 802.11a/b/g/n compatible Wi-Fi wireless network
- Please note that, at this time, we cannot connect to Wi-Fi networks requiring captive portal login (opening of a page which requires input of user name and/or password).
- If your network configuration utilizes a MAC filter, you may need to whitelist the instrument MAC address (found in Network Settings on the Miro Canvas touchscreen Settings menu).
- For the instrument to interact with the cloud platform, please ensure that your network supports the following ports: TCP 8883, 8443, 443, and 53.

Maintaining a constant internet connection is critical to enable software updates, new protocol uploads to your instrument, and aid in troubleshooting. Run data (instrument temperatures, voltages, pressures, etc.) will be uploaded to a cloud platform, which Miroculus can access for technical support, if necessary. No sample information will be entered into the instrument or transmitted via the internet.

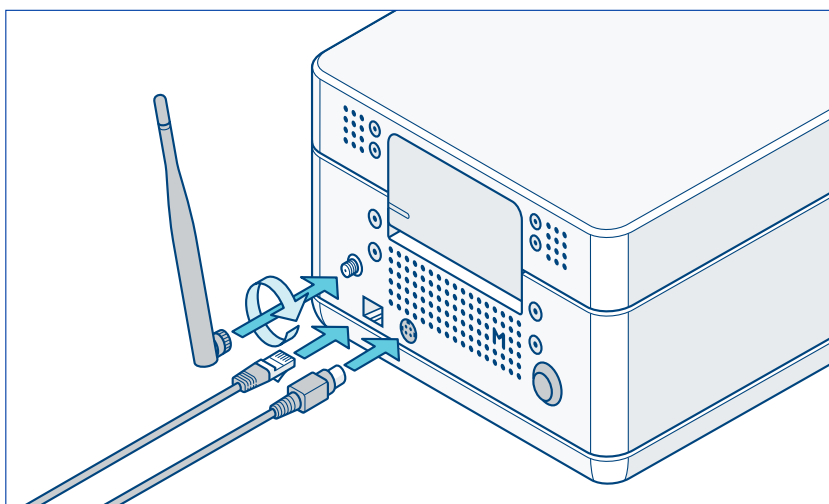
2. INSTRUMENT SETUP

- Remove the Miro Canvas (instrument and accessories) from the box and place upright on a clean, dry, level working surface (minimum 30cm W x 45 cm D) free from vibrations.
- Connect the included power cable and Wi-Fi antenna. If not using Wi-Fi, toggle off Wi-Fi on the touchscreen Settings menu and connect an Ethernet cord instead of the Wi-Fi antenna.

⚠ No other power cable may be used with the instrument.

⚠ Do not block access to power switch. Ensure adequate space is available to access power switch on back of unit.

⚠ No other Wi-Fi antenna may be used with the instrument.



- iii. Power up the instrument by pressing the black power button on the back of the Canvas. The LED indicator bar will change to blue as the instrument initializes.
 - 1. The instrument may take a few minutes to power up.
- iv. Use the touchscreen Settings menu to:
 - 1. Connect to a network
 - a. To use an Ethernet connection (recommended for stability), plug in an Ethernet cord and toggle off Wi-Fi on the touchscreen Settings menu.
 - b. To use a Wi-Fi connection, connect the Wi-Fi antenna, toggle on Wi-Fi on the touchscreen Settings menu, and ensure that an Ethernet cord is not plugged into the instrument.
 - c. Network connectivity is not required to run existing protocols, but is critical for running new protocols, software and firmware updates, and optimal troubleshooting support.
 - 2. Name your Canvas
 - 3. Level the instrument
 - a. Navigate to the Instrument settings menu and select “Level instrument”
 - b. Follow the instructions on the screen.
 - 4. Run Miro Diagnostics (optional)
 - a. Miro Diagnostics tests the core functionality of the instrument. Miro Diagnostics can be run to increase confidence prior to running a protocol with a precious sample, or to aid in troubleshooting after a protocol has behaved unexpectedly. It is good practice to run Miro Diagnostics weekly.

Section 6 • Operation

1. REQUIRED MATERIALS

- **Reagents**

- i. Reagents provided with desired library preparation kit or custom workflow, including adapters
- ii. Additional reagents, as required for desired workflow (nuclease-free water, fresh 80% ethanol, 10 mM Tris-HCl, etc.)
- iii. Miro Dropgloss

- **Equipment**

- i. Miro Canvas instrument
- ii. Uninterruptible power supply (recommended)
- iii. Miro Cartridge
- iv. Additional equipment, as required for desired workflow

2. PROCEDURE


• Tube Recommendations


The table below shows tubes that are known to be both compatible and incompatible with Miro Cartridge. This list is not comprehensive.

	SUPPLIER	CAT. NO.	PRODUCT DESCRIPTION
Compatible	Applied Biosystems	N801058	MicroAmp 8-Tube Strip; 0.2 ml
	USA Scientific	1402-4700	TempAssure PCR Flex-Free 8-Tube Strips 0.2ml
	Axygen	PCR-02-L-C	Maxymum Recovery PCR Tubes; 0.2 ml
	Axygen	PCR-02-C	PCR Tubes with Flat Cap; 0.2 ml
	Eppendorf NA	86403	Tube Microcentrifuge DNA LoBind; 1.5 ml
	VWR	87003-294	Microcentrifuge Tubes; Polypropylene; 1.7 ml
	Thermo Fisher	AB-2005	EasyStrip Plus tube strip with attached ultra clear caps
	Olympus	27-125V	Olympus plastics 17-125V, 0.2 ml 8-strip PCR tubes
Incompatible	Simport Scientific	T320-3N	Amplitube PCR Reaction Strips; 8 x 0.2 ml
	Eppendorf	0030108434	Protein LoBind tubes
		0030108441	
		0030108450	

• Reagent Preparation

- i. i. Prepare reagents as required for desired workflow
- ii. Keep Dropgloss at room temperature (19-25°C). Vortex Dropgloss well in the original container before use.

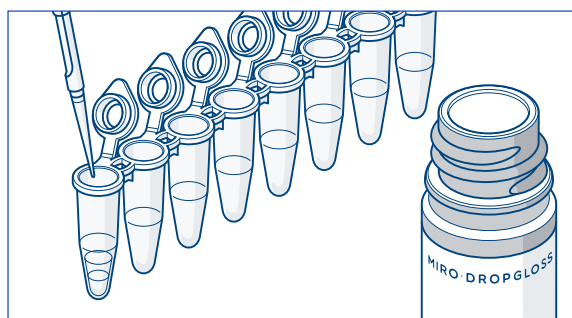
 Dropgloss will solidify below 18°C. If this occurs, hold the tube in your hand until completely thawed, then vortex well. Visually inspect the Dropgloss in your pipette tip to ensure that it has completely thawed before adding to the reaction.

 Dropgloss is light-sensitive and may also react with alternative storage plastics, resulting in diminished performance; it should never be aliquoted.

- iii. If desired, shear input DNA in an appropriate buffer (e.g. 10 mM Tris-HCl).
- iv. Barrier pipette tips should be used when preparing, loading, and recovering reagents and samples.
- v. Assemble reaction mixes in separate 0.2 ml PCR tubes:

1. Add reagent(s) to each tube, then add Dropgloss to required reagents. Dropgloss will naturally separate from reagents in the tube.

- a. Dropgloss will solidify below 18°C. While original enzyme stocks should be kept on ice, reaction mixes should be kept at room temperature on the benchtop until you are ready to load the cartridge. Do NOT keep reaction mixes on ice.



- **Instrument Loading**

- i. Power up the Miro Canvas by pressing the black power button on the back of the instrument.
- ii. Follow the directions on the touchscreen to load the instrument.
 1. If necessary, first use Miro Palette to send the protocol to the instrument.
 2. On the instrument touchscreen, select the user and the desired protocol.
- iii. Open the instrument lid by securing the base of the instrument with one hand, grasp the front center of the lid with the other hand, and lift straight up. Release the cartridge clamp and load the new, empty Miro Cartridge into the instrument. Lower the cartridge clamp until the clip engages.


 **IMPORTANT:** Do not set the cartridge on the lab bench.

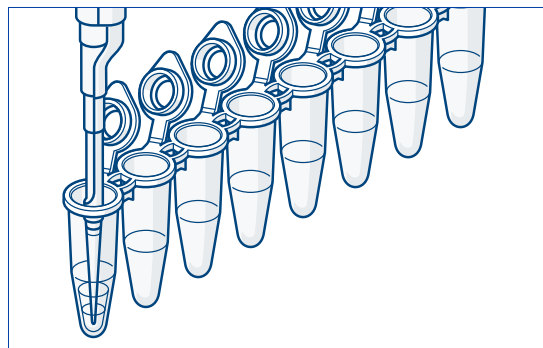
 **IMPORTANT:** Do not touch the bottom film of the cartridge.

 **IMPORTANT:** Do not slide the cartridge on the electrode board.


- **Reagent Loading**

- i. Load the prepared reagents into the cartridge inlets, as indicated on the touchscreen.
 1. Pulse spin the reagents to bring all contents to the bottom of the tube.
 2. Set a 200 µl pipette to 20 µl greater than the collective volume of the reagent and Dropgloss, and draw liquid up from the bottom of the PCR tube. Drawing reagent+Dropgloss into the pipette tip in this manner ensures that any small volume of liquid left in the PCR tube is Dropgloss, which will not negatively affect the run.

 **IMPORTANT:** For Reaction Mixes containing >50 µl Dropgloss, place the pipette tip in the top layer (Dropgloss) of liquid and draw up as much as possible, then lower the tip to the bottom of the tube and draw up the remaining liquid from the bottom.



3. To load, fully insert the pipette tip into the inlet, then depress the plunger in a single, swift, and smooth motion until you reach the first stop of the pipette. Hold the depressed pipette in the inlet for 3 seconds. Remove the pipette tip from the inlet before releasing the plunger. Repeat for each reagent.

 **IMPORTANT:** Air in the pointed end of the pipette tip is normal and will harmlessly dissipate into the air within the cartridge. However, depressing the pipette past the first stop can introduce an air bubble into the reagent droplet, which can negatively affect the run.
 4. It may take a moment for the reagent to be detected once loaded into the cartridge inlet. Once detected, the touchscreen will automatically prompt you to load the next reagent.
 5. Once all inlet reagents are loaded, press Continue on the touchscreen to advance to reservoir loading.
- ii. Load the prepared reagents into the reservoirs, as indicated on the touchscreen.
 - a. Remove the blue cap from the reservoir. To load, draw up the reagent using a 1000 µl pipette fitted with a barrier tip. Hold the pipette vertically and fully insert it into the reservoir to dispense. Remove the tip from the reservoir before releasing the pipette plunger.

- b. To seal the reservoir, fully press the blue cap onto the reservoir.
 - c. Reagents loaded into reservoirs cannot be automatically detected as inlet reagents can. Press Continue on the touchscreen to advance to the next reservoir.
- iii. Once all reagents are loaded, follow the touchscreen instructions to start the run.
 - a. Examine the manifold on the underside of the lid to ensure it is clear of debris.
 - b. Press down firmly on both front corners to ensure the instrument lid is properly closed.

• Recover the Sample and Finish the Run

- i. The Canvas touchscreen will indicate that the protocol has ended and it is time to recover the sample. Follow the instructions on the screen.
- ii. Fully open the lid immediately after the lid lock releases. To lift the lid, secure the instrument base with one hand, and grasp the center of the lid with your other hand and lift straight up. Do not tip the instrument, as this may move your sample away from the recovery inlet.

⚠ IMPORTANT: Leave the cartridge clamp engaged during sample recovery.



- iii. To recover your sample, set a 200 μ l pipette 20 μ l higher than the volume of the sample you are recovering, depress the plunger to the first stop, insert the tip vertically into the recovery inlet, and slowly release the plunger to draw up your sample. Transfer the sample to a clean, labeled tube for analysis and storage.
 - iv. To remove the cartridge, release the cartridge clamp and lift the cartridge up. Cartridges are single use only. Dispose of the cartridge after each run.
 - v. Close the lid and power off the Canvas. Closing the Canvas lid prevents dust from contaminating the electrode board.


⚠ IMPORTANT: Never touch or wipe the electrode board. Contact Technical Support if you notice your electrode board is dirty.

Section 7 • Maintenance and Troubleshooting

1. MAINTENANCE

- It is recommended to run Miro Diagnostics weekly.
- If instrument malfunction is suspected, instrument functionality can be tested by running Miro Diagnostics. Contact Miroculus Technical Support with any questions regarding suspected instrument, cartridge, or reagent malfunction.

- In the event that an instrument malfunction requires repair, contact Miroculus Technical Support to initiate the decontamination and repair process.
- After a run, ensure proper removal and disposal of the cartridge.
- Clean external surfaces gently as needed. Wipe exterior surfaces (including touchscreen) of the instrument with a Kimwipe moistened with a 10% bleach-based disinfecting solution, leaving the solution on the surface for at least 1 minute.

 Do not wipe anything under the lid, especially the electrode board. Contact Technical Support if you notice your electrode board is dirty.

 Do not operate the instrument if the internal components have been damaged or exposed to fluids.



The Miro Canvas must not be disposed of with unsorted municipal waste.

Dispose the Miro Canvas in accordance with the laws and regulations in your area governing disposal of devices.

In certain regions and countries, e.g. in EU members states, the distributor is obliged to take back this products free of charge at the end of life. Please contact your local distributor for more details.

2. SOFTWARE/FIRMWARE UPDATES

- On-screen notifications will alert users to updates for the instrument software. Upon notification, users will have the option to update immediately or delay. Additionally, users can check for available updates at any time using the Settings menu on the touchscreen. If the update is delayed, users will be periodically reminded of the update. Keeping the instrument software up-to-date will optimize protocol performance and aid in troubleshooting. During some software updates, the instrument will turn itself off. If this happens, please wait 5 minutes before attempting to turn the instrument back on.

3. TROUBLESHOOTING

Instrument Malfunction	Possible Cause and Solution
BEFORE YOU BEGIN	
The Miro Canvas does not successfully start up (indicated by blue LED indicator bar)	Power may not be flowing to the instrument. Ensure power supply cords are securely attached to the instrument, power brick, and wall outlet, and that wall outlet is supplying power.
	During some software updates, the instrument will turn itself off. If this happens, please wait 5 minutes before attempting to turn the instrument back on.
On-screen Alert: Software Update Available	If desired, update the instrument software. Software updates can also be accessed in the Settings menu.
Touchscreen Settings menu indicates the instrument is not connected to the internet or On-screen Warning: Instrument is not connected to the internet	Ensure Wi-Fi antenna is securely screwed into the instrument.
	Plug in an Ethernet cord and toggle off Wi-Fi on the Settings menu. Do not attempt to connect to Wi-Fi while an Ethernet cord is plugged in.
	Use the touchscreen Settings menu to connect to a Wi-Fi network.

RUNNING A PROTOCOL	
On-screen Error: Voltage	Voltage is not detected and run cannot proceed. Please ensure cartridge clamp is engaged, press cancel, and restart the run.
On-screen Error: Instrument Not Level	Navigate to the Instrument Settings menu, select "Level instrument," and follow the instructions on the screen. If error persists, please contact Miroculus Technical Support.
On-screen Error: Cartridge Not Detected	Cartridge may have shifted or clamp may not be properly closed. Open the instrument lid, release the cartridge clamp, and firmly press down on the cartridge (without sliding cartridge). Lower the cartridge clamp until the clip engages. Securely close the lid by pressing down on both corners. If error persists, discard the current cartridge and load a new cartridge.
On-screen Error: Lid is Not Closed	The lid has not been properly closed. Press down on both front corners of the lid to ensure full closure. If error persists, press cancel and restart the run.
On-screen Warning or Error: Low Temperature	The environment that the instrument is located in is too cold. Ensure the environmental temperature is within the operating range (19-25°C). Run will fail at 16°C.
On-screen Warning or Error: High Temperature	The environment that the instrument is located in is too hot. Ensure the environmental temperature is within the operating range (19-25°C).
	The air filter located on the bottom of the Canvas is clogged with dust and impeding air flow. Contact Miroculus Technical Support.
On-screen Error: High Humidity	The environment that the instrument is located in is too humid. Ensure the environmental humidity is within the operating range (20 - 80%, non-condensing).
On-screen Error: Used Cartridge Detected	Cartridge has already been used. Discard the current cartridge and load a new cartridge.
On-screen Error: Expired Cartridge Detected	This cartridge is expired. Discard the current cartridge and load a new, unexpired cartridge.
On-screen Error: Magnet Issue	The instrument is not functioning as expected. Recover your sample, if possible. Please restart the instrument and run Miro Diganostics. If the error persists, please contact Miroculus Technical Support.
On-screen Error: Voltage	Voltage is not detected and run has failed. Please contact Miroculus Technical Support.
On-screen Error: Heating System	The instrument is not functioning as expected. Run has failed and an attempt will be made to recover your sample. Follow the directions on the screen.

On-screen Error: Dispensing System	The instrument is not functioning as expected. Run has failed and an attempt will be made to recover your sample. Follow the directions on the screen. Keeping the cartridge clamp engaged, examine the manifold on the underside of the lid to ensure it is clear of debris. If any debris is found, remove it from the manifold and restart the run.
Cartridge clamp will not fully close (clip does not engage)	Debris in the clamp bed can interfere with clamp closing. Wet a kimwipe with isopropyl alcohol or ethanol and clean clamp bed, being careful not to touch or drip on the electrode board.
Instrument lid will not open	Lid electromagnets will not disengage. Hold the power button for 15 seconds to turn off the instrument and press the power button to turn the instrument on again.
On-screen Error: Run Failed, Reagent on Reservoir was not found	A reservoir reagent has not been detected. Run has failed and an attempt will be made to recover your sample. Follow directions on the screen. Keeping the cartridge clamp engaged, examine the manifold on the underside of the lid to ensure it is clear of debris. If any debris is found, remove it from the manifold and restart the run.
On-screen Error: Droplet Not Found	Run has failed and an attempt will be made to recover your sample. Follow the directions on the screen.
When loading cartridge inlets, reagent regurgitates up the inlet	The pipette tip may be too wide, held at too severe of an angle, or not inserted fully. Discard the current cartridge and load a fresh cartridge. Restart the run.
Unable to recover sample from the recovery inlet	The sample may have shifted during lid opening, or releasing the clamp prior to sample recovery. Contact Technical Support.
Dropgloss has solidified in the tube with the reagent prior to loading into the cartridge	Allow reagents to warm to room temperature. Dropgloss (including reaction tubes containing Dropgloss) should never be placed on ice.
Reagent is not automatically detected after loading into inlet	It may take a moment for the reagent to be detected. If after a minute the reagent remains undetected, high voltage may not be functioning as expected, potentially due to the clamp not being closed in a timely manner. Attempt to recover the reagent from the inlet, restart the run and ensure that high voltage is functioning (as indicated by its status light) and re-load the cartridge.
	It may take a moment for the reagent to be detected. If after a minute the reagent remains undetected, the reagent may be loaded into the wrong inlet. Attempt to recover the reagent from the inlet and re-load into the correct inlet.
	It may take a moment for the reagent to be detected. If after a minute the reagent remains undetected, it may be that only Dropgloss was loaded into the inlet. Attempt to recover the Dropgloss from the inlet and re-load reagent+Dropgloss.

Bubbles in pipette tip prior to loading	Wait for the bubbles to resolve before dispensing into the inlet.
On-screen Error: Droplet Mobility Failure	The instrument is not functioning as expected. Run has failed and an attempt will be made to recover your sample. Follow the directions on the screen.
Final library yields are lower than expected	Input sample quality may be lower than expected. Examine input DNA using a Bioanalyzer or similar instrument.
	Adapters may have undergone too many freeze-thaw cycles.
	If the 80% ethanol solution used in purification steps is not made fresh, it could be less than 80% ethanol (due to evaporation over time) and therefore causing inefficient purification of DNA throughout the workflow.
High Voltage indicator light begins flashing or changing from yellow to green	Cancel run immediately. Attempt to recover the sample, if possible. Contact Technical Support.
MIRO DIAGNOSTICS	
On-screen Error: Magnets	Magnets within the instrument are not functioning as expected. Restart the instrument. Re-run Miro Diagnostics. If the error persists, contact Technical Support.
On-screen Error: Dispensing System	The dispensing system within the instrument is not functioning as expected. Restart the instrument. Re-run Miro Diagnostics. If the error persists, contact Technical Support.
On-screen Error: Lid Lock	The lid has not been properly closed. Press down on both front corners of the lid to ensure full closure.
On-screen Error: Instrument Not Level	Navigate to the Instrument Settings menu, select "Level instrument," and follow the instructions on the screen. If error persists, please contact Miroculus Technical Support.
INSTRUMENT LED INDICATOR BAR	
LED is blue (solid)	The instrument is initializing, available, and ready
LED is blue (gradient)	The instrument is ready for reagent loading
LED is blue (dynamic gradient)	A protocol is running on the instrument
LED is yellow	A software error has occurred
LED is a rainbow	A firmware error has occurred
LED is green	Instrument is performing a Miro Diagnostics check

NETWORK CONNECTION INDICATORS	
Green dot on touchscreen	Connected to network, internet enabled
Yellow dot on touchscreen	Connected to network, No internet access.
Red dot on touchscreen	No network or internet connected.