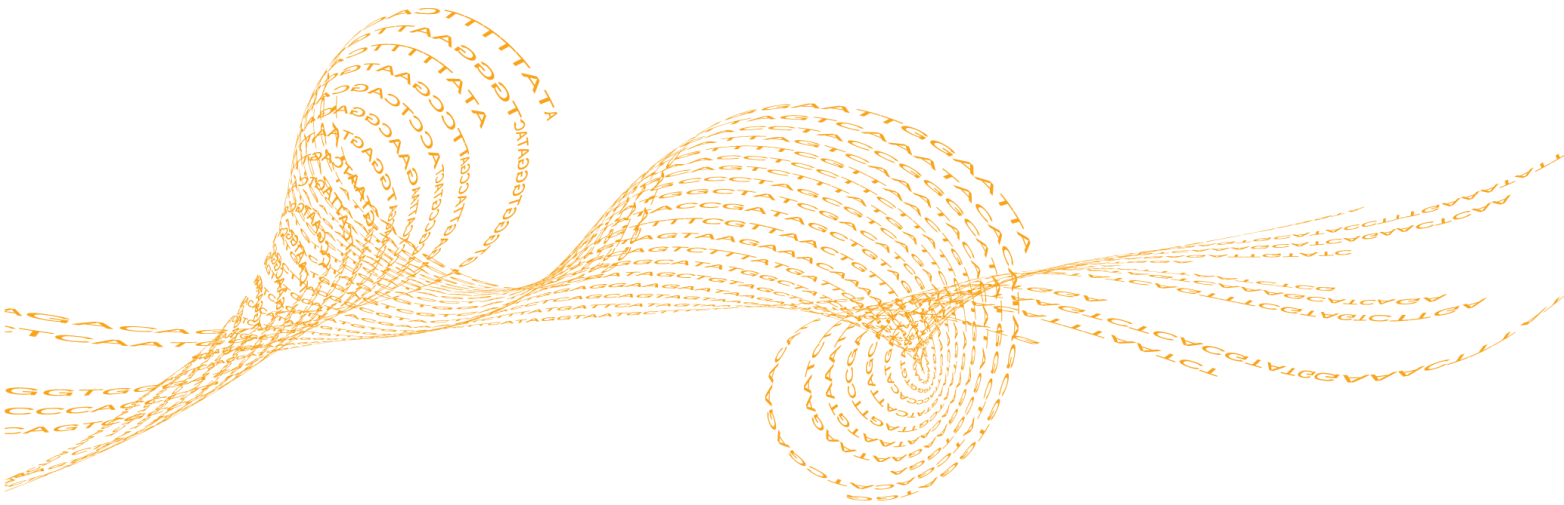
Hamilton Microlab STAR

Reference Guide



ILLUMINA PROPRIETARY
Part # 15070074 Rev. A
June 2015

illumina®

Revision History

Part #	Revision	Date	Description of Change
15070074	A	June 2015	Initial release

Introduction

The Hamilton Microlab STAR (ML STAR) is used for automated pipetting of liquid sample material and reagents.

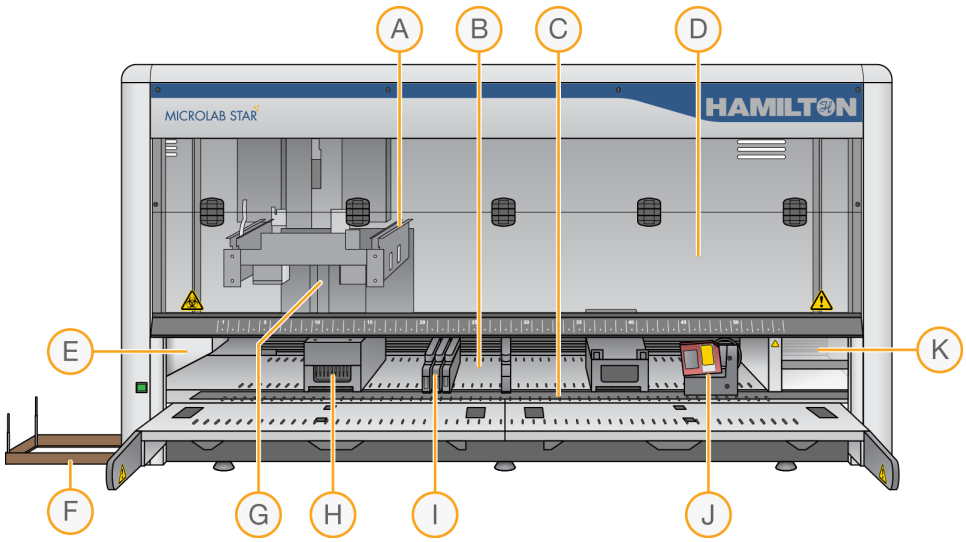
Use this guide as a reference to operate and maintain the instrument when performing Illumina protocols on the ML STAR.

ML STAR Components

The ML STAR performs pipetting operations on liquids in containers and transports plates placed on the work surface. Pipetting operations aspirate differing quantities of liquid from a source container, and then transfer the liquid to a target container.

The ML STAR work surface, called the deck, holds loadable carriers in multiple sizes. The carriers hold reagent containers, tubes, and microplates.

Figure 1 ML STAR Components



- **A** Pipetting arm
- **B** Deck
- **C** Loading tray
- **D** Front cover
- **E** Waste slide for CO-RE head tips
- **F** Waste attachment for CO-RE head tips
- **G** Pipetting channel, CO-RE head
- **H** Carrier for microplates, tips
- **I** Carrier for tubes
- **J** Autoload unit and barcode reader
- **K** Waste container for pipetting channel tips

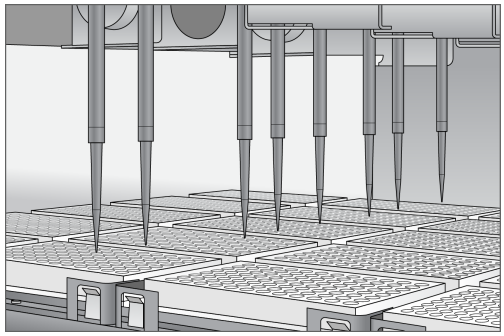
The deck of the ML STAR is divided into equal tracks that guide carriers into predetermined positions.

The deck has partitions for up to 54 specialized 1 track (1T) carriers for sample tubes, or up to 9 carriers with 6 tracks (6T) for microplates and CO-RE tips.

Pipetting Channels

The ML STAR has 8 pipetting channels working in parallel for simultaneous transfer of liquids. The dynamic positioning system (DPS) moves each 1000 µl pipetting channel independently on the Y-axis and Z-axis. The pipetting channels use disposable tips and move at a specified height to prevent collisions with other items on the deck.

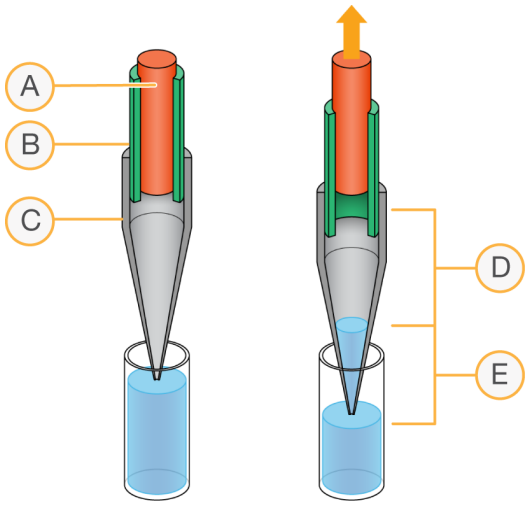
Figure 2 Pipetting Channels with 1000 µl Tips



Pipetting Principle

The ML STAR is based on the air displacement pipetting principle, which is comparable to the functionality of hand pipettes. Air displacement aspirates and dispenses the liquid into the disposable tip using a plunger.

Figure 3 Pipetting Principle Diagram



A Plunger
B Barrel
C Tip
D Air between plunger and liquid
E Aspirated liquid

Liquid Level Detection

Capacitive Liquid Level Detection (cLLD) enables the tip to find the surface of the liquid at the start of an aspiration or dispense step. This feature detects the difference in capacitance between the tip in the air and the tip in the liquid.

cLLD verifies that liquid is in a container, and then calculates the volume. If the volume is less than expected, an error message appears.

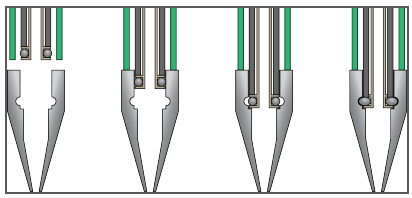
Each individual channel has the cLLD functionality. The 96 CO-RE head has cLLD sensors on the A1 and H12 channels.

CO-RE Technology

The ML STAR picks up a disposable tip using compression-induced O-ring expansion technology, or CO-RE technology. CO-RE technology enables precision tip attachment and positioning without vertical force. This technology improves overall reliability, pipetting speed, and capability.

Only use ML STAR CO-RE tips. Other tips do not mount properly and can cause errors.

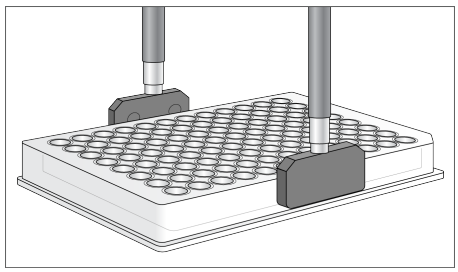
Figure 4 Precision Tip Attachment



CO-RE Gripper

The CO-RE gripper is the plate handling tool that 2 pipetting channels pick up during a run. The gripper picks up plates in landscape or portrait orientation, but does not rotate plates. The CO-RE gripper holder for the 2 gripper jaws is mounted on the waste block.

Figure 5 CO-RE Gripper



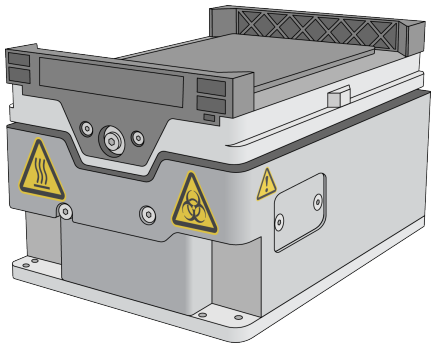
CO-RE 96 Probe Head

The CO-RE 96 Probe Head is a high-throughput pipettor with 96 pipetting channels that work simultaneously. Each 1000 µl pipetting channel uses the same volume of liquid.

Heater Shaker

The Hamilton heater shaker (HHS) heats and shakes plates during a run. When the shaking process is complete, plates are unlocked for automatic removal.

Figure 6 HHS with Universal Flat Bottom Adapter



CAUTION
Do not touch the HHS during a run or shortly after completing a run.

The HHS adapters fit to a plate type, which allows optimal heating of samples. Only use labware that complies with the HHS dimensions.

The maximum temperature of the HHS is 105°C. The HHS has 2 sensors that monitor and control the temperature. A default threshold temperature protects samples from overheating.

Carriers

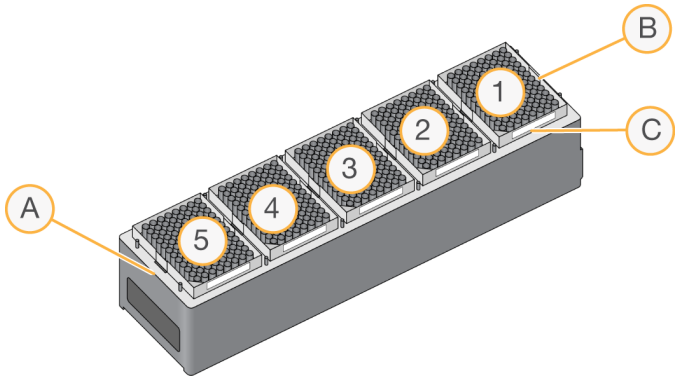
Plates, tips, and reagents are placed on carriers that are loaded onto the ML STAR.

Every carrier is equipped with at least 2 labels—1 identification label and 1 barcode label.

- The identification label is a human-readable label on the front of the carrier with the carrier name and barcode information. The ML STAR software uses the carrier name.
- The barcode label is on the back of the carrier and used for automatic identification during the loading process.

Items are loaded according to the deck layout of the method. Carrier positions are numbered from back to front and left to right. Load items with barcode labels facing right.

Figure 7 Tip Carrier with Labeled Carrier Positions and Barcodes Facing Right



A Front of carrier
B Back of carrier
C Barcode labels facing right

User-Supplied Consumables

Only use original ML STAR parts and commercially available liquid containers that meet assay specifications. To prevent damage to the pipetting channels and cross-contamination, only use ML STAR disposable CO-RE tips with filters.

Tip racks are barcode labeled for automatic identification. Tip carriers hold up to 5 tip racks.

System Software

The dedicated ML STAR software controls the instrument and accessories. The software is a Windows-based application with a menu-driven interface.

Control Software Commands

The Run Control toolbar contains the following command options to control the operation of the current method. Only use command options that are applicable for the assay.

Table 1 Operation Commands

Icon	Command
	**Analyze Only**—Analyze for syntax errors when the run control is opened. *This functionality is not applicable.*
	**Start** or **Run Process**—Starts the method.
	**Pause**—Pauses the current run after the current pipetting operation is complete. An audible beep indicates that the run is paused. Paused runs can be resumed or aborted.
	**Single Step**—Performs the next step in the method and then pauses the run.
	**Abort**—Cancels the current operation and ends the run.
	**Control Panel**—Opens the control panel, which includes commands to initialize the instrument and move mechanical components before starting a method. *This functionality is not applicable.*

Incubation Timer

The Timer Display screen shows the incubation completion time for steps performed on the ML STAR. For steps performed on other equipment, set a separate timer.

During incubation, complete other work or prepare for the next step.

Aborting A Run

To abort a run, perform the following steps.

1 Click the Abort button on the Run Control toolbar.

2 Click **Abort** to confirm, or click **Cancel** to continue the method.

3 Open the Hamilton App Launcher and restart the method.

The Abort button is active for the entire duration of a method. If a problem is identified early in the procedure, restart the method. If a problem is identified late in the procedure, do not proceed with the next step of the workflow.

Safety Precautions

Carefully review safety information before operating the ML STAR. This section describes safety labeling on the instrument, electrical and biological safety considerations, and potential hazards associated with operation.

Safety Labeling

Safety labels are affixed to the instrument in specific locations to provide information and appropriate warnings.

Figure 8 Safety Label Locations

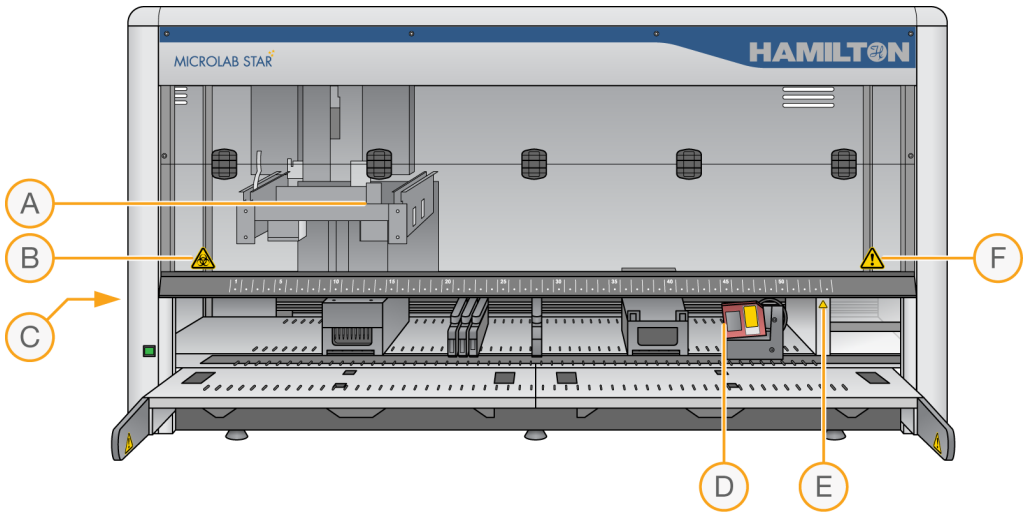


Table 2 Label Descriptions

Location	Label	Description
A		**Pipetting arm**—Never attempt to move the pipetting arm manually.
B		**Biohazard warning**—Deck contains biohazardous or chemically contaminated materials.
C		**Power connections**—Only connect to earth-grounded outlet.
		**Connection to PC**—Only use appropriately shielded cables. **USB connection**—To avoid signal interference, do not exceed a cable length of 5 m (16.4 feet).
D		**Laser beam**—Do not stare into the beam of the class 2 laser.
E		**Biohazard warning**—Waste contains biohazardous or chemically contaminated materials.
F		**Moving parts**—Keep the cover closed while parts are moving. If the cover is opened, the run is stopped.

Location	Label	Description
On HHS		**Hot surface**—Avoid contact with the Hamilton Heater Shaker (HHS). The surfaces are hot and can cause burns.

Electrical Safety

Before removing a mechanical or electrical component, turn off the ML STAR and disconnect the main electricity supply from the instrument and the control computer.

Biological Hazard Precautions

Observe the following best practices when working with biohazardous samples:

- Perform regular maintenance procedures for cleaning and decontamination. For more information, see *Maintenance* on page 14.
- Wear gloves when handling the pipetting arm and channels, carriers, racks, containers, and tips.
- Do not touch discarded tips in the waste containers. Used tips are automatically dropped into the waste containers at specific points in the method.

Operational Safety Requirements

Observe the following laboratory practices when operating the ML STAR:

- Wear suitable protective clothing, safety glasses, and protective gloves.
- Take care when troubleshooting an instrument malfunction, especially when there is risk of contamination from spilled liquids.

Completion of a certified training course is required for any persons operating the ML STAR and the computer running the software. Failure to follow the procedures as described can result in errors or malfunction.

Transport and Installation

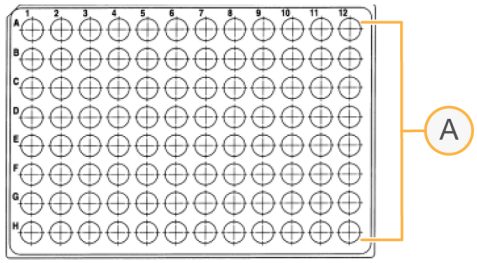
The Hamilton service technician is responsible for the installation qualification (IQ) and operation qualification (OQ). The clinical validation is the responsibility of the laboratory.

Perform A Run

1. Turn on the ML STAR.
2. Turn on the instrument control computer and enter your user name and password.
3. From the ML STAR desktop, open the Hamilton App Launcher.
4. Select **Maintenance and Verification** and perform the required maintenance procedures. For more information, see *Maintenance* on page 14.
5. Select the appropriate program.
6. Select the appropriate method.
7. Enter your user name and password, and then click **OK**.
8. Follow the on-screen instructions to load the ML STAR carriers. Click **OK** after loading each carrier.
9. Click **OK** to verify all labware positions and begin the run.

Best Practices

To ensure effective use, maintain sample and reagent tracking, prevent harm to the operator or instrument damage, perform the following best practices.

Category	Best Practices
Plates	• Place the barcode label on side A, the edge closest to column 12, as shown in the following figure.  • Position the barcode label at the top of the plate, centered and parallel to the edge. Make sure that it does not protrude above or below the edge of the plate. • Load plates so that the A1 well is oriented to the left and rear of the carrier.
Tips	• Do not mix tip size and type in the same tip rack. • Load tip racks as they are provided in the original packaging. Tips are individually labeled with a barcode for identification. • Discard used tips. • Do not empty the tip waste during a run. • Do not leave tips on the pipetting channels in between runs or overnight. Doing so can cause deformation of the channel O-ring and can result in early wear on the channel and unreliability in tip pickups. Run the daily maintenance procedure to remove the tips.

Category	Best Practices
Reagents	• When pouring liquid into the containers, make sure that there is no foam or bubbles on the surface of the liquid. • Do not overfill the liquid containers.
General	• Do not exchange the positions of plates or tubes after the barcodes are scanned. • Do not attempt to lift single-track carriers solely by the finger-hook handles. • Perform periodic maintenance as required.

Deck Layout and Icon Legend

The pre-PCR lab ML STAR has 10 carriers and the post-PCR lab ML STAR has 12 carriers. Refer to the following figures for the general deck layouts of the instruments.

Figure 9 Pre-PCR Lab ML STAR Deck

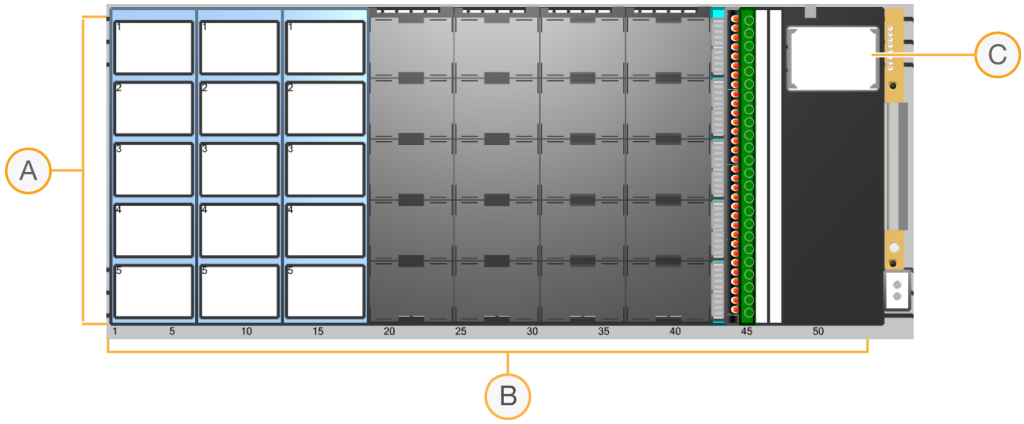
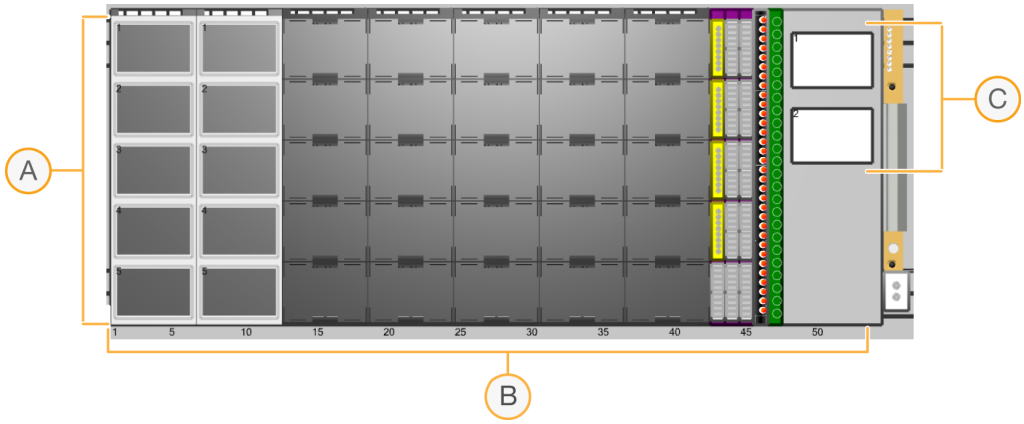


Figure 10 Post-PCR Lab ML STAR Deck



A Carrier positions numbered from back to front
B Track locations numbered from left to right
C Heater Shaker

Refer to the following table for the track location of each carrier.

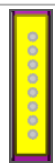
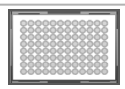
Table 3 Carrier Numbers and Track Locations

Carrier	Track Locations	Carrier	Track Locations
1	1–6	7	37–42
2	7–12	8	43
3	13–18	9	44
4	19–24	10	45
5	25–30	11*	46
6	31–36	12*	47

*Post-PCR instrument only.

Refer to the following table for the labware description of each icon.

Table 4 Example Deck Layout Icons and Labware Description

Icon	Labware Description	Icon	Labware Description
	Hamilton CO-RE tips, 50 µl, sterile, filtered		96-well reservoir
	Hamilton CO-RE tips, 300 µl, sterile, filtered		60 ml reservoir
	Axygen 384-well plates/ Roche 384-well plates		Eppendorf tube
			Reagent tube
	Covaris Rack/ 96-well TCY plate/ 96-well midi plate/ 96-well super midi plate		CST holder
	96-well black FLUOTRAC plates		

Maintenance

Maintenance procedures include daily maintenance, weekly maintenance, and preventive service every 6 months. If maintenance procedures are not completed, the instrument cannot perform a run.

Perform the required verification process within the required intervals and document the verification process.

Only certified technicians are authorized to perform mechanical maintenance on the ML STAR.

Required Materials

- 70% ethanol (EtOH)
- Deionized water
- Lint-free cloth
- Microcide SQ Broad Spectrum Disinfectant
- Personal protective equipment

NOTE
Do not spray Microcide SQ directly onto electrical components.

Daily Maintenance Procedure

The daily maintenance procedure consists of automated steps, visual inspection, and waste disposal. Automated steps check the tightness of the pipetting channel and the capacitive liquid level (cLLD) detection.

1. After starting the daily maintenance method, visually inspect the deck. If the deck is clean, proceed with daily maintenance. If the deck is not clean, cancel daily maintenance and perform a weekly maintenance.
2. When prompted, empty the CO-RE head tip and channel tip waste containers.
3. When prompted, click **OK**.
4. Remove the tip eject plate from the waste section. Spray Microcide SQ onto the waste section and wipe.
5. Reinstall the tip eject plate.
6. Click **OK**.

Weekly Maintenance Procedure

The daily maintenance procedure consists of automated steps, visual inspection, manual cleaning, and waste disposal. Automated steps check the tightness of the pipetting channel and the capacitive liquid level (cLLD) detection.

1. After starting the weekly maintenance method, clean all carriers with Microcide SQ or 70% EtOH and allow to dry. If the carriers are heavily soiled, soak the carriers in a solution of Microcide SQ.
2. Clean the tube inserts with Microcide SQ or 70% EtOH
3. Visually inspect each carrier for damage or barcode scratches. If damaged, replace the carrier.

4 Open the front cover and wipe the deck with a cloth saturated with Microcide SQ or 70% ethanol. Make sure that the slide blocks are clean, and then close the front cover.

5 When prompted, empty the CO-RE head tip and channel tip waste containers.

6 Remove the tip eject plate from the waste section. Spray Microcide SQ onto the waste section and wipe.

7 Reinstall the tip eject plate.

8 Clean the laser scanner window of the barcode reader with a lint-free cloth lightly soaked in 70% ethanol.

9 Click **OK**.

Decontamination Procedure

Decontaminate the instrument after any biohazardous fluid spills on the ML STAR deck.

1 Use a lint-free wipe to contain the spill.

2 Wipe the spill and affected area using Microcide SQ, and then wait 10 minutes.

3 Wipe with deionized water to remove all traces of Microcide SQ.

4 Dry the area with a clean wipe.

Preventive Maintenance and Verification

An authorized service technician performs preventive maintenance, which is required every 6 months, or after a maximum of 200 days. This procedure is performed during instrument installation and required after instrument service or repair. If verification procedures are not completed successfully, a run cannot be performed.

Troubleshooting

Most errors can be corrected without aborting the run. If an error occurs, follow the troubleshooting commands in the error message. The software includes an automatic recovery feature for some errors.

If an error cannot be corrected, contact your Illumina representative.

Barcode Reading Errors

The ML STAR methods check for an expected barcode mask for all items. If the labware barcode does not match what is expected, or a barcode is placed incorrectly, a barcode error is triggered.

To correct the error, select from the following options:

- Click **Repeat**, and then click **Execute** to repeat scanning at a slower speed.
- Click **Barcode** and manually scan or enter the barcode.

Insufficient Number of Tips

If the ML STAR detects an insufficient number of tips, replace the tip rack. In the error message, click **Repeat**, and then click **Execute**.

Insufficient Reagent Volumes

The ML STAR uses the tips and capacitive liquid level detection (cLLD) to check the volumes of the reagents. If volumes are insufficient, add more reagent to the container, and then select from the following options:

- Click **Repeat**, and then click **Execute** to repeat the step.
- Click **Bottom** to pipette from the bottom of the reagent container, and then click **Execute**.

CO-RE Grip Errors

If the system aborts with the CO-RE gripper or CO-RE tips on the pipetting channels, follow the on-screen instructions to check the traverse height.

- If the path to the waste bar is not clear, click **Yes**. The instrument completes the abort and the channels do not move to the waste bar. Open the control panel on the Run Control and click **Initialize Instrument** to remove the CO-RE grips or tips before the next run.
- If the path to the waste bar is clear, click **No**. Follow the on-screen instructions to check positions under specified channels. Click **Yes** to replace the CO-RE grips.

Technical Assistance

For technical assistance, contact Illumina Technical Support.

Table 5 Illumina General Contact Information

Website	www.illumina.com
Email	techsupport@illumina.com

Table 6 Illumina Customer Support Telephone Numbers

Region	Contact Number	Region	Contact Number
North America	1.800.809.4566	Italy	800.874909
Australia	1.800.775.688	Netherlands	0800.0223859
Austria	0800.296575	New Zealand	0800.451.650
Belgium	0800.81102	Norway	800.16836
Denmark	80882346	Spain	900.812168
Finland	0800.918363	Sweden	020790181
France	0800.911850	Switzerland	0800.563118
Germany	0800.180.8994	United Kingdom	0800.917.0041
Ireland	1.800.812949	Other countries	+44.1799.534000

Safety Data Sheets

Safety data sheets (SDSs) are available on the Illumina website at support.illumina.com/sds.html.

Product Documentation

Product documentation in PDF is available for download from the Illumina website. Go to support.illumina.com, select a product, then click **Documentation & Literature**.