RapidStak Operator Guide

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About This Guide

This guide contains instructions for using the Thermo Electron RapidStak™ and RapidStak 2x to load microplates into instruments. It assumes the RapidStak is installed according to the instructions provided in *The RapidStak User Guide*, which is on the CD provided with the RapidStak.

Who Uses This Guide

This guide is intended for laboratory personnel who process microplates and are trained in basic laboratory safety procedures. Before using the RapidStak, operators must read *The RapidStak User Guide*.

How to Use This Guide

Read the Safety section before operating the RapidStak. Before following instructions in a section, read the entire section first.

Throughout this manual warnings are marked by a "!" symbol in the left margin. Failure to comply with these warnings can result in system errors, damage to the RapidStak and its surroundings, or injury to personnel. ▲

This Guide has the following chapters:

- **Introduction**, which briefly introduces the RapidStak and shows its major components.
- **Safety**, which describes important safety procedures for using the RapidStak.
- **Operating the RapidStak**, which describes basic RapidStak operations.
- **Performing Runs**, which explains how to use the RapidStak and an instrument to process microplates.
- **Troubleshooting**, which provides troubleshooting tips and a list of error codes.

For More Information

The CD provided with the RapidStak includes the following additional documents:

- *The RapidStak User Guide*, which contains the information in this guide, plus setup instructions, technical specifications, and maintenance procedures.
- *RapidStak Unpacking Guide*, which describes how to unpack the RapidStak and its components from the shipping crate. A printed copy is included with each shipment.
- *RapidStak Setup Guide*, which describes how to set up and position the RapidStak, align it with an instrument, and test its operation. A printed copy is included with each shipment.

You can obtain copies of these documents, or other Thermo Electron literature, from Thermo Electron Corporation at the following addresses:

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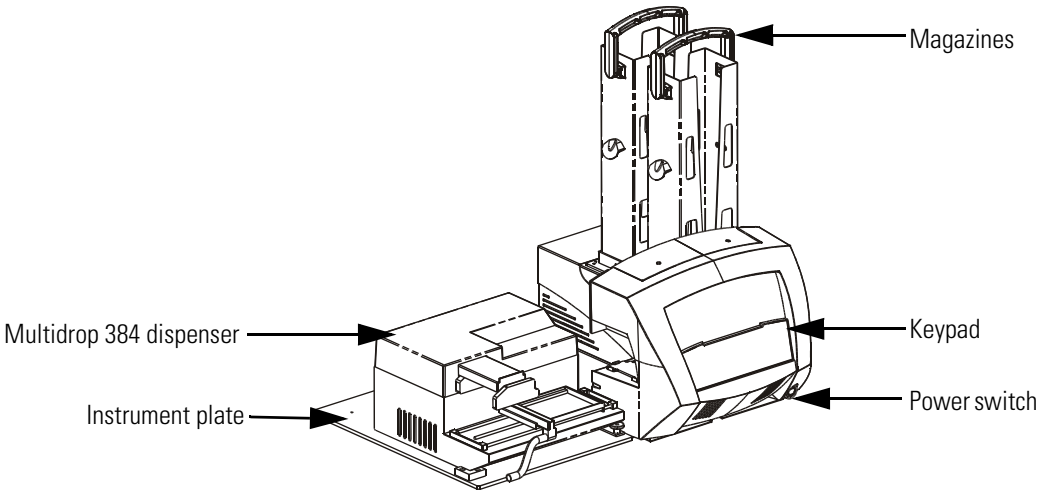
Introduction

The RapidStak™ and RapidStak 2x are easy-to-use and reliable microplate stackers that automate microplate processing for the Thermo Electron Wellwash AC washer, and the Thermo Electron Multidrop Micro and Multidrop 384 dispensers.



The RapidStak supports two removable microplate magazines, while the RapidStak 2x supports up to four magazines. Magazines are available in 30 and 50 microplate capacities, providing unattended throughput of up to 150 microplates at a time. Both models employ an optional restacking feature that returns microplates to their original positions in the magazines.

Before you can use the RapidStak to perform runs, you must:

- Install the RapidStak as described in the *RapidStak Setup Guide.* This Guide describes how to set up and position the RapidStak, align it with an instrument, and test its operation.
- Prepare the instrument, as described by the instrument manufacturer. This may include entering settings on the instrument panel, filling reagents, emptying waste, and priming.

To perform a run, you load microplates into microplate magazines, put the magazines into the RapidStak, and use the keypad to start and control the run.

Safety

This section contains the following information:

- “Warning Labels” on page 4
- “Stopping the RapidStak in an Emergency” on page 5
- “Safety Guidelines” on page 6

Warning! Failure to comply with these warnings can result in system errors, damage to the RapidStak and its surroundings, or injury to personnel! Before using the RapidStak, read the *RapidStak User Guide* found on the product CD. ▲

Warning Labels

The following warning labels indicate hazardous areas of the RapidStak. Do not remove these labels.

This symbol, which is placed on each side and the top of the RapidStak, indicates crushing and cutting hazards. Do not reach into these areas while the RapidStak is turned on or plugged in. ▲

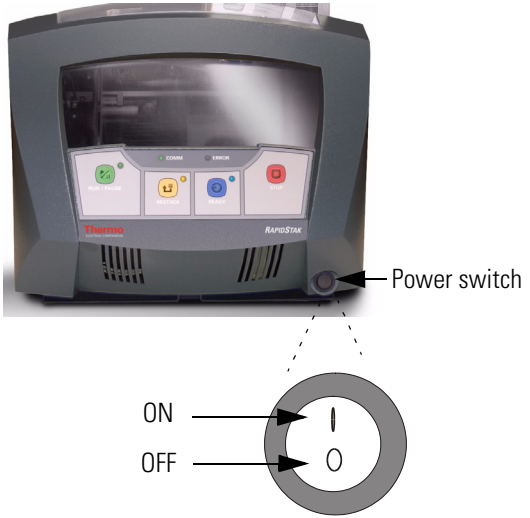
This symbol, which is placed on the rear panel of the RapidStak, indicates an electrical shock hazard. Do not remove any covers unless instructed to do so by Customer Support. ▲

Stopping the RapidStak in an Emergency

In an emergency, turn off or unplug the RapidStak. This stops all motor motion immediately and aborts the run.

To turn OFF the RapidStak, press the power switch to the down position.

If you want to pause or stop a run, see “Pausing a Run” on page 19 or “Stopping a Run” on page 20.



Safety Guidelines

Observe the following safety guidelines when using the RapidStak:

Warning! Reaching inside the RapidStak while it is turned on and plugged in can trap or crush your hand. If a microplate jams, turn off and unplug the RapidStak before troubleshooting. ▲

Warning! Filling or emptying magazines during runs can trap or crush your hand. Pause the run and remove the magazines from the RapidStak before filling or emptying them. ▲

Warning! Reaching between the RapidStak and the instrument during operation can cause injury. Pause the run before reaching between the RapidStak and the instrument. ▲

- *Use caution when lifting and carrying magazines.* Magazines can weigh several kilograms when full of microplates.
- *Avoid mixing different capacity magazines.* Use magazines of the same size to prevent overloading a magazine.

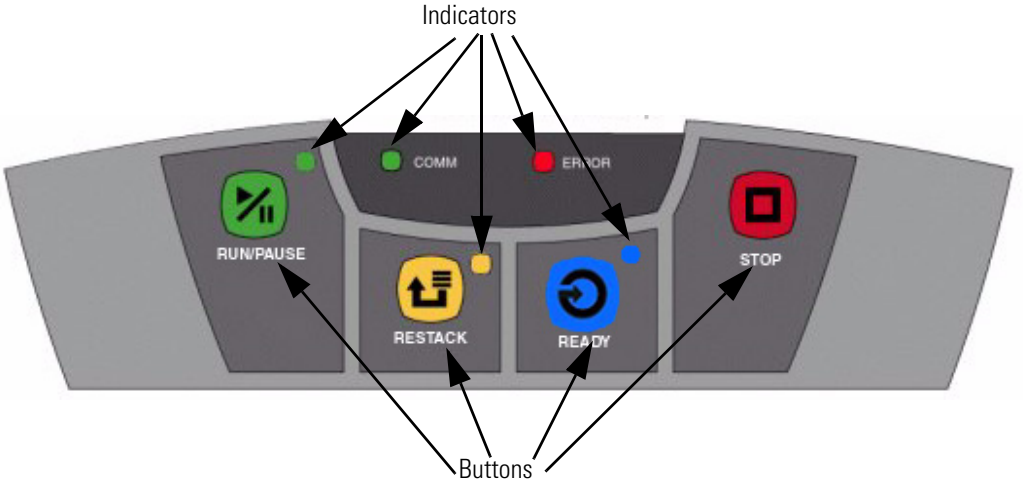
Operating the RapidStak

This chapter contains the following topics:

- “Using the Keypad” on page 8
- “Filling Magazines With Microplates” on page 10
- “Putting a Magazine into a Magazine Station” on page 14
- “Loading the RapidStak For a Run” on page 15

Using the Keypad

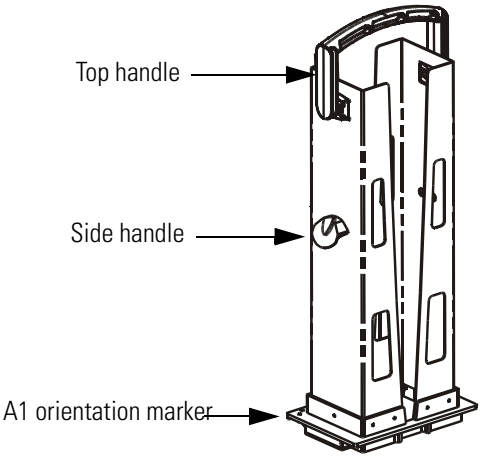
The keypad buttons enable you to control microplate processing. Keypad indicators display the RapidStak's operating status.

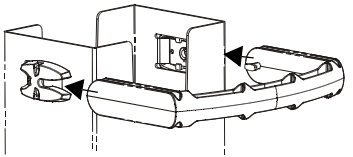


Keypad Feature	Button Function	Action
COMM		Solid green: Communication with instrument is established Solid red: No communication established
ERROR		Off: No error Flashing red: Error
 RUN/PAUSE	To start a run: Press once ↳ To pause a run: Press once ↳ To resume a run: Press once	Solid green: RapidStak is processing microplates Fast flashing green: Pausing, or run is pending Slow flashing green: Paused or suspended Off: Run is complete
 RESTACK	To restack microplates: Press once ↳ To cancel a pending restack: Press once	Off: No restack selected or restack complete Solid amber: Restack is pending Solid green: Restacking in progress
 READY	To reset the RapidStak: Press once	Slow flashing blue: Motor reset is required Fast flashing blue: RapidStak is resetting motors Solid blue: RapidStak is ready
 STOP	To stop a run: Press once ↳ To abort a run: Press once or To abort a run: Press twice	

Filling Magazines With Microplates

You fill magazines with microplates, then put the magazines into the RapidStak. Each magazine has an A1 orientation marker on its base that marks the A1 well on the microplate. Carry a magazine using the side handles or the top handle. The top handle is removable to aid in filling and emptying the magazine.





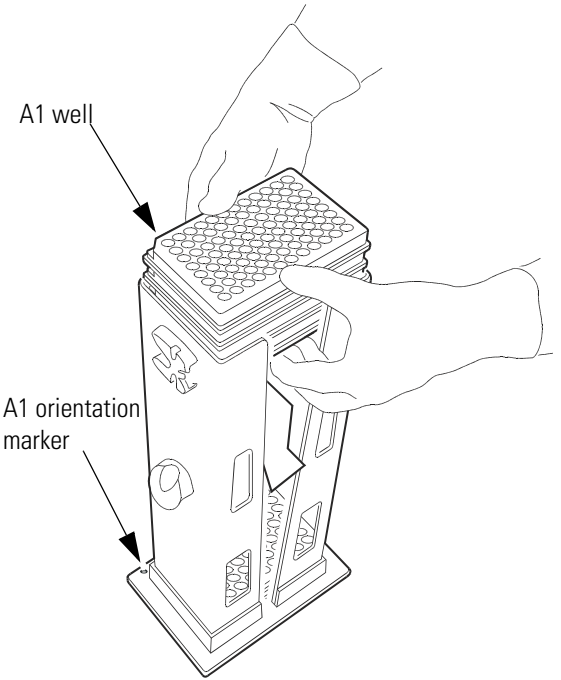
Snap the handle into the notched piece.

Follow these guidelines when filling magazines:

- Do not fill the smaller magazine with more than 30 microplates or the larger magazine with more than 50 microplates.
- Use only standard SBS, unlidded microplates.
- Do not reuse microplates. They may become worn and cause a jam.
- Do not reach into a magazine while it is in the RapidStak. Always pause the RapidStak and remove the magazine before adding or removing microplates. See “Pausing a Run” on page 19.

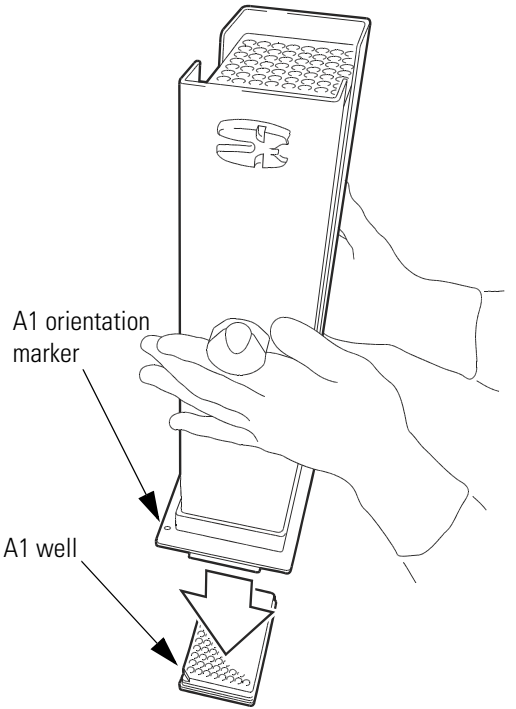
To fill a magazine with microplates

1. Place the magazine upright on a clean flat surface.
2. Remove the top handle.
3. Using both hands, grasp several microplates on their side edges, taking care not to touch the wells.
4. Align the A1 well of the microplates with the A1 orientation marker on the magazine, and slide the microplates down into the magazine until they reach the bottom.
5. Repeat for remaining microplates.
6. Check that the microplates are properly stacked. Each microplate should nest on top of the one below it, with their A1 wells aligned. Improper stacking may cause a jam.
7. Replace the top handle.



To empty a magazine of microplates

1. Place a clean empty microplate on a flat surface, with its A1 well in the same orientation as the microplates in the magazine.
2. Place the magazine onto the empty microplate, so that the bottom microplate pushes the microplates in the magazine up.
3. Remove the top handle.
4. Using both hands, grasp several microplates on the side edges, taking care not to touch the wells, and slide the microplates up and out of the magazine.
5. Continue removing the microplates until you reach the bottom empty microplate.
6. Lift the magazine off of the empty microplate.
7. Replace the top handle.



Putting a Magazine into a Magazine Station

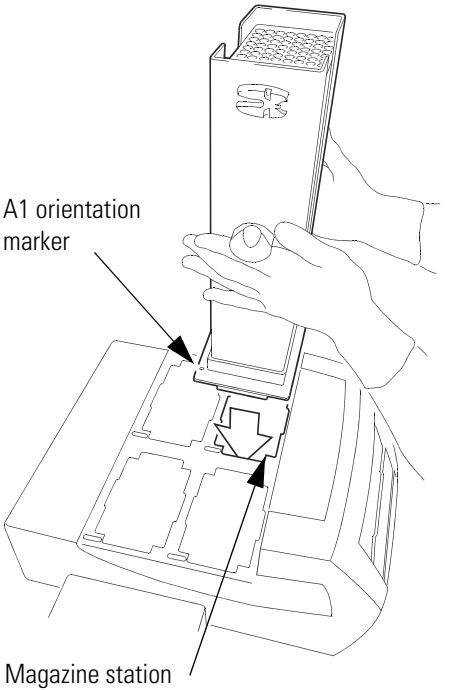
Before a run, you put either a full or an empty magazine into each of the RapidStak's magazine stations.

To put a magazine into a magazine station

1. Slide your hands under the side handles, and carefully lift the magazine.
2. Position the magazine so that the A1 orientation marker faces the rear of the RapidStak.
3. Gently lower the magazine straight down into the magazine station. All four corners should fit securely in place without rocking.

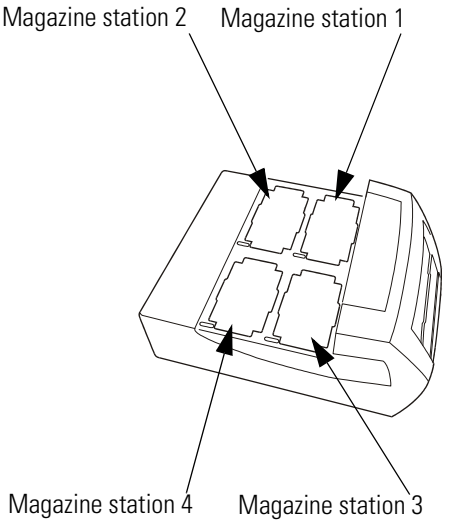
To remove a magazine from a magazine station

1. Ensure the run is complete, or the RapidStak is paused or stopped. See "Pausing a Run" on page 19.
2. Slide your hands under the side handles, and carefully lift the magazine straight up and out of the magazine station.
3. Place the magazine on a clean flat surface.



Loading the RapidStak For a Run

Magazine placement depends on the number of filled magazines, and the model of the RapidStak.



To load the RapidStak

- Put a filled magazine into magazine station 1.
- Put an empty magazine into magazine station 2.

To load the RapidStak 2x

1. Put a filled magazine into magazine station 1.
2. If you have more filled magazines, put the second magazine into magazine station 3, and put the third magazine into magazine station 4.
3. Put empty magazines into the remaining magazine stations.

Performing Runs

This chapter contains the following topics:

- "Starting a Run" on page 18
- "Pausing a Run" on page 19
- "Stopping a Run" on page 20
- "Restacking Microplates" on page 21

Starting a Run

Before you start a run, perform the following setup steps:

- Ensure the washer or dispenser is set up according to the manufacturer's instructions and is turned on, connected to the RapidStak, and ready for operation. If you are using a Multidrop dispenser, prime it before each run.
- Ensure the RapidStak is set up according to the *RapidStak Setup Guide.*

To start a run

1. Fill magazines with microplates. See "Filling Magazines With Microplates" on page 10.
2. Put magazines into the RapidStak. See "Loading the RapidStak For a Run" on page 15.
3. Ensure the RapidStak is turned on. Check that the COMM indicator is green, the ERROR indicator is off, and the READY indicator flashes. On power-up, the COMM indicator should turn green within 10 seconds, but if it does not, see "Troubleshooting Tips" on page 28.
4. Press RUN/PAUSE. The RUN/PAUSE and READY indicators flash while the RapidStak resets its motors and performs internal checks. The RUN/PAUSE and READY indicators stop flashing but stay lit, and the run begins.
5. If you want to return all microplates to their original position, press RESTACK.

Pausing a Run

You typically pause a run to refill reagents for the dispenser or washer, or to add or remove magazines. When you pause a run, the RapidStak and the instrument finish all in-process microplates, then the RapidStak stops all motors. After pausing a run, you can either resume or abort the run. After aborting a run, you may need to retrieve in-transit microplates. See "Retrieving In-transit Microplates" on page 26.

Note If you remove a magazine while a run is paused, you must return it to its original magazine station before resuming the run. ▲

To pause a run

- Press RUN/PAUSE. The RUN/PAUSE indicator flashes rapidly while the RapidStak finishes in-process microplates, then flashes slowly while paused.

To resume a run after pausing it

- Press RUN/PAUSE. The RapidStak resumes processing microplates.

To abort a run after pausing it

- Press STOP.

Stopping a Run

You typically stop a run only to address an immediate safety concern. Stopping a run stops all RapidStak motors immediately, and allows you to either resume the run or abort the run. After aborting a run, you may need to retrieve in-transit microplates. See “Retrieving In-transit Microplates” on page 26.

To stop a run

- Press STOP once. All RapidStak motion stops, although the attached dispenser or washer continues processing the current microplate. The RUN/PAUSE indicator flashes slowly to indicate the stopped state.

To continue a run after stopping it

1. Ensure it is safe to continue.
2. Press RUN/PAUSE. The RapidStak resumes operation.

To abort a run after stopping it

- Press STOP once.

To abort a run immediately

- Press STOP twice.

Restacking Microplates

You can restack microplates to their original position in their original magazine using the RESTACK button. You can select the RESTACK button during a run, or after a run. When you press the RESTACK button the RESTACK indicator turns amber, indicating a pending restack operation. The indicator turns green during restacking, then turns off when restacking finishes.

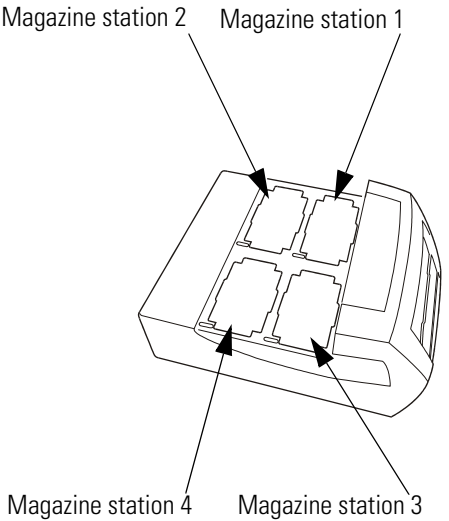
To restack microplates

1. Press RESTACK. The RESTACK indicator turns amber.
2. If the RapidStak has finished a run, press RUN/PAUSE to start the restack operation.

To cancel a pending restack

- Press RESTACK. The RESTACK indicator turns off.

You can also use the RapidStak solely for restacking magazines filled with microplates. Magazine placement depends on the number of filled magazines, and the model of the RapidStak.



To load the RapidStak for restacking

- Put the filled magazine into magazine station 2.
- Put an empty magazine into magazine station 1.

To load the RapidStak 2x for restacking

1. Put the first filled magazine into magazine station 2.
2. If you have more filled magazines, perform one of the following steps:
   - If you have one more magazine, put it into magazine station 4.
   - If you have two more magazines, put them into magazine stations 1 and 3.
3. Put empty magazines into the remaining magazine stations.

Troubleshooting

This chapter contains the following topics:

- “Error Codes” on page 24
- “Retrieving In-transit Microplates” on page 26
- “Handling Microplate Jams” on page 27
- “Troubleshooting Tips” on page 28
- “Replacing Fuses” on page 29
- “Getting Help” on page 31

Error Codes

The RapidStak flashes the ERROR indicator to indicate which error has occurred. A series of short flashes indicates a recoverable error. A long flash followed by a series of short flashes indicates a non-recoverable error. Refer to the following tables to determine the error and what action to take. For recoverable errors, press STOP to turn off the error indicator.

Recoverable Errors

# of short flashes	Error	Action to Take
1	Cam motor sensor timeout	Contact Customer Support.
2	Magazine missing	Replace missing magazine.
3	Incorrect magazine configuration	See "Putting a Magazine into a Magazine Station" on page 14.
4	Microplates found inside the RapidStak when resetting motors	Remove microplates from magazine in magazine station 2.
5	No instrument found	Check instrument power and communication connections.
6	Grip error	Retrieve microplates. See "Retrieving In-transit Microplates" on page 26.
7	Ungrip error	Retrieve microplates. See "Retrieving In-transit Microplates" on page 26
8	Stacking error	Retrieve microplates, see "Retrieving In-transit Microplates" on page 26.
9	Unstacking error	Retrieve microplates, see "Retrieving In-transit Microplates" on page 26.
10	Instrument error	Resolve instrument problem, then retrieve microplates. See "Retrieving In-transit Microplates" on page 26.

Non-recoverable Errors

# of short flashes after a long flash	Error	Action to Take
1	Internal error	Retrieve microplates. See “Retrieving In-transit Microplates” on page 26.
2	Keypad button error	Turn off then turn on the RapidStak. If unsuccessful, contact Customer Support.
3	Communication error	Communication failure. Contact Customer Support.
4	Stepper fuse error	Replace stepper motor fuse. See “Replacing Fuses” on page 29.
5	Cam 1 fuse error	Replace cam1 motor fuse. See “Replacing Fuses” on page 29.
6	Cam 2 fuse error	Replace cam2 motor fuse. See “Replacing Fuses” on page 29.
7	Power relay error	Contact Customer Support.
8	Power supply error	Contact Customer Support.

For details on contacting Customer Support, see “Getting Help” on page 31.

Retrieving In-transit Microplates

If a run is aborted, there may be in-transit microplates in the RapidStak. When you start a run, the RapidStak checks for in-transit microplates, and delivers them to the magazine in magazine station 2. You must manually remove these from the magazine and any microplates left in the washer or dispenser.

To retrieve in-transit microplates

1. Press STOP once to turn off the error indicator.
2. Remove any microplates from the washer or dispenser. Inspect the microplate to determine if it was processed, and handle accordingly.
3. Press READY. The READY indicator flashes while the RapidStak resets its motors and checks for in-transit microplates. The RapidStak delivers in-transit microplates to the magazine in magazine station 2, then flashes the error indicator.
4. Press STOP once to turn off the error indicator.
5. Remove and empty the magazine in magazine station 2. See “Filling Magazines With Microplates” on page 10.
6. Inspect the two microplates that were in the bottom of the magazine to determine if they were processed, and handle accordingly.
7. Return the empty magazine to magazine station 2, and press READY to reset the motors.

Handling Microplate Jams

Warning! Reaching into the RapidStak while it is powered is hazardous and may result in operator injury. Always turn off and unplug the RapidStak before reaching into any part of the RapidStak. ▲

If a microplate jams or falls inside the RapidStak, you must remove the microplate and clean-up any spills inside the RapidStak.

To retrieve a microplate manually

1. Turn off the RapidStak, and unplug it.
2. Carefully remove the magazines, taking care not to drop the bottom microplate if it is not fully seated in the magazine.
3. Look inside the RapidStak, through the front and inside the magazine stations.
4. Carefully remove the microplate, avoiding contact with sensors and electrical components.
5. Use a clean lint-free cloth to wipe up spills on the inside and outside of the RapidStak, and the magazine base.

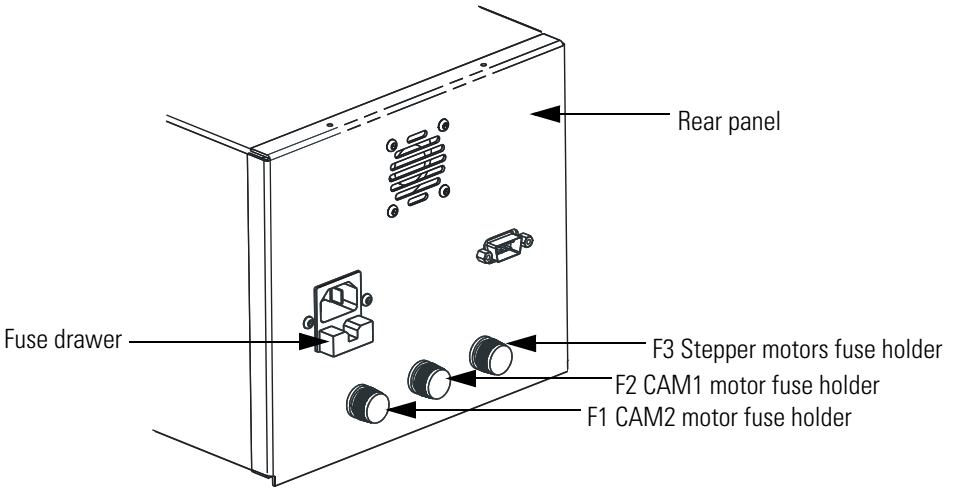
You can resume normal operation when all components are clean and dry.

Troubleshooting Tips

Problem	Possible Cause	Action to Take
The run is not finished but the RapidStak is not moving microplates, and no keypad indicators are flashing.	RapidStak lost communication with the instrument during the run.	Check the instrument and communication cables.
	Run was aborted.	See “Retrieving In-transit Microplates” on page 26.
RapidStak will not turn on.	Power cord is unplugged.	Plug in power cord.
	Blown AC fuse	Replace the AC fuse. See “Replacing Fuses” on page 29.
RapidStak turns on but COMM light remains red longer than 10 seconds.	Instrument is not turned on.	Check that the instrument is plugged in and turned on.
	Instrument is not connected to the RapidStak via the serial cable.	Check that the serial cable is connected to the RapidStak and the instrument. Inspect serial cable and replace if damaged.
	Instrument malfunction	Check that the instrument is operating properly.
Microplates are jamming in the RapidStak.	Microplates are improperly loaded.	Check that the microplates are stacked correctly on top of each other. See “Filling Magazines With Microplates” on page 10.
	Microplate magazines or magazine stations are dirty.	Clean the magazines and magazine stations. See “Handling Microplate Jams” on page 27.

Replacing Fuses

The RapidStak has two AC input fuses in the fuse drawer of the AC power inlet located on the rear panel. The RapidStak has three fuses that power the motors, housed in fuse holders that connect at the rear panel.



Fuse	Dimensions	Rating
AC Input Fuses-North America 115V AC	5 x 20 mm	1.0 Amp Type F (Fast Blow)
AC Input Fuses-Europe 240V AC	5 x 20 mm	1.0 Amp Type F (Fast Blow)
F3 Stepper Motors	1 1/4 x 1/4 inches	1.25 Amp Type F (Fast Blow)
F2 Cam 1 Motor	1 1/4 x 1/4 inches	1.25 Amp Type F (Fast Blow)
F1 Cam 2 Motor	1 1/4 x 1/4 inches	1.25 Amp Type F (Fast Blow)

To replace the AC fuses

1. Turn off and unplug the RapidStak.
2. Insert a screwdriver below the clip in the fuse drawer to release the drawer from the AC power inlet.
3. Remove the fuses and replace them with the appropriate fuses.
4. Replace the fuse drawer and push until you hear the drawer click into place.

To replace the stepper motor or cam motor fuses

1. Turn off and unplug the RapidStak.
2. Gently push and turn the fuse holder counter-clockwise until it clicks, and remove it.
3. Remove the fuse from the fuse holder and replace it with the appropriate fuse.
4. Replace the fuse holder, and gently push and turn it clockwise until it clicks into place.

Getting Help

Contact Thermo Electron Customer Support at the following addresses:

Telephone

905-332-2000 (voice)
800-365-7587 (voice: toll free in Canada and United States)
905-332-1114 (facsimile)

E-mail

Customer Support and Training: services.labautomation@thermo.com