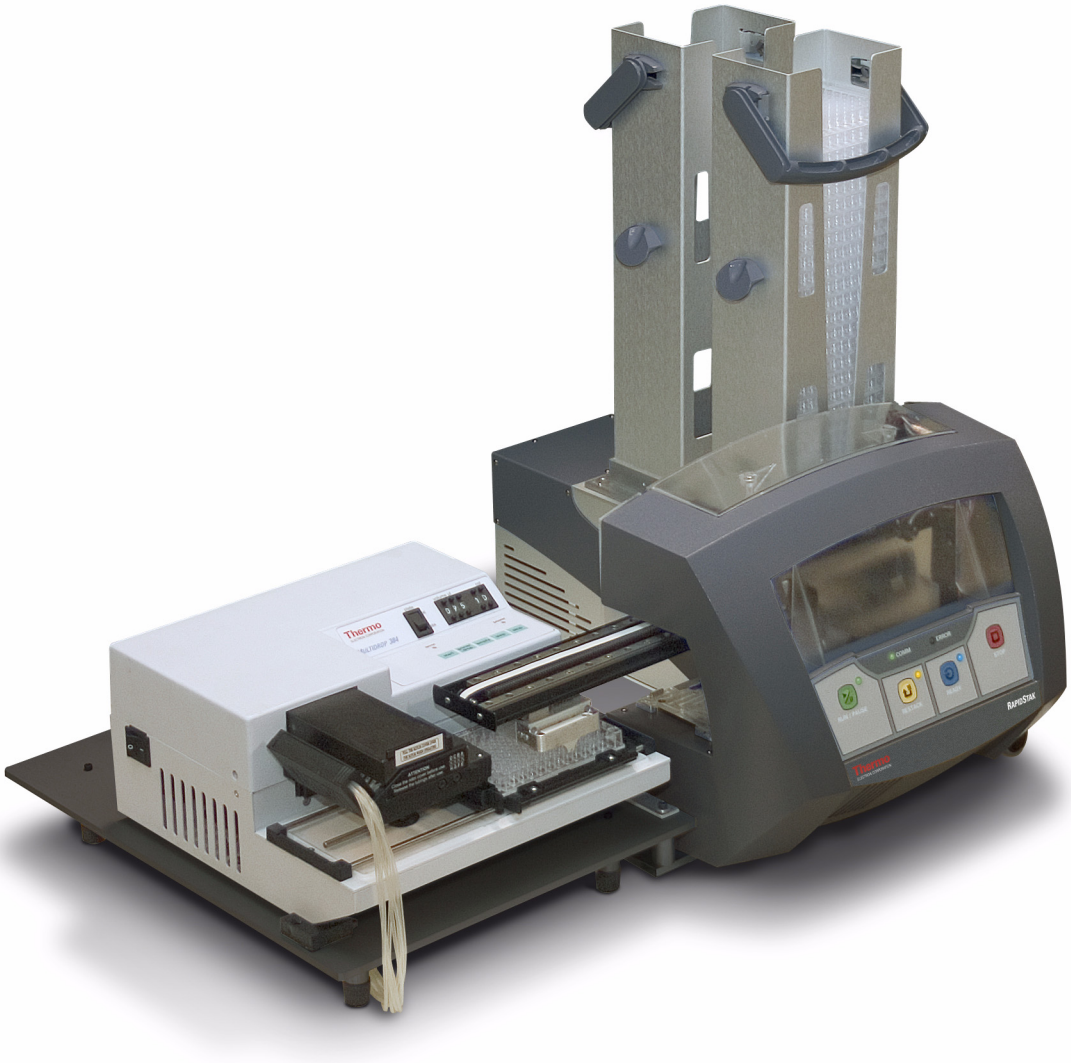
Thermo Scientific

RapidStak
RapidStak 2x

User Guide

Release 1.1



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Revision history

Revision	Revision history	Date
001	Release 1.0	October, 2004
002	Release 1.1: Added descriptions of plate weight, plate release, and null-modem cable. Added descriptions and specifications of short versions of RapidStak. Added appendices on use of the Plate Height Adjust tool and on changing the position of the gripper fingers. Added caution about overstacking microplates on the 2-magazine model. Added how to handle instrument errors.	February, 2007
003	Add Appendix C for teaching locations. Add Changing Firmware section in the Maintenance chapter. Add Integrating the Instrument section in the Installing chapter. Remove references to the plate weight.	October, 2008
004	Add Combi mode change to step 1.c of "To perform a run" procedure (Using chapter) and step 1 of "To align the RS and instument nest" procudure (Installing chapter).	January, 2009

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About This Guide

This user guide contains general information and instructions for installing, integrating, and using the RapidStak™ and RapidStak 2x to automate microplate processing for the Wellwash AC washer, and the Multidrop, Multidrop 384/Micro, and Multidrop Combi dispensers.

Who Uses This Guide

This guide is intended for laboratory personnel who process microplates and are trained in basic laboratory safety procedures.

How to Use This Guide

This manual is task-based and uses navigational aids to help you quickly find the topics and information you need.

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 equipment and its surroundings, or injury to personnel.

If a technical term is not familiar to you, refer to the “Glossary”.

Before following instructions in a section, read the entire section first.

This guide consists of the following chapters:

- Chapter 1: “Introduction”, which describes the RapidStak’s features, appropriate use, design considerations, and requirements. It also describes how to use the RapidStak to process microplates.
- Chapter 2: “Safety”, which describes important safety information for using the RapidStak.
- Chapter 3: “Installing the RapidStak”, which describes how to install the RapidStak and integrate it with the Wellwash AC washer, and the Multidrop Micro and Multidrop 384 dispensers.
- Chapter 4: “Using the RapidStak”, which describes how to use the RapidStak to process microplates.

- Chapter 5: “Maintenance”, which describes how to maintain the RapidStak and provides a list of replaceable parts.
- Chapter 6: “Troubleshooting”, which describes how to diagnose and correct minor problems, and how to contact Customer Support.
- Chapter 7: “Technical Specifications”, which lists the specifications of the RapidStak.
- Appendix A: “Changing the Gripper Fingers”, describes how to change the position of the gripper fingers so that the RapidStak can grip other types of microplates.
- Appendix B: “The Plate Height Adjustment Tool”, which describes how to use the Plate Height Adjustment Tool to adjust the height at which the gripper grasps a microplate.
- Appendix C: “Teaching Locations”, which describes instrument locations and how to teach them.
- “Glossary”, which contains a list of definitions of the terms used in this user guide.
- “Index”, which contains a list of page numbers for the subjects covered in this user guide.

Units Used in This Manual

Throughout this manual, measurements are given in both Metric and English units.

For More Information

Additional information is available in the following documents, provided with the RapidStak when shipped:

- *RapidStak Unpacking Guide*: Describes how to unpack the RapidStak and its components.
- *RapidStak Setup Guide*: Describes how to set up the RapidStak with the washer or dispenser.
- *RapidStak Operator Guide*: Describes how to use the RapidStak.

You can obtain copies of these documents from the Thermo Scientific LAI Customer Support Group.

Training

We offer courses at our facility in Burlington, Ontario Canada, or on-site at your facility. For more information, contact the Thermo Scientific LAI Training Department.

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Chapter 1 Introduction

This chapter provides an overview of the Thermo Scientific RapidStak™, and describes its features, appropriate use, usage considerations, and requirements. It also describes how an operator uses the RapidStak to process microplates. It contains the following topics:

- "What the RapidStak Does" on page 1-2, which describes the purpose of the RapidStak.
- "RapidStak Product Highlights" on page 1-4, which describes the important benefits of using the RapidStak.
- "RapidStak Features" on page 1-5, which describes the features of the RapidStak as seen from the front and the rear.
- "About Polara RS" on page 1-10, which describes the optional Polara RS software for the RapidStak
- "Typical Operation" on page 1-12, which describes how an operator typically uses the RapidStak to process microplates.
- "Appropriate Use" on page 1-13, which describes the appropriate conditions for using the RapidStak.
- "Usage Considerations" on page 1-14, which describes concerns involved when using the RapidStak.
- "RapidStak Requirements" on page 1-15, which describes the requirements of the RapidStak.

What the RapidStak Does

A microplate stacker is an automated device that loads microplates into and out of a laboratory instrument, such as a washer or dispenser. The Thermo Scientific RapidStak is a microplate stacker that automates microplate processing for the Thermo Scientific Wellwash AC washer, and the Thermo Scientific Multidrop Micro and Multidrop 384/Combi dispensers.

The RapidStak, which supports up to 50 microplates, and the RapidStak 2x, which supports up to 150 microplates, free laboratory personnel from performing repetitive and time-consuming tasks.

Figure 1-1. The RapidStak and Wellwash AC washer

The RapidStak and RapidStak 2x are also available in shorter versions that fit inside most biological safety cabinets.

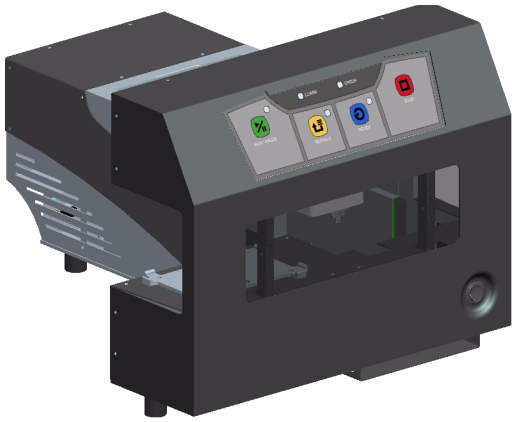


Figure 1-2. Short version of the RapidStak (shown without magazines loaded)

RapidStak Product Highlights

The RapidStak provides the following benefits:

- Built-in support for the Wellwash AC washer, and the Multidrop Micro and Multidrop 384 dispensers allows quick setup and operation.
- Automated operation allows unattended use and relieves lab personnel from performing tedious, repetitive, and time-consuming operations.
- Combination of RapidStak models and different magazine capacities addresses both low and high throughput needs:
    - RapidStak with two 30 capacity microplate magazines processes up to 30 microplates.
    - RapidStak 2x with four 50 capacity microplate magazines processes up to 150 microplates.
- Shortened versions of RapidStak and magazines enable use in biological safety cabinets.
- The user-friendly keypad simplifies operation and eliminates the need for a computer.
- Pause feature allows you to refill the instrument's reagents, empty waste bottles, remove processed microplates, and add additional microplates.
- Fast cycle time of 15 seconds from microplate magazine to instrument increases throughput.
- Restacking feature returns microplates to their original order in the magazine after processing.
- Ability to restack microplates without an instrument present allows restacking at any time.
- Easy-to-use instrument plate optimizes the RapidStak and instrument alignment and helps prevent accidental misalignment caused by bumping.
- RapidStak's low profile allows easy access to the instrument's reagents and controls, and allows you to use the dispenser or washer while still connected to the RapidStak.
- One year warranty

RapidStak Features

This section describes the features of the RapidStak, as seen from the front and the rear of the RapidStak.

Front Features

These features, shown in Figure 1-3, are visible from the front of the RapidStak:

- Microplate magazines: Each magazine holds a stack of unlidded microplates. Magazines are available in 30 or 50 microplate capacities, and are removable for easy microplate loading and unloading.
- Keypad: The keypad has large buttons that allow you to control the RapidStak, and brightly-lit indicators that display status messages and error codes.
- Power switch: Turns the RapidStak ON/OFF.
- Gripper: Holds the microplate during its transfer between the RapidStak and the washer or dispenser.

  Note You can change the position of the gripper fingers to accommodate different types of microplates. For details, see Appendix A, Changing the Gripper Fingers.

- Arm: Moves the gripper between the RapidStak and the washer or dispenser.

Figure 1-3. Front view of the RapidStak

Rear Features

These features, shown in Figure 1-4, are visible from the rear of the RapidStak:

- Magazine station: Each magazine fits into a magazine station. The RapidStak has two magazine stations, and the RapidStak 2x has four magazine stations.
- RS232 serial port: Allows communication between the RapidStak and the washer or dispenser.
- Power connector: Connects to main AC power.
- Motor fuse holders: Hold the stepper motor and cam motor fuses.
- Fuse drawer: Holds the AC power fuses.

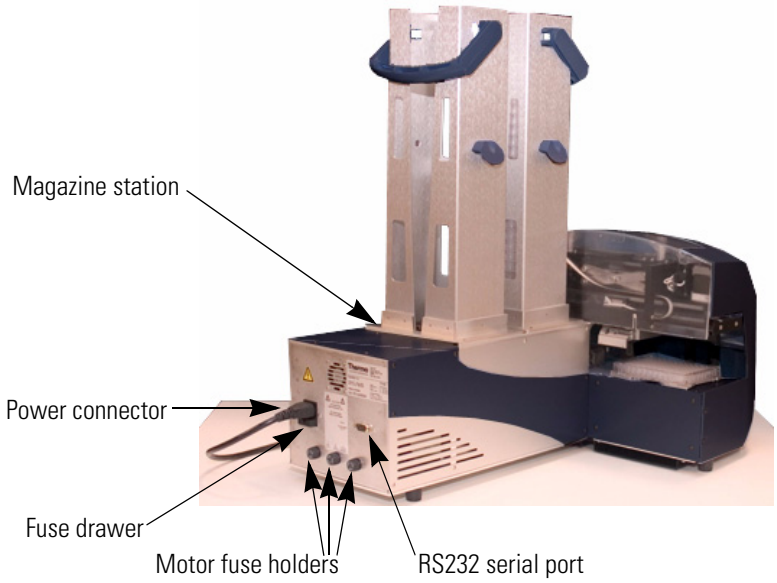


Figure 1-4. Rear view of the RapidStak (some units have recessed connectors)

Accessories

The RapidStak includes the following accessories:

- **Microplate magazines ("Staks")**. You fill all but one of the magazines with microplates and then load the magazines into the RapidStak. The magazines are available in 30- and 50-plate capacities. (A shorter, 25-plate capacity magazine is available for use in biological safety cabinets.) Each magazine features a removeable handle.

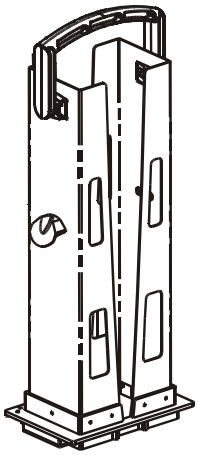


Figure 1-5. Microplate magazine (30-plate version shown)

- **Instrument plate**. The instrument plate fixes the instrument in one position relative to the RapidStak, so that the RapidStak can consistently pick up and place microplates in the instrument. When you set up the RapidStak, you fasten the plate to the RapidStak and mount the instrument on the plate. The locators on the instrument plate fit around the instrument's feet and prevent it from moving.

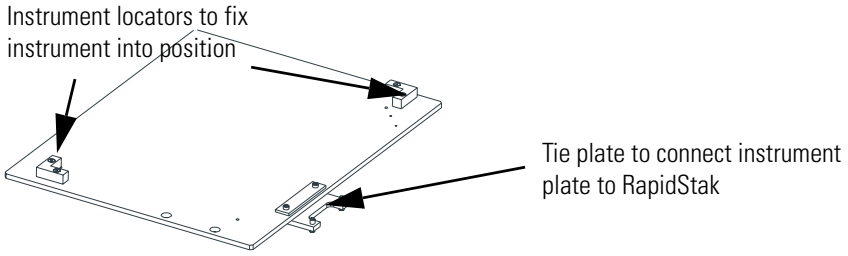


Figure 1-6. Instrument plate

- **Plate release**. You place a magazine on top of the plate release to release a microplate from the clamp at the bottom of the magazine.

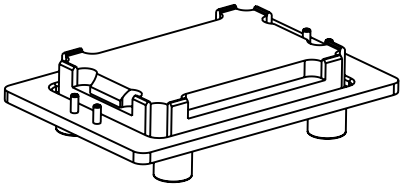


Figure 1-7. Plate release

- **Plate Height Adjustment Tool**. This application for Microsoft Windows enables you to adjust the vertical position where the RapidStak's gripper grasps a microplate. This enables the RapidStak to handle a wider range of microplates.

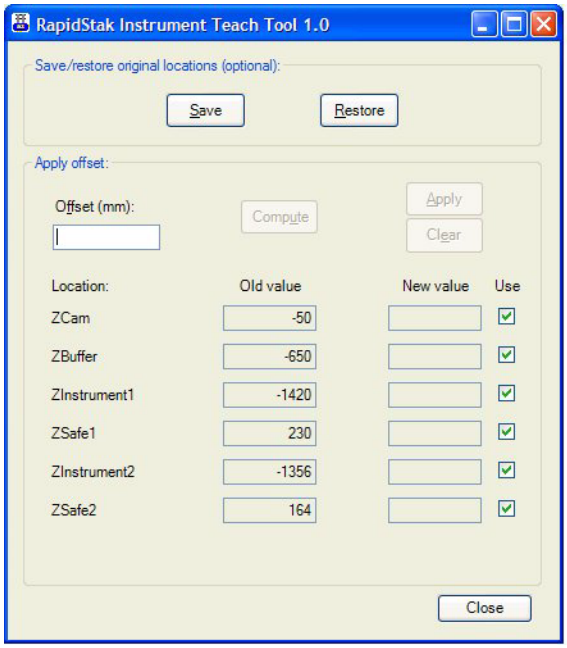


Figure 1-8. The Plate Height Adjustment Tool

- **Serial communication cable**. The null-modem serial communication cable enables the RapidStak and a personal computer to communicate. You need this cable only when using the Plate Height Adjust Tool.

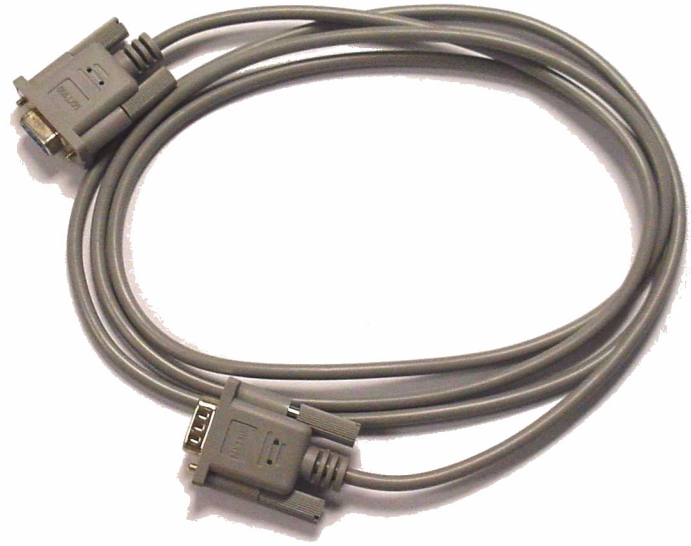


Figure 1-9. Null modem serial communications cable

About Polara RS

Polara RS is optional software for Microsoft® Windows® that enables you to easily integrate the RapidStak with a wide range of instruments.

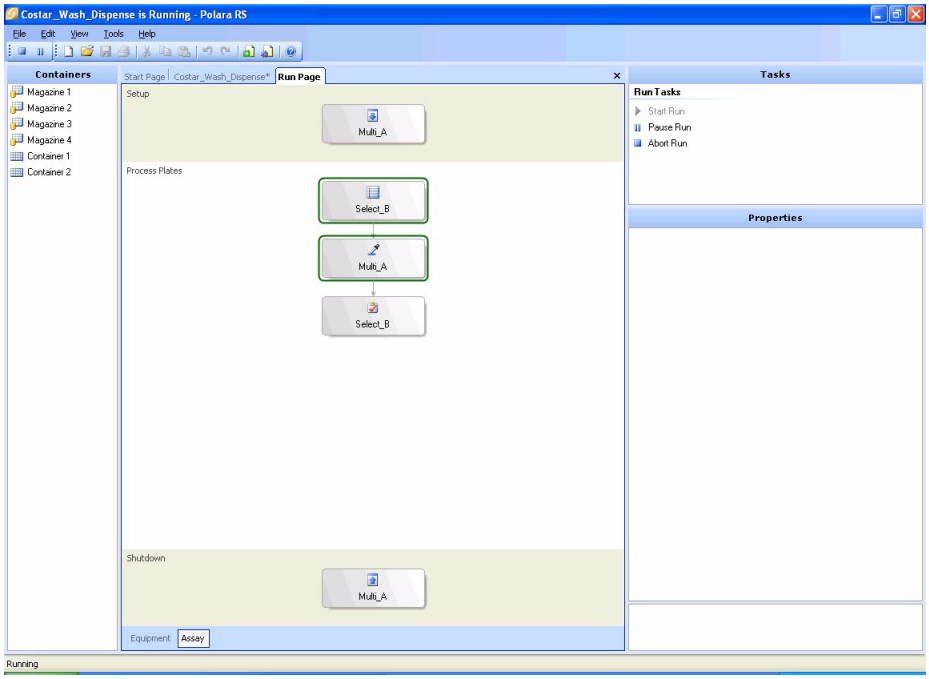


Figure 1-10. Defining an assay in Polara RS

During an automated run, the Polara RS software controls the RapidStak and the instruments, commanding the RapidStak to move microtitre plates from instrument to instrument, and commanding the instruments to process each microtitre plate as required by your assays. The Polara RS software also tracks and records the movement of each plate through the lab system.

Figure 1-11. A Polara RS run

Typical Operation

This section briefly describes how an operator uses the RapidStak.

Note This scenario assumes that the RapidStak and the washer or dispenser are properly set up and connected, turned on, and ready for use. ▲

1. **The operator prepares the equipment.**

   - The operator fills and primes the dispenser or washer with the required reagents, empties waste bottles, and manually sets the dispenser's or washer's settings.
   - The operator fills magazines with microplates, and puts the loaded magazines and at least one empty magazine into the RapidStak.

2. **The operator starts the run.**

   a. The operator presses the RUN/PAUSE button on the RapidStak keypad to start the run.

   b. The operator presses the RESTACK button on the RapidStak keypad to restack the microplates at the end of the run.

3. **The RapidStak performs the run.**

   a. The RapidStak removes a microplate from a magazine filled with microplates, and delivers it to the washer or dispenser.

   b. The RapidStak signals the washer or dispenser to perform its operation.

   c. The washer or dispenser signals the RapidStak when it is finished the operation.

   d. The RapidStak removes the microplate from the washer or dispenser and loads it into an empty magazine.

   e. Steps a to d repeat until all plates are processed.

   f. The RapidStak restacks the microplates, returning them to their original order in their original magazine.

4. **The operator removes the magazines from the RapidStak, and empties the magazines.**

Appropriate Use

The RapidStak is designed to automate microplate loading and unloading of microplates into the Thermo Scientific Wellwash AC washer, and the Thermo Scientific Multidrop and Multidrop 384 dispensers.

The RapidStak accepts unlidded 96-well and 384-well microplates that conform to SBS standards.

The RapidStak is meant to be used in typical laboratory environments. It is not intended for use under extremes of temperature, in clean-room environments, or with hazardous or corrosive materials.

To use the RapidStak, you must have basic laboratory safety training, and experience handling microplates and automated laboratory equipment.

Usage Considerations

Before using the RapidStak consider the following issues:

- You must set the dispenser's or washer's settings manually and prime the lines before you start a run.
- The 30 microplate magazines are lightweight and easier to handle than the 50 microplate magazines, which can weigh several kilograms when loaded with microplates. Some operators may have difficulty inserting or removing a fully loaded 50 microplate magazine.
- You must always match magazine capacities. For example, you can load a 30 microplate magazine full of plates, and stack the microplates into a 50 microplate magazine, but not the other way around.
- Each microplate magazine has an A1 orientation marker on its base that indicates the position of the upper left hand corner of the microplate (the A1 well) position, but it is up to the operator to load the microplates into the magazine in a consistent orientation. Always load microplates so their A1 well is aligned with the marker.

RapidStak Requirements

The RapidStak requires the following:

- Power: 115 V for North American models, 230 V for European models
- A clearance space of at least 10 cm (4 in.) on all sides, to allow for ventilation, connectors, and arm movement.
- An adequate clearance space above the RapidStak to allow enough room to safely insert and remove microplate magazines. Do not position the RapidStak under shelves or other equipment that may interfere with the magazines.

Chapter 2 Safety

This chapter discusses important safety information about using the RapidStak. All operators should read this chapter before operating the RapidStak. It contains the following topics:

- "Safety Guidelines" on page 2-2, which provides important guidelines for safely operating the RapidStak.
- "Warning Labels" on page 2-3, which describes the warning labels found on the RapidStak.
- "Turning the RapidStak ON/OFF" on page 2-4, which describes how to turn the RapidStak ON and OFF using the power switch and how to stop the RapidStak in an emergency.
- "Using the Keypad" on page 2-5, which describes how to use the keypad's buttons and indicators.
- "Motion Hazards" on page 2-6, which describes the specific hazards caused by the RapidStak's moving parts.

Safety Guidelines

The RapidStak has many moving parts that can cause serious injury! Read the following safety information before continuing, and observe all safety warnings in this document.

- *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.

CAUTION Electrical hazard! Always unplug and turn off the RapidStak before cleaning or reaching into any part of it. ▲

CAUTION Crushing and cutting hazard! 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. ▲

CAUTION Crushing and cutting hazard! 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. ▲

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

CAUTION Do not use the RapidStak for any purposes other than those specified in this guide! The safety features may be impaired if the RapidStak is used improperly. ▲

Warning Labels

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

Table 2-1. RapidStak hazard labels

Label	Hazard	Location
	Crushing and cutting hazard! Stay clear of these areas during operation. Always unplug and turn-off the RapidStak before reaching inside any part of it.	• On the front left and right sides, near the arm. • On the top near the magazine stations.
	Electrical shock hazard! Disconnect AC power before removing any part of the RapidStak's covers.	• On the rear panel.
	Caution! Refer to accompanying documents.	• On the rear panel near the AC input.
	AC current! Alternating current.	• On the rear panel near the name plate.

Turning the RapidStak ON/OFF

The RapidStak has one power switch on the front.

Figure 2-1. Power switch ON and OFF positions

To turn ON the RapidStak

Press the power switch to the upper position.

To turn OFF the RapidStak

Press the power switch to the lower position.

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.

If you want to pause or stop a run, see "Pausing, Stopping, and Aborting a Run" on page 4-13.

Using the Keypad

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

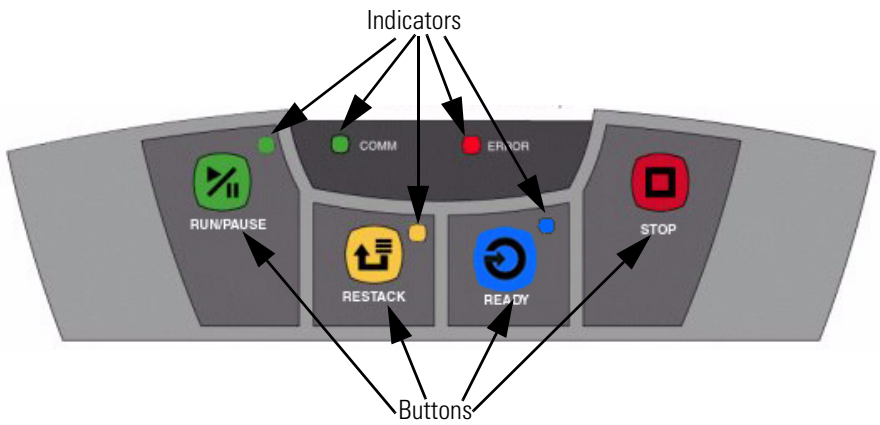


Figure 2-2. The RapidStak keypad

Table 2-2. Keypad indicators and buttons

Keypad Feature	Button Function	Status
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 a run is pending Slow flashing green: Paused or stopped 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: Reset is required Fast flashing blue: RapidStak is resetting 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	

Motion Hazards

Reaching inside the RapidStak or trying to access the gripper while the stacker is powered can cause serious injury. This section describes moving parts that present a risk to the operator while the RapidStak is powered.

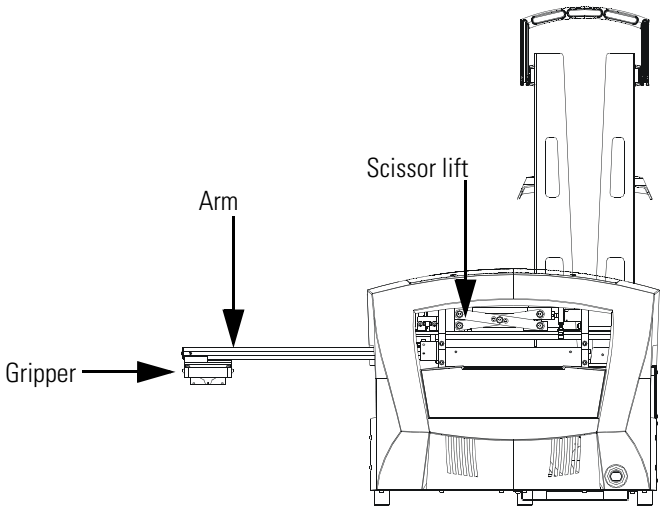


Figure 2-3. Gripper, arm, and scissor lift

Gripper

The gripper closes to hold a microplate, and opens to release the microplate.

CAUTION Pinch hazard! Never try to manually open or close the gripper while the RapidStak is turned on and plugged in. ▲

Arm

During microplate processing, the arm extends the gripper to pick up or place a microplate on the instrument nest. The arm extends on both sides of the RapidStak.

CAUTION Impact and pinch hazards! Do not place anything in the path of the arm. ▲

Scissor Lift

The scissor lift moves up and down to raise and lower the arm.

CAUTION Pinch and crush hazards! The scissor lift could trap or crush your fingers. Never reach into the RapidStak while it is powered. ▲

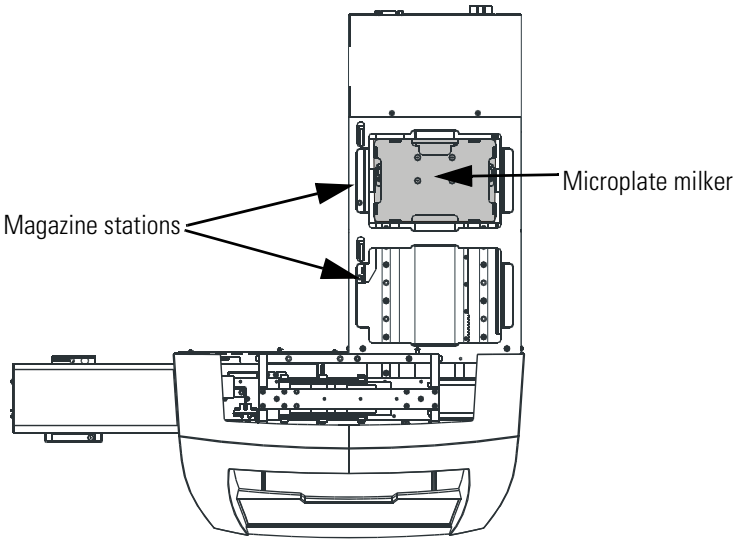


Figure 2-4. Top view of the microplate milker

Microplate Milker

The RapidStak uses a mechanical device known as a milker to put microplates into and take microplates out of a magazine. The milker travels between two magazine stations, and moves up through a magazine station into a microplate magazine.

Note The RapidStak 2x has two microplate milkers.

CAUTION Crushing and shearing hazards! Microplate milkers move without warning and can cut or trap your finger. Never reach into a magazine station or into a microplate magazine that is inside a magazine station while the RapidStak is powered. ▲

Chapter 3 Installing the RapidStak

This chapter describes how to unpack and set up the RapidStak. It contains the following topics:

- "Unpacking the RapidStak" on page 3-2, which describes how to unpack the RapidStak and its accessories.
- "Setting Up the RapidStak" on page 3-6, which describes how to position the RapidStak and align it with the washer or dispenser.
- "Integrating the Instrument" on page 3-18, which describes how to integrate an instrument with the RapidStak.

Unpacking the RapidStak

The RapidStak is shipped in a large box that contains the instrument plate, a hardware bag, a CD, and the *RapidStak Setup Guide* and *RapidStak Operator Guide*. The microplate magazines are shipped in one or more cardboard boxes.

Note Keep all the packing and shipping materials, in case you need to re-ship the RapidStak.

To unpack the RapidStak

1. Open the shipping box and remove everything but the inner box.

2. With one person at each end, grasp the handholds of the inner box. Lift the inner box up and out, and place it on the floor.

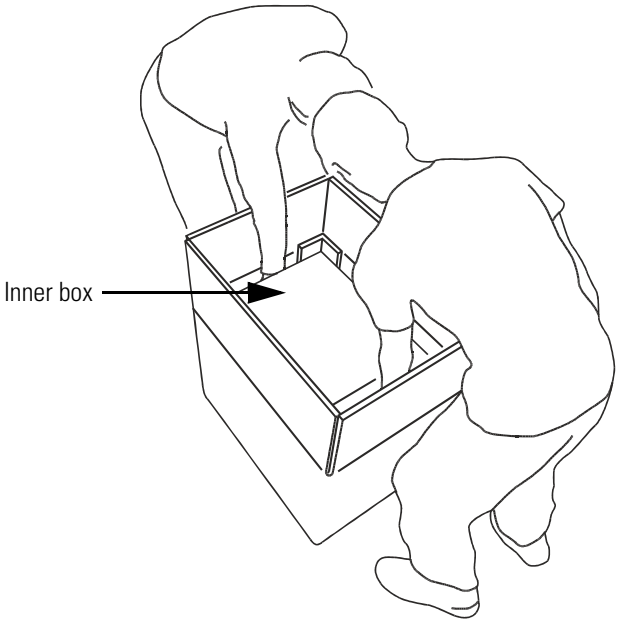


Figure 3-1. Removing the inner box

3. Cut the packing tape and open the inner box. The RapidStak is wrapped in plastic.

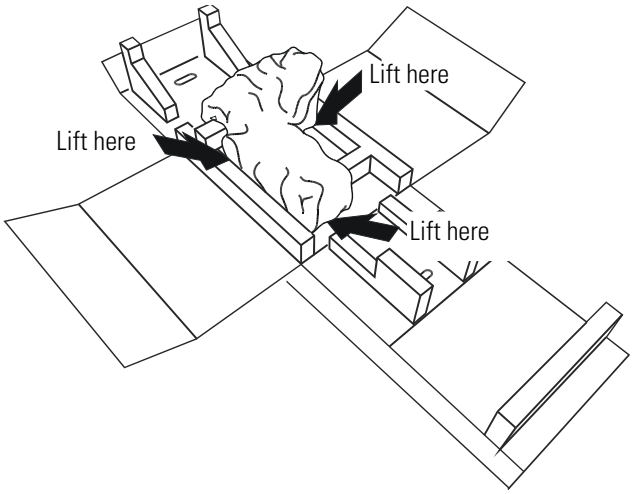


Figure 3-2. Opening the inner box

4. Slip your hands under the base at each end, and lift the RapidStak onto the work surface.

CAUTION Do not lift the RapidStak by holding the body or the upper frame. You may damage components! ▲

5. Remove the plastic wrapping.

6. Remove the shipping components, shown in Figure 3-3:

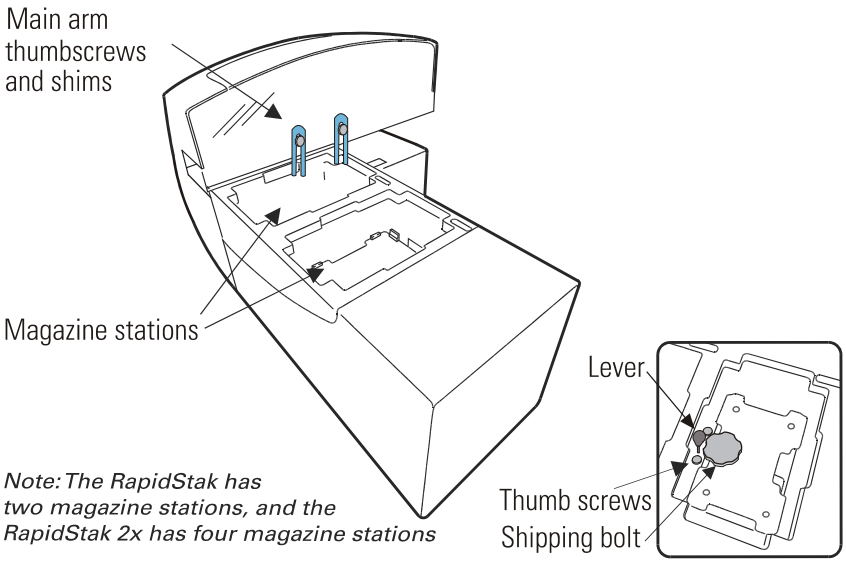


Figure 3-3. Removing the shipping components

   a. Remove the yellow shipping bolt.
   b. Push the red lever down.
   c. Remove the two thumb screws.
   d. Pull out the locking assembly.
   e. Remove the main arm thumbscrews.
   f. Remove the blue shims.

To unpack the microplate magazines

1. Remove the packing tape and open the box.

2. Take out the microplate magazines and top handles, and remove the bubble wrap.

3. Attach a top handle to each magazine. As shown in Figure 3-4, slide the handle into the notched plastic piece.

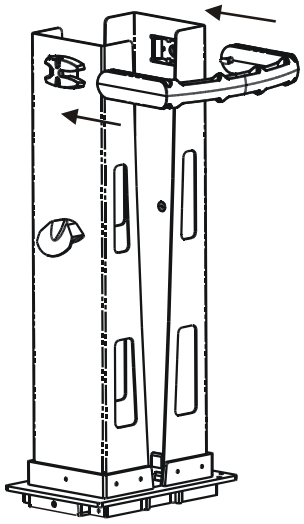


Figure 3-4. Attaching the top handle to a magazine

Setting Up the RapidStak

This section describes how to set up the RapidStak and the instrument plate, and how to align the RapidStak with the washer or dispenser. Proper alignment ensures the RapidStak repeatedly puts the microplate into the center of the instrument nest.

Tip Repeat this procedure whenever you move the washer or dispenser, the instrument plate, or the RapidStak, and whenever you find the microplate is not delivered into the center of the instrument nest. ▲

Setting up the RapidStak includes the following steps:

1. Preparing the instrument plate.

2. Positioning the RapidStak, instrument plate, and washer or dispenser on the work surface.

3. Connecting the communication and power cables.

4. Loading magazines into the RapidStak.

5. Aligning the nest of the washer or dispenser with the RapidStak.

6. Readying the RapidStak for operation.

Preparing the Instrument Plate

The instrument plate accommodates either a Wellwash AC washer or a Multidrop dispenser.

To prepare the instrument plate

- If you have the instrument plate for the Multidrop 384/Micro or Multidrop Combi dispensers (part #F01495), fasten the locators and tie plate in the positions shown in Figure 3-5, using the supplied hex key.

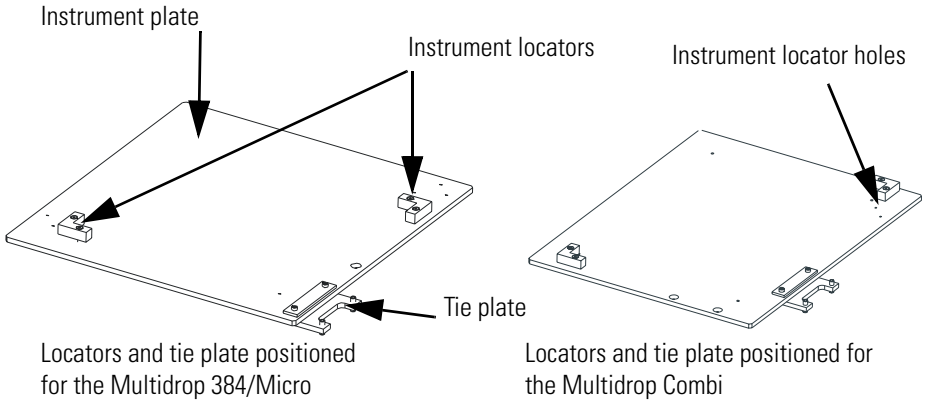


Figure 3-5. Instrument plate configurations for the Multidrop 384/Micro and Multidrop Combi

- If you have the instrument plate for the Wellwash AC washer or Multidrop dispenser (part #F01370), fasten the locators in the positions shown in Figure 3-6, using the supplied hex key.

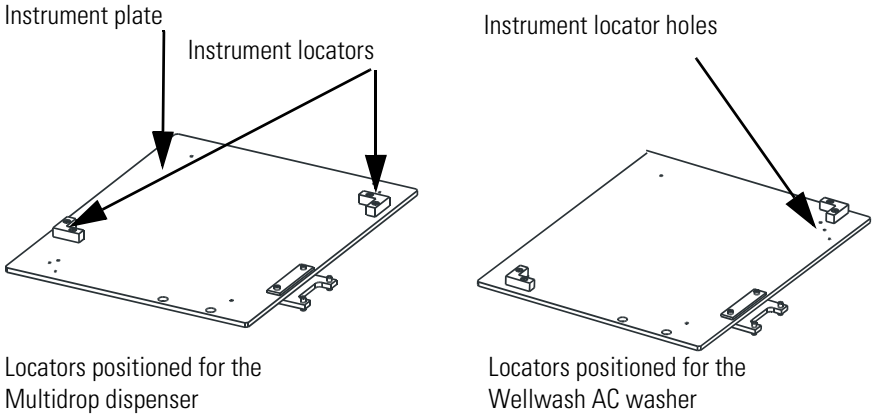


Figure 3-6. Instrument plate configurations for the Wellwash AC and Multidrop dispenser

Positioning the RapidStak and Instrument

You use the instrument plate to align the RapidStak and washer or dispenser on the work surface.

To position the RapidStak, instrument plate, and washer or dispenser

1. Place the instrument plate and the RapidStak side-by-side on the work surface. Position the side with the tie plate beside the front left corner of the RapidStak.

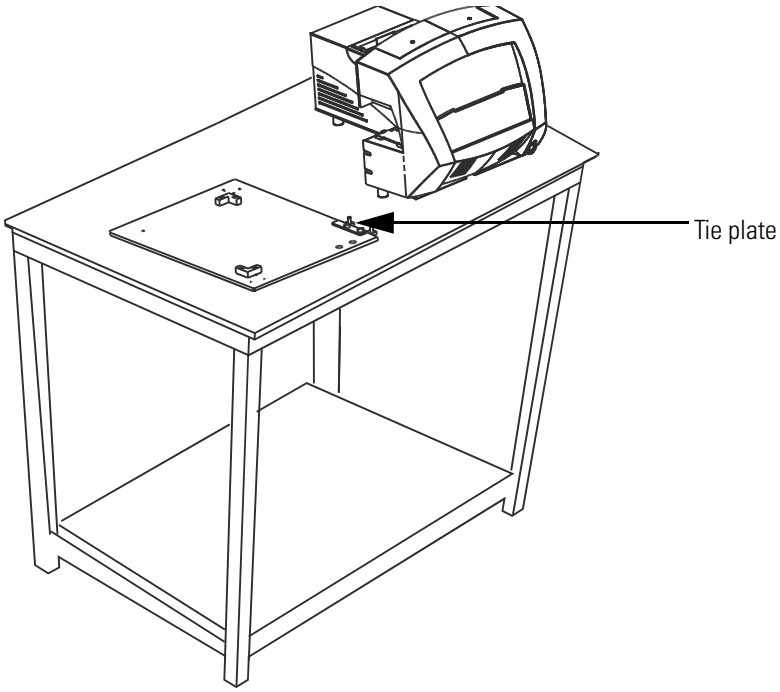


Figure 3-7. The RapidStak and instrument plate

2. Lift the front left corner of the RapidStak and slide the instrument plate up to the edge of the RapidStak. Gently lower the RapidStak onto the dowel pins.

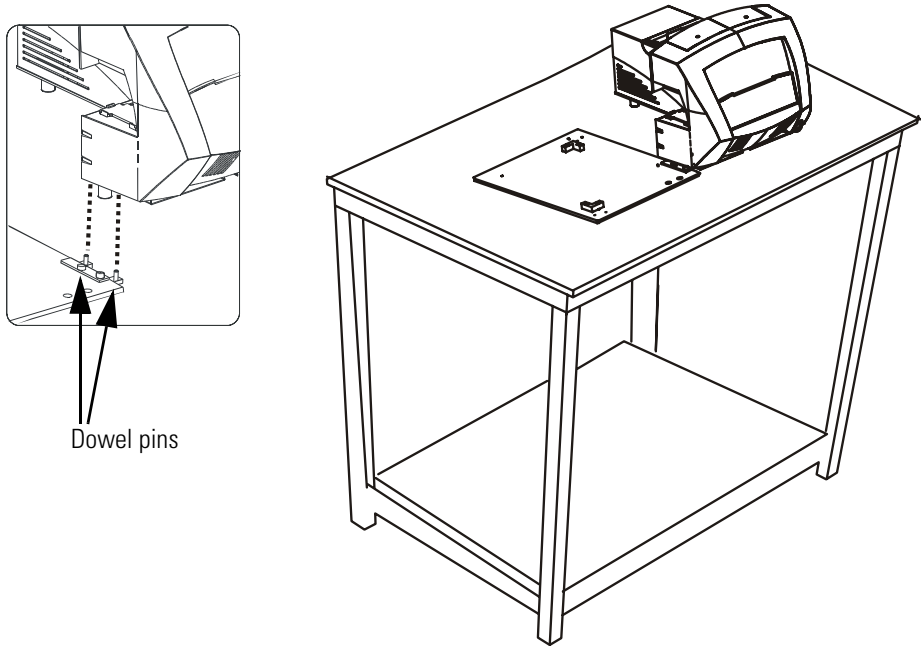


Figure 3-8. Lowering the RapidStak onto the dowel pins

3. Position the washer or dispenser within the instrument locators on the instrument plate.

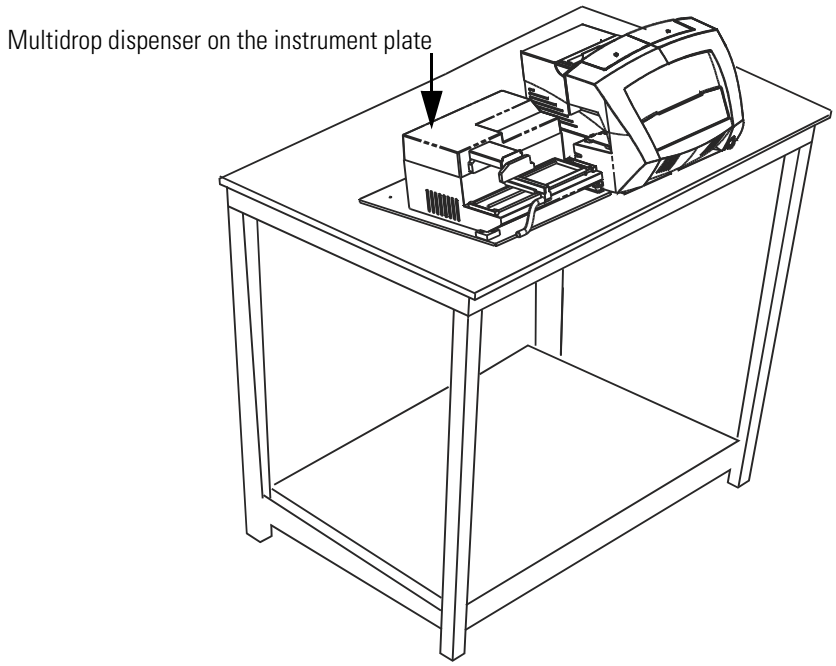


Figure 3-9. Positioning the Multidrop on the instrument plate

Connecting Communication and Power Cables

The RapidStak and washer or dispenser must be connected through a serial cable and be powered on to set up and use the RapidStak.

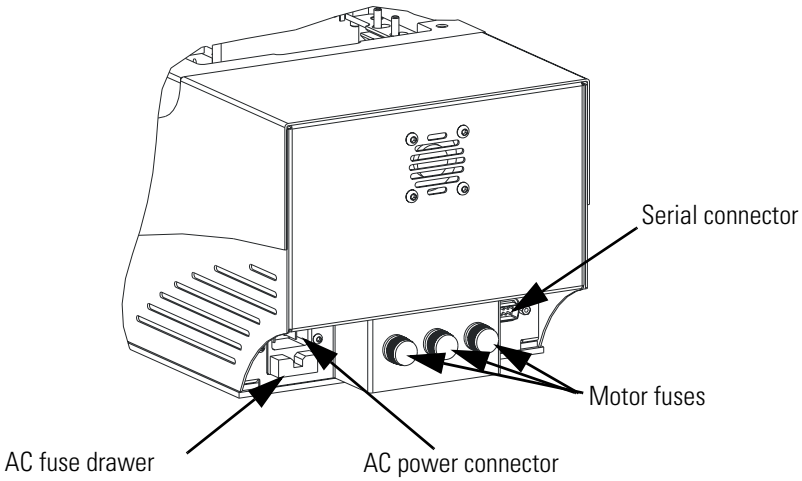


Figure 3-10. Rear panel power and communications connections

To connect power and communication

1. Connect the washer or dispenser to AC power.

2. Connect one end of the instrument's serial communications cable to the 9-pin serial connector on the rear panel of the RapidStak, and the other end to the 25-pin connector on the back panel of the Wellwash AC washer or Multidrop dispenser.

3. Check that the RapidStak's power switch is OFF, then plug one end of the supplied power cord into the power connector on the rear panel of the RapidStak and plug the other end into AC power.

CAUTION Use the supplied power cord, and do not cut off the third terminal from the cord! The power cord has the required grounding terminal. ▲

Loading Magazines into the RapidStak

You put microplates into magazines, 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.

To put microplates into a magazine

1. Using both hands, grasp several microplates on their side edges, taking care not to touch the wells.

2. Align the A1 wells of the microplates with the A1 orientation marker on the magazine base, and slide the microplates down into the magazine until they reach the bottom.

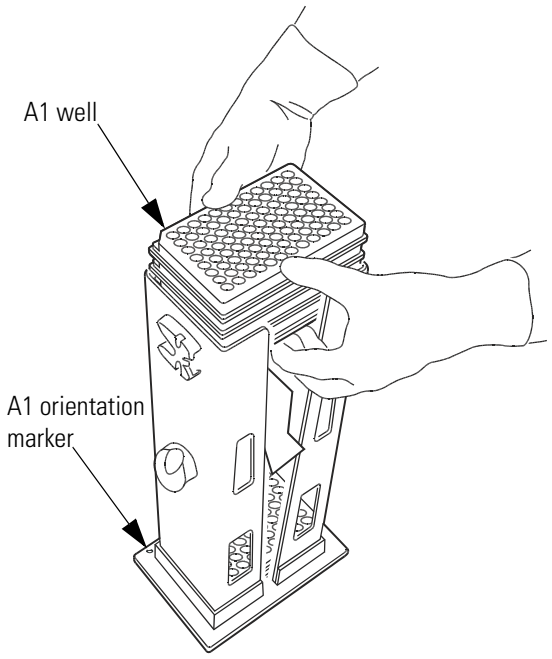


Figure 3-11. Putting microplates into a magazine

3. Check that the microplates are properly aligned. Each microplate should nest on top of the one below it, with their A1 wells aligned.

CAUTION Ensure the microplates are properly aligned! Improper alignment could cause a jam. ▲

To put magazines into the RapidStak

1. Slide your hands under the side handles, and carefully lift up 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 magazine station 1. All four corners should fit securely without rocking.

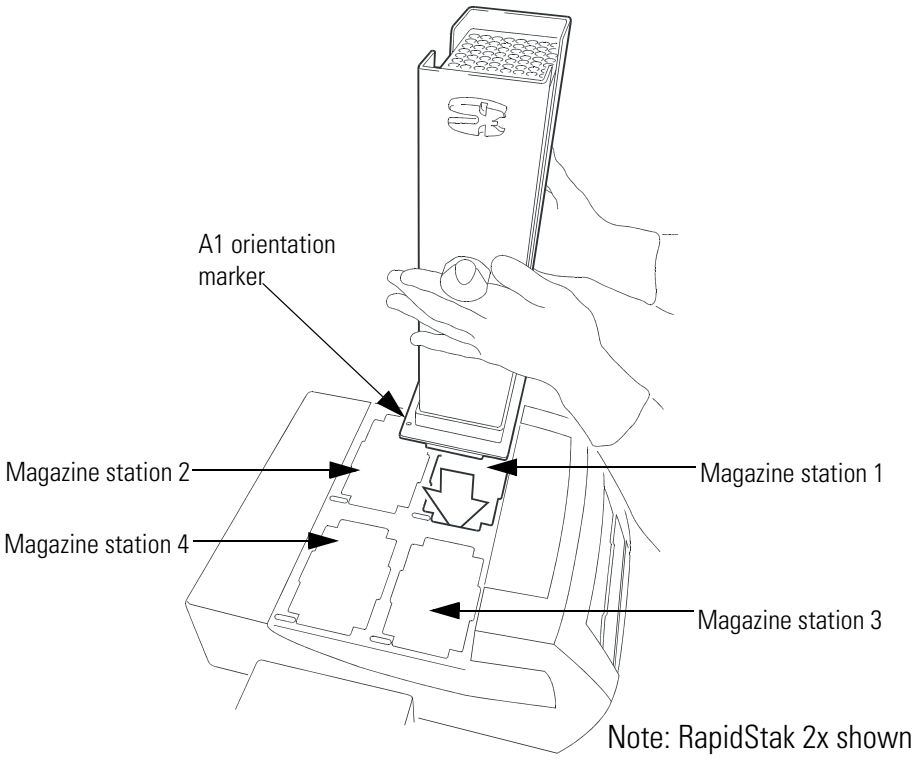


Figure 3-12. Putting a magazine into magazine station 1

4. Put empty magazines into the remaining magazine stations, using the same method.

Note Both the RapidStak and the RapidStak 2x have magazine stations 1 and 2. The RapidStak 2x has the additional magazine stations 3 and 4. ▲

Aligning the RapidStak and Instrument Nest

You fine-tune the alignment of the RapidStak and the nest of the washer or dispenser.

To align the RapidStak and the instrument nest

1. Turn ON the instrument. If a Multidrop Combi, put it in Micro or 384 mode to enable communications.

2. On the RapidStak, press and hold the RUN/PAUSE and READY buttons while turning the RapidStak ON. The COMM indicator will flash red, then turn green.

3. Press RUN/PAUSE. The RapidStak removes a microplate from the magazine in magazine station 1, grips it, and extends the arm out over the instrument nest.

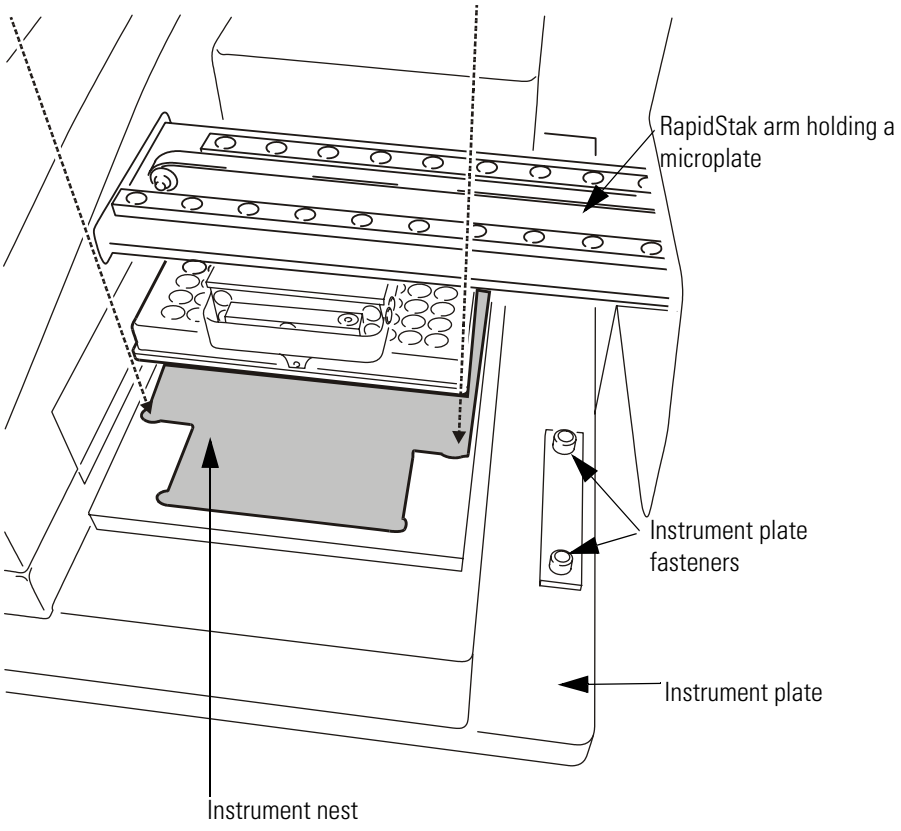


Figure 3-13. Aligning the instrument nest and microplate

4. Check the alignment of the microplate over the instrument nest. Loosen the instrument plate fasteners using the provided hex key and gently move the instrument plate so the instrument nest and microplate are aligned.

5. Press RUN/PAUSE. The RapidStak arm lowers the microplate to a position just above the instrument nest. Gently move the instrument plate so the instrument nest is centered underneath the microplate.

6. Press RUN/PAUSE. The RapidStak puts the microplate into the instrument nest. The microplate should be centered in the instrument nest.

7. Press RUN/PAUSE. The RapidStak arm rises and withdraws into the RapidStak.

8. Repeat steps 3 to 7 until the RapidStak repeatedly delivers the microplate into the center of the instrument nest.

9. With the arm inside, turn OFF the RapidStak.

10. Tighten the instrument plate fasteners to secure the positions of the instrument nest and RapidStak.

Returning to Normal Operation

Before you can resume normal operation, you must retrieve the microplate used during the setup procedure.

To retrieve the microplate

1. Turn ON the RapidStak. The READY indicator flashes.

2. Press READY. The RapidStak performs communication and internal checks, puts the microplate into the magazine in magazine station 2, and flashes the ERROR indicator.

3. Press STOP to clear the error.

4. Place the plate release on a flat surface.

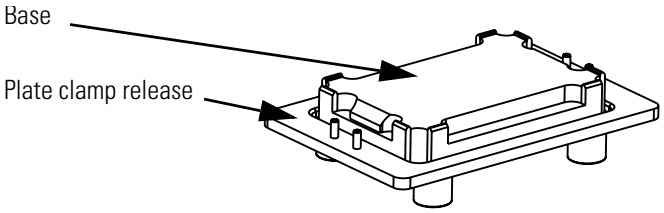


Figure 3-14. Plate release

5. Slide your hands under the side handles, and lift up the magazine in magazine station 2.

6. Place the magazine onto the plate release.

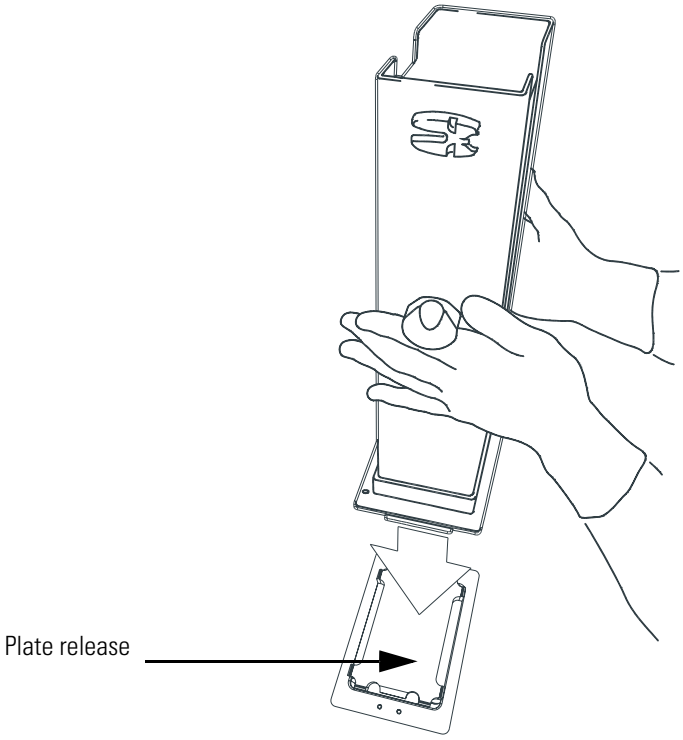


Figure 3-15. Emptying a magazine

7. With a hand on each side, grasp the plate clamp release and the base of the magazine together, lift them both off the base of the plate release, and put them down together on a flat surface.

8. Remove the released microplate from the base of the plate release.

9. Lift the magazine off the plate clamp release and return the empty magazine to magazine station 2.

10. Replace the plate clamp release on the base of the plate release.

11. Press READY.

Integrating the Instrument

When your RapidStak is unpacked and set up, you need to integrate it with its instrument. Integration consists of adjustments to the RapidStak and/or the instrument to ensure they work together. You also need to integrate if you change instruments.

Integration consists of teaching locations, changing firmware, or both, depending on the instrument.

If your instrument is set up on an instrument plate, you do not need to teach locations unless the instrument is a Multidrop 384, Micro, or DW model. Otherwise you need to teach locations. For instructions on how to teach locations, see Appendix C, Teaching Locations.

To determine the firmware

1. Find the RapidStak serial number.

2. Use Windows Explorer to open the `Firmware.htm` file on the RapidStak CD.

3. Follow the instructions in the file to determine the firmware version required by the RapidStak.

   Note Each RapidStak has the `firmware.hex` file installed at time of manufacture. ▲

4. If you need to change the firmware, see "Changing the Firmware" on page 5-6.

Chapter 4 Using the RapidStak

This chapter describes how to use the RapidStak to perform a run. It contains the following topics:

- "Turning the RapidStak ON/OFF" on page 4-2, which describes how to turn the RapidStak ON and OFF using the power switch.
- "Using the Keypad" on page 4-3, which describes how to use the keypad's buttons and indicators.
- "Using Microplate Magazines" on page 4-4, which describes how to fill magazines with microplates, and how to put magazines into the RapidStak.
- "Loading the RapidStak for a Run" on page 4-10, which describes which magazine stations receive full magazines, and which magazines receive empty magazines.
- "Performing a Run" on page 4-11, which describes how to start a run, how to monitor the run, and how to finish up after a run.
- "Pausing, Stopping, and Aborting a Run" on page 4-13, which describes how to pause, stop, and abort a run.
- "Retrieving In-transit Microplates" on page 4-15, which describes how to retrieve microplates left in the RapidStak after aborting a run.

Turning the RapidStak ON/OFF

The RapidStak has one power switch on the front.

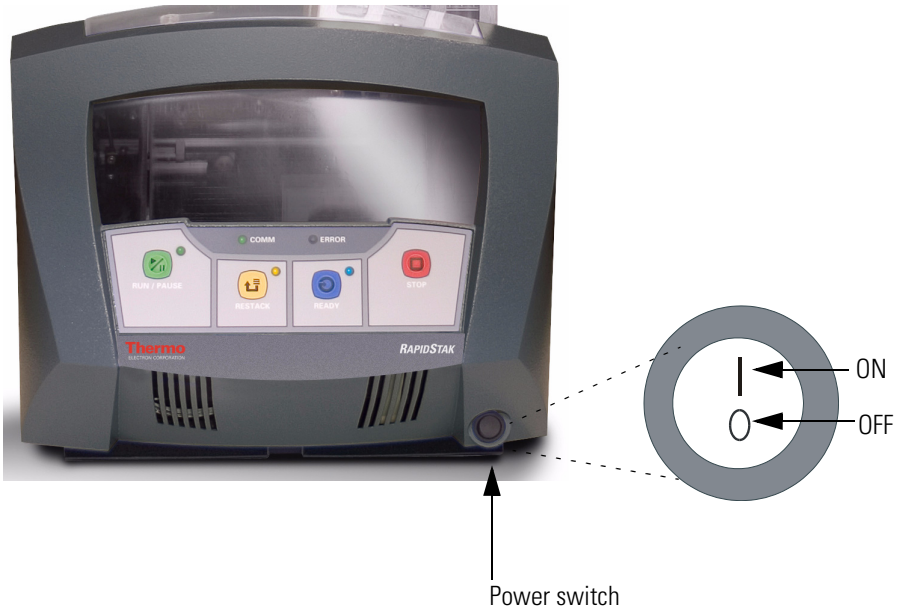


Figure 4-1. Power switch ON and OFF positions

To turn ON the RapidStak

- Press the power switch to the upper position.

To turn OFF the RapidStak

- Press the power switch to the lower position.

Using the Keypad

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

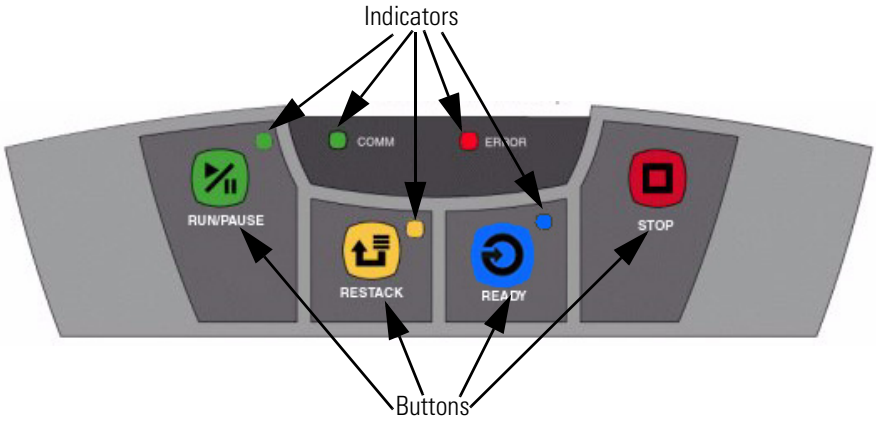


Figure 4-2. The RapidStak keypad

Table 4-1. Keypad indicators and buttons

Keypad Feature	Button Function	Status
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 a run is pending Slow flashing green: Paused or stopped 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: Reset is required Fast flashing blue: RapidStak is resetting 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	

Using Microplate Magazines

You fill magazines with microplates, then put the magazines into the RapidStak for processing. At the end of a run you empty the magazine.

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.

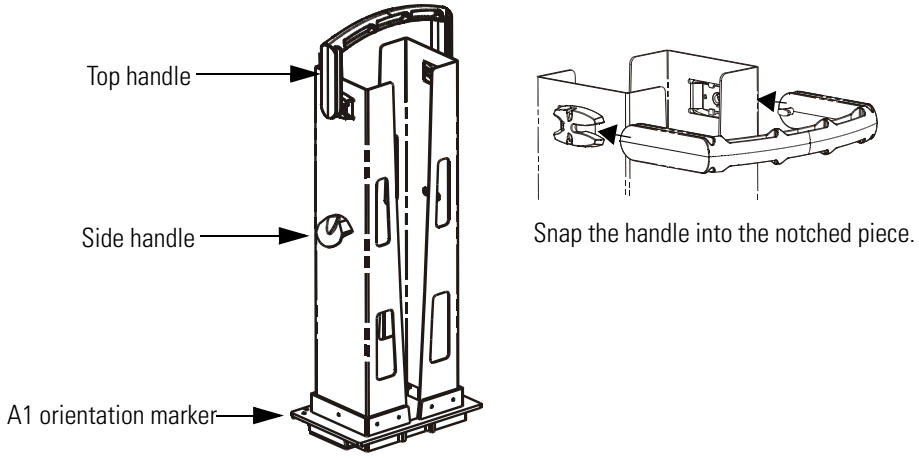


Figure 4-3. A microplate magazine

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 4-13 for more information.

To fill a magazine with microplates

1. Place the magazine upright on a clean flat surface.

2. Using both hands, grasp several microplates on their side edges, taking care not to touch the wells.

3. As shown in Figure 4-4, 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.

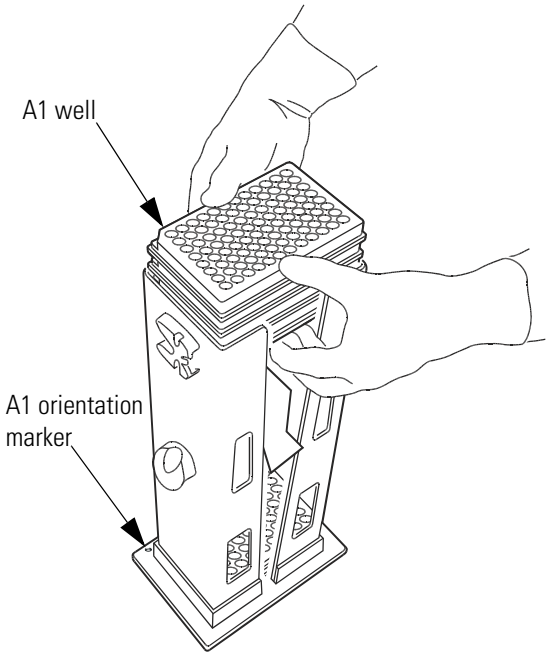


Figure 4-4. Putting microplates into a magazine

4. Repeat for the remaining microplates.

5. 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.

To empty a magazine of microplates

1. Place the magazine upright on a clean flat surface.

2. 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.

3. Continue removing the microplates until only the bottom microplate remains.

4. Place the plate release on a flat surface.

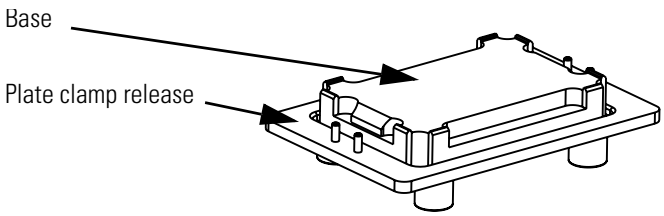


Figure 4-5. Plate release

5. Place the magazine onto the plate release.

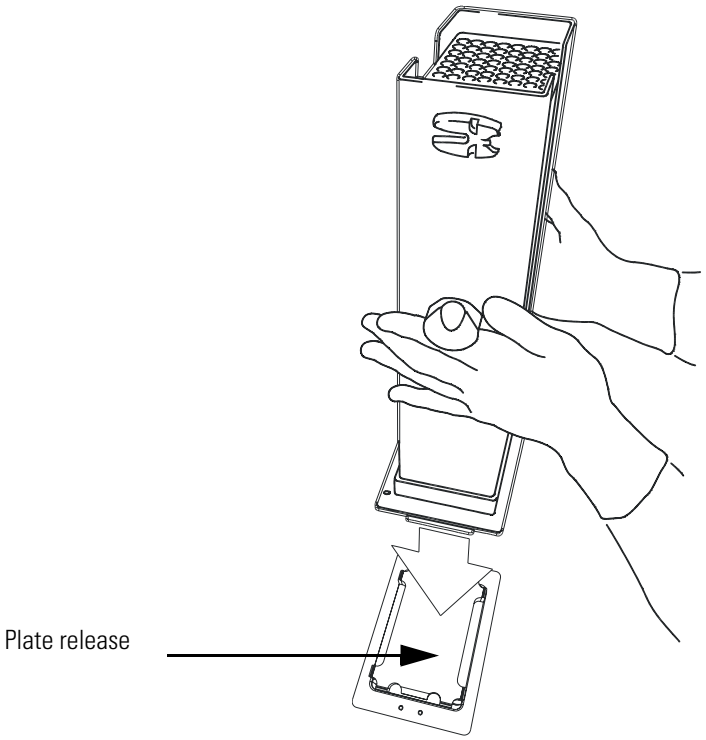


Figure 4-6. Emptying a magazine

6. With a hand on each side, grasp the plate clamp release and the base of the magazine together, lift them both off the base of the plate release, and put them down together on a flat surface.

7. Remove the released microplate from the base of the plate release.

8. Lift the magazine off the plate clamp release and place it on a flat surface.

9. Replace the plate clamp release on the base of the plate release.

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.

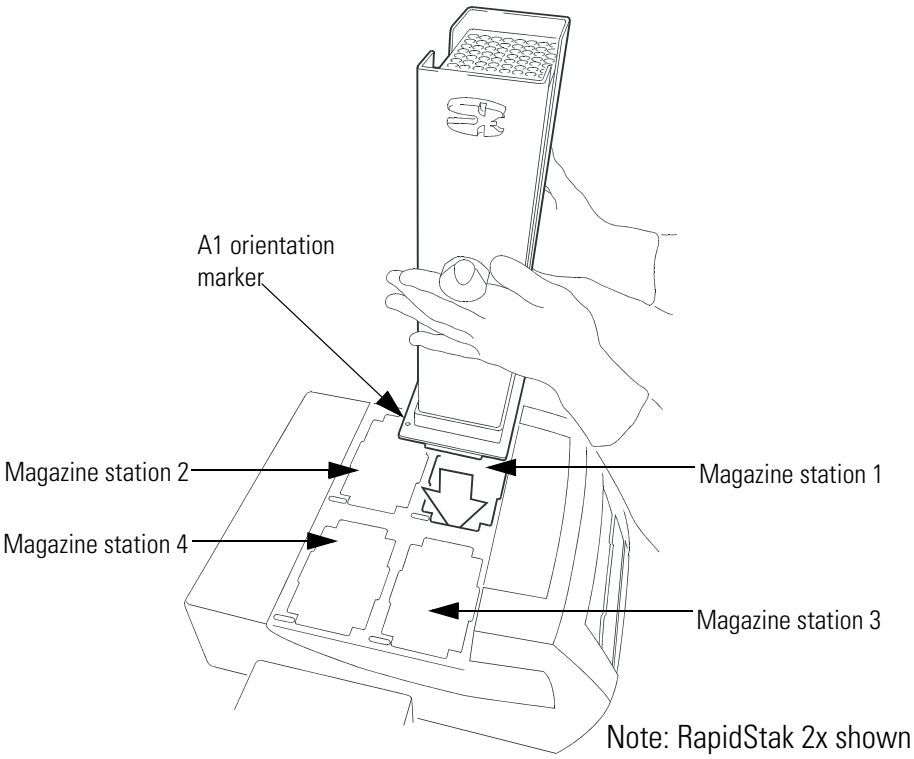


Figure 4-7. Putting a magazine into magazine station 1

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, Stopping, and Aborting a Run" on page 4-13.

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. Both the RapidStak and the RapidStak 2x have magazine stations 1 and 2, and the RapidStak 2x has the additional magazine stations 3 and 4.

When you start a run the RapidStak checks whether there is a magazine in each magazine station, and checks each magazine for microplates. If it finds an empty magazine station or an incorrect magazine placement, it flashes the ERROR indicator. For more information on error codes, see "Understanding Error Codes" on page 6-2.

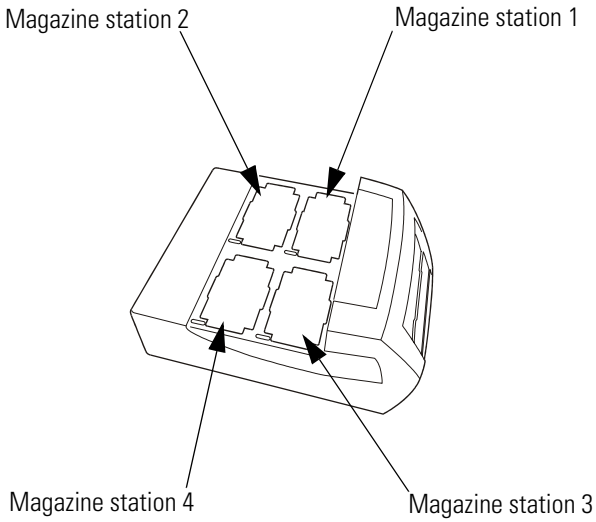


Figure 4-8. Magazine station numbering

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 a Run

Before you perform a run, complete the following steps:

- Ensure the RapidStak is set up as described in "Setting Up the RapidStak" on page 3-6.
- Set up the dispenser or washer according to the manufacturer's instructions.

To perform a run

1. **Prepare the instrument.**

   a. Ensure the washer or dispenser and the RapidStak are connected through the RS232 port.

   b. Turn on the instrument and load it with the required reagents.

   c. Manually configure the instrument settings. If a Multidrop Combi, put it in Micro or 384 mode.

   d. If you are using the Multidrop dispenser, prime it before each run.

2. **Prepare the RapidStak.**

   a. Fill one or more magazines with microplates, as described in "To fill a magazine with microplates" on page 4-5.

   b. Put the filled magazines and at least one empty magazine into the magazine stations, as described in "Loading the RapidStak for a Run" on page 4-10.

   c. Ensure the RapidStak is turned ON, and check that the COMM indicator lights green, that the ERROR indicator is off, and the READY indicator flashes blue. On power-up, the COMM indicator should turn green within 10 seconds, but if it does not, see "Troubleshooting Tips" on page 6-5.

3. **Start the run.**

   a. Press RUN/PAUSE. The RUN/PAUSE and READY indicators flash while the RapidStak resets its motors and performs internal checks. The indicators stop flashing and the RapidStak begins processing microplates.

   b. If restacking is desired, press RESTACK. The RESTACK indicator turns amber, indicating that restacking will occur after the microplates are processed.

   Tip During a run, you can enable and disable restacking by pressing RESTACK. When restacking is pending, the RESTACK indicator turns amber. When restacking is occurring, the indicator turns green. ▲

4. **Monitor the run.**

   Watch the first few microplates as they are processed. If the RapidStak does not deliver the microplate into the center of the instrument nest, review the set up procedure as described in "Setting Up the RapidStak" on page 3-6.

5. **At the end of the run, remove the processed microplates.**

   a. Check that the run and the restacking are finished. When finished, the RUN/PAUSE indicator is off, the READY indicator is on, and the RapidStak and instrument are not moving microplates. If the COMM indicator is red or the ERROR indicator is on, the run may have stopped due to an error. See "Understanding Error Codes" on page 6-2.

   b. Remove the magazines from the magazine stations, as described in "To remove a magazine from a magazine station" on page 4-9.

   c. Empty the magazines, as described in "To empty a magazine of microplates" on page 4-5.

Pausing, Stopping, and Aborting a Run

During a run you may need to pause, stop, or abort microplate processing.

Pausing a Run

You typically pause a run to refill reagents for the dispenser or washer, or to empty waste. When you pause a run, the RapidStak and instrument finish processing all unstacked microplates, then the RapidStak stops all motors. After pausing a run, you can resume the run or abort the run.

To pause a run

- Press RUN/PAUSE. The RUN/PAUSE indicator slowly flashes green.

Stopping a Run

You typically stop a run to address an immediate concern, such as a plate jam. When you stop a run, the RapidStak stops all motors immediately. If the instrument is currently processing a microplate, it finishes that microplate. After stopping a run, you can resume the run or abort the run.

To stop a run

- Press STOP once.

Resuming a Run

After pausing or stopping the run, you can resume the run.

The RapidStak continues processing microplates.

To resume a run

1. Press RUN/PAUSE once.

   The RUN/PAUSE and READY indicators flash while the RapidStak performs internal checks. When the checks complete, the READY indicator stops flashing.

CAUTION If you resume a run on the RapidStak (not the RapidStak 2x) when the front magazine contains more containers than the rear magazine can accommodate, the rear magazine may overflow, resulting in possible damage to the contents of the microplates. Make sure the rear magazine has enough free capacity to store all the containers coming from the front magazine.

2. Press RUN/PAUSE once again.

   The RapidStak resumes processing microplates, and the RUN/PAUSE indicator turns solid green.

Aborting a Run

You typically abort a run only if you want to stop processing microplates. When you abort a run, the RapidStak stops all motors immediately. If the instrument is currently processing a microplate, it finishes that microplate, and it and any other unstacked microplates remain where they are. See "Retrieving In-transit Microplates" on page 4-15 for how to handle unstacked microplates.

To abort a run

- If the run is paused or already stopped, press STOP once. If it is not, press STOP twice.

Retrieving In-transit Microplates

When you abort a run, there may be one or two microplates inside the RapidStak that are not inside a microplate magazine. These microplates were either on their way to, or were returning from, the washer or dispenser when the run aborted. When you start a run, the RapidStak checks for these in-transit microplates, and puts them into the magazine in magazine station 2. You must manually remove these 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. Remove and empty the magazine in magazine station 2. See "To empty a magazine of microplates" on page 4-5.

5. Inspect the one or two microplates that were in the bottom of the magazine to determine if they were processed, and handle accordingly.

6. Return the empty magazine to magazine station 2, and press READY to reset the motors.

Chapter 5 Maintenance

This chapter contains the following topics:

- "Cleaning" on page 5-2, which describes how to clean the RapidStak keypad and exterior, the magazine stations, and the magazines.
- "Cleaning Up Spills" on page 5-3, which describes how to clean-up spills that occur inside the RapidStak.
- "Replacing Fuses" on page 5-4, which describes how to replace the main AC power and motor fuses.
- "Changing the Firmware" on page 5-6, which describes how to change the RapidStak firmware.

Cleaning

Keeping the RapidStak magazines and magazine stations clean helps ensure proper operation. Perform the following cleaning procedures monthly, or as required.

CAUTION Electrical hazard! Always unplug and turn off the RapidStak before cleaning or reaching into any part of it. ▲

To clean the keypad and exterior

- Use a damp sponge or soft well-wrung cloth and mild detergent dissolved in water to wipe down the surface.

To clean a magazine

1. Remove the magazine from the magazine station.
2. Wipe down the inside walls of the magazine to remove dust or debris.
3. Clean around the inside and the outside of the magazine base to remove dust or debris.
4. Dry the magazine walls and base using a lint-free cloth.

CAUTION Do not autoclave the magazines as they have plastic pieces that will not withstand high heat and pressure. ▲

To clean the magazine stations

1. Unplug and turn OFF the RapidStak.
2. Using a damp, lint-free cloth and mild detergent, wipe around the aluminum magazine stations taking care not to damage the sensors.
3. Dry the surfaces using a dry lint-free cloth.

Cleaning Up Spills

If liquid spills inside the RapidStak, clean up the spill immediately. If a spill occurs due to a microplate jam see "Retrieving In-transit Microplates" on page 4-15.

CAUTION Electrical hazard! Always unplug and turn off the RapidStak before cleaning or reaching into any part of it. ▲

To clean up spills

1. Unplug and turn OFF the RapidStak.
2. Remove the magazines.
3. Carefully blot up any liquid using an absorbent lint-free cloth. Avoid contact with electrical components.

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

Replacing Fuses

The RapidStak has five fuses accessible from the rear panel: two AC input fuses, housed in the fuse drawer of the AC power inlet; and three motor fuses, housed in fuse holders.

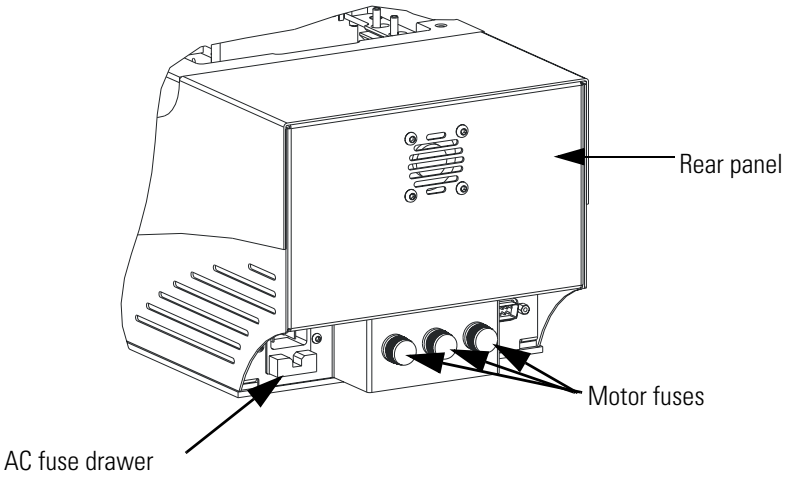


Figure 5-1. Location of RapidStak fuses

Table 5-1. RapidStak fuses

Fuse	Dimensions	Rating
AC input fuses-	5 x 20 mm	1.0 Amp Type F (Fast Blow)
Motor fuses	1 1/4 x 1/4 in.	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 1.0 Amp, fast blow fuses.
4. Replace the fuse drawer and push until you hear the drawer click into place.

To replace the 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 a 1.25 Amp, fast blow fuse.

CAUTION Do not use fuses rated higher then 1.25 Amp! Equipment damage or operator injury could occur. ▲

4. Replace the fuse holder. Gently push it in and turn it clockwise until it clicks into place.

Changing the Firmware

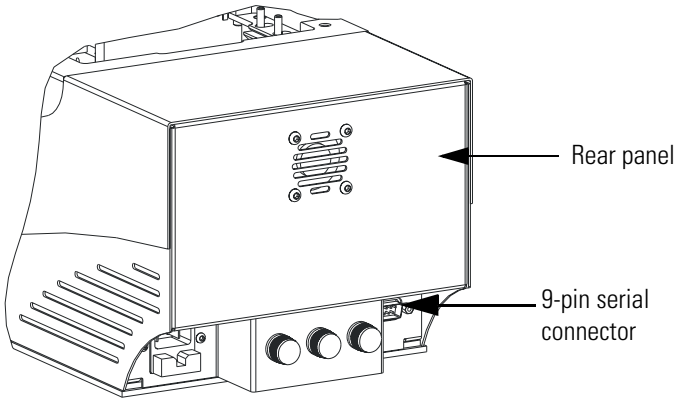
Firmware is software and data in RapidStak memory that stays in memory even when the RapidStak is powered off. You might need to change the firmware in your RapidStak because you have a version that is too old for current applications (such as Polara RS), or when instructed by Thermo Scientific personnel.

Your RapidStak CD (or the Polara RS Installation Key) has the current firmware and Boot Manager, which you use to change the firmware.

To change the firmware, you need a computer with Windows and a CD reader.

To change firmware

1. Connect one end of the supplied cable to the 9-pin serial connector on the rear panel of the RapidStak to a COM port on the lab computer.



1. Put the RapidStak in “boot mode” as follows:

   a. Power off the RapidStak.

   b. Hold down the front panel STOP and RESTACK buttons.

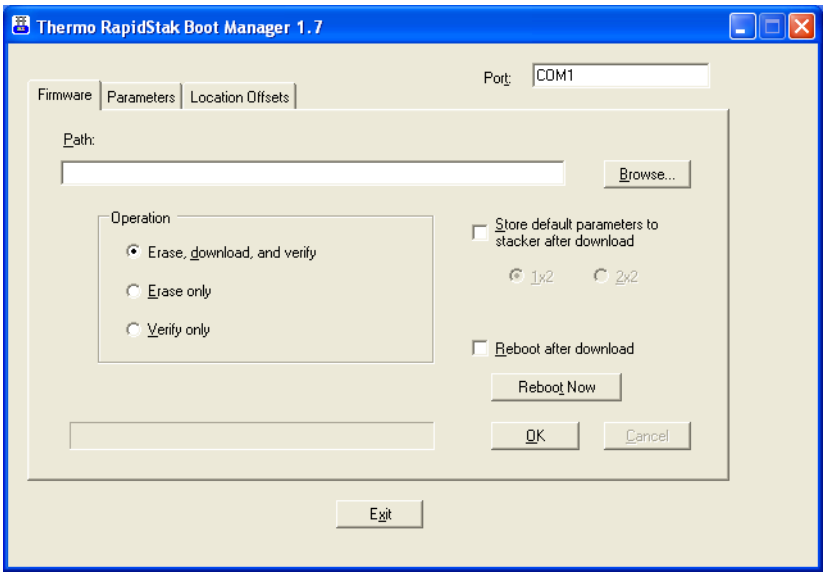
   c. Power on the RapidStak.

   d. Release the buttons.

   When all front panel lights are off, the RapidStak is in “boot mode”.

2. Put the RapidStak CD into the computer CD drive and use Windows Explorer to navigate to the Utilities directory.

3. Double click on the `bootManager.exe` file to display the Boot Manager user interface:



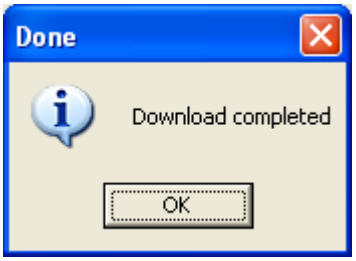
4. If necessary, change **Port** to the COM port.

5. Select the Firmware tab.

6. Choose **Browse** to find and open a firmware file.

7. In the Operation area, select 'Erase, download and verify'.

8. Choose **OK** and wait for the download complete message:



9. Choose **OK** and then exit the Boot Manager.

10. Power the RapidStak off and on.

    Do not touch any front panel buttons.

11. Press Ready to home the RapidStak.

12. If homing is unsuccessful, repeat this procedure.

    If homing is unsuccessful again, call service.

Chapter 6 Troubleshooting

This chapter describes how to troubleshoot problems and recover from errors. It also includes a list of replaceable parts and information about contacting Customer Support. It contains the following topics:

- "Handling Microplate Jams" on page 6-7, which describes what to do if a microplate jams.
- "Troubleshooting Tips" on page 6-5, which provides a list of troubleshooting tips.
- "Understanding Error Codes" on page 6-2, which describes how to interpret and respond to the RapidStak's error codes.
- "User Replaceable Parts" on page 6-8, which provides a list of parts.
- "Contacting Customer Support" on page 6-9, which describes how to contact Thermo Scientific Customer Support.

Understanding 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.

For recoverable errors, press STOP once to clear the ERROR indicator, then perform the suggested action described in Table 6-1.

For nonrecoverable errors, turn off the RapidStak, then perform the suggested action described in Table 6-2.

Note The magazine missing error clears automatically when all magazine stations contain magazines. ▲

Table 6-1. Handling recoverable errors

# of short flashes	Error	Action to take
1	Sensor timeout	Contact Customer Support.
2	Magazine missing	Replace missing magazine.
3	Incorrect magazine configuration	See "Loading the RapidStak for a Run" on page 4-10.
4	Microplates found inside the RapidStak when resetting motors	Remove microplates from magazine in magazine station 2. See "Retrieving In-transit Microplates" on page 4-15.
5	No instrument found	Check instrument power and communication connections.
6	Grip error	Retrieve microplates. See "Retrieving In-transit Microplates" on page 4-15.
7	Ungrip error	Retrieve microplates. See "Retrieving In-transit Microplates" on page 4-15.
8	Stacking error	Retrieve microplates. See "Retrieving In-transit Microplates" on page 4-15.
9	Unstacking error	Retrieve microplates. See"Retrieving In-transit Microplates" on page 4-15.

Table 6-1. Handling recoverable errors

# of short flashes	Error	Action to take
10	Instrument error	Resolve instrument problem, finish processing the microplate currently in the instrument, then press the READY button on the RapidStak to resume the run. If the instrument error cannot be resolved, abort the run and retrieve any in-transit microplates. See "Retrieving In-transit Microplates" on page 4-15.

Table 6-2. Handling nonrecoverable errors

# of short flashes after a long flash	Error	Action to take
1	Internal error	Retrieve microplates. See "Retrieving In-transit Microplates" on page 4-15.
2	Keypad button error	Turn off then turn on the RapidStak. If unsuccessful, contact Customer Support.
3	Communication error	Contact Customer Support.
4	Stepper fuse error	Replace stepper motor fuse. See "Replacing Fuses" on page 5-4.
5	Cam 1 fuse error	Replace cam1 motor fuse. See "Replacing Fuses" on page 5-4.
6	Cam 2 fuse error	Replace cam2 motor fuse. See "Replacing Fuses" on page 5-4.
7	Power relay error	Contact Customer Support.
8	Power supply error	Contact Customer Support.

Troubleshooting Tips

Table 6-3 lists tips for troubleshooting RapidStak problems.

CAUTION Reaching into the RapidStak while it is powered can trap or crush your hand. Turn OFF and unplug the RapidStak before troubleshooting. ▲

Table 6-3. Troubleshooting tips

Problem	Possible Cause	Action to take
The run is not finished but the RapidStak is not moving microplates, and the ERROR indicator signals an instrument error.	The instrument has returned an unexpected message to the RapidStak.	Fix the problem with the instrument. Complete the processing of the plate currently in the instrument. Press the READY button on the RapidStak to resume the run. The RapidStak will consider the microplate in the instrument as finished processing and place it in the output magazine.
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 4-15.
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 5-4.
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.

Table 6-3. Troubleshooting tips

Problem	Possible Cause	Action to take
Microplates are jamming in the RapidStak.	Microplates are improperly loaded.	Check that the microplates are stacked correctly on top of each other. See "To fill a magazine with microplates" on page 4-5.
	Microplates do not conform to SBS standards.	Use microplates that conform to SBS standards.
	Microplate magazines or magazine stations are dirty.	Clean the magazines and magazine stations. See "Handling Microplate Jams" on page 6-7.

Handling Microplate Jams

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, to check for microplates and spills.
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.

User Replaceable Parts

User replaceable parts can be ordered through the Thermo Scientific LAI Customer Support Group.

Table 6-4. User replaceable parts

Part	Part Number
50 microplate magazine	F01351
30 microplate magazine	F01362
25 microplate magazine (for RapidStak short versions)	F01491
Instrument plate for Multidrop 384/Micro/Combi	F01495
Instrument plate for Wellwash AC/Multidrop	F01370
RapidStak Operator Guide	F01354
1.25 Amp Fuse Type F (motor fuse)	R06333
1.0 Amp Fuse Type F (AC input fuse)	R01164

Contacting Customer Support

For technical support please contact the Customer Support group in your region:

North America

Surface Mail/Shipping
Thermo Fisher Scientific, Laboratory Automation
5344 John Lucas Drive
Burlington, Ontario
L7L 6A6
Canada

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
General: info.labautomation@thermo.com
Sales: sales.labautomation@thermo.com

Europe

Surface Mail/Shipping
Thermo Life Sciences AB
St. Lars vag 45
Lund 222 70
Sweden

Telephone
46 36 30 36 60 (voice)
46 46 32 87 70 (facsimile)

China

Surface Mail/Shipping
Thermo Electron International Trading Ltd.
23rd Floor Peregrine Building
No. 1325 Huai Hai Zhong Lu
Shanghai 200031 China

Telephone
+86-21-64457907 (voice)
+86-21-64457830 (facsimile)

Surface Mail/Shipping
Thermo Electron International Trading Ltd.
Room 1010-1016, Ping' an Mansion
No. 23 Jinrong Street, Xicheng District
Beijing 100032 China

Telephone
+86-10-58503588 (voice)
+86-10-66210847 (facsimile)

Japan

Surface Mail/Shipping
Thermo Electron K.K.
3-9-C Moriya-cho, Kanagawa-ku
Yokohama 221-0022

Telephone
+81-45-453-9220 (voice)
+81-45-453-9222 (facsimile)

Asia Pacific

Surface Mail/Shipping
Thermo Electron (HK) Ltd.
Unit 11-15, 9/F, Tower 1, Grand Central Plaza,
138 Shatin Rural Committee Road, Shatin,
New Territories, Hong Kong
Telephone
+852-2885-4613
+852-2567-4447

India and Arabian Peninsula

Surface Mail/Shipping
Thermo Electron LLS India Pvt. Ltd.
Plot No. A-255, T.T.C. Industrial Area
Mahape, Navi Mumbai - 400 705
Maharashtra (India)

Telephone
+91-22-27781101/02
+91-22-27781103

Chapter 7 Technical Specifications

This chapter lists the RapidStak's specifications. It contains the following topics:

- "Physical Specifications" on page 7-2, which lists the type of materials used in the RapidStak, the RapidStak's weight and dimensions, and provides a footprint diagram of the RapidStak and RapidStak 2x.
- "Operating Specifications" on page 7-5, which lists the operating specifications of the RapidStak.
- "Electrical Specifications" on page 7-6, which lists the electrical and communication specifications.

Physical Specifications

The RapidStak is available in four models:

- RapidStak, part number F01350 (includes two 30-microplate magazines and one instrument plate)
- RapidStak 2x, part number F01351 (includes four 30-microplate magazines and one instrument plate)
- RapidStak short version, part number F01489 (includes two 25-microplate magazines and one instrument plate)
- RapidStak 2x short version, part number F01351 (includes four 25-microplate magazines and one instrument plate)

The RapidStak is composed of stainless steel and aluminum, with plastic covers. The microplate magazines are made of stainless steel and aluminum, with plastic handles.

Table 7-1. Dimensions and weights

Component	Height	Width	Depth	Weight
RapidStak (without magazines)	31.5 cm (12.4 in.)	arm extended 63.7 cm (25.1 in.) arm not extended 38.9 cm (15.3 in.)	60 cm (23.2 in.)	13 kg (28.5 lb)
RapidStak 2x (without magazines)	31.5 cm (12.4 in.)	arm extended 63.7 cm (25.1 in.) arm not extended 38.9 cm (15.3 in.)	60 cm (23.2 in.)	18 kg (40.0 lb)
RapidStak short version (without magazines)	31.5 cm (12.4 in.)	arm extended 63.3 cm (24.9 in.) arm not extended 38.1 cm (15.0 in.)	49.2 cm (19.4 in.)	13 kg (28.5 lb)
RapidStak 2x short version (without magazines)	31.5 cm (12.4 in.)	arm extended 63.3 cm (24.9 in.) arm not extended 38.1 cm (15.0 in.)	49.2 cm (19.4 in.)	18 kg (40.0 lb)
25 microplate capacity magazine-empty	36.3 cm (13.9 in.)	17.9 cm (7.1 in.) at base	12.0 cm (4.7 in.) at base	0.8 kg (1.75 lb)
30 microplate capacity magazine-empty	42.8 cm (16.9 in.)	17.9 cm (7.1 in.) at base	12.0 cm (4.7 in.) at base	0.9 kg (2.0 lb)
50 microplate capacity magazine-empty	70.9 cm (27.9 cm)	17.9 cm (7.1 in.) at base	12.0 cm (4.7 in.) at base	1.4 kg (3.0 lb)

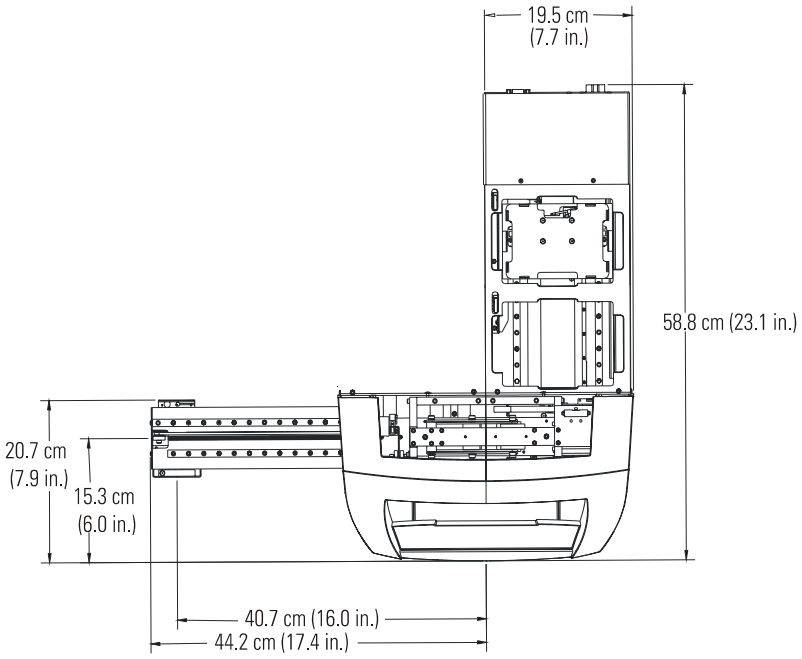


Figure 7-1. Footprint of the RapidStak

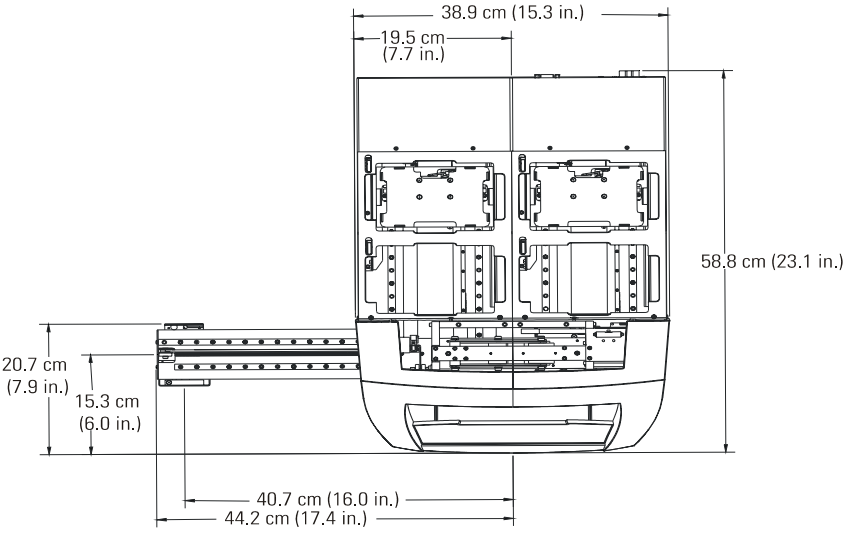


Figure 7-2. Footprint of the RapidStak 2x

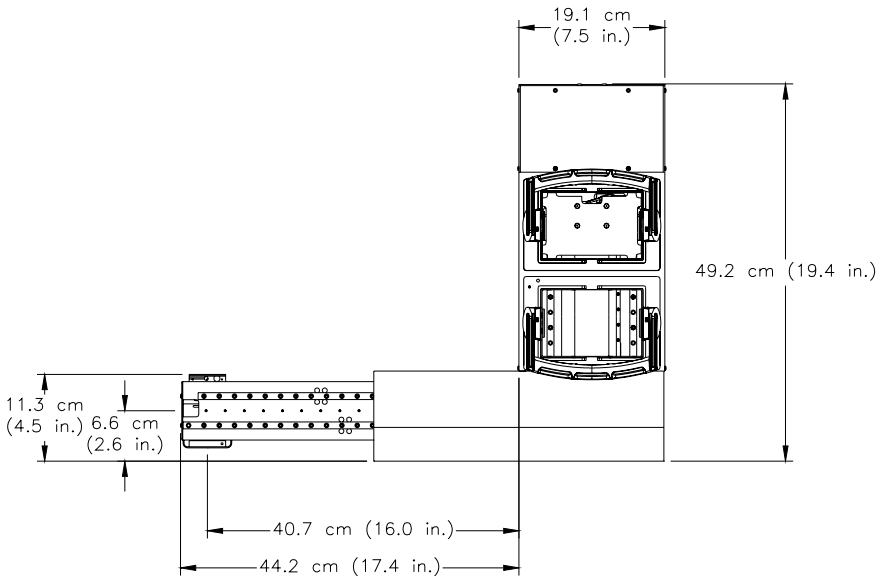


Figure 7-3. Footprint of the RapidStak short version

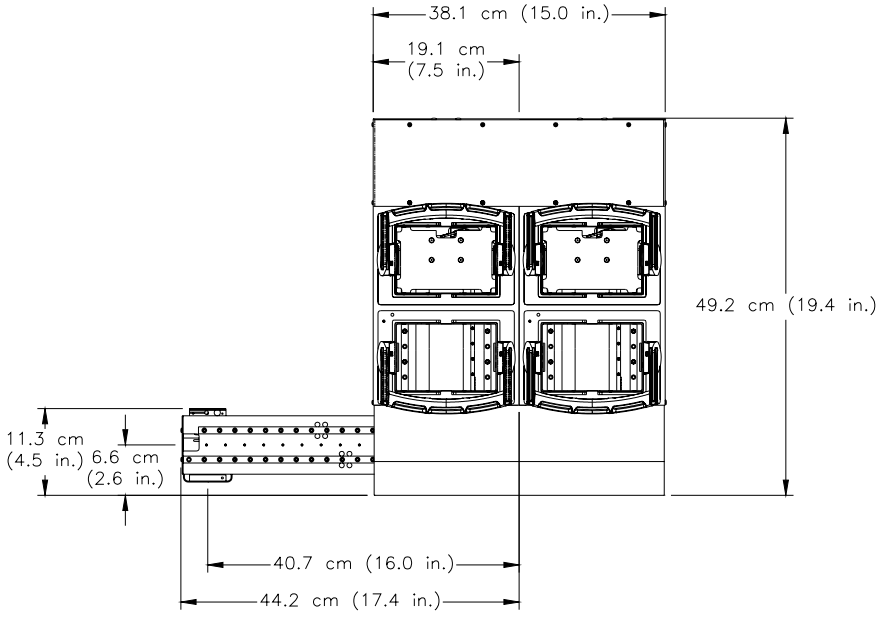


Figure 7-4. Footprint of the RapidStak 2x short version

Operating Specifications

The RapidStak accommodates both 96-well and 384-well, unlidded, SBS standard microplates.

Table 7-2. Performance ratings

Function	Cycle Time
Store one microplate (timed from instrument to magazine)	< 15 seconds
Retrieve one microplate (from magazine to instrument)	< 15 seconds
Restack one full 30 capacity magazine (transfer microplates from one magazine to another)	~ 3 minutes
Restack one full 50 capacity magazine (transfer microplates from one magazine to another)	~ 5 minutes

Table 7-3. Operating conditions

Condition	Value
Maximum operating temperature - ambient	+10 to +40° C (50 to 104° F)
Storage temperature	-20 to +75° C (-4 to 167° F)
Ambient humidity	10 to 80% RH non-condensing
Ventilation	Clearance of 10 cm (4 in.) around sides for air intake
Environment	Clean, low dust, dry office/laboratory environment. Indoor use only.
Maximum operating altitude	2000 m (6,562 ft.)
Installation category	II (Local level)[1]
Pollution category	2

[1] Installation category (overvoltage category) defines the level of transient overvoltage which the instrument is designed to withstand safely. For Category II, the expected transient overvoltage is 2500 V for a 230 V supply and 1500 V for a 120 V supply.

Electrical Specifications

The RapidStak has one AC power connector on the rear panel. The ON/OFF switch is located on the front.

Table 7-4. Power rating

Power Condition	Value
Input voltage	100/115/230 VAC Mains voltage not to exceed 10% of nominal supply voltage
Input current	1/0.5 A
Input power	50 VA
Input frequency	50/60 Hz

Fuses

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

Table 7-5. Fuses

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 in.	1.25 Amp Type F (Fast Blow)
F2 Cam 1 Motor	1 1/4 x 1/4 in.	1.25 Amp Type F (Fast Blow)
F1 Cam 2 Motor	1 1/4 x 1/4 in.	1.25 Amp Type F (Fast Blow)

Communication

The RapidStak has one RS232 serial port for communicating with the instrument, using the serial protocol configuration:

- Baud rate: 9600
- Data bits: 8
- Parity: None
- Stop bit: 1
- Flow control: None

The serial port has a DB-9 male connector.

Table 7-6. DB-9 connector pinout

Pin number	Purpose	Voltage
1, 4, 6, 7, 8, 9,	Not connected	
2	TX- Transmitted data	Output / RS-232 / ±10V
3	RX- Received data	Input / RS-232 / ±10V
5	GND	GND

Appendix A Changing the Gripper Fingers

This appendix describes how to change the position of the gripper fingers so that the RapidStak can grip other types of microplates.

For details, see the following topics:

- "When to Change the Gripper Fingers" on page A-2 explains the need for changing the gripper fingers.
- "Changing the Position of the Gripper Fingers" on page A-3 describes how to switch the position of the gripper fingers.

When to Change the Gripper Fingers

The RapidStak is supplied with the gripper fingers mounted on the inside of the gripper, so that they grasp microplates on the microplate's side walls.

For a few microplate types, however, the fingers must be set to grasp the microplates by their skirts: when the side walls are inset too far, for example, or are too high.

To learn how to change the finger positions, see "Changing the Position of the Gripper Fingers" on page A-3.

Changing the Position of the Gripper Fingers

This topic describes the procedure for changing the gripper finger positions.

To change the gripper finger positions

1. When the RapidStak is idle, and the gripper is not holding a microplate, turn it OFF.

2. With your hand, move the arm until the gripper is completely outside the RapidStak chassis.

3. Using a 1.5 mm hex key, remove the screws and nuts fastening the fingers to the gripper.

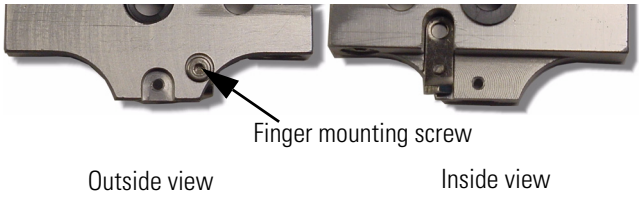


Figure A-1. The front gripper finger in the standard, inside position

Figure A-2. The rear gripper fingers in the standard, inside positions

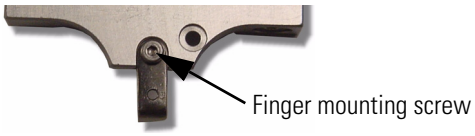


Figure A-3. The front gripper finger in the outside position, shown from the outside

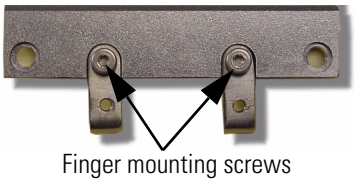


Figure A-4. The rear gripper fingers in the outside positions, shown from the outside

4. Using a 1.5 mm hex key, fasten the fingers in the alternate positions, with the finger tips pointing inwards, towards the microplate.

Appendix B The Plate Height Adjustment Tool

This appendix contains information on why and how to use the Plate Height Adjustment Tool. This tool allows you to ensure the gripper can grip plates with unusual sides, such as deep well plates.

Note The Plate Height Adjustment Tool is not supplied with the RapidStak. To obtain a free copy, contact the customer support group at the addresses listed in Contacts in the Preface.

About Plate Height Adjustment

Plate height adjustment enables the RapidStak to grip a wider range of microplate types. Although you must use microplates that conform to the Society for Biomolecular Screening (SBS) standard, their specifications are not narrow enough to ensure that a machine gripper can securely grasp all SBS conformant plate types.

Plate height adjustment applies a vertical (Z direction) offset to where the gripper *grips* plates, rather than to where the gripper *moves* a plate. This allows you to use one set of taught locations for many types of plates. When you use plates that must be gripped higher or lower than standard plates, you can adjust the plate height grip location for those plates, and then restore the plate heights to factory settings when you return to standard plates.

If, when running an assay, you find that the gripper drops plates between nests, or cannot always pick up plates from nests, verify the following:

- Dropped plates are not distorted or damaged in any way.
- Sides of dropped plated are dry; that is, reagents or other chemicals have not spilled onto the sides.
- Taught locations are accurate; that is, the arm does not flex and there are no collisions during movement.

If all these conditions are true, then you probably need to adjust the plate height for this plate type.

Sometimes you can look at the sides of a plate to see that the gripper must grasp the plate at a non-standard height. Some plates have very low sides, or a base that can interfere with gripping. When examining plates, use new plates that are not distorted by use, heat or chemicals.

Using the Plate Height Adjustment Tool

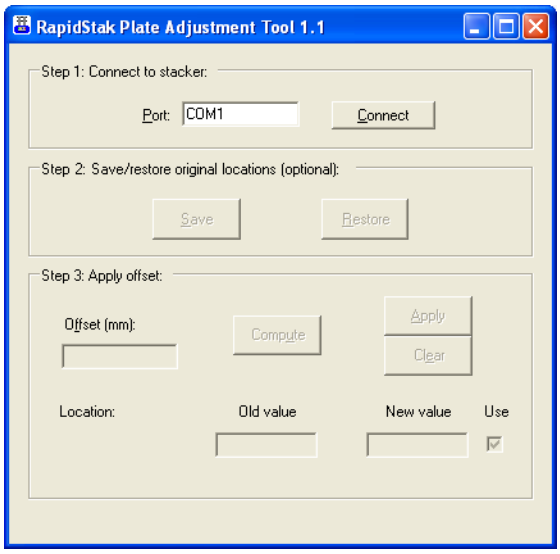
To change plate height values, you use the Plate Height Adjustment Tool to transmit the values to RapidStak firmware storage through the communications line.

After you start the Plate Height Adjustment Tool, you can calculate plate heights and save them, or restore old plate heights.

To change the current plate height values

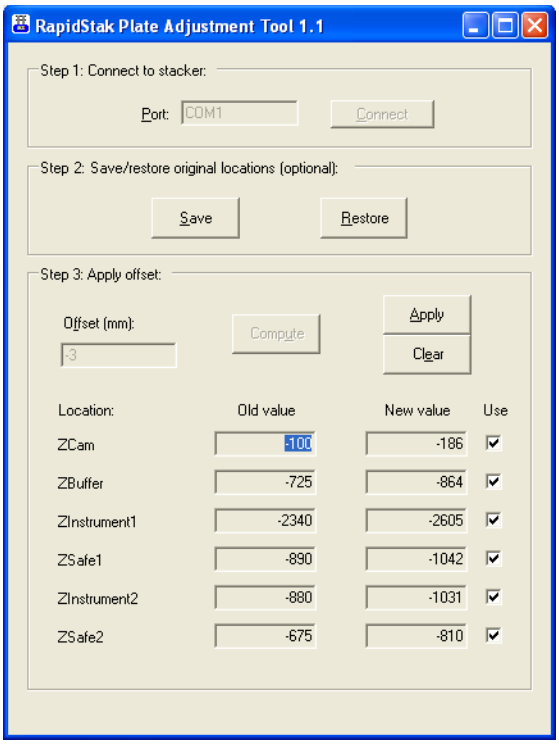
1. Run the Plate Height Adjustment tool.

   The tool displays the following form:



2. Enter the **Port** to which the RapidStak is connected and choose **Connect**.

   The tool connects to the RapidStak and expands the form to accommodate the number of available locations:



Tip As a precaution, save the current location offsets to a file before applying new offsets.

3. If you want to save the RapidStak's current location offset values, choose **Save**.

   The tool opens a file system browser, which you can use to save the location offset values to a file.

4. Enter an **Offset** value in millimeters: negative values offset the location upwards and positive values, downwards.

5. Choose **Compute**.

6. To update the location offsets in the RapidStak, choose **Apply**.

Tip Save the changed offsets with a file name that describes the plate type.

To restore plate height values

1. Start the Plate Height Adjustment tool.

2. In the Save/Restore area, choose **Restore** to open a Windows Open dialog box.

3. Find a plate height adjustment file and choose **Open**.

4. In the Apply offset area, click **Apply** to store the height adjustment values in the RapidStak.

Appendix C Teaching Locations

Sometimes you need to teach the RapidStak where to move plates so they can be processed by an instrument. This is necessary when an instrument moves with respect to the RapidStak, due to table movement, vibrations, relocation, and so on, and, for some instruments, when you install the instrument.

To teach locations, you need the following:

- a computer with Windows and a CD reader
- the RapidStak CD
- a connection cable (included with the RapidStak)

About Instrument Nests

Every instrument has at least one nest. The RapidStak can deliver plates to only one nest in an instrument. For instruments with more than one nest, such as a liquid handler, you must specify one as the instrument nest.

Instrument nests have two physical attributes: location and orientation. Nest location is its position in space. Orientation is the position of the A1 well, either upper left or lower right, in a nest.

If you turn an instrument around, for example to give the RapsidStak gripper access to its nest, you change nest orientation. In this case, you must change your assay to ensure the instrument applies well operations, such as dispense and read, to the correct wells.

About Locations

A location is the physical position of a microplate when it is in the RapidStak gripper. A physical position is specified with two coordinate numbers: X and Z. X is the horizontal position of the plate, and Z is the vertical position. The RapidStak stores locations by name in its permanent memory.

The RapidStak has two factory-set locations that you cannot teach or change, but which you use during the teaching process:

- The *Home* location is inside the RapidStak. You can always move the arm to the Home location. This is necessary because you need to start teaching from a known location.

- The *Buffer* location is at a nest inside the RapidStak. This nest increases plate throughput by enabling parallel stacking and plate motion. On the RapidStak 2x, the nest is moveable and is used for getting and storing plates for the two left magazines.

You teach two locations for each instrument.

- An *Instrument* location is the nest where plates are placed for processing in an instrument. The nest you choose for plate processing determines the Instrument location. Use *Instrument1* for the left instrument and *Instrument2* for the right instrument.

  If you move an instrument, you move its nest, and you must re-teach its nest location before running any assays.

- A *Safe* location is where the RapidStak can hold a plate so that the instrument cannot touch the plate or gripper. Most instruments have parts that move over a plate (for example, to wash or read it) or parts that move plates (for example, to dispense into wells). The RapidStak holds plates at the *Safe* location to avoid collisions while the instrument is moving. There is one *Safe* location for each instrument. Use *Safe1* for the left instrument and *Safe2* for the right instrument.

What is 'Teaching a Location'?

Teaching a location means instructing the RapidStak to move a plate to a specific location and recording the location coordinates in the RapidStak. (You can also save location coordinates in a computer file.) You perform all these steps using the RapidStak Instrument Teach Tool.

To teach a location

1. **Get a plate from a magazine.**

2. **Move the plate to a location, such as an instrument nest.**

3. **Save the location.**

   This step records the location coordinates and its name in the RapidStak memory.

4. **Test the location.**

   Move a plate to and from the location to ensure the plate is positioned accurately.

CAUTION Locations must be accurate to minimize the possibility of collisions with instruments. ▲

About the Teach Tool

The Teach Tool allows you to control the RapidStak to move and position plates in nests, and to save the locations.

Use Windows Explorer to navigate the RapidStak CD to the Teach Software folder and double click the `instrumentTeach.exe` filename to start the Teach Tool:

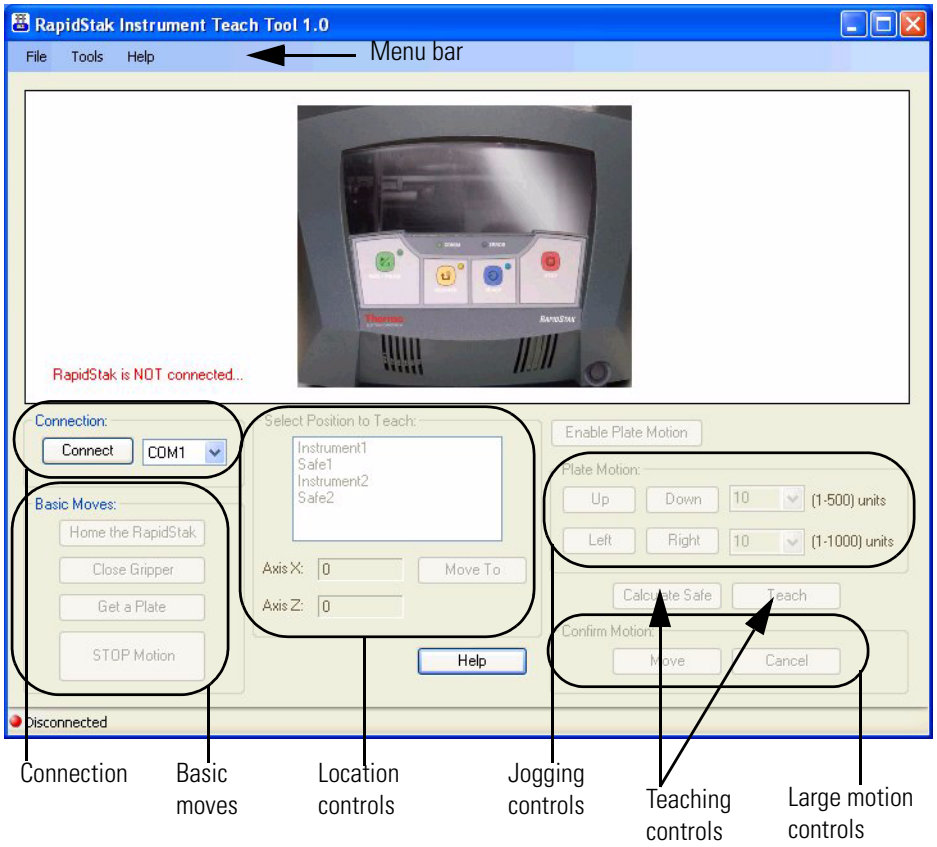


Figure C-1. The RapidStak Instrument Teach Tool

The Teach Tool main features are:

- The Menu bar provides functions such as changing gripper and arm settings, saving location information on disk, and starting the plate height adjustment tool.
- Connection controls allow you to connect and disconnect the computer to the RapidStak.
- Basic Moves controls send stacker commands such as home, get a plate, and open the gripper. They are required for teaching and testing locations.

- Location controls allow you to move a plate to a taught location. This is used when you need to make small adjustments to locations and to test the path of motion of plates.
- Use Jogging controls to move the RapidStak's gripper small distances to exact locations.
- Use Large Motion controls to move the RapidStak's gripper large distances to approximate locations.
- Teaching controls allow you to teach a current physical position and to calculate a standard safe location.

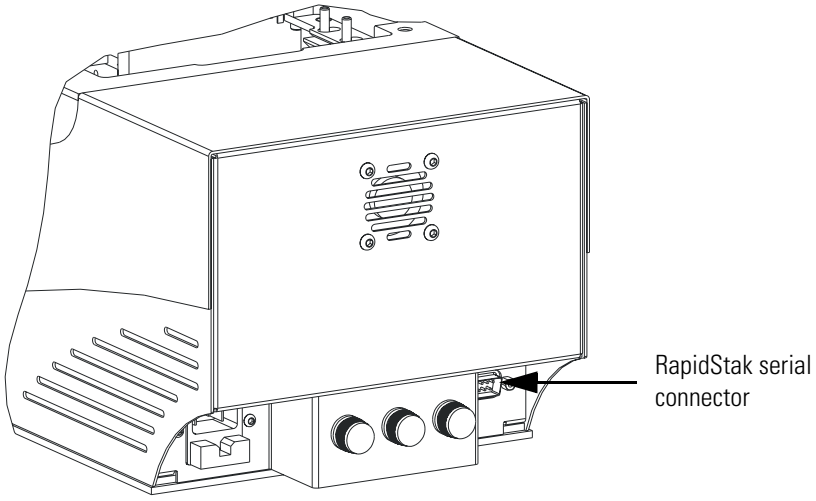
Preparing for Teaching

Prepare for teaching to ensure the RapidStak is initialized and can communicate with the computer.

To make teaching safer, you can reduce the speed of arm motion. Always return settings to their original values after teaching. To change settings, follow the procedure "To reduce arm speed" on page C-9.

To prepare for teaching

1. Connect one end of the supplied cable to the 9-pin serial connector on the rear panel of the RapidStak to a COM port on the lab computer.



Tip Write down the computer port number. You need it later when you configure the RapidStak. ▲

2. Put at least 5 clean, empty microplates into a RapidStak magazine and place it into station 1.

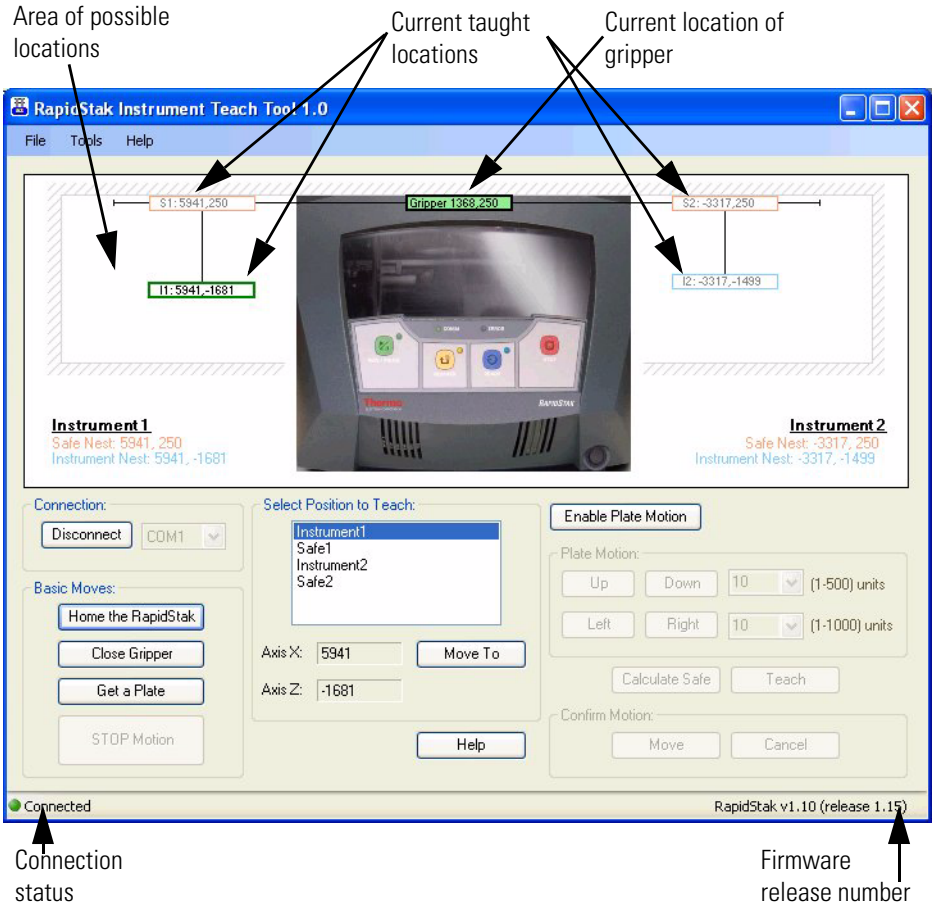
3. Put empty magazines into remaining stations.

4. Power on the RapidStak and instruments.

5. Initialize the instruments according to the manufacturer's documentation. Run self tests if available.

6. Use Windows Explorer to navigate the RapidStak CD to the Teach Software folder and double click the `instrumentTeach.exe`

filename to start the Teach Tool.



7. In the connection area, select the computer COM port number (from step 1) and click **Connect** to enable communications between the computer and the RapidStak.

8. Choose **Home the RapidStak** to move the gripper to the RapidStak's *Home* location.

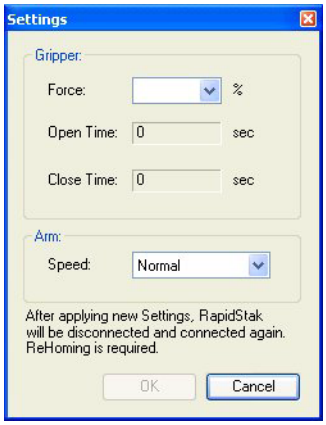
   Teach Tool now shows the current taught locations, the area of possible locations, and enables the Location controls. The box labelled Select Position to Teach lists the locations that you can teach.

9. If the RapidStak **Firmware release number** is 1.8 or earlier, update the firmware as described in "To change firmware" on page 5-6.

10. Choose **Get a Plate**, then **Store Plate** to prove the RapidStak is ready for teaching.

To reduce arm speed

1. Choose Tools > Gripper/Arm Settings.



2. Select Slow arm speed.

3. Choose **OK**.

4. Choose **Home the RapidStak**.

Teaching Instrument Locations

Teach locations for each instrument by following these steps:

1. Home the RapidStak.
2. Teach the instrument nest location.
3. Teach the safe location.
4. Test all locations.

CAUTION If a collision occurs at any time during teaching, you must immediately home the RapidStak. ▲

To home the RapidStak

1. Remove any plates that have fallen in the RapidStak.
2. Choose Home the RapidStak.

To teach an instrument location

1. Home the RapidStak.
2. Choose **Get a Plate**.
3. Choose a location (*Instrument1* or *Instrument2*, as appropriate) from the **Select Position to Teach** list.
4. Choose **Enable Plate Motion**.
5. Move the cursor into the area of possible locations where you estimate the instrument nest is positioned and click to set the target location.
6. Choose **Move** to move the plate to the target location.

7. In the Plate Motion area, use the **Up**, **Down**, **Left**, and **Right** buttons to move the plate carefully into the instrument nest. Increase or decrease the movement units as needed.

8. Choose **Teach** to save this location in RapidStak storage.

9. If you want to save all current locations in a file, choose **File > Save Locations**.

10. Choose **Store a Plate**.

To teach a Safe location

1. Home the RapidStak.

2. Choose **Get a Plate**.

3. Select a location (*Instrument1* or *Instrument2*, as appropriate) from the **Select Position to Teach** list.

4. Choose **Move To**.

5. Choose **Enable Plate Motion**.

6. Choose **Calculate Safe** to calculate and show a target location.

7. In the Confirm Motion area, click **Move**.

8. Choose **Teach** to save this location in RapidStak storage.

9. Optionally, choose **File > Save Locations** to save all current locations in a file.

10. Choose **Store Plate**.

To test instrument locations

1. Home the RapidStak.

2. Choose **Get a Plate**.

3. In the Select Position to Teach area:

   a. Select the instrument's safe location (*Safe1* or *Safe2*) and choose **Move to**.

   b. Select the instrument's nest location (*Instrument1* or *Instrument2*) and choose **Move to**.

   If there is a collision, or the arm bends when it puts the plate into the instrument nest, reteach the instrument's nest location.

4. Choose **Open Gripper**. If the plate moves, reteach the instrument's nest location.

5. Choose **Close Gripper**.

6. Move the plate to the instrument's safe location. If the gripper does not move the plate, or the plate is not horizontal, reteach the instrument's nest location.

7. Choose **Store Plate**. If there is a collision, or the plate does not stack correctly, or the magazine is moved during stacking, reteach both instrument locations.

Glossary

A1 well The microplate well in the top left corner of the microplate. It is defined by the grid printed on the microplate.

A1 orientation marker Small screw on the base of a microplate magazine. Load microplates into a magazine with their A1 well on the same side as the orientation marker. Load magazines with the A1 well orientation marker facing the rear of the RapidStak.

abort Terminate a run. Pressing the STOP button twice halts all RapidStak motors immediately and terminates the run.

arm A mechanical device that moves the gripper between the instrument nest and the RapidStak.

collision A collision occurs when the RapidStak arm, gripper, or the plate in the gripper, hits an object such as a nest or another plate. This can happen if a nest location is not taught correctly, if an instrument is moved from its setup position, or if an instrument does not return its nest to the taught location.

destack When a microplate milker removes a microplate from a magazine.

dispenser Laboratory instrument that delivers liquid into a microplate. RapidStak supports the Multidrop Micro and Multidrop 384 dispensers.

gripper Device mounted on the arm that holds microplates during the transfer between the instrument nest and the RapidStak.

in-transit microplates Any microplates not in the instrument or inside a microplate magazine when a run aborts.

instrument The device loaded by the RapidStak. The RapidStak supports these instruments: the Multidrop Micro and Multidrop 384 dispensers, and the Wellwash AC washer.

instrument nest The position in the instrument where the RapidStak delivers and retrieves the microplate.

instrument plate An aluminum plate used to mount the instrument and align the instrument with the RapidStak.

jam When a microplate becomes caught in the microplate milker or microplate magazine and causes a malfunction.

lid A cover for a microplate.

magazine *See microplate magazine.*

magazine station Supports a microplate magazine. RapidStak has two magazine stations, and RapidStak 2x has four magazine stations.

microplate A rectangular container that has sample wells arranged in a grid. RapidStak accepts unlidded 96- well and 384-well microplates that conform to SBS standards.

microplate magazine A container that holds microplates stacked on top of each other. RapidStak microplate magazines hold up to 30 or 50 microplates.

microplate milker A mechanical device that moves up through the magazine station and into the microplate magazine to remove or deliver a microplate.

pause Temporarily interrupt a run. Pressing the RUN/PAUSE button once causes the RapidStak to complete processing in-transit microplates, then halt.

ready Reset the RapidStak motors. Pressing the READY button resets the RapidStak motors.

reset Return the RapidStak motors to a known location. Pressing the READY button resets the motors. At the beginning of a run, the RapidStak automatically resets the motors if necessary.

restack Return microplates to their original position in their original microplate magazine. Restacking occurs at the end of the run. Pressing the RESTACK button enables or disables restacking.

run Automated processing of a series of microplates through an instrument. It includes destacking, delivering the microplate to the instrument nest, controlling the instrument, and retrieving and stacking the microplate.

SBS The Society for Biomolecular Screening. The society issues standards for laboratory devices.

stack *See microplate magazine*.

stacker An automated device that loads microplates into and unloads microplates from an instrument. Microplates are stacked on top of each other in microplate magazines.

stack When a microplate milker inserts a microplate into a magazine.

stop Temporarily interrupt a run. Pressing the STOP button once causes the RapidStak to stop all RapidStak motors immediately.

sensor Mechanical device that detects the presence of a microplate. RapidStak has a sensor beside magazine station 1, and a sensor on each microplate milker.

washer A laboratory instrument that flushes the wells of a microplate.

well A depression in a microplate that contains the sample or liquids of interest. RapidStak accepts microplates with 96 wells and 384 wells that conform to SBS standards.

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