TA Instruments 109 Lukens Drive New Castle, DE 19720

Thermal Analysis & Rheology

A Subsidiary of Waters Corporation

DSC Autosampler CE

Operator's Manual

PN 825616.001 Rev. B (Text and Binder)
PN 825616.002 Rev. B (Text Only)
Issued November 1999

109 Lukens Drive
New Castle, DE 19720

Notice

The material contained in this manual is believed adequate for the intended use of this instrument. If the instrument or procedures are used for purposes other than those specified herein, confirmation of their suitability must be obtained from TA Instruments. Otherwise, TA Instruments does not guarantee results and assumes no obligation or liability. This publication is not a license to operate under, or a recommendation to infringe upon, any process patents.

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Table of Contents

Table of Contents

(continued)

Table of Contents
(continued)

Table of Contents
(continued)

Table of Contents
(continued)

Table of Contents
(continued)

Notes, Cautions, and Warnings

This manual uses notes, cautions, and warnings to emphasize important and critical instructions.

NOTE: Highlights important information about equipment or procedures.

♦ ***CAUTION:*** **Emphasizes a procedure that may damage equipment or cause loss of data if not followed correctly.**

WARNING **Indicates a procedure that may be hazardous to the operator or the environment if not followed correctly.**

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To TA Instruments

For Technical Assistance ..... (302) 427-4070

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For Service Inquiries ..... (302) 427-4050

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Safety

This equipment has been designed to comply with the following standards for safety:

- IEC 1010-1/1990 + A1/1992 + A2/1995
- IEC 1010-2-010/1992 + A1/1996
- EN 61010-1/1993
- EN 61010-2-010/1994
- UL 3101-1, First Edition.

CE Compliance

In order to comply with the Electromagnetic Compatibility standards of European Council Directive 89/335/EEC (EMC Directive) and Directive 73/23/EEC on safety as amended by 93/68/EEC, the following specifications apply to the DSC Autosampler CE:

- *Safety:*
  EN 61010-1/1993
  EN 61010-2-010/1994

- *Emissions:*
  EN 55011: 1991, CISPR 11:1990 Group 1 Class B (30–1000 MHz) Radiated
  EN 55011: 1991, CISPR 11:1990 Group 1 Class B (0.15–30 MHz) Conducted

- *Immunity:*
  EN 50082-1: 1992, Electromagnetic Compatibility—Generic immunity standard Part 1. Residential, commercial, and light industry.

  — IEC 801-2: 1991, 8 kV air discharge.
  — IEC 801-3: 1984, 27–500 MHz, 3 V/m. No response above 30 nV ΔT (6 μW) and 0.01°C.
  — IEC 801-4: 1988, Fast transients common mode 1 kV AC power.

Autosampler CE Safety Labels

NEVER touch the surface of the metal exterior can covering the DSC cell when the Autosampler CE is operating. It can become very hot.

NEVER open the Autosampler CE rear electronics cabinet. Its contents should be serviced by authorized service personnel only. No user-serviceable parts are contained within the electronics enclosure, and hazardous voltages are present within.

NEVER put your fingers in the Autosampler CE's path when the turret assembly is moving. The gripper fingers are made of fine wire and could scratch or pierce your skin.

Operation Safety

- ALWAYS handle the DSC cell lids and sample pans with tweezers; they can become very hot.
- ALWAYS keep your compressed air hoses securely fastened to the lab bench (*e.g.*, use clamps or tape). Sudden increases in pressure can cause them to fly off the counter.

- NEVER leave flammable items (*e.g*., liquids, paper) around the Autosampler CE work area, especially during unattended runs. If a hot lid or pan were dropped accidentally, a fire hazard could be created.

- Never open the DSC cell when it is at a temperature of 200°C or higher; doing so can cause the cell to oxidize.

- NEVER store hot lids (>100°C) on the Autosampler CE console cover.

- NEVER try to move the turret assembly by pushing it with your hand. Doing so could cause mechanical damage and calibration errors.

- NEVER slide the Autosampler CE console to the right while the instrument is in use.

- Review the safety notes in your instrument *Operator's Manual*.

- Review the safety notes in the *LNCA Operator's Manual* or RCS addendum, if that option is installed.

Lifting the Instrument

The TGA 2950 CE is a fairly heavy instrument. In order to avoid injury, particularly to the back, please follow this advice:

! WARNING

Use two people to lift and/or carry the instrument. The instrument is too heavy for one person to handle safely.

Using This Manual

Chapter 1	Introduces you to the purpose and features of the DSC Autosampler CE, lists system requirements, and explains the terminology used in this manual.
Chapter 2	Explains how to prepare the DSC Autosampler CE system for operation.
Chapter 3	Describes how to use the Autosampler CE's manual keyboard to move the turret assembly and load and unload the cell.
Chapter 4	Provides the calibration procedures necessary for all new DSC Autosampler CEs, with guidelines for periodic calibration checks.
Chapter 5	Explains how to install the crimping die, provides guidelines for setting up the Autosampler CE tray, and describes how to prepare crimped and hermetic pans for Autosampler CE operation.

Using This Manual

(continued)

Chapter 6	Describes the diagnostic tests you can run from the DSC Autosampler CE keyboard and lists controller and Autosampler CE error messages.
Appendix	Lists the DSC Autosampler CE part numbers and TA Instruments offices and phone numbers for ordering and service.
Index	Lists the page numbers of important topics for your reference.

CHAPTER 1: Introducing the DSC Autosampler CE

Overview

Your TA Instruments DSC Autosampler CE is a four-axis robotic device that automatically loads sample and reference pans to and from the Differential Scanning Calorimeter (DSC) thermal analysis instrument. The Autosampler CE will detect the presence of a single or dual sample cell and adjust its actions and displays accordingly. Once the Autosampler CE loads the pans and covers the DSC cell, the controller takes over and runs a preprogrammed thermal analysis experiment on your samples. The Autosampler CE then uncovers the cell and unloads the pans. You can set up a series of these experiments and leave them to be executed unattended.

General Features

The following features make the DSC Autosampler CE a unique and flexible tool:

- The Autosampler CE makes decisions on the basis of current system status, operator-directed parameters, and computer-directed instructions.

- The mechanical fingers that grip the sample pans and cell lids enable the Autosampler CE to handle objects weighing from milligrams to tens of grams with more reliability than vacuum-grip systems. Open pans can be handled as safely as closed pans with the Autosampler CE's tactile-feedback gripper fingers. The tactile-feedback programming also detects improperly gripped or dropped objects and prevents the grippers from puncturing the floor of the DSC cell furnace.

- The Autosampler CE can be operated automatically through the TA controller or manually through its own keypad. Under manual operation, you can directly control turret movement to calibrate and test the Autosampler CE, whereas automatic operation (using *Thermal Solutions/ Advantage*) offers the benefits of preprogrammed runs that can be left to be executed overnight.

- If the multi-instrument option is installed on your controller, you are free to run other instruments (*e.g.*, TGA, DMA, TMA) while the Autosampler CE takes care of DSC

operations for you. The Autosampler CE has no effect on any other instrument connected to the controller. You can also connect two or more Autosampler CEs to the controller to work with two or more DSCs.

- The Autosampler CE can change both reference and sample pans.

- Preprogrammed series of runs, called AS run sequences, can be created easily through the *Thermal Solutions/Advantage* Instrument Control software. Once you have created an AS run sequence, you can edit it and save it on disk. You can even change parts of an AS run sequence as it is being run.

- Up to 62 DSC runs can be preprogrammed on the controller.

- The Autosampler CE's accuracy of pan placement ($\pm$ 0.008 inches) is more reliable and repeatable than human operation.

- The sample/reference pan storage tray has room for 62 pans and can be removed from the Autosampler CE for easy loading. A plastic lid is provided for safe carrying. The order of samples used for each experiment is completely up to you and need not follow the order of pans in the Autosampler CE tray.

- The Autosampler CE operates with crimped, hermetic, and open pans to support a wide variety of thermal analysis experiments.

- The Autosampler CE can be used with the full range of thermal analysis temperature profiles currently used in manual experiments (depending upon the cooling accessory installed).

- The AS run sequence ensures that the DSC cell is within a safe load temperature range (10 to 100 °C) at the beginning of each run by using compressed ambient air to rapidly cool or warm the DSC cell as needed. You can further narrow this temperature range if you wish when you create your AS run sequence.

- The Autosampler CE log keeps a record of all controller and Autosampler CE activities so that you can review operations even after they are performed.

- The Autosampler CE runs a series of diagnostics tests at power-up and continuously during operation to ensure that all mechanical and electrical components are operating properly.

Relationship to the System

The DSC Autosampler CE is part of a system consisting of the TA Instruments controller and a 2920 DSC instrument (see Figure 1.1).

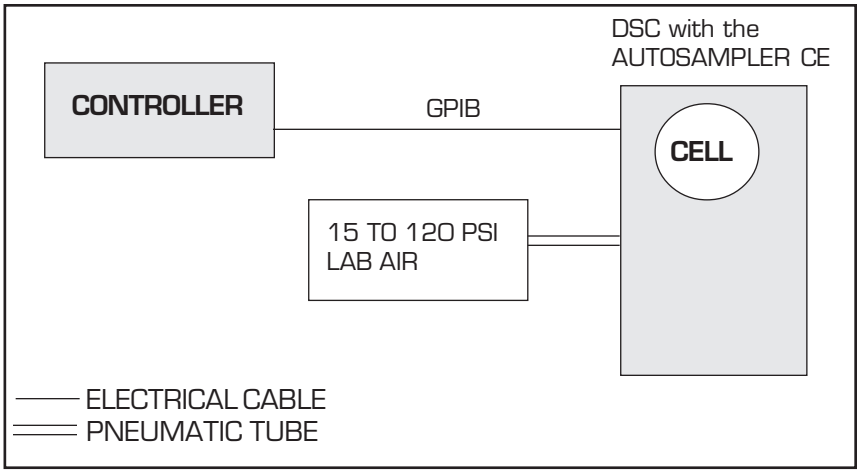


Figure 1.1
Schematic Diagram of
the DSC Autosampler CE System

The TA Instruments LNCA (Liquid Nitrogen Cooling Accessory) and RCS (Refrigerated Cooling System) can be used for cooling experiments with the Autosampler CE (see Figures 1.2 and 1.3 on the next page).

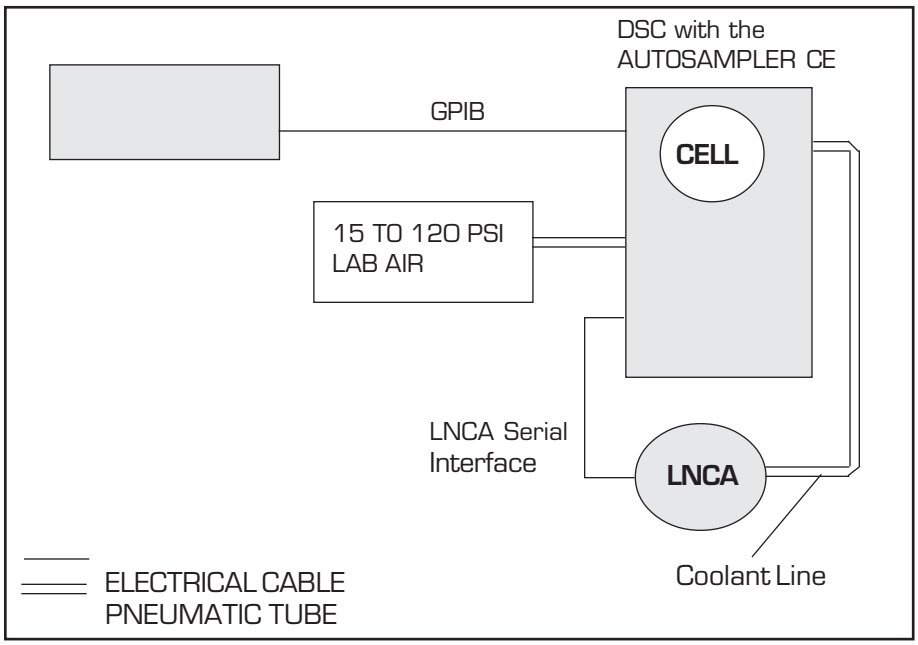


Figure 1.2
Autosampler CE System with LNCA

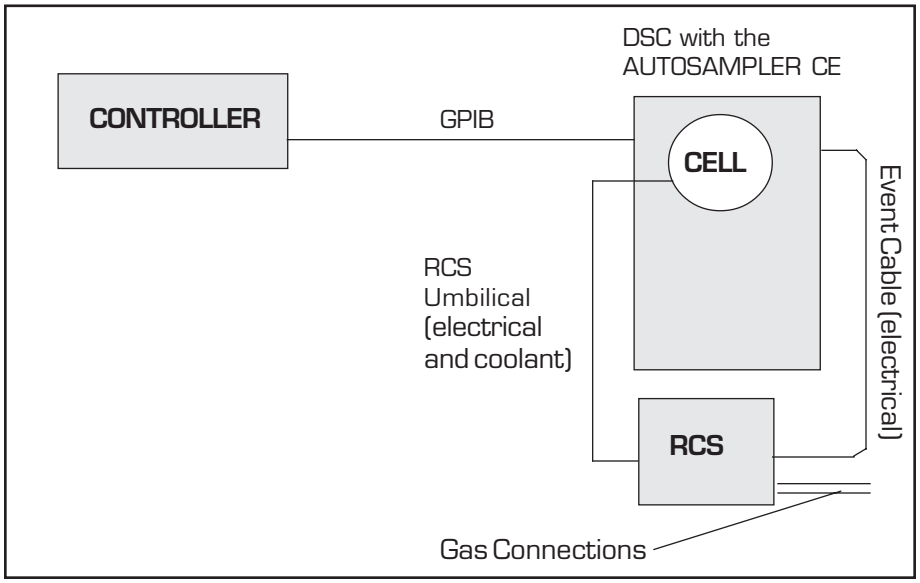


Figure 1.3
Autosampler CE System with RCS

Description

The DSC Autosampler CE consists of a turret assembly, a sample tray, an operator's keypad, and a display screen in an assembly that mounts on the instrument (see Figures 1.4 and 1.5).

NOTE: The functions of the DSC instrument keypad and display will not change when the Autosampler CE is mounted. See the appropriate *DSC Operator's Manual* for information.

Figure 1.4
The DSC Autosampler CE with LNCA Heat Exchanger

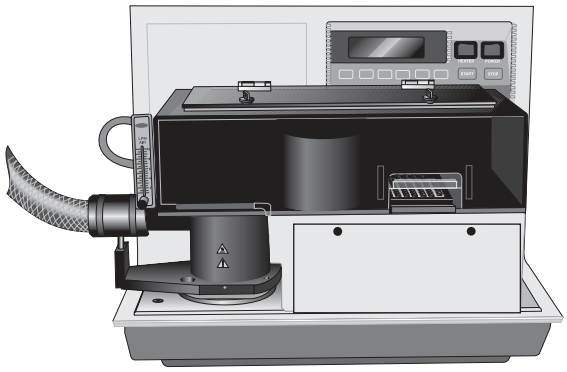


Figure 1.5
DSC Autosampler CE with an RCS Environmental Chamber

The Turret Assembly

Three stepper motors move the turret assembly through its three major axes of motion (see Figure 1.6). Rotary stepper motors rotate the turret assembly in the clockwise or counter-clockwise direction (along the θ-axis) and move the turret arm in and out (along the r-axis). A linear stepper motor moves the turret up or down (along the z-axis). A fourth, linear motor is used to activate the gripper fingers.

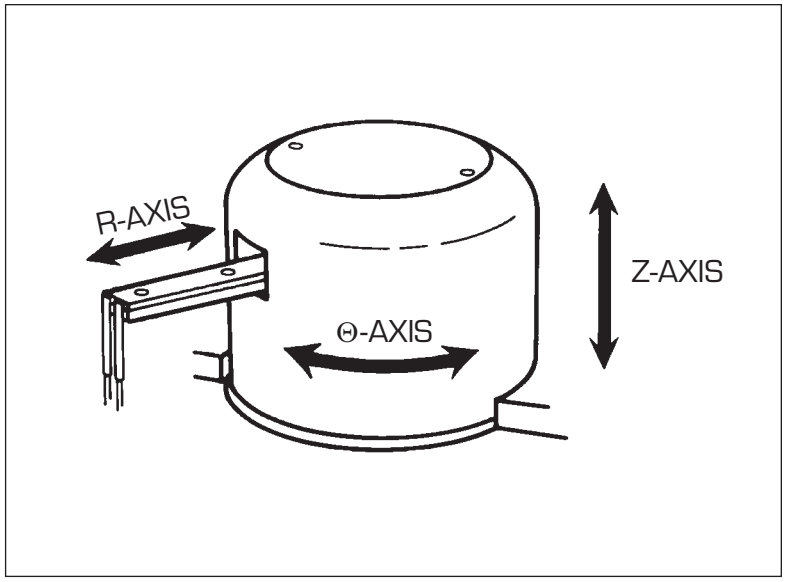


Figure 1.6
The DSC Autosampler CE's
Three Major Axes of Motion

The Gripper Fingers

The Autosampler CE's gripper fingers (see Figure 1.7) open and close to firmly grasp each sample pan while not disturbing the material in the pan. They are made of conductive stainless steel and are controlled by tactile-feedback sensors that detect improperly gripped or dropped objects.

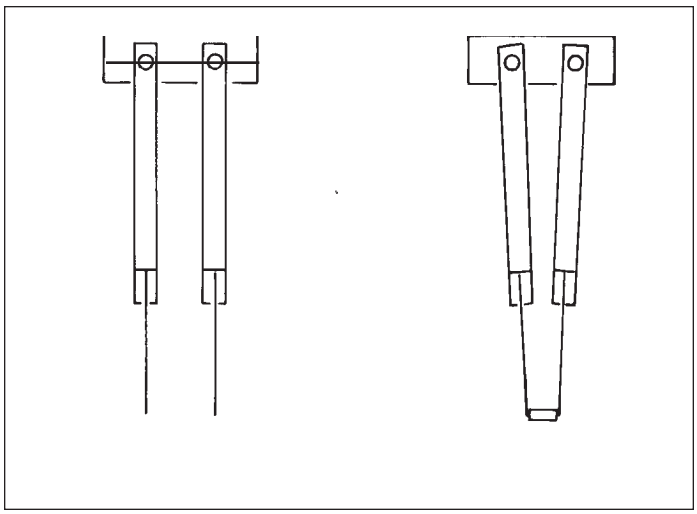


Figure 1.7
The DSC Autosampler CE
Gripper Fingers

The Sample Tray

The sample tray is constructed of anodized aluminum and has a clear acrylic cover (see Figure 1.8). It holds up to 62 pans. Chapter 5 describes how to set up the sample tray.

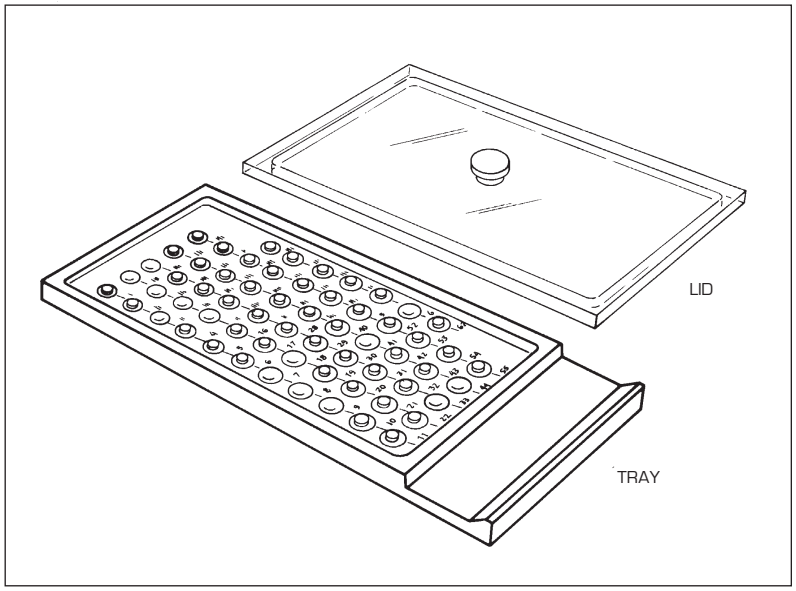


Figure 1.8
The DSC Autosampler CE
Sample Tray

The Keypad

To access the DSC Autosampler CE keypad for manual operations, open the keypad cover by loosening the captive thumbscrews in the cover (see Figure 1.9) and tilting the cover down. When you are ready to start a method, close the keypad cover and finger-tighten the thumb-screws, by pressing them in while turning, to engage the threading in the sockets behind the cover.

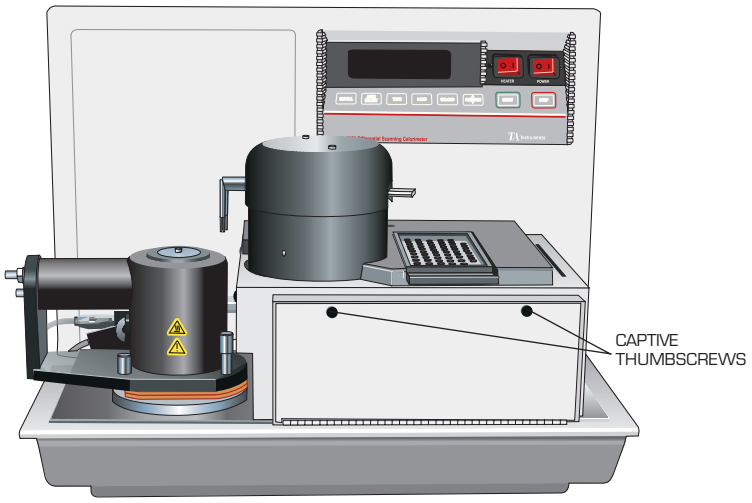


Figure 1.9
DSC Autosampler CE
Keypad Cover

The DSC Autosampler CE keypad operates independently of the DSC keypad (see your *DSC Operator's Manual* for details on its keypad). The Autosampler CE keypad consists of four types of keys (see Figure 1.10):

- *Autosampler CE control keys*:

ENTER	MANUAL/AUTOMATIC
ESCAPE/CLEAR	RESET SAMPLER
HALT	RESUME

- *Command keys*, which tell the Autosampler CE to execute a series of movements, run diagnostic tests, and so on:

AIR	LOAD
CALIBRATE	SPEED
LIDS	TEST

- *Motion keys*, which move the turret assembly in the direction indicated on the key:

EXTEND	RETRACT
GRIP	RELEASE
RAISE	LOWER
ROTATE CW	ROTATE CCW

- *Numeric entry keys.*

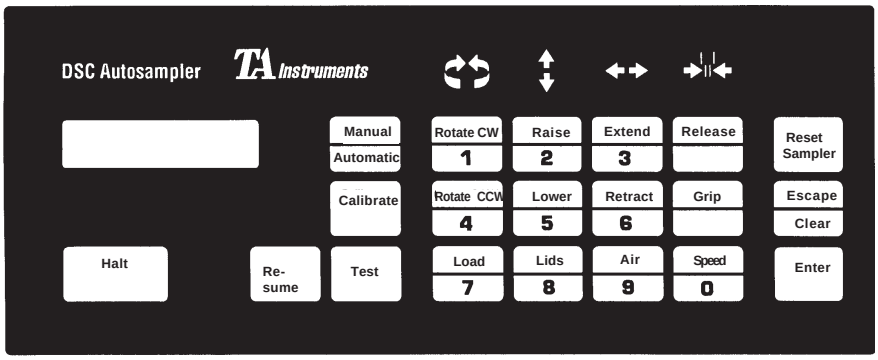


Figure 1.10
The DSC
Autosampler CE Keypad

Some of the Autosampler CE keys have dual assignments:

- Commands (white keys) or motion directions (blue keys) are shown on the upper half of the dual-assignment keys.

- Numeric entries are shown on the lower half of the keys.

The current assignment of the dual-assignment keys is determined by the stage of operation of the Autosampler CE. The numeric entry function is active only when the Autosampler CE is requesting numeric input; otherwise, the command or direction on the upper half of the key is active.

The DSC Autosampler CE keys are explained in alphabetical order in Table 1.1 (pages 1-16 to 1-19). The motion keys are grouped into one entry entitled “The Motion Keys.”

NOTE: Except for the HALT and RESET SAMPLER keys, the Autosampler CE keypad is operable only when the Autosampler CE is in manual mode (see Chapter 3).

Table 1.1 The Autosampler CE Keys

Key	Description
CALIBRATE	Enables you to calibrate pan, lid, and tray positions on the Autosampler CE (see Chapter 4).
ENTER	Enters numeric responses, selects items from a menu, and stores calibration positions.
ESCAPE/ CLEAR	Terminates any Autosampler keypad entry or command in progress. The current assignment of this key depends on the stage of operation of the Autosampler CE: • When you have selected one of the Autosampler CE command keys (CALIBRATE, LIDS, LOAD, SPEED, or TEST), you can cancel the command and return to the previous command

(table continued)

Table 1.1
(continued)

Key	Description
	by pressing the ESCAPE/CLEAR key. In this case, the ESCAPE function is active. • When numeric input is requested (indicated by blinking cursor), you can clear the current entry by pressing the ESCAPE/CLEAR key. In this case, the CLEAR function is active.
HALT	Provides two major functions (see Chapter 3): • Temporarily stops Autosampler CE motion without canceling any prior commands. • Enables you to switch from automatic to manual mode.
LIDS	Covers or uncovers the DSC cell (see Chapter 3).

(table continued)

Table 1.1
The Autosampler CE Keys
(continued)

Key	Description
LOAD	Loads pans from the Autosampler CE tray to the DSC cell or unloads pans from the cell and returns them to the tray (see Chapter 3).
MANUAL/ AUTOMATIC	Toggles the Autosampler CE back and forth between manual and automatic modes (see Chapter 3).
Motion Keys	Move the turret assembly in the direction indicated on each key (see Chapter 3).
RESET SAMPLER	Clears all commands and returns the Autosampler CE to the home position (see Figure 3.2). Also instructs the Autosampler CE to "forget" the current lid and sample pan locations (see Chapter 3).
RESUME	Resumes the previous command when the Autosampler CE has been halted with the HALT key (see Chapter 3).

(table continued)

Table 1.1
(continued)

Key	Description
SPEED	Enables you to change the speed of manual Autosampler CE movement (see Chapter 3). In automatic mode, the Autosampler CE operates at preselected speeds depending on the function being performed.
TEST	Runs diagnostic tests to check the Autosampler CE's calibration, sensors, keypad, etc (see Chapter 6).

The Display

The Autosampler CE has a 32-character liquid crystal display (see Figure 1.11). The screen displays a blinking cursor whenever user input is requested. The Autosampler CE's display is independent of the DSC instrument display (refer to the *DSC Operator's Manual* for details on the instrument display).

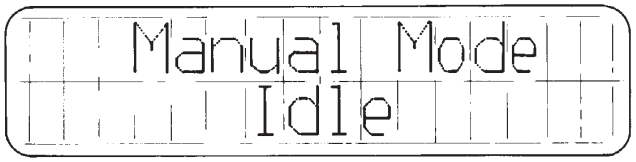


Figure 1.11
Autosampler CE Screen

The GPIB

The GPIB (General Purpose Interface Bus) is a two-way communications network consisting of the controller and the DSC instrument. Through the GPIB, the controller sends commands to control the instrument and Autosampler CE; then the instrument and Autosampler CE reply with data and status messages.

System and Equipment Requirements

The DSC Autosampler CE requires the following equipment:

- A TA Instruments controller.
- A source of compressed, dry air (15 psi minimum, 120 psi maximum) for adjusting the DSC cell temperature between runs.
- A DSC 2920 thermal analysis instrument (with a DSC heat exchanger).
- DSC sample pans (standard-autosampler or hermetic).
- The crimping die (included with the DSC Autosampler CE).

These optional components can be included:

- A nitrogen gas purge.
- An additional gas purge controlled by the TA Instruments Gas Switching Accessory.
- The TA Instruments Liquid Nitrogen Cooling Accessory (LNCA) equipped with an adapter for the DSC for cooling experiments or Refrigerated Cooling System (RCS) equipped with environmental chamber.

NOTE: The Autosampler CE is considered an accessory item for an existing instrument and therefore does not affect the space available for additional instruments on multi-instrument systems.

Terminology

The terms *manual* and *automatic* are used throughout this book to describe the DSC Autosampler CE's two modes of operation. In manual mode, the Autosampler CE does not need to communicate with the controller and is controlled directly through its own keypad. In automatic mode, all Autosampler CE operations are supervised by the controller (see the *Thermal Solutions/Advantage User Reference Guide* for information on the automatic mode). Once the Autosampler CE is in automatic mode, it can be in one of two states:

- *Online* (remote), in which the controller is correctly hooked up to the Autosampler CE and turned on.

- *Offline* (local), in which the controller is not connected to the Autosampler CE or is turned off. When the Autosampler CE is offline, it cannot communicate with the controller.

When the Autosampler CE is in *manual* mode, you can use the Autosampler CE keypad to:

- Calibrate the Autosampler CE

- Load and unload the DSC cell

- Remove and replace the lids on the DSC cell

- Run diagnostic tests.

When the Autosampler CE is in *automatic* mode, you can use the controller keyboard to:

- Input experimental parameters
- Create, edit, and execute Autosampler CE run sequences that automatically load samples, run methods, and unload samples at the end of the experiment
- Maintain a log that records all activities of the Autosampler CE.

Axis Terms

The terms *r-axis*, *θ-axis*, and *z-axis* are used to describe the three axes of motion of the Autosampler CE.

Inward and outward movement of the turret arm occurs along the r-axis:

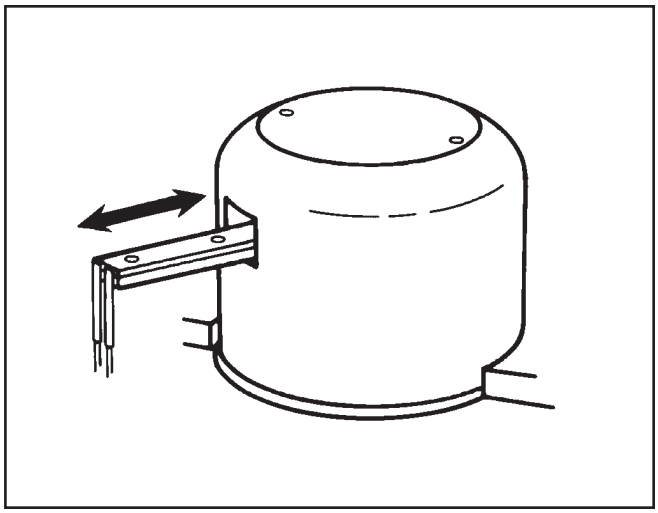


Figure 1.12
The R-Axis

Rotational movement (clockwise and counter-clockwise) occurs along the θ-axis (theta-axis):

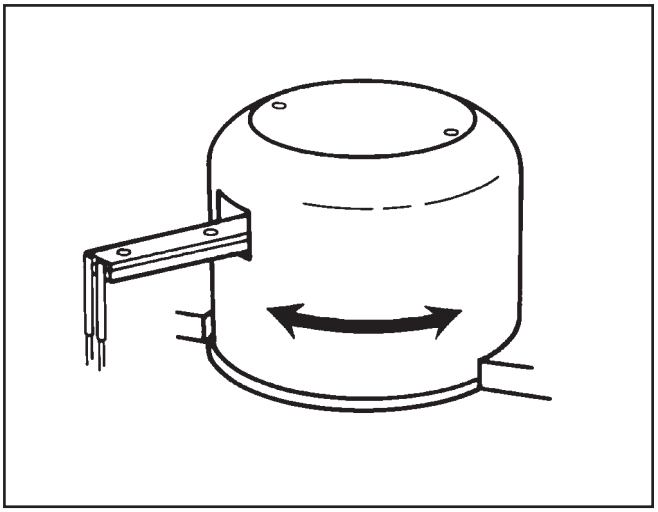


Figure 1.13
The θ-Axis

Upward and downward movement occurs along the z-axis:

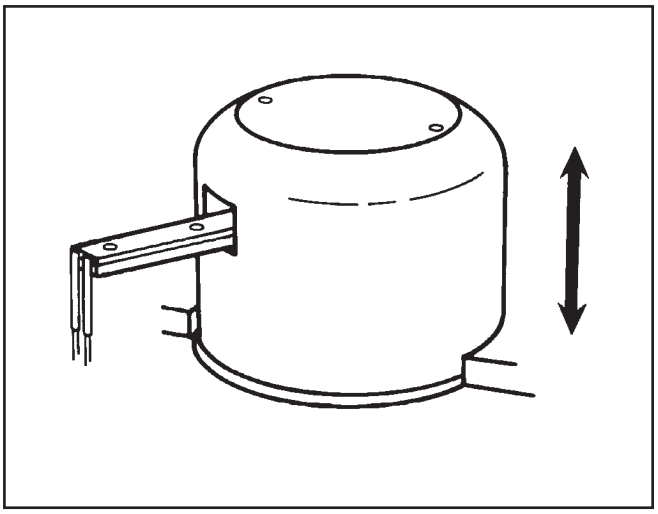


Figure 1.14
The Z-Axis

Testing Terminology

The terms *AS (Autosampler CE) run sequence* and *run* refer to the experiments that you set up to control the Autosampler CE motion and running of thermal analysis *methods*.

A *run* is a single TA experiment that consists of the following events:

- Reference and sample pans are loaded into the DSC cell furnace.
- The DSC furnace is covered with three metal lids.
- A standard thermal analysis method is executed.
- The DSC cell is returned to a near-ambient temperature.
- The DSC furnace is uncovered.
- The reference and sample pans are removed from the DSC furnace.

An *AS run sequence* is a series of runs that are executed consecutively. You create these run sequences using the *Thermal Solutions/Advantage* software (see the *Thermal Solutions/ Advantage User Reference Guide*).

A thermal analysis *method* is a set of segments that you create to control the operation of a thermal analysis instrument (see your *Thermal Solutions/Advantage User Reference Guide* for further details).

CHAPTER 2: Preparing the Autosampler CE

Introduction

When you purchase your Autosampler CE, it will be unpacked and set up by a TA Instruments representative. This section contains certain procedures that need to be performed occasionally as part of the Autosampler CE setup.

Once you have completed setting up your Autosampler CE as directed in this chapter, you will need to perform the calibration procedures, which are done while the accessory is in *manual* mode (see Chapter 3 for details on the manual mode).

Preparing for Operation

Connecting the Heat Exchanger Cable

When you place the LNCA heat exchanger on the DSC instrument with an Autosampler CE, you need to connect the heat exchanger cable to the instrument. (The *LNCA Operator's Manual* contains more details on installing the heat exchanger.) Connect the heat exchanger as follows:

1. Make sure that the DSC 2920 POWER switch is in the off position.

2. Plug the end of the heater exchanger cable into the electrical assembly as shown in Figure 2.1.

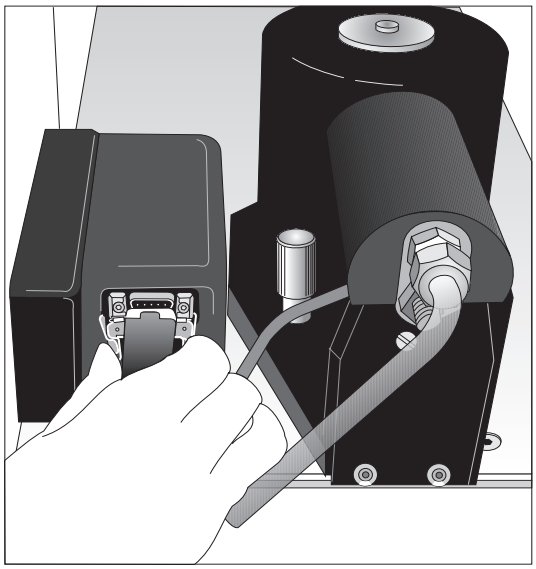


Figure 2.1
Plugging in the Heat Exchanger Cable

Installing the Autosampler CE Lids

When your Autosampler CE is unpacked, you will find three different lids that are to be used when a sample is placed into the cell. The lids are different sizes and made of different materials. In order to ensure that the Autosampler CE operates correctly while picking up and placing each lid in the appropriate place, you must make sure that the lids are installed in the proper locations on the console. The lids are identified as follows:

Lid Number	Size	Material
#1	Small	Silver (with AS stamped on it)
#2	Medium	Stainless steel
#3	Large	Aluminum

Refer to the figure below (Figure 2.2) and place the lids in their respective positions.

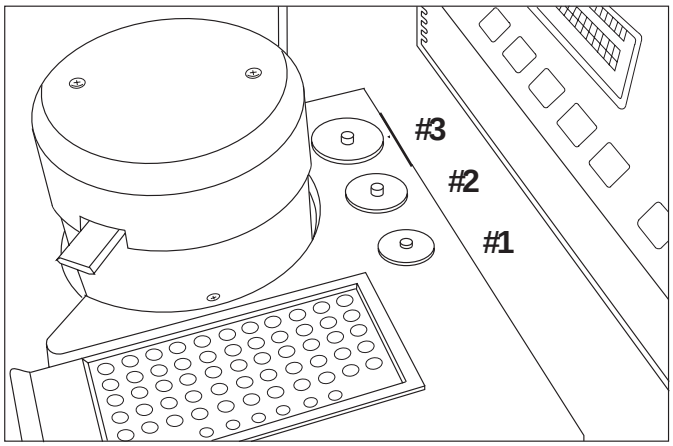


Figure 2.2 Autosampler CE Lid Positions

Installing the Dust Cover

The plastic dust cover that comes with the Autosampler CE should be in place whenever you leave the Autosampler CE to run a series of samples. This will prevent dust and dirt from interfering with your experiments.

To put the dust cover on, simply insert the lip into the slot on the right side of the console and lower the dust cover down.

NOTE: The dust cover is not used when you are using the RCS with the environmental chamber on the Autosampler CE.

After Preparation

Now that your Autosampler CE has been completely installed and set up, you will need to calibrate it so that it will properly pick up and deposit pans. Calibration is done using the manual mode functions, which are described in the next chapter. If you need information on using the manual mode, turn to Chapter 3. If you are ready to calibrate the Autosampler CE, turn to Chapter 4.

CHAPTER 3: Using the Autosampler CE in Manual Mode

Overview

Certain procedures must be done with the Autosampler CE in manual mode. (See page 1–22 for an explanation of the manual and automatic modes.) When the DSC Autosampler CE is in manual mode, it can be controlled by the Autosampler CE keypad. This chapter describes the following manual mode procedures:

- Switching to manual mode
- Moving the turret assembly manually
- Covering and uncovering the DSC cell
- Loading and unloading pans
- Stopping Autosampler CE movement.

Other manual Autosampler CE operations are described in different chapters of this manual. These include:

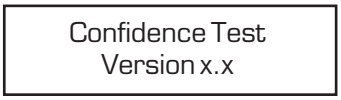
- Calibrating the Autosampler CE (Chapter 4)
- Running diagnostic tests (Chapter 6).

NOTE: For complete information on using the automatic mode, refer to the *Thermal Solutions/ Advantage User Reference Guide*.

Starting the Autosampler CE

Follow these steps to start up the DSC instrument with the Autosampler CE:

Turn on the POWER switch on the DSC Autosampler CE. The Autosampler CE displays:



then:

See page 3–6 for a discussion of the confidence tests. When the confidence tests are complete, the display reads:

The Autosampler CE will go into automatic mode upon initial startup. To change to the manual mode, follow the procedure on the next page.

Switching from Automatic to Manual Mode

1. Access the Autosampler CE keypad by loosening the captive thumbscrews on the keypad cover and tilting the cover down.

2. Press the HALT key on the Autosampler CE keypad. The display reads:

Automatic Mode Halted

3. Press the MANUAL/AUTOMATIC key. The display reads:

Manual Mode Idle

   The Autosampler CE is now in manual mode and is ready for a command from the Autosampler CE keypad. The display will read "Idle" until you press a key.

NOTE: When you have finished using the Autosampler CE keypad, remember to close the keypad cover and finger-tighten the thumbscrews before starting a method.

Understanding the Confidence Tests

At power-up, the Autosampler CE runs a set of 13 confidence tests to check its internal electronics and memory, display, keypad, motors, and sensors. If a system that is critical to continued operation fails, the confidence tests stop and the Autosampler CE shuts down with an error message on the display, unless the display itself fails the test. If the display fails, it may remain blank or display random letters and symbols. If the Autosampler CE test error is noncritical to the remaining tests, the confidence tests finish, but the last error message remains on the display and the Autosampler CE does not go into an operable mode.

If a confidence test error message is displayed, see the "Error Messages" section in Chapter 6 to determine the problem. If the display is not functional, you can use the confidence test Ready light inside the instrument (viewed through the vents on the back of the instrument) to determine which test(s) detected an error (see "Using the Confidence Test Ready Light" on page 6–3).

Moving the Turret Assembly

The motion keys (see Figure 3.1) are used to move the turret assembly in the direction indicated on the key. You can change the speed of the turret motion with the SPEED key. The motion and SPEED keys are explained on the following pages.

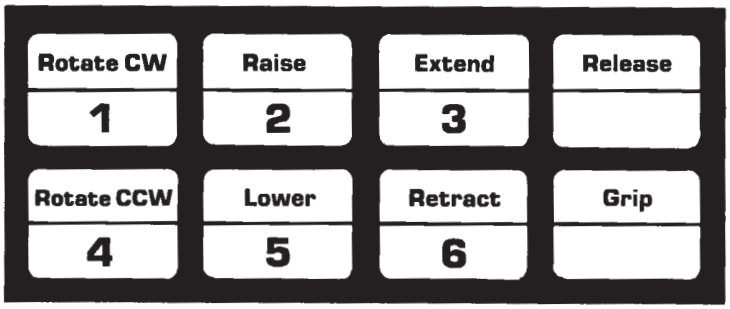
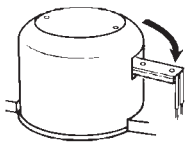
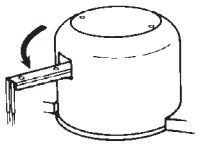
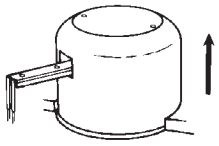
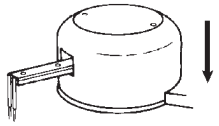
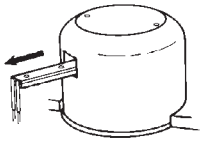
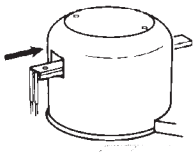
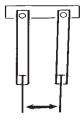
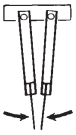


Figure 3.1
The DSC Autosampler CE Motion Keys

The Motion Keys

ROTATE CW	(Rotate Clockwise) Moves the turret clockwise until the clockwise limit is reached.	
ROTATE CCW	(Rotate Counterclockwise) Moves the turret counterclockwise until the counterclockwise limit is reached.	
RAISE	Raises the turret until the upper limit is reached.	
LOWER	Lowers the turret until the lower limit is reached.	
EXTEND	Extends the turret arm outward until the outer limit is reached.	
RETRACT	Retracts the turret arm inward until the inner limit is reached.	
RELEASE	Opens the grippers to release an object.	
GRIP	Closes the grippers to grasp an object.	

Changing the Motor Speed

The SPEED key enables you to change the speed of manual Autosampler CE movement. The speed you select applies only to the motion keys; when the Autosampler CE is executing commands from the controller or one of the Autosampler CE command keys (LOAD, LIDS), the speed is preset and is not affected by your selection.

1. Access the Autosampler CE keypad by loosening the captive thumbscrews on the keypad cover and tilting the cover down.

2. Press the SPEED key. The Autosampler CE displays the current speed. For example:

Motor Speed 7 Selected

3. Select a new speed by pressing a numeric key from 0 to 9, then pressing ENTER. The lowest speed is 0, the highest is 9, and the default is 7 (automatically selected when you turn on the Autosampler CE).

NOTE: When you have finished using the Autosampler CE keypad, remember to close the keypad cover and finger-tighten the thumbscrews before starting a method.

Covering and Uncovering the DSC Cell

The LIDS key covers or uncovers the DSC cell when the Autosampler CE is in manual mode.

♦ ***CAUTION:*** **Do not remove lids exceeding 100°C from the DSC cell; they may damage the console.**

1. Access the Autosampler CE keypad by loosening the captive thumbscrews on the keypad cover and tilting the cover down.

2. Press the LIDS key. You are prompted to select option 1 (Uncover) or 2 (Cover):

```
Uncover (1) or
Cover (2) ?  1
```

3. Select an option by pressing a numeric key, then pressing ENTER.

If you select option 1, the Autosampler CE uncovers the cell and returns all cell lids to their storage positions. If you select option 2, the Autosampler CE removes all lids from their storage positions and places them on the cell.

NOTE: If you select option 1 (Uncover) when all lids are in their storage positions or option 2 (Cover) when the lids are already on the cell, the Autosampler CE ignores the command and goes back to idle mode.

NOTE: When you have finished using the Autosampler CE keypad, remember to close the keypad cover and finger-tighten the thumbscrews before starting a method.

Loading and Unloading Sample Pans

The LOAD key loads and unloads sample pans to and from the DSC cell when the Autosampler CE is in manual mode. If the lids are on the DSC cell, the Autosampler CE first removes them, then performs the load or unload function.

♦ ***CAUTION:*** **Do not unload the DSC cell when its temperature is above 100°C.**

Loading Pans

To load sample pans to the DSC cell in manual mode, follow these steps:

1. Access the Autosampler CE keypad by loosening the captive thumbscrews on the keypad cover and tilting the cover down.

2. Press the LOAD key. You are prompted to select option 1 (Load) or 2 (Unload):

```
Load (1) or
Unload (2) ? 1
```

3. Select the Load option by pressing ENTER. You are then prompted to select which cell position to load:

```
Load Ref (1) or
Sample (2) ?  1
```

4. Select a cell position (reference or sample) by pressing a numeric key, then pressing ENTER. You are then prompted to select the tray position to load from:

Sample Pan Number ? 1

5. Type a number between 1 and 62; then press ENTER. The Autosampler CE loads the pan to the cell position you chose in step 3. If there is already a pan in the cell position you selected, the Autosampler CE first returns that pan to its original tray position, then loads the new pan.

NOTE: When you have finished using the Autosampler CE keypad, remember to close the keypad cover and finger-tighten the thumbscrews before starting a method.

Unloading Pans

The LOAD key unloads pans that have been loaded in automatic mode, manual mode, or with tweezers.

NOTE: The Autosampler CE does not keep track of the pans in the sample tray. Be careful not to unload a pan on top of another pan in the tray.

1. Access the Autosampler CE keypad by loosening the captive thumbscrews on the keypad cover and tilting the cover down.

2. Press the LOAD key. You are prompted to select option 1 (Load) or 2 (Unload):

```
Load (1) or
Unload (2) ? 1
```

3. Select the Unload option by pressing the 2 key, then pressing ENTER. You are then prompted to select which cell position to unload:

```
Unload Ref (1) or
Sample (2) ?  1
```

4. Select a cell position (reference or sample) by pressing a numeric key, then pressing ENTER. You are then prompted to select the destination tray position:

```
Sample Pan
Number ?  0
```

5. Select a tray position:

   - Press ENTER to select sample pan 0, and the Autosampler CE will unload the selected pan back to the tray position from which it was originally loaded.

   OR

   - Type a number between 1 and 62 to select a different tray position, then press ENTER.

NOTE: If you load pans into the DSC cell by hand or press RESET SAMPLER after loading them with the LOAD key, you must enter a returning pan number (you cannot use sample pan number 0).

NOTE: Press RESET SAMPLER to clear the Autosampler CE's memory whenever you remove a pan from the DSC cell with tweezers. If you do not, the Autosampler CE assumes that the pan is still in the cell, and if you later start a run on the controller, the Autosampler CE attempts to remove the pan and halts when it cannot find the pan.

NOTE: When you have finished using the Autosampler CE keypad, remember to close the keypad cover and finger-tighten the thumbscrews before starting a method.

Stopping the Autosampler CE

Three keys on the Autosampler CE keypad enable you to suspend and resume Autosampler CE motion: the HALT key, the RESUME key, and the RESET SAMPLER key.

The HALT Key

The HALT key affects only the motion of the Autosampler CE turret assembly; any currently running heating or cooling method on the controller continues. After you press the HALT key, you can resume action with the Autosampler CE RESUME key. The Autosampler CE then completes the task that was interrupted.

When the Autosampler CE is in manual mode, you can use the motion keys to move the turret assembly while it is halted without canceling the previous command. However, if you press any of the following keys while the Autosampler CE is halted, the previous command is forgotten:

- ESCAPE/CLEAR
- MANUAL/AUTOMATIC
- RESET SAMPLER

If you press ESCAPE/CLEAR after halting the Autosampler CE and then enter a new command before pressing the RESUME key, the new command is executed when you press RESUME.

The RESUME Key

The RESUME key continues the last command after the Autosampler CE has been halted with the HALT key. This key does not continue the previous command after you press the RESET SAMPLER key.

The RESET SAMPLER Key

When the RESET SAMPLER key is pressed in manual mode, all commands are cleared, the cell is assumed to be empty and all pans to be in the tray, and the Autosampler CE is returned to the home position (see Figure 3.2).

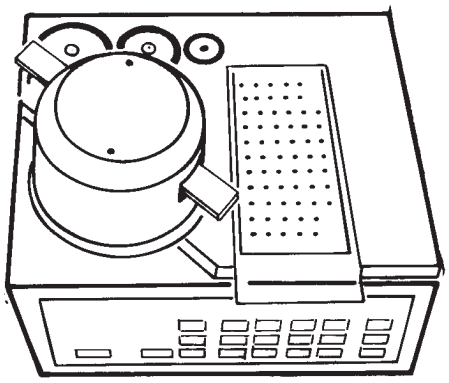


Figure 3.2
The DSC Autosampler CE in Home Position

When you press the RESET SAMPLER key, the Autosampler CE displays:

```
Enter to Reset
Escape to Cancel
```

To execute the Reset Sampler command, press ENTER. To cancel the Reset Sampler command and return to the previous operation, press ESCAPE/CLEAR.

If you press ENTER to continue the reset, the display shows:

```
Manual Mode
Resetting
```

When the Autosampler CE reaches home position, the display displays:

```
Manual Mode
Idle
```

and the Autosampler CE is ready for a command.

NOTE: When the Autosampler CE is in automatic mode, the RESET SAMPLER key stops the AS run sequence and method currently being executed from the controller.

Conditions When Resetting

The Autosampler CE assumes that the DSC cell is empty when you press RESET SAMPLER, so you should check that this is true whenever you press this key. If there are any pans in the cell after you press RESET SAMPLER, you must remove them manually with tweezers or the Autosampler CE motion keys. The Autosampler CE does check that all lids are in their storage positions and displays an error message if they are not.

NOTE: If you press RESET SAMPLER when a pan is still in the DSC cell, then use the LOAD key to load a pan into the same position, the Autosampler CE will not know that the first pan is there and will attempt to load the second pan onto the first. This could cause damage to the pans. Always check that the cell is empty after you press RESET SAMPLER.

CHAPTER 4: Calibrating the Autosampler CE

Overview

NOTE:

The calibration procedures described in this chapter are critical to proper operation of the Autosampler CE.

In order for the Autosampler CE to accurately pick up, load, and unload sample pans, it must be correctly calibrated. There are four different calibration procedures for the Autosampler CE:

- Cell lid positions
- Cell pan positions
- Lid storage positions
- Sample tray positions.

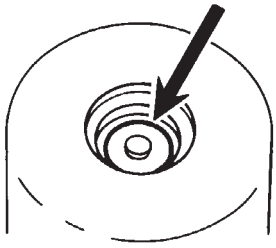
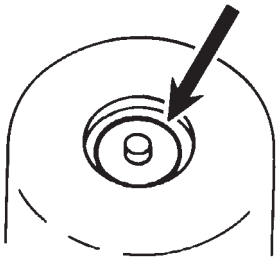
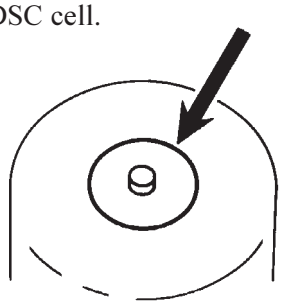
The display that is used to calibrate the positions and a brief description of each one are listed and illustrated in Table 4.1, beginning on the next page.

You will need to calibrate the cell lid and cell pan positions using the procedures described on pages 4-11 to 4-20. The lid storage and sample tray calibrations described on pages 4-21 to 4-27 are performed at the factory; however, these procedures are provided in case calibration of these positions becomes necessary.

After you calibrate the Autosampler CE, check your calibration by following the guidelines in "Checking Your Calibration" (pages 4-29 to 4-36).

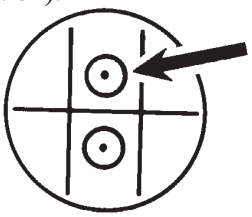
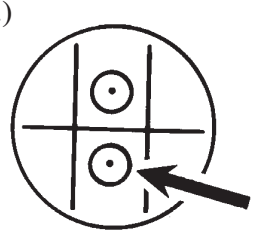
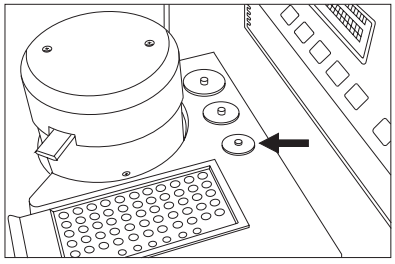
Once the Autosampler CE is correctly calibrated, you may need to recalibrate it only when you replace the DSC cell. Periodic checks are the best way of determining when the Autosampler CE needs recalibration.

Table 4.1
Autosampler CE
Calibration Position

Screen Display	Autosampler CE Position
Calibrate/Verify Lid #1 Cell	The small, silver lid's position on the DSC cell. 
Calibrate/Verify Lid #2 Cell	The medium-sized, stainless-steel lid's position on the DSC cell. 
Calibrate/Verify Lid #3 Cell	The large, aluminum lid's position on the DSC cell. 

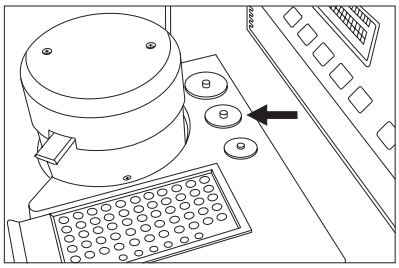
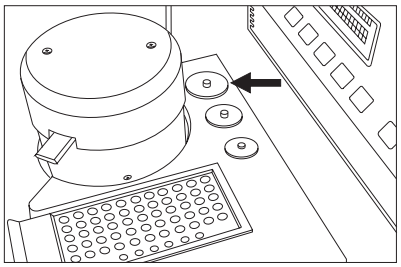
(table continued)

Table 4.1 (continued)

Screen Display	Autosampler CE Position
Calibrate/Verify Cell Ref. Pos.	The dimple in the DSC cell where the reference pan is placed (the rear position). 
Calibrate/Verify Sample Pos. Single Sample Cell Display	The dimple in a DSC cell where the sample pan is placed. (For dual sample cells [not shown], choose side A or B.)
Calibrate/Verify Sample A/B Dual Sample Cell Display	 Single Sample DSC Cell
Calibrate/Verify Lid #1 Storage	The small, silver lid's storage position. 

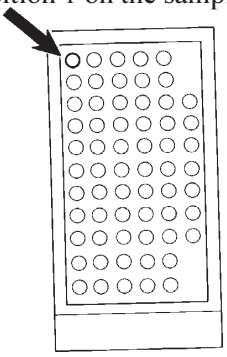
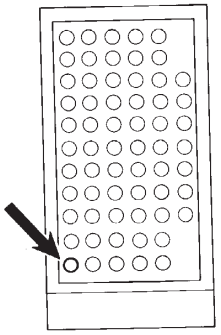
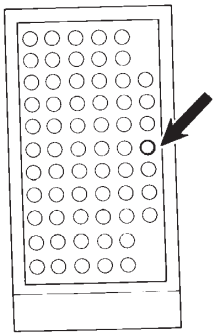
(table continued)

Table 4.1
Autosampler CE
Calibration Position
(continued)

Screen Display	Autosampler CE Position
Calibrate/Verify Lid #2 Storage	The medium-sized, stainless-steel lid's storage position. 
Calibrate/Verify Lid #3 Storage	The large, aluminum lid's storage position. 

(table continued)

Table 4.1 (continued)

Screen Display	Autosampler CE Position
Calibrate/Verify Tray Pos. #1	Position 1 on the sample tray. 
Calibrate/Verify Tray Pos. #11	Position 11 on the sample tray. 
Calibrate/Verify Tray Pos. #59	Position 59 on the sample tray. 

Precalibration Checklist

Use the checklist below to make sure your Autosampler CE system is set up properly and ready to be calibrated.

Ensure that:

- ❑ You have two properly crimped, empty pans to use in the calibration procedure (see Chapter 5 for pan crimping instructions). Hermetic or open pans are not recommended for calibration. When you have finished and checked your calibration, you can cycle hermetic or open pans for further verification.
- ❑ The DSC cell is level and properly installed.
- ❑ Air lines and optional cell purge nitrogen gas lines are connected.
- ❑ The Autosampler CE is on and has passed the confidence tests.
- ❑ The DSC cell has been calibrated for temperature, cell constant, and baseline (see your *Thermal Solutions/Advantage User Reference Guide* for instructions).
- ❑ The DSC cell is clean and free of corrosion or boiled-out material from previous experiments.

Performing the Calibration

Please read the following cautions and notes before calibrating the Autosampler CE. They are numbered for easy reference.

CAUTIONS

♦ ***CAUTION:***

1) Each time you select the Verify function or move the turret with the LIDS or LOAD key, hold your finger over the HALT key so that you can stop the Autosampler CE if it looks as if the grippers are going to run into something. After halting the Autosampler CE, take one of the following actions:

- **If the Autosampler CE was performing a Verify function, press RESET SAMPLER and repeat the Verify operation to recheck the position. If it is incorrect, HALT the Autosampler CE again, press ESCAPE/CLEAR to cancel the Verify function, press RESUME, then recalibrate the position.**
- **If the Autosampler CE was performing a LIDS or LOAD function, press ESCAPE/CLEAR to cancel the LIDS command, then press RESUME to continue with the calibration.**

♦ ***CAUTION:***

2) During calibration, the Autosampler CE does not keep track of lid and pan locations. When you use the Verify function, watch carefully to ensure that the Autosampler CE does not attempt to stack lids or pans on top of one another.

NOTES

NOTE: 1) Calibrate the Autosampler CE in the order shown in this manual.

NOTE: 2) The Autosampler CE must be in manual mode during calibration (see Chapter 3).

NOTE: 3) You should be familiar with how the motion keys work before you calibrate the Autosampler CE. For a review of motion key operation, please see Chapter 3.

NOTE: 4) You can change the speed of the motion keys at any point in the calibration procedures by pressing the SPEED key and entering a new speed (number from 0 to 9). The default speed is 7 at Autosampler CE power-up. Lower speeds are recommended for fine control, but you may want to change to higher speeds when you are moving the turret for longer distances. For more information on the SPEED key, please see Chapter 3.

NOTE: 5) If the grippers, either empty or holding a pan or lid, contact the DSC cell furnace, the Autosampler CE displays a "Contact Error" message and freezes operation of all motion keys except the RAISE key. This is a safety feature that prevents the grippers from being bent or puncturing the floor of the DSC cell furnace. To correct the condition, simply press the RAISE key to clear the grippers from the obstacle; then reposition the grippers with the other motion keys (ROTATE, EXTEND, RETRACT) and try again.

NOTE: 6) If the Autosampler CE screen displays any step-error messages during the calibration procedure, press RESET SAMPLER; then recalibrate the position. Positions calibrated during a step-error condition may not be reliable.

Calibrating the Cell Lid Positions

Because each DSC cell is custom made, the cell lid positions cannot be calibrated at the factory and must be calibrated on newly installed Autosampler CEs.

1. Access the Autosampler CE keypad by loosening the captive thumbscrews on the keypad cover and tilting the cover down.

2. Press RESET SAMPLER, and press ENTER to bring the Autosampler CE to home position.

3. Make sure all lids are in their storage positions (see Table 4.1).

4. Press the LIDS key. The screen displays:

```
Uncover (1) or
Cover (2) ?  1
```

5. Select option 2 (Cover) by pressing the 2 key, then pressing ENTER. The Autosampler CE picks up a lid and begins moving toward the cell.

6. Press the ESCAPE/CLEAR key when the Autosampler CE reaches the DSC cell area.

7. Use the motion keys to position the lid in its correct cell calibration position (see Table 4.1). Press the RELEASE and GRIP keys repeatedly to ensure that the fingers can firmly grasp the lid, and watch carefully to ensure that each finger contacts the lid at the same time (see Figure 4.1).

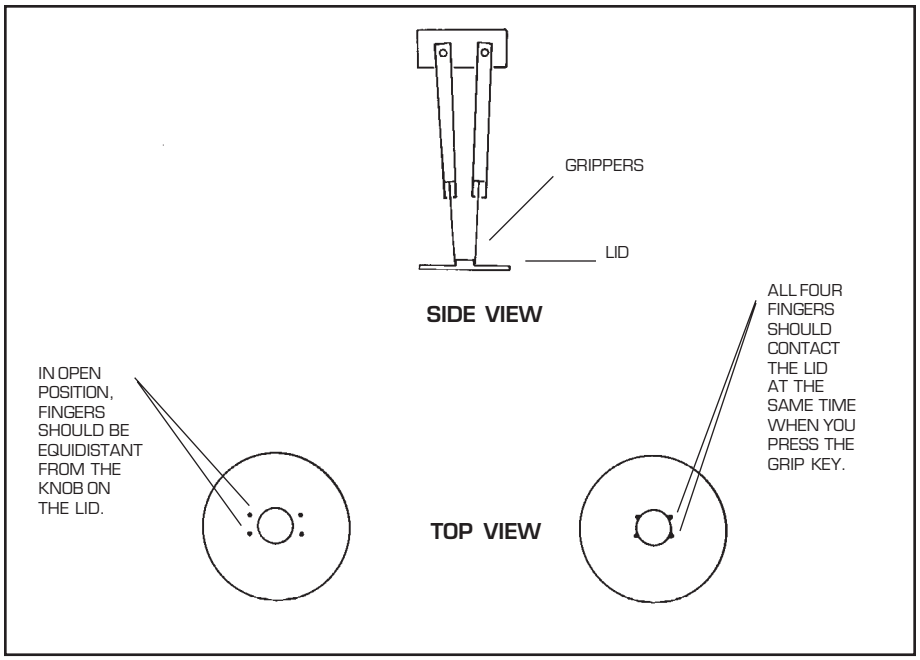


Figure 4.1
Calibrating a
Cell Lid Position

8. When you are satisfied that the lid is properly positioned, press the CALIBRATE key until you see the correct cell lid position on the display:

Calibrate/Verify Lid #1 Cell

9. Press ENTER. The screen displays:

Verify (1) or Store (2) ? 1

10. Select option 2 (Store) to store the calibration position (press the 2 key, then press ENTER). The screen displays:

```
Lid #1 Cell
Calibrated
```

11. Release the lid (press the RELEASE key). Press RESET SAMPLER and ENTER to bring the Autosampler CE to the home position. Disregard the message "Error Lid #1 not stored." Press the CALIBRATE key until you see the correct cell lid position on the display:

```
Calibrate/Verify
Lid #1 Cell
```

12. Press ENTER. The screen displays:

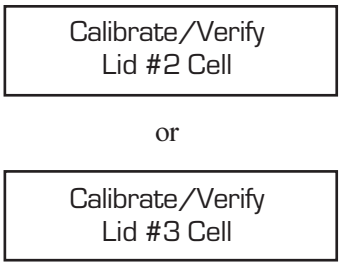
```
Verify (1) or
Store (2) ? 1
```

13. Press ENTER to select default option 1 (Verify).

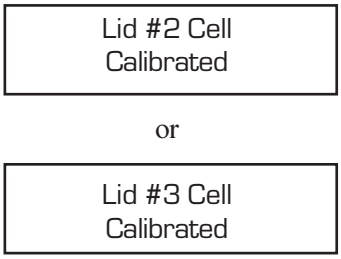
14. When the turret stops moving, close and open the grippers again and check your calibration against the criteria in Figure 4.1. Remember to release the lid. If the position is correctly calibrated, go on to step 15. If it is not, repeat steps 4 through 14 with lid #1.

15. Repeat steps 4 through 14 with lids 2 and 3 (the medium-sized and large lids). The screen displays in steps 8, 10, and 11 are the same except for the lid numbers, as shown on the next page:

Steps 8 and 11:



Step 10:



16. When you have calibrated all three cell lid positions, use the LIDS key to return the lids to their storage positions (select option 1 [Uncover]).

17. Press ESCAPE/CLEAR to exit the calibration procedure.

18. If you are calibrating a newly installed Autosampler CE, go on to "Calibrating the Cell Pan Positions" (pages 4-15 to 4-20). Otherwise, go on to the section entitled "Checking Your Calibration" (page 4-29).

NOTE: When you have finished using the Autosampler CE keypad, remember to close the keypad cover and finger-tighten the thumbscrews before starting a method.

Calibrating the Cell Pan Positions

Because each DSC cell is custom made, the cell pan positions cannot be calibrated at the factory and must be calibrated on newly installed Autosampler CEs.

1. Access the Autosampler CE keypad by loosening the captive thumbscrews on the keypad cover and tilting the cover down.

2. Press RESET SAMPLER and ENTER to bring the Autosampler CE to the home position.

3. Make sure the cell lids are in their storage positions (see Table 4.1), and place empty crimped pans in tray positions 1 and 2.

4. Press the LOAD key. The screen displays:

```
Load (1) or
Unload (2) ? 1
```

5. Select option 1 (Load) by pressing ENTER. The screen displays:

```
Load Ref (1)
Sample (2)  ?  1
```

6. Select option 1 (Load Ref) by pressing ENTER. The screen displays:

```
Sample Pan
Number ?   1
```

7. Select tray position 1 by pressing ENTER. The Autosampler CE picks up the pan in tray position 1 and begins moving toward the cell.

8. Press ESCAPE/CLEAR when the Autosampler CE reaches the DSC cell area.

9. Use the motion keys to position the pan in its correct calibration position (see Table 4.1). Press the RELEASE and GRIP keys repeatedly to ensure that the fingers can firmly grasp the pan, and watch carefully to ensure that each finger contacts the pan at the same time (see Figure 4.2).

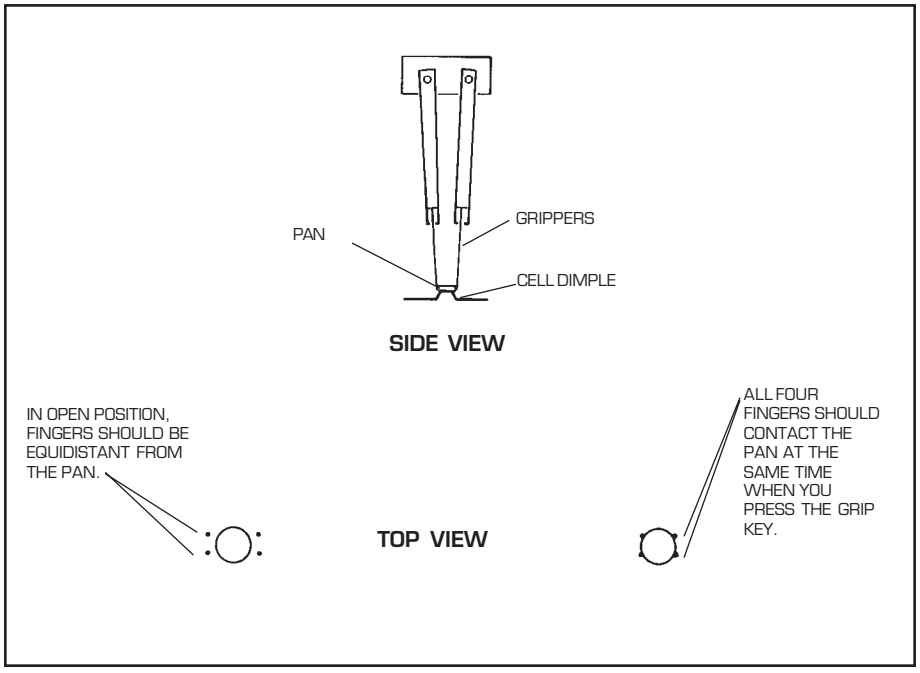


Figure 4.2
Calibrating a
Cell Pan Position

10. When you are satisfied that the pan is properly positioned, press the CALIBRATE key repeatedly until you see the correct cell pan position on the display:

Calibrate/Verify Cell Ref. Pos.

11. Press ENTER. The screen displays:

Verify (1) or Store (2) ? 1

12. Select option 2 (Store) to store the calibration position (press the 2 key, then press ENTER). The screen displays:

Cell Ref. Pos. Calibrated

13. Release the pan (press the RELEASE key). Press RESET SAMPLER and ENTER to bring the Autosampler CE to the home position. Press the CALIBRATE key until you see the correct cell lid position on the display:

Calibrate/Verify Cell Ref. Pos.

14. Press ENTER. The screen displays:

Verify (1) or Store (2) ? 1

15. Press ENTER to select default option 1 (Verify).

16. When the turret stops moving, close and open the grippers again and check your calibration against the criteria in Figure 4.2. Remember to release the pan. If the position is correctly calibrated, go on to step 17. If it is not, repeat steps 4 through 16.

17. Press the LOAD key. The screen displays:

```
Load (1) or
Unload (2) ? 1
```

18. Select option 1 (Load) by pressing ENTER. The screen displays:

```
Load Ref (1) or
Sample (2)  ?  1
```

19. Select option 2 (Sample) by pressing 2 then ENTER. The screen displays:

```
Sample Pan
Number ?   1
```

20. Select tray position 2 (press the 2 key then press ENTER). The Autosampler CE picks up the pan in tray position 2 and begins moving toward the cell.

21. Press ESCAPE/CLEAR when the Autosampler CE reaches the DSC cell area.

22. Use the motion keys to position the pan in its correct calibration position (see Table 4.1). Press the RELEASE and GRIP keys repeatedly to ensure that the fingers can firmly grasp the pan, and watch carefully to ensure that each finger contacts the pan at the same time (see Figure 4.2).

23. When you are satisfied that the pan is properly positioned, press the CALIBRATE key repeatedly until you see the correct cell pan position on the display:

Calibrate/Verify Sample Pos.

24. Press ENTER. The screen displays:

Verify (1) or Store (2) ? 1

25. Select option 2 (Store) to store the calibration position (press the 2 key, then press ENTER). The screen displays:

Sample Pos. Calibrated

26. Release the pan (press the RELEASE key). Press RESET SAMPLER and ENTER to bring the Autosampler CE to the home position. Press the CALIBRATE key until you see the correct cell lid position on the display:

Calibrate/Verify Sample Pos.

27. Press ENTER. The screen displays:

Verify (1) or Store (2) ? 1

28. Press ENTER to select default option 1 (Verify).

29. When the turret stops moving, close and open the grippers again and check your calibration against the criteria in Figure 4.2. Remember to release the pan and raise the turret out of the cell with the RAISE key.

30. Use the LOAD key to remove the pans from the cell.

31. Press ESCAPE/CLEAR to end the calibration procedure. Go on to the section entitled "Checking Your Calibration" (page 4-29).

NOTE: When you have finished using the Autosampler CE keypad, remember to close the keypad cover and finger-tighten the thumbscrews before starting a method.

Calibrating the Lid Storage Positions

To calibrate the lid storage positions, follow these steps:

1. Access the Autosampler CE keypad by loosening the captive thumbscrews on the keypad cover and tilting the cover down.

2. Press RESET SAMPLER and ENTER to bring the Autosampler CE to home position.

3. Check that the three cell lids are in their storage positions (see Table 4.1).

4. Use the motion keys to position the grippers over lid #1 (small lid). Press the GRIP and RELEASE keys repeatedly to ensure that the fingers can firmly grasp the lid, and watch carefully to ensure that each finger contacts the lid at the same time (see Figure 4.3 on the next page).

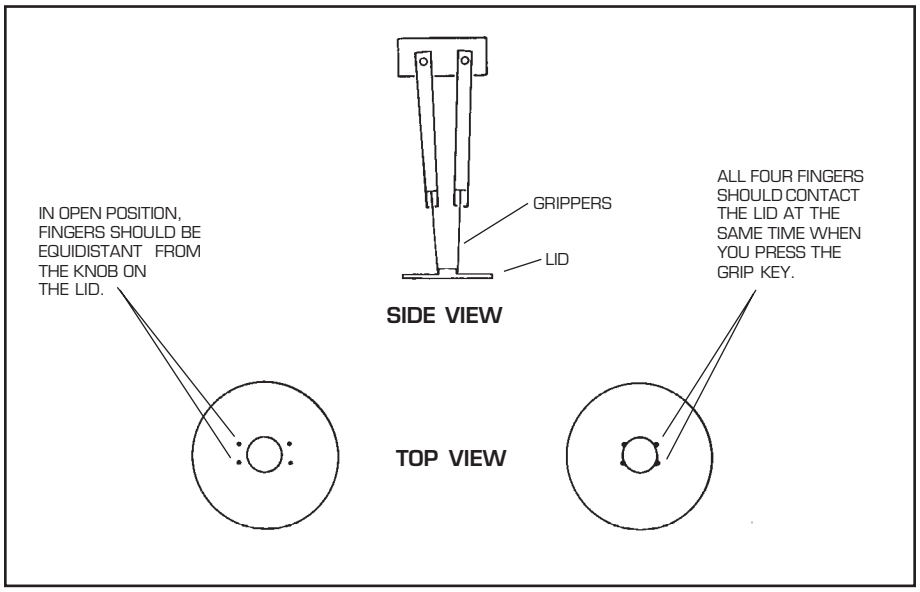


Figure 4.3
Calibrating a Lid Storage Position

5. Press the CALIBRATE key repeatedly until you see the correct lid storage position on the display:

Calibrate/Verify Lid #1 Storage

6. Press ENTER. The screen displays:

Verify (1) or Store (2) ? 1

7. Select option 2 (Store) to store the calibration position (press the 2 key, then press ENTER).

The screen displays:

```
Lid #1 Storage
Calibrated
```

8. Release the lid (press the RELEASE key). Press RESET SAMPLER and ENTER to bring the Autosampler CE to the home position. Press the CALIBRATE key until the correct cell lid position is on the display:

```
Calibrate/Verify
Lid #1 Storage
```

9. Press ENTER. The screen displays:

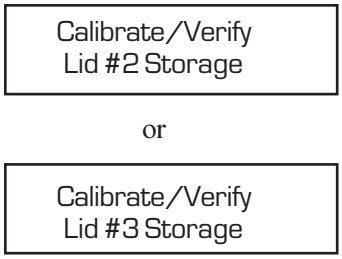
```
Verify (1) or
Store (2) ? 1
```

10. Press ENTER to select default option 1 (Verify).

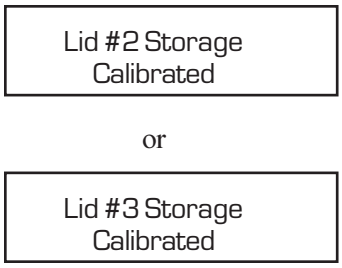
11. When the turret stops moving, close and open the grippers again and check your calibration against the criteria in Figure 4.3. Remember to release the lid. If the position is correctly calibrated, go on to step 12. If it is not, repeat steps 4 through 11 with lid #1.

12. Repeat steps 4 through 11 to calibrate the storage positions for lids 2 and 3 (the medium-sized and large lids). The screen displays in steps 5, 7, and 8 are the same except for the lid numbers, as shown on the next page.

Steps 5 and 8:



Step 7:



13. Press ESCAPE/CLEAR to exit the calibration procedure.

NOTE: When you have finished using the Autosampler CE keypad, remember to close the keypad cover and finger-tighten the thumbscrews before starting a method.

Calibrating the Sample Tray

To calibrate the sample tray positions, use the following procedures:

NOTE: The Autosampler CE uses the calibrated tray positions 1, 11, and 59 to calculate all other tray positions. Be sure to verify each of these positions as described here.

1. Access the Autosampler CE keypad by loosening the captive thumbscrews on the keypad cover and tilting the cover down.
2. Press RESET SAMPLER and ENTER to bring the Autosampler CE to the home position.
3. Make sure the sample tray is fully inserted.
4. Place empty crimped pans in tray positions 1, 11, and 59.
5. Use the motion keys to position the grippers over the pan in tray position #1. Press the GRIP and RELEASE keys to ensure that the fingers can firmly grasp the pan, and watch carefully to ensure that each finger contacts the pan at the same time (see Figure 4.4 on the next page).

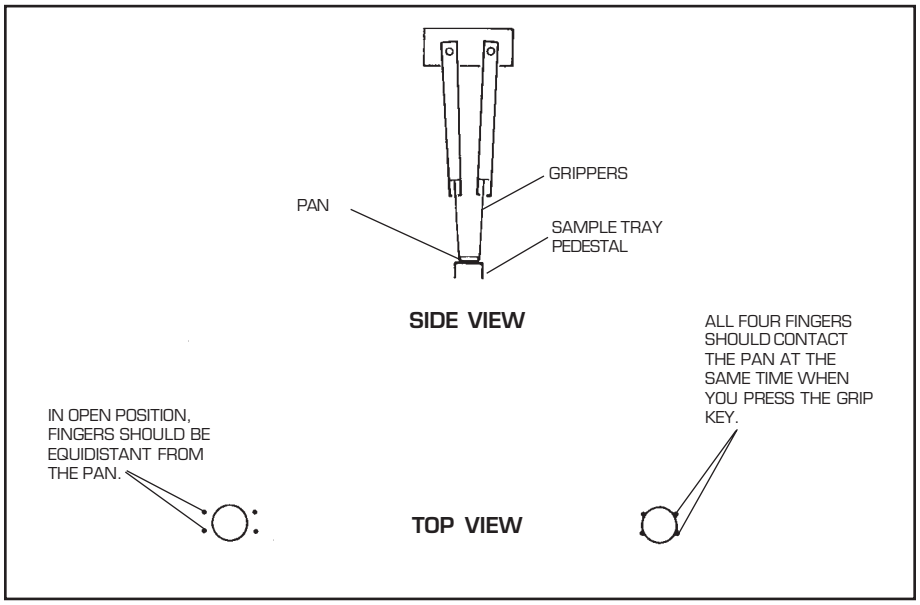


Figure 4.4
Calibrating a Tray Position

6. Press the CALIBRATE key repeatedly until you see the correct tray position on the display:

Calibrate/Verify Tray Pos. #1

7. Press ENTER. The screen displays:

Verify (1) or Store (2) ? 1

8. Select option 2 (Store) to store the calibration position (press the 2 key, then press ENTER). The screen displays:

```
Tray Pos. #1
Calibrated
```

9. Release the pan (press the RELEASE key). Press RESET SAMPLER and ENTER to bring the Autosampler CE to the home position. Press the CALIBRATE key until the correct cell lid position is on the display:

```
Calibrate/Verify
Tray Pos. #1
```

10. Press ENTER. The screen displays:

```
Verify (1) or
Store (2) ? 1
```

11. Press ENTER to select default option 1 (Verify).

12. When the turret stops moving, close and open the grippers again, and check your calibration against the criteria in Figure 4.4. Remember to release the pan. If the position is correctly calibrated, go on to step 13. If it is not, repeat steps 5 through 12 for tray position 1.

13. Repeat steps 5 through 12 for tray positions 11 and 59. The screen displays in steps 6, 8, and 9 are the same except for the tray position numbers, shown on the next page.

Steps 6 and 9:

Calibrate/Verify Tray Pos. #11

or

Calibrate/Verify Tray Pos. #59

Step 8:

Tray Pos. #11 Calibrated

or

Tray Pos. #59 Calibrated

14. Press ESCAPE/CLEAR to exit the calibration procedure.

NOTE: When you have finished using the Autosampler CE keypad, remember to close the keypad cover and finger-tighten the thumbscrews before starting a method.

Checking Your Calibration

This section recommends three methods to check the accuracy of your Autosampler CE calibrations:

- The LOAD/LIDS test
- The Verify test
- The Cycle Pans test.

We recommend that you use the LOAD/LIDS test to check your first calibration. The Verify test is ideal for quick checks after you make small adjustments. The Cycle Pans test is useful for long-term cycling tests that check the Autosampler CE's ability to continuously load and unload samples and lids. Whatever method you use, always be ready to press the HALT key if the Autosampler CE turret arm starts to run into something.

If the Autosampler CE has trouble completing any of the tests or displays any error messages, note the position(s) showing a problem, then stop the test. You do not need to recalibrate the entire Autosampler CE; recalibrate only the incorrect positions by following the appropriate steps on pages 4-11 to 4-28. If you need to recalibrate any of the sample tray positions, however, you must verify all three. The Autosampler CE uses the calibration values for positions 1, 11, and 59 to determine the locations of all pans on the tray.

After correcting a calibration, run the Verify test again.

NOTE: Make sure the DSC cell is empty before you run the following tests.

The LOAD/LIDS Test

The LOAD/LIDS test is recommended for comprehensive testing of all calibration positions.

To access the Autosampler CE keypad, loosen the captive thumbscrews on the keypad cover, and tilt the cover down.

Step A:

Use the LOAD key to test the Autosampler CE's ability to load and unload pans from the tray to the DSC cell.

1. Press RESET SAMPLER and ENTER to bring the Autosampler CE to the home position.

2. Place empty crimped pans in tray positions 6, 45, and 55.

3. Press the LOAD key. The Autosampler CE screen displays:

```
Load (1) or
Unload (2) ? 1
```

4. Select option 1 (Load) by pressing ENTER. The screen displays:

```
Load Ref (1) or
Sample (2) ? 1
```

5. Select option 1 (Ref) by pressing ENTER.

The screen displays:

Sample Pan Number ? 1

6. Select tray position 6 (press the 6 key, then press ENTER). The Autosampler CE loads the pan in tray position 6 into the cell reference position.

7. Press the LOAD key again.

8. Select option 1 (Load) by pressing ENTER.

9. Select option 2 (Sample) by pressing the 2 key, then pressing ENTER.

10. Select tray position 45 (press 45, then press ENTER). The Autosampler CE loads the pan in tray position 45 into the cell sample (or sample A) position.

11. Press the LOAD key again.

12. Select option 1 (Load) by pressing ENTER.

13. Select option 1 (Ref) by pressing ENTER.

14. Select tray position 55 (press 55, then press ENTER). The Autosampler CE loads the pan in tray position 55 into the cell reference position. The Autosampler CE first unloads pan 6 from the reference position.

15. Press the LOAD key again. The screen displays:

```
Load (1) or
Unload (2) ? 1
```

16. Select option 2 (Unload) by pressing the 2 key, then pressing ENTER. The screen displays:

```
Unload Ref(1) or
Sample (2)  ?  1
```

17. Select option 1 (Ref) by pressing ENTER. The screen displays:

```
Sample Pan
Number ?  0
```

18. Select default tray position 0 by pressing ENTER (tray position 0 tells the Autosampler CE to return the pan to the tray position from which it was loaded).

19. Press the LOAD key again.

20. Select option 2 (Unload) by pressing the 2 key, then pressing ENTER.

21. Select option 2 (Sample) by pressing the 2 key, then pressing ENTER.

22. Select default tray position 0 by pressing ENTER.

Step B:

Use the LIDS key to test the Autosampler CE's ability to cover the DSC cell.

1. Press RESET SAMPLER and ENTER to bring the Autosampler CE to home position.

2. Press the LIDS key. The Autosampler CE screen displays:

   Uncover (1) or
   Cover (2) ? 1

3. Select option 2 (Cover) by pressing the 2 key, then pressing ENTER. The Autosampler CE removes all lids from their storage positions and places them on the cell.

4. Press the LIDS key again. The screen displays:

   Uncover (1) or
   Cover (2) ? 1

5. Select default option 1 (Uncover) by pressing ENTER. The Autosampler CE removes all lids from the cell and returns them to their storage positions.

NOTE: When you have finished using the Autosampler CE keypad, remember to close the keypad cover and finger-tighten the thumbscrews before starting a method.

The Verify Test

The Verify function is best for testing individual pan or lid positions; perform it as follows:

1. Access the Autosampler CE keypad by loosening the captive thumbscrews on the keypad cover and tilting the cover down.

2. Press RESET SAMPLER and ENTER to bring the Autosampler CE to home position.

3. Press the CALIBRATE key repeatedly until the screen displays the position you want to check.

4. Press ENTER. The screen displays:

```
Verify (1) or
Store (2) ? 1
```

5. Select option 1 (Verify) by pressing ENTER. The Autosampler CE should move to the position you selected in step 2.

6. Use Table 4.1 to determine whether the turret is in the correct position when it stops moving. Press the GRIP and RELEASE keys to test the grippers' ability to firmly grasp the object.

7. To test another position, go back to step 2. Press ESCAPE/CLEAR when you are finished with the Verify test.

NOTE: When you have finished using the Autosampler CE keypad, remember to close the keypad cover and finger-tighten the thumbscrews before starting a method.

The Cycle Pans Test

The Cycle Pans test exercises all of the Autosampler CE's loading and unloading functions, but requires only a few simple keystrokes. It is recommended as a double check after the LOAD/LIDS test or as a quick verification for experienced users.

1. Access the Autosampler CE keypad by loosening the captive thumbscrews on the keypad cover and tilting the cover down.

2. Press RESET SAMPLER and ENTER to bring the Autosampler CE to home position.

3. Load the sample tray with at least five empty crimped pans. Use sample tray positions 1 through 5.

4. Press the TEST key two times. The screen displays:

Test Cycle Pans

5. Press ENTER to select the Cycle Pans test. This test causes the Autosampler CE to continuously load and unload pans into the DSC cell reference and sample positions. (See "Testing Autosampler CE Functions" in Chapter 6 for further explanation of the Cycle Pans test.)

6. Allow the Autosampler CE to complete at least one full cycle of the test:

   - Two pans are removed from their tray positions and placed in the cell.
   - The lids are placed on the cell.
   - The lids are removed.
   - The pans are returned to their storage positions.

   If you must stop the test because of calibration errors, press the ESCAPE/CLEAR key.

7. Press ESCAPE/CLEAR to stop the Cycle Pans test after the Autosampler CE completes at least one cycle of the test.

NOTE: When you have finished using the Autosampler CE keypad, remember to close the keypad cover and finger-tighten the thumbscrews before starting a method.

CHAPTER 5: Preparing Samples

Overview

This chapter explains how to:

- Install the TA Instruments crimping die in the Sample Encapsulating Press
- Set up the sample tray
- Prepare crimped and hermetic pans for Autosampler CE use.

Installing the Crimping Die

The Autosampler CE comes equipped with a crimping die designed to work with the TA Instruments Autosampler CE crimped pans. Follow the steps below to install the crimping die in the Sample Encapsulating Press before preparing crimped pans for Autosampler CE use.

1. Loosen the lower die holder thumbscrew on the Sample Encapsulating Press.

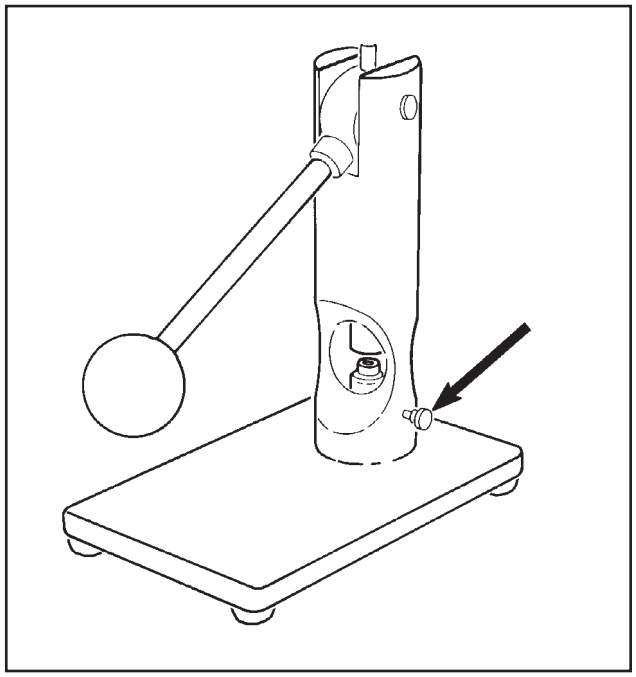


Figure 5.1
The Lower Die Holder Thumbscrew

2. Turn the sample press on its back.

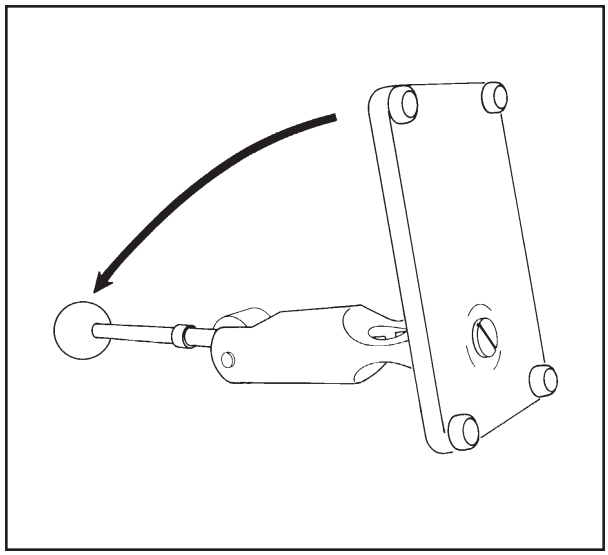


Figure 5.2 Turning the Sample Encapsulating Press on its Back

3. Turn the base screw counterclockwise to lower the height of the lower die.

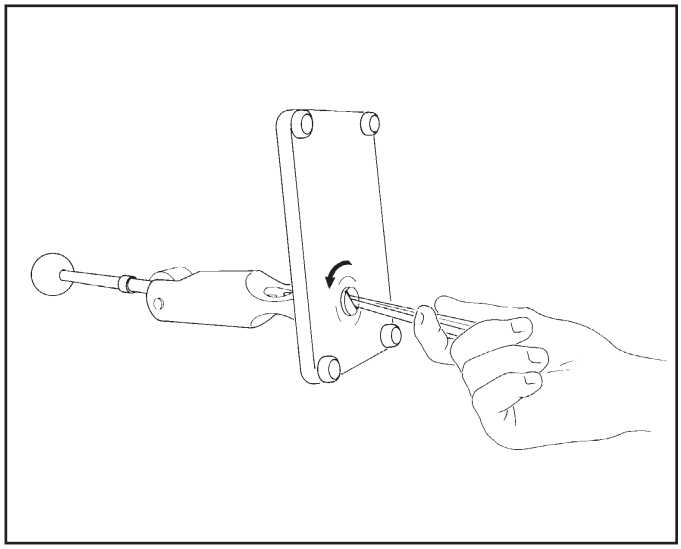


Figure 5.3 Lowering the Base Screw

4. Set the sample press upright.

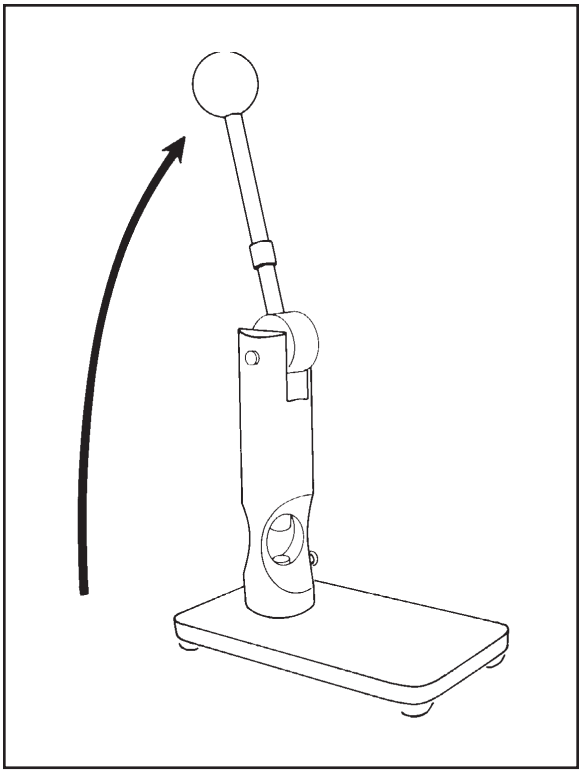


Figure 5.4 Setting the Sample Encapsulating Press Upright

5. Lift the lower die out of the sample press.

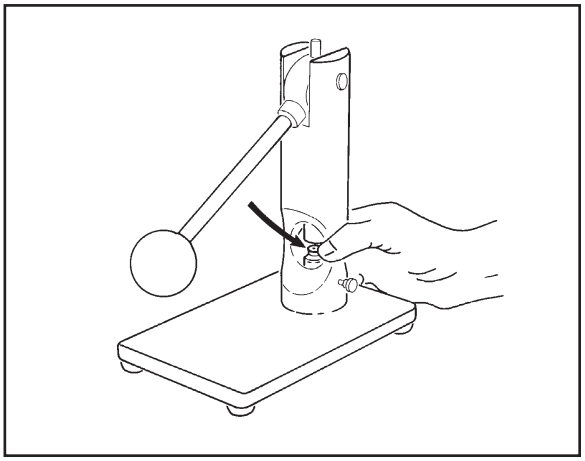


Figure 5.5 Removing the Lower Die

6. Loosen the allen screw on the lower die (see Figure 5.6), then lift the inner core out of the die.

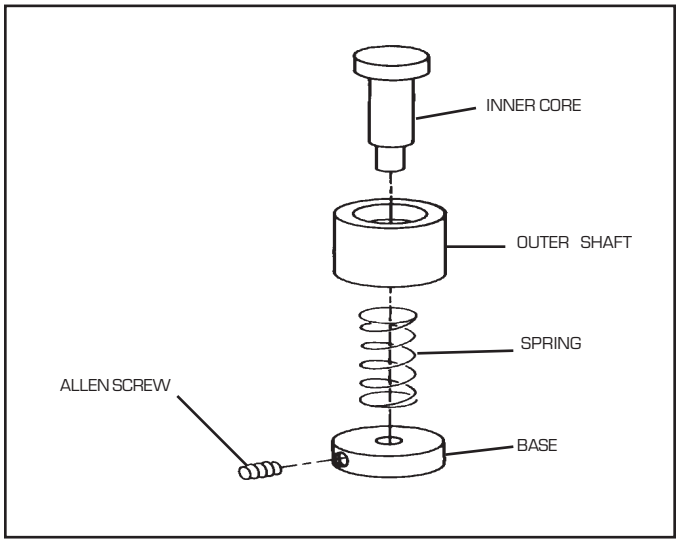


Figure 5.6 Removing the Inner Core from the Lower Die

7. Insert the new inner core (included with the Autosampler CE—see Figure 5.7) into the die. Retighten the allen screw.

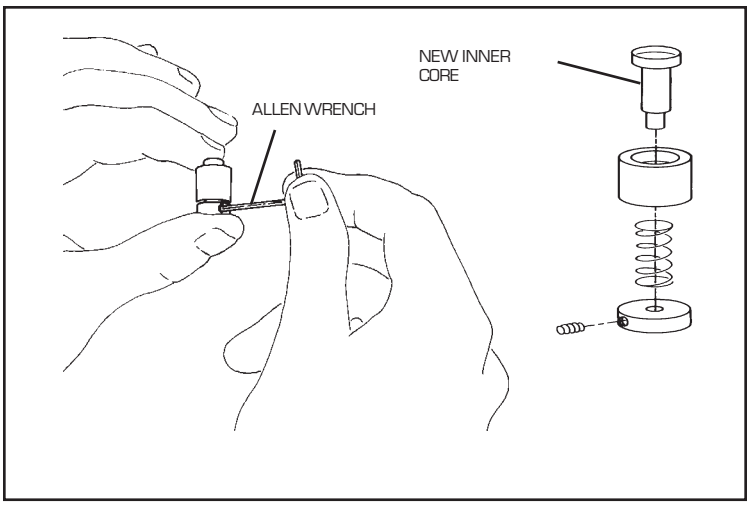


Figure 5.7
Installing the
New Inner Core

8. Insert the modified die into the sample press.

9. Tilt the sample press on its back again, and turn the base screw clockwise to adjust the height of the lower die.

10. Tilt the sample press back up, and bring the lever down to test the height of the lower die. The upper die should just touch the lower die when the lever is fully down.

11. Repeat steps 9 and 10 until the height of the lower die is satisfactory. Then tighten the lower die holder thumbscrew to hold the lower die in place.

12. Crimp a few empty pans to verify that the die is at an acceptable height (see pages 5-19 to 5-23).

Setting Up the Sample Tray

Before you prepare your sample pans and set up the sample tray, you should consider the following:

- Sample and run capacity
- Reuse of pans
- Order of runs
- Pan metal and type.

Each of these considerations is explained on the following pages.

Autosampler CE Run Capacity

When you use the Autosampler CE and controller to automate sample loading and unloading, you must create an *Autosampler CE (AS) run sequence* for each tray of samples. An AS run sequence is composed of a series of *runs*, each of which requires a reference pan and sample pan in the cell (see "Terminology" in Chapter 1 for explanations of the terms AS run sequence and run). When you set up your tray, you must consider the maximum number of runs that can be set up in an AS run sequence, known as the Autosampler CE 's *run capacity*.

If you are using the LNCA for cooling experiments, the maximum number of cooling runs in an AS run sequence is limited by the amount of liquid nitrogen in the LNCA tank. The rate at which the liquid nitrogen is used up depends, of course, on your method: the temperature you use, how long you hold the cell at a particular temperature, the rate of change in temperature, and so on. In general, you can expect to get approximately 10 to 15 cooling runs with one full LNCA tank of liquid nitrogen when your method cools to the lower limit of –150°C. If you have an autofill LNCA, you will need to allow sufficient delay times between runs for the LNCA to refill from the bulk storage tank. You are encouraged to experiment using your own thermal methods to determine what you can expect from your system.

The maximum number of runs in an AS run sequence is 62 (the number of positions in the Autosampler CE tray). Thus, you can run 62 samples in an AS run sequence if you manually

load the reference pan and place only pans that actually contain samples in the tray. (This run capacity also applies to the Autosampler CE with an RCS used for cooling.)

You should use the same pan type (*e.g.*, crimped, hermetic) and metal (*e.g.*, aluminum, copper) for the reference pan(s) as you do for your sample pan(s). Thus, if you are using more than one pan type or metal in one AS run sequence, you will need to include a corresponding reference pan for each type or metal used. This will decrease the number of actual samples in the AS run sequence.

Reuse of Pans

Because thermal analysis experiments can sometimes deform the pans or cause the sample material to boil out, we do not recommend that you reload pans in the Autosampler CE once they have been unloaded from the DSC cell. Thus, if you want to run a sample through more than one thermal method during your AS run sequence, do one of the following:

1. Run several methods on one sample pan consecutively. The Autosampler CE does not unload a pan at the completion of a run if the next run calls for the same pan.

2. If you prefer not to run consecutive methods on one sample, prepare several pans containing the same material.

Order of Runs

To avoid mistakes, we suggest that you place the pans in the sample tray in the order in which you intend to run them. The following paragraphs suggest some guidelines for determining the order of your runs.

Perform Cooling Methods Before Heating Methods. Unlike the electricity that supplies the cell heater, the LNCA's supply of liquid nitrogen is limited. Thus, you can keep the amount of liquid nitrogen needed to do a cooling method at a minimum by putting all cooling-only runs at the beginning of the AS run sequence. If you plan to run combination cooling/heating methods, these methods should come next, followed finally by any heating-only methods.

Keep Runs of a Similar Method Together. For example, if you plan to run some of your samples through a cooling method with the LNCA or RCS and some through heating methods, you should run all of the cooled samples consecutively to prevent unnecessary waste of your liquid nitrogen supply. If you alternate heating and cooling runs, the cell heater will have to work harder to bring the cell up to temperature, and the LNCA or RCS will have to work harder to bring the temperature down again.

Pan Metal and Type

The metal (*e.g.*, aluminum, copper) and type (*e.g*., crimped, hermetic) of your reference pan(s) must always match the metal and type of sample pan(s). Thus, when you are setting up the tray, remember to include a new reference pan for each new sample pan type used.

The DSC Autosampler CE operates using the following types of TA Instruments pans:

- Autosampler CE crimped pans
- Hermetic pans
- Open pans.

These pans are available in a variety of metals. Any pan metal can be used with the Autosampler CE, as long as it is conductive. However, do not use aluminum pans at temperatures above 600°C.

Operation of the Autosampler CE with pans other than those listed above is not recommended. Autosampler CE performance is not guaranteed with pans that are not provided by TA Instruments.

Preparing Sample Pans

Follow the steps in this section to prepare sample pans and set up the Autosampler CE tray. Keep these tips in mind when preparing sample pans:

- The oils on your fingers can affect the results of thermal analysis experiments. Thus, always use tweezers when handling pans and sample material.

- If you overfill a pan, the heating or cooling method may cause the sample to boil out, buckle, or explode the pan. If the Autosampler CE cannot remove a pan from the cell because of deformation or boiled-out material, operation is halted until the problem is corrected. Thus, before you use the Autosampler CE for unattended runs, you should be reasonably familiar with the effects of experimental heating and cooling methods on your samples and pans.

- Use the Sample Information Chart to keep a record of sample weights and identifications while you prepare your pans. You will need this information later when you program AS run sequences on the controller. Make several photocopies of the chart before beginning. You are authorized to photocopy pages 5-17 and 5-18 only, but no other part of the manual.

- If this is the first time you have used the DSC Sample Encapsulating Press , we recommend that you practice the following procedures with empty pans before attempting to seal a sample.

- If you wish to prepare additional trays of samples while a tray is being run on the Autosampler CE , you can purchase additional trays and covers from TA Instruments.

Tray Position	Cell Position	Reference Pan	Sample Name or Reference Pan Type	Sample Weight	Method File
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					
23					
24					
25					
26					
27					
28					
29					
30					
31					

Tray Position	Cell Position	Reference Pan	Sample Name or Reference Pan Type	Sample Weight	Method File
32					
33					
34					
35					
36					
37					
38					
39					
40					
41					
42					
43					
44					
45					
46					
47					
48					
49					
50					
51					
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61					
62					

Preparing Crimped Pans

NOTE: Make sure the crimping die is properly installed (see page 5-4) before you use it.

1. Place a pan and cover (see Figure 5.8) in a milligram balance (measuring accuracy of the balance must be ± 0.0001 gram) and record the weight.

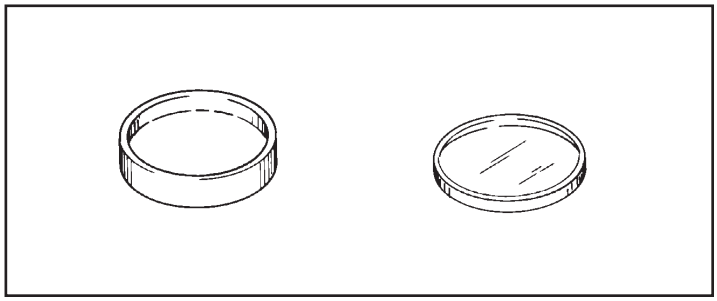


Figure 5.8 TA Instruments Crimped Pan

2. Leave the pan and cover in the balance, and place your sample in the pan. Record the weight.

3. Subtract the weight you obtained in step 1 from the weight you obtained in step 2, and enter the result in the sample weight column of the Sample Information Chart.

4. Place the pan in the well of the lower die of the Sample Encapsulating Press (see Figure 5.9).

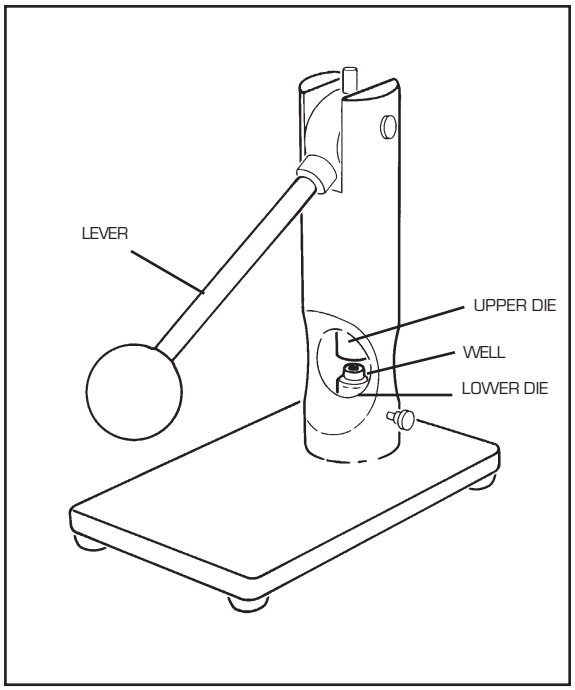


Figure 5.9 Sample Encapsulating Press Set Up for Nonhermetic Crimping

5. Place the cover over the pan:

   - If the sample is small or thin, align the cover with the pan (see Figure 5.10).

   - If the sample is large, invert the cover and place it in the pan (see Figure 5.10).

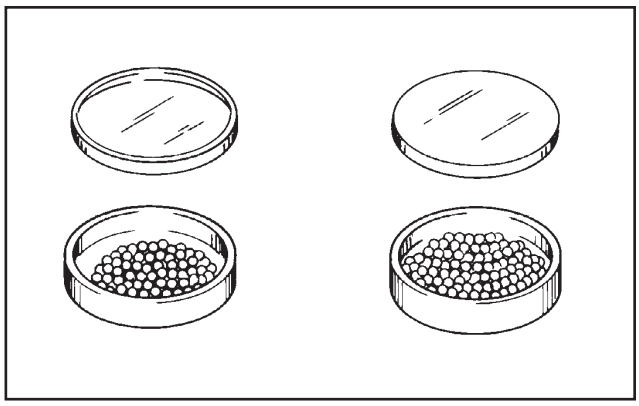


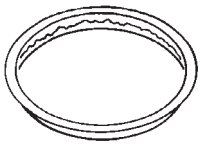
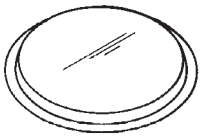
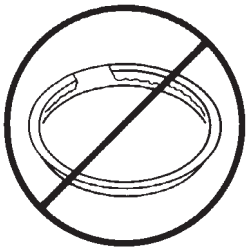
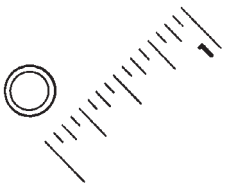
Figure 5.10 Placing the Cover over the Crimped Pan

6. Pull the sample press lever forward, and push down gently until the lever stops moving.

7. Raise the lever, and remove the pan from the well. Check the pan to ensure that it meets the specifications outlined in Table 5.1 (next page).

   If the pan does not meet the specifications in Table 5.1, you may need to adjust the height of the lower die. To adjust the lower die, loosen the lower die holder thumbscrew (see Figure 5.1), and follow steps 9 through 11 on page 5-8.

Table 5.1
Specifications for
Properly Crimped Pans

Description	Illustration
Uniform folding of lid around circumference	
Flat surface on the bottom of the pan; no ridge around circumference	
No visible gaps between lid and pan	
Diameter of pan slightly greater than 1/4 in. (0.270 to 0.275 in.)	

8. Place the pan in the Autosampler CE tray, and record the cell position, corresponding reference pan number, and sample name in the Sample Information Chart (see example in Figure 5.11). A column is also provided in this chart for the thermal method file.

Tray Position	Cell Position	Reference Pan	Sample Name or Reference Pan Type	Sample Weight	Method File
1	Ref.		(Aluminum Crimped)		
2	Samp. A	1	Indium	0.35	Indium.mth
3	Samp. B	1	Epoxy Resin	0.29	Epoxy.mth
4	Samp. A	1	Indium	0.67	Indium.mth
5	Samp. B	1	Epoxy Resin	0.71	Epoxy.mth
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
21					
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29					
30					
31					

Figure 5.11 Using the Sample Information Chart

Preparing Hermetic Pans

NOTE: Make sure your sample press is set up for hermetic sealing (see Appendix A in the *DSC Operator's Manual*) before you perform the following procedure.

1. Place the hermetic pan and cover (see Figure 5.12) in a milligram balance (measuring accuracy of the balance must be ± 0.0001 gram), and record the weight.

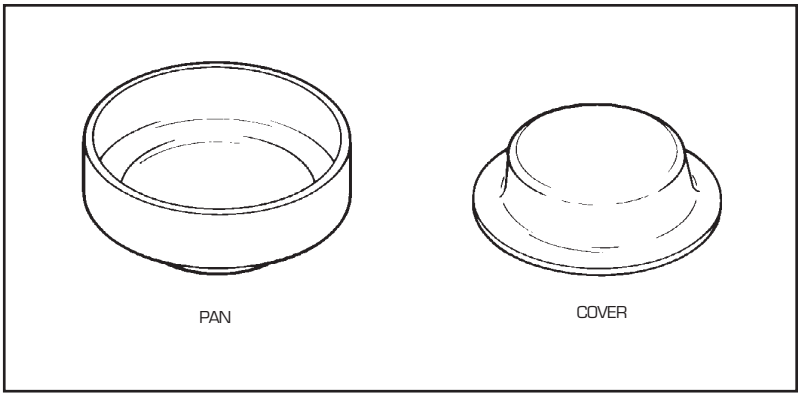


Figure 5.12
TA Instruments
Hermetic Pan

2. Leave the pan and cover in the balance, and place your sample in the pan. Record the weight.

3. Subtract the weight you obtained in step 1 from the weight you obtained in step 2, and enter the result in the sample weight column of the Sample Information Chart.

4. Place the pan in the well of the lower die of the Sample Encapsulating Press (see Figure 5.13).

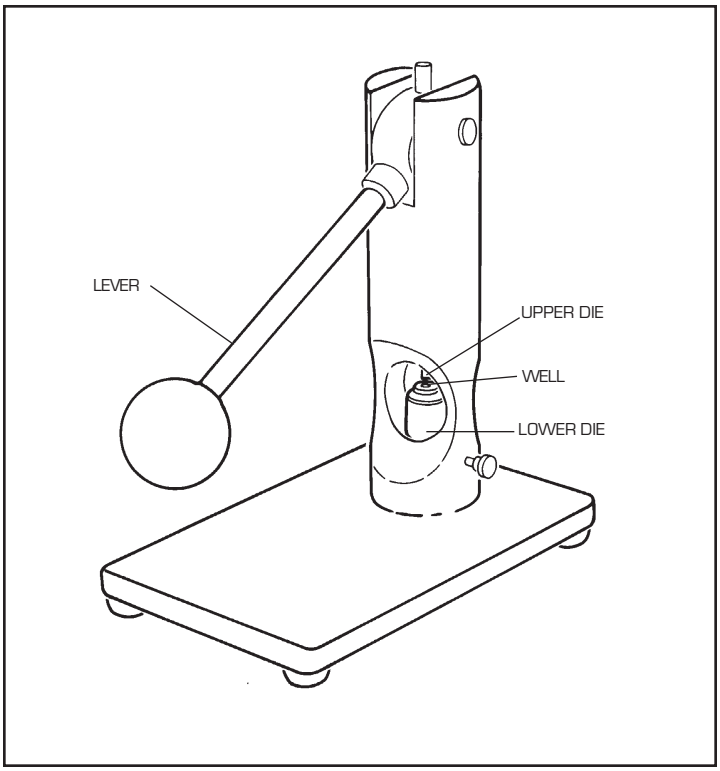


Figure 5.13 The DSC Sample Press Set Up for Hermetic Sealing

5. Place the cover over the pan as shown in Figure 5.14.

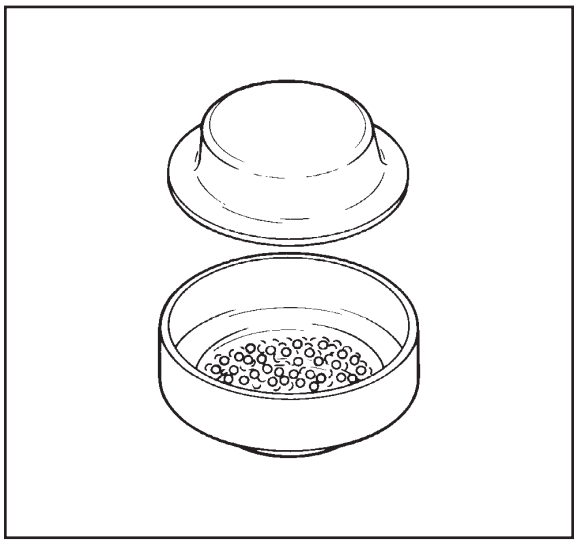


Figure 5.14
Placing the Cover over the Hermetic Pan

6. Place the hermetic preforming tool, grooved side down, around the upper die plunger (see Figure 5.15).

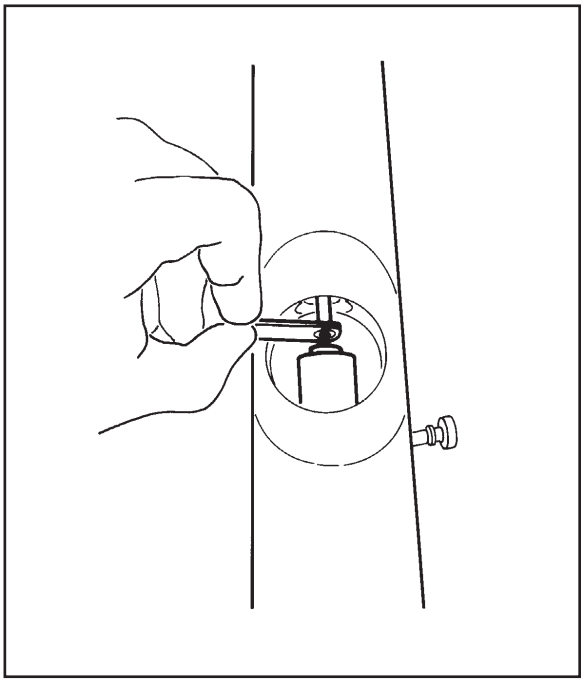


Figure 5.15
Using the Preforming Tool

7. Use your other hand to pull the lever forward. Push down on the lever until it stops moving. You will need to use more force for hermetic sealing than for crimping.

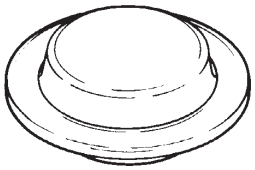
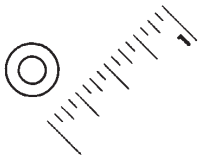
8. Raise the lever. Flip the preforming tool over (grooved side up), and place it around the upper die plunger.

9. Lower the lever again, and push down gently until it stops moving.

10. Raise the lever, and remove the pan from the well. Check the pan to ensure that it meets the specifications in Table 5.2 (next page).

    If the pan does not meet the specifications in Table 5.2, you may need to adjust the height of the lower die. To adjust the lower die, loosen the lower die holder thumbscrew (see Figure 5.1), and follow steps 9 through 11 on page 5-8.

Table 5.2 Specifications for Properly Sealed Hermetic Pans

Description	Illustration
Complete seal around circumference of pan	
Diameter of pan approximately 5/16 in. (0.300 to 0.310 in.)	

11. Place the pan in the Autosampler CE tray, and record the cell position, corresponding reference pan number, and sample name in the Sample Information Chart (see example in Figure 5.11 on page 5-23).

CHAPTER 6: Diagnostics

Using the Confidence Test Ready Light

If the Autosampler CE screen fails the confidence test at startup, you can use the red Ready light on the unit's back panel (see Figure 6.1) to determine whether the other confidence tests detect any errors.

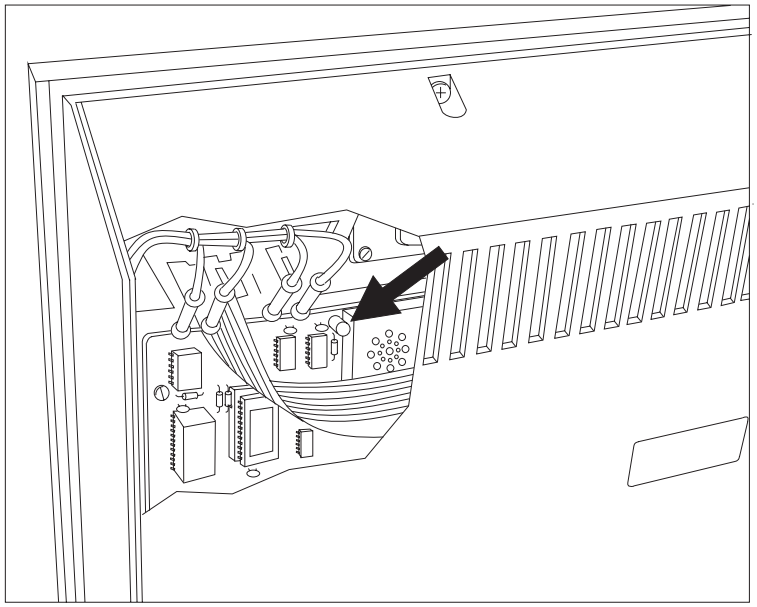


Figure 6.1
The Autosampler CE Confidence Test Ready Light

Follow the guidelines beginning on the next page to diagnose problems with the confidence test Ready light.

- If the Autosampler CE is already on, press the reset button on its back panel to restart the confidence tests (see Figure 6.2).

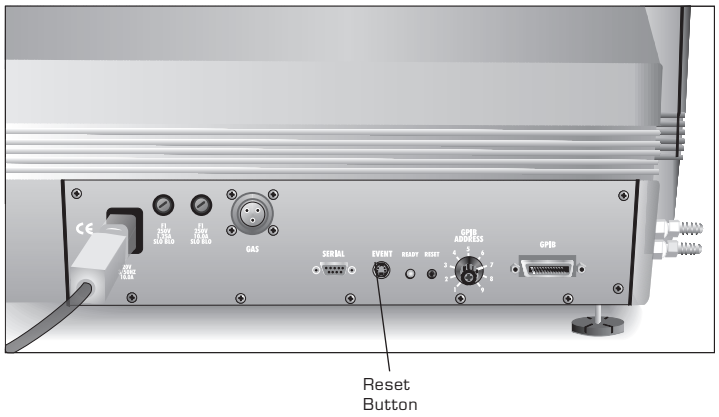


Figure 6.2
Reset Button

- Watch the Ready light carefully. As each system is tested, the light emits either a short (1/4 second) or a long (3/4 second) flash to indicate whether the system has passed or failed. A short flash means that the system being tested has passed; a long flash means that it has failed.

  Table 6.1 on the next page lists the confidence tests in the order in which they occur. If you see a long flash, use the table to determine which system failed the test, then call an authorized service representative. For example, if the fifth test yields a long flash, the keyboard has failed the confidence test.

Table 6.1
Order of the Confidence Tests

Flash Number	Test
1	EPROM checksum
2	Variable RAM
3	Liquid crystal display
4	8155
5	Keyboard
6	Location RAM
7	GPIB
8	RS-232-C
9	Timer interrupt
10	Watchdog timer
11	Up/down (z-axis) motor and sensor
12	In/out (r-axis) motor and sensor
13	Rotation (θ-axis) motor and sensors

Testing Autosampler CE Functions

The Autosampler CE TEST key, a manual mode key, calls up a menu of tests that check the Autosampler CE's:

- Calibration
  - — Cycle Lids test
  - — Cycle Pans test
- Sensors
- Configuration jumpers
- Keyboard operation
- GPIB configuration
- Display screen
- Motors
  - — Motion test
  - — Cycle A–B test.

The following pages describe how to use each of the tests available through the TEST key.

The Cycle Lids Test

The Cycle Lids test loads and unloads the cell lids continuously to test the calibration of the Autosampler CE's lid storage and cell positions.

1. Access the Autosampler CE keypad by loosening the captive thumbscrews on the keypad cover and tilting the cover down.

2. Press the TEST key once. The Autosampler CE screen displays:

Test Cycle Lids

3. Press ENTER to select the test displayed on the screen. The Autosampler CE begins moving the cell lids from their storage positions to the cell. When the cell is covered, the Autosampler CE returns the lids to their storage positions. This procedure continuously cycles until you stop the test (step 4).

4. Press ESCAPE/CLEAR when you are ready to exit the Cycle Lids test. If any of the lids are left on the cell when you interrupt the test, the Autosampler CE will not remove them; it will remove them the next time a pan needs to be placed in the cell.

NOTE: When you have finished using the Autosampler CE keypad, remember to close the keypad cover and finger-tighten the thumbscrews before starting a method.

The Cycle Pans Test

The Cycle Pans test loads and unloads pans from the tray to the DSC cell to test the calibration of the Autosampler CE's tray and cell pan positions.

1. Access the Autosampler CE keypad by loosening the captive thumbscrews on the keypad cover and tilting the cover down.

2. Press the TEST key two times. The Autosampler CE screen displays:

   Test
   Cycle Pans

3. Press ENTER to select the test displayed on the screen. The Autosampler CE begins loading the pan in tray position #1 into the cell reference position, as indicated on the screen:

   Cycle Pans 0001
   Loading Ref.

   The number in the upper right of the screen is a counter indicating how many pans have been cycled. Each time a new pan is loaded from the tray, the counter increases by one.

   The Autosampler CE continues loading and unloading pans, going through all positions in the tray, until you stop the test (step 4). Each time it fills the cell, it places the lids on the cell. It then removes the lids, removes the pans, and begins another cycle.

NOTE: If you want the Cycle Pans test to continue indefinitely, you must fill the entire sample tray with pans.

4. Press ESCAPE/CLEAR when you are ready to exit the Cycle Pans test.

NOTE: When you have finished using the Autosampler CE keypad, remember to close the keypad cover and finger-tighten the thumbscrews before starting a method.

The Sensors Test

The Sensors test displays a series of digits that indicate whether or not the Autosampler CE sensors are detecting an object.

1. Access the Autosampler CE keypad by loosening the captive thumbscrews on the keypad cover and tilting the cover down.

2. Press the TEST key three times. The Autosampler CE screen displays:

Test Sensors

4. Press ENTER to select the test displayed on the screen. The Autosampler CE screen displays a series of 0s and 1s. For example:

Sensors 1100 1110 000

Each digit in this screen corresponds to a separate sensor on the Autosampler CE.

4. Use Table 6.2 (on the next page) to determine which digit corresponds to the sensor you want to test. Then move the object being detected by the sensor (*e.g.*, remove the silver lid from its storage position), and watch the screen. If the digit changes (from 0 to 1 or from 1 to 0) as you move the object, the sensor is working correctly.

   Table 6.3 (pages 6-12 to 6-13) explains what each sensor indicates when a 0 (zero) or 1 is displayed.

5. Press ESCAPE/CLEAR to exit the Sensors test.

NOTE: When you have finished using the Autosampler CE keypad, remember to close the keypad cover and finger-tighten the thumbscrews before starting a method.

Table 6.2
The Sensor Test Digits

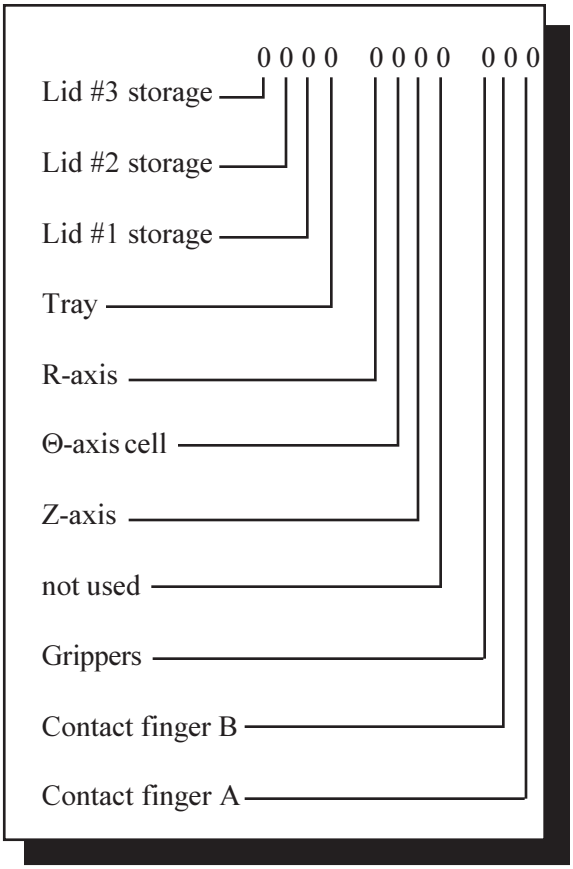


Table 6.3
Explanation of Sensors

Sensor	Indication
Lid #3 storage	1 = Lid #3 (the large lid) is in its storage position. 0 = Lid #3 is not in its storage position.
Lid #2 storage	1 = Lid #2 (the medium-sized lid) is in its storageposition. 0 = Lid #2 is not in its storage position.
Lid #1 storage	1 = Lid #1 (the small lid) is in its storage position. 0 = Lid #1 is not in its storage position.
Tray	1 = The sample tray is fully inserted. 0 = The tray is not fully inserted.
R-axis	1 = The turret arm is centered over the turret assembly (halfway between the innermost and outer-most limits; see Figure 6.3). 0 = The arm is not centered over the turret assembly.

(table continued)

Table 6.3 (continued)

Sensor	Indication
Θ-axis cell	1 = The turret arm is over the DSC cell (see Figure 6.4). 0 = The turret arm is not over the DSC cell.
Z-axis	1 = The turret is in the full-up position (see Figure 6.5). 0 = The turret is not in the full-up position.
Grippers	1 = The grippers are holding an object or the fingers are touching each other. 0 = The grippers are open.
Contact finger B*	1 = A finger (one side of the grippers) is contacting the cell. 0 = No contact.
Contact finger A*	1 = A finger (one side of the grippers) is contacting the cell. 0 = No contact.

* The sides of the grippers to which "finger A" and "finger B" correspond vary for each Autosampler CE .You can easily determine this by touching one of the fingers with a short piece of wire, touching the other end of the wire to the cell, and watching to see which sensor changes to "1."

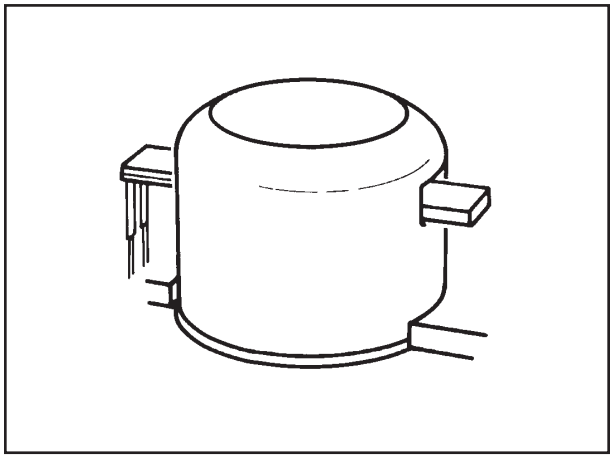


Figure 6.3
Arm Centered Over Turret Assembly

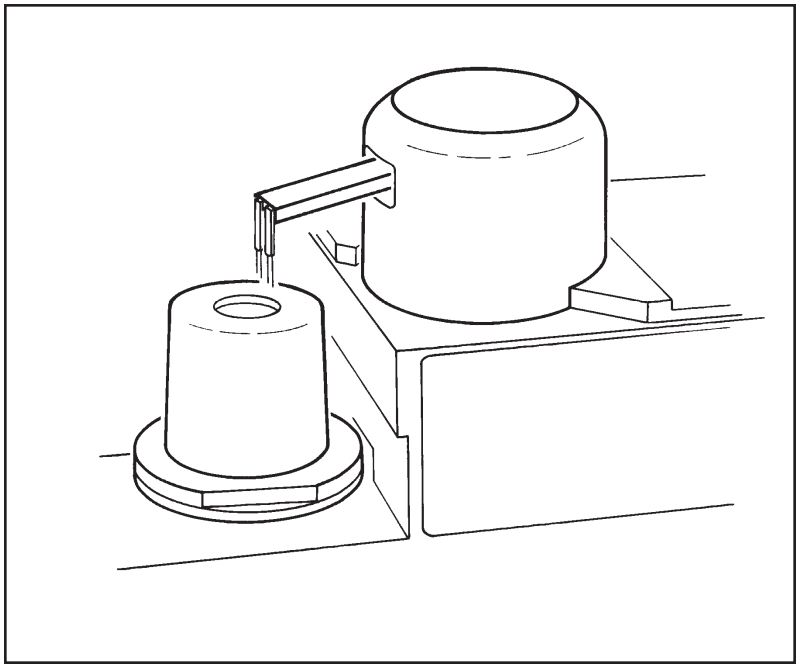


Figure 6.4
Turret Over Cell

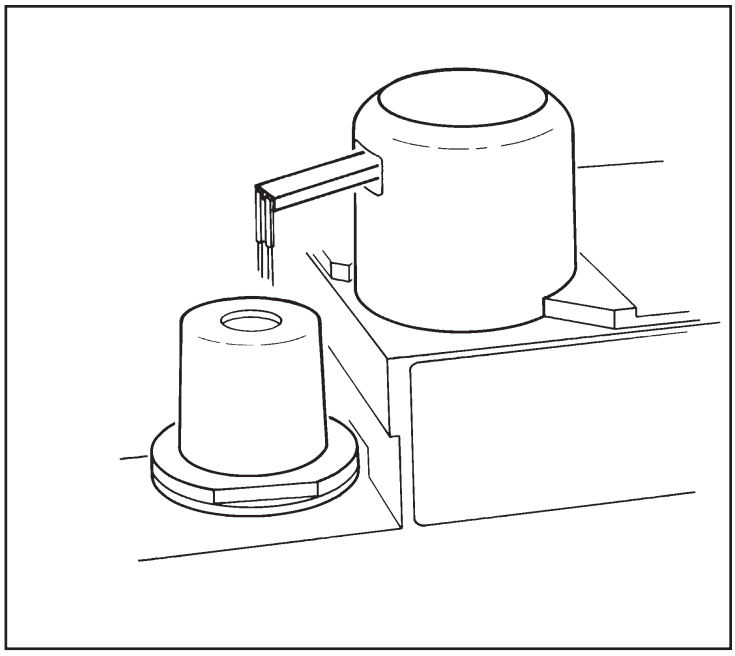


Figure 6.5
Turret in Full-Up Position

The Rear Switches Test

The Rear Switches Test determines the current settings of the system configuration jumpers inside the Autosampler CE.

1. Access the Autosampler CE keypad by loosening the captive thumbscrews on the keypad cover and tilting the cover down.

2. Press the TEST key four times. The Autosampler CE screen displays:

   ```
   Test
   Rear Switches
   ```

3. Press ENTER to select the test displayed on the screen. The Autosampler CE displays a series of 0s and 1s. For example:

   ```
   Rear Switches
   10000 01100
   ```

   A zero (0) digit means that the jumper is off; one (1) indicates that the jumper is on.

NOTE: When you have finished using the Autosampler CE keypad, remember to close the keypad cover and finger-tighten the thumbscrews before starting a method.

The Keyboard Test

The Keyboard test checks that all Autosampler CE keys are working properly.

1. Access the Autosampler CE keypad by loosening the captive thumbscrews on the keypad cover and tilting the cover down.

2. Press the TEST key five times. The Autosampler CE screen displays:

Test
Keyboard

3. Press ENTER to select the test displayed on the screen.

4. Press each key on the Autosampler CE keyboard (except the ESCAPE/CLEAR key), and watch the screen to ensure that the key displayed on the screen matches the one you are pressing.

   For example, if you press the MANUAL/AUTOMATIC key, the Autosampler CE screen should display:

Manual
Automatic

5. Press ESCAPE/CLEAR when you are ready to exit the Keyboard test.

NOTE: When you have finished using the Autosampler CE keypad, remember to close the keypad cover and finger-tighten the thumbscrews before starting a method.

The GPIB Test

The GPIB test enables you to verify the GPIB address setting for the Autosampler CE (for further information, see Chapter 2).

1. Access the Autosampler CE keypad by loosening the captive thumbscrews on the keypad cover and tilting the cover down.

2. Press the TEST key six times. The Autosampler CE screen displays:

Test GPIB

3. Press ENTER to select the test displayed on the screen. The screen should display a numeral ten higher than the address you set when you configured your DSC:

GPIB Address = xx

   For example:

   DSC 2920 address = 1
   Autosampler CE address = 11

4. Press ESCAPE/CLEAR to exit the GPIB test.

NOTE: When you have finished using the Autosampler CE keypad, remember to close the keypad cover and finger-tighten the thumbscrews before starting a method.

The Display Test

The Display test checks the Autosampler CE screen.

1. Access the Autosampler CE keypad by loosening the captive thumbscrews on the keypad cover and tilting the cover down.

2. Press the TEST key seven times. The Autosampler CE screen displays:

   Test
   Display

3. Press ENTER to select the test displayed on the screen. Strings of characters continuously move across the screen:

   DEFGHIJKLMNOPQRS
   TUVWXYZ[¥]^_'abc

4. Watch the display carefully to check for:

   - Missing rows
   - Missing columns
   - Missing pixels (see Figure 6.6 on the next page).

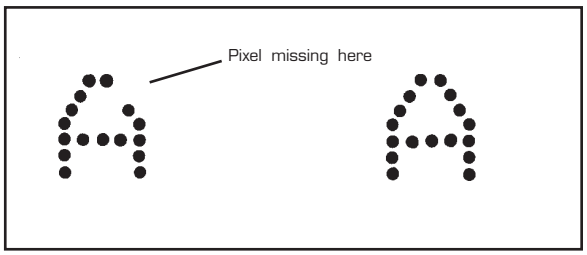


Figure 6.6 Display Showing Missing Pixel

5. Press ESCAPE/CLEAR to exit the Display test.

NOTE: When you have finished using the Autosampler CE keypad, remember to close the keypad cover and finger-tighten the thumbscrews before starting a method.

The Motion Test

The motion test overrides the software limits on Autosampler CE motor movement so that service personnel can perform motor diagnostics tests. The software limits protect the hardware from damage and prevent the motors from being overdriven.

♦ ***CAUTION:*** **The following test is provided primarily for TA Instruments service use. Improper use of this test can cause damage to the turret mechanism. Please contact an authorized service representative for further information.**

1. Access the Autosampler CE keypad by loosening the captive thumbscrews on the keypad cover and tilting the cover down.

2. Press the TEST key eight times.

The Autosampler CE screen displays:

Test Motion

3. Press ENTER to select the test displayed on the screen. The screen displays:

Motion Test

4. Press any of the motion keys. The motor continues to run even when the turret assembly reaches an obstacle. Note that the GRIP and RELEASE keys move the fingers incrementally instead of fully opening and closing them in single keystrokes.

♦ ***CAUTION:***

Once the turret stops moving, release the motion key. Do not attempt to continue motion once the motor stalls against an internal mechanical stop.

5. Press ESCAPE/CLEAR to exit the Motion test.

NOTE:

When you have finished using the Autosampler CE keypad, remember to close the keypad cover and finger-tighten the thumbscrews before starting a method.

The Cycle A–B Test

The Cycle A–B test cycles the Autosampler CE between two positions of your choice to check the Autosampler CE 's motor operation.

♦ ***CAUTION:***

The following test is provided primarily for TA Instruments service use. Improper use of this test can cause damage to the turret mechanism. This test overrides the Autosampler CE's anticollision programming; collisions of the turret arm with the enclosure, cell, or sample tray are possible. NEVER leave this test operating unattended. Please contact an authorized service representative for further information.

1. Access the Autosampler CE keypad by loosening the captive thumbscrews on the keypad cover and tilting the cover down.

2. Press the TEST key nine times. The Autosampler CE screen displays:

Test Cycle A–B

3. Press ENTER to select the test displayed on the screen. The screen displays:

Cycle A–B Enter Point "A"

4. Use the motion keys to put the Autosampler CE in the first position you wish to cycle between, then press ENTER.

The screen displays:

Cycle A–B Enter Point "B"

5. Use the motion keys to put the Autosampler CE in the second position you wish to cycle between; then press ENTER. The screen displays:

Cycle A–B Enter to Start

6. Press ENTER. The Autosampler CE continuously cycles between points A and B.

♦ ***CAUTION:*** **Be ready to press the HALT key to prevent possible collisions of the turret arm with the enclosure, tray, or cell.**

Once you are sure that the path the Autosampler CE takes between points A and B will not result in a collision, you can cycle this test indefinitely.

7. Press ESCAPE/CLEAR to exit the Cycle A–B test.

NOTE: When you have finished using the Autosampler CE keypad, remember to close the keypad cover and finger-tighten the thumbscrews before starting a method.

Error Messages

This section defines and offers solutions for three types of Autosampler CE error messages:

(1) General error messages generated by the controller about the Autosampler CE.

(2) Error messages displayed on the Autosampler CE screen. These messages are explained in alphabetical order starting on page 6-25.

(3) Error messages generated by the Autosampler CE and shown on the controller screen.

General Error Messages

If you receive any general controller or instrument error messages, please access the online help provided with the *Thermal Solutions/ Advantage* software for detailed instructions, and read the guidelines given here.

NOTE: You can access online help by opening the Error Log in *Thermal Solutions/Advantage* Instrument Control and double-clicking on the error listed.

When an instrument error occurs, the AS run sequence halts and waits for you to correct the error. Once you have corrected the error, select **Control/Resume Motion** from the Autosampler CE menu to resume the AS run sequence. If you cannot correct the error, select **Control/ Reset** or **Control/Stop** from the Autosampler CE menu to stop the current run. Then select **Control/Start at** and select the next run in the run sequence to continue.

Messages on the Autosampler CE Display

The Autosampler CE display messages are divided into two lists: fatal errors and nonfatal errors. Some of the nonfatal errors are ignored, allowing operation to continue, and some cause the Autosampler CE to halt and wait for operator intervention.

Fatal Error Messages

Fatal error messages indicate a condition that must be corrected for operation to continue. The Autosampler CE always stops operating when a fatal error occurs.

Fatal Error 8155 U12

Problem: The confidence test has detected that the Autosampler CE 's scratch-pad RAM or I/O (input/output) is not properly storing what is written to it.

Solution: Turn off the Autosampler CE, and power up again. If you still receive this message, call a qualified service representative.

Fatal Error
Display

Problem: The confidence test has detected that the Autosampler CE screen is not properly displaying what is written to it.

Solution: Turn off the Autosampler CE and power up again. If you still receive this message, call a qualified service representative.

Fatal Error
EPROM Checksum

Problem: The confidence test has detected that the EPROM (erasable programmable read-only memory) containing the Autosampler CE programming has been partially erased or altered.

Solution: Turn off the Autosampler CE, and power up again. If you still receive this message, call a qualified service representative.

Fatal Error
Power Failure

Problem: The power supply has given a power-fail signal, indicating that it cannot deliver the voltages necessary to operate the Autosampler CE.

Solution: Turn off the Autosampler CE, and power up again. If you still receive this message, call a qualified service representative.

Fatal Error RAM U5

Problem: The confidence test has detected that the RAM storing data for the Autosampler CE is not operating correctly.

Solution: Turn off the Autosampler CE, and power up again. If you still receive this message, call a qualified service representative.

Fatal Error Timer Interrupt

Problem: The confidence test has detected that the master clock signal that times all Autosampler CE functions is not operating correctly.

Solution: Turn off the Autosampler CE, and power up again. If you still receive this message, call a qualified service representative.

Fatal Error Unknown Interr.

(unknown interrupt)

Problem: The processor has been interrupted from normal operation for an unknown reason.

Solution: Turn off the Autosampler CE, and power up again. If you still receive this message, call a qualified service representative.

Fatal Error Watchdog Timeout

Problem: The Autosampler CE has detected an internal electronics or software malfunction.

Solution: Turn off the Autosampler CE, and power up again. If you still receive this message, call a qualified service representative.

Nonfatal Error Messages

Nonfatal error messages indicate a condition that may require operator intervention to correct the problem and allow the Autosampler CE to continue.

Cal. Mem. Error <position>

(calibration memory error)

Problem: The value for the indicated calibration position has been erased.

Solution: Recalibrate the position displayed on the screen (see Chapter 4).

Contact Error Finger "X"

(X = A or B)

Problem: One of the gripper fingers has touched the DSC cell. Motion is stopped when this occurs, to prevent damage to the cell or gripper fingers. All motion keys except the RAISE key become inoperable.

Solution: Press the RAISE key to clear the gripper fingers from the cell. Then use the other motion keys to reposition the grippers before you retry the interrupted task.

- OR -

Press RESET SAMPLER and then press ENTER to return the Autosampler CE to the home position; then retry the interrupted task.

NOTE: The "Contact Error" messages are functional only when the Autosampler CE is connected to the GPIB and is plugged into an outlet to provide a ground.

Contact Error Both Fingers

Problem: Both of the gripper fingers have touched the DSC cell. Motion is stopped when this occurs to prevent damage to the cell or gripper fingers. All motion keys except the RAISE key become inoperable.

Solution: Press the RAISE key to clear the gripper fingers from the cell. Then use the other motion keys to reposition the grippers before you retry the interrupted task.

- OR -

Press RESET SAMPLER and then press ENTER to return the Autosampler CE to home position; then retry the interrupted task.

Error GPIB IC U13

Problem: The confidence test has detected that the TMS9914 chip cannot generate

proper commands; this indicates a faulty part.

Solution: Turn off the Autosampler CE, and power up again. If you still receive this message, call a qualified service representative.

Error
Holding unk. obj

(holding unknown object)

Problem: (1) The Autosampler CE was switched to automatic mode while it was holding an object or was halted (with the Halt Motion key) while the grippers were closing on an object.

- OR -

(2) You manually gripped an object with the motion keys, then attempted to use the LOAD or LIDS key.

Solution: (1) Switch to manual mode (see Chapter 3), and release the object with the RELEASE key. Then return to automatic mode.

- OR -

(2) Release the object with the RELEASE key; then retry your command.

Error
Keyboard shorted

Problem: One or more of the Autosampler CE keys is shorted or was pressed during the confidence test.

Solution: Turn off the Autosampler CE, and power up again. If you still receive this message, call a qualified service representative.

Error
Lid #x dropped

Problem: The Autosampler CE has dropped a lid (lid #1, #2, or #3) or had trouble picking it up. This can be caused by (1) incorrect calibration, (2) bent or damaged gripper fingers, or (3) a faulty Autosampler CE gripper mechanism.

Solution: Try recalibrating the related position(s); then repeat the task. If the error occurs again, call a qualified service representative.

Error
Lid #x missing

Problem: The Autosampler CE cannot find a lid (lid #1, #2, or #3) either in its storage position or on the DSC cell.

Solution: Return the lid to its storage position. When the Autosampler CE senses the lid, it should return to normal operation. If this does not work, test the lid storage sensor with the TEST key (see page 6-9).

If this error message appears when the Autosampler CE is gripping a lid, the gripper sensor may be malfunctioning; test the gripper sensor with the TEST key.

```
Error
Lid #x not strd.
```

(Lid #x not stored)

Problem: The Autosampler CE has been reset with one of the Reset Sampler keys, and one of the lids (lid #1, #2, or #3) has not been returned to its storage position.

Solution: Use tweezers to return the lid to its storage position. If the Autosampler CE is in manual mode, press ESCAPE/CLEAR to clear the error message from the screen.

Error Pan #xx dropped

Problem: The Autosampler CE has dropped a pan or cannot pick it up (xx indicates the sample tray number). This can be caused by (1) incorrect calibration, (2) bent or damaged gripper fingers, or (3) a faulty Autosampler CE gripper mechanism.

Solution: Try recalibrating the related position(s); then repeat the task. If the error occurs again, call a qualified service representative.

Error Pan #xx missing

Problem: A pan that the Autosampler CE is attempting to load or unload is missing from the DSC cell or the tray.

Solution: Whether the pan is missing from the cell or the tray, return it to its proper sample tray position, and return all other pans in the cell to their proper tray positions. Press **Reset**, then select **Start AS-Run.** Enter the run number of the failed run to retry the task.

Error Position Empty

Problem: The Autosampler CE has been commanded to unload a pan from an empty cell position, or you used tray position zero (0) to unload a pan after pressing one of the Reset Sampler keys.

Solution: Enter a sample pan number (other than zero) when using the LOAD key to unload a pan after the Autosampler CE has been reset.

Errorr-axis motor or sensor

Problem: The confidence test has detected that the r-axis (in/out) motor is not running properly or that motion of the turret arm is not being sensed by the r-axis sensor.

Solution: When the confidence tests finish, try moving the r-axis motor by pressing the EXTEND and RETRACT keys. If the turret assembly does not move, the motor needs to be serviced. If the turret moves, test the r-axis sensor with the TEST key (see page 6-9). If the sensor is malfunctioning, have the sensor serviced.

Error theta-axis
motor or sensor

Problem: The confidence test has detected that the θ-axis (rotation) motor is not running properly or that rotation of the turret is not being sensed by one of the θ-axis sensors.

Solution: When the confidence tests finish, try moving the θ-axis motor by pressing the ROTATE CW and ROTATE CCW keys. If the turret assembly does not move, the motor needs to be serviced. If the turret moves, test the θ-axis sensor with the TEST key (see page 6-9). If the sensor is malfunctioning, have the sensor serviced.

Error
Watchdog Timer

Problem: The watchdog timer is taking too long to time out during the confidence tests.

Solution: Turn off the Autosampler CE, and power up again. If you still receive this message, call a qualified service representative.

Error z-axis
motor or sensor

Problem: The confidence test has detected that the z-axis (up/down) motor is not running properly or that the motion of the turret arm is not being sensed by the z-axis sensor.

Solution: When the confidence tests finish, try moving the z-axis motor by pressing the RAISE and LOWER keys. If the turret assembly does not move, the motor needs to be serviced. If the turret moves, test the z-axis sensor with the TEST key (see page 6-9). If the sensor is malfunctioning, have the sensor serviced.

GPIB Error 50
no command found

Problem: A null GPIB command was sent from the controller to the Autosampler CE.

Solution: Close the DSC Instrument Control window, and turn off the Autosampler CE. Then restart the Autosampler CE, reopen DSC Instrument Control, and retry your operation.

GPIB Error 51
unknown command

Problem: An undefined GPIB command was sent from the controller to the Autosampler CE.

Solution: Close the DSC Instrument Control window, and turn off the Autosampler CE. Then restart the Autosampler CE, reopen DSC Instrument Control, and retry your operation..

GPIB Error 52
missing AC type

Problem: An undefined GPIB command was sent from the controller to the Autosampler CE.

Solution: Close the DSC Instrument Control window, and turn off the Autosampler CE. Then restart the Autosampler CE, reopen DSC Instrument Control, and retry your operation.

GPIB Error 53
extra characters

Problem: A GPIB command containing extra characters was sent from the controller to the Autosampler CE.

Solution: Close the DSC Instrument Control window and turn off the Autosampler CE. Then restart the Autosampler CE, reopen DSC Instrument Control, and retry your operation.

GPIB Error 54
non-num. AC type

(non-numeric AC type)

Problem: An undefined GPIB command was sent from the controller to the Autosampler CE.

Solution: Close the DSC Instrument Control window, and turn off the Autosampler CE. Then restart the Autosampler CE, reopen DSC Instrument Control, and retry your operation.

GPIB Error 55
unknown AC type

Problem: An undefined GPIB command was sent from the controller to the Autosampler CE.

Solution: Close the DSC Instrument Control window, and turn off the Autosampler CE. Then restart the Autosampler CE, reopen DSC Instrument Control, and retry your operation.

GPIB Error 56
bad sequence num

(bad sequence number)

Problem: The sequence number of a GPIB command sent to the Autosampler CE contains a non-numeric character.

Solution: Close the DSC Instrument Control window, and turn off the Autosampler CE. Then restart the Autosampler CE, reopen DSC Instrument Control, and retry your operation.

GPIB Error 57 no sequence num.

(no sequence number)

Problem: A GPIB command sent to the Autosampler CE does not contain a sequence number.

Solution: Close the DSC Instrument Control window and turn off the Autosampler CE. Then restart the Autosampler CE, reopen DSC Instrument Control, and retry your operation.

GPIB Error 58 large sequen num

(large sequence number)

Problem: The sequence number of a GPIB command sent to the Autosampler CE is too large.

Solution: Close the DSC Instrument Control window, and turn off the Autosampler CE. Then restart the Autosampler CE, reopen DSC Instrument Control, and retry your operation.

GPIB Error 59
non-num pan num.

(non-numeric pan number)

Problem: The sample pan number in a GPIB command contains a non-numeric character.

Solution: Close the DSC Instrument Control window, and turn off the Autosampler CE. Then restart the Autosampler CE, reopen DSC Instrument Control, and retry your operation.

GPIB Error 60
bad pan number

Problem: The sample pan number in a GPIB command does not exist.

Solution: Close the DSC Instrument Control window, and turn off the Autosampler CE. Then restart the Autosampler CE, reopen DSC Instrument Control, and retry your operation.

GPIB Error 62
no pan number

Problem: A GPIB command sent to the Autosampler CE does not contain a pan number.

Solution: Close the DSC Instrument Control window, and turn off the Autosampler CE. Then restart the Autosampler CE, reopen DSC Instrument Control, and retry your operation.

GPIB Error 63
no “B” position

Problem: A GPIB command was sent to the Autosampler CE to load or unload sample B from a DSC cell.

Solution: Close the DSC Instrument Control window, and turn off the Autosampler CE. Then restart the Autosampler CE, reopen DSC Instrument Control, and retry your operation.

GPIB Error 64
no pan in ref

(no pan in reference position)

Problem: The Autosampler CE has been commanded to unload a pan from an empty cell reference position. Remember that the Autosampler CE always assumes that the DSC cell is empty whenever you press one of the Reset Sampler keys.

Solution: Close the DSC Instrument Control window, and turn off the Autosampler CE. Then restart the Autosampler CE, reopen DSC

Instrument Control, and retry your operation. If there is a pan in the reference position, remove it manually with tweezers.

GPIB Error 65 no pan in sample

Problem: The Autosampler CE has been commanded to unload a pan from an empty cell sample position. Remember that the Autosampler CE always assumes that the DSC cell is empty whenever you press one of the Reset Sampler keys.

Solution: Close the DSC Instrument Control window, and turn off the Autosampler CE. Then restart the Autosampler CE, reopen DSC Instrument Control, and retry your operation. If there is a pan the sample position, remove it manually with tweezers.

GPIB Error 68 rec buf overflow

(receive buffer overflow)

Problem: The Autosampler CE GPIB command-receiving buffer has overflowed.

Solution: Close the DSC Instrument Control window, and turn off the Autosampler CE. Then restart the Autosampler CE, reopen DSC Instrument Control, and retry your operation.

GPIB Error 69
xmit buf ovrflow

(transmit buffer overflow)

Problem: The Autosampler CE GPIB command-transmitting buffer has overflowed.

Solution: Close the DSC Instrument Control window, and turn off the Autosampler CE. Then restart the Autosampler CE, reopen DSC Instrument Control, and retry your operation.

GPIB Error 70
interface error

Problem: A GPIB interface error has occurred.

Solution: Close the DSC Instrument Control window, and turn off the Autosampler CE. Then restart the Autosampler CE, reopen DSC Instrument Control, and retry your operation.

GPIB Error 71
command too long

Problem: A GPIB command sent to the Autosampler CE is too long (longer than 32 characters).

Solution: Close the DSC Instrument Control window, and turn off the Autosampler CE. Then restart the Autosampler CE, reopen DSC Instrument Control, and retry your operation.

Parameter Error Zero-Power RAM

Problem: The confidence test has detected that one or more of the calibration values has been altered.

Solution: When the confidence tests finish, test all of the Autosampler CE's calibration positions (see "Checking Your Calibration" in Chapter 4), and recalibrate the position(s) that have been erased.

R step error +xxxxx steps

(or "–xxxxx steps")

Problem: The r-axis motor executed the wrong number of steps to complete a movement. The number is positive when the motor is retracting, and negative when the motor is extending. Small numbers of lost steps (<25) indicate a loose or worn gear, whereas frequent errors involving larger numbers indicate that the motor is binding.

Solution: The Autosampler CE immediately corrects for motor step errors, so this error condition usually does not require any operator action. If your Autosampler CE starts showing step errors with increasing frequency, however, you should have the unit serviced.

If you are calibrating the Autosampler CE, press the RESET SAMPLER key and recalibrate the current position whenever you receive a motor step error.

Theta step error +xxxxx steps

(or "–xxxxx steps")

Problem: The θ-axis motor had to execute the wrong number of steps to complete a movement. The number is positive when the movement is in the counter-clockwise direction, and negative for the clockwise direction. Small numbers of lost steps (<25) indicate a loose or worn gear, whereas frequent errors involving larger numbers indicate that the motor is binding.

Solution: The Autosampler CE immediately corrects for motor step errors, so this error condition usually does not require any operator action. If your Autosampler CE starts showing step errors with increasing frequency, however, you should have the unit serviced.

If you are calibrating the Autosampler CE , press the RESET SAMPLER key and recalibrate the current position whenever you receive a motor step error.

Waiting for tray

Problem: The Autosampler CE is attempting to remove a pan from the tray or return a pan to the tray, but the tray is missing or is not fully inserted.

Solution: Reinsert the tray, making sure you push it all the way back. If this does not correct the problem, you should test the tray sensor with the TEST key (see page 6-9).

Z step error
+xxxxx steps

(or "–xxxxx steps")

Problem: The z-axis motor had to execute the wrong number of steps to complete a movement. The number is positive when the turret assembly is moving down, and negative when it is moving up. Small numbers of lost steps (<25) indicate a loose or worn gear, whereas frequent errors involving larger numbers indicate that the motor is binding.

Solution: The Autosampler CE immediately corrects for motor step errors, so this error condition usually does not require any operator action. If your Autosampler CE starts showing step errors with increasing frequency, however, you should have the unit serviced.

If you are calibrating the Autosampler CE, press the RESET SAMPLER key and recalibrate the current position whenever you receive a motor step error.

Error Messages on the Controller Screen

All Autosampler CE–generated error messages that appear on the controller screen include the prefix "Err Axx:" (xx = the message number). Further information on these A# messages can be found when you access the online help provided with *Thermal Solutions/Advantage.*

NOTE: You can access online help by opening the Error Log in *Thermal Solutions/Advantage* Instrument Control and double-clicking on the error listed.

Error messages that appear in the form of message boxes are generally system-generated errors. For assistance in solving these problems, press the F1 key to access the online help (or select the **Help** button) to obtain information directly related to the message displayed.

Appendix A: Parts Lists & Ordering Information

Autosampler CE Parts Lists

Table A.1
Printed Circuit Boards

Part Number	Description
911110.901	Motor Drive
984270.901	Communications Board

Table A.2
Motors and Sensors

Part Number	Description
990720.901	Gripper Motor Assembly
990737.901	R-Axis (extend/retract) Motor Assembly
990737.902	Θ-Axis (rotation) Motor Assembly
990739.901	Z-Axis (up/down) Motor Assembly

Table A.3
Supplies

Part Number	Description
990999.901	DSC Autosampler CE Pan and Cover Kit

Table A.4
Miscellaneous Parts

Part Number	Description
990732.901	Autosampler CE Sample Tray (62 position)
990685.001	Die Punch for Crimped Sample Pan
990717.901	Gripper Finger Assembly
990687.001	Lid #1 Ambient (silver, with hole)
990686.002	Lid #2 (stainless steel)
990686.001	Lid #3 (aluminum)
990688.901	Sample Tray Lid
990689.001	Sample Tray Overlay

Ordering Information

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Fax: 1-302-427-4001

HELPLINE—U.S.A.
For technical assistance with current or potential thermal analysis applications, please call the Thermal Analysis Help Desk at 1-302-427-4070.

SERVICE—U.S.A.
For instrument service and repairs, please call 1-302-427-4050.

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Index

A

C

D

E

F

G

H

K

L

M

O

P

R

S

T

U

V

W

Z