 Denver Instrument Company

AB SERIES

Electronic Analytical Balances

Operating Instructions

AB-120

AB-160

AB-300

AB-250D

700374.3

1/1/92

Read all instructions prior to operating your AB Series Analytical Balance. Whenever using this unit, remember to follow appropriate operating and safety procedures and to observe all warning labels.

Strict compliance with all warranty stipulations must be maintained or warranty service will be voided. Repairs or internal adjustments performed by unauthorized personnel may cause serious damage.

For your reference and protection, record

Model Number _____

Serial Number _____

Purchase Date _____

Date Warranty Card Mailed _____

TABLE OF CONTENTS

Introduction	1
Features	3
Specifications	5
Installing Your Balance	7
Unpacking	7
Selecting A Work Area	9
Setting Up Your Balance	12
Power On	13
Factory Settings	14
Final Preparations	16
Operating Your Balance	17
General Directions	17
Using The Keyboard	21
Using The "Soft" Keys	23
Identifying The Display Icons	27
Calibrating Your Balance	29
Using The Manual Calibration Feature ...	30
Changing The Auto Calibrate Setting	31
Using External Weights	33
Basic Weighing	39
Taring	40
Parts Counting	42
Percentage Calculations	43
Configuring Your Balance	45
Setting Weigh Units	46
Setting Motorized Doors	47
Setting Balance Options	48
Balance ID	49
Preset Values	50
Auto Calibrate	51
Auto-Zero	53
Filter	54
Beeper	55
Lock Set Up	56


Setting Printer Options	59
Print	60
Print Interval	61
Zero Print	62
Output Format	63
Baud	64
Parity	65
Echo	66
Using Statistical Analysis	67
Dual Range Balance	71
Interface Applications	73
Technical Specifications	73
I/O Specifications	74
Output Specifications	75
I/O Commands	75
Connectors	80
Maintaining Your Balance	81
Commands.....	Appendix A
Glossary	Appendix B
Warranty Information	Appendix C
Customer Service Information	Appendix D

Thank you for choosing a Denver Instrument Analytical AB Balance for your weighing applications. This unit combines fully automatic operation with the latest in weighing technology to provide you with unprecedented ease of use and precision in weighing. In addition, this balance has been designed and engineered to the most rigorous standards in order to give you years of reliable weighing service.

This instruction manual covers the proper installation and operation of your balance and includes all warranty and guarantee information. In addition, our customer service department representatives and trained technicians are available to assist you with any problems or to answer any questions.

If we at Denver Instrument Company can be of further assistance to you, please call our toll-free number

In Colorado, call **1-800-321-1135.**
(303) 431-7255.

 Denver Instrument Company

FEATURES

Your AB Balance features:

- High-resolution liquid crystal display.
- Menu-driven user interface with highlighted cursor for easy selection.
- Temperature Activated Calibration (TAC).
- Keyboard with four "soft" keys plus 2 dedicated keys and TARE that provide access to more than 100 options and functions for custom balance applications.
- Choice of fifteen different weighing units, including parts counting.
- Motorized doors for easy chamber access.
- Statistical analysis.
- Help key provides easy-to-read messages for immediate information.
- Capacity indicator continuously displays total weight value to help avoid possible overload.
- Foot switch for remote door activation.
- Auto-switching power supply.
- Bidirectional RS-232C interface.
- Two-year warranty.
- Designed and manufactured in the U.S.A.

SPECIFICATIONS

Models	Single-Range Models			Dual-Range Model
	AB-120	AB-160	AB-300	AB-250D
Weighing Range/ Capacity	0 to 120 g	0 to 160 g	0 to 300 g	0 to 205 g 0 to 52 g
Readability	0.01 mg	0.1 mg	0.1 mg	0.1 mg 0.01 mg
Reproducibility	0.02 mg	0.1 mg	0.1 mg	0.1 mg 0.02 mg
Linearity	±0.06 mg	±0.2 mg	±0.2 mg	±0.2 mg 0.03 mg

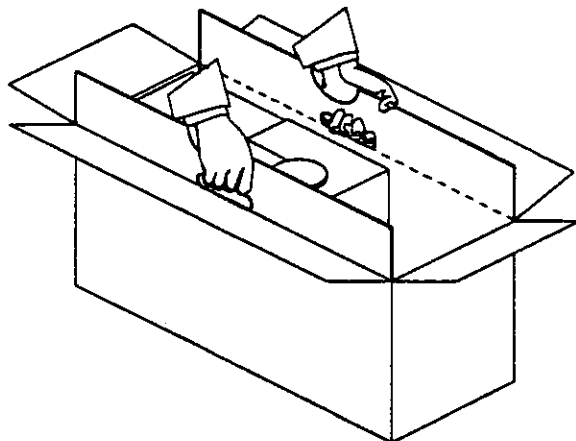
Common Specifications For All Models	
Pan Size:	3.25 inch (8cm)
Temperature Specifications:	57° - 104°F (14° - 40°C)
Dimensions (LxWxH):	19 x 9 x 12 inch (48 x 20 x 31cm)
Net Weight:	30 lb. (14kg)
Electrical Requirements:	115/230 vac, 50/60Hz, universal input
Controls:	Silicone rubber keyboard, 4 soft keys, 2 dedicated keys, Tare bar
Display:	Liquid Crystal Display with .5" high digits
Motorized Doors:	Manual and automatic control
RS-232C interface	Standard on all models

INSTALLING YOUR BALANCE

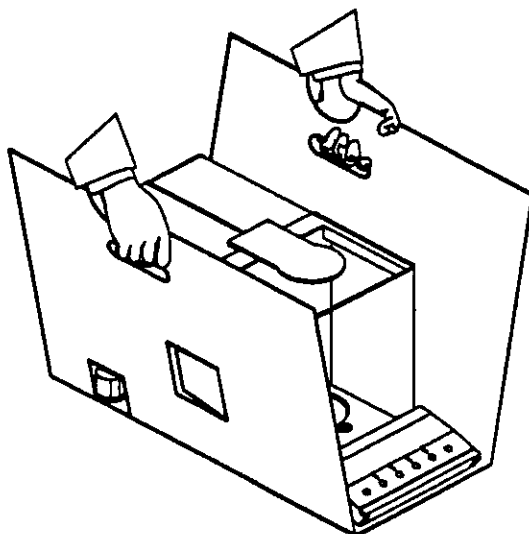
Before installing your balance, **read this entire section.**

Unpacking

- ▶ Try to avoid damaging the box and packing materials when you unpack the balance. We recommend that you keep all packing materials for possible future use.



Open the top of the box and locate the inner liner that has a handle at each side.



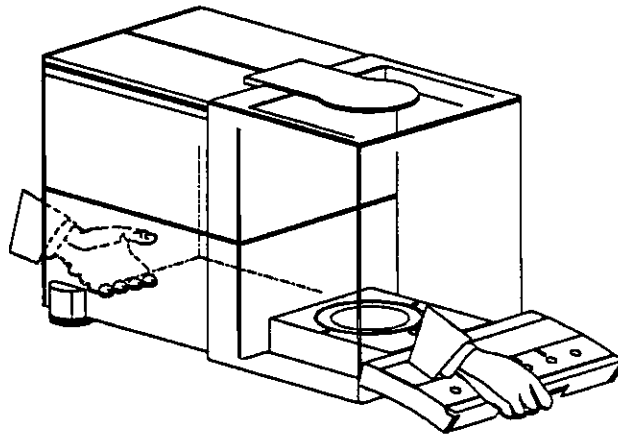
Lift the balance out of the box by raising the liner by its handles.

- Check the contents of the shipping carton.

You will find the following items:

- AB Analytical Balance
- Power Supply
- Power Cord
- Weighing Pan
- Foot Switch
- Stainless steel trim plate
- AB Operating Instructions
- Warranty Card

- **Important:** Carry the balance by placing one hand under the rear housing and the other hand under the front panel. **Do not** lift the front of the balance by the **TARE** bar because that could damage the balance.

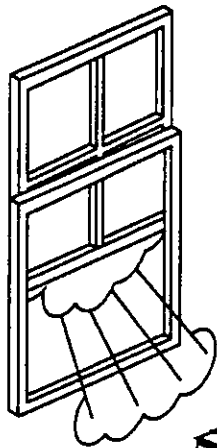


Selecting A Work Area

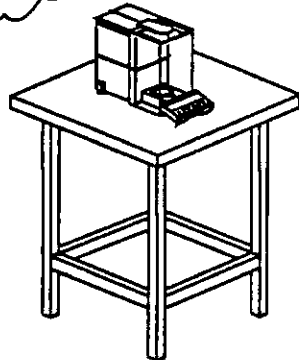
To optimize the performance of your AB Balance, select a suitable work area. In choosing a proper location, consider the following conditions that can affect the operation and accuracy of your balance performance.

Environment

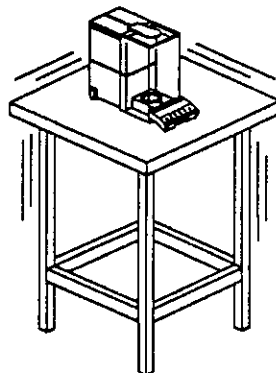
Environmental conditions do affect balance operation. Selecting a suitable environment is an important step in setting up your balance.

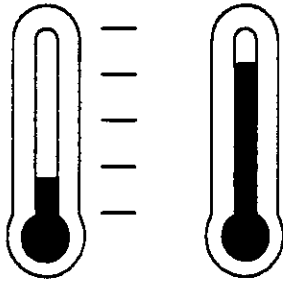


— No excessive drafts.

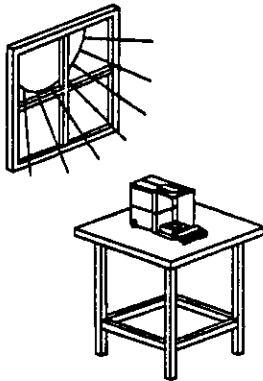


— No vibrations.





- No extreme temperature fluctuations or excessive room temperatures. (Avoid room temperatures above 40°C / 104°F or below 14°C / 57°F.)



- No direct sunlight.

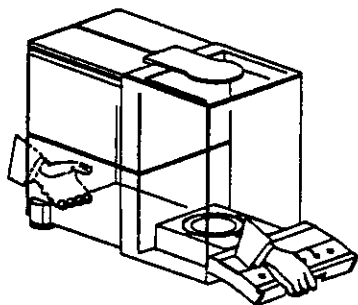
Work Station

Choosing a suitable work station ensures that your balance will give you maximum performance. Selecting a proper location is another important step in setting up your balance.

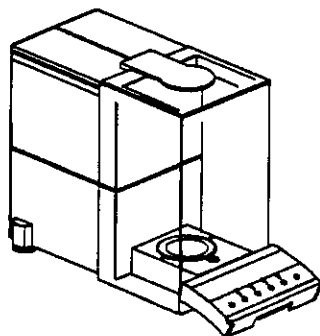
- A firm, level surface.
- No power surges.
- No magnetic materials nearby.

Setting Up Your Balance

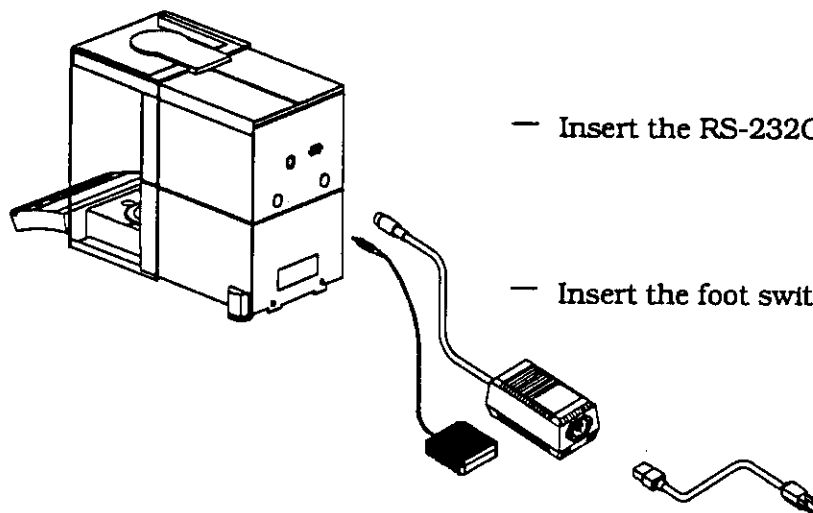
After selecting a suitable work area, set up your balance by following the steps below:



- Place the balance in a suitable location, taking care to carry it with one hand under the rear housing and the other hand under front panel. **Do not** raise the front of the balance by the TARE bar.



- Level the balance by using the level bubble and leveling feet.
- Place stainless steel trim plate in weighing chamber.
- Place the weighing pan in position and gently rotate until properly seated. Pan should be centered within stainless trim plate and **not** be touching anything.
- Insert the power cord and position the power supply away from the unit.

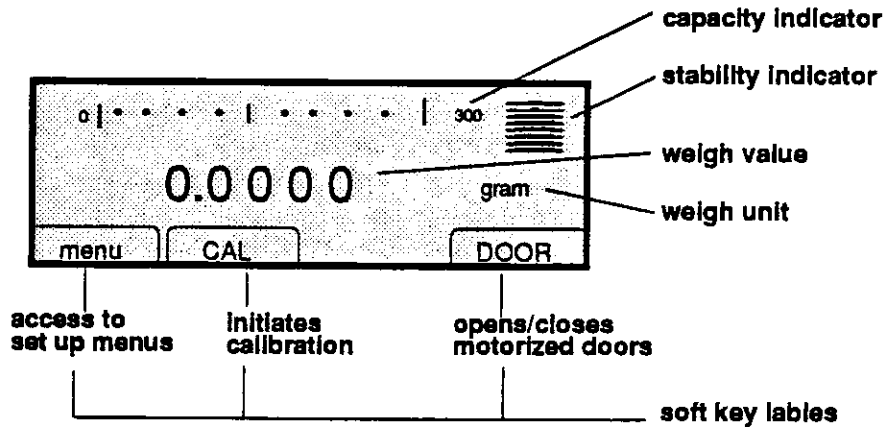


- Insert the RS-232C cable if used.
- Insert the foot switch if desired.

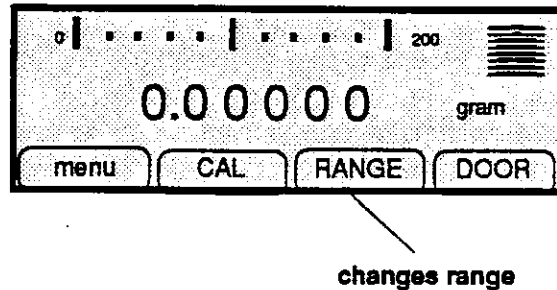
Power On

When the balance is plugged in, the display turns on and the main screen appears. The balance may take a few minutes to stabilize. If the balance is undisturbed and stable for several minutes, the automatic calibration cycle will begin. The main screen is the weighing screen and displays the weight value in large numerals. In addition, this screen supplies information related to your weighing application and your balance. It also provides access to other menus and features. However, the displays on the main screen vary slightly depending upon the model you are using. (See examples below.)

**Main Screen
AB-300**



**Main Screen
AB-250D**



FACTORY SETTINGS (Defaults)

- The AB Balance is set to operate using factory settings (defaults). These settings (with a brief description of each one) are listed below.

units — gram
Weight unit.

doors — manual
Doors operate by pressing the **DOOR** key or pressing the foot switch.

range* — coarse
Weight display shows value to 4 decimal places.

Balance set up

preset values — default
Activates factory settings.

auto calibrate — on
Balance will initiate calibration cycle using internal weights after an internal 1 degree C temperature change and a 2 minute delay provided display reading is stable.

auto zero - on
Correction for zero display is activated.

filter — 3
Sets filter speed and stability detection at 3 — Andante.

beeper — off
Beeper does not sound.

lock set up menu — off
A software lock that disables the set up keys is not engaged.

*applies to the AB-250D.

Printer set up (Defaults)

If you have interfaced this balance to a computer or printer, then the following printer defaults are used:

print — manual, after stable reading

Prints after the balance has stabilized when you press the **print** key.

print interval — 5 seconds

Prints every 5 seconds.

zero print — off

Does not print when weight is zero.

output format — 1

Uses the following output format:

Stable	Unstable
1+0010.0002	U+0010.0002
1-0000.0003	U-0000.0003

baud — 300

Data input/output rate is set at 300.

parity — none

This option that permits you to set a control bit to check the accuracy of serially transmitted data is not turned on.

echo — on (full duplex)

allows whatever is typed on the computer to appear on the host computer or terminal screen.

FINAL PREPARATIONS

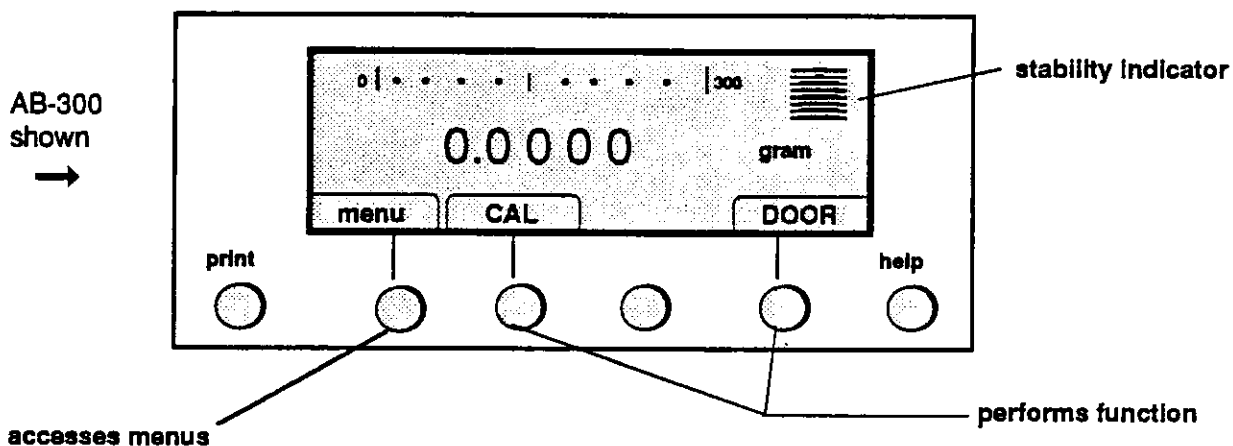
For AB-250D and AB-120 models, optimum results in the semi-micro range (0.00001) are obtained with a 24 hour warm-up period. Also, if a balance is to be moved it is optimum to wait 24 hours before precision weighing.

- Allow 60 minutes for the balance to warm up.
- While you're waiting:
 - Complete the enclosed warranty card and return it to Denver Instrument Company. Also, record the warranty information in the space provided inside the front cover of this manual.
 - Please read through this manual to be familiar with the balance features.

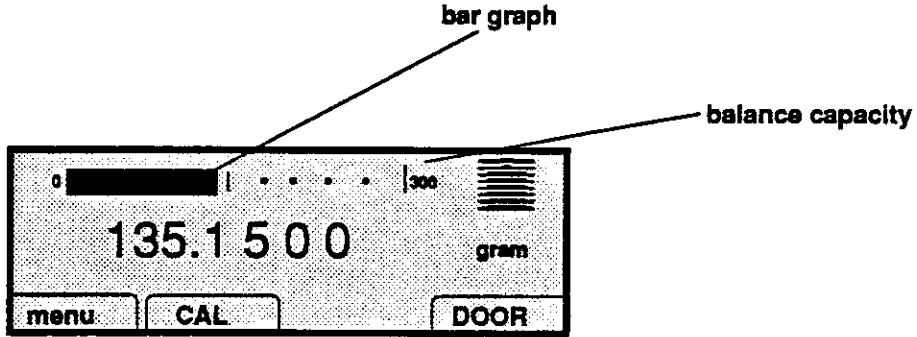
OPERATING YOUR BALANCE

General Directions

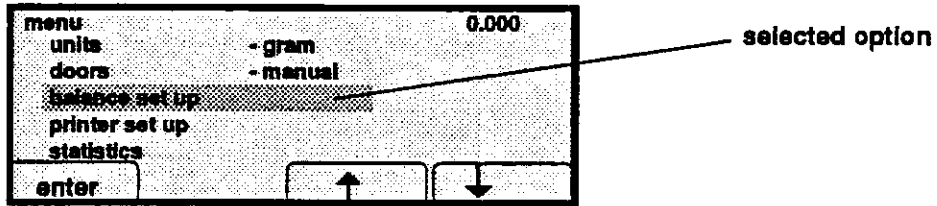
- Do not unplug your balance. This unit remains more stable if continuously plugged in.
- The number of decimal places in the display depends upon the model and units you are using.
- For best weighing results, all doors should be closed during the weighing process.
- When information is given on the display, **lower case words indicate selection of another screen** and upper case words indicate performance of a function.



- A bar graph on the main display indicates the total weight placed on the weighing pan in relation to the balance capacity.

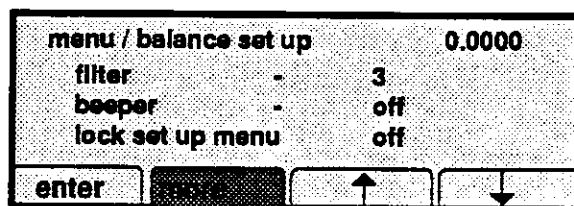


- When scrolling through the menus, the highlighted word(s) are the menu item selected.



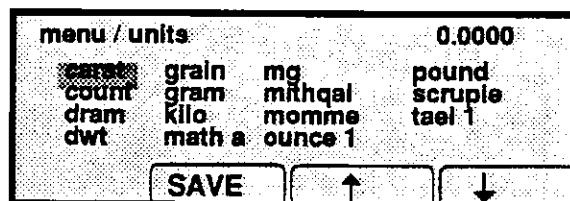
- To change the highlighted item in order to access a menu:
 - Use the appropriate arrow key to scroll to the desired option.
 - Press the **enter** key to select it.

- If menus have additional options displayed on another screen, the **more** key is highlighted as a reminder to press it. Pressing the **more** key toggles between both screens that reside under the same menu.



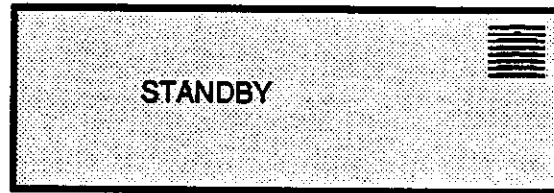
additional
menu listing

- To select and save a highlighted option:



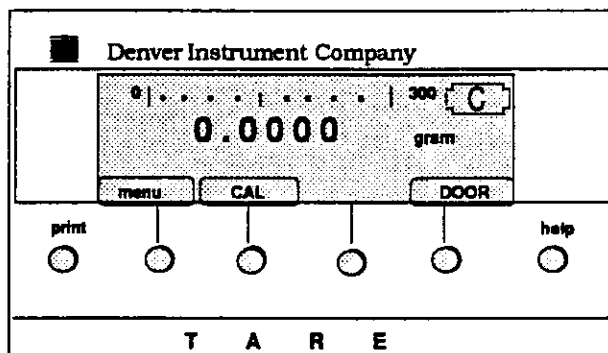
- Use the appropriate arrow key to scroll to the desired option.
 - Press the **SAVE** key to select it.
(This also returns the display to the previous menu screen.)
- All settings reside in memory, even if the balance is powered down, if saved as a "user" number. (See page 50.)

- When you are not using your balance, you may put the balance in **STANDBY** by slightly lifting up the **TARE** bar. Pressing any key returns the display to its normal operating mode.



Using The Keyboard

The keyboard on your analytical balance has been designed for convenient and easy usage. Six keys and a TARE bar provide access to all menus and functions.



- Two dedicated keys (**print** and **help**) are labeled on the keyboard.
- **print** key - (when interfaced to a printer or computer)
Prints weighing data when stable;
Stores new values when in the statistics mode.

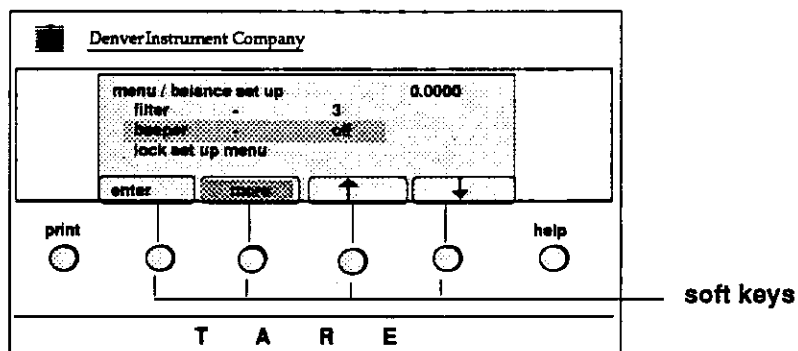
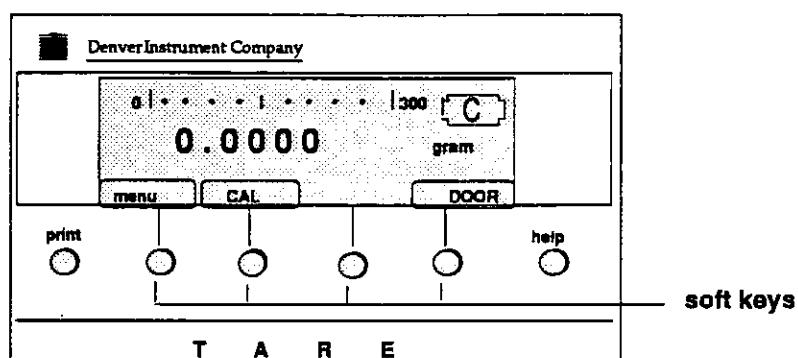
(if not interfaced to a printer or computer)
Stores new values and updates statistical results on the screen.
- **help** key - Provides information on any highlighted item on the display;
If main screen is displayed, provides information on the keys and screen.

- **four "soft" keys -** Not labeled on the keyboard. Their functions change depending upon which menu you access. These functions are identified by labels on the display. A key not having an identifying label on the display is disabled for that menu.

- **TARE bar -** Re-zeroes the display when the main screen is up. Returns the display to the previous menu when any other screen is up. Places the display in a standby mode that blanks the screen when you slightly lift up on the bar. Terminates taring or calibrating process.

USING THE "SOFT" KEYS

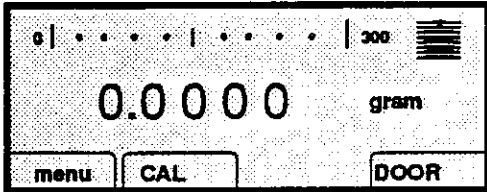
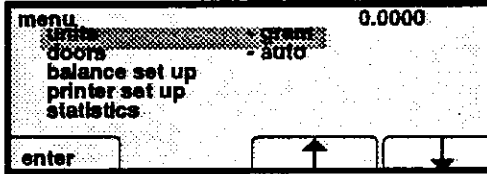
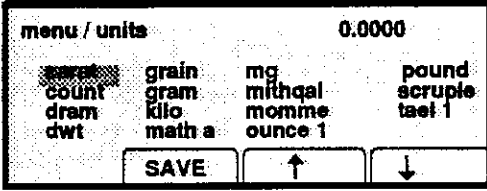
The four keys in the middle of the keyboard are not dedicated to a sole function and therefore are called "soft" keys. These keys simplify balance operation. As you change menus, the labels identifying the "soft" keys change. By reading the labels displayed on the screen, you can easily press the appropriate key for your procedure. If a key is not labeled on the display, that key is disabled for that menu.



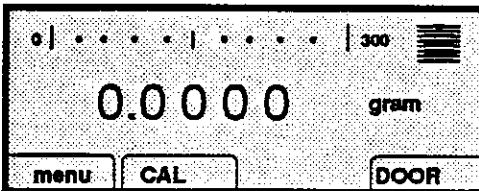
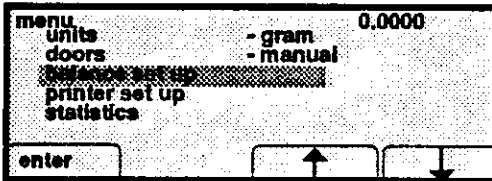
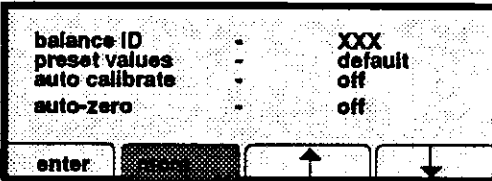
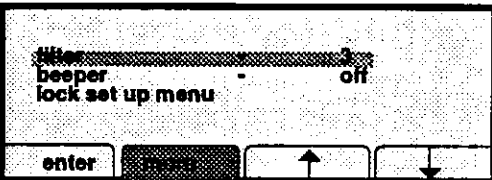
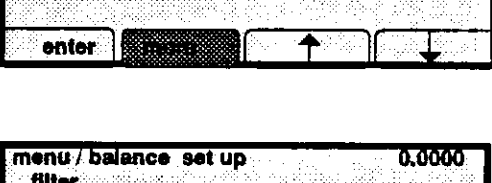
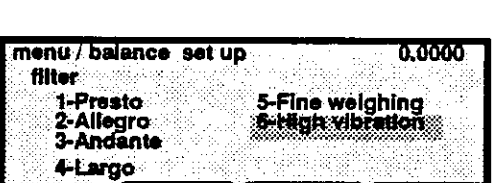
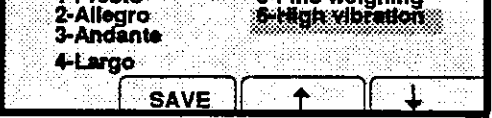
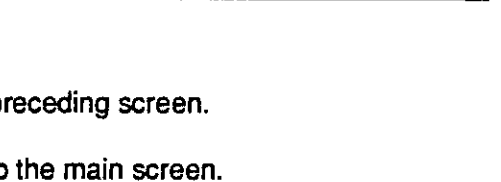
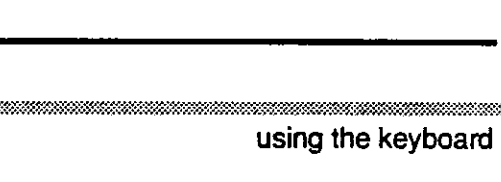
The steps for using these keys are the same on all models.

The AB-300 is being used for the two examples on the following pages.

Example 1. Changing the units from gram to carat.

	PROCEDURE	DISPLAY SHOWS
MAIN SCREEN	1. Begin on the main screen.	
	2. Press the menu key.	
MAIN MENU	3. Press the arrow key to scroll to units.	
	4. Press the enter key.	
UNITS MENU	5. Press the arrow key to scroll to carat.	
	6. Press the SAVE key to select the new weigh unit. (Display automatically returns to the main menu.)	
	7. Press the TARE bar to return to the main screen.	

Example 2. Changing the filter setting from 3 to 6.

PROCEDURE	DISPLAY SHOWS
1. Begin on the main screen.	
2. Press the menu key.	
3. Press the arrow keys to select balance set up.	
4. Press the enter key.	
5. If filter does not appear on the screen, press the more key.	
6. Press the arrow keys to select filter.	
7. Press the enter key.	
8. Press the arrow keys to select filter - 6.	
9. Press the SAVE key. (Display automatically returns to balance set up menu.)	

NOTE:

Press the **TARE** bar to return to the preceding screen.

Press the **TARE** bar again to return to the main screen.

Identifying The Display Icons

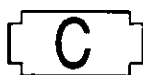
Various icons appear on the screen to quickly provide you with vital balance information. These icons let you know:

- when your balance needs to be calibrated;
- when your balance is in the process of being calibrated;
- when your balance is not stable;
- when your balance is stable;
- when your balance is taring.

(See examples below.)

The icons appear in the upper right hand corner of all screens.

Even though your balance has been calibrated at the factory prior to shipment, it needs to be re-calibrated before weighing your first sample. Also, you should re-calibrate it any time it is moved.



- flashes to indicate your balance needs calibration
- flashes to indicate previous failure to calibrate.



- indicates calibration procedure is in progress



- indicates balance is not stable



- indicates balance is stable and is calibrated



- indicates taring is in progress

Calibrating Your Balance

Your balance has two internal weights which automatically set the scale factor and linearity. All balances are calibrated at the factory prior to shipment. However, your balance is set to recalibrate itself when you power it up.

Many external conditions also can trigger recalibration of your balance. For example, a temperature change of 1.5°C initiates the calibration procedure. Turning the power off and turning the power on also initiates this procedure.

The calibration procedure begins automatically after a two-minute delay if the following conditions have occurred:

- no keys have been pressed.
- the foot switch has not been used.
- the balance is stable.
- display reads less than +/- .0010 counts.



Either pressing a key or using the foot switch resets the two-minute delay. However, the calibration icon flashes on the screen to let you know your balance needs to be recalibrated. At this time, you can either implement all of the above conditions for two minutes to enable the automatic calibration to take place or you can immediately recalibrate manually by using the easy two-step procedure on the next page.



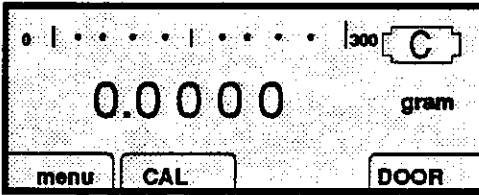
While your balance is recalibrating, the calibration icon appears on the upper right hand of the screen to let you know that this procedure is in progress.

USING THE MANUAL CALIBRATION FEATURE.

If you want to manually control the balance calibration procedure, change the setting in the balance set up menu to "auto-calibrate - off".

(See procedure on next page.)

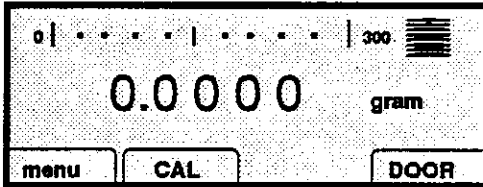
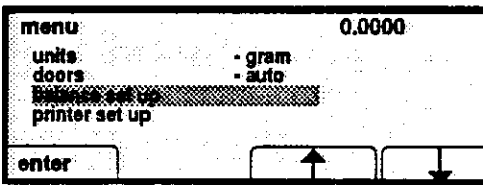
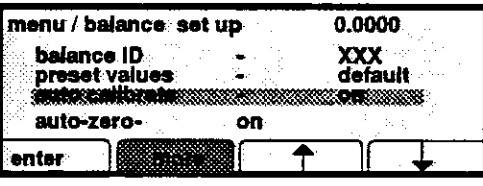
When this option has been set, the calibration icon flashes on the screen to remind you to initiate the recalibration process. Then simply use the procedure below.

PROCEDURE	DISPLAY SHOWS
<p>1. Press the TARE bar to return to the main screen. All weights must be off the pan and the displayed weight must be less than +0.001g. Close the doors if they are not all closed.</p>	
<p>2. Press the CAL key. All doors except top will close automatically.</p>	

When calibration is complete, the display returns to the main screen and the stability indicator appears.

If calibration fails, the flashing **C** icon will appear, re-tare balance and initiate **CAL** again.

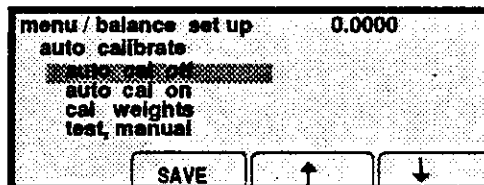
CHANGING THE AUTO CALIBRATE SETTING.

PROCEDURE	DISPLAY SHOWS
1. Begin with the main screen displayed. 2. Press the menu key.	 <p>The display shows a top status bar with a battery level indicator, a scale icon, and the number 300. Below this, the weight 0.0000 is displayed in large digits, followed by the unit 'gram'. At the bottom, there are three buttons labeled 'menu', 'CAL', and 'DOOR'.</p>
3. Use the arrow key to select balance set up . 4. Press the enter key.	 <p>The display shows a menu with '0.0000' in the top right corner. The menu items are: 'menu', 'units - gram', 'doors - auto', 'balance set up' (highlighted with a grey bar), and 'printer set up'. At the bottom, there is an 'enter' button, an up arrow button, and a down arrow button.</p>
5. If auto calibrate does not appear on the screen, press the more key. 6. Use the arrow keys to select auto calibrate . 7. Press the enter key.	 <p>The display shows 'menu / balance set up' in the top left and '0.0000' in the top right. The menu items are: 'balance ID - XXX', 'preset values - default', 'auto calibrate' (highlighted with a grey bar), and 'auto-zero- on'. At the bottom, there is an 'enter' button, a 'more' button (highlighted with a grey bar), an up arrow button, and a down arrow button.</p>

PROCEDURE

DISPLAY SHOWS

8. Use the arrow key to select **autocal** off or on.
9. Press the **SAVE** key.
10. Press the **TARE** bar until the display returns to the main screen.



USING EXTERNAL WEIGHTS

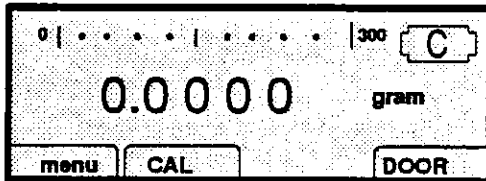
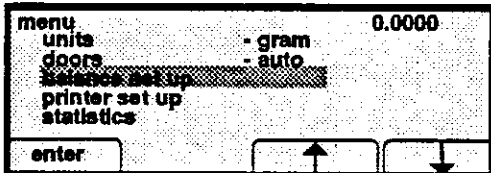
External calibration weights also can be used for calibration. Use a calibration weight with a value between half scale and full scale for your model. For example, a weight between 150g and 300g can be used to calibrate the AB-300 Balance. However, for optimal results, we recommend that you use the maximum permissible weight. NIST-traceable weight sets are available from Denver Instrument Company.

During calibration with external weights, the filter setting should be **5 - fine weighing** (See page 54).

To calibrate with an external weight there are two procedures:

- A** Setting the external weight being used.
- B** Performing calibration.

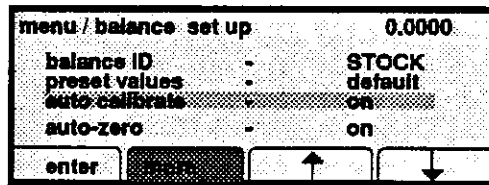
Calibrating using an external weight

A	PROCEDURE	DISPLAY SHOWS
	1. Have a weight ready that is within the permissible range, and know its exact weight.	
	2. Remove all weights from the pan and tare the balance.	
	3. Begin at the main screen.	
	4. Press the menu key.	
	5. Use the arrow keys to select balance set up .	
	6. Press the enter key.	

PROCEDURE

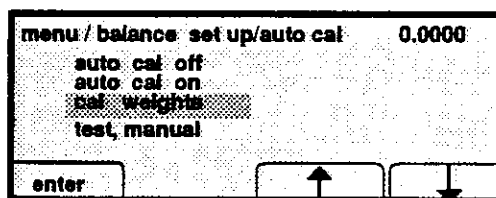
DISPLAY SHOWS

7. Use the arrow keys to select **auto calibrate**. (If **auto calibrate** is not displayed, press the **more** key, then select **auto calibrate** with the arrow keys.)



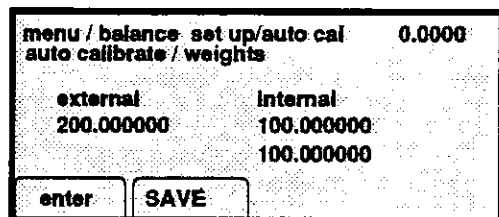
8. Press the **enter** key.

9. Use the arrow keys to select **cal weights**.



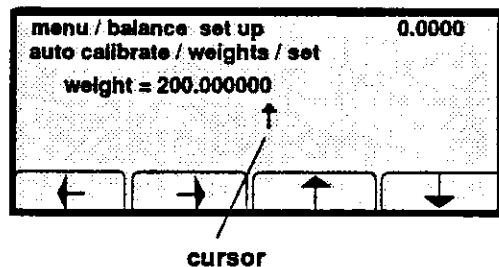
10. Press the **enter** key to access the **weights** menu.

11. Press the **enter** key again.



12. Use the left and right arrow keys to move the cursor to the digit you want to change.

13. Use the up and down arrow keys to change the numerical value.



PROCEDURE**DISPLAY SHOWS**

14. Press the **TARE** bar to return to the **weights** menu.

15. Press the **SAVE** key to store the new numerical value and to return to the **auto calibrate** menu.

menu / balance: set up		0.0000
auto calibrate / weights		
external		internal:
300.000000		100.000000
		100.000000
enter	SAVE	

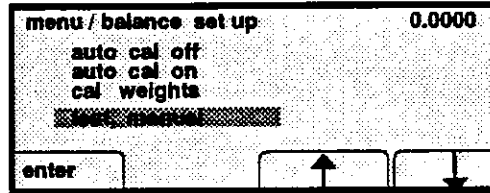
16. Continue to **B**

B

PROCEDURE

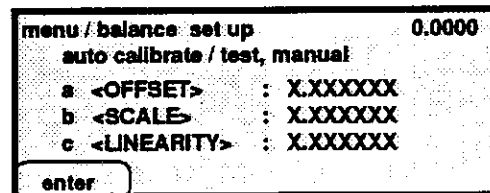
DISPLAY SHOWS

1. Use the arrow keys to select **test, manual**.



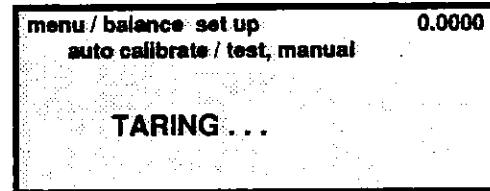
2. Press the **enter** key.

3. Press the **enter** key.
(At this point, the display prompts you.)

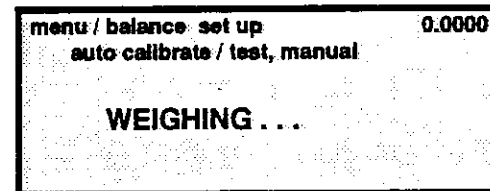


4. Remove weight from the weighing pan, then press the **enter** key.

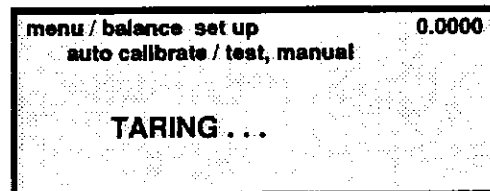
If the balance was stabilized in the tare condition the taring display may appear very briefly.



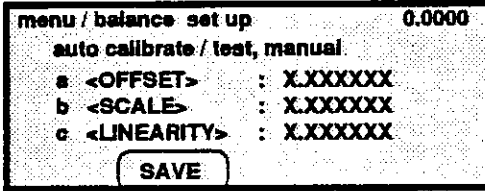
5. Open the door manually and place weight used in procedure **A** on the pan. Close the door manually, then press the **enter** key.



6. Remove the weight from the pan, then press the **enter** key.*



*If the display shows Calibration Failure, check for a drift of more than 0.001 gram during the procedure. Check if the doors are closed, if the pan moves freely, there is no weight on the pan, and that the pan is clean and dry.

PROCEDURE	DISPLAY SHOWS
7. Press the SAVE key to store the calibration value.	
8. Press the TARE bar until the main screen is displayed.	

Other data is available in the **auto calibrate** menu, but this information is mainly to aid trained technicians in troubleshooting balance problems.

Basic Weighing

Now that you have properly installed your balance, have calibrated it, have allowed adequate warm-up time, and have familiarized yourself with the key operation, you are ready to do any basic weighing application using the factory settings (defaults).

(If you need to change any of the settings, skip to the "Configuring Your Balance" section for additional instructions).

Weighing a sample:

PROCEDURE

1. Begin with the main screen being displayed.
2. Press the **TARE** bar to zero the display.
3. Open the doors.
4. Place the sample to be weighed on the weighing pan.
5. Close the doors.
6. When the stability icon appears on the screen, the weighing result is ready to be recorded.

NOTE: Only opening one door speeds up the response time. (see page 47)

Taring

Balances have tare capabilities up to their total weight capacity. (Your balance capacity is indicated on the main screen. It shows your balance capacity for the weigh units being used.) Anytime you exceed this capacity, the display shows OVER.

The bar graph, located at the top of the main screen, also is a capacity indicator. It shows you visually the weigh value of your sample in relation to the total balance capacity.

Taring (re-zeroing) the display:

PROCEDURE

1. Press the TARE bar until the main screen is displayed.
2. Press the TARE bar again.

Weighing a sample in its container with the main screen showing the weight of the sample (net weight):

PROCEDURE

1. Begin with the main screen being displayed.
2. Open doors.
3. Place the sample container on the weighing pan.
4. Close doors.
5. Wait for the stability icon to appear.
6. Press the **TARE** bar.
7. Open doors.
8. Place sample in its container.
9. Close doors.
10. When the balance is stable (stability icon appears), the display shows the weight of the sample.

NOTE: The bar graph on the main screen shows the weight of both the container and the sample.

Parts Counting

The balance can be set to count identical pieces that are within its capacity and resolution. To use this function, your total sample weight must be less than the balance capacity and the weight of each piece must be greater than the resolution of the balance.

Using your balance to do parts counting:

PROCEDURE

1. Begin with the main screen displayed.
 2. Press the **menu** key.
 3. Use the arrow keys to scroll to **units**.
 4. Press the **enter** key.
 5. Use the arrow keys to select **count**.
 6. Press the **enter** key.
 7. Press the **enter** key again.
 8. Use the arrow keys to select the number of parts you want to use for your standard sample (10-20-50-100-200-500).
 9. When the desired number is displayed on the screen, place an empty container on the weighing pan.
 10. Press the **enter** key.
 11. When the balance has stabilized, place the same container with the predetermined number of parts on the pan.
 12. Press the **enter** key.
 13. When the balance has calculated the part weight, press the **SAVE** key.
 14. Press the **TARE** bar to return to the main screen.
-

Your balance is now set to display the correct count or portion of a count when weighing individual pieces of the same weight.

Percentage Calculations

The percent function is used to measure the percentage difference between a "standard" and an unknown weight.

Using your balance to do percentage calculations:

PROCEDURE

1. Begin with the main screen displayed.
2. Press the **menu** key.
3. Use the arrow keys to select units.
4. Press the **enter** key.
5. Use the arrow keys to select **count**.
6. Press the **enter** key.
7. Press the **enter** key again.
8. Use the arrow keys to select 100.
9. Place an empty container on the weighing pan.
10. Press the **enter** key.
11. When the balance has stabilized, place the same container with your standard sample weight on the weighing pan.
12. Press the **enter** key.
13. When the balance has calculated the standard weight to be 100, press the **SAVE** key.
14. Press the **TARE** bar to return to the main weighing screen.
15. Place the unknown weight on the weighing pan.
16. When the balance is stable, the display shows a percentage of weight compared to the "standard" weight.

