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**ANALYTICAL *Plus***  
**Electronic Balances**  
**Models**  
**AP110, AP210, AP310, AP250D,**  
**AP110E, AP210E, AP310E and**  
**AP250E**

# **Instruction Manual**

**NOTE:** THIS EQUIPMENT HAS BEEN TESTED AND FOUND TO COMPLY WITH THE LIMITS FOR A CLASS A DIGITAL DEVICE, PURSUANT TO PART 15 OF THE FCC RULES.

THESE LIMITS ARE DESIGNED TO PROVIDE REASONABLE PROTECTION AGAINST HARMFUL INTERFERENCE WHEN THE EQUIPMENT IS OPERATED IN A COMMERCIAL ENVIRONMENT. THIS EQUIPMENT GENERATES, USES, AND CAN RADIATE RADIO FREQUENCY ENERGY AND, IF NOT INSTALLED AND USED IN ACCORDANCE WITH THE INSTRUCTION MANUAL, MAY CAUSE HARMFUL INTERFERENCE TO RADIO COMMUNICATIONS. OPERATION OF THIS EQUIPMENT IN A RESIDENTIAL AREA IS LIKELY TO CAUSE HARMFUL INTERFERENCE IN WHICH CASE THE USER WILL BE REQUIRED TO CORRECT THE INTERFERENCE AT HIS OWN EXPENSE.

THIS DIGITAL APPARATUS DOES NOT EXCEED THE CLASS A LIMITS FOR RADIO NOISE EMISSIONS FROM DIGITAL APPARATUS AS SET OUT IN THE INTERFERENCE-CAUSING EQUIPMENT STANDARD ENTITLED "DIGITAL APPARATUS", ICES-003 OF THE DEPARTMENT OF COMMUNICATIONS.

CET APPAREIL NUMERIQUE RESPECTE LES LIMITES DE BRUITS RADIOELECTRIQUES APPLICABLES AUX APPAREILS NUMERIQUES DE CLASSE A PRESCRITES DANS LA NORME SUR LE MATERIEL BROUILLEUR : "APPAREILS NUMERIQUES", NMB-003 EDICTEE PAR LE MINISTRE DES COMMUNICATIONS.

**Unauthorized changes or modifications to this equipment are not permitted.**



The exclamation point within the triangle is a warning sign alerting you of important instructions accompanying the product.

# TABLE OF CONTENTS

INTRODUCTION .....	7
DESCRIPTION .....	7
FEATURES .....	7
UNPACKING .....	8
INSTALLATION .....	9
Environment .....	9
Weigh Below Hook .....	9
Leveling the Balance .....	10
Installing the Pan Assembly .....	10
In-Service Cover .....	10
RS232 Interface .....	11
Hardware .....	11
Output Formats .....	11
RS232 Commands .....	11
Connecting Power .....	14
Spare Fuse .....	14
Self Test .....	14
OPERATION .....	15
Switch Functions .....	15
Symbols Used for Operation of the Balance .....	16
Navigating the Menus .....	17
Operational Guide/Index .....	18
Turning the Balance On .....	19
Display Indications .....	19
Stabilization .....	20
Auto Range (AP250 and E Only) .....	20
Weighing .....	20
Taring .....	20
Percent Weighing .....	21
Parts Counting .....	22
Check Weighing .....	23
Animal Weighing .....	24
Fill Guide .....	25
Reference Weight .....	25

Reference Number .....	26
High Point .....	26
Printing Data .....	27
Time and Date .....	27
List .....	28
Automatic Calibration Printout .....	29
User Calibration Printout .....	29
Calibration Test Printout .....	29
Statistics Printout .....	30
Sampling .....	30
Percent Weighing .....	31
Parts Counting .....	31
Check Weighing .....	32
FillGuide™ .....	32
 MENUS .....	 33
MENU LOCK-OUT PROTECTION .....	34
CALIBRATION MENU .....	35
Calibration Menu Protection .....	35
Auto Calibration .....	35
User Calibration .....	36
Cal Test .....	37
Cal End .....	37
 USER MENU .....	 38
User Menu Protection .....	38
Reset .....	38
Averaging Level .....	39
Stability Range .....	39
Auto-Zero .....	40
Dual Range Function .....	40
Exiting User Menu .....	40

SETUP MENU .....	41
Setup Menu Protection .....	42
Reset .....	42
Type Approved/LFT .....	43
Unit Selection .....	43
Functions .....	44
Statistics .....	45
Net .....	46
Custom Unit or Volume Selection .....	46
Good Laboratory Practices .....	48
Parts Counting Error .....	49
Check Weighing Options .....	49
Sample Displays .....	50
Animal Weighing Options .....	52
Fill Option .....	52
Time .....	53
Adjust .....	54
Date .....	55
Lockswitch .....	56
List .....	56
Exit Setup Menu .....	56
PRINT MENU .....	57
Print Menu Protection .....	57
Reset .....	58
Communication .....	58
Baud Rate .....	59
Data Bits .....	59
Parity .....	59
Stop Bits .....	60
Good Laboratory Practices (GLP) .....	60
Print Options .....	61
Auto Print Feature .....	61
Initialize .....	62

Print Stable Data Only .....	63
Print Numeric Data Only .....	63
Time .....	64
Date .....	64
Reference .....	64
Difference .....	65
List .....	65
CARE AND MAINTENANCE .....	66
TROUBLESHOOTING .....	66
Error Codes List .....	67
SERVICE INFORMATION .....	69
REPLACEMENT PARTS .....	69
ACCESSORIES .....	69
SPECIFICATIONS .....	70
LIMITED WARRANTY .....	71

## **INTRODUCTION**


This manual covers Installation, Operation and Troubleshooting for the Ohaus ANALYTICAL Plus Series of Electronic balances, Models AP110, AP210, AP310, AP250D, AP110E, AP210E, AP310E and AP250E. Suffixes after the basic model number are: D = Dual Range and E= Type Approved with CE conformance and bear official markings (Max, Min, Class, etc.) on a serial number plate located on the side of the balance. To ensure proper operation of the balance, please read this manual completely.

## **DESCRIPTION**

The Ohaus ANALYTICAL Plus Series balances are high precision weighing instruments, designed to be versatile, accurate, easy to operate and will provide years of service with virtually no maintenance. The Analytical Plus series is constructed using a die-cast aluminum base finished with a durable corrosion resistant epoxy powder paint. The weighing area is protected from air currents by a draft shield. It contains solid-state precision electronics PC boards, and a seven and a half, 0.5 inch digit, Vacuum Fluorescent display. Each balance operates through a series of menus which enhances operation. A built in lockswitch prevents preset settings from being changed.

## **FEATURES**

Analytical Plus balances contain four main display menus which enable you to calibrate and configure the balance for specific operating requirements.

**MENU** When  switch is pressed and released with MENU displayed, allows access to the calibration, user, setup and print menus.

**CALIBRATION** Menu - Allows the balance to be calibrated by using either Auto, User or Test calibration methods. The test function is used to verify the last calibration.

**USER** Menu - Allows the balance to be set for environmental conditions. Reset, averaging level, stability range and auto-zero functions can be set.

**SETUP** Menu - Allows the balance to be customized for specific weighing functions.

**PRINT** Menu - Allows the selection of parameters under which the balance will interface to a computer or a printer.

Each of these menus contain selectable parameters which can be entered via the front panel switches. Storing of the parameters is accomplished by selecting **End** at the completion of all selections in a particular menu. For a detailed description of each feature, refer to the individual menus in this manual.

# INSTALLATION

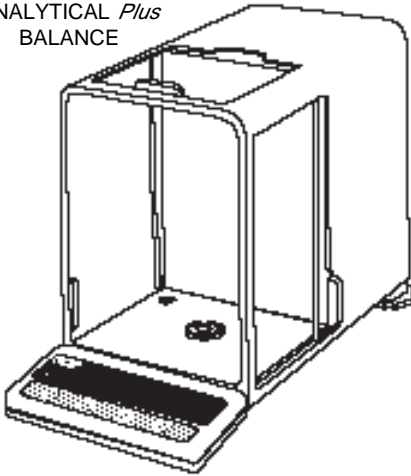
## UNPACKING

Your ANALYTICAL Plus balance was shipped with the following items:

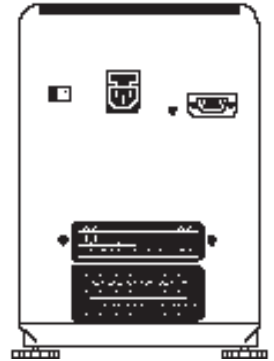
- Pan assembly (including pan, shield, ring and assembly instructions)
- In-service cover
- AC power cord
- Spare fuse
- Instruction manual
- Warranty card

Remove the contents from the carton and carefully remove all packing material. It is recommended to save the carton and packing material for storing and/or transporting the balance. Verify that all of the components have been included and there has been no damage during shipment.

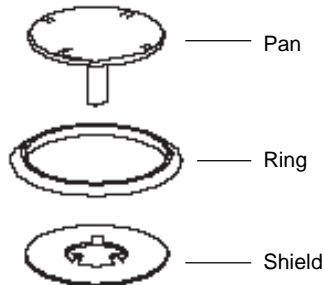
ANALYTICAL *Plus*  
BALANCE



REAR VIEW



In-Service Cover





## INSTALLATION

### Environment

The balance should always be used in an environment which is free from excessive air currents, corrosives, vibration, and temperature or humidity extremes. These factors will affect displayed weight readings.

DO NOT install the balance:

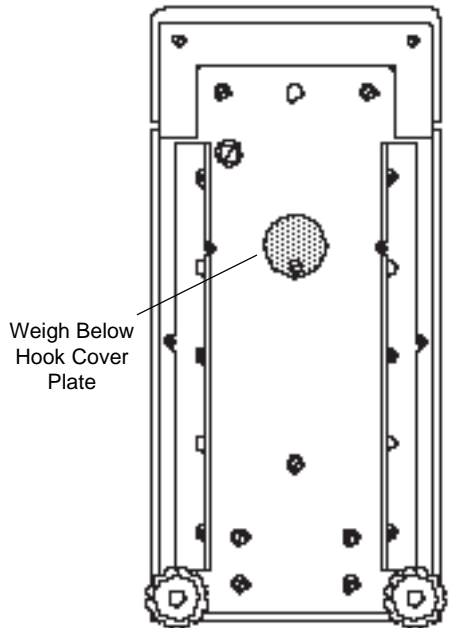
- next to open windows or doors causing drafts or rapid temperature changes.
- near air conditioning or heat vents.
- near vibrating, rotating or reciprocating equipment.
- near magnetic fields or devices that may generate magnetic fields (i.e. motors, alternators, etc.)
- on an unlevel work surface.

Install the balance in the location where it will be used before proceeding.

### Weigh Below Hook

A weigh below hook is provided inside the bottom cover under the protective plate shown in the illustration.

To access the weigh below hook, carefully turn the balance on it's side, loosen the screw which secures the cover plate, rotate the plate to clear the hole, then secure the plate in that position. Return the balance to an upright position. Mount the balance on a stable, level elevated platform and install a hook.



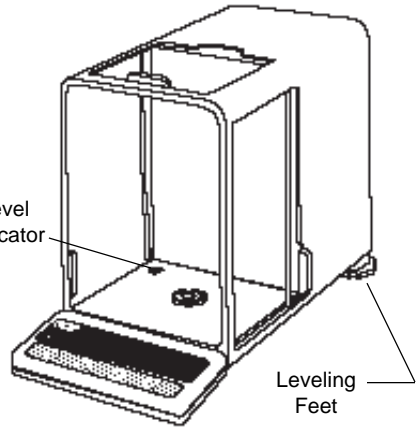
# INSTALLATION

## Leveling the Balance

The balance is equipped with a level indicator on the floor of the weighing chamber and two adjustable leveling feet at the rear. Adjust the leveling feet until the bubble appears in the center circle of the level indicator.



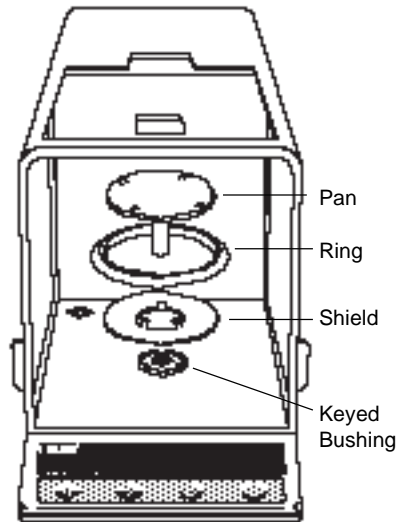
Level Indicator



Leveling Feet

## Installing the Pan Assembly

1. Place the shield onto the keyed bushing and press it down into place. The bent tabs must be facing upward and the shield should be flat against the chamber floor.
2. Place the ring over the shield. The lip on the bottom of the ring should fit against the shield to keep it from moving.
3. Insert the pan in the load receiver hole, matching the key on the pan shaft with the slot in the hole. Gently press the pan down into place.



Pan

Ring

Shield

Keyed Bushing

## In-Service Cover

Place the cover snugly over the display unit.



## RS232 INTERFACE

ANALYTICAL Plus balances are equipped with a bi-directional RS232 compatible interface for communication with printers and computers. When the balance is connected directly to a printer, displayed data can be output at any time by simply pressing PRINT, or by using the Auto Print feature.

Connecting the balance to a computer enables you to operate the balance from the computer, as well as receive data such as displayed weight, weighing mode, stability status, etc.

The following sections describe the hardware and software provided with the balance.

### Hardware

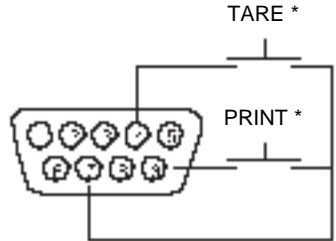
On the rear of the balance, a 9-pin sub-miniature "D" connector is provided for interfacing to other devices. The pinout and pin connections are shown in the adjacent illustration.

The balance will not output any data unless pin 5 (CTS) is held in an ON state (+3 to +15 V dc). Interfaces not utilizing the CTS handshake may tie pin 5 to pin 6 to defeat it.

### Output Formats

Data output can be initiated in one of three ways: 1) By pressing PRINT; 2) Using the Auto Print feature; 3) Sending a print command ("P") from a computer.

The output format is illustrated in the RS232 command table which follows.



- |    |                           |
|----|---------------------------|
| 1  | 5 V dc (5 mA max.)        |
| 2  | Data Out (TXD)            |
| 3  | Data In (RXD)             |
| 4* | Tare (External signal)    |
| 5  | Clear To Send (CTS)       |
| 6  | Data Terminal Ready (DTR) |
| 7  | Ground                    |
| 8  | Request To Send (RTS)     |
| 9* | Print (External signal)   |

\* External PRINT and/or TARE switches may be installed as shown in the diagram. Momentary contact switches must be used.

## RS232 Commands

All communication is accomplished using standard ASCII format. Only the characters shown in the following table are acknowledged by the balance. Any other commands, control characters or spaces are ignored. Commands sent to the balance must be terminated with a carriage return (CR) or carriage return-line line feed (CRLF). For example, a tare command should appear as shown in the adjacent diagram. Data output by the balance is always terminated with a carriage return - line feed (CRLF).

### TARE COMMAND

Field:	T	CR	LF
Length:	1	1	1

# INSTALLATION

## RS232 COMMAND TABLE

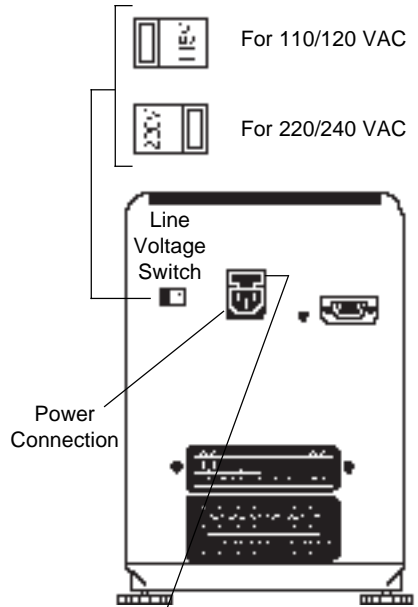
Command Character	Description	
<b>?</b>	Print current unit. GRAMS, DWT, CARAT, Oz Av, Oz T, GRAIN, TAE1 1, TAE1 2, TAE1 3, MOMME, CUSTOM UNIT	Field: Mode Stab CR LF Length: 5 1 1 1 blank if stable " ? " if unstable
<b>xI</b>	Set averaging level to "x", where x = 0, 1, 2	0 = minimum level 1 = 2 = maximum level
<b>xM</b>	Places balance in mode "x", where x = 1 to 11 (see table).  If unit is not already enabled, command will be ignored.	1 = grams 2 = pennyweight 3 = carats 4 = avoirdupois ounces 5 = troy ounces 6 = grains 7 = taels 8 = mommes 11 = custom unit
<b>P</b>	Print display data  When "numeric only" display data is selected for output in the RS232 menu, the Mode field is not output.	Field: Weight Mode Stab CR LF Length: 10 1 5 1 1 1 Same as ? command Displayed weight sent right justified w/lead zero blanking. Nine characters include: decimal point (1) weight (7 max) polarity (1): blank if positive " - " if negative
<b>hhmmss TIME</b>	Set current time to "hh: mm: ss", hh is between 0 - 23.	
<b>TIME</b>	Print current time.	
<b>mmddyy DATE</b>	Set current date 'mmddyy'.	
<b>DATE</b>	Print current date.	
<b>%</b>	Print current % ref.	
<b>#</b>	Print current ref., any function.	
<b>AC</b>	Abort calibration /Test.	
<b>C</b>	Start an auto calibration.	
<b>E</b>	Go to initial state of current function.	
<b>F</b>	Print current function.	
<b>M</b>	Same as mode button.	
<b>xD</b>	Set 1 second print delay (set x = 0 for OFF, or x = 1 for ON).	
<b>ID</b>	Print current ID string.	
<b>xxxxID</b>	Enter ID string (xxxx limit to 8 characters).	

Command Character	Description																								
<b>xS</b>	Set stable data only printing (set x = 0 for OFF, or x = 1 for ON).																								
<b>T</b>	Same effect as pressing on tare button.																								
<b>V</b>	Print EPROM version <table style="margin-left: 20px; border-collapse: collapse;"> <tr> <td style="padding-right: 5px;">Field:</td> <td style="border: 1px solid black; padding: 2px;">Model #</td> <td style="border: 1px solid black; padding: 2px;">1</td> <td style="border: 1px solid black; padding: 2px;">EPROM #</td> <td style="border: 1px solid black; padding: 2px;">CR</td> <td style="border: 1px solid black; padding: 2px;">LF</td> </tr> <tr> <td style="padding-right: 5px;">Length:</td> <td style="border: 1px solid black; padding: 2px;">6</td> <td></td> <td style="border: 1px solid black; padding: 2px;">16</td> <td style="border: 1px solid black; padding: 2px;">1</td> <td style="border: 1px solid black; padding: 2px;">1</td> </tr> <tr> <td></td> <td style="text-align: center; padding-top: 5px;"> </td> <td></td> <td style="text-align: center; padding-top: 5px;"> </td> <td></td> <td></td> </tr> <tr> <td></td> <td style="text-align: center; padding-top: 5px;">Balance Model</td> <td></td> <td style="text-align: center; padding-top: 5px;">"</td> <td style="text-align: center; padding-top: 5px;">98101-xx Sr#x.xx"</td> <td></td> </tr> </table>	Field:	Model #	1	EPROM #	CR	LF	Length:	6		16	1	1								Balance Model		"	98101-xx Sr#x.xx"	
Field:	Model #	1	EPROM #	CR	LF																				
Length:	6		16	1	1																				
	Balance Model		"	98101-xx Sr#x.xx"																					
<b>x#</b>	Set current ref., any function, CW takes two reference separated by a space.																								
<b>x%</b>	Downloads reference weight "x" for percent mode. "x" must be in grams. Command is ignored if percent mode is disabled. If percent mode is enabled, balance will automatically switch to percent mode display.																								
<b>xF</b>	Set current function to "x". x = 0 to 6. Setup menu must be unlocked. <table style="margin-left: 20px; border: 1px solid black; padding: 5px;"> <tr><td>0 = None</td></tr> <tr><td>1 = Percent</td></tr> <tr><td>2 = Parts Counting</td></tr> <tr><td>3 = Check Weighing</td></tr> <tr><td>4 = Animal Weighing</td></tr> <tr><td>5 = Fill Guide</td></tr> <tr><td>6 = High Point</td></tr> </table>	0 = None	1 = Percent	2 = Parts Counting	3 = Check Weighing	4 = Animal Weighing	5 = Fill Guide	6 = High Point																	
0 = None																									
1 = Percent																									
2 = Parts Counting																									
3 = Check Weighing																									
4 = Animal Weighing																									
5 = Fill Guide																									
6 = High Point																									
<b>xZ</b>	Set Auto Zero to "x". x = 0 for OFF, x = 1 for ON																								
<b>xSL</b>	Set stability level. User menu must be unlocked. x = 0 to 3																								
<b>Z</b>	Zero request (Gross tare) if Net/Gross enabled.																								
<b>nnnA</b>	Set Auto Print feature to "nnn"(see table). <table style="margin-left: 20px; border: 1px solid black; padding: 5px;"> <tr> <td style="padding-right: 20px;">nnn = 0</td> <td>Turns feature OFF</td> </tr> <tr> <td>nnn = S</td> <td>Output on stability</td> </tr> <tr> <td>nnn = C</td> <td>Output is continuous</td> </tr> <tr> <td>nnn = 1-256</td> <td>Sets Auto Print interval</td> </tr> </table>	nnn = 0	Turns feature OFF	nnn = S	Output on stability	nnn = C	Output is continuous	nnn = 1-256	Sets Auto Print interval																
nnn = 0	Turns feature OFF																								
nnn = S	Output on stability																								
nnn = C	Output is continuous																								
nnn = 1-256	Sets Auto Print interval																								
<b>Esc L</b>	Prints listing of Setup and Print menu settings.																								
<b>Esc R</b>	Resets Setup and Print menus to factory defaults. CAUTION: This will reset RS232 configuration.																								
<b>Esc S</b>	Save current settings.																								

# INSTALLATION

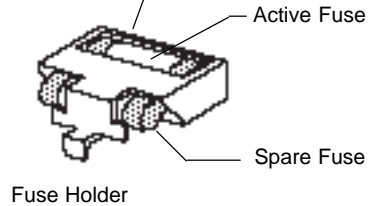
## Connecting Power

1. Before connecting the power cord, check that the line voltage switch located at the rear of the balance is set correctly for your location. If not, use a small screwdriver to set the switch correctly.
2. Make sure the doors to the weighing chamber are closed.
2. Connect the power cord receptacle to the plug on the rear of the balance.
3. Plug the power cord into a convenient AC outlet. The balance signals one long beep to indicate power has been applied.



## Spare Fuse

A spare fuse is provided in the fuse holder as shown in the diagram. All models use a 160 mA/250 V fuse.

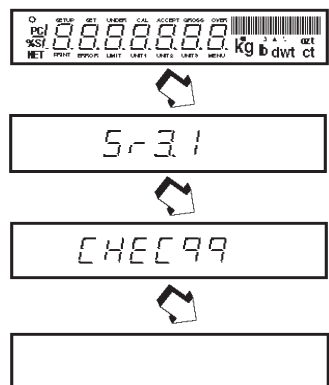


## Self Test

When power is applied to the balance, it begins a self test cycle. During this time, the display cycles as shown.

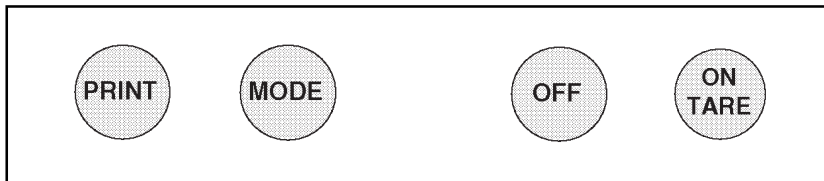
**NOTE:** Sr shown in the display is the software revision and may be different in your balance.

After the self test is completed, the display turns off. Allow the balance to stabilize for about 2 hours before using it.



## OPERATION

### Switch Functions

**Press and Release:**

Turns on the balance if it is off, zeros the balance. In the menu system, this button is used to accept a choice or enter a submenu.

**Press and Release:**

Turns the balance off.

**Press and Release:**

Selects weighing units functions or options. In menus, changes to next step or value.

**Press and Release:**

Sends weight data, statistical data, GLP data to computer/printer. In menus, allows returning to a previous menu step.

Before using the balance, carefully review the Symbols Used for Operation of the Balance shown on page 16, Navigating the Menus on page 71 and Operational Guide/Index on page 18.

Please read the entire manual as there are many features which can be enabled. The balance is shipped from the factory ready to operate with default settings as shown in the menus.

The balance is a high precision instrument and will give you years of service if kept clean and handled carefully. If you have any problems operating the instrument or require additional information, please feel free to contact our Customer Service Department at (800) 526-0659.

## Symbols Used for Operation of the Balance

This instruction manual uses certain symbols to explain various operational procedures and actions that occur. Examples of the symbols used are shown as follows:

### Pushbutton Switches:

 = **NORMAL PRESS AND RELEASE**

 = **MULTIPLE PRESS**

 = **PRESS AND HOLD FOR DESIRED DISPLAY**

### Display Area:

 **DISPLAY AREA - AS A RESULT OF USER ACTION**

   **DISPLAY AREA - AUTO CHANGE OCCURS**

 **DISPLAY AREA -SWITCHES BACK AND FORTH**  
  




## Navigating the Menu

There are **four menus** used in the balance:



**To enter the menus**, the button is pressed and held until MENU is displayed. When released, CAL is displayed which is the Calibration menu.

**When in the menus**, repeated pressing of advances through the menus. CALIBRATION USER SETUP PRINT END MENU

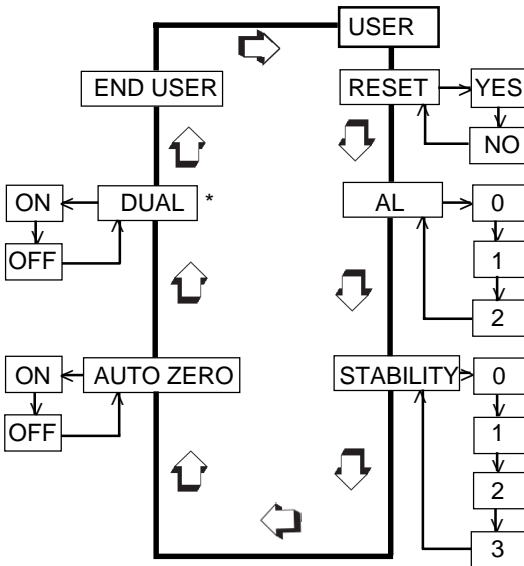
Each menu contains selections (submenus) which can be set for specific operations.

The button is used to advance through the submenu selections.

The button enters or accepts the submenu selection and returns to the beginning of the submenu selection.

The button is used to backup in the submenu if a change is desired.

The following sample illustrates the **USER menu** and submenu items



**NOTE:**

Each menu is constructed in the form of a loop. Advancing from one submenu item to the next by using the button will eventually return to the beginning of the menu

\* Only on AP250D Models.

**RULES:** Use button to advance.

Use button to enter or accept submenu.

Use button to backup.

**After selections are made, always exit menus through END MENU to store settings.**

## Operational Guide/Index

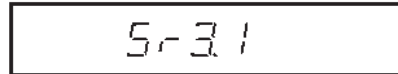
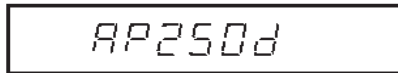
The Operational Guide/Index lists the pages for all balance operations and options. After settings are made, exit menus to save settings.

<b>FUNCTION</b>	<b>TO OPERATE</b> (See pages)	<b>SETUP</b> (See pages)
<b>1. Turning the Balance ON</b>	<b>19</b>	<b>---</b>
<b>2. Weighing (grams)</b>	<b>20</b>	<b>---</b>
<b>3. Taring</b>	<b>20</b>	<b>---</b>
<b>4. Percent Weighing</b>	<b>21</b>	<b>44</b>
<b>5. Parts Counting</b>	<b>22</b>	<b>44, 49</b>
<b>6. Check weighing</b>	<b>23</b>	<b>44, 49</b>
<b>7. Animal Weighing</b>	<b>24</b>	<b>44, 52</b>
<b>8. Fill Guide</b>	<b>25</b>	<b>44, 52</b>
<b>9. High Point</b>	<b>26</b>	<b>44</b>
<b>10. Printing Data</b>	<b>27 to 32</b>	<b>56, 57, 61 to 65</b>
<b>11. List</b>	<b>28</b>	<b>56, 65</b>
<b>12. Menu Lockout</b>	<b>34</b>	<b>---</b>
<b>13. Calibration</b>	<b>35 to 37</b>	<b>---</b>
<b>14. Net/Gross Weighing</b>	<b>---</b>	<b>46</b>
<b>15. Custom Units</b>	<b>---</b>	<b>46</b>
<b>16. GLP</b>	<b>---</b>	<b>48, 60</b>
<b>17. Time</b>	<b>---</b>	<b>53, 54</b>
<b>18. Date</b>	<b>---</b>	<b>55</b>
<b>19. Lockswitch</b>	<b>---</b>	<b>56</b>
<b>20. Legal for Trade</b>	<b>---</b>	<b>41, 42</b>
<b>21. Changing Units</b>	<b>---</b>	<b>42</b>
<b>22. Statistics</b>	<b>---</b>	<b>45</b>
<b>23. Averaging Level</b>	<b>---</b>	<b>38, 39</b>
<b>24. Stability</b>	<b>---</b>	<b>38, 39</b>
<b>25. Auto Zero</b>	<b>---</b>	<b>38, 40</b>
<b>26. Dual Range (AP250D)</b>	<b>---</b>	<b>38, 40</b>
<b>27. Reset User</b>	<b>---</b>	<b>38</b>
<b>28. Reset Setup</b>	<b>---</b>	<b>42</b>
<b>29. Reset Print</b>	<b>---</b>	<b>58</b>
<b>30. Communications</b>	<b>---</b>	<b>58 to 60</b>

## Turning the Balance ON

1. After the Self Test in the Installation Section is completed (power applied to the balance), make sure the pan on the balance is clear, then, close the chamber doors.


2. 



## Display Indications

The following table describes each of the display indicators.

### DISPLAY INDICATORS

g grams	⌘ check weighing limits
dwt pennyweight	UNIT 3 custom unit/volume
ct carats	NET net indicator
oz ounces	PC parts counting
oz <sup>t</sup> troy ounces	% percent weighing
UNIT 1 grams	S stability indicator
l lbs	GROSS gross (total) indicator
UNIT 2 mommes	■ fill guide
▲ user calibration indicator	○ center of zero
 capacity guide	

## Stabilization


Before initially using the balance, allow time for it to adjust to its new environment. The balance only requires to be plugged in to warm up. Recommended warm up period is twenty (20) minutes. The balance is powered whenever it is plugged into a power source.

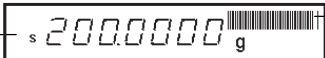
## Auto Range (AP250D and E Only)

Modes AP250D and E offer both a fine range (0.01 mg readability from 0 to 52 g) and a coarse range (0.1 mg over 52 g). When first turned on, the balance is in the fine range. It remains in this range until the weight on the pan exceeds 52 g. When weight on the pan is greater than 52 g, the balance switches to the coarse range.

If weight on the pan falls below 52 g, it automatically switches back to the fine range.

## Weighing



1.  to rezero the display.
2. Place the object(s) or material to be weighed on the pan.
3. Wait for the stability indicator to appear before reading the weight.

STABILITY INDICATOR —  — CAPACITY GUIDE

**NOTE:** The capacity guide (bars) indicates the percentage of the current weight to the balance capacity. The example above illustrates a 200 gram weight, (balance full capacity 210 grams).

## Taring

When weighing material or objects that must be held in a container, taring stores the container weight in the balance's memory, separate from the weight of the material in the container.

1. Place an empty container on the pan. Its weight is displayed.
2. , the display blanks until stable weight readings are received, then indicates zero. The container's weight is stored in memory.
3. Add material to the container. As material is added, its net weight is displayed.
4. Removing the container and material from the pan will cause the balance to display the container's weight as a negative number.
5.  resets the balance to zero.

## Percent Weighing





Percent Weighing is **enabled only** when the Percent Function is selected under the Setup menu. Refer to page 38. Percent weighing permits you to place a reference load on the balance, then view other loads as a percentage of the reference. The load you place on the platform as a reference may be displayed as any percentage you select from 5% to 100% (in 1% increments). One hundred percent does not necessarily have to represent the reference load. Subsequent loads, displayed as a percentage of the reference are limited only by the capacity of the balance. The default setting is Reference 100%.

### EXAMPLE

A 10g reference load is set for 20%:




- A subsequent load of 100 g will be displayed as 200%.
- A subsequent load of 200 g will be displayed as 400%.

To perform percent weighing when in a weighing mode, use the following procedure:




1.   \* PctCon.
2. Place an empty container on the pan (if one will be used).
3.   \* SEt 100. This is the current reference percentage.

**NOTE:** The reference percentage can be changed to any value from 5 to 100.




4.   \* SEt 5 increments to \* SEt 100.



**NOTE:**    does not return to a lower number. Instead, it sends Set x% command through the RS232 Interface, where x = 5 to 100.



5. When the selected reference value appears on the display, place the reference load in the container (or directly on the pan if no container is used).

8.   \*s 1000 , display indicates the reference load as the percentage entered. The bar graph indicates the load relative to the capacity of the balance.

9. Remove the reference load from the balance and replace it with another load. The second load is displayed as a percentage of the reference.

10.   \*s 1000000  g to view alternate display in units.



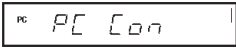









11. To restart percent weighing at any time,   \* PctCon.

12.   to exit to a weighing mode.



## Parts Counting

Parts Counting is **enabled only** when the Parts Counting Function is selected in the Setup menu. Refer to page 38. In the parts counting mode, the balance displays the quantity of parts you place on the pan. Since the balance determines the quantity based on the average weight of a single part, all parts must be reasonably uniform in weight. The accuracy of parts counting results is determined by the error level entered in PC Err of the Setup Options submenu. Refer to page 43. The default setting for PC Err is off.







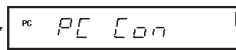


To perform parts counting when in a weighing mode, use the following procedure:

1.   .
2.   . The balance requires a sample of the parts to use as a reference for counting. The default for the sample size is 5 parts, but this can be changed to 10, 20, 30, 40, 50, or 100 parts by    (Larger samples yield more accurate results). Add the required number of sample pieces to the pan.
3.    (indicates 5 pieces).
4. If Add X is displayed, the sample is too small to provide results within the selected error level (PC Error of the Setup Options submenu).

**NOTE:** X represents the number of additional parts needed to provide a sufficient sample.

5. Add the required number of parts, then   again.
6. To count additional pieces, add them to the pan. The display indicates the actual number of pieces based on their sample size. Tolerance will be within whatever was selected under the Parts Counting Error Level.



**NOTE:** If the balance controls are not touched, the sample size is stored in memory. You can continue to use the balance to measure quantities as long as the samples to be measured are of the same weight.

7.   to display the weight of the pieces on the pan.
8.   again to display the number of pieces.
9. To restart parts counting,   .
10.  , the balance returns to a weighing mode.





## Check Weighing

Check Weighing is **enabled only** when the Check Weighing Function is selected in the Setup menu. Refer to page 38. Refer to page 43, Check Weighing Options under the Setup menu to set the Reference Type and Display Type options. In the check weighing mode, a reference weight can be set into the balance either as a reference weight on the pan or as a user entered number. The balance display shows either under, accept or over as each sample is weighed.












If **reference weight** was selected under CW Options submenu:

1. With the balance in the weighing mode,   SEE REF.

**NOTE:** If **reference number** was selected, go to step 7.




2. Place a sample weight on the pan which is considered to be the under limit for check weighing.
3.   SEE REF.
4. Place a sample weight on the pan which is considered to be the over weight limit for check weighing.
5.  . The display blanks until a stable reading is achieved, then it goes to either the (Normal, None or Sign) display type previously selected in CW Options submenu to indicate under, over or acceptable limits of the objects being weighed.
6. Check weighing can now be made by removing a sample and placing a new sample on the pan.

If **reference number** was selected under the CW Options submenu:

7. With the balance in the weighing mode,   SEE REF.
8.   to return to weighing.
9.   0000000 g indicates under value with first digit flashing.
10.    until the first digit (under weight) is correctly displayed.
11.   to accept the value.
12. Repeat steps 10 and 11 and set all digits to the desired value. When the last digit is entered, display changes to an over value to be entered with the first digit flashing 0000000 g.

**NOTE:**    allows going back.

## Check Weighing (Cont.)



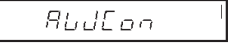
13. Repeat steps 10 and 11 to set the over value. When the last digit is entered, the display indicates one of three display modes for check weighing.
14. Check weighing can now be performed by removing a sample and placing a new sample on the platform.
15.    allows other weighing units to be displayed if previously selected.



## Animal Weighing




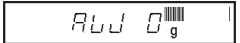
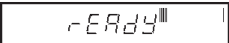
Animal Weighing is **enabled only** when Animal Weighing Function is selected under the Setup menu. Refer to page 38. To set options, refer to page 46, Animal Weighing Options under the Setup Options submenu. Under normal weighing conditions, the movement of animal subjects on the balance platform causes unstable fluctuating display readings and corresponding inaccuracies in the weighing result. The Animal Weighing mode is a feature designed to minimize these fluctuations through a combination of several digital signal processing techniques.



When used in this mode, the balance automatically detects the presence of a subject placed on the platform and starts an animal weighing cycle. The balance samples the weight data for a variable sampling interval and processes the data to filter out the instabilities by the live animal.

With the balance in a weighing mode, proceed as follows:



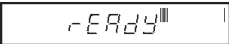
1.    (Animal Weighing Container).
2. Place the container on the platform.

**NOTE:**   to return to weighing mode.

3.   . The container weight is tared.
4. Place the subject in the container. The balance indicates a countdown to . This cycle accommodates for movement. The balance then displays the actual weight of the subject with flashing unit indicator and returns to  after approximately six seconds.

Repeat steps 1 through 4 for another subject or   to start another weighing cycle.

**NOTE:** If Auto Print is enabled, the display returns to ready in approximately one second.

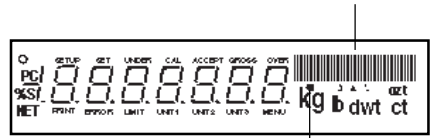
5.   to return to weighing mode while display shows .



## Fill Guide

Fill Guide is **enabled only** when Fill Guide Function is selected under the Setup menu. Refer to page 38. To set options, refer to page 46, Fill Options under the Setup Options submenu.

FILLGUIDE™ BAR GRAPH



FILLGUIDE™ INDICATOR



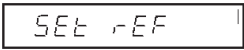

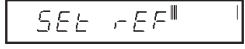





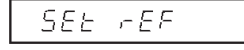



The FillGuide™ is a bar graph which appears in the upper right hand portion of the display. When the load on the balance is at the balance's capacity, all of the segments are on. When the load is at half capacity, only the first half of the segments are on. During normal operation of the balance, the bar graph displays the relationship between the load on the pan and the capacity of the balance. In the Fill Guide mode, the bar graph can be set to a desired target value. The FillGuide™ feature can be used in any one of the available weighing units.

The Fill Option under the Setup Options submenu provides two choices for a reference weight (similar to check weighing). Either a mass can be placed on the pan and used as a reference weight or a number can be entered to establish the weight value. Both methods are used to establish a reference for a 100% bar graph reading. Target parameter provides two choices, one is fill to the reference, the other to zero weight and Target = to reference..

With the balance in a weighing mode, proceed as follows:

### Reference Weight


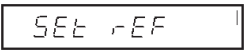






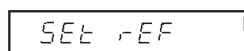


With the balance in a weighing mode, and if reference weight was selected under Fill Options submenu proceed as follows:

1.    .
2. Place a sample weight on the pan which is the reference weight   . Assumes 50 grams weight reference.
3.    . The display indicates a 50 gram mass (target = reference. For target = to zero, display shows 0.0000 as the actual weight of the sample with the bar graph at 100%.
4. The Fill Guide feature can now used by placing samples on the pan. If the sample is equal to the reference weight used to calibrate the fill mode, the actual weight is displayed with a full bar graph. When target is selected, the balance will show the normal weight of the object on the pan.
5.    to exit the fill option mode.
6.    , the balance is now in a weighing mode.

## Fill Guide (Cont.)

### Reference Number

If reference number was selected under the Fill Option submenu with the balance in a weighing mode, proceed as follows:


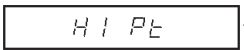


1.   .
2.   . Set the flashing digit to the desired weight value.
3.   until the first digit is correctly displayed.
4.  to accept the digit.
5. Repeat steps 3 and 4 until all digits are set. When the last digit is entered, the balance is automatically in the fill mode.
6. The fill mode can now be used by placing samples on the pan. If the sample weight equals the reference weight, the bar graph indicates 100%, the weight is displayed.
7.   to exit the fill option mode.
8.   , the balance is now in a weighing mode.

## High Point


High Point is **enabled only** when High Point Function is selected under the Setup menu. Refer to page 38. High point is a feature which permits a number of samples to be weighed with the balance **storing the lowest** sample weight and the **highest sample weight**. The samples which are in between the low and high points are disregarded and not displayed.

**NOTE:** When using this function, the balance does not respond to weights below 100 digits.



With the balance in a weighing mode, proceed as follows:

1.     , LIMIT is displayed, indicating the function is on.
2. Place the first sample on the balance pan. When the balance has stabilized, the weight is displayed. Remove the weight.
3. Place a second sample on the pan. After the balance stabilizes, the second sample weight is displayed if it is greater than the first sample. This procedure can be continued with a number of samples. The highest weight sample is always displayed.

**High Point (Cont.)**


4.  To view the lowest and highest sample weight. The display LIMIT flashes, the lowest sample weight is displayed followed by two short beeps, display then indicates the highest sample weight for a few seconds then automatically changes back to the normal weighing mode.



5. To use the High Point function again, repeat steps 1 through 4.
6.   to exit High Point and return to a weighing mode.

**Printing Data**

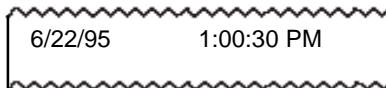
Printing data to an external computer or printer requires that the communications parameters in the Print menu be set first. Refer to page 51 Print menu. A wide variety of printing options are available, refer to page 55, Print Options under the Print menu

and set the desired options before proceeding. To print data, .

This section defines the various printing setups with printing samples.

**Time and Date**


When time and date are entered in the balance through the Setup menu and with both Time and Date options set to ON under the Print Options submenu, each printout starts with the time and date on the first line.



## Printing Data (Cont.)

### List

List is a convenient method of examining which parameters are set up in the balance. The parameters do not show up on the display but print out when selected. Both the Setup and Print menus have a List function.

When LIST is displayed in either the Setup or Print Menu,  causes the parameters of the User, Setup and Print menus to be printed on an external printer or computer screen.

The sample shown, indicates the status in three menus.

AP250D 98101-35 Sr# 3.0  
183

User Menu  
AL = 1, Stb = 1  
AZT = On

Setup Menu  
LFT is Off  
Enabled Modes:  
g, dwt,  
ct, oz,  
oz t, GN  
custom  
Tael = Hong Kong  
Function = Animal Weighing  
AW Lev = 1  
Statistics On  
Std Dev = Pop  
Mean = On  
Sum = On  
Max = On  
Min = On  
Diff = On  
Net = On  
GLP  
Time/Date On  
Bal Id = On  
User Id = On  
Project # = On  
Cal = On  
Name = On  
Time = US 8:24:06 AM  
Date = US 6/22/95  
Lock Switch is Off

Print Menu  
RS-232 = 2400: N: 7: 2  
Print Options  
Auto Print = Off  
Interval = 6  
Non - PL = 100.0000g  
Non - PH = 200.0000g  
Stable Print = Off  
Nu = Off  
Time = On  
Date = On  
Print Ref = On  
Print Ref = On  
Print Diff = Off

**Printing Data (Cont.)**

**Automatic Calibration Printout**

When performing an Automatic calibration with CAL option (GLP submenu of the Setup Options submenu set to ON), a printout is made after calibration is completed.

```

----- AUTO SPAN CAL -----
6/22/95      8:42:24 AM
Bal Id 183
Auto. Cal. completed !
Dif:                - 0.00136g
ID 2000000
PR 10000
Name.....

----- END -----
    
```

**User Calibration Printout**

When performing User calibration with CAL option (GLP submenu of the Setup Options submenu set to ON), a printout is made after calibration is completed.

```

----- USER SPAN CAL -----
6/22/95      8:52:21 AM
Bal Id 183
Cal:          200.0000g
Old:          200.0398g
Dif:          0.0398g
Wt. Ref.....
ID 2000000
PR 10000
Name.....

----- END -----
    
```

**Calibration Test Printout**

When performing a Calibration Test with CAL option (GLP submenu of the Setup Options submenu set to ON), a printout is available.

```

----- CAL TEST -----
6/22/95      8:47:02 AM
Bal Id 183
Cal. test completed !
Dif:          -0.00045g
ID 2000000
PR 10000
Name.....

----- END -----
    
```



## Printing Data (Cont.)

### Statistics Printout

When statistics is enabled, a printout can be made with any of the major balance functions such as; Percent, Parts Counting, Check Weighing, Animal Weighing and FillGuide™. Under the Setup Options menu, Statistics has parameters such as Enable, Standard Deviation, Mean, Sum, High, Low and Difference which can be turned on or off. Statistics can be printed any time the balance is operational and statistics is enabled (turned on).



For example, to weigh ten samples and obtain a printout, proceed as follows:

### Sampling

1.   S T A R T

2. Place the *first* sample on the platform, wait for the stability indicator **S** on the display to show.



3.

  S . 1

appears and the printer outputs the first sample weight.

4. Remove the first sample.

5. Place the *second* sample on the platform, wait for the stability indicator **S** on the display to show.



6.   S . 2

appears and the printer outputs the second sample weight.

7. Remove the second sample.

**NOTE:** The weight of each sample is shown on the display and printed. Maximum sample size = 256.

8. Repeat procedure for as many samples as required.

9.   S T O P

to end the sampling procedure. Printout completes the data. See sample at right.

----- START -----	
6/22/95	1:40:00 PM
1	200.0369 g
2	200.0372 g
3	200.0370 g
4	200.0369 g
5	200.0371 g
6	200.0372 g
7	200.0372 g
8	200.0369 g
9	200.0369 g
10	200.0371 g
-----	
SD Pop.	0.000119
Mean	200.037030
Sum	2000.03720
Max.	200.03720
Min.	200.03690
Diff	0.00030
Finish	1:43:17 PM
Bal Id	183
ID	2000000
PR	10000
Name	.....
----- END -----	

**Printing Data (Cont.)**

**Percent Weighing**

Statistical printouts of Percent Weighing are similar to sampling statistics. Loads on the balance platform may be displayed as a percentage of a defined sample. To obtain a printout in this mode, the balance must be set up in Percent Weighing. Refer to basic Sampling procedure for operation. The sample illustration shown at the right had the balance reference set to 100% using a weight of 25.22573 grams.

```


----- START -----
6/22/95      9:58:00 AM
 1           20 Pcs
 2           14 Pcs
 3           11 Pcs
 4           25 Pcs
 5           23 Pcs
-----
SD Pop.      5.31
Mean         18.60
Sum          93.0
Max.         25.0
Min.         11.0
Diff.        14.0
Finish      10:01:00 AM
PC Ref      0.888604 g
Bal Id 183
ID 2000000
PR 10000
Name.....
----- END -----
    
```

```

----- START -----
6/22/95      10:53:24 AM
 1           100.0%
 2           148.9%
 3           46.9%
 4           70.4%
 5           94.0%
-----
SD Pop.      34.077
Mean         92.040
Sum          460.20
Max.         148.90
Min.         46.90
Diff.        102.00
Finish      10:53:39 AM
Bal Id 183
ID 2000000
PR 10000
Name.....
----- END -----
    
```

**Parts Counting**


When the balance is in a Parts Counting mode, each time a batch of items are counted, they can be recorded

statistically by pressing  as described in the Sampling procedure. The example shown on the left used a five piece sample weight of 80.2273 grams.

## Printing Data (Cont.)

### Check Weighing

When the balance is in a Check Weighing mode, each sample can be checked to print an under, accept or over weight on the printout by setting the Print Options parameter Difference to ON. Use the procedure described in Sampling to obtain

data by pressing  each time a sample is weighed.

```


----- START -----
6/22/95 12:09:29 PM
 1 17.28667 g
Fill Dif 7.95202 g
 2 31.75109 g
Fill Dif 6.51240 g
 3 13.85533 g
Fill Dif 11.38335 g
 4 200.0372 g
Fill Dif 174.7985 g
 5 28.18002 g
Fill Dif 2.94133 g
-----
SD Pop. 71.216407
Mean 58.222062
Sum 291.11031
Max. 200.03720
Min. 13.85533
Diff 186.18187
Finish 1:30:25 PM
Fil Ref 25.23869 g
Bal Id 183
ID 2000000
PR 10000
Name.....
----- END -----
    
```

```

----- START -----
6/22/95 12:09:29 PM
 1 5.96781 g
CW UNDER 0.00397 g
 2 14.84395 g
CW OVER 2.98037 g
 3 20.50947 g
CW OVER 8.64589 g
 4 5.96424 g
CW UNDER 0.00753 g
 5 8.93100 g
CW ACCEPT 8.93100 g
-----
SD Pop. 5.654601
Mean 11.243294
Sum 56.21647
Max. 20.50947
Min. 5.96424
Diff 14.54523
Finish 12:12:57 PM
Min Ref 5.97177 g
Max Ref 11.86358 g
Bal Id 183
ID 2000000
PR 10000
Name.....
----- END -----
    
```

### FillGuide™

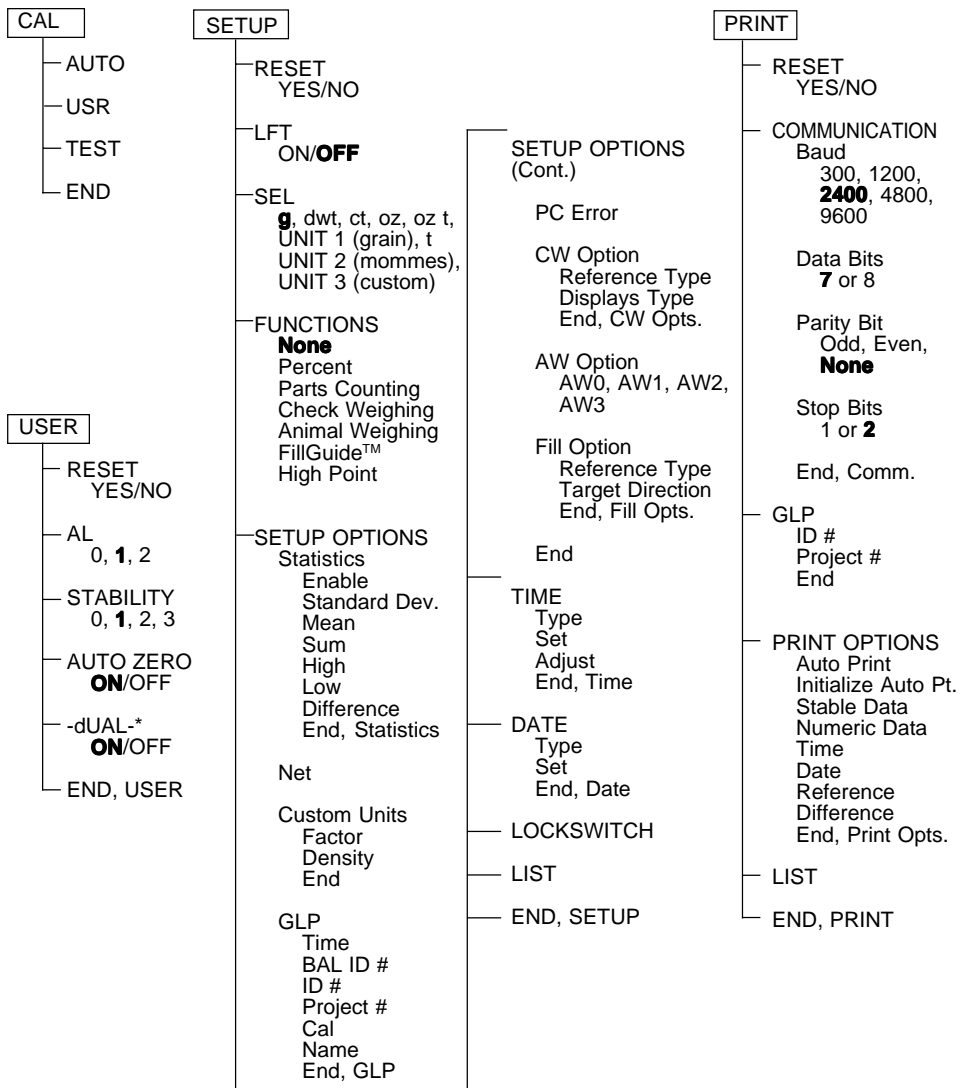
When the balance is in the FillGuide™ mode, each sample can be checked against the defined FillGuide™ full capacity and to print the difference on the printout by setting the Print Options parameter Difference to ON. Use the procedure described in Sampling to obtain data

by pressing  each time a sample is weighed.



**MENUS**

Each submenu of the AP Balance contains numerous selections which can be set for specific operations. To customize the operation of the balance for specific measurements, functions and printing, it is necessary to make selections in each menu. The following illustration identifies the major items in each menu. The factory default settings are shown in bold type.



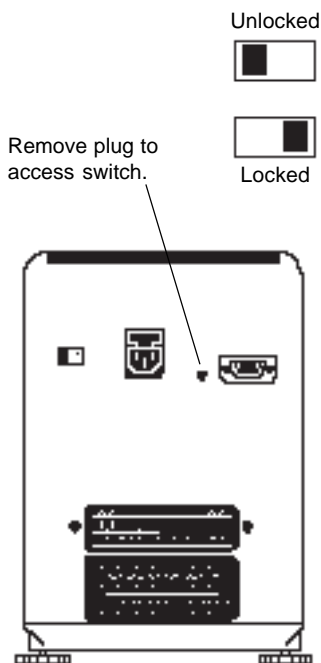
\* For AP250D only.

## MENU LOCK-OUT PROTECTION

The menus can be locked out to prevent settings from being changed. When locked out, Setup and Print menus may still be accessed for viewing but settings may not be changed. The word **SAFE** will be displayed before the menus indicating they have been locked out.

Before setting menus for Lock or Unlock in the Loc SW section, this lock-out switch must be set to Unlock. After selections are made, set this switch to Lock.

1. Turn the balance OFF.
2. Locate the hole plug next to the RS-232 Interface connector at the rear of the balance.
3. Remove the hole plug to access the switch.
4. Using a small screwdriver, slide the switch to the right to lock out, or to the left to unlock menus.
5. Replace the hole plug.
6. Turn the balance ON again.

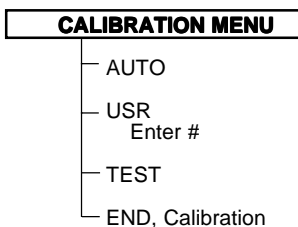


### **For verified balances:**

Place verification label over hole with switch in locked position. Fully verified balances are sealed with the Setup menu locked out.

## CALIBRATION MENU

Analytical Plus balances features ***Auto***, ***USER*** and ***TEST*** calibration methods. ***Auto*** is a method where the balance calibrates itself using internal calibrated masses. ***USER*** is a method where the balance can be calibrated using an external mass of known value by entering that value into the balance. ***Test*** allows the stored calibration data to be tested against the internal mass being used for the test. The following figure illustrates the sequence in which submenus appear on the Calibration menu. Item shown bolded is a default setting.



### Calibration Menu Protection

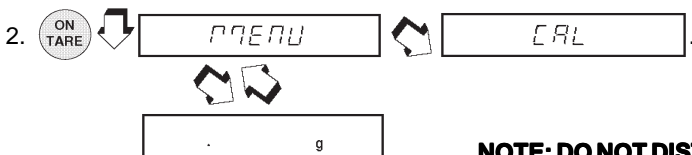
**NOTES:**

1. Calibration may be locked out to prevent unauthorized personnel from changing calibration. If calibration has been locked out, you can only access Test.
2. To lock out calibration menu, after calibration, refer to the section titled Menu Lock-Out Protection.

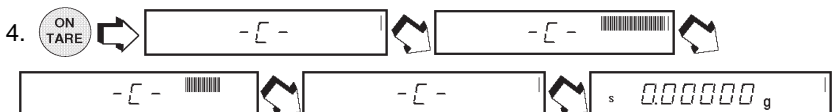
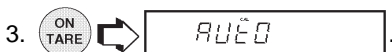
### Auto Calibration

Auto calibration is used when it is desired to calibrate the balance automatically. Proceed as follows:

1. Make sure there is no load on the pan and close the chamber doors.



**NOTE: DO NOT DISTURB THE BALANCE WHEN -C- IS DISPLAYED.**



## User Calibration

User calibration is used when it is desired to calibrate the balance using a mass of known value.

**NOTE:** Before beginning user calibration, make sure masses are on hand.

If you are in the calibration menu and realize masses are not available or you do not want to calibrate, exit the menus and return to normal weighing.

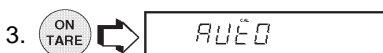
Refer to the adjacent table for correct mass values to use with the balance. For optimum calibration, the exact value of masses should be known. The value will be entered to four decimal places during the procedure.

USER CALIBRATION MASSES	
MODEL	MASS VALUE
AP110S	100 g
AP210S	200 g
AP310S	300 g
AP250D	200 g

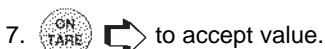
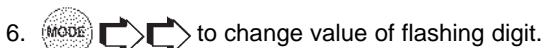
Calibration weights must meet or exceed ASTM Class 1 Tolerance. In Europe, use OIML Class E2 weights.

Proceed as follows:

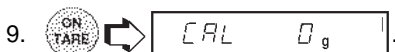
1. Make sure there is no load on the pan and close the chamber doors.



5. → the value of last calibration mass is displayed.



8. Repeat steps 6 and 7 and set the numbers to match the value of the selected calibration mass.




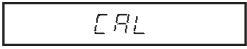




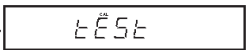

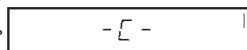

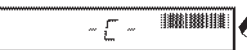



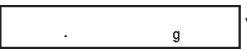




= User Calibration Indicator

**Cal Test**




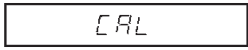




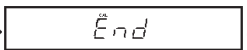

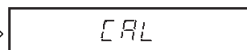


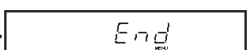


This feature checks the calibration against last stored calibration information. The Cal Error display indicates the difference since the last automatic calibration.

1. Make sure there is no load on the pan and close the chamber doors.

2.     .
3.   .
4.    .
5.      .  
    .  
 .

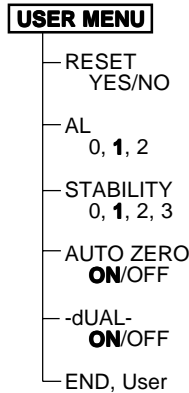
**Cal End**

To exit the calibration menus, proceed as follows:

1.     .
2.   .
3.    .
4.   .
5.    .
6.   .

## USER MENU

The User menu is used to adapt the balance to environmental conditions. It contains submenus which enable you to turn features on or off, and program balance parameters. *Reset* changes all submenus to original factory default settings. *Reset* does not appear if menu has been locked out. *AL* specifies the averaging level. *STB* specifies the desired stability range. *Auto Zero* sets the automatic zero threshold. *Dual*, when set on, enables dual range function on model AP250D. *End User* is used to exit the User menu and store the selections. The following figure illustrates the sequence in which submenus appear on the User menu. Items shown in bold are the default settings.




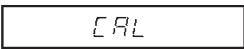

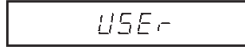

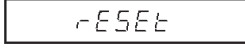

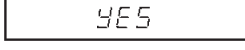


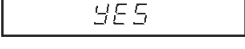
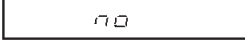

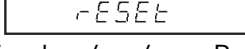
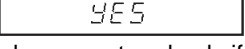
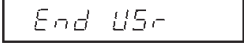


### User Menu Protection

The User menu may be locked out to prevent unauthorized personnel from changing the settings. If **-SAFE-** is displayed, the User menu has been locked out. Settings may be viewed but not changed. To lock out the User menu, refer to the section titled Menu Lock-Out Protection.

### Reset

This submenu enables you to reset all User menu selections to the *factory default settings*: Averaging Level **1**, Stability Range **1**, Auto-Zero Tracking **ON** and Dual Range **ON**. Reset does not appear if the menu has been locked out.

1.     .
2.   .
3.   .
4.   .
5.   to select  or  .
6.   . If  is selected, the balance signals a *long beep*. Reset values are stored only if exited through  .

## Averaging Level

Averaging level compensates for vibration or excessive air currents. Factory default setting is shown in bold type.








AL 0 reduced stability, fastest stabilization time

**AL 1 normal stability, normal stabilization time**

AL 2 more stability, slow stabilization time

**NOTE:** Averaging level does not affect balance accuracy, but it does affect stabilization time.

To view or change the averaging level:

1. Access the Averaging Level  submenu.
2.   .
3.    to select  through .
4.   .

## Stability Range

The stability range specifies the weighing results must be within a preset tolerance limit for a certain time to turn the stability indicator ON. When a displayed weight changes beyond the allowable range, the stability indicator turns OFF, indicating an unstable condition. Factory default setting is shown in bold type.

Stb 0 Smallest range: stability indicator is ON only when displayed weight is within a preset tolerance limit for one second.

**Stb 1 Normal range.**








Stb 2 Larger range.

Stb 3 Largest range: stability indicator is ON when displayed weight is within a preset tolerance limit for several seconds.

weight

When the RS232 interface is configured to print stable data only, the stability range also governs data output. Displayed data will only be output if it is within the selected stability range.

To view or change the stability range:








1. Access the Stability Range  submenu.
2.   .
3.    to select  through .
4.   .

## Auto-Zero

Auto-Zero minimizes the effects of temperature changes and shift on the zero reading. The balance maintains the zero display until the threshold is exceeded. Factory default setting is shown in bold type.








OFF Turns Auto-Zero OFF.  
**On Turns Auto-Zero ON.**

To view or change the auto-zero setting:

1. Access the Auto-Zero Auto-0 submenu.
2.   On.
3.    to select On or OFF.
4.   Auto-0.








## Dual Range Function

Enables dual range operation on model AP250D only. To turn the feature ON, proceed as follows:

1. Access the Dual -DUAL- submenu.
2.   On.
3.    to select On or OFF.
4.   -DUAL-.

## Exiting User Menu

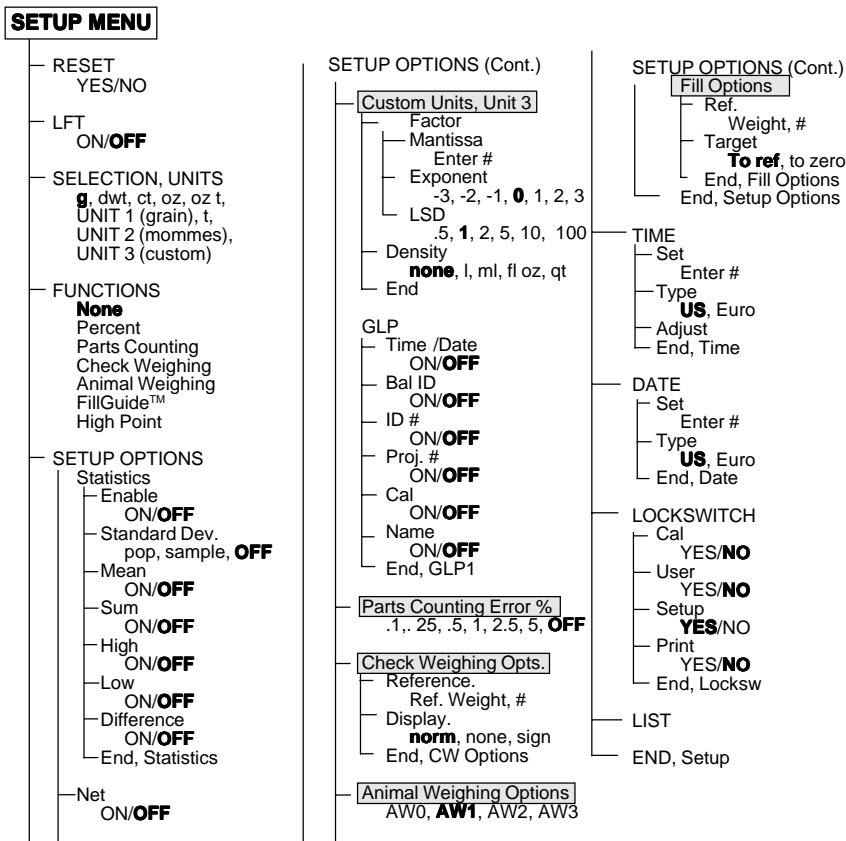
To exit the User menu and store settings, proceed as follows:

1. Access End Usr End USr submenu.
2.   USER.
3.    End.
4.   s 0.000000 g.



## SETUP MENU

The Setup menu is used to customize the operation of the balance for your specific requirements. It contains submenus which enable you to turn features on or off, and program balance parameters. *Reset* changes all submenus to original factory default settings. *Reset* does not appear if menu has been locked out. *LFT* sets the balance for type approved operation. *SEL* (selection) specifies one of nine weighing units with a custom unit for specialized applications. *Functions* contains six mutually exclusive items, only one at a time can be selected for operation. The functions are: Percent, Parts Counting, Check Weighing, Animal Weighing, FillGuide™ or High Point. Several of these functions have submenus under the Setup Options Menu which permit various options to be selected and printed. *Setup Options* contains submenus as follows: Statistics, Net, Custom Units, Good Laboratory Practices, Parts Counting Error, Check Weighing Options, Animal Weighing Options, Fill Options, Time, Date, Lock Switch, List and End. The following figure illustrates the sequence in which submenus appear on the Setup menu. Areas shaded only appear in the menu if the appropriate function or weighing unit is selected. Items shown in bold type are the default settings.



## Setup Menu Protection

The Setup menu may be locked out to prevent unauthorized personnel from changing the settings. If -SAFE- is displayed, the Setup menu has been locked out. Settings may be viewed but not changed. To lock out the Setup menu, refer to the section titled Menu Lock-Out Protection.



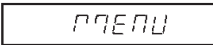

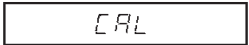



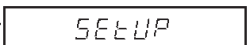


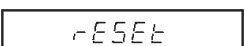


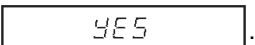



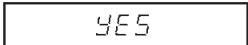
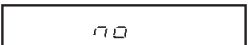



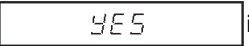
## Reset

This submenu enables you to reset **all** Setup menu selections to the factory default settings shown in the table. Reset does not appear if the menu has been locked out.

### NOTES:

1. Default settings of the Lockswitch menu only appear if the hardware Lock-out switch is set to the locked position.
2. Function related options shown in italics in the table only appear if that function is enabled.








SETUP MENU FACTORY DEFAULTS	
Unit Selection	grams
Functions	None
Statistics	All-Off
Net	Off
<i>Conversion Factor</i>	
Mantissa	1.000000
Exponent	0
LSD	1
Density	None
GLP	Off
<i>Animal Weighing</i>	<i>AW1</i>
<i>PC Error Level</i>	<i>OFF</i>
<i>Check Weighing</i>	
Reference	Ref Wt.
Display	Normal
<i>Fill Options</i>	
Reference	Ref Wt.
Target	To Ref
Time	U.S.
Date	U.S.
Lockswitch Menu	
Cal	Yes
User	No
Setup	Yes
Print	No

1.     .
2.    .
3.   .
4.   .
5.     or .
6.   . If  is selected, the balance signals a *long beep*.

## Type Approved/LFT

LFT can be set to ON or OFF. Selecting ON automatically sets the parameters shown in the table to conform to type approved requirements. For sealing method, refer to Type Approved Sealing section. Default setting are shown as follows:

Lockswitch Menu Print Stable Data Only	Setup Locked ON
---	--------------------

1. Access the  submenu.
2.   .
3.     or .
4.   .

## Unit Selection










The Unit Selection (SEL) submenu permits the selection of weighing units for use during operation. The balance can display weights in every unit of measure listed in table. The default setting is shown in bold type.

**NOTE:**

If Taels is enabled, see next page before exiting the menu.

Weighing Units	
<b>g</b>	<b>Grams</b>
dwt	Pennyweight
ct	Carats
oz	Ounces
ozt	Troy ounces
UNIT1	Grains
t	Taels (see note)
UNIT2	Mommes
UNIT3	Custom








To view or change the various weighing units:

1. Access the  submenu.
2.   .
3.     or .
4.   for next unit status.
5. Repeat steps 2 through 4 for each unit.
6.   .

## Unit Selection (Cont.)








### Taels

If taels are enabled, choose one of three different taels: Hong Kong, Singapore, or Taiwan.

1.    .
  2.     (Hong Kong),  (Singapore), or  (Taiwan).
  3.    .
- 































### Functions

The Functions submenu permits the selection of only one function. These functions are: Percent, Parts Counting, Check Weighing, Animal Weighing, FillGuide™, High Point or None. The default setting is **none**. *Only **one** function at a time can be selected for balance operation.* Selection of a function, other than None or Percent, requires additional selections to that function be reviewed in the section titled Setup Options.


1. Access the  submenu.
  2.    .
  3.     ,  ,  
 ,  ,  ,  
 .
  4.    .
-

**Statistics**

Statistics provides printed display data of: Standard Deviation either population or sample, Mean, Sum, High, Low and Difference readings. Each can be individually set ON or OFF.


1. Access  menu.
2.   .
3.   . Enable allows the statistics feature to be turned off without losing the individual settings programmed into memory.
4.   .
5.     or .
6.   .
7.   .
8.   .
9.    , ,  
.
10.   .
11.    to select other parameters.
12.   to accept.
13.     or .
14.   .
15. Continue the same procedure to set Sum, High, Low and Difference parameters and finish by selecting .

## Net

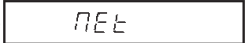


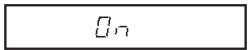



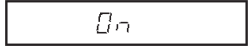
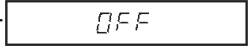


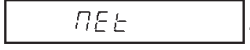
Weight shown on the display can be referred to as a zero value (gross value) or tare value (net value). When enabled the display value also has GROSS/NET Indicator turned ON, this feature will allow you to obtain a zero value by a long press on . A short press is a tare.

**Net Weight** - the weight of a material or sample after deducting the weight of its packaging or container with which it had previously been weighed.

**Gross Weight** - the weight of object or sample (Net Weight) including container or packaging.

**NOTE:** When in a weighing mode,   switches between Gross weight and Net weight.

The Net function can be set either ON or OFF.

1. Access the  menu under the Setup Options menu.
2.   .
3.     or .
4.   .

## Custom Unit or Volume Selection

Custom Unit is enabled when Unit 3 under Unit Selection is selected. When you need to display weight measurements in a weighing unit other than those provided standard with the balance, this feature can be used to create your own custom weighing unit. It permits you to enter a conversion factor which the balance will use to convert grams to the desired unit of measure.

$$\begin{array}{rcccl} \text{Conversion} & & \text{Weight} & & \text{Weight} \\ \text{Factor} & \times & \text{in} & = & \text{in} \\ & & \text{grams} & & \text{custom unit} \end{array}$$

Conversion factors are expressed in scientific notation and entered into the balance in three parts:

- a number between 0.1 and 1.999999 called the mantissa
- a power of 10 called the exponent
- a least significant digit (LSD)

### SCIENTIFIC NOTATION

Conv. Factor	Number Between 0.1 and 1.999999	Power of 10	Mantissa	Exp.
123.4	= .1234	x 1000	= .1234	x 10 <sup>3</sup>
12.34	= .1234	x 100	= .1234	x 10 <sup>2</sup>
1.234	= .1234	x 10	= .1234	x 10 <sup>1</sup>
.1234	= .1234	x 1	= .1234	x 10 <sup>0</sup>
.01234	= .1234	x .1	= .1234	x 10 <sup>-1</sup>
.001234	= .1234	x .01	= .1234	x 10 <sup>-2</sup>
.000123	= .123	x .001	= .123	x 10 <sup>-3</sup>

**Custom Unit or Volume Selection (Cont.)**

1. Access the submenu under the Setup Options menu.

2. .

3. .

The mantissa of the current conversion is displayed. The mantissa of the current conversion factor is displayed. This is a number between 0.1 and 1.999999 with the first digit flashing. For conversion factors outside of this range, the exponent will be used to move the decimal point.

4. changes first digit.

5. .

next digit flashes.

6. Repeat steps 4 and 5, and set value of all digits.

7. to backup for errors.

8. After the last digit is entered, the display indicates the current exponent preceded by the letter . There are 7 exponent values which you can choose from (see table).

9. to change the exponent.

10. . When released, the display shows the current least significant digit. The least significant digit is the digit in the last decimal place on the display. The selection you make causes the balance to count by 1's, 2's or 5's in this position. There are 6 LSD settings you can choose from (see table).

11. to change the LSD.

12. .







13. .

Density permits the selection of density of a liquid by measuring the volume by weight. If the Factor is the density of a liquid, the appropriate unit of volume can be selected for printing.

EXONENTS	
E-3	Moves decimal point 3 places to the left.
E-2	Moves decimal point 2 places to the left.
E-1	Moves decimal point 1 place to the left.
<b>E0</b>	<b>Leaves decimal point in normal position.</b>
E1	Moves decimal point 1 place to the right.
E2	Moves decimal point 2 places to the right.
E3	Moves decimal point 3 places to the right.


LSD's	
LSD .5*	Adds one decimal place display counts by 5's.
<b>LSD 1</b>	<b>Display counts by 1's.</b>
LSD 2	Display counts by 2's.
LSD 5	Display counts by 5's.
LSD 10	Display counts by 10's.
LSD 100	Display counts by 100's.
* Sensitivity to vibration is increased with this LSD setting.	

## Custom Unit or Volume Selection (Cont.)

14.   none.
15.   L I B E R, P O U N D,  
F L O Z, Q U A R T. Selecting NONE disables the volumetric units.
16.   d E N S I T Y.

**NOTE:** To use this function the printer must be on and all communication parameters must be set first.









### Operating Procedure

1. Place a container on the platform,   to tare the container .
2. Fill the container.
3.  , printer will now print out quantity of selected unit of measurement.

## Good Laboratory Practices

Good Laboratory Practices (GLP) submenu allows the selection of Time, Balance Identification Number, Identification Number, Project Number, Calibration and Name data to be printed. The purpose of this submenu is to permit the printing of the above selected items. These items are not displayed. The default setting is off.

When an external printer is used, and all items are set ON and the balance is calibrated, the printer will print out calibration data for audit trail purposes and will indicate date, and time. The Balance ID number is entered through the RS232 command xxxxD. It should be noted that the ID number and Project number must be entered in the Print/GLP submenu before printed data is available. Since all of the settings for the GLP submenu are done in a similar manner, only one example is shown.

1. Access the GLP submenu under <sup>SETUP</sup> Options menu.
2.   t I M E.
3.   O N.
4.   O N or O F F.
5.   t I M E.
6. Repeat steps above for Balance ID#, ID#, Project#, Calibration and Name.



## Parts Counting Error

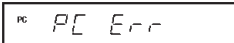






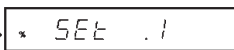
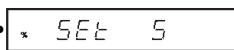


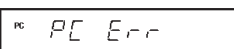


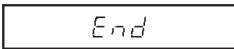


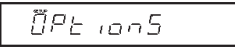
Parts counting Error is enabled only when the Parts Counting Function is selected.

The parts counting error level is the level of accuracy you consider acceptable for parts counting results. The adjacent table lists error levels that you can choose from. The default setting is shown in bold type.

EXAMPLE: With 5 Pct selected, 100 parts on the platform may yield a displayed count from 95 to 105 parts.

ERROR LEVELS	
<b>OFF</b>	<b>Disables error level limits.</b>
.1 %	±0.1% acceptable error.
.25 %	±0.25% acceptable error.
.5 %	±0.5% acceptable error.
1 %	±1.0% acceptable error.
2.5 %	±2.5% acceptable error.
5 %	±5.0% acceptable error.

To view, change or disable the PC Error Level:

1. Access the  submenu under the Setup Option submenu.
2.    indicates percentage of acceptable error.  
Settings are shown in table.
3.     •••  to change the percentage error limits,
4.    when the desired setting is reached.
5.   .
6.   .

## Check Weighing Options

Check Weighing is enabled only when the Check Weighing Function is selected. This feature may be used for check weighing or package weight control in any one of the available weighing units. When in use, the display will show the relationship between the load on the pan, and the selected target weight. The bar graph will visibly display where the weight of the load falls in relationship to the under, acceptable, and over limits. The balance also displays UNDER, ACCEPT, and OVER messages as appropriate. The default settings are: Reference = Reference weight, Display = normal.

Two choices are provided for programming the Reference Weight. One choice is the use of a mass (package, container, etc.) and the other is a number which can be entered as a high and low limit.

Three choices are provided for programming the display: normal, none, and sign. Sample displays are shown on the next page.

## SAMPLE DISPLAYS

**NOTE:** Samples of the displays for check weighing are shown as follows using a reference weight of 50 grams. The over limit was set at 55 grams, and the lower limit was set at 45 grams.

### NORMAL DISPLAYS

When normal is selected, the display indicates the actual weight.



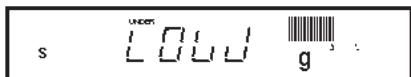
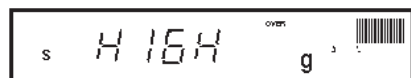
### NONE DISPLAYS

When none is selected, the numeric section of the display is blank if the values exceed the limits. Numbers appear only if they are within the limits.



### SIGN DISPLAYS



When sign is selected, the display spells out in words; HIGH, LOW or ACCEPT with no weight values showing.










### Check Weighing Options (Cont.)

The following procedure describes how to set up the balance for all choices. Before starting, the Check Weighing option must have been selected under the Functions submenu.



1. Access the [ C W O P t ] submenu under the Setup Options sub menu.



2.   r E F (reference).



3.   r E F W t (reference weight).




4.    r E F W t   n u m b e r.



If REF WT is selected, a sample reference is used later to set the weight parameter into the balance. If NUMBER is selected, a number representing the sample weight has to be entered manually. See section titled Check Weighing.



5.   r E F .



6.   d I S P L A Y .



7.   n o r m a l .



8.    n o r m a l , n o n e ,  
5 1 g .

9.   d I S P L A Y .

10.   E n d .

11.   [ C W O P t ] .












12.   E n d .

13.   O P t i o n s .

## Animal Weighing Options








Animal Weighing Options is enabled only when Animal Weighing Function is selected. The balance samples the weight data for a variable sampling interval and processes the data to filter out the instabilities by the live animal.

The strength of the filtering activity as well as the duration of the sampling period can be adjusted by selecting one of four AW OPT levels, 0 through 3. 0 is the least amount of processing, as well as the shortest sampling interval while level 3 is the maximum processing amount and the longest sampling interval. AW3 should be used for an active subject. The default setting is AW1.






1. Access the AW OPT submenu under the Setup Option submenu.
2.   AW 1.
3.    AW 1, AW 2,  
AW 3, AW 0 for desired sensitivity.
4.   AW OPT.
5.   End.
6.   OPT 1075.

## Fill Option



Fill Option provides two choices for a reference weight (similar to check weighing). Either a mass can be placed on the pan and used as a reference weight or a number can be entered to establish the weight value. Both methods are used to establish a reference for a 100% bar graph reading. Target parameter provides two choices, one is fill to the reference, the other to zero. The following procedure describes how to set up the balance for all choices. Before starting, the Fill Function must have been selected.



1.    to select the desired weighing unit, g, dwt, oz, etc.
2. Access the FILL OPT submenu under the Setup Options submenu.
3.   REF (reference).
4.   REF WGT (reference weight).

**Fill Option (Cont.)**




5.    REF WT   NUMBER.



If REF WT is selected, a sample reference weight is used later to set the weight parameter into the balance. If NUMBER is selected, a number representing the desired sample weight has to be entered. Select either REF WT or NUMBER.



6.   REF.



7.   TARGET. When target is selected, the balance will show the normal weight of the object on the pan.


8.  .



9.    to REF or to ZERO. When zero is selected, the balance indicates the weight as a negative number after the reference is set in the main menu. When an object is placed on the balance that weighs exactly what the reference was set to, the display shows zero with a full bar graph.

10.   TARGET.

11.   End.

12.   FILL OPT.



13.   End.



14.   Options.




**Time**



Time is a feature which enables the balance to be set to the current time in either U.S.A. standards (12 hour periods) or European/Military standards (24 hour periods). The default setting is US Standard. To enter time, proceed as follows:

1. Access the TIME submenu which is under the Setup menu.


























2.   TYPE.

3.   US.

4.    US or EURO.

















5.   TYPE.

## Time (Cont.)

6.   5 E E .
7.   12 00 A first two digits are flashing.
8.    or   to change flashing digits to current local hour.
9.   1 00 A flashes the last two digits.  
**NOTE:**   will back up display.
10.    or   changes minutes display.
11.   to accept. AM or PM is flashing, A for AM, P for PM.
12.    to select AM or PM.
13.   5 E E .

































## Adjust

Adjust is a feature which enables the internal clock of the balance to be corrected + or - 59 seconds a day. The internal clock is accurate to within 8 seconds a day. To enter or subtract time, proceed as follows:

1. Access the A D J U S T submenu which is under the Time sub menu.
2.   A d J 00 . First digit is flashing.
3.    to change first digit (ten seconds) from 0 to +5 or -5.
4.   A d J 00 , seconds digit is flashing.
5.    to change seconds from 0 to 9.
6.   A D J U S T .
7.   E n d .
8.   t i m e .

**Date**














Date is a feature which enables the balance to be set to a U.S.A. date standard or European date standard. U.S. standard has the month, date followed by the year each separated by (/) in the printout. The European date standard has the day first, followed by the month and then the year each separated by a period. The default setting is US Standard.

1. Access the DATE submenu which is under Setup menu.
2.   TYPE.
3.   US.
4.    US or EU-D.
5.   TYPE.
6.   SET.
7.   000000 flashes first two digits.
8.    to change the first flashing digit to current month for US or day for European standard.
9.   30000.
10.    to change flashing digit.
11.   30/95.
12.    to change year.
13.   SET.
14.   End.
15.   DATE.

**NOTE:** At power up, if Time in the GLP submenu is set to ON, the display flashes E 177E for about 1.5 seconds to prompt setting of time and date .




## Lockswitch

Lockswitch enables you to lock out one or more menu selections. Each menu can be individually locked on or off **after all functions have been set**. The **Calibration, User, Setup** and **Print** menus can be individually locked on or off by selecting the appropriate menu and then locked by the switch located under the front of the control panel. See Menu Lockout Section. Cal Test under Calibration remains functional with the Lockswitch On or Off. Before performing the lockout procedure, decide which functions of the balance are to be locked on or off.

1. Access the  submenu which is under the Setup menu.
2.    to access either Calibration, User, Setup or Print menus.
3.   to access selected desired menu.
4.    to select  or .  
**YES = locked, NO = not locked.**
5.   to accept.
6.    to change to other menus.
7. To change other menus, repeat steps 2 through 5.

## List



This submenu can be used to output a listing of current menu settings via the RS232 interface. When selected, all menu settings for the User, Setup and Print menus will be output either to an external printer or computer. To use this feature, your balance must be connected to a computer or printer.

1. Access the  submenu under the Setup or Print menus.
2.     . The display indicates a series of dots traveling right to left when the balance is sending information.

## Exit Setup Menu

1.   .

**NOTE:** If any Setup parameter is different from previous settings, indicator SETUP in the display flashes while the balance is storing new settings. Proceed with next step.

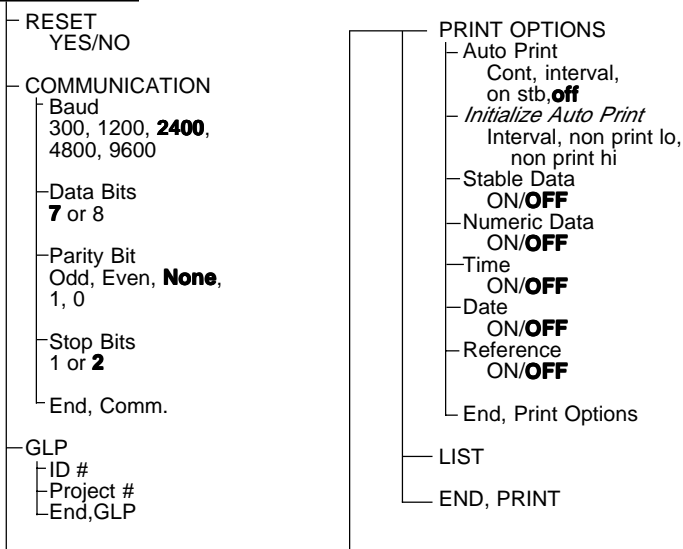
2.   .



## PRINT MENU

The Print menu provides a number of options which includes: reset, communications, good laboratory practices, print options, and list. *Reset* sets all submenus contained in the Print menu to factory default settings. *Communication* specifies baud rate, number of data bits, parity bit type and stop bits. *GLP* Good laboratory practices permits the entering of your own identification number and project number which shows up on printing. *Print Options* Enables/disables Auto print feature, specifies time interval for automatic output of displayed data and/or exclude a range of weights from being output. The following items can be turned on or off: Stable data-only feature, numeric only or full display data for output, time and date. Items shown in bold type are default settings. Items shown in italics in the print menu below appear only if the appropriate Functions are turned on.

### PRINT MENU













## Print Menu Protection

The Print menu may be locked out to prevent unauthorized personnel from changing settings. If SAFE is displayed, the Print menu has been locked out. Settings may be viewed but not changed. To lock out the Print menu or unlock, refer to the section titled Menu Lock-Out Protection.

## Reset

This submenu enables you to reset **all** Print menu selections to the factory default settings shown below. Reset does not appear if the menu has been locked out.

Function	Default
Baud Rate	br2400
Data Bits	7 data
Parity	none
Stop Bits	2 stop
Auto Print	OFF
Auto Print interval	1 second
Non Print Low Limit	0
Non Print High Limit	0
Stable data Only	OFF
Numeric Data Only	OFF
Time	OFF
Date	OFF

1.     .
2.   .
3.  .
4.  .
5.    or .
6.  . If  is selected, the balance signals a **long beep** and all selections reset to factory settings.

## Communication








The Communication submenu contains submenus which permit the setting of: baud rates, data bits, parity and stop bits necessary for communications to an external printer or computer.

Access the  submenu under the Print menu..

**Baud Rate**








This submenu is used to select the desired baud rate. There are five available baud rates to choose from: 300, 1200, 2400, 4800 and 9600. The default setting is 2400 baud.

To view or change the baud rate:

1. Access the brud submenu.
2.   br 1200 .
3.    br 1200 , br 2400 ,  
br 4800 , br 9600 , br 300 ,  
br 1200 . Normal baud rate is 2400.
4.   brud .







**Data Bits**

To set the number of data bits to 7 or 8:

1. Access the data submenu.
2.   7 data .
3.    7 data or 8 data .
4.   data .







## Parity

Parity can be set to Odd, Even or None. The default setting is None. To set parity, proceed as follows:

1. Access the  submenu.
2.   .
3.   , ,  
.
4.   .







## Stop Bits

The number of stop bits can be set to 1 or 2. The default setting is 2. To set stop bits, proceed as follows:



1. Access the  submenu.
2.   .
3.    or .
4.   .














## Good Laboratory Practice (GLP)

This submenu enables the storage of an identification number and/or a project number. When entered into the balance, the identification number and project number are available when printing. The reason the entries are made under the Print submenu, is that when legal for trade operation (LFT) is enabled, the Setup submenu is locked out, leaving the Print submenu free to make entries.

1. Access the  submenu.
2.   .
3.    first digit is flashing.
4.   changes the value of the first digit.

## Good Laboratory Practice (GLP) (Cont.)

**NOTE:**   allows going back to the previous digit for correction.

5.   accepts value and moves to second digit.
6.    to change next digit.
7. Repeat steps 4 through 6 to change all digits.
8.    .
9.    to enter project number.
10.   and repeat steps 3 through 7.
11.    .








## Print Options

This submenu contains additional features which can be set and include Auto Print, Initialize Auto Print, Stable Data only, Numeric Data only, Time, Date and Reference data and Difference. To change any of the above listed options, enter the submenu.

### Auto Print Feature

When enabled, the Auto Print feature causes the balance to automatically output display data in one of three ways: continuously, at user specified time intervals, or upon stability.

To select one of these Auto Print methods, or to turn the feature off:

1. Access the  submenu.
2.    .
3.     ,  ,  
 or  .
4.    .

**NOTE:** If you select interval to automatically output data at user specified time intervals, the interval is entered in the Initialize submenu which follows.

## Initialize

This submenu allows you to:

- Specify a time interval (in seconds) for automatic output.
- Exclude a range of weights from being output, or specify a range for output, by the Auto Print feature.

It does not appear on the Print menu if Auto Print is set to OFF. Use the following procedure to set these features:

1. Access the submenu under the Print Options submenu.
2. displays if Interval was selected in the Auto Print submenu and you may continue with step 3. If interval was not selected, is displayed. Proceed to step 7.
3. to enter time interval for automatic data output.  
The current interval from to (in seconds) is displayed.
4. to increase or to decrease the interval number.
5. .
6. to enter a range of non printing values.
7. , the current value for the low end of the range is displayed with the first digit flashing.
8. to change the number, start with the first digit (flashing). Change the value to any number from -9 to +9. A minus sign will light to indicate a negative value.
9. to accept it and the next digit will begin flashing.
10. Set all digits in the same manner. If an error is made, to backup to the desired digit and change it.

### To exclude data

#### WITHIN SELECTED RANGE:

SET non-PL < non-PH

Example: non-PL=7g, non-PH=11g  
Values <7 **OR** >11 will be output.









### To exclude data

#### OUTSIDE SELECTED RANGE:

Set non-PL > non-PH








Example: non-PL=11g, non-PH=7g  
Values >7 **AND** <11 will be output.

**Initialize (Cont.)**

11. After the last digit is entered, non-PL is displayed again.
12.   non-PH for the high limit.
13.   00000000 indicates current high end value.
14. Repeat steps 8 through 10 to change the numbers as required.
15. After the last digit is entered, non-PH displayed again.
16.   End.
17.   Init.








**Print Stable Data Only**

When enabled, this feature permits only stable display data to be output. To set the feature ON or OFF, proceed as follows:

1. Access the StABLE submenu under the Print Options menu.
2.   OFF.
3.    OFF or On.
4.   StABLE.








**Print Numeric Data Only**

This submenu is used to select numeric data only, or full display data for RS232 output. Set this feature ON to output numeric display data only, or OFF to output full display data as follows:

1. Access the nu submenu under the Print Options menu.
2.   OFF.
3.    OFF or On.
4.   nu.








## Time


When the Time function is set ON, allows the balance to output the current time to the printer. To set the Time feature ON or OFF, proceed as follows:

1. Access the  submenu under the Print Options menu
2.   .
3.     or .
4.   .

## Date








When the Date function is set ON, allows the balance to output the current date to the printer. To set the Date feature ON or OFF, proceed as follows:

1. Access the  submenu under the Print Options menu
2.   .
3.     or .
4.   .

**NOTE:** With Print Time or Date set to ON, if either current Time or Date has not been set in Setup menu, "Set Time/Date !" is sent through the RS232 Interface with each press of  button.

## Reference








When the Reference function is set ON, prints the value of weight used as a reference in either Check Weighing, Fill Guide, Percent and Parts Counting modes. When set to Current, the printer prints the current reference immediately.

1. Access the  submenu under the Print Options menu
2.   .
3.    ,  or .
4.   .






**Difference**

Difference data is only output to the printer when Check Weighing or Fill Guide™ mode was selected.

1. Access the  submenu under the Print Options menu
2.    .
3.     or  .
4.    .

**List**


This submenu can be used to output a listing of current menu settings via the RS232 interface. When selected, all menu settings for the User, Setup and Print menus will be output either to an external printer or computer. To use this feature, your balance must be connected to a computer or printer.

1. Access the  submenu under the Setup or Print menus.
2.      The display indicates a series of dots traveling right to left when the balance is sending information.

## CARE AND MAINTENANCE

To keep the balance operating properly, the housing and platform should be kept clean and free from foreign material. If necessary, a cloth dampened with a mild detergent may be used. Keep calibration masses in a safe dry place.

## TROUBLESHOOTING

SYMPTOM	PROBABLE CAUSE(S)	REMEDY
Unit will not turn on.	Power cord not plugged in or properly connected to balance.	Check power cord connections.
Incorrect weight reading.	Balance was not re-zeroed before weighing.  Balance not properly calibrated.	Press  with no weight on the pan, then weigh item. Recalibrate correctly.
Cannot display weight in desired unit or cannot access desired weighing mode.	Desired unit/mode not set to ON in Unit Selection of Setup menu.	See Unit Selection section of Setup menu.
Unable to store menu settings/changes.	End not being used to exit menus.	You <b>MUST</b> use End to exit menus and save settings.
RS232 interface not working.	Print menu settings not properly set up.  Cable connections.	Verify interface settings in Print menu correspond to those of peripheral device.  Check cable connections.
Random segments displayed or display locks up.	Microprocessor locks up.	Turn power off, then turn on again. If condition persists, unit must be serviced.
Unable to change settings.	Lock set ON. (LFT set ON)	Set Lock switch to OFF.
Unstable readings.	Vibration on table surface.	Place balance on a stable surface or change averaging level.
Error message display.	_____	See Error Codes list.

## Error Codes List

The following list describes the various error codes and which can appear on the display and the suggested remedy.

### Data Errors

- 0.0 Internal data errors. If error persists, the balance must be serviced.
- 1.0 Internal data errors. If error persists, the balance must be serviced.

### Tare Errors

- 2.0 Illegal tare operation or balance is unable to stabilize within time limit after taring. Environment is too hostile or balance needs recalibration.

### Calibration Errors

- 3.0 Incorrect or no calibration weight used for User calibration. Recalibrate with correct weights.
- 5.0 Auto calibration failed. Environment is too hostile, recalibrate the balance.

### RS232 Errors

- 4.4 RS232 buffer is full (if installed). May occur if no printer or computer is connected to the interface. To clear buffer, turn balance off or enter Print menu and select END.
- 4.5 Function is disabled by the Lock switch.

### User Errors

- 7.0 User entry out of range (custom factor, non-pH, non-pL, etc...)
- 7.1 Bad percent (%) mode, sample too low.
- 7.2 Number outside of display capacity.

### Over-Under Load Errors

- 8.0 Hardware error causing an internal weight signal which is too low. Check if platform or platform support is off. If not, the balance must be serviced.
- 8.2 Internal power on error. Turn the power off, then turn it back on.
- 8.3 Hardware error caused by an internal weight signal which is too high. Check load on the platform which may be excessive. If error persists, the balance must be serviced.

## **Error Codes List (Cont.)**

### **System Errors**

5.1 through 5.9

System errors. Turn the power off, then turn it back on. If error persists, have the balance serviced.

### **Checksum Errors**

9.7 Invalid setup data checksum. Check Setup, User, and Print menus settings. if possible, try to enter menus and exit using END to restore menu settings. May be caused by a faulty component, or in rare cases, a severe static charge. If error persists, balance must be serviced.

## SERVICE INFORMATION

If the Troubleshooting section does not resolve or describe your problem, you will need to contact an authorized Ohaus Service Agent. For Service assistance in the United States, please call Ohaus Corporation toll-free at (800) 526-0659. An Ohaus Product Service Specialist will be available to help you.

## REPLACEMENT PARTS

	<b>OHAUS <u>Part No.</u></b>
Power Cords:	
U.S. 120 V ac	6569-00
European 220 V ac	76212-00
European 240 Vac	76448-00
Pan (AP110, AP210 and AP250 modes)	9773-00
Pan (AP310 models)	9773-01
Pan Shield	9773-02
Pan Ring	9773-03
Leveling Foot	9773-04
In-Service Cover	9773-78
Fuse (160 mA/250 V for all models)	90167-42

## ACCESSORIES

Anti-Theft Device	77401-00
Density Determination Kit	77402-00
Storage Cover	9773-79
Calibration Masses - ASTM Class 1 Tolerance:	
100 g	49015-11
200 g	49025-11

## SPECIFICATIONS

MODEL	AP110	AP210	AP310	AP250D
Capacity (g)	110	210	310	52/210
Readability (mg)	0.1			0.01/0.1
Weighing modes	g, oz, ct, dwt, (3) taels, oz t, gn, mommes, 1 custom unit, parts counting, percent weighing,			
Repeatability (Std. dev.) (mg)	0.1		0.2	0.02/0.1
Linearity (mg)	±0.2		±0.5	±0.03/0.2
Tare range	To capacity by subtraction			
Stabilization time (sec)	4		8	12/5
Sensitivity drift (10 - 30 °C)	±2 ppm/ °C			
Operating temperature range	50° to 104°F/10° to 40°C			
Calibration	Motorized internal and manual external			
Internal calibration weights	Stainless steel - measured to ±0.1 mg at an air density of 1.2 mg/cm <sup>3</sup> on virtual mass with density 8.0 g/cm <sup>3</sup>			
Power requirements	100, 120, 220, 240 V ac, 50/60Hz			
Display (in/cm)	Vacuum fluorescent (0.5/1.3 high)			
Pan size (in/cm)	3.5/9			
Free height above pan (in/cm)	9.5/24			
Dimensions (WxHxD) (in/cm)	7.7 x 12.2 x 15.7 19.5 x 31 x 40			
Net weight (lb/kg)	22.5/10.2			

## **LIMITED WARRANTY**

Ohaus products are warranted against defects in materials and workmanship from the date of delivery through the duration of the warranty period. During the warranty period Ohaus will repair, or, at its option, replace any component(s) that proves to be defective at no charge, provided that the product is returned, freight prepaid, to Ohaus.

This warranty does not apply if the product has been damaged by accident or misuse, exposed to radioactive or corrosive materials, has foreign material penetrating to the inside of the product, or as a result of service or modification by other than Ohaus. The warranty period shall begin at the date of installation, or three months from shipment to the buyer, whichever occurs first. A properly completed Warranty Registration Card must be received by Ohaus within 30 days from date of purchase to initiate coverage under the warranty. No other express or implied warranty is given by Ohaus Corporation. Ohaus Corporation shall not be liable for any consequential damages.

As warranty legislation differs from state to state and country to country, please contact Ohaus or your local Ohaus dealer for further details.



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With offices worldwide.



# **ANALYTICAL *Plus*** **Electronic Balances**

**Models AP110S, AP210S, AP310S,  
AP250D, AP110E, AP210E,  
AP310E and AP250E**

**Instruction Manual**

# **OHAUS<sup>®</sup>**

**WARNING:** THIS EQUIPMENT HAS BEEN TESTED AND FOUND TO COMPLY WITH THE LIMITS FOR A CLASS A DIGITAL DEVICE, PURSUANT TO BOTH PART 15 OF THE FCC RULES AND THE RADIO INTERFERENCE REGULATIONS OF THE CANADIAN DEPARTMENT OF COMMUNICATIONS.

THESE LIMITS ARE DESIGNED TO PROVIDE REASONABLE PROTECTION AGAINST HARMFUL INTERFERENCE WHEN THE EQUIPMENT IS OPERATED IN A COMMERCIAL ENVIRONMENT. THIS EQUIPMENT GENERATES, USES, AND CAN RADIATE RADIO FREQUENCY ENERGY AND, IF CHANGES, MODIFICATIONS, INSTALLATION OR USE IS NOT IN ACCORDANCE WITH THE INSTRUCTION MANUAL, MAY CAUSE HARMFUL INTERFERENCE TO RADIO COMMUNICATIONS. OPERATION OF THIS EQUIPMENT IN A RESIDENTIAL AREA IS LIKELY TO CAUSE HARMFUL INTERFERENCE IN WHICH CASE THE USER WILL BE REQUIRED TO CORRECT THE INTERFERENCE AT HIS OWN EXPENSE.

LE PRÉSENT APPAREIL NUMÉRIQUE N'ÉMET PAS DE BRUITS RADIOÉLECTRIQUES DÉPASSANT LES LIMITES APPLICABLES AUX APPAREILS NUMÉRIQUES DE CLASSE A PRÉSCRITES DANS LE RÈGLEMENT SUR LE BRUILLAGE RADIOÉLECTRIQUE ÉDICTÉ PAR LE MINISTÈRE DES COMMUNICATIONS DU CANADA.

**Ohaus Corporation  
EC Declaration of Type Conformity**

Ohaus Corporation declares that this instrument complies with the following EC directives and EN standards:

EC Directive 90/384/EEC  
EN 45501  
EC Type Approval Certificate (verified versions)  
EC Directive 89/336/EE  
EN 50081-1  
EN 50082-1  
EN 55022  
EN60555-2  
EN60555-3

## PREFACE

Your OHAUS® ANALYTICAL *Plus* balance is a precision weighing instrument that is designed to be accurate and easy to operate. This manual explains how to use your balance properly and should be read before operation.

ANALYTICAL *Plus* balances are software controlled devices with a host of user-programmable features. Calibrating and setting up features are easily accomplished through the software using the front panel buttons and display. These are a few of the standard features included with ANALYTICAL *Plus* balances:

### Selectable Weighing Units

The balance is shipped to you preprogrammed to display weight in grams only. However, using the built-in setup program, you can choose up to 13 different weighing modes including a user-definable custom unit, parts counting and percent weighing.

### RS-232 Interface

The bi-directional RS-232 interface enables ANALYTICAL *Plus* balances to communicate with printers and computers. Instructions on connecting and using the interface are included in this manual.

### Dual Range Operation (Model AP250D Only)

This model features two operating ranges; a fine range with greater readability for lower capacities, and a coarse range for higher capacities.

# TABLE OF CONTENTS

UNPACKING .....	6
INSTALLATION.....	7
Environment .....	7
Weigh Below Hook .....	7
Leveling the Balance .....	8
Installing the Pan Assembly .....	8
In-Service Cover.....	8
Connecting Power .....	9
Spare Fuse.....	9
Self Test .....	9
Turning the Display ON and OFF .....	10
INITIAL CALIBRATION .....	11
OPERATION .....	12
Auto Range (Model AP25OD Only).....	12
Selecting a Weighing Unit or Mode .....	12
Weighing .....	12
Taring .....	13
Parts Counting.....	14
Percent Weighing .....	17
Printing .....	20
USING MENUS TO CONFIGURE THE BALANCE.....	21
CALIBRATION MENU AND PROCEDURE .....	22
Auto Calibration.....	23
External Calibration .....	23
SETUP MENU.....	26
Reset to Original Factory Settings .....	27
Unit Selection .....	28
Averaging Level.....	29
Stability Range .....	29
Auto-Zero .....	30
Custom Unit Conversion Factor.....	31

Parts Counting Error Level .....	33
Parts Counting Alternate Display .....	34
Percent Weighing Alternate Display .....	35
Menu Lockout .....	36
List.....	37
End .....	37
PRINT MENU .....	38
Reset to Original Factory Settings .....	39
Baud Rate .....	40
Data Bits .....	40
Parity .....	41
Stop Bits .....	41
Auto Print Feature .....	42
Auto Print Time Interval and Non Printing Weight Values .....	42
Print Stable Data Only .....	45
Print Numeric Data Only .....	45
List.....	46
End .....	46
MENU LOCK-OUT PROTECTION.....	47
RS-232 INTERFACE.....	47
Hardware .....	48
Output Formats.....	48
RS-232 Commands .....	48
RS-232 COMMAND TABLE .....	49
TROUBLESHOOTING .....	51
Error Codes .....	52
SPECIFICATIONS .....	53
CARE AND MAINTENANCE.....	54
SERVICE INFORMATION .....	54
REPLACEMENT PARTS .....	54
ACCESSORIES .....	54
LIMITED WARRANTY.....	55

# UNPACKING

Your *ANALYTICAL Plus* balance was shipped with the following items:

- a pan assembly (includes pan, shield, ring and assembly instructions)
- an *in-service cover*
- an AC power cord
- a spare fuse
- this instruction manual
- two warranty cards

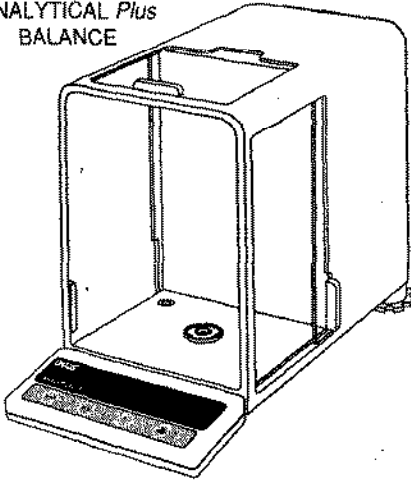
Remove the contents from the carton and carefully remove all packing material. It is recommended to save the carton and packing material for storing and/or transporting the balance. Verify that all of the components have been included and there has been no damage during shipment.

## Warranty Card

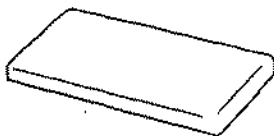
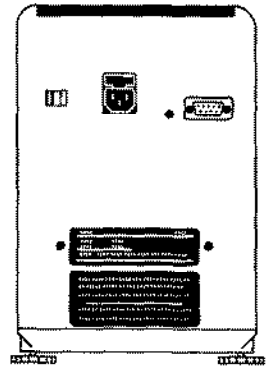
Included with the balance are two warranty cards:

- United Kingdom and European users complete and return the BLUE warranty card
- All other users complete and return the WHITE warranty card

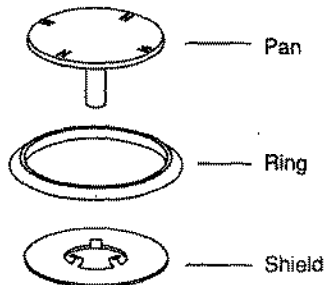
*ANALYTICAL Plus*  
BALANCE



REAR VIEW



In-Service Cover



# INSTALLATION

## Environment

The balance should always be used in an environment which is free from excessive air currents, corrosives, vibration, and temperature or humidity extremes. These factors will affect displayed weight readings.

DO NOT install the balance:

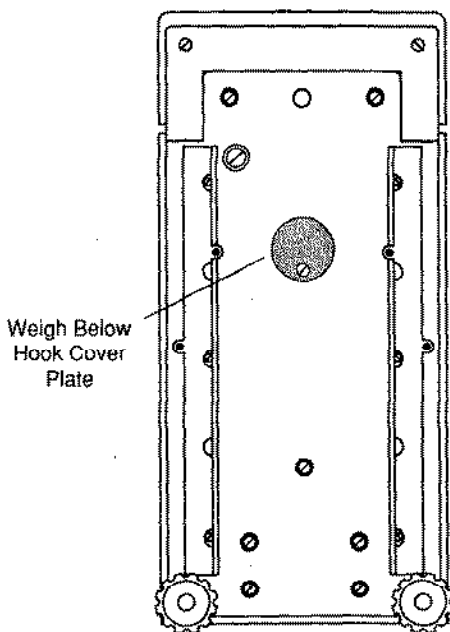
- next to open windows or doors causing drafts or rapid temperature changes.
- near air conditioning or heat vents.
- near vibrating, rotating or reciprocating equipment.
- near magnetic fields or devices that may generate magnetic fields (i.e. motors, alternators, etc.)
- on an unlevel work surface.

Install the balance in the location where it will be used before proceeding.

## Weigh Below Hook

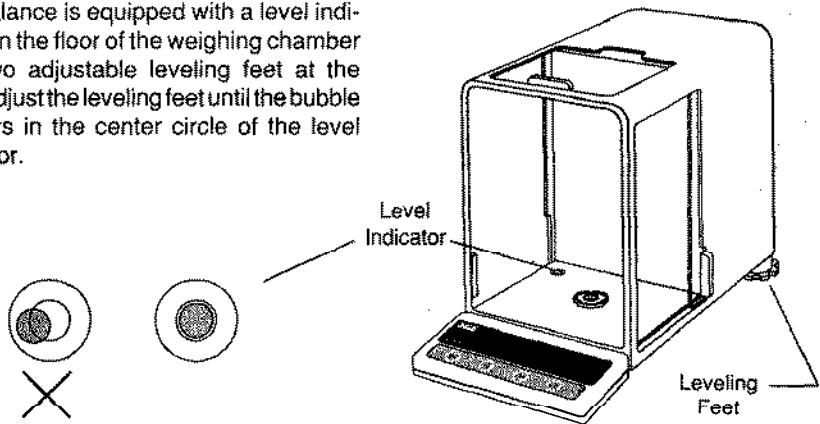
A weigh below hook is provided inside the bottom cover under the protective plate shown in the illustration.

To access the weigh below hook, loosen the screw which secures the cover plate, rotate the plate to clear the hole, then secure the plate in that position.



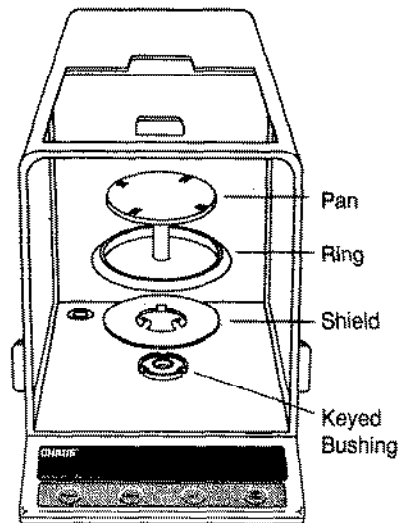
## Leveling the Balance

The balance is equipped with a level indicator on the floor of the weighing chamber and two adjustable leveling feet at the rear. Adjust the leveling feet until the bubble appears in the center circle of the level indicator.



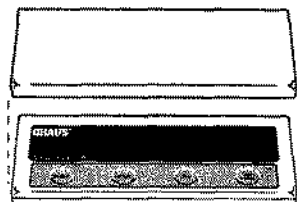
## Installing the Pan Assembly

1. Place the shield onto the keyed bushing and press it down into place. The bent tabs must be facing upward and the shield should be flat against the chamber floor.
2. Place the ring over the shield. The lip on the bottom of the ring should fit against the shield to keep it from moving.
3. Insert the pan in the load receiver hole, matching the key on the pan shaft with the slot in the hole. Gently press the pan down into place.



## In-Service Cover

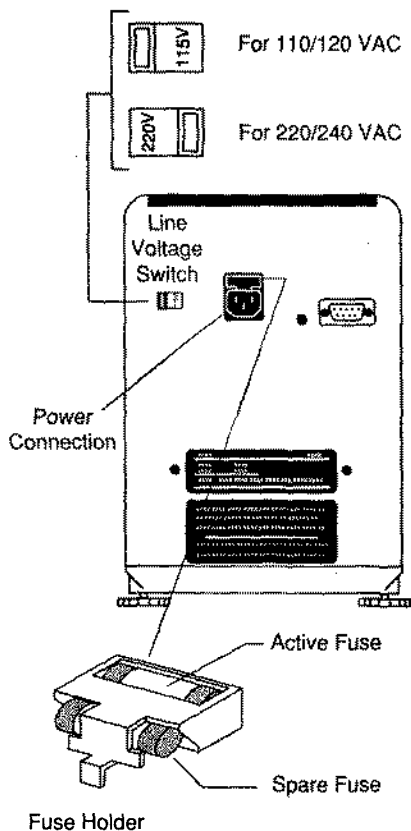
Place the cover snugly over the display unit.





## Connecting Power

1. Before connecting the power cord, check that the line voltage switch located at the rear of the balance is set correctly for your location. If not, use a small screwdriver to set the switch correctly.
2. Make sure the doors to the weighing chamber are closed.
2. Connect the power cord receptacle to the plug on the rear of the balance.
3. Plug the power cord into a convenient AC outlet.



## Spare Fuse

A spare fuse is provided in the fuse holder as shown in the diagram. All models use a 160 mA/250 V fuse.


## Self Test

When power is applied to the balance, it begins a "self test" cycle. During this time, the display will count down from 250 and display the word "CHEC".

After the self test is completed, the display turns off. Allow the balance to stabilize for about 2 hours before using it.

CHEC250

## Turning the Display ON and OFF

With no load on the pan and the chamber doors closed, switch the display ON by pressing .

When first switched ON, all segments and indicators on the display should be on as shown in the illustration.



This "display check" will be displayed briefly, then the model number of the balance will be displayed, then the software revision level.

AP250d

The display will momentarily blank and then indicate zero. The following table describes each of the display indicators.

### DISPLAY INDICATORS

<b>O</b>	stability indicator	<b>MENU</b>	indicates menu is active
<b>PC</b>	parts counting	<b>g</b>	grams
<b>%</b>	percent weighing	<b>dwt</b>	pennyweight
<b>NET</b>	net indicator	<b>ct</b>	carat
<b>GROSS</b>	gross (total) indicator	<b>oz</b>	avoirdupois ounces
<b>UNIT1</b>	grains	<b>ozt</b>	troy ounces
<b>UNIT2</b>	mommes	<b>t</b>	taels
<b>UNIT3</b>	custom unit	<b>▲</b>	user calibration indicator

To turn the display OFF, simply press the OFF button.

NOTE: Turning the display OFF does not turn the balance off. The internal components of the balance are on as long as power is connected.





## INITIAL CALIBRATION

Before using the balance, it should be calibrated. The balance has been calibrated before shipment, however, it could be influenced by factors such as:

- variations in the earth's gravitational field at different latitudes of the world
- rough handling
- changes in work location

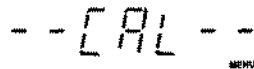
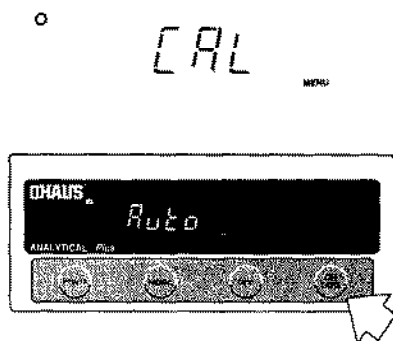
Although ANALYTICAL *Plus* balances may be calibrated using external calibration weights (see CALIBRATION MENU AND PROCEDURE section), the following procedure is recommended using the balance's internal weights.

Before beginning, make sure the balance has stabilized for at least 2 hours:

1. Close the chamber doors.
2. With the display on and no load on the pan, press and hold  until "CAL" is displayed, then release it.
3. When  is released, "Auto" will be displayed. Press  to select Auto Calibration.
4. When  is released, "-- CAL --" will be displayed and the balance will begin its internal calibration sequence.

DO NOT DISTURB THE BALANCE WHEN "-- CAL --" IS DISPLAYED.

5. When the display indicates zero again, calibration is completed.



The diagram shows the digital display of the balance showing "-- CAL --" in large characters. Below the display, the text "ANALYTICAL Plus" is visible. Below the display are four buttons: "ON TARE", "MODE", "CAL", and "MENU". A small "MENU" label is also present to the right of the display.

## OPERATION

The balance is shipped preprogrammed to display weight in GRAMS ONLY. All other weighing units and modes are disabled. Other balance features are preprogrammed as outlined in the adjacent table.

If you need to use other weighing units or modes, or you need to reconfigure balance features, you MUST refer to the section titled "USING MENUS TO CONFIGURE THE BALANCE" before proceeding with OPERATION.

ORIGINAL FACTORY SETTINGS	
Unit Selection	Grams
Averaging Level	1
Stability Range	2
Auto-Zero Tracking	ON
Conversion Factor:	
Mantissa	0000000
Exponent	0
LSD	1
PC Error Level	OFF
PC Alt. Display	TOTAL PCS
% Alt. Display	TOTAL %

### Auto Range (AP250D and E Only)

Modes AP250D and E offer both a fine range (0.01 mg readability from 0 to 52 g) and a coarse range (0.1 mg over 52 g). When first turned on, the balance is in the fine range. It remains in this range until the weight on the pan exceeds 52 g. When weight on the pan is greater than 52 g, the balance switches to the coarse range.

If weight on the pan falls below 52 g, coarse range readability remains in effect until you tare the balance with no weight on the pan.

### Selecting a Weighing Unit or Mode

To select a different weighing unit or operating mode for use,


repeatedly press  until the desired indicator appears on the display.

If the desired indicator does not appear, refer to "Unit Selection" in the "SETUP MENU" section to enable it for use.

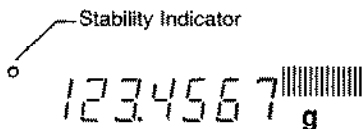
 g or dwt or oz

Original factory setting is GRAMS ONLY.

### Weighing

1. Select the desired weighing unit.
2. Press  to zero the display.

- Place the object(s) or material to be weighed on the pan.
- Wait for the stability indicator to appear before reading the weight.




### Capacity Guide

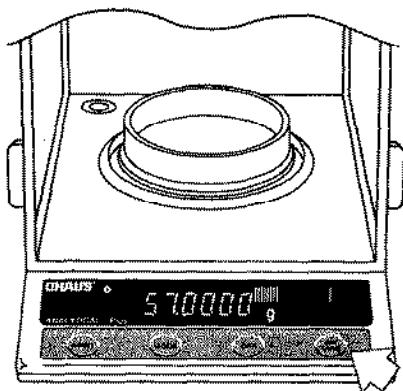
During weighing operations the capacity guide displays the relationship between the total load on the platform and the total capacity of the balance. Taring does not affect this display.



### Taring

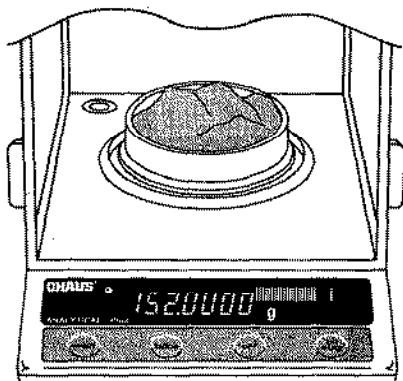
When weighing material or objects that must be held in a container, taring enables you to store the container weight in the balance's memory, separate from the weight of the material in the container.


- Place an empty container on the pan. Its weight will be displayed.
- Press . The display will show zero and the container's weight will be stored in memory.



Notice that the capacity guide displays the tared weight relative to the balance's capacity.

- Add material to the container. As material is added, its net weight will be displayed.
- Removing the container and material from the pan will cause the balance to display the container's weight as a negative number.




Tared weight remains in balance memory until  is pressed again.

## Parts Counting

NOTE: Parts counting must first be enabled in the Setup menu to use it.


In the parts counting mode, the balance calculates and displays the quantity of parts you place on the pan. Since the balance determines the quantity based on the average weight of a single part, all parts must be reasonably uniform in weight. The accuracy of parts counting results is determined by the error level entered in "PC Err" of the Setup menu.



To perform parts counting, use the following procedure:


1. Repeatedly press  until "PC Con" is displayed.

 PC Con

2. Place an empty container on the pan (if one will be used).

3. Press .

NOTE: To exit or restart parts counting at any time: Press and hold  until "PC Con" is displayed, then release it. Return to step 2 to restart, or press  to exit.

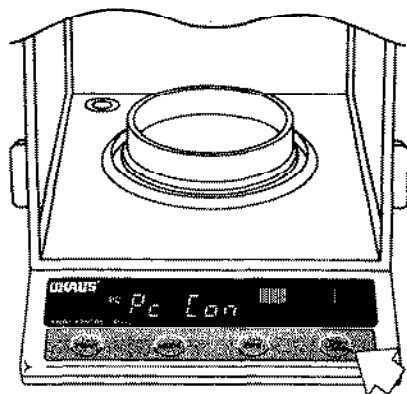
4. When  is released, "Add 5" will be displayed.

 Add 5

The balance needs a sample of the parts to use as a reference for counting. The factory setting for the sample size is 5 parts, but this can be changed to 10, 20, 30, 40, 50 or 100 parts. (Larger samples yield more accurate results.)

### Parts Counting Factory Settings

Parts Counting .....	Disabled
PC Err .....	OFF
PC Alternate Display .....	TOTAL PCS



5. To change the sample size, repeatedly press **MODE** until the desired quantity is displayed.

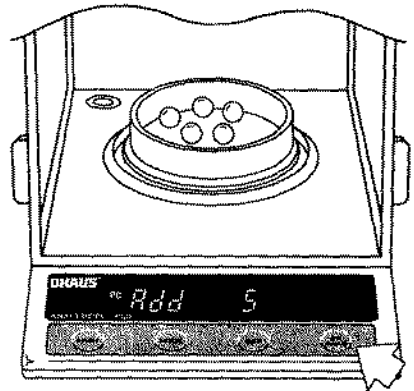
6. Add the sample number of pieces to the container, then press **ON TARE**.

If "Add X" is displayed, the sample is too small to provide results within the selected error level ("PC Err" of the Setup menu). "X" represents the number of additional parts needed to provide a sufficient sample.

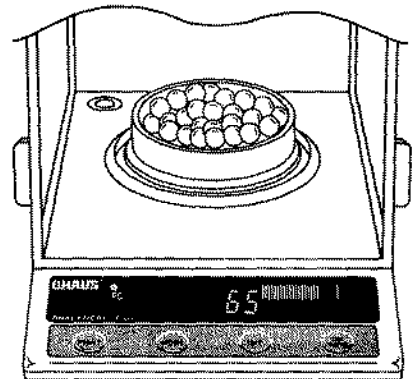
Add the required number of parts, then press **ON TARE** again.

8. The balance will calculate the average piece weight based on the net weight of the sample, and then display the current number of parts.


9. Add parts to the container as desired and read the quantity on the display.



PC 5



## Parts Counting Alternate Display


To view the weight or gross number of parts on the pan, press .


Weight is displayed in the weighing unit selected in "PC ALt" in the Setup menu.

**IF NET** has been selected for the alternate display, you may repeatedly tare the balance as needed. The alternate display will show the net weight of parts added since the last tare.



**IF TOTAL** has been selected for the alternate display, total weight or quantity of parts on the pan (relative to weight of container already tared) will be displayed. Taring will not affect the alternate display.


- The primary parts count display always shows the NET number of parts.
- Average piece weight is not affected by taring.

To view the average piece weight press and hold . This also causes the average piece weight to be output over the RS-232 interface.

To switch between alternate display and parts count display, press .

You may change the alternate display unit through the Setup menu without losing the current average piece weight.

To exit or restart parts counting, press and hold  until "PC Con" is displayed, then release it. Return to step 2 to restart, or press  to change to another operating mode.

<sup>o</sup>PC 1234567  g

Alternate Display showing TOTAL weight of parts on pan.



Lights to indicate NET weight.



Lights to indicate TOTAL weight or parts.

<sup>o</sup>PC 5.83325 g

Average Piece Weight

<sup>o</sup>PC PC Con




## Percent Weighing

NOTE: Percent weighing must first be enabled in the Setup menu to use it.

Percent weighing permits you to place a reference load on the balance, then view other loads as a percentage of the reference. The load you place on the pan as a reference may be displayed as any percentage you select from 5% to 100% (in 1% increments). One hundred percent does not necessarily have to represent the reference load. Subsequent loads, displayed as a percentage of the reference are limited only by the capacity of the balance.

To perform percent weighing, use the following procedure:

1. Repeatedly press  until "PctCon" is displayed.

2. Place an empty container on the pan (if one will be used).

3. Press .

4. "SEt xxx" will be displayed where "xxx" is the current reference percentage.

### Percent Weighing Factory Settings

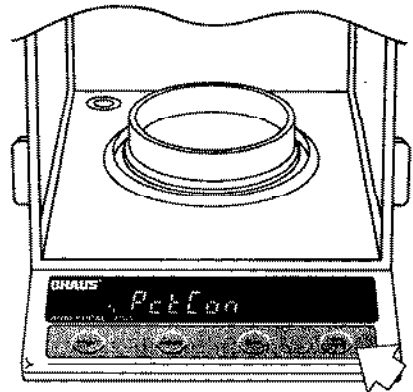
% Mode ..... Disabled  
% Alternate Display ..... TOTAL %  
Reference % ..... 100%

### EXAMPLE

A 10g reference load is set for 20%:

- A subsequent load of 100 g will be displayed as 200%.
- A subsequent load of 200 g will be displayed as 400%.

○  
% PctCon

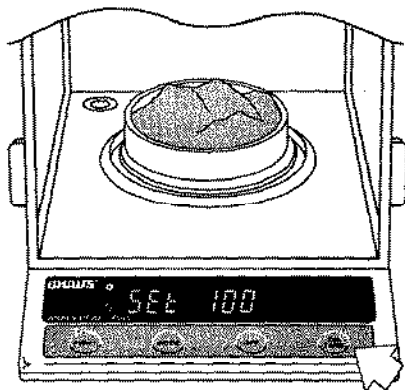


○  
% SEt 100

5. The reference percentage can be changed to any value from 5 to 100.

Press **MODE** to change the value.  
(Pressing and holding **MODE** causes the display to increment quickly.)

6. Place the reference load in the container (or directly on the pan if no container is used).
7. Press **ON TARE**.
8. The display will show the reference load as the percentage you selected.

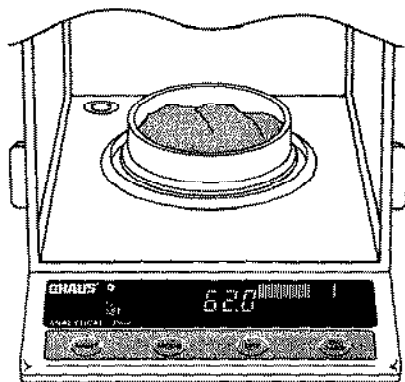


NOTE: To exit or restart percent weighing at any time, press and hold **ON TARE** until "PctCon" is displayed, then release it. Return to step 2 to restart, or press **MODE** to change to another weighing mode.


○  
% PctCon

9. Remove the reference load from the balance and replace it with another load.
10. The second load will be displayed as a percentage of the reference.

The reference weight may be viewed at any time by pressing and holding **PRINT**. This also causes the reference weight to be output over the RS-232 interface.



## Percent Weighing Alternate Display


To view the weight or gross percentage of the load on the pan, press .

Weight will be displayed in the weighing unit selected in "Pct ALT" in the Setup menu.

**IF NET** has been selected for the alternate display, you may repeatedly tare the balance between weighings. The alternate display will show the net weight of material added since the last tare.



**IF TOTAL** has been selected for the alternate display, the balance will display the gross weight (relative to weight of container already tared) or percentage of material on the pan. Taring will not affect the alternate display.


**NOTE:** The primary percentage display always shows the NET percentage.

To switch between the alternate display and the percentage display, repeatedly press .

**NOTE:** You may change the alternate display unit through the Setup menu without losing the current reference.

To exit or restart percent weighing,

Press and hold  until "PctCon" is displayed, then release it. Return to step 2 to restart, or press  to change to another weighing mode.

o  
% 123.4567  g


Alternate Display showing TOTAL weight of load on pan.




Lights to indicate NET weight.



Lights to indicate TOTAL weight or parts.

o  
% NET 27.0 


Percent Display

o  
% 123.4567  g

Alternate Display

o  
% PctCon

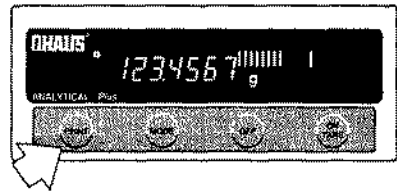
## Printing

If the RS-232 interface is being used with a printer, computer or other output device, display data can be output at any time during operation by pressing .

The output format is illustrated under the "P" command in the RS-232 COMMAND TABLE found in the "RS-232 INTERFACE" section of this manual.

For more information on printing and using the interface refer to:

- the "PRINT MENU" section for information on configuring the interface
- the "RS-232 INTERFACE" section for information on how the interface works



## USING MENUS TO CONFIGURE THE BALANCE

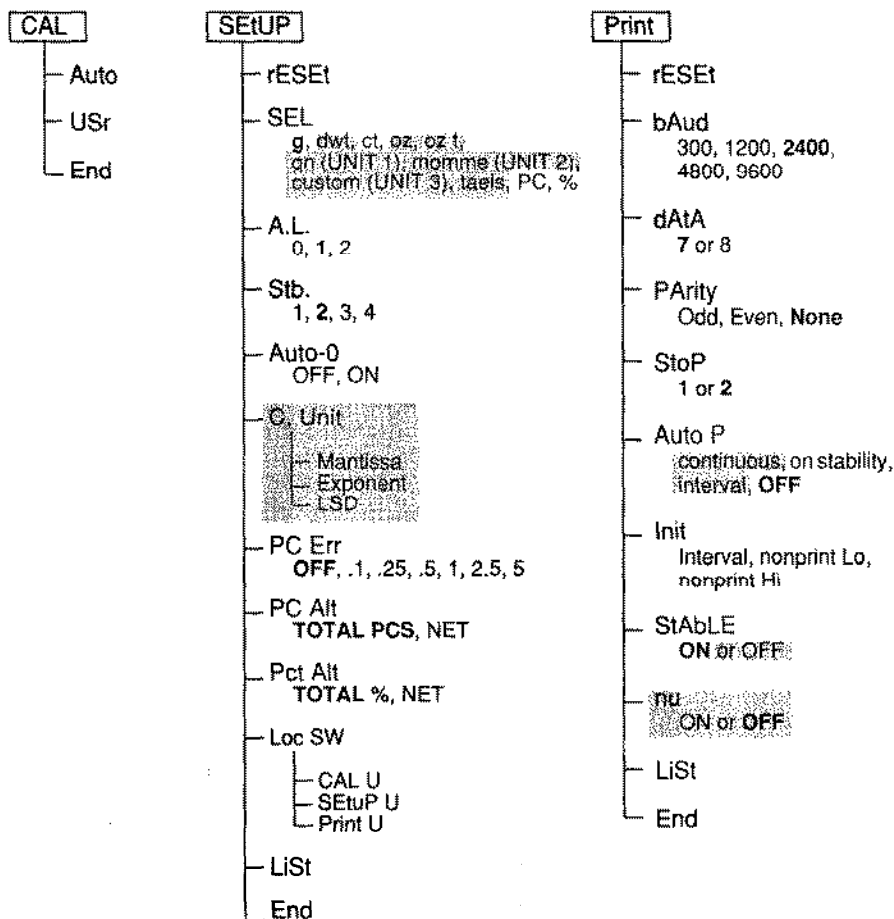
ANALYTICAL *Plus* balances contain three display "menus" which enable you to calibrate and configure the balance for your specific operating requirements.

**Calibration Menu:** Used to calibrate the balance

**Setup Menu:** Used to enable, disable or customize different balance features

**Print Menu:** Used to configure the RS-232 interface

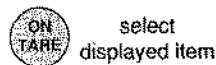
Functions not allowed on verified balances have shaded background.



To access a menu, press and hold  until desired menu appears, then release it.

Original factory settings are shown in boldface type.

Use these buttons to step through menus and select submenus:



## CALIBRATION MENU AND PROCEDURE

ANALYTICAL *Plus* balances can be calibrated in two ways: Using the balance's internal calibration feature (Auto Calibration) or using external calibration weights (User Calibration). Calibration should be performed as necessary to ensure accurate weighing.

### CALIBRATION MENU TABLE

---

<i>Auto</i>	selects internal calibration
-------------	------------------------------


---

<i>U5r</i>	selects external calibration
------------	------------------------------


---


To access the calibration menu:

press and hold  until "CAL" is displayed, then release it.




MENU


When  is released, "Auto" will be displayed.

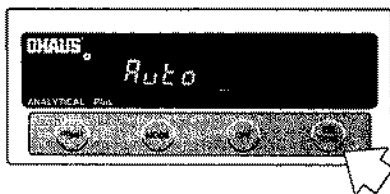
Pressing  will change the displayed calibration method.

### Aborting Calibration

You can abort either calibration procedure at any time by pressing and holding  the normal operating mode is returned or a desired menu is displayed.

## Auto Calibration

1. Make sure "Auto" is displayed and there is no load on the pan.
2. Close the chamber doors.
3. Press  to begin.
4. "--CAL--" is displayed while the balance recalibrates. **DO NOT DISTURB THE BALANCE WHEN "--CAL--" IS DISPLAYED.**
5. When calibration is completed, the display will indicate zero and the balance will be in the weighing mode which was used last.




--CAL--

MEMO

**NOTE:** Dual range models will be left in the coarse range after calibration. Rezero the balance to obtain fine range.

## External Calibration

BEFORE BEGINNING EXTERNAL CALIBRATION, MAKE SURE WEIGHTS ARE ON HAND.


If you begin calibration and realize weights are not available, press and hold  to abort calibration and return to normal weighing or another menu.

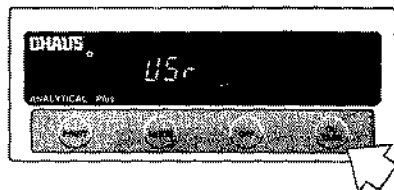
Refer to the adjacent table for correct weight values to use with your balance. For optimum calibration, the exact value of your weight should be known. The value will be entered to four decimal places during the procedure.

### EXTERNAL CALIBRATION WEIGHTS




MODEL	WEIGHT
AP110S	100 g
AP210S	200 g
AP310S	300 g
AP250D	200 g

Calibration weights must meet ASTM Class 1 or NBS Class S Tolerance. In Europe use OIML Class E2 weights.

1. Make sure "USr" is displayed and there is no load on the pan.
2. Close the chamber doors.
3. Press .



The value of the calibration weight last used will be displayed with the first digit flashing.

4. If the displayed value must be changed:
  - press  to change the value of a flashing digit
  - press  to accept a flashing digit and proceed to the next digit
  - press  to backup to a previous digit or to the calibration menu.

20000000  
└ Flashing

Set the number to match the value of your calibration weight. The number you enter must be within 1% of the required weight value to be accepted (see "EXTERNAL CALIBRATION WEIGHT" table on previous page for required weight). The balance will not proceed to the next step if the weight is not within 1%.

5. After the last digit has been accepted, "CAL 0" will be displayed.

Press .

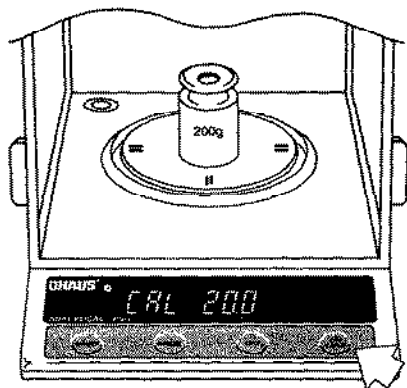
CAL 0



6. The display will show "CAL ----" briefly, then "CAL" followed by the value of the weight which must be placed on the pan.

DO NOT DISTURB THE BALANCE DURING CALIBRATION.

7. Place the weight on the pan, close the chamber door, then press



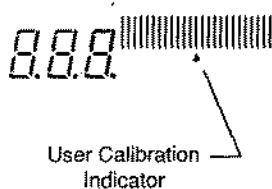
The display will show "---- CAL" while the balance recalibrates. Calibration is completed when the capacity guide stops flashing and the display is returned to the current weighing mode.

---- CAL

DO NOT REMOVE CALIBRATION WEIGHT(S) UNTIL DISPLAY RETURNS TO NORMAL WEIGHING MODE.

### User Calibration Indicator

After the balance has been externally calibrated, the User calibration indicator will be on in the display. This indicator will remain on until the balance is calibrated using the Auto calibration (internal weights) procedure.



## SETUP MENU

The Setup menu is used to customize the operation of the balance for your specific requirements. It contains submenus which enable you to turn features on or off, and program balance parameters. The following table shows the sequence in which submenus appear on the Setup menu.

### SETUP MENU TABLE

** rESEt	sets all submenus below to original factory settings
SELEct	specifies which weighing units and operating modes will be available during operation
AL	specifies the averaging level
Stb	specifies the desired stability range
Auto-0	sets Auto-Zero feature ON or OFF
* CUnit	enables entering a custom weighing unit
* PC Err	specifies an allowable percentage of error for parts counting results
* PC ALt	specifies the weighing unit for parts counting alternate display
* Pct ALt	specifies the weighing unit for percent weighing alternate display
LOCStD	specifies which menus will be locked out by setting the menu lockout switch
LISt	enables printing a listing of current Setup menu settings
End	used to exit the Setup menu and store your selections

- \* "CUnit" only appears in menu if custom unit is enabled in "SEL" submenu.
- \* "PC Err" and "PC Alt" only appear in menu if parts counting is enabled in "SEL" submenu.
- \* "PctAlt" only appears in menu if percent weighing is enabled in "SEL" submenu.
- \*\* "rESEt" does not appear in menu if menu has been locked out.

To access the Setup menu press and hold



until "SEtUP" is displayed, then



SEtUP MENU

release it.

If "SAFE" is displayed, the menu-lockout feature has been activated. Settings may be viewed but not changed. See the "MENU LOCK-OUT PROTECTION" section to enable making changes.

SAFE

To access a submenu:

1. Repeatedly press  until the desired submenu is displayed.
2. Press  to select the displayed submenu.

**NOTE:** YOU MUST USE "End" to store any changes you make to the Setup menu.

The following sections describe each item on the Setup menu in detail.


### Reset to Original Factory Settings

This submenu enables you to reset all Setup menu selections to the original factory settings listed in the adjacent table.

rESET


SETUP MENU ORIGINAL FACTORY SETTINGS	
Unit Selection	Grams
Averaging Level	1
Stability Range	2
Auto-Zero Tracking	ON
Conversion Factor:	
Mantissa	0.0000000
Exponent	0
LSD	1
PC Error Level	OFF
PC Alt. Display	TOTAL PCS
% Alt. Display	TOTAL %

To reset to factory settings:

1. Access the "rESET" submenu.
2. Press  to change the displayed setting, "YES" to reset or "no" to leave current settings.

YES

no

Press  to accept the displayed setting.

## Unit Selection


The Unit Selection submenu permits you to specify which weighing units and operating modes will be enabled for use during operation. The adjacent table lists the units and modes available on ANALYTICAL Plus balances.


To enable or disable the various weighing units and operating modes, use the following procedure:

Weighing Units and Modes	
grams	
pennyweight	UNIT 2 mommes
carats	UNIT 3 custom
ounces	taels
troy ounces	parts counting
UNIT 1 grains	percent weighing


1. Access the "SEL" submenu.
2. The display will show the grams unit indicator (g) along with the current status (ON/OFF).

On MENU g

3. Press  to change the status.

Press  to accept the displayed status.

OFF MENU g

When  is released, the display will show the next unit indicator along with the current status.

4. Set each unit or mode On or OFF as in step 3.

## Taels


If taels are enabled, you will be required to choose one of three different taels: Hong Kong, Singapore, or Taiwan.

When the display shows "tAEL 1",

tAEL 1 Hong Kong

press  to change to another tael,

tAEL 2 Singapore

press  to accept the displayed tael.

tAEL 3 Taiwan

When the last weighing unit/mode has been set, the display will show "SEL" again and the Setup menu will be returned.


## Averaging Level


Averaging level compensates for vibration or excessive air currents on the pan. During operation, the balance continually takes weight readings from the load cell. Successive readings are then digitally processed to achieve a stabilized display. Use this submenu to specify how much processing you need to obtain stable results.


Select one of three averaging levels using the adjacent table as a guide.

To view or change the averaging level:

1. Access the "AL" submenu to display the current setting.

2. Press  to change the setting.

Press  to accept the displayed setting.

When  is released, "AL" will be displayed again and the Setup menu will be returned.

AVERAGING LEVELS	
0	reduced stability, fastest stabilization time
1	<b>normal stability, normal stabilization time</b>
2	more stability, slow stabilization time

AL 1

## Stability Range

566

The stability range specifies how much a displayed weight may change while the stability indicator remains ON. When displayed weight changes beyond the allowable range, the stability indicator turns OFF indicating an unstable condition. ANALYTICAL Plus balances permit you to select one of four stability ranges as shown in the table.


When the RS-232 interface is configured to print stable data only, the stability range also governs data output. Displayed data will only be output if it is within the selected stability range.


STABILITY RANGE	
1	smallest range: stability indicator is ON only when displayed weight is extremely stable
2	<b>normal range</b>
3	increased range
4	largest range: stability indicator is ON even though displayed weight changes slightly


To view or change the stability range:

1. Access the "Stb" submenu to display the current setting.

Stb 2

2. Press  to change the setting.

Press  to accept the displayed setting.

When  is released, "Stb" will be displayed again and the Setup menu will be returned.

## Auto-Zero


Auto-0

Auto-Zero minimizes the effects of temperature changes and shift on the zero reading. The balance maintains the zero display until a certain threshold is exceeded. Using this submenu you can turn the feature ON or OFF. Auto-Zero only functions when the display reads zero.


To view or change the Auto-Zero setting:


1. Access the "Auto-0" submenu to display the current setting.

OFF

2. Press  to change the setting.

On

Press  to accept the displayed setting.

When  is released, "Auto-0" will be displayed again and the Setup menu will be returned.

## Custom Unit Conversion Factor

When you need to display weight measurements in a weighing unit other than those provided standard with the balance, this feature can be used to create your own custom weighing unit. It permits you to enter a conversion factor which the balance will use to convert grams to the desired unit of measure.

$$\begin{array}{rcccl} \text{Conversion} & & \text{Weight} & & \text{Weight} \\ \text{Factor} & \times & \text{in} & = & \text{in} \\ & & \text{grams} & & \text{custom unit} \end{array}$$



Conversion factors are expressed in scientific notation and entered into the balance in three parts:

- a number between 0.1 and 1.9999999 called the mantissa
- a power of 10 called the exponent
- a least significant digit (LSD)

Use the following procedure to enter conversion factors:


1. Access the "C.Unit" submenu.
2. The mantissa of the current conversion factor will be displayed. This will be a number between 0.1 and 1.9999999 with the first digit flashing.

NOTE: The number you enter should be between 0.1 and 1.9999999. For conversion factors outside of this range, the exponent will be used to move the decimal point.

3. Press  to change the value of the first digit.
4. When the desired value is displayed, press  to accept it and the next digit will begin flashing.


SCIENTIFIC NOTATION				
Conv. Factor	Number Between 0.1 and 1.9999999	Power of 10	Mantissa	Exp.
1234	= .1234	x 10000	= .1234	x 10 <sup>4</sup>
123.4	= .1234	x 1000	= .1234	x 10 <sup>3</sup>
12.34	= .1234	x 100	= .1234	x 10 <sup>2</sup>
1.234	= .1234	x 10	= .1234	x 10 <sup>1</sup>
.1234	= .1234	x 1	= .1234	x 10 <sup>0</sup>
.01234	= .1234	x .1	= .1234	x 10 <sup>-1</sup>
.001234	= .1234	x .01	= .1234	x 10 <sup>-2</sup>

Exponent

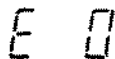


Flashing


Decimal point only flashing indicates "0." flashing. Pressing MODE will change display to "1." flashing.


5. Set the value of all digits in the same manner. If an error is made, you can press  to backup to the desired digit and change it.

6. After the last digit is entered, the display will show the current exponent. The exponent is shown on the display preceded by the letter "E".




There are 7 exponent values which you can choose from (see table).

7. Press  to change the exponent.

8. Press  to accept the displayed exponent.

#### EXPONENTS

E-2	Moves decimal point 2 places to the left
E-1	Moves decimal point 1 place to the left
E0	Leaves decimal point in normal position
E 1	Moves decimal point 1 place to the right
E 2	Moves decimal point 2 places to the right
E 3	Moves decimal point 3 places to the right
E 4	Moves decimal point 4 places to the right

9. When  is released, the display will show the current least significant digit.






The least significant digit is the digit in the last decimal place on the display. The selection you make causes the balance to count by 1's, 2's, 5's, 10's or 100's in this position. There are 5 LSD settings you can choose from (see table).

#### LSD's

LSD 1	display counts by 1's
LSD 2	display counts by 2's
LSD 5	display counts by 5's
LSD 10	display counts by 10's
LSD 100	display counts by 100's



10. Press  to change the LSD.
11. Press  to accept the displayed LSD.

When  is released, "C.Unit" will be displayed again and the Setup menu will be returned.

C.U n i t

## Parts Counting Error Level


PC Err

The parts counting error level is the level of accuracy you consider acceptable for parts counting results. The adjacent table lists error levels that you can choose from.


EXAMPLE: With 5 % selected, 100 parts on the pan may yield a displayed count from 95 to 105 parts.


ERROR LEVELS	
OFF	disables error level limits
.1 %	±0.1% acceptable error
.25 %	±0.25% acceptable error
.5 %	±0.5% acceptable error
1 %	±1.0% acceptable error
2.5 %	±2.5% acceptable error
5 %	±5.0% acceptable error

To view, change or disable the PC Error Level:

1. Access the "PC Err" submenu to display the current setting.
2. Press  to change the setting.

SET .5

Press  to accept the displayed setting.

When  is released, "PC Err" will be displayed again and the Setup menu will be returned.

PC Err

## Parts Counting Alternate Display

In addition to displaying the number of parts, the parts counting feature offers an alternate display mode. Using the "PC ALT" submenu, you can specify the following for the alternate display:



- an alternate unit/mode for displaying weight or quantity of parts (can be any unit/mode the balance offers regardless of which units are enabled in the Unit Selection submenu)
- NET or TOTAL


NET permits repetitive taring and causes the alternate display to show only the weight of parts added since the last tare.

TOTAL causes the display to show the total weight or quantity of all parts on the pan. Taring only affects the primary parts count display.

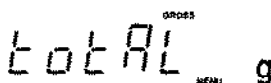
- turn alternate display OFF

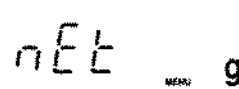
To select NET, TOTAL or OFF for the alternate display, use the following procedure:

1. Access the "PC ALT" submenu to display the current setting.
2. Press  to change the setting.  
Press  to accept the displayed setting.

When  is released, "PC ALT" will be displayed again and the Setup menu will be returned.

TOTAL PCS = factory setting

o PC 

o PC  
NET 

Example shows alternate display set for TOTAL grams and NET grams.

PC ALT

## Percent Weighing Alternate Display

Pct ALT

In addition to displaying the percentage of material on the pan in relation to a reference, the percent weighing feature offers an alternate display mode. Using the "PctALT" submenu, you can specify the following for the alternate display:



- an alternate unit/mode for displaying weight or percentage of the load (can be any unit/mode the balance offers regardless of which units are enabled in the Unit Selection submenu)
- NET or TOTAL


NET permits repetitive taring and causes the alternate display to show only the weight of material added since the last tare.

TOTAL causes the display to show the total weight or percentage of all material on the pan. Taring only affects the primary percentage display.

- turn alternate display OFF

To select NET, TOTAL or OFF for the alternate display, use the following procedure:

1. Access the "PctALT" submenu to display the current setting.
2. Press  to change the setting.  
Press  to accept the displayed setting.

When  is released, "PctALT" will be displayed again and the Setup menu will be returned.

TOTAL % = factory setting



Example shows alternate display set for TOTAL grams and NET grams.


Pct ALT


## Menu Lockout


The Menu Lockout submenu permits you to specify which of the Calibration, Setup, and Print menus will be accessible or inaccessible to users.

To lock or unlock the menu choices, use the following procedure:

1. Access the "Loc SW" submenu.
2. The display will show the current setting for the CAL menu (U or L).

3. Press  to change the status.

Press  to accept the displayed status.

When  is released, the display will show the next menu along with the current status.

4. Set each menu to Lock or Unlock as in step 3.
5. The individual parameters can only be changed if the lock-out switch in the back of the unit is in the unlocked position (see page 47).

Loc SW U

CAL U


CAL L

U - unlocked  
L - locked

## List

List


This submenu can be used to output a listing of current menu settings via the RS-232 interface. When selected, menu settings for both the Setup and Print menus will be output. To use this feature, your balance must be connected to a computer or printer.


To obtain a listing of current settings, simply press  when "List" is displayed in the Setup menu.

## End

End

**YOU MUST USE "End" to exit the Setup menu. Changes you make in the Setup menu are only stored in memory if you use "End".**

To exit the Setup menu and store your settings, press  when "End" is displayed.

When  is released, the balance will be returned to normal weighing operations.

## Setup Menu Protection

The Setup menu may be "locked-out" to prevent unauthorized changes to settings. To lock out the Setup menu refer to the "MENU LOCK-OUT PROTECTION" section.

## PRINT MENU

The Print menu is used to configure the RS-232 interface parameters and customize the balance's print functions for your requirements. The following table shows the sequence in which submenus appear on the Print menu.

PRINT MENU TABLE

** rESEt	sets all submenus below to original factory settings
BAUD	specifies baud rate
DATA	specifies number of data bits
PARity	specifies parity type, if any
StoP	specifies number of stop bits
AutOP	enables/disables Auto print feature
*Int	specifies time interval for automatic output of displayed data, and/or a range of displayed weight values that cannot be output
StABLE	enables/disables printing stable-data-only feature
nu	specifies numeric-only or full display data for output
LISt	enables printing a listing of current Print menu settings
End	used to exit the Print menu and store your selections

\* Only appears in Print menu if "AutoP" is enabled.

\*\* Does not appear in menu if menu is locked out.

To access the Print menu press and hold





until "Print" is displayed, then release it.

Print MENU

If "SAFE" is displayed, the menu lock out feature has been activated. Settings may be viewed but not changed. See the "MENU LOCK-OUT PROTECTION" section to enable making changes.

SAFE

To access a submenu:

1. Repeatedly press  until the desired submenu is displayed.
2. Press  to select the displayed submenu.

**NOTE:** YOU MUST USE "End" to store any changes you make to the Print menu.

The following sections describe each item on the Print menu in detail.


### Reset to Original Factory Settings

This submenu enables you to reset all Print menu selections to the original factory settings outlined in the adjacent table.


rESEt

PRINT MENU ORIGINAL FACTORY SETTINGS	
Baud rate	2400
Data Bits	7
Parity	None
Stop Bits	2
Auto Print	OFF
Auto Print Interval	1 second
Non Print Low Limit	0
Non Print High Limit	0
Stable Data Only	ON
Numeric Data Only	OFF

To reset to original factory settings:

1. Access the "rESEt" submenu to view the current setting.
2. Press  to change the displayed setting; "yES" to reset or "no" to leave current settings.

yES  
no

Press  to accept the displayed setting.

## Baud Rate

bAud


This submenu is used to select the desired baud rate. There are five available baud rates to choose from: 300, 1200, 2400, 4800 and 9600.


To view or change the baud rate:


1. Access the "bAud" submenu to display the current setting.

br 2400

(factory setting)

2. Press  to change the setting.

Press  to accept the displayed setting.

When  is released "bAud" will be displayed again and the Print menu will be returned.

## Data Bits


dAtA


The number of data bits may be set to 7 or 8 as follows:

1. Access the "dAtA" submenu to display the current setting.


7 dAtA

(factory setting)

2. Press  to change the setting.

Press  to accept the displayed setting.

8 dAtA


When  is released "dAtA" will be displayed again and the Print menu will be returned.





## Parity

Parity may be set to Odd, Even or None as follows:

1. Access the "PARITY" submenu to display the current setting.

2. Press  to change the setting.

Press  to accept the displayed setting.

When  is released "PARITY" will be displayed again and the Print menu will be returned.

PARITY

none (factory setting)


Odd


-E-


## Stop Bits

The number of stop bits may be set to 1 or 2 as follows:

1. Access the "StoP" submenu to display the current setting.

2. Press  to change the setting.

3. Press  to accept the displayed setting.

When  is released "StoP" will be displayed again and the Print menu will be returned.

StoP

1 StoP (factory setting)



2 StoP

# AutoP

## Auto Print Feature

When enabled, the Auto Print feature causes the balance to automatically output display data in one of three ways: continuously, at user-specified time intervals, or upon stability.

To select one of these Auto Print methods, or to turn the feature off:


1. Access the "AutoP" submenu to display the current setting.
2. Press  to change the setting.  
Press  to accept the displayed setting.

OFF (factory setting)

Cont

IntEr

OnStb

When  is released "AutoP" will be displayed again and the Print menu will be returned.

If you select "IntEr" to automatically output data user-specified time intervals, the interval is entered in the "Init" submenu which follows.

## Auto Print Time Interval and Non Printing Weight Values

# Init

This submenu allows you to:

- specify a time interval (in seconds) for automatic output
- exclude a range of weights from being output, or specify a range for output, by the Auto Print feature.


It does not appear on the Print menu if Auto Print is set to OFF. Use the following procedure to set these features:

1. Access the "Init" submenu.



- If "IntEr" was selected in the Auto Print submenu, "IntEr" will be displayed and you may continue with step 3.

IntEr

If it was not selected, "non-PL" will be displayed. Proceed to step 7.



- To enter a time interval for automatic data output, press  when "IntEr" is displayed.


The current interval (in seconds) will be displayed.

- Press  to increase or  to decrease the number.

Int 1 TO 255

Set time interval from  
1 to 255 seconds.

- When the desired number is displayed, press  to accept it.
- Press  once to proceed to step 7, or three times to display "End" and proceed to step 16.







- To enter a range of non printing values, press  when "non-PL" is displayed.

non-PL

The current value for the low end of the range will be displayed with the first digit flashing.

000.0000 g

└ Flashing

8. To change the number, start with the first digit (flashing).
9. Repeatedly press  to change the value of the first digit.  
  
The number may be from -3 to +3. A minus sign will light to indicate a negative number.
10. When the desired value is displayed, press  to accept it and the next digit will begin flashing.
11. Set the value of all digits in the same manner. If an error is made, you can press PRINT to backup to the desired digit and change it.
12. After the last digit is entered, "non-PL" will be displayed again. Press  to proceed to "non-PH", the high limit.
13. Press  to view the current value for the high end of the range.
14. Change the number as needed using the same procedure as in step 9.
15. After the last digit is entered, "non-PH" will be displayed again. Press  to display "End".
16. Press  when "End" is displayed to return to the Print menu.

**To exclude data**

**WITHIN SELECTED RANGE:**

SET non-PL < non-PH

Example: non-PL=7g, non-PH=11g

Values <7 **OR** >11 will be output.

**To exclude data**

**OUTSIDE SELECTED RANGE:**

Set non-PL > non-PH

Example: non-PL=11g, non-PH=7g

Values >7 **AND** <11 will be output.

non-PH

End


## Print Stable Data Only

StAbLE


When enabled, this feature permits only stable display data to be output. Use this submenu to set the feature ON or OFF as follows:


1. Access the "StAbLE" submenu to display the current status.

On (factory setting)

2. Press  to change the status.

OFF

Press  to accept the displayed status.

When  is released, "StAbLE" will be displayed again and the Print menu will be returned.


## Print Numeric Data Only

nu


This submenu is used to select numeric data only, or full display data for RS-232 output. Set this feature ON to output numeric display data only, or OFF to output full display data as follows:


1. Access the "nu" submenu to display the current status.

OFF (factory setting)

2. Press  to change the status.

On


Press  to accept the displayed status.

When  is released "nu" will be displayed again and the Print menu will be returned.

## List

L iSt


This submenu can be used to output a listing of current menu settings via the RS-232 interface. When selected, menu settings for both the Setup and Print menus will be output. To use this feature, your balance must be connected to a computer or printer.

To obtain a listing of current settings, simply press  when "LiSt" is displayed in the Print menu.

End

## End

YOU MUST USE "End" to exit the Print menu. **Changes you make in the Print menu are only stored in memory if you use "End".**

To exit the Print menu and store your selections, press  when "End" is displayed. The balance will be returned to normal weighing operations.

## Print Menu Protection

The Print menu may be "locked-out" to prevent unauthorized personnel from changing settings. To lock out the Print menu refer to the "MENU LOCK-OUT PROTECTION" section which follows.

## MENU LOCK-OUT PROTECTION

Before setting menus for "Lock or Unlock" in the Loc SW section (p. 36), this lock-out switch must be set to "Unlock." After selections are made, set this switch to "Lock."

1. Turn the display OFF.
2. Locate the hole plug next to the RS-232 Interface connector at the rear of the balance.
3. Remove the hole plug to access the switch.
4. Using a small screwdriver, slide the switch to the right to lock out, or to the left to unlock menus.
5. Replace the hole plug.
6. Turn the display ON again.

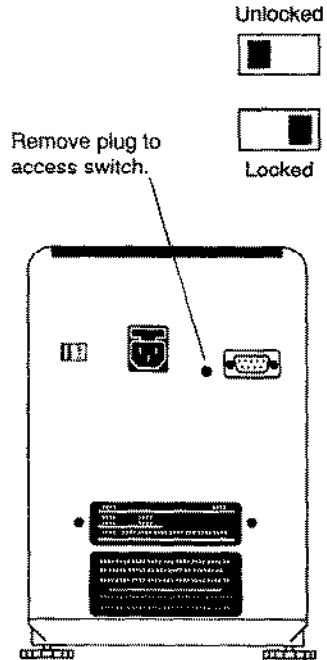
When locked out, Setup and Print menus may still be accessed for viewing but settings may not be changed. The word "SAFE" will be displayed before the menus indicating they have been locked out.

## RS-232 INTERFACE

ANALYTICAL *Plus* balances are equipped with a bi-directional RS-232 compatible interface for communication with printers and computers. When the balance is connected directly to a printer, displayed data can be output at any time by pressing PRINT, or using the Auto Print feature.

Connecting the balance to a computer enables you to operate the balance from the computer, as well as receive data such as displayed weight, weighing mode, stability status, etc.

The following sections describe the balance's hardware and software.



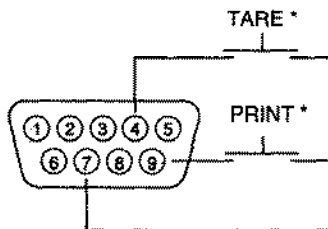
### For verified balances:

Place verification label over hole with switch in locked position. Fully verified balances are sealed with the Setup and Print menus locked out.

## Hardware

On the rear of the balance, a 9-pin subminiature "D" connector is provided for interfacing to other devices. The pinout and pin connections are shown in the adjacent illustration.

The balance will not output any data unless pin 5 (CTS) is held in an ON state (+3 to +15 VDC). Interfaces not utilizing the CTS handshake may tie pin 5 to pin 6 to defeat it.



- |    |                           |
|----|---------------------------|
| 1  | No Connection             |
| 2  | Data Out (TXD)            |
| 3  | Data In (RXD)             |
| 4* | Tare (External signal)    |
| 5  | Clear To Send (CTS)       |
| 6  | Data Terminal Ready (DTR) |
| 7  | Ground                    |
| 8  | Request To Send (RTS)     |
| 9* | Print (External signal)   |

\* External PRINT and/or TARE switches may be installed as shown in the diagram. Momentary contact switches must be used.

## Output Formats

Data output can be initiated in one of three ways: 1) By pressing PRINT; 2) Using the Auto Print feature; 3) Sending a print command ("P") from a computer.

The output format is illustrated in the RS-232 command table which follows.

## RS-232 Commands

All communication is accomplished using standard ASCII format. Only the characters shown in the following table are acknowledged by the balance. Any other commands, control characters or spaces are ignored.

Commands sent to the balance must be terminated with a carriage return (CR) or carriage return-line line feed (CRLF). For example, a tare command should appear as shown in the adjacent diagram. Data output by the balance is always terminated with a carriage return - line feed (CRLF).

### TARE COMMAND

Field:  
Length:

T	CR	LF
1	1	1



## RS-232 COMMAND TABLE

Command Character	Description																																	
?	<p>Print current mode</p> <div style="display: flex; align-items: flex-start; margin-left: 20px;"> <div style="margin-right: 10px;">Field: Length:</div> <table border="1" style="border-collapse: collapse; text-align: center;"> <tr> <td style="padding: 2px;">Mode</td> <td style="padding: 2px;">Stab</td> <td style="padding: 2px;">CR</td> <td style="padding: 2px;">LF</td> </tr> <tr> <td style="padding: 2px;">5</td> <td style="padding: 2px;">1</td> <td style="padding: 2px;">1</td> <td style="padding: 2px;">1</td> </tr> </table> <div style="margin-left: 20px;"> <p>blank if stable " ? " if unstable</p> <table style="margin-left: 20px;"> <tr> <td style="padding-right: 10px;">GRAMS</td> <td>GRAIN</td> <td>PARTS</td> </tr> <tr> <td>DWT</td> <td>TAE1</td> <td>CUST</td> </tr> <tr> <td>CARAT</td> <td>TAE2</td> <td>%</td> </tr> <tr> <td>OZ AV</td> <td>TAE3</td> <td></td> </tr> <tr> <td>OZ T</td> <td>MOMME</td> <td></td> </tr> </table> </div> </div>	Mode	Stab	CR	LF	5	1	1	1	GRAMS	GRAIN	PARTS	DWT	TAE1	CUST	CARAT	TAE2	%	OZ AV	TAE3		OZ T	MOMME											
Mode	Stab	CR	LF																															
5	1	1	1																															
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DWT	TAE1	CUST																																
CARAT	TAE2	%																																
OZ AV	TAE3																																	
OZ T	MOMME																																	
nnnA	<p>Set Auto Print feature to "nnn" (see table).</p> <table border="1" style="margin-left: 20px; border-collapse: collapse;"> <tr> <td style="padding: 2px;">nnn = 0</td> <td style="padding: 2px;">Turns feature OFF</td> </tr> <tr> <td style="padding: 2px;">nnn = S</td> <td style="padding: 2px;">Output on stability</td> </tr> <tr> <td style="padding: 2px;">nnn = C</td> <td style="padding: 2px;">Output is continuous</td> </tr> <tr> <td style="padding: 2px;">nnn = 1-255</td> <td style="padding: 2px;">Sets Auto Print Interval</td> </tr> </table>	nnn = 0	Turns feature OFF	nnn = S	Output on stability	nnn = C	Output is continuous	nnn = 1-255	Sets Auto Print Interval																									
nnn = 0	Turns feature OFF																																	
nnn = S	Output on stability																																	
nnn = C	Output is continuous																																	
nnn = 1-255	Sets Auto Print Interval																																	
C	Begin calibration																																	
xD	Set 1 second print delay (set x = 0 for OFF, or x = 1 for ON)																																	
E	Exit parts counting or percent weighing																																	
xI	<p>Set Averaging Level to "x", where x = 0, 1 or 2 (see table).</p> <table border="1" style="margin-left: 20px; border-collapse: collapse;"> <tr> <td style="padding: 2px;">0</td> <td style="padding: 2px;">=</td> <td style="padding: 2px;">minimum level</td> </tr> <tr> <td style="padding: 2px;">1</td> <td style="padding: 2px;">=</td> <td style="padding: 2px;"></td> </tr> <tr> <td style="padding: 2px;">2</td> <td style="padding: 2px;">=</td> <td style="padding: 2px;">maximum level</td> </tr> </table>	0	=	minimum level	1	=		2	=	maximum level																								
0	=	minimum level																																
1	=																																	
2	=	maximum level																																
M	Same effect as pressing mode button																																	
xM	<p>Places balance in mode "x", where x = 1 to 11 (see table).</p> <p>If unit or mode is not already enabled, command will be ignored.</p> <table border="1" style="margin-left: 20px; border-collapse: collapse;"> <tr> <td style="padding: 2px;">1</td> <td style="padding: 2px;">=</td> <td style="padding: 2px;">grams</td> </tr> <tr> <td style="padding: 2px;">2</td> <td style="padding: 2px;">=</td> <td style="padding: 2px;">pennyweight</td> </tr> <tr> <td style="padding: 2px;">3</td> <td style="padding: 2px;">=</td> <td style="padding: 2px;">carats</td> </tr> <tr> <td style="padding: 2px;">4</td> <td style="padding: 2px;">=</td> <td style="padding: 2px;">avoirdupois ounces</td> </tr> <tr> <td style="padding: 2px;">5</td> <td style="padding: 2px;">=</td> <td style="padding: 2px;">troy ounces</td> </tr> <tr> <td style="padding: 2px;">6</td> <td style="padding: 2px;">=</td> <td style="padding: 2px;">grains</td> </tr> <tr> <td style="padding: 2px;">7</td> <td style="padding: 2px;">=</td> <td style="padding: 2px;">mommes</td> </tr> <tr> <td style="padding: 2px;">8</td> <td style="padding: 2px;">=</td> <td style="padding: 2px;">custom unit</td> </tr> <tr> <td style="padding: 2px;">9</td> <td style="padding: 2px;">=</td> <td style="padding: 2px;">taels</td> </tr> <tr> <td style="padding: 2px;">10</td> <td style="padding: 2px;">=</td> <td style="padding: 2px;">parts counting</td> </tr> <tr> <td style="padding: 2px;">11</td> <td style="padding: 2px;">=</td> <td style="padding: 2px;">percent weighing</td> </tr> </table>	1	=	grams	2	=	pennyweight	3	=	carats	4	=	avoirdupois ounces	5	=	troy ounces	6	=	grains	7	=	mommes	8	=	custom unit	9	=	taels	10	=	parts counting	11	=	percent weighing
1	=	grams																																
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10	=	parts counting																																
11	=	percent weighing																																

## RS-232 COMMAND TABLE (continued)

Command Character	Description														
<p><b>P</b></p>	<p>Print display data</p> <p>When "numeric only" display data is selected for output in the RS-232 menu, the Mode field is not output.</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td style="padding: 2px;">Field:</td> <td style="padding: 2px;">Weight</td> <td style="padding: 2px;">1</td> <td style="padding: 2px;">Mode</td> <td style="padding: 2px;">Stab</td> <td style="padding: 2px;">CR</td> <td style="padding: 2px;">LF</td> </tr> <tr> <td style="padding: 2px;">Length:</td> <td style="padding: 2px;">10</td> <td style="padding: 2px;">1</td> <td style="padding: 2px;">5</td> <td style="padding: 2px;">1</td> <td style="padding: 2px;">1</td> <td style="padding: 2px;">1</td> </tr> </table> <p style="margin-left: 150px;">Same as ? command</p> <p>Displayed weight sent right justified w/lead zero blanking.            Nine characters include:            decimal point (1)            weight (8 max))            polarity (1): blank if positive                              " - " if negative</p>	Field:	Weight	1	Mode	Stab	CR	LF	Length:	10	1	5	1	1	1
Field:	Weight	1	Mode	Stab	CR	LF									
Length:	10	1	5	1	1	1									
<p><b>xS</b></p>	<p>Set stable data only printing (set x = 0 for OFF, or x = 1 for ON).</p>														
<p><b>T</b></p>	<p>Same effect as pressing tare button</p>														
<p><b>V</b></p>	<p>Print EPROM version</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td style="padding: 2px;">Field:</td> <td style="padding: 2px;">Model #</td> <td style="padding: 2px;">1</td> <td style="padding: 2px;">EPROM #</td> <td style="padding: 2px;">CR</td> <td style="padding: 2px;">LF</td> </tr> <tr> <td style="padding: 2px;">Length:</td> <td style="padding: 2px;">6</td> <td style="padding: 2px;">1</td> <td style="padding: 2px;">4</td> <td style="padding: 2px;">1</td> <td style="padding: 2px;">1</td> </tr> </table> <p style="margin-left: 100px;">Balance Model</p> <p style="margin-left: 200px;">VX.X</p>	Field:	Model #	1	EPROM #	CR	LF	Length:	6	1	4	1	1		
Field:	Model #	1	EPROM #	CR	LF										
Length:	6	1	4	1	1										
<p><b>xZ</b></p>	<p>Set Auto Zero to "x".    x = 0 for OFF                                              x = 1 for ON</p>														
<p><b>Esc L</b></p>	<p>Prints listing of Setup and Print menu settings.</p>														
<p><b>Esc R</b></p>	<p>Resets Setup and Print menus to original factory settings.            CAUTION: This will reset RS-232 configuration.</p>														
<p><b>Esc S</b></p>	<p>Save current settings.</p>														
<p><b>ID</b></p>	<p>Allows identification of the balance with an ID code of 8 characters or less. To program, type the string of characters to be the identification code, followed by 'ID', then carriage return and line feed. 'ID' alone will echo the balance ID over the RS232 lines. "Space"ID' will clear the balance ID.</p> <p>For example:            "1234ABCD"ID CR LF                    balance ID code = 1234ABCD            "X"ID CR LF                            balance ID code = X</p>														

## TROUBLESHOOTING

SYMPTOM	PROBABLE CAUSE(S)	REMEDY
Unit will not turn on.	Power cord not plugged in or not properly connected to balance.  Line voltage switch incorrectly set.	Check power cord connections.  Check line voltage switch.
Incorrect weight reading.	Balance was not re-zeroed before weighing.  Balance not properly calibrated.	Press TARE with no weight on the pan, then weigh item.  Recalibrate correctly.
Cannot display weight in desired unit or cannot access desired weighing mode.	Desired unit/mode not set to "ON" in Unit Selection of Setup menu.	See Unit Selection section of Setup menu.
Unable to store menu settings/changes.	"End" not being used to exit menus.	You MUST use "End" to exit menus and save settings.
RS-232 interface not working	Print menu settings not properly set up.  Cable connections.	Verify interface settings in Print menu correspond to those of peripheral device.  Check cable connections.
Random segments displayed or display locks up.	Microprocessor lock-up.	Disconnect power to balance, then reconnect power. Turn balance on again. If condition persists, unit must be serviced.

## Error Codes

- 2.0 Balance is unable to stabilize within time limit after taring. Environment is too hostile or balance needs recalibration.
- 3.0 User calibration error. Incorrect or no calibration weight used for external calibration. Weight may differ from required value by more than 1%. Recalibrate with correct weights. Error may also occur if balance is unable to stabilize during calibration.
- 4.4 RS-232 buffer is full. May occur if no printer or computer is connected to the interface. To clear buffer, turn balance off or enter Print menu and select "End".
- 4.5 Clear To Send (CTS) is disabled.
- 5.0 Attempt was made to perform Auto Calibration (internal) with a load on the pan. Remove load from pan and recalibrate. Error may also occur if balance is unable to stabilize during calibration.
- 7.0 Attempt was made to enter a Non Printing limit or Custom Unit which exceeds the capacity of the balance.
- 7.1 Insufficient sample size. Occurs in parts counting or percent weighing.
- 8.0 Hardware error causing an internal weight signal which is too low. Check if pan or pan support is off. If not, balance must be serviced.
- 8.2 Power-on load out of specification: Balance was turned on with load on pan or pan off balance. No load may be on pan when turned on and pan must be in place.
- 8.3 Overrange error. Load on pan exceeds capacity of balance.
- 8.4 An attempt was made to display a number greater than 19999999.

## SPECIFICATIONS

MODEL	AP110S	AP210S	AP310S	AP250D
Capacity (g)	110	210	310	52/210
Readability (mg)	0.1	0.1	0.1	0.01/0.1
Weighing Modes	g, dwt, ct, oz, oz t, gn, mommes, (3) tael, parts counting, percent weighing, 1 custom unit			
Tare	To Capacity by Subtraction			
Precision/Reproducibility (mg)	0.1	0.1	0.2	0.02/0.1
Linearity (mg)	±0.2	±0.2	±0.5	±0.03/0.2
Sensitivity Drift (10 - 30 °C)	±2 ppm/ °C			
Display	Vacuum Fluorescent (Approx. 0.5"/12.7 mm high)			
Stabilization Time (sec)	4	4	8	12/5
Operating Temperature	50° to 104°F/10° to 40°C			
Power Supply	100, 120, 220, 240 VAC			
Calibration	Motorized Internal and Manual External			
Internal Calibration Weights	Stainless Steel - Measured to ±0.1 mg at an air density of 1200 mg/l on virtual mass with density 8.0 g/cm <sup>3</sup>			
Pan Size (in)/(mm)	3.5/90			
Housing Size (in) W x L x H (mm)	7.7 x 15.7 x 12.2 195 x 400 x 310			
Free Height Above Pan (in)/(mm)	9.5/240			
Net Weight (lb)/(kg)	22.5/10.2			

## CARE AND MAINTENANCE

To keep the balance operating properly, the housing, chamber and pan should be kept clean and free from foreign material. If necessary, a cloth dampened with a mild detergent may be used. Keep calibration weights in a safe dry place.

## SERVICE INFORMATION

If the Troubleshooting section does not resolve or describe your problem, you will need to contact an authorized Ohaus Service Agent. For Service assistance in the United States, please call Ohaus Corporation toll-free at (800) 526-0659. An Ohaus Product Service Specialist will be available to help you.

## REPLACEMENT PARTS

	OHAUS <u>Part No.</u>
Power Cords:	
U.S. 120 VAC	6569-00
European 220 VAC	76212-00
European 240 VAC	76448-00
Pan (AP110, AP210 and AP250 modes)	9773-00
Pan (AP310 models)	9773-01
Pan Shield	9773-02
Pan Ring	9773-03
Leveling Foot	9773-04
In-Service Cover	9773-78
Fuse (160 mA/250 V for all models)	90167-42

## ACCESSORIES

	OHAUS <u>Part No.</u>
Anti-Theft Device	77401-00
Density Determination Kit	77402-00
Storage Cover	9773-79

## LIMITED WARRANTY

Ohaus products are warranted against defects in materials and workmanship from the date of delivery through the duration of the warranty period. During the warranty period Ohaus will repair, or, at its option, replace any component(s) that proves to be defective at no charge, provided that the product is returned, freight prepaid, to Ohaus.

This warranty does not apply if the product has been damaged by accident or misuse, exposed to radioactive or corrosive materials, has foreign material penetrating to the inside of the product, or as a result of service or modification by other than Ohaus. In lieu of a properly returned warranty registration card, the warranty period shall begin on the date of shipment to the authorized dealer. No other express or implied warranty is given by Ohaus Corporation. Ohaus Corporation shall not be liable for any consequential damages.

As warranty legislation differs from state to state and country to country, please contact Ohaus or your local Ohaus dealer for further details.

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