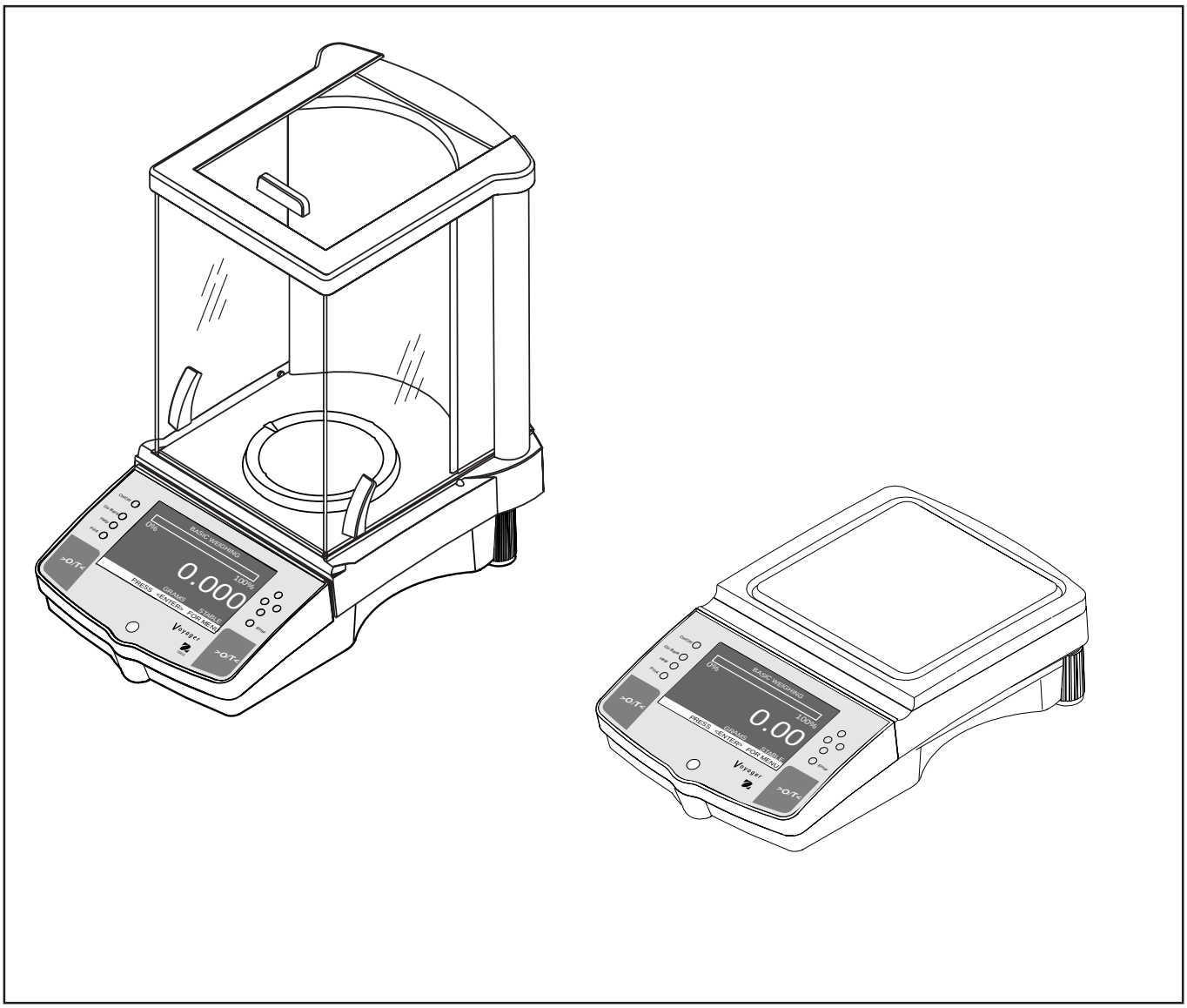
# Operating instructions

## *Voyager* balances



Declaration of Conformity

The undersigned, representing the following manufacturer

Ohaus Corporation
19A Chapin Road
PO Box 2033
Pine Brook, NJ 07058 USA

hereby declares that the following products are in conformity with the EEC directives listed below (including any and all modifications).
V10640, V00640, V10642, V10645, V11140, V11142, V01140, V11145, V12140, V02140, V12142, V12145, V1RR80, V0RR80, V1RR82, V1RR85, V12130, V02130, V12132, V02132, V12135, V14130, V04130, V14132, V04132, V14135, V1RV70, V0RV70, V1RV72, V0RV72, V1RV75, V16120, V06120, V16122, V06122, V16125, V1B120, V0B120, V1B122, V0B122, V1B125, V1D120, V0D120, V1D122,V0D122, V1D125, V1RW60, V0RW60, V1RW62, V0RW62, V1RW65, V1D110, V0D110, V1D112, V0D112, V1D115, V1F110, V0F110, V1F112, V0F112, V1F115, V1H110, V0H110, V1H112, V0H112, V1H115, V16130, V06130, V16132, V16135, V1F120, V0F120, V1F122, V0F122, V1F125

| Marked with: | **EC Directive** (Including applicable amendments) | **Standard** |
|---|---|---|
| CE | **73/23/EC**<br>Electrical equipment for use within specified voltage limits<br>CE marking affixed in 97 | **IEC 1010 -1:1990 + A1: 92 + A2: 95**<br>Safety requirements for Electrical Equipment for Measurement, Control Laboratory Use, Part 1: General Requirements |
| | **89/336/EC**<br>Electromagnetic compatibility | **EN61326: -1:1997 (class B) + A1: 1998**<br>EMC Emissions, residential, commercial and light industry.<br><br>**EN61326: -1:1997 A1:1998 (industrial requirements)**<br>EMC Immunity.<br><br>**EN61000-3-2:1995 + A1:1998 + A2: 1998; EN61000-3-3:1995**<br>EMC Part 3 (for equipment rated input current < or=16A)<br>Limits- Section 2: Limits for harmonic current emissions<br>Limits- section 3: Limitation of voltage fluctuations and flicker in low voltage supply systems |

CE **XX**
122 M T2914
xx= year CE affixed

**ISO 9001 Registration for Ohaus Corporation**. Ohaus Corporation, USA, was examined and evaluated in 1994 by the Bureau Veritas Quality International, BVQI, and was awarded ISO 9001 registration. This certifies that Ohaus Corporation, USA, has a quality system that conforms with the international standards for quality management and quality assurance (ISO 9000 series). Repeat audits are carried out by BVQI at intervals to check that the quality system is operated in the proper manner.

Ted Xia
President
Ohaus Corporation, Pine Brook, NJ USA
Date march 6, 2003n

Johan Dierbach
General Manager
Ohaus Europe
Greifensee, Switzerland
Date: March 6, 2003

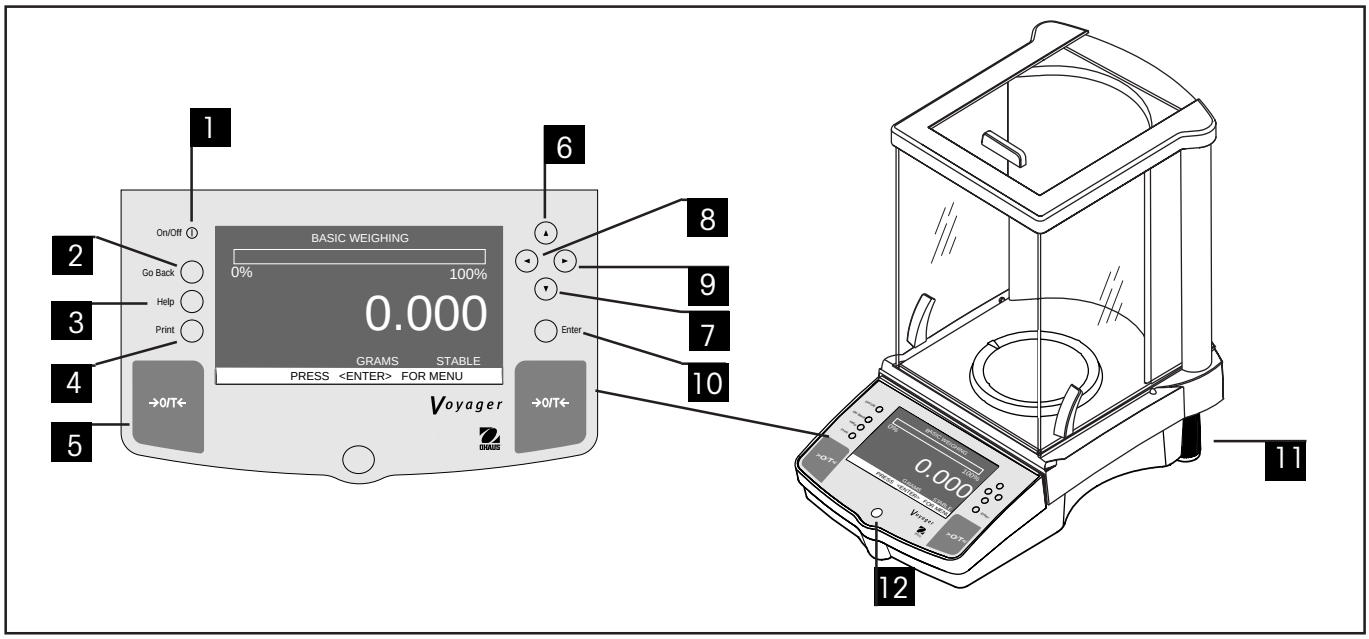
| **Additional Standards** | |
|---|---|
| CSA C US | **CAN/CSA-C22.2 No. 1010.1-92; UL Std. No. 3101-1**<br>Safety requirements for Electrical Equip. for measurement, Control and Laboratory Use, Part 1; General Requirements |
| FCC | **FCC, Part 15, class A** Emission |
| C 315 | **AS/NZS4251.1 AS/NZS4252.1** Emission and Immunity |

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 Class A digital apparatus complies with Canadian ICES-003.
Cet appareil numérique de la classe A est conforme à la norme NMB-003 du Canada

# Contents

# Overview of controls




| No. | Designation | Function |
|---|---|---|
| 1 | ⏻ | LCD display on off button. |
| 2 | Go Back button | Permits going back in menus. |
| 3 | Help button | Non functional. |
| 4 | Print button | When pressed, prints data either on an external printer or computer. |
| 5 | >O/T< button | When pressed, sets balance to zero. |
| 6 | ▲ button | When pressed, travels up through menu options and selects alphanumeric characters. |
| 7 | ▼ button | When pressed, travels down through menu options and selects alphanumeric characters. |
| 8 | ◄ button | When pressed, travels to the left through displays. |
| 9 | ► button | When pressed, travels to the right through displays. |
| 10 | Enter button | When pressed, accepts item on display. |
| 11 | Leveling feet | Used to level the balance. |
| 12 | Leveling indicator | Indicates leveling position of the balance. |

# 1. Getting to know your Voyager balance

This section provides you with detailed information on your Voyager balance. Please read through the section carefully even if you have experience with OHAUS balances and be sure to familiarize yourself with the safety notes.

## 1.1 Introduction

Thank you for deciding to purchase a Voyager Balance from Ohaus. Behind your instrument stands OHAUS, a leading manufacturer of precision Balances, Scales and Indicators. An Aftermarket Department with trained instrument technicians is dedicated to provide you with the fastest service possible in the event your instrument requires servicing. OHAUS also has a Customer Service Department to answer any inquiries regarding applications and accessories.

To ensure you make full use of the possibilities offered by your Voyager balance, please read the manual completely before installation and operation.

## 1.2 Overview of the Voyager balance

The Voyager balances offer a high level of operating convenience and useful functions to make accurate measurements.

The Voyager balances have the following features:

— Extremely rugged and chemically resistant construction.
— Convenient operating controls and large, easily readable display.
— Easy to follow menus for simplified operation.
— Go Back button permits going back in menus.
— Built-in functions for filling, percent weighing, piece counting, animal weighing, check weighing, density, pipette calibration, statistics, and SQC.
— Built-in leveling feet and level indicator for consistent operation on unlevel surfaces.
— Automatic internal calibration (on some models).
— Menu locks which prevent settings from being changed.
— Built-in RS232 interface.
— 14 units of measurement and custom units.
— Bar graph indicator for quick visual indication of values in addition to a large numerical readout.
— A variety of accessories includes in-use display cover kit, table mount, remote displays, interface communication cables and security device.

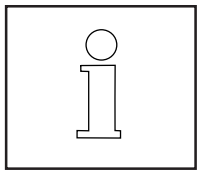
A brief word regarding standards, directives and procedures for quality assurance: Your Voyager balance conforms with all common standards and directives. It supports standard procedures, work techniques and records as required by GLP (Good Laboratory Practices) and SOP (Standard Operating Procedure). Recording of the sequences of operations and calibration work is highly important in this connection: we recommend use of OHAUS AS-142 Printer. Your Voyager balance has a CE declaration of conformity and OHAUS is registered to ISO 9001 - Management System.

## 1.3 What you should know about these instructions

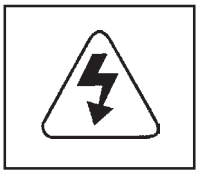
These instructions contain orientation aids which represent certain functions, notices and controls. These graphic aids are not meant to be step by step operational procedures but simply a guide.

This symbol indicates pressing a button.

This representation symbolizes the current display of your balance.



This symbol indicates additional information and instructions which facilitate your handling of the balance and contribute to proper and economical use.



These symbols indicate safety and hazard instructions which must be complied with. Nonconformance with such instructions can lead to personal injuries to the user, damage to the balance or other tangible assets or to malfunctions.

## 1.4 Safety is first

Please note the following instructions for safe and problem-free operation of your balance.

Voyager balances may be used only indoors and only when attached to receptacle outlets with a ground connection.

The Voyager balances may not be operated in a hazardous environment.

Use only the AC adapter supplied with your Voyager balance and ensure that the voltage value printed on it matches the local line voltage.

Operate and use your Voyager balance only in accordance with these operating instructions.

Use only optional equipment and peripherals supplied by OHAUS.

Your Voyager balance is ruggedly constructed, but is still a precision instrument. Treat it with the appropriate care and it will provide you with years of trouble-free operation.

# 2. Installation

In this section, you will learn how you unpack and install your new balance and prepare it for operation. On completion of the steps described in this section, your balance is ready for operation.

## 2.1 Unpacking and checking the standard equipment

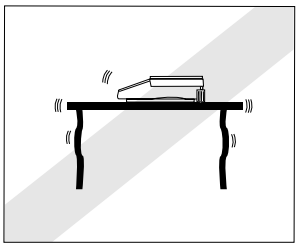
Open the package and remove the instrument and the accessories. Check the completeness of the delivery. The following accessories are part of the standard equipment of your new Voyager balance.

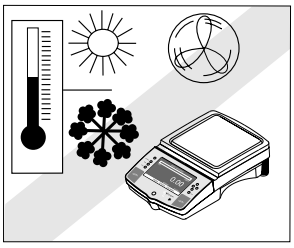
| | **Analytical** | **Capacity** | | |
|---|---|---|---|---|
| Equipment | 62g, 110g, 210g, 210/100g | 210, 410, 610g 410/100g | 610g - 6100g 4100/1000g | 6100g - 8100g |
| Pan 3.5″ | • | | | |
| Pan 4.75″ | | • | | |
| Pan 6″ (0.01g units and 0.1g units w/AutoCal) | | | • | |
| Pan 8″ (0.1g units w/o AutoCal) | | | • | • |
| Draft Shield | • | • | | |
| Wind Shield (6" Pan Units, 0.01g) | | | • | |
| AC Power Adapter | • | • | • | • |
| Instruction Manual | • | • | • | • |
| Warranty Card | • | • | • | • |
| In-Use Cover | • | • | • | • |

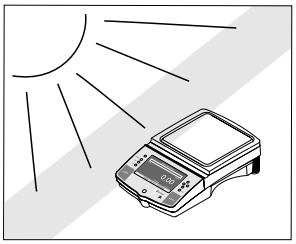
- 4100g, 6100g and 8100g balances with internal calibration are equipped with 6″ Pan and Windshield.
- Remove packing material from the instrument.
- Check the instrument for transport damage. Immediately inform your Ohaus dealer if you have complaints or parts are missing.
- Store all parts of the packaging. This packaging guarantees the best possible protection for the transport of your instrument.

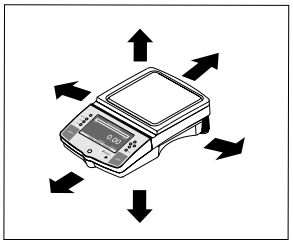
## 2.2 Selecting the location

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.







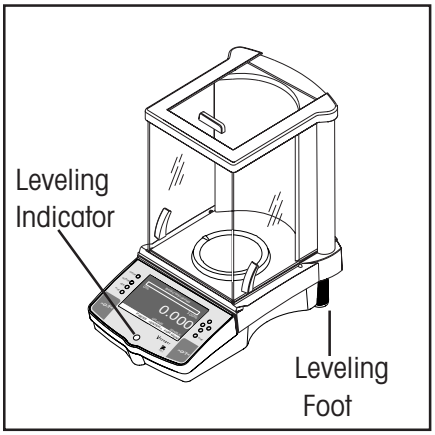


**DO NOT** install the balance:

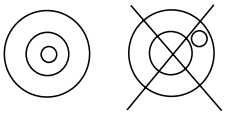
- Next to open windows or doors causing drafts or rapid temperature changes.
- Near air conditioning or heat vents.
- Near vibrating, rotating or reciprocating equipment.
- Near magnetic fields or equipment that generates magnetic fields.
- On an unlevel work surface.
- In confined areas, allow sufficient space around the instrument for ease of operation and keep away from radiating heat sources.

## 2.3 Leveling the balance

Exact horizontal positioning and stable installation are prerequisites for repeatable results. To compensate for small irregularities or inclinations at the location, the instrument can be leveled.

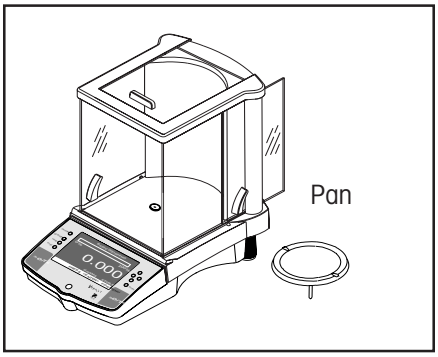



Adjust the leveling feet at the rear of the balance until the air bubble in the indicator is centered.



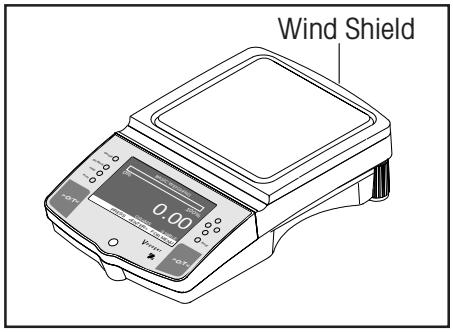
NOTE: The instrument should be leveled each time its location is changed.

## 2.4 Installing pan




Balances are shipped with the pan not installed. On balances equipped with a draft shield, slide open the side door and insert the pan into the center hole which is the measuring transducer.

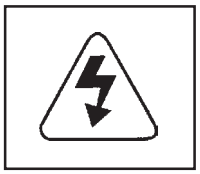
## 2.5 Wind shield




On 610g to 6100g balances with 0.01g resolution, a wind shield is required to reduce the possibility of air currents from disturbing the pan. Make sure the wind shield is firmly snapped into place.

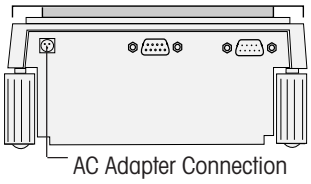
**NOTE**: 4100g, 6100g and 8100g balances with 0.1g resolution and internal calibration are equipped with a 6″ Pan and Wind Shield.

## 2.6 Power supply



Check to ensure the voltage printed on the AC adapter matches your local line voltage. If this is not the case, on no account connect the AC adapter to the power supply, but contact your responsible OHAUS dealer.

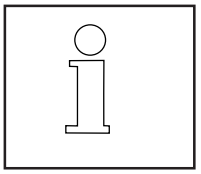
**Ensure that the AC adapter can never come into contact with liquids!**



Rear of Balance

Connect the AC Adapter supplied to the three pin connector located at the rear of the balance.

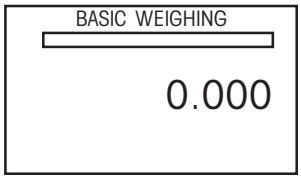
The balance now performs a self-test, loads parameters, displays the software version, capacity, indicates if autocal is installed and the normal weight display then appears.



**Allow your balance to warm up for at least 30 minutes** to enable it to adapt itself to the ambient conditions. If the balance has been stored in a very cold environment before installation, it may require several hours for the balance to stabilize.

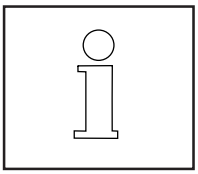
## 2.7 Switching the balance on and off

Your balance is on at all times when connected to a power source, the display is on initially and can be turned off.




To **switch the balance on**, press the ⏽ button. As soon as the weight display appears, your balance is ready.

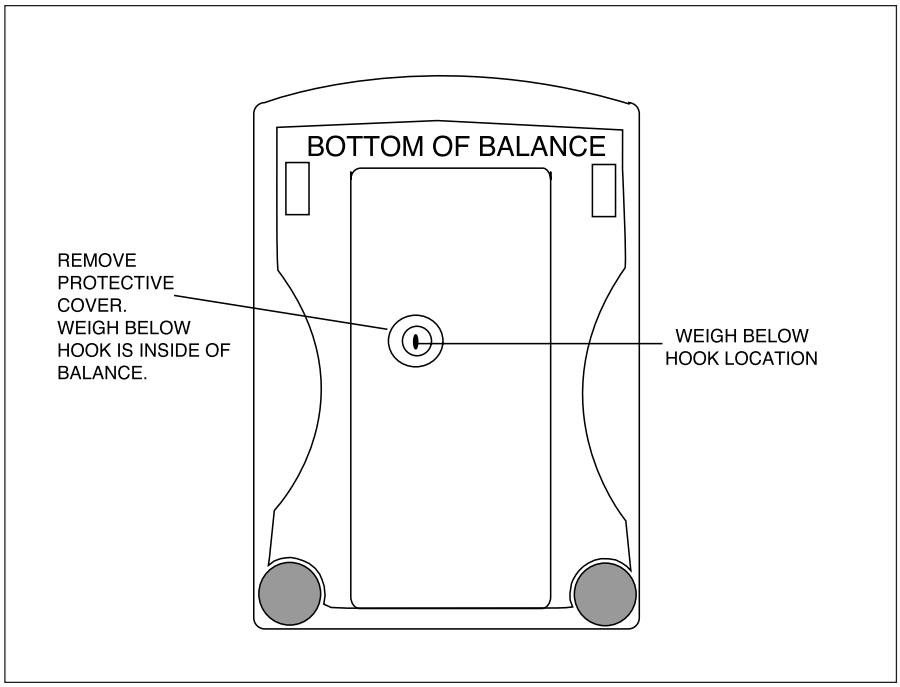
To **switch the balance off**, press the ⏽ button. After the balance has been switched off, your balance is in the standby mode. If you wish to perform a weighing, press the ⏽ button again.



As your balance needs no warm-up time when in the standby mode and is immediately ready for weighing, we advise you to switch the display off by use of the ⏽ button and not to disconnect it from the power supply. This also ensures that the balance is always in thermal equilibrium.

## 2.8 Weigh below preparation

The Voyager balance is equipped with a weigh below hook at the bottom of the balance. To use this feature, remove power from the balance and remove the protective cover underneath the balance. See illustration for location. The balance can be supported using lab jacks or any other convenient method. Make sure the balance is level and secure. Apply power and operate the balance. Attach items to be weighed to the hook underneath the balance.



# 3. The menu

## 3.1 What is the menu?

The menu allows you to match your balance to your specific weighing needs. In the menu, you can change the settings of your balance and activate functions. The Main Menu contains 7 selections.

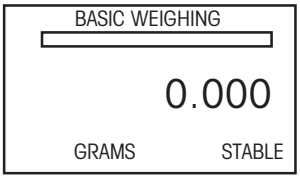
| CHANGE MODE | CHANGE UNITS | SET BALANCE | CUSTOM MENU | LIBRARY | CALIBRATION | CONTRAST |
|---|---|---|---|---|---|---|
| Basic weighing | Milligrams | Readout | Run | Contains list of stored setups | Span | LCD contrast/ brightness adjust |
| Parts counting | Grams | Interface | Setup custom menu | | Linearity | |
| Filling | Kilograms | Print option | Exit to weigh | | User | |
| Animal weighing | Pennyweight | Setup GLP | | | Calibration test | |
| Check weighing | Carats | Set time/date | | | Autocal | |
| Diff weighing | Ounces | Autocal enable | | | Autocal delta correction | |
| Formulation | Troy ounces | Print current settings | | | Exit to weigh | |
| Quick check | Grains | Reset | | | | |
| Statistics | Hong Kong taels | Lockout | | | | |
| Density | Singapore taels | Software version | | | | |
| SQC | ROC taels | Exit to weigh | | | | |
| Pipette | Mommes | | | | | |
| | Pounds | | | | | |
| | Newtons | | | | | |
| | Ticals | | | | | |
| | Custom units | | | | | |
| | Exit to weigh | | | | | |

1. **Change mode:** Permits setting the balance to one of 12 different operating modes.
2. **Change units:** Allows balance to measure in any of 15 selected measuring units and custom units.
3. **Set balance:**
   - **Readout:** Permits setting averaging level, stability level, auto zero and legal for trade.
   - **Interface:** Communication settings of baud, data, parity and stop bits can be set.
   - **Print option:** Includes auto print, stable & numeric data, date, time and reference.
   - **Setup GLP:** Project name, user name and GLP print options can be entered.
   - **Set time/date:** Allows balance to be set to current time and date with options on date types.
   - **Autocal enable:** Automatic calibration can be set to on or off (when balance is equipped with autocal).
   - **Print current settings:** When selected, current balance settings can be printed.
   - **Reset:** Allows resetting of readouts, RS232, print option, GLP or all to factory defaults.
   - **Lockout:** Units, calibration and functions can be set to on or off.
   - **Software version:** Indicates software version installed in balance at time of manufacture.
4. **Custom menu:** Permits running a custom menu and setting up of a custom menu.
5. **Library:** Contains a list of stored setups which can be recalled for operating the balance.
6. **Calibration:** Span, linearity, user, calibration test, auto calibration can be selected to calibrate the balance. Autocal delta correction permits user to adjust internal calibration weight to match local standard.
7. **Contrast:** Allows LCD screen contrast to be set for best viewing conditions.

**NOTE**: Availability of shaded weighing units subject to local regulations.

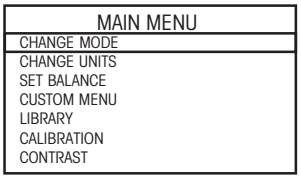
# 3.2 Menu operation

In this section you will learn how to work with the menu. Information regarding the individual menu options and available settings can be found in the following sections.

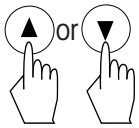



## How to change from the weighing mode to the main menu

The balance is operating in the basic weighing mode.

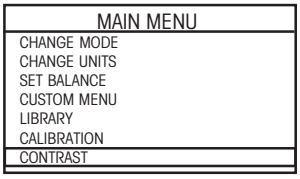

Press the **Enter** button. The main menu is displayed with the first option highlighted.




## How to select the menu options

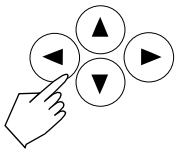
Press either the up or down arrow buttons and scroll to the desired option.

Each time the arrow (▼) button is pressed, the balance switches to the next menu option. Each time the (▲) arrow button is pressed, the balance switches to the previous menu option.


## How to enter the menu option

Press the **Enter** button when the desired menu option is highlighted.



## How to enter alpha numeric data

Certain menu options can have names or numerical entries made. When prompted to enter information, use the arrow buttons as follows:
Press the (▲) and (▼) arrow buttons to scroll through numbers or alphabet.

Press the (►) arrow button to advance to the next character in the display.

Press the (◄) arrow button to go back to the previous character in the display.


Press the **Enter** button to accept entry.


Press the **Go Back** button to cancel entry.


MAIN MENU

SAVING

## How to save your settings and quit the menu

Certain menu options have ON and OFF settings. In these options, pressing the **Enter** button saves the setting after you make a selection.

In options which offer various settings, after you have selected a setting, press the **Enter** button. SAVING is momentarily displayed and the display returns to the same option.


BASIC WEIGHING

0.000

GRAMS STABLE

## How to back out of a menu

You can back out of a menu and return to the weighing mode at any time with the **Go Back** button. Use the **Go Back** button to cancel a number, alphanumeric entry or to leave a mode.

# 3.3 Library

Approximately 200 names can be stored in the library. Eight functions in the balance have provisions for storing a library name, they are: Advanced Counting, Check Weighing, Statistics, Differential Weighing, Formulation, Density, SQC and Pipette. When a library name is selected, the associated function is also displayed. A Library menu is provided which allows the selected library name and function to be run, deleted or delete all entries. If you have accessed the library and do not want to run or delete a name, an exit to weighing selection can be made by pressing the **Go Back** button which does not affect the library

MAIN MENU
- CHANGE MODE
- CHANGE UNITS
- SET BALANCE
- CUSTOM MENU
- LIBRARY
- CALIBRATION
- CONTRAST

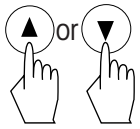
LIBRARY 15.21% USED

| | | |
|---|---|---|
| P1 | PIP | 1.26% |
| P2 | PIP | 1.26% |
| SQ1 | SQC | 3.17% |
| SQ2 | SQC | 3.17% |
| SQ3 | SQC | 3.17% |
| SQ5 | SQC | 3.17% |

## From main menu

Select LIBRARY, then press the **Enter** button. Display advances to LIBRARY % USED menu indicating all previously entered names, their corresponding functions and the percentage of the library which has been used.

The sample shown indicates six library entries. Entries are stored in alphabetical order.




LIBRARY
- RUN
- DELETE
- DELETE ALL

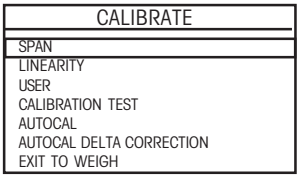
## Accessing library function

Select LIBRARY function and press the **Enter** button. Display advances to LIBRARY menu with RUN, DELETE and DELETE ALL options shown.

Select either RUN, DELETE, or DELETE ALL. When RUN is selected, that particular balance operation is enabled and can be run. When a particular name is selected and the DELETE selection is made, that particular name and function with all parameters is removed from the library. DELETE ALL, when selected, removes the ***entire*** contents of the library.

# 4. Calibration

Your balance can be calibrated with an internal mass (optional) or external masses. The balance can also be checked by a test with internal or external masses. If you have a printer attached to your balance, the data of the calibration and the results are printed out following GLP recommendations. A choice of six calibration methods are available: Span, Linearity, User, Test, Automatic AutoCal™ and AutoCal™ with Delta Correction.




***Span -*** Span calibration ensures that the balance reads correctly within specifications using two weight values: zero and a weight value at 100% of the balance's full capacity.

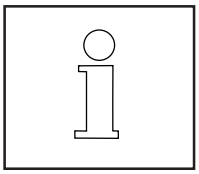
***Linearity -*** Linearity calibration minimizes deviation between actual and displayed weights within the balance's weighing range. Three weight values are used: zero, a weight value at midpoint of the balances weighing range, and a weight value at or near the balance's specified capacity.

***User -*** User calibration is a method where the balance can be calibrated using a mass of known value by entering that value into the balance.

***Test -*** Calibration test allows the stored calibration data to be tested against the current mass being used for the test.

***AutoCal™*** On balances equipped with AutoCal™, automatic calibration of the balance is accomplished by an internal mass.

***AutoCal™*** **W/Delta Correction** On balances equipped AutoCal™, a software feature allows the internal calibration mass to be adjusted ± 100 divisions at full scale capacity. This permits adjusting the balance using an external Class I mass which is traceable to a certified standard.



## Calibration Menu Protection

Calibration may be locked out to prevent unauthorized personnel from changing calibration under LFT (Legal for Trade) mode. If calibration has been locked out, you can only access Internal Weight Calibration and Calibration Test.

To lock out calibration menu, after calibration, refer to paragraph 7.14 titled Menu Lock-Out Protection.

Linearity, Span and User calibration are disabled for Type Approved/LFT balances.

## Calibration Masses

Before beginning calibration, make sure masses are available. If you begin calibration and realize calibration masses are not available, exit the menu. The balance will retain previously stored calibration data. Calibration should be performed as necessary to ensure accurate weighing. Masses required to perform the procedures are listed in the following table.

**CALIBRATION MASSES**

| CAPACITY | LINEARITY CAL POINT | SPAN ONLY CAL POINT |
|---|---|---|
| 62g | 20g/50g | 50g |
| 110g | 50g/100g | 100g |
| 210g | 100g/200g | 200g |
| 410g | 200g/400g | 400g |
| 610g | 200g/500g | 500g |
| 2100g | 1000g/2000g | 2000g |
| 4100g | 2000g/4000g | 4000g |
| 6100g | 2000g/5000g | 5000g |
| 8100g | 4000g/8000g | 8000g |

Masses must meet or exceed ASTM Class 1 Tolerance. Calibration masses are available as accessories.

# 4.1 Span calibration

Span calibration normally requires that calibration be made using a mass equal to the full capacity of the balance, however, the Voyager balance can be calibrated using other lesser values as specified on the display.


CALIBRATE
SPAN
LINEARITY
USER
CALIBRATION TEST
AUTOCAL
AUTOCAL DELTA CORRECTION
EXIT TO WEIGH

## From main menu

Scroll to CALIBRATION and press the **Enter** button. Display advances to CALIBRATE with SPAN highlighted.


SPAN CALIBRATION

PLEASE CLEAR THE PAN. . .
AND PRESS <ENTER>.

Clear the pan.


SPAN CALIBRATION

PLEASE PUT 400.000 GRAMS
ON PAN AND PRESS <ENTER...
OTHER WEIGHTS MAY BE USED:
300 200 100

Place indicated mass value on pan.


SPAN CALIBRATION

PLEASE WAIT. . .
THE DIFFERENCE BETWEEN THIS CAL
AND THE LAST CAL IS: 0.000 GRAMS
PRESS <ENTER> TO CONTINUE

Display indicates the difference between the present calibration and the last calibration.


BASIC WEIGHING
0% 100%
400.000
GRAMS STABLE
PRESS <ENTER> FOR MENU

Display indicates weight of the calibration masses. Remove masses from pan. Balance returns to a weighing mode.

# 4.2 Linearity calibration

Linearity calibration utilizes three calibration points, one at zero, center span and full span. This method minimizes deviation between actual and displayed weights within the balance's weighing range. Three weight values are used; zero, a weight value at midpoint of the balance's weighing range and a weight value at or near the specified capacity.


CALIBRATE
SPAN
LINEARITY
USER
CALIBRATION TEST
AUTOCAL
AUTOCAL DELTA CORRECTION
EXIT TO WEIGH

## From main menu

Scroll to CALIBRATION and press the **Enter** button. Display advances to CALIBRATE with SPAN highlighted. Scroll to LINEARITY.


LINEARITY CALIBRATION

PLEASE CLEAR THE PAN. . .
AND PRESS <ENTER>.

Clear the pan.


LINEARITY CALIBRATION

PLEASE PUT 200.000 GRAMS
ON PAN AND PRESS <ENTER...

Place indicated mass value on pan.


LINEARITY CALIBRATION

PLEASE PUT 400.000 GRAMS
ON PAN AND PRESS <ENTER...

Place indicated mass value on pan.


LINEARITY CALIBRATION

PLEASE WAIT. . .
THE DIFFERENCE BETWEEN THIS CAL
AND THE LAST CAL IS: 0.000 GRAMS
PRESS <ENTER> TO CONTINUE

Display indicates the difference between the present calibration and the last calibration.


BASIC WEIGHING
0% 100%
400.000
GRAMS STABLE
PRESS <ENTER> FOR MENU

Display indicates weight of the calibration masses. Remove masses from pan. Balance returns to a weighing mode.

# 4.3 User calibration

User calibration is used when it is desired to calibrate the balance using a mass of known value. To use this calibration feature, proceed as follows:

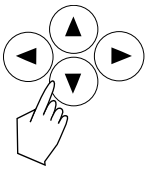

| CALIBRATE |
|---|
| SPAN |
| LINEARITY |
| USER |
| CALIBRATION TEST |
| AUTOCAL |
| AUTOCAL DELTA CORRECTION |
| EXIT TO WEIGH |

## From main menu

Scroll to CALIBRATION and press the **Enter** button. Display advances to CALIBRATE with SPAN highlighted. Scroll to USER.


| USER CALIBRATION |
|---|
| USER CALIBRATION RANGE:<br>100-400 GRAMS<br>PRESS <ENTER. TO CONTINUE. |

User calibration range is specified.



| USER CALIBRATION |
|---|
| ENTER CAL VALUE IN GRAMS<br>200.000 200.000 |

Enter the calibration value.


| USER CALIBRATION |
|---|
| PLEASE CLEAR THE PAN. . .<br>AND PRESS <ENTER>. |

Clear the pan.


| USER CALIBRATION |
|---|
| PLEASE PUT 200.000 GRAMS<br>ON PAN AND PRESS <ENTER... |

Place selected mass value on pan.


| USER CALIBRATION |
|---|
| PLEASE WAIT. . .<br>THE DIFFERENCE BETWEEN THIS CAL<br>AND THE LAST CAL IS: 0.000 GRAMS<br>PRESS <ENTER> TO CONTINUE |

Display indicates the difference between the present calibration and the last calibration.


| BASIC WEIGHING |
|---|
| 0% 100% |
| 200.000 |
| GRAMS STABLE |
| PRESS <ENTER> FOR MENU |

Display indicates weight of the calibration masses. Remove masses from pan. Balance returns to a weighing mode.

# 4.4 Calibration test

Calibration test feature allows a check of a known calibration mass against the last stored calibration information in the balance.


CALIBRATE
SPAN
LINEARITY
USER
CALIBRATION TEST
AUTOCAL
AUTOCAL DELTA CORRECTION
EXIT TO WEIGH

## From main menu

Scroll to CALIBRATION and press the **Enter** button. Display advances to CALIBRATE with SPAN highlighted. Scroll to CALIBRATION TEST.


CALIBRATION TEST

PLEASE CLEAR THE PAN. . .
AND PRESS <ENTER>.

Clear the pan.


CALIBRATION TEST

PLEASE PUT 400.000 GRAMS
ON PAN AND PRESS <ENTER...

Place indicated mass value on pan.


CALIBRATION TEST

PLEASE WAIT. . .
THE DIFFERENCE BETWEEN THIS CAL
AND THE LAST CAL IS: 0.000 GRAMS
PRESS <ENTER> TO CONTINUE

Display indicates the difference between the present calibration and the last calibration.


BASIC WEIGHING

0% 100%

200.000

GRAMS STABLE

PRESS <ENTER> FOR MENU

Display indicates weight of the calibration masses. Remove masses from pan. Balance returns to a weighing mode.

# 4.5 Auto calibration (AutoCal™)

On balances equipped with the AutoCal™ feature, calibration can be accomplished using an internal calibration mass. Auto calibration can be performed at any time providing the balance has warmed up to operating temperature.


CALIBRATE
SPAN
LINEARITY
USER
CALIBRATION TEST
AUTOCAL
AUTOCAL DELTA CORRECTION
EXIT TO WEIGH

## From main menu

Scroll to CALIBRATION and press the **Enter** button. Display advances to CALIBRATE with SPAN highlighted. Scroll to AUTOCAL.


INTERNAL CALIBRATION

PLEASE CLEAR THE PAN. . .
AND PRESS <ENTER>.

Clear the pan.

INTERNAL CALIBRATION

PLEASE WAIT...

Please wait is displayed while the balance is calibrating. If the balance is unstable, a message indicating this appears. The balance will continue self calibration until successful.

INTERNAL CALIBRATION

PLEASE WAIT. . .
THE DIFFERENCE BETWEEN THIS CAL
AND THE LAST CAL IS: 0.000 GRAMS
PRESS <ENTER> TO CONTINUE

Display indicates if calibration was successful and the difference between the last calibration. It is not necessary to press the **Enter** button, the balance returns to a weighing mode automatically.

BASIC WEIGHING

0% 100%

0.000

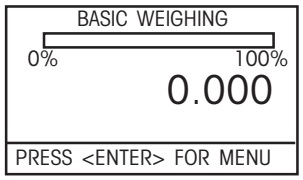
GRAMS STABLE

PRESS <ENTER> FOR MENU

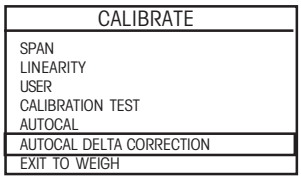
Balance returns to a weighing mode.

# 4.6 AutoCal™ delta correction

Balances with AutoCal™ contain software which allows the internal calibration mass to be adjusted ± 100 divisions at full scale capacity. This permits calibrating the balance using an external ASTM Class 1 mass which is traceable to a certified standard.

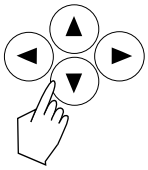



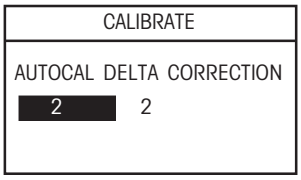

Tare the balance, then place an ASTM Class 1 mass equal to the span calibration value of the balance. Note the reading. If the reading is higher or lower than the value of the mass, proceed as follows:

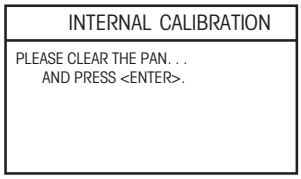

## From main menu

Scroll to CALIBRATION and press the **Enter** button. Display advances to CALIBRATE with SPAN highlighted. Scroll to AUTOCAL DELTA CORRECTION.

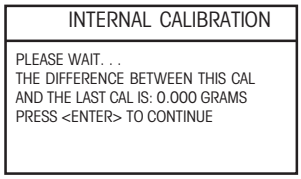




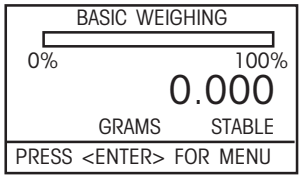

Enter the number of digits shown between the span calibration value of the balance and the actual reading. For example, on a 400g balance, the reading is 400.002g. The difference is 0.002g. This indicates a correction of 2 divisions is required.


Clear the pan. Internal calibration starts.




Display indicates if calibration was successful and the difference between the last calibration. It is not necessary to press the **Enter** button, the balance returns to a weighing mode automatically. If a difference still exists, repeat the procedure. The difference should be 0.000 grams.



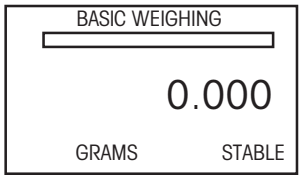

Balance returns to a weighing mode.

# 5. Weighing made simple

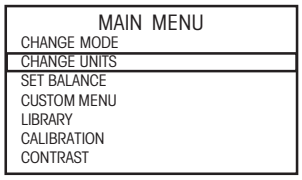
In this section, you will learn how to select a weighing unit, tare the balance, perform simple weighings and enter a custom unit.

## 5.1 Selecting a weighing unit

In this menu option you specify which weighing unit is to be displayed. There are a total of 15 measuring units and custom units which can be selected.




The balance shows the result in grams


### From main menu

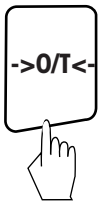
Select CHANGE UNITS. Scroll to the desired measuring unit and press **Enter** button. If a custom unit is desired, refer to paragraph 5.4. The following units are available:

| Display/Designation | Comments |
|---|---|
| milligrams | with mg balances only |
| grams | |
| kilograms | with higher capacity balances only |
| penny weight | |
| carats | |
| ounces | |
| troy ounces | |
| grains | |
| Hong Kong taels | |
| Singapore taels | |
| ROC taels | |
| mommes | |
| pounds | |
| newtons | |
| ticals | |
| custom units | available in library |

**NOTE**: Availability of shaded weighing units subject to local regulations.

## 5.2 Taring the balance

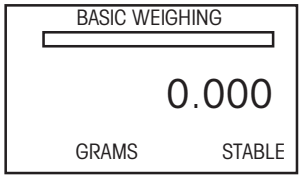
The weight of any container can be tared by the press of a button. The taring range covers the entire weighing range of your balance.



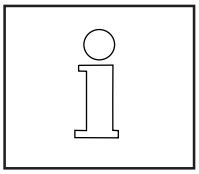

To tare a container, place it on the weighing pan.

Close all draft shield doors (if draft shield is used).

Press the **>0/T<** button to start the taring operation.



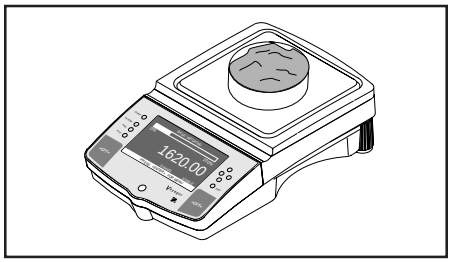

You cannot tare the balance when the weighing pan is unstable. On completion of taring, the word **STABLE** appears in the lower right hand portion of the display and the numerical display indicates zero.



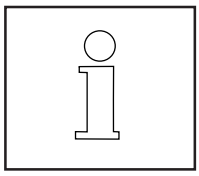
Remember, when taring a container, the weight of the container is subtracted from the total capacity of the balance.

## 5.3 Performing a simple weighing

The balance always starts in a weighing mode when first turned on.




After taring the balance, place sample on the pan. Wait until display indicates STABLE. Now read the weight in the display.



If the balance is in another mode, press the **Go Back** button repeatedly to get back to the weighing mode.

# 5.4 Custom unit

Custom unit allows the creation of your own custom weighing units. It permits entering a conversion factor which the balance will use to convert grams to the desired unit of measure. Custom Units are stored in the Library. Values for up to fifteen different custom units can be entered.

Conversion Factor x Weight in grams = Weight in custom unit

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

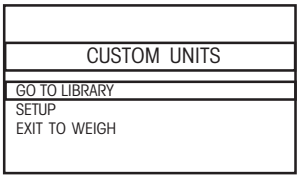
1) a number between 0.1 and 1.999999 called the mantissa
2) a power of 10 called the exponent
3) a least significant digit (LSD)

**SCIENTIFIC NOTATION**

| Conv. Factor | Number Between 0.1 and 1.999999 | Power of 10 | Mantissa | Exp. |
|---|---|---|---|---|
| 123.4 | = .1234 x | 1000 = | .1234 x | $10^3$ |
| 12.34 | = .1234 x | 100 = | .1234 x | $10^2$ |
| 1.234 | = .1234 x | 10 = | .1234 x | $10^1$ |
| .1234 | = .1234 x | 1 = | .1234 x | $10^0$ |
| .01234 | = .1234 x | .1 = | .1234 x | $10^{-1}$ |
| .001234 | = .1234 x | .01 = | .1234 x | $10^{-2}$ |
| .000123 | = .123 x | .001 = | .123 x | $10^{-3}$ |

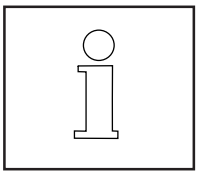
**EXPONENTS**

| | |
|---|---|
| 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. |
| E0 | Leaves decimal point in normal position. |
| 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. |

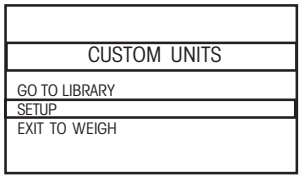




## From main menu

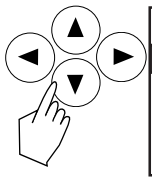
Select CHANGE UNITS. Scroll to CUSTOM UNITS and press **Enter** button. The display indicates GO TO LIBRARY.



When using the balance for the first time, the library is empty and does not contain any custom units. Later, after you have performed the setup procedures, you will be able to select a custom unit by a name you have assigned. Proceed to SETUP.


Scroll to SETUP and press **Enter** button. UNIT NAME is displayed.



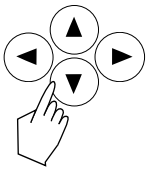
UNIT NAME

UNIT1

<LEFT> / <RIGHT> TO MOVE CURSOR
<UP> / <DOWN> TO SCROLL CHARACTERS
PRESS <ENTER> TO ACCEPT

## Unit name

Enter a unit name. The name you enter and custom unit characteristics will be stored in the library when you complete all entries. Display returns to CUSTOM UNIT SETUP with ENTER FACTOR highlighted.



CUSTOM UNIT SETUP

| | |
|---|---|
| UNIT NAME | UNIT1 |
| ENTER FACTOR | 1.0000 |
| SELECT DP | E-2 |
| SELECT LSD | LSD1 |
| RETURN | |

## Factor

Enter the factor number. This can be a number between 0.1 and 1.999999. For conversion factors outside of this range, the exponent will be used to move the decimal point.

CUSTOM UNIT SETUP

| | |
|---|---|
| UNIT NAME | UNIT1 |
| ENTER FACTOR | 1.0000 |
| SELECT DP | E-2 |
| SELECT LSD | LSD1 |
| RETURN | |

## Decimal point

Scroll to SELECT DP, press **Enter** button. SELECT DP LOCATION is displayed.

SELECT DP LOCATION

E-3
E-2
E-1
E0
E1

Select a decimal point. Scroll to either E-3, E-2, E-1, E0, E1, E2, or E3, and press **Enter** button. Display returns to CUSTOM UNIT SETUP with UNIT NAME highlighted.

CUSTOM UNIT SETUP

| | |
|---|---|
| UNIT NAME | UNIT1 |
| ENTER FACTOR | 1.0000 |
| SELECT DP | E-2 |
| SELECT LSD | LSD1 |
| RETURN | |

## Least significant digit

Scroll to SELECT LSD which is the **L**east **S**ignificant **D**igit, press **Enter** button. SELECT LSD is displayed.

| LSD's | |
|---|---|
| LSD 0.5 | Adds one decimal place display counts by 5'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. |
| RETURN TO SETUP | |

| SELECT LSD |
|---|
| LSD 0.5 |
| LSD 1 |
| LSD 2 |
| LSD 5 |
| LSD 10 |

Select the least significant digit. Scroll to either LSD 0.5, LSD 1, LSD 2, LSD 5 or LSD 10 and press **Enter** button. Display returns to CUSTOM UNIT SETUP with UNIT NAME highlighted.

| CUSTOM UNIT SETUP | |
|---|---|
| UNIT NAME | UNIT1 |
| ENTER FACTOR | 1.0000 |
| SELECT DP | E-2 |
| SELECT LSD | LSD1 |
| RETURN | |

Scroll to RETURN, press **Enter** button. CUSTOM UNITS menu is displayed with GO TO LIBRARY highlighted.


| CUSTOM UNITS |
|---|
| GO TO LIBRARY |
| SETUP |
| EXIT TO WEIGH |

At this point, you can select the custom unit you just entered from the library or exit to weigh. When LIBRARY is selected, scroll to the custom unit you entered, press **Enter** button and select RUN from the menu. The abbreviation for custom units in the display is CU.

# 6. Balance modes

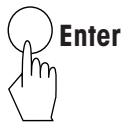
Your balance has 11 additional modes of operation in addition to basic weighing. These built-in modes expand the possibilities of your balance and facilitate your daily work. The following sections will acquaint you with these modes.

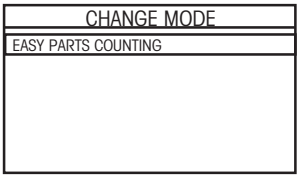
## 6.1 Parts counting

Your balance can be set to either Easy Count or Advanced Count parts method.

### 6.1.1 Easy count

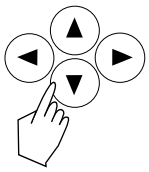
Easy count is a simplified method for counting parts. After specifying a sample size, the balance will display the actual number of samples placed on the pan. Accuracy is based on the average piece weight (APW) of a single part. **All parts must be reasonably uniform in weight.**

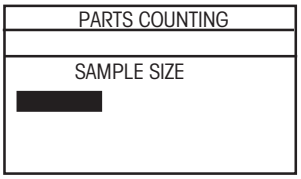


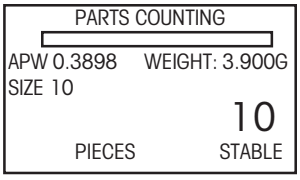

#### From main menu

Enter CHANGE MODE, scroll to PARTS COUNTING and select EASY PARTS COUNTING.





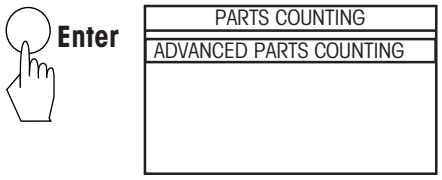

Enter numeric sample size and press **Enter** button.




Place specified number of samples on the pan. After a few seconds, the display indicates the number of pieces based on the sample size. Repeated batches of samples may be placed on the pan and counted.

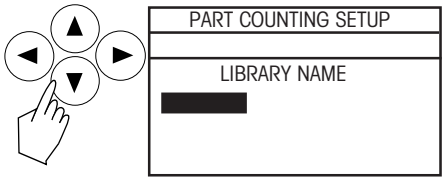
## 6.1.2 Advanced counting

Advanced Count contains a number of entries which include assigning a library name, filling and sorting applications and statistical information which can be printed. Once a library name is assigned, this particular counting function can be recalled at any time.



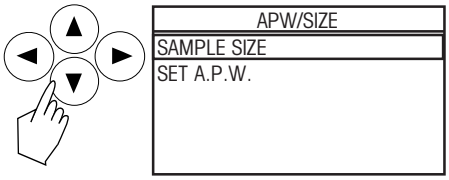

### From main menu

Enter CHANGE MODE. Select PARTS COUNTING and then select ADVANCED PARTS COUNTING. Display advances to PARTS COUNTING SETUP with LIBRARY NAME highlighted.



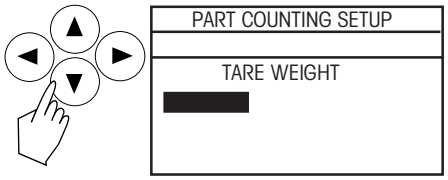

### Library name

Enter library name, up to 8 characters and press **Enter** button. The library name can be recalled later and the same type of items can be counted at any time. The display advances to APW/SIZE.



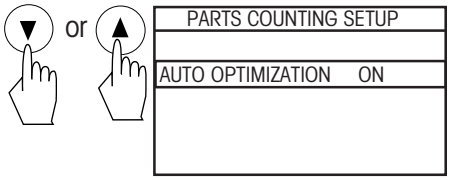

### APW/Size

Enter APW/SIZE. You have a choice of entering a sample size or average piece weight. Enter required data. Display advances to TARE WEIGHT.



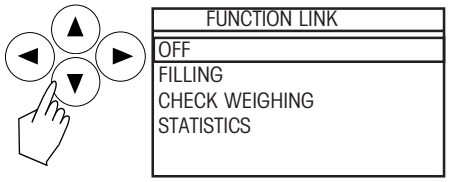

### Tare weight

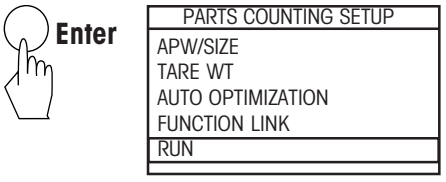
Enter the tare weight. This is the tare weight of the container holding the samples.




### Auto optimization

An ON or OFF function. When set ON, optimizes the accuracy based on sample size. After selecting, the display advances to FUNCTION LINK.



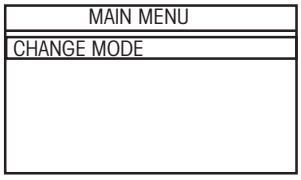




### Function link

Four options are available, OFF, FILLING, CHECK WEIGHING and STATISTICS. When FILLING is selected, a target weight is entered which is shown as 100% on the bar graph on the display. When material is added to the balance pan, it is displayed as a percentage and weight. When CHECK WEIGHING is selected, a separate display has entries for nominal pieces, over pieces, under pieces, run and exit. This type of function permits checking of individual pieces against the stored information in the balance. When STATISTICS is selected, provides display of Standard Deviation, either population or sample, Mean, Sum, High, Low and Difference readings. Each can be individually set ON or OFF. RUN when selected starts the program.

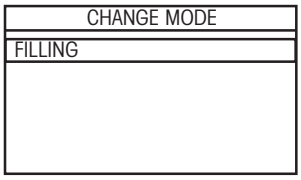
# 6.2 Filling

Filling permits you to enter a target reference weight, then view other loads as a percentage of the reference which has been set in the balance parameters. The load placed on the pan is displayed as a percentage of what was entered into the balance. A twin bar display indicates to 89% on the first bar and to 110% on the second bar.

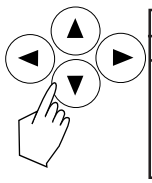



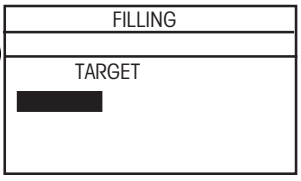

## From main menu

Enter CHANGE MODE.

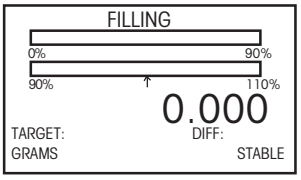



Select FILLING, display advances to TARGET.

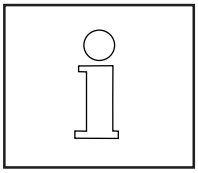





Enter the target weight, up to 8 characters and press **Enter** button. The display advances to FILLING with a dual bar display.



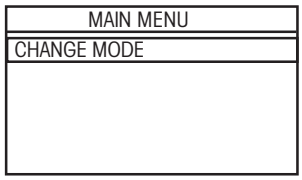

Place filling material on the balance pan, the display indicates on the bar graph as a percentage and displays the actual load weight numerically. Target and difference weights are also displayed.



After you have completed the filling procedure, you have choices at the bottom of the display to either enter a new target value, change mode or return to the main menu.

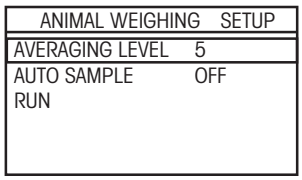
# 6.3 Animal weighing

This feature permits weighing small animals directly on the balance. If an animal cage is used, the balance can be tared (weight of cage is subtracted) and then the subject is placed in the cage and weighed. An averaging filter compensates for animal movements. The filter can be set in a range from Good to Best. The large numeric display indicates the weight of the subject and the bar graph indicates balance capacity used.

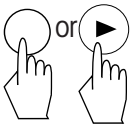



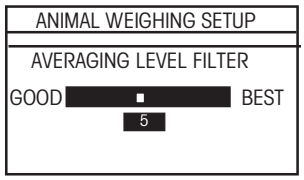

## From main menu

Enter CHANGE MODE. Select ANIMAL WEIGHING, display advances to ANIMAL WEIGHING SETUP.

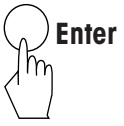



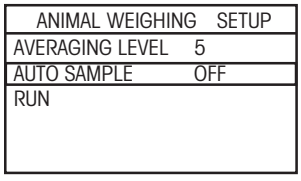

Enter AVERAGING LEVEL, display advances to AVERAGING LEVEL FILTER.



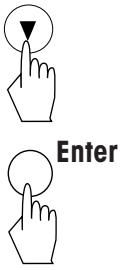



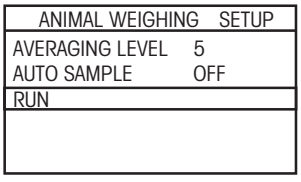

A setting of GOOD is used for subjects which are inactive. The balance will respond quickly and present an average reading. When a setting of BEST is used, the balance responds slowly providing a much longer averaging time for very active subjects. Select filtering level and press **Enter** button.



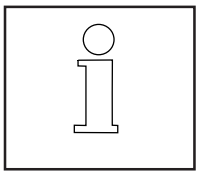




AUTO SAMPLE when selected and set ON permits placing subjects on pan one after another with the weight showing automatically after each subject. When OFF is selected, user must press **Enter** button after each subject is placed on the pan.




Select RUN. Place animal on the pan, press **Enter** button, START SAMPLE is highlighted at the bottom of the display. An averaged reading is displayed after a count-down. The count-down time is affected by the averaging level filter setting.



When AUTO SAMPLE has been selected, it is not necessary to press the **Enter** button to activate sampling.

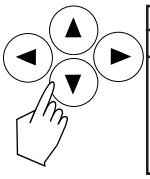
# 6.4 Check weighing

Check weighing is used when items are checked against preset balance parameters. This feature permits you to weigh an item, assign a library name, set balance parameters such as the nominal weight, over weight and under weight. Library recall eliminates the need to enter the weighing parameters again. A bar graph at the top of the Check Weighing screen indicates UNDER, ACCEPT and OVER for items being checked.


MAIN MENU
CHECK WEIGHING

## From main menu

Enter CHANGE MODE. Select CHECK WEIGHING, display advances to LIBRARY NAME.

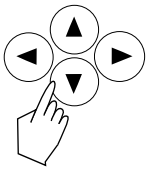


CHECK WEIGHING SETUP
LIBRARY NAME
CW1

Enter a Library Name, up to 8 characters and press **Enter** button. Display advances to NOMINAL WT entry. If a previous name was entered and selected, the balance displays the parameters which were set.

CHECK WEIGHING SETUP
LIBRARY NAME
NOMINAL
OVER
UNDER
RUN

Enter the Nominal option.



CHECK WEIGHING SETUP
NOMINAL WT
200.000

Enter the nominal weight and then enter over and under weights. Press **Enter** button after each entry.


CHECK WEIGHING SETUP
LIBRARY NAME
NOMINAL
OVER
UNDER
RUN

Select RUN.

CHECK WEIGHING
UNDER ACCEPT OVER
OVER: 202.000 NOMINAL: 200.00
UNDER: 199.000 DIFF: 0.026
200.026

Place the item to be checked on the balance pan, the display indicates the over, under, nominal and difference weight of the item. The bar graph indicates UNDER, ACCEPT and OVER.

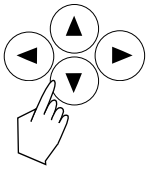
# 6.5 Differential weighing

Differential weighing stores tare and weight values so samples can be dried or processed and the difference in weight calculated at a later time. Up to 80 samples can be stored. The balance has the capability to work with one or two different containers or no container at all. A Sieve Analysis procedure is also included in Appendix A-1 for this type of application. Samples can be added to the applications library or extracted by name using the previously stored data. The balance can be used for other applications during processing time.


CHANGE MODE
DIFF WEIGHING

## From main menu

Enter CHANGE MODE. Select DIFF WEIGHING, display advances to LIBRARY NAME.



DIFF WEIGHING SETUP
LIBRARY NAME

## Library name

Enter a Library Name, up to 8 characters and press **Enter** button. Display advances to DIFF STARTUP. If a previous name was entered and selected, the balance displays the parameters which were set.

DIFF STARTUP
SETUP
RESUME

For first time entries, select SETUP. Display advances to DIFF WEIGHING SETUP. RESUME will bring you directly to RUN which starts the program. Do not use RESUME initially.


DIFF WEIGHING SETUP
LIBRARY NAME
TARE SETUP
AUTO SAMPLE OFF
DIFF RESULT WEIGHT
NUMBER OF SAMPLES
VIEW RESULTS
CLEAR ALL DATA
RUN

Enter TARE SETUP.

TARE SETUP
NO TARE
SINGLE TARE
DUAL TARE
RETURN

TARE SETUP offers a choice of NO TARE (no container is used), SINGLE TARE (one container used during entire process), and DUAL TARE (two containers used, one at the start of a process and a different container at the end of a process). DUAL TARE is also used for sieve analysis. Select the appropriate tare option for your process.


TARE SETUP
NO TARE
SINGLE TARE
DUAL TARE
RETURN

Select RETURN. Display returns to DIFF WEIGHING SETUP.


DIFF WEIGHING SETUP
LIBRARY NAME
TARE SETUP
AUTO SAMPLE OFF
DIFF RESULT WEIGHT
NUMBER OF SAMPLES
VIEW RESULTS
CLEAR ALL DATA
RUN

## Automatic sampling

Enter AUTO SAMPLE. Auto Sampling permits repetitive sampling automatically. Select ON or OFF. Display advances to DIFF RESULT.

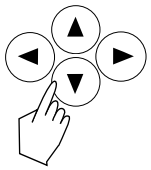

DIFF WEIGHING SETUP
LIBRARY NAME
TARE SETUP
AUTO SAMPLE OFF
DIFF RESULT WEIGHT
NUMBER OF SAMPLES
VIEW RESULTS
CLEAR ALL DATA
RUN

## Difference result

Enter DIFF RESULT. Difference result enables final weighing results to be shown by weight, percentage (for sieve analysis), or % retention. Select appropriate result for your process.


DIFF WEIGHING SETUP
LIBRARY NAME
TARE SETUP
AUTO SAMPLEOFF
DIFF RESULT WEIGHT
NUMBER OF SAMPLES
VIEW RESULTS
CLEAR ALL DATA
RUN

Select RETURN and press **Enter**. Display advances to DIFF WEIGHING SETUP with NUMBER OF SAMPLES highlighted. Enter the NUMBER OF SAMPLES display.



DIFF WEIGHING SETUP
NUMBER OF SAMPLES

## Enter number of samples

Enter the number of samples you want to test. A maximum of 80 samples can be run per library entry. After specifying number of samples, press **Enter** button, display returns to DIFF WEIGHING SETUP with RUN highlighted.

## Processing the samples

Since there are three options of taring, each procedure will be covered separately. Follow either NO TARE, SINGLE TARE or DUAL TARE methods depending upon which you have selected.


DIFF WEIGHING SETUP
LIBRARY NAME
TARE SETUP
AUTO SAMPLE OFF
DIFF RESULT WEIGHT
NUMBER OF SAMPLES
VIEW RESULTS
CLEAR ALL DATA
RUN

## No Tare - Initial weighing

After pressing the **Enter** button, the display indicates PUT INITIAL SAMPLE # 1 ON PAN. This first sample is your unprocessed sample.

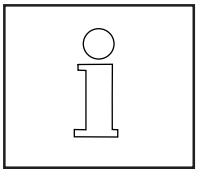
DIFF WEIGHING
TARE WT: TARE WT:
IN IT WT: FINAL WT:
0.000
PUT INITIAL SAMPLE #1 ON PAN STABLE
START/SAMPLE | EDIT | SETUP

Put first unprocessed sample on the pan. When the weight has stabilized, press **Enter** button with START/SAMPLE highlighted on the display. This advances to the next sample. Continue adding samples and pressing the **Enter** button for each sample until all samples have been weighed. When the last sample has been weighed, the display indicates the initial weight of all samples.

| TAREWT | INIT WT | TARE WT | FINAL \VT |
|---|---|---|---|
| N/A | 7.705 | NA | 0.000 |
| N/A | 7.702 | N/A | 0.000 |
| N/A | 7.701 | N/A | 0.000 |

CONTINUE | SAVE | RESAMPLE | DELETE

This sample display indicates 3 samples taken with no tare.
Four options are available at the bottom of the display. CONTINUE permits continuing with the procedure. SAVE permits saving the data and returns the balance to a weighing mode. RESAMPLE allows going back to resample a selected entry. DELETE permits deleting a selected entry.



To return to your final weighing, find and select the Library name of your test. The balance then returns to where you left off in your sampling procedure for final weighing.


DIFF WEIGHING

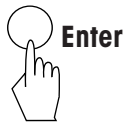
TARE WT: TARE WT:
IN IT WT: FINAL WT:
7.299

PUT INITIAL SAMPLE #1 ON PAN STABLE

START/SAMPLE | EDIT | SETUP

## No Tare - Final weighing

After pressing the **Enter** button, the display returns to final weighing. Put first processed sample on the pan. When the weight has stabilized, press **Enter** button with START/SAMPLE highlighted on the display. This advances to the next sample. Continue adding samples and pressing the **Enter** button for each sample until all final samples have been weighed. When the last sample has been weighed, the display indicates the final weight of all samples.




| TAREWT | INITWT | TARE WT | FINAL \VT |
|---|---|---|---|
| N/A | 7.705 | NA | 7.299 |
| N/A | 7.702 | N/A | 7.299 |
| N/A | 7.701 | N/A | 7.299 |

CONTINUE | SAVE | RESAMPLE | DELETE

With CONTINUE highlighted, press **Enter** button to review final display.

| SAMPLE # | INIT WT | FINAL WT | WT DIFF |
|---|---|---|---|
| N/A | 7.705 | 7.220 | -0.407 |
| N/A | 7.702 | 7.299 | -0.403 |
| N/A | 7.701 | 7.299 | -0.402 |
| TOTAL | 23.109 | 21.896 | -1.212 |

PRESS <ENTER> FOR MENU

Final display.


DIFF WEIGHING SETUP

LIBRARY NAME
TARE SETUP
AUTO SAMPLE OFF
DIFF RESULT WEIGHT
NUMBER OF SAMPLES
VIEW RESULTS
CLEAR ALL DATA

RUN

## Single Tare - Initial weighing (one container)

This procedure is used when one container is used with the initial and final samples. After pressing the **Enter** button, the display indicates PUT INITIAL CONTAINER #1 ON PAN.

DIFF WEIGHING

TARE WT: TARE WT:
IN IT WT: FINAL WT:
0.000

PUT INITIAL SAMPLE #1 ON PAN STABLE

START/SAMPLE | EDIT | SETUP

Put container #1 on the pan. When the weight has stabilized, press **Enter** button with START/SAMPLE highlighted on the display. This advances to the next container. Continue adding containers and pressing the **Enter** button for each container until all containers have been weighed. When the last container has been weighed, the display indicates the initial weight of all containers.

| TAREWT | INIT WT | TARE WT | FINAL \VT |
|---|---|---|---|
| 8.739 | 0.000 | N/A | 0.000 |
| 8.744 | 0.000 | N/A | 0.000 |
| 8.738 | 0.000 | N/A | 0.000 |

CONTINUE | SAVE | RESAMPLE | DELETE

This sample display indicates 3 containers weighed. Four options are available at the bottom of the display. CONTINUE permits continuing with the procedure. SAVE permits saving the data and returns the balance to a weighing mode. RESAMPLE allows going back to resample a selected entry. DELETE permits deleting a selected entry.


DIFF WEIGHING

TARE WT: TARE WT:
IN IT WT: 20.006 FINAL WT:
20.006

PUT INITIAL SAMPLE #1 ON PAN STABLE

START/SAMPLE | EDIT | SETUP

Select CONTINUE. Display changes to PUT INITIAL SAMPLE #1 ON PAN. Place sample # 1 on the pan, press **Enter** button. Repeat steps and place each sample on the pan.

| TAREWT | INIT WT | TARE WT | FINAL \VT |
|---|---|---|---|
| 8.739 | 20.006 | N/A | 0.000 |
| 8.744 | 20.096 | N/A | 0.000 |
| 8.738 | 20.096 | N/A | 0.000 |

SAMPLE #1

CONTINUE | SAVE | RESAMPLE | DELETE

When the last sample is placed on the pan and entered, the display indicates the tare weight of the containers and the initial weight of the samples.

DIFF WEIGHING

TARE WT: TARE WT:
IN IT WT: FINAL WT:16.144
16.144

PUT FINAL SAMPLE #1 ON PAN STABLE

START/SAMPLE | EDIT | SETUP

## Single Tare - Final weighing (one container)

After pressing the **Enter** button, the display returns to final weighing. Put first processed sample with the container on the pan. When the weight has stabilized, press **Enter** button with START/SAMPLE highlighted on the display. This advances to the next sample. Continue adding samples and pressing the **Enter** button for each sample until all final samples have been weighed. When the last sample has been weighed, the display indicates the final weight of all samples.


| TARE WT | INIT WT | TARE WT | FINAL \VT |
|---|---|---|---|
| 8.739 | 20.006 | N/A | 16.143 |
| 8.744 | 20.096 | N/A | 16.598 |
| 8.738 | 20.096 | N/A | 16.685 |

SAMPLE #1

CONTINUE | SAVE | RESAMPLE | DELETE

With CONTINUE highlighted, press **Enter** button to review final display.

| SAMPLE # | INIT WT | FINAL WT | WT DIFF |
|---|---|---|---|
| 1 | 11.267 | 7.404 | -3.863 |
| 2 | 11.352 | 7.854 | -3.498 |
| 3 | 11.358 | 6.947 | -4.411 |
| TOTAL | 33.977 | 22.205 | -11.772 |

PRESS <ENTER> FOR MENU

Final display.


| DIFF WEIGHING SETUP | |
|---|---|
| LIBRARY NAME | |
| TARE SETUP | |
| AUTO SAMPLE | OFF |
| DIFF RESULT | WEIGHT |
| NUMBER OF SAMPLES | |
| VIEW RESULTS | |
| CLEAR ALL DATA | |
| RUN | |

## Dual Tare - Initial weighing (two containers)

This procedure is used when separate containers are used at the start of a process and the end of a process. After pressing the **Enter** button, the display indicates to PUT INITIAL CONTAINER #1 ON PAN.

DIFF WEIGHING

TARE WT: 8.738 TARE Wf:
IN IT WT: FINALWT:8.738

8.738

PUT INITIAL CONTAINER #1 ON PAN STABLE

| START/SAMPLE | EDIT | SETUP |
|---|---|---|

Put container #1 on the pan. When the weight has stabilized, press **Enter** button with START/SAMPLE highlighted on the display. This advances to the next container. Continue adding containers and pressing the **Enter** button for each container until all containers have been weighed. When the last container has been weighed, the display indicates the initial weight of all containers.

| TAREWT | INIT WT | TARE WT | FINAL \VT |
|---|---|---|---|
| 8.738 | 0.000 | N/A | 0.000 |
| 8.738 | 0.000 | N/A | 0.000 |
| 8.738 | 0.000 | N/A | 0.000 |

| CONTINUE | SAVE | RESAMPLE | DELETE |
|---|---|---|---|

This sample display indicates 3 containers weighed. Four options are available at the bottom of the display. CONTINUE permits continuing with the procedure. SAVE permits saving the data and returns the balance to a weighing mode. RESAMPLE allows going back to resample a selected entry. DELETE permits deleting a selected entry.


DIFF WEIGHING

TARE WT: TARE WT:
IN IT WT: 23.076 FINAL WT:

23.076

PUT INITIAL SAMPLE #1 ON PAN STABLE

| START/SAMPLE | EDIT | SETUP |
|---|---|---|

Select CONTINUE. Display changes to PUT INITIAL SAMPLE #1 ON PAN. Place sample # 1 on the pan, press **Enter** button. Repeat steps and place each sample on the pan.

| TAREWT | INIT WT | TARE WT | FINAL \VT |
|---|---|---|---|
| 8.738 | 23.989 | N/A | 0.000 |
| 8.738 | 23.994 | N/A | 0.000 |
| 8.738 | 24.064 | N/A | 0.000 |

SAMPLE #1

| CONTINUE | SAVE | RESAMPLE | DELETE |
|---|---|---|---|

When the last sample is placed on the pan and entered, the display indicates the tare weight of the containers and the initial weight of the samples.

## Dual Tare - Final weighing (two containers)

DIFF WEIGHING

TARE WT: TARE WT:
IN IT WT: FINAL WT:8.738

8.738

PUT FINAL CONTAINER #1 ON PAN STABLE

| START/SAMPLE | EDIT | SETUP |
|---|---|---|

After pressing the **Enter** button, the display returns to final weighing. Put final container #1 on the pan. Repeat process for all containers.


| TARE WT | INIT WT | TARE WT | FINAL \VT |
|---|---|---|---|
| 8.738 | 23.989 | 8.738 | 19.647 |
| 8.738 | 23.994 | 8.741 | 20.580 |
| 8.738 | 24.064 | 8.738 | 20.102 |

SAMPLE #1

| CONTINUE | SAVE | RESAMPLE | DELETE |
|---|---|---|---|

Put first processed sample with the container on the pan. When the weight has stabilized, press **Enter** button with START/SAMPLE highlighted on the display. This advances to the next sample. Continue adding samples and pressing the **Enter** button for each sample until all final samples have been weighed. When the last sample has been weighed, the display indicates the final weight of all samples. With CONTINUE highlighted, press **Enter** button to review final display.

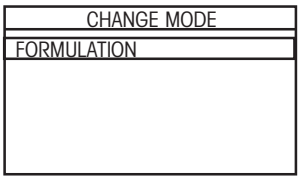
| SAMPLE # | INIT WT | FINAL WT | WT DIFF |
|---|---|---|---|
| 1 | 15.251 | 10.909 | .342 |
| 2 | 15.256 | 1.839 | -3.417 |
| 3 | 15.326 | 11.364 | -3.962 |
| TOTAL | 45.833 | 34.112 | -11.721 |

PRESS <ENTER> FOR MENU

Final display.

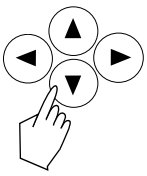
# 6.6 Formulation

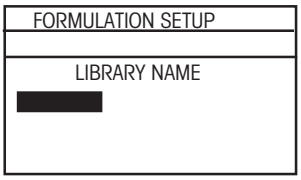
Formulations can be named and have from 2 to 10 components specified. Names are limited to 8 characters. Once named, they may be recalled and used at any time. Each component of a given formulation can be specified as to its weight or percentage. Each element of a formulation is shown on a dual bar graph as a percentage and displays the desired weight. Thus, each component may be placed on the pan until 100% is indicated.




## From main menu

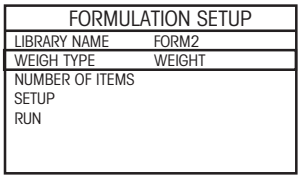
Enter CHANGE MODE. Select FORMULATION, display advances to LIBRARY NAME.



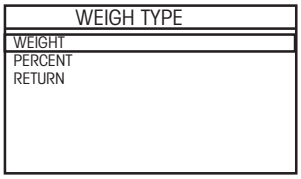



## Library name

Enter a library name, up to 8 characters and press **Enter** button. Display advances to FORMULATION SETUP with WEIGH TYPE highlighted. If a previous name was entered and selected, the balance displays the parameters which were set.

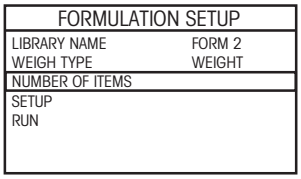







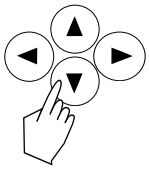

## Weigh type

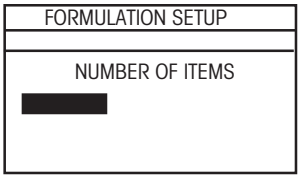
Enter the weigh type. You can select the components to be specified by weight or percentage. Display returns to FORMULATION SETUP.



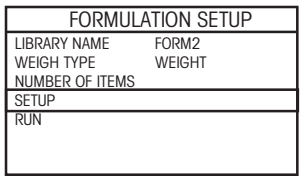

## Number of items

Select NUMBER OF ITEMS.

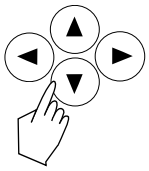


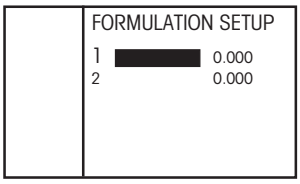



Specify the number of items (components) in the formulation. After specifying the number of items, the display returns to FORMULATION SETUP with SETUP highlighted.

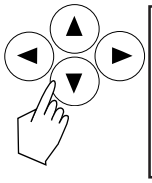

Enter SETUP in the FORMULATION SETUP. Display advances to a split screen.

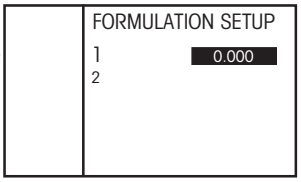





## Specifying component names

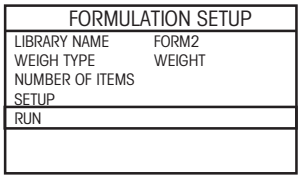
Specify the name for the first component of the formula, then press **Enter** button. Display advances to right of screen which is either weight or percentage (whichever was previously selected).



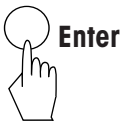


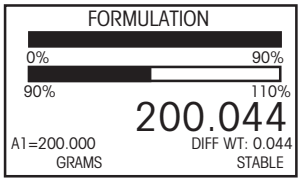

## Specifying weight or percentage values

Specify either weight value or percentage value which you had previously selected for the first component. Repeat these two steps for all components in your formula. After you enter all component names and values, the display advances to FORMULATION SETUP with RUN highlighted.



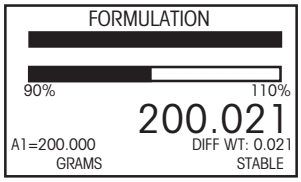

Select RUN. A dual bar display appears indicating the weight or percentage to be placed on the pan.



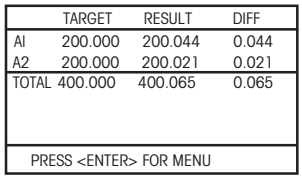

## Adding first component

Add the first component on the pan. The bar graph is used as a guide to precisely add 100% of the first component. NEXT appears highlighted at the bottom of the display. Press **Enter** button to add next component. Sample indicates 200.044 grams. Leave the first component on the pan. Repeat this procedure for all additional components.


## Adding remaining components

Add all remaining components one at a time, pressing the **Enter** button after each component is placed on the pan.

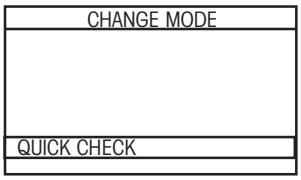




## Final results

After the last component is placed on the pan, the final result is indicated on the display.

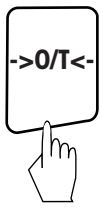
# 6.7 Quick check weighing

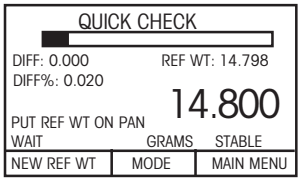
Quick check weighing permits placing a reference sample on the balance pan which is used as a reference weight to measure against similar samples. A single bar display indicates up to 100% of the capacity of the balance. The difference in percentage is also shown along with the reference weight. The large numeric display indicates the weight of the sample.




## From main menu

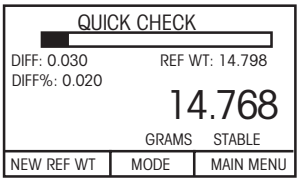
Enter CHANGE MODE. Select QUICK CHECK, display advances to QUICK CHECK.



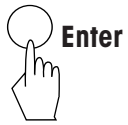

## Setting reference weight

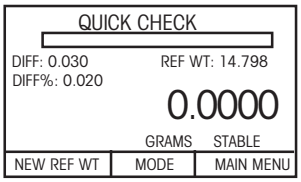
Tare the balance. The display indicates PUT REF WT ON PAN. Place the reference weight on the pan. WAIT is momentarily displayed as the balance accepts the reference weight.




## Adding samples

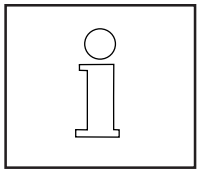
After the balance accepts the weight, remove the reference weight and place the first sample on the pan. The display indicates the difference in weight and percentage of the sample against the reference weight. You may continue to weigh additional samples.




## Setting new reference weight

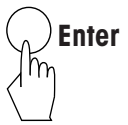
Clear the pan and tare the balance. With NEW REF WT highlighted at the bottom of the display, press **Enter** button. The display indicates PUT REF WT ON PAN. You may now place a new reference weight on the pan and repeat the above procedure for new samples using a new reference weight.



When you exit quick check weighing and use other balance functions and return to quick check weighing, the previous reference weight appears in the display. Disregard display readings. When you place a new reference weight on the pan, the balance resets to the new weight.

# 6.8 Statistics/Function link

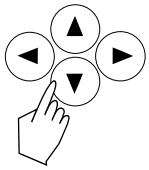
Statistics are used when it is desired to compare a number of samples and examine the relative deviation of the samples along with other statistical data. A minimum of three samples is required in this program. Statistics contains menu options which include standard deviation, mean, sum, maximum, minimum, difference, relative deviation, auto sample and sample size. Most of these can be set ON or OFF except sample size which can be set for a particular number. When a printer or computer is connected to the balance, all statistical information can be observed and printed. FUNCTION LINK offers a choice of three functions; CHECK WEIGHING, FILLING and ANIMAL WEIGHING which can be linked directly to statistical data. Statistics can be enabled either through the CHANGE MODE menu or the LIBRARY. The library method will automatically run the link. Changes can be made through the CHANGE MODE menu setup.




MAIN MENU
CHANGE MODE

## From main menu

Enter CHANGE MODE and select STATISTICS, display advances to LIBRARY NAME.



STATISTICS SETUP
LIBRARY NAME

## Library name

Enter a library name, up to 8 characters and press **Enter** button. Display advances to STATISTICS SETUP with STD DEV highlighted. If a previous name was entered and selected, the balance uses the parameters which were previously set.

| STATISTICS SETUP | |
|---|---|
| LIBRARY NAME | STATS1 |
| STD DEV | ON |
| MEAN | ON |
| SUM | ON |
| MAXIMUM | ON |
| MINIMUM | ON |
| DIFFERENCE | ON |
| RELATIVE DEV | ON |

## Turning statistics on or off

Select each option under the STATISTICS SETUP and turn either ON or OFF. When you reach FUNCTION LINK, you have a choice of linking the statistical data to either CHECK WEIGHING, FILLING or ANIMAL WEIGHING or not linking and leave the FUNCTION LINK OFF.

FUNCTION LINK
OFF
FILLING
CHECK WEIGHING
ANIMAL WEIGHING
RETURN TO SETUP

## Selecting a function link

Selecting FUNCTION LINK offers a choice of either FILLING, CHECK WEIGHING, or ANIMAL WEIGHING functions to have statistics available on printouts. Select the desired function and press **Enter** button.

| STATISTICS SETUP | |
|---|---|
| DIFFERENCE | ON |
| RELATIVE DEV | ON |
| AUTO SAMPLE | OFF |
| AUTO PRINT | OFF |
| SAMPLE SIZE | 3 |
| FUNCTION LINK | OFF |
| RUN | |

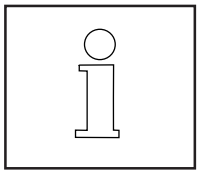
## Running the program

Select RUN and press **Enter** button. If statistics was selected to link with any function, the display for that function will indicate STATS ON at the top of the display.

STATISTICS RESULT
NUMBER OF SAMPLES: 3
UNIT: GRAMS
MEAN: 203.571
MAXIMUM: 203.929
MINIMUM: 203.283
STD DEVIATION: 0.310
RELATIVE DEV: 0.064
SUM: 610.713
DIFFERENCE:0.546

## Statistical result display

When a program has been run, a typical display as shown appears.



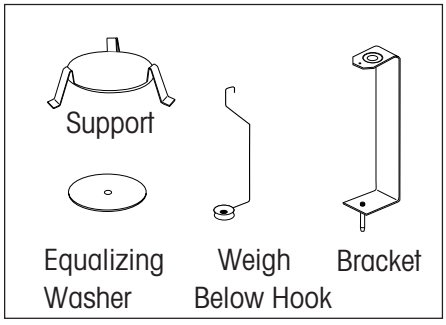
Function links when set up to a particular function such as FILLING, CHECK WEIGHING, or ANIMAL WEIGHING can be run directly from the Library listing. Scrolling through the Library will reveal which item(s) are linked to statistics.

# 6.9 Density

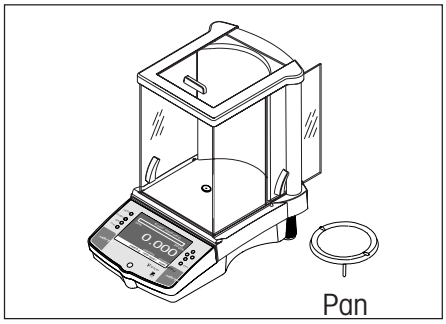
Four methods of density determinations can be made with the Voyager balance. These are: solids more dense than water, solids less dense than water, porous material (impregnated with oil), and liquid density. A Density Determination Kit Part Number 470007-010 is specifically designed to be used with Ohaus® Analytical Voyager balances. Illustrations in this procedure refer to the density kit, however, you may use whatever lab apparatus that will suit the requirements for density measurements. A built in reference density table for water at temperatures between 10ºC and 30ºC is included in the balance software. When making density measurements, the material should weigh at least 10.0 mg on an analytical balance and 100 mg on a precision balance.

## 6.9.1 Balance preparation with density kit

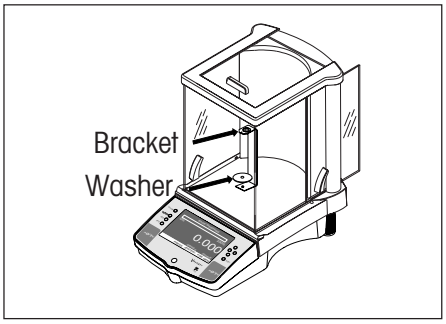
Allow the balance to warm up sufficiently before making measurements.



Kit Components



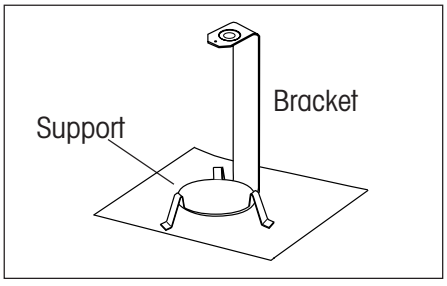
Balance preparation



Bracket and Washer Mounting

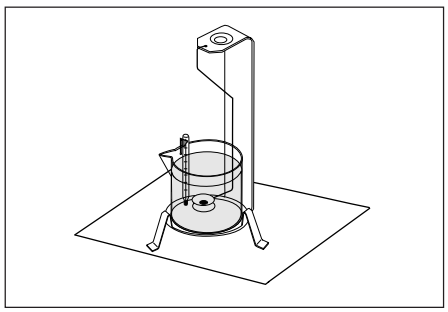
Open either the left or right side door of the balance and remove the Pan as shown. Insert the Bracket into the balance where the Pan was removed.

On balances which are rated over 400g, place the Equalizing Washer on top of the Bracket as shown in the illustration.



Support Mounting

Place the Support into position over the bracket making sure the Support **does not** make contact with the Bracket as shown in illustration.


Beaker Installation

Install beaker on support as shown.

**NOTE: Beaker and thermometer are not supplied as part of the density kit.**

## 6.9.2 Solid density determinations for items more dense than water

The density ***Q*** is the quotient of the mass ***m*** and the volume ***V***.

$$Q = \frac{m}{V}$$

Density determinations are performed by using **Archimedes' principle**. This principle states that every solid body immersed in a fluid loses weight by an amount equal to that of the fluid it displaces. The density table for water is included in the Voyager balance software.

The density of a solid is determined with the aid of a liquid whose **density, Qo,** is known (water is used as an auxiliary liquid). The solid is weighed in air (***A***) and then in the auxiliary liquid (***B***). The density **Q** can be calculated from the two weighings as follows:

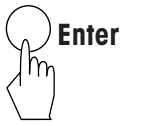
$$Q = \frac{A}{A - B} \bullet Q_0$$

The balance allows direct determination of the buoyancy P *(P =A - B )* and consequently the above formula can be simplified:

$$Q = \frac{A}{P} \bullet Q_0$$

Q = Density of the solid
*A* = Weight of the solid in air
B = Weight of the solid in the auxiliary liquid
$Q_0$ = Density of the auxiliary liquid at a given temperature (this value depends on the temperature). The density table for water is included in Voyager balances.
P = Buoyancy of the solid in the auxiliary liquid (corresponds to *A -B).*

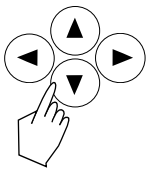
In the event that a different liquid is to be used, provisions are made to enter the density of the desired liquid and enter its name into a library. The following procedure uses water.




MAIN MENU
CHANGE MODE

### From main menu

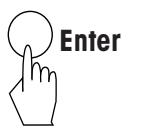
Enter CHANGE MODE. Select DENSITY, display advances to LIBRARY NAME.



DENSITY SETUP
LIBRARY NAME

### Library name

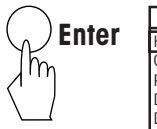
Enter a library name, up to 8 characters and press **Enter** button. Display advances to DENSITY SETUP with SOLID DENSITY highlighted. If a previous name was entered and selected, the balance uses the parameters which were previously set.




DENSITY SETUP

| | |
|---|---|
| LIBRARY NAME | D2 |
| SOLID DENSITY | <-SELECTED |
| LIQUID DENSITY | |
| AUTO SAMPLE | OFF |
| AUTO PRINT | OFF |
| RUN | |

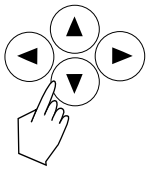
After you select SOLID DENSITY, display advances to AUX LIQ & MODE with H2O highlighted.




| AUX LIQ & MODE | |
|---|---|
| H2O | <-SELECTED |
| OTHER | |
| POROUS MATERIAL | OFF |
| DRY WEIGHT | 0.000 |
| DENSITY OF OIL | 0.0000 |
| RETURN TO SETUP | |

## Selecting water as auxiliary liquid

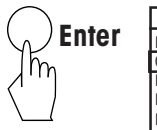
Select H2O, and perform the next step. If you are using a different liquid, skip the next step and continue.



| AUX LIQ & MODE |
|---|
| ENTER TEMPERATURE CELSIUS |

## Specify temperature

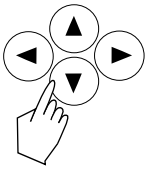
Enter the temperature of the water and press **Enter** button. Display advances to AUX LIQ & MODE with POROUS MATERIAL highlighted. Skip the next two steps.




| AUX LIQ & MODE | |
|---|---|
| H2O | <-SELECTED |
| OTHER | |
| POROUS MATERIAL | OFF |
| DRY WEIGHT | 0.000 |
| DENSITY OF OIL | 0.0000 |
| RETURN TO SETUP | |

## Selecting an auxiliary liquid

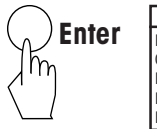
Select OTHER, and perform the next step.



| AUX LIQ & MODE |
|---|
| ENTER LIQUID DENSITY IN CC |

## Specify auxiliary liquid density

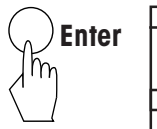
Enter the density of the auxiliary liquid and press **Enter** button. Display advances to AUX LIQ & MODE with POROUS MATERIAL highlighted.




| AUX LIQ & MODE | |
|---|---|
| H2O | <-SELECTED |
| OTHER | |
| POROUS MATERIAL | OFF |
| DRY WEIGHT | 0.000 |
| DENSITY OF OIL | 0.0000 |
| RETURN TO SETUP | |

## Return to setup

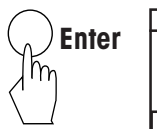
Select RETURN TO SETUP. Disregard POROUS MATERIAL in menu as this is explained in Appendix A-2. Display returns to DENSITY SETUP with AUTO SAMPLE highlighted.




| DENSITY SETUP | |
|---|---|
| LIBRARY NAME | D2 |
| SOLID DENSITY | <-SELECTED |
| LIQUID DENSITY | |
| AUTO SAMPLE | OFF |
| AUTO PRINT | OFF |
| RUN | |

## Auto sample

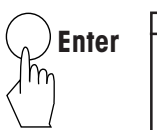
Select AUTO SAMPLE and turn it ON or OFF. A setting of ON allows samples to be sequentially sampled without pressing the **Enter** button for each sample.




| DENSITY SETUP | |
|---|---|
| LIBRARY NAME | D2 |
| SOLID DENSITY | <-SELECTED |
| LIQUID DENSITY | |
| AUTO SAMPLE | OFF |
| AUTO PRINT | OFF |
| RUN | |

## Auto print

At this point you can select AUTO PRINT. To turn on, press the **Enter** button and select ON. If you do not want automatic printing, select OFF.

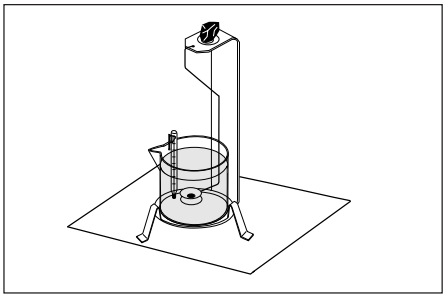



| DENSITY SETUP | |
|---|---|
| LIBRARY NAME | D2 |
| SOLID DENSITY | <-SELECTED |
| LIQUID DENSITY | |
| AUTO SAMPLE | OFF |
| AUTO PRINT | OFF |
| RUN | |

## Testing the sample

Select RUN and press the **Enter** button. The display advances to DENSITY and requests WEIGH IN AIR shown at the bottom of the screen.

| DENSITY - - D2 | | |
|---|---|---|
| WEIGH IN AIR: 0.000 | | TEMP:25.0 |
| WEIGH IN LIQ: | | AUX D= 9.971 |
| | | VOLUME: |
| WEIGH IN AIR | 0.000 | |
| START/SAMPLE | SETUP | MAIN MENU |

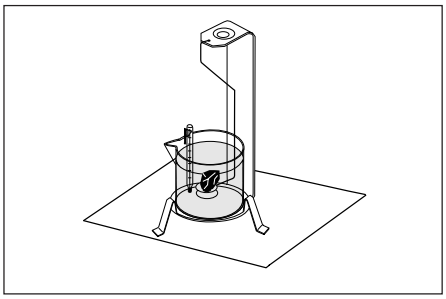


Sample Weighing in Air

START/SAMPLE is highlighted.

Make sure a beaker with liquid is in position on the stand in the balance. Press the **>0/T<** button to zero the balance reading.

Place solid on top of the bracket as shown and close the draft shield doors. Weigh the solid (weight *A)* and press the **Enter** button. The display now requests WEIGH IN LIQUID.

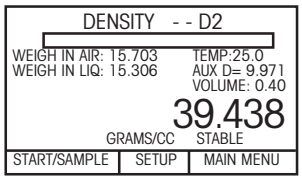


Sample Weighing in Liquid

Open the draft shield of the balance and place the solid in the Weighing Pan on the Weigh Below Hook in the liquid as shown. Ensure that there are no air bubbles on the solid to be weighed.

Close the draft shield doors and weigh the solid (buoyancy P) by pressing the **Enter** button. The display indicates the density in grams/cc.

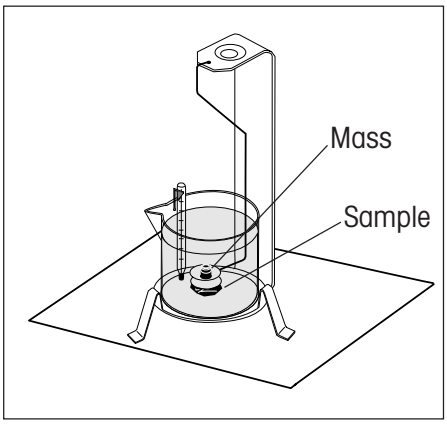
Successive samples may be taken simply by pressing **Enter** with the START SAMPLE bar highlighted. If AUTO SAMPLE was selected previously, samples can be taken as per the indication on the display.




A typical final display is shown which indicates all of the parameters and values.

## 6.9.3 Solid density determinations for items less dense than water

For density determination of solids with a density less than 1 g/CM$^3$, the bottom of the Weigh Below Hook for solids must be used as it holds the solid body below the surface of the auxiliary liquid. If the buoyancy of the solid is greater than the weight of the Weigh Below Hook, the Weigh Below Hook must be weighted by placing an additional mass on the submerged part of the Weigh Below Hook as shown.




Buoyancy Sample Weighing

Weigh the sample in air first as explained in the previous procedure.

After loading the additional mass, tare the balance and start the weighing again. Wait until the balance has reached stability and note the displayed weight ***P*** (buoyancy of the solid).

## 6.9.4 Improving the accuracy of the result of solid density

The following tips should help you improve the accuracy of the results in the density determination of solids.

### Temperature

Solids are generally so insensitive to temperature fluctuations that the corresponding density changes are of no consequence. However, as work is performed with an auxiliary liquid in the density determination of solids, their temperature must be taken into account as the temperature has a greater effect with liquids and causes density changes in the order of magnitude 0.l to 1% per °C. This effect is already apparent in the third decimal place of the result.

To obtain accurate results, we recommend that you always take the temperature of the auxiliary liquid into account on all density determinations.

### Air buoyancy

1 $CM^3$ of air weighs approximately 1.2 mg (depending on the physical condition). As a consequence, in the weighing in air, each solid experiences a buoyancy of this magnitude (the so-called "air buoyancy") per $cm^3$ of its volume.

However, the air buoyancy must be taken into account only when a result is required with an accuracy of 3 to 4 decimal places. To correct for this, the air buoyancy (0.0012 g per $cm^3$ volume of the body) is added to the calculated result:

| |
|---|
| Calculated density **+ 0.0012 g/cm³ air buoyancy =** effective density |

### Surface tension of the auxiliary liquid

Adhesion of the liquid to the Weigh Below Hook causes an apparent weight increase of up 3 mg.

As the Weigh Below Hook is immersed in the auxiliary liquid in both weighings of the solid (in air and in the auxiliary liquid), the influence of the apparent weight increase can be neglected because the balance is tared before every measurement.

To reduce the effect of air bubbles and to ensure the greatest possible accuracy, use a few drops of a wetting agent (not supplied) and add them to the auxiliary liquid.

## 6.9.5 Liquid density determinations

The density of a liquid can be made using a sinker of known volume. The sinker is weighed in air and then in the liquid whose density is to be determined, The density, ***Q,*** can be determined from the two weighings as follows:

$$Q = \frac{A - B}{V}$$

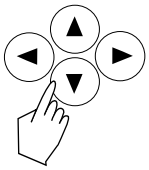
***Q*** **=** Density of the liquid
***A*** **=** Weight of the sinker in air
***B*** **=** Weight of the sinker in liquid
***V*** **=** Volume of the sinker
***P*** **=** Buoyancy of the sinker in the liquid ( *P = A-B)*

DENSITY SETUP

| | |
|---|---|
| LIBRARY NAME | D2 |
| SOLID DENSITY | <-SELECTED |
| LIQUID DENSITY | |
| AUTO SAMPLEOFF | |
| AUTO PRINT | OFF |
| RUN | |

### Select liquid density

The balance is prepared in the same manner. Follow the same procedure for solid density determination except select LIQUID DENSITY under the DENSITY SETUP display. Press the **Enter** button. The display advances to ENTER SINKER VOLUME IN CC.



DENSITY SETUP

ENTER SINKER VOLUME IN CC

30.000

### Enter sinker volume

Enter the sinker volume in CC's. The display starts with 30 cc. Continue with the instructions on the displays and select RUN.

DENSITY - - D3

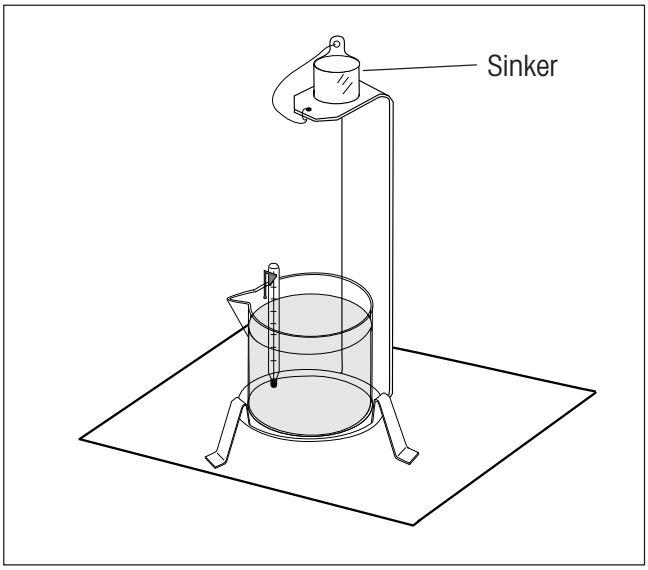
WEIGH IN AIR: 211.395
WE GH IN LIQ: 200.043 SKRVOL:30.000

0.378

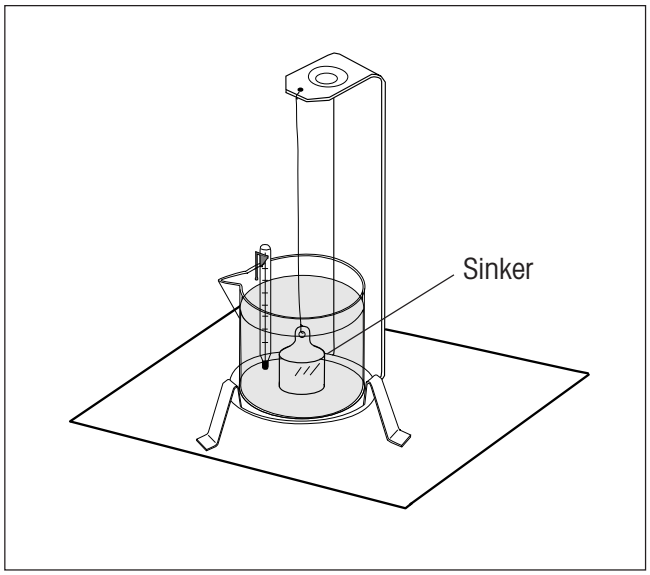
GRAMS/CC STABLE

START/SAMPLE | SETUP | MAIN MENU

After weighing the sinker in air and then weighing the sinker immersed in liquid, the balance calculates the density of the liquid and is displayed in grams/cc. See illustrations below for placement of the sinker. When the sinker is immersed in the liquid, it **must not** come into contact with the bottom of the beaker.




Sinker In Air




Sinker In Liquid

# 6.10 Statistical quality control (SQC)

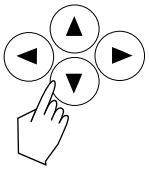
The Statistical Quality Control (SQC) feature is extremely useful during various types of process filling operations when it is desired to monitor and control the process to eliminate under and over filling. Provisions are made in the balance to accommodate the weight of various packaging methods. During operation, parameters of the packaged product are set into the balance such as packaging weight, acceptable weight limits and non-acceptable weight limits of the product. These weight limits are identified as +TI, +T2, NOMINAL and -TI, -T2. As samples are weighed and stored in the balance, a trend analysis is developed and displayed on the balance. Up to 25 samples in a batch with up to ten batches are visible on a trend screen for quality control purposes. Each batch of samples is shown on the display which indicates the maximum/minimum standard deviation and mean values for each batch. An on going examination of the relative deviation of the samples along with other statistical data can be viewed and is stored. By observing the results of the TREND ANALYSIS screen, you can effectively monitor the filling process operation. Setup parameters can be stored in the library and up to 5 products with statistical history can be stored in memory. All SQC information can be printed.


CHANGE MODE

SQC

## From main menu

Enter CHANGE MODE and select SQC, display advances to LIBRARY NAME.



SQC SETUP

LIBRARY NAME

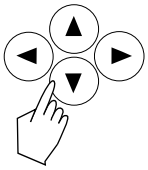
## Library name

Enter a Library Name, up to 8 characters and press **Enter** button. Display advances to SQC SETUP with TOLERANCE highlighted. If a previous name was entered and selected, the balance uses the parameters which were previously set.


| SQC SETUP | |
|---|---|
| LIBRARY NAME | SQC1 |
| TOLERANCE | |
| TARE | NO TARE |
| MEAN TARE VALUE | OFF |
| AUTO SAMPLEOFF | I |
| AUTO PRINT OFF | |
| NUMBER OF SAMPLES | I |
| BATCH NAME | |

## Tolerance

Enter TOLERANCE. Display advances to DEFINE TOLERANCE with +T2 highlighted.



| DEFINE TOLERANCE | |
|---|---|
| +T2 | 0.000 |
| +T1 | 0.000 |
| NOMINAL WEIGHT | 0.000 |
| -Ti | 0.000 |
| -T2 | 0.000 |
| RETURN TO SETUP | |

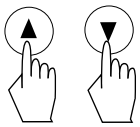
## Defining tolerances

Define the tolerances for your product. Start with +T2, continue with +TI, NOMINAL WEIGHT, then -TI, finish with -T2. After entering values, press **Enter** button. Display advances to RETURN TO SETUP, press **Enter** button.

| SQC SETUP | |
|---|---|
| LIBRARY NAME | SQC1 |
| TOLERANCE | |
| TARE | NO TARE |
| MEAN TARE VALUE | OFF |
| AUTO SAMPLEOFF | I |
| AUTO PRINT OFF | |
| NUMBER OF SAMPLES | I |
| BATCH NAME | |

## Selecting tare

Select TARE and press **Enter** button. Display advances to TARE SELECTION with NO TARE highlighted.



| TARE SELECTION |
|---|
| NO TARE |
| MEAN TARE |
| INDIVIDUAL TARE |
| ADD. WITH MT |
| RETURN TO SETUP |

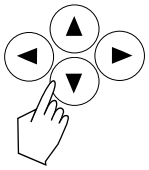
## Selecting type of tare

Four types of taring are available. NO TARE is self explanatory, MEAN TARE is used to subtract the packaging weight automatically, INDIVIDUAL TARE is for each sample with display prompts, ADD with MT is additive weighing with mean tare. After selecting tare type, press **Enter** button.

| SQC SETUP | |
|---|---|
| LIBRARY NAME | SQC1 |
| TOLERANCE | |
| TARE | NO TARE |
| MEAN TARE VALUE | OFF |
| AUTO SAMPLE | OFF |
| AUTO PRINT | OFF |
| NUMBER OF SAMPLES | I |
| BATCH NAME | |

## Selecting auto sample/auto print

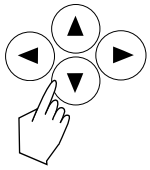
AUTO SAMPLE and AUTO PRINT are ON/OFF selectable functions. When AUTO SAMPLE is turned ON, samples can be taken without pressing any buttons. When AUTO PRINT is set ON, automatic printing of results are made. Select functions and press **Enter** button.



| SQC SETUP | |
|---|---|
| LIBRARY NAME | SQC1 |
| TOLERANCE | |
| TARE | NO TARE |
| MEAN TARE VALUE | OFF |
| AUTO SAMPLE | OFF |
| AUTO PRINT | OFF |
| NUMBER OF SAMPLES | 3 |
| BATCH NAME | |

## Specifying sample size

Enter NUMBER OF SAMPLES. Specify the number of samples to be measured. After specifying sample size, display advances to SQC SETUP with BATCH NAME highlighted. Press **Enter** button.



| SQC SETUP | |
|---|---|
| LIBRARY NAME | SQC1 |
| TOLERANCE | |
| TARE | NO TARE |
| MEAN TARE VALUE | OFF |
| AUTO SAMPLE | OFF |
| AUTO PRINT | OFF |
| NUMBER OF SAMPLES | 3 |
| BATCH NAME | |

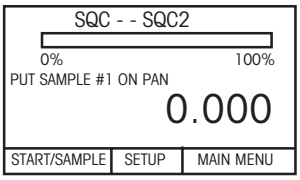
## Specifying batch name

Enter BATCH NAME. Specify the name of the batch and press **Enter** button. After specifying the batch name, the display advances to SQC SETUP with RUN highlighted. You are now ready to take samples.

| SQC SETUP | |
|---|---|
| AUTO SAMPLE | OFF |
| AUTO PRINT | OFF |
| NUMBER OF SAMPLES | 3 |
| BATCH NAME | 0 |
| V IEW MEAN VALUE TRACE | |
| VIEW BATCH HISTORY | |
| RUN | |

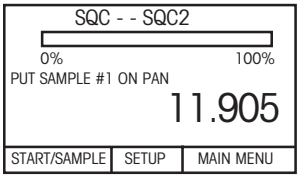
## Taking samples

The balance has a total limit of 5 history files which can include other functions such as Differential Weighing and Formulation. If more than five sets are entered, one or more data files will have to be removed. If when saving, a message appears FAILED TO SAVE, the library is full.

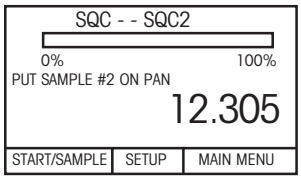



## Sample # 1

With the SQC SETUP displayed and RUN highlighted, press **Enter** button, display indicates the previously entered data Library name at the right hand top of the display and instructs: PUT SAMPLE #1 ON PAN.

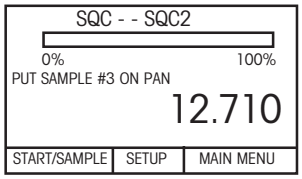



Place your first sample on the balance pan, then press **Enter** button. When the balance stabilizes, it will record the weight you have placed on the pan and will automatically advance to sample number 2.



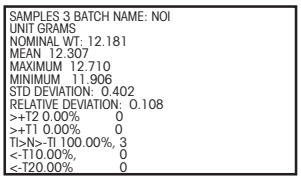

## Sample # 2

Remove the first sample from the pan and place the second sample on the pan. When the balance stabilizes, press the **Enter** button. When AUTO SAMPLE is ON, you do not have to press **Enter**.



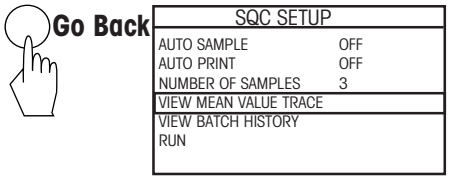

## Remaining samples

Continue this procedure until all of your samples have been entered. When all samples have been entered, a History screen is displayed which indicates the parameters of the first batch.



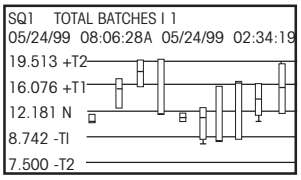

## Batch history result

The sample history result at the left represents a batch of three samples. To run additional batches of samples, press the **Enter** button, the display will return to PUT SAMPLE #1 ON PAN. Remember that only ten batches will be displayed, however, if more batches are run, data is still recorded.




## Analyzing data

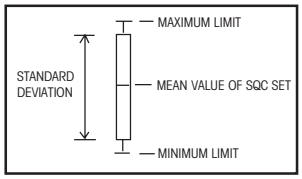
Press the **Go Back** button until SQC SETUP is displayed. Select VIEW MEAN VALUE TRACE. Press the **Enter** button and the Trace Value screen appears. This screen indicates the limits you have set for your samples and the amount of deviation per batch.



Sample Value Trace

## Viewing mean value trace

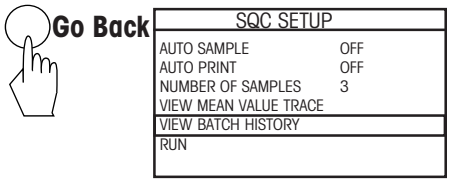
After you have taken the required number of data samples, you can view the sample value trace and/or the sample batch history. Screen indicates 11 batches were processed with the last 10 displayed.



Symbol definitions

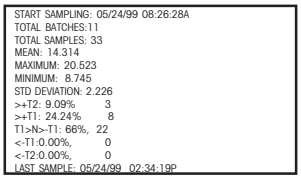
## Symbol Definitions

The sample illustration at the left describes the symbols used on the Mean Value Trace screen and their definitions.




## Selecting batch history

To select the batch history, press the **Go Back** button to enter the SQC SETUP screen and scroll down to VIEW BATCH HISTORY. Press the **Enter** button.

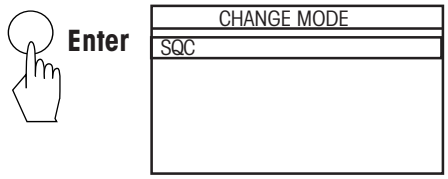



## Viewing batch history

Eleven batches of samples with three samples per batch were taken as an example. The sample illustration at the left indicates the parameters taken during the last 33 samples.

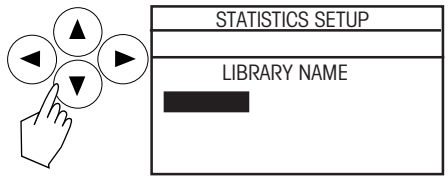
### 6.10.1 Resuming a particular SQC setup

SQC has a resume feature which enables you to recall any SQC procedure which has been named and stored in the library. The Setup procedure enabled you to designate the product parameters and assign a basic name. To use a stored product parameter with a new set of samples, you recall the procedure by name.



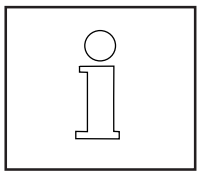

## From main menu

Enter CHANGE MODE and select SQC, display advances to LIBRARY NAME.

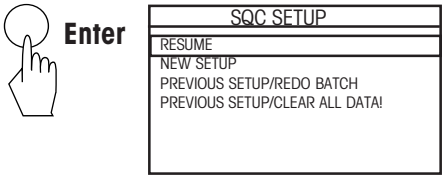



## Enter library name

Enter the library name of the previous SQC procedure you want to resume. Press **Enter** button. Display advances to SQC STARTUP with RESUME highlighted. The balance uses the parameters which were previously set.



In the next step, you cannot use the **Go Back** to exit the menu. If you decide to exit, you must enter RESUME first, then back out.



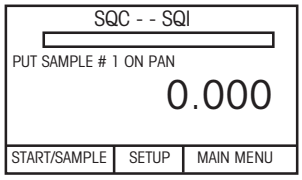

## Select resume

When RESUME is selected, the display returns to the SQC SETUP with RUN highlighted.


| SQC SETUP | |
|---|---|
| AUTO SAMPLE | OFF |
| AUTO PRINT | OFF |
| NUMBER OF SAMPLES | 3 |
| BATCH NAME | 0 |
| VIEW MEAN VALUE TRACE | |
| VIEW BATCH HISTORY | |
| RUN | |

### Select run

With RUN selected, press **Enter** button.




### Adding additional samples

Display returns to the name of the SQC identified and is ready to run sample # 1. You may now run additional samples with the parameters previously set. These samples will be added to the original sample set. The last ten samples are displayed on the MEAN VALUE TRACE.

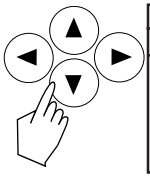
## 6.10.2 Specifying new SQC setup

There are two methods of entering SQC for a new setup. One is to start at the beginning of the SQC procedure. The second method is to enter the SQC STARTUP menu. The second method is specified.


| CHANGE MODE |
|---|
| SQC |

### From main menu

Enter CHANGE MODE and select SQC, display advances to LIBRARY NAME.



| STATISTICS SETUP |
|---|
| LIBRARY NAME |
| ■■■■■ |

### Enter library name

If you have selected an existing library name you can still change the setup in the next step. Press the **Enter** button. Display advances to SQC STARTUP with RESUME highlighted.


| SQC STARTUP |
|---|
| RESUME |
| NEW SETUP |
| PREVIOUS SETUP/REDO BATCH |
| PREVIOUS SETUP/CLEAR ALL DATA! |

### Select new setup

When NEW SETUP is selected, the display returns to the SQC SETUP with TOLERANCE highlighted.

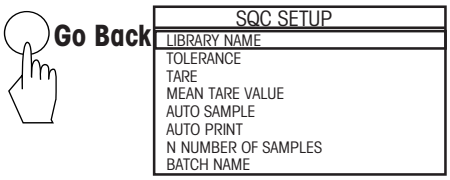

| SQC SETUP | |
|---|---|
| LIBRARY NAME | SQC 1 |
| TOLERANCE | |
| TARE | NO TARE |
| MEAN TARE VALUE | OFF |
| AUTO SAMPLE | OFF |
| AUTO PRINT | OFF |
| N NUMBER OF SAMPLES | 1 |
| BATCH NAME | |

### Completing new setup

Refer back to section 6.10 and enter all information required for a new setup.

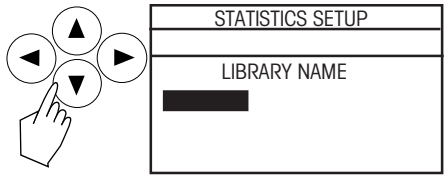
## 6.10.3 Redoing or correcting a batch

If during the course of taking samples, an error has occurred and you want to rerun the set of samples you are currently working with, this procedure will allow you to start a new set without recording data from the set containing errors.



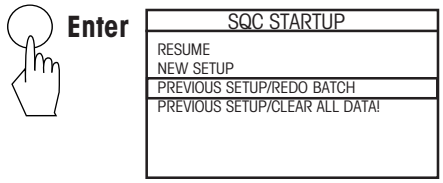

### Exiting a sample set containing an error

When the current sample you are working with is incorrect, you can exit by pressing the **Go Back** button. The display returns back to SQC SETUP with LIBRARY NAME highlighted. Press the **Enter** button.



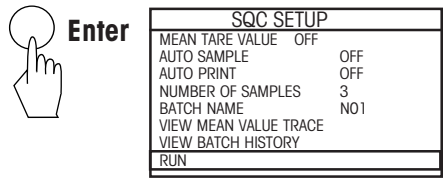

### Entering current library name

The current name you assigned should be displayed. Press the **Enter** button. Display advances to SQC STARTUP with RESUME highlighted.



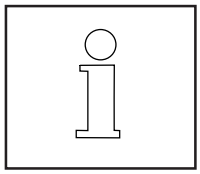

### Select previous setup

Select PREVIOUS SETUP/REDO BATCH and press **Enter** button. The display returns to SQC SETUP with VIEW BATCH HISTORY highlighted.




### Select run

Scroll to RUN. With RUN selected, press the **Enter** button. The balance returns to the sample set interrupted and you may continue to take samples.

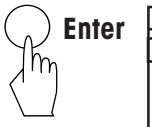


### Clearing previous data set

When you are in the SQC STARTUP menu, you can elect to remove all data if desired by selecting PREVIOUS SETUP/CLEAR ALL DATA and pressing **Enter** button.

# 6.11 Pipette calibration

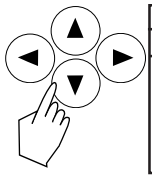
Pipette calibration checks the accuracy and precision values of pipettes by weight analysis. An analytical balance is recommended for maximum accuracy. The balance is capable of recording data from 3 to 30 samples of each pipette tested. Each test run is stored in the application library. The number of tests which can be stored will depend on the number of samples per test. The density table for water is included. If other liquids are used for pipette calibration, you must enter the liquid's density in g/cc at current room temperature. Since all calculations are made within the balance, it is also required that you know the atmospheric pressure which has to be entered. A printout can be made which specifies all parameters of the test made.




CHANGE MODE
PIPETTE

## From main menu

Enter CHANGE MODE and select PIPETTE, display advances to LIBRARY NAME.



PIPETTE SETUP
LIBRARY NAME

## Library name

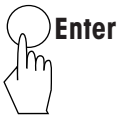
Enter a Library Name, up to 8 characters and press **Enter** button. Display advances to PIPETTE SETUP with TEST LIQUID G/CC highlighted. If a previous name was entered and selected, the balance uses the parameters which were previously set.


PIPETTE SETUP

| | |
|---|---|
| LIBRARY NAME | P2 |
| TEST LIQUID(G/CC) | 0.9971 |
| BARO PRESSURE | 1.0ATM |
| AUTO SAMPLE | OFF |
| AUTO PRINT | OFF |
| NUMBER OF SAMPLES | 10 |
| PIPETTE NAME | |

## Test liquid

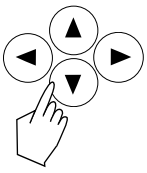
Press **Enter** button. Display advances to SELECT TEST LIQUID with H2O highlighted.




SELECT TEST LIQUID
H2O
OTHER
RETURN TO SETUP

## Selecting water as the test liquid

If you are using water as the test liquid, press the **Enter** button. If you are using a liquid other than water, skip the next step and continue.



ENTER TEMPERATURE CELSIUS
25.000 25.000

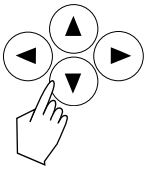
## Enter temperature of water

Measure the temperature of water you will be using for Pipette measurements in Celsius. A standard room temperature of 25 degrees Celsius has been pre-entered in the balance. Enter the correct value.

SELECT TEST LIQUID
H2O
OTHER
RETURN TO SETUP

## Selecting other test liquid

If you are using a liquid other than water as the test liquid, scroll to OTHER and press the **Enter** button. The display advances to ENTER LIQUID DENSITY IN CC.



ENTER LIQUID DENSITY IN CC
0.9971 0.9971

## Enter density of test liquid

Enter the density value for the test liquid. The standard density for water has been pre-entered. Enter the correct value for the liquid you are using, and press **Enter** button. Display advances to RETURN TO SETUP.


| SELECT TEST LIQUID |
|---|
| H2O |
| OTHER |
| RETURN TO SETUP |

## Return to setup

Press the **Enter** button. Display advances to PIPETTE SETUP with BARO PRESSURE highlighted.


| PIPETTE SETUP | |
|---|---|
| LIBRARY NAME | P2 |
| TEST LIQUID(G/CC) | 0.9971 |
| BARO PRESSURE | 1.0ATM |
| AUTO SAMPLE | OFF |
| AUTO PRINT | OFF |
| NUMBER OF SAMPLES | 10 |
| PIPETTE NAME | |

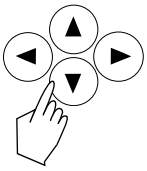
## Enter barometric pressure

Press the **Enter** button. The display advances to BAROMETRIC PRESSURE with ATM highlighted.

| BAROMETRIC PRESSURE |
|---|
| ATM |
| PSIG |
| MMHG |
| MBAR |
| HPA |
| INHG |

## Select unit of atmospheric pressure measurement

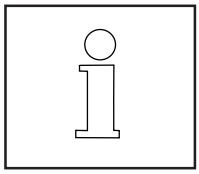
Select unit, press **Enter** button. The display advances to BAROMETRIC PRESSURE.



BAROMETRIC PRESSURE
1.0000 1.000

## Specify barometric pressure

Enter the barometric pressure of the test area, then press the **Enter** button. Display advances to PIPETTE SETUP with AUTO SAMPLE OFF highlighted. If you do not want auto sampling, skip next two steps and select AUTO PRINT.



It should be noted that in the next step you can select AUTO SAMPLE either ON or OFF. When AUTO SAMPLE is turned ON, it is a real time saver as the balance controls do not have to be touched during sampling.


| PIPETTE SETUP | |
|---|---|
| LIBRARY NAME | P2 |
| TEST LIQUID(G/CC) | 0.9971 |
| BARO PRESSURE | 1.0ATM |
| AUTO SAMPLE | OFF |
| AUTO PRINT | OFF |
| NUMBER OF SAMPLES | 10 |
| PIPETTE NAME | |

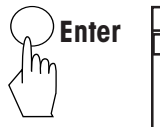
## Select auto sampling

If you want auto sampling, press **Enter** button. Display advances AUTO SAMPLE with ON highlighted. Press the **Enter** button.


| PIPETTE SETUP | |
|---|---|
| LIBRARY NAME | P2 |
| TEST LIQUID(G/CC) | 0.9971 |
| BARO PRESSURE | 1.0ATM |
| AUTO SAMPLE | OFF |
| AUTO PRINT | OFF |
| NUMBER OF SAMPLES | 10 |
| PIPETTE NAME | |

## Select auto print on

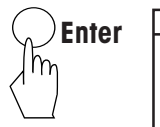
Press the **Enter** button. The display advances to PIPETTE SETUP with AUTO PRINT OFF highlighted.




| AUTO PRINT |
|---|
| ON |
| OFF |

## Set auto print on

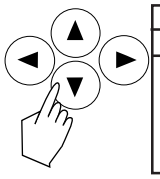
When set ON, results are automatically printed. Press the **Enter** button. Display advances to PIPETTE SETUP with NUMBER OF SAMPLES highlighted.




| PIPETTE SETUP | |
|---|---|
| LIBRARY NAME | P2 |
| TEST LIQUID(G/CC) | 0.9971 |
| BARO PRESSURE | 1.0ATM |
| AUTO SAMPLE | OFF |
| AUTO PRINT | OFF |
| NUMBER OF SAMPLES | 10 |
| PIPETTE NAME | |

## Select number of samples

Press the **Enter** button. The display advances to NUMBER OF SAMPLES.



| NUMBER OF SAMPLES |
|---|
| 10 10 |

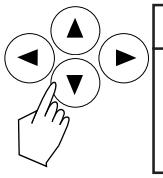
## Enter sample size

Enter the number of samples. Press **Enter** button. The display advances to PIPETTE SETUP with PIPETTE NAME highlighted.


| PIPETTE SETUP | |
|---|---|
| LIBRARY NAME | P2 |
| TEST LIQUID(G/CC) | 0.9971 |
| BARO PRESSURE | 1.0ATM |
| AUTO SAMPLE | OFF |
| AUTO PRINT | OFF |
| NUMBER OF SAMPLES | 10 |
| PIPETTE NAME | |

## Select pipette name

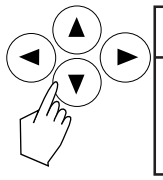
Press **Enter** button. Display advances to new screen PIPETTE NAME.



| PIPETTE NAME |
|---|
| WHEAT |

## Enter pipette name

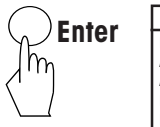
Enter the name of the pipette. Press **Enter** button. Display advances to PIPETTE NUMBER. Press **Enter** button.



| PIPETTE NUMBER |
|---|
| 345 |

## Enter pipette number

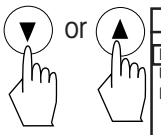
Enter the number of the pipette. Press the **Enter** button. The display advances to PIPETTE SETUP with NOMINAL highlighted.




| PIPETTE SETUP | |
|---|---|
| BARO PRESSURE | 1.0ATM |
| AUTO SAMPLE | OFF |
| AUTO PRINT | OFF |
| NUMBER OF SAMPLES | 10 |
| PIPETTE NAME | WHEAT |
| PIPETTE NUMBER | 345 |
| NOMINAL | 0.00ML |

## Select nominal

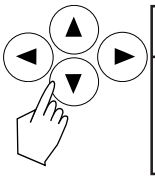
Press the **Enter** button. The display advances to NOMINAL VALUE UNITS with ML highlighted.

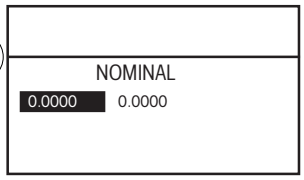



| NOMINAL VALUE UNITS |
|---|
| ML |
| UL |
| RETURN TO SETUP |

## Select nominal value unit

Select either ML (milliliters) or UL (microliters). Press the **Enter** button. Display advances to NOMINAL.





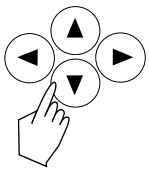

## Enter nominal value

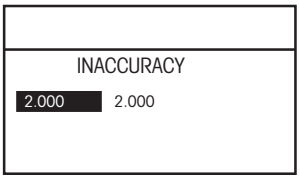
Enter the nominal value. Press the **Enter** button. The display advances to PIPETTE SETUP with INACCURACY highlighted.


| PIPETTE SETUP | |
|---|---|
| AUTO SAMPLE | OFF |
| AUTO PRINT | OFF |
| NUMBER OF SAMPLES | 10 |
| PIPETTE NAME | WHEAT |
| PIPETTE NUMBER | 345 |
| NOMINAL | 3.45ML |
| INACCURACY | 2.00% |

## Select inaccuracy

Select INACCURACY. Press **Enter** button. The display advances to INACCURACY.





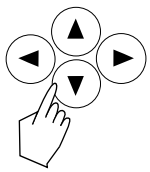

## Enter inaccuracy value

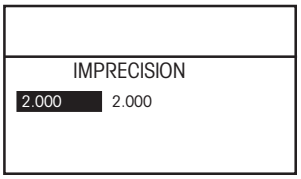
Enter the percentage of acceptable inaccuracy. This indicates the deviation of all pipette samples (mean error). Press **Enter** button. The default setting is 2 percent. Display advances to IMPRECISION.


| PIPETTE SETUP | |
|---|---|
| AUTO PRINT | OFF |
| NUMBER OF SAMPLES | 10 |
| PIPETTE NAME | WHEAT |
| PIPETTE NUMBER | 345 |
| NOMINAL | 3.45ML |
| INACCURACY | 2.00% |
| IMPRECISION | 2.00% |

## Select imprecision

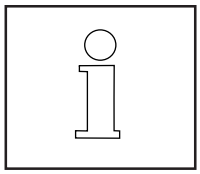
Select IMPRECISION. Press the **Enter** button. Display advances to IMPRECISION.






## Enter imprecision value

Enter the imprecision value. This indicates the variation of all pipette samples from the mean value (Coefficient of Variation). Press the **Enter** button. The default setting is 2 percent. The display advances to RUN.

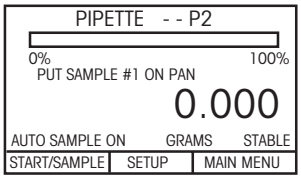


When placing samples in the vessel during pipette calibration, make sure to continue the calibration to the end without significant pauses in between each sample. If a significant amount of time has elapsed (30 seconds or more) between samples, re-tare the balance before adding the next sample. This is to eliminate errors introduced by evaporation.


| PIPETTE SETUP | |
|---|---|
| PIPETTE NUMBER | 345 |
| NOMINAL | 3.45ML |
| INACCURACY | 2.00% |
| IMPRECISION | 2.00% |
| VIEW RESULTS | |
| CLEAR ALL DATA | |
| RUN | |

## Taking samples

With RUN highlighted, press the **Enter** button. The display advances to a screen requesting to PUT SAMPLE #1 ON PAN.



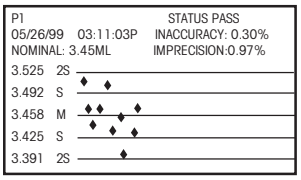

Press **Enter**, the display indicates PIPETTE -- NAME of test at the top of the screen.

START/SAMPLE is at the bottom of the screen. Pressing **Enter** starts the testing. If you are using water, use distilled water only.

Place empty vessel on the balance, fill the vessel with a small amount of liquid, and then tare the balance.

When AUTO SAMPLE has been selected, it is not necessary to press the **Enter** button for each sample. If the balance fails to advance to the next sample, press the **Enter** button.

Place the first sample from the pipette into the vessel and press **Enter**. The display indicates SAMPLE #1. Place the second sample from the pipette into the vessel and press **Enter**.




Repeat the above steps until all samples have been run. When the last sample is placed on the balance and the **Enter** button is pressed, the panel display indicates the results of the test which includes the Date, Time, Status, Nominal value, Inaccuracy and Imprecision. The graph on the display indicates the mean value in the center with standard deviation and 2 times standard deviation above and below shown as lines across the screen. Each sample is shown as a diamond shaped mark on the graph. A ten sample set is shown.

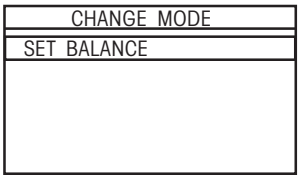
If AUTO PRINT was selected during the setup, the results are automatically printed. Printout contains numerical results and all statistics.

For manual printing of test results, press the **Print** button on the balance.

# 7. Balance settings

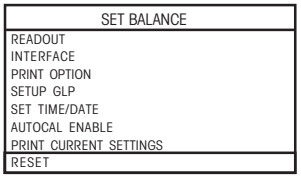
## 7.1 Reset to factory settings

In this menu option you can reset selected functions or all menu settings to factory settings.

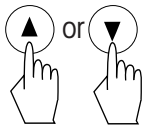



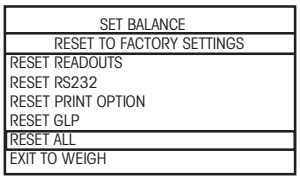

### From main menu

Select SET BALANCE, display advances to SET BALANCE.




Select RESET, press **Enter** button. Display advances to RESET TO FACTORY SETTINGS.

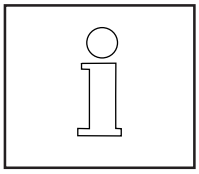




### Reset to factory settings

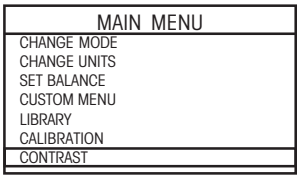
The RESET TO FACTORY SETTINGS has several reset functions. To reset a function, select the function using the arrow buttons and press **Enter** button. To reset all functions, select RESET ALL using arrow buttons and press **Enter** button.



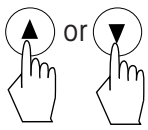
RESET ALL when selected, will return the balance to factory default settings.

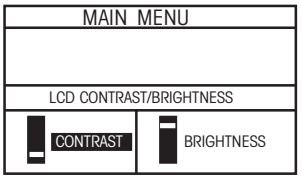
## 7.2 Setting contrast and brightness of display

When the balance is first turned on, you may want to adjust the balance's LCD display contrast and brightness to suit your needs.

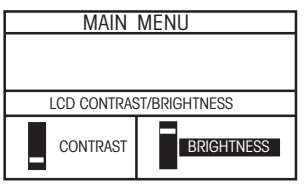




Enter the MAIN MENU and select CONTRAST and press **Enter** button. Display advances to LCD CONTRAST / BRIGHTNESS ADJUST.



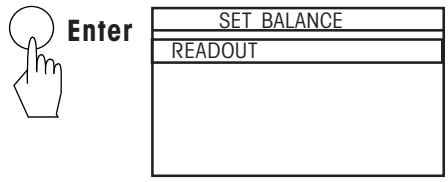

Using arrow buttons, adjust contrast as needed.




Press arrow buttons and adjust brightness as needed. Press **Enter** or **Go Back** button to return to MAIN MENU.

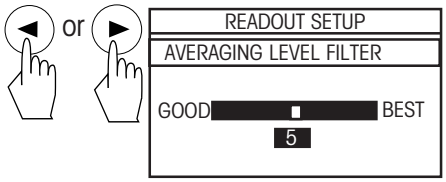
# 7.3 Setting the readout

This menu option enables you to set the balance averaging level, stability level, auto zero, and legal for trade (LFT).



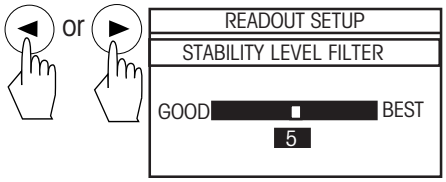

## From main menu

Select SET BALANCE and press the **Enter** button. Display advances to SET BALANCE with READOUT highlighted. Press the **Enter** button, display advances to READOUT SETUP.



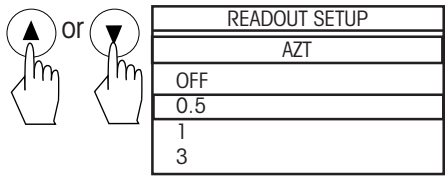

## Setting averaging level

Press **Enter** button, AVERAGING LEVEL FILTER is displayed. Averaging level filter compensates for vibration or excessive air currents. A zero setting (GOOD) corresponds to minimum filtering with fastest stabilization time. A setting of (BEST)10 is maximum filtering with the slowest stabilization time. Adjust to desired setting and press **Enter** button.



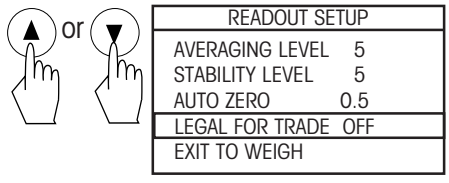

## Setting stability level

Scroll to STABILITY LEVEL and press **Enter** button, STABILITY LEVEL FILTER is displayed. Stability level filter determines the variation range in divisions for a given reading depending upon the filter setting. A setting of zero (GOOD) permits the balance to respond to variations of .5 divisions. A setting of (BEST) 10 sets the threshold to 3 divisions. Adjust to desired setting and press **Enter** button.




## Setting auto-zero

Scroll to AUTO ZERO and press **Enter** button, AZT is displayed. Auto zero minimizes the effects of temperature changes and shift on the zero reading. There are 4 settings, OFF, 0.5, 1, and 3. The numbers represent display divisions. The balance maintains the zero display until the set threshold is exceeded. Select the desired setting and press **Enter** button.

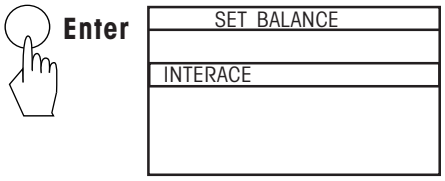



## Setting legal for trade

Scroll to LEGAL FOR TRADE and press **Enter** button. Legal for trade can be set ON or OFF. When set ON, only the functions allowed by the national weights and measures legislation are available. Press Enter button after making your selection.

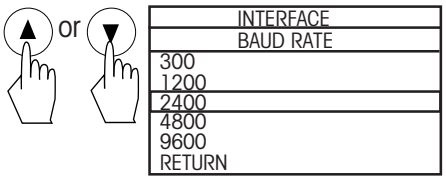
# 7.4 Setting the interface

This menu option enables you to set the balance communication parameters for the RS232 interface which include: baud rate, data bits, parity and stop bit.



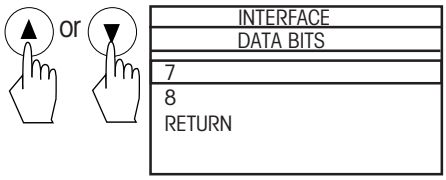

## From main menu

Select SET BALANCE and press the **Enter** button. Display advances to SET BALANCE with READOUT highlighted. Scroll to INTERFACE and press the **Enter** button, display advances to INTERFACE.



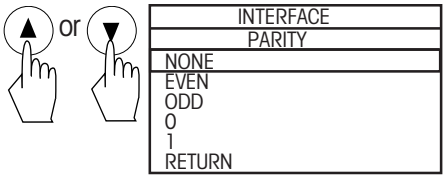

## Setting baud rate

Baud rates of 300, 1200, 2400, 4800 and 9600 are available for communications. Select the appropriate rate. Default setting is 2400 baud. Press **Enter** button.



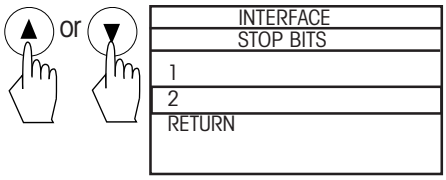

## Setting data bits

Data bits of 7 or 8 are selectable. Select appropriate bit rate. Default setting is 7. Press **Enter** button.




## Setting parity

Select appropriate parity setting of either NONE, EVEN, ODD, 0, or 1. Default setting is NONE. Press **Enter** button.

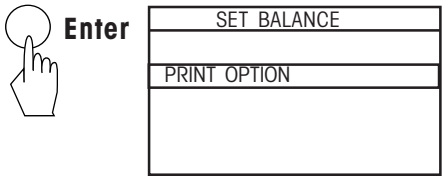



## Setting stop bits

Select appropriate stop bits setting of either 1 or 2. Default setting is 2. Press **Enter** button.

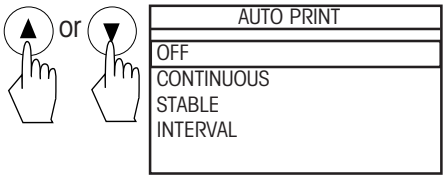
# 7.5 Setting print option

This menu option enables you to set various print features ON or OFF and include Auto Print, Data, Numeric Data, Print Date, Print Time and Print Reference.



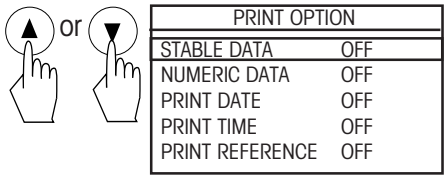

## From main menu

Select SET BALANCE and press the **Enter** button. Display advances to SET BALANCE with READOUT highlighted. Scroll to PRINT OPTION and press the **Enter** button, display advances PRINT OPTION with AUTO PRINT OFF highlighted.



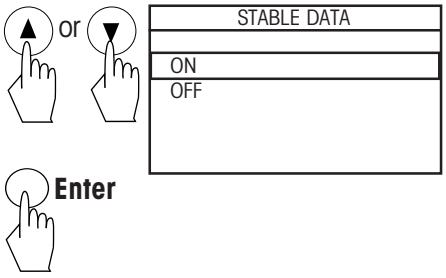

## Setting auto print

Enter AUTO PRINT. AUTO PRINT can be set to output display data in one of three ways: CONTINUOUS, STABLE or INTERVAL at user specified interval (seconds). When Interval is selected, you will have to specify number of seconds. Select desired mode and press **Enter** button.




## Setting stable data, numeric data, print date, print time, print reference

All of these features can be set ON or OFF. STABLE DATA, when set ON, prints only when the reading is stable. NUMERIC DATA, when set ON, prints numerical data. PRINT DATE, when set ON, prints current date. PRINT TIME, when set ON, prints current time. PRINT REFERENCE, when set ON, prints the value of the weight used as a reference to the printer.

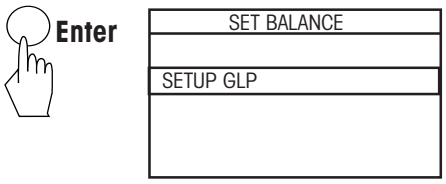



## Setting functions on or off

Select each of the above functions and select either ON or OFF.

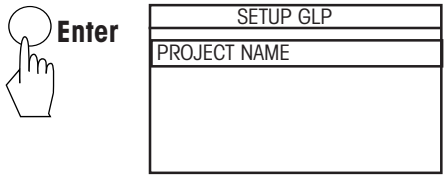
# 7.6 Setting GLP print options

This menu **GLP** (Good Laboratory Practices) options allows the entering of a Project Name, User Name, and GLP Print Options which include: Date & Time, Balance ID, Project Name, User Name and Calibration all of which can be set ON or OFF.



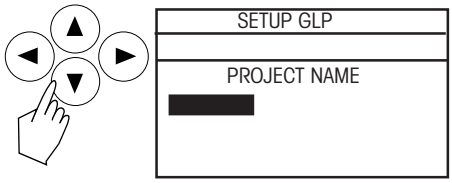

## From main menu

Select SET BALANCE and press the **Enter** button. Display advances to SET BALANCE with READOUT highlighted. Scroll to SETUP GLP and press the **Enter** button, display advances SETUP GLP with PROJECT NAME highlighted.



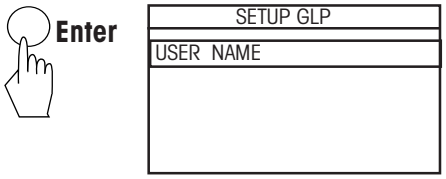

## Enter project name

Enter PROJECT NAME, the display advances to permit entering project name.

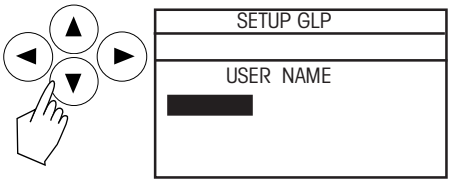



## Specify the project name

Specify the project name. The name can have any combination of alpha numeric characters not to exceed 8 characters. After specifing the project name, the display advances to USER NAME.

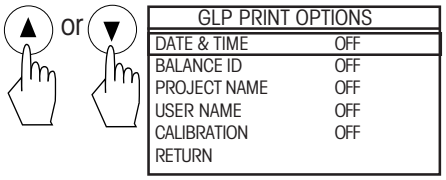



## Select user name



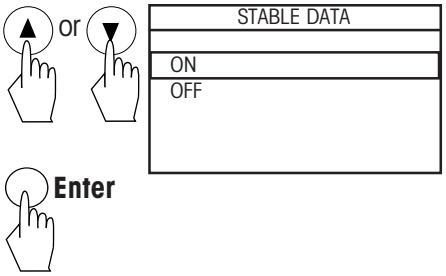

## Specify the user name

Specify the user name, and press **Enter** button. The display advances to GLP PRINT OPTIONS. Press **Enter**, the display advances to GLP PRINT OPTIONS with DATE & TIME highlighted.




## Setting GLP print options

GLP PRINT OPTIONS permit DATE & TIME, BALANCE ID, PROJECT NAME, USER NAME, and CALIBRATION DATA to be turned ON or OFF for printing.

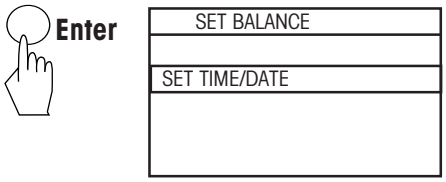



## Setting functions on or off

Select each of the above functions and select either ON or OFF.

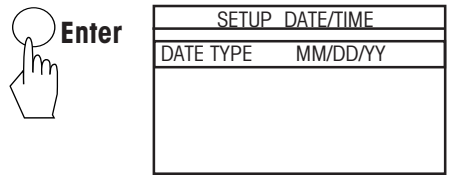
# 7.7 Setting time and date

This menu permits entering time and date. A battery backup is used for the memory. The battery has a life of 5 years.



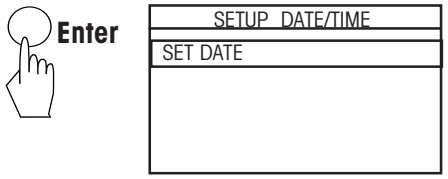

## From main menu

Select SET BALANCE and press the **Enter** button. Display advances to SET BALANCE with READOUT highlighted. Scroll to SET TIME/DATE and press the **Enter** button.



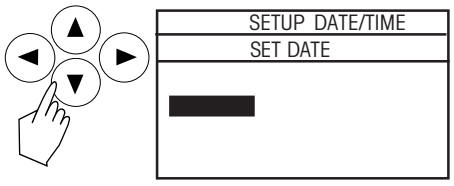

## Setting date type

This option offers 6 arrangements of date styles to suit your needs. They are: MM/DD/YY, DD/MM/YY, YY/MM/DD, MM/YY/DD, DD/YY/MM, YY/DD/MM. Enter the date type option and press the **Enter** button. The display advances to SET DATE.

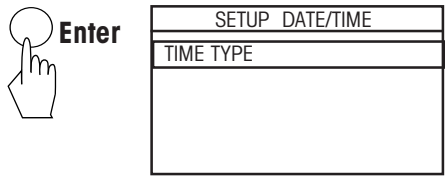



## Setting date

This option permits entering the current date. Enter the SET DATE option. The display advances to a new SET DATE display.

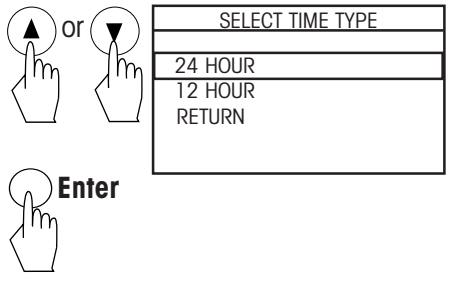



Enter the date in the format you have chosen above. After entering the date, press the **Enter** button. The display advances to SETUP DATE/TIME with TIME TYPE highlighted.

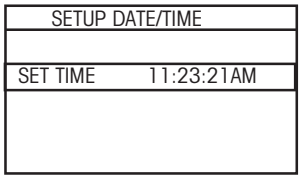



## Setting time type

This option permits entering either a 12 hour or 24 hour display for time. Enter the TIME TYPE option. The display advances to SELECT TIME TYPE.

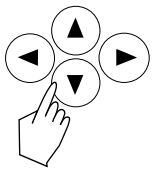


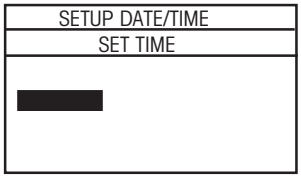

Select either 24 hour or 12 hours. This will be displayed on printouts which have time and date turned on. After selecting time type, press the **Enter** button. The display advances to SET TIME.


### Enter set time

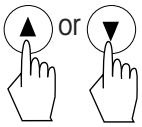
Enter the SET TIME option. The previously entered time appears in the display. Press the **Enter** button.

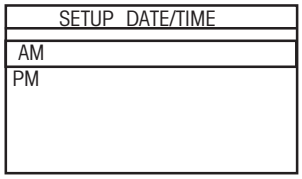





### Setting the time

Enter the time in the format you have chosen above. After entering the time, the display advances to SELECT AM/PM display only if 12 hour time type was selected.



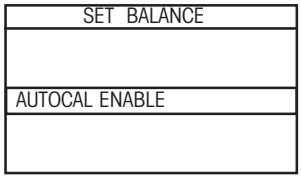




### Setting am/pm

Select AM or PM as required. The display returns to the DATE TYPE. Press the **Go Back** button to return to SET BALANCE menu, SET TIME/DATE is displayed.

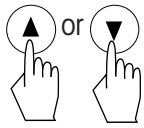
## 7.8 Setting auto calibration

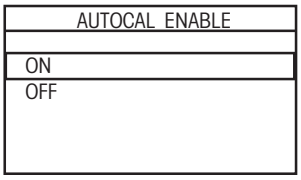
Automatic calibration of the balance can be accomplished when equipped with this option. When this function is turned ON, the balance automatically calibrates itself due to a temperature change.


### From main menu

Select SET BALANCE and press the **Enter** button. Display advances to SET BALANCE with READOUT highlighted. Scroll to AUTOCAL ENABLE and press the **Enter** button.

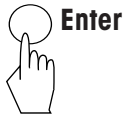


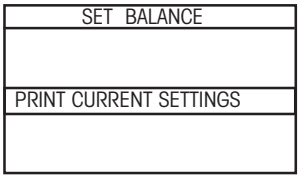




Select either ON or OFF and press the **Enter** button. The display returns to AUTOCAL ENABLE.

## 7.9 Print current settings

When this option is selected, you may view all settings made in your balance on an external printer.



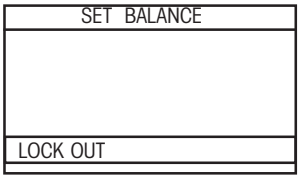




### From main menu

Enter SET BALANCE and select PRINT CURRENT SETTINGS. Press the **Enter** button. The balance wil print current settings out to a printer. If a printer is not connected or improperly connected, the balance will display PRINT FAILED after displaying PRINTING.

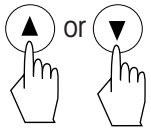
# 7.10 Lock out

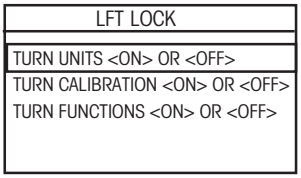
This software option works in conjunction with a hardware Lockswitch and LFT software. It permits various measurement units, calibration methods and balance functions to be selected and either turned ON or OFF.
Before using this sofware function, check the status of the hardware lock switch and Legal for Trade software (see section 7.14). If the hardware switch is ON, and the Legal for Trade software is set ON (locked), you cannot access the LFT LOCK software.


## From main menu

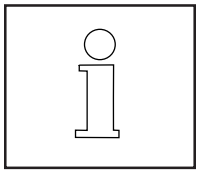
Enter the SET BALANCE menu and scroll to LOCK OUT.




Select any one of the available options and press **Enter** button.

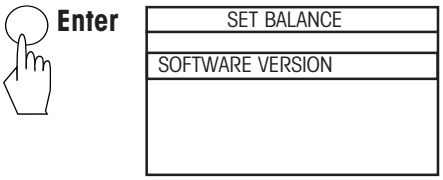

Depending on what you have selected, an entire list of all Units, Calibration methods and balance Functions are displayed. Every item in each list can be individually turned ON or OFF. These items when turned OFF will not be available for balance operation and are locked out.



All selected items which have been turned OFF will still function. Menu lock out is accomplished with the setting of a physical switch located under the pan. Paragraph 7.14 describes how to lock out the selected menus. The balance can then be sealed if required.

# 7.11 Software version

This option allows you to view the software version number, date installed and main board version number. These numbers are very important for servicing. To view software version, proceed as follows;

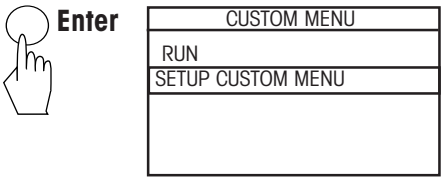



## From main menu

Enter SET BALANCE. Select SOFTWARE VERSION, press the **Enter** button, the software version is indicated on the display. Keep a written record of this information in the event servicing is required and the display does not work. Software Version_____.

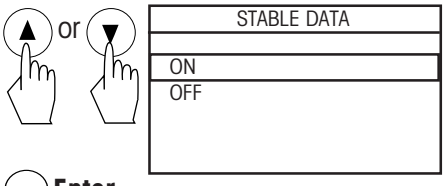
# 7.12 Setting custom menu

This option allows you to enter specific balance functions. These functions can be selected conveniently from this menu to operate the balance in a RUN mode. There are 18 items which can be selected and are listed with the associated paragraphs in the following table.




## From main menu

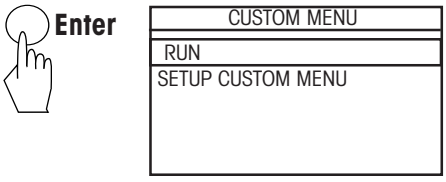
Enter the CUSTOM MENU and select SETUP CUSTOM MENU. Review list on menu shown in table.




## Setting functions on or off

Select any of the functions and set either ON or OFF.

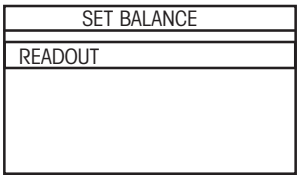

| LIST OF CUSTOM MENU ITEMS | |
|---|---|
| FILLING | SQC |
| CHECK WEIGHING | PIPETTE |
| ANIMAL WEIGHING | READOUT |
| PARTS COUNTING | INTERFACE |
| DIFF WEIGHING | PRINT OPTION |
| QUICK CHECK | SETUP GLP |
| FORMULATION | SET TIME/DATE |
| STATISTICS | AUTOCAL ENABLE |
| DENSITY | PRINT CURRENT SETTINGS |




To run a particular function, select RUN and press the **Enter** button.

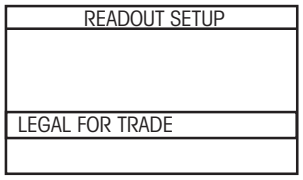
# 7.13 Legal for trade (LFT)

LFT is a software controlled option which can be set to Legal For Trade ON or OFF. When set ON, certain items in the CALIBRATION and SET BALANCE menus are automatically preset and locked to permit the balance to operate in a legal for trade application and works in conjunction with a Lock Out switch (see section 7.14). Default setting is OFF. The READOUT menu enables you to set the balance legal for trade (LFT) ON or OFF. See default table.


## From main menu

Enter SET BALANCE and select READOUT. The READOUT SETUP menu is displayed.



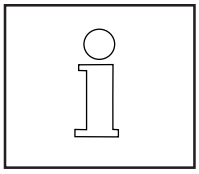

Select LEGAL FOR TRADE, press **Enter** button.

## Legal for trade default settings

The following table indicates the menus and options which are locked and unlocked when LFT is set ON.

**LFT DEFAULT TABLE**

| LFT and Lockswitch | Default Value |
|---|---|
| **Set Balance Menu** | |
| **Readout** | |
| Averaging Level | Unlocked |
| Stability Level | **Locked to 1** |
| Auto Zero | **Limited to OFF & 0.5** |
| **Interface** | Unlocked |
| **Print Option** | |
| Auto Print | Unlocked |
| Stable Data | **Locked ON** |
| Numeric Data | Unlocked |
| Print Data | Unlocked |
| Print Time | Unlocked |
| Print Reference | Unlocked |
| **Setup GLP** | Unlocked |
| **Set Time and Date** | Unlocked |
| **Autocal Enable** | **Locked** |
| **Print Current Settings** | Unlocked |



When LFT is turned ON, the last digit on the weight display has a white colored block behind it. This signifies that the balance is in a legal for trade operational mode and that the last digit should be ignored. The CENTER OF ZERO is displayed only for LFT operation.

# 7.14 Menu lockout protection

Access to the various menus can be disabled by setting the Lock switch located on the PC board inside the balance to ON position. The Lock switch locks out certain menus when Legal For Trade is turned ON. The default setting for the Lock switch is OFF.

## Type Approved/Legal for Trade Balance Sealing

All Voyager balances may be sealed for type approved/legal for trade applications. Type Approved balances include a lead seal with wire and security screw as shown in the illustration.

For type approved balances consult local Weights and Measures officials to determine sealing method requirements.

After the balance has been set up properly and LFT is set ON, proceed to sealing the balance.

## Sealing the balance

— Turn the display off and unplug the power cord.

— On balances with a draft shield, slide the door open and remove the pan and cover plate.

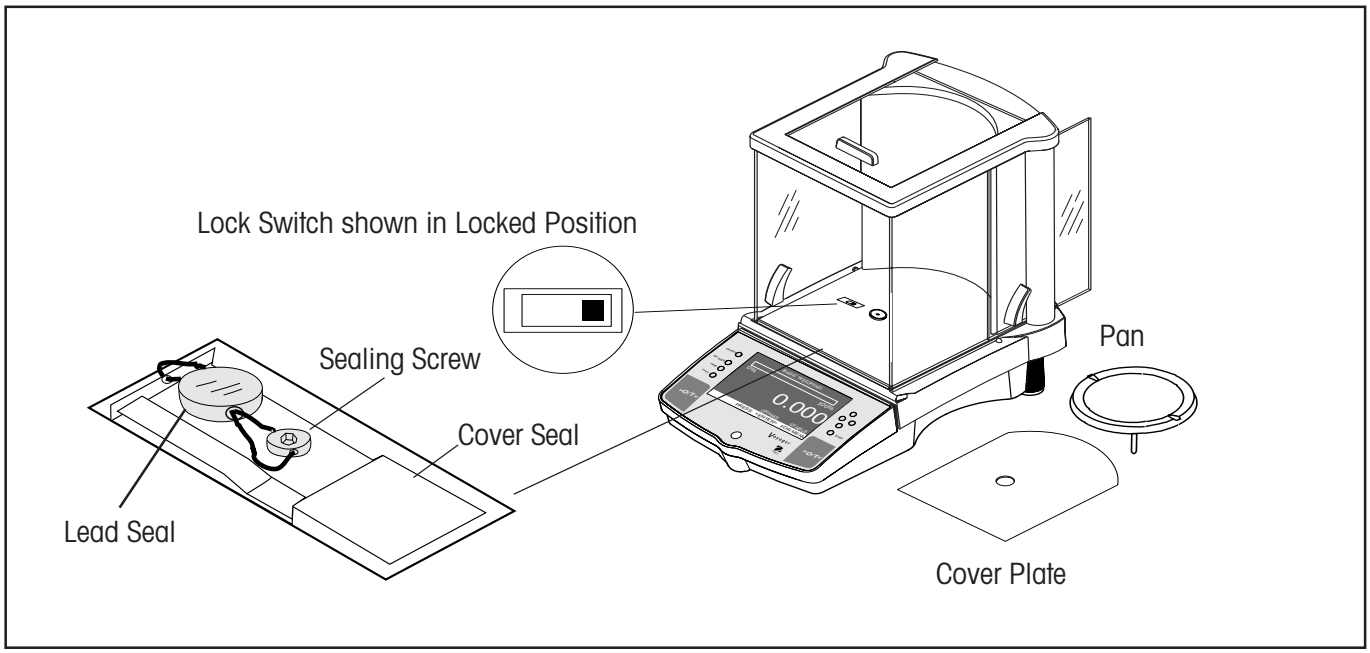
***Higher capacity balances with a 6" or 8" pan do not have a cover plate.***

— On balances without a draft shield, remove the pan and cover plate.

— Remove the protective cover seal.

— The Lock switch is located to the left of the pan support hole.

— Select the desired position on the Lock switch, seal and reassemble the balance.



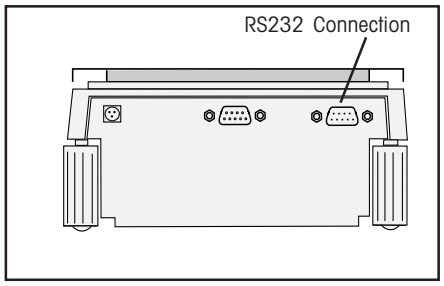

Example of Sealing Method

# 8. RS232 interface/printing data

## 8.1 RS232 interface

The balance is 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.

The balance can be operated from a 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, the right-hand, 9-pin male subminiature "D" connector is provided for interfacing to other devices.

| | |
|---|---|
| 1 | N/C |
| 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.

### RS232 Commands

All communication is accomplished using standard ASCII format. Only the characters shown in the following table are acknowledged by the balance. Invalid command response "ES" error indicates the balance has not recognized the command. 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).

## RS232 COMMAND TABLE

| Command Character | Description |
|---|---|
| **?** | Print current mode<br>Field: Mode \| Stab \| CR \| LF<br>Length: 5 \| 1 \| 1 \| 1<br>blank if stable<br>" ? " if unstable<br>mg g kg dwt ct oz oz t<br>GN tael tael tael momme lb<br>N tical custm Pcs % |
| **nnnn** | Set Auto Print feature to "nnnn" (see table)<br>nnn = 0 Turns feature OFF<br>nnn = S Output on stability<br>nnn = C Output is continuous<br>nnnn = 1-3600 Sets Auto Print Interval |
| **xD** | Set 1 second print delay (set x = 0 for OFF, or x = 1 for ON) |
| **F** | Print current function. |
| **xI** | Set Averaging Filter Level to "x", where x = 0 to 9 (see table). If LFT, level 0 to 2.<br>0 = minimum level<br>1 =<br>2 =<br>3 =<br>4 =<br>5 =<br>6 =<br>7 =<br>8 =<br>9 = maximum level |
| **xM** | Places balance in mode "x", where x = 1 to 17 (see table). If unit or mode is not already enabled, command will be ignored.<br>1 = milligrams<br>2 = grams<br>3 = kilo grams<br>4 = dwt<br>5 = Carats<br>6 = Ounces<br>7 = Ounces troy<br>8 = Grains<br>9 = Taels Hong Kong<br>10 = Taels Singapore<br>11 = Taels Taiwan<br>12 = Mommes<br>13 = Decimal Pounds<br>14 = Pounds-Ounces combined<br>15 = Newton's<br>16 = tical<br>17 = Custom Units |
| **P** | Print display data<br>Field Lenght: Number field Variable 3-9 \| Units 6 characters \| Stab \| CR \| LF<br>mg g kg dwt ct oz oz t<br>GN tael tael tael momme lb<br>N tical custm Pcs %<br>blank if stable<br>" ? " if unstable |

**NOTE**: Availability of shaded weighing units subject to local regulations.

## RS232 COMMAND TABLE (Cont.)

| Command Character | Description |
|---|---|
| **T** | Same effect as pressing O/T button. |
| **V** | Print EPROM version |
| **Esc V** | Print balance ID (13 characters). |
| **xZ** | Set Auto Zero to "x",where x = 0 to 3 ). 0=Off, 1=0.5d, 2=1d, 3=5d.If LFT, programs Auto zero level from 0 to 1. |
| **Esc R** | Resets Setup and Print menus to factory defaults. CAUTION: This will reset RS232 configuration. |
| **ON** | Turns balance on. |
| **OFF** | Turns balance off. |
| **?** | Print current weigh mode. |
| **#** | Print current Parts Count Reference Weigh. |
| **%** | Print current Percent Reference Weigh. |
| **xA** | Set Auto Print feature, action CA - continuous printing, SA - print on stability, 0A - turns all selections off. |
| **ID** | Print Current ID String. |
| **XID** | Program User ID String, 1-8 characters. |
| **SN** | Show Serial Number. |
| **xS** | Print Stable Only. Where x =0 Off and x=1 On. |
| **TIME** | Print Current Time. Note, a ? mark will follow if date or time has not been set. |
| **SETDATE** | Set Date Command and remove Invalid Indicator |
| **SETTIME** | Set Time Command and Remove Invalid Time Indicator |
| **DATE** | Prints Current Date. Note, a ? mark will follow the year if date or time has not been set. |

# 8.2 Printing data

Printing data to an external computer or printer requires that the communications parameters be set first.

Printing to an external printer or computer will occur each time the **Print** button is pressed unless the autoprint feature is turned on, in which case, printing can occur in a continuous fashion at specified intervals or each time a stable reading is achieved. When an external printer or computer is properly connected and the communication parameters are set correctly, the display indicates PRINTING... If the external printer or computer is improperly connected or the communication parameters are set incorrectly, PRINT FAILED is displayed. To clear the screen, press the **Go back** button. Check computer/printer settings and connections.

This section defines the various printing setups with printing samples.

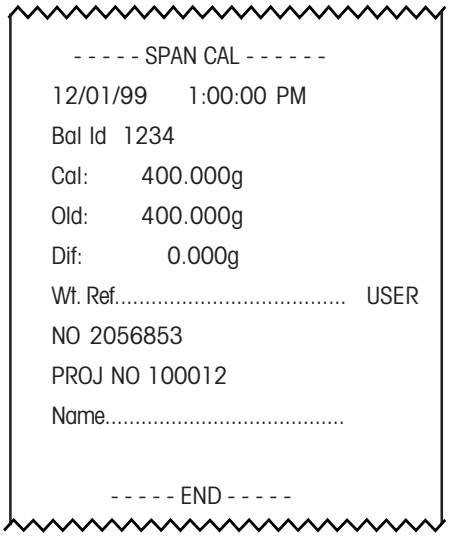
The sample shown, indicates the status in the menus.

SAMPLE PRINTOUTS

```
TYPE= MM/DD/YY
TYPE= 24 HOUR
12/01/99   16:00:00
READOUT
        STABILITY LEVEL FILTER = 0.5d
        AVERAGING LEVEL FILTER = 1
        AZT LEVEL = 0.5d
GLP PRINT OPTIONS
        DATE & TIME = OFF
        BALANCE ID = OFF
        PROJECT NAME = OFF
        USER NAME = OFF
        DIFFERENCE = OFF
PRINT OPTION
        AUTO PRINT =  OFF
        INTERVAL=  0
        STABLE PRINT =  OFF
        NUMERIC DATA =  OFF
        DATE=  OFF
        TIME=  OFF
        PRINT REFERENCE =  OFF
RS232 = 2400: NONE: 7 : 2
```

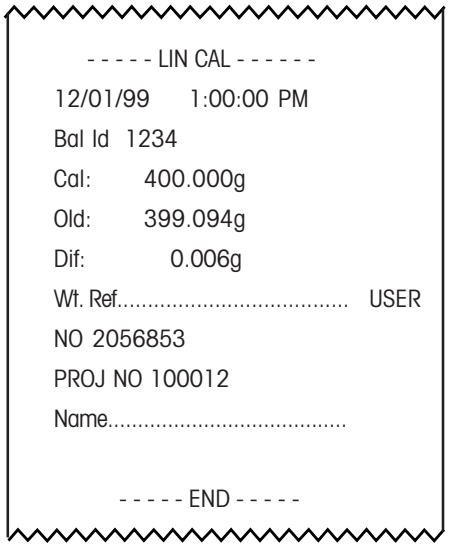
## Time and date

When time and date are entered in the balance with both Time and Date options set to ON, each printout starts with the date and time on the first line.



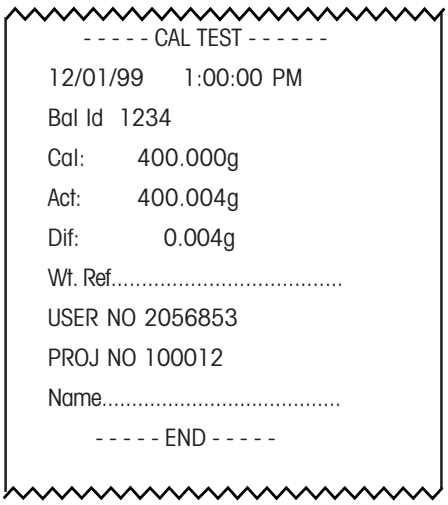

## Span calibration printout

When performing a Span calibration with GLP turned ON, a printout is automatically made after the calibration mass is placed on the pan.




## Linearity calibration printout

When performing a Linearity calibration with GLP turned on, a printout is automatically made after the calibration mass is placed on the pan.




## Calibration test printout

When performing a Calibration Test with GLP turned on, a printout is automatically made after the calibration mass is placed on the pan.

Pipette Results
Library Name: WHEATON
Pipette Name: WHEATON
Pipette Number: 832
Water Temp(C): 25.0
Test Liquid Density(g/cc): 0.9971
Barometric Pressure: 1.00PSIA
Nominal Value: 3.448ml
INACCURACY
E%: 0.31%
E% Limit: 2.00%
Mean Value: 3.459ml
IMPRECISION
CV: 0.88%
CV Limit: 2.00%
Standard Deviation: 0.031ml

Status: PASS
07/01/99
-----Sample Data ml----
3.488
3.485
3.487
3.435
3.458
3.430
3.470
3.510
3.446
3.456

Operator:----------

## Pipette test printout

When performing a Pipette Test with GLP turned on, a printout is available. The following sample printout is shown.

# 9. 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.

## 9.1 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.<br><br>Balance not properly calibrated. | Press **>0/T<** with no weight on the pan, then weigh item.<br><br>Recalibrate correctly. |
| Cannot display weight in desired unit or cannot access desired weighing mode. | Desired unit not selected. | Check setting. |
| Unable to store menu settings/ changes. | Exit was not selected. | You MUST use SAVE & Exit to leave menus and save settings. |
| RS232 interface not working. | Print menu settings not properly set up.<br><br>Cable connections. | Verify interface settings in RS232 menu correspond to those of the peripheral device.<br><br>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.<br>(LFT set ON) | Set Lock switch to OFF. |
| Unstable readings. | Excessive air current<br><br>Vibration on table surface. | Check environmental condition.<br><br>Place balance on a stable surface or change averaging level. |
| Error message display. | ——— | See Error Codes list. |

# 9.2 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

1.0 Transient error (hardware error, probably static discharge). If error persists, the balance must be serviced.
1.1 Balance temperature transducer hardware error.
1.2 No data from main board.

## Tare Errors

2.0 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 mass used for calibration. Recalibrate with correct masses.

## RS232 Errors

4.4 RS232 buffer is full.

## User Errors

7.0 User entry out of bounds.
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 pan is off. If not, the balance must be serviced.
8.1 Hardware error caused by an internal weight signal which is too high. Check load on the pan which may be excessive. If error persists, the balance must be serviced.
8.2 Power-on load out of specification (LFT only)
8.3 Rated capacity exceeded. Remove excessive weight from pan.
8.4 Underload condition on balance. Check that the proper pan is installed.
8.5 AutoCal™ weight internal sensor indicated its weight on the pan.

## CheckSum Errors

9.1 Bad factory checksum. If error persists, have the balance serviced.
9.2 Bad factory checksum. If error persists, have the balance serviced.
9.3 Bad factory checksum. If error persists, have the balance serviced.
9.4 AutoCal™ data failed checksum. This failure will disable access to the autocal feature (if installed).
9.5 Factory calibration data failed checksum.
9.6 Bad program checksum.
9.7 Bad CMOS checksum.
9.8 User calibration data failed checksum.
9.9 Temperature compensation data failed checksum.

## 9.3 Information messages

Informational messages and error messages appear on the display either when an action is required on the users part or a malfunction has occurred in the balance due to hardware, software errors or misapplication. A typical message is shown below.

**SCALE UNSTABLE** -Balance was unable to acquire stable data during calibration. The balance will try again.

## 9.4 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 Aftermarket, Ohaus Corporation toll-free at (800) 526-0659. An Ohaus Product Service Specialist will be available to help you.

## 9.5 Replacement parts

| Description | US Part No. | Global Part No. |
|---|---|---|
| Power Pack, 100/120 V ac US Plug (Cord set part of power pack) | 490202-01 | 21202536 |
| Power Pack, (Cord set required for UK, European and Australian) | 490203-01 | 21202537 |
| Cord Set, 230 V ac, UK Plug | 76448-00 | 89405 |
| Cord Set, 230 V ac, European Plug | 76212-00 | 87925 |
| Cord Set, 230 V ac, Australian plug | 76199-01 | 88751 |
| In-Use Display Cover Kit | 80850042 | 80850042 |

## 9.6 Accessories

| Description | | |
|---|---|---|
| **Calibration Masses - ASTM Class 1 Tolerance:** | | |
| 20 g | 49024-11 | 80780022 |
| 50 g | 49054-11 | 80730028 |
| 100 g | 49015-11 | 80780020 |
| 200 g | 49025-11 | 80780023 |
| 500 g | 49055-11 | 80780029 |
| 1 kg | 49016-11 | 80780021 |
| 2 kg | 49026-11 | 80780024 |
| 4 kg | 49046-11 | 80780027 |
| Security Device | 470004-010 | 80850043 |
| Density Determination Kit | 470007-010 | 80850045 |
| Auxilliary Display Kit (Table Mount) | 470009-010 | 80850048 |
| RS232 Interface Cable, Blunt end (user defined) | AS017-01 | 80850013 |
| RS232 Interface Cable, IBM® - PC 25 Pin | AS017-02 | 80850014 |
| RS232 Interface Cable, (connects impact printer) | 80500570 | 80500570 |
| RS232 Interface Cable, IBM® - PC 9 Pin | AS017-09 | 80850015 |
| RS232 Interface Cable, Apple® IIGS/Macintosh | AS017-10 | 80850072 |
| Printer | SF42 | SF42 |
| Printer Cable SF42 | 80500570 | 80500570 |
| Battery, Memory - 3 Volt Lithium ( Use BR2325, Ray O Vac or Panasonic) | ---- | |

NOTE: When the Memory Battery is replaced, all stored data in the balance will be lost.

# 9.7 Specifications

## Admissible Ambient Conditions

| | |
|---|---|
| | Use only in closed rooms |
| Ambient Temperature range: | 5 ºC to 40 ºC |
| Atmospheric humidity: | 80% rh @ to 30 ºC |
| Voltage fluctuations: | –15% +10% |
| Installation category: | II |
| Pollution degree: | 2 |
| Power supply voltage: | 12 VAC, 50/60 Hz or 12 VDC, 1A |

## Analytical Balances

| | | | | |
|---|---|---|---|---|
| Capacity (g) | 62 | 110 | 210 | 100/210 * |
| Readability (mg) | 0.1 | | | 0.1/1 |
| Repeatability (Std. dev.) (mg) | 0.1 | | | 0.1/0.5 |
| Linearity (mg) | (±) 0.2 | | | (±) 0.2/0.5 |
| Weighing units *** | gram, milligram, ounce, ounce troy, carat, pennyweight, Hong Kong Tael, Singapore Tael, Taiwan Tael, mommes, grain, tical, Newton, custom | | | |
| Application modes<br>Tare | Weighing, Parts Counting, Animal Weighing, Check Weighing, Percent Weighing, Filling, Gross-Net-Weighing | | | |
| Features | RS232 Port, Auxillary Display Port, GLP Protocol, Selectable Language, Display Text, Selectable Displayed Information Settings, Selectable Environmental Settings, Selectable Auto-Print Settings, Integral Weigh Below Hook, Contrast and Brightness Control, Protective In-Use cover | | | |
| Tare range | Full capacity by subtraction | | | |
| Stabilization time (s) | 4 | | | |
| Calibration | External / Internal | | | |
| Display Type | LCD Dot Matrix w/CCFL Backlight | | | |
| Display Size (in/cm) | 2.5 x 4.7 / 64 x 120 | | | |
| Pan size (in/mm) | 3.5/9 | | | |
| Operating temperature range: | Non LFT w/internal calibration 10°C to 40° C / 50°F to 104° F<br>w/o internal calibration 10°C to 30°C / 50°F to 86° F | | | |
| Power requirements | External Adapter, 100 -120 VAC 150mA, 220 - 240 VAC 100mA, 50/60 Hz<br>Plug configuration for US, Euro, UK, Japan & Australia | | | |
| Draft shield (in/cm)<br>(free height above platform) | 10.2/25.9 | | | |
| Pan size (in/cm) | 3.5 / 9. diameter | | | |
| Dimensions (WxHxD) (in/cm) | 8.5 x 13.5 x 14.5 / 21.5 x 35.5 x 37 | | | |
| Net Weight (lb/kg) | 12.5 / 5.7 | | | |
| Net Weight (lb/kg) InCal Models | 14.8 / 6.7 | | | |

* Moveable FineRange ™

*** Units availability is country dependent.

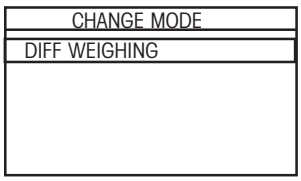
**Precision Balances**

| Capacity (g) | 210 | 410 | 510 | 610 | 100/410* | 610 | 1500 | 2100 | 4100 | 6100 | 1000/4100* | 4100** | 6100** | 8100** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Readability (g) | 0.001 | | | | 0.001/0.01 | 0.01 | | | | | 0.01/0.1 | 0.1 | | |
| Repeatability (Std. dev.) (g) | 0.0005 | | 0.0015 | | 0.0005/0.005 | 0.005 | | | | 0.01 | 0.01/0.05 | 0.05 | | |
| Linearity (g) | (±)0.002 | | | | (±)0.002/0.005 | (±)0.02 | | | | (±)0.04 | (±)0.02/0.05 | (±)0.1 | | |
| Weighing units*** | gram, milligram, kilogram, pound, ounce, ounce troy, carat, pennyweight, Hong Kong Tael, Singapore Tael, Taiwan Tael, mommes, grain, tical, Newton, custom | | | | | | | | | | | | | |
| Application modes | Weighing, Parts Counting, Animal Weighing, Check Weighing, Percent Weighing, Filling, Gross-Net-Tare Weighing | | | | | | | | | | | | | |
| Features | RS232 Port, Auxillary Display Port, GLP Protocol, Selectable Language, Display Text, Selectable Displayed Information Settings, Selectable Environmental Settings, Selectable Auto-Print Settings, Integral Weigh Below Hook, Contrast and Brightness Control, Protective In-Use cover | | | | | | | | | | | | | |
| Tare range | Full capacity by subtraction | | | | | | | | | | | | | |
| Stabilization time (s) | 3 | | | | | | | | | | | | | |
| Operating temperature range: | Non LFT w/internal calibration 10°C to 40°C / 50°F to 104° F<br>All others 10°C to 30°C / 50°F to 86°F | | | | | | | | | | | | | |
| Calibration | External / Internal | | | | | | | | | | | | | |
| Power requirements | External Adapter, 100 -120 VAC 150mA, 220 - 240 VAC 100mA, 50/60 Hz<br>Plug configuration for US, Euro, UK, Japan & Australia | | | | | | | | | | | | | |
| Draft shield (in/cm)<br>(free height above platform) | 10.2/25.9 | | | | | None | | | | | | | | |
| Display Type | LCD Dot Matrix w/CCFL Backlight | | | | | | | | | | | | | |
| Display size (in/mm) | 2.5 x 4.7 / 64 x 120 | | | | | | | | | | | | | |
| Pan size (in/cm) | 4.7/12 Dia. | | | | | 6.8 x 6.8/17.2 x 17.2 w/windshield | | | | | | 8 x 8/ 20.3 x 20.3 ** | | |
| Dimensions (WxHxD) (in/cm) | 8.5x13.5x14.5/21.5x35.5x37 | | | | | 8.5 x 4 x 14.5/21.5 x 10.1 x 37 | | | | | | | | |
| Net Weight (lb/kg) | 12.5 / 5.7 | | | | | 8.4 / 3.8 | | | | 10/4.5 | 8.4 / 3.8 | | 10 / 4.5 | |
| Net Weight (lb/kg) InCal Models | 14.8 / 6.7 | | | | | 10 / 4.5 | | | | 15.5/7 | 10 / 4.5 | | 15.5 / 7 | |

* Moveable FineRange ™
** Balances with Auto Cal are equipped with a 6.8 in. x 6.8 in. / 17.2 cm x 17.2 cm Pan and Windshield.
*** Units availability is country dependent.

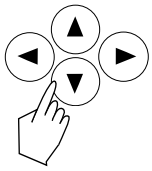
# A-1 Sieve analysis

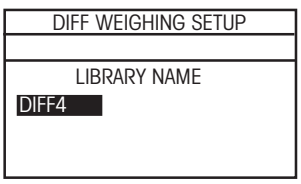
During most sieving operations, it is necessary to record the initial weight of each sieve before beginning as the weights of the sieves may change due to particles being retained from the previous operation. In this procedure, the *basic sample is weighed first with it's container weight tared*. This sample weight is entered into the balance manually and stored during the procedure. Then, each sieve is weighed in sequence and the weights are stored. After the screening process, each sieve along with its retained sample, is weighed in sequence. The balance stores the weight values and automatically subtracts the weight of each sieve and displays the retained amount in a table as percent retension. Up to 80 sieve weights can be stored.


## From main menu

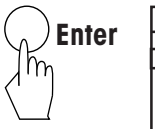
Enter CHANGE MODE and select DIFF WEIGHING, display advances to DIFF WEIGHING SETUP with LIBRARY NAME highlighted.






## Specify the library name

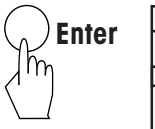
Specify the library name. The name can have any combination of alpha numeric characters not to exceed 8 characters. After specifing the library name, the display advances to DIFF STARTUP with SETUP highlighted. Press the **Enter** button. The display advances to DIFF WEIGHING SETUP with TARE SETUP highlighted.




| DIFF WEIGHING SETUP | |
|---|---|
| LIBRARY NAME | DIFF4 |
| TARE SETUP | NO TARE |
| AUTO SAMPLE | OFF |
| DIFF RESULT | WEIGH |
| NUMBER OF SAMPLES | 1 |
| VIEW RESULTS | |
| CLEAR ALL DATA | |
| RUN | |

## Tare setup

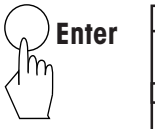
Press the **Enter** button, the display indicates a choice of NO TARE, SINGLE TARE, DUAL TARE and RETURN. Select type of tare and press **Enter** button. Then scroll to RETURN and press **Enter** button.




| DIFF WEIGHING SETUP | |
|---|---|
| LIBRARY NAME | DIFF4 |
| TARE SETUP | NO TARE |
| AUTO SAMPLE | OFF |
| DIFF RESULT | WEIGH |
| NUMBER OF SAMPLES | 1 |
| VIEW RESULTS | |
| CLEAR ALL DATA | |
| RUN | |

## Auto sample

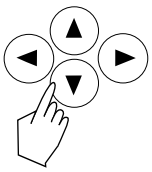
Press the **Enter** button, the display indicates a choice of ON or OFF, then press **Enter** button. AUTO SAMPLE permits one sieve after another to be weighed without pressing the **Enter** button. Display returns to DIFF RESULT highlighted.




| DIFF WEIGHING SETUP | |
|---|---|
| LIBRARY NAME | DIFF4 |
| TARE SETUP | NO TARE |
| AUTO SAMPLE | OFF |
| DIFF RESULT | % RETENSION |
| NUMBER OF SAMPLES | 1 |
| VIEW RESULTS | |
| CLEAR ALL DATA | |
| RUN | |

## Diff result

Press the **Enter** button, the display indicates a choice of WEIGHT, PERCENT, % RETENSION and RETURN. Select % RETENSION, then press **Enter** button. Display indicates to ENTER TOTAL SAMPLE WEIGHT.



ENTER TOTAL SAMPLE WEIGHT

200.025

## Enter total sample weight

Enter the total sample weight. This is the weight of the actual sample. Press **Enter** button. Display advances to RETURN.


DIFF RESULT

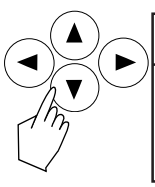
WEIGHT
PERCENT
% RETENSION <-SELECTED
RETURN

With RETURN highlighted, press the **Enter** button.


| DIFF WEIGHING SETUP | |
|---|---|
| LIBRARY NAME | DIFF4 |
| TARE SETUP | NO TARE |
| AUTO SAMPLE | OFF |
| DIFF RESULT | % RETENSION |
| NUMBER OF SAMPLES | 1 |
| VIEW RESULTS | |
| CLEAR ALL DATA | |
| RUN | |

## Enter number of samples

Enter the number of samples, press the **Enter** button.,



NUMBER OF SAMPLES

3

## Specify the number of samples

Specify the number of samples and press **Enter** button. Display advances to DIFF WEIGHING SETUP with RUN highlighted.


| DIFF WEIGHING SETUP | |
|---|---|
| LIBRARY NAME | SIEVE 2 |
| TARE SETUP | OFF |
| AUTO SAMPLE | ON |
| DIFF RESULT | % RETENTION |
| NUMBER OF SAMPLES | 3 |
| VIEW RESULTS | |
| CLEAR ALL DATA | |
| RUN | |

## Initial weighing of sieves

Press the **Enter** button, the display indicates to PUT EMPTY SIEVE #1 ON PAN.


DIFF WEIGHING

TARE WT: TARE WT:3.426
IN IT WT: FINAL WT:
3.426
PUT EMPTY SIEVE # 1 ON PAN STABLE

| START/SAMPLE | EDIT | SETUP |
|---|---|---|

Place empty sieve #1 on the pan and press **Enter** button. When AUTO SAMPLE is set ON, display advances to the next sieve. Continue adding sieves until all sieves have been weighed pressing the **Enter** button after each sieve. When the last sieve has been weighed, the display indicates the tare weight of all sieves. Press the **Enter** button.

| TAREWT | INIT WT | TARE WT | FINAL \VT |
|---|---|---|---|
| N/A | NA | 3.426 | 0.000 |
| N/A | N/A | 3.969 | 0.000 |
| N/A | N/A | 3.962 | 0.000 |

SAMPLE #1

| CONTINUE | SAVE | RESAMPLE | DELETE |
|---|---|---|---|

This sample display indicates 3 sieves were weighed. With CONTINUE highlighted at the bottom of the display, press **Enter** button. The display advances and indicates PUT FULL SIEVE #1 ON PAN.

DIFF WEIGHING

TARE WT: TARE WT:
INIT WT: FINAL WT:3.841
3.841
PUT FULL SIEVE #1 ON PAN STABLE

| START/SAMPLE | EDIT | SETUP |
|---|---|---|

## Final weighing of sieves

After pressing **Enter** button, the display returns to final weighing. Place first full sieve on the pan and press **Enter** button. Repeat weighing with remaining sieves pressing the **Enter** button after each sieve. When the last sieve has been weighed, the display indicates the final weight of all samples.


| TAREWT | INIT WT | TARE WT | FINAL \VT |
|---|---|---|---|
| N/A | NA | 3.426 | 3.839 |
| N/A | N/A | 3.969 | 4.388 |
| N/A | N/A | 3.962 | 4.377 |

SAMPLE #1

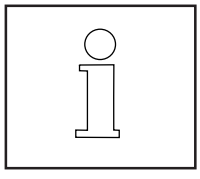
| CONTINUE | SAVE | RESAMPLE | DELETE |
|---|---|---|---|

With CONTINUE highlighted, press **Enter** button to review final display.

| SAMPLE # | INIT WT | FINAL WT | % RETENSION |
|---|---|---|---|
| 1 | 200.025 | 0.413 | 0.206 |
| 2 | 200.025 | 0.419 | 0.209 |
| 3 | 200.025 | 0.415 | 0.207 |
| TOTAL | | 1.247 | 0.623 |

PRESS <ENTER> FOR MENU

Final display indicates the initial weight, final weight of all sieves and the total weight and total amount of retention in percent.



The above illustration represents 3 sieves which weighed between 3.4 and 3.9 grams each. TARE SETUP was set OFF, AUTO SAMPLE was set OFF and % RETENTION was selected. The sample weight retained in each different sieve weighed between 3.839 and 4.377 grams. The total amount of retention is shown in percent on the last display which was 0.623 for three sieves. Initial sample was 200.25 grams.

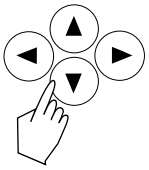
## A-2 Porous material density determinations

The density of a porous (oil impregnated part) can be made with the balance. Weigh the part (dry) prior to oil impregnation and ***record its weight***. You must also know the density value of the oil to be used in immersing the part before starting. In this procedure, you will follow the method for solid density measurements using water.


MAIN MENU
CHANGE MODE

### From main menu

Enter CHANGE MODE. Select DENSITY, display advances to LIBRARY NAME.



DENSITY SETUP
LIBRARY NAME

### Library name

Enter a library name, up to 8 characters and press **Enter** button. Display advances to DENSITY SETUP with SOLID DENSITY highlighted. If a previous name was entered and selected, the balance uses the parameters which were previously set.

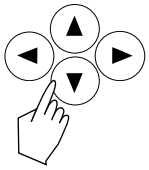

DENSITY SETUP
LIBRARY NAME D2
SOLID DENSITY <-SELECTED
LIQUID DENSITY
AUTO SAMPLE OFF
AUTO PRINT OFF
RUN

Select SOLID DENSITY, display advances to AUX LIQ & MODE with H2O highlighted.


AUX LIQ & MODE
H2O <-SELECTED
OTHER
POROUS MATERIAL OFF
DRY WEIGHT 0.000
DENSITY OF OIL 0.0000
RETURN TO SETUP

### Selecting water as auxiliary liquid

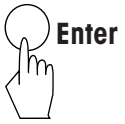
Select H2O, display advances to AUX LIQ & MODE with ENTER TEMPERATURE CELSIUS highlighted.



AUX LIQ & MODE
ENTER TEMPERATURE CELSIUS

### Specify temperature

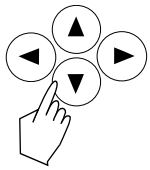
Enter the temperature of the water and press **Enter** button. Display advances to AUX LIQ & MODE with POROUS MATERIAL highlighted.




AUX LIQ & MODE
H2O <-SELECTED
OTHER
POROUS MATERIAL OFF
DRY WEIGHT 0.000
DENSITY OF OIL 0.0000
RETURN TO SETUP

### Specify porous material

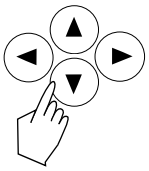
Select Porous Material and press **Enter** button. Display advances to POROUS MATERIAL ON/OFF. Select ON and press **Enter** button.



AUX LIQ & MODE
H2O <-SELECTED
OTHER
POROUS MATERIAL ON
DRY WEIGHT 200.040
DENSITY OF OIL 0.0000
RETURN TO SETUP

### Enter dry weight

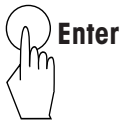
Enter the dry weight of the part as previously measured. Press **Enter** button. Display advances to DENSITY OF OIL highlighted.



| AUX LIQ & MODE | |
|---|---|
| H20 | <-SELECTED |
| OTHER | |
| POROUS MATERIAL | ON |
| DRY WEIGHT | 200.040 |
| DENSITY OF OIL | 0.4000 |
| RETURN TO SETUP | |

## Enter oil density

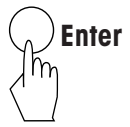
Enter the density of the oil being used to impregnate the part. Press **Enter** button. Display advances to RETURN TO SETUP highlighted. Press **Enter** button. Display returns to DENSITY SETUP with AUTO SAMPLE highlighted.




| DENSITY SETUP | |
|---|---|
| LIBRARY NAME | D2 |
| SOLID DENSITY | <-SELECTED |
| LIQUID DENSITY | |
| AUTO SAMPLE | OFF |
| AUTO PRINT | OFF |
| RUN | |

## Auto sample

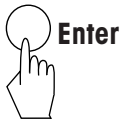
Select AUTO SAMPLE and turn it ON or OFF. A setting of ON allows samples to be sequentially sampled without pressing the **Enter** button for each sample.




| DENSITY SETUP | |
|---|---|
| LIBRARY NAME | D2 |
| SOLID DENSITY | <-SELECTED |
| LIQUID DENSITY | |
| AUTO SAMPLE | OFF |
| AUTO PRINT | OFF |
| RUN | |

## Auto print

At this point you can select automatic printing. To turn on, press the **Enter** button and select ON. If you do not want automatic printing, select OFF.




| DENSITY SETUP | |
|---|---|
| LIBRARY NAME | D2 |
| SOLID DENSITY | <-SELECTED |
| LIQUID DENSITY | |
| AUTO SAMPLE | OFF |
| AUTO PRINT | OFF |
| RUN | |

## Testing the sample

Select RUN and press **Enter** button. Display advances to final DENSITY display and requests to weigh the sample in air.

DENSITY - - D7

WEIGH IN AIR: 207.457 TEMP: 25.0
WEIGH IN LIQ: 204.005 AUX: D:0.9971
DRY WEIGHT: 200.040 VOLUME: 3.59

57.779

P1: 535.58%
WEIGH IN AIR GRAMS/CC STABLE

START/SAMPLE | SETUP | MAIN MENU

Now follow balance prompts to weigh sample in air and water. After weighing in air, weigh the sample in water. The balance will calculate Dry Density and Oil Content by Volume (P1).

## To determine wet density

Wet density of the sample can be calculated by following the normal Solid Density procedure using the oil impregnated part. When in AUX LIQ MODE menu, turn OFF POROUS MATERIAL, then follow previous solid density measuring procedure.

## 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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