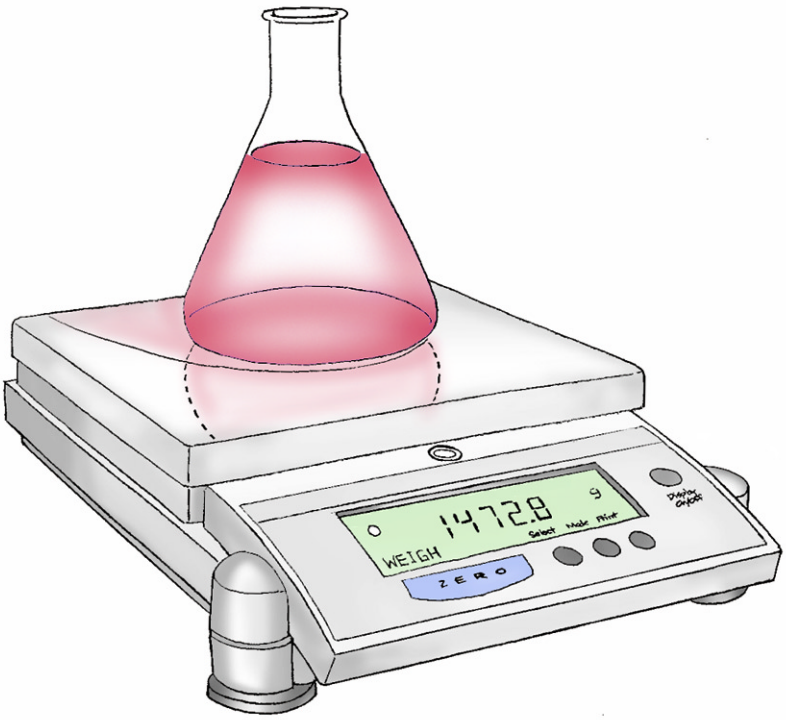
Denver Instrument Company



TR-Series
Toploading Balances

Operation Manual

602173.1
Rev. G

Declaration Of Conformity

Denver Instrument Company declares that the following products:

TR-Series Balances

conform to the European Union Council Directives and other standards listed below:

73/23/EEC, "Low Voltage Directive"
EN 61010-1, "Safety requirements for electrical equipment for measurement, control, and laboratory use. Part 1. General requirements"

89/336/EEC, "Electromagnetic Compatibility Directive"
EN 55011, Group 1, Class A, "Limits and methods of measurement of radio disturbance characteristics of industrial, scientific, and medical (ISM) radio-frequency equipment"
EN 50082-1, "Electromagnetic compatibility - Generic immunity standard; Part 1: Residential, commercial, and light industry"

Further information may be obtained from the manufacturer, or from the manufacturer's representative:

manufacturer:
Denver Instrument Company
6542 Fig Street
Arvada, CO 80004 USA

manufacturer's representative:
Denver Instrument Company, Ltd.
Denver House
Sovereign Way
Trafalgar Business park
Downham market
Norfolk, UK PE38 9SW

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You have purchased a quality precision weighing instrument that requires handling with care.

*Read entire contents of this **Operation Manual** prior to operating your new Denver Instrument balance.*

Disclaimer Notice

"Calibrate your balance using reference weights of the appropriate tolerance (class). An instrument can be no more accurate than the standard to which it has been compared. For assistance in the selection of reference weights, please contact the factory".

Class A Digital Devices:

Notice: 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. The 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 device in a residential area is likely to cause harmful interference in which the user will be required to correct the interference at his own expense.

Caution: Changes or modifications not expressly approved by the manufacturer could void the user's authority to operate this equipment.

Manufactured in the U.S.A. by:

Denver Instrument Company

6542 Fig Street • Arvada, Colorado 80004
(303) 431-7255 • (800) 321-1135 • Fax(303) 423-4831

Introduction

Thank you for selecting a precision Denver Instrument Company balance. Your balance is designed and engineered to provide years of reliable performance.

WARNING
Use of this product in a manner not specified by the manufacturer may impair any safety protection provided by the equipment!

UNPACKING YOUR BALANCE

Carefully remove your balance from the packing material. The weigh pan assembly and power transformer are removed from the balance for shipping but are in the same box.

Be sure that you have received each of the following items with your balance:

- Balance
- Operation Manual
- Warranty Registration Card
- Weigh Pan Assembly:
  Round pan and ring (for 3.5" or 4.5" pans)
  or square pan
- Power Transformer

Carefully read this operation manual in order to take full advantage of the many features of your balance. Be sure to read the section on the proper care and maintenance of your balance so that it will provide you with years of reliable service.

Please complete and return your warranty registration card, so that in the event your balance is lost or stolen, Denver Instrument Company will have a record of your balance's serial number. Also take a moment right now to record the model and serial number of your balance on the inside back cover of this manual for future reference.

Model Specifications

Analytical Models

Model	64	104	204
Weighing Range	61g	110g	210g
Readability	0.1mg	0.1mg	0.1mg
Linearity	0.2mg	0.2mg	0.2mg
Repeatability, (s)	0.1mg	0.1mg	0.1mg
Stabilization Time	4 sec	4 sec	4 sec
Pan Dimensions	3.5" (9cm)	3.5" (9cm)	3.5" (9cm)

Toploading Models

Model	203	403	402	602
Weighing Range	210g	410g	410g	610g
Readability	0.001g	0.001g	0.01g	0.01g
Linearity	0.002g	0.003g	0.01g	0.01g
Repeatability, (s)	0.001g	0.001g	0.01g	0.01g
Stabilization Time	2 sec	2 sec	2 sec	2 sec
Pan Dimensions	4.5" (11cm)	4.5" (11cm)	6.0" (15cm)	6.0" (15cm)

Model	2102	4102	2101	4101	6101
Weighing Range	2100g	4100g	2100g	4100g	6100g
Readability	0.01g	0.01g	0.1g	0.1g	0.1g
Linearity	0.01g	0.02g	0.1g	0.1g	0.1g
Repeatability, (s)	0.01g	0.01g	0.1g	0.1g	0.1g
Stabilization Time	2 sec	2 sec	2 sec	2 sec	2 sec
Pan Dimensions	8.375x8.375" (21x21cm)	6.0" (15cm)	8.375x8.375" (21x21cm)	8.375x8.375" (21x21cm)	8.375x8.375" (21x21cm)

Model	8101	12001	603D	4102D	8102D
Weighing Range	8100g	12000g	610/110g	4100/410g	8100/810g
Readability	0.1g	0.1g	0.01/0.001g	0.1/0.01g	0.1/0.01g
Linearity	0.2g	0.2g	0.01/0.002g	0.1/0.01g	0.2/0.01g
Repeatability, (s)	0.1g	0.1g	0.01/0.001g	0.1/0.01g	0.1/0.01g
Stabilization Time	2 sec	2 sec	2 sec	2 sec	2 sec
Pan Dimensions	8.375x8.375" (21x21cm)	8.375x8.375" (21x21cm)	4.5" (11cm)	8.375x8.375" (21x21cm)	8.375x8.375" (21x21cm)

Common Specifications

Electrical Requirements: 15VDC @ 800 mA with AC Adapter, center pin (+)
Controls: Silicone rubber keypad, Zero, Display ON/OFF, and 3 softkeys
Display: 4.5 x 1.75 inch (12.3 x 4 cm) custom LCD
Interface: RS-232 Bidirectional
16 weighing units and 2 custom
Calibration with external weight (minimum of 4 permissible)
Count mode
Environmental settings
Animal weighing mode
Height above pan (analyticals): 9.5" (24cm)
Net Weight: 8.7 lbs. (3.9 kg) Round Pan
10 lbs. (4.5kg) Square Pan
14.6 lbs. (6.6 kg) Analytical
Shipping Weight: 12.0 lbs. (5.4 kg) Round Pan
13.0 lbs. (5.9 kg) Square Pan
17.8 lbs. (8.0 kg) Analytical

Installation

Preparation

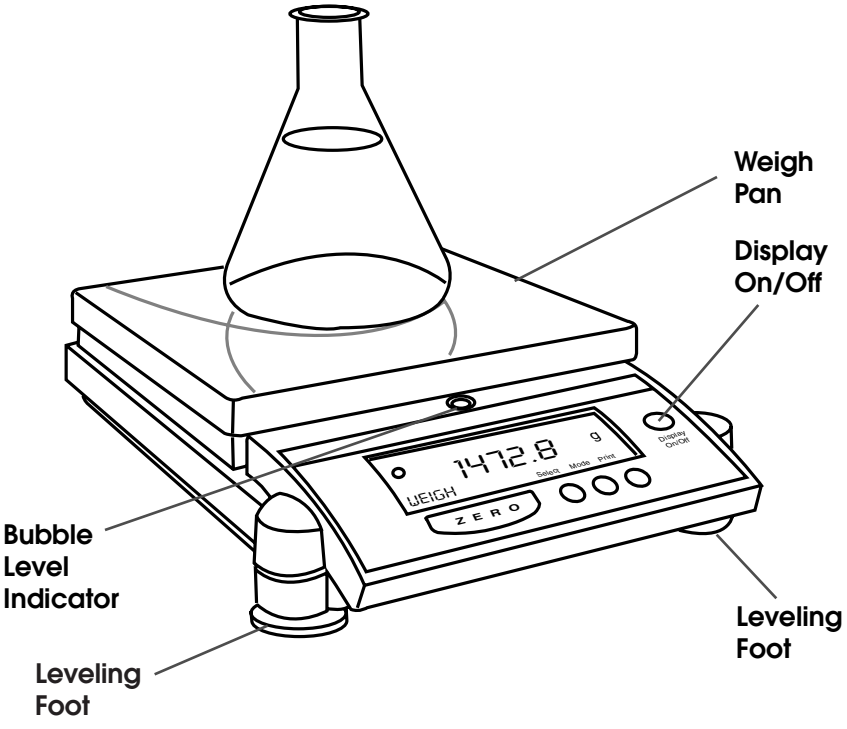
This product is intended for indoor use.

Select a level, rigid work area that is free from drafts and vibrations (i.e. away from doors, windows, air conditioning/heating vents).

The line voltage to the balance should be reasonably constant (+/-10%) and free from fluctuations.

Position balance to allow the removal of the power adapter plug from the wall outlet. It is not advisable to use an outlet that is shared with fluorescent fixtures or other electrical equipment that draws current in an inconsistent manner.

Do not locate the balance near magnetic materials, or near instruments that incorporate magnets in their design.
Avoid areas that experience extreme highs, lows or fluctuations in room temperature. Excessive temperatures that may affect balance operation and accuracy are 1) above 105°F (40°C) and 2) below 60°F (15°C).



Setup

Carefully remove the balance and all accessories from the carton. There are no tie-downs; however there may be packing materials under the pan support (square-pan models only).

LEVELING THE BALANCE

1. The leveling feet are located on the bottom of the balance. Do not turn the balance over. Viewing the balance from above, turn all leveling feet counterclockwise until the feet are fully retracted into the balance base.
2. Note the position of the bubble on the leveling vial. For maximum weighing accuracy, the bubble should be located inside the black ring. Some adjustment will likely be necessary.
3. Begin with the foot that is opposite of the location of the bubble and turn clockwise until the bubble is moved into the black ring. If necessary, repeat this step with the other leveling feet until the bubble is positioned in the center of the black ring.
4. Avoid extending the level feet too far. If it seems necessary to do so, it is likely that the tabletop is not level. Check the surface on which you have placed the balance; it may be necessary to choose another location.

The bubble moves TOWARD a foot when that foot is turned CLOCKWISE. The bubble moves AWAY from a foot when that foot is turned COUNTERCLOCKWISE.

POWERING THE BALANCE

WARNING
Verify that you have received the proper voltage power supply for your country of use!

Insert the power cord into the receptacle located at the back of the balance and plug the power adapter into a wall outlet. The display will perform a quick test in which all segments are briefly illuminated and display "stabilizing" for 30 seconds.

INITIAL WARM-UP PERIOD

After the initial power-up, it is necessary to allow a minimum of 60 minutes for the balance components to become warm and for the internal temperature to stabilize.

It is not necessary to unplug your balance from the power source when it is not in use. It is advised to leave the unit plugged in so that all components are warm and the balance is ready to weigh at any time. If you wish, the display can be turned off to save the segment life, by simply pressing the Display On/Off button.

WEIGH PAN INSTALLATION

WARNING
Mishandling the balance weigh pans can cause serious mechanical damage!

The balance weigh pan engages critical and delicate mechanical components inside the balance. Please observe the following precautions when handling the weigh pans:

1. Do not apply manual pressure to the weigh pan at any time.
2. Do not bump the pan.
3. Do not drop objects onto the pan.
4. Do not attempt to clean or vigorously wipe the pan while it is installed on the balance.

ROUND-PAN MODELS

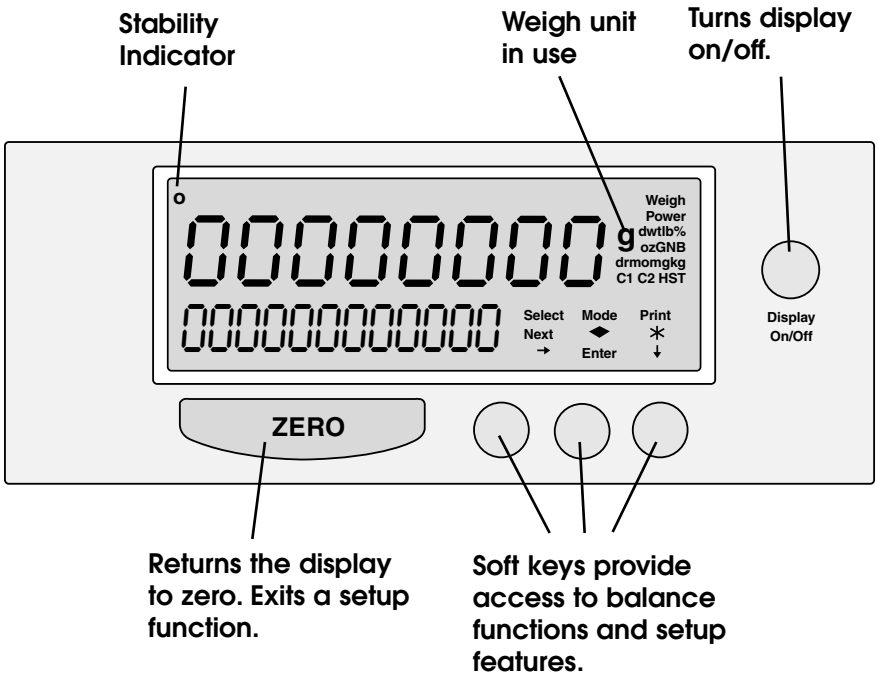
Balances with 3.5" or 4.5" round pans feature a weigh pan assembly that consists of an aluminum pan and an impact protection ring that helps to shield the weigh pan from lateral shocks. (For models with 6" pans, simply place pan on pan stem).

1. Place the impact ring on the balance first.
2. Center the weigh pan over the impact ring and gently slide or twist (do not push) the pan onto the pan stem.
3. When removing the pan for cleaning, remove the impact ring first and then pull the weigh pan straight up and off (pulling the pan at an angle could result in mechanical breakage).

SQUARE-PAN MODELS

Simply place the square top-pan on the pan support.
You're ready to begin weighing!

Display and Keypad



The balance features an integrated display/keypad. The high-contrast LCD display simultaneously provides alpha and numeric information for ease in setup and accuracy in interpretation of results.

DISPLAY

Stability Indicator. This icon is illuminated when the balance has stabilized, indicating that the displayed weight is your final result.

Weigh Units. The current selected weigh unit is displayed. The balance will keep two weigh units resident for ready use at all times. Press "Select" to toggle between the two resident weigh units. (Factory default is grams.) See page 11 for a complete list of weigh units, their display abbreviations and how to change the current weigh units.

Functions. The functions align with the soft keys on the keypad to provide access to the balance's many setup features.

KEYPAD

Zero key. Pressing the zero key returns the weight display to a zero reading. This is especially useful for taring (subtracting) container weights.

Soft keys. Three soft keys align with the displayed functions to provide easy access to all balance setup features. See "Soft Key Operation"

Display On/Off key. Turns display only on or off to save segment life.

SOFT KEY OPERATION

Your balance contains a broad range of features that allow you to customize the unit to your specific weighing application(s). Navigating through the options is easy using the "soft key" (software programmable key) operation.

Each soft key on the keypad aligns with a balance function on the display. To select a function, press the key that is just below it.

To exit any setup function, press the ZERO key and the balance will return to the weigh screen.

Software Layout

The balance has a wide variety of modes of operation and set up parameters for different weighing applications. Parameters can easily be changed by scrolling through the options and choosing the desired selection. The different weighing modes include: basic weighing, animal weighing and counting. The default mode is basic weighing. When a mode is turned ON, the mode name will appear in the lower left corner of the display.

Basic weighing = WEIGH
Counting = PCS (for pieces)
Animal weighing = ANIMAL

Note **Modes must be turned Off to return to basic weighing or entering a new mode will turn the previous mode Off**.

Setup parameters for optimizing the balance for your specific needs and conditions include: weighing unit, environmental settings, and serial interface settings.

Other administration functions can also be accessed different parameters or checking system conditions (ie software version).

All selection of modes and changes to parameters are made by pressing the Mode softkey and then using the Next softkey to scroll through the available options. When the desired selection is shown, press the Enter softkey.

Note **On entering a setup function with multiple selections (ie baud rate), the first selection will be the current setting.**

The following shows the order of the available routines by screen name, however a complete listing of all selections is the the Menu Tree on page 39 of the manual.

Screen Name	Function
CALIBRATE	Calibration
UNITS	Weighing unit selection
ENVIRO	Environmental settings
ANIMAL	Animal weighing mode
COUNT	Counting mode
SERIAL	Serial interface settings
SYSTEM	Check system status
FACTORY	Return to factory default settings

Calibration

Your balance was calibrated at the factory; however, it is necessary to re-calibrate upon setup and on a regular basis thereafter. The factory recommendation for calibration is once per week using the maximum permissible weight standard. Reasons for more frequent calibration include 1) moving the balance, 2) organizational procedures, 3) special samples/applications which require documented calibration time/date stamp.

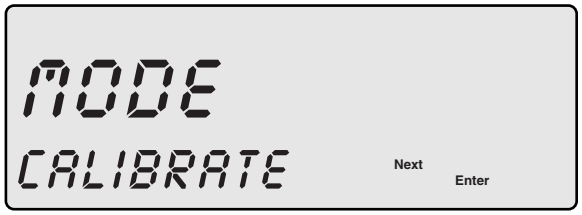
PERMISSIBLE WEIGHTS

Model	Weight																	
	20	30	50	60	100	200	300	400	500	600	800	1000	2000	4000	5000	6000	8000	12000
64	X	X	X	X														
104	X	X	X	X	X													
204			X	X	X	X												
203			X	X	X	X												
403					X	X	X	X										
402					X	X	X	X										
602					X	X	X	X	X	X								
2102								X	X	X		X	X					
4102										X		X	X	X				
2101								X	X	X		X	X					
4101										X		X	X	X				
6101													X	X	X	X		
8101													X	X	X	X	X	
12001													X	X	X	X	X	X
603D				X	X	X	X	X	X	X								
4102D								X	X	X		X	X	X				
8102D											X	X	X	X	X	X	X	

EXTERNAL CALIBRATION (using a mass standard)

Be certain that the balance has stabilized.

1. Select "Mode".



2. Press "Enter".

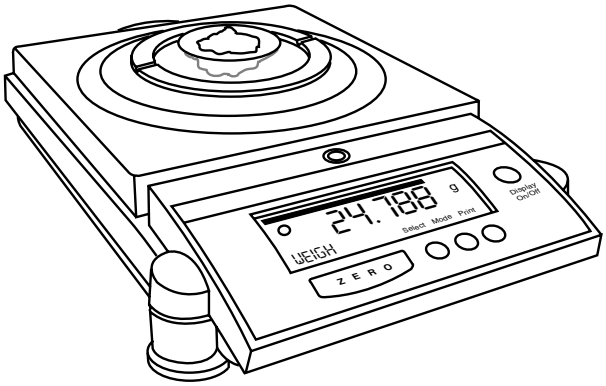
2. Place mass standard on the weighing pan (see Permissible Weights at the end of this section). The balance recognizes the mass and automatically calibrates.
3. Once calibrated, the balance will return to the weigh display.

Basic Weighing

You are ready to begin weighing if you have:

- Set up the balance in an acceptable location (see page 3)
- Calibrated the balance (see page 9)

For optimum accuracy, please place your samples as near the center of the weighing pan as possible.



Your balance is designed to provide accurate measurements regardless of where you place the sample on the pan; however, repeatability, accuracy and stabilization time are optimized if the load is placed as close to the center of the pan as possible.

Press the ZERO key to access the weighing mode (the word WEIGH will appear in both the upper right-hand corner and the lower left-hand corner.

TARING

To subtract the weight of the sample container:

1. Place the empty container on the weighing pan.

2. Press ZERO.

3. Add sample to the container and wait for the stability icon to appear (upper left-hand corner).

4. The weight of the sample only will appear on the display.

Stability icon →

Units

Your balance offers 16 different weigh units and 2 user-customizable units. Weigh units available (display symbol): Grams (g), Kilograms (kg), Milligrams (mg), Ounces (oz), Troy Ounces (ozt), Pounds (lb), Grains (gn), Pennyweight (dwt), Carats (c), Tael HK, Hong Kong (H), Tael Sing, Singapore (S), Tael Taiwan (T), Momme (mom), Dram (dr), Baht (B), Tola (t), and two custom, user-defined (C1 and C2).

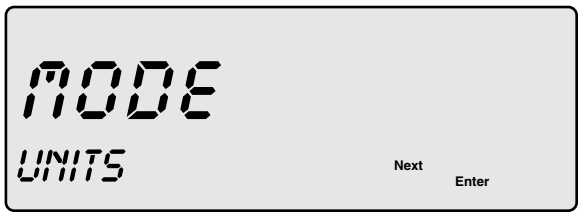
Selecting Weigh Units

Your balance will keep two weigh units resident for ready use at all times. To toggle between the two weigh units, press the soft key "Select" which appears on the main weighing screen.

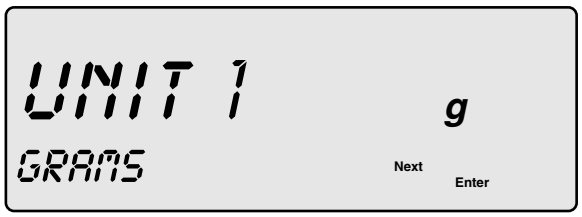
The factory default weigh unit is grams. To change the selected weigh units:

1. Select "Mode".

2. Press "Next".



3. Press "Enter".



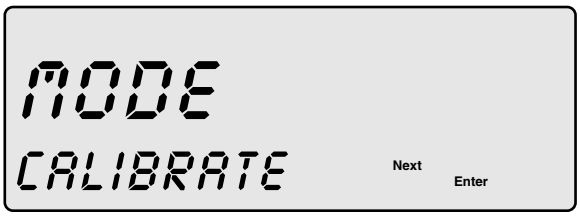
4. To scroll through the weigh units, continue to press "Next".
5. To choose a weigh unit, simply press "Enter".
6. Weigh Unit 1 will be stored into memory. Repeat steps 4 and 5 above to select Unit 2.
7. To return to the weigh mode, press ZERO.
8. Press "Select" to toggle between the two weigh units. An icon will appear to the right of the weight display indicating which weigh unit is in use.

Custom Weigh Units

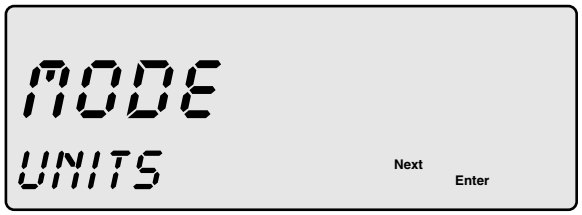
To have the balance automatically perform a multiplication of the weight value (g) or to set a Custom unit, simply enter the appropriate factor into one of two Custom units. These can also be set as Unit 1 and Unit 2 for immediate access.

To enter a Custom unit:

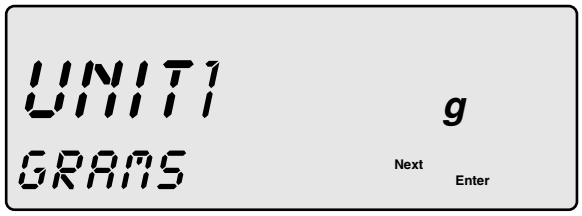
1. Select "Mode".



2. Press "Next".



3. Press "Enter".



4. Scroll through the weight units, with the "Next" key until CUSTOM is displayed.

5. Press "Enter".

6. Enter the desired factor using the arrow keys.
7. To save the factor entry press "Enter".
8. Select UNIT2 or press Zero to return to the weigh screen.

Environmental

Your balance can be set up for optimized weighing to compensate for varying conditions including building vibration, drafts, surface vibration, etc. The Environmental settings consist of four subsettings including Filter, Stability Speed, Stability Sensitivity and Autozero. Each has multiple selections.

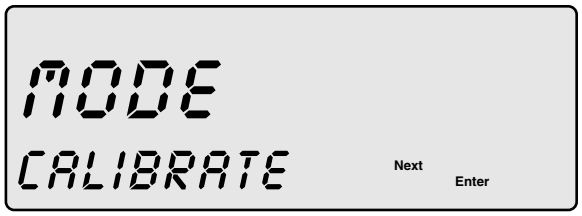
Environmental Settings

Filter	Stability Speed	(sec)	Stability Sensitivity	(counts)
Very Low	Very Slow	4	Very Fine	.25
Low	Slow	2	Fine	.5
Normal	Normal	1	Normal	1
High	Fast	.5	Coarse	2
Very High	Very Fast	.25	Very Coarse	4

Examples	Filter	Stability Speed	Stability Sensitivity
Good weighing	Normal	Normal	Normal
Filling	Low	Fast	Very Fine
Low vibration	High	Slow	Coarse
High vibration or Breeze	Very High	Very Slow	Very Coarse

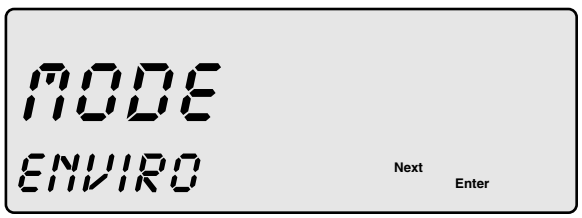
To change the Environmental settings:

1. Select "Mode".



2. Press "Next" until MODE, ENVIRO.

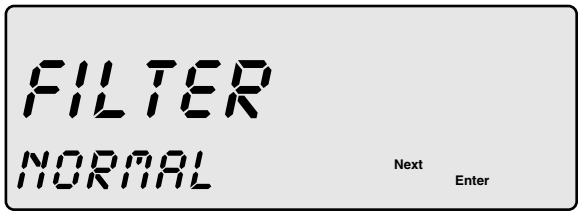
3. Press "Enter".



To change Filter

1. From ENVIRO, FILTER press "Enter".

2. Press "Next "to scroll through the 5 selections (very low, low, normal, high, very high).



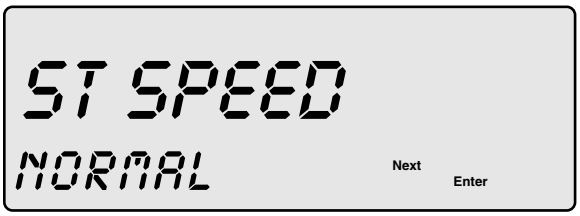
3. Press "Enter" to select and return to ENVIRO, ST SPEED.

To change Stability Speed

1. From ENVIRO, STABIL SPEED press "Enter".

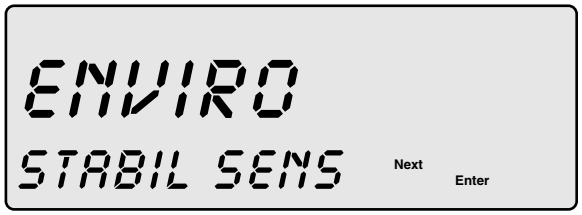
2. Press "Next "to scroll through the 5 selections (very slow, slow, normal, fast, very fast).

3. Press "Enter" to select and return to ENVIRO.



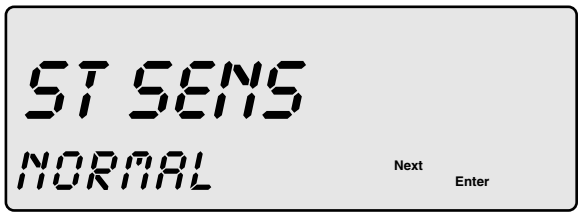
To change Stability Sensitivity

1. From ENVIRO, STABIL SENS press "Enter".



2. Press "Next" to scroll through the 5 selections (very coarse, coarse, normal, fine, very fine).

3. Press "Enter" to select and return to ENVIRO.



To change Autozero

1. From ENVIRO, AUTOZERO press "Enter".

2. Press "Next" to scroll through the 4 selections.

3. Press "Enter" to select and return to ENVIRO.

Animal Weighing Mode

Your balance is featured with an animal weighing mode to easily weigh animals which are continuously moving as a weight is taken. This mode must first be turned ON. The weigh screen will show Animal in the lower left corner when the animal weighing mode is ON. Animal weighing settings include: Stability Speed and Stability Sensitivity.

Animal Weighing Settings

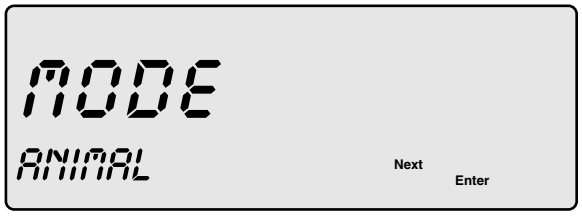
Stability Speed	(seconds)	Stability Sensitivity	(counts)
Slow	8	Very Fine	4
Normal	4	Fine	8
Fast	2	Normal	16
		Coarse	32
		Very Coarse	64

Changing the stability speed will vary the integration time. Changing the stability sensitivity is needed to filter the effect of the moving animal. If the lock does not come on, decrease the sensitivity by going to a coarser setting.
During weighing when the stability criteria is met the weight will lock on the display. When the weight is removed the display will unlock and be ready for the next sample.

To turn Animal mode ON

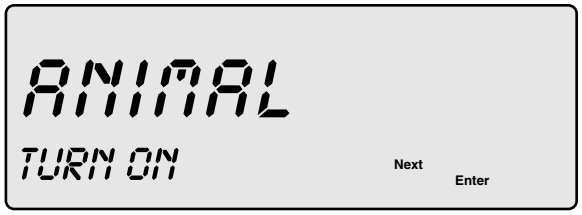
1. Select "Mode".

2. Press "Next" until MODE, ANIMAL.



3. Press "Enter" for TURN ON.

4. Press "Enter".

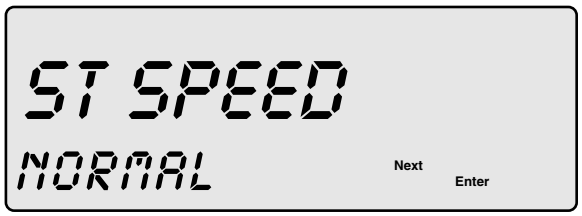


To change Stability Speed

1. From ANIMAL, STABIL SPEED press "Enter".

2. Press "Next" to scroll through the 3 selections.

3. Press "Enter" to select and return to ANIMAL.

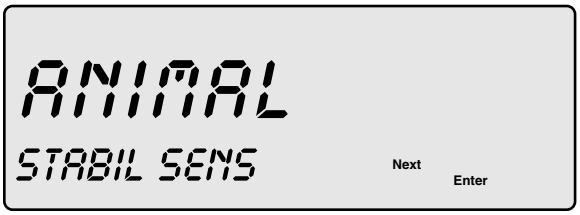


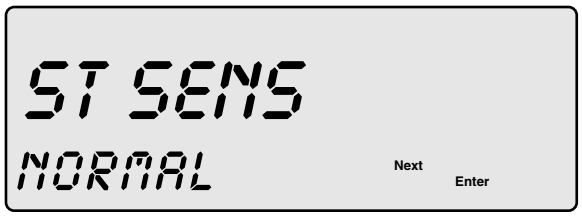
To change Stability Sensitivity

1. From ANIMAL, STABIL SENS press "Enter".

2. Press "Next" to scroll through the 5 selections.

3. Press "Enter" to select and return to ANIMAL.





Note **To rapidly return to the Animal set up, press Select from the Animal Weigh screen.**

To turn OFF animal weighing mode

1. From ANIMAL, TURN OFF press "Enter" and return to the weigh display.

Count Mode

The balance can be set to count common pieces that are within the capacity and resolution of the balance. Please note that counting accuracy will be affected by weight variation among pieces. Select parts which are appropriate to the resolution of the balance:

- The total sample weight must not exceed the balance capacity
- The weight of each piece must be greater than the resolution of the balance.

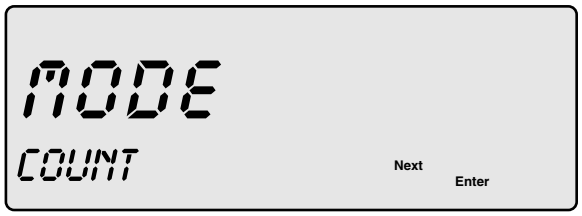
See "Specifications" inside the front cover for the capacity and resolution of your particular balance.

Piece Count allows the operator to perform basic counting of identical items. This operation is carried out by first weighing a known number of items (5, 10, 20, 50 or 100), as follows:

1. Select "Mode".

2. Press "Enter".

3. Count out 5 pieces and place them on the weighing pan.



4. Press "Enter". The balance will store the per-piece value and return to the weigh display with the precise total in the lower left corner. To count additional pieces, simply add them to the weighing pan.

Note **The select softkey in the count mode will return to the count setup menu.**

To turn the Count mode off.

1. Press "Select".
2. Press "Next" until TURN OFF and press "Enter".

Serial

The balance has a serial port which enables communications with other serial devices such a printer or computer. The Interface Applications section of this manual will assist in selecting the proper set up parameters. Serial set up parameters include: print mode, print format including custom printout, baud rate, parity, bit, echo and handshake. The following are instructions to change set up parameters.

Print mode:

Manual - serial port only outputs weight data when the Print key is pressed and the balance is stable.

Stable - serial port outputs weight data automatically when stable

Interval – serial port output at the set time interval

SAMPLE OUTPUT CHART

Actual output may vary decimal places depending on model.

Output can be in one of the following formats:

Analytical Balances

Type	Stable	Unstable
Type 1	1 +100.0001	U +100.0001
	1 + 0.0001	U + 0.0001
Type 2	S +100.0002	SD +100.0002
	S + 0.0002	SD + 0.0002
Type 3	ST +100.0001	US +100.0003
	ST + 0.0001	US + 0.0003
Type 4	+ 100.0003	+ 100.0002
	+ 0.0003	+ 0.0002
Type 5	+100.0002 GRAMS	+100.0002 US
	+ 0.0002 GRAMS	+ 0.0002 US
Type 6	+100.0002 GRAMS	+100.0001 GRAMS
	+ 0.0002 GRAMS	+ 0.0001 GRAMS
Type 7	1 + 100.0002 GRAMS	U + 100.0003 GRAMS
	1 + 0.0002 GRAMS	U + 0.0003 GRAMS
Type 8	S 100.0002 g	SD 100.0002 g
	S 0.0002 g	SD 0.0002 g
Type 9	1+0100.0002	U+0100.0002
	1+0000.0002	U+0000.0002

SAMPLE OUTPUT CHART

Actual output may vary decimal places depending on model.

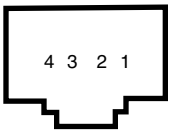
Output can be in one of the following formats:

Toploading Balances

Type	Stable	Unstable
Type 1	1 +100.002	U +100.002
	1 +100.003	U +100.003
Type 2	S +100.001	SD +100.001
	S + 0.002	SD + 0.002
Type 3	ST +100.003	US +100.003
	ST + 0.001	US + 0.003
Type 4	+ 100.003	+ 100.001
	+ 0.0001	+ 0.0001
Type 5	+100.002 GRAMS	+100.003 US
	+ 0.002 GRAMS	+ 0.003 US
Type 6	+100.001 GRAMS	+100.002 GRAMS
	+ 0.001 GRAMS	+ 0.002 GRAMS
Type 7	1 + 100.003 GRAMS	U + 100.001 GRAMS
	1 + 0.003 GRAMS	U + 0.001 GRAMS
Type 8	S 100.002 g	SD 100.003 g
	S 0.003 g	SD 0.003 g
Type 9	1+0100.001	U+0100.002
	1+0000.001	U+0000.002

Baud rates:	38,400	1,200
	19,200	600
	9,600	300
	4,800	150
	2,400	
Bits/Parity:	8 - none	
	7 - even	
	7 - odd	
	7 - none	
Echo:	Off, On	
Handshake:	XON/XOFF, None	

The serial port pin configuration:

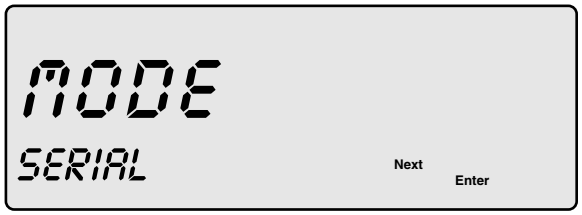


1 GND 3 OUT
2 IN 4 GND

To change print mode

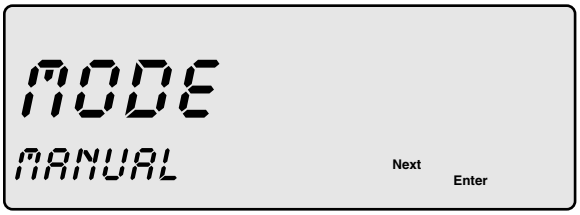
1) Select "Mode".

2) Press "Next" until MODE, SERIAL.

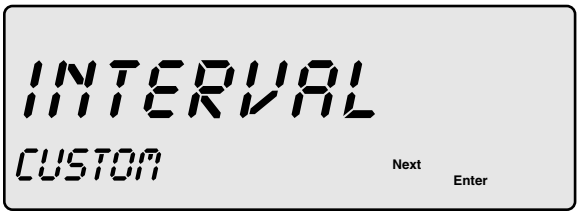


3) Press "Enter".

4) Press "Enter".



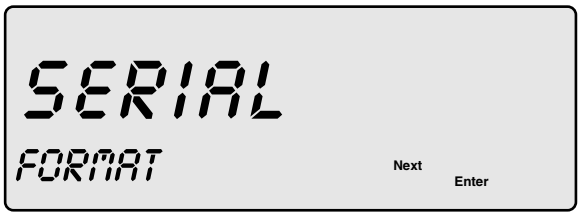
5) Press "Next" to scroll through selections and press Enter. A selection of 5, 10 or 60 seconds is standard or a custom number up to 9999 may be entered.



To change format

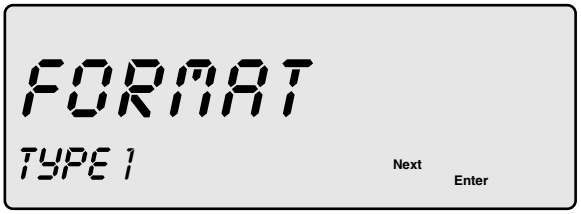
Nine selections of the format are preset for simple weight documentation or communications to a computer.

1. From SERIAL, FORMAT press "Enter".



2. Press "Next" to scroll through selections (Type 1-9).

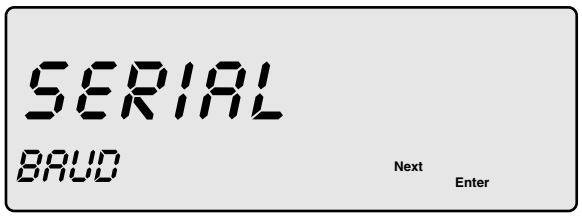
3. Press "Enter".



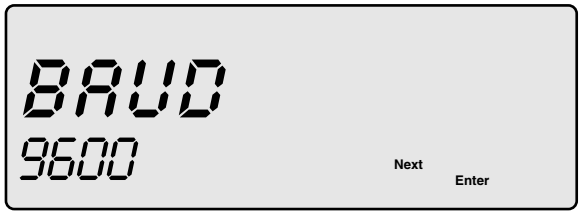
If using custom printout, the interval print cannot be set faster than the time to print the custom printout.

To change Baud rate

1. From SERIAL, BAUD press "Enter".



2. Press "Next" to scroll through selections (150-19200) and press "Enter".



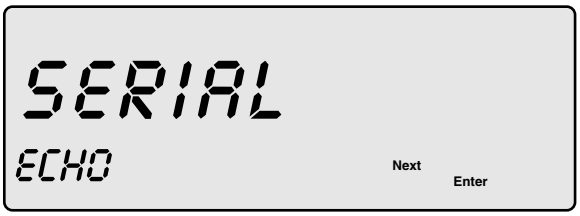
To change Bits/Parity

1. From SERIAL, PARITY press "Enter".

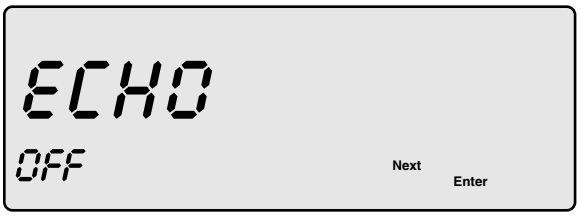
2. Press "Next" to scroll through selections (8-none, 7-even, 7-odd and 7-none) and press "Enter".

To change Echo:

1. From SERIAL, ECHO press "Enter".



2. Press "Next" to scroll through selections (Off and On) and press "Enter".



To change Handshake:

1. From SERIAL, HANDSHAKE press "Enter".

2. Press "Next" to scroll through selections (XON/XOFF or none) and press "Enter".

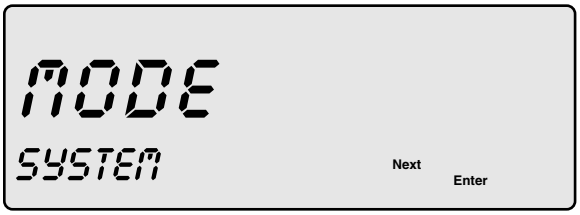
System

The balance features options to identify the specific unit,and its software version or date and time of last calibration. This screen also gives access to secured options intended for super users including a routine to adjust linearity. For access to the secured routines call your local distributor or Denver Instrument Company.

To check software version

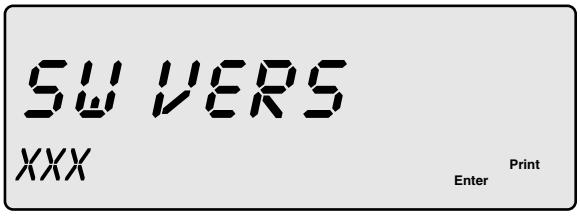
1. Select "Mode".

2. Press "Next" until MODE, SYSTEM.



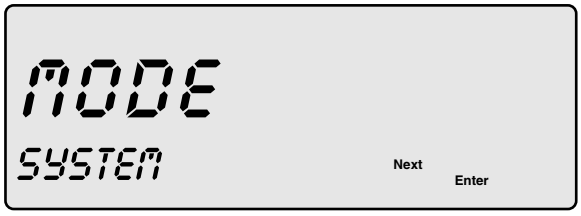
3. Press "Enter" to show SYSTEM, SW VERSION.

4. Press "Enter" to show SW VERS, XXX.

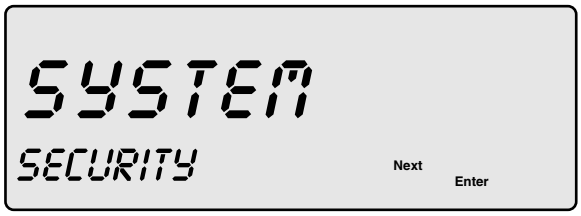


To enter security routines

1. From MODE, SYSTEM press "Enter".



2. Press "Next" until SYSTEM, SECURITY.



3. Press "Enter" for super user access.

4. Enter the security password using the arrow keys and press "Enter".

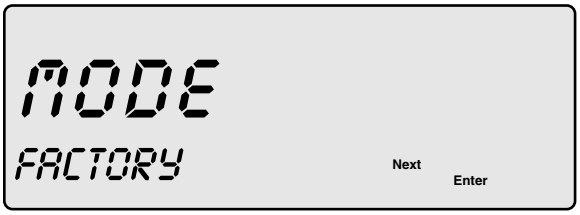
Factory Settings

The balance comes preset with factory default settings. At some time you may want to reset the balance to factory settings.

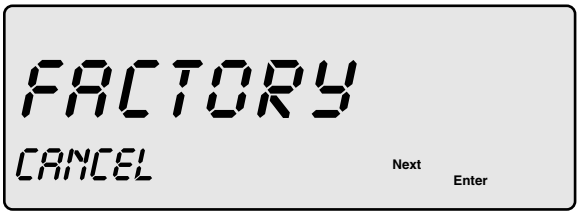
To reset to factory default settings

1. Select "Mode".

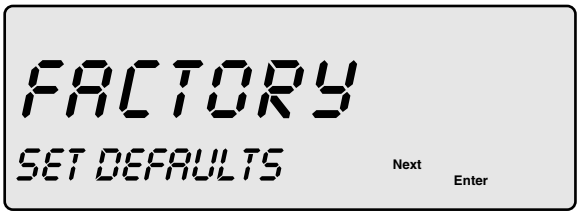
2. Press "Next" until MODE, FACTOR.



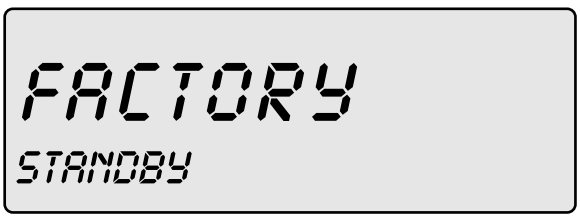
3. Press "Enter".



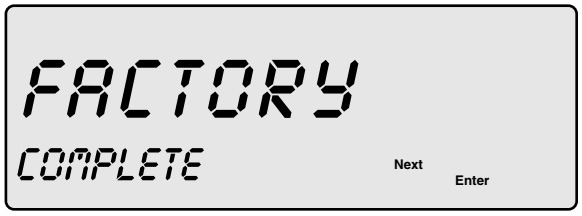
4. Press "Next".



5. Press "Enter". Displayed momentarily (15 seconds).



6. At COMPLETE, press "Enter" to return to the Weigh screen.



List of Factory Defaults

Units1	grams
Unit2	grams
Count mode	Off
Filter	Normal
Stability speed	Normal
Stability sensitivity	Normal
Auto-Zero	Normal
Serial print mode	Manual
Serial format	Type 1
Serial baud	9600
Serial bits/parity	8-none
Serial echo	Off
Serial handshake	XOn
Animal weighing	Off

Troubleshooting

Display Shows	Cause	Remedy
	Power cord not connected.	Connect cord.
(Blank Screen)	No power to outlet or improper voltage.	Check power supply and voltage switch.
	Temporary fault	Disconnect and reconnect power cord. (Wait at least five seconds before reconnecting it.)
	Bad connection in connecting cord.	Make sure connectors are securely clipped into sockets, disconnect and reconnect cord.
OVER	Weight exceeds balance capacity.	Reduce weight.
Unstable (Stability indicator does not appear and erratic weight display)	Air movement around balance.	Use draft shield and/or change environmental setting.
	Unstable location.	Move balance and/or alter filter setting.
	Sample not stationary.	Use animal weighing mode.
Incorrect weight reading.	Balance operating error.	Re-calibrate balance. Check level.
	Incorrect weigh unit.	Check weigh unit setting.
	Pan obstructed.	Check pan place ment. Check optional in use cover.

Interface Details and Serial Commands

Serial Commands		Command
SET KEYWORD PARAMETER GET KEYWORD DO KEYWORD "•" Decimal point 0 - 9 Numeric entry		
AS	Set and Get Autozero sensitivity Parameters for set are one of:	OFF NORMAL STRONG VERY STRONG
AU	Set and Get alternative units (UNITS2), Parameters for set are one of:	GRAMS KG MG MOMME OZA OZT LB DRAM CARAT GRAIN HTAEL STAEL TTAEL PENNYWEIGHT TOLA BAHT CUSTOM1 CUSTOM2
CE	Do external calibration procedure	
CU	Set and get current units to Primary (UNITS1) or Alternate (UNITS2) Parameters for set are one of:	PRI ALT
DS	Set and Get current display state Parameters for set are one of:	ON OFF
FL	Set and Get current environmental filter length Parameters for Set are one of:	VERY_LOW LOW NORMAL HIGH VERY_HIGH
PF	Set and Get current print format Parameters for Set are one of:	FORMAT_! FORMAT_2 FORMAT_3 FORMAT_4 FORMAT_5 FORMAT_6 FORMAT_7 FORMAT_8 FORMAT_9
PI	Set and Get current print interval Parameters for Set are interval in seconds	
PM	Set and Get current print mode Parameters for Set are one of:	MANUAL STABLE INTERVAL
PR	Do print current weight data	

Serial Commands		Command
PU	Set and Get Primary units (UNITS1) Parameters for Set are one of:	GRAMS KG MG MOMME OZA OZT LB DRAM CARAT GRAIN HTAEL STAEL TTAEL PENNYWEIGHT TOLA BAHT CUSTOM1 CUSTOM2
SB	Set and Get current serial port baud rate Parameters for Set are one of:	38400 19200 9600 4800 2400 1200 600 300 150
SE	Set and Get current serial port echo settings Parameters are Set for one of:	ON OFF
SH	Set and Get current Serial Port Handshake settings Parameters are Set for one of:	NONE XON CTS
SL	Set and Get current serial port parity setting Parameters for Set are one of:	8-none 7-OFF 7-ODD 7-EVEN
SP	Set and Get current stability speed Parameters for Set are one of:	VERY_FAST FAST NORMAL SLOW VERY_SLOW
SS	Set and Get current stability sensitivity Parameters for Set are one of:	VERY_COARSE COARSE NORMAL FINE VERY_FINE
SV	Get Software Version	
T		Zero (tare)
U1	Set and Get current value for custom 1 units Parameter for Set is multiplier conversion factor	
U2	Set and Get current value for custom 2 units Parameter for Set is multiplier conversion factor	
Z	Zero (tare)	

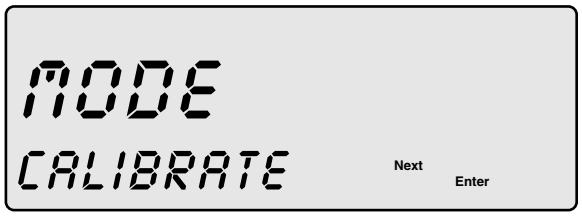
Linearity Procedure

(Version 3.10 and Later)

Class 1, calibrated weights MUST be used to set linearity. See attached chart for acceptable weight values for each model.

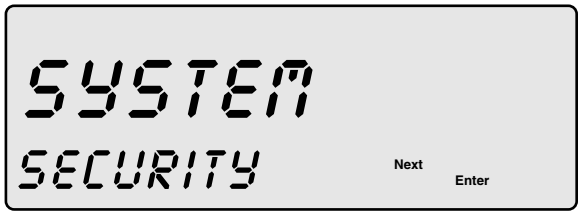
1. Remove any weight on the balance and press the "Zero" key to re-zero the balance.

2. Press "Mode" key. Display reads "MODE…. CALIBRATE".



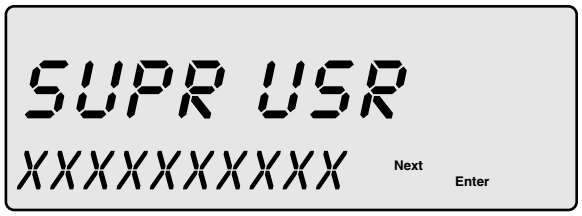
3. Press "Next" key until "SYSTEM" appears, then press "Enter".

4. Press "Next" key until "SECURITY" appears, then press "Enter".



(**NOTE!** If you have previously been in the security mode, and have not unplugged the balance, the next steps, 6-10 will be unnecessary.)

5. "SUPR USR" appears, as well as some asterisks, the first of which will be flashing.



6. Press the 'down' arrow key to advance the first asterisk to "L".

7. Press the 'right' arrow key to move to the next digit.

8. Press the 'down' arrow key to advance the second asterisk to "I".

9. Press the 'right' arrow key to move to the next digit.

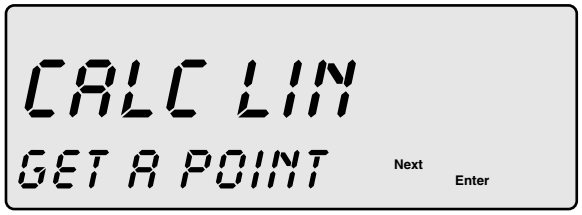
10. Press the 'down' arrow key to advance the third asterisk to "N".

11. Press "Enter". "MAINT….SCALE" appears.

12. Press "Select" key until "LINEARITY" appears.

13. Press "Enter". "CALC LIN…..GET A POINT" appears.

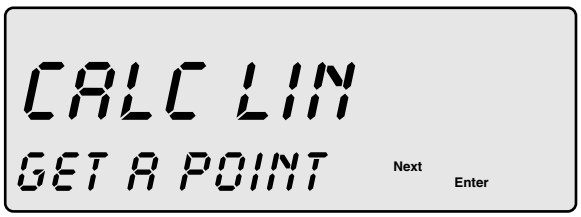
14. Press "Select" until "CLEAR DATA" appears.



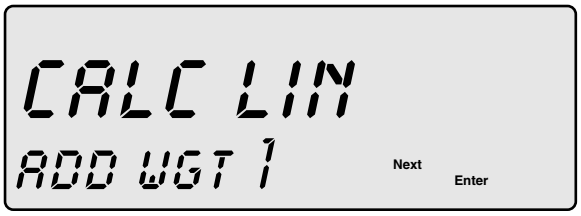
15. Press "Enter". "CALC LIN…..COMPUTE" appears.

16. Press "Select" until "GET A POINT" appears.

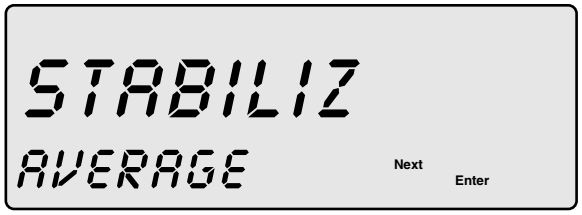
17. Press "Enter". "ADD WGT 1" appears.



18. Place 1st weight, according to attached chart for the model, on the pan.



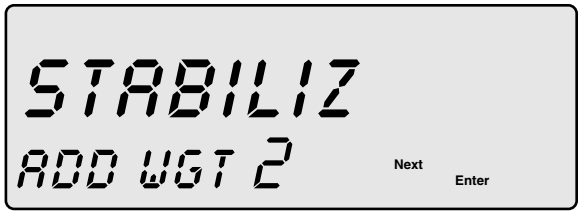
19. Press "Enter". Unit will display "STABILIZ", counting down, and then "AVERAGE", counting down, then "LIN WGT", and some numbers.



20. Remove weight, and press "Enter" twice.

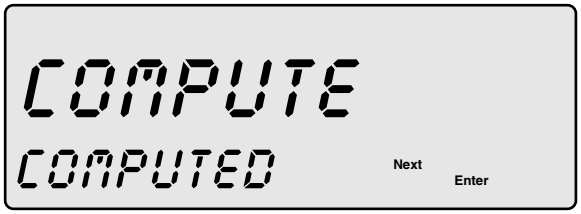
21. Unit will now display "ADD WGT 2".

22. Repeat this process until all of the weights indicated in the chart have been utilized.



23. Press "Enter".

24. Press "Select" until "COMPUTE" appears.



25. Press "Enter".
Unit should now display "COMPUTE….COMPUTED".

26. Press "Zero" button to go back to weigh mode, and check to see if linearity is set.

Linearity Weight Settings

Model	1	2	3	4	5	6	7	8
64	10	20	30	40	50	60		
104	10	20	50	60	70	90	100	
204	10	20	30	50	100	150	200	
203	10	20	30	50	100	150	200	
403	10	20	50	100	200	300	400	
402	10	20	50	100	200	300	400	
603D	50	100	200	300	400	500	600	
602	50	100	200	300	400	500	600	
2102	200	400	600	800	1000	1500	2000	
2101	200	400	600	800	1000	1500	2000	
4102D	200	500	1000	1500	2000	3000	4000	
4102	200	500	1000	1500	2000	3000	4000	
4101	200	500	1000	1500	2000	3000	4000	
6101	500	1000	2000	3000	4000	5000	6000	
8102D	1000	2000	3000	4000	5000	6000	7000	8000
8101	1000	2000	3000	4000	5000	6000	7000	8000
12001	1000	2000	3000	4000	5000	8000	10000	12000

Glossary of Terms

Average Piece Weight	The statistic average weight of a part used in part counting
Auto Zero	Automatically correcting the zero display due to slow drift.
Baud Rate	The transfer rate unit for serial data transmission in transitions per second between the computer and the printer.
Bit	Binary digit.
Calibration	A process where the balance is adjusted to weigh relative to a standard weight.
Capacity	The maximum mass that a balance is capable of weighing accurately. (See "Specifications" section or the max value on the product label for the capacity of your particular model.)
Percent Weighing	Weighing application that uses a preset reference value to equal 100% with the numeric display showing the deviation of the sample weight in percent.
Dynamic Fine Range	A dynamically switching fine resolution (10x) whose effective measurement range is dependent upon the sample weight and the gross weight.
Electronic Balance	An electronic balance senses physical force when weight is placed on it and translates this force into digital form.
Factory Setting	Preset operation parameters set by the manufacturer for normal applications and conditions. These can be changed by the user, but they also can be reset using the Factory mode.
Gross Weight	The total weight on the balance including tare weight.
Leveling	Horizontal aligning of the balance during installation using a level vial.
Linearity	The amount a weight reading may deviate from a straight line between 0 grams and the maximum capacity of the balance.
Parity	A parameter whose values may be odd, even, or none which is used in a method of error checking information in a data transmission.
Permissible Weight	An acceptable standard mass which can be used to calibrate the balance.
Piece Counting	A weighing application for determining the piece count of identical weighing pieces.
Resolution	The smallest fraction of a weight that a balance is able to discern. Example: If weight were added to a balance in increments of .0001grams, the resolution would be defined as the amount added before the balance reading would change.

Glossary of Terms (continued)

Setup	The process of configuring the balance to operate in a certain way.
Zero Weight	Weight of a container or package that should not be taken into account in the weighing. This value is also referred to as the tare weight.
Zeroing	Compensating for a tare weight by setting the display of the balance at zero with the container or other packaging material on the weighing pan. Often called taring.
Stable Indicator	Symbol that is automatically displayed when the balance reading or weight is not stable. It disappears when the reading becomes stable.
Weigh Pan	The round or square surface upon which the object is placed for weighing.
Weigh Unit	How the weight of the object is expressed.

Gram Conversion Chart

1 Gram	=	0.03527396	AV OZ
		0.03215075	TROY OZ
		0.00220462	POUNDS
		0.64301493	PENNY WEIGHT
		15.43235835	GRAIN
		0.77161792	SCRUPLE
		0.56438339	AV DRAM
		0.03527396	AP DRAM
		5.00000000	CARAT
		0.02671725	TAEL (HK)
		0.02645547	TAEL (S)
		0.02666667	TAEL (T)
		0.26666670	MOMME
		0.08573532	TOLA
		0.06596306	BAHT
		0.00980665	NEWTON

Menu Tree

From the weigh screen press the Mode key:
(Enter key to go right in chart, Next key to go down in chart)

Screen	Screen	Screen	Screen	Screen
CALIBRATE	ADD WEIGHT	CAL OK, Weigh screen		
UNITS	UNIT1/grams	UNIT2/grams	Weigh screen	
	Kilogram	Kilogram		
	Milligrams	Etc		
	Ounce			
	Troy Ounce			
	Pound			
	Grain			
	Pennyweight			
	Carat			
	Tael Hong Kong			
	Tael Singapore			
	Tael Taiwan			
	Momme			
	Dram			
	Baht			
	Tola			
	Custom	00000.000000	UNIT2/grams	
ENVIRO	FILTER	NORMAL	STABIL SPEED	
		HIGH	"	
		VERY HIGH	"	
		VERY LOW	"	
		LOW	"	
	STABIL SPEED	NORMAL	STABIL SENS	
		SLOW	"	
		VERY SLOW	"	
		VERY FAST	"	
		FAST	"	
	STABIL SENS	NORMAL	AUTOZERO	
		FINE	"	
		VERY FINE	"	
		VERY COARSE	"	
		COARSE	"	
	AUTOZERO	NORMAL	Weigh screen	
		STRONG	"	
		VERY STRONG	"	
		OFF	"	
ANIMAL	TURN ON	STABIL SPEED		
	STABIL SPEED	NORMAL	STABIL SENS	
		SLOW	"	
		FAST	"	
	STABIL SENS	NORMAL	Weigh screen	
		FINE	"	
		VERY FINE	"	
		VERY COARSE	"	
		COARSE	"	

Menu Tree (continued)

Screen	Screen	Screen	Screen	Screen
COUNT	ADD 5 PCS	Weigh Screen		
	ADD 10 PCS	"		
	ADD 20 PCS	"		
	ADD 50 PCS	"		
	ADD 100 PCS	"		
	TURN OFF/ON	"		
SERIAL	PRINT MODE	MANUAL	FORMAT	
		STABLE	"	
		INTERVAL	CUSTOM	0000 secs
			5 SEC	FORMAT
			10 SEC	"
			60 SEC	"
	FORMAT	TYPE1	BAUD	
		TYPE2-9	"	
SERIAL	BAUD	9600	PARITY	
		4800	"	
		2400	"	
		1200	"	
		600	"	
		300	"	
		150	"	
		38400	"	
		19200	"	
	BITS/PARITY	8-NONE	ECHO	
		7-EVEN	"	
		7-ODD	"	
		7-NONE	"	
	ECHO	OFF	HANDSHAKE	
		ON	"	
	HANDSHAKE	XON/XOFF	Weigh Screen	
		NONE	"	
		CTS		
TARE WEIGHTS	SELECT	No Container	STORE-AUTO	
	STORE-AUTO	CONTAINER 1-10		
	STORE-MANUAL	CONTAINER 1-10	(* to store manual)	
	CLEAR	Clear All	SELECT	
		CNTNR 1-10		
BATCH	TURN ON/OFF	Weigh Screen	(* to next setup option)	
SYSTEM	SW VERSION	VX.X	BALANCE ID	
	BALANCE ID	XXX-XXX-XXX	LAST CAL	
	LAST CALL	CAL DATE	SECURITY	
		CAL TIME		
		CAL WEIGHT	(secured area)	
	SECURITY	SUPR USR XXX	Weigh screen	
PASSWORD	XXXXXXXX	Weigh screen		
SPC GRAVITY	WEIGH ABOVE	WEIGH BELOW		
	WEIGH BELOW	Calculates Specific Gravity		
FACTORY	CANCEL	Weigh screen		
	SET DEFAULTS	STANDBY (15 seconds)		
		Then COMPLETE	Weigh screen	

External Transformers

One of the following external transformers is supplied for use with the balance:

Part #	input	output	mains plug type
101627.1	120 VAC ~ 60 hz	15 VDC ⎓ @ 800 mA	North American NEMA 5-15p
101556.1	230 VAC ~ 50/60 hz	15 VDC ⎓ @ 800 mA	Continental European CEE 7/16
101557.1	240 VAC ~ 60 hz	15 VDC ⎓ @ 800 mA	United Kingdom BS 1363

The tolerance for AC input voltage is +/- 10%

Other main plug configurations may be available. Contact your local distributor or Denver Instrument Company.

Accessories

A variety of accessories are available from Denver Instrument to enhance your weighing experience. Contact your local distributor or Denver Instrument for part numbers and pricing.

Spill Cover
Lock Down device
Weigh Below
Draft Ring (for 4.5 and 6 inch round pan models only)
Draft Shield (for round pan models only)
Calibration Weights
Cable, RJ11 (4) - DB25S IBM-PC
Cable, RJ11 (4) - DB25P Printer
Cable, RJ11 (4) - DB9S IBM-AT
Cable, RJ11 (4) - Blunt
Printer, thermal 4" print area, parallel and serial ports
Printer, dot matrix 2" print area, serial only

Cleaning Instructions

- Disconnect electrical power from the balance before cleaning.
- Do not immerse the balance in any liquid.
- Use mild soap or diluted bleach (9 parts water to 1 part bleach) with a soft cloth.
- Do not use chemical solvents for cleaning.
- Before using any cleaning or decontamination methods, except those recommended by the manufacturer, verify with the manufacturer that the proposed method will not damage the equipment.

Maintenance

WARNING
There are no user serviceable parts within the unit.
Opening the case will void the warranty.

All repairs must be performed by a factory-trained technician. Contact Denver Instrument Company for your nearest authorized repair location.

Warranty Instructions

1. Please return the prepaid, pre-addressed Purchase Registration Card to Denver Instrument Company promptly upon your purchase of the Denver Instrument product. The return of the card is not a condition precedent to warranty coverage.

2. If you have any questions about a Denver Instrument product, please call toll-free, **1-800-321-1135** (or FAX description of problem to (303) 423-4831) for technical assistance.

3. If it becomes necessary to return your Denver Instrument product for service, you must obtain a **"Return Authorization Number"**. Please pack the product securely in its original approved packing carton or other suitable container and include your Return Authorization Number on the shipping label and as a precaution also a note inside the box. Shipping charges must be fully prepaid.

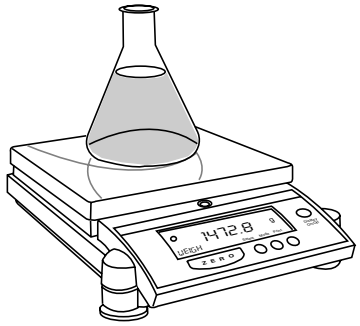
   Ship to:

   Denver Instrument Company
   6542 Fig Street
   Arvada, Colorado 80004

Purchase Date: _____

Model: _____

Serial Number: _____



Denver Instrument Company

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