HA-202M

SEMI-MICRO ANALYTICAL BALANCE

INSTRUCTION MANUAL

Instruction-HA-202M-v.2.a 93.06.25

SEMI-MICRO ANALYTICAL BALANCE

A&D Company, Limited

Table of Contents

Compliance with FCC Rules

Please note that this equipment generates, uses and can radiate radio frequency energy. This equipment has been tested and has been found to comply with the limits of a Class A computing device pursuant to Subpart J of Part 15 of FCC rules. These rules are desingned to provide reasonable protection against interference when equipment is operated in a commercial environment. If this unit is operated in a residential area it might cause some interference and under these circumstances the user would be required to take, at his own expense, whatever measures are necessary to eliminate the intrference.

(FCC = Federal Communications Commission in the U.S.A.)

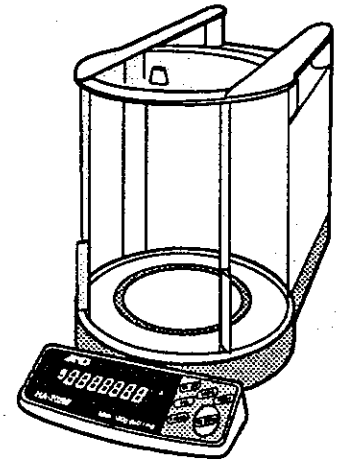
The information contained in this manual and the equipment described is subject to change without any obligation on the part of the manufacturer to notify the user.

A&D makes no warranty or representation for this manual, ether expressed or implied, with respect to published quality, completeness, salability, or fitness for a particular purpose.

In any event A&D will not be liable for direct, indirect, special, incidental, or consequential damages resulting from any defect in this manual.

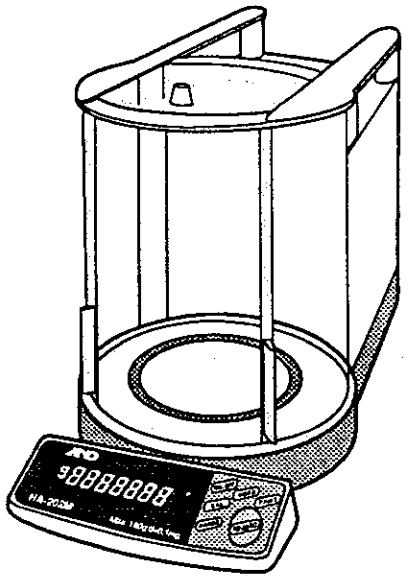
HA SERIES • Section A

Set-Up

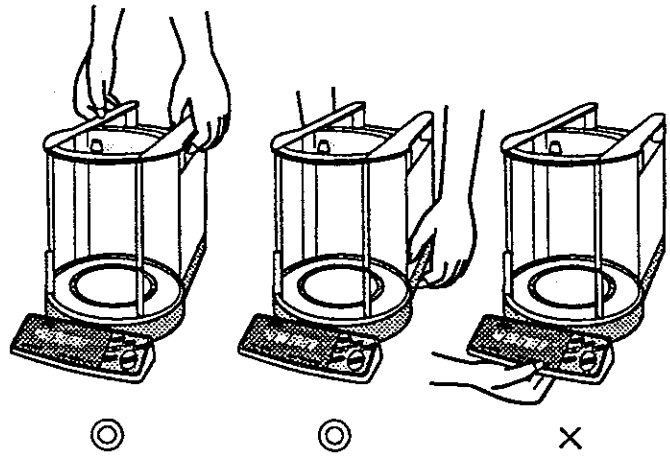


Unpacking Your HA

Main Body

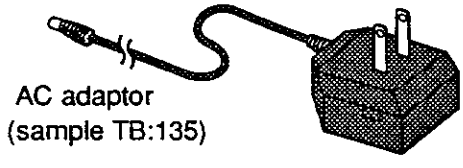


Special care should be taken when handling a precision balance. It may be convenient to keep the packing material, should the balance require later movement, shipping or storage.

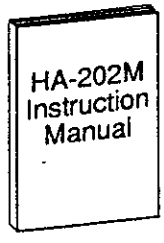


In addition to this manual, the package contains the following components:

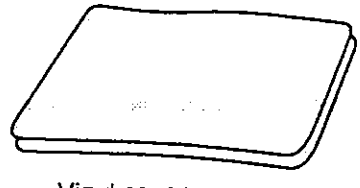
Accessories


AC adaptor
(sample TB:135)


Spare fuse
(500mA, Time lag)



Instruction Manual

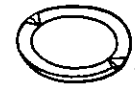

Vinyl cover


Indicator cover


Three- channel miniature plug
(For external input terminal)

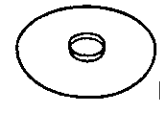

Front door knob (2)/Joint knob


Draft ring


Weighing pan


Balance weight


Pan support

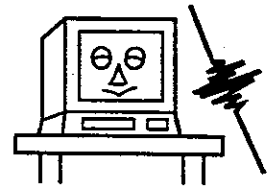

Dust guard

Best Conditions for Weighing

To obtain the best performance using the HA series electronic force balance, follow the installation conditions indicated below:

- ❑ Level the balance. (Check using the level gauge on the rear of the balance.)
- ❑ Ideal ambient temperature and humidity should be 20°C±2°C and 45 to 60%RH, respectively.
- ❑ The room in which the balance is used should be free of dust.

- ❑ The balance should be placed on a hard stable surface. (Slate is most suitable)



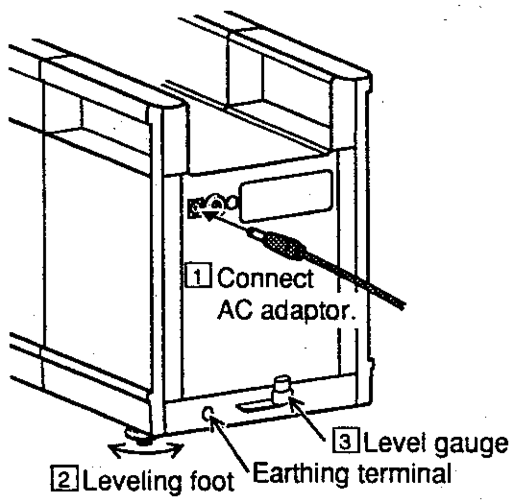
- ❑ Measurements should be made with the balance located near the corner of the room. There usually is less vibration and traffic in corner areas.
- ❑ Avoid placing the balance at the entrance where the effects from temperature variations and air flow are relatively bigger.
- ❑ Do not install the balance in the draft from an air conditioning vent.
- ❑ Do not install the balance in direct sunlight.
- ❑ Do not install the balance near equipment that generates a magnetic field.

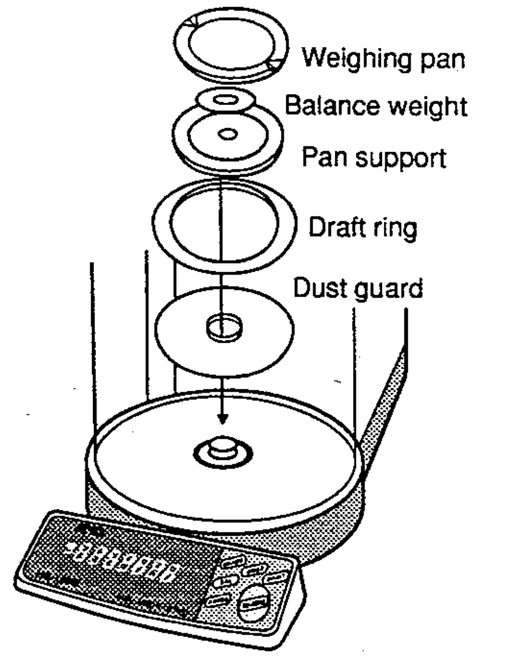
- ❑ Keep the balance apart from the equipment generating noise such as electronic motors. If it cannot be avoided, it should be grounded.
- ❑ Be sure to warm up the balance one hour or more before use or place it in the stand-by state (display-off state, refer to **page A•5**) after use.

Setting Up Your HA Balance

1. Put the balance on a hard stable surface (refer to Best Conditions For Weighing on the **previous page**).

Adjust the leveling feet [1] so that bubble in the level gauge [2] is located at the center of the red circle. Set the dust guard, draft ring, pan support, balance weight, and weighing pan.





2. Insert the AC adaptor plug. [3]

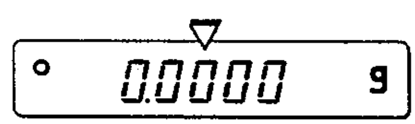
When the plug is inserted, a power fail display may illuminate. See the **next page.**

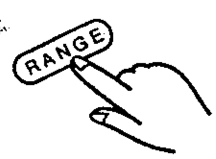
3. 

▶ Press the (ON : OFF) key.

○ All displays should illuminate.

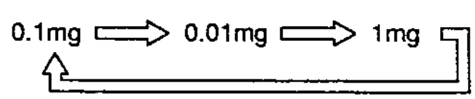
○ Zero should then be displayed.



4. 

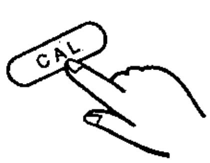
▶ Press the (RANGE) key.

○ The minimum display is changed everytime this key is pressed.



5. Insufficient warm-up may cause an inaccurate measured value. Connect the AC power and allow at least one hour for the balance to warm up. (Special care is required when measuring in the 0.01 mm range.)

6. Perform auto calibration once the balance has warmed up. (Refer to **"Auto Calibration"** on **page C•4**.)



▶ Press the (CAL) key.

Power Supply Notes

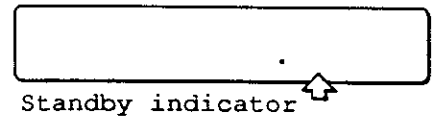
As long as the AC adaptor is connected, the balance is always in the energized state. This state will not adversely effect the balance.
Before using, be sure to energize (warm up) the balance at least one hour.

Display-off State

○ With the AC adaptor connected to the balance, the display remains off due to the **"Display-off State"**. In this case, there are two types of displays as indicated below:

❑ Power indicator

The rightmost decimal point should illuminate.
This display usually appears in the display-off state.



❑ Power failure

"P FAIL" appears when the power is interrupted (due to power failure) during normal use.

Display ON & Power Errors

When the power is applied or turned on, the balance self-diagnoses any possible errors in its operation. If an error is detected, the error display will appear.

Power failure

"P FAIL" appears when the power is interrupted during normal use

▶ Press the ON : OFF key.

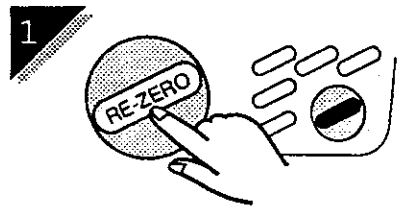
Error indicating an unstable state

If an unstable condition exists for more than 15 seconds, the balance will not display zero.
"Error 1" will be displayed.

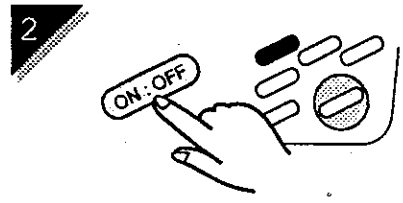
▶ Check the clearance between the draft ring and the pan.

Reset the pan and press the ON : OFF key.

▶ If "Error 1" is displayed even with the pan properly set, the error may be the result of a poor working environment.

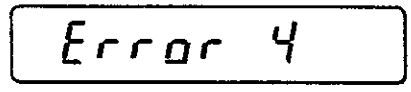


When the (RE-ZERO) key is pressed, a value zero should be displayed. Check the installation conditions on **page A•3**, especially for the draft and vibration.



When "Error 1" still appears, press the (ON : OFF) key and then change the C-Parameter setting from "Cond ?CO" to "Cond 3 CO". (To change C-Parameter settings, refer to **page E•3** and **E•4**.)
If the error continues, ask for servicing.

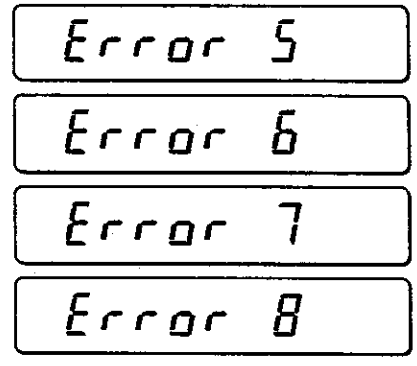
☐ Weighing pan error



This error occurs when the weighing pan and pan support are not set properly or when the (ON : OFF) key is pressed with something on the weighing pan.

▶ Properly assemble the weighing pan and pan support. Remove any objects that may be on the weighing pan.
If the error is still continued, ask for servicing.

☐ Memory error



"Error 5" to "Error 8" indicates a balance memory error.

▶ Disconnect the AC power. After several seconds, reapply power.
If this error still continues, ask for servicing.

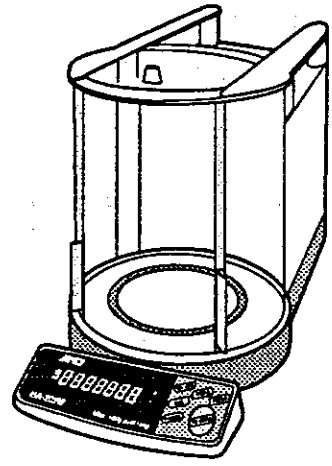
☐ Blinking of the "g" mark

Blinking of the "g" mark does not mean an error but indicates that there has been a change in the ambient temperature

▶ Approximately 2 minutes later, the automatic self-calibration function starts auto calibration.
Refer to "Auto Calibration" on **page C•3.**

HA SERIES • Section B

Introduction

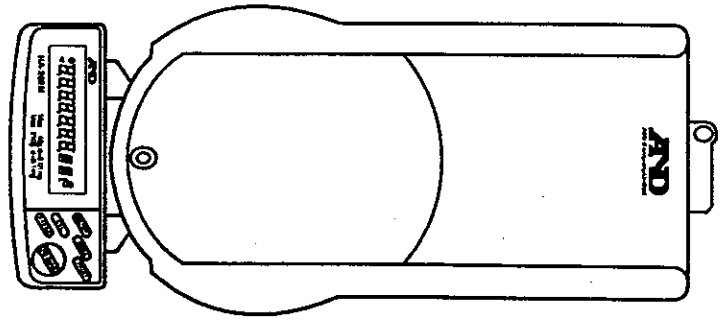


Specifications

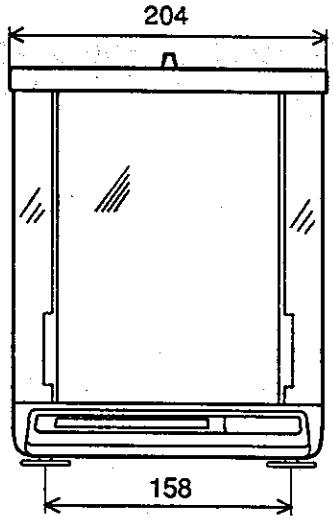
		HA-202M	
		0.01 mg range	0.1 mg range
Gram	(g)	42 × 0.00001 g	210 × 0.0001 g
miligram	(mg)	42000 × 0.01 mg	210000 × 0.1 mg
Decimal Ounce	(0z)	1.4 × 0.000001 oz	7.4 × 0.00001 oz
Troy Ounce	(ozt)	1.3 × 0.000001 ozt	6.7 × 0.00001 ozt
Penny weight	(dwt)	27 × 0.00001 dwt	135 × 0.0001 dwt
Carat	(ct)	210 × 0.0001 ct	1050 × 0.001 ct
Momme	(mm)	11 × 0.00001 mm	56 × 0.0001 mm
Grain Unit	(GN)	648 × 0.0002 GN	3240 × 0.002 GN
Tola	(t)	3.6 × 0.000001 t	18 × 0.00001 t
Tael	(TL)	1.1 × 0.000001 TK	5 × 0.00001 TL
Display by an arbitrary coefficient factor*	[MLt]	———	0.000210 × 0.000001 to 2100000 × 1
Maximum Displayed capacity		42.0000 g	210.0000 g
Repeatability (standard deviation)		0.00002 g	0.0001 g
Linearity		± 0.00003 g	± 0.0002 g
Stabilization (typically)		8 seconds	4 seconds
Sensitivity drift		± 1ppm/°C (10°C to 30°C / 50°F to 86°F)	
Operating environment		5°C to 40°C / 41°F to 104°F, RH<85%	
Display update		4 per sec. (when data stable), 8 per sec. (when data unstable)	
Pan size		ø80 mm (ø3.2 inches)	
Chamber dimensions		ø178 × 212 (H) mm	
Balance dimensions		204 (W) × 465 (D) × 265 (H) mm	
Power		100, 120, 220, 240 V_{AC} ,50/60Hz as required, (factory preset) 50/60 Hz (AC adoptor)	
Net weight (approx.)		8.0 kg / 18 lb	

* Display by an arbitrary coefficient.
The value when the gram value is multiplied by an arbitrary coefficient is displayed.
For details, refer to **page B•12.**
Specifications subject to change for improvement without notice

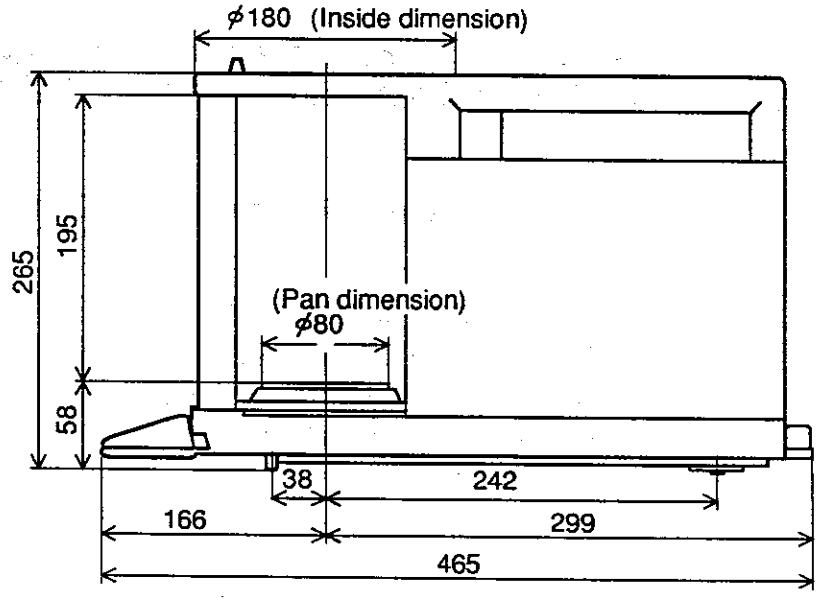
Dimensional Outline Drawing



TOP VIEW



FRONT VIEW



SIDE VIEW

Features

- ❒ This electronic balance has an automatic self-calibration function. With this function, as soon as an change in ambient temperature is sensed, calibration is automatically performed using built-in calibration weights. (Sensitivity drift and linearity are also calibrated.)
- ❒ The cylindrical chamber enables front measurement, providing easier operation than with conventional types.
- ❒ Weighing units can be grams **'g'**, milligrams **'mg'**, decimal ounces **'oz'** (avoir), troy ounces **'ozt'**, penny weights **'dwt'**, carats **'ct'**, mommes **'mm'**, grain units **'GN'**, tolas **'t'**, and taels **'TL'**. **'MLt'** is displayed when the gram value is multiplied an arbitrary coefficient.
- ❒ A dedicated range key easily enables speedy measurement according to the required measuring accuracy.
- ❒ An input jack on the rear of the balance enables external re-zero control, external command, or a vibratory spoon (option).
- ❒ An underhook weighing fitting for easy measurement of specific gravity is provided as a standard equipment.

Options

- ○ **OP-03 (Option)**
  This serial interface (bidirectional RS-232C and current loop) can be installed by the user.

- ○ **Vibratory Spoon AD-1651 (Option)**
  This spoon is used for extraction and mixing of small amounts of leaves and dyes. It uses the frequency resonating method to allow for frequencies from 110Hz to 230Hz. The connection of this spoon to the HA series balances will enable auto measurement.
  (The target weight can be set by the front panel key on the balance HA or by actually placing the reference weight.)

- ○ **Compact Printer AD-8121 (Option)**
  This thermal serial impact dot-matrix printer (with statistical operation functions) can print out the weight value, total weight, count, standard deviation, etc.

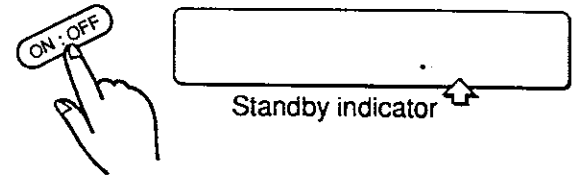
- ○ **OP-11 (Option)**
  The OP-11 is a locked anti-theft device which secures a balance on a table to prevent victimization by theft. (The balance table mounting section should have a thickness of 10cm max. and a ϕ20mm to ϕ25mm hole.)

Stand-by State

As long as the AC adaptor is connected, the electronic balance is always in the energized state. This state will not adversely effect the balance.
Before using, be sure to energize (warm up) the balance for at least one hour.

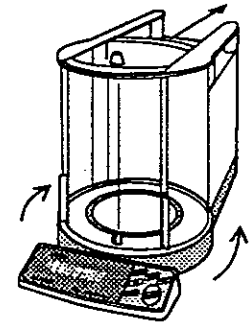
○ **"The stand-by state"** indicates a state in which the AC adaptor is connected and the balance display is off.

▶ Use the (ON : OFF) key to turn on and off the display. When the balance is in the stand-by state, the rightmost decimal point should be illuminated.

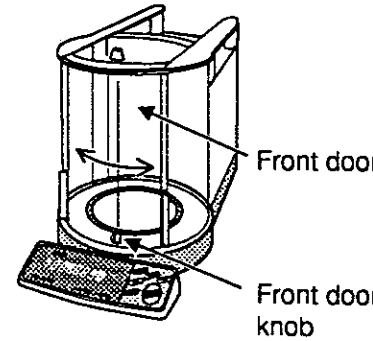


Door Opening/Closing

❒ Open the doors properly (to reduce the influence of air flow).



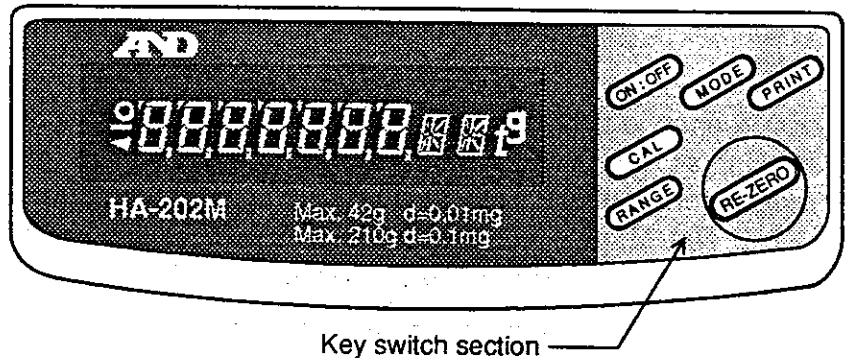
❒ Stick on door knobs supplied are convenient in opening and closing the front door.



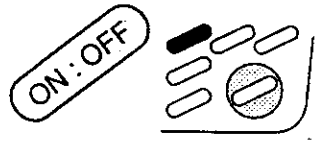
C-Parameter Settings

In HA series, the internal settings of the balance can be changed according to ambient environments and applications.
These settings can freely be changed and stored in the memory, and retained when the AC adaptor is disconnected.
A list of C-Parameter settings and alteration methods are indicated in **pages E•2** and **E•3**, respectively.
For details, refer to **"The C-Parameter Settings"** (on **pages E•4** to **E•13**).

The Display and Keyboard

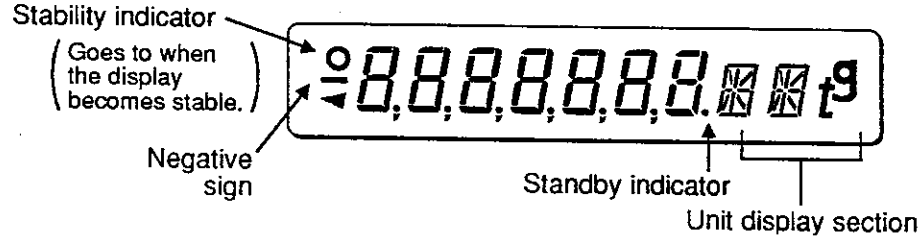


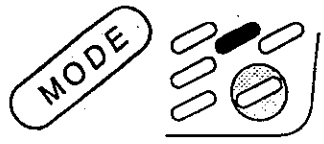
Press the center of each key switch firmly. When the key switch is pressed, a "beep" sound is emitted.
(Do not use a pointed object such as a pen.)



ON : OFF key

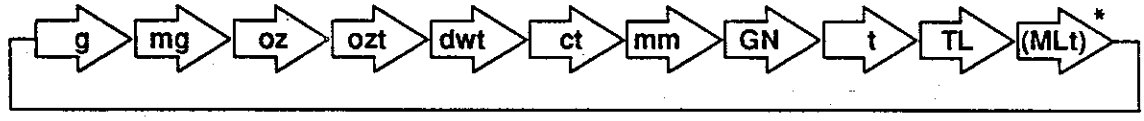
- The (ON : OFF) key turns on and off the display. Irrespective of operating (ON : OFF) key, the balance is in the energized state, if the AC adaptor is connected.
- When the display is turned on, all displays appear for approximately 10 seconds during which an operation check is performed with the two built-in weights going up and down.
  A stability indicator "8", negative sign "-", and weight value "8.8.8.8.8.8.8." are displayed. A single decimal point, to the right of the last digits, indicates that power is connected when the display is off.
  The three-digit section next to a decimal point indicates the unit.



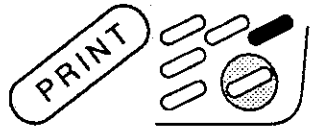


MODE key

- ❒ When the MODE key is pressed, the display mode is changed.
- ❒ Weighing units can be grams **'g'**, milligrams **'mg'**, decimal ounces **'oz'** (avoir), troy ounces **'ozt'**, penny weights **'dwt'**, carats **'ct'**, mommes **'mm'**, grain units **'GN'**, tolas **'t'**, and taels **'TL'**. (Refer to **"Weighing Units and Their Conversions"** (on **page B•14**) for more information concerning the different weighing units.) The **'MLt'** when the gram value is multiplied by an arbitrary coefficient can also be displayed. (For details, refer to **page B•12**.)
- ❒ The display mode is changed in the following order:

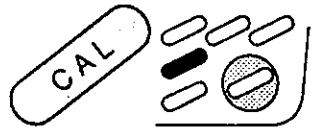


* In the MLt mode, no display is made on the unit section during weighing.
Coefficient is 1 at shipment time.



PRINT key

- ❒ When the balance is connected to a printer or computer, the PRINT key is used to transfer data.
  In this case, the serial interface OP-03 (option) is also needed. (Refer to **Page F•1**.)

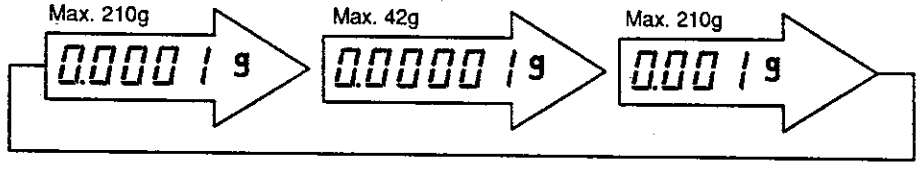


CAL key

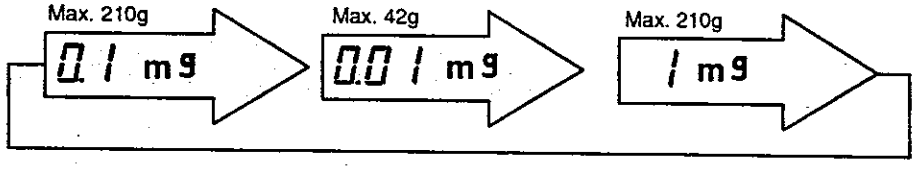
- ❒ When the CAL key is pressed, calibration is performed.
  After warming up the balance sufficiently, make sure that nothing is on the pan and press the CAL key. Calibration weights (200g × 2) is automatically applied to the balance mechanism, and then removed. (Refer to **"Calibration"** on **page C•1**.)
- ❒ To make precise measurements, calibration should be made at least once a day.
- ❒ When the operating temperature changes, the auto self-calibration function (on **page C•3**) is activated to perform full-auto calibration without touching the key.

RANGE key

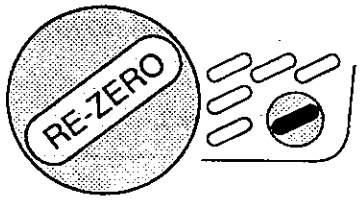
- When the (RANGE) key is pressed, the min. display and maximum range amount are changed.
- When the unit is a gram



When the unit is a milligram



- When 42g on the 0.01 mg range, the range is automatically switched to the 0.1 mg range (automatic range switching function). However, this function can be turned off by changing the internal settings. (Internal Settings "**AL-r PC1" page E-3**)
- Selecting the 0.01 g range using the (RANGE) key will increase the time required to stabilize the balance. This facilitates faster measurement.



RE-ZERO key

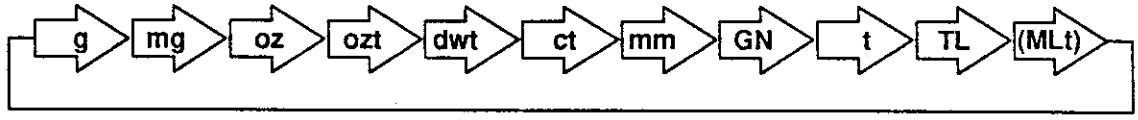
- When the (RE-ZERO) key is pressed, the display is set to zero.

  The taring operation can be performed up to the max. balancing amount.

- If the display is off from zero, press the (RE-ZERO) key to set the display to zero.

Selecting Weighing Units

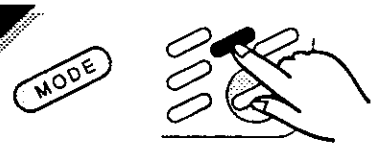
The HA series balances are multi-functional instruments where switching between the weighing units contained in the balance software is done by pressing the MODE key. You may use all of the units, or at this software level ***you can disable the weighing units you don't regularly use.*** Also, some dealers may initially turn OFF units which are not regularly used, but you may want to turn them back ON. The complete weighing mode cycle is as follows (if some are missing please refer to your dealer):



To Turn Weighing Units OFF or ON

To return to the normal mode during operation, press the ON : OFF key.

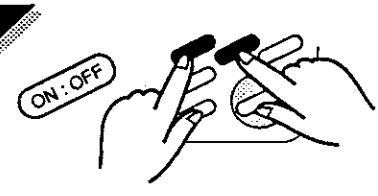
1



▶ After setting the display to off, press and hold the MODE.

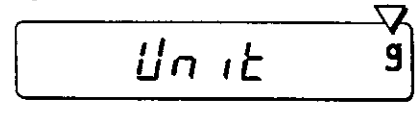
key.

2

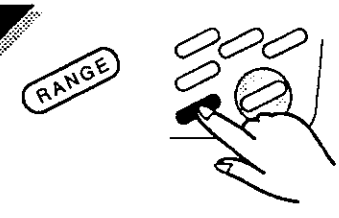


▶ With the MODE key held down, press the ON : OFF key.

○ "Unit g" is displayed.

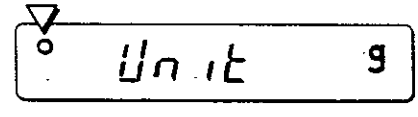


3

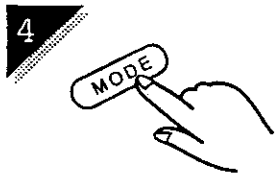


▶ When storing a gram "g" value, press the RANGE key.

○ A stability indicator "°" goes on.

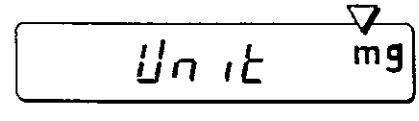


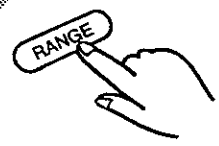
4



▶ Press the MODE key to move the next unit.

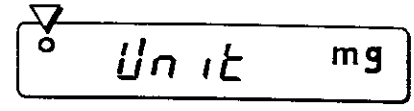
○ "Unit mg" is displayed.



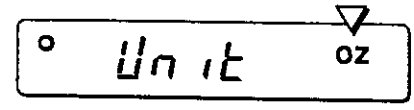
5 

▶ When storing a milligram **"mg"** value, press the (RANGE) key.

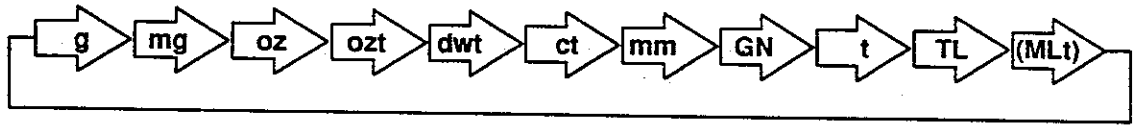
○ A stability indicator **"°"** goes on.



▶ When **"mg"** is not chosen to be stored, press the (MODE) key to move the next unit **"Unit oz"**.



6 Similarly, press the (MODE) key and (RANGE) keys to set the unit.



○ Weighing units can be grams **'g'**, milligrams **'mg'**, decimal ounces **'oz'** (avoir), troy ounces **'ozt'**, penny weights **'dwt'**, carats **'ct'**, mommes **'mm'**, grain units **'GN'**, tolas **'t'**, and taels **'TL'**.
In the **'MLt'** mode, the value when the gram value is multiplied by an arbitrary coefficient is displayed. (**'MLt'** does not appear on the display during weighing. For setting and checking arbitrary coefficient, refer to **page B•12**.)

7 

▶ After the completion of setting the necessary units, press the (PRINT) key. The units are stored and the balance returns to the measurement mode.

▶ To abort this sequence, press the (ON : OFF) key.
The display returns to off.

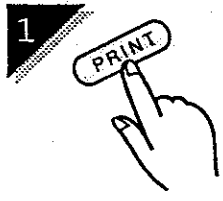
Setting and Checking Arbitrary Coefficient (MLt Unit Mode)

- In the multi-unit mode **'MLt'**, the value displayed is the gram value is multiplied by an arbitrary coefficient. (Example: In **'MLt'** mode, at a coefficient of 0.5, "50.0000" is displayed when a 100g weight is placed on the balance.)
- During weighing in the multi-unit, no display is made on the unit section.
- The coefficient is "1" at shipment time. (A numerical value the same as that in gram is displayed.)
- When the min. display is switched by pressing the RANGE key in the "MLt" mode, the min. display corresponding to the 0.01 mg range is not displayed. Only that corresponding to the 0.1 mg and 1 mg range is displayed.
- The coefficient can be set and checked by the keys on the front panel and RS-232C (option).

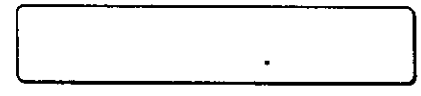
The following is an example of setting and checking the coefficient by the keys on the front panel.

To return to the normal mode during operation, press the ON : OFF key.

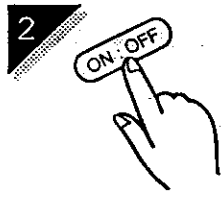
1



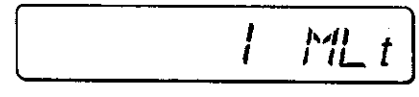
▶ With the display OFF, press and hold the PRINT key.



2

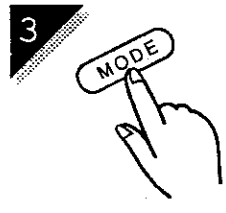


▶ With the PRINT key held down, press the ON : OFF key.



- ○ The value previously set is displayed. (Coefficient = "1" in the example)
- ○ When checking the coefficient only, press the PRINT key to return to the normal.

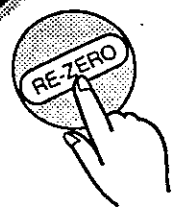
3



▶ Press the MODE key. The display on the left end is changed to "0" and blinks.

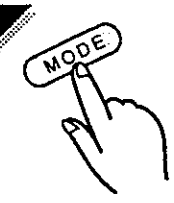
- ○ A coefficient of up to 7 digits, with the positive polarity only, can be entered. The input range for the coefficient is: "0.000000 ~ 10000.00"
- ○ The coefficient will be set to "25.00000" in subsequent examples.

4



▶ Press the (RE-ZERO) key twice to set "2".

5



▶ Press the (MODE) key to move to the next digit.

▶ Thereafter, set the numerical value by the (RE-ZERO) and (MODE) keys.
Use the (RANGE) key to enter a decimal point.

6

▶ After entering the necessary numerical values, press the (PRINT) key.

○ After the set values were stored, the unit is returned to the weigh mode.

(This example shows that when the unit is set to the "MLt" mode after returning to the weigh mode, "2500.00" is displayed with a 100g weight placed on the balance.)

To set and check the coefficient using the RS-232C (option), proceed as follows: (Refer to **pages F•14** to **F•16**.)

▶ Confirming the set value (by RS-232C)

?	M	L	CR

A personal computer requests the balance to send the currently set coefficient.

Example of response

M	L	,	+	2	5	.	0	0	0	0	0	CR

(25.00000 set)

▶ Changing the set value (by RS-232C)

Example)

M	L	3	.	0	CR

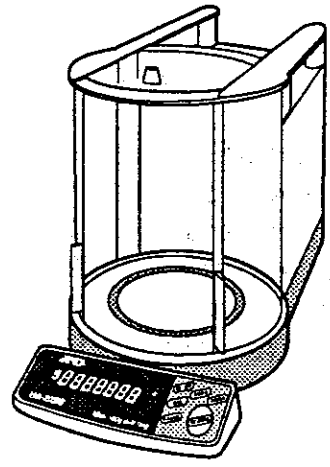
(This example shows that 3.0 has been newly set.
The input range of coefficient is 0.000000 to 10000.00 .)

Weighing Units and Their Conversions

Abbrev.	Name in full	Conversion
mg	Milligram	0.001g
oz	Ounce (Avoir)	28.3495231g
ozt	Troy Ounce	31.1034768g
dwt	Penny weight	1.55517384g
ct	Metric Carat	0.2g
mm	Momme (Japan)	3.75g
GN	Grain (UK)	0.06479891g
t	Tola (India)	11.6638038g
TL	Tael (HK, general)	37.7994g
TL	Tael (HK, jewellery)	37.429g
TL	Tael (China)	31.25g
TL	Tael (Sing.)	37.7994g
TL	Tael (Taiwan)	37.5g

HA SERIES • Section C

Calibration



Calibration

A high-precision electronic force balance like the HA series is generally affected by the installation conditions (longitude and altitude) and ambient environmental conditions (temperature, humidity, atmospheric pressure) and may cause errors in the value measured.

HA series balances can be calibrated using the built-in or external reference weight.

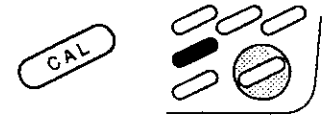
There are three calibration methods as indicated below:

❒ Auto Self-calibration

Balances of the HA series always monitor the ambient temperature. As soon as the balance detects a change in ambient temperature, calibration is automatically performed using the built-in weight. (In this case, the sensitivity and linearity of the balance are calibrated.)
At calibration start, the unit display section blinks. After about 2 minutes, calibration is automatically started.
Usually, the balance is kept in the calibrated state due to this auto self-calibration feature.

❒ Auto Calibration

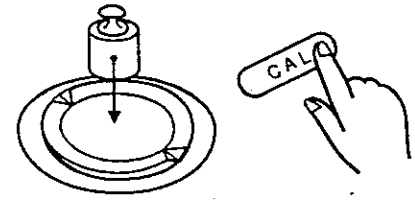
After making sure that nothing is on the pan, when the CAL key is pressed, the balance is calibrated by means of the built-in weight. (In this case, the sensitivity and linearity of the balance are calibrated.)



When changing the installation conditions of the balance, calibration can be performed at any time with one touch of a button.

❒ Manual Calibration

This calibration can be performed with the user's weight.
(In this case, only the sensitivity of the balance is calibrated.)



- ▶ Normally, the balance remains calibrated all the time by automatic self-calibration. However, auto calibration or manual calibration can be performed at any time.
- ▶ Automatic self-calibration or entire calibration can be disabled by the internal settings. (Internal Settings "CAL?C2" **pages E•3** and **E•7**)
- ▶ The weights incooporated in the balance HA are two loog weights.

Automatic Self-calibration

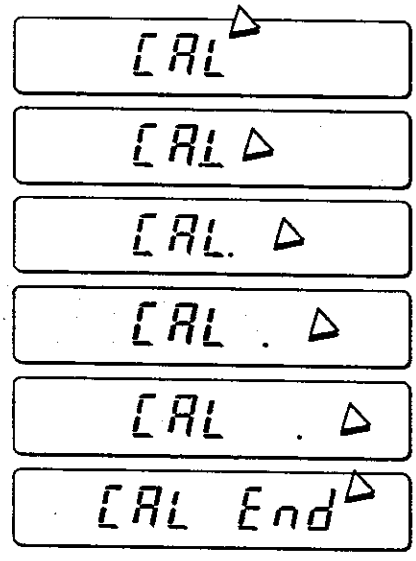
Balance of the HA series detects a change in ambient temperature by itself and uses a built-in weight to perform automatic self-calibration.
This function can be inhibited through the **"C-Parameter Setting C2"** "CAL C2" (refer to **pages E•3** and **E•7**).

With power applied, the auto self-calibration function is active, even when in the display-off state; calibration is performed automatically. (In this case, the power indicator blinks to inform of a change in ambient temperature.)

---

1 When the balance detects the change in outside temperature, the measuring unit blinks for about 2 minutes (example:). During this period, remove any object that may be on the pan.

2 When the display "CAL" appears, calibration is started automatically.



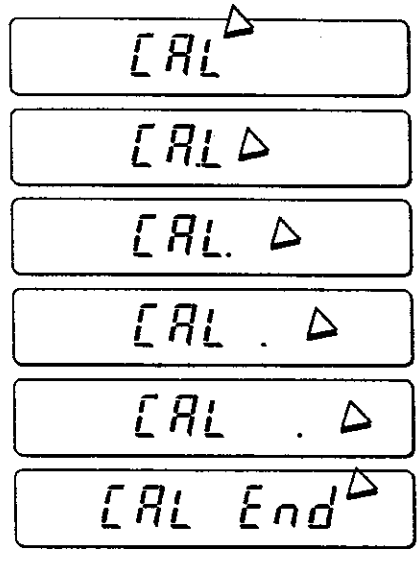
3 After the completion of calibration, the balance returns to the normal weighing mode.

Automatic Calibration

1 If the balance has been on for one hour or more, remove all objects measured from the pan.

2 

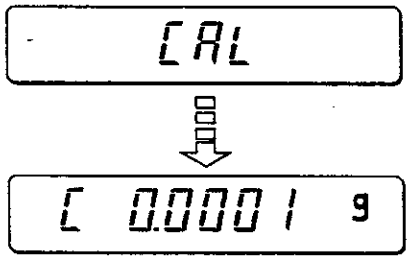
▶ Press the CAL key.



3 After the completion of calibration, the balance returns to the normal weighing mode.

Checking Automatic Calibration

It is possible to automatically check if "auto calibration" has been performed correctly through the C-Parameter setting "CAL -C c2" (**"Auto Check after Auto Calibration"**) (refer to **pages E•3** and **E•7**).
After the auto check, the error in calibration is displayed.



(Calibration with the error range of ±0.0002g is normal. When this range is exceeded, check the "Setting Condition" (**page A•3**).)

When the RE-ZERO key is pressed, the unit is returned to the original state and the zero is displayed.
Before shipping the balance, the C-Parameter setting should be set to "CAL -C 0 c2" **"No Auto Check"**.

Manual Calibration

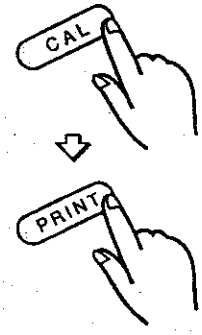
Calibration is performed with the user's weight.
Weights of 200g, 150g, 100g and 20g can be used. The error compensation range for weights 200g, 150g, and 100g is ±15.0mg and for weight 20g is ±1.50 mg.

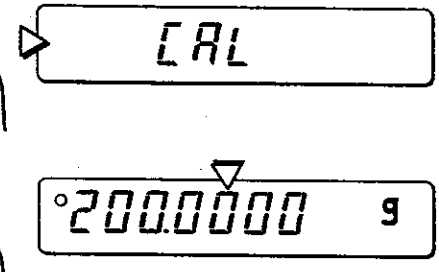
---

1 If the balance has been on for one hour or more, remove all objects measured from the pan.

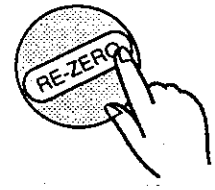
2 With the CAL key held down, press the PRINT key.

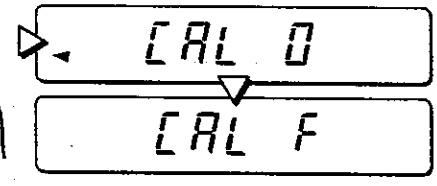
○ The value of the calibration weight used is displayed (200.0000g at shipment). To change the weight value setting, refer to the next page.





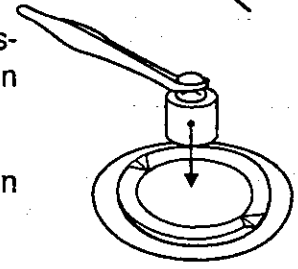
3 Press the RE-ZERO key.

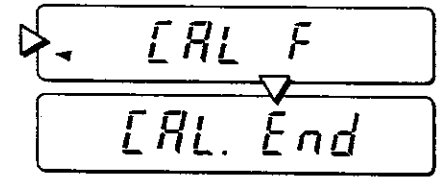




4 When "CAL F" is displayed, put a calibration weight on the pan.

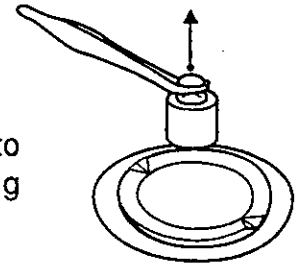
○ "CAL End" is then displayed.





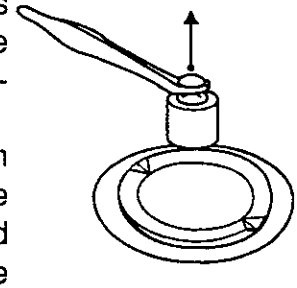
5 Remove a weight.

The balance returns to the normal weighing mode.



6 Place the weight again and check if the error is within ±2 digits before terminating the calibration.

If the error is not within ±2 digits, check the ambient vibration and air flow and retry the procedure.

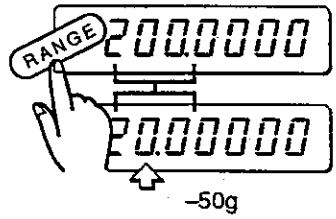


Changing the Set Value of a Calibration Weight

To change the set value of a calibration weight, perform the following operations between steps 2 and 3 on the previous page.

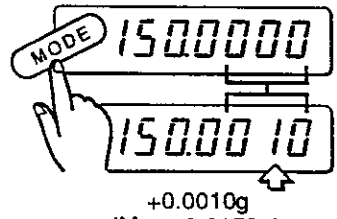
200g, 150g, 100g : ± 0.015g
20g : ±0.00150g

▶ When the RANGE key is pressed, the value is changed to 200g, 20g, 100g, 150g in that order.



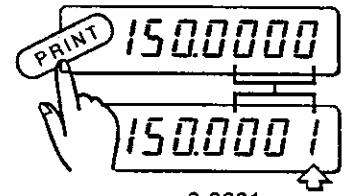
–50g

▶ When the MODE key is pressed, the value is changed by 10 digits.



+0.0010g
(Max.±0.0150g)

▶ When the PRINT key is pressed, the value is changed by 1 digit.



+0.0001g
(Max.±0.0150g)

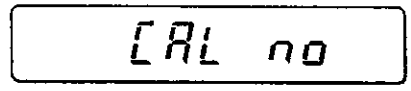
Calibration Notes and Errors

Error display

"-CAL E" is displayed when a calibration weight is too light.

"CAL E" is displayed when a calibration weight is too heavy.

▶ Make sure that all measured objects are removed, the weighing pan is set properly, and the value of a weight is set correctly, and then press the RE-ZERO key.

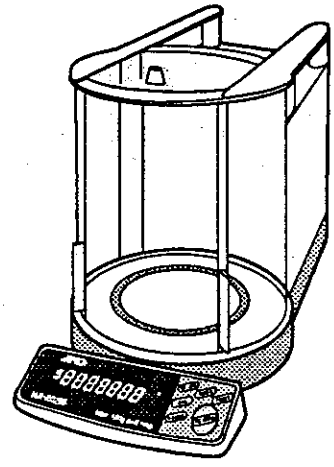


"CAL no" is displayed when calibration cannot be performed since the balance is unstable due to factors such as vibration and air flow.

▶ After checking for vibration and air flow, press the RE-ZERO key. Refer to **"Best Conditions For Weighing"** on **page A•3.**

HA SERIES • Section D

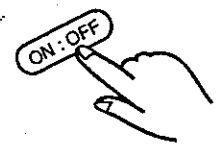
Weighing Mode



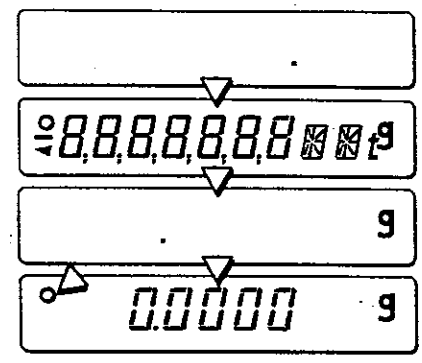
Simple Weighing

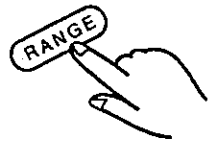
To make accurate measurements, be sure to warm up the balance for one hour or more, refer to **"Best Conditions For Weighing"** (on **page A•3**).

---

1 

▶ Press the ON : OFF key.
○ All displays go on.
○ Display blanks until the stable state is obtained.
○ Zero and stability indicator should be displayed.

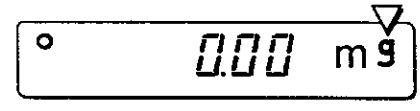


2 

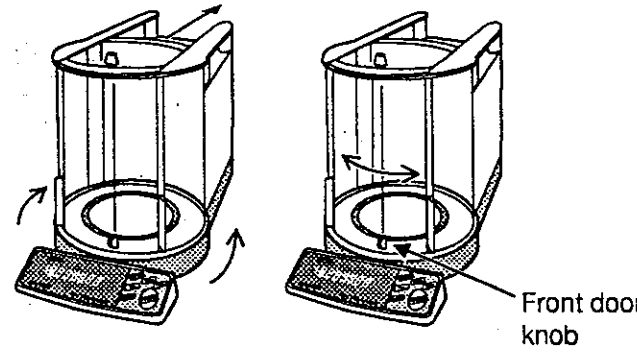
○ To change the min. display, press the RANGE key. (Refer to **"RANGE key"** on **page B•9.**)

3 

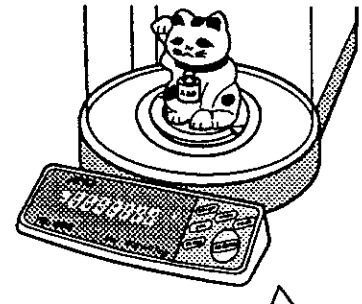
○ Press the MODE key to select the unit, as needed.



4 ▶ Open the door.



5 ▶ Place the object to be measured on the pan.

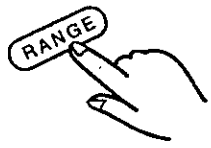


▶ Close the door and read the measured value after the stability indicator is displayed.

Measurement within the 0.01 mg (Automatic Range Switching Function)

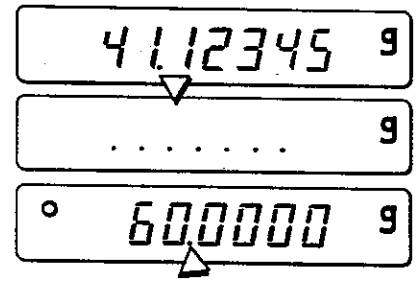
When measuring within the 0.01 mg range, if 42g is exceeded, the range is automatically changed to the 0.1 mg range.

---

1 

▶ After ensuring that nothing remains on the pan, press the (RANGE) key to select the 0.01 mg range.

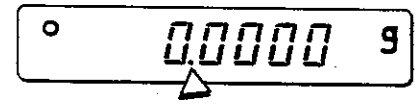
2 ▶ Place a sample of 42g or more (60g in the example).

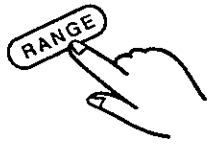


○ Use the automatic function to change to the 0.1 mg range.

3 ▶ Remove the sample.

○ The 0.1 mg range remains the same.



4 

▶ If measurement is performed again within the 0.01 mg range, press the (RANGE) key.

▶ Setting can be changed to "no automatic switching" by changing the internal settings.

In this setting, if 42g is exceeded in the 0.01 mg range, "E" is displayed. Internal Setting "A -r ? c1" (**pages E•3** and **E•6**)

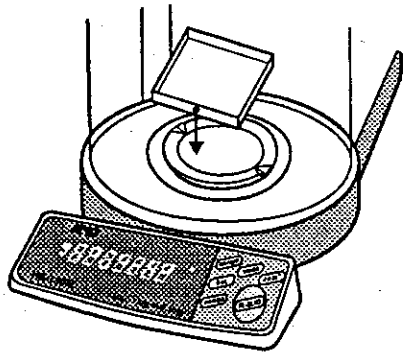
▶ Immediately after the display is turned on by the # key, the 0.1 mg range is normally used in the display. (See the previous page.)

"The 0.01 mg range after display on" can be set by changing the internal settings. Internal Settings "SEL -r ? c1" on **pages E•3** and **E•6**.

▶ Perform measurement within the 0.01 mg range taking special care of environment (air flow in particular). For other cautions, refer to "For More Accurate Measurement" (**page D•6**).

Using RE-ZERO to Tare

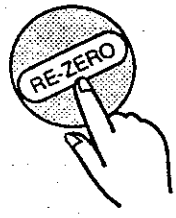
1 When measuring within the 0.01 mg range, if 42g is exceeded, the range is automatically changed to the 0.1 mg range.



▶ Put a container on the weighing pan.

○ The weight of the container is displayed. (The 0.01 mg range is shown in the example.)

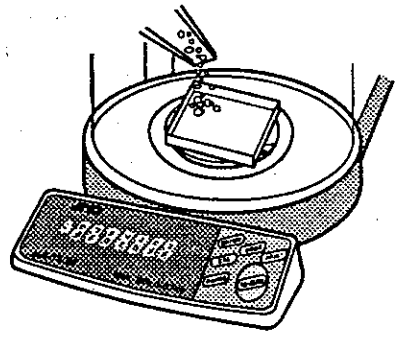
2



▶ Press the (RE-ZERO) key to tare the containers weight.

○ Zero is displayed.

3



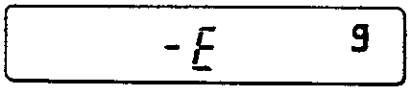
▶ Add samples until the target weight is obtained. Each time another sample is measured, press the (RE-ZERO) key prior to measurement.

○ The weight of sample is displayed. To escape from this measurement, press the (ON : OFF) key.

▶ Care is required when measuring with the tare in the 0.01 mg range. If the total weight of the tare and sample exceeds 42g (max. balancing amount within the 0.01 mg range), the range is changed automatically to the 0.1 mg range. (Refer to **page D•3.**)

Weighing Error

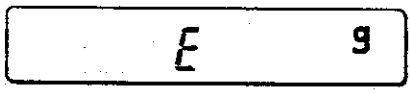
Weighing pan error



○ "-E" appears when the weighing pan, pan support, or balance weight is missing.

▶ When an error continues, even after the weighing pan or pan support is properly assembled, ask for servicing.

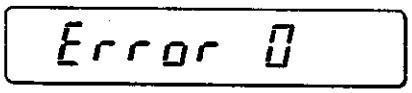
Overload error



○ "E" apperas when the weight of a measured object exceeds the balancing capacity.

▶ When an error continues, even after the measured object is removed, ask for servicing.

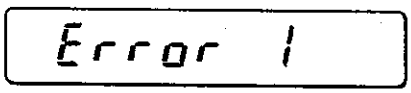
Internal operation error



○ "Error 0" indicates that an error occurs during internal operations of the balance.

▶ Ask for servicing.

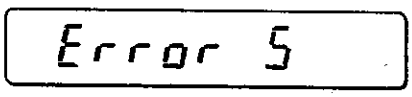
Error indicating unstable state

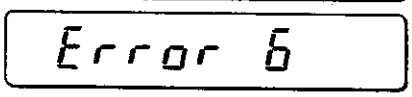


○ "Error 1" indicates that no zero can be displayed because the balance was unstable during re-zero operation.

▶ After checking for vibration and air flow, press the (RE-ZERO) key. Refer to **"Trouble"** on **page I•2**.

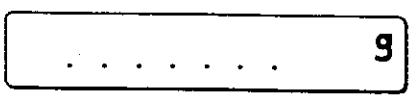
Memory error





○ "Error 5" to "Error 8" indicates a balance memory error.

▶ Disconnect the AC adaptor and connect it with power.
If this error still continues, ask for servicing.



○ ". . . . . g" does not indicate an error. It indicates that the automatic range switching function is operating. The range is changed from the 0.01 mg range to the 0.1 mg range after this display.

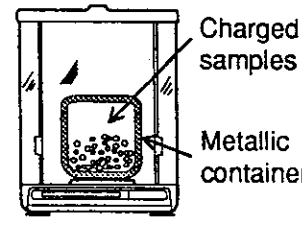
Making More Precise Weighing

To make full use of the HA series balance performance for more precise measurements, care should be given to the following items. In particular, special care is required when measuring within the 0.01 mg range:

- ❒ Selection of the installation site and ambient environment of the balance. Refer to the **"Best Conditions For Weighing"** (on **page A•3**). To make stable and precise measurements, be sure to warm up the balance 4 hours or more before using.

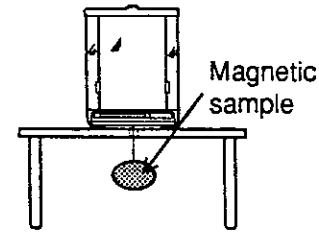
- ❒ Swiftly perform the measuring operation with care. Taking time for measurement will increase the risk of error due to changes in temperature and humidity in the measuring room, fluctuation in air, reaction of sample, and humidity absorption.

- ❒ The Static electricity may cause errors in a measurement. When the ambient humidity drops below 45%, an insulating material such as plastic or the clothes worn by the tester (especially sweater, etc.) can easily be charged with static electricity.

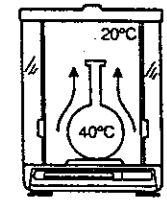


  One countermeasure is to increase the relative humidity in the measuring room. Other countermeasures are shown below.
  (1) Place the sample in an electrically conductive recipient.
  (2) Wear anti-static clothes.

- ❒ The influence of magnetic field may cause an error. When measuring a magnetic substance (such as iron), use the underhook method of measurement, keeping the balance body away from the sample. (Refer to **page D•7**).



- ❒ If there is a difference in temperature of the weighing chamber and the sample (including the tare), an error may result in measurement. For example, placing a flask of 40°C in the weighing chamber of 20°C, causes a convection current. This makes the weight displayed less than the real weight. The sample and the tare should be acclimated to the environment before being measured if possible.
  Avoid touching the flask, etc. with bare hands.



❒ The measurement results may include an error caused by air buoyancy. Air buoyancy varies with the volume of sample, atmospheric pressure, temperature, and humidity. Compensate for the buoyancy for precise measurement.

Example of air buoyancy effect

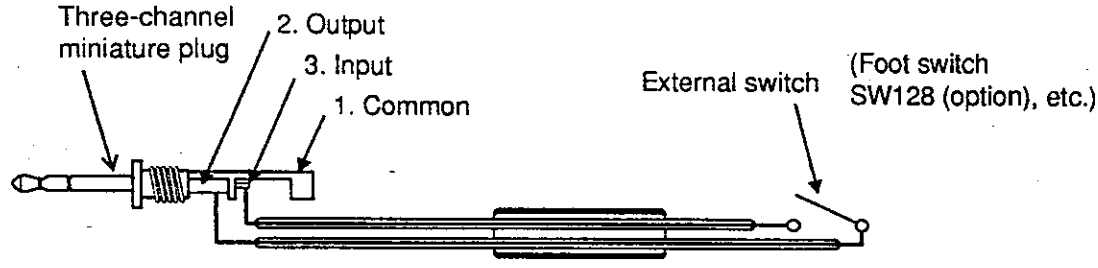
Suppose that a weight of 20g (specific gravity 8g/cm^3) is measured under a condition: temperature 20°C, relative humidity 60%, atmospheric pressure 1000 hPa (=mb)
If the atmospheric pressure only increase by 20 hpa to become 1020 hpa, the display decreases by approximately .06 mg due to an increase of air buoyancy.

Atmospheric pressure	10000 hPa → 1020 hPa	Weight of 20g (8g/cm^3)
Balance display	20,00000 g → 19,99994g	

Re-zero/Print Operation via External Input Terminal

The "re-zero" or "print" operation can externally be performed by using an EXT. switch (external input terminal) on the rear of the main body. This terminal is also used to connect the balance and **"Vibratory Spoon AD-1651"** (option) (refer to **page G-1**). Either one of these three functions of the EXT switch is selected according to the internal setting of the balance (refer to **page E•1**).

The following are the methods in performing "re-zero" or "print" operation:



- Connect the switch between 2 (output) and 3 (input) of the three channel miniature plug (accessory). The short circuit between 2 and 3 will serve for the same operation as the key (RE-ZERO or PRINT) pressed on the panel.
- Select the RE-ZERO or PRINT function according to internal setting "Cont C4" of the balance (refer to **page E•3** and **E•9**).

C4 Restriction of Setting and Others

☐ Cont	? C4	Selection of external input terminal function	
Cont	0 •	RE-ZERO function	FC40:0
	1	PRINT function	FC40:1
	2	Vibratory spoon control function	FC40:2

Underhook Weighing

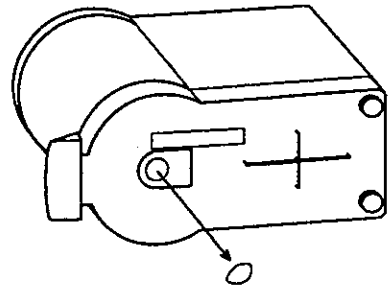
The HA series balance has an underhook weighing fitting as standard equipment. The underhook weighing is the method used for measuring the specific gravity and the weight of a magnetic substance.

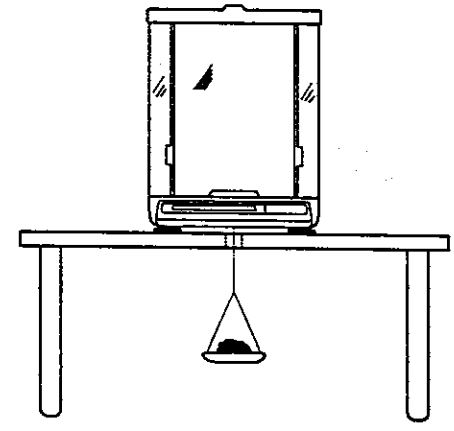
① When the cap on the bottom of the main body is removed, the underhook weighing fitting can be seen.

② Set the balance on a rigid table.

③ As shown in the figure to the right, put a thread through the fitting and suspend a weighing pan.

④ Care should be taken to prevent the air from flowing around the balance.





The specific gravity of metal can be measured by the reduction of weight in water. This is based on the fact that 1g of water is almost 1cm^3 (refer to "Reference" on the **next page**).
Specific gravity (g/cm^3) can be calculated by dividing (Weight in air) by (Reduction of weight in water).

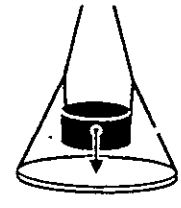
Underhook Weighing Example

1 ▶ After preparing for underhook weighing, press the (RE-ZERO) key to set the balance weight to zero.

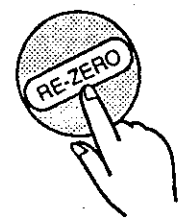
○ Zero is displayed.

2 ▶ Put a sample on the pan and record the value.

○ In this example, weight in air should be 10g.

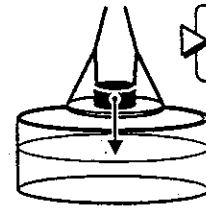


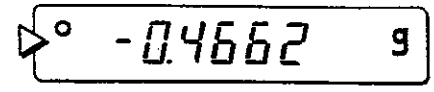
3 ▶ After removing the sample to put the pan in the water, press the (RE-ZERO) key to set the display to zero.



4 ▶ Put a sample in 4°C water.

○ In this sample, the balance weight is displayed as –0.4662g, which almost corresponds to 0.4662cm³.





5 ▶ Calculation: $\frac{10.0000g}{0.4662cm^3} \approx 21.45g/cm^3$

The above value shows that this sample may be platinum.

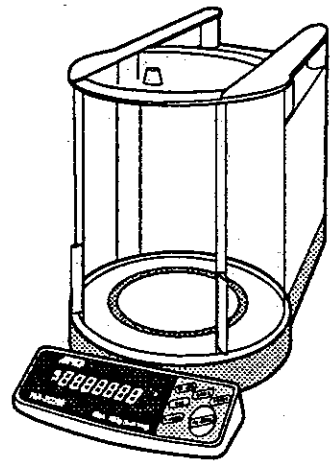
[Reference]

Density of water (g/cm³)

0°C	0.99984 g/cm³
4°C	0.99997
10°C	0.99970
15°C	0.99910
20°C	0.99821
25°C	0.99705
30°C	0.99565

HA SERIES • Section E

Internal C-Parameter Settings

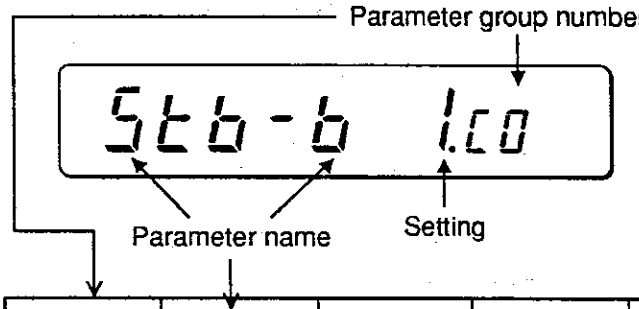


Internal C-Parameter Settings

HA series balance has various internal settings that are used to modify response characteristics, display update rate and data output format, match it to the working environment and various peripheral equipment.

These set values can freely be changed and are stored in the memory, even when the AC adaptor is disconnected. A list of C-Parameter settings are shown below.

- To change C-Parameter settings, refer to **"Changing C-Parameter Settings"** (on **page E•3**), and the detailed explanation of each C-Parameter setting is given in **"The C-Parameter Settings C0 to C6"** (on **pages E•4** to **E•13**).
- It is also possible to initialize the internal setting to the factory setting or disable the internal setting changes. Refer to PF of C4 **"Setting Disable and Others"** (**page E•9**)



○ When changing C-Parameter settings, the Parameter numbers, current setting and Parameter group number as shown in the figure to the left are displayed.

C0 Environment	Stb-b Stable detection width	Cond Response characteristics	trc Zero tracking			
C1 Display	SPEEd Display re-writing speed	Point Decimal point	P-on Auto start	SEL-r Range at start	At-r Automatic range switching	
C2 Calibration	CAL . CAL select	CAL-C Auto check	CAL-L Linearity compensation			
C3 Auto re-zero	Ar-0 Auto re-zero	Ar-b Auto re-zero width	Ar-t Detecting time			
C4 Setting restriction and others	Cont External input terminal	bEEP Alarm	PF Restriction of setting change			
C5 Data output	Pr int Mode select	AP-P Auto print polarity	AP-b Auto print width	COdE Data No.	PAUSE Data output pause	At-F Auto feed
	Ar-d Re-zero after output					
C6 Serial interface	bPS Baud rate	PAr Parity	bit Bits per character	StoP Stop bit	Cr-LF Terminator	tYPE Data format
	t-UP Time-out	dP Decimal point code	E-Cod Error code	CtS CTS control		

Not displayed without serial interface OP-03 (option).

Changing C-Parameter Settings

❒ When a change is restricted by the setting "PF C4" (on **page E•9**), the C-Parameter setting cannot be changed.
If a change of settings, "PF 1 C4", to "PF 0 C4".

❒ All the internal settings are initialized to the factory setting through a setting operation in **"PF 2.C4"** by setting **"PF?C4"** (**page E•9**).

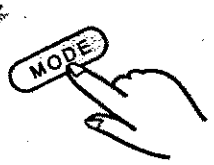
❒ If the (ON : OFF) key is pressed during this process, the C-Parameter is not changed and the balance is returned to the weighing mode.

1

▶ After setting the display to off, press the (ON : OFF) key with the (RE-ZERO) key held down.

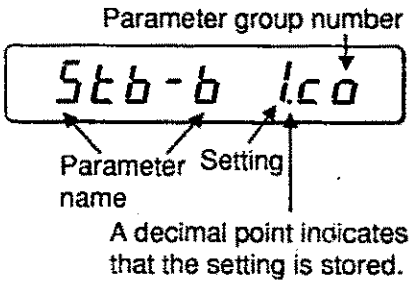
○ All displays should illuminate.

2



▶ When the (MODE) key is pressed, the balance is returned to the C-Parameter setting mode.

○ After the program version has been displayed for about one second, the Parameter name, setting, and group number is displayed.

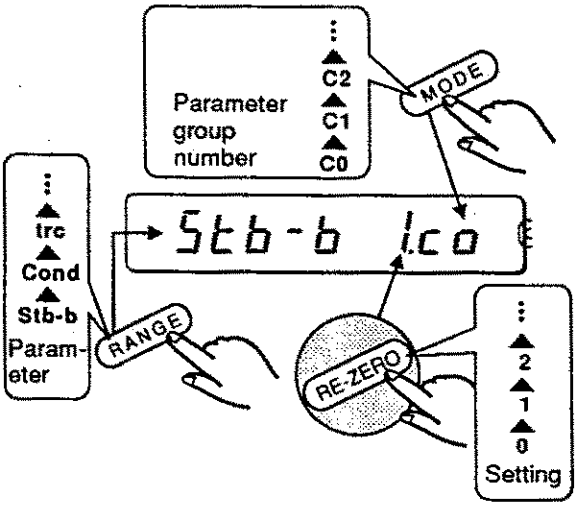


3

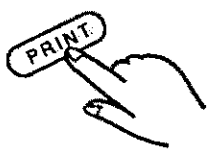
▶ Use the keys shown in the right figure to change the C-Parameter setting.

○ The decimal point of the current set value internally stored should illuminate..

○ The Parameter name, Setting, and Group number are displayed in sequence. Continuously pressing the key will return the display to the original location, if the correct location was skipped.

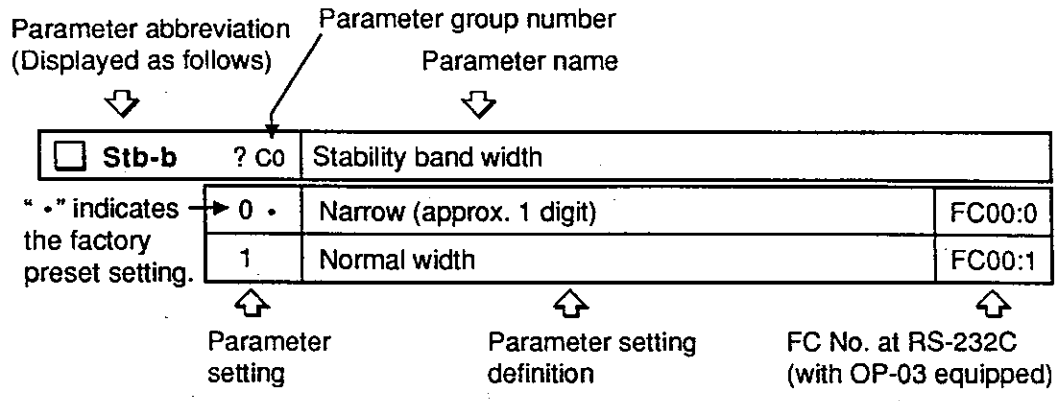


4



▶ After the completion of the above steps, press the (PRINT) key. The new setting is internally stored and the balance will return to the weighing mode.

The C-Parameter Settings (C0 to C6)



C0 Environment

Stb-b ? C0	Stability band width ○ When the display change is within the width set by " Stb-b" for about one second, the stability indicator goes on.	
Stb-b	0 •	Narrow (approx. 1 digit*)	FC00:0
	1	Normal width	FC00:1
	2	Wide (approx. 3 digits)	FC00:2

* The minimum change of a figure displayed is called one digit. For example, when the RANGE key is pressed to display 0.1mg, one digit is 0.1mg. Similarly, when 0.01mg is displayed, one digit is 0.01mg. (For the RANGE key, refer to **page B•9**.)

Cond ? C0	Response characteristics/Environment (" Cond 0", is suitable for scaling.)	
Cond	0	Very quick response/Very good environment	FC01:0
	1	Quick response/Good environment	FC01:1
	2 •	Normal response/Normal environment	FC01:2
	3	Slightly slow response/Slightly poor environment	FC01:3

The setting affixed with "." is default.

☐ trc ? C0	Zero tracking detection time ○ In general, the zero point of the balance may change slowly due to variations in the ambient temperature, humidity and atmospheric pressure, etc. The HA balance uses the zero tracking function to absorb these slow zero point changes and keep the zero point stable. When a change within the period determined by trc is below one digit, the display remains 0. When measuring a very light sample, select "0" or "1".

trc

0	Zero tracking OFF	FC02:0
1	Zero tracking ... long/Effect ... weak	FC02:1
2.	Normal/Normal	FC02:2
3	Short/Strong	FC02:3

The setting affixed with "." is default.

C1 Display

☐ SPEEd ? C1	Display update speed	
SPEEd	0 • Normal speed in stable state, high speed only in unstable state	FC10:0
	1 Normal speed (4 times/sec)	FC10:1
	2 Always high speed (8 times/sec)	FC10:2

☐ Point ? C1	Display of decimal point	
Point	0 • Point (.)	FC11:0
	1 Comma (,)	FC11:1

☐ P-on ? C1	Auto start function	
P-on	0 • Auto start is not performed.	FC12:0
	1 Auto start is not performed. It is not necessary to press the (ON : OFF) key at measurement start up. Upon turning the power on, the measurement is automatically started. This function is available to incorporate into an automatic machine.	FC12:1

☐ SEL-r ? C1	Range selection after display on	
SEL-r	0 • 0.1 mg range is set after display on.	FC13:0
	1 0.01 mg range is set after display on.	FC13:1

☐ At-r ? C1	Automatic range switching function	
At-r	0 Automatic range switching is not performed. (If 42g is exceeded within the 0.01 mg range, the "E" display range does not change.)	FC14:0
	1 • Automatic range switching is performed. (If 42g is exceeded within the 0.01 mg range, the display range is changed automatically to the 0.1 mg range.)	FC14:1

The setting affixed with "." is default.

C2 Calibration

☐ CAL	? C2	Calibration selection	
CAL	0 •	Auto calibration enabled (Refer to **page C-2.**)	FC20:0
	1	Only auto self-calibration disabled (When the ambient temperature changes, a part of unit "⚠" blinks.	FC20:1
	2	Only auto self-calibration disabled No warning is given even if the ambient temperature changes.	FC20:2
	3	All calibration disabled	FC20:3

☐ CAL-C	? C2	Auto check after auto calibration	
CAL-C	0 •	No auto check is made after auto calibration.	FC21:0
	1	Auto check is made after auto calibration. (Auto check is not activated for auto self-calibration or manual calibration.	FC21:1

☐ CAL-L	? C2	Linearity compensation during calibration	
CAL-L	0	Linearity is not compensated during calibration. Sensitivity is compensated only.	FC22:0
	1 •	Linearity is also compensated during calibration. Compensation of both sensitivity and linearity is carried out. (In manual calibration, linearity compensation is not carried out even if this mode is set.)	FC22:1

The setting affixed with "." is default.

C3 Auto Re-zero

☐ Ar-0	? C3	Auto re-zero function near zero	
Ar-0	0 •	Auto re-zeroing is not performed.	FC30:0
	1	Auto re-zeroing is performed. (The re-zero operation is automatically performed when the measured value is continued in fixed widths (selected by " Ar-b ") near zero at a fixed time (selected by " Ar-t ").)	FC30:1

☐ Ar-b	? C3	Selection of size determined to be near zero	
Ar-b	0 •	±5 digits	FC31:0
	1	±50 digits	FC31:1
	2	±500 digits	FC31:2

☐ Ar-t	? C3	Detecting time for near zero	
Ar-t	0 •	0.5 sec.	FC32:0
	1	1 sec.	FC32:1
	2	2 sec.	FC32:2
	3	4 sec.	FC32:3

The setting affixed with "." is default.

C4 Restriction of Setting and Others

☐ Cont	? C4	Selection of external input terminal function	
Cont	0 •	RE-ZERO function (Refer to **page D-6.**)	FC40:0
	1	PRINT function (Refer to **page D-6.**)	FC40:1
	2	Vibratory spoon control function (Refer to **page G-2.**)	FC40:2

☐ bEEP	? C4	Alarm tone	
bEEP	0	Alarm does not sound.	FC41:0
	1 •	Alarm sounds. (When the key on the front panel is pressed)	FC41:1

☐ PF	? C4	Setting change disable/internal setting initialization	
PF	0 •	Internal setting change enabled.	FC42:0
	1	Internal setting change disabled. If this is set to 1, the internal setting cannot be changed. The internal setting can be changed only after returning to "0".	FC42:1
	2	Regarding this setting "2", if stored in memory by the (PRINT) key, all the internal settings (c0 to c6) are initialized to the default. This PF itself returns to "0".	FC42:2

The setting affixed with "•" is default.

C5 Data Output

Settings in C5 are used for HA series balances with the OP-03 serial interface installed. For details, refer to **pages F•1** to **F•24.**

☐ Print	? C5	Data output mode selection	
Pr int	0.	Key A mode: The PRINT key is acknowledged only when the display is stable. One data stream is output.	FC50:0
	1	Key B mode: the PRINT key is always acceptable. One data is output after the display becomes stable.	FC50:1
	2	Auto print A: One data stream is output when the display becomes stable at the fixed value or a larger shift away from zero. After output, when the displayed value is returned within the auto print width, the next data can be output.	FC50:2
	3	Auto print B: One data stream is output when the display becomes stable at the fixed value or a larger shift (auto print width) away from a displayed value.	FC50:3
	4	Stream mode: Data is automatically output in sequence each time the display is updated.	FC50:4
	5	Command mode: Data is output via a command from an external unit such as a computer. In addition to the data output command, there are many commands which can externally control the balance.	FC50:5

☐ AP-P	? C5	Auto print polarity Selects the polarity (+/-) of data which can be output by auto print A/B.	
AP-P	0.	Output only when polarity is positive	FC51:0
	1	Auto print A: Output when polarity is positive or negative Auto print B: Output only when polarity is negative	FC51:1

☐ AP-b	? C5	Auto print width (Selects the width of data which can be output by auto print A/B.)	
AP-b	0.	10 digits	FC52:0
	1	100 digits	FC52:1
	2	1000 digits	FC52:2
	3	10000 digits	FC52:3
	4	100000 digits	FC52:4

The setting affixed with "." is default.

☐ COde ? C5	Data no. output	
CodE	0.	Data No. is not output.	FC53:0
	1	Data no. is output. (Output data no. prior to weight data. After one data stream is output, data no. is automatically increased by one.)	FC53:1

☐ PAUSE ? C5	Data output pause	
PAUSE	0.	There is no data output pause.	FC54:0
	1	There is a data output pause. (With the AD-8121 printer connected, set the value of 'PAUSE' to "1" so that the printer can complete printing.)	FC54:1

☐ At-F ? C5	Auto feed function	
At-F	0.	Paper is not automatically fed.	FC55:0
	1	Paper is automatically fed. (With the AD-8121 printer connected, 1 sec after data is output, <CR> and <LF> are output to feed paper. In the stream or command mode, this function is not activated.)	FC55:1

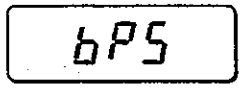
☐ Ar-d ? C5	Auto re-zero after data output (In key A/B or auto print A/B, selects whether or not to perform an auto re-zero operation after output.)	
Ar-d	0.	Auto re-zero is not performed after data output.	FC56:0
	1	Auto re-zero is performed after data output.	FC56:1

The setting affixed with "." is default.

C6 Serial Interface

Settings in C6 are used for HA series balances with the serial interface OP-03 installed. For details, refer to **pages F•1** to **F•24**.

☐ **bPS** ? C6 | Baud rate

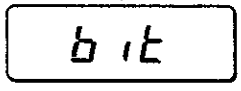


0	600 bps	FC60:0
1	1200 bps	FC60:1
2 •	2400 bps [Specified when the AD-8121 printer is connected.]	FC60:2
3	4800 bps	FC60:3
4	9600 bps	FC60:4

☐ **PAr** ? C6 | Parity

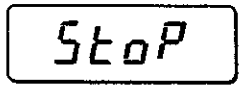
0 •	EVEN	FC61:0
1	ODD (When bits per character is 8 bits, non-parity is automatically specified.)	FC61:1

☐ **bit** ? C6 | Bits per character



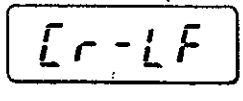
0 •	7 bits (Always attach parity.)	FC62:0
1	8 bits	FC62:1

☐ **StoP** ? C6 | Stop bit



0 •	1 bit	FC63:0
1	2 bits	FC63:1

☐ **Cr-LF** ? C6 | Terminator (Set for sending and receiving.)



0 •	<CR> <LF>	FC64:0
1	<CR>	FC64:1

The setting affixed with "." is default.

☐ tYPE	? C6	Data format (Selects the format of weight data to be output. For details, refer to "Weight Data Output Format" on **page F-9**.)	
tYPE	0 •	A&D standard format	FC65:0
	1	Dump Print (DP) format	FC65:1
	2	KF format	FC65:2

☐ t-Up	? C6	Timer when command is received	
t-UP	0 •	Timer ON	FC66:0
	1	Timer OFF	FC66:1

☐ dP	? C6	Decimal point code (Selects ASCII code of a decimal point to be output.)	
dP	0 •	2EH (Point ".")	FC67:0
	1	2CH (Comma ",")	FC67:1

☐ E-Cod	? C6	Output of "AK" and error code in command mode	
E-Cod	0 •	Not output.	FC68:0
	1	Output. (In the command mode, the balance outputs "AK" and an error code.)	FC68:1

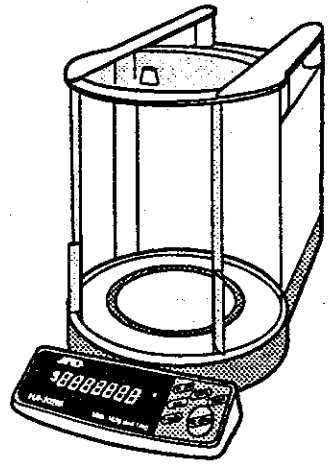
☐ CtS	? C6	CTS control (Selects CTS control or RTS check.)	
CtS	0 •	Setting when the balance is connected to a computer or the AD-8121 printer. Usually, this setting is used.	FC69:0
	1	In the stream mode, data output is stopped when the RST pin is set to a minus value. (Refer to **pages F-3** and **F-5**.)	FC69:1

The setting affixed with "•" is default.

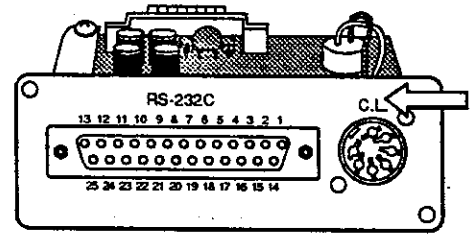
HA SERIES • Section F

Serial Interface

OP-03 (Option)

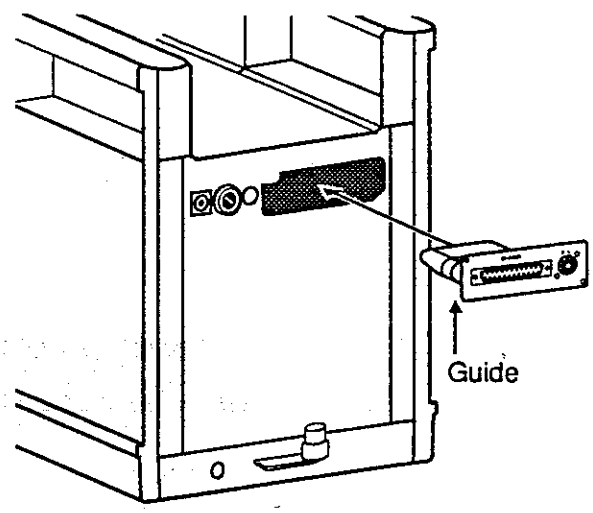


* This chapter applies to the HA series balances in which the OP-03 is installed.



OP-03 Installation

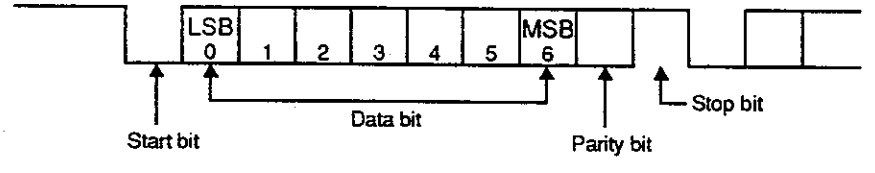
1. Disconnect the AC adapter from the balance. Remove to setscrews on the rear of the balance.
2. Insert the OP-03 board guide into the body of the balance. Make sure that the connector is aligned correctly.
3. Attach the OP-03 with the two screws removed in step number one.



Specifications

Transmission system : EIA RS-232C, 20mA current loop (passive)
Transmission form : Asynchronous transmission, bidirectional, half-duplex
Data format : Baud rate : 600, 1200, 2400, 4800, 9600 bps
Data bits : 7 or 8 bits
Parity : Even/Odd (bits per character: 7 bits)
None (bits per character: 8 bits)
Stop bit : 1 or 2 bits
Code : ASCII

RS-232C	20mA current loop
1 = –5V ~ –15V	20mA
0 = +5V ~ +15V	0mA



Computer Connection

Cautions on connection

① The OP-03 is a DCE (Data Communication Equipment).
② The current loop is of a passive type, requiring an external power of 20mA.
③ The current loop outputs the same data as that from the RS-232C.

④ Before connection, read the instruction manual for the equipment to be connected.

⑤ Use the connecting cables for a modem.
(Example) PC-8895 (NEC), cable sets #705 and #724 (EPSON)

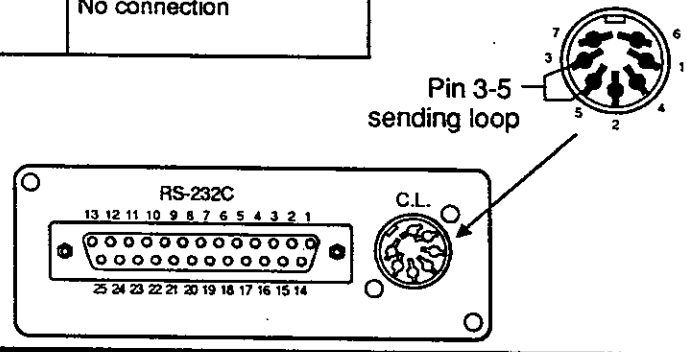
RS-232C Pin Connection

RS-232C

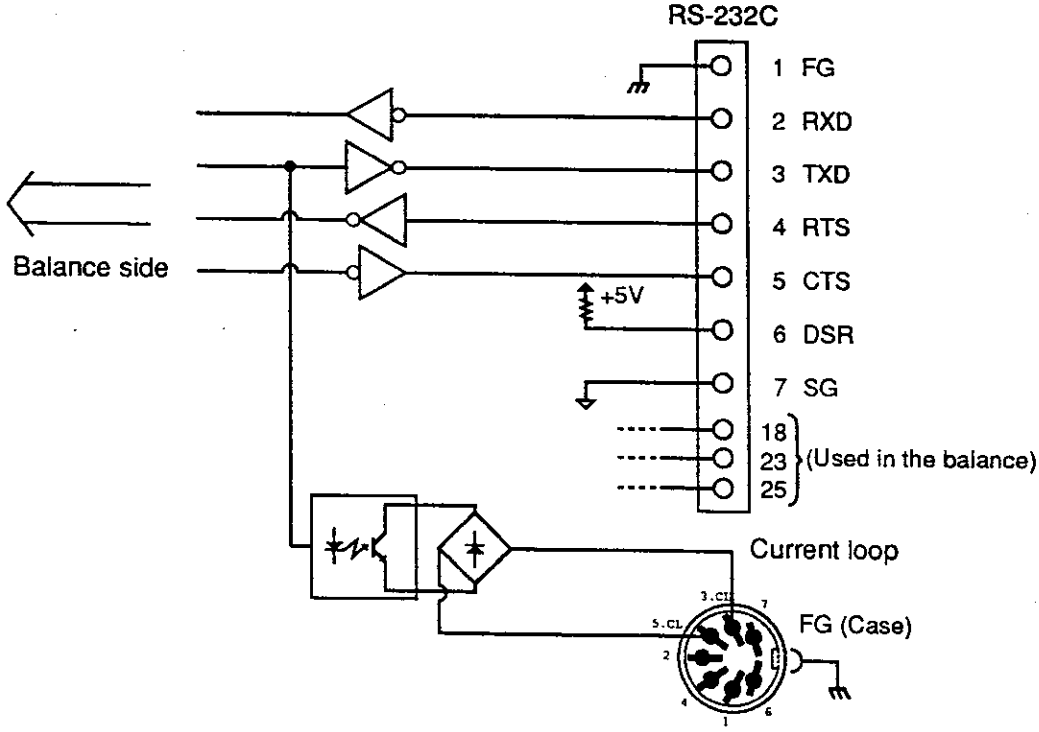
Pin No.	Signal Name	Direction	Meaning
1	FG	← →	Frame ground
2	RXD	In	Receive data
3	TXD	Out	Transmit data
4	RTS	In	Request to send
5	CTS	Out	Clear to send
6	DSR	Out	Data set ready
7	SG	← →	Signal ground
18, 23, 25	—	—	Used on the balance side
8 to 17, 19 to 22, 24	N.C.		No connection

Current Loop

Pin No.	Signal Name
3, 5	Sending loop
Peripheral equipment	Case
1, 2, 4, 6, 7	No connection



OP-03 Circuit Diagram



OP-03 Data Output Mode

There are four data output modes each of which can be changed through **"C-Parameterl Settings"** (refer to **page E•10**).

- ❒ Key mode — Press the PRINT key on the balance to output data. There are two types of modes: Key mode A and Key mode B.
- ❒ Auto Print mode — When the balance becomes stable, the data is automatically output at once, There are two types of modes: Auto Print A and Auto Print B.
- ❒ Stream mode — Data is output each time the display is rewritten.
- ❒ Command mode — Data is output by the command given from a computer.

Print Key Mode

In the key mode, when the PRINT key is pressed and the balance is stable, the data is output one time. In this case, the display will blink once to indicate data output. There are two types of modes: Key mode A in which the PRINT key is accepted only when the balance is stable, and Key mode B in which the PRINT key is accepted when the balance is either stable or unstable. Data is output after the balance becomes stable.

- ☐ **Print 0** C5 ..... Key mode A
- ☐ **Print 1** C5 ..... Key mode B

Auto Print Mode

Data is automatically output one time when the balance is stable. Thereafter, data will not be output unless certain conditions are met. It is convenient to read data on which the weight of an object is measured continuously. The conditions of auto print can be changed through combinations of internal settings.

- ☐ **Print 2** C5 ..... Auto Print A

When the balance becomes stable at a fixed value or greater width (**"Auto print width"** "AP-b C5" on **page E•10**) away from zero, one group of data is output. Once output, the displayed value must return to within the auto print width, enabling the next data output. The polarity of data to be output can be selected through "AP-P C5" (on **page E•10**).

Print 3 C5 ····· Auto Print B

When the balance becomes stable at a fixed value or greater width (**"Auto print width"** "AP-b C5" on **page E•10**) away from zero, one group of data is output. The polarity of data to be output can be selected through "AP-P C5" (**page E•10**).

Stream Mode

Print 4 C5 ····· Stream mode

Each time the display is updated, data is output.

- Unlike the key or auto print mode, data when the balance is unstable is also output. The display does not blink during data output.
- The display is updated 4 times/sec in the stable state and 8 times/sec in the unstable state at shipment time. The display update rate may be set by "SPEEd C1" (**page E•13**).

  If slow baud rate is used (600bps, 1200bps), the data output timing may be slower than the display switching timing.
- With "CtS C6" (**page E•13**) set to "1", when the RTS terminal of the OP-03 is set to minus, data output is stopped.

Command Mode

Print 5 C5 ····· Command mode

Data is output through commands of external equipment such as a computer.

- In addition to the data output command, there are many commands which can externally control the balance.

Connection to AD-8121 (Normal Printing)

To connect the balance to the AD-8121 compact printer (option), set the C-Parameter settings as follows:

Select one of:	Print 0	CS	(Key A mode, AD-8121 is used in MODE 1.)
	Print 1	CS	(Key B mode, AD-8121 is used in MODE 1.)
	Print 2	CS	(Auto Print A mode, AD-8121 is used in MODE 1.)
	Print 3	CS	(Auto Print B mode, AD-8121 is used in MODE 1.)
	Print 4	CS	(Stream mode, AD-8121 is used in MODE 2.)

	CODE	0 CS	(Data No. not assigned.)
	bPS	2 CS	(2400 bps)
	PAr	0 CS	(Parity: EVEN)
	bit	0 CS	(Bits per character: 7 bits)
	StoP	0 CS	(Stop bit: 1 bit)
	Cr-LF	0 CS	(Terminators <CR> and <LF>)
	tYPE	0 CS	(A&D standard format)
	dP	0 CS	(Decimal point: 2EH point)
	CtS	0 CS	(Setting for a personal computer or an AD-8121)

- ❒ Connect using the cable (KO: 256A) supplied with the AD-8121.
- ❒ The connection for a current loop requires an adaptor cable (Option 01 of AD-8121).
- ❒ For details about the AD-8121, refer to the printer instruction manual.

Connection to AD-8121 (Priority with Data Number, etc.)

The connection of the balance to the AD-8121 (accessory) with the printer DIP switch set to "MODE3" will allow printing of the data number and list output of the internal settings. Set the balance internal settings as follows:

Select one of:	Print 0	C5	(Key A mode)
	Print 1	C5	(Key B mode)
	Print 2	C5	(Key A mode)
	Print 3	C5	(Auto Print B)

	CodE 1	C5	(Set the data number)
	PAUSE 1	C5	(Setting data output intervals)
	bPS 2	C6	(2400 bps)
	PAr 0	C6	(Parity: EVEN)
	bit 0	C6	(Bit per character: 7 bits)
	StoP 0	C6	(Stop bit: 1 bit)
	Cr-LF 0	C6	(Terminators <CR> and <LF>)
	tYPE 1	C6	(Dump print [DP] format)
	CtS 0	C6	(Settings for connection with a personal computer or AD-8121)

- ❒ Connect the balance using the cable (KO: 256A) supplied with the AD-8121.
- ❒ The connection for a current loop requires an adaptor cable (Option 01 of AD-8121).
- ❒ The printer AD-8121 is used in MODE 3. In this state, switches other than the FEED key and power key do not function.
- ❒ For details about the AD-8121, refer to the printer instruction manual.

Sample Computer Programs

❒ The C-Parameter settings and an example of a program for the connection of the balance to an IBM PC-AT are shown below:

This example applies to the command mode in which commands are transmitted from the personal computer and a bi-directional communication is carried out.

❒ The C-Parameter settings of the balance

PrInt	5	C5	(Command mode)
bPS	3	C6	(4800 bps)
PAr	0	C6	(Parity: Even)
bit	0	C6	(Data bits: 7)
StoP	0	C6	(Stop bit: 1)
Cr-LF	1	C6	(Terminators <CR>)
tYPE	0	C6	(A&D standard format)
t-UP	0	C6	(Timer ON)
dP	0	C6	(Decimal point 2EH)
E-Cod	1	C6	(Transmit error code)
CtS	0	C6	(Setting for personal computer or AD-8121)

❒ Example of a program for a personal computer [IBM PC-AT]
After the re-zero operation, access data items one after another. The contents are displayed by the computer.

```
10  OPEN "COM1:4800" AS #1
20  PRINT #1, "R"+CHR$ (&HD)
30  LINE INPUT #1, AK$                    {Reply to "R" command}
40          IF AK$< >CHR$ (6) THEN GOTO 130
50  LINE INPUT #1, AK$                    {End of RE-ZERO}
60          IF AK$="EC, E0"   THEN GOTO 140
70          IF AK$="EC, E11"  THEN GOTO 150
80  FOR I=1 TO 1000: NEXT I
90  PRINT #1, "Q"+CHR$ (13)
100 INPUT #1, HD$, DT$
110 PRINT HD$, DT$
120 GOTO 80
130 PRINT "BALANCE NOT READY!" : CLOSE : END
140 PRINT "COMMUNICATION ERROR!" : CLOSE : END
150 PRINT "ERROR 1 . . . BALANCE NOT STABLE!" : CLOSE : END
```

Weighing Data Output Format

The weight data output format is set by "tYPE C6" (refer to **"Data Format"** on **page E-13**). This setting provides the following three formats:

① A&D format	Applicable to A&D peripheral equipment such as the AD-8121 printer (when using in MODE 1 or MODE 2) (tYPE 0 C6)
② DP (dump print) format	Applicable to AD-8121 MODE 3. (tYPE 1 C6)
③ KF format	Applicable to the Karl Fischer's moisture tester which cannot be connected in the A&D standard format. (tYPE 2 C6)

A&D Standard Format

This format is applicable to A&D peripheral equipment such as the AD-8121.

- ❒ At the beginning, there is a header of two characters indicating the data type and status.
- ❒ Data is signed and output up including leading zeros.
- ❒ The unit is represented in three characters.
- ❒ One data group is fixed at 15 characters (excluding a terminator).

DP (Dump print) Format

This format is applicable to AD8121 MODE 3.

- ❒ When not over, there is a header of two characters at the beginning.
- ❒ Data is signed or unsigned if it is zero.
- ❒ The leading zeros are replaced by spaces.
- ❒ The unit is represented in three characters.
- ❒ One data group is fixed at 16 characters (excluding a terminator).

KF Format

This format is applicable to the Karl Fischer's moisture tester which cannot be connected in the A&D standard format.

- ❒ There is no header.
- ❒ When not over, there is a sign at the beginning (no sign when data is zero).
- ❒ The leading zeros are replaced by spaces.
- ❒ The stable data is assigned with a unit (only g).
- ❒ One data group is fixed at 13 characters (excluding a terminator).

Weighing Data Format Examples

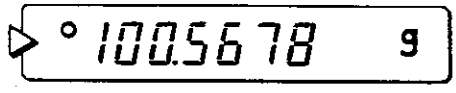
In the following examples, the space code is represented by (20H).

Stable Data Examples

Example : Display = "0.00000g":

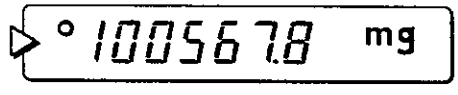
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
A&D Standard	S	T	,	+	0	0	0	.	0	0	0	0	(20H)	(20H)	g	CR LF	
DP	W	T	(20H)	(20H)	(20H)	(20H)	(20H)	0	.	0	0	0	0	(20H)	(20H)	g	CR LF
KF	(20H)	(20H)	(20H)	(20H)	0	.	0	0	0	0	(20H)	g	(20H)	CR LF			

Example : Display = "100.5678g":



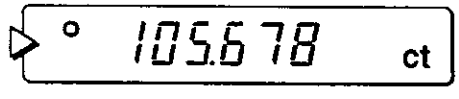
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
A&D Standard	S	T	,	+	1	0	0	.	5	6	7	8	(20H)	(20H)	g	CR LF	
DP	W	T	(20H)	(20H)	+	1	0	0	.	5	6	7	8	(20H)	(20H)	g	CR LF
KF	+	(20H)	1	0	0	.	5	6	7	8	(20H)	g	(20H)	CR LF			

Example : Display = "100567.8mg":



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
A&D Standard	S	T	,	+	1	0	0	5	6	7	.	8	(20H)	m	g	CR LF	
DP	W	T	(20H)	(20H)	+	1	0	0	5	6	7	.	8	(20H)	m	g	CR LF
KF	+	(20H)	1	0	0	5	6	7	.	8	(20H)	(20H)	(20H)	CR LF			

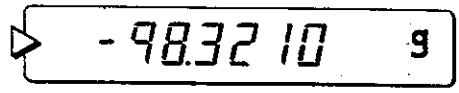
Example : Display = "105.678ct":



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
A&D Standard	S	T	,	+	0	1	0	5	.	6	7	8	(20H)	c	t	CR LF	
DP	W	T	(20H)	(20H)	(20H)	+	1	0	5	.	6	7	8	(20H)	c	t	CR LF
KF	+	(20H)	(20H)	1	0	5	.	6	7	8	(20H)	(20H)	(20H)	CR LF			

Unstable Data Example

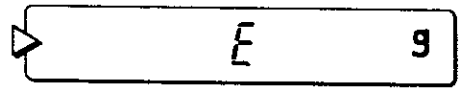
Example : Display = "-98.3210g":



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
A&D Standard	U	S	,	—	0	9	8	.	3	2	1	0	(20H)	(20H)	g	CR LF	
DP	U	S	(20H)	(20H)	(20H)	—	9	8	.	3	2	1	0	(20H)	(20H)	g	CR LF
KF	—	(20H)	(20H)	9	8	.	3	2	1	0	(20H)	(20H)	(20H)	CR LF			

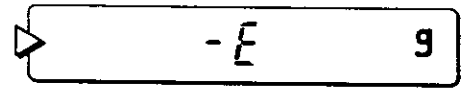
Overload Data Examples

Example : Display = "Eg":



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
A&D Standard	O	L	,	+	9	9	9	9	9	9	9	E	+	1	9	CR LF	
DP	(20H)	(20H)	(20H)	(20H)	(20H)	(20H)	(20H)	(20H)	E	(20H)	(20H)	(20H)	(20H)	(20H)	(20H)	(20H)	CR LF
KF	(20H)	(20H)	(20H)	(20H)	H	.	(20H)	(20H)	(20H)	(20H)	(20H)	(20H)	(20H)	CR LF			

Example : Display = "-Eg":



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
A&D Standard	O	L	,	—	9	9	9	9	9	9	9	E	+	1	9	CR LF	
DP	(20H)	(20H)	(20H)	(20H)	(20H)	(20H)	(20H)	—	E	(20H)	(20H)	(20H)	(20H)	(20H)	(20H)	(20H)	CR LF
KF	(20H)	(20H)	(20H)	(20H)	L	.	(20H)	(20H)	(20H)	(20H)	(20H)	(20H)	(20H)	CR LF			

Independent Data Formats

Output formats of data other than weight data are common irrespective of which format is selected by the C-Parameter setting.
In the following examples, the space code is represented by (20H).

Data No.

The data no. is always a 6-digit integer. The upper figures less than 6 digits are filled with 0. After output, the numerical value is increased by 1.
(9 9 9 9 9 9 → 0 0 0 0 0 0)

1	2	3	4	5	6	7	8	9	10	11
N	o	.	(20H)	0	1	2	3	4	5	CR

Code No.

The code no. consists of 6 characters including space and hyphen (–). It cannot be output with weight data every time.

1	2	3	4	5	6	7	8	9	10	11	12
C	O	D	E	(20H)	0	1	(20H)	3	—	5	CR

Code No.

Parameter Setting Value

(n) = Parameter group number
(m)= Parameter number
(i) = Parameter name (5 characters)
(v) = Parameter setting value

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
C	(n)	(m)	(20H)	(20H)	(i)	(i)	(i)	(i)	(i)	(20H)	(20H)	(20H)	(v)	CR
C	0	0	(20H)	(20H)	S	T	B	—	B	(20H)	(20H)	(20H)	0	CR

Stb-b	? C0	Stability band width
0.	Narrow (approx. 1 digit)	FC00:0

Other Commands for the RS-232C Serial Interface

A given time (delay time) is needed to output a command to the balance after a personal computer has received "AK (06H)" from the balance.
The delay time is set according to the number of operations from "FOR" to "NEXT" and varies according to the clock and performance of the personal computer used. If a program does not run normally, increase the number of operations from "FOR" to "NEXT".

[Example of basic program]

```
1..
123 LINE INPUT #1, AK$          {AK received}
124 FOR I=1 TO 100:NEXT I       {Delay}
125 PRINT #1, "Q"               {Q command output}
1..
```

❒ When internal setting " "AK" and an error code output in command mode" is set to "0" (E-Cod 0 C6), the balance does not output "AK (06H)" or the error code. Refer to **page E•13**.

❒ When this setting is set to 1 (E-Cod 1 C5), after receiving a specific command (command other than data request), the balance outputs the ID code "AK (06H)".
This "AK" is output not only when the specified command is received but also after the command is executed. When the command is not executed, the HA series balance outputs the error code to the personal computer.

❒ A space code is represented as (20H).

1) | ? | # | .Data No. output command

Command	?	#	CR/LF								
Example of response	N	O	.	(20H)	1	2	3	4	5	6	CR/LF

2) | ? | $ | Code No. output command

Command	?	$	CR/LF								
Example of response	C	O	D	E	(20H)	1	2	3	-	5	6	CR/LF

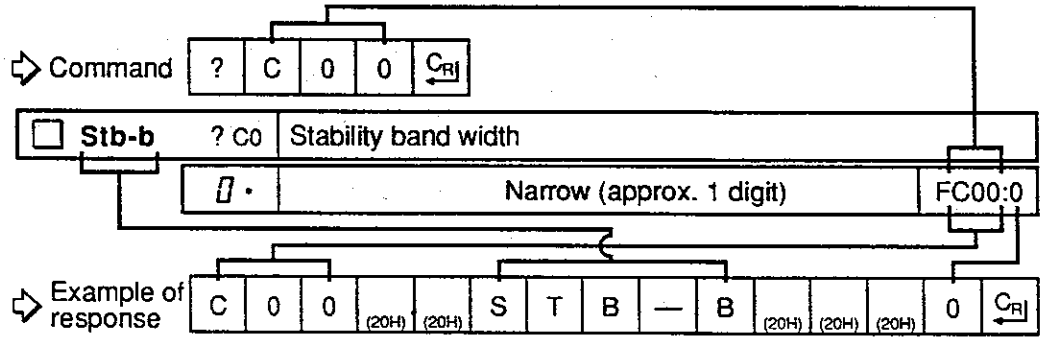
3) | ? | A | L | L | All set values output command

❒ This command outputs all set values stored internally.

Command	?	A	L	L	CR											
Example of response																
Target weight	T	G	,	+	0	0	2	.	0	0	0	0	(20H)	(20H)	g	CR
Calibration weight set value	C	W	,	+	1	5	0	.	0	0	0	0	(20H)	(20H)	g	CR
Coefficient output command in MLt mode	M	L	,	+	2	5	.	0	0	0	0	0	CR			
Data No.	N	o	.	(20H)	1	2	3	4	5	6	CR					
Code No.	C	O	D	E	(20H)	1	2	3	—	5	6	CR				

4) | ? | C | (n) | (m) | Parameter setting output command

❒ This command outputs the set value of the parameter setting. The parameter group number and parametetr number must be preceded by "?C". Refer to **"Parameter Setting Value"** on **page F•12.**



5) | ? | C | W | Set calibration weight value output command

Command	?	C	W	CR												
Example of response	C	W	,	+	1	5	0	.	0	0	0	0	(20H)	(20H)	g	CR

6) | ? | M | L | Coefficient set command in MLt mode

(Refer to **page B•13.**)

Command	?	M	L	CR												
Example of response	M	L	,	+	2	5	.	0	0	0	0	0	CR			

7) | ? | T | G | Target weight output command

Command	?	T	G	CR↵											
Example of response	T	G	,	+	0	0	2	.	0	0	0	0	(20H)	(20H)	g	CR↵

8) | ? | U | Unit check command

❒ This command outputs the unit currently being displayed. It is represented in three characters in the same way as those attached to the weight data in the A&D standard format.

Command	?	U	CR↵	
Example of response	(20H)	c	t	CR↵

9) | # | Data No. set command

❒ This command sets the data no. to be added when the next data is output. Transmit an integer of 8 digits or less, following "#". A negative sign or decimal point will cause an error.

Example of output	#	1	2	3	4	5	6	CR↵
or	#	1	2	3	CR↵			

10) | $ | Code No. set command

❒ This command sets the code no. Transmit 6 characters including space and hyphen (–), following "$".

Example of output	$	8	8	—	1	(20H)	2	CR↵

11) | C | SIR command cancel command

❒ This command stops the output by the "SIR" command. (Refer to **page F•18 "SIR"**.)

12) | C | A | L | CAL switch command

❒ This command functions similarly to the CAL key on the panel.

13) | C | W | Calibration weight set command

❒ This command sets the calibration weight value for manual calibration.
When a unit is not attached after the numerical value, the value is set in the unit being displayed.
When attaching the unit, the value is represented in 3 characters as with those for the response of "?U". It is not possible to set a value exceeding the balancing amount, i.e., a value below around 1/2 of the balancing amount (99.9850g), or a minus value.
It is not necessary to attach a leading zero or trailing zero after the decimal point.

Example of output	C	W	1	5	0	.	0	0	1	2	CR LF

14) | E | X | C | Manual calibration execute command

❒ This command executes manual calibration.

15) | F | C | Parameter setting set command

❒ This command sets the set value of the parameter setting. Transmit the parameter group and parameter number following by a colon (:) and the set value.

(n) Parameter group number
(m) Parameter number
(v) Parameter setting value

F	C	(n)	(m)	:	(v)	CR LF

In this example, the parameter setting COde is set to "0".

Example of output

F	C	5	3	:	0	CR LF

☐ COde	? C5	Data No. output	
0 •		Data No. not output	FC53:0

16) | M | L | Coefficient set command in MLt mode (Refer to **page B•13.**)

Example of output	M	L	3	.	0	CR LF

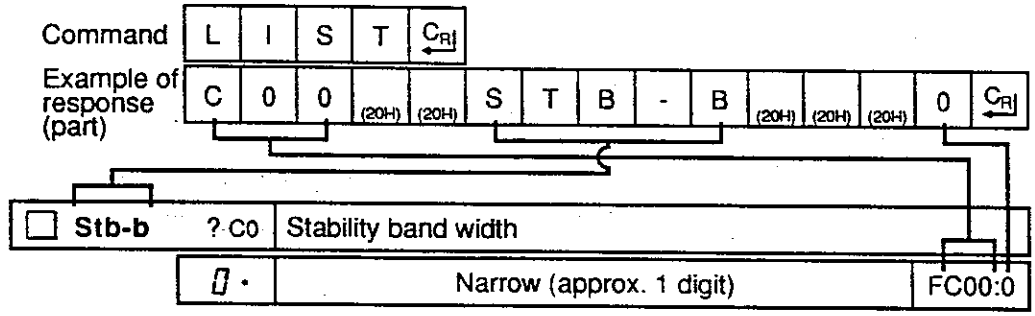
(This example shows that the coefficient 3.0 has been newly set.)

17) | F | E | E | D | Feeder start command

❒ This command starts the vibratory spoon AD-1651 feeder.

18) | L | I | S | T | Parameter setting list output command

❒ This command outputs a parameter setting list.



19) | O | F | F | Display off command

❒ This command turns off the display and does nothing when the display is already off.

20) | O | N | Display on command

❒ This command turns on the display and does nothing when the display is already on.

21) | P | Display on/off command

❒ This command functions similarly to the ON : OFF key on the panel

22) | P | R | T | PRINT key command

❒ This command functions similarly to the PRINT key on the panel.

23) | Q | Weight data output command (instant)

❒ This command outputs one data group irrespective of the stable or unstable state.

24) [R] RE-ZERO command

❒ This command functions similarly to the (RE-ZERO) key on the panel

25) [R][E][A][D] Weight data output command (instant)

❒ This command outputs one weight data group irrespective of the stable or unstable state. (Same as "Q" command)

26) [S] Weight data output command (stable)

❒ After receiving the command, this command outputs one stable weight data group. The display blinks once at the time of output.

27) [S][I] Weight data output command (instant)

❒ This command outputs one weight data irrespective of the stable or unstable state. (Same as "Q" command)

28) [S][I][R] Weight data output command (instant repeat)

❒ This command continues the output of the weight data group irrespective of the stable or unstable state. To return from this state (Stream mode by command) to the original state (where the balance can accept other commands), transmit the "C" command. (Refer to **page F•15**.)

29) [R][N][G] RANGE key command

❒ This command functions similarly to the (RANGE) key on the panel

30) [S][T][O][P] Feeder stop command

❒ This command stops the vibratory spoon AD-1651 feeder.

31) | T | G | Target weight set command

❒ This command sets the target weight when the vibratory spoon is used. When attaching no unit after the numerical value, the value is set in the unit being displayed. When attaching the unit, the value is represented in 3 characters in the same way as those for the response of "?U". It is unnecessary to attach leading zeros or trailing zeros after the decimal point.

Example of output

T	G	2	.	0	0	0	0	(20H)	(20H)	g	CR/LF

32) | U | MODE key command

❒ This command functions similarly to the (MODE) key on the panel

33) | U | : | × | × | × | Unit change command

❒ This command changes to the unit represented by ×××. ××× is specified by a character string identical to that to be output by the "?U" command. If the character string is different or the unit is not stored, an error (EC, E6) occurs. After executing this command, the unit to be changed by the "?U" command or MODE key is the one to be stored next to the unit being displayed.

Example of output

U	:	(20H)	m	g	CR/LF

Error Codes in the Command Mode

When an error of some kind occurs in the Command mode, the error code can be output (by **"C-Parameter Setting"** "E-Cod i C6", refer to **page E•13.**)

- When there is no error, the requested data is output by the data request command ("S", etc.), and "AK (06H)" is output by other commands. A response is made to all commands, increasing the reliability of external control.
- If the computer program can display the balance error codes, the balance can be set to output these codes.
- In the error code output format, "EC" is attached as a header, followed by "E" and a figure which indicates the error type.

E	C	,	E	<n>	CR/LF

<n> indicates an error figure

or

E	C	,	E	<n>	<n>	CR/LF

E0 Communication error

- This error occurs when a communication error is detected.
  - ① Parity error — The parity does not match. The bits per character may differ from the set value.
  - ② Framing error — The bits per character may differ from the set value.
  - ③ Other communication errors

E1 Undefined command

- This error occurs when the command does not match the specified value (excluding the numerical part).

Example

?	t	g	CR/LF

(Lower-case characters cannot be used.)

E2 Execution disabled state

- This error occurs when the balance cannot execute the command.
  - ① When not in the measuring state — A data request command such as "Q" cannot be executed.
  - ② During re-zero — A data request command cannot be executed.

E3 Time overrun

❒ This error occurs when the time required to receive the next start bit after a character other than a terminator was received is over 1 sec. (**"C-Parameter Setting"** is "t-UP 0 C6". Refer to **page E•13.**)

E4 Character overrun

❒ This error occurs when in the numerical value command, the number of digits on the numerical side exceeds the limit value.

Example	C	W	+	1	5	0	.	1	2	3	4	5	(20H)	(20H)	g	CR LF

E5 Terminator error

❒ This error occurs when setting <CR> <LF>. Characters other than <LF> preceded by <CR> or when <LF> is received before <CR>.

E6 Format error

❒ This error occurs when a command with a numerical value is used and the description of the numerical part (including ' : ', ' + ' and ' – ') is incorrect.

Example	C	W	1	0	0	(20H)	(20H)	G	CR LF

(When the unit is a gram, lower-case characters cannot be used.)

E7 Set value error

❒ This error occurs when a command with a numerical value is used and the numerical value exceeds the limit value.

Example	T	G	+	3	2	0	.	0	(20H)	(20H)	g	CR LF

E11 Error indicating the unstable state

- ❒ Balance display Error 1
- ❒ Refer to **page I•3.**

E14 Weighing pan error

- ❒ Balance display Error 4
- ❒ Refer to **page I•4.**

E15 → 18 Error in balance

- ❒ Balance display Error 5 → 8
- ❒ Refer to **page I•4.**

E20 Calibration error

- ❒ Balance display CAL E
- ❒ Refer to **page I•4.**

E21 Calibration error

- ❒ Balance display -CAL E
- ❒ Refer to **page I•4.**

E23 Calibration error

- ❒ Balance display CAL no
- ❒ Refer to **page I•5.**

E40 Re-zero error

- ❒ Re-zero impossible

Command Examples Illustrated

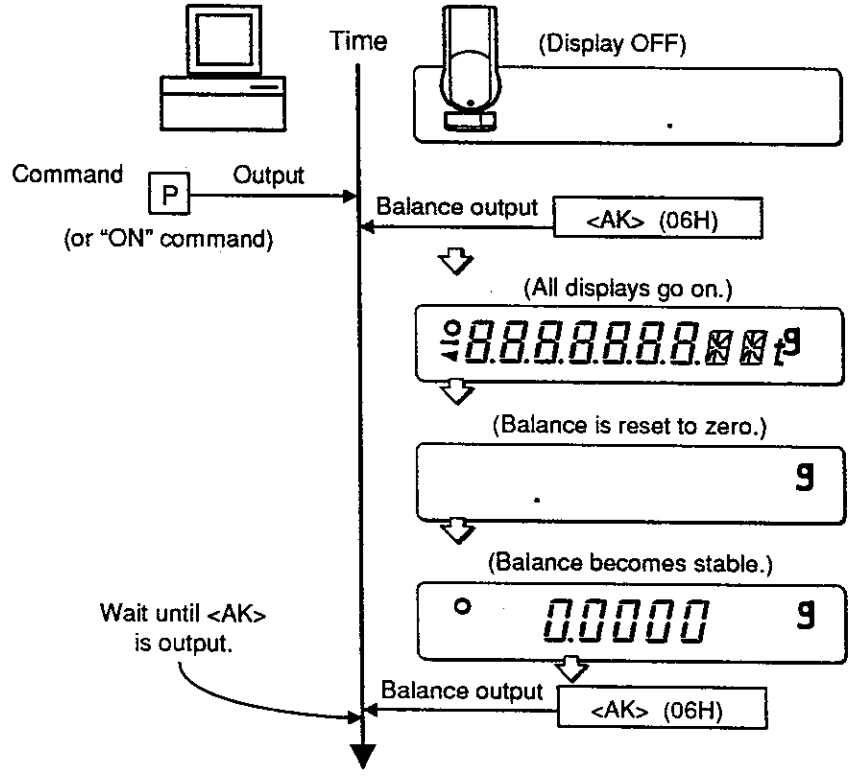
The following is an illustration of communication between a personal computer and HA series balance via RS-232C.

- ❒ The C-Parameter setting of the balance is assumed as "E-Cod 1 C6" (output of AK error code).
- ❒ A fixed time (delay) is required to output the command to the balance after a personal computer receives "AK (06H)" from the balance.
  This delay time is provided by the number of operations in the "FOR" to "NEXT" loop and varies with the performance of the personal computer used. If the program does not run normally, increase the number of operations from "FOR" to "NEXT". Change line 124 to read "FOR I=1 to 200: NEXT I "

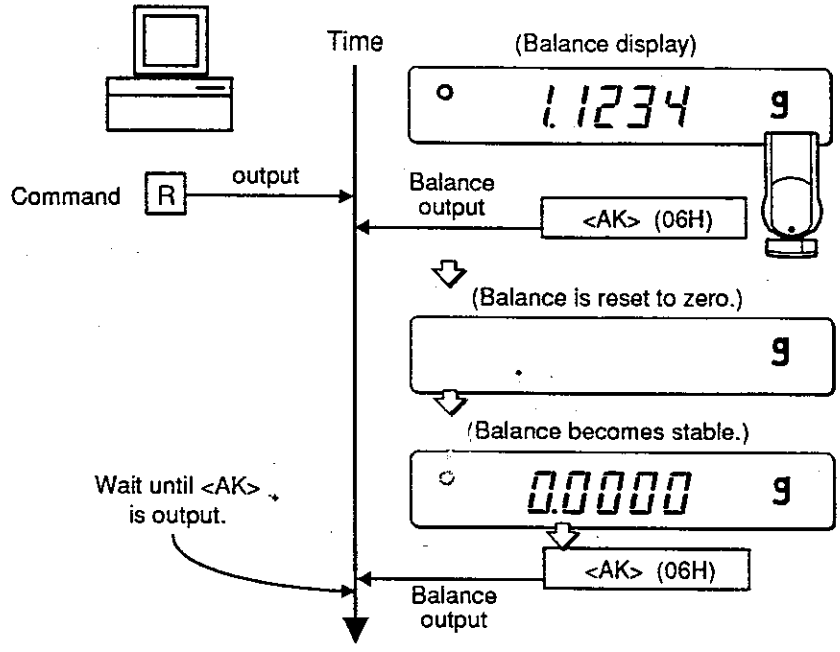
[Example of BASIC program]

```
1..
123 LINE INPUT #1, AK$          {AK received}
124 FOR I=1 TO 100:NEXT I       {Delay}
125 PRINT #1, "Q"               {Q command output}
1..
```

"P" "ON" Command (Display ON/OFF)



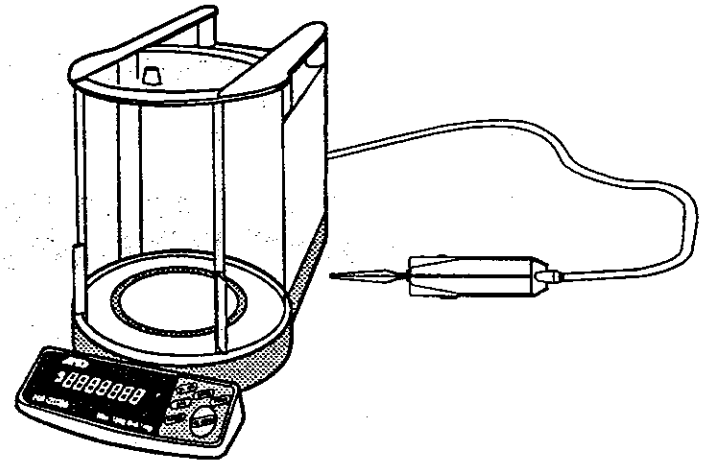
"R" Command (RE-ZERO)



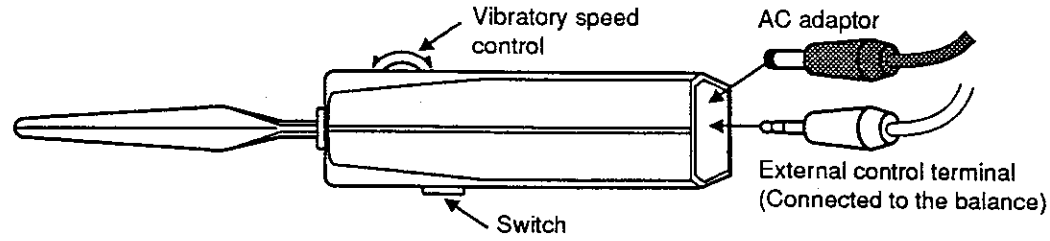
HA SERIES • Section G

Vibratory Spoon

AD-1651 (Accessory)



Vibratory Spoon AD-1651



- The connection to the **Vibratory Spoon AD-1651** (accessory) will facilitate weighing powder and granular materials up to the target weight.
- Set the C-Parameter setting **"Selection of External Input Terminal Function"** to **"2"**. Refer to "Cont 2 C4" on **pages E•3 and E•9**.)
- Use a stereo audio cable (available from most electronics supply stores) to connect the "EXT. SW" on the rear of the balance to the AD-1651 "I/O".
- Power is not supplied to the AD-1651 from the balance. Therefore, install a battery or use an AC adaptor.
- When the switch on the AD-1651 is pressed, vibration is started to drop powder or granular materials. When the measured value set into the balance approaches the target weight, vibration is automatically stopped.

Target Weight

- The target weight is set by the following three methods.

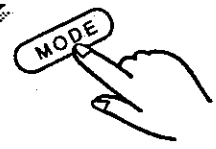
  ① Method of registering the target weight by actual weight.
  ② Digital input from the balance front panel.
  ③ RS-232C (accessory) methods (refer to page G-19).

- The target weight is set and confirmed by the unit displayed.
  (When the weight is set by computer command, it can be set by the unit not displayed). When the unit of weight is changed after setting, the new one is displayed.
- The balance will not accept values greater than the capacity.

Registering Target Weight by Actual Weight

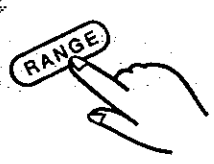
- The following example shows the method whereby the actual weight is registered as the target weight.
  The set values previously registered can also be confirmed.
- Press the (ON : OFF) key to return to the normal mode during the operation.
- Register within the 0.01 mg range is not possible.

1



- Press the (MODE) key to select the gram "g" mode.
  - The subsequent operations are also possible in a mode other than the gram "g" mode. However, care is required because the value displayed is a converted value.

2

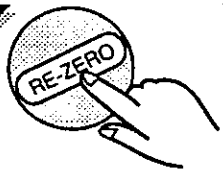


- Press and hold the (RANGE) key for 2 seconds.
  - "TG" unit is displayed, the target weight previously set is displayed, and the value can be confirmed. (10g is set in this example.)
  - When only confirming the target weight, wait approx. 4 seconds to return to the normal mode.

3

- To set a new target weight, after "TG" is displayed, press the (RE-ZERO) key within 4 seconds.
  - The input mode is entered and unit "TG" blinks.

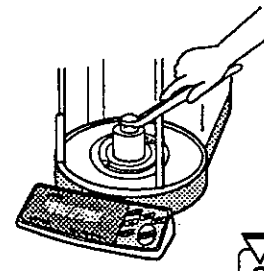
4

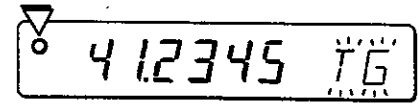


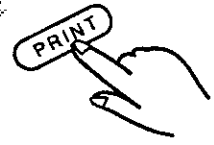
- Press the (RE-ZERO) key to for a re-zero operation.

5 ▶ Place a substance to be registered as the "target weight" on the pan.

○ Check stabilization mark ".".

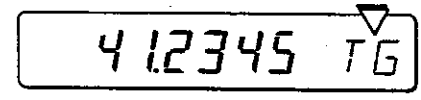




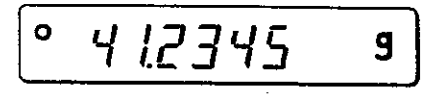
6 

▶ Press the PRINT key to store the data.

○ The "TG" display changes from blinking to steady illumination.



○ Wait for 4 seconds to return to the normal weighing state and the register is completed.



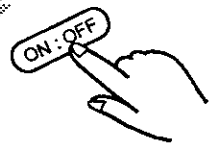
Target Weight Digital Input by Front Key

▶ The target weight can be digitally input directly by front key manipulation.

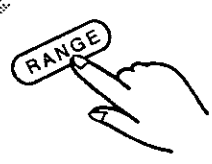
▶ To return to the normal mode during the operation, press the ON : OFF key.

▶ 0.01mg range input cannot be performed.

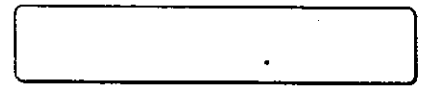
---

1 

▶ After setting the unit of weight to be set, press the ON : OFF key to turn off the display.
(The gram unit is shown in this example.)

2 

▶ In the display-off state, press and hold the RANGE key.



3 

▶ With the RANGE key held down, press the ON : OFF key.

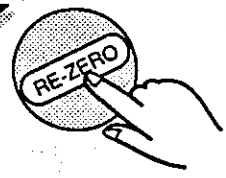
○ The value previously set is displayed. (10g is set in this example.)

○ When only confirming the target weight, the PRINT key is pressed to return to the normal mode.

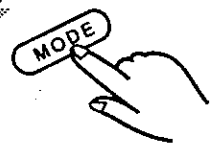
4 

▶ Press the MODE key. The display of the rightmost digit becomes 0 and blinks.

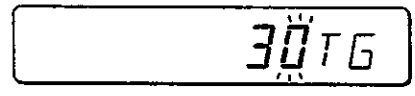
○ "31.0000g" will be set in the following example.

5 

▶ Press the RE-ZERO key three times to set "3".

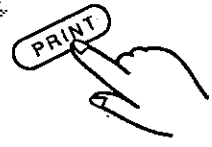
6 

▶ Press the MODE key to move to the next digit.



▶ Thereafter, press RE-ZERO and the MODE keys for setting.
Use the RANGE key to enter a decimal point.

▶ After entering the data, the CAL can be used to change the polarity.

7 

▶ After entering the necessary numerical value, press the PRINT key.

○ The set value is registered, and the balance will return to the weighing mode.

○ The set value is registered in the weighing unit set before the display is turned off in step 1.

Setting and Confirming the Target Weight by RS-232C

Confirming the set value (by RS-232C)

?	T	G	CR

A request for transmission of the current target weight is made to the balance.

Example of response

T	G	,	+	0	0	2	.	0	0	0	0	(20H)	(20H)	g	CR

(2g is set in this example.)

Changing the set value (by RS-232C)

Example)

T	G	4	.	0	(20H)	(20H)	g	CR

4g is newly set in this example.

○ Refer to **page F•19.**

Starting AD1651

Weighing by the AD1651 is started by either of the following methods.

① Press the switch of the Vibratory Spoon AD-1651.

② Send the "FEED" command via | F | E | E | D | RS-232C.

Start feeding by either one of the above. Once started, it is unnecessary to continue to press the switch on AD-1651.

When the weighing is started, the Vibratory Spoon AD1651 automatically starts vibrating. Vibration can be adjusted by the volume provided on the AD1651.

Stopping AD1651

The AD1651 stops automatically when the display approaches the target weight. To stop the AD1651 forcibly before the display reaches the target weight, use either of the following methods.

① Press the switch on the Vibratory Spoon AD1651 again.

② Send "STOP" command via RS-232C. | S | T | O | P |

Addition after Stop

If the displayed is below the target value, restart according to the procedures indicated in "Starting AD-1651".
If the value exceeds the target value, a restart cannot be performed unless the switch on the AD-1651 is pressed continuously.

Weighing Accuracy

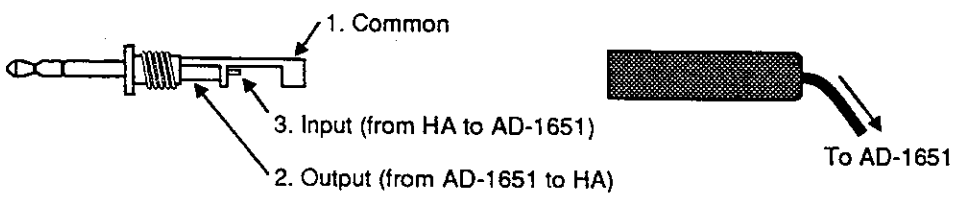
❒ The following can be the causes of reducing AD-1651 weighing accuracy.

1) The angle of AD-1651 changes ..... Flow rate change
2) The height of AD-1651 changes .....Flow rate change
3) Samples are not uniform. (There are some lumps)
4) Flow rate is too large for the target weight.

❒ While weighing with the HA series balance connected to the AD-1651, the balance responds at a constant high speed irrespective of the internal settings of the "Response Characteristics/Selection" "Cond co".

When Using a Provided Plug

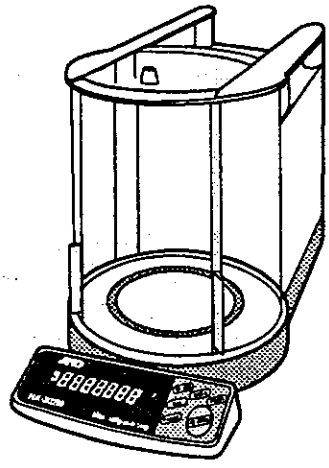
Connect the plug supplied to the "EXT.SW" jack on the rear of the balance as shown in the figure below:

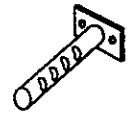


HA SERIES • Section H

Anti-theft Device

OP-11 (Accessory)

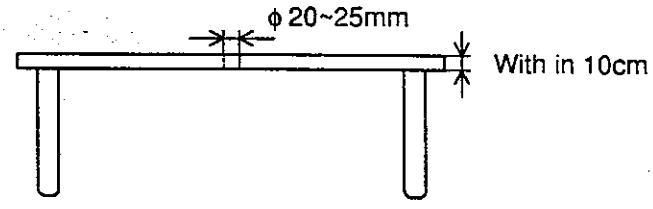




OP-11 Installing Procedure

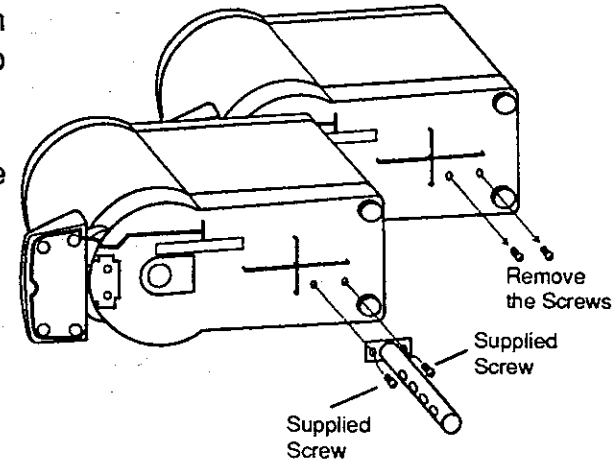
- ○ The OP-11 is an anti-theft device to securely connect the balance table to the balance to prevent theft.
- ○ Locking table type
- ○ The balance table mounting section should have a thickness of 10cm max.
- ○ The balance table mounting section should have a ϕ20mm to ϕ25mm hole.

1 ▶ Cut a hole (ϕ20 ~ ϕ25mm) in the balance table.

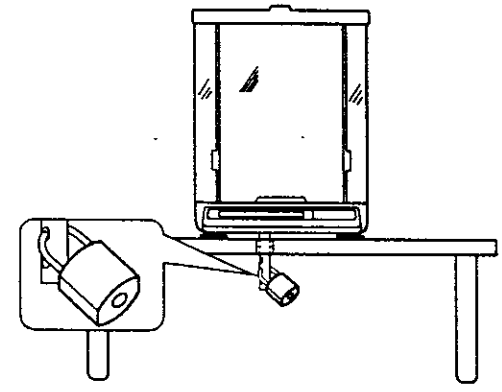


2 ▶ Remove the two screws on the bottom of the balance to mount the anti-theft device.

▶ Mount the anti-theft device with supplied two screws.

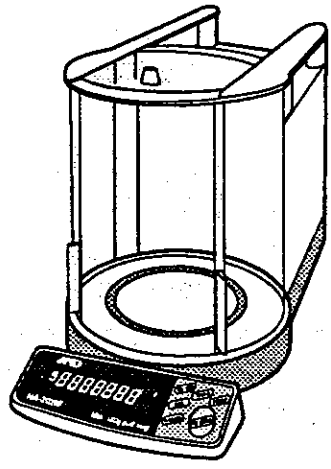


3 ▶ Put the anti-theft device through the table hole and lock it.



HA SERIES • Section I

Troubleshooting



Trouble

❒ **Display does not stabilize.**

- ○ Check if the balance table is steady. Use a steady table.
- ○ Check if the draft ring and weighing pan are installed correctly.
- ○ Check if the balance door is closed properly. Close it so that drafts do not cause instability.
- ○ Check if the air flow around the balance is okay. Block off the air flow as much as possible.
- ○ Check if warming-up has been performed for over one hour.
  (In the 0.01mg range, approx. 2 hours may be required for warming-up depending on the environment.)
- ○ After checking all of the above, set internal setting "Cond co", as needed. (For the change method, refer to **page E•3**.)
- ○ Ask for servicing if the display remains unstable.

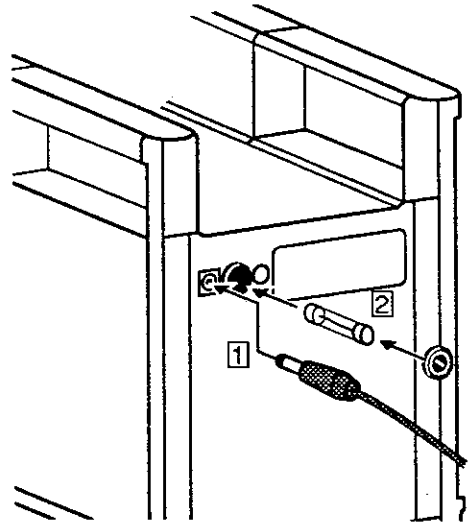
❒ **There is no repeatability of the measured value. An apparently incorrect value is displayed.**

- ○ Check if the balance is leveled using the level gauge.
- ○ Check if calibration was performed in a place free of vibration and drafts.
- ○ Check if the (RE-ZERO) key has been pressed before putting the sample on the pan.
- ○ Check if the sample comes into contact with any part of the weighing chamber other than the pan.
- ○ Check if the sample is on the center of the pan. Putting the sample on the edge of the pan may cause an error.
- ○ Check if the sample or the clothes worn by the tester is charged with static electricity. Take necessary measures such as weighing the sample placed in a electrically conductive recipient or wearing anti-static clothes. (Refer to **page D•6**.)
- ○ Check if a magnetic substance such as iron has been used as a sample. Since the HA series uses a magnet, measurement of a magnetic substance may cause an error. In this case, perform underhook weighing. (Refer to **page D•9**.)
- ○ Check if there is a difference in temperature of the air in the weighing chamber, sample and tare.
  The sample and tare should be acclimated to the environment before being measured. Do not touch the flask, etc. by hand. (Refer to **page D•6**.)
- ○ Check the air density for the day of data recording. With changes in atmospheric pressure, temperature, and humidity, the air density may cause fluctuation of the air buoyancy of the sample,causing reduced reliability of the results of a measurement. Special care should be given when using the 0.01 mg range. (Refer to **page D•6**.)
- ○ After checking the above, if there is still up repeatability of the balance, ask for servicing.

❒ The power indicator (decimal point at the left side) does not illuminate even when the AC adaptor is plugged in. The display does not react, even if the (ON : OFF) key is pressed.

○ Replace the fuse on the rear of the balance according to the procedure shown in the figure below.

Fuse Replacement



1. Disconnect the AC adaptor cable from the balance. [1]
2. With the fuse holder pressed in, make a half turn to the left and pull out the fuse with the cap.
3. Replace the fuse in the cap with a new 500mA time lag fuse. [2]
4. After replacement, if the fuse burns out again, ask for servicing.

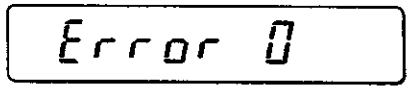
Error Display and Countermeasures

❒ Power failure

"P FAIL" indicates that the power was interrupted.

▶ Press the (ON : OFF) key.

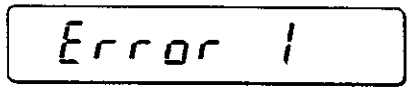
❒ Internal operation error



"Error 0" indicates that an error occurred during the internal operation of the balance.

▶ Ask for servicing.

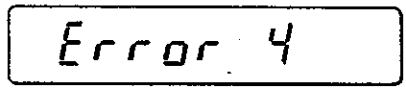
❒ Error indicating unstable state



"Error 1" indicates that the zero display does not appear because the balance is unstable during the re-zero operation.

▶ Check for vibration and air flow and press the (RE-ZERO) key. Refer to **"Trouble" on page I•2.**

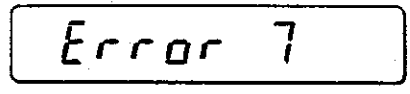
Weighing pan error

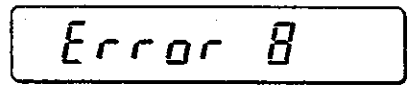


"Error 4" indicates that the (ON : OFF) key was pressed with the weighing pan, balance weight, and pan support assembled incorrectly, or with an object on the weighing pan.

▶ Assemble the weighing pan, balance weight, and pan support correctly. Remove any objects from the weighing pan. If the error still continues, ask for servicing.

Memory error

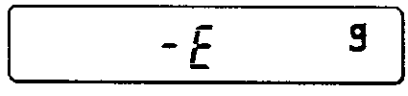




"Error 5" to "Error 8" indicates a balance memory error.

▶ Disconnect the AC adaptor from the balance and reconnect it after several seconds. If this error still continues, ask for servicing.

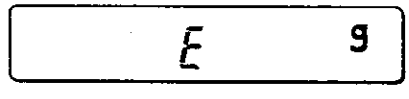
Weighing pan error



"-E" indicates that the weighing pan, balance weight, and pan support are not assembled correctly.

▶ After assembling correctly, if the error still continues, ask for servicing.

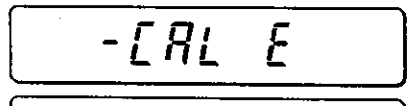
Overload error

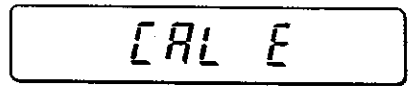


"E" indicates that the weight of a measured object exceeds the balancing capacity.

▶ After removing the measured object, if the error still continues, ask for servicing.

Calibration error





"-CAL E" indicates that the weight is too light for calibration.

"CAL E" indicates that the weight is too heavy for calibration.

▶ Check that all objects are removed from the pan, the weighing pan is assembled correctly, and the value of the weight corresponds to the set value, then press the (RE-ZERO) key.

"CAL no" indicates that calibration cannot be performed because the balance is unstable due to factors such as vibration and air flow.

▶ Check for vibration and air flow, and then press the (RE-ZERO) key.
Refer to **"Best Conditions For Weighing"** on **page A•3**.

The unit display section blinks. This blinking does not indicate an error but a change in the ambient temperature.

▶ After about two minutes, calibration is automatically started by the auto self-calibration function.
Refer to **"Automatic Self-calibration"** on **page C•3**.

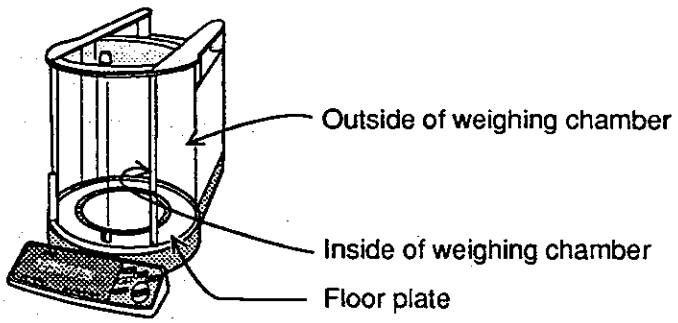
"⚠" of the unit display section blinks. This blinking does not indicate an error but an change in the ambient temperature. Only a warning is given and calibration is not started automatically. This is because the C-Parameter setting is set to "CAL L C2". Refer to **page E•7**.

". . . . . g" does not indicate an error. This indicates that the automatic range switching function is operating in the 0.01 mg range. After this, the display is automatically changed to the 0.1 mg range. Refer to **page D•3**.

Maintenance

○ If the door glass, pan, and floor plate (made of glass are dirty, clean them as follows.

- Wipe with alcohol the outside of the weighing chamber and floor plate.
- Wipe with a soft cloth the inside of the weighing chamber (except floor plate). Never use alcohol becuase an anti-static material has been applied to this part.



Index

E

F

I

L

M

O

P

R

S

T

U

W

Z

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