AD-4712

INFRARED MOISTURE DETERMINATION BALANCE

INSTRUCTION MANUAL

Instruction-AD-4712-v.2.b 92.08.10.OGA

INFRARED MOISTURE DETERMINATION BALANCE

A&D Company, Limited

Table of Contents

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 designed 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 interference.

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

Welcome !

Thank You For Your A&D Purchase!

This is an Instruction Manual for the AD–4712 Moisture Balance. Every care has been taken during the manufacturing process of this moisture balance to ensure that it will perform accurately and reliably for many years. Electronic balances are in one sense extremely simple products, that is they are very easy to use. In another sense they are rather complex in that they are high technology products. This manual will try to tell you in simple language how this balance works and how to get the most out of it in terms of performance.

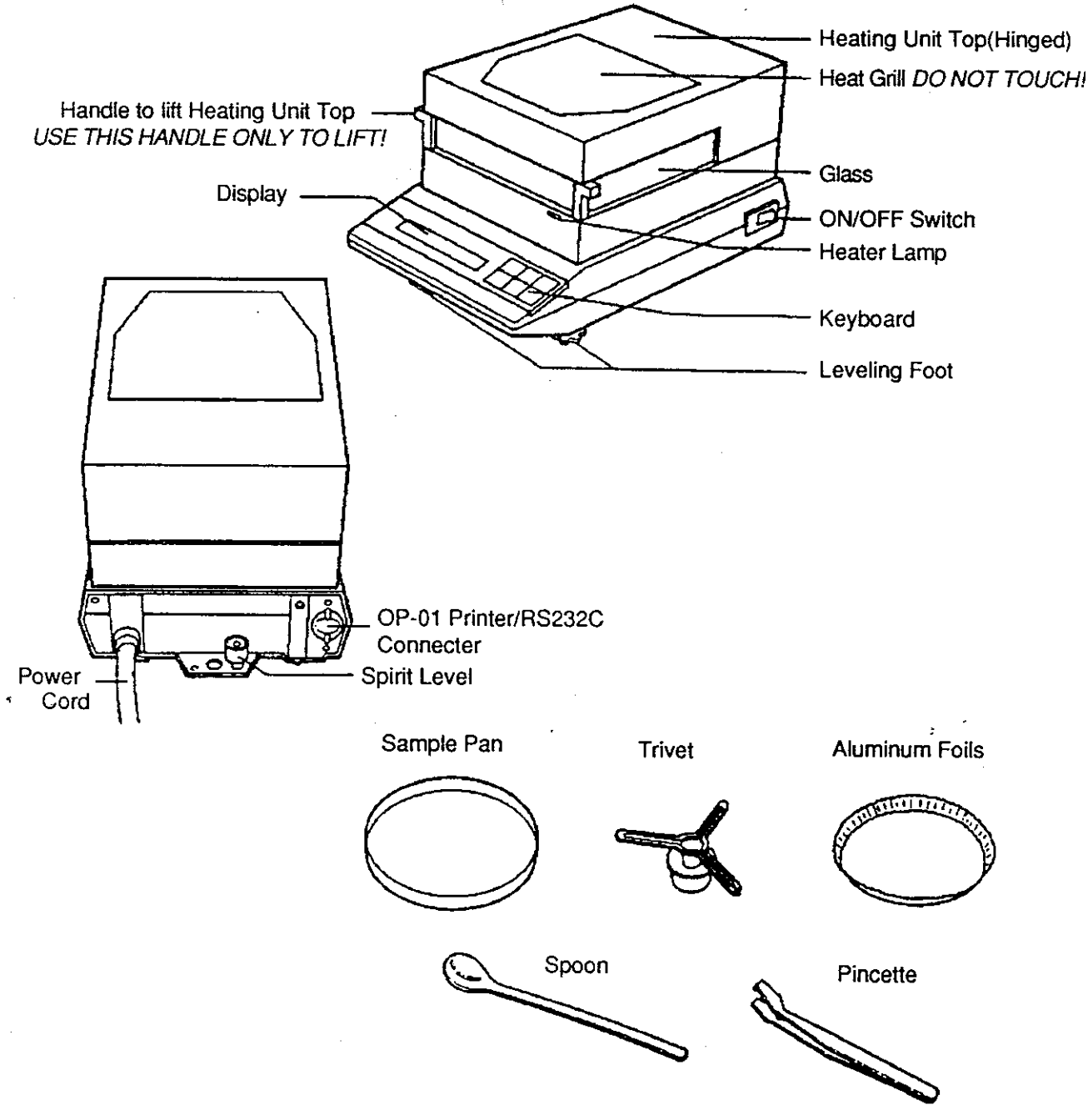
The AD-4712 Moisture Balance is the product of years of research, design, development and in-field testing. It incorporates the latest advances in electronic and mechanical engineering. The AD-4712 is equipped with an electronic weighing balance, micro-computer analytical functions, and a Ceramic sheathed heating coil for quick drying of a sample. When the optional serial interface is installed, connection with a printer or computer is possible for a hard copy of the moisture determination cycle.

Best Conditions For Weighing

- ❑ The Balance must be level (check the spirit level at the rear of the Balance).
- ❑ Best temperature is about 20°C/68°F at about 50% Relative Humidity.
- ❑ The weighing room should be kept clean and dry.
- ❑ The weighing table must be of a solid construction.
- ❑ Corners of rooms are best as they are less prone to vibrations.
- ❑ Don't install the balance near heaters or air conditioners.
- ❑ Don't install the balance in direct sunshine.
- ❑ Try to ensure a stable AC power supply.
- ❑ Keep equipment containing magnets away from the balance.
- ❑ Ground the balance when using an adaptor.

Unpacking Your Balance

- Please unpack the balance carefully and keep the packing material if you are likely to want to transport the balance again in the future.
- In the carton you should find this manual plus:
  - ❑ The AD-4712 Balance with Heating Unit.
  - ❑ Stainless Steel Sample Pan.
  - ❑ Protective plastic cover for the balance.
  - ❑ Trivet.
  - ❑ Stainless Steel sample spoon.
  - ❑ Pincette for removing hot samples.
  - ❑ A package of 20 Aluminum Foils to hold samples.



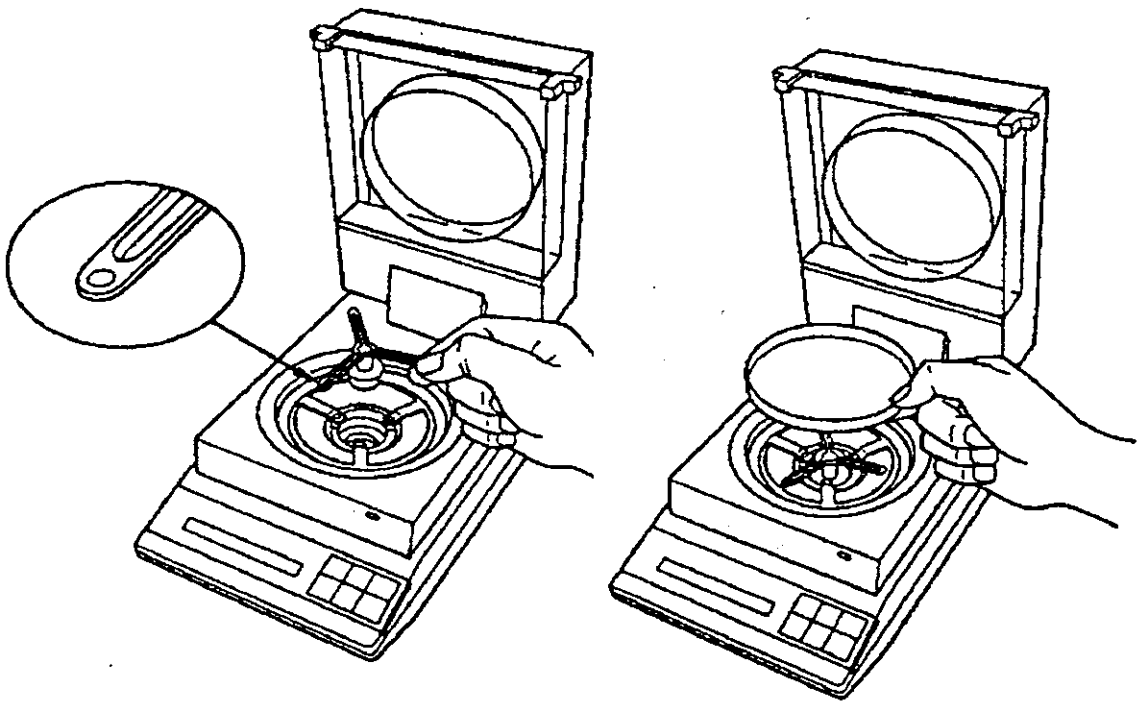
Installation

■ Assembly

Step 1 Place the AD-4712 on a flat and stable surface (see the BEST CONDITIONS FOR WEIGHING section). While watching the spirit level at the back of the balance - level the balance by using the two front feet.

Step 2 Place the Trivet as shown - with the arm that has the "0" at its end, pointing to the front.

Step 3 Place the Sample Pan on the Elevator.



Step 4

Connect the balance to power. The AC input requirements are 100 to 120 Volts, or, 220 to 240 Volts (50/60Hz) depending on the area in the world you are in. (if you are uncertain, please check that the model is correct for your area). Connect the earth cord to ground if adaptor is used.

Please Note

- ❑ For highly accurate weighing (if needed) - leave the balance switched ON to "warm-up" for at least 30 minutes before use.

Quick Instructions

The following is a Quick Instruction for use of the AD-4712, for full Instructions and explanations, please read FULL INSTRUCTIONS FOR THE MOISTURE DETERMINATION PROCEDURE section.

Step 1 — Turn the power switch ON.

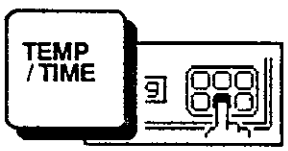
Display — 

The display will show "BUSY" while the Sample Pan goes up and down twice.

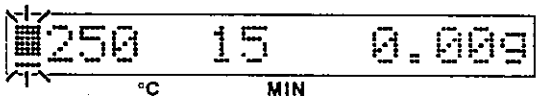
Note: You must have the Sample Pan on the Elevator, or the display will never change from "BUSY".

Display — After a few moments, the display will show the temperature, time, and "0.009" from the last moisture determination.

■ Set Desired Temperature:

Step 2 — 

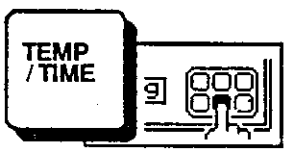
Press the [TEMP/TIME] key. You may change the temperature setting only while this cursor is flashing - if the setting is not changed within two seconds, the cursor will stop.

Display — 

A cursor will flash by the °C setting shown.

Step 3 — While this cursor is flashing - use the [▲] key to increase, or the [▼] key to decrease the displayed setting until you have reached your new setting. If you hold these keys down - after moving 10 digits, the change will speed up.

■ Set Desired Time:

Step 4 — 

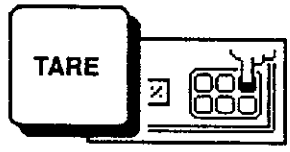
Press the [TEMP/TIME] key. You may change the time setting only while this cursor is flashing - if the setting is not changed within two seconds, the cursor will stop.

Display — The cursor will flash by the **MIN** (minutes) setting shown.

Step 5 — Again, use the [▲] key to increase, or the [▼] key to decrease the displayed setting. The "**00**" setting means that the heater is always ON. The [START/STOP] key must be pressed to stop.

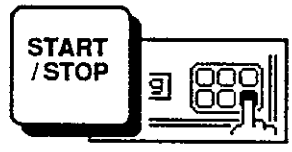
■ TARE the Display:

Step 6 — Set a piece of aluminum foil (or other non-flammable tare container) in the Sample Pan.

Step 7 — 

Press the **TARE** key to Zero the display.

Step 8 — After "BUSY" stops, add your sample to be analyzed to the Sample pan - you can use display to measure the sample. Be sure to smooth out the sample for even drying.

Step 9 — 

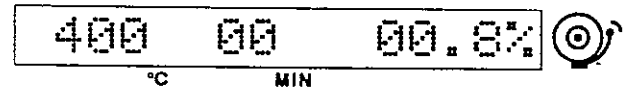
Lower the Heating Unit Top down. Press the **START/STOP** key to begin.

Display — For a few seconds, the display will show the target temperature and time set. When the heating unit starts, the red light will come on, and a "*" asterisk will be shown at the far left.

Note: — Every 30 seconds, the AD-4712 goes through a measurement/analysis cycle. When the cursor flashes at the far left, it means that the sample is going through this cycle.

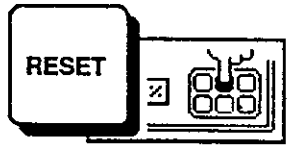
Note: — You may stop the moisture determination cycle at any point by pressing the **START/STOP** key - EXCEPT when the cursor is flashing during the measurement/analysis as above. The red light will go OFF when the cycle has been stopped.

Display — At the end of the moisture analysis cycle (time is up) an electronic alarm tone will sound and the final moisture content will be displayed.



Step 10 — Press the **START/STOP** key to stop the alarm tone.

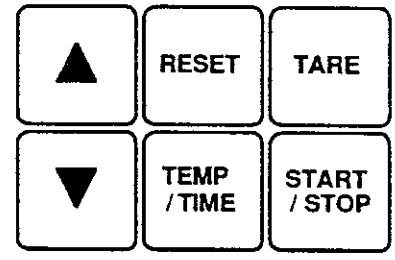
Step 11 — Carefully lift the Heating Unit Top up. Be careful not to touch any part of the cover except for the handle, it is likely to be hot.

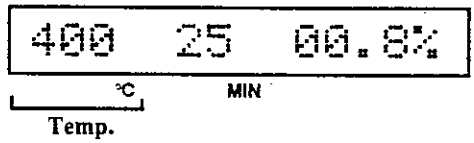
Step 12 — 

If you wish to do another moisture analysis, or see the resulting sample weight, press the **RESET** key.

Step 13 — Use the Pincette to lift the Sample Pan off of the elevator. Do not place it on anything that is heat sensitive. Load another sample if you want, or - if you are finished, switch the AD-4712 OFF.

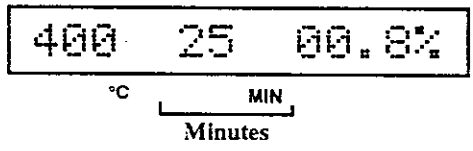
The Front Panel





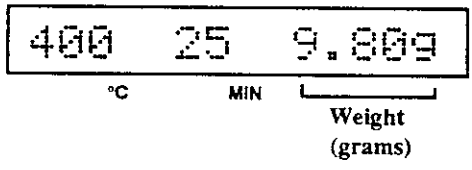
Temperature

- The Temperature setting is at the far left of the display, shown in degrees Centigrade. The AD-4712 has a range from 50°C to 400°C.
- The temperature shown is of the ceramic heater, not that of your sample. As to the real sample temperature, please refer to the TEMPERATURE CONVERSION section.



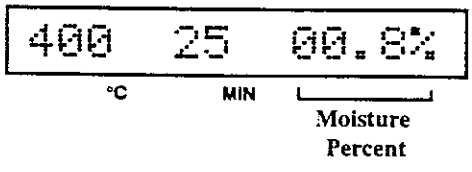
Drying Time

- The set Drying Time is displayed to the right of the temperature. It can be set in one minute increments, 1 min. to 90 min (The **"00"** setting means that the heater is always ON. The START/**STOP** key must be pressed to stop). To set a timer value of 91, 92 or 93 is to select the Automatic Stop Mode. Please see page 14 for more information concerning the " Auto Stop Mode".



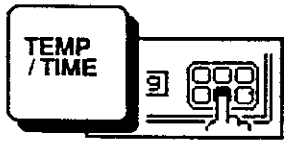
Sample Weight

- When you turn ON the AD-4712, and before you start the moisture determination procedure, the balance will be in a weighing mode - displaying samples on the sample pan in grams.



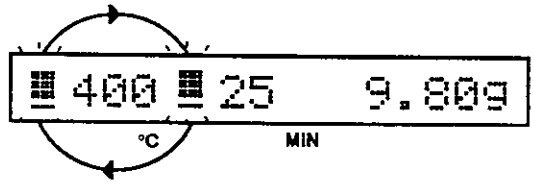
Moisture Content

- Every 30 seconds during the moisture determination cycle the display will show the samples moisture content (%) to that point in the cycle. At the end of the cycle, the final moisture content will be displayed.



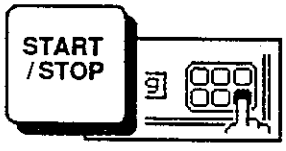
The TEMP/TIME Key

- This key is used to move between the Temperature and Time settings for the moisture determination cycle. By pressing it, a flashing cursor appears by the °C setting. Press it again and the cursor moves to the MIN setting.



The ▲& ▼ Keys

- Increases or decreases the Temperature or Time displays. These keys work when the cursor is flashing by either setting.



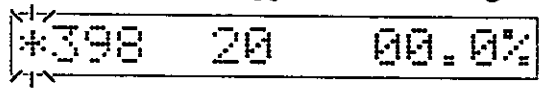
The START/STOP Key

- This key is used to START, or STOP the heating cycle. After the **START**/STOP key is pressed: the heating unit red light goes ON, an asterisk will appear at the far left, and heating starts. Every 30 seconds the AD-4712 will do a measurement/ analysis and a cursor appears at the far left. The START/**STOP** key only works while the asterisk is ON.

During the Heating Cycle:

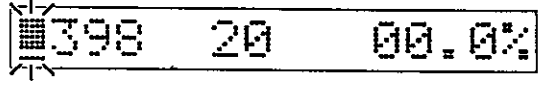
START key is pressed.

Asterisk will appear when heating.



STOP key works with asterisk display.

Cursor will appear when analysing.



STOP key will not work with cursor display.

Fuse Replacement

- If the internal fuse should blow, please see your local A&D dealer for replacement.

Detailed Instructions

For the Moisture Determination Procedure

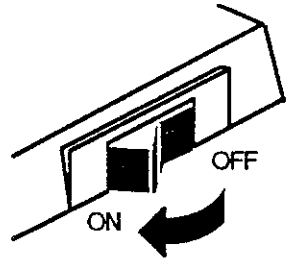
Attention!

- **Do not try to measure any material that is potentially combustible or flammable!**
- **Use only the handles on the Heating Unit Top to lift it. DO NOT TOUCH any part of the heating unit after it has been activated.**
- **Be sure to monitor the sample - DO NOT leave it unattended.**

Please Note

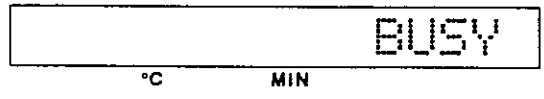
- For highly accurate weighing (if needed) - leave the balance switched ON to "warm-up" for at least 30 minutes before use.
- The temperature displayed is of the ceramic heater, not that of your sample. As to the real sample temperature, please see the TEMPERATURE CONVERSION TABLE.

Step 1



Turn the power switch ON.

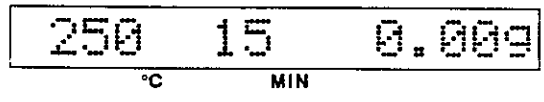
Display



The display will show "BUSY" while the Sample Pan goes up and down twice.

Note: You must have the Sample Pan on the Elevator, or the display will never change from "BUSY".

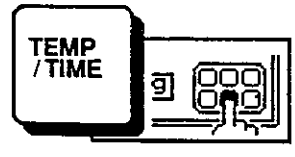
Display



After a few moments, the display will show the temperature, time, and "0.009" from the last moisture determination.

■ Set Desired Temperature:

Step 2

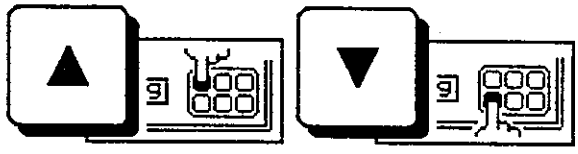


Press the **TEMP/TIME** key.

Display 

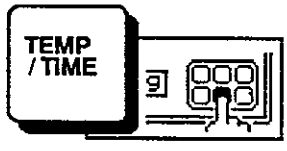
A cursor will flash by the °C setting shown.

Note: You may change the temperature setting only while this cursor is flashing - if the setting is not changed within a few moments, the cursor will stop.

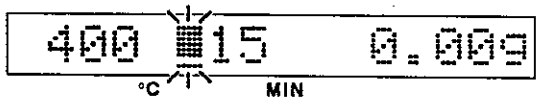
Step 3 

Use the ▲ key to increase, or the ▼ key to decrease the displayed setting until you have reached your new setting. If you hold these keys down - after moving 10 digits, the change will speed up.

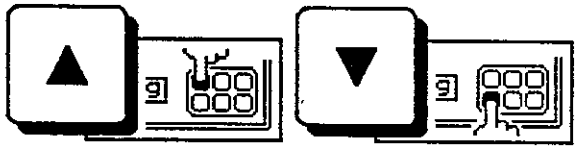
■ Set Desired Time:

Step 4 

Press the TEMP/**TIME** key.

Display 

The cursor will flash by the **MIN** (minutes) setting shown.

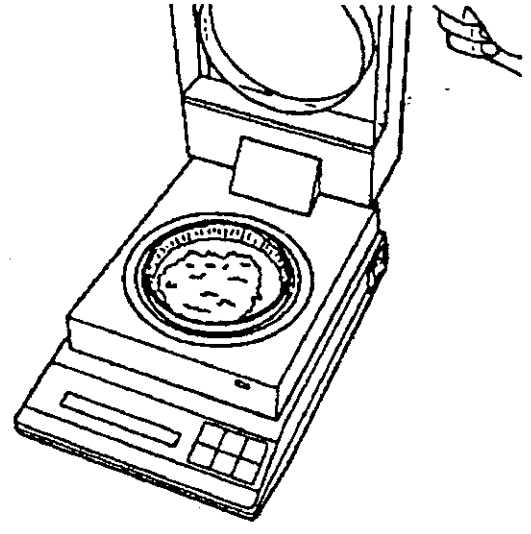
Step 5 

While the cursor is flashing -use the ▲ key to increase, or the ▼ key to decrease the displayed setting until you have reached your new setting.

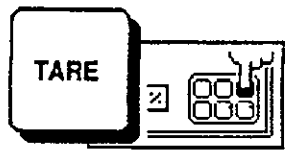
Note: The **"00"** setting means that the heater is always ON. The START/**STOP** key must be pressed to stop. To set a timer value of 91, 92 or 93 is to select the Automatic Stop Mode.

■ TARE the Display:

Step 6 Set a piece of aluminum foil (or other non-flammable tare container) in the Sample Pan.

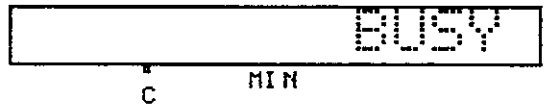


Step 7



Press the **TARE** key to Zero the display.

Display



The display will show "BUSY" while the Sample Pan goes up and down twice.

Display

The "g" display will be ZEROed.

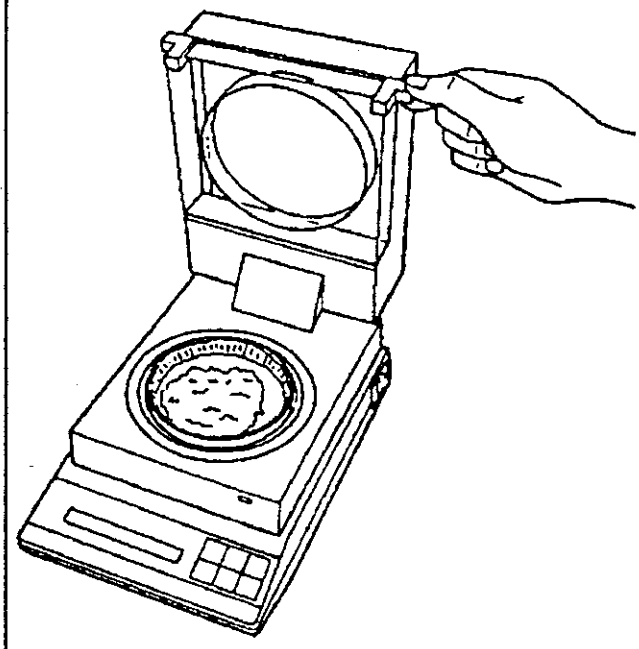
Step 8

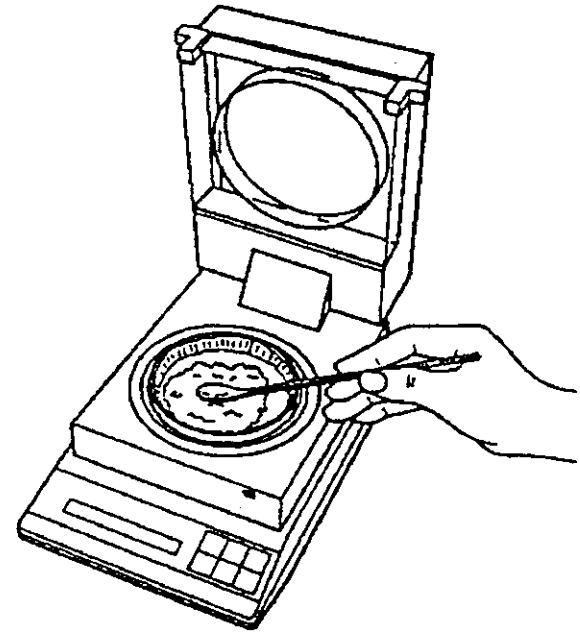
Add your sample to be analyzed to the sample pan - you can use display to measure the sample.

Note:

Be sure to smooth out the sample for even drying.

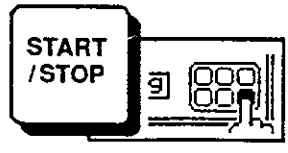
Step 9





Lower the Heating Unit Top down.

Step 10



Press the **START**/STOP key to begin.

Display

The display will show "BUSY" while the Sample Pan goes up.

Display

Then, for a few seconds, the display will show the target temperature and time set. (The temperature shown on the display is the temperature of the ceramic heater and time is the time left.)

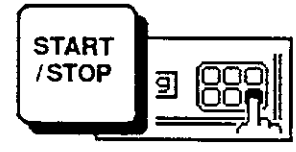
Display

When the heating unit starts, the red light will come on, and a "*" asterisk will be shown at the far left (If the temperature of the AD-4712 itself is below 50°C, the temp. display will be blank).

Display

Every 30 seconds, the AD-4712 goes through a measurement/ analysis cycle. When the cursor flashes at the far left, it means that the sample is going through this cycle.

Note: You may stop the moisture determination cycle at any point by pressing the START/**STOP** key - EXCEPT when the cursor is flashing during the measurement/analysis as above. The red light will go OFF when the cycle has been stopped.

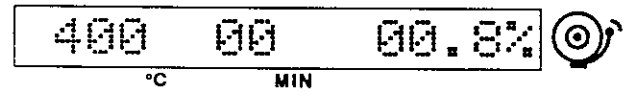


Display

After the measurement/analysis cycle, the moisture content to that point will be displayed, and sample drying continues.

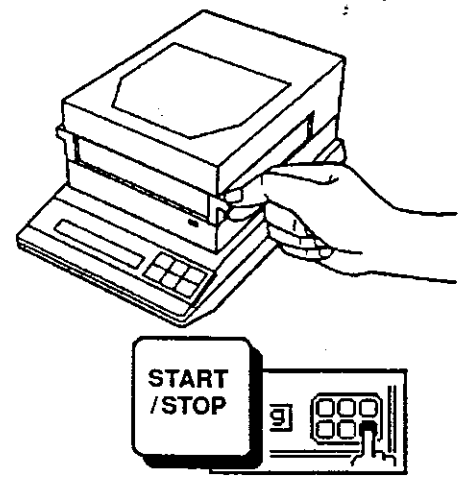
Display

At the end of the moisture analysis cycle (time is up) an electronic alarm tone will sound and the final moisture content will be displayed.

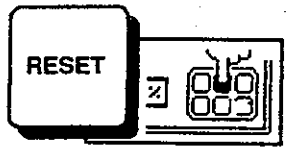


Step 11 Press the START/**STOP** key to stop the alarm tone.

Step 12 Carefully lift the Heating Unit Top up. Be careful not to touch any part of the cover except for the handle, it is likely to be hot.



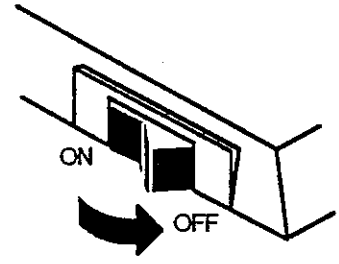
Step 13



If you wish to do another moisture analysis, or see the resulting sample weight, press the **RESET** key.

Step 14 Use the Pincette to lift the Sample Pan off of the elevator. Do not place it on anything that is heat sensitive.

Step 15 Load another sample if you want, or - if you are finished, switch the AD-4712 OFF.



Fast Mode and Auto Stop Mode

Fast Mode

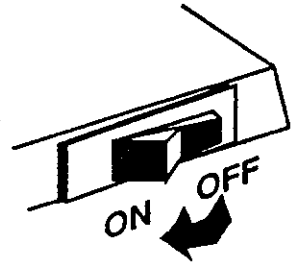
This mode is used to shorten the drying time by increasing the high temperature during the first part of the drying cycle.

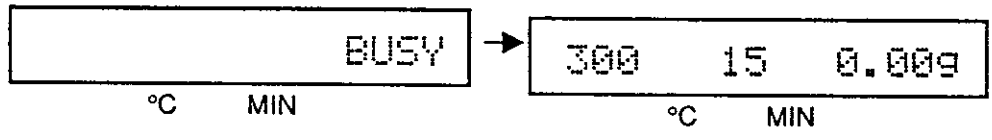
The AD-4712 increases the drying temperature by 100 °C above the temperature set, during the initial drying period, then returns to the original drying temperature when amount of vaporization begins to decrease.

The highest drying temperature is 450°C.

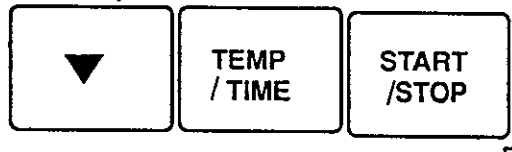
How To Select The Fast Mode

1. Turn on the Main Power Switch. The display will show " BUSY " and then a normal display.

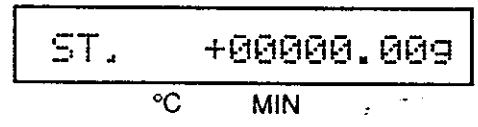




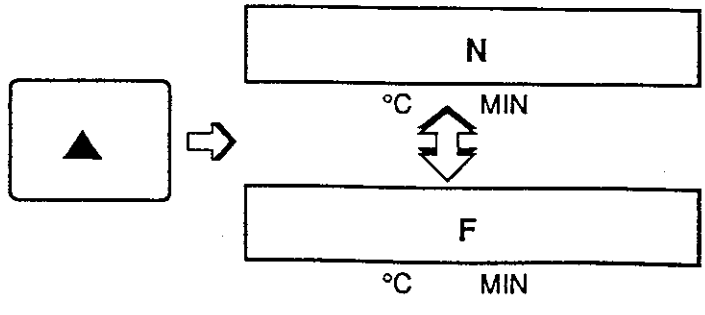
2. Press the [▼], [TEMP/TIME] and [START/STOP] keys simultaneously.



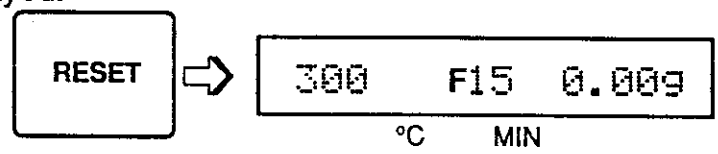
3. The weighing mode will be displayed.



4. Press the [▲] key to alternately display the Normal Mode " **N** " or the Fast Mode " **F** ".



5 Press the RESET key to select " Fast Mode " when an " **F** " is displayed.



In the " Fast Mode ", an " **F** " is displayed on the left side of the time during measuring.

Once you select either " Fast Mode " or " Normal Mode ", the mode selected will not be cleared when the power is turned off.

Auto Stop Mode

In this mode, drying is automatically terminated when the change in moisture content decreases during the interval set.

When the average change in moisture content over a 30 seconds period becomes smaller than 0.05 %, 0.10 % or 0.15 %, drying is automatically terminated.

How To Select The Auto Stop Mode

The Auto Stop Mode is selected by setting a timer value of 91, 92 or 93. The timer settings from 91 to 93 do not indicate the drying intervals. The number indicates a change in moisture content for 30 seconds.

Intervals	Change in Moisture Content for 30 seconds
9 1	Within 0.05 %
9 2	Within 0.10 %
9 3	Within 0.15 %

The moisture content displayed by the AD-4712 is limited to 0.1 %. The Automatic Stop is based on a value obtained by averaging the data for 90 seconds.

About the Bases

The AD-4712 displays the moisture content of a Wet, Dry or Solid base.

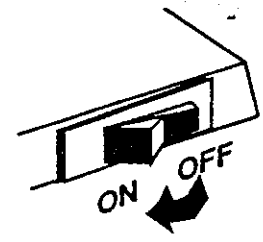
Wet Base : Moisture = (Initial Weight - Dried Weight) ÷ Initial Weight

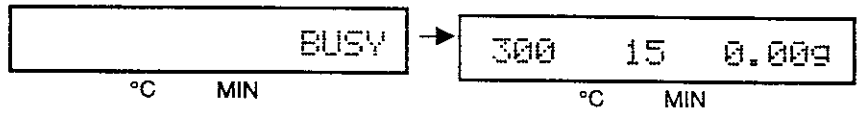
Dry Base : Moisture = (Initial Weight - Dried Weight) ÷ Dried Weight

Solid Base : Solid content = 100 - { (Initial Weight - Dried Weight) ÷ Initial Weight } ÷ 100

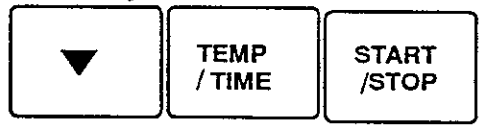
How To Select Wet, Dry, or Solid Base

1. Turn on the Main Power Switch. The display will show " BUSY " and then a normal display.

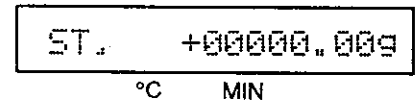




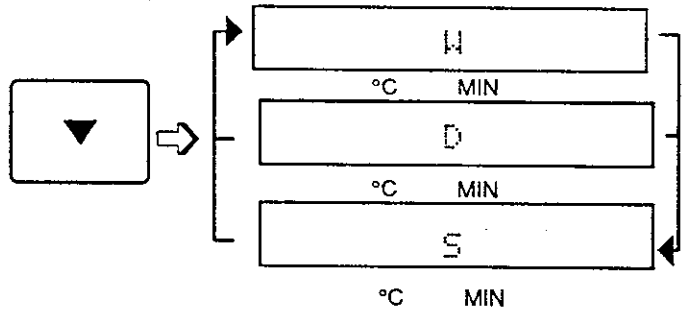
2. Press the [▼], [TEMP/TIME] and [START/STOP] keys simultaneously.



3. The weighing mode will be displayed.



4. Press the [▼] key to select a " Wet ", " Dry " or " Solid " base.



Press the [RESET] key to select the Base desired.
" W " indicates a Wet base.
" D " indicates a Dry base.
" S " indicates a Solid base.

The AD-4712 does not indicate which base mode has been selected.

Once you select a base mode, the selected base mode will not be cleared when the power is turned off.

Sample Temperature Conversion

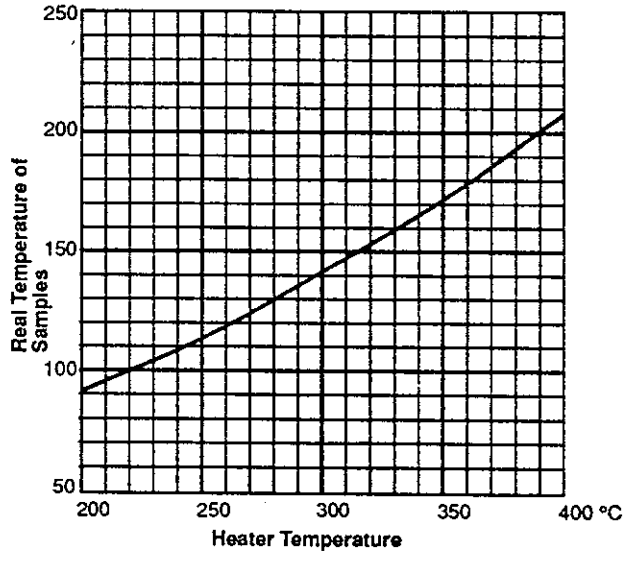
The temperature that is shown on the display is not temperature of the sample, but the temperature of the ceramic heater.

To obtain an approximation of the sample temperature, the following equation is widely applicable to all materials and products which can safely be heated. This table was derived by heating : wheat flour, skim milk, and active carbon.

The sample temperature we describe here is the value obtained after heating 20 minutes.

$$Y = 0.0005\,X^2 + 0.258\,X + 19.1$$

Preset Heater Temp.(°C)	Real Temp. of Samples
200	90.7
210	95.1
220	99.6
230	104.3
240	109.2
250	114.2
260	119.4
270	124.7
280	130.1
290	135.8
300	141.5
310	147.5
320	153.5
330	159.8
340	166.1
350	172.7
360	179.4
370	186.2
380	193.2
390	200.3
400	207.6



Removing Foreign Objects

Attention!

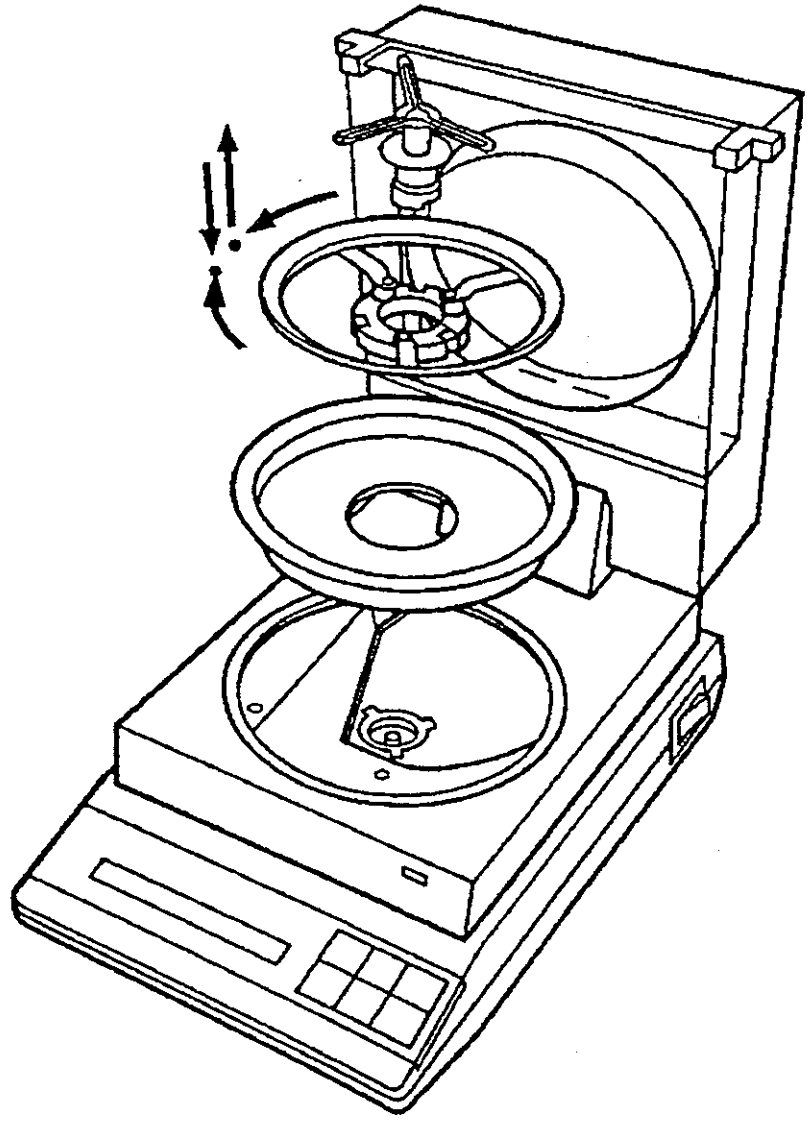
- **If anything should fall into the Sample Pan Guard, or down into the balance mechanism, it should be removed immediately. Please follow the steps below.**

Step 1 Remove the Trivet by gently lifting it out.

Step 2 Remove the Sample Pan Holder by rotating it to the right about a quarter of a turn. There is a small tooth on the stem of the Holder that must line up with a gap in the mechanical lifter's plate. You may remove the Holder by lifting up when the two line up.

Step 3 Remove the Sample Pan Guard and clean out any foreign objects.

Step 4 Replace the pieces in reverse order.



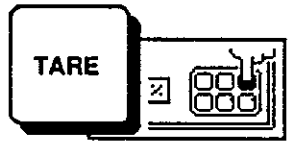
Calibration

Attention!

- ❑ **The AD–4712 must be warmed up (switched ON) for at least 30 minutes before starting calibration.**
- ❑ **During calibration, the weighing system must be kept stable for accurate adjustment.**

Step 1 Remove the Weighing Pan.

Step 2

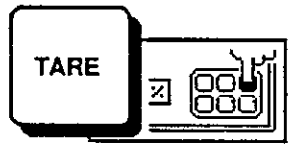


Press and hold the: [▲] key, [RESET] key, and the [TARE] key for a couple of seconds.

Display

"TARE KEY" will be displayed.

Step 3

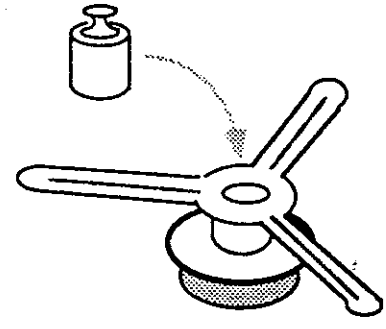


Press the [TARE] key.

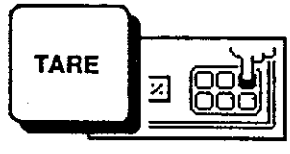
Display

"CAL 100g" will be displayed.

Step 4 Place a 100g calibration mass on the center of the Trivet.



Step 5



Wait for at least five seconds and press the [TARE] key.

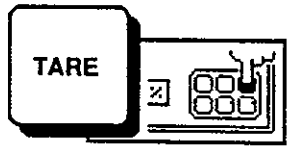
Display

After a couple of seconds, "BUSY" will be displayed.

Step 6 Remove the Calibration Mass.

Step 7 Replace the Sample Pan.

Step 8



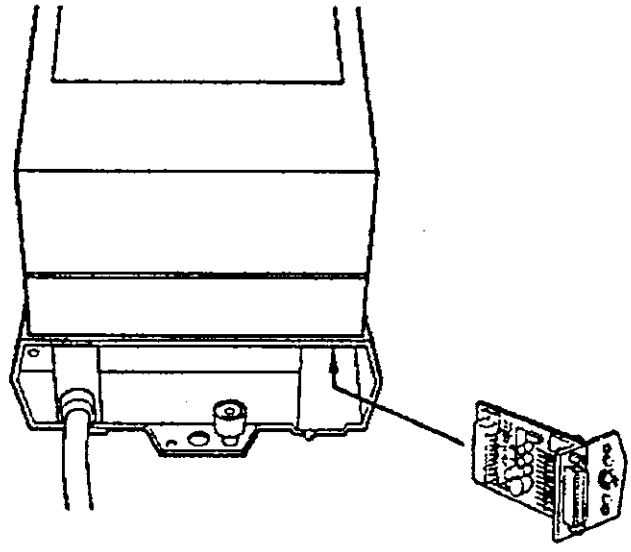
Press the **TARE** key.

Step 9 You are ready for moisture analysis.

OP-01 RS-232C Serial Interface

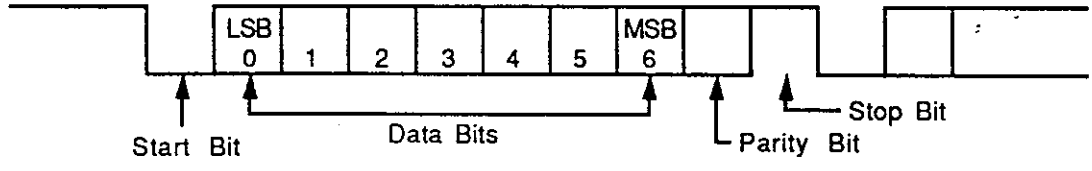
■ Installing the Interface :

❶ Switch **OFF** the balance and unplug the power cord.
❷ Remove the blanking plate held by two screws.
❸ Slide the Interface into the slot and push until the connector mates.
❹ Replace the two screws and restore power to the balance.



■ Communication Specifications:

Type EIA-RS-232C/Passive 20mA Current Loop
Method Half-duplex, Asynchronous Transmission, Uni-directional.
Format
Baud rate: 2400 bps
Parity: Even
Stop bit: 1
Code: ASCII



RS-232C	20mA Cur. Loop
1 = −5V → −10V	20mA
0 = +5V → +10V	0mA

■ Data Format:

❑ 1 datum consists of 16 characters plus <CR> <LF>.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
*	S	e	t		T	E	M	P			4	0	0	°	C
*	W	e	t		W	T			0	9	.	7	9		g
*	D	r	y		W	T			0	8	.	3	7		g
	0	0	m		3	0	s				0	3	9	°	C
											0	0	.	0	%

Note: "°" = 7F HEX

■ Connecting to AD-8121 Printer:

(Set the print mode to MODE 3 / set the DIP switch No.2 ON.)

The AD-8121 is supplied with a KO:256A cable for connection to the balance. All of the switches except the [FEED], [DATA] keys and the power switch of the printer will not work.

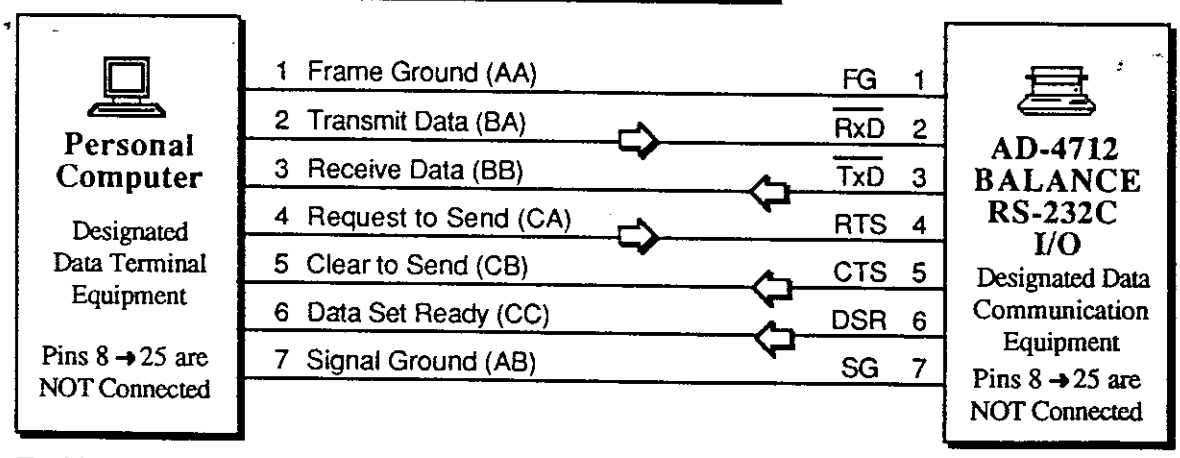
At the beginning of the moisture determination cycle, the Preset Temperature (*Set TEMP XXX°C), Wet Weight (*Wet WT XX.XX g), and Time & Temperature (00m 00s XX°C) Moisture Percent (00.0%) are printed out.

Next: Time & Temperature (XXm XXs XXX°C), and Moisture Percent (XX.X%) are printed out automatically every 30 seconds.

Finally, the Dry Weight (*Dry WT XX.XX g) is printed out at the end of the measurement.

As to the operation of the AD-8121, please refer to its Instruction Manual.

■ RS-232C I/O Pin Connections:



❑ Use a high quality modem type cable between the computer and balance.

Data Printout Example

The following printing examples were printed out by the AD-8121 Multi-Function Printer. (Set the print mode of the AD-8121 printer to MODE 3)

1. Setting Time : 15 minutes

* Set TEMP	310	°C
* Set TIME	15	M
* Wet WT	09.98	g
00m 00s	257	°C
	00.0	%

2. Setting Time : 15 minutes in the Fast Mode

* Set TEMP	310	°C
* Set TIME	F15	M
* Wet WT	09.99	g
00m 00s	262	°C
	00.0	%

3. Continuous Measuring

* Set TEMP	310	°C
* Set MODE	00	M
* Wet WT	10.00	g
00m 00s	285	°C
	00.0	%

4. Auto Stop Mode Set MODE: 93

* Set TEMP	310	°C
* Set MODE	93	M
* Wet WT	09.99	g
00m 00s	274	°C
	00.0	%

5. Auto Stop Mode in the Fast Mode

* Set TEMP	310	°C
* Set MODE	F93	M
* Wet WT	09.99	g
00m 00s	272	°C
	00.0	%

6. Measuring a Solid Base

* Set TEMP	310	°C
* Set TIME	05	M
* Wet WT	04.39	g
00m 00s		°C
	100.0	%
00m 30s	081	°C
	99.8	%
01m 00s	163	°C
	99.6	%
01m 30s	250	°C
	99.2	%
02m 00s	309	°C
	98.4	%
02m 30s	310	°C
	97.3	%
03m 00s	310	°C
	96.0	%
03m 30s	310	°C
	94.9	%
04m 00s	309	°C
	93.9	%
04m 30s	309	°C
	93.1	%
05m 00s	310	°C
	92.4	%
* Dry WT	04.05	g

Specifications

■ DIGITAL SECTION

Measuring Principle	Drying method using ceramic sheathed heater.
Weighing Resolution	0.01g
Moisture % Resolution	0.1%
Sample Weight Range	5 → 70 grams.
Accuracy - 5g→20g	±0.2%
Accuracy - 21g→70g	±0.1%
Moisture Measuring Range	0→100% (Wet Base, Solid) 0→500% (Dry Base)
Time (MIN) Set Range	1 → 90 MIN by 1 minute - (00 MIN = always ON)
Automatic Stop Mode	To set a timer value of 91, 92 or 93 is to select the Automatic Stop Mode.
Temp (°C) Set Range	50 → 400°C by 1 degree Celsius (°C) [122 → 752 °F by 1.8 degrees Fahrenheit (°F)]
Display	16 Digit Liquid Crystal Display (LCD)
Moisture Content Display	"00.0 %"
Weight Display	"0.00g"
Calibration Mass	100g
Output to Printer (optional)	Output every 30 seconds

❑ GENERAL

Power Requirements	100→120V or 220→240V AC ±10% 50/60Hz
Power Consumption	Heater - 280W, +2W (maximum)
Weight	Approx. 4.9kg (11 lb)
Operating Temperature	-5°C to 40°C (23°F to 104°F)
Heat Source	Ceramic Sheathed Coil
Temperature Control	PID Control (accuracy: ±5°C [41°F])
Temperature Sensor	Platinum Thermal Resistor
Sample Pan	120mm, Stainless Steel
Physical Dimensions	195(W)x315(D)x170(H)mm 7.8"x12.6"x6.8"
Alarm (end of event)	Electronic Tone.

❑ OPTIONS

Option OP-01	Serial Interface. Two types of serial interface are available with this option: 1) EIA-RS-232C, without handshake. 2) 20mA current loop (passive). Baud Rate & Format are identical to RS-232C.

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