

FR SERIES

ANALYTICAL BALANCES

INSTRUCTION MANUAL

own-FR-v.2.a 90.07.27 BLP

FR Mark II (MKII) MULTI-FUNCTION ANALYTICAL BALANCES

A&D
A&D Company, Limited



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Warranty

Warranty rights vary from country to country but it is the general intention of A&D Co., Ltd., to offer customers a one year warranty on this product from the day it is purchased. In some countries consumer protection legislation states that your dealer is responsible for offering a warranty and under these circumstances please refer to your local dealer.

In the U.S.A. the product (if defective) should be returned, freight prepaid by the customer, to A&D Engineering Inc. in California and in Europe the product can be returned freight prepaid to A&D Instruments GmbH in Frankfurt, West Germany. Elsewhere the product can be returned to A&D Co., Ltd. in Japan. In any event please contact your nearest A&D office, before shipping, to confirm that the product is covered by this warranty. Simple repairs can be carried out by your local dealer under warranty and this may be the fastest method of solving your problem.

This warranty only applies to product failures due to defective materials and/or workmanship. This warranty will be rendered invalid if, upon inspection, it is found that the product was: Abused; used for a purpose for which it was not designed; mishandled; placed in a hostile environment; repaired by unauthorized personnel; improperly installed or not adjusted in accordance with instructions given in this manual.

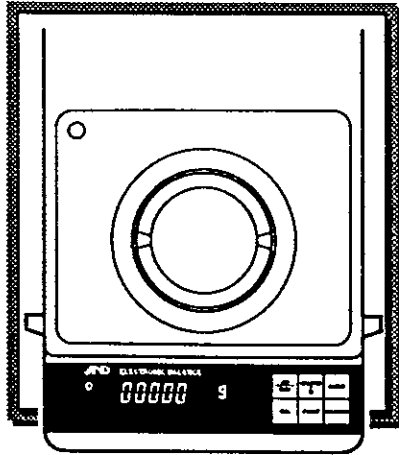
If repair under warranty is confirmed by A&D, then the product will be repaired (or replaced, at the discretion of A&D) and then returned to the customer at no extra cost.



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.)



FR Series • Section A

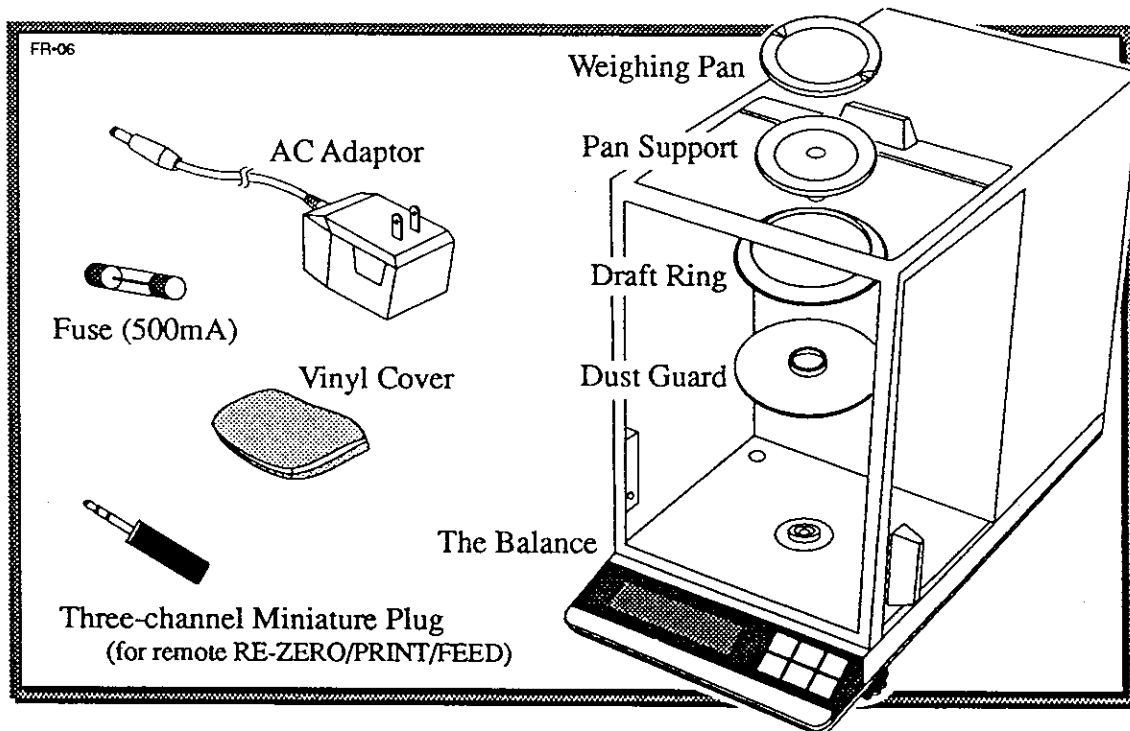
Set-Up

Unpacking & Setting-Up Your FR



Unpack the scale carefully and keep the packing material if you are likely to transport the scale again in the future.

- In the carton you should find this manual plus:
- The Balance.
 - The Weighing Pan, Pan Support, Draft Ring and Dust Guard Plate.
 - An AC adaptor (check that the AC input rating is correct).
 - A spare fuse (0.5A slow blow).
 - Vinyl Cover.
 - Mini 3-channel jack plug for connecting an optional remote RE-ZERO, PRINT, or FEED (see J•4, M•2).



Best Conditions For Weighing



To ensure that you get the most from your balance, please try to meet the following 'Best Conditions' as closely as possible:

- The Balance must be level (check the spirit level on 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 when using an adaptor.
- Keep equipment containing magnets away from the balance.
- Warm-up the balance before use or leave it on standby (display OFF State, see page A•4) overnight.
- Earth the balance chassis for electrostatic discharge if the weighing conditions warrant (see next page).

Setting Up Your FR Balance

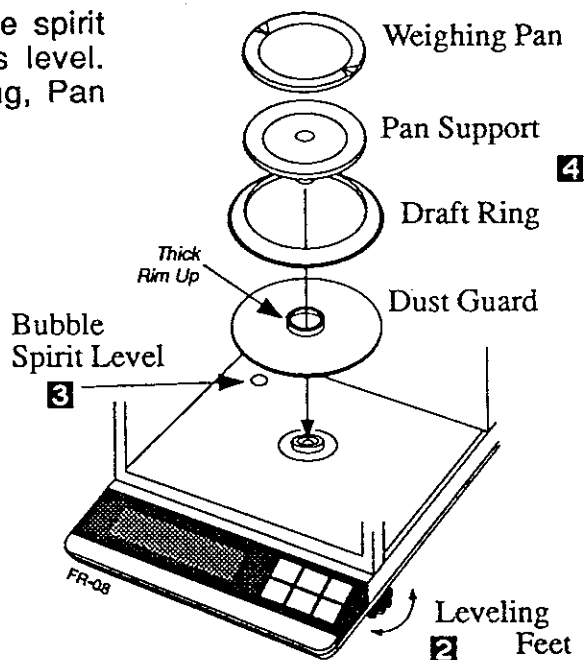
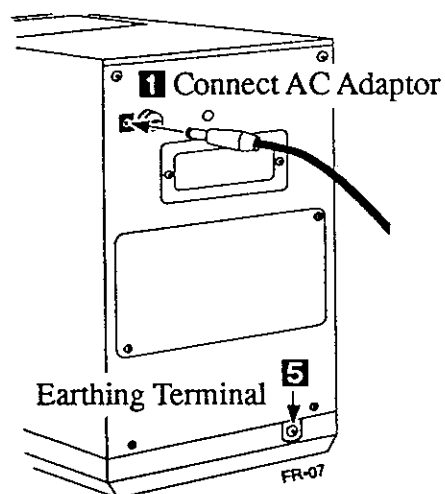
- 1** Place the balance on a suitable weighing surface (see BEST CONDITIONS FOR WEIGHING, previous page) and connect the AC adaptor **1**. Please earth the chassis if you think static electricity may be a problem (there is a GND ground connection at the back of the balance **5**).



P-F A I L

Power Failure may be displayed when you plug in the AC Adaptor: see next page.

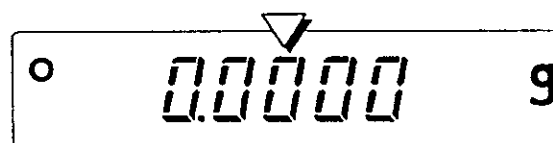
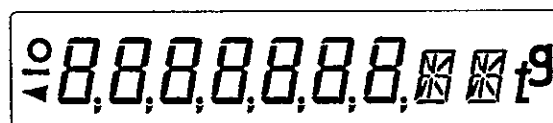
- 2** Turn the leveling feet **2** until the spirit level **3** indicates the balance is level. Install the Dust Guard, Draft Ring, Pan Support and Weighing Pan **4**.



- Press the **ON/OFF** key.

All the display segments will come ON and you will hear the ZEROing mechanism.

Moments later, zero will be displayed.



- 4** At this stage any weight reading will not be very accurate because the balance has not been "calibrated". You should calibrate the balance next: but first, the balance must be supplied with AC Adaptor power to "warm-up" for at least one hour before moving to calibration. You may turn OFF the display by pressing the **ON/OFF** key if you like.

Please also take the time to read SECTION B Introduction, it explains several important features of the FR, before proceeding to calibration SECTION C. **17**



Power Supply Notes



Please use the AC adapter that was supplied with the balance, an alternative 12V DC power supply might not be stable enough for this balance.



The balance is always warmed-up and ready-to-use as long as the AC adaptor is connected. This is the normal state and does no harm to the balance. Please warm-up (plug-in) the balance for one hour before use.

WARM-UP
YOUR
BALANCE
BEFORE USE.

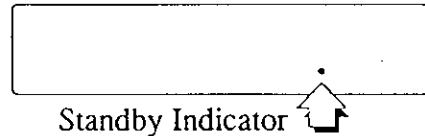


Display OFF State

- When the balance is plugged-in, but the display is OFF, it is in the "Display OFF State". There are three possible displays while in Display OFF State:

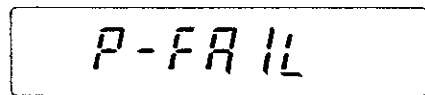
- Power Indicator**

One decimal point at the right of the display.



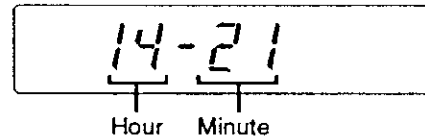
- Power Failure**

"P-FAIL" power failure is displayed if power was interrupted during weighing the last time the balance was used (see below).



- Time Display (24hr)**

If you have the optional AD-1652 Wireless Remote Keyboard or RS-232C (OP-03) – time can be displayed (see "Display OFF State" setting "oFF 1c1" see p. G-7).

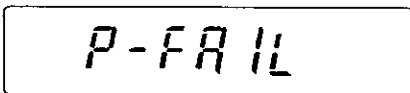


Display ON & Power Errors



The balance does a self check when you connect the AC adaptor, or press the **ON/OFF** key. If there is a problem, you will get an error display:

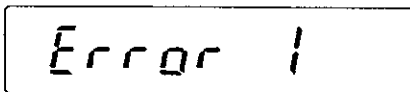
- Power Failure:**



"P-FAIL" power failure is displayed if power was interrupted during weighing the last time the balance was used.

- Press the **ON/OFF** key to clear.

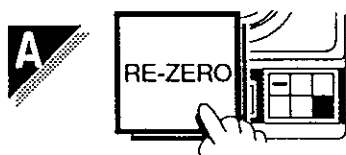
- Stability Error:**



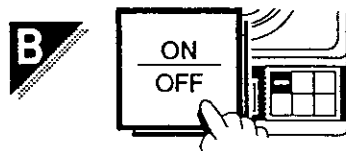
'Error 1' will be displayed if the balance takes more than thirty seconds while attempting to ZERO.

- Make sure that nothing is touching the weighing pan. If there is: press the **ON/OFF** key to clear.

- ▶ If there is nothing touching the weighing pan or interfering with the balance, then it is an 'environment' error.



Press the **RE-ZERO** key and the display will show near ZERO. See that all of the BEST CONDITIONS FOR WEIGHING (page A•2.) have been met, especially avoiding drafts and vibrations.



If that doesn't work: press the **ON/OFF** key and then try changing C-Parameter "Cond Xco" to "Cond 3co" slow/bad (see pages G•6, G•2). After that, try altering the other environmental parameters. If the error persists, call your dealer for service.

☞ Weighing Pan Error:

Error 4

'Error 4' will be displayed if the weighing pan or pan support is not correctly set, touching something or if there is a sample on the weighing pan when the **ON/OFF** key is pressed.

- ▶ Check the weighing pan and pan support, remove any sample from the weighing pan and wait for a minute. If it doesn't correct itself, press the **ON/OFF** key and try again after a few seconds. If the error persists, call your dealer for service.

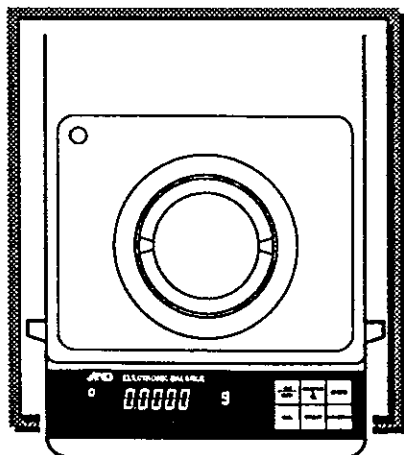
☞ Memory Error:

Error 6

Error 7

'Error 6' or 'Error 7' will be displayed if the balance has a memory problem.

- ▶ Disconnect and connect AC power and try again. If error persists, call for service. ☒



FR Series • Section B

Introduction



Welcome!

*Thank You for Your **AND** Purchase!*

This is an owner's INSTRUCTION MANUAL for the A&D Analytical Balances,

□ **FR-200 Mark II** 210g x 0.0001g Range

□ **FR-300 Mark II** 310g x 0.0001g Range

Electronic Analytical Balances are in one sense extremely simple products: they are very easy to use. In another sense they are rather complex in that they are high technology products, with many features available. This manual will try to explain simply how your balance works and how to get the most out of it in terms of performance.

The FR *Mark II* Series high resolution, multi-function, analytical balance is the product of years of research, design, development and in-field testing. It incorporates the latest advances in electronic and mechanical engineering and offers increased features, increased functions, high resolution and portability; all in a low profile balance base. Every care has been taken during the manufacturing process of this balance to ensure that it will perform accurately and reliably for many years.



Specifications

Capacity x Resolution	FR-300	FR-200
Gram (g)	310 x 0.0001g	210 x 0.0001g
Decimal Ounce (oz)	10 x 0.00001 oz	7 x 0.00001 oz
Troy Ounce (OZt)	9.9 x 0.00001 OZt	6.7 x 0.00001 OZt
Pennyweight (dwt)	199 x 0.0001 dwt	135 x 0.0001 dwt
Carat (ct)	1,550 x 0.001 ct	1,050 x 0.001 ct
Momme (mm)	82 x 0.0001 mm	56 x 0.0001 mm
Grain Unit (GN)	4,784 x 0.002 GN	3,240 x 0.002 GN
Tola (t)	26 x 0.00001 t	18 x 0.00001 t
Tael (TL)	8 x 0.00001 TL	5 x 0.00001 TL
Display Capacity	310.0010	210.0010
Linearity	±0.0001g(Δ10g) ±0.0003g(full range)	±0.0001g(Δ10g) ±0.0002g(full range)
Repeatability	0.0002g	0.0001g
Stabilization Time	5 seconds (typically)	
Sensitivity Drift (10°-30°C)	± 2ppm°C	
Display Refreshment	4 per sec. (Normal) / 8 per sec. (Hi-Speed)	
Pan Size	ø90mm (ø3.6")	
Breeze Break Dimensions	184(W) x 156 (D) x 253 (H) mm	
Balance Dimensions	195(W) x 400 (D) x 310 (H) mm	
Operating Environment	5°-40°C, 41°-104°F - RH<85%	
Net Weight (Approx)	10.2kg / 23 lb	
Power	100, 200, 220, 240VAC as required, (factory preset) 50/60HZ	



The following sections introduce you to some of the major features of your FR. Please take a moment to familiarize yourself with these items as they will be helpful for proper balance operation.



Features

- ❑ Weighing units are **g** gram; **OZ** ounce (avoir); **OZt** troy ounce; **dwt** pennyweight; **ct** carat; **mm** momme; **GN** grain; **t** tola; and **TL** tael. Counting up to 310,000 (for FR-300, 210,000 for FR-200) units at the minimum unit weight of 0.0001g and percentage modes are also standard.
- ❑ Automatic Self Calibration with motor driven internal calibration weight when the balance senses a change in ambient conditions, for outstanding accuracy (can be turned off).
- ❑ One Touch Automatic Calibration with motor driven internal calibration weight. Calibration can also be done using an external calibration mass (within weight limits) via the weighing pan.
- ❑ TARE, and Comparator HI & LO limits, can be set using the optional AD-1652 Wireless Remote Keyboard, or a computer via the Serial Interface OP-03.
- ❑ Using the comparator function, a built-in buzzer can sound when weight exceeds set limits (external comparator displays HI/GO/LO).
- ❑ Interval data output settings, with clock function.
- ❑ The balance is equipped with a built-in underhook for relative density experiments.



Accessories & Options

- **AD-1652 WIRELESS REMOTE KEYBOARD Accessory**
Optional infrared Remote Keyboard expands FR functions with a 3m, 60° operating range for remote or isolated spaces. It has the same keys as the FR series balance, plus many more, and a 10 key input.
- **VIBRATORY SPOON AD-1651 Accessory**
Handy vibratory spoon for medical compounds or powders. Vibration frequency variable from 110Hz to 230Hz. Automatic weighing adjustment with feed control output from the FR series balance.
- **COMPACT PRINTER AD-8117 Accessory**
A quiet, sharp, clear printout serial thermal dot-matrix printer with a full range of statistical functions: Weight Data, Total Weight Data, Counting Data, Total Counting Data, Numbers of Operations, Standard Deviation, Range, Average and Statistical calculation on up to 999 data blocks. Also available is the AD-8117A for those who do not require the statistical features of the AD-8117.
- **Option OP-03**
User installable serial interface. RS-232C & Current Loop with Comparator Output for HI/GO/LO Relay.

Standby and Operating Modes

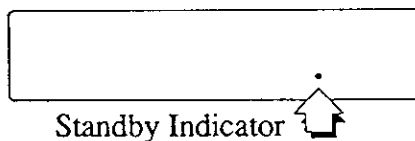
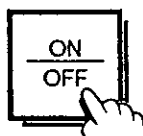


The balance is always warmed-up and ready-to-use as long as the AC adaptor is connected. This is the normal state and does no harm to the balance. Please warm-up (plug-in) the balance for one hour before use.

**WARM-UP
YOUR
BALANCE
BEFORE USE!**

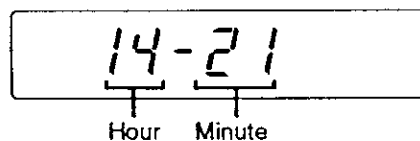
- The **ON/OFF** key switches the display ON & OFF. The display can also be turned ON & OFF via the AD-1652 Remote Keyboard, or using a computer via the Serial Interface OP-03.
- **Standby Mode** is: when the balance display is OFF, but power is supplied via the AC Adaptor. The last decimal stays lit as an indicator.

- ☑ Use the **ON/OFF** key to turn the display ON or OFF. When the balance is in Standby mode, a period appears in the Display as an indicator that power is connected.



- ☑ **Time Display (24hr)**

If you have the optional AD-1652 Wireless Remote Keyboard or RS-232C (OP-03) – time can be displayed (see "Display OFF State" setting "oFF 1c1" see p. G•7).



The FR balance has two main modes: *Standby Mode* and *Operating Mode*. In day-to-day operation, Standby Mode is normal when the balance is not in use. This keeps the weighing mechanism warmed-up for accurate readings, and also keeps the balance's temporary memory active. If the balance is not going to be used for a long period of time, then it may be appropriate to disconnect the main power.



C-Parameters

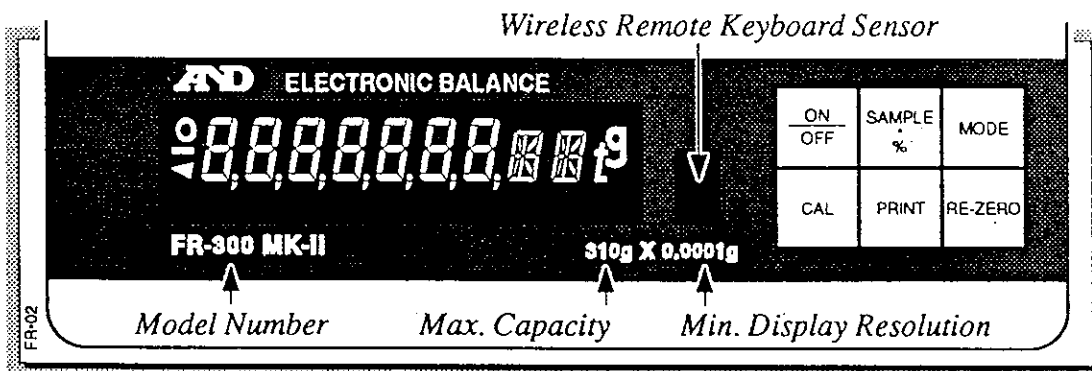
Your FR balance has a number of software parameters that enable you to select the best weighing features for your needs. These settings control how the balance responds to various commands, operations and options. C-Parameters are listed on page G•2 and can be set using the method as shown in the section CHANGING C-PARAMETERS SETTINGS, page G•3. The individual settings for each group are detailed in the following section THE C-PARAMETERS SETTINGS, page G•5.



ACAI Automatic Counting Accuracy Improvement

The ACAI™ (Automatic Counting Accuracy Improvement) function is an exclusive A&D software advancement that re-calculates the unit weight as more pieces are added, to improve count accuracy. This is a very useful function when counting light items, especially when there is a large number to be counted. Please see page E•5 for more information.

The Display and Keyboard



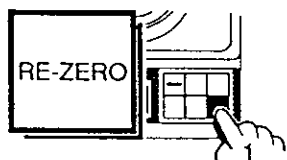
- Care should be taken not to scratch or break the display and Remote Keyboard Sensor windows.
- Press on the middle of the keys to activate them, firmly but not forcefully. You will hear a faint 'beep' when the key has been activated.



The ON/OFF Key

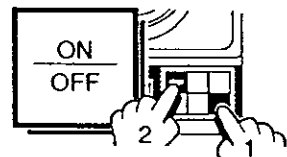
The **ON/OFF** key switches the display ON and OFF but does not cut the power to the balance - so the balance will remain on standby (warmed-up) while the AC adaptor remains connected (See POWER SUPPLY NOTES section). The FR series uses a cobalt blue fluorescent display. You can make sure that all the display segments are working properly by:

1

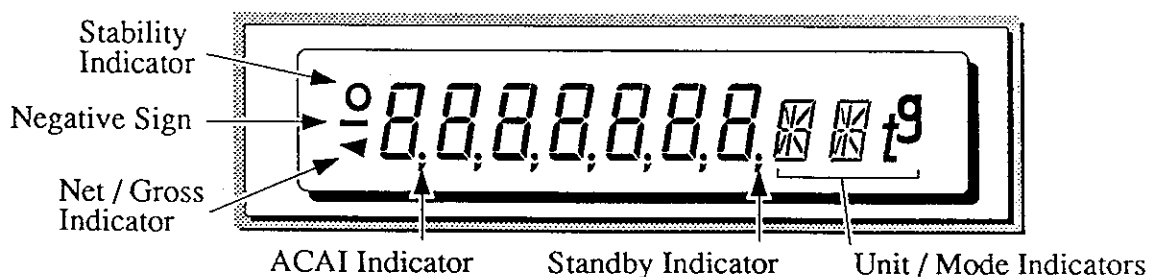


- With the display OFF, press and hold the **RE-ZERO** key.

2



- While holding the **RE-ZERO** key, press the **ON/OFF** key. All the display segments will come ON (Press the **ON/OFF** key again when finished).



- Starting at the left end of the display you will see a 'O' circular stability indicator, a minus weight display symbol and the '◀' triangular NET/GROSS symbol. Next you can see the display '8.8.8.8.8.8.' used to

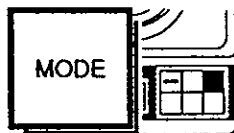
display the weight, the first decimal point acts as the ACAI indicator (see page E-5 for more information) and the final decimal point acts as a standby indicator and remains on when power is connected.

- The final three character spaces are made up of two 14 segment displays which can display any letter in the alphabet and one two segment display which can display "g" or "t". These three character spaces are used to note which weighing mode the balance is in.



The SAMPLE•% Key

The **SAMPLE•%** key can be used to register a sample count (eg: 10 units) in counting "cnt" mode or register 100% in percentage "Pct" mode.



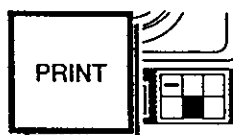
The MODE Key

- Press the **MODE** key to rotate through the balance weighing modes.
- The weighing units are **g** gram; **OZ** ounce (avoir); **OZt** troy ounce; **dwt** pennyweight; **ct** carat; **mm** momme; **GN** grain; **t** tola; and **TL** tael (see the WEIGHING UNITS AND THEIR CONVERSIONS section (page B-9) for more information concerning the different weighing unit). There is also a percentage mode **Pct**, and counting mode **cnt**.
- The **MODE** key changes the units in the following sequence:



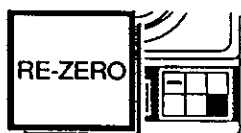
The CAL Key

The **CAL** key starts the calibration process. From the normal weighing mode, with nothing on the weighing pan and the balance level, press the **CAL** key and the balance will calibrate itself! There is more information about calibration on page C-2.



The PRINT Key

The **PRINT** key can be used to transmit data to the AD-8117 printer, or to a computer, via the optional RS-232C/CL interface, outlined on page xx.



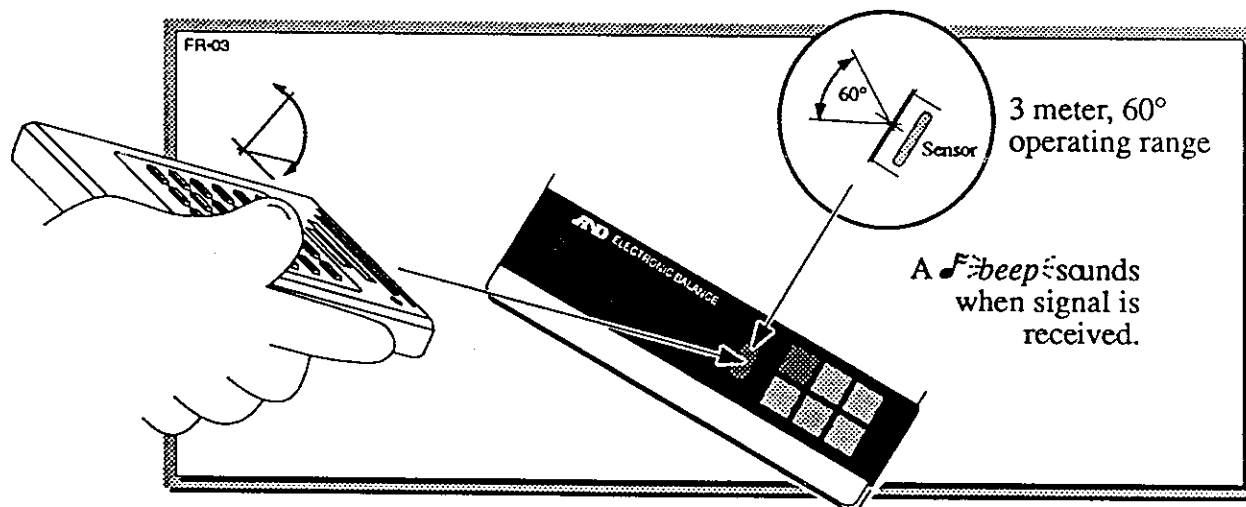
The RE-ZERO Key

- ❑ The **RE-ZERO** key returns the balance to the center of ZERO when the weighing pan is empty, and can also TARE total weight (sample and container), RE-ZEROing the display up to the maximum capacity of the balance.
- ❑ When the display shows a small deviation from ZERO and the weighing pan is empty (and TARE is not being used), then press the **RE-ZERO** key to return the display to ZERO.
- ❑ Please see page D•4 for more information concerning NET and GROSS weighing.

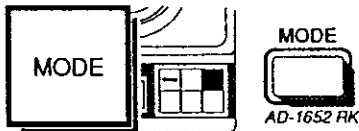


If you are using an AD-1652 Wireless Remote Keyboard, remember that the balance sensor has a 3-meter, 60° operating range.

⚠ You will hear a faint *beep* if the key has been successfully received.



Selecting Weighing Units



The FR series balances are multi-functional instruments where switching between the weighing units contained in the balance software is done by pressing the **MODE** key.

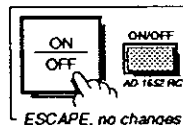
If the law in your area permits, you may use all of the units, or at this software level *you can disable the weighing units you don't regularly use*. Also, some dealers may initially turn OFF units which are not regular used, but you may want to turn them back ON. The complete weighing mode cycle is as follows (if some are missing please refer to your dealer):



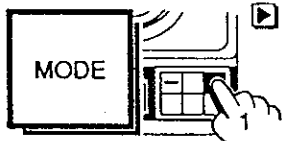
To Turn Weighing Units OFF or ON



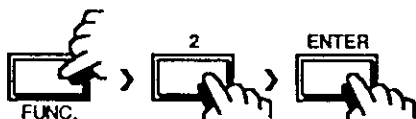
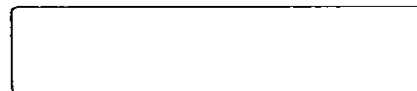
In this procedure, *all available weighing units are initially turned OFF* – you will have to select all the units you want to use! You can escape at any time by pressing the **ON/OFF** key.



1

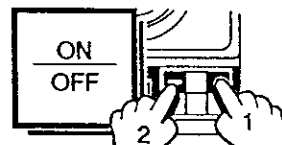


With the display **OFF**: Press and hold the **MODE** key (see below if using the AD-1652 Remote Keyboard).

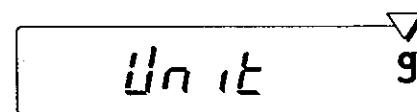


Using the AD-1652 Remote Keyboard, press the **FUNC** key, then the **2** key, then the **ENTER** key. Go to Step 3.

2



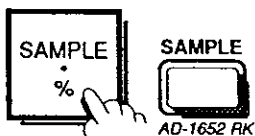
While holding **MODE** key, press the **ON/OFF** key.
 "Unit **g**" will be displayed.



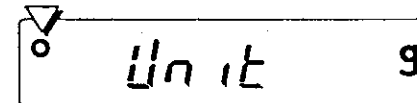
3



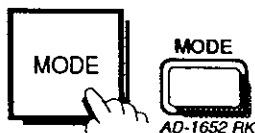
If you want only gram for your weighing mode, press the **RE-ZERO** (**ZERO** on the AD-1652 Remote) key - only "g" will be enabled and you will exit to the weighing mode.



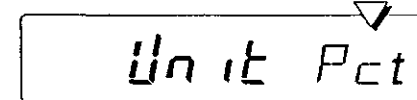
If you wish to keep "g", press the **SAMPLE-%** key.
 The "O" stability indicator will come ON, indicating that the unit is enabled.



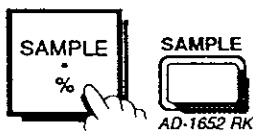
4



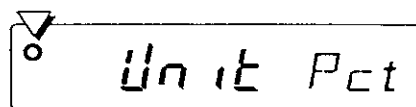
Press the **MODE** key to move to the next unit.
 "Unit **Pct**" will be displayed.



5

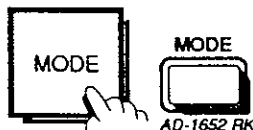


▶ If you wish to keep "Pct" as a mode, then press the **SAMPLE-%** key.

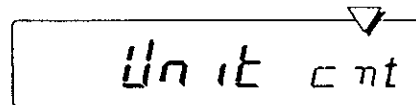


○ The "O" will come ON, the unit is enabled.

- or -



▶ If you want to skip "Pct" as a mode, then press the **MODE** key instead, to move to the next unit.

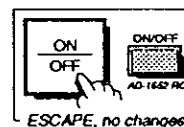


⚠ The weighing units/modes are **g** gram; **Pct** percentage mode; **cnt** counting mode; **OZ** ounce (avoir); **OZt** troy ounce; **dwt** pennyweight; **ct** carat; **mm** momme; **GN** grain; **t** tola; and **TL** tael.

6

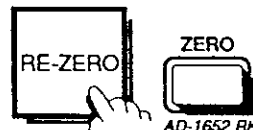
Continue enabling the modes using the the **MODE** and **SAMPLE-%** keys until you have all weighing units desired.

⚠ Remember: *all available weighing units are turned OFF at this point – you will have to select all the units you want to use!*



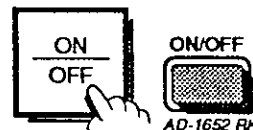
ESCAPE, no changes

7



▶ When you have the units you want, press the **RE-ZERO** (**ZERO** on the AD-1652 Remote) key to save any changes and exit to the weighing mode.

- or -

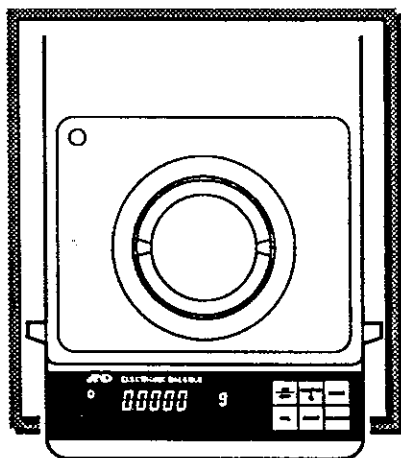


▶ Or, if you want to exit without saving any changes: press the **ON/OFF** key to exit without saving and go to display OFF state.



Weighing Units and Their Conversions

Abbrev.	Name In Full	Conversion
OZ	Ounce (Avoir)	28.349 523 125g
OZt	Troy Ounce	31.103 476 8g
dwt	Pennyweight	1.555 173 84g
ct	Metric Carat	0.2g (5 = 1 gram)
mm	Momme (Japan)	3.75g (10 = 1 Tael)
GN	Grain (UK)	0.064 798 91g
t	Tola (India)	11.663 803 8g
TL	Tael (Taiwan)	37.5g
TL	Tael (Sing.)	37.793g
TL	Tael (HK)	37.437g
TL	Tael (China)	31.25g



FR Series • Section C

Calibration

About Calibration



Your FR balance should be calibrated when it is first installed, if it is moved, and on a regular basis as conditions warrant. Calibration is part of regular balance operation: to correct changes in temperature, humidity, air pressure, etc.

The FR's internal software parameters can be set to disable calibration if desired (see section C5 "CAL c5", pages G•13, G•2).

The FR *Mark II* series balance features three ways to calibrate your balance:

Automatic Self Calibration

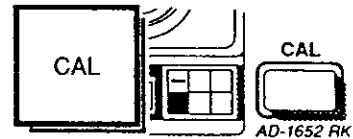
The balance will automatically calibrate using its internal calibration mass when it senses a change in ambient temperature.



The weighing unit will blink to notify you that the balance would like to calibrate and waits two minutes for you to remove any objects on the weighing pan (shown as **g** in the display above).

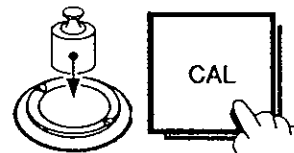
One-Touch Automatic Calibration

Clear the weighing pan and press the **CAL** key and the balance will calibrate using its internal calibration weight, you don't have to do anything else.



Manual Calibration

You may calibrate manually by using your own calibration mass in a simple procedure.



The FR must be warmed up (plugged in) for at least 1 hour before starting calibration.

During calibration, the weighing system must be kept stable for accurate adjustment.

Calibration Check

By setting a software parameter "CAL C" SELF CHECK AFTER CALIBRATION "CAL-C c5" (see pages G•13, G•2) the balance will check the calibration procedure's accuracy automatically. After the calibration, the balance display will show the calibration error in grams. (The factory setting of this parameter is "CAL-C 0c5" "No Self Check").

Press the **RE-ZERO** key to return to weighing mode, and the display will ZERO.

Automatic Self Calibration



The balance will automatically calibrate using its internal calibration mass when it senses a change in ambient temperature. This feature can be disabled by software parameter, see SOFTWARE PARAMETERS section C5 "CAL c5", pages G-13, G-2.

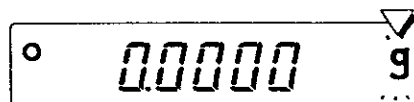


Please note that the balance will also perform Automatic Self Calibration when the balance is in the Display OFF State (see p. A-4).



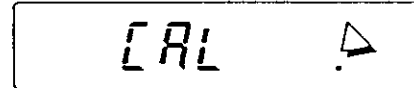
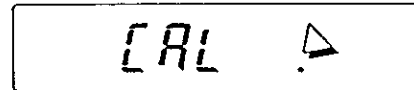
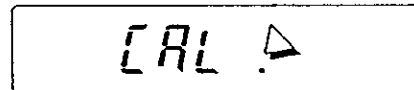
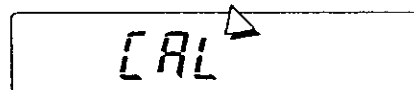
1

When the balance senses a change in ambient temperature, the weighing unit will blink (for example: **g**) and waits two minutes for you to clear the weighing pan.



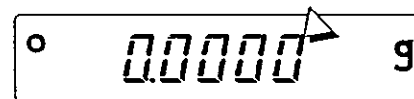
2

You will hear the calibration mechanism working as the display goes to **CAL**. A decimal point will move to show that calibration is in progress.



3

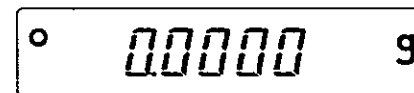
When the balance is finished calibrating it will return to normal weighing mode. **g**



One Touch Calibration

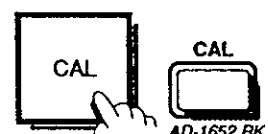
1

Have the display ON, in normal weighing mode and stable. Check that there is nothing on the weighing pan and the balance is level.

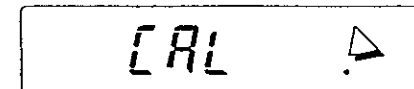
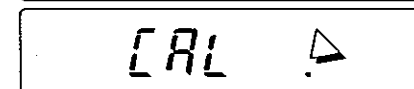
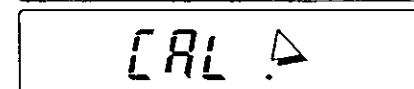


2

Press the **CAL** key.

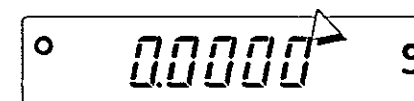


You will hear the calibration mechanism working as the display goes to **CAL**. A decimal point will move to show that calibration is in progress.



3

When the balance is finished calibrating it will return to normal weighing mode. **g**




Manual Calibration



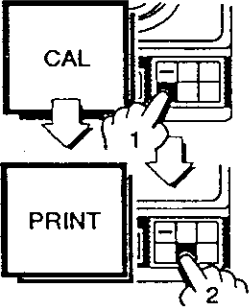
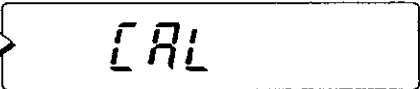

You can easily calibrate your FR balance by using your own 200g calibration mass. If you want to enter the precise weight of the calibration mass, or what to use a different size mass, see the following page for instructions (ENTERING A DIFFERENT CAL MASS VALUE).

1 ▶ Have the display ON, in normal weighing mode and stable. Check that there is nothing on the weighing pan and the balance is level.



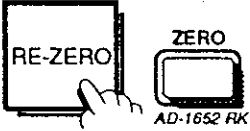
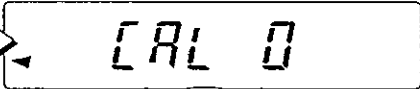
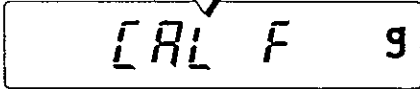
2 ▶ Press the **CAL** key, and then immediately press the **PRINT** key.

○ The last set CAL weight will be displayed ("200.0000g" is the factory setting). If you wish to change this setting see section below.

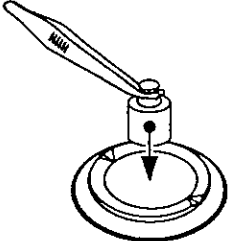
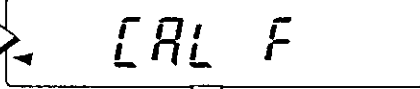
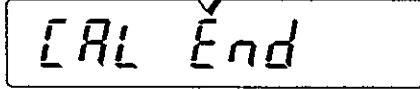
3 ▶ Press the **RE-ZERO** key.


○ "CAL 0", then the "◀" mark, and then "CAL F" will be displayed.

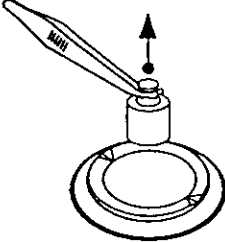





4 ▶ When "CAL F" is displayed, place the calibration mass on the pan.

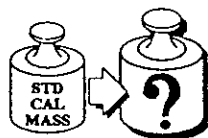
○ The "◀" mark, and then "CAL End" will be displayed.

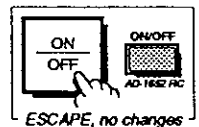
5 ▶ Remove the calibration mass and the display will return to normal weighing. 

Entering a Different CAL Mass Value



If you want to enter the precise weight of the calibration mass, or what to use a different size mass, then between Step 2 and 3 above, use the keys as shown below to enter the new mass value.



FR-200:	100g	150g	200g	-	±0.0150g
FR-300:	150g	200g	250g	300g	±0.0150g

▶ Press the **SAMPLE·%** key to increase value by 50g

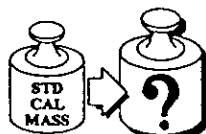
▶ Press the **MODE** key to increase the value by 0.0010g

▶ Press the **PRINT** key to increase value by 0.0001g



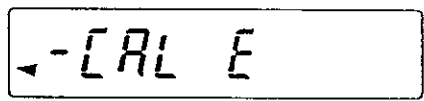
⚠ The calibration mass value can be entered digitally via the 10-key pad on the AD-1652 Remote Keyboard: but C-Parameter "CAL-r cs" will have to be set to "0" (set to "CAL-r 0cs", see pages G-13, G-3).

Calibration Notes and Errors

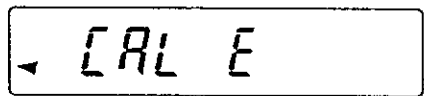


⚠ If you are using two calibration masses (say a 100g and a 50g to make 150g) a "-CAL E" will be given after you load the first mass – but "CAL F" will be displayed when you place the second on the weighing pan.

☐ CAL Errors:

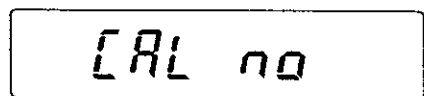


'-CAL E' will be displayed if the calibration mass is too light (varies by more than 10g of set weight).



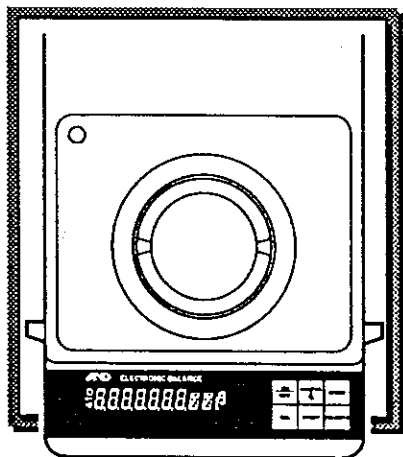
'CAL E' will be displayed if the calibration mass is too heavy (varies by more than 10g of set weight).

▶ Check the mass weight, look for something touching the weighing pan. Press the **RE-ZERO** key, then the **CAL** key (to use the balances' internal CAL mass) before trying again with an external CAL mass.



'CAL no' will be displayed if the balance can not become stable while weighing the calibration mass.

▶ Check for excessive vibrations or drafts. Press the **RE-ZERO** key and see BEST CONDITIONS FOR WEIGHING, p. A-2. **VI**



FR Series • Section D

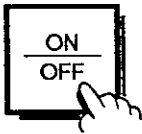
Weighing Mode

Simple Weighing



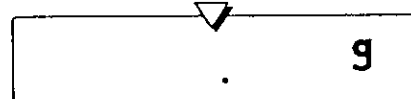
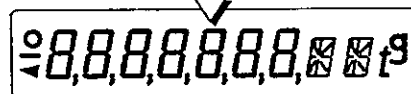
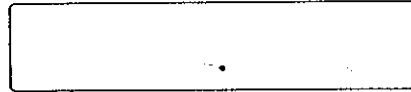
For accurate weighing, please warm-up the balance for an hour before using (see page B•4) and try to meet the BEST CONDITIONS FOR WEIGHING (see page A•2).

1

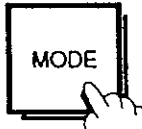


▶ Press the **ON/OFF** key.

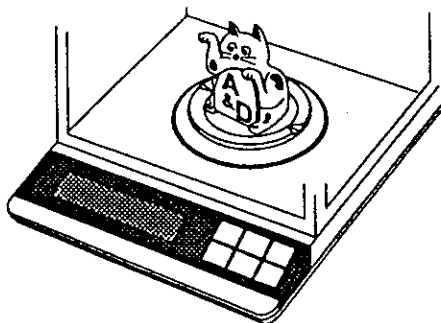
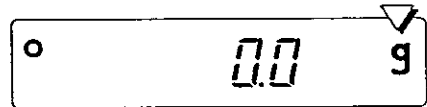
- The display will come ON with all segments lit;
- The display will blank for a moment while the balance zero's;
- Moments later, '0' is displayed, and the 'o' stability indicator will come ON.



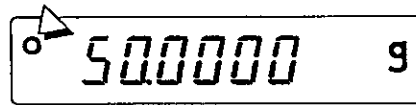
2



- ▶ Press the **MODE** key to select a unit if desired.
- For this example we will leave it at grams.



▶ Place any item(s) on the pan, wait for the round stability indicator to come ON and read the weight.



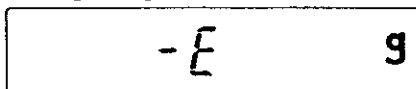
Wait for Stability!

Weighing Errors



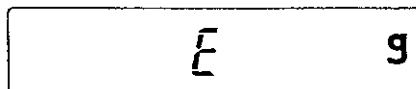
If there are stability problems, the environmental parameters can be adjusted to meet different conditions, please see the C0•Environment parameter group (see pages G•5, G•2).

□ **Weighing Pan Error:**

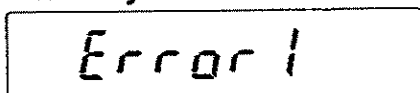


- '-E' will be displayed if the the weighing pan or pan support are not mounted.

□ **Overload Error:**



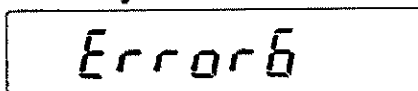
- 'E' will be displayed if the weight is beyond the balance capacity.

Stability Error:

Error 1

'Error 1' will be displayed if the balance can not become stable while weighing.

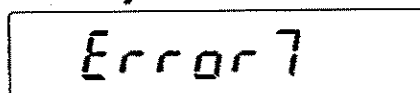
- Check for excessive vibrations or drafts. Press the **RE-ZERO** key and see BEST CONDITIONS FOR WEIGHING, p. A•2.

 Memory Error:

Error 6

'Error 6' will be displayed if the balance has a memory problem.

- Disconnect and connect AC power and try again. If error persists, call for service.

 Memory Error:

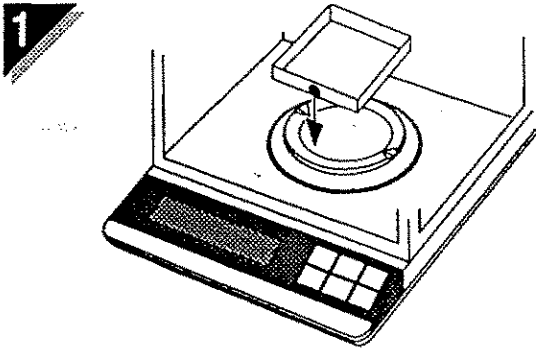
Error 7

'Error 7' will be displayed if the balance has a memory problem.

- Disconnect and connect AC power and try again. If error persists, call for service.

Using RE-ZERO to Tare (or TARE key on RK)

Weighing into a Container



- Place a container on the weighing pan.



- The display will show the container weight.



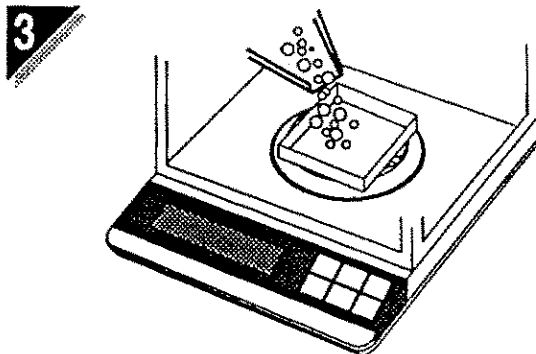
- Press the **RE-ZERO** (**TARE**) on the AD-1652 Remote) to cancel the weight.



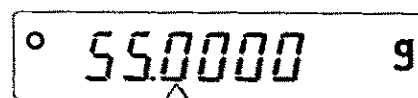
- The display goes to zero.



- When using the AD-1652 Remote Control **TARE** key, the Net/Gross Indicator will come ON.



- Fill the container until the target weight is reached. •When adding more than one ingredient to the container, press the **RE-ZERO** key after each.



- The display will show the sample weight.

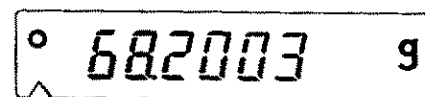
When Using the AD-1652 RK TARE key...



- When using the AD-1652 Remote Control **TARE** key, the Net/Gross Indicator will come ON when weight is canceled.

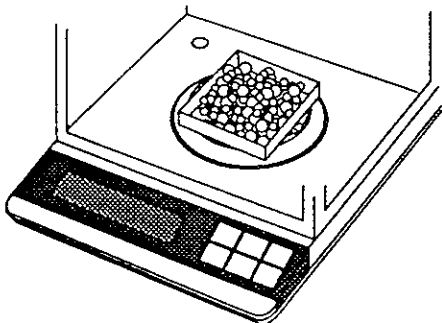


- The **NET/GROSS** key switches the display between Net and Gross mode. **VI**



Weighing Out of a Container

1

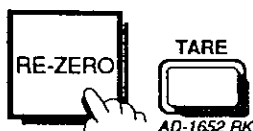


- ▶ Place a full container on the weighing pan.

0 103.2063 g

- The display will show the weight of the container and its contents.

2

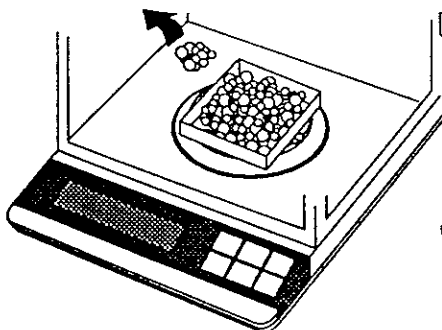


- ▶ Press the **RE-ZERO** (**TARE** on AD-1652 Remote, see D-4) to cancel the weight.

0 0.0000 g

- The display goes to zero.

3



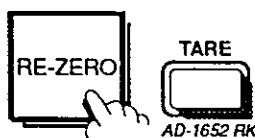
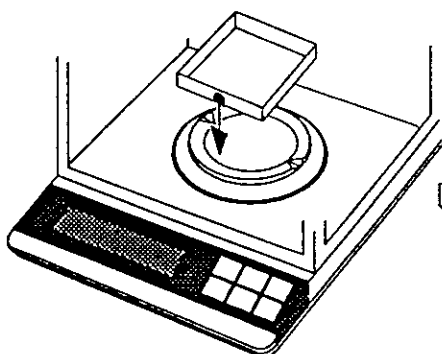
- ▶ Remove until target weight is reached, as shown by the negative display.

0 -50.0000 g

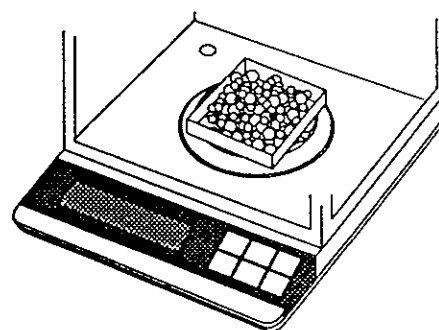
- When subtracting more than one ingredient from the container, press the **RE-ZERO** key after each.

Weighing Out, Goal Remains in Container

1



- ▶ Press the **RE-ZERO** (**TARE** on AD-1652 Remote, see D-4) to cancel the weight.

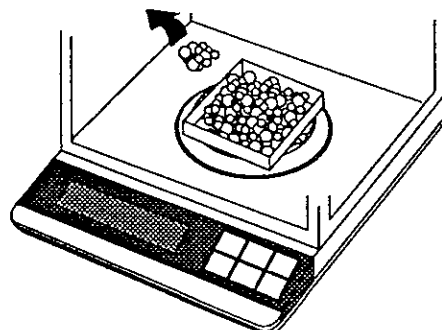


- ▶ Place a container on the weighing pan.

- The display goes to zero.

- ▶ Fill the container (the container may be removed and filled outside the weighing chamber).

2

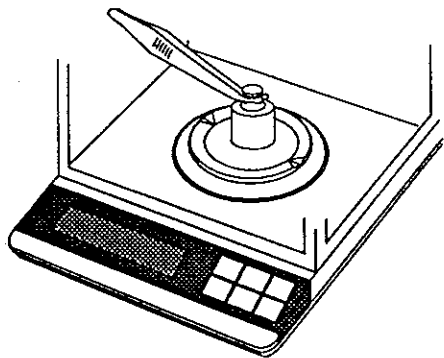


- ▶ Remove until the target weight is reached. **T**

0 50.0000 g

Deviatonal Weighing (Difference from an Ideal)

1

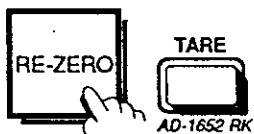


- ▶ Place a reference object (an ideal) on the weighing pan.



- In this case, an object that will be weighed next should ideally weigh 50g.

2



- ▶ Press the **RE-ZERO** (**TARE**[®] on the AD-1652 Remote) to cancel the weight.



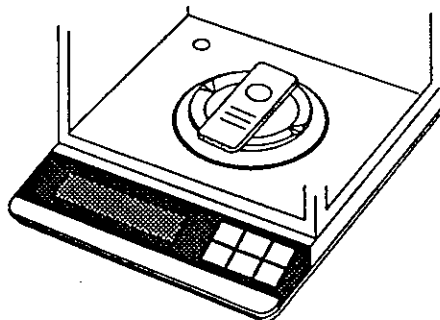
- The display goes to zero.



- ⚠ When using the AD-1652 Remote Control **TARE**[®] key, the Net/Gross Indicator will come ON.




3

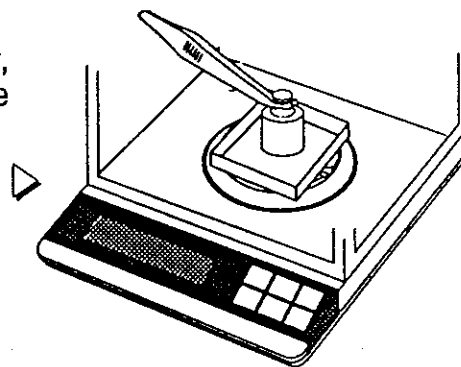


- ▶ Comparative objects will now show their deviation from the reference weight (zero) by a plus or minus weight.



- The bar is -0.0003g under the ideal weight of 50g.

- ⚠ If you want to use a container, you would also put it on the weighing pan in Step 1. 



NET and GROSS Weight Notes



NET Weight = GROSS Weight – TARE Weight.



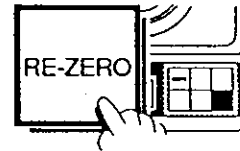
RE-ZERO:



RE-ZEROing returns the balance to ZERO and then goes to GROSS mode up to the maximum capacity of the balance.



The **RE-ZERO** key on the FR balance front panel serves the double purpose of ZEROing the balance, and allowing you to TARE up to the capacity of the balance. In effect, serving as both **ZERO** and **TARE** key on the Remote Keyboard.



You may also RE-ZERO by transmitting the 'R' RE-ZERO command via the RS-232C.



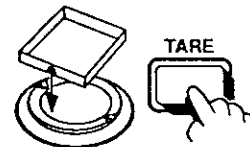
TARE:



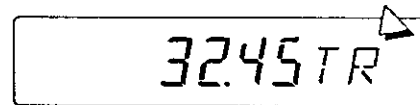
TAREing returns the display to "0" and then goes to NET mode, up to the maximum capacity of the balance. The **TARE** key (or command) is ignored if the TARE would be less than the ZERO point.



TARE by pressing the AD-1652 Remote keyboard **TARE** key while an object is on the weighing pan. See page H-5.



Or, input digitally by using the **FUNC** **TARE WT.** 10-key sequence on the AD-1652 Remote. See page H-5.



Transmitting the proper TARE, or TARE WT. code through the RS-232C (OP-03).



- ⚠ When the display is in percentage or counting mode, the tare weight is set in grams. In other units, the TARE weight is set in whichever unit is on the display.
- ⚠ After you enter the TARE in one weight unit and then change the weighing unit, the TARE weight will be converted into the new unit. For example: TARE weight of 10.0000g is displayed as 50.000ct in carat mode.
- ⚠ You cannot set the TARE weight over the capacity, or negatively.

ZERO:



- In the GROSS mode, ZEROing returns the balance to the center of ZERO when the weighing pan is empty and within $\pm 2\%$ of balance capacity.
- In the NET mode, ZEROing will display the Tare weight as a negative display.



ZERO by using the AD-1652 Remote **ZERO** key. See page H•7.



Balance won't ZERO? Calibrate your balance: see Section C.



You may also ZERO by transmitting the 'Z' ZERO command via the RS-232C.



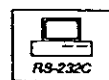
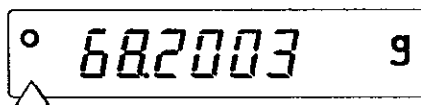
When a TARE Weight has been entered:



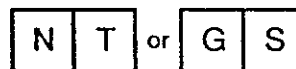
When using the **TARE** key, the Net/Gross Indicator will come ON when weight is cancelled.



The **NET/GROSS** key switches the display between Net and Gross mode.



Send a 'NT' command (NET) or a 'GS' command (GROSS) via the RS-232C.



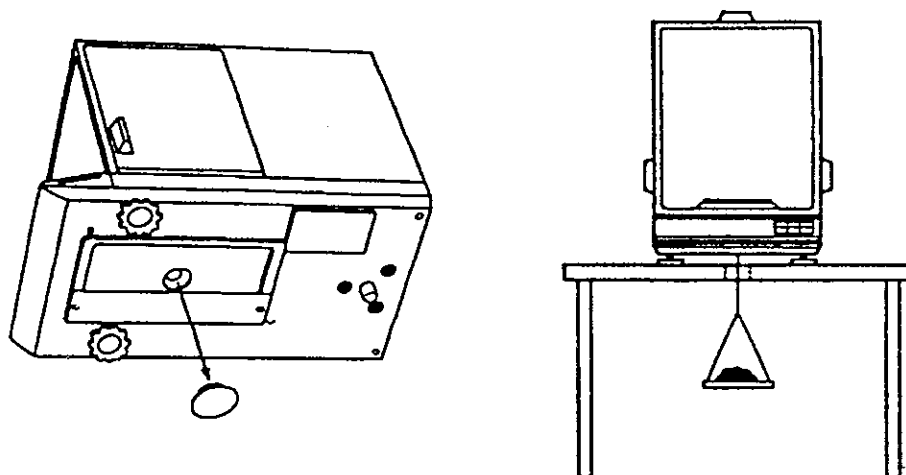
Underhook Weighing Density Determination



The FR Series comes equipped with a standard built-in underhook. This makes density determination a relatively simple matter. You may hang a light-weight weighing harness from this hole or thread a strand of fishing line through it. For best results re-calibrate the balance with the harness fitted. Place the balance on a weighing table with a hole cut in it or place it on a firm metal stand designed for underhook weighing. In either event take care to exclude drafts with a breeze break around the apparatus.

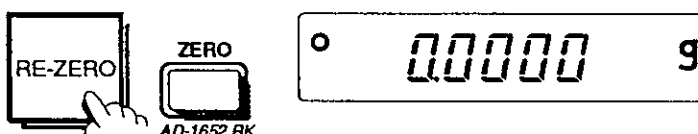


You can find the relative density (specific gravity) of a metal or some other material from its loss in weight when weighed in water. Because one gram of water is almost exactly one cubic centimeter in volume, the loss in weight (floating weight through displacement) associated with weighing an object in water is in proportion to the object's volume. By dividing the object's weight in air by the loss in weight in water (volume), you can find the relative density of the object (expressed as g/cm^3).



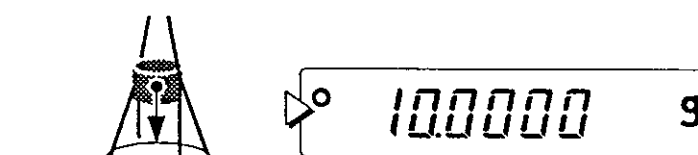
Underhook Weighing Example

1 After you have prepared the weighing mechanism: Press the **RE-ZERO** key to cancel the mechanisms' weight.



2 Place an object on the weighing mechanism and record the weight.

In this example, the mass weighs 10g in the air.

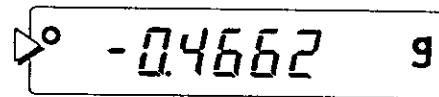
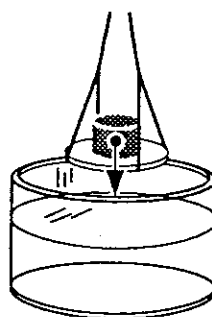


3 After recording the weight: Press the **RE-ZERO** key to cancel the weight of the mass.



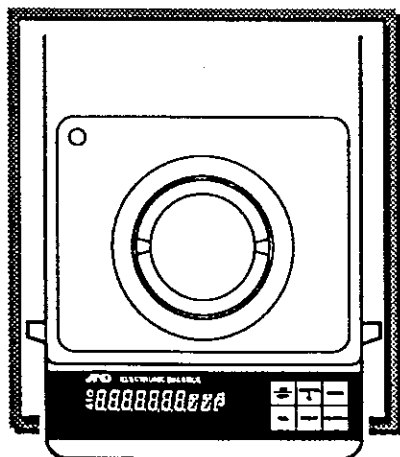
4

- ▶ Lower the object into water at 4°C (maximum density).
- In this example, the mass weighs -0.4662g in water, which is almost the same as 0.4662 cm³.



5

- ▶ Compute: $10.0000\text{g} \div 0.4662\text{cm}^3 \approx 21.45\text{g/cm}^3$. The mass is most likely platinum.



FR Series • Section E

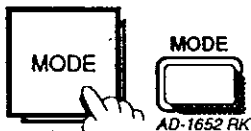
Counting Mode

'cnt' Counting Mode



The FR balance counts by calculating the average weight of one piece-weight called the **unit weight**, then applying it to the total weight of what you are trying to count. A&D has added exclusive software called **ACAI™ Automatic Counting Accuracy Improvement** that constantly updates the unit weight. It is explained on page E-5.

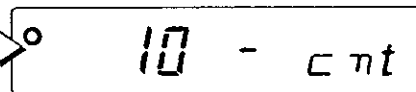
1 Select "cnt" with the **MODE** key.



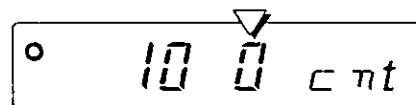
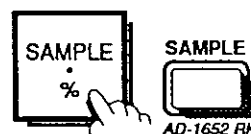
a) If you see this display, then a previous count weight has been entered, continue to Step 2.



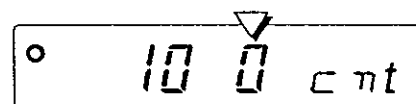
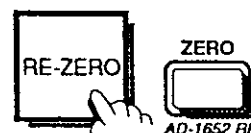
b) If you see this display: continue from Step 3.



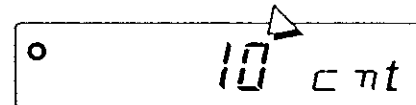
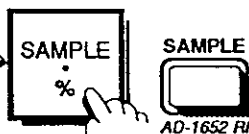
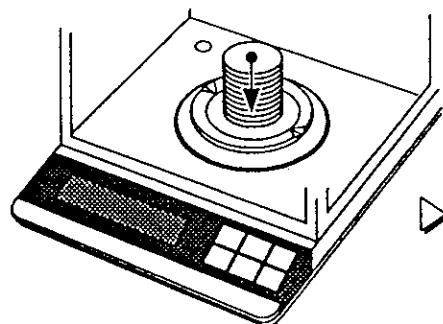
2 Press the **SAMPLE·%** key (also see step 1b).
 "10 0 cnt" will be displayed.



3 Press the **RE-ZERO** key to ZERO the display.



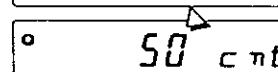
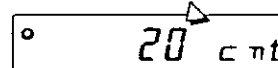
4 Place 10 units on the pan: and press the **SAMPLE·%** key.



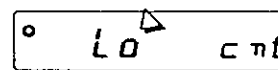
"10 cnt" will be displayed indicating the samples you have on the pan.



If 20, 50 or 100 is displayed, the balance has decided that 10 units are not enough for accurate counting (see following **Weight Table**). If so, you must hand count the sample number called for, onto the pan.

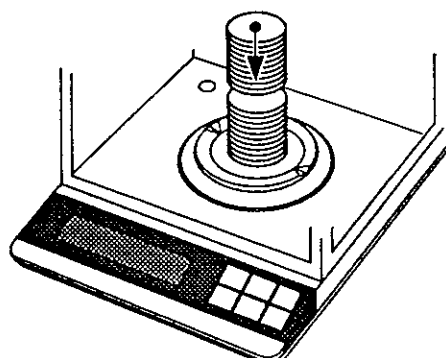


'Lo cnt' will be displayed if the unit weight is too small: less than 0.01g. The display will return to the "10 - cnt" display.



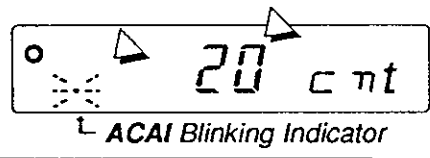
	Sample Size	Weight of 10 samples (= W)
cnt	10	$W \geq 0.0100g$
	20	$0.0100g > W \geq 0.0050g$
	50	$0.0050g > W \geq 0.0020g$
	100	$0.0020g > W \geq 0.0010g$
	Lo	$0.0010g > W$

5



- Now, to activate the **ACAI**, you will need to *approximately* double the sample. The number you add can be an estimate, but must be between 3 and 16 additional units (see following **ACAI Table** just below).
- ▣ For this example we will add 10 more units (double the sample).

- "20 cnt" will be displayed and the **ACAI** indicator (the first ".") should blink three times (then stay OFF) meaning count was within the **ACAI** range.



6

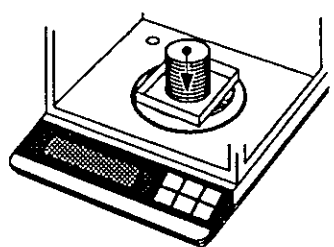
At this point please refer to the **ACAI Table**, or the following section: **ACAI OPERATION** (p. E-4), concerning the number of units that need to be added to satisfy **ACAI**. A rule of thumb is to approximately double the previous count until you reach your target. Make sure that the **ACAI** indicator blinks as you build. When you have reached your target: count!

ACAI Table

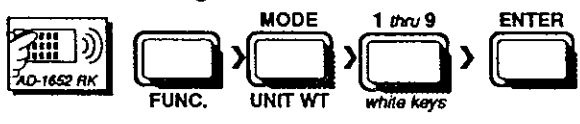
The table below shows that with an approximate number of sample unit "Pcs" on the weighing pan - to keep **ACAI** working, you add more units within the **ACAI** Addition Range shown, you don't have to be exact.

Pcs On the Weighing Pan	ACAI Addition Range	
10	13 → 26	60.....63 → 108
20	23 → 47	70.....73 → 118
30	33 → 65	80.....83 → 128
40	43 → 81	90.....93 → 128
50	53 → 95	100.....103 → 148
		over 100.....104 → ...

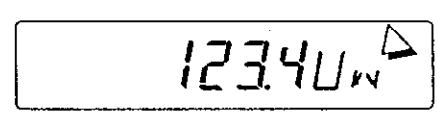
Counting Mode Notes



If you want to use a tared container: Load the container before pressing the **RE-ZERO** key in Step 3 (you may also use the **ZERO** or **TARE** key on the AD-1652 Remote Key-board).



Example:
123.4g
as unit weight



⚠ unit weight can only be set in grams, and **ACAI** does not operate.



- The Unit weight can also be set digitally using the optional Serial Interface OP-03, described on page K-17. *Unit weight can only be set in grams and the **ACAI** will not operate.*



- The unit weight memory is non-volatile, even though the AC adaptor is disconnected, so unit weight is remembered (except: if you turn weighing units OFF or ON as described on page B-8). **☑**

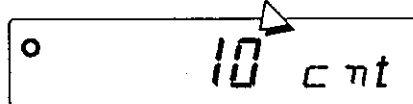
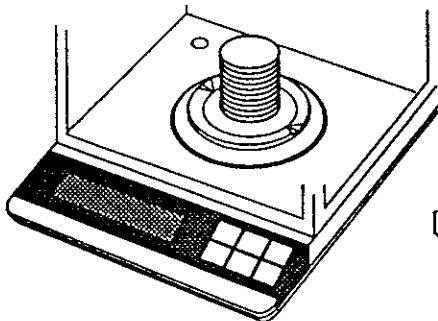
Using ACAI



⚠ Do not take any pieces off until the end of the **ACAI** procedure. If you do, **ACAI** will stop operating and you will have to start again to use the **ACAI**. If you are unfamiliar with **ACAI**, please read the next section before you start, page E-5

⚠ You don't have to count out the pieces when you add, just stay within the **ACAI** range.

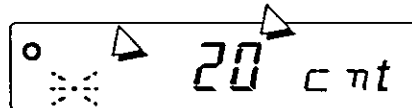
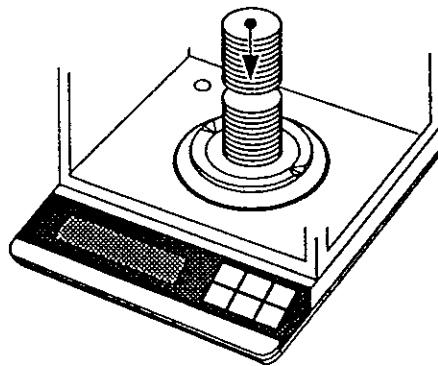
1



⚠ We are at the same place as Step 5 on page E-2.

▶ To start **ACAI** operation, unit weight must be registered and the sample still on the weighing pan.

2

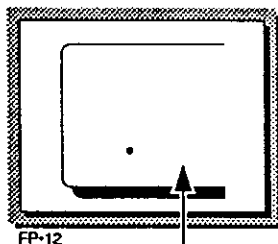


⌊ ACAI Blinking Indicator

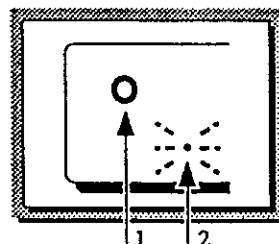
▶ Add pieces within the nearest **ACAI** range, following the table below.

Pcs On the Weighing Pan	ACAI Addition Range
10	13 → 26
20	23 → 47
30	33 → 65
40	43 → 81
50	53 → 95

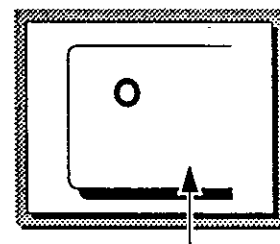
60	63 → 108
70	73 → 118
80	83 → 128
90	93 → 128
100	103 → 148
over 100	104 → ...



As you add, the **ACAI** indicator will be ON as long as you are in range.



When you stop adding, 1) the stable indicator comes ON, 2) the **ACAI** indicator will blink.



After the new unit weight is calculated, the **ACAI** indicator will disappear until you add more.

3

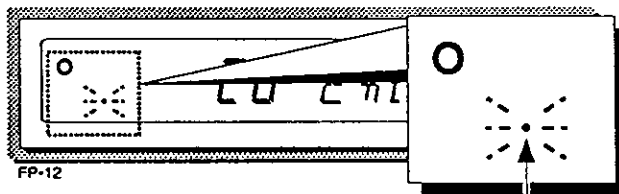
- ▶ Continue adding pieces within the **ACAI** range until you have reached a sample size as large as the largest number of pieces that you will be counting. For example, if you are going to be counting up to 300 bolts, follow the **ACAI** procedure until you have over 300 pieces on the weighing pan.
- ▶ When you have added the maximum number of pieces required, remove the sample pieces and start your counting job.



ACAI Automatic Counting Accuracy Improvement



The **ACAI**[™] (Automatic Counting Accuracy Improvement) function re-calculates the unit weight as more pieces are added, to improve count accuracy.



ACAI Indicator

When the balance calculates unit weight from sample pieces, the more sample pieces that are used, the higher the accuracy. For example: let's say that you use 10 pieces as your sample and the unit weight calculated by the balance from your sample is 1g. Using the **ACAI** feature, after loading on 200 pieces, the balance determines that the average unit weight is really 0.98g instead of 1g. This is improved accuracy and could make a big difference when you are counting thousands of pieces.

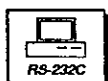
You need to stay within the **ACAI** counting range as you add more pieces. But this is easy to do and only needs to be done once, up to 500 pieces. After that, the **ACAI** remembers the most accurate unit weight.

If you set the unit weight digitally, by using the optional AD-1652 Remote Keyboard or by computer via the serial interface, the **ACAI** function will not operate.



ACAI Notes

- ❑ You must do the **ACAI** procedure just after you set the unit weight. *Samples must be still on the weighing pan.*
- ❑ Do not take the samples off until the end of the **ACAI** procedure.
- ❑ You don't have to count out the pieces when you add, just stay within the **ACAI** range.
- ❑ Continue the **ACAI** procedure to reach the largest amount that you will be counting (or 500 pieces).
- ❑ If you want the most precise counting results every time you count different batches of the same item, use **ACAI** every time you start counting the next batch (in other words, if you are counting to 100, start with approximately 10 pieces and then when you add, approximately double the amount until you get to 100).



⚠ *The **ACAI** function DOES NOT work when the unit weight is set digitally by the optional AD-1652 Remote Keyboard, or using a computer via the Serial Interface OP-03.*



Counting Errors

- ❑ **Count Sample too light:**

Lo cnt

'Lo cnt' will be displayed if the unit weight is too small. The display will show 'Lo' and returns to the "10 - cnt" display.

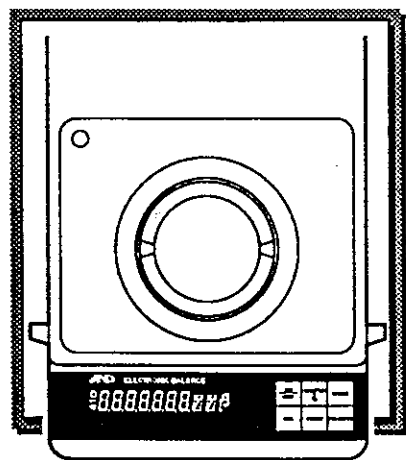
- ▣ Unit weight is less than 0.0001g.

- ❑ **Stability Error:**

Error 2

'Error 2' will be displayed if the balance can not become stable while registering the unit weight.

- ▣ Check for excessive vibrations or drafts. Press the **RE-ZERO** key and see BEST CONDITIONS FOR WEIGHING, p. A-2.



FR Series • Section F

Percent Mode

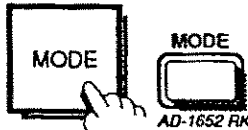
'Pct' Percentage Mode



The FR balance contains a percentage mode which will tell you what percentage an item being weighed differs from an ideal weight. This ideal weight is called a '100%' weight. For example: if you have a metal bar that should weigh 50g, you simply register 50g as 100% weight - then when you weigh subsequent bars, the balance will display what percentage of the 100% weight they are (100% = 50g).

1

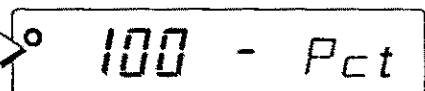
▶ Select "Pct" with the **MODE** key.



a) If you see this display, then a previous percentage weight has been entered, continue to Step 2.

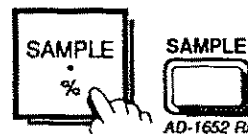


b) If you see this display: continue from Step 3.



2

▶ Press the **SAMPLE-%** key (also see step 1b).

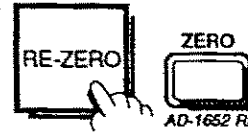


○ "100 0 pct" will be displayed.

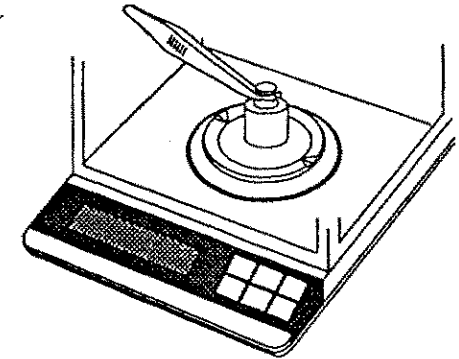


3

▶ Press the **RE-ZERO** key to ZERO the display.



4



▶ Load the ideal 100% sample.



○ The '0' will go to a '-' to indicate that a sample has been loaded.

6

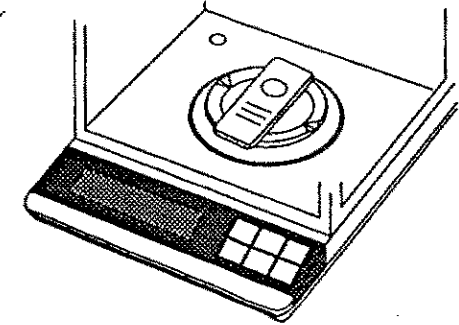
▶ Press the **SAMPLE-%** key.



○ "100 pct" will be displayed when the ideal weight has been registered.




7

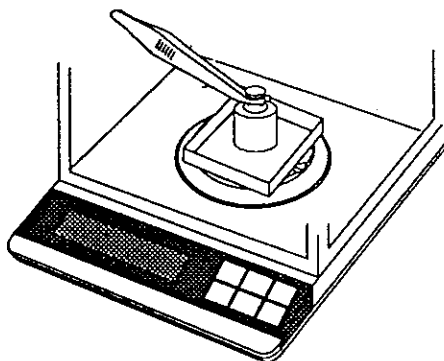


▶ Items will now show their deviation from the ideal weight.



○ In this example the bar is 99.95% of the ideal, or 0.05% under weight. 

Percentage Mode Notes



- ⚠ If you want to use a tared container: Load the container before pressing the **RE-ZERO** key in Step 3 (you may also use the **ZERO**® or **TARE**® key on the AD-1652 Remote Keyboard).



Example:

123.45g

as 100% weight

123.45Pct

⚠ 100% weight can only be entered in grams.



- ❑ The 100% weight can also be set digitally using the optional Serial Interface OP-03, described on page K•17. *100% weight can only be set in grams.*



- ❑ The 100% weight memory is non-volatile, even though the AC adaptor is disconnected, so unit weight is remembered (except: if you turn weighing units OFF or ON as described on page B•8).

Percentage Mode Errors

- ❑ **100% Sample too light:** 'Lo Pct' will be displayed if the 100% weight is too small. The display will show 'Lo' and returns to the "100 - pct" display.


Lo Pct

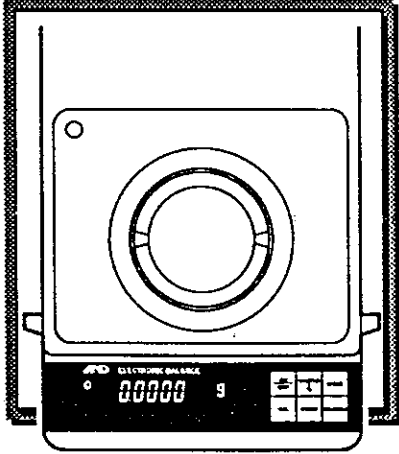
- ☑ 100% weight is less than 0.1g.

- ❑ **Stability Error:**

Error 2

'Error 2' will be displayed if the balance can not become stable while registering the 100% weight.

- ☑ Check for excessive vibrations or drafts. Press the **RE-ZERO** key and see BEST CONDITIONS FOR WEIGHING, p. A•2. 



FR Series • Section G

Internal C-Parameter Settings

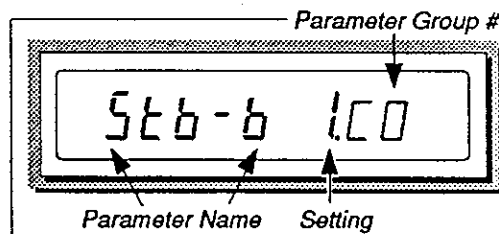
Internal Parameter C-Functions



Your FR balance has a number of internal software parameters that enable you to select the best weighing features for your needs. These settings control how you want the balance to respond to its environment, various commands, operations and options. An overall C-Parameters table is shown below.

All of the C-Parameters have initial settings from the factory, or possibly from your dealer. You may change these settings easily as you need them, or conditions vary.

CHANGING C-PARAMETERS, page G-3, explains how to change the settings. The individual settings for each group are detailed in the following section THE C-PARAMETERS, page G-5.



○ When you are in the CHANGING C-PARAMETERS mode, the parameter name, its present setting, and the group number are displayed.

pages:

G-5-6

G-7

G-8-9

G-10-11

G-12

G-13

G-14

G-15

G-15

	C0 Environment	5t6-b Stability Band Width	5t6-t Stability Deact. Time	FLt-b Ave. Band Width	C0nd Response/Environ.	trc Zero Tracking	
	C1 Display	SPEED Refresh Rate	dISP Blanking Digit	Point Decimal Display	off Display OFF State	P-on Auto Start Func	P-off Auto OFF Func
	C2 Data Output	Print Data Out Mode	RP-P Auto Print Polarity	RP-b Auto Print Band	RP-E PRINT key at Auto	t-out Send Time Data	Code Send Code No.
		PAUSE Data Pause	dATE Data Order	At-F Auto Feed			
	C3 Serial Interface	bPS Baud Rate	PAR Parity Bit	bit Data Bit Length	StoP Stop Bit Length	Cr-LF Terminator	tYPE Data Format
		t-UP Receive Time	dP ASCII decl. code	E-Cod Error Code			
	C4 Auto Re-Zero	Ar-0 Auto Function	Ar-t Command Interrupt	Ar-d Auto Data Transmit			
	C5 Calibration	CAL CAL Inhibition	CAL-C Self Check	CAL-r Weight by AD-1652			
	C6 Comparator Out.	CP Comparison Mode	out Comp. Out	CP-0 Comp. Near Zero	CP-L Equation at LO	CP-H Equation at HI	
		bEEP- Buzzer LO	bEEP- Buzzer GO	bEEP- Buzzer HI			
	C7 External Switch	An Input Selection					
	C8 Misc.	id Remote Keybd. ID	bEEP AD-1652 key beep	PF Parameters Protect			

FR-04

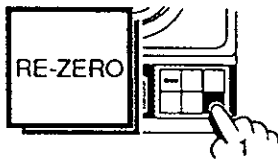
Changing C-Parameter Settings



- ❑ The C-Parameters can't be changed when the memory is protected by "PF" C8 group, page G•15. If this parameter is set to 'protect', PF 1CB, change to PF 2CB.
- ❑ You can escape without saving any changes, at any time, by pressing the ON/OFF key.



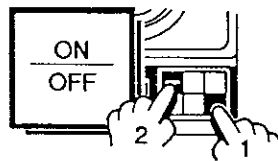
1



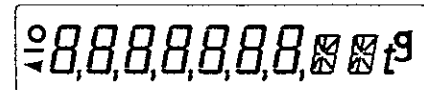
- ▶ With the display OFF: Press and hold the RE-ZERO key.



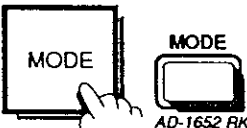
2



- ▶ While holding RE-ZERO, press the ON/OFF key.
- All display segments will come ON.

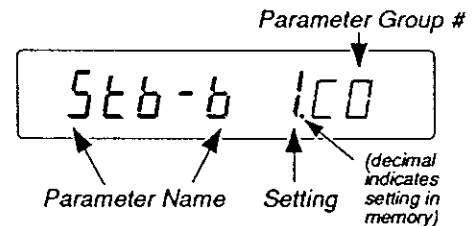


3



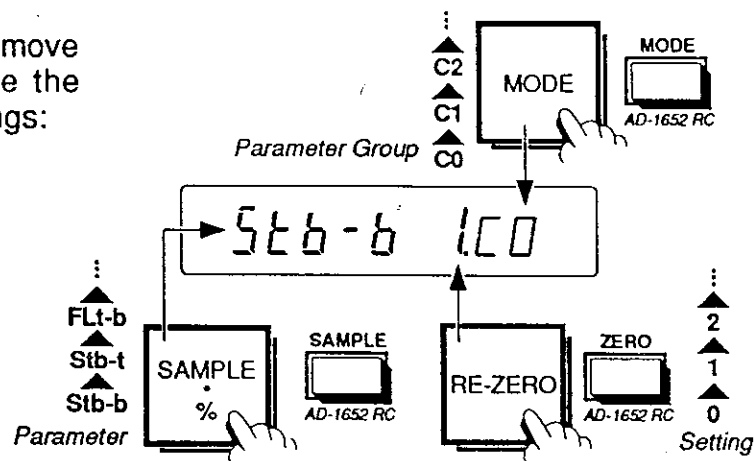
- ▶ Press the MODE key to move to C-Parameter Settings mode (see p. G•5 for listings).

- The software version number will be displayed briefly, then the first **Parameter Name, Setting and Group Number** will be displayed.



4

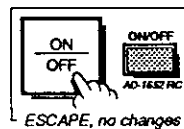
- ▶ Use these keys to move through, or change the C-Parameter settings:



- ⚠ The decimal point appears to indicate the value that is presently stored in memory.
- ⚠ **Parameter Names, Settings and Group Numbers** will loop. So if you miss a setting by pressing once too much, keep going until it comes around again.



❑ Remember that you can escape at any time *without saving any changes*, by pressing the **ON/OFF** key.



5



▶ When you have finished: Press the **PRINT** key to save the changes and exit to the weighing mode.

The C-Parameter Settings

Parameter Abbreviation
(As seen on Balance Display)

Parameter Name

<input type="checkbox"/> Stb-b	X co	Stability Band Width	
** Indicates Factory Setting	0.	± 0.5 digits	FC00:0
	1	± 1 digits	FC00:1

Parameter Group Number Parameter Setting Parameter Setting Definition RS-232C FC Number

C0 • Environment

<input type="checkbox"/> Stb-b	X co	Stability Band Width	
NOTE: The Stability Indicator turns ON when display deviation is within the range set by "Stb-b" and that continues for the time set by "Stb-t". These choices will also affect the judgement for the Auto-Print timing.			

Stb-b

0.	Stable when within ± 0.5 digits	FC00:0
1	Stable when within ± 1 digit	FC00:1
2	Stable when within ± 2 digits	FC00:2
3	Stable when within ± 3 digits	FC00:3

<input type="checkbox"/> Stb-t	X co	Stability Detection Time	
NOTE: The Stability Indicator turns ON when display deviation is within the range set by "Stb-b" and that continues for the time set by "Stb-t". These choices will also affect the judgement for the Auto-Print timing.			

Stb-t

0.	0.5 seconds	FC01:0
1	1 second	FC01:1
2	2 seconds	FC01:2
3	3 seconds	FC01:3

<input type="checkbox"/> FLt-b	X co	Average Band Width	
--------------------------------	------	--------------------	--

FLt-b

0	Narrow Band / Good Environment	FC02:0
1	Mid-Narrow	FC02:1
2	Normal	FC02:2
3	Wide Band / Bad Environment	FC02:3

<input type="checkbox"/> Cond	Xco	Response / Environment	
<i>Cond</i>	0	Fast Response / Good Environment	FC03:0
	1	Mid-Fast Response	FC03:1
	2	Normal	FC03:2
	3	Slow Response / Bad Environment	FC03:3

<input type="checkbox"/> trc	Xco	Zero Tracking Detection Time	
		NOTE: The balance traces a zero-drift caused by the change of temperature, humidity, air pressure, etc., and stabilizes the ZERO point. Display continues ZERO if the drift is less than 1 digit (0.0001g) per time decided by 'trc' parameter. If weighing very light samples, select a smaller number.	
<i>trc</i>	0	ZERO tracking OFF	FC04:0
	1	Long (Weak Tracking)	FC04:1
	2	Normal	FC04:2
	3	Short (Strong Tracking)	FC04:3

C1 • Display

<input type="checkbox"/> SPEED Xc1	Display Refreshing Rate		
SPEED	0 •	Normal (4 times/second)	FC10:0
	1	Hi Speed (8 times/second)	FC10:1
	2	Normal if Stable, Hi speed if Unstable	FC10:2

<input type="checkbox"/> dISP Xc1	Blanking Digit		
NOTE: You can blank the last or last two digits if they are never used.			
dISP	0 •	Normal (no blanking)	FC11:0
	1	Last digit blanks if unstable	FC11:1
	2	Last two digits blank if unstable	FC11:2
	3	Always blank the last digit	FC11:3
	4	Always blank the last two digits	FC11:4

<input type="checkbox"/> Point Xc1	Decimal Point Display		
Point	0 •	Point (.)	FC12:0
	1	Comma (,)	FC12:1

<input type="checkbox"/> oFF Xc1	Display at 'Display OFF State' see p. A-4		
oFF	0 •	Power Indicator (right decimal ".")	FC13:0
	1	Time Displayed (requires optional AD-1652 Remote Control Unit, or RS-232C OP-03 to set the time. See p. H-11, K-17)	FC13:1

<input type="checkbox"/> P-on Xc1	Auto Start Function		
P-on	0 •	No Auto start	FC14:0
	1	Auto Start (You don't have to press the ON/OFF key to start weighing, the display will come ON when power is supplied)	FC14:1

<input type="checkbox"/> P-oFF Xc1	Auto Power OFF		
P-oFF	0 •	No Auto Power OFF	FC15:0
	1	Auto Power OFF (If balance is not in operation and stable for more than 5 minutes, then the display will go OFF)	FC15:1

C2 • Data Output

These parameters are used with the optional OP-03 RS-232C Serial Interface and Current Loop. Please see Section K.

<input type="checkbox"/> Print	Xc2	Data Out Mode	
Print	0	PRINT Key A Mode: PRINT key command accepted only if the display is stable. The display will blink when data is transmitted.	FC20:0
	1	PRINT Key B Mode: PRINT key command accepted and output if display stable. The display will blink when data is transmitted.	FC20:1
	2	Auto Print A mode: Data output if display is over the 'Auto Print Band' "AP-b c2" setting and stable. Polarity by "AP-P c2"	FC20:2
	3	Auto Print B mode: Data output when the difference between the display and the last transmitted data is over the 'Auto Print Band' "AP-b c2" setting and stable. Polarity by "AP-P c2"	FC20:3
	4	Stream Mode: Data output continuously.	FC20:4
	5	Command Mode: Data output is initiated by a request from an external computer or device.	FC20:5

<input type="checkbox"/> AP-P	Xc2	Polarity at Auto Print Mode	
AP-P	0	Send only positive data.	FC21:0
	1	<ul style="list-style-type: none"> • At Auto Print A Mode: both positive and negative data sent. • At Auto Print B Mode: Negative data only 	FC21:1

<input type="checkbox"/> AP-b	Xc2	Auto Print Band	
AP-b	0	10 digits	FC22:0
	1	100 digits	FC22:1
	2	1,000 digits	FC22:2
	3	10,000 digits	FC22:3
	4	100,000 digits	FC22:4

<input type="checkbox"/> AP-E	Xc2	PRINT key function at Auto Print Mode	
AP-E	0	PRINT key disable.	FC23:0
	1	PRINT key enable (same as Key B mode).	FC23:1

<input type="checkbox"/> t-out	Xc2	Send Time Data	
t-out	0	No Time Data.	FC24:0
	1	Sent Time Data before the weighing result.	FC24:1

<input type="checkbox"/> CCode	Xc2	Send Code Number	
CCode	0	No Code Number.	FC25:0
	1	Send Code Number before the weighing result and the code number is increased by 1.	FC25:1

<input type="checkbox"/> PAUSE	Xc2	Pause Between Data	
PAUSE	0	No Pause.	FC26:0
	1	Pause 1 second (NOTE: When AD-8117A compact printer is connected with FR, set 'PAUSE' to 1 so that printer can print the continuous data).	FC26:1

<input type="checkbox"/> dAtE	Xc2	Date Order	
dAtE	0	yy-mm-dd	FC27:0
	1	mm-dd-yy	FC27:1
	2	dd-mm-yy	FC27:2

<input type="checkbox"/> At	Xc2	Auto Paper Feed Function	
At-F	0	No Paper Feed.	FC28:0
	1	Paper Feed (NOTE: When AD-8117(A) compact printer is connected with FR, <CR> and <LF> are sent one second after data, except in stream or command mode).	FC28:1

C3 • Serial Interface OP-03

These parameters are used with the optional OP-03 RS-232C Serial Interface and Current Loop. Please see Section K

<input type="checkbox"/> bPS	Xc3	Baud Rate	
bPS	0	600 bps	FC30:0
	1	1200 bps	FC30:1
	2	2400 bps (for AD-8117 & AD-8117A)	FC30:2
	3	4800 bps	FC30:3
	4	9600 bps	FC30:4

<input type="checkbox"/> PAR	Xc3	Parity bit	
PAR	0	Even	FC31:0
	1	Odd (NOTE: When data bit length is selected as 8, "bit 1c3", its regarded as No Parity)	FC31:1

<input type="checkbox"/> bit	Xc3	Data Bit Length	
bit	0	7 bits	FC32:0
	1	8 bits	FC32:1

<input type="checkbox"/> StoP	Xc3	Stop Bit Length	
StoP	0	1 bit	FC33:0
	1	2 bits	FC33:1

<input type="checkbox"/> Cr-LF	Xc3	Terminator	
NOTE: This parameter is applied to both transmitted or received data.			
Cr-LF	0	<cr> <lf>	FC34:0
	1	<cr>	FC34:1

<input type="checkbox"/> tYPE	Xc3	Data Format	
NOTE: Weighing result format can be changed by this parameter. For further information, see DATA FORMAT section.			
tYPE	0	A&D Standard	FC35:0
	1	AD-8117A format	FC35:1
	2	KF format	FC35:2

<input type="checkbox"/> t-Up	Xc3	Time for Command Receiving	
t-Up	0	Timer ON	FC36:0
	1	Timer OFF	FC36:1
<input type="checkbox"/> dP	Xc3	ASCII Code of the Decimal Point	
dP	0	2EH(.)	FC37:0
	1	2CH(,)	FC37:1
<input type="checkbox"/> E-Cod	Xc3	Error Code at Command Mode	
E-Cod	0	No Error Code	FC38:0
	1	Transmit Error Code (NOTE: The balance transmits Error Code at Command Mode)	FC38:1

C4 • Auto Re-ZERO Function

<input type="checkbox"/> Ar-0	Xc4	Auto Re-ZERO function near ZERO	
-------------------------------	-----	--	--

Ar-0	0	No Auto Re-ZERO	FC40:0
	1	Auto Re-ZERO (NOTE: If display is ZERO ±5 digits for the time set by "Ar-t Xc3" parameter, re-ZERO will be executed automatically)	FC40:1

<input type="checkbox"/> Ar-t	Xc4	Detecting Time for near ZERO	
-------------------------------	-----	-------------------------------------	--

Ar-t	0	0.5 seconds	FC41:0
	1	1 second	FC41:1
	2	2 seconds	FC41:2
	3	4 seconds	FC41:3

<input type="checkbox"/> Ar-d	Xc4	Auto Re-ZERO after Weighting Data Transmission NOTE: This Auto Re-ZERO is executed only at Key A/B mode, or at Auto Print A/B mode.	
-------------------------------	-----	---	--

Ar-d	0	No Auto Re-ZERO	FC42:0
	1	Auto Re-ZERO	FC42:1

C5 • Calibration

<input type="checkbox"/> CAL	X _{C5}	Calibration Inhibition	
------------------------------	-----------------	-------------------------------	--

[CAL]	0	All Calibration permitted (see p. C•2)	FC50:0
	1	Automatic Self Calibration inhibited	FC50:1
	2	All Calibration inhibited	FC50:2

<input type="checkbox"/> CAL-CX	C ₅	Self Check after Calibration (not with Automatic Self Calibration)	
---------------------------------	----------------	---	--

[CAL-C]	0	No Self Check	FC51:0
	1	Self Check (NOTE: Self Check is executed only when Calibration is done by the inner automatic balance calibration mass)	FC51:1

<input type="checkbox"/> CAL-r	X _{C5}	Calibration Weight Set by Optional Remote Controller Unit AD-1652	
--------------------------------	-----------------	--	--

[CAL-r]	0	Can be set by AD-1652 Remote	FC52:0
	1	Cannot be set by AD-1652 Remote	FC52:1

C6 • Comparator Output

<input type="checkbox"/> CP	Xc6	Comparison Mode	
CP	0	Comparator OFF	FC60:0
	1	Compare all Data	FC60:1
	2	Compare Stable or Overload Data	FC60:2

<input type="checkbox"/> out	Xc6	Comparator Output	
out	0	Output OFF	FC61:0
	1	Output ON	FC61:1

<input type="checkbox"/> CP-0	Xc6	Comparison Nearby ZERO	
CP-0	0	Compare	FC62:0
	1	No Compare near ZERO	FC62:1

<input type="checkbox"/> CP-L	Xc6	Equation at LO Limit	
CP-L	0	< (less than)	FC63:0
	1	≤ (less than or equal to)	FC63:1

<input type="checkbox"/> CP-H	Xc6	Equation at HI Limit	
CP-H	0	< (less than)	FC64:0
	1	≤ (less than or equal to)	FC64:1

<input type="checkbox"/> bEEP_	Xc6	Buzzer for LO Limit	
bEEP_	0	No beep at LO limit	FC65:0
	1	Beep at LO limit	FC65:1

<input type="checkbox"/> bEEP-	Xc6	Buzzer for GO Range	
bEEP-	0	No beep for GO range	FC66:0
	1	Beep for GO range	FC66:1

<input type="checkbox"/> bEEP^	Xc6	Buzzer for HI Limit	
bEEP^	0	No beep at HI limit	FC67:0
	1	Beep at HI limit	FC67:1

C7 • External Switch

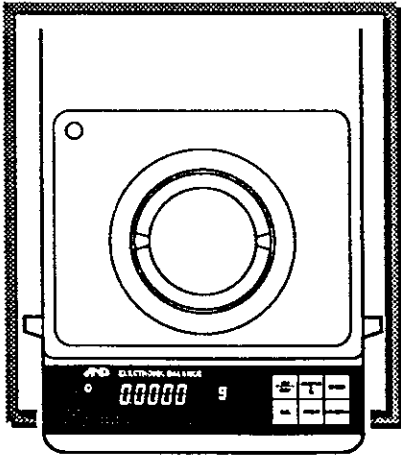
<input type="checkbox"/> An	Xc7	FEEDER Input Setting	
An	0	Feeder control I/O Function (see p. J•4)	FC70:0
	1	Input is RE-ZERO function (see p. M•2)	FC70:1
	2	Input is PRINT function (see p. M•2)	FC70:2

C8 • Others

<input type="checkbox"/> Id	Xc8	ID Code for Remote Keyboard AD-1652	
Id	0	No action to Remote Keyboard	FC80:0
	1	ID Code Number "1"	FC80:1
	2	ID Code Number "2"	FC80:2
	3	ID Code Number "3"	FC80:3
	4	ID Code Number "4"	FC80:4
	5	ID Code Number "5"	FC80:5
	6	ID Code Number "6"	FC80:6
	7	ID Code Number "7"	FC80:7

<input type="checkbox"/> bEEP	Xc8	Buzzer when Key is Pressed	
bEEP	NOTE: The beep control for the comparator is independent of this parameter.		
	0	No beep	FC81:0
	1	Beep (When Front Panel key, or Remote Controller key is pressed and command received)	FC81:1

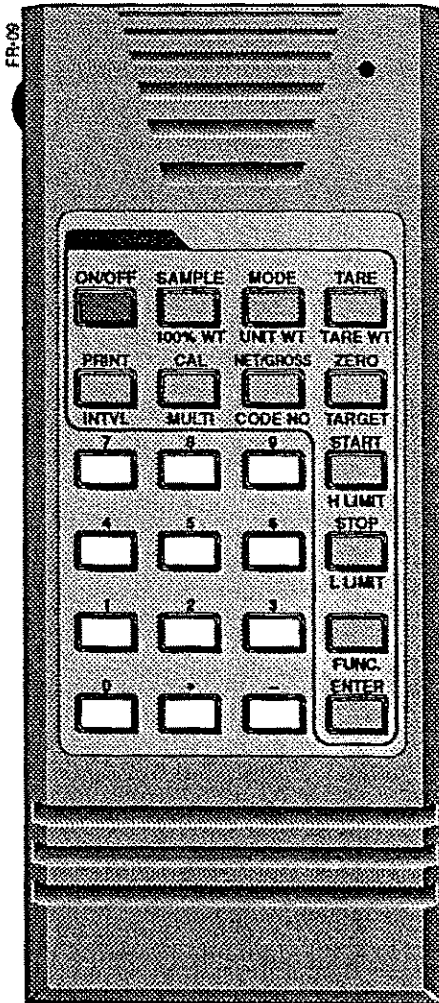
<input type="checkbox"/> PF	Xc8	Protect the set Parameters	
PF	NOTE: Even when 'PF' is set at "1", you can enter the Parameter Change mode and change the display, but the memories will keep the same value.		
	0	Parameters can be changed	FC82:0
	1	Parameters cannot be changed	FC82:1



FR Series • Section H

AD-1652
Wireless Remote
Keyboard

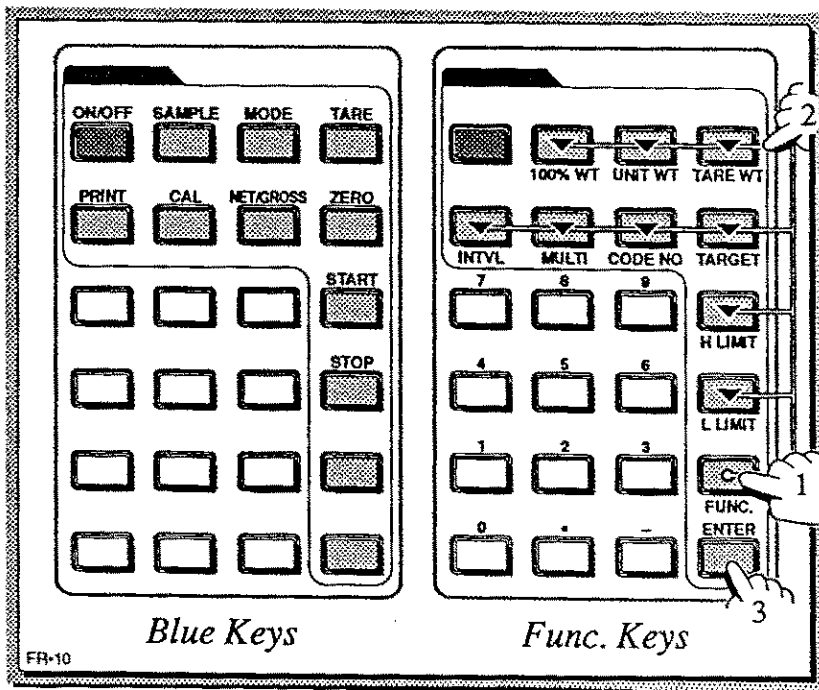
AD-1652 Remote Keyboard



AD-1652 WIRELESS REMOTE KEYBOARD Accessory


By using the Wireless Remote Keyboard AD-1652 Accessory, the FR Series Balance can be controlled with a 3m, 60° operating range. You never have to touch the balance itself, avoiding unnecessary vibrations.

Since every balance feature can be controlled by the AD-1652 Remote Keyboard, and digital data can also be entered through the 10-key keys, you greatly simplify the more complicated balance functions.



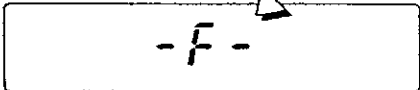
- The **Blue Keys** have two modes:
 1. When pressed by themselves, the balance does what is printed in black above the key.
 2. When the **FUNC.** key is pressed first, you may then enter a value for what is printed in blue below the key. In this section, these keys will be described as "F-keys". See the next page.
- The white 10-key pad keys are used to enter number values. In this section, these keys will be shown as: 1 2 3 . 4 5 keys, or 123.45.


Entering Values with FUNC. Keys

1  **FUNC**


- ▶ Press the **FUNC**[®] key.
- "-F-" will be displayed.

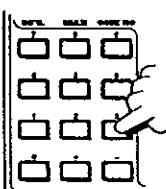
▲ Press the **FUNC**[®] key again anytime to exit, without saving any changes.



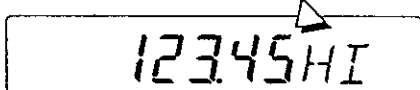
2  **STAY**
H.LIMIT


- ▶ Press the F-key desired, in this example: High Limit.
- Any previously set value will be displayed, in this example: 150g.




3 


- ▶ Use the 10-key pad to display value to enter.
- In this example: **1****2****3****.****4****5** keys, or 123.45g.

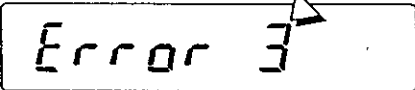


4  **ENTER**

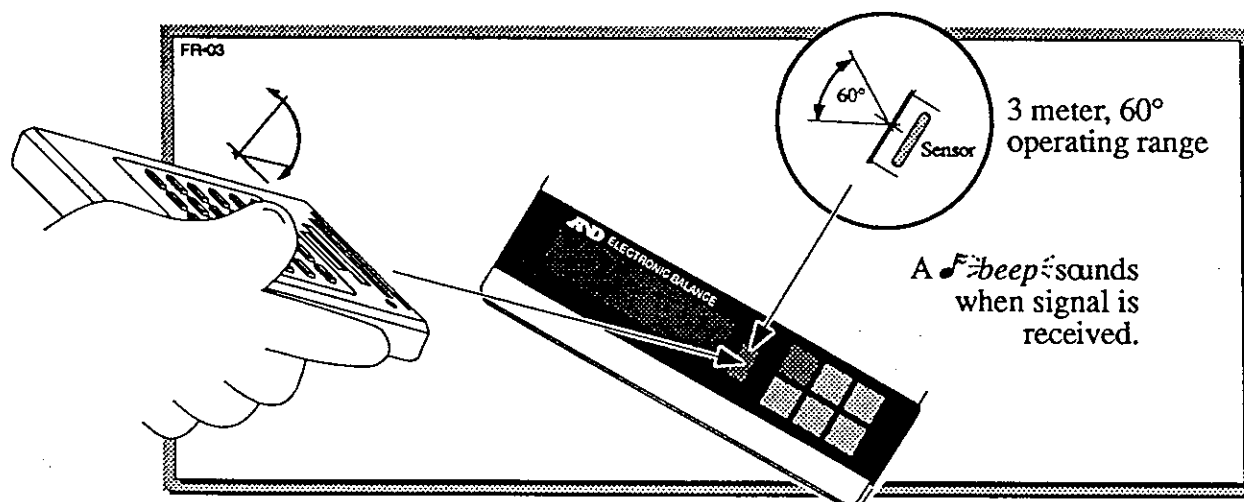
- ▶ Press the **ENTER**[®] key to enter the value.
- The display will return to where you left it.



 **"Error 3"** will be displayed if the value entered is out of the range permitted for the function. To return to weighing mode, press any key.

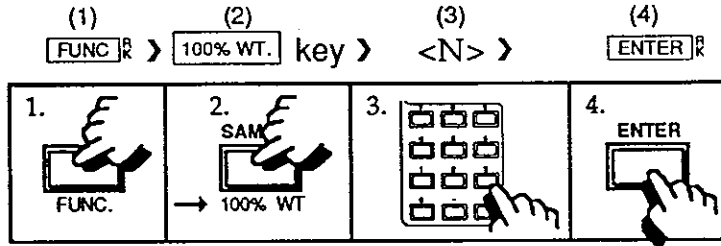


- ▲** When using the AD-1652 Wireless Remote Keyboard, remember that the balance sensor has a 3-meter, 60° operating range. You will hear a faint *beep* if the key signal has been successfully received.







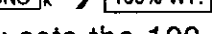

AD-1652 Keyboard Operation




- ❖ The "□" sections are descriptions of the blue keys performing the operations printed in black above the keys.
- ❖ The "○" sections are descriptions of the F- key operations printed in blue below the keys. The ">" represents 'next', and <N> represents any number entered onto the display using the 10-key pad. For example:



- ❖ If there is another key combination operation, it will be listed after the two above.







SAMPLE / 100% WT. Key




-  100% WT. □ The  key can be used to register a sample count (eg: 10 units) in counting "cnt" mode or register 100% in percentage "Pct" mode (when the 100 Pct sample is on the weighing pan).
-  100% WT. □ The  >  key > <N> >  key combination digitally sets the 100 Pct. There will be an error if the entered value is negative or the number is less than 0.01g.

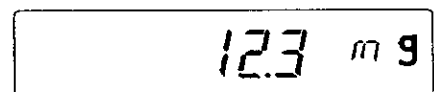
Example:  >  key > 2 0 . 0 2 > 
 the balance will enter 20.02g as the 100% weight (if "g" unit weight is being used).



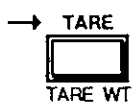
MODE / UNIT WT. Key

-  UNIT WT. □ The  key switches between the balance weighing modes: g, OZ, OZt, dwt, ct, mm, GN, t, and TL. There is also a percentage mode "Pct", and counting mode "cnt".
-  UNIT WT. □ The  >  key > <N> >  key combination digitally sets the unit weight in milligrams (mg). **NOTE: This function only works with the counting mode.** There will be an error if the entered value is negative or the number is less than 0.0001g (0.1mg).

Example:  >  key > 1 2 . 3 > 
 the balance will enter 12.3mg as the unit weight.



TARE / TARE WT. Key



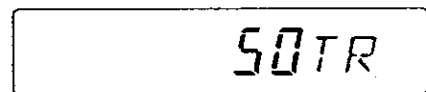
- The **TARE** key re-ZERO's the display up to the maximum capacity of the scale, places the scale in NET mode (NET indicator will come ON), and should not be confused with the **ZERO** key which returns the scale to the center of ZERO when the weighing pan is empty. The TARE weight (container weight) subtracts from the range of the scale.



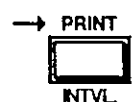
- The **FUNC** > **TARE WT.** key > <N> > **ENTER** combination digitally sets the TARE weight. There will be an error if the entered value is negative or the number is greater than balance capacity.

Example: **FUNC** > **TARE WT.** key > **50** > **ENTER**

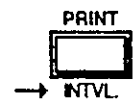
the balance will enter 50g as the TARE weight (if "g" unit weight is being used).



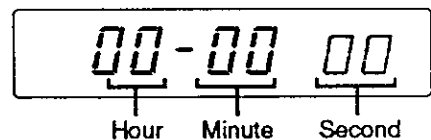
PRINT / INTVL. Key



- The **PRINT** key can be used to transmit data to the AD-8117(A) printer, or to a computer, via the optional RS-232C/CL interface.



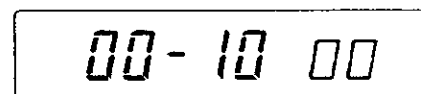
- The **FUNC** > **INTVL.** key > <N> > **ENTER** combination digitally sets the data send interval time. As the time is being entered, the digit being set will flash, and move right when a 10-key is pressed.



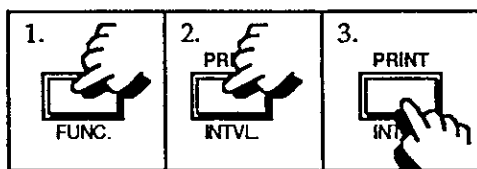
Interval OFF is "00:00:00".
An error will be displayed if it is set over "24:00:00".

Example: **FUNC** > **INTVL.** key > **001000** > **ENTER**

the balance will enter 10 minutes as the data send interval time.

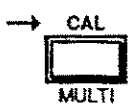


Interval Start: _____

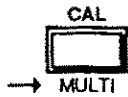


To start interval data output, press the **FUNC** key then the **INTVL.** key and then again, as the **PRINT** key.

CAL / MULTI Key



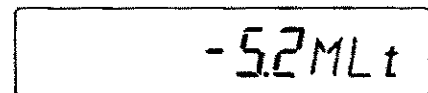
- The **[CAL]** key starts one-touch automatic calibration. From the normal weighing mode, with nothing on the weighing pan and the balance level, press the **[CAL]** key and calibration will be performed automatically.



- The **[FUNC]**^R > **[MULTI]** key > <N> > **[ENTER]**^R key combination digitally sets a multiplier to an object being weighed. When an object is weighed, the balance will display the result of the objects' weight times the multiplier.
 - A negative multiplier is permitted.
 - When using the 10-key to enter the number, the far left digit will be replaced by the next digit when more than 8 digits are pressed.
 - The balance goes into the 'MULTI' mode when the **[FUNC]**^R key is finally pressed. In this 'MULTI' mode weighing units are not displayed.
 - If you press the **[FUNC]**^R key without entering a value via the 10-key, the last set multiplier will be automatically used.
 - Set the multiplier to "1" to clear.
 - You may return to normal weighing by pressing the **[FUNC]**^R key then the **[MULTI]** key and then the **[ENTER]**^R key.

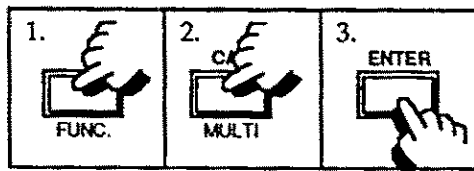
Example: **[FUNC]**^R > **[MULTI]** key > **[-]** **[5]** **[.]** **[2]** > **[ENTER]**^R

the balance will display "-520g" for an object weighing 100g (if "g" unit weight is being used).



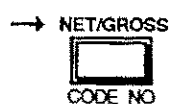
Entering and Exiting MULTI.: _____

(Once a multiplier has been set)

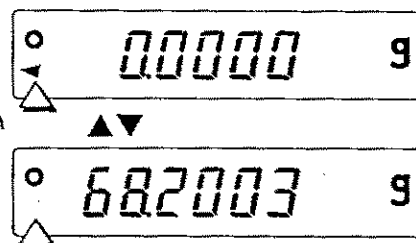
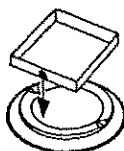


1. If you press the **[ENTER]**^R key (After pressing the **[FUNC]**^R and **[MULTI]** keys) without entering a value via the 10-key, the last set multiplier will be automatically used and you will go into 'MULTI' mode.
2. Once in 'MULTI' mode, you may return to normal weighing by pressing the **[FUNC]**^R key then the **[MULTI]** key and then the **[ENTER]**^R key.

NET/GROSS / CODE NO. Key



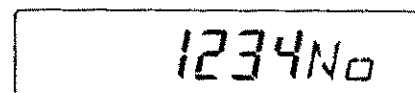
- The **NET/GROSS** key alternates the display between the NET and GROSS modes. The NET/GROSS indicator will come ON while the balance is in NET mode.



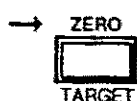
- The **FUNC** > **CODE NO.** key > <N> > **ENTER** key combination digitally sets the code number that will be transmitted (via RS-232C) at the next data-out operation. 10-key numbers are entered to the left up to 6 digits. The maximum number allowed is 999,999. Please see Parameter setting "Code c2" page G-8.

Example: **FUNC** > **CODE NO.** key > 1 2 3 4 > **ENTER**

the balance will enter code number '001234'.



ZERO / TARGET Key



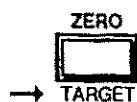
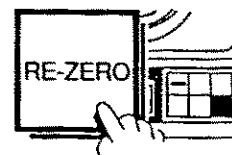
- The **ZERO** key returns the balance to the center of ZERO when the weighing pan is empty and within $\pm 2\%$ of balance capacity. It should not be confused with the **TARE** key which re-ZERO's the display and places the balance in NET mode.

⚠ When the display shows a small deviation from ZERO ($\pm 2\%$ of balance capacity) and the weighing pan is empty (and the tare function is not being used), then press the **ZERO** key to return the display to "0.0000". If there is a large deviation from ZERO, than there may be something else wrong, like something touching the weighing pan.

⚠ If the **ZERO** key will not set the display to ZERO, then you should carry out CALIBRATION.



The balance keyboard does not have a **ZERO** key, it has a **RE-ZERO** key which can also be used to perform TARE operations (see p. D-7). These two keys should not be confused as they perform different functions.




- The **FUNC** > **TARGET** key > <N> > **ENTER** key combination digitally sets the target weight to stop the optional AD-1651 Spoon Feeder. There will be an error if the entered value is over the balance capacity.


Example: **FUNC** > **TARGET** key > 2 > **ENTER**

the balance will enter 2.0000g as the target weight (if "g" unit weight is being used).

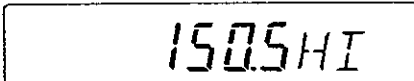


START / H. LIMIT Key


→  The **START** key starts the optional AD-1651 Vibrating Spoon.


→  The **FUNC** ^R > **H. LIMIT** key > <N> > **ENTER** ^R key combination digitally sets the comparator higher limit. A negative number is permitted and the acceptable range is from -9999999 to +9999999.

Example: **FUNC** ^R > **H. LIMIT** key > **1****5****0****.****5** > **ENTER** ^R
the balance will enter 150.500g as the comparator's high limit (if "g" unit weight is being used).

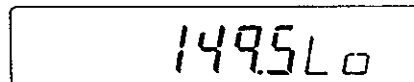


STOP / L. LIMIT Key


→  The **STOP** key stops the optional AD-1651 Vibrating Spoon.

→  The **FUNC** ^R > **L. LIMIT** key > <N> > **ENTER** ^R key combination digitally sets the comparator lower limit. A negative number is permitted and the acceptable range is from -9999999 to +9999999.


Example: **FUNC** ^R > **L. LIMIT** key > **1****4****9****.****5** > **ENTER** ^R
the balance will enter 149.500g as the comparator's lower limit (if "g" unit weight is being used).



FUNC. Key

 When the **FUNC** ^R key is pressed before another blue key, the balance will set what is printed in blue below the key - after waiting for you to enter a number via the 10-key, and then press the **ENTER** ^R key.

ENTER Key

 The **ENTER** ^R key tells the balance to accept the number that has been entered via the 10-key, or to start an action.

FUNC. key, Plus a 10-key



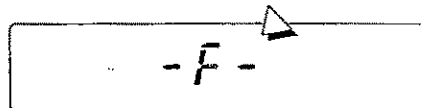
When using the AD-1652 Remote Keyboard, there are a number of short-cuts into various modes that set conditions and parameters on the balance.



1



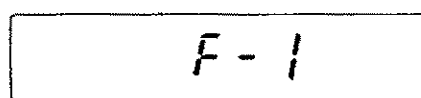
- ▶ Press the **FUNC** key.
- "—F—" will be displayed.
- ⚠ Press the **FUNC** key again anytime to exit, without saving any changes.



2



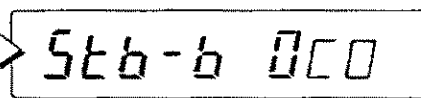
- ▶ Press the 10-key desired, in this example: C-Parameter setting mode.



4



- ▶ Press the **ENTER** key.
- You will enter the mode, in this example: "Stb-b" is the first C-Parameter.



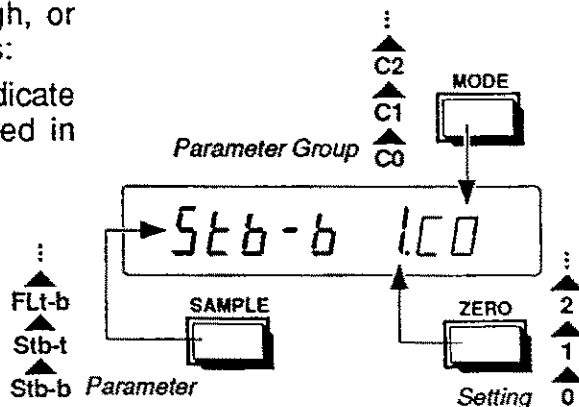
Func. + 1 key • C-Parameter Setting Mode



- Display goes to C-Parameter Setting Mode. See page G-3, CHANGING THE PARAMETER SETTINGS section for full instructions

1

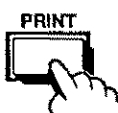
- ▶ Use these keys to move through, or change the C-Parameter settings:
- ⚠ The decimal point appears to indicate the value that is presently stored in memory.
- ⚠ Parameter Names, Settings and Group Numbers will loop. So if you miss a setting by pressing once too much, keep going until it comes around again.



- Remember that you can escape from the PARAMETER SETTING MODE at any time *without saving any changes*, by pressing the **ON/OFF** key.

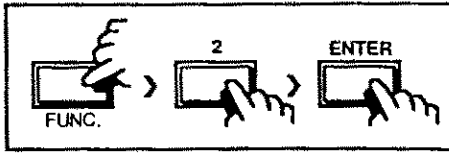


2







- ▶ When you have finished: Press the **PRINT** key to save the changes and exit to the weighing mode.

Func. + 2 key • Selecting Weighing Units



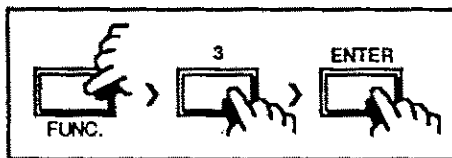
- Display goes to Disabling/Enabling Weighing Units Mode. See page B-8, SELECTING WEIGHING UNITS section for full instructions.

	<input type="checkbox"/> Use the MODE key to move through the weighing units for selection.
	<input type="checkbox"/> If you wish to keep unit displayed as a weighing mode, press the SAMPLE-% key. The stability indicator "0" will come ON indicating acceptance.
	<input type="checkbox"/> Press the ZERO key to save any changes and exit to the weighing mode. (or the TARE or PRINT keys).
	<input type="checkbox"/> Press the ON/OFF key to exit without saving and go to display OFF state.

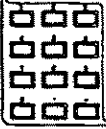

Func. + 3 key • Set Code String






While in this function, the panel keys will not work, except for the **ON/OFF** key.



- A code string can be transmitted via the Serial Interface OP-03 to record a sample number or similar. The code string is a character string which consists of 6 numbers including spaces and hyphens.

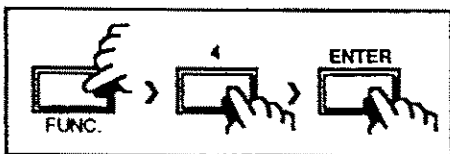
	<input type="checkbox"/> The keys 0 → 9 will display the numbers 0→9. The period '.' key displays a space, and the hyphen '-' displays a hyphen.
	<input type="checkbox"/> Save the code string and return to weighing mode.

	<input type="checkbox"/> Save the code string and transmit it. NOTE: The Print key input works only when Serial Interface card OP-03 is installed and 'Data Out Mode' is not in Command Mode "Print 5c2" see p. G•8.
	<input type="checkbox"/> Press the FUNC key to exit and return to weighing mode.
	<input type="checkbox"/> Press the ON/OFF key to exit and go to display OFF state.






Func. + 4 key • Set the Date



While in this function, the panel keys will not work, except for the **ON/OFF** key.



- The date is set in YY-mm-dd (or other depending on the setting 'Date Order' "dAtE 5c2" see p. G•9) using the 10-key pad. Enter flashing digit as it moves to the right.

	<input type="checkbox"/> The keys 0 → 9 will display the numbers 0→9.
	<input type="checkbox"/> Save the date and return to weighing mode.
	<input type="checkbox"/> Save the date and transmit it. NOTE: The Print key input works only when Serial Interface card OP-03 is installed and 'Data Out Mode' is not in Command Mode "Print 5c2" see p. G•8.
	<input type="checkbox"/> Press the FUNC key to exit and return to weighing mode (or the [-] key).
	<input type="checkbox"/> Press the ON/OFF key to exit and go to display OFF state.

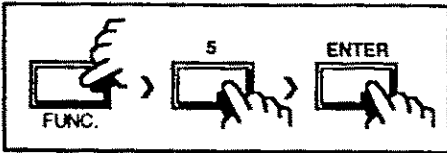
Func. + 5 key • Time



While in this function, the panel keys will not work, except for the **ON/OFF** key.



Using the setting "Display at 'Display OFF State" "oFF 1c1" (see p. A•4, G•7) the time can be shown while the display is OFF. It can also transmitted if the Serial Interface card OP-03 is installed. The time display is in 24hr mode.



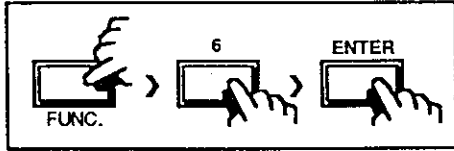
- This key combination allows you to:
 - 1) Transmit the time data;
 - 2) Move to Clock Adjustment;
 - or 3) Exit to weighing mode.

1)		<ul style="list-style-type: none"> The PRINT key transmits the time (exit by pressing the FUNC or - key). NOTE: The Print key input works only when Serial Interface card OP-03 is installed and 'Data Out Mode' is not in Command Mode "Print 5c2" see p. G•8.
2)		<ul style="list-style-type: none"> Press the FUNC key to go into clock-adjustment mode (see "3" below).
		<ul style="list-style-type: none"> The keys 0 → 9 will display the numbers 0→9. Enter flashing digit as it moves to the right.
		<ul style="list-style-type: none"> Although the displayed time is fixed, the clock is still working.
		<ul style="list-style-type: none"> Save the time and return to weighing mode.
		<ul style="list-style-type: none"> Save the time and transmit it (exit: FUNC or - key). NOTE: The PRINT key works only when Serial Interface card OP-03 is installed and 'Data Out Mode' is not in Command Mode "Print 5c2" see p. G•8.
3)		<ul style="list-style-type: none"> Press the FUNC key to exit and return to weighing mode (or the - key).
		<ul style="list-style-type: none"> Press the ON/OFF key to exit and go to display OFF state.

Func. + 6 key • Software Parameter List

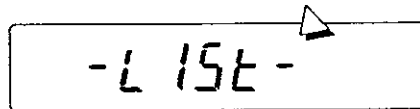





While in this function, the panel keys will not work, except for the **ON/OFF** key.



- This key combination allows the printing (transmission) of a list of the parameter settings that are saved in the balance. NOTE: The Print key input works only when Serial Interface card OP-03 is installed and 'Data Out Mode' is not in Command Mode "Print 5c2" see p. G•8.

- ▣ "-LISt-" will be displayed until one of the following keys is pressed:



 PRINT	<input type="checkbox"/> Transmit the parameter list.
 FUNC.	<input type="checkbox"/> Press the FUNC key to exit and return to weighing mode (or the - key).
 ON/OFF	<input type="checkbox"/> Press the ON/OFF key to exit and go to display OFF state.

- ▣ After the complete parameter list is sent, the display goes back to weighing mode.

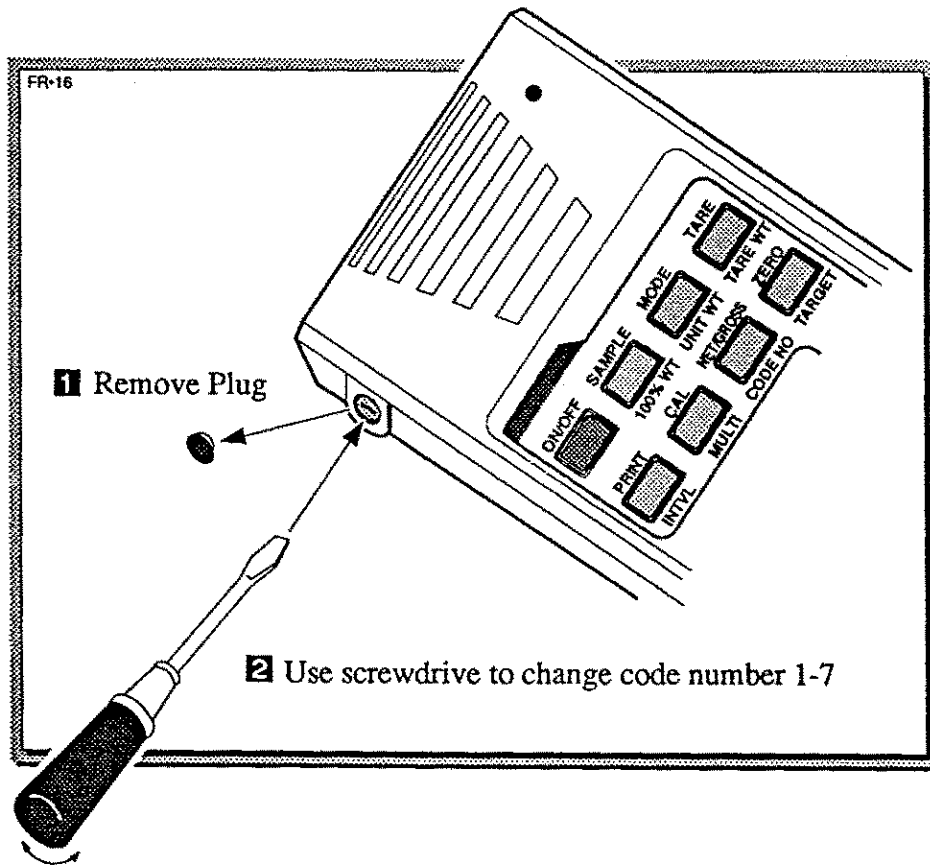


If you are using the AD-8117A printer, you must set parameter 'Pause Between Data' to "PAUSE 1c2" see p. G•9.

AD-1652 Remote Code Number



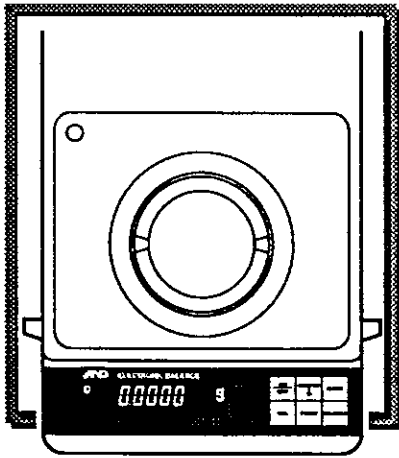
The AD-1652 Remote Keyboard can be reset to a different code number if more than one balance is being used, or for what ever reason. If the number is changed on the AD-1652 Remote Keyboard, the C-Function "id 1c8" (see p. G•15) must also be changed.



C8 • Others (from page G•15)

<input type="checkbox"/> id	x c8	ID Code for Remote Keyboard AD-1652	
id	0	No action to Remote Keyboard	FC80:0
	1	ID Code Number "1"	FC80:1
	2	ID Code Number "2"	FC80:2
	3	ID Code Number "3"	FC80:3
	4	ID Code Number "4"	FC80:4
	5	ID Code Number "5"	FC80:5
	6	ID Code Number "6"	FC80:6
	7	ID Code Number "7"	FC80:7

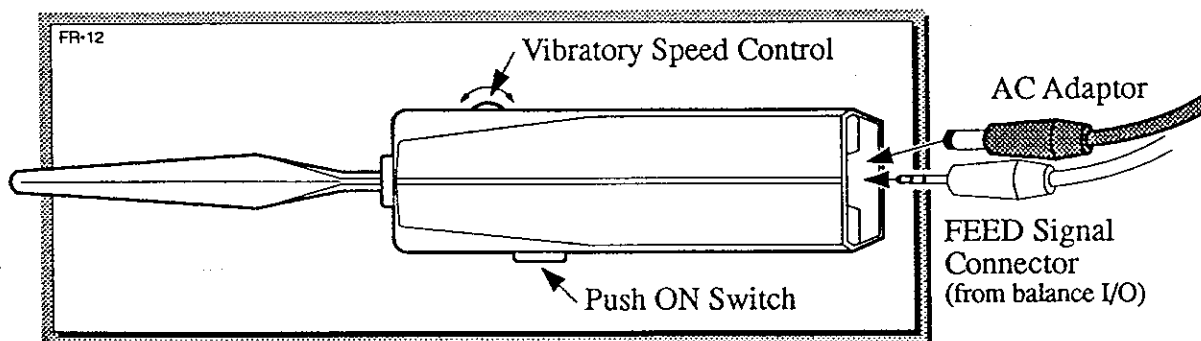
The factory setting is "1", ID Code Number 1



FR Series • Section J

**AD-1651
Vibratory Spoon**

AD-1651 Vibratory Spoon



- The optional AD-1651 Vibratory Spoon makes it easy to accurately feed powders to be weighed.
- With the cable supplied with the Vibratory Spoon, connect one end to the "I/O" connection in the back of the Spoon, and the other end to the "FEEDER" connection in the rear panel of the balance.
- Since no DC power is supplied from the balance, make sure that there are batteries in the Spoon, or connect the AC Adaptor.
- The push switch operates the spoon. If a Target Weight has been set (via AD-1652 Remote Keyboard or RS-232C), the spoon will stay ON until the limit is reached: unless a STOP signal is sent (see next page).

Target Weight

- To set, see next page. The target weight will be the weighing unit last seen on the balance display as you go into the setting mode. Later, if you change the weighing units, the target weight will also be converted. For example: the target weight of 10g is displayed as 50 ct in carat mode.
- If the unit weight (cnt) or 100% weight (Pct) is not registered in cnt/Pct mode, the target weight shows zero. However, after the registration, target weight is converted to each unit.
- You cannot set the target weight over the capacity.

Notes on Feeding Accuracy

- Feeding accuracy may be decreased by the following:
 - a) Flow rate changes due to the AD-1651 Spoon angle changing.
 - b) Free Fall weight (weight of airborne sample) changes due to AD-1651 Spoon being move further away from the weighing pan.
 - c) Sample is not uniform.
 - d) Flow rate is too large for the target weight.
 - e) Flow rate is too small (display changes slowly on average).
 - f) Display is not in high-speed mode (see 'Display Refreshing Rate' "Speed 1c1" see p. G•7).



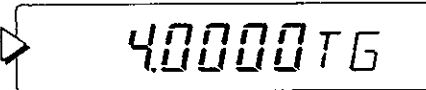
Setting (or Viewing) Target Weight

1



▶ Press the **FUNC** key, then the **TARGET** key.

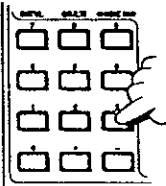
○ Any previously set value will be displayed, in this example: 4g.



If you are just viewing the Target Weight, or want to exit without saving any changes, press the **FUNC** key again.

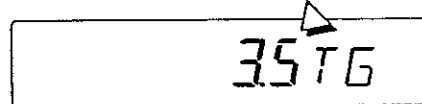


2



▶ Use the 10-key pad to display value to be entered.

○ In this example: **3****.****5** keys, or 3.5g.



3



▶ Press the **ENTER** key to enter.

○ The display will return to where you left it.

▶ See **START/STOP SPOON FEEDING** sections, next page.



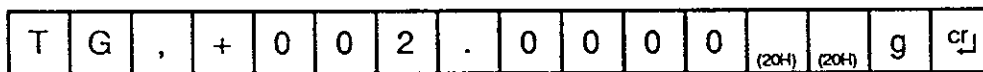
Setting (or Viewing) Target Weight

Ex 1.

?	T	G	↵
---	---	---	---

 Request the balance to send the target weight presently set.

□ For example if the balance has 2g set as the target weight, then it will send:



Ex 2.

T	G	4	.	0	(20H)	(20H)	g	↵
---	---	---	---	---	-------	-------	---	---

 Set a new target weight (ex: 4g).


T	G	4	.	0	(20H)	o	z	↵
---	---	---	---	---	-------	---	---	---

 Set a new target weight (ex: 4oz).


To START Spoon Feeding

A Press the AD-1651 Vibratory Spoon button.



B Press the  key on the AD-1652 Remote Keyboard.




C  Send a 'FEED' command via the RS-232C.


To STOP Spoon Feeding

A Spoon feeding stops when the display reaches near the target weight; or when the display becomes stable, even though under the target weight.



B Press the  key on the AD-1652 Remote Keyboard.

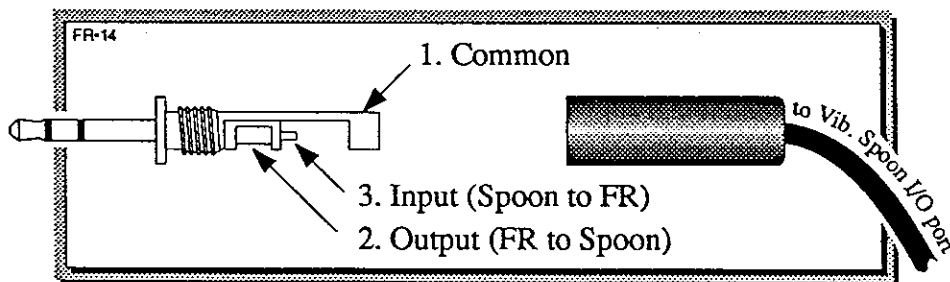


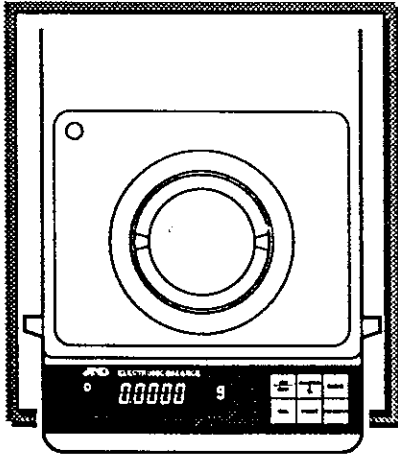
C  Send a 'STOP' command via the RS-232C.

To Re-START Spoon Feeding

- ☑ If the display is under the target weight, you may restart by any of the methods in the To START section above.
- ☑ If the display is over the target weight, you must press the button on the AD-1651 Spoon to restart.

Connector Hook-up





FR Series • Section K

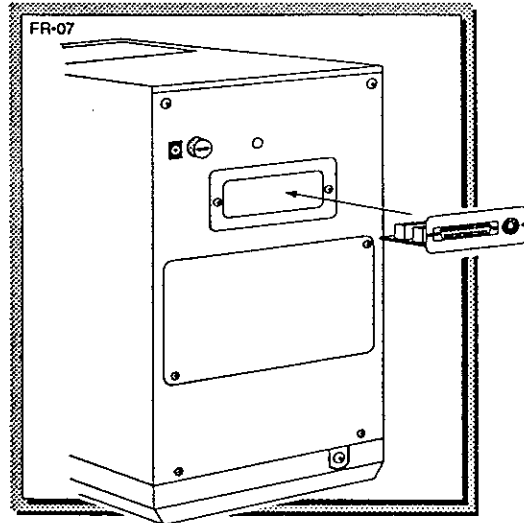
OP-03 RS-232C Serial Interface & Current Loop

OP-03 Installation

1 Disconnect the AC Adaptor from the balance. Remove the two screws and panel covering the RS-232C slot.

2 Check the "CTS CONTROL SWITCH" on the OP-03 card. In general, you would set this switch to 'LOOP'. For more information please see the CTS CONTROL SWITCH section, page K-3.

3 Insert the OP-03 board, making sure that it makes a good connection with the connector in the balance.



4 Replace the two screws and panel covering the RS-232C slot. Connect the AC/DC adaptor from the balance. Earth the chassis if you think static electricity may be a problem.

Specifications

Type EIA-RS-232C/Passive 20mA Current Loop (passive)

Method Asynchronous Transmission, Bi-directional.

Format Baud rate: 600, 1200, 2400, 4800 and 9,600 baud. Rates user selectable, see page G-10.

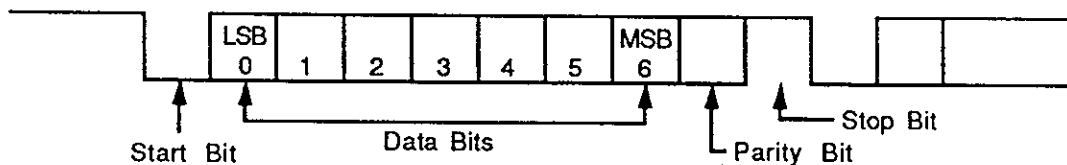
Data bit 7 or 8, see page G-10.

Parity Even/Odd (data 7 bit)
None (data 8 bit), p. G-10.

Stop bit 1 or 2, see page G-10.

Code ASCII.

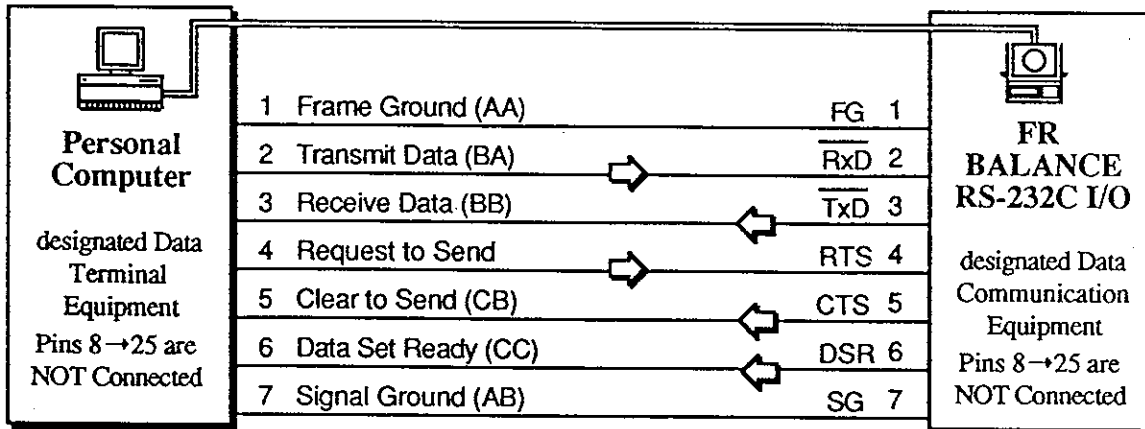
RS-232C	20mA Cur. Loop
1 = -5V → -15V	20mA
0 = +5V → +15V	0mA



Computer Connection

- The FR is designated as DCE (Data Communication Equipment).
- The Current Loop is passive. An external power supply is required.
- The Current Loop transmits the same data as the RS-232C.
- Please confirm that proper conditions have been met before connecting equipment. Refer to connection equipment's manual.
- The connecting cable should be of a high quality. For example: NEC PC-8895, Epson cable set #705, #724.

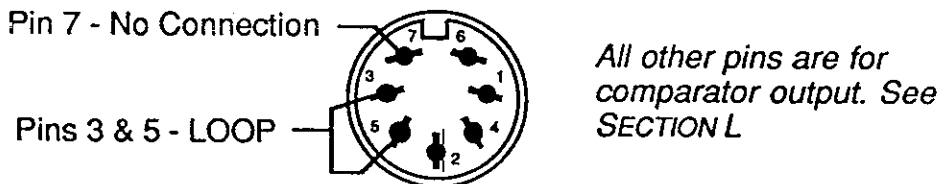
RS-232C Pin Connection



- A 25-pin RS-232C male connector and cover (HDB-25P & HDB-CTF) are not provided with this option.
- Use a high quality modem type cable between the computer and balance.
- AD-8117 is supplied with a cable for connection to the balance.

Current Loop Pin Connection

A 7-pin DIN male Current Loop connector (TCP 0576) is provided for the passive Current Loop interface.



- AD-8117/A** to connect the balance with the AD-8117/A via the current loop, please order the AD-8117 OP-01 option cable.

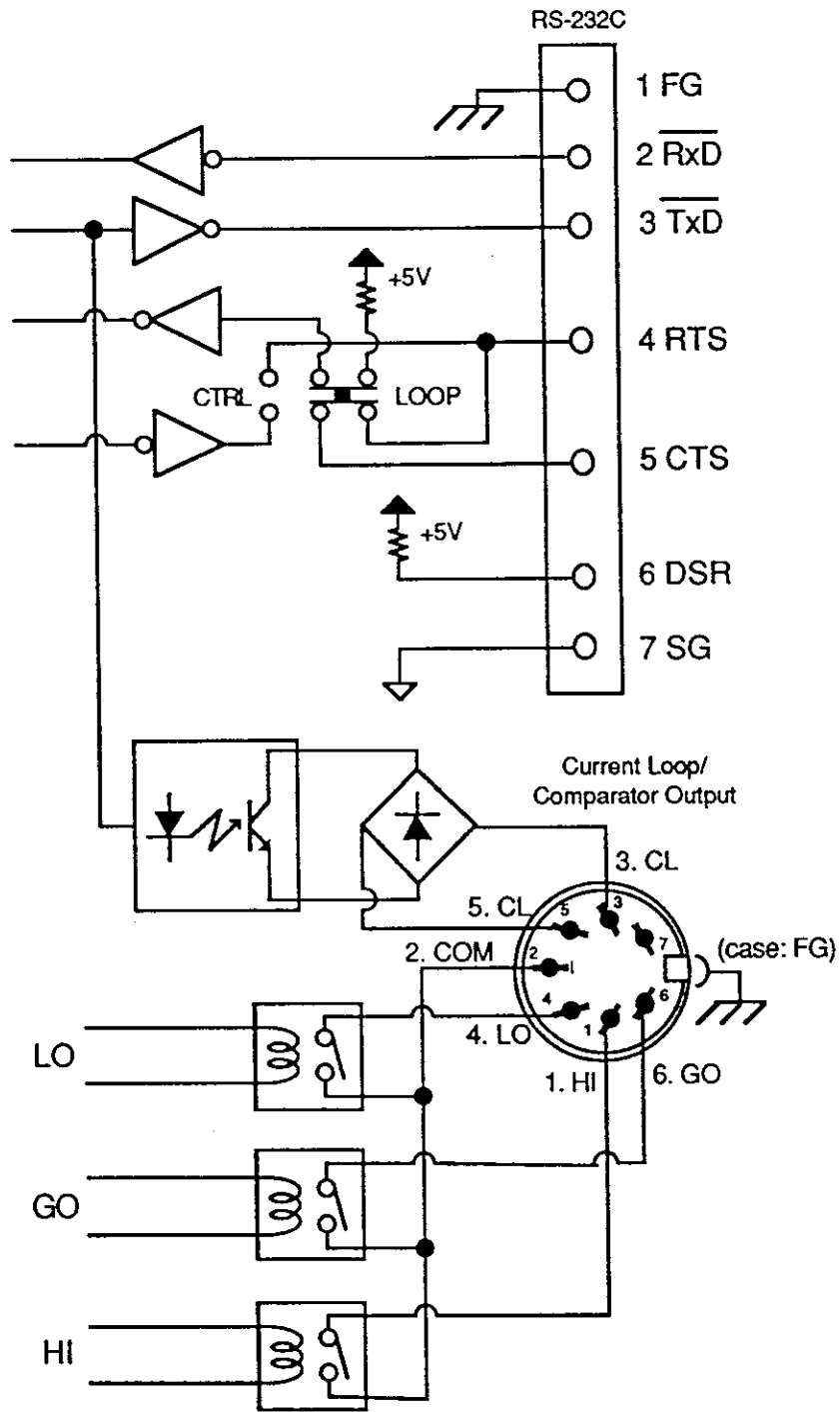
CTS Control Switch



Select 'LOOP' for Current Loop, 'CTRL' for the RS-232C. The CONTROL switch on the PCB permits shorting RTS and CTS lines, or for the balance to send the Clear to Send signal (RTS and CTS are normally shorted).

- Switched to 'LOOP' RTS input and CTS output is shorted. Select 'LOOP' if printer is connected.
- Switched to 'CTRL' The balance sets the CTS at minus level when the received command can not be executed. If the RTS is at minus level, the balance does not transmit the data. In STREAM mode, data transmission can be paused or re-started by CTS-control.

OP-03 Circuit Diagram



Other pin numbers for the RS-232C or Current Loop interfaces are not connected.

OP-03 Data Output



There are five modes to handle the transmission of weighing data, they are:

- PRINT** Key A or B Mode. Sends Data when panel (or AD-1652 remote) **PRINT** key is pressed.
- Auto Print A or B Mode. Data is automatically sent when the display become stable, and other user set conditions are met.
- Stream Mode. Data is sent continuously with display refreshing (user set).
- Command Mode. Data output is initiated by a request from an external computer or device (not available for Current Loop).
- Timed Mode. Data is sent at user set time intervals.



No matter which data out mode selected, if the CTS switch (p. K-3) is set to 'CTRL', the balance cannot transmit any data when the RTS signal is at the minus level.

PRINT Key Mode (when PRINT key is pressed)

Print 0 c 2

PRINT Key A Mode: **PRINT** key command accepted only if the display is stable. The display will blink when data is transmitted.

Print 1 c 2

PRINT Key B Mode: **PRINT** key command accepted and output if display stable. The display will blink when data is transmitted.

Auto Print Mode

Print 2 c 2

Auto Print A Mode: Data output if display is over the 'Auto Print Band' "**AP-b c2**" (p. G-9) setting and stable, data is output once. Polarity is set by "**AP-P c2**" (p. G-9). •Next transmission is done after the display falls below the selected band

Print 3 c 2

Auto Print B Mode: Data output when the difference between the display and the last transmitted data is over the 'Auto Print Band' "**AP-b c2**" (p. G-9) setting and stable, data is output once. Polarity is set by "**AP-P c2**" (p. G-9). •Next transmission is done after the display falls below the selected band



Reaction to a **PRINT** key input in Auto Print Mode is decided by how parameter "AP-E Xc2" (p. G•10) is set. When "AP-E" is set at "1", the **PRINT** key operates the same as the **PRINT** Key B Mode (see previous section).

Stream Mode

Print 4 c 2 Stream Mode: Data output is continuous.

- In this mode weighing data is transmitted continuously. The display does not blink when data is output, and the **PRINT** key is ignored.
- Transmission can be stopped by the CTS control switch (p. K•3) on the OP-03 board.

Command Mode

Print 5 c 2 Command Mode: Data output is initiated by a request from an external computer or device.

- In this mode weighing data output is caused by commands from an external computer, or similarly equipped device. Various commands controlling the balance are listed on pages K•14 →20.

Timed Mode (Interval Data Output)



Data is transmitted at the time interval set by the AD-1652 Remote Keyboard or by an RS-232C command:

- The interval output can be started only in the **PRINT** Key or Auto Print modes ("Print 0c2 thru 3c2"). When not using the interval output, the **PRINT** Key or Auto Print modes work normally.
- To start the interval output, you must use the AD-1652 remote keyboard. See page H•5 for instructions.
- The balance also transmits data one time when the interval timer is started and stopped.
- The display will blink when the data is transmitted.
- The interval timer stops if you move from the weighing mode to other mode - including display OFF (make sure that if parameter "P-oFF" is set to "0", so it does not interfere: p. G•7) or the calibration mode.
- While the interval timer is ON, the decimal point will flash. In the case of the counting mode, the power indicator flashes.
- To stop the interval timer, press the **PRINT** key on the front panel, or the AD-1652 Remote Keyboard (user cannot stop via the serial interface).



Sample Computer Programs



IBM PC-AT (STREAM Mode)

□ Balance parameters set to:

Print	4.c2	(STREAM Mode)
t-out	0.c2	(no time data)
CODE	0.c2	(no code number)
PAUSE	0.c2	(no pause)
bPS	3.c3	(4800 bps)
PAr	0.c3	(parity even)
bit	0.c3	(data bit 7)
StoP	0.c3	(stop bit 1)
Cr-LF	0.c3	(terminator <CR><LF>)
tYPE	0.c3	(A&D Standard Format)
dP	0.c3	(decimal point 2EH)

```

10 OPEN "COM1:4800,,,,,CS" AS #1
20 LINE INPUT #1,DT$
30 INPUT #1,HD$,DT$
40 IF HD$<>"OL" THEN GOTO 60
50 DT$=" "+LEFT$(DT$,1)+"E":GOTO 80
60 IF HD$<>"US" THEN GOTO 80
70 DT$=LEFT$(DT$,9)
80 PRINT HD$,DT$
90 GOTO 30
100 END

```



IBM PC-AT (COMMAND Mode)

□ Balance parameters set to:

Print	5.c2	(COMMAND Mode)
bPS	3.c3	(4800 bps)
PAr	0.c3	(parity even)
bit	0.c3	(data bit 7)
StoP	0.c3	(stop bit 1)
Cr-LF	1.c3	(terminator <CR>)
tYPE	0.c3	(A&D Standard Format)
t-UP	0.c3	(timer ON)
dP	0.c3	(decimal point 2EH)
E-Cod	1.c3	(transmit error code)

```

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 REZERO}
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

```

NEC PC-9801

□ Balance parameters set to:

Print	5.c2	(COMMAND Mode)
bPS	3.c3	(4800 bps)
PAr	0.c3	(parity even)
bit	0.c3	(data bit 7)
StoP	0.c3	(stop bit 1)
Cr-LF	0.c3	(terminator <CR><LF>)
tYPE	0.c3	(A&D Standard Format)
t-UP	0.c3	(timer ON)
dP	0.c3	(decimal point 2EH)
E-Cod	1.c3	(transmit error code)

```

10  OPEN "COM:E71NN" AS #1  {NN=PC-9801 BASIC dialect}
20  PRINT #1, "R" {RE-ZERO the balance}
30  LINE INPUT #1, AK$ {Return <AK>}
40  IF AK$<>CHR$(6) THEN *ERROR {If ERROR, "EC,EXX" is received}
50  LINE INPUT #1, AK$ {End of REZERO}
60  IF AK$<>CHR$(6) THEN *ERROR
70  FOR I=1 TO 1000: NEXT I {Delay after <AK> received}
80  PRINT #1, "Q" {Question the balance}
90  INPUT #1, HD$, DT$ {Receive the data strings}
100 PRINT HD$, DT$ {Display the data strings}
110 CLOSE
120 END {Stop}
130 *ERROR
140 PRINT "ERROR HAS OCCURRED"
150 CLOSE
160 END

```



Weighing Data Formats



Some weighing data output is formatted according to how 'tYPE c3' (Data Format, see page G-10) is set. This parameter allows for three types of data formats:

- 1) **A&D Standard Format** Adapted for peripheral instruments made by A&D, such as the AD-8117 compact printer (tYPE 0c3).
- 2) **AD-8117A Format** Adapted for A&D's AD-8117A compact printer (tYPE 1c3).
- 3) **KF Format** Adapted for Karl-Fischer moisture tester which cannot communicate by A&D Standard Format (tYPE 2c3).



A&D Standard Format

- Adapted for peripheral instruments made by A&D, such as the AD-8117 compact printer.
 - Header of two characters indicate the status.
 - Data with a polarity symbol, including the zero character of upper plates.
 - Unit code of three characters.
 - One data set consists of fifteen characters (excluding terminator).



AD-8117A Format

- Adapted for A&D's AD-8117A compact printer.
 - Header of two characters indicate the status if not overloaded.
 - Data with a polarity symbol, but omitted if data is zero.
 - Zero-suppressed by a space.
 - One data set consists of sixteen characters (excluding terminator).



KF Format

- Adapted for Karl-Fischer moisture tester, which cannot communicate by A&D Standard Format.
 - No header in data.
 - Polarity symbol as the first character if not over-loaded, but omitted if data is zero.
 - Zero-suppressed by a space.
 - Unit code 'g' is transmitted only if stable and weighing in gram unit.
 - One data set consists of thirteen characters (excluding terminator).

Weighing Data Format Examples



Space code is noted as (20H) in the following examples.

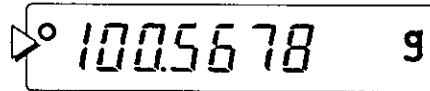
Stable Data Examples

Example: display = "0.0000g":



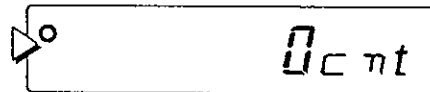
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
A&D Std.	S	T	,	+	0	0	0	.	0	0	0	0	(20H)	(20H)	g	↵	
AD-8117A	W	T	(20H)	(20H)	(20H)	(20H)	(20H)	0	.	0	0	0	0	(20H)	(20H)	g	↵
KF	(20H)	(20H)	(20H)	(20H)	0	.	0	0	0	0	(20H)	g	(20H)	↵			

Example: display = "100.5678g":



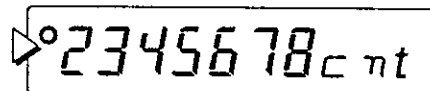
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
A&D Std.	S	T	,	+	1	0	0	.	5	6	7	8	(20H)	(20H)	g	↵	
AD-8117A	W	T	(20H)	(20H)	+	1	0	0	.	5	6	7	8	(20H)	(20H)	g	↵
KF	+	(20H)	1	0	0	.	0	0	0	0	(20H)	g	(20H)	↵			

Example: display = "0 cnt":



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
A&D Std.	Q	T	,	0	0	0	0	0	0	0	0	0	(20H)	P	C	↵	
AD-8117A	Q	T	(20H)	(20H)	(20H)	(20H)	(20H)	(20H)	(20H)	(20H)	(20H)	(20H)	0	(20H)	P	C	↵
KF	(20H)	(20H)	(20H)	(20H)	(20H)	(20H)	(20H)	(20H)	(20H)	0	(20H)	(20H)	(20H)	↵			

Example: display = "2345678 cnt":



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
A&D Std.	Q	T	,	+	0	2	3	4	5	6	7	8	(20H)	P	C	↵	
AD-8117A	Q	T	(20H)	(20H)	(20H)	+	2	3	4	5	6	7	8	(20H)	P	C	↵
KF	+	(20H)	(20H)	2	3	4	5	6	7	8	(20H)	(20H)	(20H)	↵			

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 Std.	U	S	,	-	0	9	8	.	3	2	1	0	(20H)	(20H)	g	↻	
AD-8117A	U	S	(20H)	(20H)	(20H)	-	9	8	.	3	2	1	0	(20H)	(20H)	g	↻
KF	-	(20H)	(20H)	9	8	.	3	2	1	0	(20H)	(20H)	(20H)	(20H)	↻		

Overload Data Examples

Example: display = "E g":

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
A&D Std.	O	L	,	+	9	9	9	9	9	9	9	E	+	1	9	↻	
AD-8117A	(20H)	(20H)	(20H)	(20H)	(20H)	(20H)	(20H)	(20H)	E	(20H)	(20H)	(20H)	(20H)	(20H)	(20H)	g	↻
KF	(20H)	(20H)	(20H)	(20H)	H	.	(20H)	(20H)	(20H)	(20H)	(20H)	(20H)	(20H)	(20H)	(20H)	↻	

Example: display = "-E g":

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
A&D Std.	O	L	,	-	9	9	9	9	9	9	9	E	+	1	9	↻	
AD-8117A	(20H)	(20H)	(20H)	(20H)	(20H)	(20H)	(20H)	-	E	(20H)	(20H)	(20H)	(20H)	(20H)	(20H)	g	↻
KF	(20H)	(20H)	(20H)	(20H)	L	.	(20H)	(20H)	(20H)	(20H)	(20H)	(20H)	(20H)	(20H)	(20H)	↻	

Unit Codes Examples

		A&D Standard & AD-8117A			KF		
Gram	(g)	(20H)	(20H)	g	(20H)	g	(20H)
Percent	(pct)	(20H)	(20H)	%	(20H)	(20H)	(20H)
Count	(cnt)	(20H)	P	C	(20H)	(20H)	(20H)
Decimal Ounce	(oz)	(20H)	o	z	(20H)	(20H)	(20H)
Troy Ounce	(OZt)	o	z	t	(20H)	(20H)	(20H)
Pennyweight	(dwt)	d	w	t	(20H)	(20H)	(20H)
Carat	(ct)	(20H)	c	t	(20H)	(20H)	(20H)
Momme	(mm)	m	o	m	(20H)	(20H)	(20H)
Grain Unit	(GN)	(20H)	G	N	(20H)	(20H)	(20H)
Tola	(t)	(20H)	(20H)	t	(20H)	(20H)	(20H)
Tael	(TL)	(20H)	T	L	(20H)	(20H)	(20H)

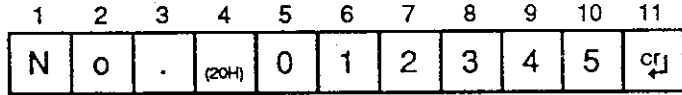
Independent Data Formats



Some data formats are independent of how parameter 'TYPE c3' (Data Format, see page G•10) is set. •Space code is noted as (20H) in the following examples.

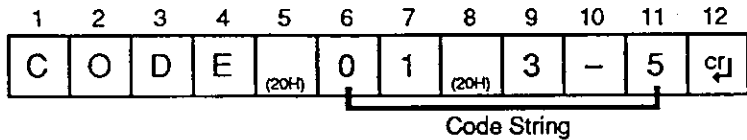
Code Number

- ▣ The code number itself must consist of six digits.

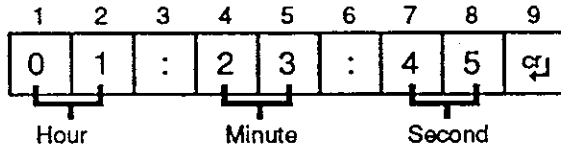


Code String

- ▣ The code string itself must consist of six digits, including spaces or hyphens.

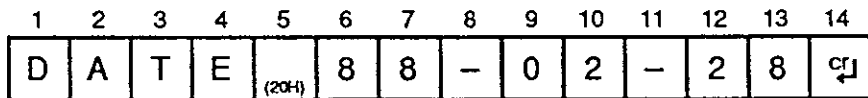


Time



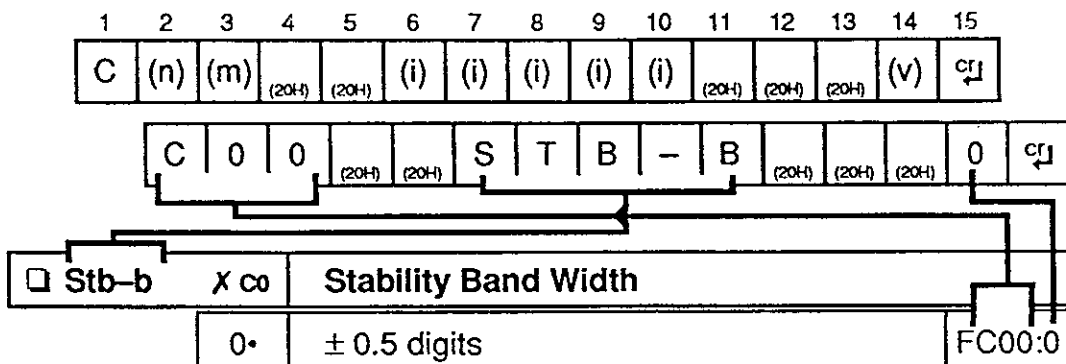
Date

- ▣ The order of the date, yy-mm-dd, depends on how parameter 'dAtE c2' is set (see page G•9).



Parameter Setting

- ▣ (n) = the parameter group number 0 though 8.
- ▣ (m) = the parameter number.
- ▣ (i) = the parameter name (5 characters)
- ▣ (v) = parameter setting value





Commands for the RS-232C Serial Interface



Please note that there needs to be a delay time between a balance acknowledgement <AK>, and the transmission of the next command to the balance. The FOR~NEXT loop times depend on your computer's operating clock and performance. Make the FOR~NEXT longer if the program does not work correctly.

For an example, using a BASIC program:

```

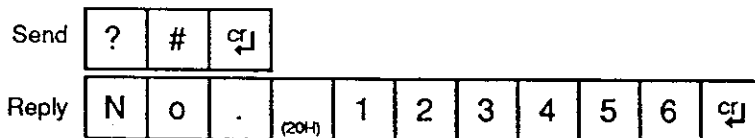
1..
123 LINE INPUT #1, AK$           Receive <AK>
124 FOR I=1 TO 100:NEXT I       Delay
125 PRINT #1, "Q"              TX: 'Q' command
1..
    
```

- ❑ If the ERROR CODE AT COMMAND MODE parameter is set at '0' (E-Cod 0c3), then the balance transmits no error codes nor acknowledgement code <AK> (ASCII 06H).
- ❑ If the ERROR CODE AT COMMAND MODE parameter is set at '1' (E-Cod 1c3), then when the following commands are accepted by the balance: 'P', 'ON', 'R', 'T' or 'TARE', 'Z', 'CAL', 'EXC', 'SMP', the FR transmits the acknowledgement code <AK> (ASCII 06H).

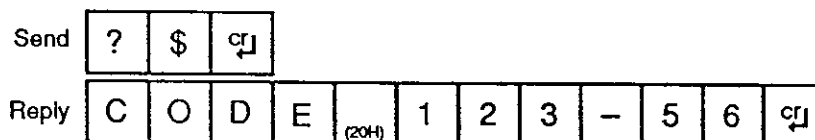
It will send not only after the command is received, but also after the command is executed. If the command can't be executed, then the FR sends the various codes to inform the host computer.

⚠ Space code is noted as (20H) in the following examples.

1) [?] [#] Request the Code Number

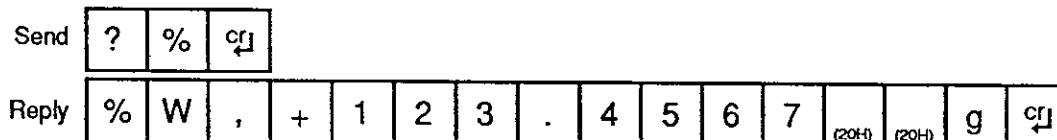


2) [?] [\$] Request the Code String



3) [?] [%] Request the 100% Weight

- ❑ The balance reply is the weighing unit used last. If the balance is in Percent or Count mode, the reply is in grams (g).



4) ? @ **Request the Unit Weight**

- The reply is always in milligrams (mg), independent of the unit being displayed on the balance.

Send ? @ ↵

Reply U W , + 0 0 0 0 0 0 . 1 2 (20H) m g ↵

5) ? A L L **Request All User Defined Parameters**

- 11 sets of data will be sent by the balance in reply.

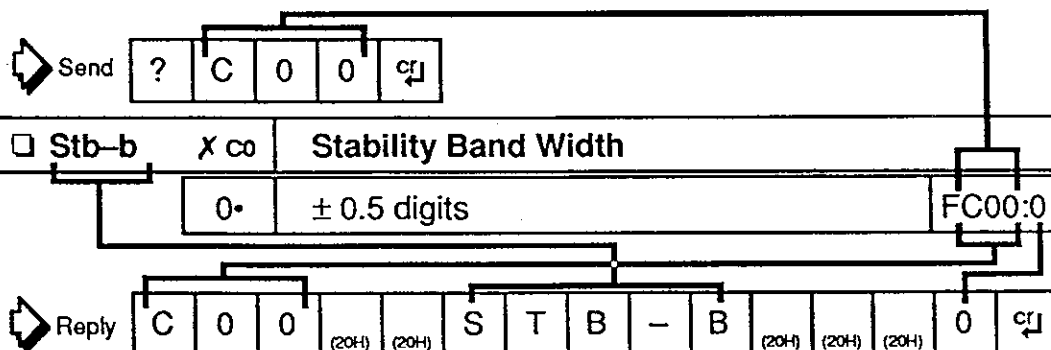
Send ? A L L ↵

Reply:

TARE Weight	T	W	,	+	1	0	0	.	5	0	0	0	(20H)	(20H)	g	↵	
Target Weight	T	G	,	+	0	0	2	.	0	0	0	0	(20H)	(20H)	g	↵	
HI Limit	H	I	,	+	1	5	0	.	0	0	0	0	(20H)	(20H)	g	↵	
LO Limit	L	O	,	-	0	5	0	.	0	0	0	0	(20H)	(20H)	g	↵	
Unit Weight	U	W	,	+	0	0	0	0	0	.	1	2	(20H)		m	g	↵
100% Weight	%	W	,	+	1	2	3	.	4	5	6	7	(20H)	(20H)	g	↵	
External CAL Weight	C	W	,	+	2	0	0	.	0	0	0	0	(20H)	(20H)	g	↵	
Interval	T	I	,	0	0	:	0	5	:	0	0	↵					
Time	C	K	,	0	1	:	2	3	:	4	5	↵					
Code Number	N	o	.	(20H)	1	2	3	4	5	6	↵						
Code String	C	O	D	E	(20H)	1	2	3	-	5	6	↵					

6) ? C (n) (m) **Request a Parameter Setting**

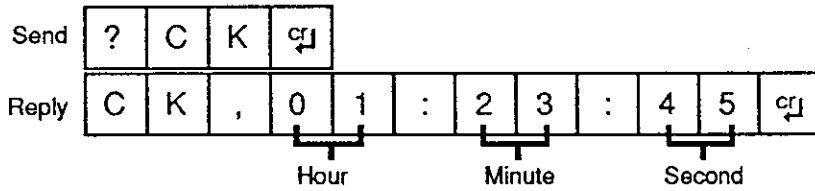
- You must specify the parameter group number (n) and parameter number (m). See PARAMETER SETTING, p. K-13.



7)

?	C	K
---	---	---

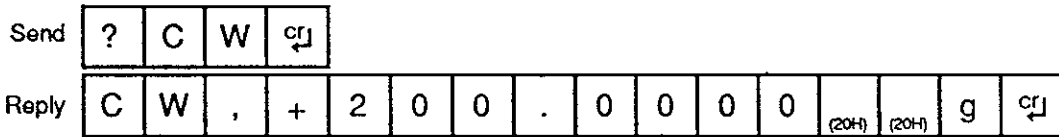
 Request the Time



8)

?	C	W
---	---	---

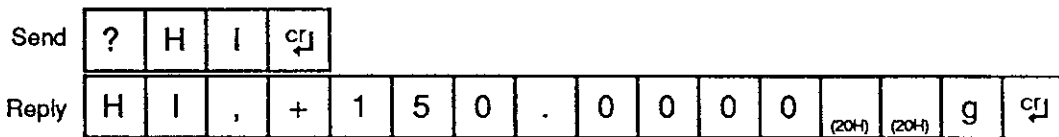
 Request the Weight of the External Calibration Weight



9)

?	H	I
---	---	---

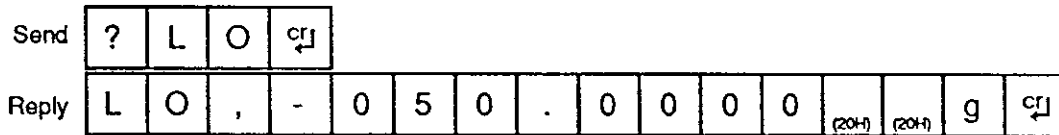
 Request the HI Limit



10)

?	L	O
---	---	---

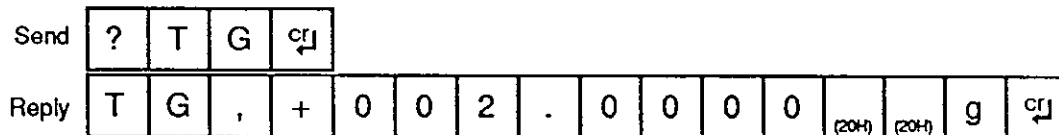
 Request the LO Limit set



11)

?	T	G
---	---	---

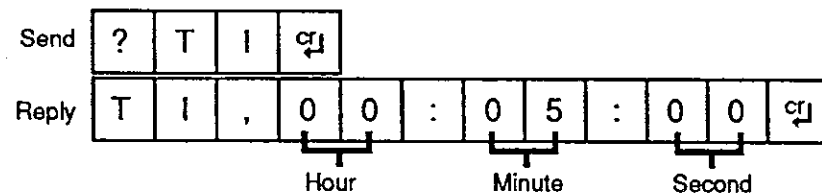
 Request the Target Weight



12)

?	T	I
---	---	---

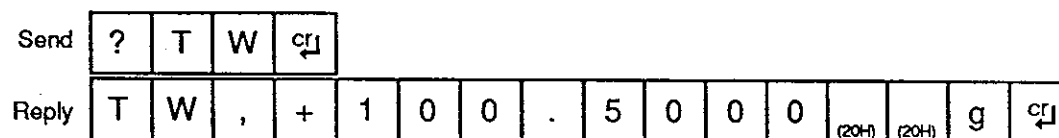
 Request the Interval Time



13)

?	T	W
---	---	---

 Request the TARE Weight



14) **[?] [U]** Request the Balance's Present Weighing Unit

The balance reply is in the weighing unit used last.

Send

[?]	[U]	[↵]
-----	-----	-----

 Reply

(20H)	[P]	[C]	[↵]
-------	-----	-----	-----

15) **[#]** Set the Code Number

The balance will error if '-' or '.' are included. Code doesn't need to have exactly six digits.

Send

[#]	[1]	[2]	[3]	[4]	[5]	[6]	[↵]
-----	-----	-----	-----	-----	-----	-----	-----

 -or- Send

[#]	[1]	[2]	[3]	[↵]
-----	-----	-----	-----	-----

16) **[\$]** Set the Code String

The code string must be six digits including '-' or a space.

Send

[\$]	[8]	[8]	[-]	[1]	(20H)	[2]	[↵]
------	-----	-----	-----	-----	-------	-----	-----

17) **[%]** Set the 100% Weight

Every weighing unit is acceptable. If the weighing unit code is omitted, the balance assumes you want the last weighing unit used. If you are in Percentage mode and the weighing unit code is omitted, then gram (g) is assumed. •The balance will error if: 1) The value is over the capacity; 2) The value is negative; 3) The value is less than 0.0100g. Example:

Send

[%]	[1]	[0]	[.]	[1]	[2]	(20H)	(20H)	[g]	[↵]
-----	-----	-----	-----	-----	-----	-------	-------	-----	-----

 -or- Send

[%]	[1]	[0]	[.]	[1]	[2]	[↵]
-----	-----	-----	-----	-----	-----	-----

 if in carat mode, then 10.12ct
 if in ounce mode, then 10.12oz

18) **[@]** Set the Unit Weight

The weighing unit must be in milligrams (mg). If the weighing unit code is omitted, then milligrams is assumed. •The balance will error if: 1) The value is over the capacity; 2) The value is negative; 3) The value is less than 0.100000mg; 4) A unit code is sent that is *not* milligram.

Send

[@]	[0]	[.]	[1]	[2]	[3]	(20H)	[m]	[g]	[↵]
-----	-----	-----	-----	-----	-----	-------	-----	-----	-----

 or Send

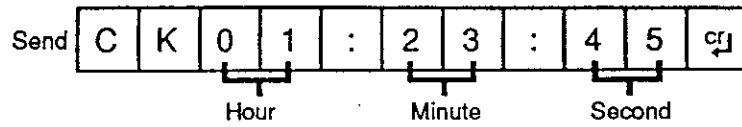
[@]	[0]	[.]	[1]	[2]	[3]	[↵]
-----	-----	-----	-----	-----	-----	-----

 balance assumes 'mg'.

19) **[C]** Release the SIR See the SIR command that follows.

20) **[C] [A] [L]** Perform Calibration Same as pressing the **[CAL]** key.

21) **[C] [K]** To Adjust the Clock Send: <hour>:<minute>:<second>.

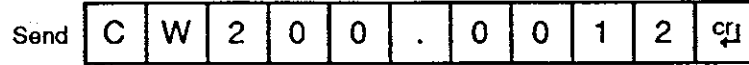


22)

C	W
---	---

 To set the External Calibration Weight

- Every weighing unit is permitted. If the weighing unit is omitted, the balance will assume the present weighing unit. If in percent, or counting, then weighing unit will be grams (g). Example:



External Calibration weight would be registered as +200.0012g (balance was in grams). The balance will error if: 1) The value was over capacity; 2) The value was negative; 3) The value was less than half of capacity.

23)

E	X	C
---	---	---

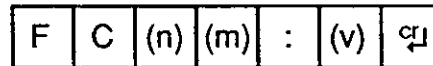
 Go to External Calibration See MANUAL CALIBRATION section, page C-4.

24)

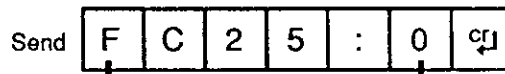
F	C
---	---

 To change a Parameter Setting Send <FC><nm>:<v>, the parameter section and parameter number, and setting.

- (n) = the parameter group number 0→8.
- (m) = the parameter number.
- (v) = parameter setting value



- Example, parameter 'CCode' is set at '0', No Code Number:



<input type="checkbox"/> CCode	X c2	Send Code Number	
	0•	No Code Number	FC25:0

25)

F	E	E	D
---	---	---	---

 Start feeding by the AD-1651 Vibratory Spoon

26)

G	S
---	---

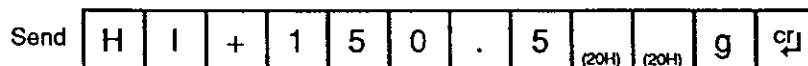
 To change the display to GROSS Mode No change if already in GROSS mode.

27)

H	I
---	---

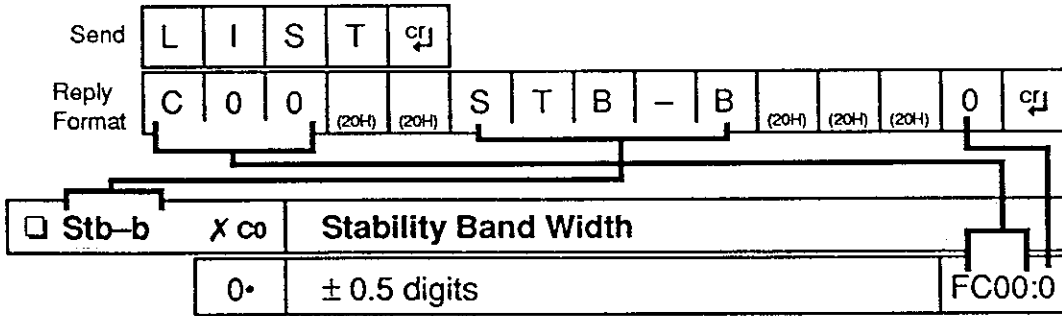
 To set the HI Limit

- Every weighing unit is permitted, including a negative value. If the weighing unit is omitted, the balance will assume the present one. If in percent, or counting, then weighing unit will be grams (g).



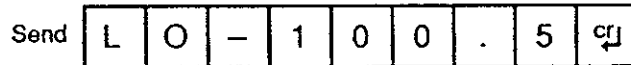
28) **L I S T** Request a listing of the Parameter Settings

A list of the 47 parameters will be sent by the balance. Example:



29) **L O** To set the LO Limit

Every weighing unit is permitted. A negative value is permitted. If the weighing unit is omitted, the balance will assume the present weighing unit. If in percent, or counting, then weighing unit will be grams (g).



30) **N T** To change the display to NET Mode No change if already in NET mode.

31) **O F F** Go to Display OFF mode No change if already in Display OFF mode.

32) **O N** Go to Display ON mode No change if already in Display ON mode.

33) **P** Display ON/OFF The same as pressing the **ON/OFF** key.

34) **P R T** Print The same as pressing the **PRINT** key.

35) **Q** Question the balance for Weighing Data Balance will send the weighing data immediately.

36) **R** RE-ZERO The same as pressing the **RE-ZERO** key.

37) **R E A D** Read the balance Weighing Data Balance will send weighing data immediately (same as 'Q').

38) **S** Send Stable Data Display will blink when data transmitted.

39) **S I** Send Weighing Data Immediately Balance will send the weighing data immediately (same as 'Q').

40) **S I R** Send Immediately the Weighing Data & Repeat

- Balance will send the weighing data immediately with continuous transmission (like a stream mode) until the 'C' command is received.

41) **S M P** SAMPLE The same as pressing the **SAMPLE-%** key.

42) **S T O P** Stop the AD-1651 Vibratory Spoon

43) **T** TARE the balance Same as pressing the AD-1652 **TARE** key.

44) **T A R E** TARE the balance (same as above)

45) **T G** Set the Target Weight

- Every weighing unit is acceptable. If the weighing unit code is omitted, the balance assumes you want the last weighing unit used. If you are in Percentage mode and the weighing unit code is omitted, then grams (g) is assumed. •The balance will error if the value is over the capacity.

Send

T	G	2	.	0	0	0	0	<small>(20H)</small>	<small>(20H)</small>	g	↵
---	---	---	---	---	---	---	---	----------------------	----------------------	---	---

46) **T I** Set the Interval Time

- The value must be in the range of '00:00:00' to 23:59:59. Example of a 5 minute setting:

Send

T	I	0	0	:	0	5	:	0	0	↵
		└───┘		:	└───┘		:	└───┘		
		Hour			Minute			Second		

47) **T W** Set the TARE Weight

- Every weighing unit is acceptable. If the weighing unit code is omitted, the balance assumes you want the last weighing unit used. If you are in Percentage mode and the weighing unit code is omitted, then grams (g) is assumed. The balance will error if: 1) The value is over the capacity; 2) The value is negative. Example of a TARE weight of 2g:

Send

T	W	2	.	0	0	0	0	<small>(20H)</small>	<small>(20H)</small>	g	↵
---	---	---	---	---	---	---	---	----------------------	----------------------	---	---

48) **U** Change the Weighing Unit The same as pressing the **MODE** key.

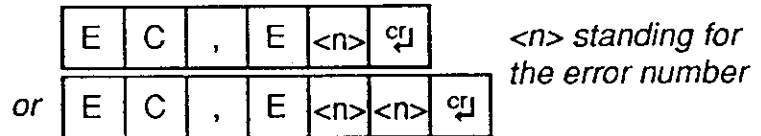
49) **Z** ZERO Set the GROSS weight to ZERO. The same as pressing the AD-1652 **ZERO** key.

Error Codes for the Serial Interface



In the Command mode, the computer may receive an error code from the balance if the software parameter 'E-Cod cs' is set at '1' (p. G•11). Also:

- In the case the Command requests the weighing data, ex: the 'Q' command: then:
 - 1) If there is no error, then the balance sends the data; or
 - 2) If there is an error, then the balance sends the error code.
- In the case the Command is not a request, ex: 'TW' command: then:
 - 1) If there is no error, then the balance sends <ak> (06H) code; or
 - 2) If there is an error, then the balance sends the error code.
- To raise the reliance of the RS-232C communication, the balance replies to all commands.
- The format of the error codes is:



E0 Communication Error

- Parity error, framing error, etc.

E1 Undefined Command Error

- Example:

?	h	i	↵
---	---	---	---

The command must be in uppercase – 'HI'

E2 Balance not ready Error

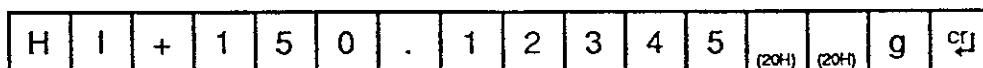
- If the display is OFF, then only 'P' and 'ON' commands accepted.
- Data request commands (such as 'Q', 'S' commands) cannot be accepted if the balance is not in the weighing mode.

E3 Time Over Error

- The balance couldn't receive the next character in 1 second after the last character was received.

E4 Too Many Characters Error

- Example, command contains more than 7 digits:



E5 Terminator Error

- The command contains an illegal terminator.

E6 Format Error Examples:

T	I	0	0	:	1	0	↵	- missing Seconds
@	0	.	5	6	7	8	(20H) (20H) g ↵	- unit must be '_mg' or omitted
L	O	-	1	0	(20H) (20H)	G	↵	- unit must be '_g' for gram (not capitalized)

E7 Out of Range Error Example:

T	W	+	3	2	0	.	0	(20H) (20H)	g	↵	- must be within balance capacity
---	---	---	---	---	---	---	---	-------------	---	---	-----------------------------------

E11 Stability Error Balance display shows *Error 1*

- The balance takes more than 30 seconds to ZERO (see p. A•4).

E12 Stability Error Balance display shows *Error 2*

- Please follow the same recommendations as **Error 1** on p. A•4.

E13 Invalid Value Error Balance display shows *Error 3*

- Value entered by the AD-1652 RK is out of the range permitted for the function (example: TW 400g is out of the TARE range). To return to weighing mode, press any key.

E14 Weighing Pan Error Balance display shows *Error 4*

- The weighing pan touching something, or there is something on the pan when the **ON/OFF** key is pressed (see p. A•5).

E15→17 Internal Error Balance display shows *Error 5→7*

- Disconnect the AC adaptor, wait a few seconds and try again. If the error persists, call your dealer for service.

E20 Calibration Error Balance display shows *[RL E*

- Calibration weight is too heavy (see page C•5).

E21 Calibration Error Balance display shows *- [RL E*

- Calibration weight is too light (see page C•5).

E23 Calibration Error Balance display shows *[RL no*
 Balance unstable during calibration (see page C•5).

E30 Sample Too Light Error Balance display shows *° 20 -*
 Sample too light, load 20 samples (see pages E•2→5).

E31 Sample Too Light Error Balance display shows *° 50 -*
 Sample too light, load 50 samples (see pages E•2→5).

E32 Sample Too Light Error Balance display shows *° 100 -*
 Sample too light, load 100 samples (see pages E•2→5).

E33 Sample Too Light Error Balance display shows *L 0*
 Individual sample weight too light (see pages E•2→5).

E40 REZERO Error REZERO cannot be executed (see p. D•7).

E41 ZERO Error ZERO cannot be executed (see p. D•8).

E42 TARE Error TARE cannot be executed (see p. D•7).

Command Examples Illustrated



The following examples illustrate the interaction between the host computer and the FR Balance during RS-232C Serial Interface communication.



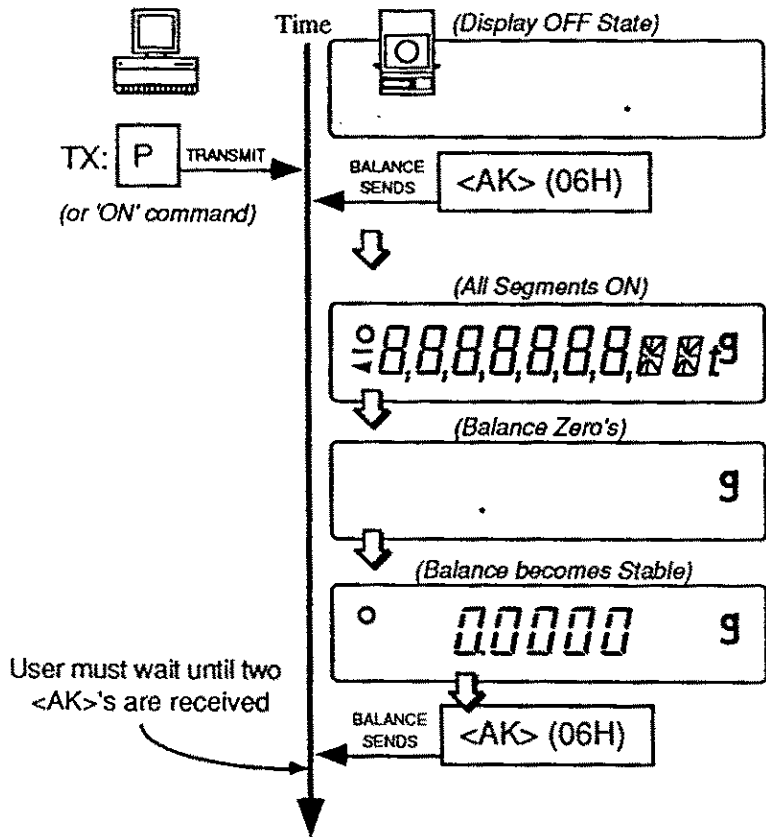
Please note that there needs to be a delay time between a balance acknowledgement <AK>, and the transmission of the next command to the balance. The FOR~NEXT loop times depend on your computer's operating clock and performance. Make the FOR~NEXT longer if the program does not work correctly.

□ For an example using a BASIC program:

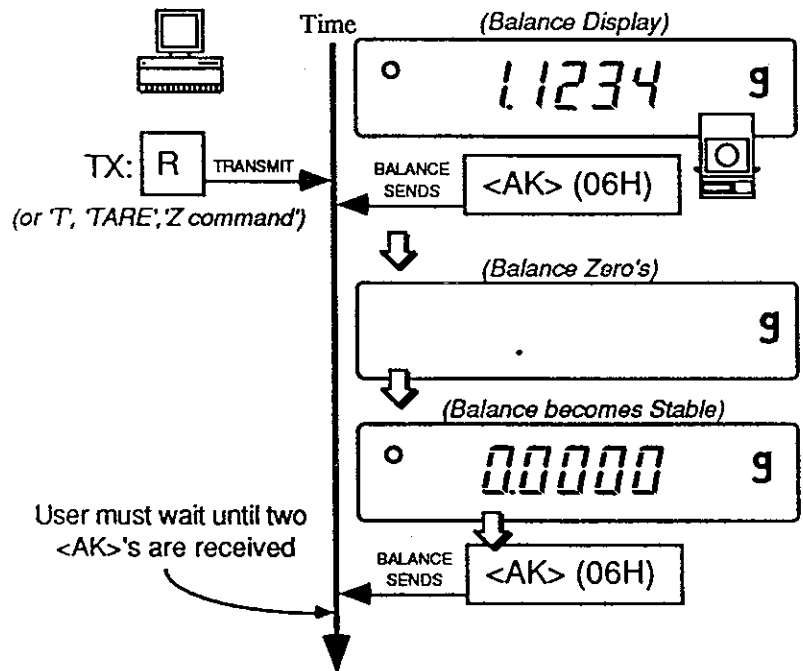
```

1..
123 LINE INPUT #1, AK$           Receive <AK>
124 FOR I=1 TO 100:NEXT I       Delay
125 PRINT #1, "Q"              TX: 'Q' command
1..
    
```

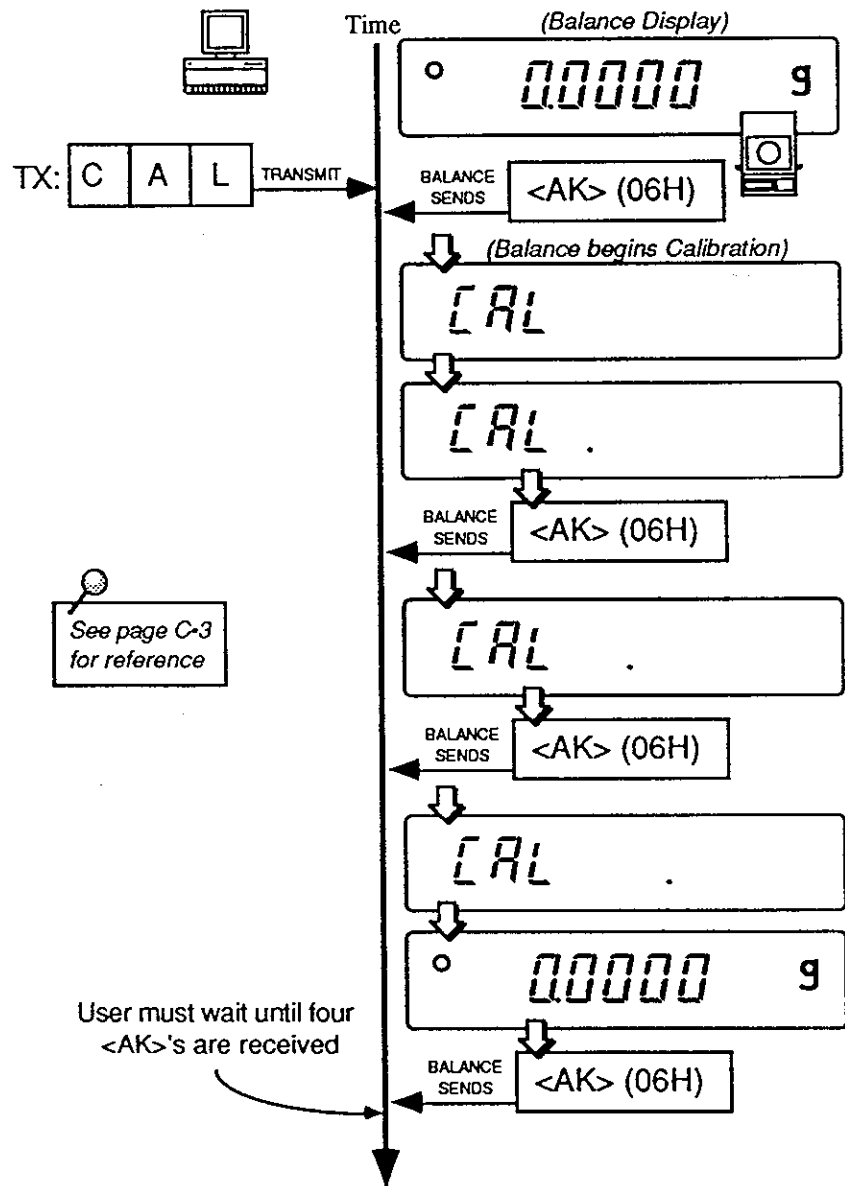
T P O N Display ON/OFF



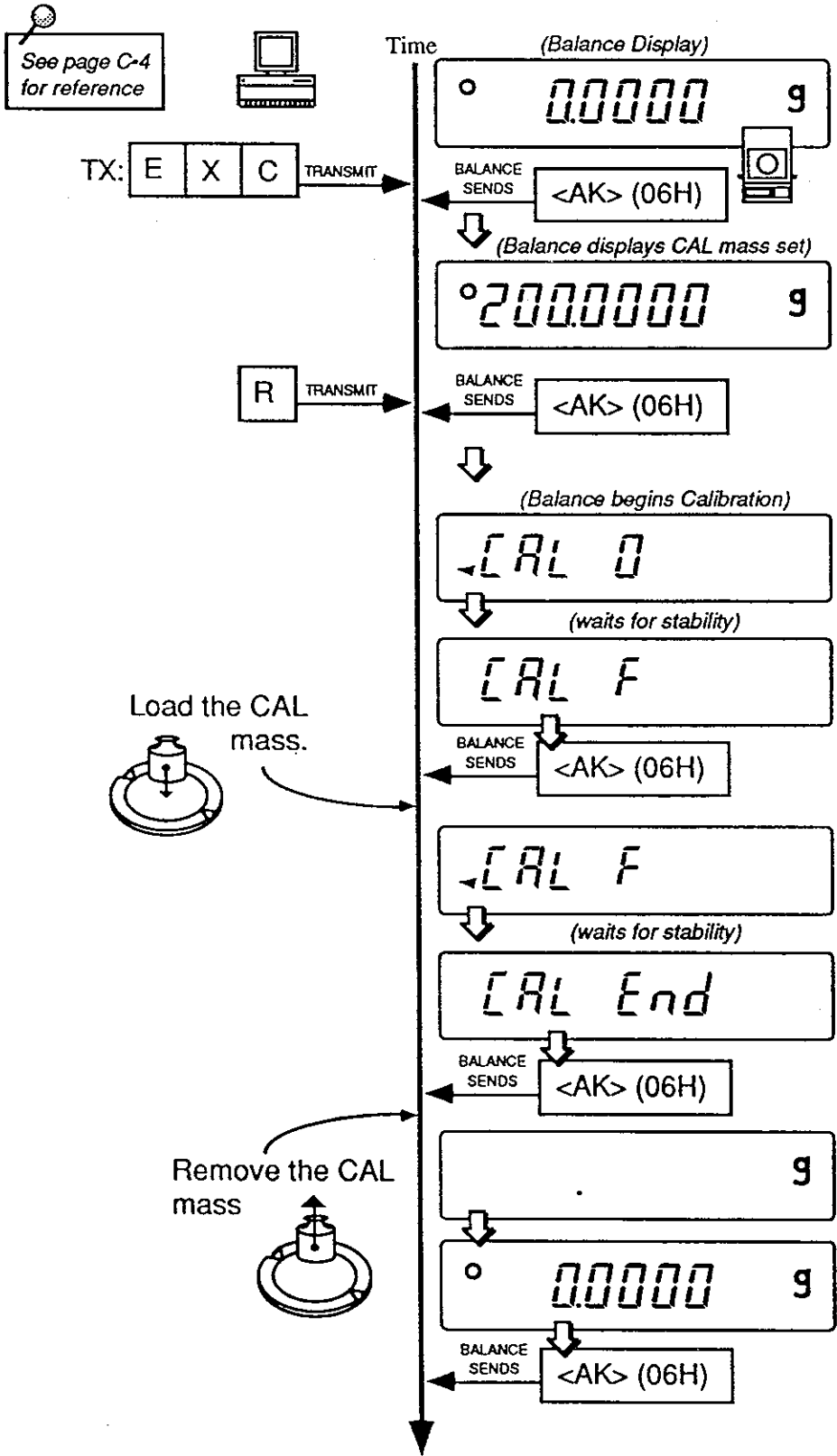
2 R T T A R E Z ReZero or Tare



3 CAL Calibration

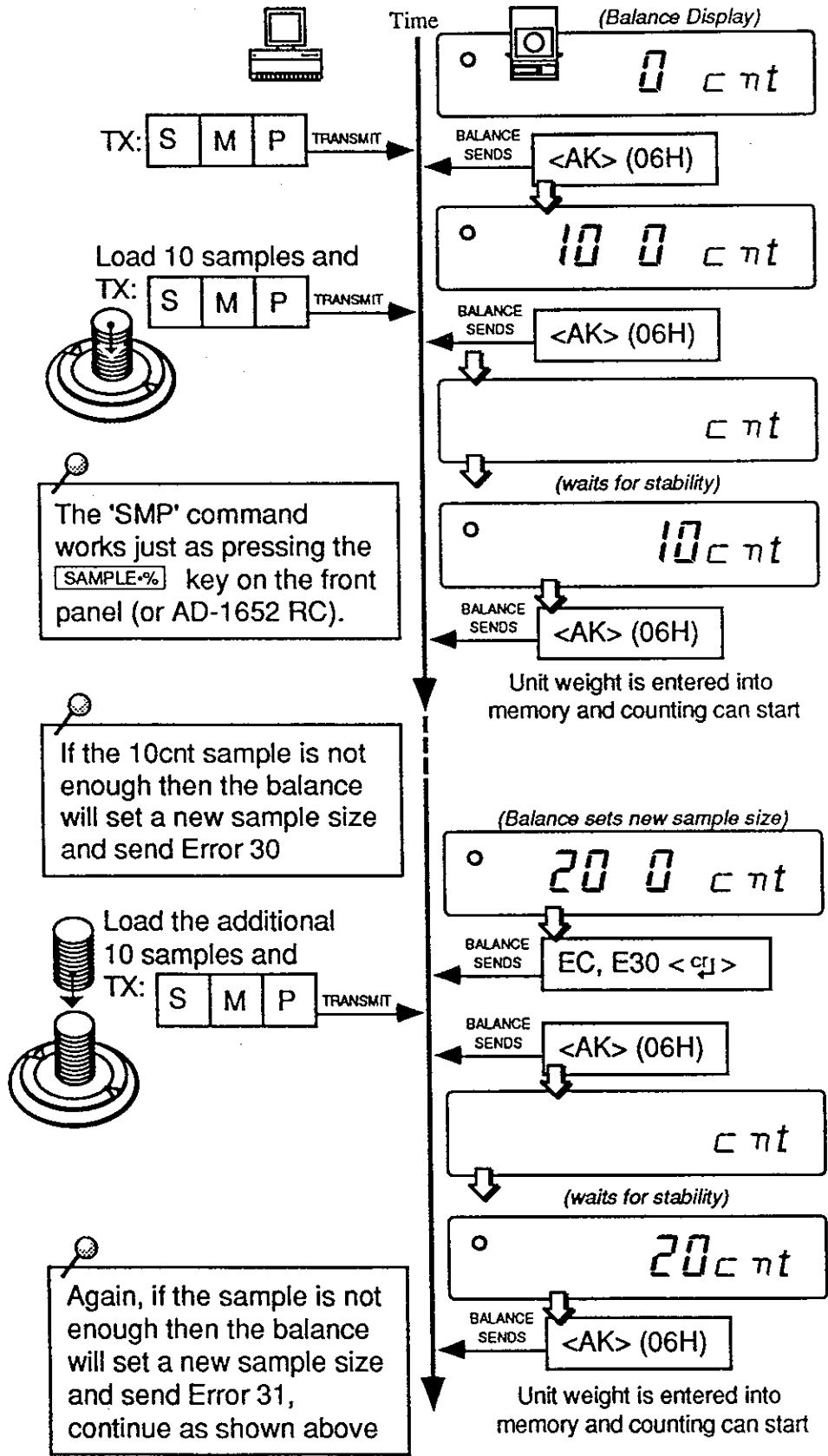


4 E X C Manual Calibration Command



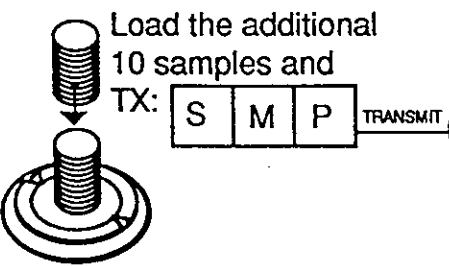
5 SMP Counting / Percentage

See Sections E, F for reference

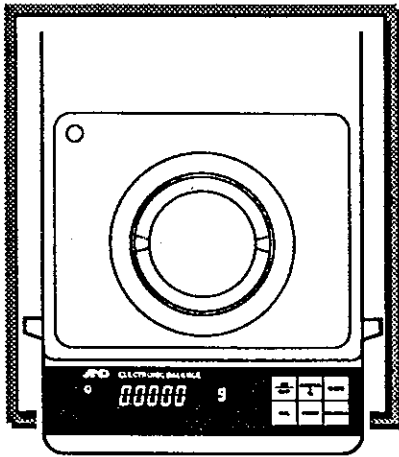


The 'SMP' command works just as pressing the **SAMPLE-%** key on the front panel (or AD-1652 RC).

If the 10cnt sample is not enough then the balance will set a new sample size and send Error 30



Again, if the sample is not enough then the balance will set a new sample size and send Error 31, continue as shown above

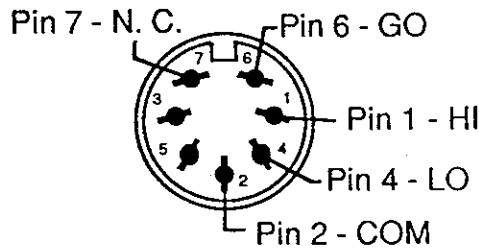


FR Series • Section L

Comparator
(part of OP-03 Current Loop)

Comparator (part of OP-03)

Pin Connection and Specifications



- Pin 1 - HI
- Pin 2 - COM
- (Pin 3 - LOOP)
- Pin 4 - LO
- (Pin 5 - LOOP)
- Pin 6 - GO
- Pin 7 - N. C.

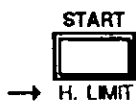
Specifications: **Max. Voltage** 50V DC
 Max. Current 200 mA

Setting HI/LO Limits

You may set or view the HI/LO limits using the AD-1652 Remote controller, or via the serial interface. Also:

- If the weighing unit is changed, the HI/LO limits are converted to the unit displayed. For example: if the HI limit is 10g, if the unit is changed to carats, then then HI limit will be displayed as 50ct.
- If the unit weight or 100% weight is not registered in cnt/Pct mode, then the HI/LO limits will show zero. But after registration, the HI/LO limits are converted into each consecutive unit.
- The maximum HI/LO limits are limited to seven digits, -9999999 to +9999999.

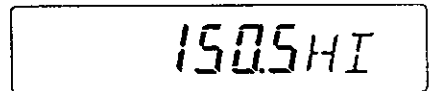
To Set HI Limit



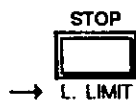
The **FUNC** key > **H.LIMIT** key > <N> > **ENTER** key combination digitally sets the comparator higher limit. A negative number is permitted and the acceptable range is from -9999999 to +9999999.

Example: **FUNC** key > **H.LIMIT** key > 1|5|0|.5 > **ENTER**

the balance will enter 150.5000g as the comparator's high limit (if "g" unit weight is being used).



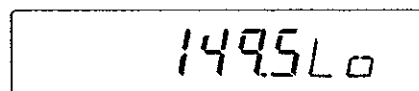
To Set LO Limit



The **FUNC** key > **L.LIMIT** key > <N> > **ENTER** key combination digitally sets the comparator lower limit. A negative number is permitted and the acceptable range is from -9999999 to +9999999.

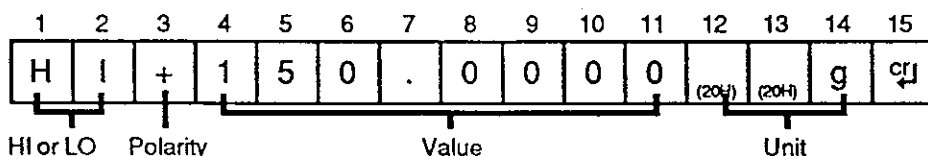
Example: **FUNC** > **L. LIMIT** key > **1 4 9 . 5** > **ENTER**

the balance will enter 149.5000g as the comparator's lower limit (if "g" unit weight is being used).



Using the RS-232C Serial Interface

- ▣ To set HI or LO limit. A unit code of three characters must be added after the value if the HI/LO limits is in a different unit from the one presently on the display.



- ▣ To view HI or LO limit.

? H I Request the HI Limit

Send **? H I crj**

Reply **H I , + 1 5 0 . 0 0 0 0 (20H) (20H) g crj**


? L O Request the LO Limit set

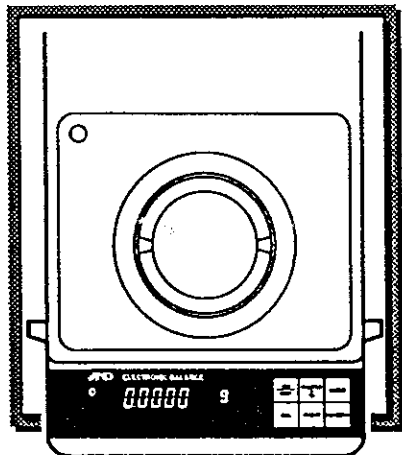
Send **? L O crj**

Reply **L O , - 0 5 0 . 0 0 0 0 (20H) (20H) g crj**

Comparator C-Parameters



There are a number of Parameters that can and need to be set. These include Comparison Mode, Comparator Output, Buzzer, etc. See page G•2 for a listing of parameters; page G•14 for comparator output section. 



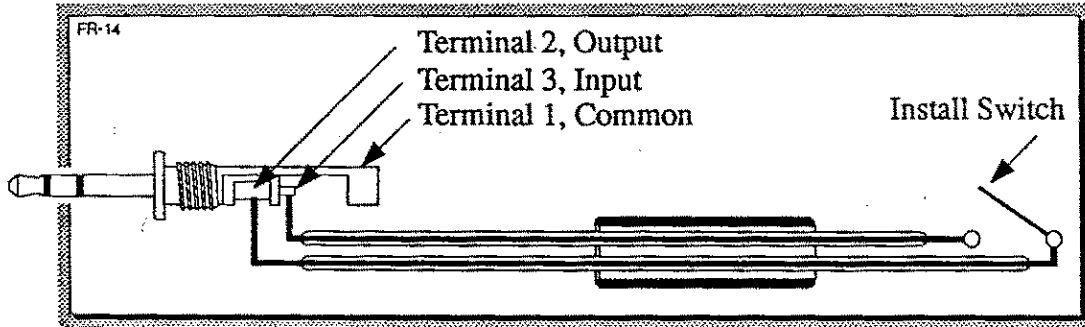
FR Series • Section L

Miscellaneous

Remote RE-ZERO or PRINT Switch



You can execute RE-ZERO (same as **RE-ZERO** key) or PRINT (same as **PRINT** key) using a remote switch by using the 3-channel pin included with your balance and selection either RE-ZERO or PRINT from the C-Functions.



- ▶ Connect a switch between terminals 2 and 3 as shown above. When the circuit is closed the balance responds as if the appropriate panel switch was pressed once.
- ▶ Select the desired C-Function RE-ZERO or PRINT (also see Section G):

C7 • External Switch

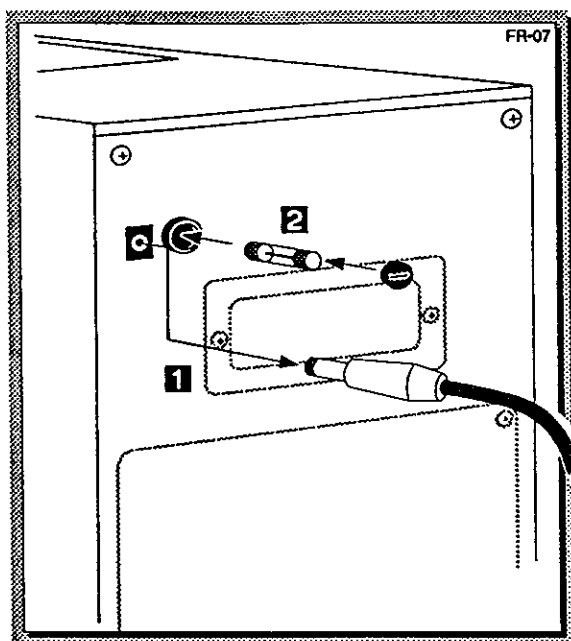
<input type="checkbox"/> A n	Xc7	FEEDER Input Setting	
A n	0	Feeder control I/O Function (see p. J•4)	FC70:0
	1	Input is RE-ZERO function	FC70:1
	2	Input is PRINT function	FC70:2

Trouble?

- ❑ What if the weighing result is not stable? Check that the weighing table is stable. Check that there are no drafts. Check that the breeze break (if any) is installed correctly. Check that the power supply voltage is stable.
- ❑ What if the weight displayed is obviously incorrect? Check that the balance is level. Check that it has been accurately calibrated. Check that the display started from zero before the mass was placed on the pan. Check that the mass is not overhanging and touching something else, like the sides of the breeze break or the top cover of the balance.
- ❑ What if "Lo" is displayed in "cnt" or "Pct" mode after I press the **SAMPLE%** key? The weight of the sample was too low. In counting mode you will be prompted to increase the sample size from 10 units to 20, 50 or 100 units but remember that the minimum unit weight cannot be less than the resolution of the balance. In percentage mode you can place a sample on the pan which is only 100 times the basic resolution but you will not be able to weigh to a percentage resolution of 0.01% until you use a sample which is 10,000 times the basic resolution (100.00% is 10,000 counts).

- What if the standby decimal point is not on when the adaptor is plugged in, and the display doesn't switch on when I press the **ON/OFF** key? Check external fuses and if they have not blown check the internal fuse. Open the balance carefully as shown in the diagrams below. If the internal fuse has not blown, check that the adaptor is working. If the internal fuse has blown and blows again immediately, have the balance repaired.

Changing the Fuse



1. Remove the AC adaptor from its plug at the back of the balance **1**.
2. Find the fuse holder - press and turn it counter-clockwise, remove.
3. Replace the fuse with a new one. 500 mA, slow blow **2**.
4. If the fuse blows again, please contact your nearest A&D dealer for service.

Errors

- Power Failure Error:

P-FAIL

"P-FAIL" power failure is displayed if power was interrupted during weighing the last time the balance was used.

- ▣ Press the **ON/OFF** key, see p. A•4.

- Stability Error:

Error 1

'Error 1' will be displayed if the balance can not become stable while zeroing, or weighing.

- ▣ Check for excessive vibrations or drafts. Press the **RE-ZERO** key and see BEST CONDITIONS FOR WEIGHING, p. A•2.

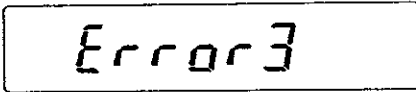
- Stability Error:

Error 2

'Error 2' will be displayed if the balance can not become stable while registering the unit weight.

- ▣ Check for excessive vibrations or drafts. Press the **RE-ZERO** key and see BEST CONDITIONS FOR WEIGHING, p. A•2.

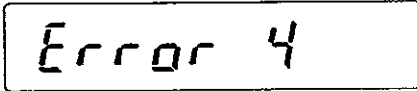
Value Error:



'Error 3' will be displayed if the value entered is out of the range permitted for the function.

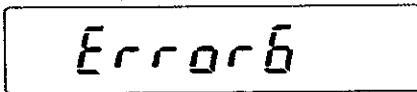
To return to weighing mode, press any key, p. H•3.

Weighing Pan Error:



'Error 4' will be displayed if the weighing pan or pan support is not correctly set, touching something or if there is a sample on the weighing pan when the **ON/OFF** key is pressed, p. A•5.

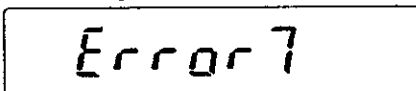
Memory Error:



'Error 6' will be displayed if the balance has a memory problem.

Disconnect and connect AC power and try again. If error persists, call for service.

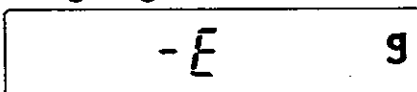
Memory Error:



'Error 7' will be displayed if the balance has a memory problem.

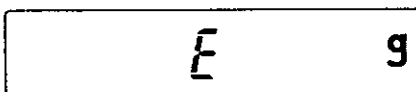
Disconnect and connect AC power and try again. If error persists, call for service.

Weighing Pan Error:



'-E' will be displayed if the the weighing pan or pan support are not mounted, p. D•2.

Overload Error:



'E' will be displayed if the weight is beyond the balance capacity, p. D•2.

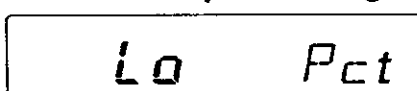
Count Sample too light:



'Lo cnt' will be displayed if the unit weight is too small. The display will show 'Lo' and returns to the "10 - cnt" display.

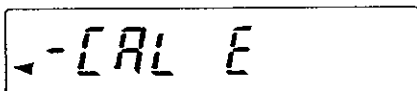
Unit weight is less than 0.0001g.

100% Sample too light:

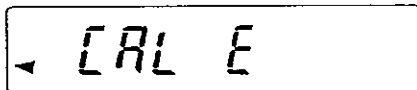


'Lo Pct' will be displayed if the 100% weight is too small. The display will show 'Lo' and returns to the "100 - pct" display.

100% weight is less than 0.1g.

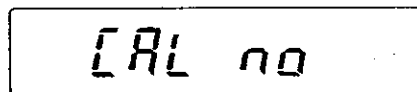
CAL Errors:

'-CAL E' will be displayed if the calibration mass is too light (varies by more than 10g of set weight).



'CAL E' will be displayed if the calibration mass is too heavy (varies by more than 10g of set weight).

- Check the mass weight, look for something touching the weighing pan. Press the **RE-ZERO** key, then the **CAL** key (to use the balances' internal CAL mass) before trying again with an external CAL mass.



'CAL no' will be displayed if the balance can not become stable while weighing the calibration mass.

- Check for excessive vibrations or drafts. Press the **RE-ZERO** key and see BEST CONDITIONS FOR WEIGHING, p. A•2. **VI**



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MEMORANDA



We hope that you have found this Instruction Manual useful and informative. If you have any suggestions for product improvement, found an error in this manual, or if you would like more information concerning this product, please don't hesitate to contact your nearest A&D office, or:

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