OXFORD

F SERIES TOP PAN

INSTRUCTION MANUAL

CONTENTS

Basic Operation

Adapting to the Environment

Functions

1. INTRODUCTION

1-1 About This Manual

This manual consists of the following five parts:

Basic operation .... Describes precautions on handling the balance, balance construction and basic balance operation.

Adapting to the environment .... Describes response adjustment, calibration and calibration test.

Functions .... Describes various functions of the balance.

RS-232C serial interface .... Describes the interface which transmits data and controls the balance.

Maintenance .... Describes maintenance, error codes, troubleshooting, specifications and options.

1-2 Features

- Stabilization time of one second. When FAST is selected for the response rate, a stabilization time of one second, to read a displayed value after a sample is placed on the pan, has been achieved.
- Self Check Function, provided to self-check the balance.
- Data Memory Function, storing weighing data or unit mass in the counting mode. (About weighing data, 40 sets of data can be stored.) Interval Memory Mode is provided to weigh a sample and store the weighing data periodically.
- Good Laboratory Practice (GLP) data output using the standard RS-232C serial interface.
- Comparator Indicators, displaying the comparison results.
- Capacity Indicator, displaying the weight value in percentage relative to the weighing capacity.
- Hold Function, provided for weighing a moving object such as an animal.
- Underhook, for measuring density and weighing magnetic materials.
- Density Mode, for calculating the density of a solid.
- Multiple Weighing Units, with most of the common units used around the world.
- Reference Card, provided for a quick reference to the balance operation.
- Breeze Break, provided for the F3103, for more accurate weighing.

1-3 Compliance

Compliance with FCC Rules

Please note that this equipment generates, uses and can radiate radio frequency energy. This equipment has been tested and has been found to comply with the limits of a Class A computing device pursuant to Subpart J of Part 15 of FCC rules. These rules are 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.)

Compliance with EMC Directives

This device features radio interference suppression in compliance with valid EC Regulation 89/336/EEC.

2-1 Unpacking

- The balance is a precision instrument. Unpack the balance carefully. Keep the packing material to be used for transporting the balance in the future.

- The packing contents depend on the balance model. See the illustrations to confirm that everything is contained.

F3103
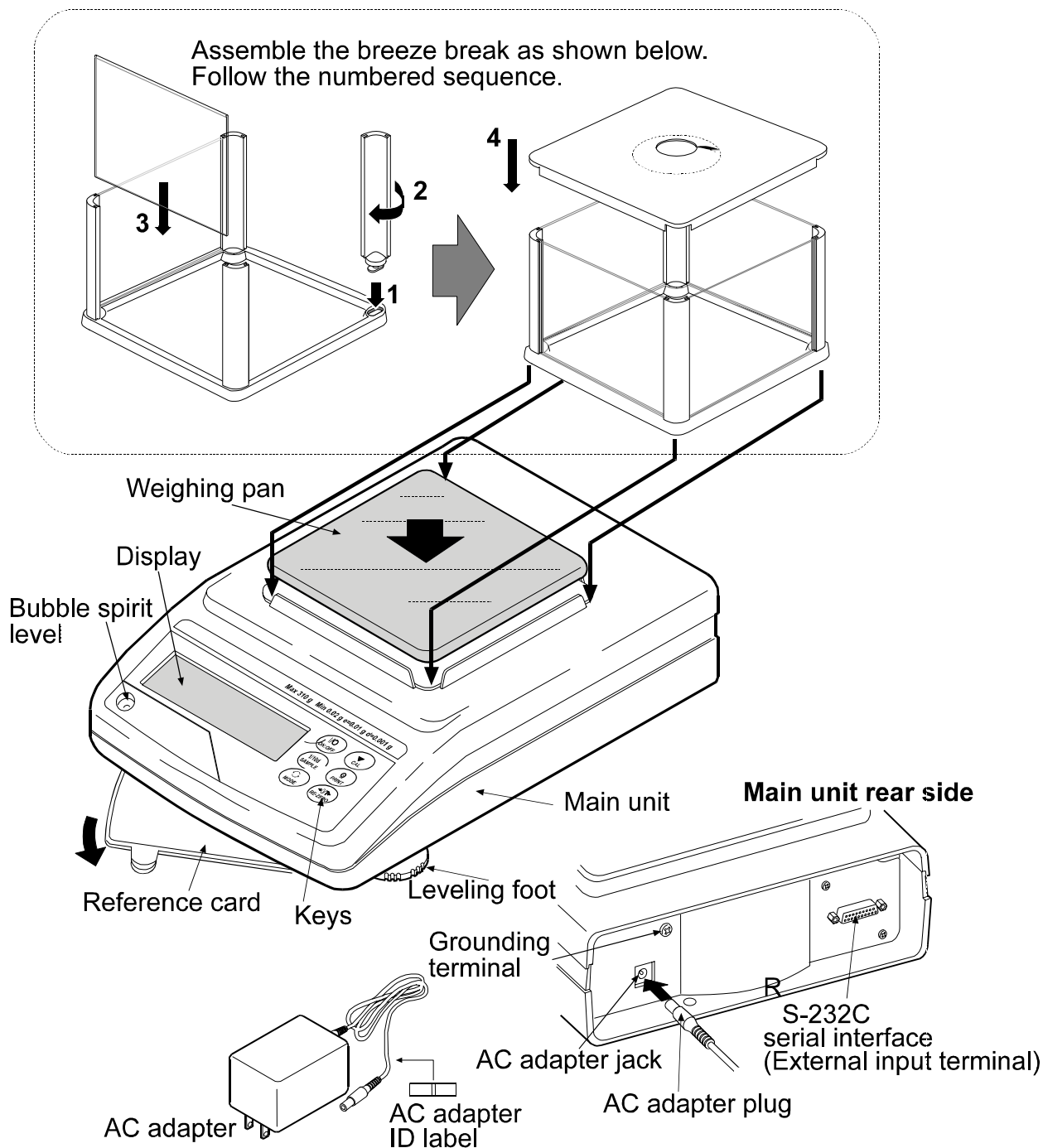
Assemble the breeze break as shown below.
Follow the numbered sequence.

Weighing pan

Display

Bubble spirit level

Main unit

Main unit rear side

Reference card   Keys

Leveling foot

Grounding terminal

S-232C serial interface (External input terminal)

AC adapter jack

AC adapter plug

AC adapter   AC adapter ID label

Note

Please confirm that the AC adapter type is correct for your local voltage and receptacle type.

F12102 / F31002 / F61001
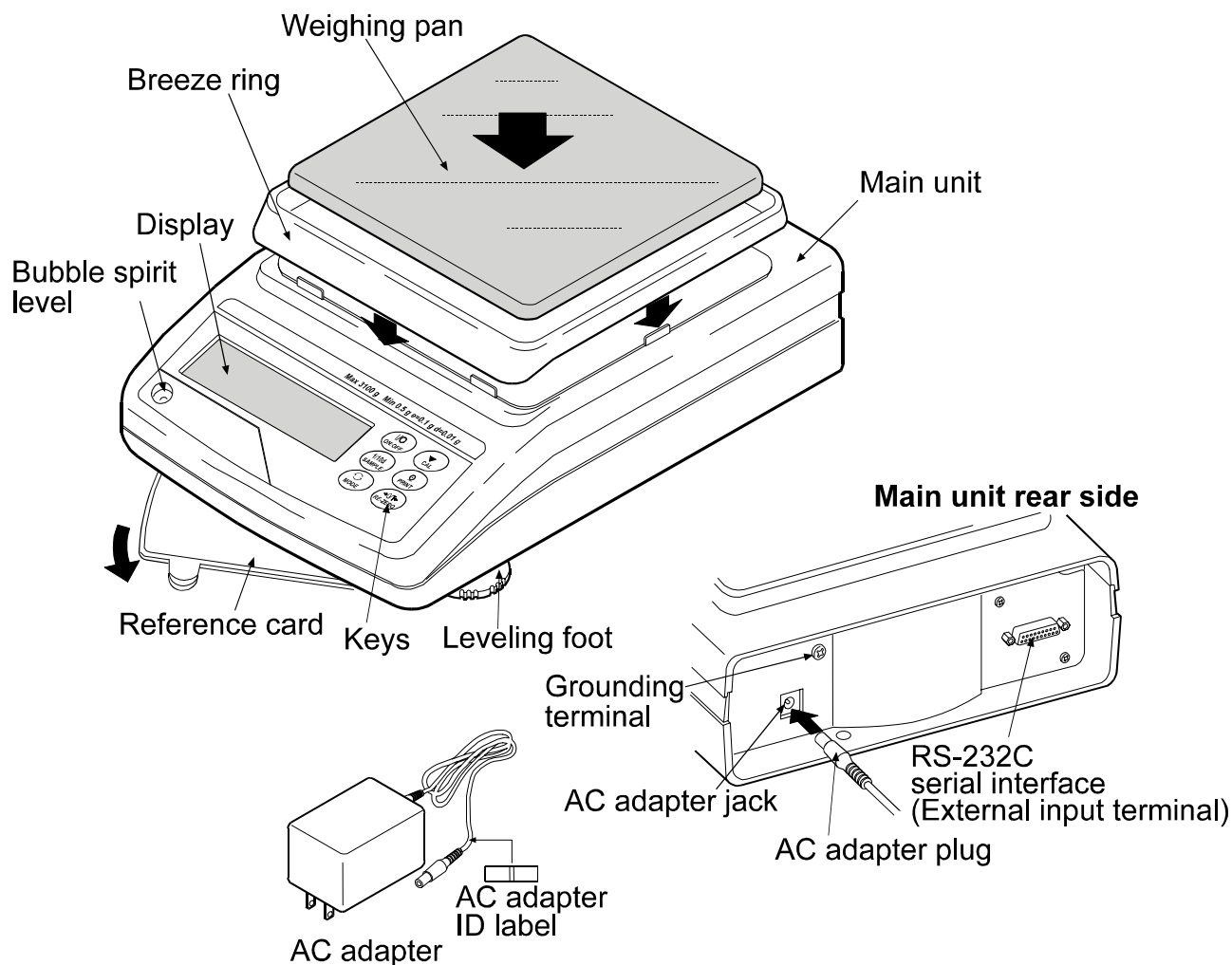
Weighing pan

Breeze ring

Display

Bubble spirit
level

Main unit

Main unit rear side

Reference card Keys Leveling foot

Grounding
terminal

AC adapter jack

RS-232C
serial interface
(External input terminal)

AC adapter plug

AC adapter
ID label

AC adapter

Note

**Please confirm that the AC adapter type is correct
for your local voltage and receptacle type.**

2-2 Installing the Balance

Install the balance as follows:

1. Refer to "3. PRECAUTIONS" for installing the balance. Place the balance on a solid weighing table.

2. F3103
   Assemble the breeze break on the balance as shown in the illustration on page 5.

   F12102 / F31002 / F61001
   Assemble the breeze ring and weighing pan on the balance as shown in the illustration above.

3. Adjust the leveling feet to level the balance. Confirm it using the bubble spirit level.

4. Confirm that the adapter type is correct for the local voltage and power receptacle type.

5. Connect the AC adapter to the balance. Warm up the balance for at least 30 minutes with nothing on the weighing pan.

3. PRECAUTIONS

To get the optimum performance from the balance and acquire accurate weighing data, note the following:

3-1 Before Use

- Install the balance in an environment where the temperature and humidity are not excessive. The best operating temperature is about 20°C / 68°F at about 50% relative humidity.

- Install the balance where it is not exposed to direct sunlight and it is not affected by heaters or air conditioners.

- Install the balance where it is free of dust.

- Install the balance away from equipment which produces magnetic fields.

- Install the balance in a stable place avoiding vibration and shock. Corners of rooms on the first floor are best, as they are less prone to vibration.

- The weighing table should be solid and free from vibration, drafts and as level as possible.

- Level the balance by adjusting the leveling feet and confirm it using the bubble spirit level.

- Ensure a stable power source when using the AC adapter.

- Warm up the balance for at least 30 minutes. Plug in the AC adapter as usual.

- Calibrate the balance before use or after having moved it to another location.
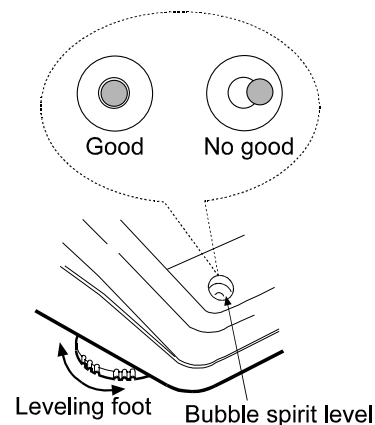
Caution
Do not install the balance where flammable or corrosive gas is present.

3-2 During Use

- Discharge static electricity from the material to be weighed (hereinafter referred to as sample). When a sample could have a static charge, the weighing data is influenced. Try to keep the ambient humidity above 45%RH or use the metal shield case.

- This balance uses a strong magnet as part of the balance assembly, so please use caution when weighing magnetic materials such as iron. If there is a problem, use the underhook on the bottom of the balance to suspend the material away from the influence of the magnet.

Charged material
Metal case
Grounding
Magnetic material

- Cancel the temperature difference between a sample and the environment. When a sample is warmer (cooler) than the ambient temperature, the sample will be lighter (heavier) than the true weight. This error is due to a rising (falling) draft around the sample.
- Make each weighing gently and quickly to avoid errors due to changes in the environmental conditions.
- Do not drop things upon the weighing pan, or place a sample on the pan that is beyond the balance weighing capacity. Place a sample in the center of the weighing pan.
- Do not use a sharp instrument such as a pencil to press the keys. Use your finger only.
- Press the RE-ZERO key before each weighing to prevent possible errors.
- Calibrate the balance periodically so as to cancel possible errors.
- Take into consideration the affect of air buoyancy on a sample when more accuracy is required.
- Keep the balance interior free of dust and foreign materials.
- The breeze break (F3103 only) and the clear cover are provided as accessories. They may be charged with static electricity when they are unpacked or when the humidity is low. If the weighing value is unstable or the balance has a problem with repeatability, remove the breeze break or the clear cover. Or wipe the clear cover with a moistened cloth or apply an anti-static spray.
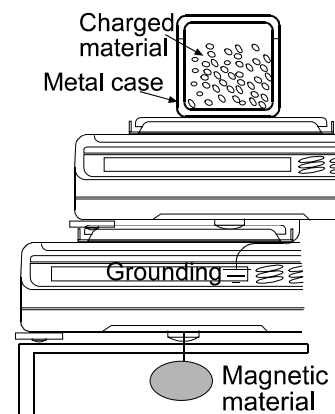
3-3 After Use

- Avoid mechanical shock to the balance.
- Do not disassemble the balance. Contact the local Oxford dealer if the balance needs service or repair.
- Do not use organic solvents to clean the balance. Clean the balance with a lint free cloth that is moistened with warm water and a mild detergent.
- Avoid dust and water so that the balance weighs correctly. Protect the internal parts from liquid spills and excessive dust.

3-4 Power Supply

- When the AC adapter is connected, the balance is in the standby mode if the standby indicator is on (refer to "3-5 Display Symbols and Key Operation"). This is a normal state and does not harm the balance. For accurate weighing, warm up the balance for at least 30 minutes before use.
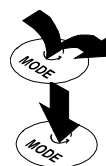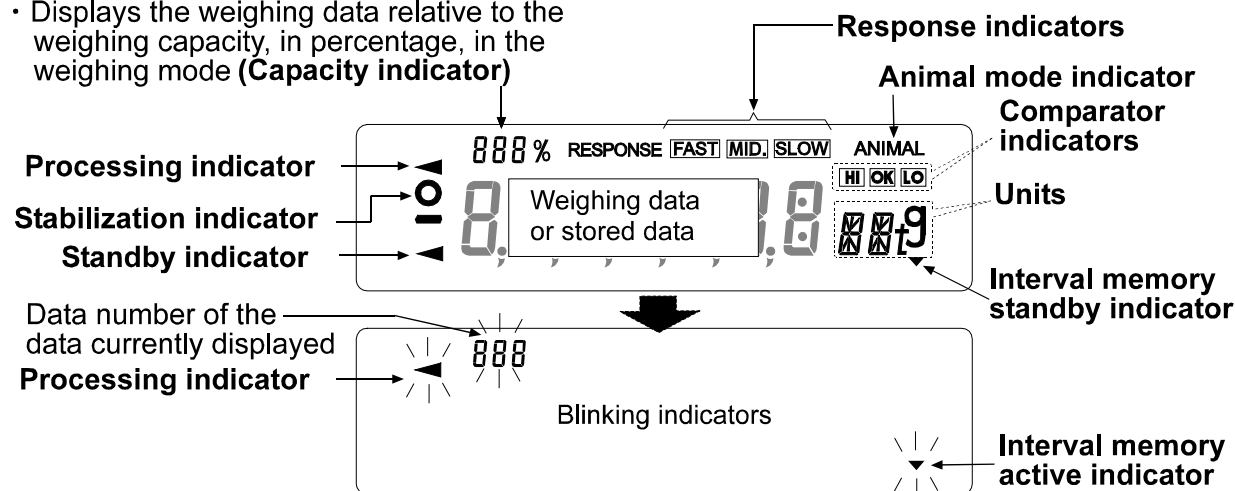
3-5 Display Symbols and Key Operation

Key operation

Key operation affects how the balance functions. The basic key operations are:

- "Press and release the key immediately" or "Press the key"

    = normal key operation during measurement

- "Press and hold the key"

Display symbols

・ Displays data stored in memory
・ Displays the weighing data relative to the weighing capacity, in percentage, in the weighing mode **(Capacity indicator)**

Response indicators

Animal mode indicator

Comparator indicators

Processing indicator

Stabilization indicator

Standby indicator

Units

Interval memory standby indicator

Weighing data or stored data

Data number of the data currently displayed

Processing indicator

Blinking indicators

Interval memory active indicator

Each key, when pressed or when pressed and held, functions as follows:

Key	When pressed	When pressed and held
I/⏻ ON:OFF	Turns the display ON or OFF. The standby indicator is displayed when the display is turned off. The weighing mode is enabled when the display is turned on. This key is available anytime. Pressing the key during operation will interrupt the operation and turn the display OFF.	
1/10d SAMPLE	In the weighing mode, turns the minimum weighing value ON or OFF. In the counting or percent mode, enters the sample storing mode.	Enters the function table mode. Refer to "9. FUNCTION TABLE".
MODE	Switches the weighing units stored in the function table. Refer to "4. WEIGHING UNITS".	Enters the response adjustment/self check mode.
CAL	No function.	Displays items of the calibration menu.
PRINT	Stores the weighing data in memory or outputs to a printer or personal computer using the RS-232C interface (Factory setting), depending on the function table settings.	No function at the factory setting. By changing the function table: Outputs "Title block" and "End block" for GLP report. Displays the data memory menu.
→0/T← RE-ZERO	Sets the display to zero.	

4. WEIGHING UNITS

4-1 Units

With the F series balance, the following weighing units and weighing modes are available:

| g | PC | Pct | OZ | Lb | ∟OZ | OZt | ct | mm | dwt | GN | TL | t | MS | DS |

└── Counting mode

└── Percent mode

└── Density mode (To use this mode, it must be stored in the function table as described on the next page. For details about this mode, refer to "14. DENSITY MEASUREMENT". To select this mode, press the MODE key until the processing indictor blinks with the unit "g" displayed. "DS" appears only when the density value is displayed.)

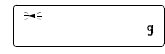└── Programmable-unit (No unit displayed. For details, refer to "13. PROGRAMMABLE-UNIT".)

A unit or mode can be selected and stored in the function table as described on the next page.

If a weighing mode (or unit of weight) has been turned off, that mode or unit will be missing in the sequence. Tael has four varieties, one of which can be selected and installed at the factory.

To select a unit or mode for weighing, press the MODE key.

For details about the units and modes, see the table below:

Name (unit, mode)	Abbrev.	Display	Function table (Storing mode)	Conversion factor 1 g =
Gram	g	g	g	1 g
Counting mode	PC	PC	PC	——
Percent mode	Pct	Pct	Pct	——
Ounce (Avoir)	OZ	OZ	OZ	28.349523125 g
Pound	Lb	Lb	Lb	453.59237 g
Pound/Ounce	∟ OZ	∟ OZ	10	1Lb=16 oz, 1 oz=28.349523125 g
Troy Ounce	OZt	OZt	OZt	31.1034768 g
Metric Carat	ct	ct	ct	0.2 g
Momme	mm	mm	mm	3.75 g
Pennyweight	dwt	dwt	dwt	1.55517384 g
Grain (UK)	GN	GN	GN	0.06479891 g
Tael (HK general, Singapore)				37.7994 g
Tael (HK jewelry)	TL	TL	TL	37.429 g
Tael (Taiwan)				37.5 g
Tael (China)				31.25 g
Tola (India)	t	t	t	11.6638038 g
Messghal	MS	MS	MS	4.6875 g
Density mode (See note below)	DS	⌐⌐g DS is used to show the density.	DS	——
Programmable-unit (Multi-unit)	Mlt	——	MLt	——

Note: The blinking processing indicator with "g" indicates that the density mode is selected.

9

The tables below indicate the weighing capacity and the minimum display for each unit, depending on the balance model.

| Unit	Capacity	Minimum display	Capacity		Minimum display	Capacity	Minimum display
	F3103		**F12102**	**F31002**		**F61001**	
Gram	310.000	0.001	1210.00	3100.00	0.01	6100.0	0.1
Ounce (Avoir)	10.93495	0.00005	42.6815	109.3495	0.0005	215.170	0.005
Pound	0.683435	0.000005	2.66760	6.83435	0.00005	13.4480	0.0005
Pound/Ounce	0Lb 10.93oz	0.01oz	2Lb 10.68oz	6Lb 13.35oz	0.01oz	13Lb 7.17oz	0.01oz
Troy Ounce	9.96675	0.00005	38.9025	99.6675	0.0005	196.120	0.005
Metric Carat	1550.000	0.005	6050.00	15500.00	0.05	30500.0	0.5
Momme	82.6665	0.0005	322.665	826.665	0.005	1626.65	0.05
Pennyweight	199.335	0.001	778.05	1993.35	0.01	3922.4	0.1
Grain (UK)	4784.04	0.02	18673.2	47840.4	0.2	94138	2
Tael (HK general, Singapore)	8.20120	0.00005	32.0110	82.0120	0.0005	161.380	0.005
Tael (HK jewelry)	8.28235	0.00005	32.3280	82.8235	0.0005	162.975	0.005
Tael (Taiwan)	8.26665	0.00005	32.2665	82.6665	0.0005	162.665	0.005
Tael (China)	9.92000	0.00005	38.7200	99.2000	0.0005	195.200	0.005
Tola (India)	26.5780	0.0001	103.740	265.780	0.001	522.99	0.01
Messghal	66.1335	0.0005	258.135	661.335	0.005	1301.35	0.05

4-2 Storing Units

The units or modes can be selected and stored in the function table. The sequence of displaying the units or modes can be arranged so as to fit the frequency of use in the function table.

Select a unit or mode and arrange the sequence of display as follows:

1 Press and hold the SAMPLE key until ba5fnc of the function table is displayed.

2 Press the SAMPLE key several times to display Unit .

3 Press the PRINT key to enter the unit selection mode.

4 Specify a unit or mode in the order to be displayed using the following keys.

SAMPLE key   To sequentially display the units.

RE-ZERO key   To specify a unit or mode. The stabilization indicator appears when the displayed unit or mode is specified.
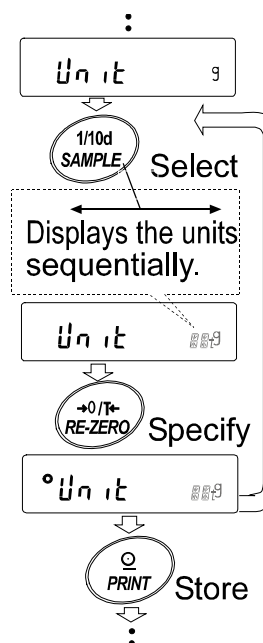
5 Press the PRINT key to store the units or modes. The balance displays end and then displays the next menu of the function table.

6 Press the CAL key to exit the function table. Then the balance returns to the weighing mode with the selected unit.

7 To select other unit or mode for weighing, press the MODE key.

5. WEIGHING

5-1 Basic Operation (Gram Mode)

1 Place a container on the weighing pan, if necessary.
  Press the RE-ZERO key to cancel the weight (tare). The balance displays 0.00 g. (The decimal point position depends on the balance model.)

2 Place a sample on the pan or in the container.

3 Wait for the stabilization indicator to be displayed. Read the value.

4 Remove the sample and container from the pan.

Notes
To use other units, press the MODE key and select an appropriate unit.
Press the SAMPLE key to turn ON or OFF the minimum weighing value.
The weighing data can be stored in memory. For details, refer to "11. DATA MEMORY".
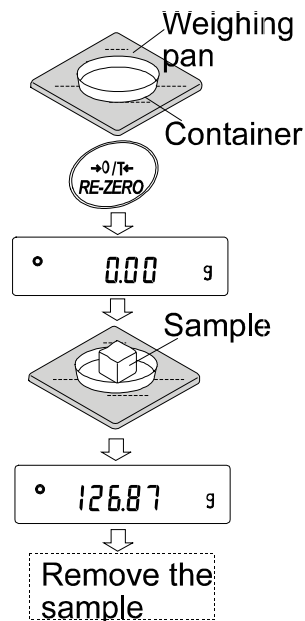
5-2 Counting Mode (PC)

This is the mode to determine the number of objects in a sample based on the standard sample unit mass. Unit mass means the mass of one sample. The smaller the variables in each sample unit mass is, the more accurate the counting will be. The F series balance is equipped with the Automatic Counting Accuracy Improvement (ACAI) function to improve the counting accuracy.
Note
If the sample unit mass variable is too large, it may cause a counting error.

Selecting the counting mode
1 Press the MODE key to select pC (counting mode).

Storing a sample unit mass
2 Press the SAMPLE key to enter the sample unit mass storing mode.
Even in the storing mode, pressing the MODE key will switch to the next mode.

3 To select the number of samples, press the SAMPLE key several times. It may be set to 10, 25, 50 or 100.

Note
A greater number of samples will yield more accurate counting result.

4 Place a container on the weighing pan, if necessary. Press the RE-ZERO key to cancel the weight (tare). The number specified in step 3 appears.
e.g.: 25 0 pc is displayed if 25 is selected in step 3.

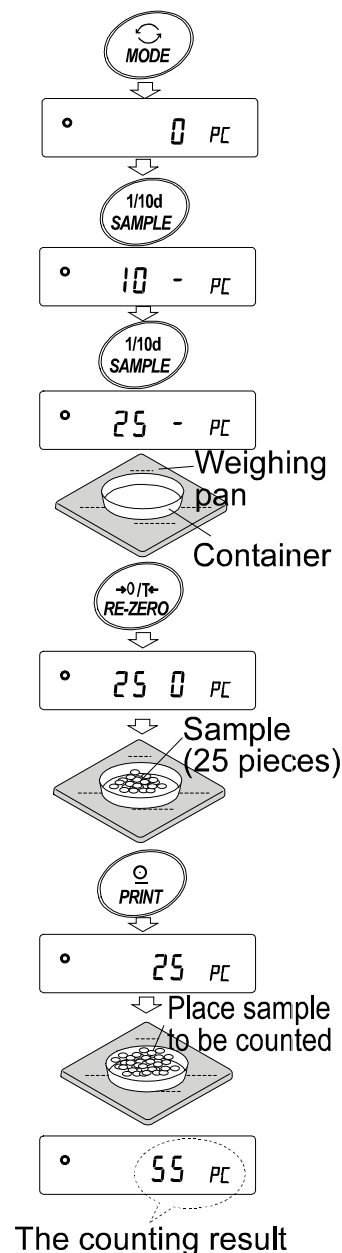5 Place the number of samples specified on the pan. In this example, 25 pieces.

6 Wait for the stabilization indicator to come on. Press the PRINT key to calculate and store the unit mass. The balance displays 25 pc (counting mode) and is set to count samples with this unit mass. (The sample unit mass stored, even if the AC adapter is removed, is maintained in non-volatile memory.)

To improve the accuracy of the unit mass, proceed to step 8.

Notes
If the balance judges that the mass of the samples is too light and is not adequate to be used as the unit mass, it displays lo . Do not use the samples.

If the balance judges that the mass of the samples is too light to aquire accurate weighing, it displays an error requiring the addition of more samples to the specified number. In the example above, 50- pc appears, requiring 25 more samples. Add 25 samples and press the PRINT key. When the unit mass is stored correctly, the balance proceeds to the counting mode.

MODE

0 PC

1/10d SAMPLE

10 - PC

1/10d SAMPLE

25 - PC

Weighing pan
Container

→0/T← RE-ZERO

25 0 PC

Sample (25 pieces)

PRINT

25 PC

Place sample to be counted

55 PC

The counting result

Counting operation

7   Place the samples to be counted on the pan.

Note
Up to 20 unit masses can be stored in memory for the multiple sample. For details, refer to "11. DATA MEMORY". The unit mass data in memory can be recalled or changed using commands from the computer.

Processing indicator

50 PC

Counting mode using the ACAI function

The ACAI is a function that improves the accuracy of the unit mass automatically by increasing the number of samples as the counting process proceeds.
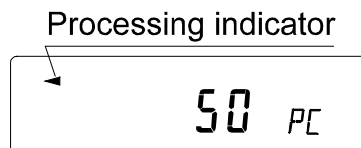
8   If a few more samples are added, the processing indicator turns on. To prevent an error, add three or more. The processing indicator does not turn on if overloaded. Try to add the same number of samples as displayed.

9   The balance re-calculates the unit mass while the processing indicator is blinking. Do not touch the balance or samples on the pan until the processing indicator turns off.

10   Counting accuracy is improved when the processing indicator turns off.

   Each time the above operation is performed, a more accurate unit mass will be obtained. There is no definite upper limit of ACAI range for the number of samples exceeding 100. Try to add the same number of samples as displayed.

11   Remove all the samples used in ACAI and proceed with the counting operation using the improved unit mass.

5-3 Percent Mode (Pct)

This is the mode to display the weight value in percentage compared to a 100% reference mass and is used for target weighing or checking the sample variable.

Selecting the percent mode

1 Press the MODE key to select pct (percent mode). If the percent mode can not be selected, refer to "4. WEIGHING UNITS".

Storing the 100% reference mass

2 Press the SAMPLE key to enter the 100% reference mass storing mode.

Even in the storing mode, pressing the MODE key will switch to the next mode.

3 Place a container on the weighing pan, if necessary. Press the RE-ZERO key to cancel the weight (tare). The balance displays 100 0 pct.

4 Place the sample to be set as the 100% reference mass on the pan or in the container.

5 Press the PRINT key to store the reference mass. The balance displays 100.00 pct. (The decimal point position depends on the reference value. The reference mass stored, even if the AC adapter is removed, is maintained in non-volatile memory.)

Note

If the balance judges that the mass of the sample is too light to be used as a reference, it displays lo . Do not use the sample.

6 Remove the sample.

Reading the percentage

7 Place a sample to be compared to the reference mass on the pan. The displayed percentage is based on the 100% reference mass.

Weighing pan

Container

Sample (100%)

Place sample to be weighed

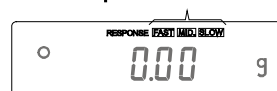Weighing result compared to 100% reference mass

14
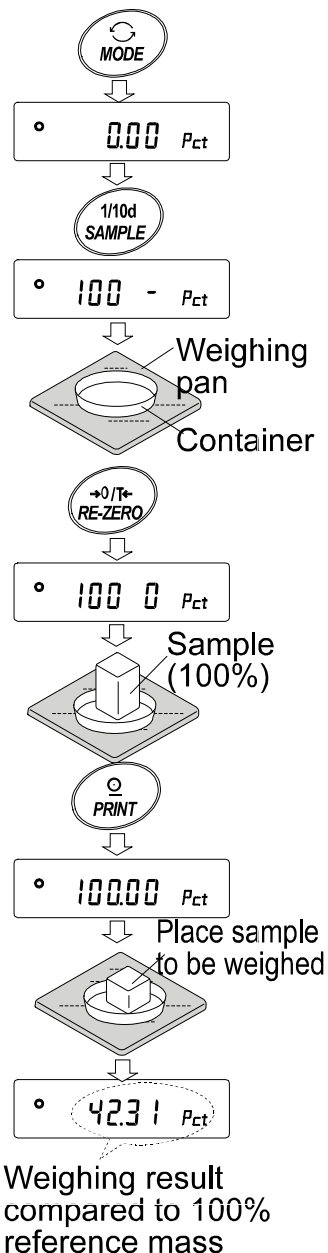
6. RESPONSE ADJUSTMENT / SELF CHECK FUNCTION

6-1 Manual Response Adjustment

The function has three rates as follows:

Response indicators

Changing the response rate changes the display refresh rate.

Indicator	Parameter	Response characteristic	Display refresh rate
FAST	Cond 0	Fast response, Sensitive value	If the response rate is changed as follows:
MID.	Cond 1	⬆ ⬇	MID. or SLOW→FAST =10 times/second
SLOW	Cond 2	Slow response, Stable value	FAST→MID. or SLOW = 5 times/second

Note
To set the refresh rate of 5 times/second when the response rate is FAST or 10 times/second when the response rate is MID. or SLOW, change the "Display refresh rate (5pd)" parameter of "Environment, Display (ba5fnc)" in the function table. For details, refer to "9. FUNCTION TABLE".
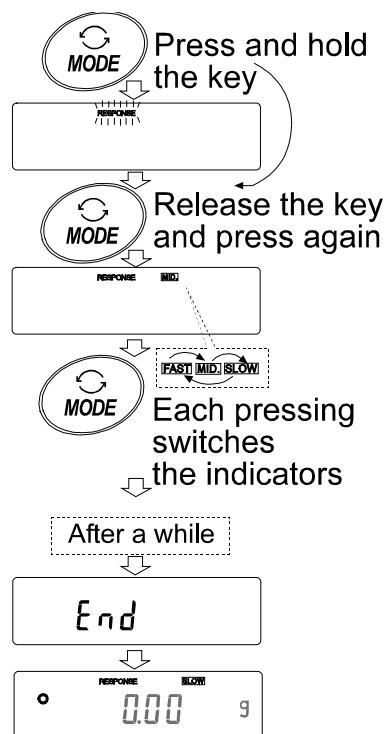
To increase the response rate, or to obtain a more stable display, perform the following:

Operation

1 Press and hold the MODE key until RESPONSE is displayed.

   And then, press the MODE key again quickly.

2 Press the MODE key to select a rate of the response adjustment. Either FAST, MID. or SLOW can be selected.

3 After a few seconds of inactivity the balance displays end. Then, it returns to the weighing mode and displays the updated response indicator. The response indicator remains displayed for a while.

Note
The response adjustment can be changed at "Condition (Cond)" of "Environment, Display (ba5fnc)" in the function table. For details, refer to "9. FUNCTION TABLE".

Press and hold the key

Release the key and press again

Each pressing switches the indicators

After a while

End

15

6-2 Self Check Function

This function self-checks the internal performance of the balance.

Operation

1 Press and hold the MODE key until RESPONSE is displayed, and then release the key.

2 The balance automatically starts to check its internal performance

3 After self-check, the balance displays the checking result and returns to the weighing mode.

   e.g. " OK "

   The example above indicates that the result of the self check is good.
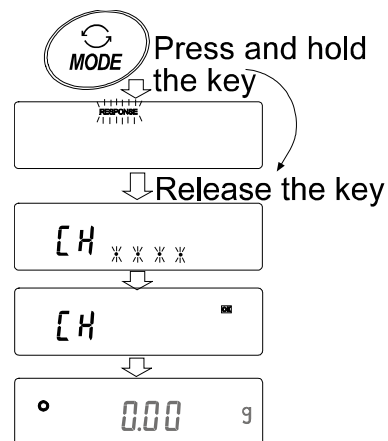
Note
If improper performance is found in the self check, the balance displays CH no. Contact the local Oxford dealer for repair.

Press and hold the key

Release the key

[H ※※※※

[H

0.00 g

7. CALIBRATION

7-1 Calibration Modes

The F series balance has the following two modes.
- Calibration using an external weight
- Calibration test using an external weight (Calibration test does not perform calibration.)

Terms

The following terms are defined as follows:

External weight　　＝　A weight that you have. Referred to as a calibration weight when used for calibration.

Calibration weight　＝　A weight used for calibration

Target weight　　　＝　An external weight used for calibration test

Caution

- Calibration adjusts the balance for accurate weighing.

   Besides periodic calibration and before each use, perform calibration when:
   - the balance is installed for the first time.
   - the balance has been moved.
   - the ambient environment has changed.

- Do not allow vibration or drafts to affect the balance during calibration.

- To output the data for GLP using the RS-232C interface, set "GLP output (info)" of "Data output (dout)". For details, refer to "9. FUNCTION TABLE".

- Calibration test is available only when "GLP output (info)" of "Data output (dout)" is set to "1" or "2",

Caution on using an external weight

- The accuracy of an external weight can influence the accuracy of weighing. Select an appropriate weight as listed below:

Model	Usable calibration weight	Adjustable range
		-0.015 g to +0.015 g
F3103	300 g, **200 g**	
F12102	**1000 g,** 500 g	
		-0.15 g to +0.15 g
F31002	3000 g, **2000 g**	
F61001	6000 g, **5000 g**, 4000 g, 3000 g, 2000 g	-1.5 g to +1.5 g

   The calibration weight in bold type: factory setting
   The calibration weight value can be adjusted within the range above.

Display

◂

- This indicator means "the balance is measuring calibration data". Do not allow vibration or drafts to affect the balance while this indicator is displayed.

7-2 Calibration Using an External Weight

This function calibrates the balance using an external weight.

Operation

1 Connect the AC adapter and warm up the balance for at least 30 minutes with nothing on the pan.

2 Press and hold the CAL key until `Calout` is displayed, and then release the key.

3 The balance displays `Cal 0`.

   ● If you want to change the calibration weight (a list of usable weights is shown on page 17), press the SAMPLE key and proceed to step 4.

   ● If you use the calibration weight value stored in the balance, proceed to step 5.

4 Specify the calibration weight value as follows:

SAMPLE key	To switch the display condition to: "All of the segments blinking" (calibration weight selection mode) or "The last two digits blinking" (value adjustment mode).
RE-ZERO key	To select the calibration weight or adjust the value. In the value adjustment mode, -15 digits appear after +15 digits.
PRINT key	To store the new weight value. Even if the AC adapter is removed, the data is maintained in non-volatile memory.
CAL key	To cancel the operation and return to `Cal 0`.
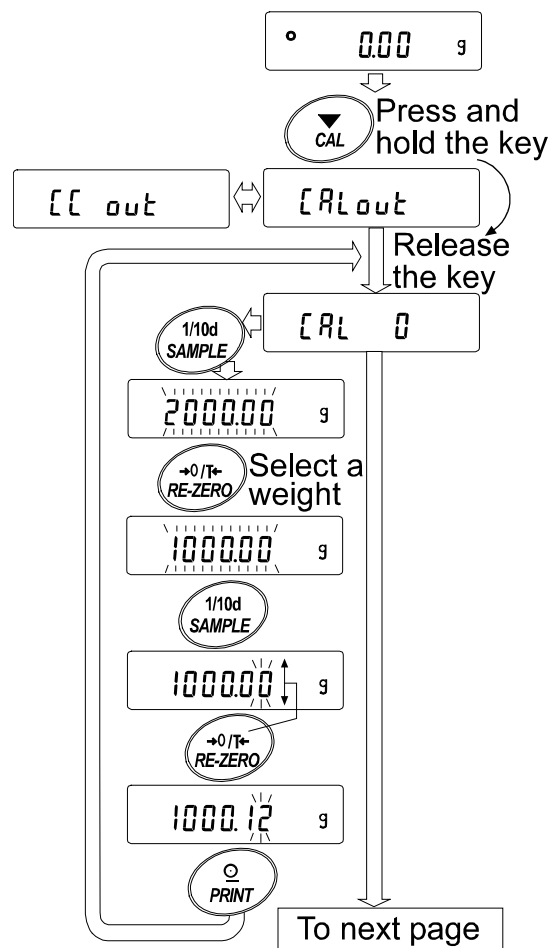
**Note**
Digit, when used for the F series balance, indicates a unit of minimum weighing value.

Press and hold the key

Release the key

Select a weight

To next page

e.g. Calibration weight value
1000.12 g

5 Confirm that there is nothing on the pan and press the PRINT key. The balance measures the zero point. Do not allow vibration or drafts to affect the balance.

The balance displays the calibration weight value.

6 Place the displayed calibration weight on the pan and press the PRINT key. The balance measures the calibration weight. Do not allow vibration or drafts to affect the balance.

7 The balance displays end . Remove the weight from the pan.

8 If the "GLP output (info)" parameter, of the function table, is set to "1" or "2", the balance displays glp and outputs "Calibration Report" using the RS-232C interface or stores the data in memory. For details on the calibration report format, refer to "10-2 GLP Report".

9 The balance will automatically return to the weighing mode.

10 Place the calibration weight on the pan and confirm that the value displayed is within ±2 digits of the specified value. If it is not within the range, check the ambient conditions such as breeze and vibration, also check the weighing pan. Then, repeat steps 1 to 10.

From previous page

PRINT

CAL 0

1000

Calibration weight

PRINT

1000

End

GLP output

GLP

End

0.00 g

19
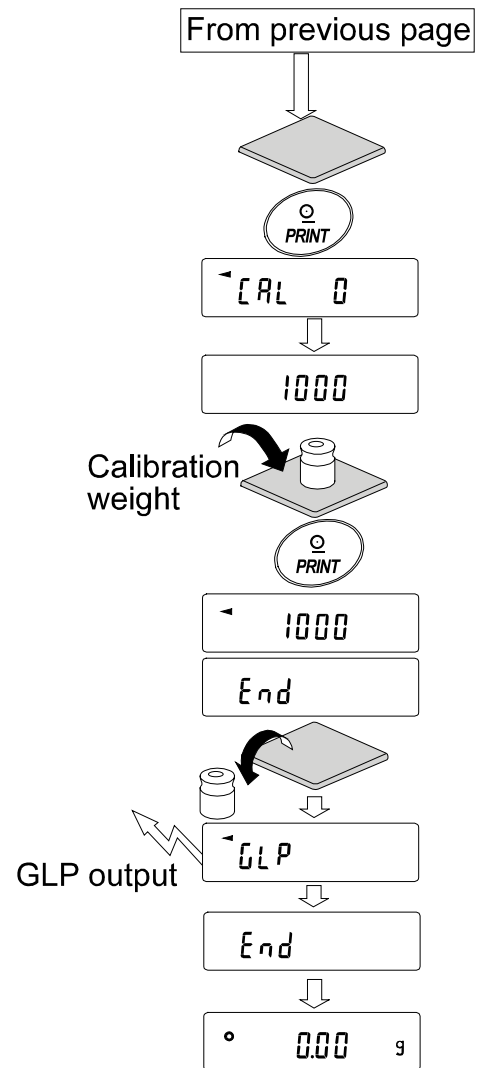
7-3 Calibration Test Using an External Weight

This function tests the balance weighing accuracy using an external mass and outputs the result. This is available only when the "GLP output (info)" parameter is set to "1" or "2". (Calibration test does not perform calibration.)

Operation

1 Connect the AC adapter and warm up the balance for at least 30 minutes with nothing on the pan.

2 Press and hold the CAL key until CCout is displayed, and then release the key.

3 The balance displays CC 0 .
   ● If you want to change the target weight (a list of usable weights is shown on page 17), press the SAMPLE key and proceed to step 4.
   ● If you use the target weight value stored in the balance, proceed to step 5.

4 Specify the target weight value as follows:

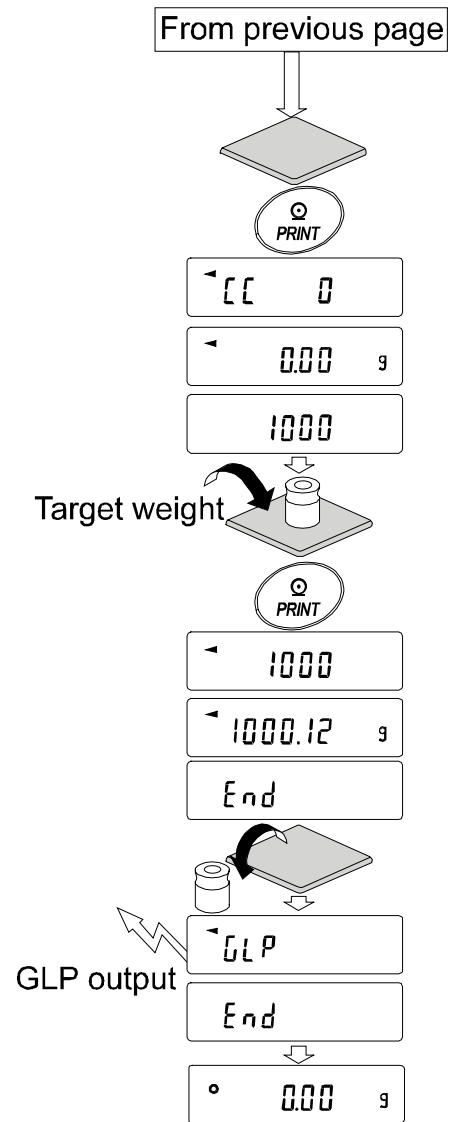 | | |
   |---|---|
   | SAMPLE key | To switch the display condition to: "All of the segments blinking" (target weight selection mode) or "The last two digits blinking" (value adjustment mode). |
   | RE-ZERO key | To select the target weight or adjust the value. In the value adjustment mode, -15 digits appear after +15 digits. |
   | PRINT key | To store the new weight value. Even if the AC adapter is removed, the data is maintained in non-volatile memory. |
   | CAL key | To cancel the operation and return to CC 0 . |
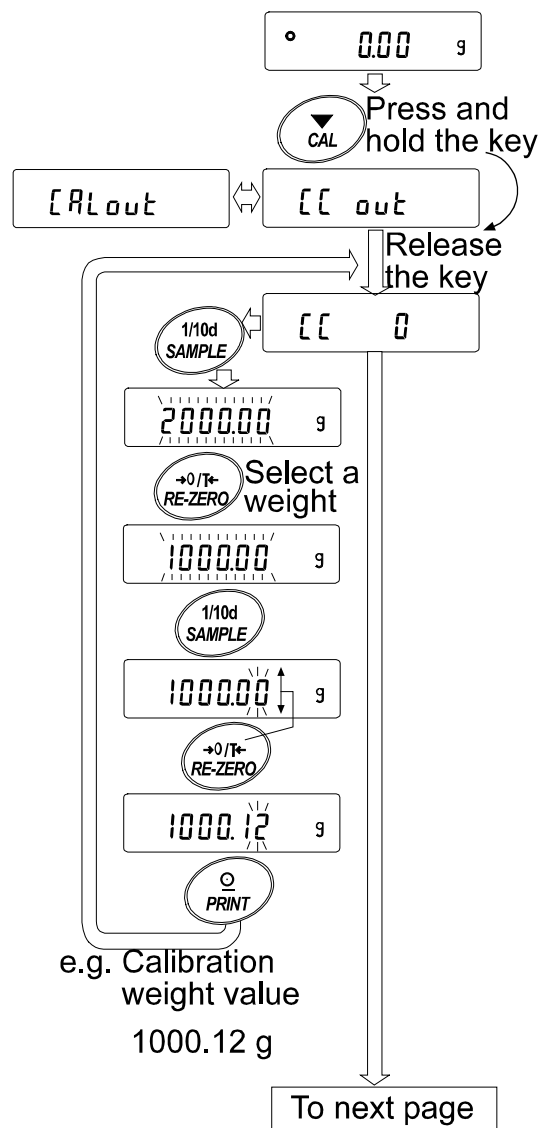
   Note
   Digit, when used for the F series balance, indicates a unit of minimum weighing value.

° 0.00 g

CAL ▼ — Press and hold the key

CALout ⇔ CC out

Release the key

CC 0

1/10d SAMPLE

2000.00 g

→0/T← RE-ZERO — Select a weight

1000.00 g

1/10d SAMPLE

1000.00 g

→0/T← RE-ZERO

1000.12 g

○ PRINT

e.g. Calibration weight value
1000.12 g

To next page

20

5   Confirm that there is nothing on the pan and press the PRINT key. The balance measures the zero point and displays the measured value. Do not allow vibration or drafts to affect the balance.
The balance displays the target weight value.

6   Place the displayed target weight on the pan and press the PRINT key. The balance measures the target weight and displays the measured value. Do not allow vibration or drafts to affect the balance.

7   The balance displays end . Remove the weight from the pan.

8   The balance displays glp and outputs "Calibration Test Report" using the RS-232C interface or stores the calibration test data in memory. For details on the calibration test report format, refer to "10-2 GLP Report".

9   The balance will automatically return to the weighing mode.

PRINT

⌐[[0

⌐   0.00   g

1000

Target weight

PRINT

⌐   1000

⌐ 1000.12   g
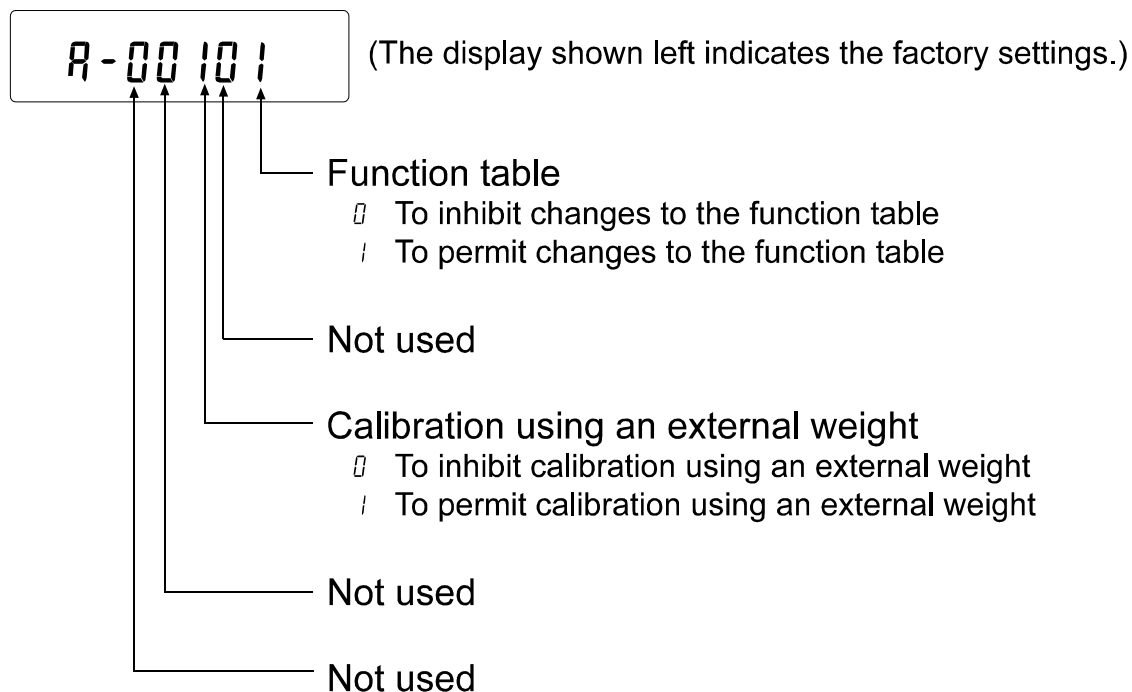
End

GLP output

⌐[L P

End

○   0.00   g

8. FUNCTION SWITCH AND INITIALIZATION

8-1 Permit or Inhibit

The balance stores parameters that must not be changed carelessly (e.g. Calibration data for accurate weighing, Data for adapting to the operating environment, Control data for the RS-232C interface). There are five switches for the purpose of protecting these parameters. Each switch can select either "permit" or "inhibit". The "inhibit" protects parameters against careless operations.

Switches

$A-001101$ (The display shown left indicates the factory settings.)

Function table
- *0* To inhibit changes to the function table
- *1* To permit changes to the function table

Not used

Calibration using an external weight
- *0* To inhibit calibration using an external weight
- *1* To permit calibration using an external weight

Not used

Not used

Operation

1 Press the ON:OFF key to turn off the display.

2 While pressing and holding the PRINT key and the SAMPLE key, press the ON:OFF key. The balance displays p5 .

3 Press the PRINT key. Then the balance displays the function switches.

4 Set the switches using the following keys.

SAMPLE key	To select the switch to change the parameter.
RE-ZERO key	To change the parameter of the switch selected.
	0:To inhibit changes.　1:To permit changes
PRINT key	To store the new parameter and return to the weighing mode.
CAL key	To cancel the operation (Clr is displayed.) To return to the weighing mode, press the CAL key once again.

8-2 Initializing the Balance

This function returns the following parameters to factory settings.

- Calibration data
- Function table
- The sample unit mass value (counting mode), 100% reference mass value (percent mode)
- The data that is stored in the balance using the data memory function
- External calibration weight and target weight value
- Function switch settings
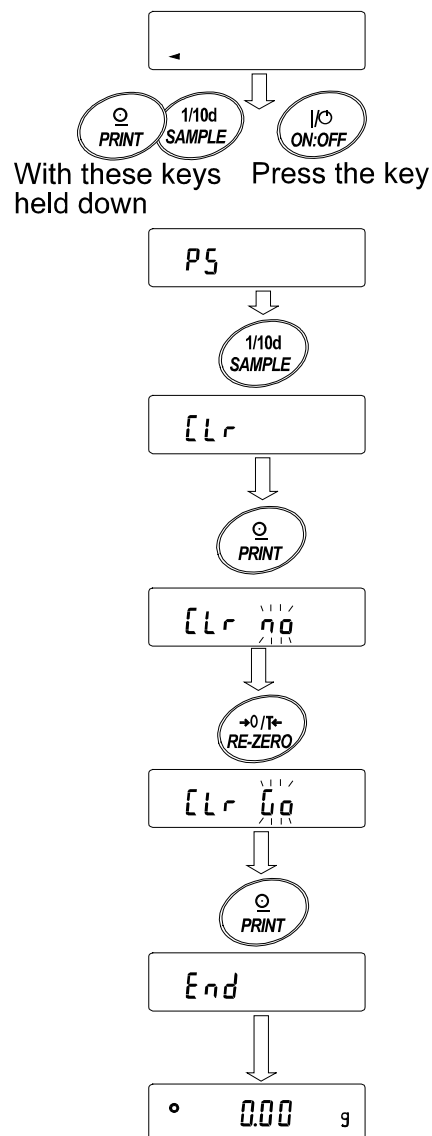- Liquid density and temperature in the density mode

Note
Be sure to calibrate the balance after initialization.

Operation

1   Press the ON:OFF key to turn off the display.

2   While pressing and holding the PRINT key and the SAMPLE key, press the ON:OFF key. The balance displays p5 .

3   Press the SAMPLE key to display Clr .

4   Press the PRINT key.
    To cancel this operation, press the CAL key.

5   Press the RE-ZERO key.

6   Press the PRINT key to initialize the balance.

    The balance will automatically return to the weighing mode.

With these keys held down   Press the key

PS

1/10d SAMPLE

Clr

PRINT

Clr no

RE-ZERO

Clr Go

PRINT

End

0.00 g

9. FUNCTION TABLE

The function table reads or rewrites the parameters that are stored in the balance. These parameters stored, even if the AC adapter is removed, are maintained in non-volatile memory.

9-1 Structure and Sequence of the Function Table

The function table menu consists of two layers. The first layer is the "Class" and the second layer is the "Item". Each item stores a parameter.

Example
This example sets "Stores weighing data" for "Data memory" and "Every 1 minute" for "Interval time".
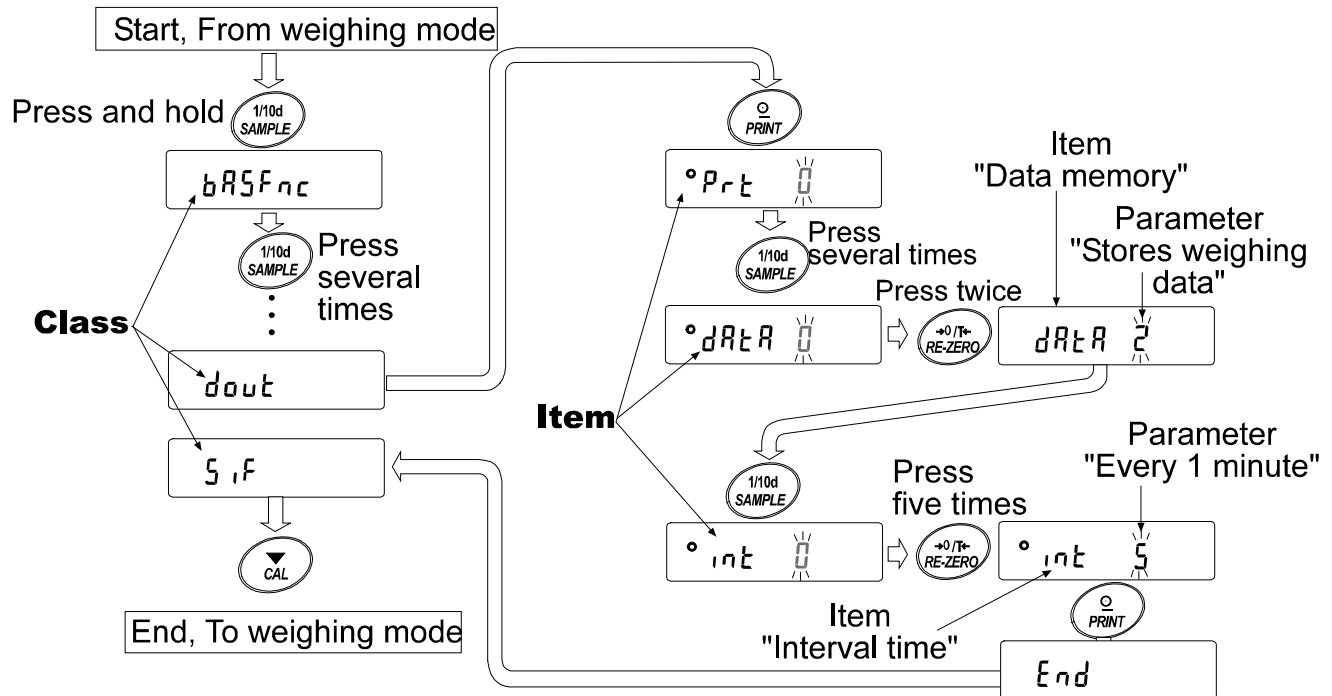
9-2 Display and Keys

Display/Key	Description
°	The symbol "○ indicates that the parameter displayed is in effect.
1/10d SAMPLE	When pressed and held in the weighing mode, enters the function table mode. Selects the class or item in the function table mode.
→0/T← RE-ZERO	Changes the parameter.
PRINT	When a class is displayed, moves to an item in the class. When an item is displayed, stores the new parameter and displays the next class.
CAL	When an item is displayed, cancels the new parameter and displays the next class. When a class is displayed, exits the function table mode and returns to the weighing mode.

9-3 Details of the Function Table

Class	Item	Parameter	Description	
bASFnc Environment Display	Cond Condition	0	Fast response, sensitive value [FAST]	Can be changed by response adjustment. With "Hold 1", sets the averaging time.
		▪ 1	[MID.]	
		2	Slow response, stable value [SLOW]	
	St-b Stability band width	0	Stable when within ±1 digit	The stabilization indicator illuminates with the display fluctuation within the range. With "Hold 1", sets the stabilization range.
		▪ 1		
		2	Stable when within ±3 digts	
	Hold Hold function	▪ 0	OFF	Holds the display when stable in animal mode. With "Hold 1", [ANIMAL] turns on.
		1	ON	
	trc Zero tracking	0	OFF	Keeps zero display by tracking zero drift.
		▪ 1	ON	
	SPd Display refresh rate	▪ 0	5 times/second	Period to refresh the display
		1	10 times/second	
	Pnt Decimal point	▪ 0	Point (.)	Decimal point format
		1	Comma (,)	
	P-on Auto display-ON	▪ 0	OFF	Turns on the weighing mode display when AC adapter is connected.
		1	ON	
	PoFF Auto display-OFF	▪ 0	OFF	Turns off the display after 10 minutes of inactivity.
		1	ON (10 minutes)	
	GSi Capacity indicator	▪ 0	OFF	Capacity indicator. Zero: 0% Maximum capacity: 100%
		1	ON	
CP Fnc Comparator	CP Comparator mode	▪ 0	No comparison	
		1	Comparison, excluding "near zero" when stable value or overloaded	
		2	Comparison, including "near zero" when stable value or overloaded	
		3	Continuous comparison, excluding "near zero"	
		4	Continuous comparison, including "near zero"	
	CP in Input method	▪ 0	Digital input, upper/lower limits	CP Hi, CP Lo can be selected.
		1	Weighing input, upper/lower limits	
		2	Digital input, reference value	CP rEF, CP Lnt can be selected.
		3	Weighing input, reference value	
CP Hi Upper limit			See "9-9 Comparator Function"	Displayed when CP in 0 or CP in 1 is selected.
CP Lo Lower limit				
CP rEF Reference value			See "9-9 Comparator Function"	Displayed when CP in 2 or CP in 3 is selected.
CP Lnt Tolerance				

▪ Factory setting **Note: "Digit" is a unit of miminum weighing value.**

Class	Item	Parameter	Description	
dout Data output	*Prt* Data output mode	▪ *0*	Key mode	Accepts the PRINT key only when the display is stable.
		1	Auto print mode A (Reference = zero)	Outputs data when the dispaly is stable and conditions of *AP-P, AP-b* and the reference value are met.
		2	Auto print mode B (Reference = last stable value)	
		3	Stream mode / Interval memory mode	With *dAtA 0*, outputs data continuously; with *dAtA 2*, uses interval memory.
	AP-P Auto print polarity	▪ *0*	Plus only	Displayed value>Reference
		1	Minus only	Displayed value<Reference
		2	Both	Regardless of displayed value
	AP-b Auto print difference	▪ *0*	10 digits	Difference between reference value and displayed value
		1	100 digits	
		2	1000 digits	
	dAtA Data memory	▪ *0*	Not used	Related items: *Prt, int, d-no*
		1	Stores unit mass in counting mode	
		2	Stores weighing data	
	int Interval time	▪ *0*	Every measurement	Interval time in the interval memory mode (with *Prt 3, dAtA 2*)
		1	Every 2 seconds	
		2	Every 5 seconds	
		3	Every 10 seconds	
		4	Every 30 seconds	
		5	Every 1 minute	
		6	Every 2 minutes	
		7	Every 5 minutes	
		8	Every 10 minutes	
	d-no Data number output	*0*	No output	See "11 DATA MEMORY".
		1	Output	
	S-id ID number output	▪ *0*	No output	Selects whether or not the ID number is output.
		1	Output	
	PUSE Data output pause	▪ *0*	No pause	Selects the data output interval.
		1	Pause (1.6 seconds)	
	At-F Auto feed	▪ *0*	Not used	Selects whether or not auto feed is performed.
		1	Used	
	inFo GLP output	▪ *0*	No output	Selects GLP output method.
		1	AD-8121 format	
		2	General data format	
	Ar-d Zero after output	▪ *0*	Not used	Adjusts zero automatically after data is output.
		1	Used	

▪ Factory setting

Class	Item	Param-eter	Description	
5 ,F Serial interface	*bP5* Baud rate	*0*	600 bps	
		1	1200 bps	
		▪ *2*	2400 bps	
		3	4800 bps	
		4	9600 bps	
	bEPr Data bit, parity bit	▪ *0*	7 bits, even	
		1	7 bits, odd	
		2	8 bits, none	
	CrLF Terminator	▪ *0*	CR LF	CR: ASCII code 0Dh
		1	CR	LF: ASCII code 0Ah
	EYPE Data format	▪ *0*	A&D standard format	See "9-6 Description of Item "Data Format".
		1	DP format	
		2	KF format	
		3	MT format	
		4	NU format	
		5	CSV format	
	E-UP Timeout	*0*	No limit	Selects the wait time to receive a command.
		▪ *1*	1 second	
	ErCd AK, Error code	▪ *0*	No output	AK: ASCII code 06h
		1	Output	
	CE5 CTS, RTS control	▪ *0*	Not used	Controls CTS and RTS.
		1	Used	
d5 Fnc Density function	*Ld in* Liquid density input	▪ *0*	Water temperature	Available only when density mode is selected. See "14. DENSITY MEASUREMENT".
		1	Liquid density	
nLE Programmable-unit (Multi-unit)			Sets an arbitrary coefficient.	Available only when programmable-unit mode is selected.
Un iE Unit			See "4. WEIGHING UNITS".	
id ID number setting			See "10. ID NUMBER AND GLP REPORT".	

▪ Factory setting

Caution
The balance may not transmit the data completely at the specified refresh rate, depending on the baud rate or data added to the weighing data such as ID number.

9-4 Description of the Class "Environment, Display"

Condition (`Cond`)

Cond 0 | This parameter is for sensitive response to the fluctuation of a weight value. Used for powder target weighing, weighing a very light sample or when quick response weighing is required.
After setting, the balance displays FAST .

⇕

Cond 2 | This parameter is for stable weighing with slow response. Used to prevent a weight value from drifting due to vibration or drafts.
After setting, the balance displays SLOW .

Note
With "Hold function (`Hold`)" set to "ON (`1`)", this item is used to set the averaging time.

Stability band width (`5t-b`)

This item controls the width to regard a weight value as a stable value. When the fluctuation per second is less than the parameter, the balance displays the stabilization indicator and outputs or stores the data. The parameter influences the "Auto print mode"

5t-b 0 | This parameter is for sensitive response of the stabilization indicator. Used for exact weighing.

⇕

5t-b 2 | This parameter ignores slight fluctuation of a weight value. Used to prevent a weight value from drifting due to vibration or drafts.

Note
With "Hold function (`Hold`)" set to "ON (`1`)", this item is used to set the stabilization range.

Hold function (`Hold`) (Animal weighing mode)

This function is used to weigh a moving object such as an animal.

When the weighing data is over the weighing range from zero and the display fluctuation is within the stabilization range for a fixed period of averaging time, the processing indicator illuminates and the balance displays the average weight of the animal. When the animal is removed from the weighing pan, the display returns to zero automatically.

This function is available only when the hold function parameter is set to "`1`" (the animal mode indicator ANIMAL illuminates) and any weighing unit other than the counting mode is selected.

The stabilization range and averaging time are set in "Condition (`Cond`)" and "Stability band width (`5t-b`)".

Weighing range		Averaging time		Stabilization range	
F3103	0.200 g or over	Cond 0	2 seconds Faster 4 seconds |	5t-b 0	Small |
F12102 / F31002	2.00 g or over	Cond 1	8 seconds More accurate	5t-b 1	Big
F61001	10.0 g or over	Cond 2		5t-b 2	

Note
The animal weighing bowl kit (OP-12) is available as an option for the F-1200/2000/3000/6000.

Zero tracking (`trc`)

This function tracks zero point drift caused by changes in the environment and stabilizes the zero point. When the weighing data is only a few digits, turn the function off for accurate weighing.

Note
Digit, when used for the F series balance, indicates a unit of minimum weighing value.

trc 0   The tracking function is not used. Used for weighing a very light sample.

t⇕c 1   The tracking function is used.

Display refresh rate (`5pd`)

Period to refresh the display. This parameter influences "Baud rate", "Data output pause" and "Stream mode".

Note
This item is selected automatically in the manual response adjustment.

Decimal point (`pnt`)

The decimal point format can be selected.

Auto display-ON (`p-on`)

When the AC adapter is connected, the display is automatically turned on without the ON:OFF key operation, to display the weighing mode. Used when the balance is built into an automated system. 30-minute warm up is necessary for accurate weighing.

Auto display-OFF (`poff`)

When the AC adapter is connected and no operation is performed (inactivity state) for 10 minutes, the display is automatically turned off and the standby indicator is illuminated.

Capacity indicator (`g5i`)

In the weighing mode, the indicator displays the weighing data relative to the weighing capacity in percentage. (Zero = 0%, maximum capacity = 100%)
When the "Data memory (data)" parameter is set to "1" (to store unit mass in the counting mode) or to "2" (to store the weighing data), the indicator displays the information stored in memory, such as the amount of memory data or data number.

9-5 Description of the Item "Data output mode"

The parameter setting of the "Data output mode (prt)" applies to the performance when the "Data memory (data)" parameter is set to "2" (to store the weighing data) and when the data is transmitted using the RS-232C interface.

Key mode

When the PRINT key is pressed with the stabilization indictor turned on, the balance outputs or stores the weighing data and the display blinks one time.

Required setting   dout   prt 0   Key mode

Auto print modes A and B

When the displayed value is stable and the conditions of "Auto print polarity", "Auto print difference" and reference value are met, the balance outputs or stores the weighing data.

When the PRINT key is pressed with the stabilization indictor turned on, the balance outputs or stores the data and the display blinks one time.

Mode A: Required setting	dout	prt 1	Auto print mode A (reference = zero)
	dout	ap-p	Auto print polarity
	dout	ap-b	Auto print difference
Example		"For weighing each time a sample is placed and removed."	

Mode B: Required setting	dout	prt 2	Auto print mode B (reference = last stable value)
	dout	ap-p	Auto print polarity
	dout	ap-b	Auto print difference
Example		"For weighing while a sample is added."	

Stream mode

The balance outputs the weighing data continuously regardless of the display condition. The display does not blink in this mode. This mode is not available and the interval memory mode is used when the "Data memory (data)" parameter is set to "2" (to store the weighing data).

Required setting	dout	prt 3	Stream mode
	dout	data 0	Data memory function is not used.
	ba5fnc	5pd	Display refresh rate
	5if	bp5	Baud rate
Example		"For monitoring data on a computer"	

Caution

The balance may not transmit the data completely at the specified refresh rate, depending on the baud rate or data added to the weighing data such as time, date and ID number.

Interval memory mode

The weighing data is periodically stored in memory.

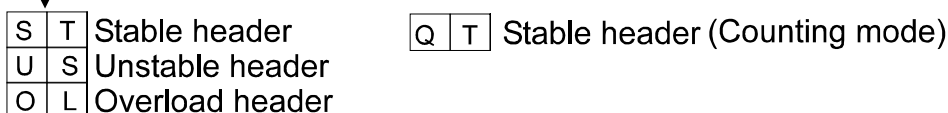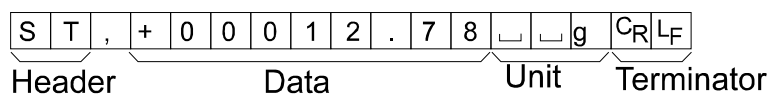|			
Required setting	dout	prt 3	Interval memory mode
	dout	data 2	Data memory function is used. Stores weighing data.
	dout	int	Interval time
Example		"For periodical weighing without a computer command and to output all of the data, to a computer, at one time"	

9-6 Description of the Item "Data format"

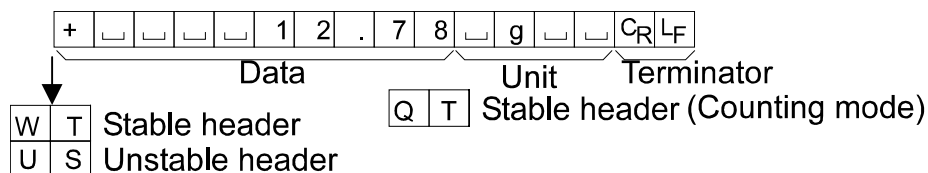**Standard format**   `5if type 0`

This format is used when the peripheral equipment can receive the format. If an AD-8121 is used, set the printer to MODE 1 or 2.

- This format consists of fifteen characters excluding the terminator.
- A header of two characters indicates the balance condition.
- The polarity sign is placed before the data with the leading zeros. If the data is zero, the plus sign is used.
- The unit, consisting of three characters, follows the data.

S	T	,	+	0	0	0	1	2	.	7	8	␣	␣	g	C_R	L_F

Header   Data   Unit   Terminator

S	T	Stable header
U	S	Unstable header
O	L	Overload header

Q	T	Stable header (Counting mode)

DP (Dump print) format   `5if type 1`

This format is used when the peripheral equipment can not receive the format. If an AD-8121 is used, set the printer to MODE 3.

- This format consists of sixteen characters excluding the terminator.
- A header of two characters indicates the balance condition. No overload header is used.
- The polarity sign is placed before the data, with spaces in place of leading zeros, if the data is not zero or overloaded.
- The unit, consisting of three characters, follows the data.

+	␣	␣	␣	␣	1	2	.	7	8	␣	g	␣	␣	C_R	L_F

Data   Unit   Terminator

W	T	Stable header
U	S	Unstable header

Q	T	Stable header (Counting mode)

KF format   `5if type 2`

This is the Karl-Fischer moisture meter format and is used when the peripheral equipment can only communicate using this format.

- This format consists of fourteen characters excluding the terminator.
- This format has no header characters.
- The polarity sign is placed before the data, with spaces in place of leading zeros, if the data is not zero or overloaded.
- This format outputs the unit only for a stable value.

W	T	␣	␣	␣	␣	␣	+	1	2	.	7	8	␣	␣	g	C_R	L_F

Header   Data   Unit   Terminator

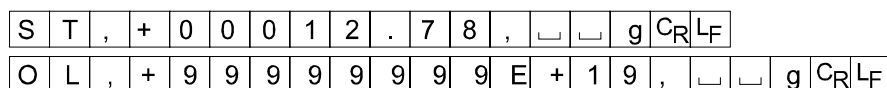| ␣	g	␣	␣	Stable value
␣	␣	␣	␣	Unstable value
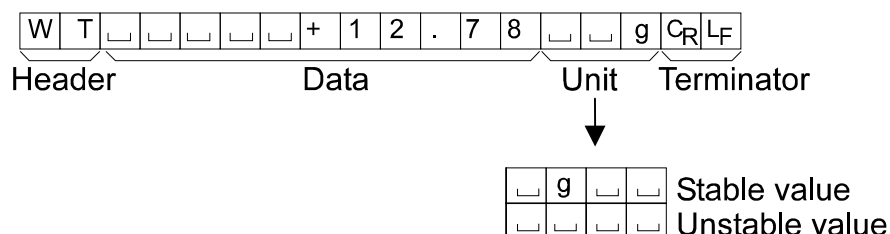
MT format `5if type 3`

- A header of two characters indicates the balance condition.
- The polarity sign is used only for negative data.
- The weighing data uses spaces in place of the leading zeros.
- The character length of this format changes dependent upon the unit

| S | ␣ | ␣ | ␣ | ␣ | ␣ | ␣ | 1 | 2 | . | 7 | 8 | ␣ | g | C$_R$ | L$_F$ |

Header ‾‾‾‾‾‾‾‾‾‾‾ Unit Terminator

␣	␣	Stable header (When data is output using the PRINT key or external print input.)
S	␣	Stable header (When data is output using methods other than the above.)
S	D	Unstable header
S	I	Overload header
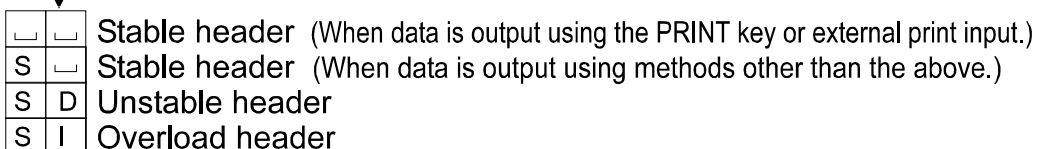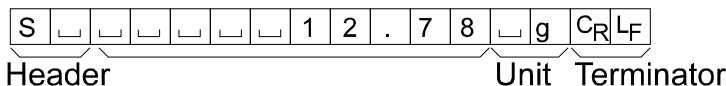
NU (numerical) format `5if type 4`

This format outputs only numerical data.

- This format consists of nine characters excluding the terminator.
- The polarity sign is placed before the data with the leading zeros. If the data is zero, the plus sign is used.

| + | 0 | 0 | 0 | 1 | 2 | . | 7 | 8 | C$_R$ | L$_F$ |

Data ‾‾‾‾‾‾‾‾‾ Terminator
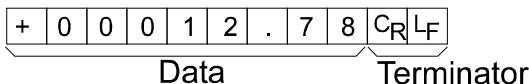
CSV format `5if type 5`

- Separates the data of standard format and the unit by a comma (,).
- Outputs the unit even when the data is overloaded.
- When ID number and data number are added, outputs ID number, data number and weighing data in this order and separates each item by a comma and treats all the items as one group of data.

LAB-123, No,012, ST,+00012.78, ␣ ␣ g<CR><LF>
ID number Data number Weighing data

| S | T | , | + | 0 | 0 | 0 | 1 | 2 | . | 7 | 8 | , | ␣ | ␣ | g | C$_R$ | L$_F$ |
| O | L | , | + | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | E | + | 1 | 9 | , | ␣ | ␣ | g | C$_R$ | L$_F$ |

9-7 Description of the Data Format Added to the Weighing Data

Data number `dout d-no 1`

This format outputs the data number just before the data is transmitted using the RS-232C interface.

- This format consists of six characters excluding the terminator.
- When CSV format (`5if type 5`) is selected, the period (.) is replaced with a comma (,).

| N | o | . | 0 | 0 | 1 | C$_R$ | L$_F$ |

Data number Terminator
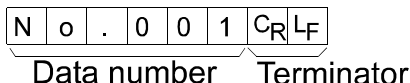
Note

The data number is added only to the weighing data that is stored in memory.

ID number `dout 5-id 1`

The number to identify a specific balance.

- This format consists of seven characters excluding the terminator.

`L A B - 1 2 3 CR LF`

Note
When the data described above is added to the weighing data, the output is in the following order: ID number, Data number, and Weighing data.

9-8 Data Format Examples

Stable

° `1.27` g

A&D	S	T	,	+	0	0	0	0	1	.	2	7	␣	␣		CR	LF
DP	W	T	␣	␣	␣	␣	␣	␣	+	1	.	2	7	␣	␣	g	CR LF
KF	+	␣	␣	␣	␣	␣	1	.	2	7	␣	g	␣	␣	CR	LF	
MT*1	␣	␣	␣	␣	␣	␣	␣	␣	1	.	2	7	␣	g	CR	LF	
MT*2	S	␣	␣	␣	␣	␣	␣	␣	1	.	2	7	␣	g	CR	LF	
NU	+	0	0	0	0	1	.	2	7	CR	LF						

Note
Two formats are available for MT. *1 is the output format when the PRINT key or external print input is used. *2 is the output format for others.

Unstable

`-183.69` g

A&D	U	S	,	-	0	0	1	8	3	.	6	9	␣	␣	g	CR	LF
DP	U	S	␣	␣	␣	␣	-	1	8	3	.	6	9	␣	␣	g	CR LF
KF	-	␣	␣	␣	1	8	3	.	6	9	␣	␣	␣	␣	CR	LF	
MT	S	D	␣	␣	␣	-	1	8	3	.	6	9	␣	CR	LF		
NU	-	0	0	1	8	3	.	6	9	CR	LF						

Overload
Positive error

`E` g

A&D	O	L	,	+	9	9	9	9	9	9	9	E	+	1	9	CR	LF
DP	␣	␣	␣	␣	␣	␣	␣	␣		␣	␣	␣	␣	␣	␣	CR	LF
KF	␣	␣	␣	␣	␣	␣	H	␣	␣	␣	␣	␣	␣	␣	CR	LF	
MT	S	I	+	CR	LF												
NU	+	9	9	9	9	9	9	9	9	CR	LF						

Overload
Negative error

`-E` g

A&D	O	L	,	-	9	9	9	9	9	9	9	E	+	1	9	CR	LF
DP	␣	␣	␣	␣	␣	␣	␣	-	E	␣	␣	␣	␣	␣	␣	CR	LF
KF	␣	␣	␣	␣	␣	␣	L	␣	␣	␣	␣	␣	␣	␣	CR	LF	
MT	S	I	-	CR	LF												
NU	-	9	9	9	9	9	9	9	9	CR	LF						

␣ Space, ASCII 20h
CR Carriage Return, ASCII 0Dh
LF Line Feed, ASCII 0Ah

Units

Units		A&D	D.P.	KF	MT
g	g	⊔⊔g	⊔⊔g	⊔g⊔⊔	⊔g
Counting mode	PC	⊔PC	⊔PC	⊔pcs	⊔PCS
Precent mode	Pct	⊔⊔%	⊔⊔%	⊔%⊔⊔	⊔%
Ounce (Avoir)	OZ	⊔oz	⊔oz	⊔oz⊔	⊔oz
Pound	Lb	⊔lb	⊔lb	⊔lb⊔	⊔lb
Pound Ounce	L OZ	⊔oz	⊔oz	⊔oz⊔	⊔oz
Troy Ounce	OZt	ozt	ozt	⊔ozt	⊔ozt
Metric Carat	ct	⊔ct	⊔ct	⊔ct⊔	⊔ct
Momme	mm	mom	mom	⊔mom	⊔mo
Pennyweight	dwt	dwt	dwt	⊔dwt	⊔dwt
Grain	GN	⊔GN	⊔GN	⊔gr⊔	⊔GN
Tael (HK general, Singapore)	TL	⊔tl	⊔tl	⊔tls	⊔tl
Tael (HK, jewelry)	TL	⊔tl	⊔tl	⊔tlh	⊔tl
Tael (Taiwan)	TL	⊔tl	⊔tl	⊔tlt	⊔tl
Tael (China)	TL	⊔tl	⊔tl	⊔tlc	⊔tl
Tola (India)	t	⊔⊔t	⊔⊔t	⊔tol	⊔t
Messghal	MS	mes	mes	⊔MS⊔	⊔m
Density	DS	⊔DS	⊔DS	⊔DS⊔	⊔DS
Multi	(Blank)	⊔⊔⊔	⊔⊔⊔	⊔⊔⊔⊔	⊔

⊔   Space, ASCII 20h

Note
   When "Pound Ounce" is selected, the data is output with the unit of ounce (oz).

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9-9 Comparator Function

The results of the comparison are indicated by HI OK LO on the display.

Operating conditions:
- No comparison
- Comparison when the weighing data is stable or overloaded, excluding "near zero"
- Comparison when the weighing data is stable or overloaded, including "near zero"
- Continuous comparison, excluding "near zero"
- Continuous comparison, including "near zero"

To compare, use:
- Upper limit value and lower limit value
- Reference value and tolerance value

Input method:
- Digital input
- Weighing input
- Command input from a computer (Refer to "17. COMMANDS".)

For the description of "Comparator mode (Cp fnc)", refer to "9-3 Details of the Function Table".

Setting example 1
(Continuous comparison, excluding "near zero", reference value and tolerance value, digital input)
Selecting a comparator mode

1 Press and hold the SAMPLE key until ba5fnc of the function table is displayed.

2 Press the SAMPLE key several times to display Cp fnc.

3 Press the PRINT key.

4 Press the RE-ZERO key several times to display Cp 3.

5 Press the SAMPLE key several times to display Cp in.

6 Press the RE-ZERO key several times to display Cp in 2.

7 Press the PRINT key to store the selected mode.

Entering the reference and tolerance values

8 With Cp ref displayed, press the PRINT key. The current setting is displayed with all the digits blinking.

- When the current setting is not to be changed, press the PRINT or CAL key to proceed to step 9.

- When the current setting is to be changed, press the RE-ZERO key. Change the setting using the following keys.

   SAMPLE key   To select the digit to change the value.
   RE-ZERO key   To change the value of the digit selected.
   MODE key   To switch the polarity.
   PRINT key   To store the new setting and go to step 9.
   CAL key   To cancel the new setting and go to step 9.

9 With Cp lñt displayed, press the PRINT key. The current setting is displayed. When the current setting is to be changed, change the setting using the following keys. Enter the tolerance value, in percentage to the reference value, as 100%.

SAMPLE key	To select the digit to change the value.
RE-ZERO key	To change the value of the digit selected.
PRINT key	To store the new setting and go to step 10.
CAL key	To cancel the new setting and go to step 10.

10　Press the CAL key to exit the comparator function and return to the weighing mode.

Setting example 2

(Comparison when the weighing data is stable or overloaded, including "near zero", upper limit and lower limit, weighing input)

Selecting a comparator mode

1　Press and hold the SAMPLE key until `ba5fnc` of the function table is displayed.

2　Press the SAMPLE key several times to display `Cp fnc`.

3　Press the PRINT key.

4　Press the RE-ZERO key several times to display `Cp 2`.

5　Press the SAMPLE key several times to display `Cp in`.

6　Press the RE-ZERO key several times to display `Cp in 1`.

7　Press the PRINT key to store the selected mode.

Entering the upper and lower limit values

8　With `Cp Hi` displayed, press the PRINT key. The current setting is displayed with all of the digits blinking. Press the RE-ZERO key to enter the weighing input mode.

9　Press the RE-ZERO key. The balance displays `0.00g`. Place a sample with a mass that corresponds to the upper limit value on the pan. Press the PRINT key to store the upper limit value. Remove the sample. The balance displays `Cp lo`.

10　With `Cp lo` displayed, press the PRINT key. The current setting is displayed with all of the digits blinking. Press the RE-ZERO key to enter the weighing input mode.

11　Press the RE-ZERO key. The balance displays `0.00g`. Place a sample with a mass that corresponds to the lower limit value on the pan. Press the PRINT key to store the lower limit value. Remove the sample.

12　Press the CAL key to exit the comparator function and return to the weighing mode.

Notes

When Pound/Ounce is selected as a weighing unit, enter the values in ounces for comparison.

In the density mode, comparison is performed to the density obtained.

10. ID NUMBER AND GLP REPORT

- The ID number is used to identify the balance when Good Laboratory Practice (GLP) is used.

- The ID number is maintained in non-volatile memory even if the AC adapter is removed.

- The GLP output format is selected at "GLP output (`info`)" of the function table and can be output to a personal computer or printer using the RS-232C serial interface.

- The GLP output format includes the balance manufacturer, model, serial number, ID number and space for signature for weighing data, and the weight used and results for calibration or calibration test data.
  When the AD-8121 is used, the date and time can be printed using the AD-8121 clock and calendar function. In this case, set the "GLP output (`info`)" parameter to "`1`".

- The balance can output the following reports for GLP.
  "Calibration report" of the calibration, using an external weight.
  "Calibration test report" of the calibration test, using an external weight.
  "Title block" and "End block" for the weighing data.

10-1 Setting the ID Number

1 Press and hold the SAMPLE key until `ba5fnc` of the function table is displayed.

2 Press the SAMPLE key several times to display `id`.

3 Press the PRINT key. Set the ID number using the following keys.

    RE-ZERO key   To set the character of the digit selected. Refer to the display character set shown below.

    SAMPLE key   To select the digit to change the value.

    PRINT key   To store the new ID number and display `ba5fnc`.

    CAL key   To cancel the new ID number and display `ba5fnc`.

4 With `ba5fnc` displayed, press the CAL key to return to the weighing mode.

Display character set

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | - | ␣ | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S | T | U | V | W | X | Y | Z |

␣ Space

10-2 GLP Report

Set the following parameters to output the report.

- To print the report, set the "GLP output (`info`)" parameter to "`1`" and use MODE 3 of the AD-8121. For details on using the printer, refer to "16-1 Connection to the AD-8121 Printer".
  If the time and date are not correct, adjust the AD-8121 clock and calendar.

- To output the report to a personal computer using the RS-232C interface, set the "GLP output (`info`)" parameter to "`2`".

Note
For operational details about calibration and calibration test, refer to "7. CALIBRATION".

Calibration report using an external weight

When the setting is "info 1":

AD-8121 format

```
MODEL     G -2000
S/N       01234567
ID        ABCDEFG
DATE    00/07/01
10:23:30 AM
CALIBRATED(EXT.)
CAL.WEIGHT
    +2000.00  g
SIGNATURE


 _ _ _ _ _ _ _ _
```

← Manufacturer →
← Model →
← Serial number →
← ID number →
← Date →
← Time
← Calibration type
← Calibration weight
← Signature

␣   Space, ASCII 20h
<TERM> Terminator, C_R, L_F or C_R
C_R Carriage return, ASCII 0Dh
L_F Line feed, ASCII 0Ah

When the setting is "info 2":

General data format

```
␣␣␣␣␣␣␣␣␣␣ ␣ ␣ <TERM>
MODEL␣␣␣␣G -2000<TERM>
S/N␣␣␣␣␣01234567<TERM>
ID␣␣␣␣␣␣␣ABCDEFG<TERM>
DATE<TERM>
<TERM>
TIME<TERM>
<TERM>
CALIBRATED(EXT.)<TERM>
CAL.WEIGHT
␣␣␣␣␣+2000.00   g<TERM>
SIGNATURE<TERM>
<TERM>
<TERM>
---------------<TERM>
<TERM>
<TERM>
```

Calibration test report using an external weight

(Calibration test does not perform calibration.)

When the setting is "info 1":

AD-8121 format

```
MODEL     G -2000
S/N       01234567
ID        ABCDEFG
DATE    00/07/01
02:34:30 PM
CAL.TEST(EXT.)
ACTUAL
        0.00   g
    +1999.99
TARGET
    +2000.00   g
SIGNATURE


 _ _ _ _ _ _ _ _
```

← Manufacturer →
← Model →
← Serial number →
← ID number →
← Date →
← Time
← Calibration test type
← Zero point value
← Target weight value
← Target weight
← Signature

␣   Space, ASCII 20h
<TERM> Terminator, C_R, L_F or C_R
C_R Carriage return, ASCII 0Dh
L_F Line feed, ASCII 0Ah

When the setting is "info 2":

General data format

```
␣␣␣␣␣␣␣␣␣␣␣ A␣&␣D<TERM>
MODEL␣␣␣␣G -2000<TERM>
S/N␣␣␣␣␣01234567<TERM>
ID␣␣␣␣␣␣␣ABCDEFG<TERM>
DATE<TERM>
<TERM>
TIME<TERM>
<TERM>
CAL.TEST(EXT.)<TERM>
ACTUAL<TERM>
␣␣␣␣␣␣␣␣␣0.00   g<TERM>
␣␣␣␣␣+1999.99   g<TERM>
TARGET<TERM>
␣␣␣␣␣+2000.00   g<TERM>
SIGNATURE<TERM>
<TERM>
<TERM>
---------------<TERM>
<TERM>
<TERM>
```

Title block and end block

When a weight value is recorded as the GLP data, "Title block" and "End block" are inserted at the beginning and at the end of a group of weight values, in the GLP report.

Note
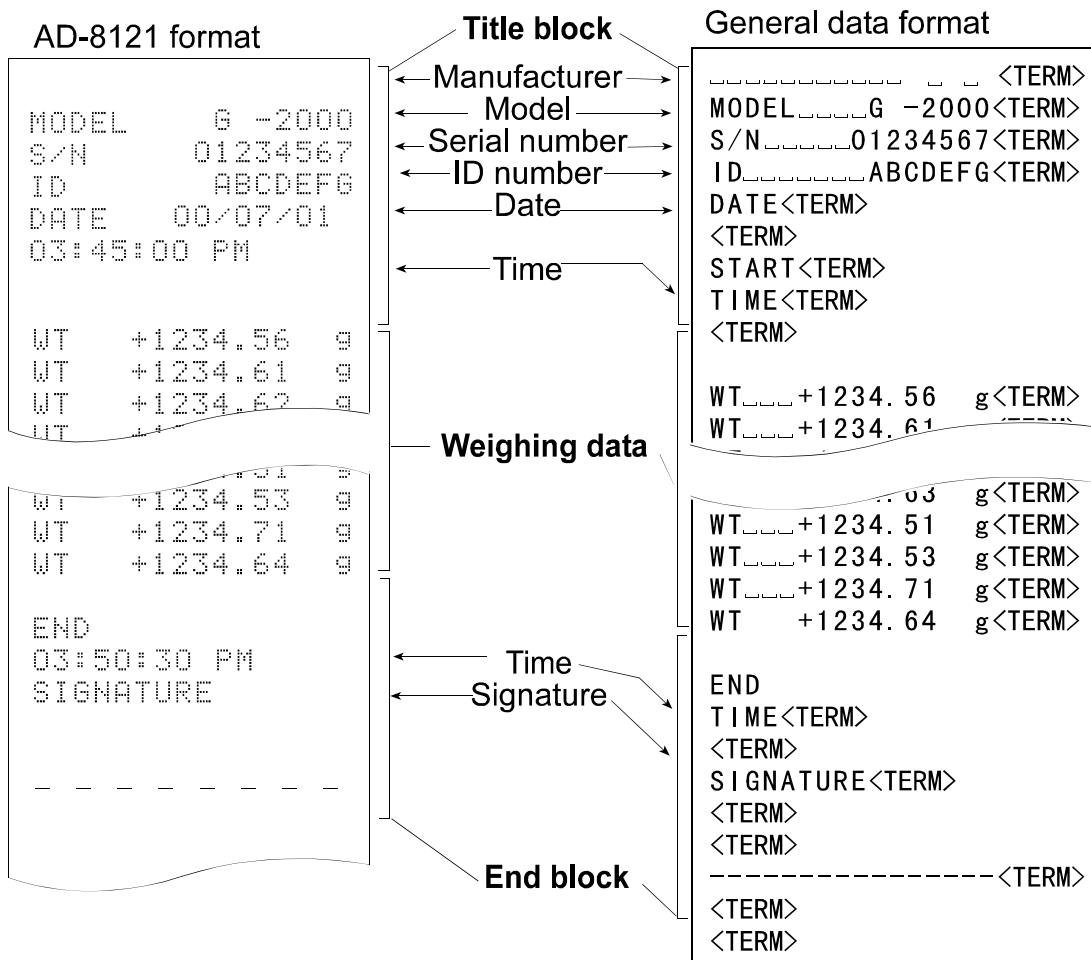**To output the report to an AD-8121 , use MODE 3 of the AD-8121.**

Caution
If the data memory function is used, the "Title block" and "End block" can not be output.

Operation
1   With the weighing data displayed, press and hold the $\boxed{\text{PRINT}}$ key until $\boxed{\texttt{S5tart}}$ is displayed. The "Title block" is output.

2   The weighing data is output according to the parameter setting of the data output mode.

3   Press and hold the $\boxed{\text{PRINT}}$ key until $\boxed{\texttt{recend}}$. The "End block" is output.

When the setting is "`info 1`":   When the setting is "`info 2`":

AD-8121 format   **Title block**   General data format

```
MODEL      G -2000
S/N        01234567
ID         ABCDEFG
DATE    00/07/01
03:45:00 PM


WT    +1234.56   g
WT    +1234.61   g
WT    +1234.62   g
WT    +
```

```
WT    +1234.53   g
WT    +1234.71   g
WT    +1234.64   g

END
03:50:30 PM
SIGNATURE


_ _ _ _ _ _ _ _
```

←Manufacturer→
← Model →
←Serial number→
←ID number→
←Date→

←Time→

Weighing data

←Time→
←Signature→

End block

```
_ _ _ _ _ _ _ _ _ _ _ _  _  _ <TERM>
MODEL____G -2000<TERM>
S/N_____01234567<TERM>
ID_____ABCDEFG<TERM>
DATE<TERM>
<TERM>
START<TERM>
TIME<TERM>
<TERM>


WT___+1234.56   g<TERM>
WT___+1234.61
```

```
          .03   g<TERM>
WT___+1234.51   g<TERM>
WT___+1234.53   g<TERM>
WT___+1234.71   g<TERM>
WT    +1234.64   g<TERM>


END
TIME<TERM>
<TERM>
SIGNATURE<TERM>
<TERM>
<TERM>
---------------<TERM>
<TERM>
<TERM>
```

11. DATA MEMORY

Data memory is a function to store weighing data and unit mass in memory. Of the data in memory, the balance can only display the weighing data. The weighing data in memory is available for outputting at one time to a printer or personal computer.

One of the following data set can be stored:

- Weighing data (Up to 40 sets.)
- Unit mass in the counting mode (Up to 20 sets)

11-1 Notes on Using Data Memory

To use the memory function, set the "Data memory (data)" parameter of the function table. For details on setting the data memory, refer to "9. FUNCTION TABLE".

Releasing "Clr"

If a different type of data exists in memory when the data is stored, "Clr" appears blinking in the upper left of the display. For example, you want to store weighing data but unit mass data remains in memory.

Under such a condition, before storing data, delete the data in memory as follows:

1 Press and hold the PRINT key until SClr no with "no" blinking is displayed.

2 Press the RE-ZERO key to display SClr go with "go" blinking.

The type of data stored in memory appears on the upper left of the display as shown below:

Unit mass in the counting mode	pC
Weighing data without time and date	-d-

3 Press the PRINT key to delete all the data in memory.

4 The balance displays end and returns to the weighing mode.

11-2 Memory for Weighing Data

- The data memory function can store 40 sets of weighing data. Even if the AC adapter is removed, the data is maintained in non-volatile memory.

- It is not necessary that the printer or computer be continually connected to the balance, because the balance stores the weighing data in memory.

- The data in memory is available to be displayed on the balance for confirmation, or to output several sets of data at one time to a printer or personal computer. In the function setting, what data is to be added to the output data (ID number and data number) can be selected.

Storing the weighing data

Note
If "Clr" appears blinking in the upper left of the display, delete the data in memory.

1 Set the "Data memory (data)" parameter to "2".

2 The storing operation depends on the "Data output mode (prt)" parameter setting. Four types of operating modes are available to store data.

Key mode	When the PRINT key is pressed and the displayed value is stable, the balance stores the weighing data.
Auto print modes A and B	When the displayed value is stable and the conditions of "Auto print polarity", "Auto print difference" and reference value are met, the balance stores the weighing data.
Interval memory mode	Weighing data is stored at an interval specified in "Interval time (int)". Press the PRINT key to start and stop this mode.

The data amount in memory — 008
Memory full — FUL   Weighing data being displayed
Interval memory standby indicator
Interval memory active indicator

Data number of the data currently displayed — 008   Memory data being displayed
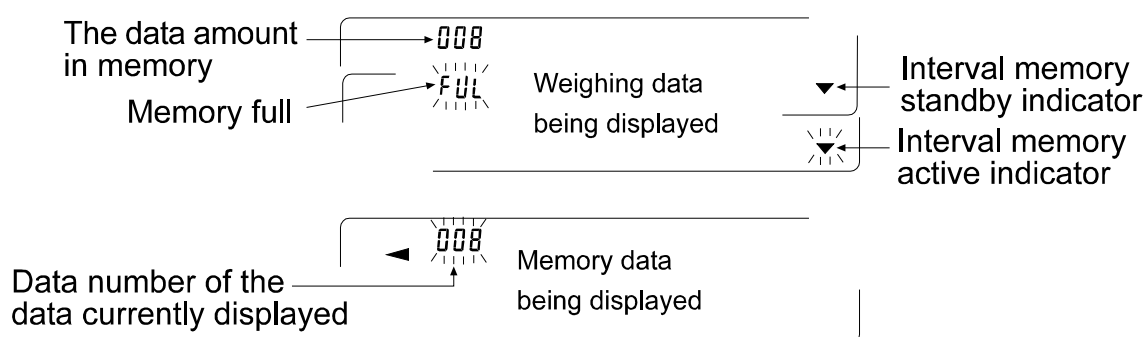
Caution

- When weighing data is being stored in memory, the data can not be output to a personal computer using the RS-232C interface.

- "fUl" indicates that memory is full or the memory capacity has been reached. More data can not be stored unless the memory data is deleted.

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● The following commands can not be used during data storage.

    Q   Query command for weighing data.

    S, $^E_{SC}$P Query command for stable weighing data.

    SI   Query command for weighing data.

    SIR   Query command for continuous weighing data.

    $^E_{SC}$: 1Bh in ASCII code

Setting the function table

Parameter settings for each output mode are as follows:

Item / Mode	Data output mode	Auto print polarity, difference	Data memory function	Interval time
Key mode	`prt 0`	Not used	`data 2`	
Auto print mode A	`prt 1`	`ap-a 0-2`	`data 2`	Not used
Auto print mode B	`prt 2`	`ap-b 0-2`	`data 2`	
Interval memory mode	`prt 3`	Not used	`data 2`	`int 0-8`

Set each item, depending on the situation, as follows:

Data number	No	`d-no 0`
	Yes	`d-no 1`
ID number	No	`5-id 0`
	Yes	`5-id 1`

Enabling data memory function

1 Press and hold the SAMPLE key until `ba5fnc` of the function table is displayed.

2 Press the SAMPLE key several times to display `dout`.

3 Press the PRINT key.

4 Press the SAMPLE key three times to display `data 0`.

5 Press the RE-ZERO key to change `data 0` to `data 1`.

6 Press the PRINT key to save.

7 Press the CAL key to return to the weighing mode.

Recalling the memory data

Confirm that the "Data memory (`data`)" parameter is set to "2".

1 Press and hold the PRINT key until `reCall` is displayed.

2 Press the PRINT key to enter the memory recall mode. Recall the data in memory using the following keys

　　　RE-ZERO key　　　　　To proceed to the next data set.

　　　MODE key　　　　　　To go back to the previous data set.

　　　PRINT key　　　　　　To transmit the current data using the RS-232C interface.

　　　With SAMPLE held down, press the CAL key
　　　　　　　　　　　　　To delete the data currently displayed.

Note: Deleting the data will not increase the number of data that can be stored.

　　　CAL key　　　　　　To exit the memory recall mode.

3 Press the CAL key to return to the weighing mode.

Transmitting all memory data at one time

Confirm that the "Serial interface (`5if`)" parameters are set properly. For details, refer to "9. FUNCTION TABLE" and "16. CONNECTION TO PERIPHERAL EQUIPMENT".

1 Press and hold the PRINT key until `reCall` is displayed.

2 Press the SAMPLE key to display `out` .

3 Press the PRINT key to display `Sout no` with "no" blinking.

5 Press the RE-ZERO key to display `out go` with "go" blinking.

6 Press the PRINT key to transmit all data using the RS-232C interface.

7 The balance displays `Clear` when all data is transmitted. Press the CAL key to return to the weighing mode.

Deleting all memory data at one time

1 Press and hold the PRINT key until `reCall` is displayed.

2 Press the SAMPLE key several times to display `Clear` .

3 Press the PRINT key to display `SClr no` with "no" blinking.

4 Press the RE-ZERO key to display `SClr go` with "go" blinking.

5 Press the PRINT key to delete all data

6 The balance displays `end` , then `reCall` when all data is deleted.

7 Press the CAL key to return to the weighing mode.

11-3 Memory for Unit Mass in the Counting Mode

● The data memory function can store 20 sets of unit mass for the counting mode. Even if the AC adapter is removed, the data is maintained in non-volatile memory. Among the 20 sets, "p01" is the memory function for the standard counting mode.

● The unit mass in memory can be recalled and used for weighing.

● The unit mass in memory can be recalled and changed.

Recalling the unit mass

1 Set the "Data memory (data)" parameter to "1".

2 Press the MODE key to select PC (counting mode).

Notes
If the counting mode can not be selected, refer to "4. WEIGHING UNITS".

If "Clr" appears blinking in the upper left of the display, delete the data in memory.

3 Press and hold the PRINT key until the balance enters
    the sample unit mass selection mode as shown below.

Unit mass number
(The second data in memory)
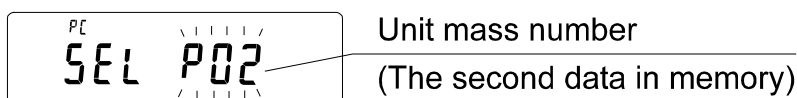
4 Select the unit mass to be used using the following keys.

RE-ZERO key	To increase the unit mass number by one.
MODE key	To decrease the unit mass number by one.
PRINT key	To select the unit mass number to be used.
CAL key	To cancel the operation and go to step 5.

5 To re-store the unit mass or perform Automatic Counting Accuracy Improvement (ACAI) on
    the stored unit mass, follow the procedure described in "5-2 Counting Mode (PC)".

Notes
ACAI can not be performed on the recalled unit mass.

Using the "UN:mm" command, the unit mass stored in memory can be recalled. ("mm" will be replaced by a two-digit number, 01 to 20, that corresponds to the unit mass numbers, P01 to P20.) The recalled unit mass can be output by the "?UW" command and can be changed by the "UW: " command.

12. UNDERHOOK

The underhook can be used for weighing large samples, magnetic materials or for measuring density. The built-in underhook is revealed by removing the plastic cap on the bottom of the balance. Use the underhook as shown below.

Cap

Underhook

Bottom of the balance
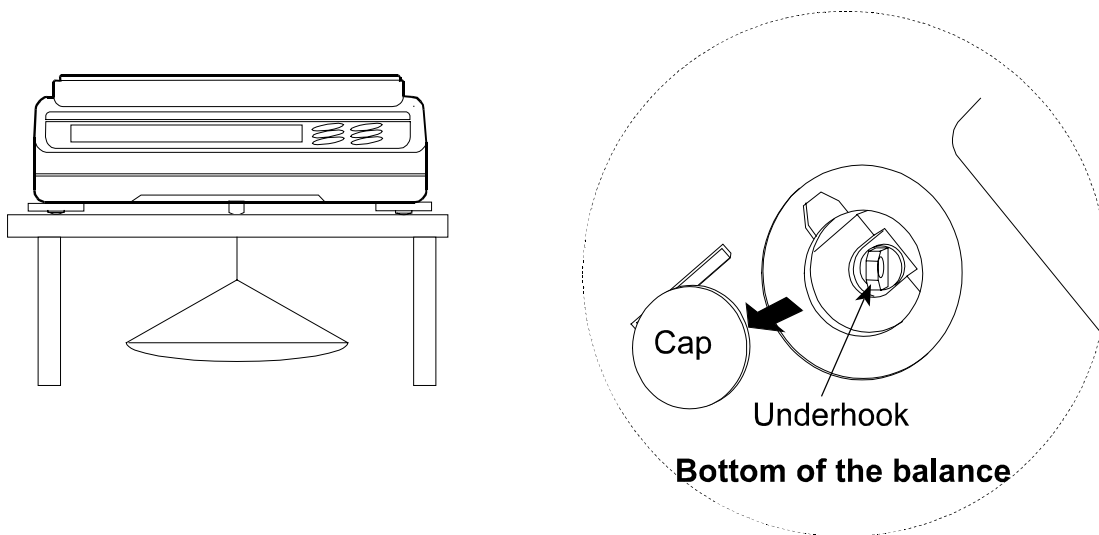
Caution
Do not apply excessive force to the underhook.
When not in use, attach the plastic cap to prevent dust from getting into the balance.

13. PROGRAMMABLE-UNIT

This is a programmable unit conversion function. It multiplies the weighing data in grams by an arbitrary coefficient set in the function table and displays the result.

The coefficient must be within the range between the minimum and maximum shown below. If the coefficient set is beyond the range, an error is displayed and the balance returns to the coefficient setting mode, prompting to enter an appropriate value. A coefficient of 1 was set at the factory.

Model	Minimum coefficient	Maximum coefficient
F3103		1000
F12102 / F31002	0.000001	100
F61001		10

Operation

1 Press and hold the $\boxed{\text{SAMPLE}}$ key until `ba5fnc` of the function table is displayed.

2 Press the $\boxed{\text{SAMPLE}}$ key several times to display $\boxed{\text{mlt}}$.

3 Press the $\boxed{\text{PRINT}}$ key. The balance enters the mode to confirm or set the coefficient.

Confirming the coefficient

4 The current coefficient is displayed with the first digit blinking.
   ● When it is not to be changed, press the $\boxed{\text{CAL}}$ key and proceed to step 8.
   ● When it is to be changed, press the $\boxed{\text{RE-ZERO}}$ key and proceed to step 6.

Setting the coefficient

5 Set the coefficient using the following keys.

$\boxed{\text{SAMPLE}}$ key	To select a digit to change the value. The selected digit blinks.
$\boxed{\text{RE-ZERO}}$ key	To change the value.
$\boxed{\text{MODE}}$ key	To change the decimal point position. Each time the switch is pressed, the decimal point position changes as follows:

0.000001 ⟶ 00.00001 ⟶ ... ⟶ 000000.1 ⟶ 0000001

$\boxed{\text{PRINT}}$ key	To store the new setting, display $\boxed{\text{end}}$ and go to step 6.
$\boxed{\text{CAL}}$ key	To cancel the new setting and go to step 6.
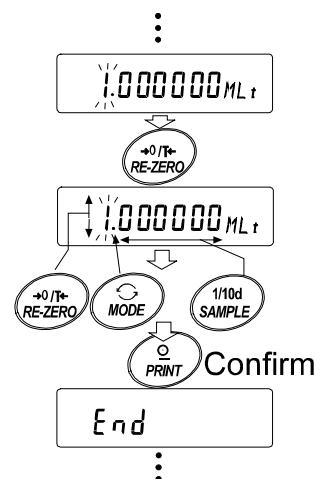
Quitting the operation

6 The balance displays $\boxed{\text{Unit}}$. Press the $\boxed{\text{CAL}}$ key to exit the programmable-unit function and return to the weighing mode.

Using the function

Press the $\boxed{\text{MODE}}$ key to select the programmble-unit (no display on the unit section). Perform weighing as described in "5-1 Basic Operation (Gram Mode)". After weighing, the balance displays the result (weighing data in grams x coefficient).

14. DENSITY MEASUREMENT

The F series balance is equipped with a density mode. It calculates the density of a solid using the weight of a sample in air and the weight in liquid.

- The density mode was not selected for use when the balance was shipped from the factory. To use the mode, change the function table and activate the density mode.

- Two ways to set the density of a liquid are available:
  by entering the water temperature or by entering the density directly.

- The density determination kit (OP-13) is available as an option for F3103.

Formula to obtain the density

The density can be obtained by the following formula.

The density can be obtained by the following formula.

$$\rho = \frac{A}{A-B} \times \rho_0$$

Where
- ρ : Density of a sample
- A: Weight value of a sample in air
- B: Weight value of a sample in liquid
- ρ_0 : Density of a liquid

Changing the function table

(1) Selecting the density mode

The density mode is available as one of the weighing units. To use the mode, select it in the function table. For details, refer to "4-2 Storing Units".

(2) Selecting a way to set the density of a liquid

Select the liquid density input method from the function table below. The function table is available only when the density mode is selected.

Class	Item	Parameter	Description
d5 fnc	ld in	0	Water temperature
Density function	Liquid density input	1	Liquid density

0 = Factory setting

Setting the density of a liquid

1. Press the MODE key as necessary to select the density mode. When the processing indicator blinks with the unit "g" displayed, it indicates that the density mode is selected.

2. In the density mode, press and hold the MODE key to enter the mode to set the liquid density.

Note
In the normal weighing mode, the same procedure will activate the manual response adjustment/self check function. These are not available in the density mode.

Entering the water temperature (ldin 0)

In the density mode, press and hold the MODE key until the water temperature currently set (unit:°C, factory setting : 25°C) is displayed. Use the following keys to change the value.

```
t    25
```
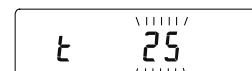
RE-ZERO key	To increase the temperature by one degree. (0-99)
MODE key	To decrease the temperature by one degree. (0-99)
PRINT key	To store the change, display end and return to the density mode.

| CAL | key | To cancel the change and return to the density mode. |

The relation between the water temperature and density is shown below.

Temp. (°C)	+0	+1	+2	+3	+4	+5	+6	+7	+8	+9
0	0.99984	0.99990	0.99994	0.99996	0.99997	0.99996	0.99994	0.99990	0.99985	0.99978
10	0.99970	0.99961	0.99949	0.99938	0.99924	0.99910	0.99894	0.99877	0.99860	0.99841
20	0.99820	0.99799	0.99777	0.99754	0.99730	0.99704	0.99678	0.99651	0.99623	0.99594
30	0.99565	0.99534	0.99503	0.99470	0.99437	0.99403	0.99368	0.99333	0.99297	0.99259
40	0.99222	0.99183	0.99144	0.99104	0.99063	0.99021	0.98979	0.98936	0.98893	0.98849
50	0.98804	0.98758	0.98712	0.98665	0.98618	0.98570	0.98521	0.98471	0.98422	0.98371
60	0.98320	0.98268	0.98216	0.98163	0.98110	0.98055	0.98001	0.97946	0.97890	0.97834
70	0.97777	0.97720	0.97662	0.97603	0.97544	0.97485	0.97425	0.97364	0.97303	0.97242
80	0.97180	0.97117	0.97054	0.96991	0.96927	0.96862	0.96797	0.96731	0.96665	0.96600
90	0.96532	0.96465	0.96397	0.96328	0.96259	0.96190	0.96120	0.96050	0.95979	0.95906

Entering the density directly (`ldin 1`)

In the density mode, press and hold the | MODE | key until the density currently set (unit : g / cm^3, factory setting : 1.000g / cm^3) is displayed. Use the following keys to change the value.

~~~
d  1.0000
~~~

| RE-ZERO | key | To set the value of the digit selected. |

| SAMPLE | key | To select the digit to change the value. |

| PRINT | key | To store the change, display | end | and return to the density mode. |

| CAL | key | To cancel the change and return to the density mode. |

Note
The range to set the density is 0.0000 to 1.9999 g / cm^3

Measuring the density

In the density measurement, the balance displays the weight of a sample in air, the weight in liquid and then the density.

● Measuring the weight of a sample in air.

~~~
12.345  g
~~~
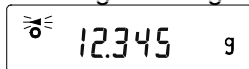
The processing indicator blinks with the unit "g" displayed.

● Measuring the weight of a sample in liquid.

~~~
9.876  g
~~~
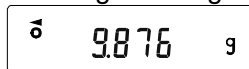
The processing indicator illuminates with the unit "g" displayed.

● Displaying the density.

~~~
5.000  DS
~~~
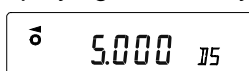
The processing indicator illuminates with "DS" displayed.

To cycle through the above three, press the | SAMPLE | key.

Note
The | SAMPLE | key can not be used to change the minimum weighing value. The density is displayed with three decimal places.

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Measuring procedure

1. Confirm that the balance is in the mode to measure the weight of the sample in air. ("g" displayed and processing indicator blinking)

2. Confirm that the balance indicates zero. If it does not indicate zero, press the RE-ZERO to reset the displayed value to zero.

3. Place the sample on the upper pan (in air). When the value displayed on the balance becomes stable, press the SAMPLE key to confirm the value (the weight of the sample in air). The balance enters the mode to measure the weight of the sample in liquid ("g" displayed and processing indicator illuminating).

Note
If a negative value or E (error) is displayed, the SAMPLE key is disabled.

4. Remove the sample from the upper pan and place it on the lower pan (in liquid). When the value displayed on the balance becomes stable, press the SAMPLE key to confirm the value (the weight of the sample in liquid). The balance enters the mode to display the density ("g" disappears).

Note
If E (error) is displayed, the SAMPLE key is disabled.

5. To output or store the density, press the PRINT key. The density output unit is "DS". To measure the density of another sample, press the SAMPLE key to return to the mode to measure the weight in air and repeat the procedure described above.

Note
If the liquid temperature or the type of liquid is changed during measurement, reset the value of the liquid density as necessary. For details, refer to "Setting the density of a liquid".
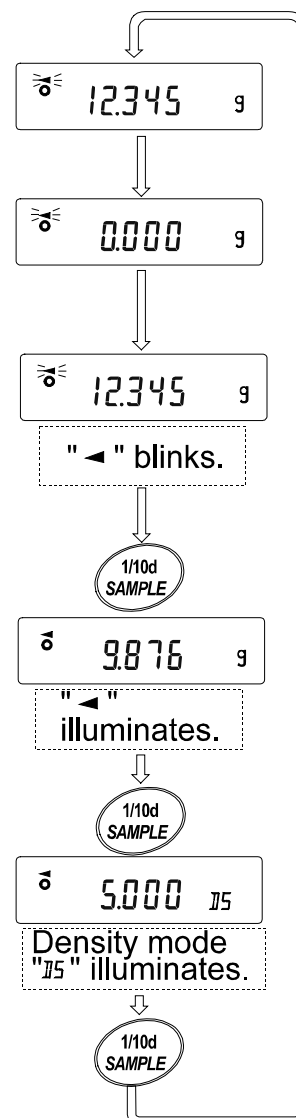
15. RS-232C SERIAL INTERFACE / EXTERNAL INPUT

Transmission system   : EIA RS-232C

Transmission form   : Asynchronous, bi-directional, half duplex

Data format   : Baud rate   : 600, 1200, 2400, 4800, 9600 bps

                              Data bits   : 7 or 8 bits

                              Parity   : Even, Odd   (Data bits 7 bits)

                                                  None   (Data bits 8 bits)

                              Stop bit   : 1 bit

                              Code   : ASCII
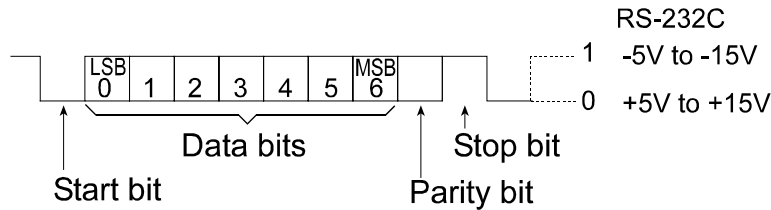
Pin connections

Pin No.	Signal name	Direction	Description
1	FG	-	Frame ground
2	RXD	Input	Receive data
3	TXD	Output	Transmit data
4	RTS	Input	Ready to send
5	CTS	Output	Clear to send
6	DSR	Output	Data set ready
7	SG	-	Signal ground
18	PRINT	Input	Same as the PRINT key
19	RE-ZERO	Input	Same as the RE-ZERO key
8 – 25 (Excluding 18 and 19)	-	-	Not connected

Circuits

RS-232C
D-Sub25 pin, female connector
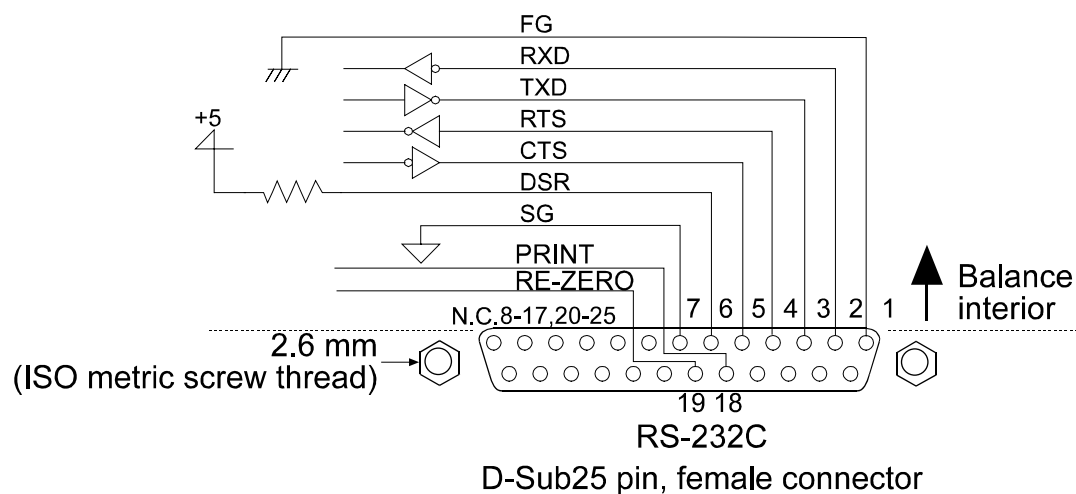
External input

Pin 18 and pin 19 perform the same function as pressing the PRINT and RE-ZERO keys respectively by connecting each pin to pin 7 for at least 100 m seconds.
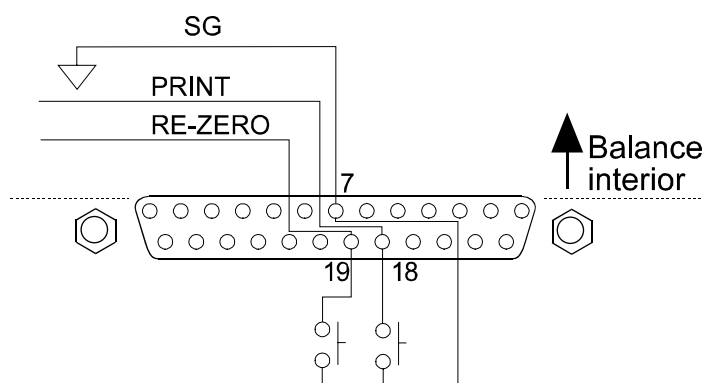
16. CONNECTION TO PERIPHERAL EQUIPMENT

16-1 Connection to the AD-8121 Printer

Set the following parameters to use the AD-8121 printer.

Function setting		Description
dout prt 0-3		Selects a print mode.
dout ap-p 0-2		Selects the polarity for the auto print mode.
dout ap-b 0-2		Selects the auto print difference.
dout pU5e 0,1		Selects data output pause.
5if bp5 2	Factory setting	2400 bps
5if btpr 0	Factory setting	7 bits, Even parity check
5if Crlf 0	Factory setting	CR, LF
5if Ct5 0	Factory setting	CTS and RTS control, not used

When "MODE 1" or "MODE 2" of the AD-8121 printer is used		
5if type 0	Factory setting	standard format

When "MODE 3" of the AD-8121 printer is used.	
5if type 1	DP format

When data is transmitted continuously. When all memory data is transmitted at one time.	
dout pU5e 1	Uses pause.

Note

The printer performs as follows, depending on the data memory setting.

Setting	What is printed
data 0	The weighing data
data 2	The weighing data stored in memory

Refer to "10. ID NUMBER AND GLP REPORT" for a print sample.

17. COMMANDS

17-1 Command List

Commands to query weighing data

C	Cancels the **S** or **SIR** command.
Q	Requests the weighing data immediately.
S	Requests the weighing data when stabilized.
SI	Requests the weighing data immediately.
SIR	Requests the weighing data continuously.
$^E{}_{SC}$P	Requests the weighing data when stabilized.

Commands to control the balance

CAL	Same as the CAL key.
MCL	Deletes all data in memory.
MD:nnn	Deletes weighing data with the data number nnn.
OFF	Turns the display off.
ON	Turns the display on.
P	Same as the ON:OFF key
PRT	Same as the PRINT key
R	Same as the RE-ZERO key
SMP	Same as the SAMPLE key.
U	Same as the MODE key
T	Same as the RE-ZERO key
Z	Same as the RE-ZERO key
$^E{}_{SC}$T	Same as the RE-ZERO key

Commands to control the memory function

?MA	Outputs all data in memory.
?MQnnn	Outputs weighing data with the data number nnn.
?MX	Outputs the number of weighing data in memory.
MCL	Deletes all data in memory.
MD:nnn	Deletes weighing data with the data number nnn.
UN:mm	Changes the unit mass stored in memory with the number of mm (01-20).
?UN	Outputs the unit mass number of the selected unit mass.
UW:∗∗∗.∗∗ g	Sets the unit mass value. e.g.,UW:+0.123 g (to set the unit mass to 0.123 g: represents a space.)
?UW	Outputs the unit mass value of the selected unit mass number.

Commands to control the comparator function

HI:∗∗∗.∗∗ g	Sets the upper limit value. e.g.,HI:+2.34 g (to set the upper limit value to 2.34 g: represents a space.)
LO:∗∗∗.∗∗ g	Sets the lower limit value. e.g.,LO:+1.23 g (to set the lower limit value to 1.23 g: represents a space.)
?HI	Outputs the upper limit value.
?LO	Outputs the lower limit value.

Notes

"nnn" and "mm" indicate, respectively, three-digit and two-digit numerical values.

$^E{}_{SC}$: 1Bh in ASCII code

Before transmitting a command, add the terminator (<CR><LF> or <CR>), that is specified in the "Terminator (`Crlf`)" parameter of "Serial interface (`5if`)" in the function table, to the command.

17-2 Acknowledge Code and Error Codes

When the "Serial interface function (5if)" parameter is set to "erCd 1", the balance outputs <AK> code or an error code for each command as follows:

<AK> (06h)　　　Acknowledge in ASCII code.

- When the balance receives a command to request data and can not process it, the balance transmits an error code (EC, Exx).
  When the balance receives a command to request data and can process it, the balance outputs the data.

- When the balance receives a command to control the balance and can not process it, the balance transmits an error code (EC, Exx).
  When the balance receives a command to control the balance and can process it, the balance transmits the acknowledge code.

  Among commands to control the balance, the following transmit the acknowledge code both when the balance receives the command and when the balance has accomplished the command. If the command can not be processed properly, the balance transmits an error code (EC, Exx). This error can be released using the CAL command.

  CAL command (Calibration command)　　　　ON command (Display ON command)

  P command (Display ON/OFF command)　　　R command (RE-ZERO command)

- When a communication error has occurred due to external noise, or a parity error has occurred due to transmission error, the balance transmits an error code. In this case, send the command again.

17-3 Control Using CTS and RTS

Depending on the "Ct5" parameter of "Serial interface (5if)", the balance performs as follows:

Ct5 0
Regardless of whether the balance can receive a command or not, the balance keeps the CTS line HI. The balance outputs data regardless of the condition of the RTS line.

Ct5 1
The CTS line is kept Hi normally. When the balance can not receive the next command (e.g. while the balance is processing last command), the balance sets the CTS line to Lo. The balance confirms the level of the RTS line before outputting a set of data. If the RTS level is Hi, the balance outputs data. If the RTS level is Lo, data is not output (The data is canceled).

17-4 Settings Related to RS-232C

Concerning the RS-232C, the balance has two functions: "Data output (dout)" and "Serial interface (5if)". Set each function as necessary.

18. MAINTENANCE

- Do not disassemble the balance. Contact the local Oxford dealer if the balance needs service or repair.

- Use the original packing material for transportation.

- Do not use organic solvents to clean the balance. Clean the balance with a lint free cloth that is moistened with warm water and a mild detergent.

19. TROUBLESHOOTING

19-1 Checking the Balance Performance and Environment

The balance is a precision instrument. When the operating environment or the operating method is inadequate, correct weighing can not be performed. Place a sample on the pan and remove it, and repeat this several times. If the balance seems to have a problem with repeatability or to perform improperly, check as described below. If improper performance persists after checking, contact the local Oxford dealer for repair.

Checking that the balance performs properly

- Check the balance performance using the self-check function as described in "6-2 Self Check Function".

  An error display appears when a malfunction is found.

- Check the balance repeatability using an external weight. Be sure to place the weight in the center of the weighing pan.

- Check the balance repeatability, linearity and calibrated value using external weights with a known value.

Checking that the operating environment or weighing method is proper

Operating environment

- Is the weighing table solid enough (especially for the F3103, the balance with a minimum weighing value of 0.001 g)?

- Is the balance level? Refer to "3-1 Before Use".

- Is the operating environment free from vibration and drafts? For the F3103, has the breeze break been installed?

- Is there a strong electrical or magnetic noise source such as a motor near the balance?

Weighing method

- Does the weighing pan touch the breeze ring or anything? Is the weighing pan installed correctly?

- Is the RE-ZERO key pressed before placing a sample on the weighing pan?

- Is the sample placed in the center of the weighing pan?

- Has the balance been calibrated using the external mass?

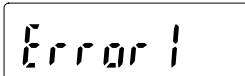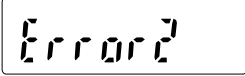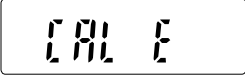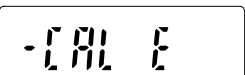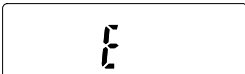- Has the balance been warmed up for 30 minutes before weighing?

Sample and container

● Has the sample absorbed or lost moisture due to the ambient conditions such as temperature and humidity?

● Has the temperature of the container been allowed to equalize to the ambient temperature? Refer to "3-2 During Use".

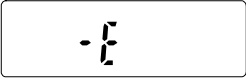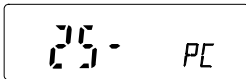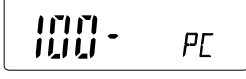● Is the sample charged with static electricity? Refer to "3-2 During Use".

   The F3103 is prone to be charged with static electricity when the relative humidity is low.

● Is the sample of magnetic material such as iron? Caution is required for weighing magnetic materials. Refer to "3-2 During Use"

19-2 Error Codes

Display Error code	Description
EC, E11 `Error 1`	**Stability error** The balance can not stabilize due to an environmental problem. Prevent vibration, drafts, temperature changes, static electricity and magnetic fields. Refer to "3. PRECAUTIONS" for details on the operating environment and "6. RESPONSE ADJUSTMENT" about adapting the balance to the environment. To return to the weighing mode, press the CAL key.
`Error2`	**Out of range error** The value entered is beyond the settable range. Re-enter the value.
EC, E20 `CAL E`	**Calibration weight error** The calibration weight is too heavy. Confirm the calibration weight value. Press the CAL key to return to the weighing mode.
EC, E21 `-CAL E`	**Calibration weight error** The calibration weight is too light. Confirm the calibration weight value. Press the CAL key to return to the weighing mode.
`E`	**Overload error** A sample beyond the balance weighing capacity has been placed on the pan. Remove the sample from the pan.

Display	Error code	Description
-E		**Weighing pan Error** The weight value is too light. Confirm that the weighing pan is properly installed and calibrate.
Lo		**Sample mass error** The balance can not store the sample for the counting mode or for the percent mode because it is too light. Use a larger sample.
25- PC 50- PC 100- PC		**Unit mass error** The sample unit mass for the counting mode is too light. Storing and using it for counting will cause a counting error. Add samples to reach the specified number and press the PRINT key. Pressing the PRINT key without adding samples will shift the balance to the counting mode. But, to acquire accurate weighing, be sure to add samples.
CH no (CHECK NO)		**Internal error** Indicates an internal error as the result of self-check function. Repair is required. Contact the local Oxford dealer.
FUL (Blinking)		**Memory full** The amount of weighing data in memory has reached the maximum capacity. Delete data in memory to store new data. For details, refer to "11. DATA MEMORY".
CLr		**Memory type error** Type of memory set in the function table and type of data stored are different. For details, refer to "11. DATA MEMORY".
	EC, E00	**Communications error** A protocol error occurred in communications. Confirm the format, baud rate and parity.
	EC, E01	**Undefined command error** An undefined command was received. Confirm the command.
	EC, E02	**Not ready** A received command can not be processed. e.g. The balance received a Q command, but not in the weighing mode. e.g. The balance received a Q command while processing a RE-ZERO command. Adjust the delay time to transmit a command.

Display Error code	Description
EC, E03	**Timeout error**
	If the timeout parameter is set to "t-Up1", the balance did not receive the next character of a command within the time limit of one second.
	Confirm the communication.
EC, E04	**Excess characters error**
	The balance received excessive characters in a command.
	Confirm the command.
EC, E06	**Format error**
	A command includes incorrect data.
	e.g. The data is numerically incorrect.
	Confirm the command.
EC, E07	**Parameter setting error**
	The received data exceeds the range that the balance can accept.
	Confirm the parameter range of the command.
Other errors	If the errors described above can not be released or other errors are displayed, contact the local Oxford dealer.

19-3 Asking For Repair

If the balance needs service or repair, contact the local Oxford dealer.

The balance is a precision instrument. Use much care when handling the balance and observe the following when transporting the balance.

- Use the original packing material.
- Remove the weighing pan from the main unit

20. SPECIFICATIONS

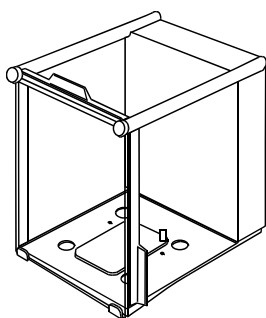|	F3103	F12102	F31002	F61001
Weighing capacity	310 g	1210 g	3100 g	6100 g
Maximum display	310.084 g	1210.84 g	3100.84 g	6108.4 g
Minimum weighing value (1 digit)	0.001 g	0.01 g		0.1 g
Repeatability (Standard deviation)	0.001 g	0.01 g		0.1 g
Linearity	±0.002 g	±0.02 g		±0.1 g
Stabilization time (typical at FAST)	Approx. 1 second			
Sensitivity drift (10°C-30°C/50°F-86°F)	±2 ppm/°C			±5 ppm/°C
Counting mode Minimum unit mass	0.001 g	0.01 g		0.1 g
Number of samples	10, 25, 50 or 100 pieces			
Percent mode Minimum 100% reference mass	0.100 g	1.00 g		10.0 g
Minimum 100% display	0.01%, 0.1%, 1% (Depends on the reference mass stored.)			
External calibration weight (**Bald type** = Factory setting)	300 g **200 g** 100 g	**1000 g** 500 g	3000 g **2000 g** 1000 g	6000 g **5000 g** 4000 g 3000 g 2000 g
Weighing pan	128 x 128 mm	165 x 165 mm		
Net weight	Approx. 3.8 kg	Approx. 4.3 kg		
Display refresh rate	5 times/second or 10 times/second			
Operating environment	5°C to 40°C (41°F to 104°F), 85%RH or less (No condensation)			
External dimensions	210 (W) x 317 (D) x 86 (H) mm			
AC adapter	Confirm that the adapter type is correct for the local voltage and power receptacle type			
Power consumption	Approx. 11VA (supplied to the AC adapter)			
Interface (Provided as standard)	RS-232C			

21. OPTIONS

AD-8121 Printer

- Compact dot-matrix printer
- Statistical function, clock and calendar function, interval print function, graphic print function, terminal mode
- 5 x 7 dots, 16 characters per line
- Print paper (AX-PP143, 45 (W) x 50 (L) mm , ø65 mm)
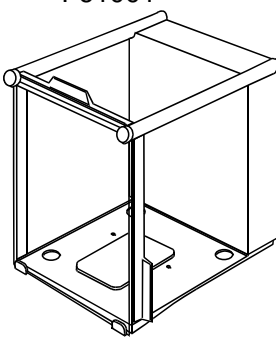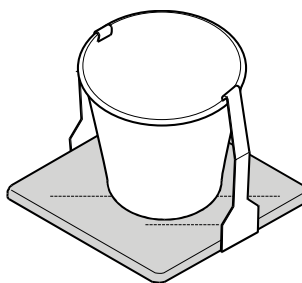- AC adapter or alkaline battery.
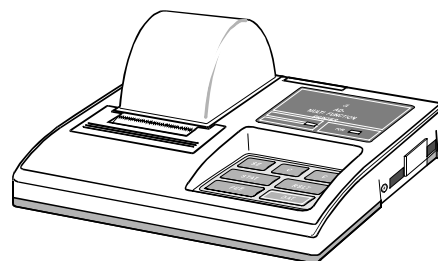
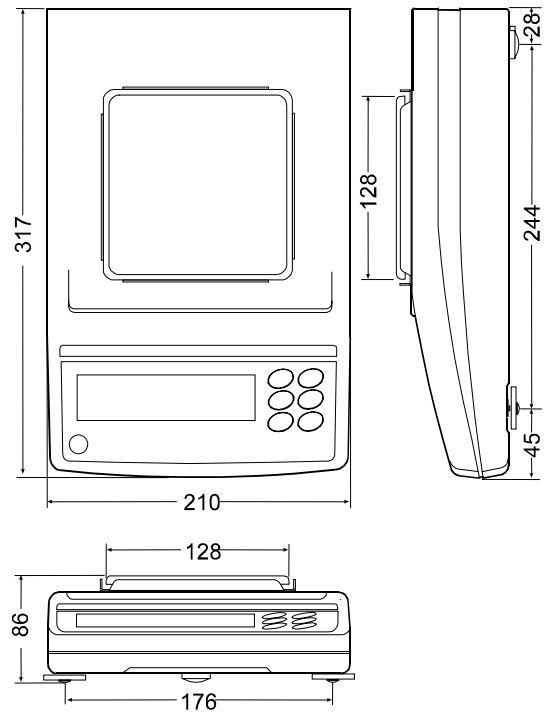| **Glass Breeze Break (OP-10)**	**Glass Breeze Break (OP-11)**	**Animal Weighing Bowl Kit (OP-12)**	**Density Determination Kit (OP-13)**
For F3103	For F12102 / F31002 F61001	For F12102	For F3103
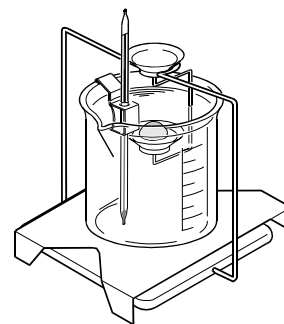
Options installed at the factory before shipment:
OP-04: Comparator output with a buzzer / RS-232C / Current loop output
OP-06: Analog output / Current loop output

22. EXTERNAL DIMENSIONS

F3103

F12102 / F31002 / F61001