MC series

Mass comparator

INSTRUCTION MANUAL

MC-1000
MC-6100

A&D

A&D Company, Limited

This Manual and Marks

All safety messages are identified by the following, "WARNING" or "CAUTION", of ANSI Z535.4 (American National Standard Institute: Product Safety Signs and Labels). The meanings are as follows:

⚠ WARNING	A potentially hazardous situation which, if not avoided, could result in death or serious injury.
⚠ CAUTION	A potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

⚠ This is a hazard alert mark.

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1. INTRODUCTION

This manual describes how the MC Series Mass Comparator Balances, MC-1000 and MC-6100, work, and how to get the most out of them in terms of performance.

Read this manual thoroughly before using the balance and keep it at hand for future reference.

For other functions and operations that this manual does not describe, refer to the GX series instruction manual.

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

- Display resolution, one digit greater than a standard balance. This allows management of OIML class F1 weights.

- Capable of weighing small amounts of powdery or liquid material, even with a massive tare.

- When used as a mass comparator, the balance can achieve even more precise weighing, by using the optional auto-centering pan (sold separately), which reduces eccentric loading errors.

1-3 Compliance

Compliance with FCC Rules

Please note that this device generates, uses and can radiate radio frequency energy. This device 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 this device is operated in a commercial environment. If this unit is operated in a residential area, it may 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.)

2. UNPACKING THE BALANCE

- 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..

2-1 MC-1000

Main unit

Weighing pan

Dust guard

Display

Bubble spirit level

Keys

Reference card

Leveling foot

RS-232C serial interface (External input terminal)

Grounding terminal

Main unit rear

AC adapter jack

AC adapter ID label

AC adapter

Note

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

Breeze break securing screw (2 pieces)

Windows Communication Tools WinCT

Main unit cover

Glass breeze break

4

Glass breeze break installation procedure

Caution: During installation, do not apply excessive force to the balance.

1. Remove the weighing pan, pan support receptors, and dust guard from your balance. To remove the dust guard, remove the two screws that secure it to the balance.

Weighing pan

Pan support receptor (4 pieces)

Dust guard securing screw (2 pieces)

Dust guard

Main unit

2. Place the breeze break on the main unit

Breeze break

3. Secure the breeze break to the main unit using two screws provided with the breeze break. Replace the pan support receptors and weighing pan.

Weighing pan

Pan support receptor (4 pieces)

Breeze break securing screw (2 pieces)

Rear left

Shock absorber

Front right

- When installing the pan support receptors at the front right and rear left, note the following:

  Push in the pan support receptors so that the shock absorber springs are above the receptor head surface. If the pan support receptors are hard to push in, hold the head of the receptor as shown below and push it in while rotating the head to the right and left.

- Keep the removed dust guard and dust guard securing screws (2 pieces).

- To reinstall the dust guard after removing the breeze break, use the two screws to secure the dust guard.

- The dust guard securing screws and breeze break securing screws are different in length.

Auto-centering pan (AX-MC1000PAN) installation procedure

Caution: During installation, do not apply excessive force to the balance.

● **When used as a mass comparator, the balance can achieve even more precise weighing, by using the auto-centering pan (sold separately), which reduces eccentric loading errors.**

1. At step 2 of the glass breeze break installation procedure, secure the breeze break provided with the AX-MC1000PAN option using the breeze break securing screws provided with the option. At this time make sure that the side of the breeze break with the screws is placed at the back. Attach the pan support receptors to the shock absorbers.

2. Place the auto-centering pan guide on the pan support receptors, and then place the auto-centering pan on the guide.

Note

When replacing the weighing pan with the auto-centering pan, be sure to calibrate the balance before weighing.
Refer to "7. CALIBRATION".

2-2 MC-6100

Weighing pan

Breeze ring

Dust guard

Display

Bubble spirit level

Keys

Reference card

Main unit

Max 6100g Min 0.1g e=0.01g d=0.001g

Leveling foot

RS-232C serial interface
(External input terminal)

Grounding terminal

AC adapter jack

Main unit rear

AC adapter
ID label

AC adapter

Note

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

Windows Communication Tools
WinCT

Main unit cover

Breeze break
securing screw
(2 pieces)
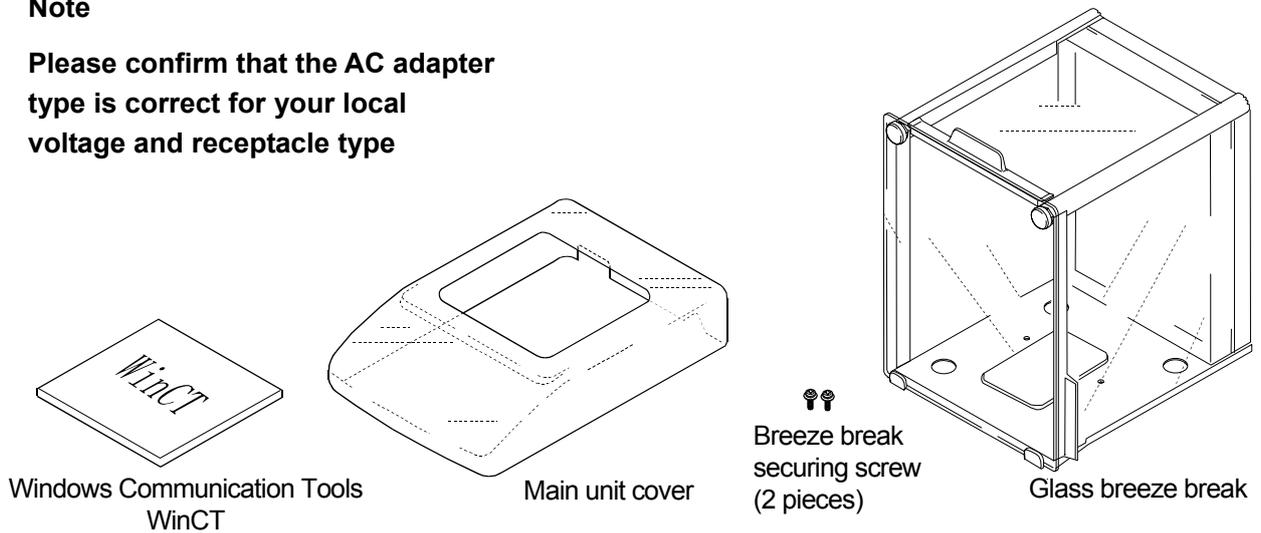
Glass breeze break

Glass breeze break installation procedure

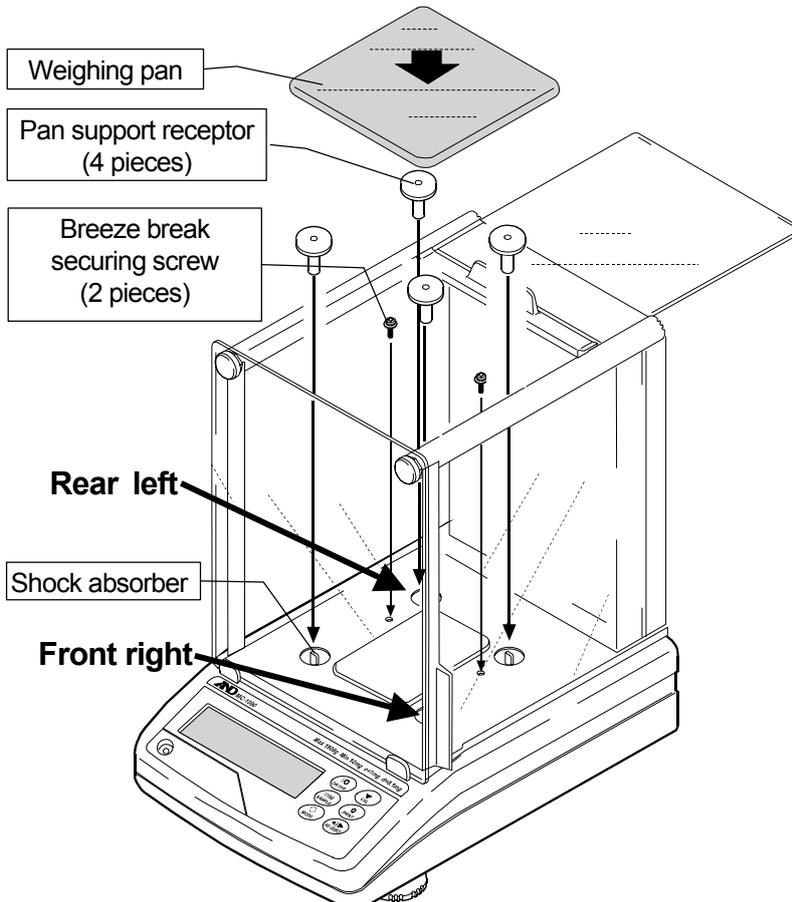**Caution: During installation, do not apply excessive force to the balance.**

1. Remove the weighing pan, breeze ring, pan support receptors, and dust guard from your balance.
To remove the dust guard, remove the two screws that secure it to the balance.

Weighing pan

Breeze ring

Dust guard securing screw (2 pieces)

Pan support receptor (4 pieces)

Dust guard

Main unit
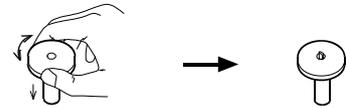
2. Place the breeze break on the main unit

Breeze break

3. Secure the breeze break to the main unit using two screws provided with the breeze break.
Replace the pan support receptors and weighing pan.

Weighing pan

Pan support receptor (4 pieces)

Breeze break securing screw (2 pieces)

Rear left

Shock absorber
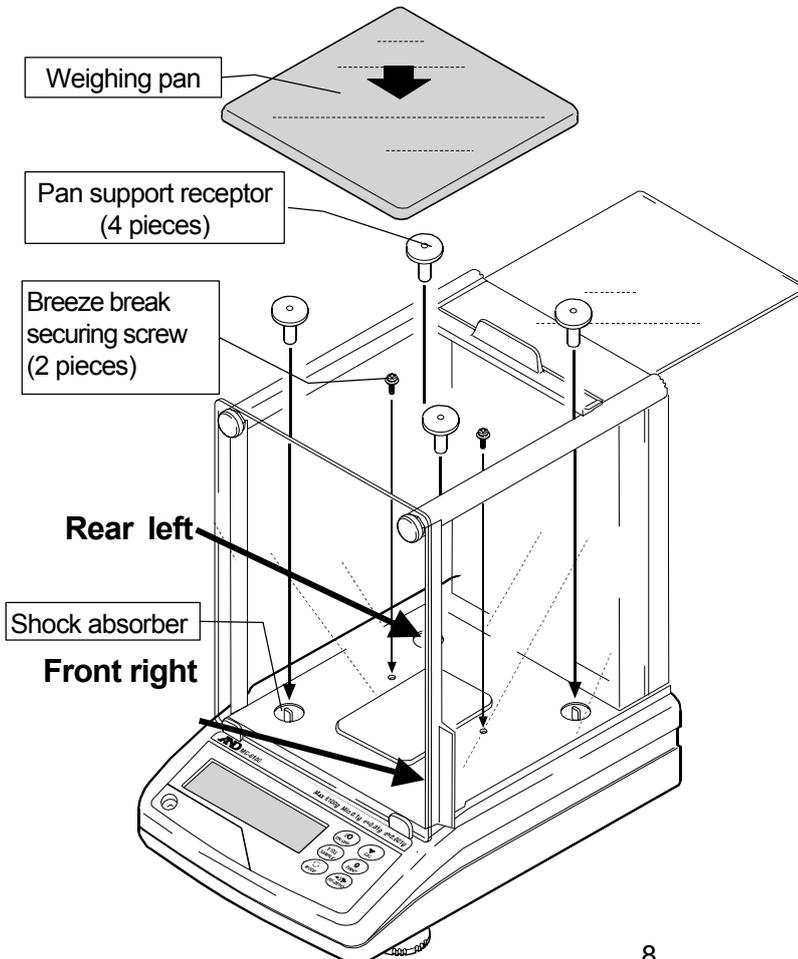
Front right

- When installing the pan support receptors at the front right and rear left, note the following:

  Push in the pan support receptors so that the shock absorber springs are above the receptor head surface. If the pan support receptors are hard to push in, hold the head of the receptor as shown below and push it in while rotating the head to the right and left.
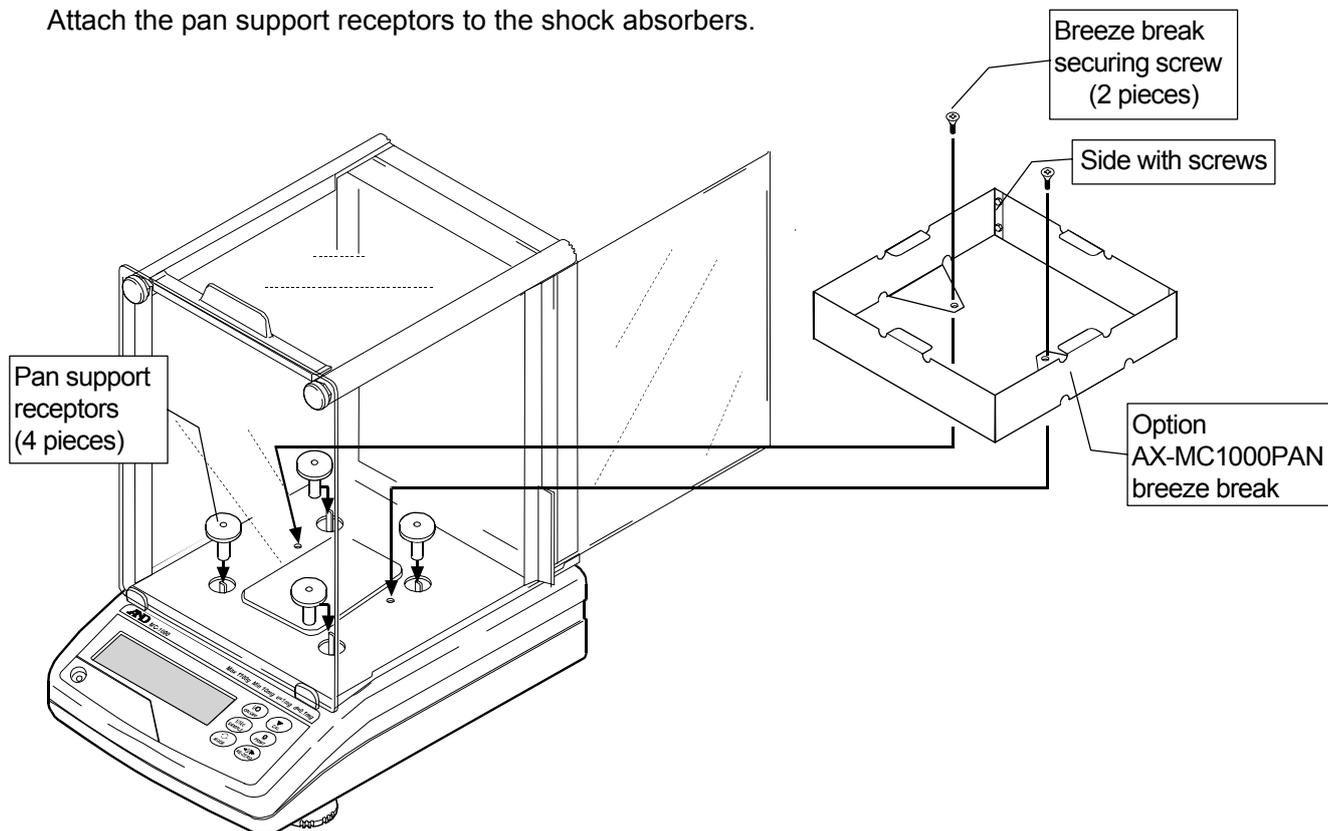
- Keep the removed dust guard, dust guard securing screws (2 pieces) and breeze ring.

- To reinstall the dust guard after removing the breeze break, use the two screws to secure the dust guard.

- The dust guard securing screws and breeze break securing screws are different in length.

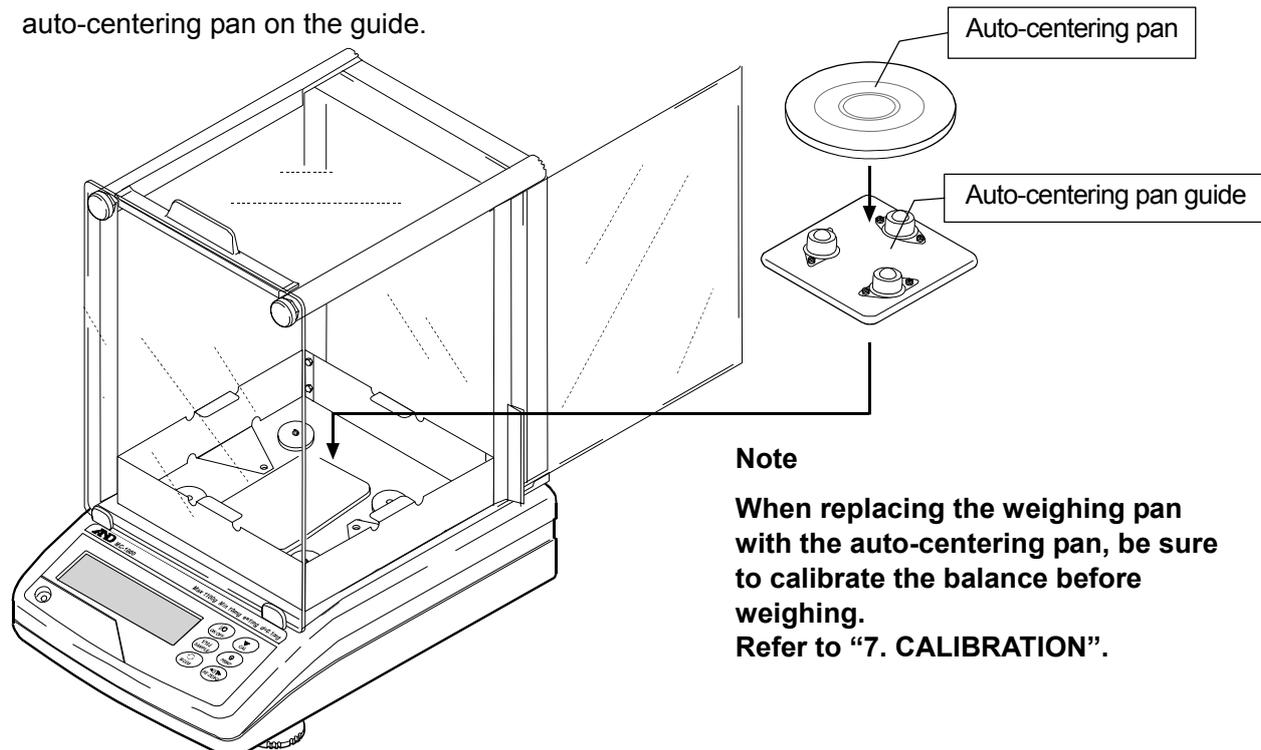## Auto-centering pan (AX-MC6100PAN) installation procedure

Caution: During installation, do not apply excessive force to the balance.

● **When used as a mass comparator, the balance can achieve even more precise weighing, by using the auto-centering pan (sold separately), which reduces eccentric loading errors.**
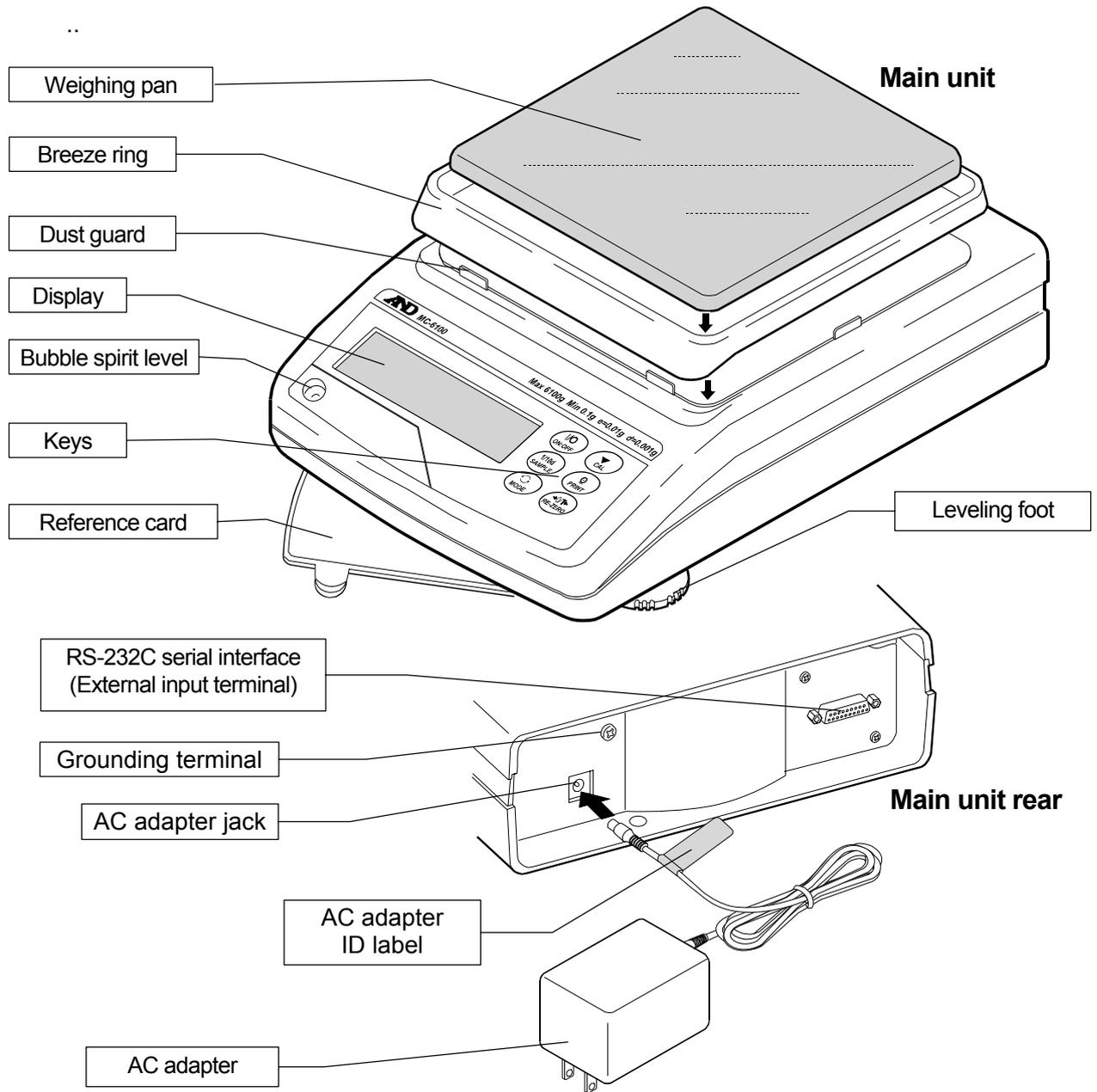
1. At step 2 of the glass breeze break installation procedure, secure the breeze break provided with the AX-MC6100PAN option using the breeze break securing screws provided with the option. At this time make sure that the side of the breeze break with the screws is placed at the back. Attach the pan support receptors to the shock absorbers.

Breeze break securing screw (2 pieces)

Side with screws

Option AX-MC6100PAN breeze break

Pan support receptors (4 pieces)

2. Place the auto-centering pan guide on the pan support receptors, and then place the auto-centering pan on the guide.
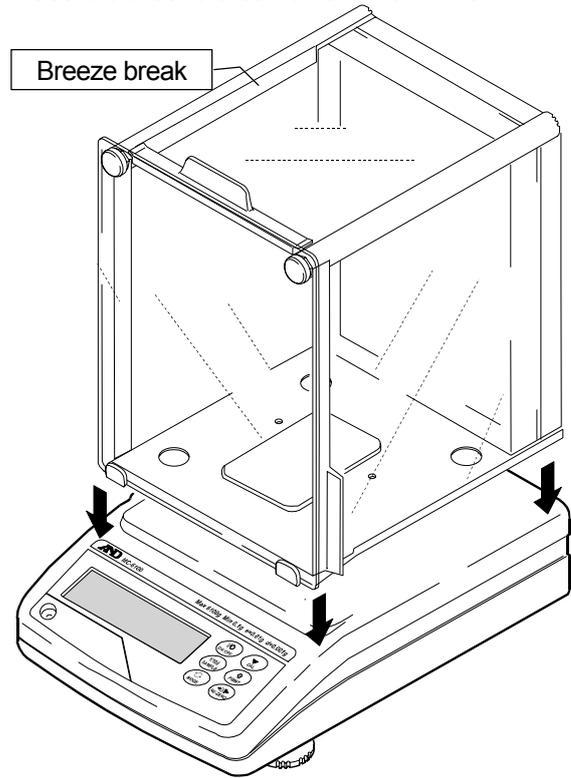

Auto-centering pan

Auto-centering pan guide

When placing on the pan support receptors, tilt the auto-centering pan guide to the left and right, forward and backward.

Note

When replacing the weighing pan with the auto-centering pan, be sure to calibrate the balance before weighing. Refer to "7. CALIBRATION".
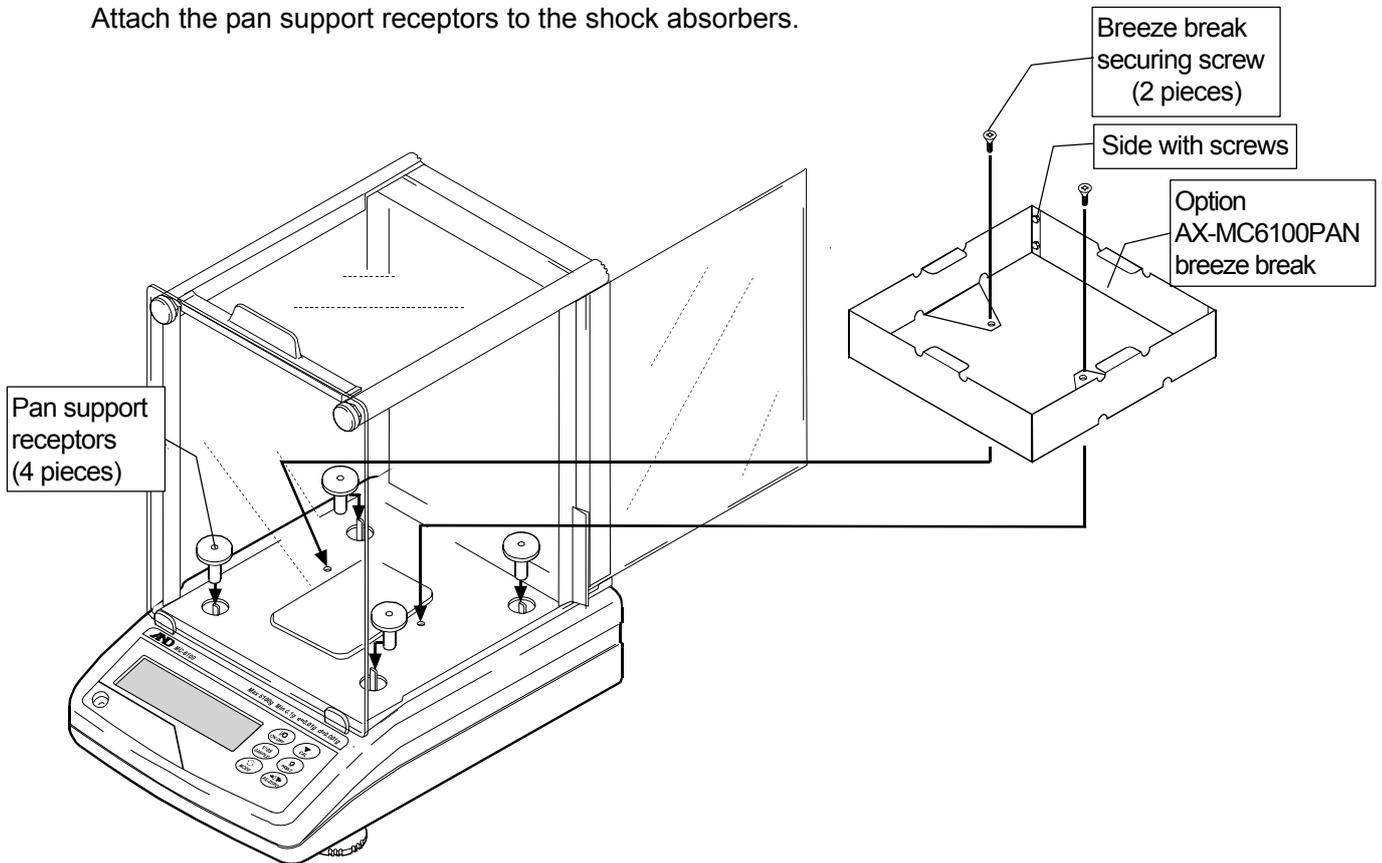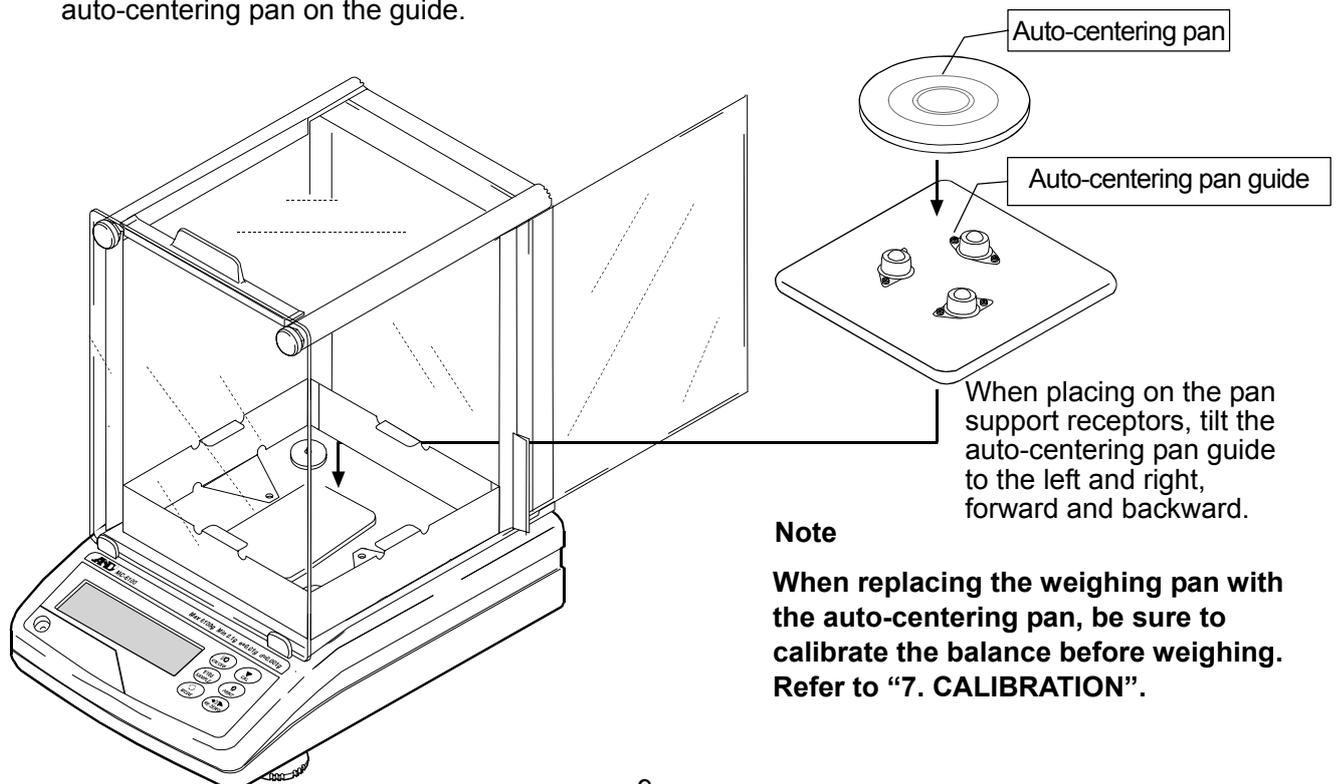
2-3 Installing the Balance

Install the balance as follows:

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

2. Assemble the balance as shown in "2. UNPACKING THE BALANCE".

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

- The MC series is a high-precision balance with a resolution of 1/10000000. It is prone to changes in temperature and pressure, static electricity, drafts and vibration of the installation site. During calibration using an internal mass, it resolves up to one digit lower than the minimum weighing value. Therefore, be sure to place the balance in a stable environment.

- The best operating temperature is about 20°C±2°C at 45-60% 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.

- If static electricity is a problem at the installation site, use the electrostatic field meter and the static eliminator.

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

Good   No good

Leveling foot   Bubble spirit level
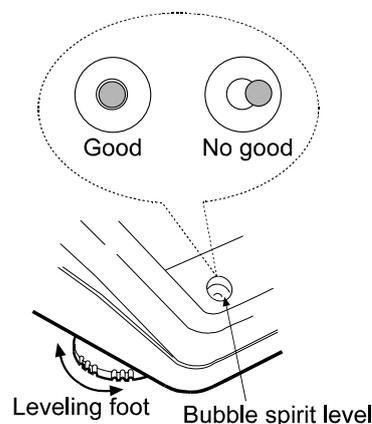
- Warm up the balance for at least 30 minutes. Plug in the AC adapter as usual.
- Calibrate the balance periodically for accurate weighing.
- Before using the balance for the first time or after having moved it to another location, warm up the balance for six hours or more to allow the balance to reach equilibrium with the room temperature, and then calibrate the balance.

Caution

Do not install the balance where flammable or corrosive gas is present.

3-2 During Use

- Static charge may cause weighing errors. When the ambient humidity is less than 45% RH, insulators such as plastic or glass are prone to static electricity. Discharge static electricity from the material to be weighed (hereinafter referred to as sample). Ground the balance and try the following:

  - Eliminate the static electricity by using an optional static eliminator, AD-1683,
  - Or try to keep the ambient humidity above 45%RH.
  - Or use a metal shield case.
  - Or wipe a charged plastic sample with the wet cloth.

Charged material
Metal case
Grounding

- 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.

Magnetic material
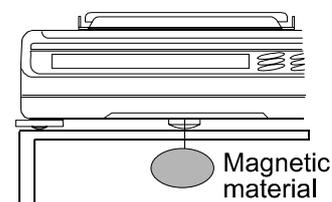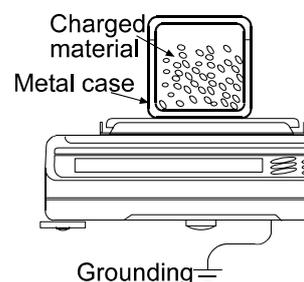
- Cancel the temperature difference between a sample, tare and the environment. When a sample is warmer (cooler) than the ambient temperature, the sample will be lighter (heavier) than the true weight. This error is due to a rising (falling) draft around the sample.

- 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.

- 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.

3-3 After Use

- Avoid mechanical shock to the balance.

- Do not disassemble the balance. Contact the local A&D 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.

- Protect the internal parts of the balance from liquid spills and excessive dust.

3-4 Power Supply

- Do not remove the AC adapter while the internal mass is in motion, for example, right after the AC adapter is connected, or during calibration using the internal mass.
  If the AC adapter is removed under the conditions described above, the internal mass will be left unsecured, that may cause mechanical damage when the balance is moved.
  Before removing the AC adapter, press the ON:OFF key and confirm that zero is displayed.

- When the AC adapter is connected, the balance is in the standby mode if the standby indicator is on (refer to "4. 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.

4. DISPLAY SYMBOLS AND KEY OPERATION

Display symbols

□ Displays the highest-order digit when placing a load of 1 kg or more on the MC-1000.
□ Displays data stored in memory.
□ Displays the weight data relative to the weighing capacity, in percentage, in the weighing mode (Capacity indicator).

Response indicators (Weighing speed)

Animal mode indicator

Processing indicator

Comparator indicators

Stabilization indicator

Units

Standby indicator

Interval memory standby indicator

Data number of the data currently displayed

Weight data or stored data

Processing indicator

Blinking indicators

Prior notice indicator of automatic self calibration

Interval memory active indicator

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"

Key	When pressed	When pressed and held
I/Ò ON:OFF	Turns the display on and 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 and off. In the counting or percent mode, enters the sample storing mode.	Enters the function table mode. Refer to "9. FUNCTION TABLE".
MODE	No function at the factory setting. Switches the weighing units when units other than "g" are stored in the function setting.	Performs response adjustment and self check.
CAL	Performs calibration of the balance using the internal mass.	Displays calibration-related 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 settings.	No function at the factory setting. By changing the function setting: Outputs "Title block" and "End block" for GLP report. Displays the data memory menu.
→0/T← RE-ZERO	Sets the display to zero.	

5-1 Selecting the Weighing Units (Modes)

The unit "g" (gram) was set at the factory.
To use other units, select and store units and displaying order in the function setting of " $Un\,it$ ".

For details on weighing unit selection procedure, refer to the GX series instruction manual, "5. WEIGHING UNITS".

5-2 Basic Weighing

When using as a mass comparator

● To reduce the influence of drafts and vibration, set the following function settings as below.
"Condition ($Cond$)" of "Environment, Display ($bASFnc$)" to "Slow (2)"
"Filter ($F\,IL$)" of ""Environment, Display ($bASFnc$)" to "Used (1)"

For details, refer to "9. FUNCTION TABLE".

● To avoid eccentric loading errors, place the sample in the center of the weighing pan.
As an option, auto-centering pans are available: AX-MC1000PAN for the MC-1000 and AX-MC6100PAN for the MC-6100.
Using an AD-8922A remote controller, which is sold separately, the balance can be controlled remotely by the AD-8922A key operations in the same way as when the CAL or RE-ZERO key of the balance is pressed. For the connection procedure between the balance and the AD-8922A, refer to the AD-8922A instruction manual.

● Take measures against causes of weighing error at the installation site, such as changes in temperature, atmospheric pressure, drafts, vibration and static electricity. Perform weighing operations in a stable environment.

● The table below lists the weight class and recommended measuring range for each model of the MC series. The measuring range is determined so that the balance repeatability is to be less than one third of the maximum permissible error for each weight class.

Weight class and recommended measuring range

Model	MC-1000				MC-6100			
Class	F1	F2	M1	M2	F1	F2	M1	M2
5 kg					↑	↑	↑	↑
2 kg					↓			
1 kg	↑	↑	↑	↑		↓		
500 g	↓							
200 g							↓	
100 g								
50 g		↓						↓
20 g								
10 g								
5 g								
2 g								
1 g			↓					
500 mg								
200 mg								
100 mg				↓				

(Left column label: Weight (Displayed value))

▢ F1   ▢ F2   ▢ M1   ▢ M2

When building into a system

- When a special weighing pan is to be designed, the weight of the pan and the material to be weighed should not exceed the weighing capacity of the balance.
  To reduce influences of static electricity and magnetism, use materials other than resin and magnetic material such as iron.

- There is a function available to maintain the previous weight value in non-volatile memory, even if the AC adapter is removed.
  When "Zero upon power-on (P-tr)" of "Environment, Display ($bASFnc$)" is set to " 1 ", the previous weight value is displayed upon power-on.
  For details, refer to "Zero upon power-on" on page 33.

- There is a function available to perform span calibration only, when performing calibration with a tare on the weighing pan.
  When "Span calibration (SPn)" of "Environment, Display ($bASFnc$)" is set to " 1 ", span calibration using the internal mass is performed, with a tare on the weighing pan.
  For details, refer to "Span calibration" on page 33.

- To set a higher response rate or to batch-weigh small amounts of material, such as a powdery material, refer to "14. EXTENDED FUNCTION".

6. RESPONSE ADJUSTMENT / SELF CHECK FUNCTION

This function detects the influence on weighing that is caused by drafts and/or vibration at the place where the balance is installed and sets the response characteristic automatically. When this function is selected, the balance self-checks the performance at the same time.

Two modes of response adjustment are available: automatic and manual.

Response indicators

The function has three rates as follows:

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 (SPd)" parameter of "Environment, Display ($bASFnc$)" in the function table. For details, refer to "9. FUNCTION TABLE".

6-1 Automatic Response Adjustment / Self Check Function

This function automatically updates the response adjustment by analyzing the influence of the environment on the weighing data and also self-checks the balance performance using the internal mass.

Operation

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

2 The balance automatically starts to check the balance performance and sets the response characteristic.

Caution

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

3 After automatic adjustment, the balance displays the updated response indicator and returns to the weighing mode. The response indicator remains displayed for about 30 seconds.

e.g. " MID. OK "

The example above indicates that the result of the self check is good and MID. is selected as the response rate.

Press and hold the key

Release the key

Displays the results.

Notes

☐ **If improper performance is found in the self check, the balance displays** `CH no`. **Contact the local A&D dealer for repair.**

☐ **If the automatic response adjustment fails, the balance displays** `CH nG`. **Check the ambient conditions such as breeze and vibration, also check the weighing pan. Then, perform the adjustment again. To return to the weighing mode, press the** CAL **key.**

☐ **If the automatic response adjustment is awkward, try to refine it using the manual response adjustment.**

6-2 Manual Response Adjustment

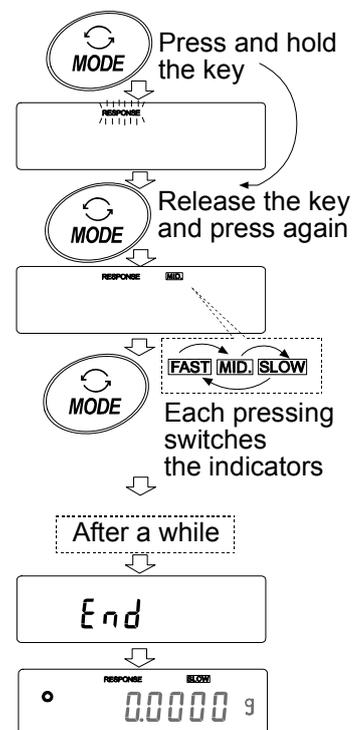This function manually updates the response adjustment.

Operation

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

   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 about 30 seconds.

Note

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

Press and hold the key

Release the key and press again

FAST MID. SLOW
Each pressing switches the indicators

After a while

`End`

RESPONSE SLOW
`0.0000` g

7. CALIBRATION

7-1 Calibration Group

Calibration	● Automatic self calibration (calibration due to changes in temperature)
	● Calibration using the internal mass (one-touch calibration)
	● Calibration using an external weight
Calibration test	● Calibration test using an external weight (Calibration test does not perform calibration.)

Correction of the internal mass value

Terms

The following terms are defined as follows:

Internal mass	=	Built-in calibration weight
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". Time and date are added to the GLP report. If the time or date is not correct, adjust them. For details, refer to the GX series instruction manual, "10-9 Clock and Calendar Function".
● Calibration test is available only when "GLP output ($inFo$)" of "Data output ($dout$)" is set to " 1 " or " 2 ".
● The calibration and calibration test data can be stored in memory. To store them, set "Data memory ($dAtA$)" to " 3 ". For details, refer to the GX series instruction manual, "12. DATA MEMORY".

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
MC-1000	**1000g**, 900g, 800 g, 700 g, 600 g, 500 g**,** 400 g, 300 g, 200 g	-0.0150 g to +0.0159 g
MC-6100	6000 g, **5000 g**, 4000 g, 3000 g, 2000 g	-0.150 g to +0.159 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 Automatic Self Calibration (Calibration due to changes in temperature)

This function automatically calibrates the balance when the balance detects an ambient temperature change. If GLP output is selected in the function table, the balance outputs the calibration report or stores the data in memory. Automatic self calibration functions even if the display is turned off (standby state). ,

Caution

If something is on the weighing pan, the balance judges that it is in use and does not perform automatic self calibration. To maintain the calibrated state, keep the weighing pan clear while not in use.

The displays shown below are related to the automatic self calibration.

Indicates that the balance detects a change in ambient temperature and automatic self calibration will start. If the balance is not used for a few minutes with this indicator blinking, the balance performs automatic self calibration. The blinking duration depends on the environment.
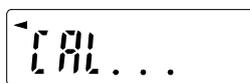
Indicates that the balance is measuring calibration data. Do not allow vibration or drafts to affect the balance while this indicator is displayed. After calibration, the balance returns to indicate the previous display.

Note

The balance can be used while the indicator blinks. But, it is recommended that to maintain the accuracy, stop using the balance and confirm that there is nothing on the pan and allow the balance to perform self calibration.

7-3 Calibration Using the Internal mass (One-touch calibration)

This function calibrates the balance using the internal mass. The only operation required is to press the CAL key

Operation

1. Connect the AC adapter and warm up the balance for at least 30 minutes with nothing on the weighing pan.
2. Press the CAL key.
3. The balance displays $\boxed{CAL\ in}$ and performs calibration using the internal mass. Do not allow vibration or drafts to affect the balance.
4. The balance displays $\boxed{End}$ after calibration. If the "GLP output ($info$)" parameter of the function table is set to " 1 " or " 2 ", the balance displays $\boxed{GLP}$ and outputs the "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".
5. The balance will automatically return to the weighing mode after calibration.

About the internal mass

The value of the internal mass may change due to corrosion or other damage caused by the operating environment, or due to aging. Check the internal mass periodically. Correct the internal mass value as necessary. For details, refer to "7-6 Correcting the Internal Mass Value".

To maintain the weighing accuracy, perform the calibration using an external weight periodically, as described below.

7-4 Calibration Using an External Weight

This function calibrates the balance using an external weight.

When the MC-1000 is used

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, 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 18), 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 between the calibration weight selection mode (All of the digits blinking) or the value adjustment mode (The selected digits blinking). With the MC-1000, the digits in the 2nd, 3rd, and 4th decimal places can be adjusted. With the MC-6100, the digits in the 2nd and 3rd decimal places can be adjusted. |
   | RE-ZERO key | To select the calibration weight (All of the digits blinking) or adjust the value (The selected digits blinking). Refer to page 18 |
   | 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⌉. |
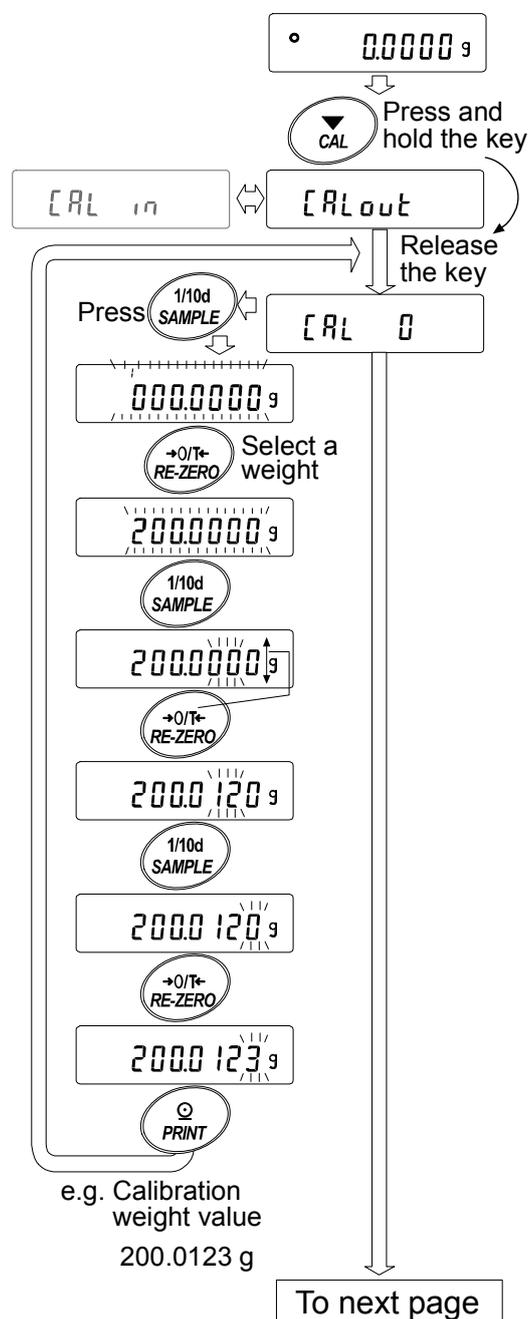
e.g. Calibration weight value 200.0123 g

To next page

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 the "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.

Note
Digit indicates a unit of minimum weighing value.

PRINT

▸ CAL 0

200

Calibration weight

PRINT

◂ 200

End

GLP output

▸ GLP

End

○ 0.0000 g
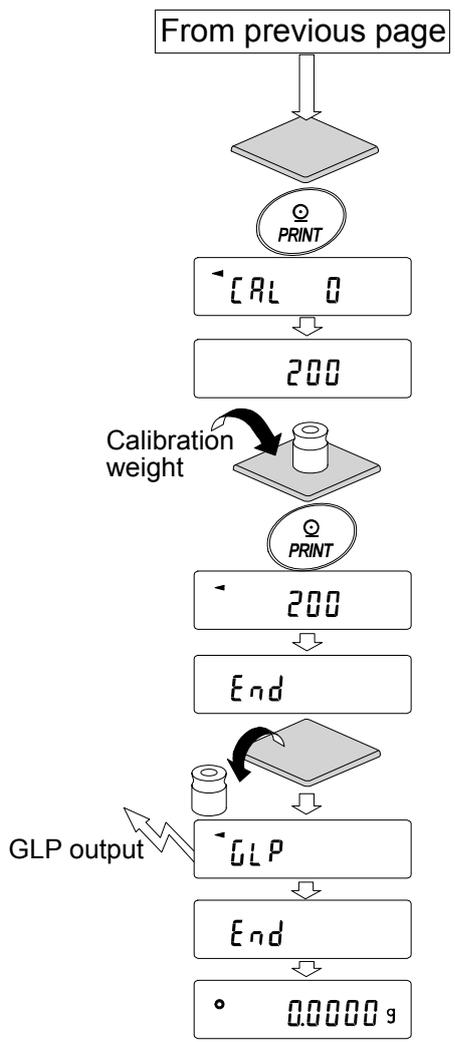
7-5 Calibration Test Using an External Weight

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.)

When the MC-1000 is used

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 $\boxed{CCout}$ is displayed, then release the key.

3 The balance displays $\boxed{CC\ 0}$.
   ● If you want to change the target weight (a list of usable weights is shown on page 18), 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 between the target weight selection mode (All of the digits blinking) or the value adjustment mode (The selected digits blinking). With the MC-1000, the digits in the 2nd, 3rd, and 4th decimal places can be adjusted. With the MC-6100, the digits in the 2nd and 3rd decimal places can be adjusted.

   RE-ZERO key   To select the target weight (All of the digits blinking) or adjust the value (The selected digits blinking). Refer to page 18

   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 $\boxed{CC\ 0}$.

0.0000 g

Press and hold the key

$\boxed{CAL\ in}$ ⟺ $\boxed{CC\ out}$

Release the key

$\boxed{CC\ 0}$

Press 1/10d SAMPLE

000.0000 g

→0/T← RE-ZERO Select a weight

200.0000 g

1/10d SAMPLE

200.0000 g

→0/T← RE-ZERO

200.0120 g

1/10d SAMPLE

200.0120 g

→0/T← RE-ZERO

200.0123 g

PRINT

e.g. Target weight value 200.0123 g

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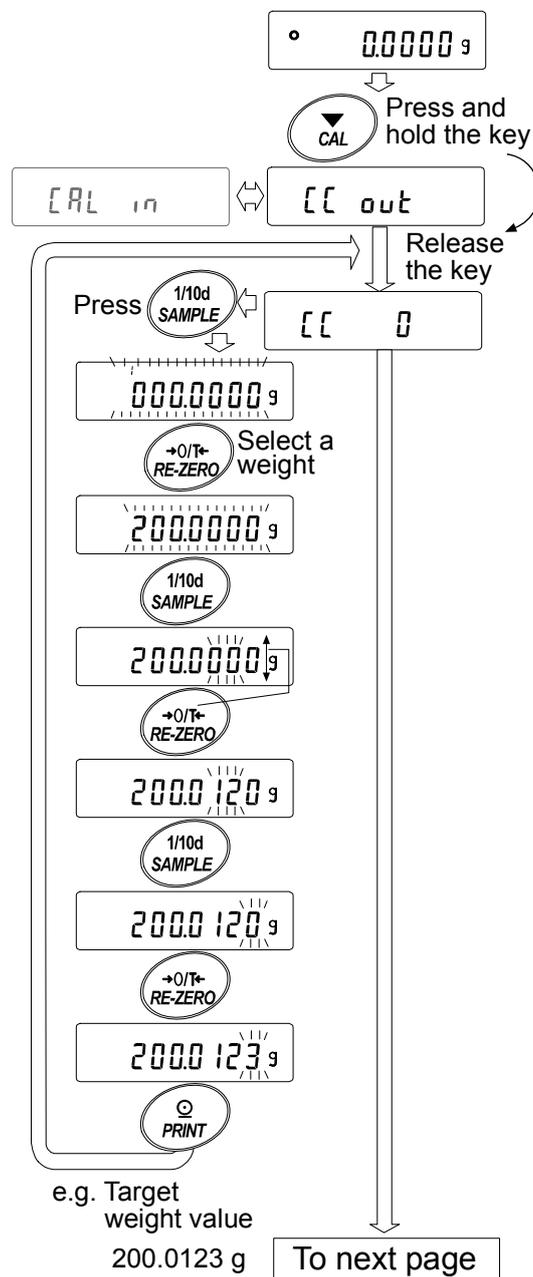
5 Confirm that there is nothing on the pan and press the PRINT key. The balance measures the zero point and displays the measured value. Do not allow vibration or drafts to affect the balance.
The balance displays the target weight value.

◎ PRINT

⊿ [[0

⊿ 0.0000 g

2 0 0

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.

Target weight

◎ PRINT

⊿ 2 0 0

⊿ 200.0123 g

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

End

GLP output

⊿ GLP

8 The balance displays GLP and outputs the "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".

End

○ 0.0000 g

9 The balance will automatically return to the weighing mode.
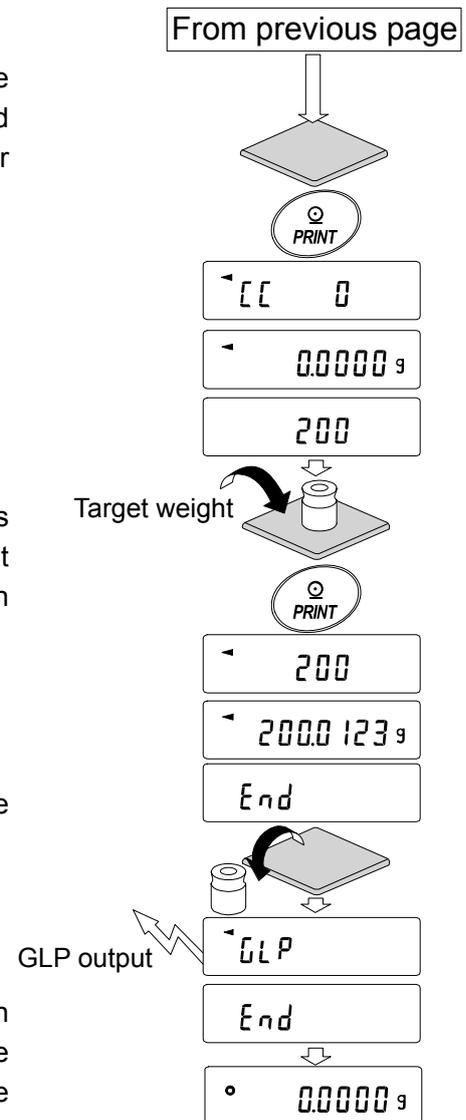
7-6 Correcting the Internal Mass Value

The MC series balance can correct the internal mass value within the range shown below. This function corrects the internal mass value to conform to an external weight. The corrected mass value is maintained in non-volatile memory even if the AC adapter is removed.

The internal mass value is corrected as follows:

Model	Correction reference value	Correction range
MC-1000	500.0000 g	±0.020 g
MC-6100	2000.000 g	±0.20 g

Example: Using the MC-6100

Use the same weight

Correct the internal mass by +0.030 g in 2 kg. Calibrate the balance with the corrected internal mass.
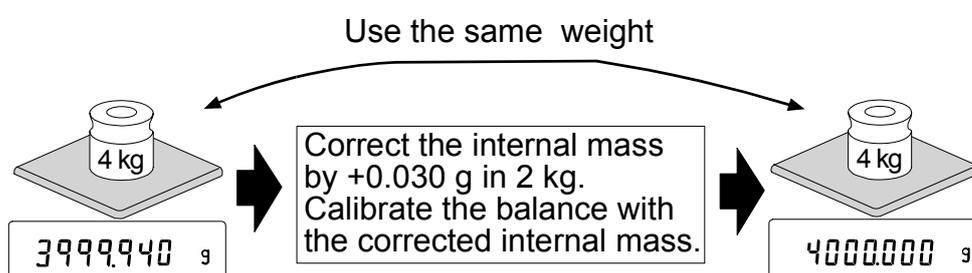
Operation

1 Calibrate the balance using the internal mass (one-touch calibration). Then, place an external weight and confirm the value to be corrected.

In the example, the value is off by -0.060 g and the correction reference value of the MC-6100 is 2 kg. So, the value is to be corrected by 0.030 g in 2 kg.

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

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

With these keys held down   Press the key

PS

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

$A - I$ x x x I ◄——— Function table (I:Factory setting) switch

Internal mass (0:Factory setting) correction switch
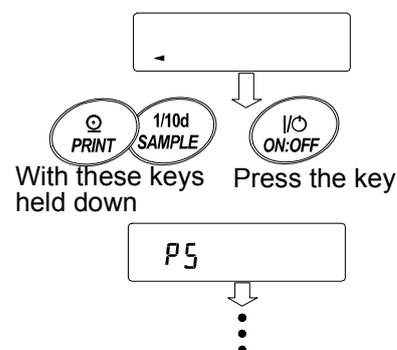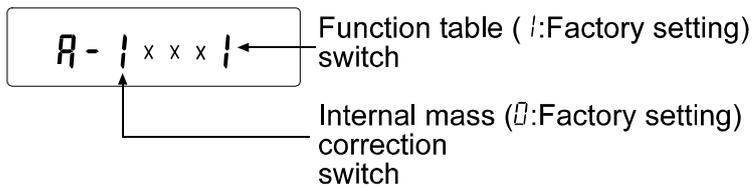
Set the function table switch and internal mass correction switch to " I " as shown above using the following keys.

SAMPLE key   To select the switch to change the value.
RE-ZERO key   To change the parameter of the switch selected.

5   Press the PRINT key to store the new setting. The balance returns to the weighing mode.

6   Press and hold the SAMPLE key to enter the function table and release the key when $bASFnc$ is displayed.

7   Press the SAMPLE key several times until $CS\ in$ is displayed.

8   Press the PRINT key to enter the procedure for correcting the internal mass value.

9   Correct the internal mass value using the following keys.

RE-ZERO key   To select the value.
              (-20 digits appear after +20 digits.)
PRINT key   To store the new value and display the next menu of the function table.
CAL key   To cancel the correction and display the next menu of the function table.

10   Press the CAL key. The balance returns to the weighing mode.

11   Press the CAL key to calibrate the balance using the internal mass.

12   Place the external weight on the pan and confirm that the correction has been performed properly (Confirm that the value displayed is within the range that is described at "Accuracy right after calibration using the internal mass" of "17. SPECIFICATIONS".)

If the internal mass value has not been corrected properly, repeat the procedure, starting at step 6 and adjust the correction value.

25
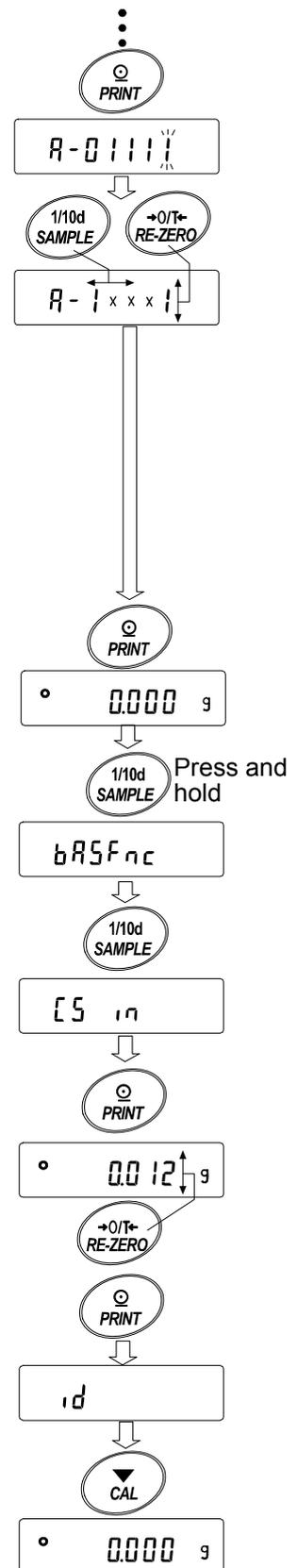
8. FUNCTION SWITCH AND INITIALIZATION

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". "Inhibit" protects parameters against careless operations.
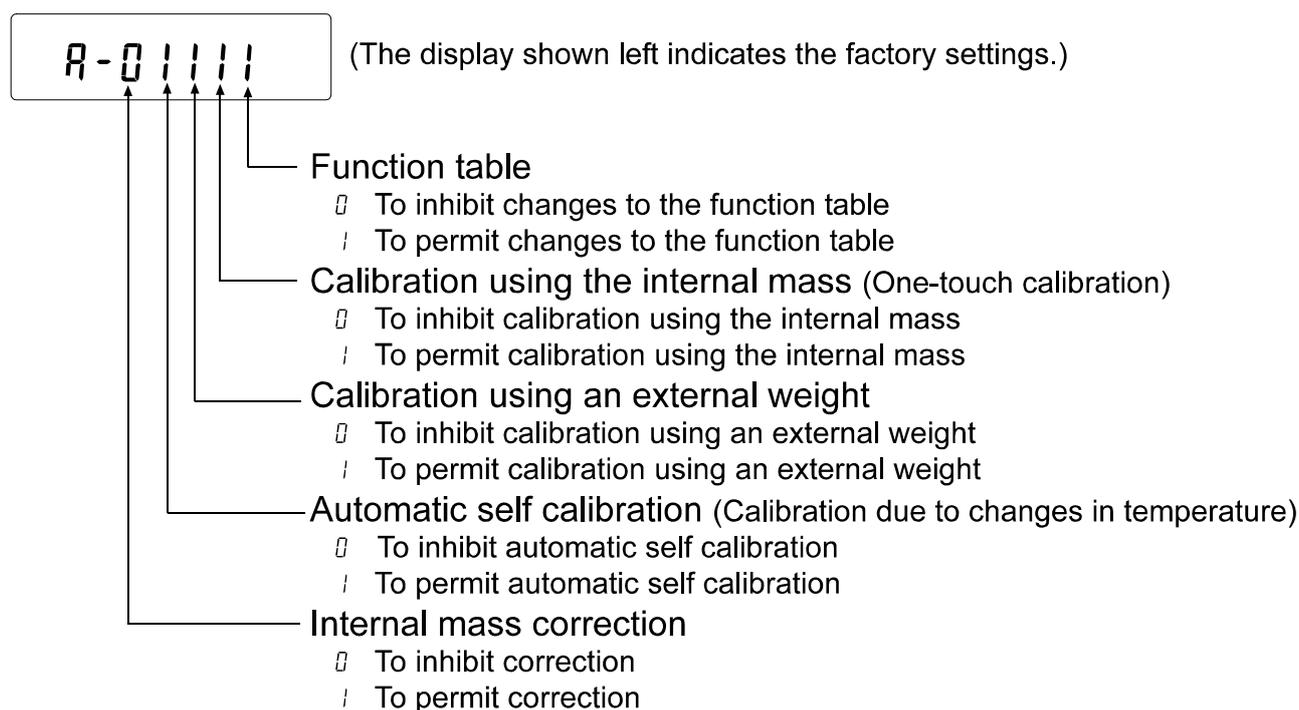
Switches

$R - 0 1 1 1 1$ (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

Calibration using the internal mass (One-touch calibration)
- *0* To inhibit calibration using the internal mass
- *1* To permit calibration using the internal mass

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

Automatic self calibration (Calibration due to changes in temperature)
- *0* To inhibit automatic self calibration
- *1* To permit automatic self calibration

Internal mass correction
- *0* To inhibit correction
- *1* To permit correction

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 PS .

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 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

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 PS.

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

Clr

Clr no

Clr Go

End

0.0000 g
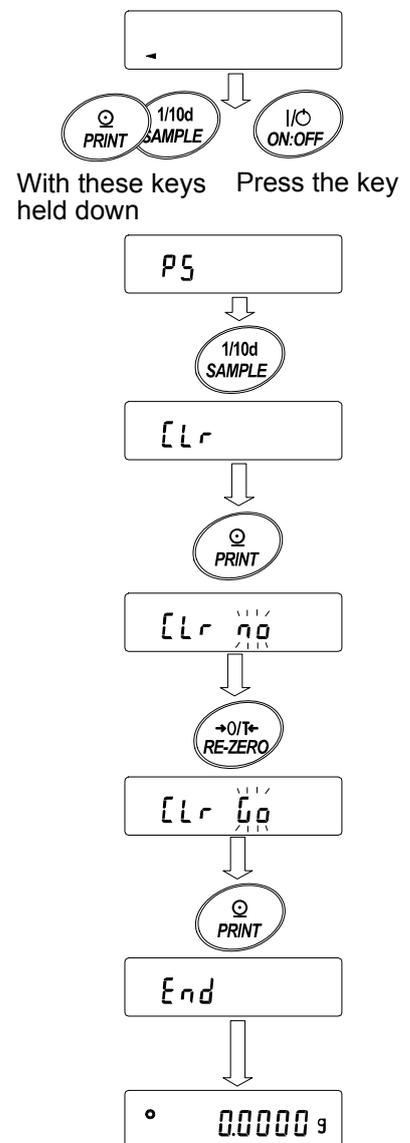
9. FUNCTION TABLE

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

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".
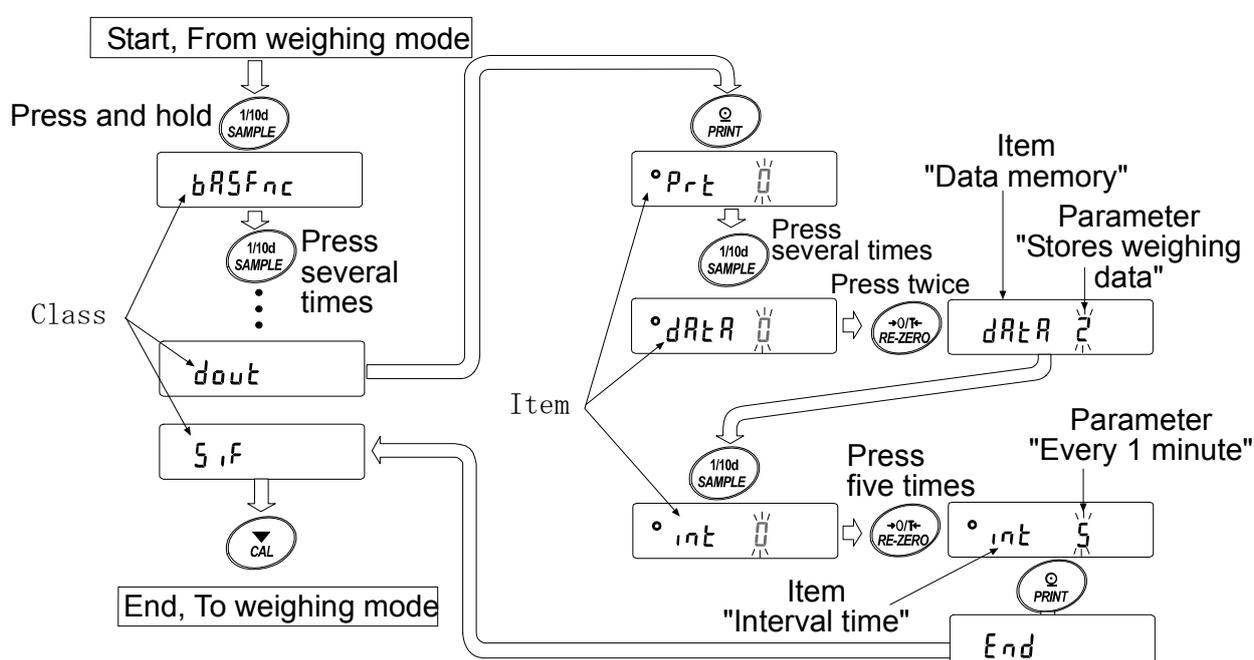
9-2 Display and Keys

Display/Key	Description
°	The symbol "O" 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 and Parameter		Description	
bASFnc Environment Display	*Cond* Condition	*0* ■ *1* *2*	Fast response rate, sensitive value FAST ⇕ Slow response rate, stable value SLOW	MID.	Can be changed by response adjustment. With "*hold 1*", sets the averaging time.
	St-b Stability band width	*0* ■ *1* *2*	Stable range is ±1 digit ⇕ Stable range is ±3 digits	The stabilization indicator illuminates when the display fluctuation is within the range. With "*hold 1*", sets the averaging time.
	Hold Hold function	■ *0* *1*	OFF ON	Holds the display when stable in animal mode. With "*Hold 1*", ANIMAL turns on.
	trc Zero tracking	*0* ■ *1* *2* *3*	OFF Normal Strong Very strong	Keeps zero display by tracking zero drift.
	SPd Display refresh rate	■ *0* *1*	5 times/second 10 times/second	Period to refresh the display
	Pnt Decimal point	■ *0* *1*	Point (.) Comma (,)	Decimal point format
	P-on Auto display-ON	■ *0* *1*	OFF ON	Turns on the weighing mode display when the AC adapter is plugged in.
	PoFF Auto display-OFF	■ *0* *1*	OFF ON (10 minutes)	Turns off the display after 10 minutes of inactivity.
	GSi Capacity indicator	■ *0* *1*	OFF ON	Capacity indicator Zero: *0*%, Maximum capacity: *100*%
	FIL Filter	■ *0* *1*	Not used Used (when the balance is used as a mass comparator)	
	P-tr Zero upon power-on	■ *0* *1*	Sets the display to zero. Does not set the display to zero. Displays the previous value. With this setting, do not perform re-zero operations frequently. Refer to "Zero upon power-on" on page 33.	
	SPn Span calibration	■ *0* *1*	Performs zero and span calibration Performs span calibration only. Span calibration using the internal mass is possible with a tare on the weighing pan. Refer to "Span calibration" on page 33.	
CL Adj Clock			Refer to the GX series instruction manual, "10-9 Clock and Calendar Function".	Confirms and sets the time and date. The time and date are added to the output data.
CP Fnc Comparator	*CP* Comparator mode	■ *0* *1* *2* *3* *4*	No comparison Comparison, excluding "near zero" when stable or overloaded Comparison, including "near zero" when stable or overloaded Continuous comparison, excluding "near zero" Continuous comparison, including "near zero"	
	CP in Input method	■ *0* *1* *2* *3*	Digital input, upper/lower limits Weighing input, upper/lower limits Digital input, reference value Weighing input, reference value	*CP Hi*, *CP Lo* can be selected. *CP rEF*, *CP Lmt* can be selected..

■ Factory setting
Note: "Digit" is a unit of minimum weighing value

Class	Item and Parameter			Description	
CP Hi Upper limit				Refer to the GX series instruction manual, "10-10 Comparator Function".	Displays when *CP in 0* or *CP in 1* is selected.
CP Lo Lower limit					
CP rEF Reference value					Displays when *CP in 2* or *CP in 3* is selected.
CP Lmt Tolerance					
dout Data output	*Prt* Data output mode	▪ *0*	Key mode (when stable)	Accepts the PRINT key only when the display is stable.	
		1	Auto print mode A (Reference = zero)	Outputs data when the display 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, 5-td, info*	
		1	Stores unit mass in counting mode		
		2	Stores weighing data		
		3	Stores calibration data		
	int Interval time	▪ *0*	Every measurement	Interval time in the interval memory mode when using *Prt 3, dAtA 2*	
		1	2 seconds		
		2	5 seconds		
		3	10 seconds		
		4	30 seconds		
		5	1 minute		
		6	2 minutes		
		7	5 minutes		
		8	10 minutes		
	d-no Data number output	▪ *0*	No output	Refer to the GX series instruction manual, "12. DATA MEMORY".	
		1	Output		
	5-td Time/Date output	▪ *0*	No output	Selects whether or not the time or date is added to the weighting data. For details, Refer to the GX series instruction manual, "10-9 Clock and Calendar Function".	
		1	Time only		
		2	Date only		
		3	Time and date		
	5-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)		

▪ Factory setting
Note: "Digit" is a unit of minimum weighing value

Class	Item and Parameter			Description
dout Data output	**At-F** Auto feed	■ 0	Not used	Selects whether or not automatic feed is performed.
		1	Used	
	info GLP output	■ 0	No output	Selects GLP output method. For how to set time and date to be added, refer to the GX series instruction manual, "10-9 Clock and Calendar Function".
		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	
S iF Serial interface	**bPS** Baud rate	0	600 bps	
		1	1200 bps	
		■ 2	2400 bps	
		3	4800 bps	
		4	9600 bps	
	btPr 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 LF: ASCII code 0Ah
		1	CR	
	tYPE Data format	■ 0	A&D standard format	Refer to the GX series instruction manual, "10-6 Description of Item "Data Format".
		1	DP format	
		2	KF format	
		3	MT format	
		4	NU format	
		5	CSV format	
	t-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	
	CtS CTS, RTS control	■ 0	Not used	Controls CTS and RTS.
		1	Used	
Un it Unit		g	gram	Refer to the GX series instruction manual, "5. WEIGHING UNIT".
dS Fnc Density function	**Ld in** Liquid density input	■ 0	Water temperature	Available only when density mode is selected. Refer to the GX series instruction manual, "15. DENSITY MEASUREMENT".
		1	Liquid density	
CS in Internal mass value correction			Refer to "7. CALIBRATION".	Displayed only when the internal mass value correction switch is set to 1.
id ID number setting			Refer to "10. ID NUMBER AND GLP REPORT".	

■ Factory setting

Class	Item and Parameter		Description	
ErFnc Extended function	*F1-b* Averaging range for the first moving average	*0*	Small ↑ ↓ Large	
		1		
		2		
		3		
		▪ *4*		
		5		
		6		
		7		
	F1-t Averaging time for the first moving average	*0*	No averaging	
		1	0.5 second	
		▪ *2*	1.0 second	
		3	1.5 seconds	
		4	2.0 seconds	
		5	2.5 seconds	
		6	3.2 seconds	
		7	4.8 seconds	
		8	6.4 seconds	
Only when *FiL* is *0*	*F2-b* Averaging range for the second moving average	*0*	Small ↑ ↓ Large	
		▪ *1*		
		2		
		3		
		4		
		5		
		6		
	F2-t Averaging time for the second moving average	*0*	No averaging	
		1	0.5 second	
		2	1.0 second	
		3	1.5 seconds	
		4	2.0 seconds	
		▪ *5*	2.5 seconds	
		6	3.2 seconds	

▪ 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 time, date and 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.

Notes

□ **In automatic response adjustment, the response rate is selected automatically.**

□ **With "Hold function ($Hold$)" set to "ON (1)", this item is used to set the averaging time.**

Stability band width ($St-b$)

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"

$St-b$ 0

This parameter is for sensitive response of the stabilization indicator. Used for exact weighing.

$St-b$ 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.

Zero upon power-on ($P-tr$)

When a hopper is attached to the weighing pan and loss-in weighing is performed, the remaining amount of the material will become unknown if tare is performed each time a weighing starts.
When " $P-tr$ " is set to " 1 ", tare is not performed at weighing start. So, the remaining amount of the material can be monitored, when the power is turned on again after it was turned off.

Span calibration (SPn)

When a hopper is attached to the weighing pan and calibration is to be performed with the hopper attached, set " SPn " to " 1 ". When the tare value (hopper and other devices attached) is within the value in the table below, calibration using the internal mass is possible.

Model	Tare value
MC-1000	500 g or less
MC-6100	5 kg or less

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.
		$bASFnc$	SPd	Display refresh rate
		$S\,iF$	bPS	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
Optional setting	dout	S-td 1, 2, or 3	Adds the time and date.
Example			"For periodical weighing without a computer command and outputting all of the data to a computer at one time"

9-6 Description of the Item "Data format"

A&D standard format   5 iF tYPE 0

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

● This format consists of fifteen or sixteen characters excluding the terminator.
  With the MC-1000, when the numerical data excluding the decimal point exceeds eight characters, the data format will be sixteen characters long.

● 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	.	0	1	2	7	␣	␣	g	C_R	L_F

Header　　　　　Data　　　　　　Unit　　Terminator

S	T	,	+	1	0	0	0	.	0	0	0	0	␣	␣	g	C_R	L_F

(Data example exceeding 8 characters)

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   5 iF tYPE 1

This format is used when the peripheral equipment can not receive the A&D format. If an AD-8121B 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.

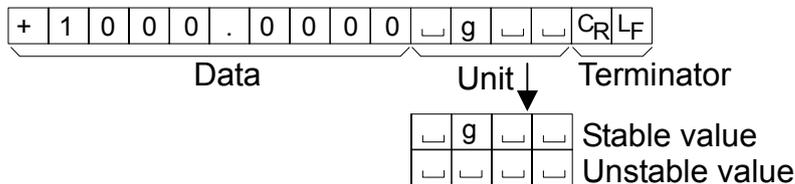● The unit, consisting of three characters, follows the data.

W	T	␣	+	1	0	0	0	.	0	0	0	0	␣	␣		C_R	L_F

Header　　　　　Data　　　　　Unit　　Terminator

W	T	Stable header
U	S	Unstable header

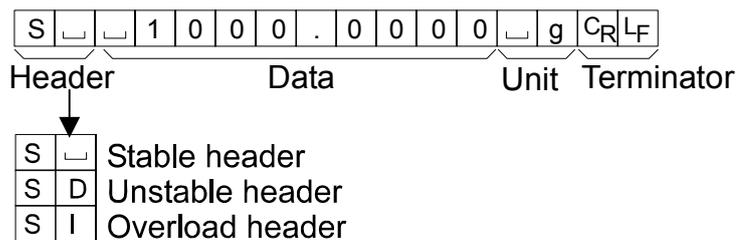| Q	T	Stable header (Counting mode)

KF format *SiF 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.
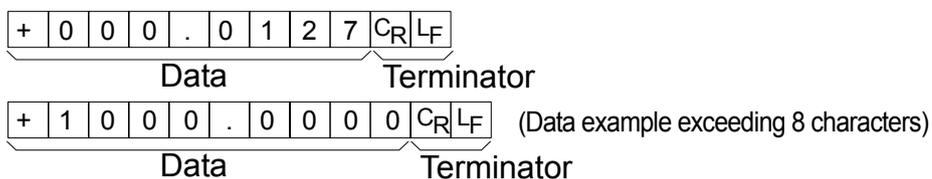- This format outputs the unit only for a stable value.

| + | 1 | 0 | 0 | 0 | . | 0 | 0 | 0 | 0 | ␣ | g | ␣ | ␣ | C_R | L_F |

Data ──────────── Unit ↓ Terminator

| ␣ | g | ␣ | ␣ | Stable value
| ␣ | ␣ | ␣ | ␣ | Unstable value

MT format *SiF 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 | 0 | 0 | 0 | . | 0 | 0 | 0 | 0 | ␣ | g | C_R | L_F |

Header ──── Data ──── Unit Terminator

| S | ␣ | Stable header
| S | D | Unstable header
| S | I | Overload header

NU (Numerical) format *SiF tYPE 4*

This format outputs only numerical data.

- This format consists of nine or ten characters excluding the terminator.
  With the MC-1000, when the numerical data excluding the decimal point exceeds eight characters, the data format will be ten characters long.
- 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 | . | 0 | 1 | 2 | 7 | C_R | L_F |

Data ──────── Terminator

| + | 1 | 0 | 0 | 0 | . | 0 | 0 | 0 | 0 | C_R | L_F | (Data example exceeding 8 characters)

Data ──────── Terminator

CSV format *5 iF type 5*

- Separates the data of A&D standard format and the unit by a comma (,).
- Outputs the unit even when the data is overloaded.
- When the ID number, data number, time and date are added, outputs the ID number, data number, date, time 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, 2009/12/31, 12:34:56, ST,+1000.0000, ␣ ␣ g<CR><LF>
ID number Data number Date   Time   Weighing data

S	T	,	+	1	0	0	0	.	0	0	0	0	,	␣	␣	g	C_R	L_F

O	L	,	+	9	9	9	9	9	9	9	E	+	1	9	,	␣	␣	g	C_R	L_F

Note

To add the ID number, data number, time and date, the function settings must be changed.

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

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	C_R	L_F

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 (*5 iF 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.

Date   *dout 5-td 2* or *3*

- The date output order can be changed in "Clock (*CL Adj*)". Outputs the year in four-digit format.

2	0	0	9	/	1	2	/	3	1	C_R	L_F

Time   *dout 5-td 1* or *3*

- Outputs time in 24-hour format.

1	2	:	3	4	:	5	5	C_R	L_F

Note

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

9-8 Data Format Examples

Stable

Display: `1.2700 g`

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

(Data example exceeding 8 characters)

Display: `1000.0000 g`

A&D	S	T	,	+	1	0	0	0	.	0	0	0	0	⎵	⎵	g	CR LF
NU	+	1	0	0	0	.	0	0	0	0	CR	LF					

Unstable

Display: `-183.6900 g`

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

(Data example exceeding 8 characters)

Display: `-1000.0127 g`

A&D	U	S	,	-	1	0	0	0	.	0	1	2	7	⎵	⎵	g	CR LF
NU	-	1	0	0	0	.	0	1	2	7	CR	LF					

Overload — Positive error

Display: `E g`

A&D	O	L	,	+	9	9	9	9	9	9	9	E	+	1	9	CR LF
DP	⎵	⎵	⎵	⎵	⎵	⎵	⎵	E	⎵	⎵	⎵	⎵	⎵	⎵	⎵	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

Display: `-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					

Unit

g (gram) g

A&D	D.P.	KF	MT
⎵ ⎵ g	⎵ ⎵ g	⎵ g ⎵ ⎵	⎵ g

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

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, date, time and space for signature for weighing data, and the weight used and results for calibration or calibration test data.

● The balance can output the following reports for GLP.

"Calibration report" of the calibration, using the internal mass (Calibration due to changes in temperature and one-touch calibration.)

"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.

● Calibration and calibration test data can be stored in memory to output several reports at the same time. Refer to the GX series instruction manual, "12. DATA MEMORY" for details.

● For details on confirming and setting the time and date, refer to the GX series instruction manual, "10-9 Clock and Calendar Function".

10-1 Setting the ID Number

1 Press and hold the SAMPLE key until $\boxed{\mathit{bASFnc}}$ of the function table is displayed.

2 Press the SAMPLE key several times to display $\boxed{\mathit{id}}$.

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 $\boxed{\mathit{bASFnc}}$.

    CAL key   To cancel the new ID number and display $\boxed{\mathit{bASFnc}}$.

4 With $\boxed{\mathit{bASFnc}}$ 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* ", the "Data output pause (*PUSE*)" parameter to " *1* ", and use MODE 3 of the AD-8121B. For details on using the printer, refer to "12-1 Connection to the AD-8121B Printer".

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

- If the time and date are not correct, set the correct time and date in "Clock (*CL AdJ*)" of the function table.

Calibration report using the internal mass

When the setting is " *inFo 1* ":

When the setting is " *inFo 2* ":

AD-8121 format

General data format

```
         A & D
MODEL    MC-1000
S/N      01234567
ID       ABCDEFG
DATE  2009/12/31
TIME    12:34:56
CALIBRATED(INT.)
SIGNATURE


— — — — — — — —
```

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

```
␣␣␣␣␣␣␣␣␣␣␣A␣&␣D<TERM>
MODEL␣␣␣␣␣MC-1000<TERM>
S/N␣␣␣␣␣␣01234567<TERM>
ID␣␣␣␣␣␣␣ABCDEFG<TERM>
DATE<TERM>
␣␣␣␣␣␣␣2009/12/31<TERM>
TIME<TERM>
␣␣␣␣␣␣␣␣␣12:34:56<TERM>
CALIBRATED(INT.)<TERM>
SIGNATURE<TERM>
<TERM>
<TERM>
---------------<TERM>
<TERM>
<TERM>
```
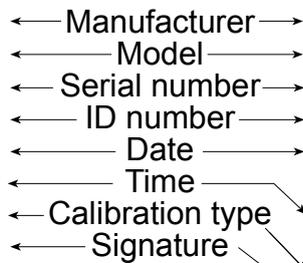
␣ Space, ASCII 20h

<TERM> Terminator, C_R , L_F or C_R

C_R Carriage return, ASCII 0Dh

L_F Line feed, ASCII 0Ah

Calibration report using an external weight

When the setting is " _inFo_ _1_ ":

AD-8121 format

```
              A & D
MODEL     MC-1000
S/N       01234567
ID        ABCDEFG
DATE   2009/12/31
TIME     12:34:56
CALIBRATED(EXT.)
CAL.WEIGHT
       +2000.0000g
SIGNATURE


 _ _ _ _ _ _ _
```

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

When the setting is " _inFo_ _2_ ":

General data format

```
⌴⌴⌴⌴⌴⌴⌴⌴A⌴&⌴D<TERM>
MODEL⌴⌴⌴⌴MC-1000<TERM>
S/N⌴⌴⌴⌴⌴01234567<TERM>
ID⌴⌴⌴⌴⌴⌴⌴ABCDEFG<TERM>
DATE<TERM>
           2009/12/31<TERM>
TIME<TERM>
⌴⌴⌴⌴⌴⌴⌴⌴12:34:56<TERM>
CALIBRATED(EXT.)<TERM>
CAL.WEIGHT<TERM>
⌴⌴⌴⌴⌴+2000.0000g<TERM>
SIGNATURE<TERM>
<TERM>
<TERM>
---------------<TERM>
<TERM>
<TERM>
```

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

Calibration test report using an external weight

(Calibration test does not perform calibration.)

When the setting is " _inFo_ _1_ ":

AD-8121 format

```
              A & D
MODEL     MC-1000
S/N       01234567
ID        ABCDEFG
DATE   2009/12/31
TIME     12:34:56
CAL.TEST(EXT.)
ACTUAL
         0.0000g
      +1999.9999g
TARGET
      +2000.0000g
SIGNATURE


 _ _ _ _ _ _ _
```

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

When the setting is " _inFo_ _2_ ":

General data format

```
⌴⌴⌴⌴⌴⌴⌴⌴⌴⌴⌴A⌴&⌴D<TERM>
MODEL⌴⌴⌴⌴MC-1000<TERM>
S/N⌴⌴⌴⌴⌴01234567<TERM>
ID⌴⌴⌴⌴⌴⌴⌴ABCDEFG<TERM>
DATE<TERM>
⌴⌴⌴⌴⌴⌴2009/12/31<TERM>
TIME<TERM>
⌴⌴⌴⌴⌴⌴⌴⌴12:34:56<TERM>
CAL.TEST(EXT.)<TERM>
ACTUAL<TERM>
⌴⌴⌴⌴⌴⌴⌴⌴⌴0.0000g<TERM>
⌴⌴⌴⌴⌴+1999.9999g<TERM>
TARGET<TERM>
⌴⌴⌴⌴⌴+2000.0000g<TERM>
SIGNATURE<TERM>
<TERM>
<TERM>
---------------<TERM>
<TERM>
<TERM>
```

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

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.

Notes

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

☐ **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 PRINT key until ⌈ 5ŁArŁ ⌉ 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 PRINT key until ⌈ rŁcŁnd ⌉ is displayed. The "End block" is output.

When the setting is " ınFo 1 ":

When the setting is " ınFo 2 ":

AD-8121 format

Title block

General data format

```
               A & D
MODEL      MC-1000
S/N        01234567
ID         ABCDEFG
DATE   2009/12/31
START
TIME       09:30:00


WT    +1234.5600g
WT    +1234.6100g
WT    +1234.⌐⌐⌐⌐
```

```
⌐⌐⌐⌐4.5100g
WT    +1234.5300g
WT    +1234.7100g
WT    +1234.6400g

END
TIME      10:40:15
SIGNATURE


‥ ‥ ‥ ‥ ‥ ‥ ‥
```

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

— Weighing data

← Time
← Signature

End block

```
_____A_&_D<TERM>
MODEL____MC-1000<TERM>
S/N_____01234567<TERM>
ID_____ABCDEFG<TERM>
DATE<TERM>
_____2009/12/31<TERM>
START<TERM>
TIME<TERM>
_____09:30:00<TERM>
<TERM>
WT___+1234.5600g<TERM>
WT___+1234.6100g<TERM>
WT___+1234.6200⌐⌐⌐⌐⌐
```

```
⌐⌐⌐5100g<TERM>
WT___+1234.5300g<TERM>
WT___+1234.7100g<TERM>
WT___+1234.6400g<TERM>
<TERM>
END<TERM>
TIME<TERM>
_____10:40:15<TERM>
SIGNATURE<TERM>
<TERM>
<TERM>
---------------<TERM>
<TERM>
<TERM>
```

␣ Space, ASCII 20h

<TERM> Terminator, C_R , L_F or C_R

C_R Carriage return, ASCII 0Dh

L_F Line feed, ASCII 0Ah

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11. RS-232C SERIAL INTERFACE / EXTERNAL INPUT

RS-232C

The balance is a DCE device. Connect the balance to a personal computer (DTE), using a straight through cable or a modem cable.

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

RS-232C
1 -5V to -15V
0 +5V to +15V

| LSB 0 | 1 | 2 | 3 | 4 | 5 | MSB 6 |

Start bit — Data bits — Parity bit — Stop bit
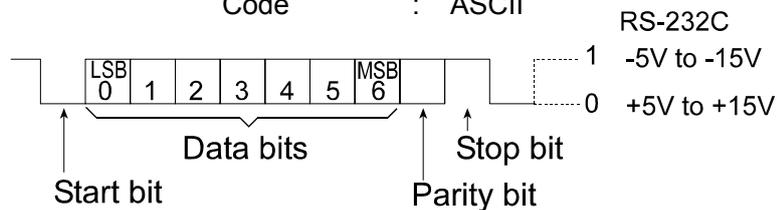
Pin connections

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

Note

The signal names for the RS-232C are the same as those for the DTE side except TXD and RXD.

Circuits

FG
RXD
TXD
+5
RTS
CTS
DSR
SG
PRINT
RE-ZERO
N.C.8-17,20-25   7 6 5 4 3 2 1

Balance interior

2.6 mm
(ISO metric screw thread)

19 18

RS-232C
D-Sub25 pin, female connector

RS-232C Terminals

Balance side DCE			Computer side DTE
FG	1		FG
RXD	2	◄	TXD
TXD	3	►	RXD
RTS	4	◄	RTS
CTS	5	►	CTS
DSR	6	►	DSR
SG	7		SG
Inside of balance			Terminals sample
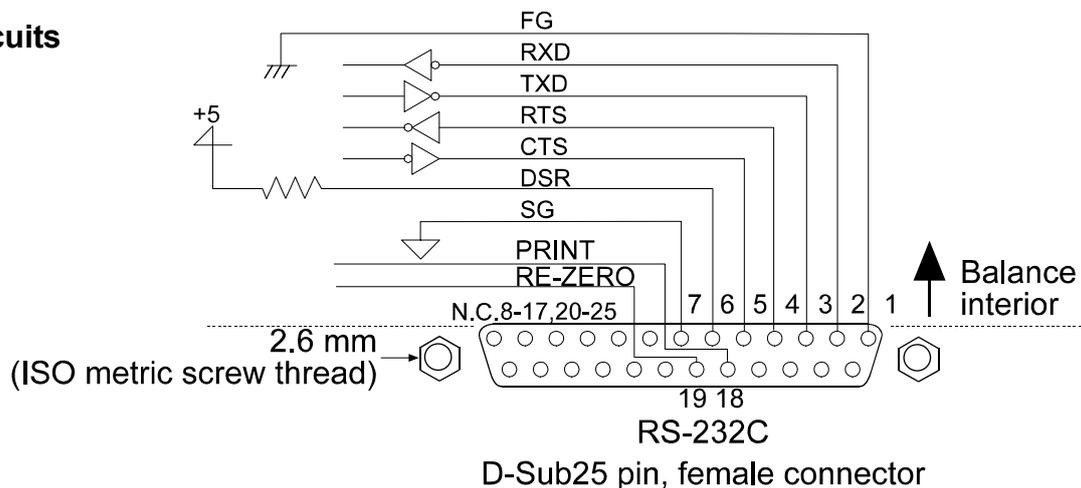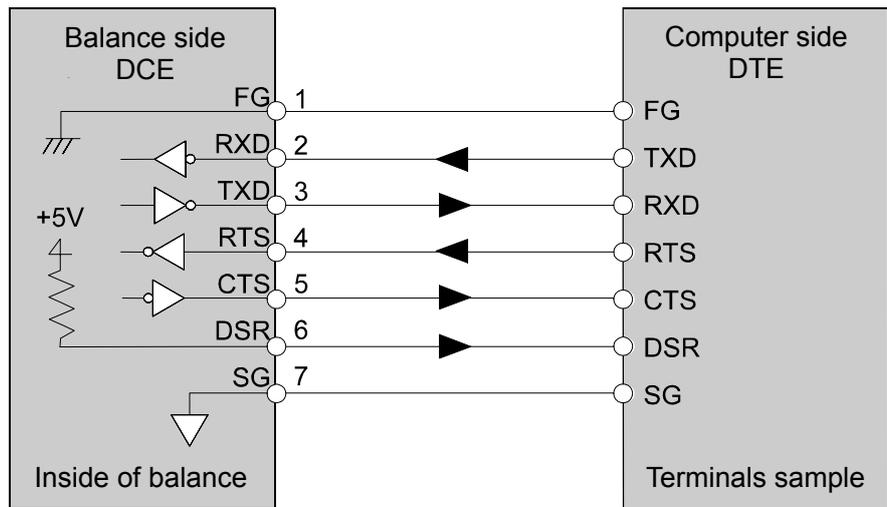
External contact input

By connecting pin 18 (PRINT command) to pin 7, or pin 19 (RE-ZERO command) to pin 7 for 100 ms or more, the same operation as performed by pressing the PRINT key or the RE-ZERO key, will be performed.

Example of foot switch

Connector
AX-HDB-25P

Connector cover
AX-HDB-CTF

Foot switch
AX-SW128
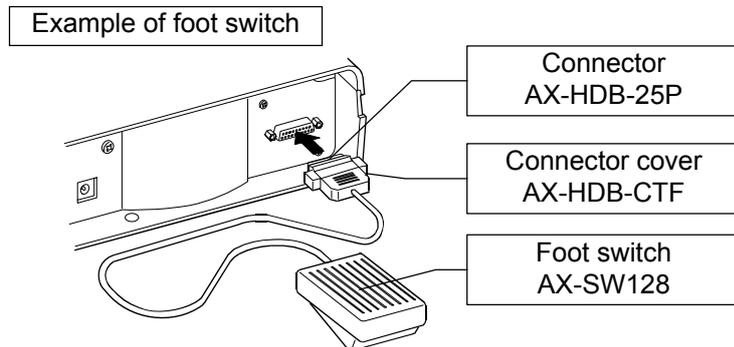
Option

Connector   :   AX-HDB-25P/CTF
Foot switch   :   AX-SW128

Balance side	
SG	7
PRINT	18
RE-ZERO	19

PRINT key
RE-ZERO key

7

19 18
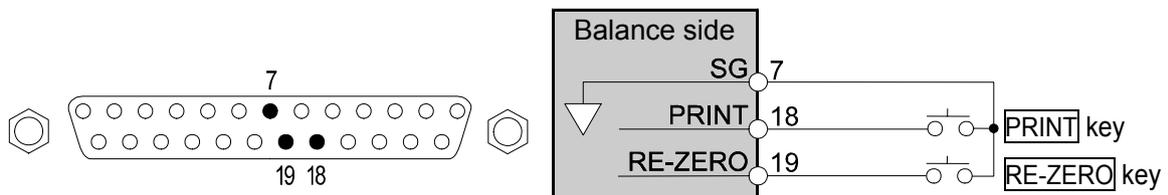
12. CONNECTION TO PERIPHERAL EQUIPMENT

12-1 Connection to the AD-8121B Printer

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

Class	Item	Factory setting	AD-8121B Mode 1	AD-8121B Mode 2	AD-8121B Mode 3
dout Data output	Prt Data output mode	0	0, 1, 2, 4, 5	3	0, 1, 2, 4, 5
	AP-P Auto print polarity	0	*1	Not applicable	*1
	AP-b Auto print difference	1			
	d-no Data number output	0	0	0	0, 1
	S-td Time/date output	0	0	0	0, 1, 2, 3
	S-id ID number output	0	0	0	0, 1
	PUSE Data output pause	0	0	0	0, 1 *2
	At-F Auto feed	0	0	0	0, 1
SiF Serial interface	bPS Baud rate	2	2	2	2
	PtPr Data bit, parity bit	0	0	0	0
	CrLF Terminator	0	0	0	0
	tYPE Data format	0	0	0	1
	CtS CTS, RTS control	0	0	0	0

*1 Set the parameter when the data output mode is set to the auto print mode (Prt 1 or Prt 2).

*2 When multiple lines are to be printed, set the parameter to 1.

AD-8121B settings

Mode	AD-8121B DIP switches	Description
Mode 1	MODE	Prints upon data receipt Standard mode, statistical calculation mode
Mode 2	MODE	Prints using the AD-8121B DATA key or the AD-8121B built-in timer Standard mode, interval mode, chart mode
Mode 3	MODE	Prints upon data receipt Dump print mode
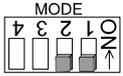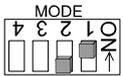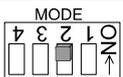
DIP switch 3: Handling unstable data
ON = To print unstable data
OFF = Not to print unstable data
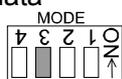
DIP switch 4: Data input specification
ON = Use the current loop
OFF = Use the RS-232C
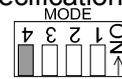
▢ With dAtA 0, the weight data can be output to the printer.

▢ With dAtA 2, the weight data stored in memory can be output to the printer.

▢ With dAtA 3, the calibration report stored in memory can be output to the printer.

▢ Refer to "10. ID NUMBER AND GLP REPORT" for print samples.

12-2 Connection to a Computer

The MC series balance is of the DCE type (Data Communication Equipment), which can be connected to a personal computer using the RS-232C interface.

Before connection, read the personal computer manual thoroughly.

Use a standard DCE cable for connection (cable type: straight-through).

12-3 Using Windows Communication Tools (WinCT)

When Windows is used as an operating system in a personal computer, the provided WinCT can be used to transmit the weighing data to the personal computer.
The WinCT has two communication methods: "RsCom" and "RsKey". For details on WinCT, refer to the WinCT instruction manual.
The current version of the WinCT can be downloaded from the A&D website.

RsCom

● Can transmit commands to control the balance.

● Can perform bi-directional communication between the balance and a personal computer using the RS-232C interface.

● Can display or store the data using a text file format. Can also print the data using a printer connected to the personal computer.

● When several ports of a personal computer have balances connected, the personal computer can communicate with each balance simultaneously.

● Can share a personal computer with other application software.

● Can receive the balance GLP report.

RsKey

● Can transmit the weighing data output from the balance directly to other application software such as Microsoft Excel.

● Can be used with most application software.

● Can receive the balance GLP report.

Note
Windows and Excel are the registered trademarks of the Microsoft Corporation.

Using the WinCT software, the balance can do the following:

1 Analyzing the weighing data and the statistics input by "RsKey"
   The weighing data can be input directly into an Excel worksheet. Then, Excel can analyze the data to obtain total, average, standard deviation, maximum and minimum value, and display them in a graph.

2 Controlling the balance using commands from a personal computer
   By using "RsCom", the personal computer sends commands such as "re-zero" or "send weighing data" to the balance and controls the balance.

3 Printing the balance GLP report using your printer
   The balance GLP report can be printed using a printer connected to the personal computer.

4 Receiving weighing data at a certain interval
   The weighing data can be received at a certain interval and data characteristic with elapsed time can be obtained.

5 Using the MC series balance memory function
   The weighing data, instead of outputting it immediately to an external device, can be stored in the balance's memory. Later, all of the weighing data stored can be output to a personal computer at one time.

6 Using a personal computer as an external indicator
   With the "RsKey" test mode function, a personal computer can be used as an external weight indicator for the balance. (To do this, set the balance data output mode to stream mode.)

13. COMMANDS

13-1 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.

Note: The "Q" and "SI" commands, the "S" and "$^E{}_{sc}$P" commands behave the same.

Commands to control the balance

CAL ⌴⌴	Same as the CAL key.
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.
T	Same as the RE-ZERO key
Z	Same as the RE-ZERO key
$^E{}_{sc}$T	Same as the RE-ZERO key
U	Same as the MODE key
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.
?ID	Requests the ID number.
?SN	Requests the serial number.
?TN	Requests the model name.

Note: The "R", "T", "Z" and "$^E{}_{sc}$T" commands behave the same.

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.

Note: To use a command to control the comparator function, set the "Input method ($CP{}_{in}$)" parameter to "0" or "1".

Commands to control the memory function

MCL	Deletes all data in memory.
MD:nnn	Deletes weighing data with the data number nnn.
?MA	Outputs all data in memory.
?MQnnn	Outputs weighing data with the data number nnn.
?MX	Outputs the number of weighing data in memory.

Note: "nnn" indicates a three-digit numerical value.
$^E{}_{sc}$: 1Bh in ASCII code

13-2 Acknowledge Code and Error Codes

When the "Serial interface function (5 ıF)" parameter is set to " ErCd I ", the balance outputs <AK> code or error code to 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)

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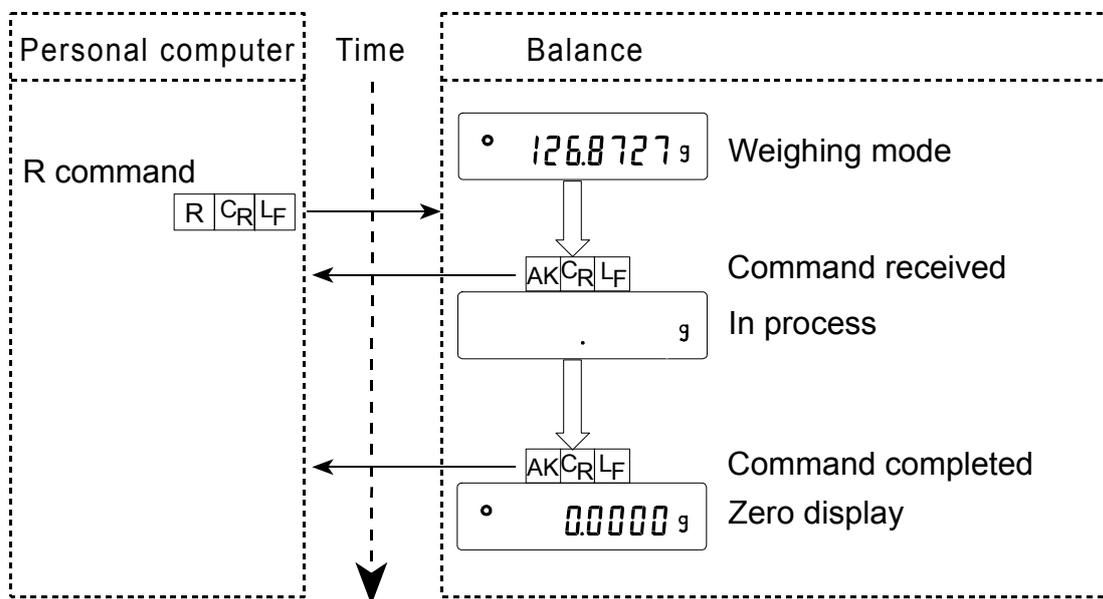
- When a communication error has occurred due to external noise, or a parity error has occurred due to transmission error, the balance transmits an error code. In this case, send the command again.

13-3 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 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).

13-4 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.

14. EXTENDED FUNCTION

The MC series balance has several extended functions equipped for special applications or to troubleshoot when using the standard functions.

When the "Filter (*F IL*)" is set to " *0* ", extra items are available as shown below.

Class	Item and Parameter			Description
ErFnc Extended function	*F1-b* Averaging range for the first moving average	*0*	Small ▲	When the fluctuation of a weight value is within the averaging range, the averaging operation starts to stabilize the value. When the fluctuation is small, for example, when weighing or filling a small amount of sample, the averaging operation is always performed and the response rate may be slow. Under such a condition, change the parameter. Refer to "Averaging range (*F1-b*) and averaging time (*F1-t*)"
		1		
		2		
		3		
		▪ *4*		
		5		
		6		
		7	▼ Large	
	F1-t Averaging time for the first moving average	*0*	No averaging	When the fluctuation of a weight value is within the averaging range, the averaging operation starts. Once the duration of averaging operations reaches the averaging time, moving averaging starts. This parameter sets the time to start moving averaging. Refer to "Averaging range (*F1-b*) and averaging time (*F1-t*)"
		1	0.5 second	
		▪ *2*	1 second	
		3	1.5 seconds	
		4	2.0 seconds	
		5	2.5 seconds	
		6	3.2 seconds	
		7	4.8 seconds	
		8	6.6 seconds	
	F2-b Averaging range for the second moving average	*0*	Small ▲	Refer to "Filter depending on differences in the amount to deliver powdery and liquid material".
		▪ *1*		
		2		
		3		
		4		
		5		
		6	▼ Large	
	F2-t Averaging time for the second moving average	*0*	No averaging	
		1	0.5 second	
		2	1 second	
		3	1.5 seconds	
		4	2.0 seconds	
		▪ *5*	2.5 seconds	
		6	3.2 seconds	

14-1 Description of "Averaging range" and "Averaging time"

Averaging range ($F1\text{-}b$) and averaging time ($F1\text{-}t$)

1. When the fluctuation of a weight value is beyond the range that is selected in " $F1\text{-}b$ ", the averaging operation is disabled and the display reflects the varying value.

2. Once the fluctuation becomes within the selected range, the averaging operation starts to stabilize the weight value.

3. The process of averaging increases. When the selected time is reached, moving averaging will be performed.
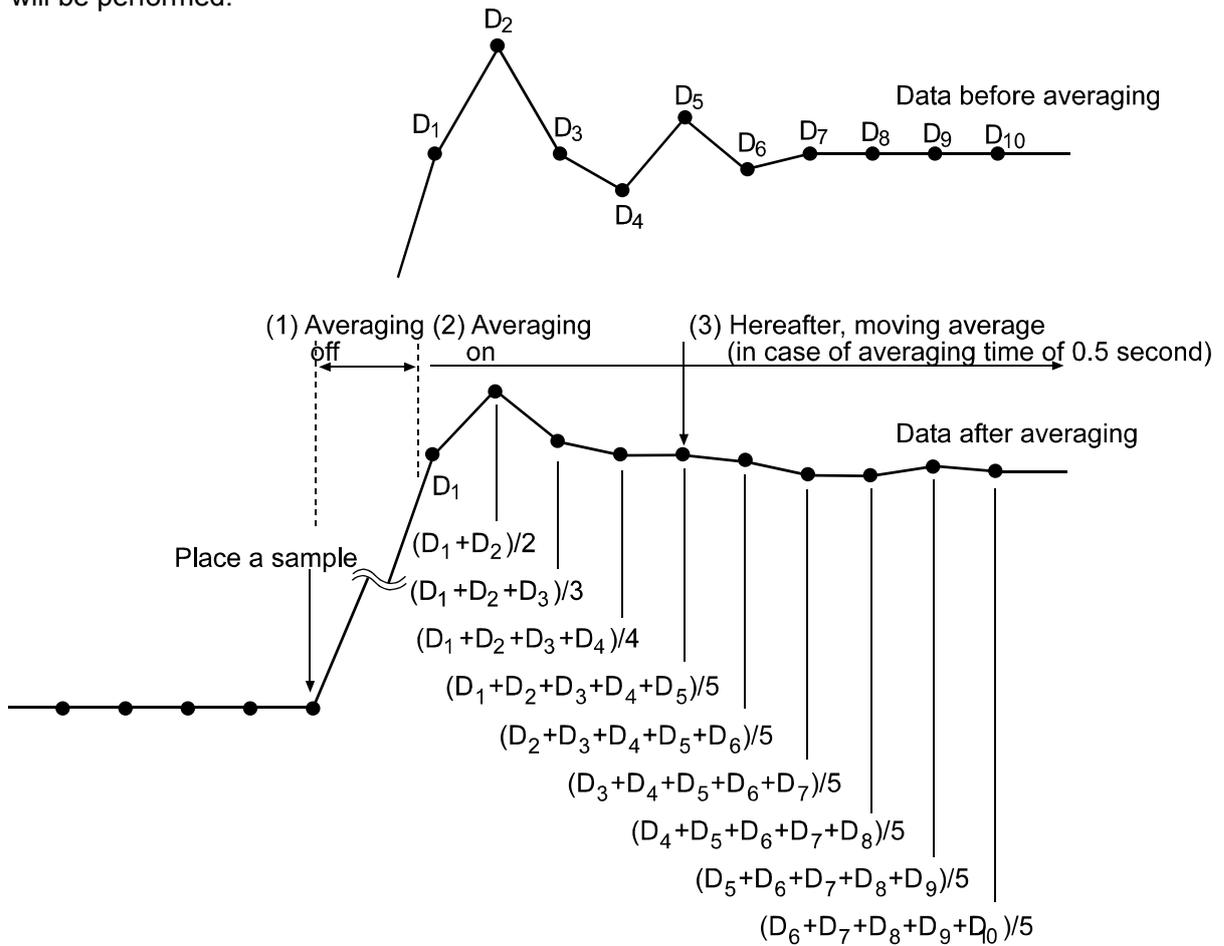
When a small amount of sample is weighed or is filled, the fluctuation of a weight value is too small to be beyond the selected range and the averaging operation is not disabled. Consequently moving averaging is always performed and it takes a longer time to reach the final weight value. Under such a situation, change the setting of " $F1\text{-}b$ " to a smaller range. But please note that the smaller the range is, the more prone to external disturbance the value will become.

Filter depending on differences in the amount to deliver powdery and liquid material

● When the weight value is not stable even without load fluctuations

    □ Increase the averaging range for the first moving average parameter ($F1\text{-}b$).
    □ Increase the averaging time for the first moving average parameter ($F1\text{-}t$).
    □ Strengthen the digital filter. (Increase the function setting "Condition ($Cond$)" parameter.)

● When response is slow during full and medium flow

    □ Decrease the averaging range for the first moving average parameter ($F1\text{-}b$).
    □ Weaken the digital filter. (Decrease the function setting "Condition ($Cond$)" parameter.)

● When response is slow during dribble flow

    □ Decrease the averaging time for the first moving average parameter ($F1\text{-}t$).
    □ Weaken the digital filter. (Decrease the function setting "Condition ($Cond$)" parameter.

● To increase stability without load fluctuations

    □ Increase the averaging range for the second moving average parameter ($F2\text{-}b$).
    □ Increase the averaging time for the second moving average parameter ($F2\text{-}t$).

15. MAINTENANCE

- 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.
- Do not disassemble the balance. Contact the local A&D dealer if the balance needs service or repair.
- Use the original packing material for transportation.

16. TROUBLESHOOTING

16-1 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 A&D dealer for repair.

Checking that the balance performs properly

- Check the balance performance using the self-check function as described in "6-1 Automatic Response Adjustment / 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 balance with a minimum weighing value of 0.0001 g)?
- Is the balance level? Refer to "3-1 Before Use".
- Is the operating environment free from vibration and drafts? 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 internal mass (one-touch calibration)?
- 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".

Static electricity is generated 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".

16-2 Error Codes

Display	Error code	Description
Error 1	EC, E11	**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.
Error 6	EC, E16	**Internal mass error** Applying the internal mass does not yield a change in the weighing value as specified. Confirm that there is nothing on the pan and perform the weighing operation from the beginning again.
Error 7	EC, E17	**Internal mass error** The internal mass application mechanism does not function properly. Perform the weighing operation from the beginning again.
CAL E	EC, E20	**Calibration weight error** The calibration weight is too heavy. Confirm the calibration weight value. Press the CAL key to return to the weighing mode.
-CAL E	EC, E21	**Calibration weight error** The calibration weight is too light. Confirm the calibration weight value. Press the CAL key to return to the weighing mode.

Display	Error code	Description
⊟ **E**		**Overload error**
		A sample beyond the balance weighing capacity has been placed on the pan.
		Remove the sample from the pan.
⊟ **-E**		**Weighing pan Error**
		The weight value is too light.
		Confirm that the weighing pan is properly installed and calibrate the balance.
⊟ **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, for accurate counting, be sure to add samples.
⊟ **CH 0**		**Automatic response adjustment zero error**
		The automatic response adjustment can not be performed because there is something on the pan.
		Clear the pan. Press the CAL key to return to the weighing mode.
⊟ **CH nG** (CHECK NG)		**Automatic response adjustment unstable error**
		The automatic response adjustment can not be performed because the weight value is unstable.
		Check the ambient conditions such as breeze, vibration and magnetic fields, also check the weighing pan. Press the CAL key to return to the weighing mode.
⊟ **CH no** (CHECK NO)		**Internal error**
		Indicates an internal error as the result of the self-check function.
		Repair is required. Contact the local A&D dealer.
⊟ **rtc PF**		**Clock battery error**
		The clock backup battery has been depleted.
		Press any key and set the time and date. The clock and calendar function works normally as long as the AC adapter is connected to the balance. If this error appears frequently, contact the local A&D dealer.
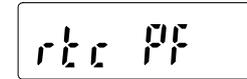
Display	Error code	Description
FUL (Blinking)		**Memory full** The amount of weighing data in memory has reached the maximum capacity. Delete the data in memory to store new data. For details, refer to the GX series instruction manual, "12. DATA MEMORY".
FUL (Illuminated)		**Memory full** The amount of calibration or calibration test data in memory has reached the maximum capacity (50 sets). The data in memory will be deleted automatically to store new data. For details, refer to the GX series instruction manual, "12. DATA MEMORY".
CLr		**Memory type error** The type of memory set in the function table and the type of data stored are different. For details, refer to the GX series instruction manual, "12. 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.
	EC, E03	**Timeout error** If the timeout parameter is set to " *t-UP 1* ", 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.
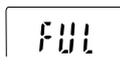
Display	Error code	Description
	EC, E06	**Format error**
		A command includes incorrect data.
		e.g. The data is numerically incorrect.
		Confirm the command.
	EC, E07	**Parameter setting error**
		The received data exceeds the range that the balance can accept.
		Confirm the parameter range of the command.
Other errors		If the errors described above can not be released or other errors are displayed, contact the local A&D dealer.
Other symbol		
		When this indicator blinks, automatic self calibration is required. The indicator blinks when the balance detects changes in ambient temperature. If the balance is not used for several minutes with this indicator blinking, the balance performs automatic self calibration. The blinking duration depends on the operating environment.

16-3 Asking For Repair

If the balance needs service or repair, contact the local A&D 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.

17. SPECIFICATIONS

	MC-1000	MC-6100
Weighing capacity	1100 g	6100 g
Maximum display	1100.0844 g	6100.844 g
Minimum weighing value	0.0001 g	0.001 g
Repeatability (Standard deviation) See Note 1 below.	0.0005 g / 1 kg 0.0004 g / 500 g	0.004 g / 5 kg 0.0015 g / 2 kg
Sensitivity drift (10°C-30°C/50°F-86°F with)	±2 ppm/°C (When automatic self calibration is not used)	
Accuracy right after calibration using the internal mass. See Note 2 below	$\pm$0.0100 g	$\pm$0.150 g
	The value above is to the weighing capacity.	
Operating environment	5°C to 40°C (41°F to 104°F) 85%RH or less (No condensation)	
Internal mass	Yes	
Data memory function, weight data	Maximum 200 (Maximum 100 when the time and date are added)	
Calendar function	Yes	
Display refresh rate	5 times/second or 10 times/second	
Display mode	g (gram)	
Interface (Provided as standard)	RS-232C with Windows Communication Tools WinCT	
External calibration weight	1000 g, 900 g 800 g, 700 g 600 g, 500 g 400 g, 300 g 200 g	6000 g 5000 g 4000 g 3000 g 2000 g
Weighing pan	128 x 128 mm	165 x 165 mm
Net weight	Approx. 4.6 kg	Approx. 5.1 kg
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)	
Accuracy class F1	500 g, 1 kg	2 kg, 5 kg

Note 1: When the auto-centering pan or automatic system is used in good ambient conditions.
Note 2: Accuracy right after calibration using the internal mass in good ambient conditions (within the temperature range of 10°C to 30°C (50°F to 86°F) with no abrupt changes in temperature or humidity, no drafts, no effect by magnetic fields or static electricity).
The value of the internal mass may change due to corrosion or other damage caused by the operating environment, or due to aging. Check the internal mass using an external weight periodically.

18. OPTIONS

AX-MC1000PAN   Auto-centering pan for the MC-1000
- Consists of an auto-centering pan, a breeze break, two breeze break securing screws and an auto-centering pan guide(128 x 128 mm).

AX-MC6100PAN   Auto-centering pan for the MC-6100
- Consists of an auto-centering pan, a breeze break, two breeze break securing screws and an auto-centering pan guide (165 x 165 mm).

AD-1682 Rechargeable battery
- Allows use of the balance in a place where AC power is not available.

AD-1683 DC static eliminator
- Used to minimize weighing errors due to static electricity on the material.

AD-8121B Printer
- Compact dot-matrix printer
- Statistical function, clock and calendar function, interval print function, graphic print function, dump print 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.
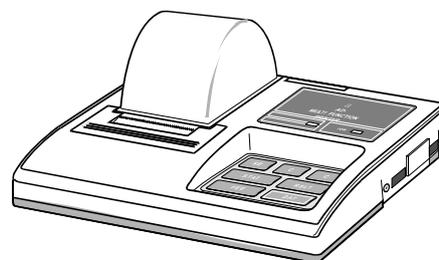
AD-8524A/B Keyboard adapter
- Used to connect the balance to a personal computer with appropriate OS and applications.

AD-8920A Remote display
- Connected to the MC series using the RS-232C interface to display the weighing data away from the balance.

AD-8922A Remote controller
- Connected to the MC series balance using the RS-232C interface to display the weighing data and to remotely control the balance.

AX-HDB-25P/CTF Connector

AX-SW128 Foot switch
- Used to externally transmit a RE-ZERO or PRINT signal to the balance.

AX-USB-25P-EX USB converter
- An RS-232C cable is provided to connect the USB converter to the balance.

19. EXTERNAL DIMENSIONS

MC-1000
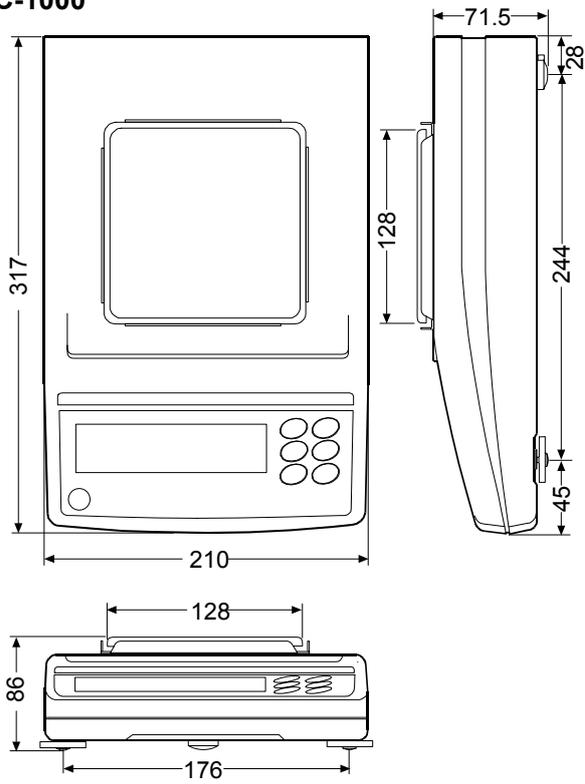
MC-6100
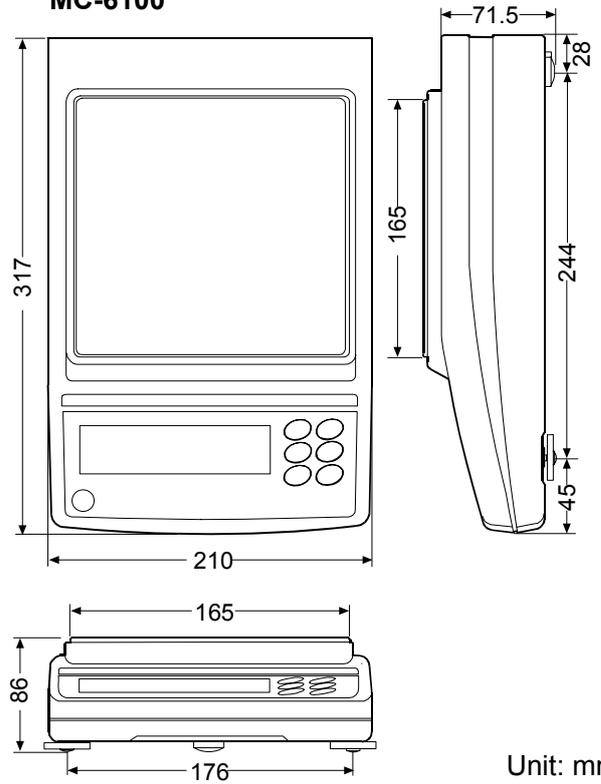
Unit: mm

20. TERMS/INDEX

Terms

Stable value   The weight data when the stabilization indicator appears.

Environment   Ambient conditions such as vibration, drafts, temperature, static electricity and magnetic fields which affect the weighing operation.

Store   To save the weighing data, unit mass or calibration data using the data memory function.

Calibration   Adjustment of the balance so that it can weigh accurately.

Output   To output the weighing data using the RS-232C interface.

Zero point   A weighing reference point or the zero display. Usually refers to the value displayed when nothing is on the weighing pan.

Data number   Numbers assigned sequentially when weighing data or unit weight is stored.

Digit   Unit of digital resolution. Used for the balance, a unit of minimum weighing value.

Tare   To cancel the weight of a container which is not included in the weighing data.

Mode   Balance operational function.

Re-zero   To set the display to zero.

GLP   Good Laboratory Practice.

Repeatability   Variation in measured values obtained when the same weight is placed and removed repetitively. Usually expressed as a standard deviation.

e.g. Standard deviation=1 digit: This means that measured values fall within ±1 digit in the frequency of about 68%.

Stabilization time Time required after a sample being placed, until the stabilization indicator illuminates and the weighing data is displayed.

Sensitivity drift An affect that a change in temperature causes to the weighing data. Expressed as temperature coefficient.

e.g. Temperature coefficient = 2 ppm/$°$C : If a load is 500 g and the temperature changes by 10$°$C, the value displayed changes by the following value.

0.0002%/$°$C x 10$°$C x 500 g = 10 mg

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