EK-H SERIES
OPTION

INSTRUCTION MANUAL

OP-03H
OP-04H
OP-05H
OP-07H
OP-09H

A&D
This is the hazard alert mark.

This notice mark is to inform you on the operation of the balance.

This information mark that informs you about the operation of balance.
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</table>
Introduction

THANK YOU FOR YOUR A&D PURCHASE

This manual will tell you in simple language how these options work and how to get the most out of them in terms of performance.

The following options are available to be purchased separately.

1. OP-03H RS-232C serial interface
2. OP-04H Comparator relay output (With a buzzer)
3. OP-05H Printer interface (Current loop output)
4. OP-07H Underhook
5. OP-09H NiCd battery pack

Note: OP-03H, OP-04H, and OP-05H can not be used at the same time. Refer to page 3 of this manual for details. The current loop interface is a passive type and requires an external power source that can supply 20mA. The external power source is not necessary when connecting an AD-8121.

- OP-03H, OP-05H can use data formats that manage the balance and is based on GLP.

- The OP-03H is a Bi-directional RS-232C interface.
  - The RS-232C Interface is used to communicate with a computer principally and the balance is able to perform as peripheral equipment. The following operations are available through a command from the computer.
    - Output measurement data
    - Control the balance
    - Balance setup input
    - Comparison value setup

- OP-05H is a current loop interface.
  - The current loop interface is primarily used as a printer interface. This interface is for output only and can not receive any commands from peripheral equipment (printer).

- If you connect the current loop interface to AD-8121 printer, you need an OP-01 printer cable for the AD-8121.

Compliance with FCC Rules

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

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

Accessory

- AD-8121 Multi-function printer. This printer can print weighing data, total weighing, counting and standard deviation, along with the time and date.

Installation (OP-03H/04H/05H)

1. Remove the cover of the OP-03H/04H/05H installation area on the rear of the main unit by pressing and lowering this cover. Then, remove the option securing screws from the main unit.

2. Insert the main unit connector to the option board connector as shown above.

3. Insert the connector in the correct direction.

4. Insert the option board into the main unit.

5. Secure the option board using the screws removed in step 1.

The illustration above is an installation example using OP-03H, RS-232C serial interface.
**Specification**

**OP-04H (Comparator)**
- Maximum open circuit voltage: DC 100V
- Maximum switch current: DC 100mA
- Maximum switch ON resistance: 20Ω
- Method of setting the limit value: Weighing or Digital input to the balance
- Contact output: In the balance internal setting "P", select Yes or No for sounding the buzzer
- Method of setting the buzzer: $b \in \mathbb{P}$

<table>
<thead>
<tr>
<th>Comparison Result</th>
<th>Output (Pins 1 to 2)</th>
<th>Output (Pins 6 to 2)</th>
<th>Output (Pins 4 to 2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HI</td>
<td>Short circuit</td>
<td>Open</td>
<td>Open</td>
</tr>
<tr>
<td>OK</td>
<td>Open</td>
<td>Short circuit</td>
<td>Open</td>
</tr>
<tr>
<td>LO</td>
<td>Open</td>
<td>Open</td>
<td>Short circuit</td>
</tr>
</tbody>
</table>

**OP-03H (RS-232C), OP-05H (Current loop)**
- Transmission system: EIA RS-232C, 20mA current loop (passive)
- Transmission form: Asynchronous, bi-directional, half duplex
- Data format:
  - Baud rate: 600, 1200, 2400, 4800, 9600 bps
  - Data: 7 or 8 bits
  - Parity: Even, Odd (7 bit), None (8 bit)
  - Stop bit: 1 bits
  - Code: ASCII

**DATA**

<table>
<thead>
<tr>
<th>DATA</th>
<th>Signal level</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>RS-232C</td>
</tr>
<tr>
<td>1</td>
<td>-5V ~ -15V</td>
</tr>
<tr>
<td>0</td>
<td>5V ~ 15V</td>
</tr>
</tbody>
</table>

Stop bits
Parity bit
Data bits
Start bit

Page 4
Pin connections

RS-232C

<table>
<thead>
<tr>
<th>Pin No.</th>
<th>Signal name</th>
<th>Direction</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>FG</td>
<td>-</td>
<td>Frame ground</td>
</tr>
<tr>
<td>2</td>
<td>RxD</td>
<td>Input</td>
<td>Receive data</td>
</tr>
<tr>
<td>3</td>
<td>TxD</td>
<td>Output</td>
<td>Transmit data</td>
</tr>
<tr>
<td>4</td>
<td>RTS</td>
<td>Input</td>
<td>Ready to send</td>
</tr>
<tr>
<td>5</td>
<td>CTS</td>
<td>Output</td>
<td>Clear to send</td>
</tr>
<tr>
<td>6</td>
<td>DSR</td>
<td>Output</td>
<td>Data set ready</td>
</tr>
<tr>
<td>7</td>
<td>GND</td>
<td>-</td>
<td>Signal ground</td>
</tr>
<tr>
<td>8-25</td>
<td>N.C.</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Current loop

<table>
<thead>
<tr>
<th>Pin No.</th>
<th>Signal name</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>N.C.</td>
</tr>
<tr>
<td>2</td>
<td>N.C.</td>
</tr>
<tr>
<td>3</td>
<td>Loop</td>
</tr>
<tr>
<td>4</td>
<td>N.C.</td>
</tr>
<tr>
<td>5</td>
<td>Loop</td>
</tr>
<tr>
<td>CASE</td>
<td>Frame GND</td>
</tr>
</tbody>
</table>

Pin connections and partial circuit diagrams

Option 04H
**Comparator interface**

The balance compares the weight value to an upper and lower limit value, and outputs the results to the contacts. The buzzer can be set to work when the output contact is "short".

**How to use the comparator**

1. Install the option in the balance.
2. Set the **CP F n C**. (Refer to "Setting examples")
3. Set the upper limit and lower limit value. (Refer to "Comparator setting" on the next page)
4. If you weigh something, the balance will output the result.

---

<table>
<thead>
<tr>
<th>Class</th>
<th>Item</th>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CP F n C</strong> Comparator</td>
<td><strong>CP</strong> Comparator mode</td>
<td>0</td>
<td>No comparison</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>Comparison, not near zero, when stable value or over</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
<td>Comparison, near zero, when stable value or over</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3</td>
<td>Continuous comparison, not near zero</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4</td>
<td>Continuous comparison, near zero</td>
</tr>
<tr>
<td><strong>CP in</strong> Input method</td>
<td><strong>CP</strong></td>
<td>0</td>
<td>Digital input, upper/lower limits</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>Weighing input, upper/lower limits</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
<td>Weighing input, reference value</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3</td>
<td>Weighing input, reference value</td>
</tr>
<tr>
<td>(Displayed only when OP-04H is connected.)</td>
<td><strong>bEP</strong></td>
<td>0</td>
<td>OFF</td>
</tr>
<tr>
<td></td>
<td>LO buzzer</td>
<td>1</td>
<td>ON</td>
</tr>
<tr>
<td></td>
<td><strong>bEP</strong>- OK buzzer</td>
<td>0</td>
<td>OFF</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>ON</td>
</tr>
<tr>
<td></td>
<td><strong>bEP</strong>- HI buzzer</td>
<td>0</td>
<td>OFF</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>ON</td>
</tr>
</tbody>
</table>

*Factory setting

*1 "Digit" is the minimum display unit.
Comparator setting

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

Operating conditions: No comparison (comparison turned off)
Comparison at a stable value or over, not including near zero
Comparison at a stable value or over, including near zero
Continuous comparison, not including near zero
Continuous comparison, including near zero

Comparison value:
Upper limit value and lower limit value
Reference value plus and minus tolerance value

Input methods:
Digital input, Weighing input

Refer to the function list about the meaning of \( F_{\text{Fc}} \).
Whenever the weighing unit is changed, re-enter the comparator value.

9-1. Setting example 1

This example will use:
"Continuous comparison, not including near zero",
"Reference value with a tolerance value"
and "Digital input".

Selecting a comparison method

1. Press and hold the SAMPLE key to display \( bR SFnc \).
2. Press the SAMPLE key several times to display \( CP Fnc \).
3. Press the PRINT key.
4. Press the ZERO key several times to display \( CP \ 3 \).
5. Press the SAMPLE key to display \( CP \ in \).
6. Press the ZERO key several times to display \( CP \ in \ 2 \).
7. Press the PRINT key to store the settings.
Entering the reference and tolerance values

8. With \( CP \) and \( REF \) displayed, press the PRINT key. All the digits blink. Press the ZERO key. Enter the reference value with the following keys.

- **SAMPLE** key: To select the digit to change.
- **ZERO** key: To set the value of the digit selected. Hold down the key to switch the polarity.
- **PRINT** key: To store the value and proceed to the next step.
- **MODE** key: To cancel the value and proceed to the next step.

9. With \( CP \) and \( Lin \) displayed, press the PRINT key. Enter the tolerance value in percentage to the reference value as 100%, using the following keys.

- **SAMPLE** key: To select the digit to change.
- **ZERO** key: To set the value of the digit selected.
- **PRINT** key: To store the value and proceed to the next step.
- **MODE** key: To cancel the value and proceed to the next step.

10. Press the PRINT key. \( \text{Unit} \) appears after \( \text{End} \).

11. Press the MODE key to return to the weighing mode.
9-2. Setting example 2

This example will use "Continuous comparison, including near zero", "Upper limit / lower limit" and "Digital input".

Selecting a comparison method

1. Press and hold the Sample key to display \( hRSF \). (See Example 1 for the detail about steps 1-7)

2. Press the Sample key to display \( L^P \).

3. Press the Print key to display \( L^P \).

4. Press the Zero key several times to display \( L^P \).

5. Press the Sample key several times to display \( L^P \).

6. Press the Zero key several times to display \( L^P \).

7. Press the Print key to store the selection.

See Example 1

Entering the upper and lower limit values

8. With \( L^PH \) displayed, press the Print key. All the digits blink. Press the Zero key. Enter the upper limit value using the following keys.

   - **Sample** key: To select the digit to change.
   - **Zero** key: To set the value of the digit selected. Hold down the key to switch the polarity.
   - **Print** key: To store the value and proceed to the next step.
   - **Mode** key: To cancel the value and proceed to the next step.

Set using the relevant keys

To store
9. With \[ \text{P lo} \] displayed, press the \text{PRINT} key. All the digits blink. Press the \text{ZERO} key. Enter the lower limit value using the following keys.

- \text{SAMPLE} key: To select the digit to change.
- \text{ZERO} key: To set the value of the digit selected.
- \text{PRINT} key: To store the value and proceed to the next step.
- \text{MODE} key: To cancel the value and proceed to the next step.

10. Press the \text{PRINT} key. \text{Un it} appears after \[ \text{End} \].

11. Press the \text{MODE} key to return to the weighing mode.

9-3. Setting example 3

This example will use "Comparison at a stable value or over, including near zero", "Upper limit / lower limit" and "Weighing input".

Selecting a comparison method (See example 1)

1. Press and hold the \text{SAMPLE} key to display \[ \text{hR5fnC} \]. (See Example 1 for the detail about steps 1-7)

2. Press the \text{SAMPLE} key to display \[ \text{P fnC} \].

3. Press the \text{PRINT} key to display \[ \text{P} \].

4. Press the \text{ZERO} key several times to display \[ \text{P} \].

5. Press the \text{SAMPLE} key several times to display \[ \text{P in} \].

6. Press the \text{ZERO} key several times to display \[ \text{P in, l} \].

7. Press the \text{PRINT} key to store the selection.
Entering the upper and lower limit values

8. With \textit{\textbf{P Hi}} displayed, press the \textbf{PRINT} key. All the digits blink. Press the \textbf{ZERO} key. The weight value is displayed.

9. Place a sample whose weight corresponds to the upper limit value on the pan. Press the \textbf{PRINT} key to store the weight. Remove the sample. Press the \textbf{ZERO} key to display zero.

10. \textit{\textbf{P Lo}} appears after the above operation has completed.

11. With \textit{\textbf{P Lo}} displayed, press the \textbf{PRINT} key. All the digits blink. Press the \textbf{ZERO} key. The weight value is displayed.

12. Place a sample whose weight corresponds to the lower limit value on the pan. Press the \textbf{PRINT} key to store the weight. Remove the sample. Press the \textbf{ZERO} key to display zero.

13. Press the \textbf{PRINT} key. \textit{\textbf{Unit}} appears after \textit{\textbf{End}}.

14. Press the \textbf{MODE} key to return to the weighing mode.
Combination of comparator output

Do not set a lower limit value that is more than the upper limit value.

This is the principal combination of comparator output. The buzzer can be selected to sound by internal setting $\text{FRC}$ when the contact output is "short circuit".

1. The case of setting the upper limit and lower limit.

<table>
<thead>
<tr>
<th>Weighing value</th>
<th>LO</th>
<th>OK</th>
<th>HI</th>
</tr>
</thead>
<tbody>
<tr>
<td>(upper limit value) &lt; (weighing value)</td>
<td>Open</td>
<td>Short circuit</td>
<td></td>
</tr>
<tr>
<td>(lower limit value) ≤ (weighing value) ≤ (upper limit value)</td>
<td>Short circuit</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(weighing value) &lt; (lower limit value)</td>
<td>Short circuit</td>
<td>Open</td>
<td></td>
</tr>
</tbody>
</table>

Example of using the comparator output

This is a sample using the AD-8951 (comparator light, purchased separately). The resulting compared weighing value is displayed by the light (Red, Green, Orange).

Set up the function $CP_{\text{ref}}$ as follows:

- $CP = 3$ Continuously comparison (not near zero)
- $CP_{\text{in}} = 0$ Digital input (upper/lower limits)
- $bEEP = 1$ Sound the buzzer at LO.
- $bEEP = 0$ Do not sound the buzzer at OK.
- $bEEP = 1$ Sound the buzzer at HI.

Set limit values as follows:
- Upper limit value: 10100.0 g
- Lower limit value: 9900.0 g

(1) When the weight value is 9000.0 g, the balance turns the Orange light on and sounds the buzzer.

(2) When the weight value is 10000.0 g, the balance turns the Green light on.

(3) When the weight value is 11000.0 g, the balance turns the Red light on and sounds the buzzer.
### Functions

**Note:** Whether or not to use this mode can be selected in "permit or prohibit key operation". Refer to page 17 of the Instruction manual.

#### Key operation

- **ON/OFF I/O**: Cancels the operation and turns off the display.
- **SAMPLE**: Item key
  - Selects a class and an item.
  - In the weighing mode, press and hold the key to enter the function setting mode.
- **PRINT**: Enter key
  - Proceeds to the selected class.
  - Stores the settings per class and goes to the next class.
- **MODE**: Parameter key
  - Selects a parameter.
- **ZERO → O T ←**: Cancel key
  - Cancels the operation and closes the mode.

#### Functions

<table>
<thead>
<tr>
<th>Class</th>
<th>Item</th>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CP Func Comparator</td>
<td>CP Comparator mode</td>
<td>a</td>
<td>No comparison</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>Comparison, not near zero, when stable value or over</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
<td>Comparison, near zero, when stable value or over</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3</td>
<td>Continuous comparison, not near zero</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4</td>
<td>Continuous comparison, near zero</td>
</tr>
<tr>
<td>CP in Input method</td>
<td>CP in</td>
<td>a</td>
<td>Digital input, upper/lower limits CP H or CP L can be selected.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>Weighing input, upper/lower limits</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
<td>Digital input, reference value CP rEF or CP rLT can be selected.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3</td>
<td>Weighing input, reference value</td>
</tr>
<tr>
<td>(Displayed only when OP-04H is connected.)</td>
<td>bEP LO buzzer</td>
<td>a</td>
<td>OFF</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>ON</td>
</tr>
<tr>
<td></td>
<td>bEP - OK buzzer</td>
<td>a</td>
<td>OFF</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>ON</td>
</tr>
<tr>
<td></td>
<td>bEP HI buzzer</td>
<td>a</td>
<td>OFF</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>ON</td>
</tr>
</tbody>
</table>

*Factory setting

*1 "Digit" is the minimum display unit.
<table>
<thead>
<tr>
<th>Class</th>
<th>Item</th>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>dout</strong> Data output</td>
<td><strong>Pr</strong> Data output mode</td>
<td>0</td>
<td>Key mode</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>Auto print mode A (Reference=zero)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
<td>Auto print mode B (Reference=last stable value)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3</td>
<td>Stream mode</td>
</tr>
<tr>
<td></td>
<td><strong>Rp-P</strong> Auto print polarity</td>
<td>0</td>
<td>Plus only</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>Minus only</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
<td>Both polarities</td>
</tr>
<tr>
<td></td>
<td><strong>Rp-b</strong> Auto print difference</td>
<td>0</td>
<td>10 digits</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>100 digits</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
<td>1000 digits</td>
</tr>
<tr>
<td></td>
<td><strong>PuSE</strong> Data output pause</td>
<td>0</td>
<td>No pause</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>Pause (1.5 seconds)</td>
</tr>
<tr>
<td></td>
<td><strong>Re-f</strong> Auto feed</td>
<td>0</td>
<td>Not used</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>Used</td>
</tr>
<tr>
<td></td>
<td><strong>InFg</strong> GLP output</td>
<td>0</td>
<td>No output</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>AD-8121 format</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
<td>Data format</td>
</tr>
<tr>
<td></td>
<td><strong>Rr-d</strong> Zero after output</td>
<td>0</td>
<td>Not displayed</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>Displayed</td>
</tr>
<tr>
<td><strong>SiF</strong> Serial interface</td>
<td><strong>bps</strong> Baud rate</td>
<td>0</td>
<td>600 bps</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>1200 bps</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
<td>2400 bps</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3</td>
<td>4800 bps</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4</td>
<td>9600 bps</td>
</tr>
<tr>
<td></td>
<td><strong>bP-r</strong> Length, parity bits</td>
<td>0</td>
<td>7 bits, EVEN</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>7 bits, ODD</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
<td>8 bits, NON</td>
</tr>
<tr>
<td></td>
<td><strong>Ter</strong> Terminator</td>
<td>0</td>
<td>CR, LF</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>CR</td>
</tr>
<tr>
<td></td>
<td><strong>tp</strong> Data format</td>
<td>0</td>
<td>A&amp;D format</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>DP format</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
<td>KF format</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3</td>
<td>MT format</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4</td>
<td>NU format</td>
</tr>
<tr>
<td></td>
<td><strong>tlp</strong> Time up</td>
<td>0</td>
<td>No limit</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>For one second</td>
</tr>
<tr>
<td></td>
<td><strong>Erc-d</strong> AK, error code</td>
<td>0</td>
<td>No output</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>Output</td>
</tr>
<tr>
<td></td>
<td><strong>Cts</strong> CTS control</td>
<td>0</td>
<td>Not used</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>Used</td>
</tr>
</tbody>
</table>

- Factory setting

*page 16*
Auto print

The data is transmitted at stable value.

Band width
Plus polarity

Weighing value

Standard value
Zero point on auto print A.
Last value on auto print B.

Band width
Minus polarity

The data is transmitted at stable value.

Case of plus polarity
Case of minus polarity

Setting example

In this example, data output is set to stream mode.

1. Set the balance to the weighing mode.

2. Press and hold the [SAMPLE] key to display \( b_{AFc} \).

3. Press the [SAMPLE] key several times to display \( d_{out} \).

4. Press the [PRINT] key to display \( Prt \).

5. Press the [ZERO] key several times to display \( Prt \ 3 \).

6. Press the [PRINT] key. \( 5.1F \) appears after \( End \).

7. Press the [MODE] key to exit the function setting mode. The balance returns to the weighing mode with the selected unit.

Press and hold

\( b_{AFc} \)

SAMPLE

\( d_{out} \)

PRINT

\( Prt \ 0 \)

PRINT

\( Prt \ 3 \)

PRINT

\( End \)

\( 5.1F \)

MODE

Returns to the weighing mode
Data output mode

There are four modes to control the transmission of the weighing data.

Key Mode
When you press the [PRINT] key, the balance transmits the weighing data when the display is stable (the stability indicator is on). When the data is transmitted the display will blink one time.

\[\text{dout} \quad \text{Pt} \quad 0 \quad \ldots \quad \text{Print key mode}\]

Auto-print Mode A
The balance transmits the weighing data when the display is stable (the stability indicator is on), meets the conditions of "Auto-print polarity" and "Auto-print band". The reference for the auto-print band is the zero point. When the data is transmitted the display will blink one time.

\[\begin{align*}
\text{dout} & \quad \text{Pt} \quad 1 \quad \ldots \quad \text{Auto-print mode A} \\
\text{dout} & \quad \text{RP-P X} \quad \ldots \quad \text{Auto-print polarity} \quad X = 0, \ 1, \ 2 \\
\text{dout} & \quad \text{RP-b X} \quad \ldots \quad \text{Auto-print band} \quad X = 0, \ 1, \ 2
\end{align*}\]

Auto-print Mode B
The balance transmits the weighing data when the display is stable (the stability indicator is on), meets the conditions of "Auto-print polarity" and "Auto-print band". The reference for the auto-print band is the last stable weighing data that printed. When the data is transmitted the display will blink one time.

\[\begin{align*}
\text{dout} & \quad \text{Pt} \quad 2 \quad \ldots \quad \text{Auto-print mode B} \\
\text{dout} & \quad \text{RP-P X} \quad \ldots \quad \text{Auto-print polarity} \quad X = 0, \ 1, \ 2 \\
\text{dout} & \quad \text{RP-b X} \quad \ldots \quad \text{Auto-print band} \quad X = 0, \ 1, \ 2
\end{align*}\]

Stream Mode
The balance transmits the weighing data continuously.

\[5 \quad F \quad b^{5} X \quad \ldots \quad \text{Baud rate} \quad X = 0, \ 1, \ 2, \ 3, \ 4\]

CAUTION:
When the baud rate is set to 600 or 1200bps and the refresh rate of the display is set to high speed, the balance does not transmit the displayed data completely (and transmits it intermittently).
Data format

There are five formats for transmission of the weighing data. The data format can be selected with the setting of $S_i F$ type. Either of terminator $C_r$ or $C_r L_F$ can be selected with the setting of $S_i L_F E L L F$.

A&D Standard Format type 0
This format is used when the peripheral equipment is capable of receiving A&D format. If an AD-8121 is to be used and you receive a 15 character data string (excluding the terminator), set the printer to mode 1 or 2.

- A two character header indicates the status of the stability.
- The weighing data (with leading zeros) plus sign and decimal point, followed by a three character "unit of weight" make up the body of the data.
- A terminator consisting of $C_r L_F$ to indicate to the peripheral equipment that all of the data has been sent.
- Header: Stable header is $S_T$, Stable header for counting mode is $Q_T$
  Unstable header is $U_S$, Overload header is $O_L$

Dump Print Format type 1
This format is used when the peripheral equipment is not capable of receiving A&D format. If an AD-8121 is to be used and you receive a 16 character data string (excluding the terminator), set the printer to mode 3.

- A two character header indicates the status of the stability except overloading.
- The weighing data (with leading zeros replaced by spaces) plus sign and decimal point, followed by a three character "unit of weight" make up the body of the data.
- When the weighing data is zero, this format does not contain the polarity sign.
- A terminator consisting of $C_r L_F$ to indicate to the peripheral equipment that all of the data has been sent.
- Header: Stable header is $W_T$, Stable header for counting mode is $Q_T$
  Unstable header is $U_S$
KF Format  type 2
This is the Karl-Fischer moisture meter format and is used when the peripheral equipment can communicate using only this mode.

```
+----+----+----+----+----+----+----+----
  1   2   3   4   5   6   7   8
    Unit   Data   Polarity
  9    10   11   12   13   14
    Terminator
```

- The information transmitted consists of 14 characters (excluding the terminator).
- The sign of the weighing data is first if the balance is not in overload. The sign is omitted if the balance is at zero.
- The sign is followed by the weight data (with leading zeros replaced by spaces) and decimal point. The weight data is followed by the unit if the balance is stable.
- A terminator consisting of \( C_R \), \( L_F \) to indicate to the peripheral equipment that all of the data has been sent.
- The unit is output if stable. Example "g".
- No unit is output if unstable.

MT Format  type 3
- The information transmitted length will be changed by the unit or overload.

```
S----+----+----+----+----+----+----
   1   2   3   4   5   6   7
    Unit   Data   Polarity
  8    9   10   11   12   13   14
    Header
```

- The weight data is proceeded by a header of two characters. If stable, one character and a space are transmitted.
- The minus sign will be next if the weight data is negative. The sign is omitted if the weight data is positive or at zero. Leading zeros are replaced by spaces.
- If the balance is in overload, the weight data is omitted.
- Header: Stable header is \( S \), Unstable header is \( S D \)
- Overload header is \( S I \)

NU Format  type 4
- The Numerical format

```
+----+----+----+----+----+----+----+----
  1   2   3   4   5   6   7   8
    Data   Polarity
  9    10   11   12   13   14   15   16
    Terminator
```

- The information transmitted consists of sign (+,−) and weight data followed by the terminator.
- The weight data length is eight figures including decimal point.
- When the weight data is zero, polarity sign is plus.
### Data format examples

#### STABLE

<table>
<thead>
<tr>
<th>A&amp;D</th>
<th>D.P.</th>
<th>KF</th>
<th>MT</th>
<th>NU</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>000</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\[ \begin{align*}
\text{ST} & : +000000.00000 \quad g_{RF} \\
\text{WT} & : 0.000 \quad g_{RF} \\
\text{KF} & : 0.000 \quad g_{RF} \\
\text{MT} & : 0.000 \quad g_{RF} \\
\text{NU} & : +000000.00 \quad g_{RF}
\end{align*} \]

#### UN-STABLE

<table>
<thead>
<tr>
<th>A&amp;D</th>
<th>D.P.</th>
<th>KF</th>
<th>MT</th>
<th>NU</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>32.10</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\[ \begin{align*}
\text{US} & : -00032.100 \quad g_{RF} \\
\text{KF} & : 32.100 \quad g_{RF} \\
\text{MT} & : -32.100 \quad g_{RF} \\
\text{NU} & : -00032.10 \quad g_{RF}
\end{align*} \]

#### OVERLOAD

**Positive error**

<table>
<thead>
<tr>
<th>A&amp;D</th>
<th>D.P.</th>
<th>KF</th>
<th>MT</th>
<th>NU</th>
</tr>
</thead>
<tbody>
<tr>
<td>E</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\[ \begin{align*}
\text{OL} & : +9999999999 \quad E_{RF} \\
\text{KF} & : E_{RF} \\
\text{MT} & : S_{RF} + g_{RF} \\
\text{NU} & : +9999999999 \quad g_{RF}
\end{align*} \]

**Negative error**

<table>
<thead>
<tr>
<th>A&amp;D</th>
<th>D.P.</th>
<th>KF</th>
<th>MT</th>
<th>NU</th>
</tr>
</thead>
<tbody>
<tr>
<td>-E</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\[ \begin{align*}
\text{OL} & : -9999999999 \quad E_{RF} \\
\text{KF} & : E_{RF} \\
\text{MT} & : S_{RF} - g_{RF} \\
\text{NU} & : -9999999999 \quad g_{RF}
\end{align*} \]

#### Pound Ounce

When unit 'Pound ounce' is displayed, the balance converts the 'Pound ounce' into Ounce and transmits the display value.

1 pound = 16 ounce

ex. When the balance displays 1 pound 2.34 ounce,

The data is 18.34 ounce.

\[ \begin{align*}
\text{ST} & : +00018.340 \quad g_{RF} \\
\text{A&D} & : +00018.340 \quad g_{RF}
\end{align*} \]
<table>
<thead>
<tr>
<th>Unit and display sign</th>
<th>A&amp;D</th>
<th>D.P.</th>
<th>KF</th>
<th>MT</th>
</tr>
</thead>
<tbody>
<tr>
<td>g</td>
<td>g</td>
<td>g</td>
<td>g</td>
<td>g</td>
</tr>
<tr>
<td>Counting mode</td>
<td>pcs</td>
<td>pcs</td>
<td>pcs</td>
<td>pcs</td>
</tr>
<tr>
<td>Precent mode</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>Ounce (Avoir)</td>
<td>oz</td>
<td>oz</td>
<td>oz</td>
<td>oz</td>
</tr>
<tr>
<td>Pound</td>
<td>lb</td>
<td>lb</td>
<td>lb</td>
<td>lb</td>
</tr>
<tr>
<td>Pound Ounce</td>
<td>l oz</td>
<td>l oz</td>
<td>l oz</td>
<td>l oz</td>
</tr>
<tr>
<td>Troy Ounce</td>
<td>ozt</td>
<td>ozt</td>
<td>ozt</td>
<td>ozt</td>
</tr>
<tr>
<td>Metric Carat</td>
<td>ct</td>
<td>ct</td>
<td>ct</td>
<td>ct</td>
</tr>
<tr>
<td>Momme</td>
<td>mom</td>
<td>mom</td>
<td>mom</td>
<td>mom</td>
</tr>
<tr>
<td>Pennyweight</td>
<td>dwt</td>
<td>dwt</td>
<td>dwt</td>
<td>dwt</td>
</tr>
<tr>
<td>Grain</td>
<td>GN</td>
<td>GN</td>
<td>gr</td>
<td>GN</td>
</tr>
<tr>
<td>Tael (HK general, Sing.)</td>
<td>tl</td>
<td>tl</td>
<td>tl s</td>
<td>tl</td>
</tr>
<tr>
<td>Tael (HK, jewelry)</td>
<td>tl</td>
<td>tl</td>
<td>tl h</td>
<td>tl</td>
</tr>
<tr>
<td>Tael (China)</td>
<td>tl</td>
<td>tl</td>
<td>tl t</td>
<td>tl</td>
</tr>
<tr>
<td>Tael (Taiwan)</td>
<td>tl</td>
<td>tl</td>
<td>tl c</td>
<td>tl</td>
</tr>
<tr>
<td>Tola (India)</td>
<td>t</td>
<td>t</td>
<td>t o l</td>
<td>t</td>
</tr>
<tr>
<td>Messghal</td>
<td>m</td>
<td>m</td>
<td>m S</td>
<td>m</td>
</tr>
</tbody>
</table>

**NU** format does not have a unit.

- Space, ASCII 20H
- CR Carriage Return, ASCII 0DH
- LF Line Feed, ASCII 0AH
Connection to peripheral equipment

Connection to an AD-8121

- The printer cable AD-8121-01 is necessary to connect the AD-8121 to the balance by the current loop interface.
- The following balance functions must be set to use the AD-8121 printer

<table>
<thead>
<tr>
<th>&quot;C&quot; function</th>
<th>Settings</th>
</tr>
</thead>
<tbody>
<tr>
<td>dout Prt 0, 1, 2, 3</td>
<td>To select a print mode</td>
</tr>
<tr>
<td>dout RP-P 0, 1, 2</td>
<td>To select the polarity for the auto-print mode</td>
</tr>
<tr>
<td>dout RP-b 0, 1, 2</td>
<td>To set the auto-print band</td>
</tr>
<tr>
<td>dout PRUSE 0, 1</td>
<td>To select the use of a pause.</td>
</tr>
<tr>
<td>s If bPS 2</td>
<td>To select &quot;2400bps&quot;</td>
</tr>
<tr>
<td>s If bPr 0</td>
<td>To select &quot;7 bits, Even parity check&quot;</td>
</tr>
<tr>
<td>s If CrLF 0</td>
<td>To select &quot;CR, LF&quot;</td>
</tr>
<tr>
<td>s If type 0, 1</td>
<td>To select &quot;A&amp;D Standard format&quot; or &quot;Dump print format&quot;</td>
</tr>
<tr>
<td>s If CES 0</td>
<td>To select &quot;Not using CTS and RTS&quot;</td>
</tr>
</tbody>
</table>
Connection to other equipment

- The current loop is of the passive type. It requires an external source of 20mA DC.
- The RS-232C is of the DCE type (Data Communications Equipment) and can use standard DCE cables.
- When connecting to another piece of equipment, consult the manual for that equipment for proper settings and connections.
- Keep RTS at "active HI", when RTS line is used.

This sample is the settings for connecting to computer:

| dout PrE | 0       | Key mode          |
| dout PRUSE | 0     | Not used          |
| dout bPS | 2       | Baud rate : 2400pbs |
| S iF bTrPr | 0   | Data length and parity : 7 bit EVEN |
| S iF CrLf | 0      | Terminator : CR LF |
| S iF TYPE | 0   | Data format : A&D standard |
| S iF E-Cod | 1 | Error code and <AK> : Output . (ASCII code 06h) |

This sample is a program that the balance performs re-zeroing and transmits one stable weighing data.

```
10   OPEN "COM1:2400" AS #1
20   PRINT #1, "Z"+CHR$(13)+CHR$(10)
30   LINE INPUT #1, AK$       \{Reply to "R" command\}
40   IF AK$<>CHR$(6) THEN GOTO 130
50   LINE INPUT #1, AK$       \{End of ZERO\}
60   IF AK$="EC, E00" THEN GOTO 140
70   IF AK$="EC, E11" THEN GOTO 150
80   FOR I=1 TO 1000: NEXT I
90   PRINT #1, "Q"+CHR$(13)+CHR$(10)
100  INPUT #1, HD$, DT$
110  PRINT HD$, DT$
120  GOTO 80
130  PRINT "BALANCE NOT READY!":CLOSE:END
140  PRINT "COMMUNICATION ERROR!":CLOSE:END
150  PRINT "ERROR1...BALANCE NOT STABLE":CLOSE:END
```
GLP

Function
- The "Calibration report" can be output after the balance performs calibration.
- The "Calibration test report" can be output after the balance performs the calibration test.
- The "Start block" and "End block" can be output for GLP data.

Format

Calibration report

AD-8121 format

Print sample

<table>
<thead>
<tr>
<th>A &amp; D</th>
</tr>
</thead>
<tbody>
<tr>
<td>MODEL</td>
</tr>
<tr>
<td>S/N</td>
</tr>
<tr>
<td>ID</td>
</tr>
<tr>
<td>DATE</td>
</tr>
<tr>
<td>TIME</td>
</tr>
<tr>
<td>CALIBRATED(EXT.)</td>
</tr>
<tr>
<td>CAL.WEIGHT</td>
</tr>
<tr>
<td>SIGNATURE</td>
</tr>
</tbody>
</table>

Data format

Data output sample

<table>
<thead>
<tr>
<th>A &amp; D&lt;TERM&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>MODEL&lt;TERM&gt;</td>
</tr>
<tr>
<td>S/N&lt;TERM&gt;</td>
</tr>
<tr>
<td>ID&lt;TERM&gt;</td>
</tr>
<tr>
<td>DATE&lt;TERM&gt;</td>
</tr>
<tr>
<td>TIME&lt;TERM&gt;</td>
</tr>
<tr>
<td>CALIBRATED&lt;TERM&gt;</td>
</tr>
<tr>
<td>CAL.WEIGHT&lt;TERM&gt;</td>
</tr>
<tr>
<td>+500.00&lt;TERM&gt;</td>
</tr>
<tr>
<td>SIGNATURE&lt;TERM&gt;</td>
</tr>
</tbody>
</table>

<TERM>  Space mark, ASCII 20H.
<TEERM>  Terminator mark, CR LF or CR. The terminator that is set at CRLF.
CR      Carriage return mark, ASCII 0DH
LF      Line feed mark, ASCII 0AH
# Calibration test report

## AD-8121 format

<table>
<thead>
<tr>
<th>Print sample</th>
<th>Data output sample</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>R &amp; D</strong></td>
<td><strong>A &amp; D</strong></td>
</tr>
<tr>
<td><strong>MODEL</strong></td>
<td><strong>MODEL</strong></td>
</tr>
<tr>
<td><strong>S/N</strong></td>
<td><strong>S/N</strong></td>
</tr>
<tr>
<td><strong>ID</strong></td>
<td><strong>ID</strong></td>
</tr>
<tr>
<td><strong>DATE</strong></td>
<td><strong>DATE</strong></td>
</tr>
<tr>
<td><strong>CAL. TEST (EXT.)</strong></td>
<td><strong>CAL. TEST (EXT.)</strong></td>
</tr>
<tr>
<td><strong>ACTUAL</strong></td>
<td><strong>ACTUAL</strong></td>
</tr>
<tr>
<td>0.00 g</td>
<td>0.00 g</td>
</tr>
<tr>
<td>+500.00 g</td>
<td>+500.00 g</td>
</tr>
<tr>
<td><strong>TARGET</strong></td>
<td><strong>TARGET</strong></td>
</tr>
<tr>
<td>+500.00 g</td>
<td>+500.00 g</td>
</tr>
<tr>
<td><strong>SIGNATURE</strong></td>
<td><strong>SIGNATURE</strong></td>
</tr>
</tbody>
</table>

---

- **Space mark, ASCII 20H.**
- **<TERM>** Terminator mark, Q, or Q. The terminator that is set at S, LF.
- **Q** Carriage return mark, ASCII 0DH
- **LF** Line feed mark, ASCII 0AH

---
Start block and End block

AD-8121 format

Data format

Parameter

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Function and output format of GLP are selected.</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Inactive setting of GLP.</td>
</tr>
<tr>
<td>1</td>
<td>AD-8121 format</td>
</tr>
<tr>
<td>2</td>
<td>Data format</td>
</tr>
</tbody>
</table>

Set the parameter to \texttt{dout, info 1}, when GLP data is output to AD-8121.

Set the parameter to \texttt{dout, info 2}, when GLP data is output to other than AD-8121.
Operation

Output procedure for the "Calibration report"
If \textit{dout}, \textit{info 1} or \textit{2} is selected.

1. Press and hold the \textit{SAMPLE} key and the \textit{PRINT} key. Release the \textit{SAMPLE} key and \textit{PRINT} key when \textit{CLICALout} is displayed.
The balance starts calibration.
For details on calibration, refer to the balance instruction manual.

2. Remove the mass from the pan when the balance displays \textit{End}. Calibration report is output finishing this mode.
Output procedure for the "Calibration test"
If using a mass and selecting $d_{out}$, $inf_{0}$ 1 or 2.

The calibration test mode is used to confirm accurate weighing.

1. Press and hold the [SAMPLE] and [PRINT] keys. $CC_{out}$ appears after $CC_{out}$. Release the keys when $CC_{out}$ is displayed.

2. $CC_{0}$ is displayed.

3. Press the [SAMPLE] key and change the weight value using the following keys.
   - ZERO key: To set the value of the digit selected.
   - SAMPLE key: To select the digit to change.
   - PRINT key: To store the value and return to step 2.

4. At step 2, press the [PRINT] key. The zero point is weighed and is displayed for a few seconds.
5. Place a weight, with the same value as displayed, on the pan. Press the [PRINT] key to weigh it. The weighed value is displayed for a few seconds.

6. **End** appears. Remove the weight.

7. **ULP** is displayed and the data is output.

8. The balance will return to the weighing mode.
Commands for the serial interface (OP-03)

Outline of command control
The functions of the balance can be controlled using the following commands that are transmitted by OP-03H.

- Commands to request weighing data
- Commands to control the balance instead of using the keys

⚠ The current loop interface is for transmitting data only. Therefore, the OP-05H interface cannot use the commands of this section.

Settings, and how they relate to a command
The balance has functions relative to the RS-232C interface. It is necessary to set the functions to adapt to the interface condition.

\( d_{out} \) Data out
- PrE Data out mode
- Rp-P Auto print polarity
- Rp-b Auto print band
- Puse Data pause
- Re-f Auto feed
- Rr-d Automatically zero after data out
- Info GLP output

Parameter to select the data output mode.
Parameter to select the polarity to detect data.
Parameter to select the band width to detect data.
Parameter to select a delay time for the printer.
Parameter to select a feed action for the printer.
Parameter to select a zero action.
Parameter to select the GLP output format.

\( s_{if} \) Serial interface
- Bps Baud rate
- Parity bit
- Terminator
- Data format
- Receive time
- Error code
- CTS CTS control

Parameter to select a baud rate (bps).
Parameter to select the parity bit and data length.
Parameter to select the terminator.
Parameter to select the data format.
Parameter to select a delay time for receive.
Parameter to select if to announce an error.
Parameter to select the use of CTS and RTS.
### Command list

**Commands to request weighing data**

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>Clear the S,SIR command</td>
</tr>
<tr>
<td>Q</td>
<td>Request for weighing data immediately</td>
</tr>
<tr>
<td>S</td>
<td>Request for weighing data when stable</td>
</tr>
<tr>
<td>SI</td>
<td>Request for weighing data immediately</td>
</tr>
<tr>
<td>SIR</td>
<td>Request for weighing data continuously</td>
</tr>
</tbody>
</table>

**Commands to control the balance**

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAL</td>
<td>Perform calibration</td>
</tr>
<tr>
<td>OFF</td>
<td>Display OFF</td>
</tr>
<tr>
<td>ON</td>
<td>Display ON</td>
</tr>
<tr>
<td>P</td>
<td>Display ON/OFF (same as ON-OFF key)</td>
</tr>
<tr>
<td>Z</td>
<td>Display zero (same as ZERO key)</td>
</tr>
<tr>
<td>SMP</td>
<td>Enter the sample weight in counting mode and percent mode (same as SAMPLE key)</td>
</tr>
<tr>
<td>PRT</td>
<td>Output data(same as PRINT key)</td>
</tr>
<tr>
<td>U</td>
<td>Change unit of weight (same as MODE key)</td>
</tr>
<tr>
<td>TST</td>
<td>Perform calibration test</td>
</tr>
</tbody>
</table>

---

### Commands to request weighing data

The Data format can be selected at parameter setting of $S_iF_{TYPE}$.

**Cancel command for SIR command**
The balance will stop sending data in stream mode.

Command: $C_cR_lF$

**Query command for weighing data**
The balance will respond with the weighing data immediately.

Command: $Q_cR_lF$

Reply:

```
ST, +00127.83__g_cR_lF
```

**Request for the weighing data when it is stable**
The balance display will blink when the data is transmitted.

Command: $S_cR_lF$

Reply:

```
ST, +00127.83__g_cR_lF
```

**Request for the weighing data immediately** (same as Q command)
The balance will respond with the weighing data immediately.

Command: $S1_cR_lF$

Reply:

```
US, +00127.83__g_cR_lF
```
**SIR**
Request for the weighing data continuously
The balance sends the data in stream mode.

Command: \texttt{SIR\_CR\_LF}
Reply: \texttt{US, +00127.83\_CR\_LF}
\texttt{...}
\texttt{ST, +00127.83\_CR\_LF}
\texttt{ST, +00127.83\_CR\_LF}

**Commands to control the balance**

**CAL**
Calibration command
This command performs calibration using a calibration mass. The balance will enter the calibration mode.
Command: \texttt{CAL\_CR\_LF}

**OFF**
Display OFF command
If the balance is ON, it will turn OFF.
If the balance is already off, nothing will happen.
Command: \texttt{OFF\_CR\_LF}

**ON**
Display ON command
If the balance is OFF, it will turn ON.
Command: \texttt{ON\_CR\_LF}

**P**
Display ON/OFF command (same as the \texttt{ON/OFF} key)
If the balance is on, it will turn off.
If it is off, it will turn on.
Command: \texttt{P\_CR\_LF}

**Z**
Display ZERO command (same as the \texttt{ZERO} key)
The balance will display zero.
Command: \texttt{Z\_CR\_LF}

**SMP**
Command to enter the data (same as the \texttt{SAMPLE} key)
The balance will enter the sample weight in counting mode or percent mode.
Command: \texttt{SMP\_CR\_LF}

**U**
Command to change the mode (same as the \texttt{MODE} key)
The balance will shift to the next selected unit in the normal weighing mode.
Command: \texttt{U\_CR\_LF}

**TST**
Calibration test command
This command performs calibration test using a calibration mass. The balance will enter the calibration mode.
Command: \texttt{TST\_CR\_LF}

**PRT**
Print command (same as the \texttt{PRINT} key)
Command: \texttt{PRT\_CR\_LF}
Acknowledge code and error code

When setting the functions \( S \), \( F \), \( E \), \( r \), \( E \), \( c \), \( d \), \( l \), the balance replies to any commands using <AK> code or outputs an error code.

<AK> code............Acknowledge in ASCII code. The code is 06h.

If \( S \), \( F \), \( E \), \( r \), \( E \), \( c \), \( d \), \( l \) was set

- When the balance received a command to request data and does not achieve it, the balance outputs an error code (EC, Exx). Refer to section "error code".
- When the balance receive a command to control the balance and does not achieve it, the balance outputs an error code.
- When the balance receive a command to control the balance and achieves it, the balance outputs <AK> (06h).
- There are commands that output plural <AK> codes from balance.
  - ZERO command (Z command)
  - ON command (ON command)
  - Calibration command (CAL command)
  - (etc..)
- When a communication error has occurred due to external noise, or a parity error has occurred due to transmission error, the balance outputs <AK> . In this case, send the command once more.

Error code

<table>
<thead>
<tr>
<th>Display</th>
<th>Error code</th>
<th>Description of the error</th>
</tr>
</thead>
<tbody>
<tr>
<td>EC, E00</td>
<td>Communications error</td>
<td>A protocol error occurred in communications. Confirm the format, baud rate and parity.</td>
</tr>
<tr>
<td>EC, E01</td>
<td>Undefined error</td>
<td>Undefined command is received. Confirm command.</td>
</tr>
<tr>
<td>EC, E02</td>
<td>Balance not ready</td>
<td>A received command can not be achieved. Adjust the delay time to transmit the command. Example: The balance received &quot;R&quot; command in the weighing mode. The balance then received &quot;Q&quot; command before achieving last RE-ZERO command.</td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>Display</th>
<th>Error code</th>
<th>Description of the error</th>
</tr>
</thead>
<tbody>
<tr>
<td>EC, E03</td>
<td><strong>Time over error</strong>&lt;br&gt;The balance did not receive the next character of a command within the time limit of one second, when the function ( \text{F} ) was set and a command is being received. Confirm communication.</td>
<td></td>
</tr>
<tr>
<td>EC, E04</td>
<td><strong>Excess characters error</strong>&lt;br&gt;The command has more characters than is required or the range of the data is beyond what the balance will accept.&lt;br&gt;Example: When the calibration weight that is entered is greater than the range of the balance.</td>
<td></td>
</tr>
<tr>
<td>Error 0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Error 1</td>
<td>EC, E11</td>
<td><strong>Stability error</strong>&lt;br&gt;The balance can not stabilize due to vibration or other environmental problem.</td>
</tr>
<tr>
<td>CAL E</td>
<td>EC, E20</td>
<td><strong>Calibration error</strong>&lt;br&gt;The calibration weight is too heavy.</td>
</tr>
<tr>
<td>-CAL E</td>
<td>EC, E21</td>
<td><strong>Calibration error</strong>&lt;br&gt;The calibration weight is too light.</td>
</tr>
<tr>
<td>Lo</td>
<td>EC, E30</td>
<td><strong>Unit weight error</strong>&lt;br&gt;The sample is too light to calculate the unit weight.</td>
</tr>
</tbody>
</table>
Control using CTS, RTS

The balance performs the following action by the setting of CTS and RTS in Functions.

If CTS 0 was set
- Regardless of the condition of a balance that can receive the command or not, the balance keeps the CTS terminal to active HI. The balance outputs data regardless of condition of the RTS terminal.

If CTS 1 was set
- The CTS terminal is keeps to active HI normally. When the condition is that the balance can not receive the next command (ex. processing last command), the balance sets CTS to LO. The balance confirms the level of the RTS terminal when data can be output. If RTS level is active HI, the balance outputs data. If the RTS level is set LO, data is not output.
Examples of command

This example is set to $\text{OF} \ f \ \text{OF} \ f$ so as to output the <AK> code.
There is a necessary delay time between receiving <AK> and transmitting the next
command by peripheral equipment. When the command is transmitted to the balance,
include a delay time as follows:

Example using BASIC program

120 LINE INPUT #1, AK$
130$ FOR L = 1 TO 100 : NEXT L
140 PRINT #1, "Q"
1...

<AK> code............Acknowledge in ASCII code. The code is 06h.

ON Command

<table>
<thead>
<tr>
<th>Computer</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>ON command</td>
<td>$\text{ON} \ F \ \text{ON} \ F$</td>
</tr>
</tbody>
</table>

The balance

OFF state

Confirmation of command receipt

Display test

Command completion

Display zero

ZERO Command

<table>
<thead>
<tr>
<th>Computer</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Z command</td>
<td>$\text{Z} \ F \ \text{Z} \ F$</td>
</tr>
</tbody>
</table>

The balance

Weighing mode

Confirmation of command receipt

Processing command

Command completion

Display zero

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CAL Command

This example sets $d_{out}$.

**Computer**
- **CAL command**
  - $\text{CAL CR LF}$
  - The balance
    - **Weighing mode**: $0.000 \ g$
    - **Confirmation of command receipt**: $\text{CAL 0}$
    - **Ready for zero calibration**: $\text{CAL 0}$
    - **Zero calibration in progress**: $\text{- 2000}$
    - **Ready for span calibration**: $\text{2000}$
    - **Place the calibration weight on the weighing pan**: $\text{End}$
    - **Span calibration in progress**: $\text{- 2000}$
    - **Calibration completed**: $\text{End}$
    - **Remove the calibration weight from the weighing pan**: $\text{0 . g}$
    - **Zeroing the display**: $\text{0 . g}$
    - **Weighing mode**: $0.000 \ g$

**Time**
Example of an error code

When a command is not achieved, the balance outputs an error code. This example is set to $E_{111}^{CF}$ so as to output the error code from the balance.

<table>
<thead>
<tr>
<th>Computer</th>
<th>The balance</th>
</tr>
</thead>
<tbody>
<tr>
<td>\text{Z command} $Z^C_R^{LF}$</td>
<td>\text{Error 1}</td>
</tr>
<tr>
<td>\text{U command} $U^C_R^{LF}$</td>
<td>\text{20.37 g}</td>
</tr>
</tbody>
</table>

Weighing mode

Processing command.

It assumes that the balance cannot stabilize due to vibration or other environmental problem.

The balance sends the error code and displays it.

If you send the U command, the balance returns to weighing mode.

Weighing mode

Time

| 29.37 g |

Weighing mode
Underhook assembly (OP-07H)

By attaching the underhook assembly to the bottom of the main unit, large objects that are difficult to load on the weighing pan can be weighed in suspension, and the specific gravity of an item may be measured.

OP-07H installation

1. Remove the cover of the underhook installation port on the bottom of the main unit.

2. Screw the underhook assembly into the mounting port.

Before weighing using the underhook, calibrate with the underhook attached.
Battery pack (OP-09H)

By installing the NiCd battery pack in the balance, cordless operation can be carried out continuously for 8 hours. (When the OP-03H/04H/05H options are attached, the usable time will be approximately 6 hours. The time may vary with the method of use.)

OP-09H installation

1. Detach the cover of the battery pack compartment on the bottom of the main unit by pulling the cover forward while pressing the two catches. Be sure not to apply an excessive force to the weighing pan.

2. Remove the battery switch cover as shown to the right.

3. Hold the battery pack with the battery switch facing to the opening made available in step 2.

4. Insert the connector from the main unit to the battery pack connector. Be sure to insert the connector in the correct direction.

5. Insert the battery pack in the main unit towards the bottom. Attach the cover as before.

About the battery switch

The condition of the battery switch is as follows:
Pressed in : Battery switch = ON
Not pressed in : Battery switch = OFF
Notes on using the battery pack

Before using the battery pack for the first time, charge it with the AC adapter connected to the main unit.

Be sure to turn the battery switch OFF when the balance is not in use. With the battery switch ON, the balance consumes electrical power even if it is not used.

Even when the display is turned OFF, the balance consumes electrical power. To completely turn power off, remove the AC adapter and turn the battery switch OFF. (Connecting the AC adapter at this time will start charging the battery pack.)

Each time the battery switch is turned ON and OFF with the AC adapter connected to the main unit, charging starts. Unnecessary and repetitive charging will shorten the battery life.

Charging the battery pack

Charge the battery pack after "Lb" is displayed or after the balance has been used for over 8 hours.

The balance cannot be used while the battery pack is being charged.

1. Turn the battery switch OFF.
   Pressed : Battery switch = ON
   Unpressed : Battery switch = OFF

2. Connect the AC adapter. Charging will start automatically.

3. Allow 15 hours to charge completely. Charging will stop automatically after 15 hours have elapsed.

4. Remove the AC adapter to avoid unnecessary re-charging.
How to use
Operation mode

<table>
<thead>
<tr>
<th>Battery switch</th>
<th>AC adapter</th>
<th>Performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>ON</td>
<td>Connected</td>
<td>Powered by the AC adapter</td>
</tr>
<tr>
<td></td>
<td>Removed</td>
<td>Powered by the battery pack (About 8 hours)</td>
</tr>
<tr>
<td>OFF</td>
<td>Connected</td>
<td>Charges the battery pack</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(About 15 hours to full charge)</td>
</tr>
<tr>
<td></td>
<td>Removed</td>
<td>None</td>
</tr>
</tbody>
</table>

⚠️ When the battery pack installed, use the balance with the battery switch turned ON.
For charging, connect the AC adapter and turn the battery switch OFF.

When "Lb" is displayed while the balance is in use, it indicates that the battery has been depleted. Stop using the balance immediately and charge the battery pack.