# 13. OP-03 RS-232C SERIAL INTERFACE

This interface allows the HC-*i* series to be connected with a multifunction printer or a personal computer.

£ The OP-03 unit includes an interface board, a connector plug (DIN type) and two screws. (M3x6 tapping type).
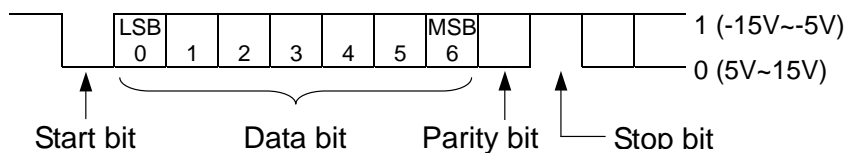
13-1. Installation

1. Disconnect the AC adapter from the scale. If the battery is used, switch off the scale.

2. Loosen the screw and remove the panel covering the option slot.

3. Connect the connector cable on the OP-03 to the connector inside the option slot.

4. Fix the OP-03 unit using the two screws included in the OP-03.

Option slot

Screw

Interface

Screws
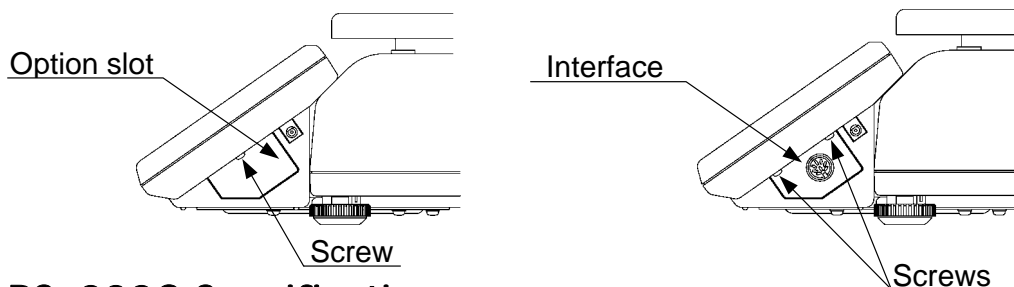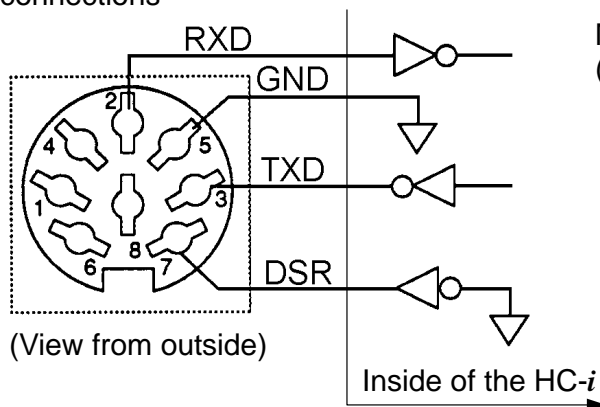
13-2. RS-232C Specifications

Transmission form   Asynchronous, bi-directional, half-duplex
Data format   Baud rate: 2400, 4800, 9600 bps
                     Data: 7 bits + parity 1bit (even / odd) or 8 bits (non-parity)
                     Start bit: 1 bit
                     Stop bit: 1 bit
                     Code: ASCII
                     Terminator: Data Send / $C_R L_F$ Data Receive / C_R or $C_R L_F$

| LSB 0 | 1 | 2 | 3 | 4 | 5 | MSB 6 | | | 1 (-15V~-5V) |

0 (5V~15V)

Start bit   Data bit   Parity bit   Stop bit

Pin connections

RXD
GND

TXD

DSR

(View from outside)

Inside of the HC-*i*

Mating connector: JA+TCP0586
(Included in the OP-03)

2   Receive data
3   Transmit data
5   Signal ground
7   Data set ready
1, 4, 6 and 8   N.C.

£ The HC-*i* is designated as DCE (Data Communication Equipment).

13-3. Data Output Mode

£ The Data Output Modes and Parameters are set by F-Functions in F-06-X as described in the "9-2. F-Functions"

£ To control the scale using commands form an external device, see "13-6. Command Mode".

£ Refer to "13-6. Command Mode" about the output data format.

Data Output Mode (f-06-01)

£ Key Mode (f-06-01="0")
When the weight display is stable, data is sent by pressing the ⌐PRINT⌐ key. The count display will blink when the data has been sent.

£ Stream Mode (f-06-01="1")
Data is sent continuously. The data-update rate is approximately 10 times per second for f-06-03="2". For f-06-3="0" or "1", the interval between continuous data is approximately 2 seconds.

£ Auto-print Mode A (f-06-01="2")
Data is sent if the weight display is stable at +5d (weighing display division) and above. The next transmission can not occur until after the weight display falls below +5d.

£ Auto-print Mode B (f-06-01="3")
Data is sent if the weight display is stable at ±5d (weighing display division) and above/below. The next transmission can not occur until after the weight display falls between –5d and +5d.

⚠ To use with the UFC format, refer to "13-7. Using UFC (Universal Flex Coms) Function"

Data to be Sent (f-06-02)

Select which data to be sent by keying in a ⌐0⌐ or ⌐1⌐ for the data: ID No., PCS (count), weight or unit weight.

Example: Key in ⌐1⌐ ⌐1⌐ ⌐0⌐ ⌐0⌐ to display 1100, this setting would send only the ID number and the count.

$$f\text{-}06\text{-}02$$

1100

ID No.
PCS (count)
subtracts

'0' not to send data
'1' to send data
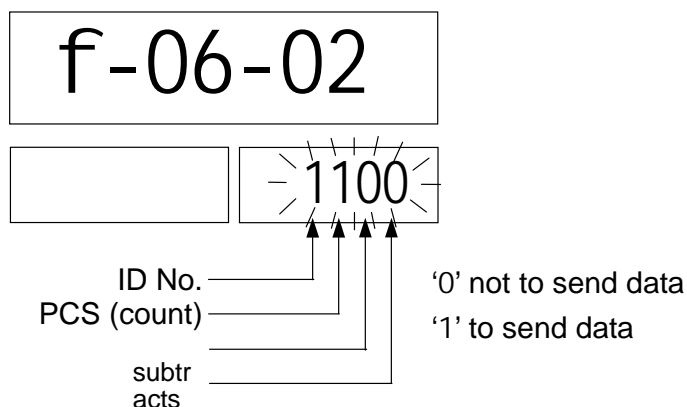
Data Format (f-06-03)

£ Format for AD-8121 MODE 1 or 2. (f-06-03="0")

£ Format for AD-8121 MODE 3. (f-06-03="1")

£ Format for general apparatuses, computers, etc. (f-06-03="2")

Baud Rate (f-06-04)

Select the baud rate according to the device to be connected.

£ 2400 bps (f-06-04="0") Select 2400 bps to connect with an AD-8121.

£ 4800 bps (f-06-04="1")

£ 9600 bps (f-06-04="2")

13-4. Connecting the AD-8121 Printer / MODE 1 or MODE 2

£ When using the AD-8121 printer (MODE 1 or MODE 2), you will be able to get data: Number of data items, total, maximum, minimum, mean value, range of data (max. - min. data) and standard deviation.

£ When using the AD-8121 with MODE 2, set f-06-02 to print pcs (count) data only or weight data only.

£ To print date and time, use the AD-8121's calendar / clock function and set f-06-02 to print pcs (count) data only or weight data only.

Print Operations Settings

Print By:	F-Function f-06-01	Printer MODE
HC PRINT key	0	MODE 1
Auto Print	2 or 3	MODE 1
Printer DATA key	1	MODE 2

Example of f-06-02 settings

£ To print pcs (count) data only: set f-06-02 at "0100"

£ To print weight data only: set f-06-02 at "0010"

£ To print pcs (count) and weight data: set f-06-02 at "0110"

£ To print pcs, weight and unit weight data: set f-06-02 at "0111"

£ To print total data (accumulated by the M+ key), press the TOTAL key so the count display shows the total, then press the PRINT key.

£ If you are using the AD-8121's statistic functions, then set f-06-02 at "01#0" (# = 0 or 1) for pcs (count) data or "0010" for weight data.
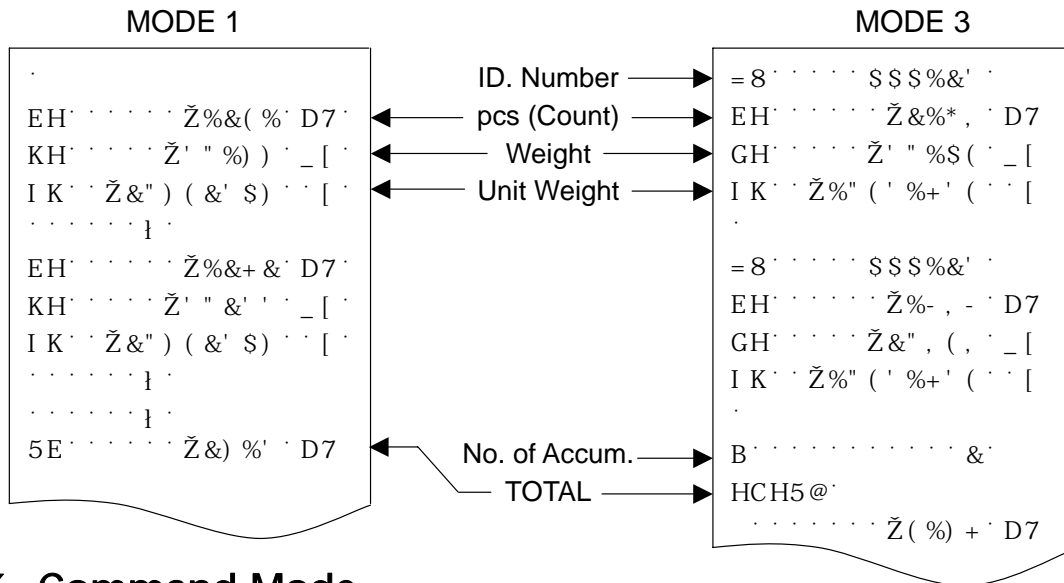
£ MODE 1 and 2 of the AD-8121 can not print ID numbers.

13-5. Connecting the AD-8121 Printer / MODE 3

£ When using MODE 3 of the AD-8121 printer, printouts are obtained using the
PRINT key (f-06-01 = 0), or auto-print mode A/B (f-06-01 =2 or 3).

£ The total data (accumulated by the M+ key) will be printed along with the number of additions to **M+** memory.

⚠ The AD-8121 / MODE 3 does not have statistical functions.

AD-8121 Printout Sample

MODE 1   MODE 3

```
.
EH` ` ` ` `Ž%&( %` D7`        ID. Number ────►    =8 ` ` ` ` `$$$%&' `
KH` ` ` `Ž' " %) ) ` _[ `     pcs (Count) ────►   EH` ` ` ` `Ž&%*, ` D7
I K` `Ž&") ( &' $) ` `[ `     Weight ────►         GH` ` ` `Ž' " %$( ` _[
` ` ` ` ` `} `                Unit Weight ────►    I K` `Ž%" ( ' %+' ( ` `[
EH` ` ` ` `Ž%&+ &` D7`                             .
KH` ` ` `Ž' " &' ' ` _[ `                          =8 ` ` ` ` `$$$%&' `
I K` `Ž&") ( &' $) ` `[ `                          EH` ` ` ` `Ž%-, - ` D7
` ` ` ` ` `} `                                     GH` ` ` `Ž&" , ( , ` _[
` ` ` ` ` `} `                                     I K` `Ž%" ( ' %+' ( ` `[
5E` ` ` ` `Ž&) %' ` D7        No. of Accum. ────►  B` ` ` ` ` ` ` ` `&`
                             TOTAL ────►           HCH5@`
                                                   ` ` ` ` ` ` ` `Ž( %) +` D7
```
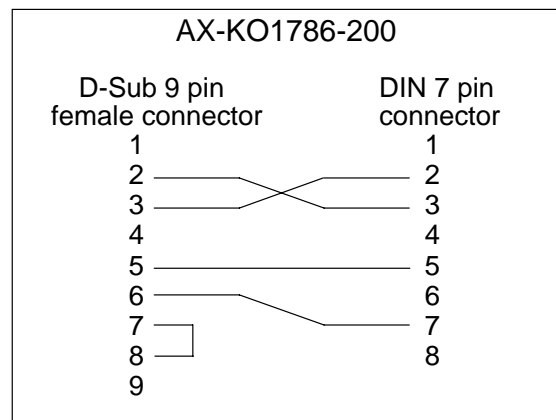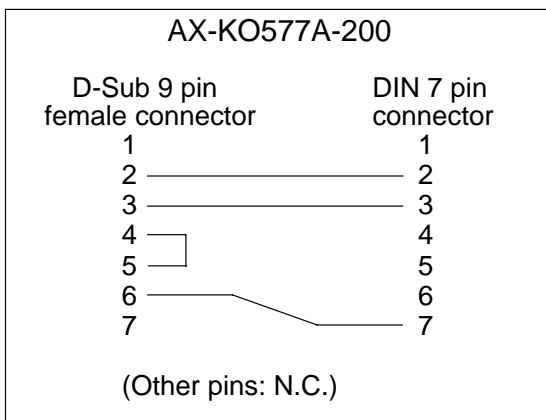
13-6. Command Mode

£ In the command mode, the scale is controlled by commands that come from an external device, computer etc.

⚠ Do not set f-06-01="1" (stream mode) to use with the command mode. if you don't want to use command mode together with key mode or auto-print mode, set f-06-01="4" (command mode only).

£ Use an optional cable below to connect with a computer.
    AX-KO577A-200   RS-232C cable, for D-sub 25 pin, length 2m
    AX-KO1786-200   RS-232C cable, for D-sub 9 pin, length 2m
    (These cable have a DIN 7pin connector, but it can connect with the OP-03.)

AX-KO577A-200	AX-KO1786-200
D-Sub 9 pin female connector — DIN 7 pin connector	D-Sub 9 pin female connector — DIN 7 pin connector
1 — 1	1 — 1
2 ——— 2	2 ⨯ 2
3 ——— 3	3 ⨯ 3
4 ⌐ 4	4 — 4
5 ⌐ 5	5 ——— 5
6 ——— 6	6 — 6
7 ——— 7	7 ⌐ 7
(Other pins: N.C.)	8 ⌐ 8
	9

Command List

Command	Definition	Notes
@	Start / stop continuous data transmission.	
A	Same as RESET key.	Key command
D	Set a known tare weight.	"D,1.23C_RL_F" sets the tare weight as "1.23kg".
E	Store the unit weight and other values in use to ID memory.	Refer to the data format. Refer f-01-05
F	Recall a unit weight from ID memory.	"F12C_RL_F" recalls from ID12.
G	Set a known unit weight.	"G,0.123C_RL_F" sets the unit weight as "0.123g" (or "0.123 lb").
J	Same as the TOTAL key.	Key command
K	Same as the M+ key.	Key command
Q	Send data immediately.	Data depends on f-06-02
S	Send stable data after accepting command.	
T	Same as the TARE key.	Key command
X	Request a list of the F-Function parameters.	The last data terminates with <EOT> (04H)
Y	Request a list of the ID memory contents.	
Z	Same as the ZERO key.	Key command
ON	Start the scale from power on sequence	
?ID	Send the ID number in use.	
?QT	Send the pcs (count) data.	
?WT	Send the weight data.	
?UW	Send the unit weight in use.	Refer to the data format for the reply.
?AQ	Send the total (accumulated) M+ memory count	
?AN	Send the number of additions to M+ memory.	
?TR	Send the tare weight in use.	
?MR	Send the specified ID memory contents.	
MR	Store the unit weight and tare weight into the specified ID memory.	Refer to the data format for the reply.
ML	Store the comparator limits into the specified ID memory.	
CM	Clear the specified ID memory contents	"CM,1.2C_RL_F" clears content of i d12.
?FC	Send the specified F-Function setting.	Refer to the data format for the reply.
FC	Store the specified F-Function setting value.	

Acknowledgment and Error Codes

When the scale receives an external command, it reacts as follows:

£ If the command requests a data reply, the scale will send the data.
For other commands, the scale will send an acknowledgment <ACK><C_R><L_F> or <ACK> (see F-Function "f-09-02") upon acceptance of the command.

£ If the command is $\boxed{S}$, $\boxed{T}$ or $\boxed{Z}$, the scale will send a second acknowledgment <ACK><C$_R$><L$_F$> or <ACK> (see F-Function "f-09-02") when the command operation is completed.

If an error occurs, the scale will send an error code.

£ The error format is $\boxed{E}\boxed{C}$, $\boxed{E}\boxed{n}\boxed{C}\boxed{L_F}$, "n" being error number.

En	Definition	Notes
E0	Communication Error	Parity error, framing error, etc.
E1	Undefined command Error	Command does not exist for the scale.
E2	Scale not ready Error.	The scale is not in a state where a command could be expected.
E4	Too many characters Error	Command contains too many characters.
E6	Format Error	Command contains invalid characters.
E7	Out of range Error	Value is out of range. Tare weight is more than the capacity, etc.

Data Format ☐ " ⌣ " in examples below shows "Space" (20H).

£ Examples below are for f-09-02="0000". <ACK>=06H.

£ Store unit weight and other value in use (according to f-01-05).

Command $\boxed{E}$, $\boxed{1}\boxed{2}\boxed{C}\boxed{L_F}$ Stores to id-12. (E,000012C$_R$L$_F$ is acceptable.)

Reply $\boxed{ACK}\boxed{C}\boxed{L_F}$

£ ID Number

Command $\boxed{?}\boxed{I}\boxed{D}\boxed{C}\boxed{L_F}$

Reply $\boxed{I}\boxed{D}$, $\boxed{0}\boxed{0}\boxed{0}\boxed{0}\boxed{1}\boxed{2}\boxed{C}\boxed{L_F}$

£ PCS (Count) Data

Command $\boxed{?}\boxed{Q}\boxed{T}\boxed{C}\boxed{L_F}$

Reply $\boxed{Q}\boxed{T}$, $\boxed{+}\boxed{0}\boxed{0}\boxed{0}\boxed{0}\boxed{1}\boxed{2}\boxed{3}\boxed{4}\boxed{⌣}\boxed{P}\boxed{C}\boxed{C}\boxed{L_F}$ Stable Positive Data
$\boxed{U}\boxed{S}$, $\boxed{-}\boxed{0}\boxed{0}\boxed{0}\boxed{0}\boxed{5}\boxed{6}\boxed{7}\boxed{8}\boxed{⌣}\boxed{P}\boxed{C}\boxed{C}\boxed{L_F}$ Unstable Negative Data
$\boxed{O}\boxed{L}$, $\boxed{+}\boxed{9}\boxed{9}\boxed{9}\boxed{9}\boxed{9}\boxed{9}\boxed{9}\boxed{9}\boxed{⌣}\boxed{P}\boxed{C}\boxed{C}\boxed{L_F}$ 'E' display

£ Weight Data

Command $\boxed{?}\boxed{W}\boxed{T}\boxed{C}\boxed{L_F}$

Reply $\boxed{S}\boxed{T}$, $\boxed{+}\boxed{0}\boxed{0}\boxed{1}\boxed{.}\boxed{2}\boxed{3}\boxed{4}\boxed{6}\boxed{⌣}\boxed{k}\boxed{g}\boxed{C}\boxed{L_F}$ Stable Positive Data
$\boxed{S}\boxed{T}$, $\boxed{-}\boxed{0}\boxed{0}\boxed{2}\boxed{.}\boxed{7}\boxed{2}\boxed{5}\boxed{5}\boxed{⌣}\boxed{l}\boxed{b}\boxed{C}\boxed{L_F}$ Stable Negative Data
$\boxed{U}\boxed{S}$, $\boxed{-}\boxed{0}\boxed{0}\boxed{1}\boxed{2}\boxed{.}\boxed{3}\boxed{4}\boxed{6}\boxed{⌣}\boxed{l}\boxed{b}\boxed{C}\boxed{L_F}$ Unstable Negative Data
$\boxed{U}\boxed{S}$, $\boxed{+}\boxed{0}\boxed{0}\boxed{0}\boxed{5}\boxed{.}\boxed{5}\boxed{9}\boxed{3}\boxed{⌣}\boxed{k}\boxed{g}\boxed{C}\boxed{L_F}$ Unstable Positive Data
$\boxed{O}\boxed{L}$, $\boxed{+}\boxed{9}\boxed{9}\boxed{9}\boxed{9}\boxed{.}\boxed{9}\boxed{9}\boxed{9}\boxed{⌣}\boxed{k}\boxed{g}\boxed{C}\boxed{L_F}$ 'E' display
$\boxed{O}\boxed{L}$, $\boxed{-}\boxed{9}\boxed{9}\boxed{9}\boxed{9}\boxed{.}\boxed{9}\boxed{9}\boxed{9}\boxed{⌣}\boxed{l}\boxed{b}\boxed{C}\boxed{L_F}$ '-E' display

£ Unit Weight

Command `? U W C LF`

Reply
`U W , + 1 . 2 3 4 5 6 7 ␣ ␣ g C LF`
`U W , + 0 . 2 7 2 5 3 1 ␣ l b C LF`

£ Total Count

Command `? A Q C LF`

Reply `A Q , + 0 0 9 9 9 9 9 ␣ P C C LF`

£ Accumulation Numbers

Command `? A N C LF`

Reply `A N , 0 0 0 0 1 2 3 4 C LF`

£ Tare Weight

Command `? T R C LF`

Reply `T R , + 0 0 1 . 2 3 4 6 ␣ k g C LF`

£ Request the scale to reply with the contents of ID memory.

Command `? M R , 1 2 C LF`   Request the contents of i d-12.

Reply
`M R , 0 0 0 0 1 2 , 1 2 . 3 4 5 6 7 , + 0 0 0`
`. 2 3 4 5 , + 0 0 0 0 1 3 5 7 , + 0 0 0 0 1 2`
`4 6 , + 0 1 2 3 4 5 6 7 , 0 0 0 0 1 2 3 4 C LF`

MR, ID number (6 digit), unit weight (8 digit including decimal point), tare weight (9 digit including sign and decimal point), upper limit (9 digit including sign), lower limit (9 digit including sign), total count (9 digit including sign), number of addition (8 digit) C_R L_F .

£ Memorize (enter) unit weight and tare weight into a specified ID memory.

Command `M R , 1 2 , 1 . 2 3 , 0 . 3 4 5 C LF`

ID #   Unit Weight   Tare Weight

Reply `ACK C LF`

ID Number: Maximum 6 digit
Unit Weight: Maximum 8 digit including decimal point
Tare Weight: Maximum 8 digit including decimal point ('kg' or 'lb' depends on
               f-00 setting).

£ Store the comparator limits into a specified ID memory.

Command `M L , 1 2 , + 1 0 1 0 , + 9 9 0 C LF`

ID #   Upper Limit   Lowe Limit

49

Reply `ACK` `C` `L_F`

ID Number: Maximum 6 digit
Upper Limit: Maximum 9 digit including sign
Lower Limit: Maximum 9 digit including sign

£ Request the scale to reply with the setting of F-Function.

Command `?` `F` `C` `,` `0` `5` `0` `1` `C` `L_F` Request to reply with the setting of ſ-05-01.

Reply `F` `C` `,` `0` `5` `0` `1` `,` `0` `C` `L_F` ſ-05-01 = 0

                F-#   Setting value

£ Store the specified F-Function setting value

Command `F` `C` `,` `0` `5` `0` `3` `,` `+` `1` `2` `3` `4` `C` `L_F` Set "1234" as the Upper limit.

              F-#   Setting value

F-Function Number: 4 digits
Setting Value: Maximum 8 digits including sign.

Reply `ACK` `C` `L_F`

Command `O` `N` `C` `L_F`   Start with new settings.

Reply `ACK` `C` `L_F`

⚠ Having finished the "FC" command, send the "ON" command to start the scale with new settings. The scale replies <ACK> (06H) and starts.

50

13-6. Using UFC (Universal Flex Coms) Function

£ The UFC function allows you to print out as you format the printer (UFC format).

£ The scale can store the UFC format as text data. It will include parameters to replace with the count data, weight data and so on.

£ The maximum number of text data is 384 characters.

£ Terminator for the "PF" command is "C_R" or "$C_R L_F$".

£ Using "PF" command, the text data has to be sent to the scale from the computer in advance. Then, connect the scale with the printer.

£ When the PRINT key is pressed or by auto-print mode A/B, the scale will send the stored text data with the parameters replaced by the original data.

Store Text Data into the Scale Memory

Command | P F , $ P C , ' T E X T ' , # 2 0 , $ S P × 2 , &
$ C R , $ L F , $ W T , $ C R , $ L F C L_F

Reply | ACK C L_F   Terminator

The "PF" command sends text data that will include:

£ Parameters for the scale data and control codes

Parameter	Data & Code	Parameter	Data & Code
$PC	Count	$CD	ID number in use
$WT	Weight	$CP	Comparator result
$UW	Unit weight in use	$CM	Comma
$TR	Tare weight in use	$SP	Space
$TL	Total count	$CR	Carriage Return
$AN	Accumulation numbers	$LF	Line Feed

⚠ These parameters must be used in capital letters.

£ ASCII text string
Text string is described in single quote marks as 'Data'.
The single quote itself is written as ''(2 single quotes).
    Example: Text 'ABC' is described as '''ABC'''.

£ The ASCII hexadecimal code
The ASCII hexadecimal codes are written in the form "#" + 2 hexadecimal digits.
This will mainly be used to send control codes that can't be described as a text string.
    Example: #04   "EOT" of ASCII code

£ Repeat data
The control codes $SP, $CR and $LF can be used with "✳ + maximum 2 digit number". That code will be repeated the number of times designated.
    Example: $LF✳9   Repeat "$LF" 9 times.
              $SP✳12   Put 12 "Spaces".

£ Link mark "&"
If you will send more than 2 lines of data, attach "&" to the end of the first line. Then, the scale considers the data to be continued.

⚠️ "Space" or "," will be used to separate these data. You can skip them, but you cannot skip "," after "PF". You must start with "PF,".

Data Format for the Scale Data

“ ␣ ” in examples below shows "Space" (20H).

Parameters for the scale data will be replaced by the format below when the scale sends them out.

⚠️ Data has a fixed number of digits including a sign and a decimal point. The insignificant zeros are replaced by "Space (20H)" (except the ID number).

| $PC | ␣ ␣ ␣ ␣ + 1 2 3 4 ␣ P C | 1234 pcs / 9 digit data + 3 digit unit |

| $WT | ␣ ␣ + 4 . 3 2 1 0 ␣ k g | 4.3210 kg / 9 digit data + 3 digit unit |

| $UW | + 1 . 2 3 4 5 6 7 ␣ ␣ g | 1.234567 g / 9 digit data + 3 digit unit |

| $TR | ␣ ␣ + 1 . 2 3 4 5 ␣ k g | 1.2345 kg / 9 digit data + 3 digit unit |

| $TL | ␣ ␣ + 9 9 9 9 9 9 ␣ P C | 999999 pcs / 9 digit data + 3 digit unit |

| $AN | ␣ ␣ ␣ ␣ 1 2 3 4 | 1234 times / 8 digit data |

| $CD | 0 0 0 0 1 2 | ID Number 000012 / 6 digit data |

| $CP | O K | Result is "OK" / 2 characters |
| | ␣ ␣ | Result is not available. |

Examples of PF command and AD-8121 Printout Sample

AD-8121 (f-06-03=" 0" or "1")   "PF" Command
(HC-*i* à AD-8121)   (Computer à HC-*i*)

```
= 8˙ $ $ $ $ % & ˙
.

7 c i b h ˙
˙ ˙ ˙ ˙ ˙ ˙ ˙ ˙ Ž % & ' ( ˙ D 7
I b] h˙ KY] [ \ h ˙
˙ ˙ ˙ ˙ Ž % " & ' ( ) * + ˙ ˙ [
KY] [ \ h˙
˙ ˙ ˙ ˙ ˙ ˙ Ž % " ) & ' ) ˙ _ [
.

8 5 H 9 ˙ $ - # %, # & $ $ )
H = A 9 ˙ ˙ ˙ % &. ' ( . ) *
.

˙ ˙ 5 / 8 ˙ < 7 ! %) ? ] ˙
```

```
PF,'ID~', $CD, $CR, $LF, &
$CR, $LF, &
'Count', $CR, $LF, &
$SP✱4, $PC, $CR, $LF, &
'Unit~Weight', $CR, $LF, &
$SP✱4, $UW, $CR, $LF, &
'Weight', $CR, $LF, &
$SP✱4, $WT, $CR, $LF, &
$CR, $LF, &
#1B, #44, $CR, $LF, &
#1B, #54, $CR, $LF, &
$CR, $LF, &
'~~A&D~HC-15Ki', $CR, $LF
```
                    ▲
              Terminator codes

"~" shows "Space.".

⚠️ Normally the printer needs to receive the terminator, and do not forget to add the terminator code(s) to the end of text data.

14. OP-04 RS-232C & RELAY OUTPUT

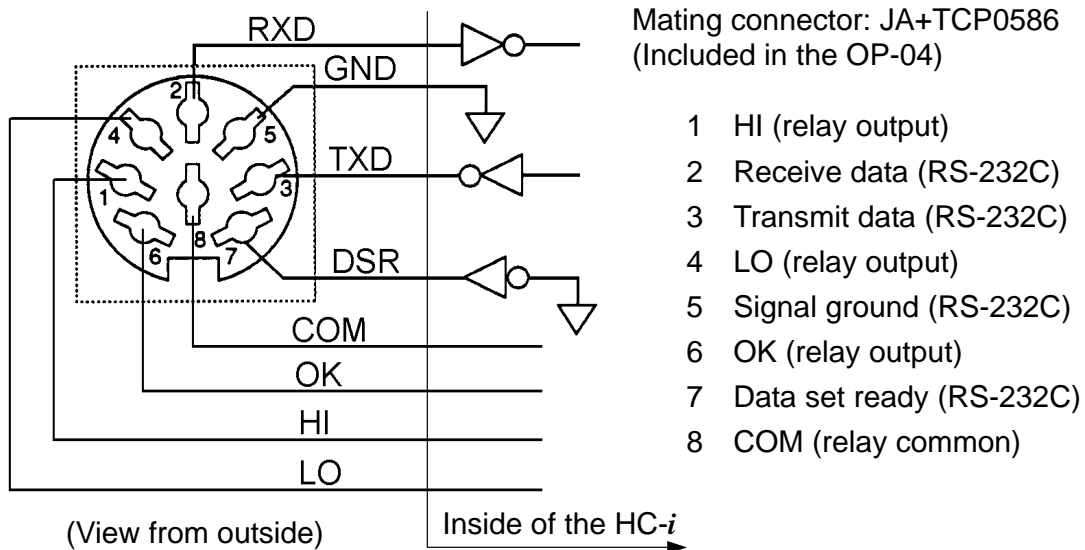RS-232C interface and relay output for comparator results are obtained by installing OP-04.

£ The OP-04 unit includes an interface board, a connector plug (DIN type) and two screws. (M3x6 tapping type).

OP-04 Installation

£ See "13-1. Installation".
£ OP-04 is installed to the same slot with the OP-03.
£ The RS-232C specifications are same as the OP-03 RS-232C interface and refer to "13. OP-03 RS-232C SERIAL INTERFACE".

Comparator Relay Output Circuit

Pin connections

Mating connector: JA+TCP0586
(Included in the OP-04)

1   HI (relay output)
2   Receive data (RS-232C)
3   Transmit data (RS-232C)
4   LO (relay output)
5   Signal ground (RS-232C)
6   OK (relay output)
7   Data set ready (RS-232C)
8   COM (relay common)

(View from outside)   Inside of the HC-*i*

£ The HC-*i* is designated as DCE (Data Communication Equipment).

Maximum rating of the Relay Output

The maximum rating of the replay output is as follows.

£ Maximum voltage: 50V DC
£ Maximum current: 100mA DC
£ Maximum ON resistance   30ô