

INSTRUCTION MANUAL

MODELS

EX-300A

EX-3000A

EY-320A

EY-3200A



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A.

GENERAL

This instruction manual deals with four (4) electronic precision balance models: EX-300A , EX-3000A, EY-320A and EY-3200A.

The EX-A series are single-range, high-precision top-loading balances with a resolution of $1/300,000$ and a temperature co-efficient of max. $3\text{ppm}/^{\circ}\text{C}$.

The EY-A series are dual-range, high-precision top-loading balances with a resolution of $1/30,000$ in each range and a temperature co-efficient of max. $10\text{ppm}/^{\circ}\text{C}$. The balance will automatically select the higher range when the lower range has been overloaded unless the range hold key has previously been pressed. Range Hold is ON when the LED pilot lamp on the key is ON.

Every balance in both the EX-A and the EY-A series is housed on a sturdy die-cast chassis and has the following features:

1. Ultra-stable weighing by rounding the extra lower digit and filtering.
2. Convenient optional interfaces such as the IEEE-488, RS-232C, parallel BCD and 20mA current loop.
3. Taring capability to the max. capacity of the balance with the press of a button or by using external terminals. Taring is generally used to cancel the weight of a container.
4. Easy-to-read cobalt blue display.
5. Clear visual annunciators for various functions.
6. Print key for commanding a print of weighing data when an output option and printer have been connected.

*please read this manual carefully before
you start to use your new balance!*

B.

INSTALLATION

1. UNPACKING

A screw driver and fuse are attached to the top of the packing material. The weighing pan and its support are wrapped in plastic and can be found to the side of the packing material.

- 1 Lift the upper packing material and remove the screw driver and fuse.
- 2 Take out the instruction manual, protective cover, pan and its support.
- 3 Take out the main unit and remove the protective plastic.

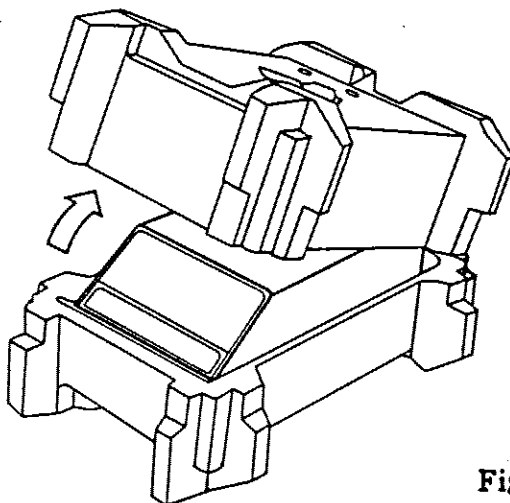


Fig. N° 1

2. POWER MAIN VOLTAGE

The power main voltage for each unit is factory preset at 100, 115, 220, or 240 V AC and CANNOT be adjusted by the user. The factory preset voltage is clearly marked on the rear of the case, just above where the power cable enters the case.

Fuse = 0.5A for 100/115V & 0.2A for 220/240V.

The balance can operate on a power frequency of either 50 or 60 hz.

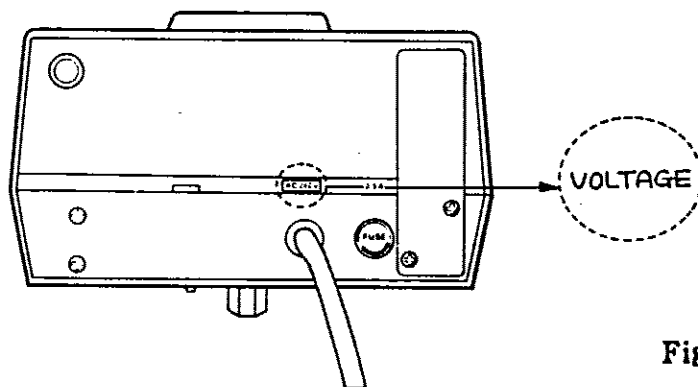


Fig. N° 2

3. OPENING THE CASE

Before opening the case you may wish to check the initial dip-switch settings as shipped on page 5, para -5 to see if it is necessary to change them and therefore if it is necessary to open the case.

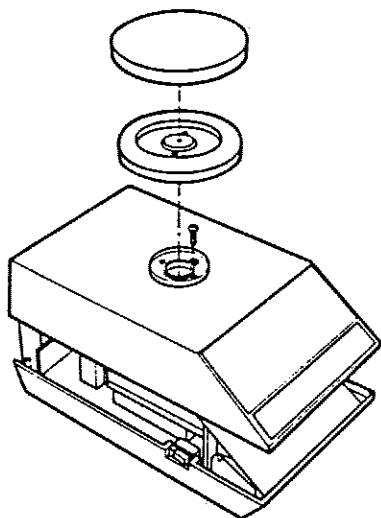


Fig. N° 3

- 1 Remove the weighing pan and its support if they are already installed.
- 2 Unscrew the single large screw that holds the upper and lower cases together.
- 3 Lift up the upper case.

4. DIP-SWITCH PROGRAMMING

The dip-switches located on the lower right side of the display board are to program the parameters for *averaging time*, *display rate* and *no-motion band*.

-1 Averaging time (segment no. 1 & 2)

Data displayed is the average of all past data measured within the programmed averaging time. The following table indicates the settings for the various averaging times.

Table 1 Averaging time

seg. no. 1	seg. no 2	Av. time
ON	ON	1 sec.
ON	OFF	2 sec.
OFF	ON	4 sec.
OFF	OFF	6 sec.

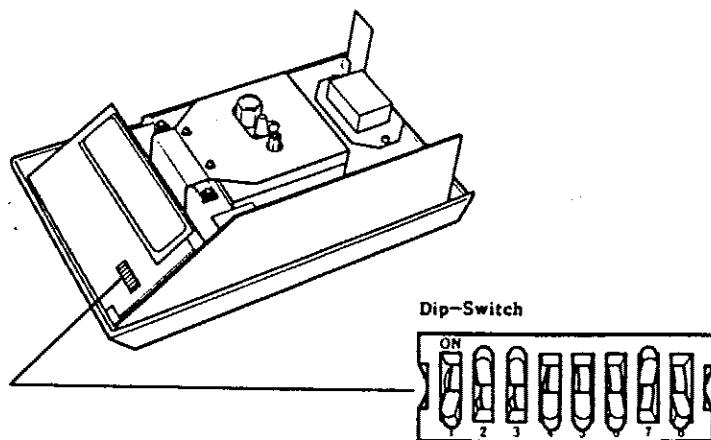


Fig. N° 4

-2 Display rate (segment no. 3)

The display rate is the length of the time interval between each display. When the balance is to be used for filling applications, a faster display rate (when the weight indicated by the display changes at a faster rate) is appropriate. A slower display rate is suitable for stable weighing. The table below indicates the settings for the various display rates.

Table 2

seg. no. 3	Display rate (per second)	
ON	Always 1/4 stable or unstable	
OFF	Unstable 1/8	Stable 1/4

-3 Segments 5 & 6 are used internally and should not be changed (OFF/OFF).

-4 No-motion band (segment no. 7 & 8)

The No-motion band is the allowed band of weight deviation/oscillation. When weight deviation is within the programmed range, then the no-motion annunciator will be lit. The no-motion band can be programmed by setting the segments as shown in the following table.

Table 3 No-motion band

seg. no. 7	seg. no 8	No-motion band
ON	ON	$\pm 1 d *$
ON	OFF	$\pm 2 d$
OFF	ON	$\pm 4 d$
OFF	OFF	$\pm 8 d$

* "d" means divisions or scale interval. " $\pm 1d$ " means ± 1 mg for EX-300A.

-5 Dip-switch settings

The dip-switches are set, at the time of shipment, as follows;

seg. no	1	2	3	4	5	6	7	8
	OFF	ON	ON	OFF*	OFF	OFF	ON	OFF

* ON when Option-09 fitted

5. CLOSING THE CASE (Refer to the fig. no. 3.)

-1 Replace the upper case on the lower case.

-2 Replace the large screw.

6. INSTALLATION SITE

- 1 Avoid installing the balance in direct sunlight.
- 2 The balance should be operated in normal room temperature and other environmental conditions. Optimum weighing conditions are around 20°C (or 68°F) with a relative humidity level of about 50→60%.
- 3 The balance should be used on a stable base, free from excessive vibration.
- 4 The weighing room should be kept clean and should not be prone to excessive air movement. The balance must be level.

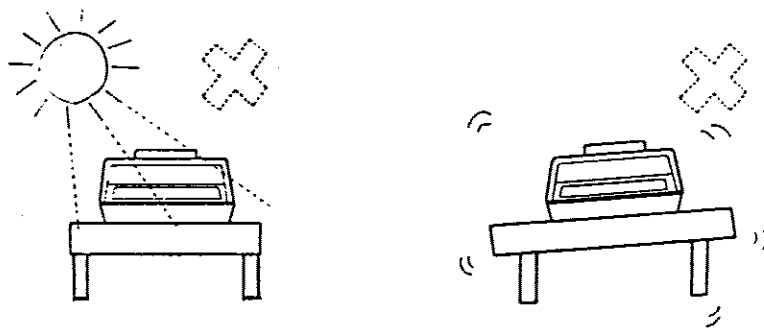


Fig. N° 5

7. LEVELING THE BALANCE

After placing the balance on an appropriately solid surface, level the balance via the adjustable front feet and level vial located under the pan support. Rotate the front feet of the balance until the bubble in the vial is in the center of the red circle.

8. INSTALLATION OF THE PROTECTIVE COVER

- * Remove the dust ring by unscrewing all the screws.
- * Put protective cover on tightly without wrinkling.
- * Replace the dust ring using the three screws.
- * Replace the pan support and weighing pan.

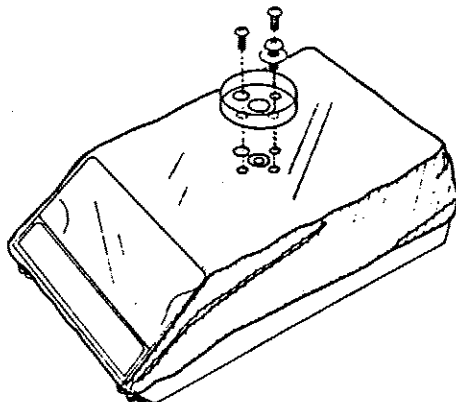


Fig. N° 6

C.

PANEL DESCRIPTION

- | | |
|----------------------------------|------------------------------------|
| (1) Polarity annunciator | (2) No-motion annunciator |
| (3) Weight display | (4) Tare key |
| (5) Model marking | (6) Print key |
| (7) Adjustable front feet | (8) Rear foot |
| (9) Weighing pan | (10) Plastic cover for span volume |
| (11) Slot for optional interface | (12) Fuse holder |
| (13) Power cable | (14) Power main voltage marking |
| (15) Ground Terminal | (16) External tare terminal |
| (17) Mode switch | (18) Power switch |
| (19) Range hold key (EY only) | (20) Power pilot lamp (LED) |

Fig. N° 7

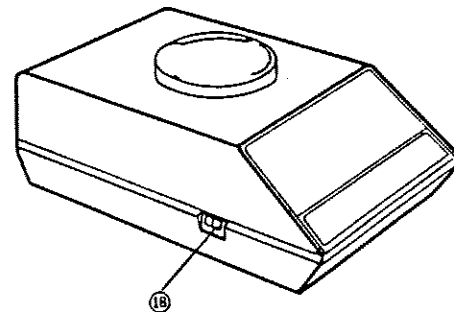
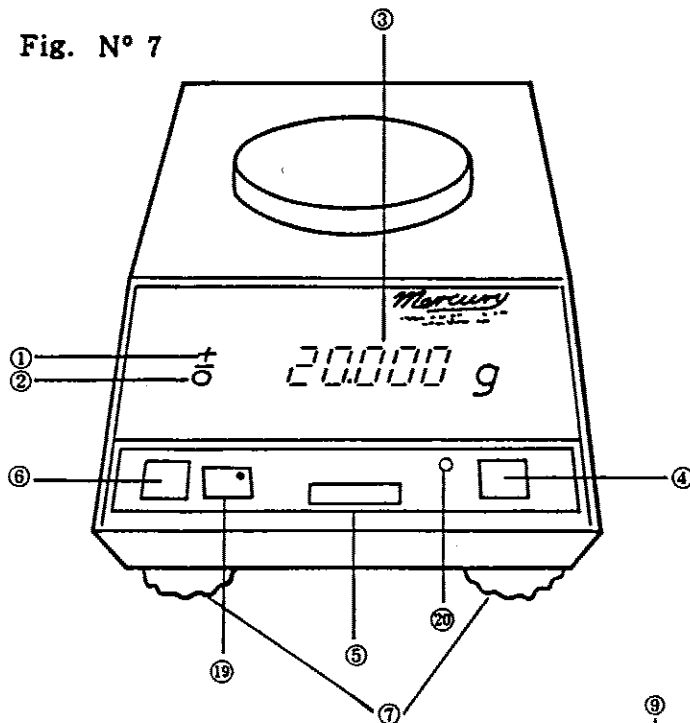


Fig. N° 8

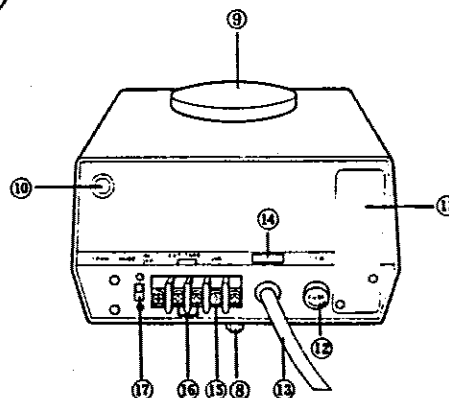


Fig. N° 9

D CALIBRATION

Calibration of the balance is required when it is initially installed, when changing the installation site and additionally every three months or so.

"Weight" = Mass $\times$ acceleration due to Earth gravity (about 9.8m/s^2 in a vacuum) but gravity, air buoyancy and various other factors vary from location to location and from time to time.

1. PREPARATION

- a) Check that the balance is horizontal.
- b) Turn on power and allow a warm-up period of at least 30 minutes.
- c) Obtain a standard weight equal to the maximum capacity of the balance.

2. PROCEDURE

- a) Remove plastic span protection plug from the rear of the balance.
- b) Inside you will see a small volume screw accessible with a small screw driver (such as the one supplied with the balance).
- c) Confirm that nothing is on the pan and press TARE. Weight display must be zero and stable.
- d) Put the standard weight on the pan.
- e) If the display does not indicate the correct weight, turn the span screw clockwise if the display is too low and anticlockwise if it is too high.
- f) Remove the standard weight and if the display does not zero press TARE (zero and span are slightly interactive).
- g) Repeat the above steps until you obtain a stable zero and exact weight display.

E OPERATION

1. WEIGHING

- a) Press TARE to zero the display.
- b) Place the object(s) to be weighed on the pan.
- d) Read the displayed weight after the display is stable (when 0 is displayed).

2. WEIGHING-IN

- a) Place a container on the pan.
- b) Press TARE to zero the display or use a remote N/O switch connected to the rear TARE input terminals.
- c) Fill the container until the target weight is reached.
- d) When mixing ingredients in a container press tare after each addition.

3. WEIGHING-OUT

- a) Place a full container on the pan.
- b) Press TARE to zero the display.
- c) When anything is subsequently removed from the container the amount removed will be displayed as weight loss.

4. WEIGHING A DEVIATION

- a) Place a reference or standard sample weight on the pan.
- b) Press TARE and then remove weight, weight loss will be displayed.
- c) Now any sample weight (to be compared with the reference weight) placed on the pan will indicate its deviation from reference (zero display) in terms of a positive or negative display. This function is useful in check-weighing operations.

F OPTIONS

1. OP-01 Parallel BCD output.
2. OP-02 Plastic Breeze-Break (EX-300A/EY-320A only).
3. OP-03 RS-232C serial interface.
4. OP-04 Glass Breeze-Break (EX-300A/EY-320A only).
5. OP-05 Under-hook (EX-300A/EY-320A only).
6. OP-06 Under-hook (EX-3000A/EY-3200A only).
7. OP-09 GP-IB IEEE-488 interface.

This section will first deal with the Breeze-Breaks, then the Under-hooks and finally the Interfaces.

1. BREEZE-BREAK

Two types of breeze-break are available for the EX-300A/EY-320A balances.

OP-02 is a simple unfolding plastic box type structure with a flip-up lid which, when placed around the pan, excludes light drafts.

OP-04 is a taller more solid glass and metal structure with opening sides (glass) and top (metal). This type is installed by removing the pan & pan support, placing the breeze-break on top of the balance and then replacing the pan & pan support inside the breeze-break.

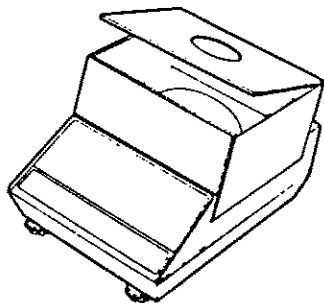


Fig. N° 10

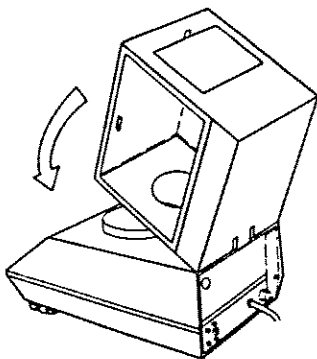


Fig. N° 11

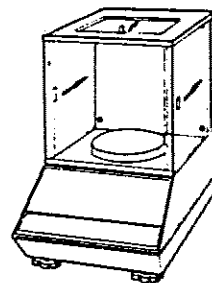


Fig. N° 12

2. UNDER-HOOK

An under hook is required for weighing objects which have to be suspended. One application for under hook weighing is finding the floating weight of an object when it is suspended in a liquid. The relative density (specific gravity) of an object is found by the ratio of the mass of a given volume of the substance to the mass of an equal volume of pure water at (maximum density) 4°C. 1 litre = 1kg [1 litre=1.000028dm³ @ std.a.p. of 1.01325×10^5 N/m²]. An object immersed in a fluid will suffer a loss in weight (tare before immersion) equal to the weight of fluid it displaces.

Please recalibrate the balance for weighing in suspension.

OP-05 is designed for EX-300A/EY-320A and OP-06 for EX-3000A/EY-3200A.

INSTALLATION METHOD

1. Remove the pan and pan support and carefully tip the balance up-side-down.
2. Remove the small metal cover you will find underneath the balance directly below the brass weighing pan peg.
3. Gently screw the under-hook into the threaded hole in the center of the brass bolt then accessible.
4. Turn the balance the right way up and place it on solid table with a hole cut in it through which the under-hook can freely protrude.
5. Replace pan & pan support, install suspension harness and recalibrate balance.

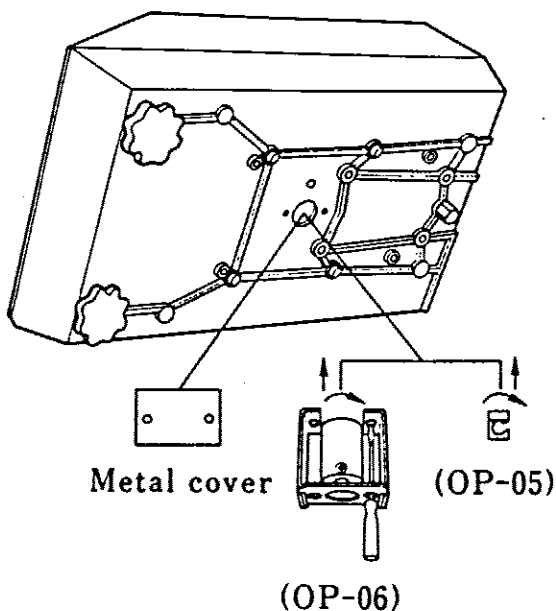


Fig. N° 13

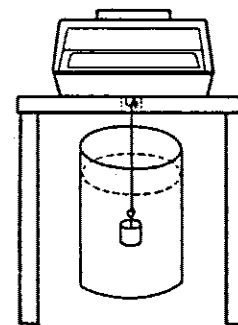


Fig. N° 14

3. INTERFACES

OP-01, OP-03 and OP-09

As these interfaces occupy the same space in the balance, only one may be installed at a time

1. Option-01 is a parallel BCD (binary-coded-decimal) output card for interfacing the balance to peripherals with a BCD input capability. A & D printer AD-8114B may be used when this option is installed. Rear panel MODE switch should be OFF for Balance Keyboard Print Control & ON for Automatic Single Print when Stable.

BCD OUTPUT TABLE

Pin No.	Signal	Pin No.	Signal
1	GROUND	26	1×10^6
2	1×10^0	27	2×10^6
3	2×10^0	28	4×10^6
4	4×10^0	29	8×10^6
5	8×10^0	30	Decimal Point 10^5
6	1×10^1	31	Decimal Point 10^6
7	2×10^1	32	Decimal Point 10^7
8	4×10^1	33	Not-in-motion (Hi)
9	8×10^1	34	Unit A
10	1×10^2	35	
11	2×10^2	36	
12	4×10^2	37	Unit B
13	8×10^2	38	
14	1×10^3	39	
15	2×10^3	40	Polarity (+ = Hi)
16	4×10^3	41	
17	8×10^3	42	
18	1×10^4	43	Decimal Point 10^1
19	2×10^4	44	Decimal Point 10^2
20	4×10^4	45	Decimal Point 10^3
21	8×10^4	46	Decimal Point 10^4
22	1×10^5	47	OVERLOAD
23	2×10^5	48	No Polarity (Norm.Hi)
24	4×10^5	49	PrintCommand
25	8×10^5	50	BUSY (Input)

TTL level, positive logic, fan out 3.

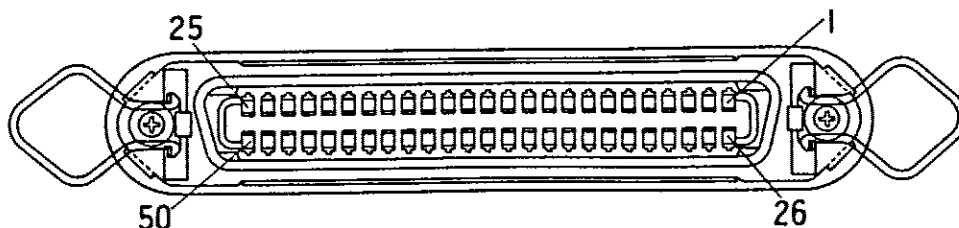
Mating connector---AMPHENOL:57-30500

Print command--- Positive pulse with 1m. sec. width. Pin 49.

No polarity---"Lo" when the display is zero, -P or being Tared.

Busy---Fan in 1, latches output data when input is low.

OP-01



2. Option-03 is a serial RS-232C interface card for interfacing A & D balances to an AD-8116 compact printer or to another external device such as a computer.

a) Specifications

Type-----EIA-RS-232C

Passive 20mA Current Loop

Method-----Half-duplex method, asynchronous transmission

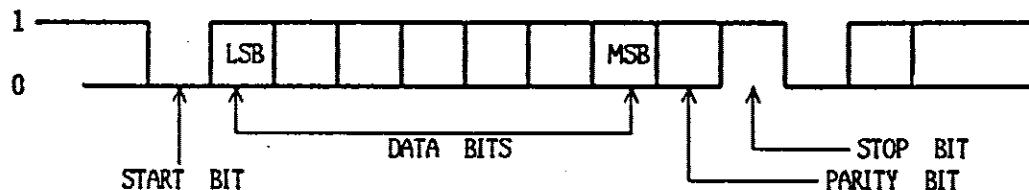
Format-----Baud rate : 600 or 2400 (dip-switch selectable)

Data bit : 7

Parity bit : 1 (EVEN)

Stop bit : 1

Code : ASCII



RS-232C 1 = -5V → -15V
 0 = +5V → +15V

20mA Current Loop
 1 = 20mA
 0 = 0mA

b) Transmission modes

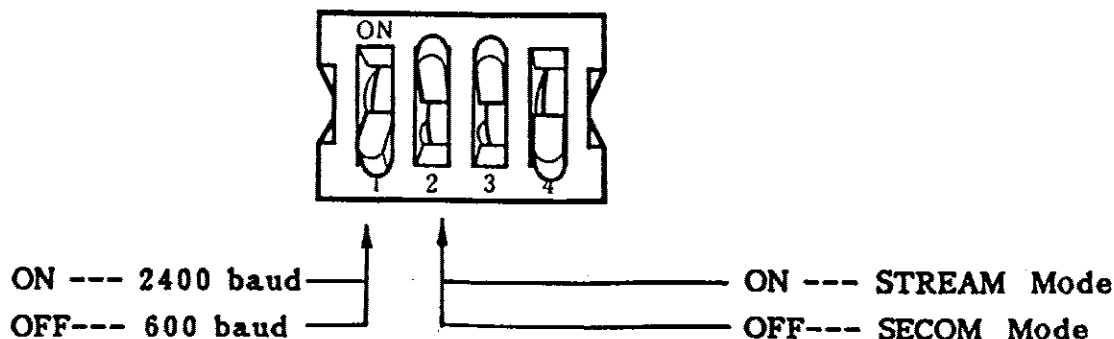
Two transmission modes are available, "Synchronised to External Command" (SECOM) Mode and "Stream Mode" (STREAM). "Balance Keyboard Output Control" (BAKOC) is available when the balance is in STREAM Mode.

In SECOM data will only be sent after the display is stable (O is displayed) and after an external "READ" command has been received by the balance. SECOM is only available from RS-232C.

In BAKOC no external command is required and data will be sent whenever the print key is pressed. BAKOC is available from both the RS-232C and Current Loop in continuous output STREAM Mode. *CURRENT LOOP IS PASSIVE. External 20mA source required.

c) Dip-Switch Selection

Mode and baud rate are selected by dip-switch 1 & 2 on the interface card.



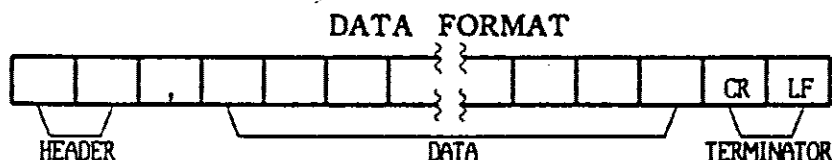
d) SECOM Mode

i) TARE Command: RxD----- (TARE) (CR) (LF)

When this TARE command is received, the TARE function of the balance is activated. As 1 second is required to execute this command, the next command should be sent no sooner than 1 second after the TARE command has been given (if it is sent sooner it will be ignored).

ii) READ Command: RxD----- (READ) (CR) (LF)

When this READ command is received, a weight data sample immediately following the command will be transmitted.



Three types of HEADER are transmitted:

OL----- Overload

ST----- Stable Weight (O is on)

US----- Unstable Weight

Weight data samples are transmitted by ASCII numerals including the following codes:

2D (HEX) -----	"-" (minus)
----------------	-------------

2D (HEX) ----- * - * (minus)

2B (HEX) ----- "+" (plus)

20 (HEX) ----- " " (space)

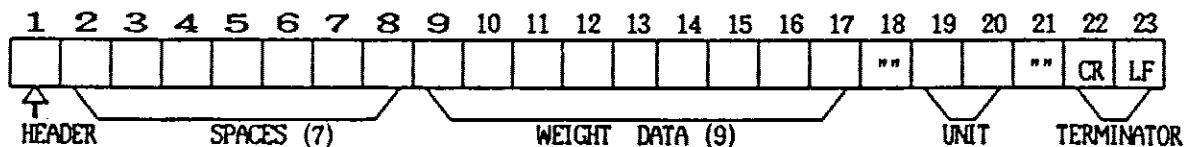
45 (HEX) ----- "E" (exponent)

2E (HEX) ----- "." (decimal point)

Keep the MODE switch located on the rear panel of the balance OFF whenever SECOM is in use and segment number 4 of the balance (not Option-03) dip-switches is set OFF (the initial setting). This format will be Keyboard Print Control after READ command received. Balance segment number 4 must be ON for normal SECOM format when printing will be controlled externally via READING.

e) STREAM Mode

In this mode data is transmitted continuously without need of a data request.



HEADER:- NULL: 00 (HEX) = Display is stable.

HEADER:- DC2 : 12 (HEX) = Display is unstable. "" = SPACE = 20 (HEX)

f) Rear Panel MODE Switch plus balance dip-switch #4 and Automatic Printing.

For the Automatic sending of one print command per weighing event in STREAM mode when the display is stable, the MODE switch should be ON with #4 OFF. A weighing event will be judged to be over when the display has returned to within zero $\pm 10d$ after the previous object has been removed. If #4 is ON a print command will be sent once every display cycle (continuously) and the setting of rear panel MODE switch will have no effect (see top of next page).

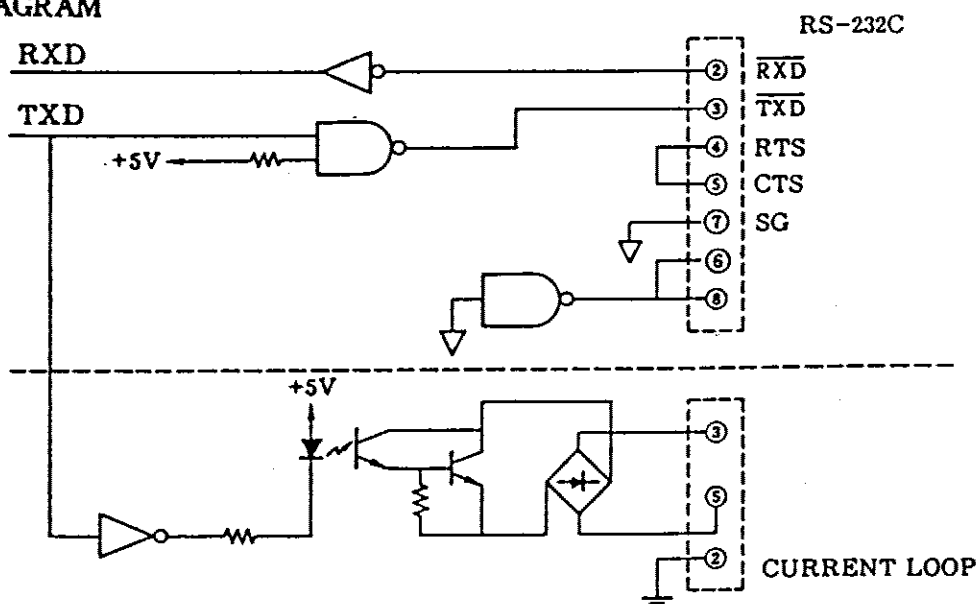
FORMAT	TRANSMISSION	MODE SWITCH	BALANCE DIP-SWITCH #4
COMMAND	SECOM	-----	ON
BAKOC	STREAM	OFF	OFF
CONTINUOUS	STREAM	-----	ON

g) Passive 20mA Current Loop Pin Connections:-

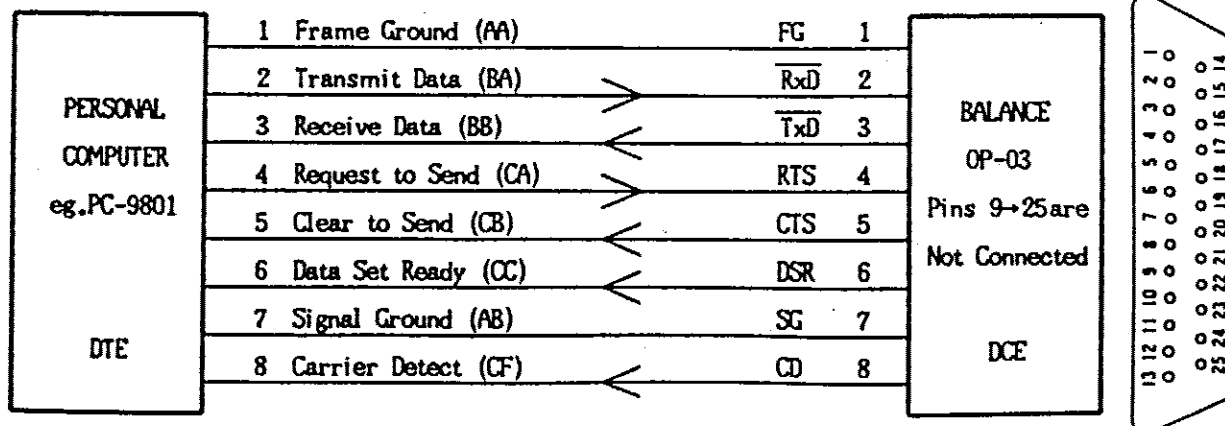
7 Pin DIN	SIGNAL
#1	NOT CONNECTED
#2	FRAME GROUND
#3	CURRENT LOOP
#4	NOT CONNECTED
#5	CURRENT LOOP
#6	NOT CONNECTED
#7	NOT CONNECTED



h) CIRCUIT DIAGRAM



i) RS-232C Pin Connections: AD-8116 and other devices.
AD-8116 uses a KO:256 interface cable. Select Stream Mode at 2400 baud.
These balances are designated as Data Communication Equipment for other devices.



j) STANDARD ACCESSORY

Current loop connector (1) TCP 0576

* An RS-232C connector is not provided with this option because A & D peripherals such as AD-8116 are equipped with cables and connectors.

k) SAMPLE RS-232C COMPUTER PROGRAM

When interfacing to NEC PC-9801 (Microsoft BASIC), in "SECOM" mode, type in the following:

```
"M" "O" "N" "CR"
"S" "S" "W" "2" "CR"
"0" "4" "CR" (600 baud) "0" "6" "CR" (2400 baud)
"CTRL" "B"

10  T$="TARE"
20  R$="READ"
30  OPEN "COM:E71NN" AS #1          * 1 (Interface file, Even/7bits/1stop)
40  PRINT #1, "CLEAR"              (CLEAR interface buffer)
50  FOR I=1 TO 100 : NEXT I        (Delay)
60  PRINT #1, T$                   (TARE)
70  FOR I = 1 TO 2000: NEXT I      (Delay after TARE)
80  PRINT #1, R$                   (READ)
90  INPUT #1, HD$, DT              (Receive Data)
100 PRINT HD$, DT                  (Display Data)
110 FOR J = 1 TO 100: NEXT J      * 2 (Delay after (CR))
120 GOTO 80                       (Loop)
130 CLOSE #1                      (Close interface file)
140 END                           (HALT)
```

* 1 "NN" is NEC Microsoft dialect & * 2 PC-9801 requires this delay.

3. Option-09 GP-IB general-purpose interface bus (IEEE-488) is an interface for a controller. When selected, measured data can be transmitted to, and "TARE" commands can be received from, a controller.

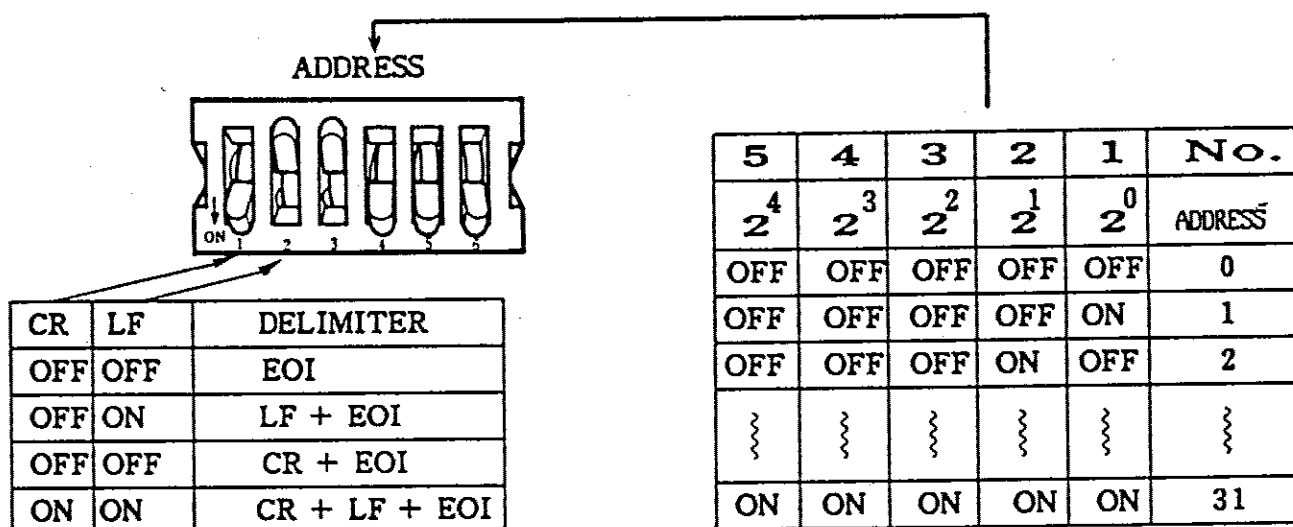
(1) Specifications (Inst.of Electrical & Electronics Engineers/International Electrotechnical Commission)

All specifications comply with IEEE-488-1975 and IEC-TC66 (CO) 22.

Interface functions-SH1, AH1, T6, L4, SR1, RL0, PP0, DC0, DT1, C0.

(2) Address and Delimiter switches

The dip switches for the address and delimiter are located on the option PCB.



(3) Commands

The following commands are available:

Commands

Function

SO Prohibit the service request from the balance

S1 Permit the service request from the balance.

E Memorize displayed data of the balance when E is received
and when S1 has been received, SRQ will be sent out.

TARE The balance will be tared and display will zero.

NOTE:- Device trigger has an identical function to "E".

(4) SRQ (Service request)

SRQ will not be sent out until S1 has been received after power on. When one of the following conditions has been satisfied after receiving S1, SRQ will be sent out.

Condition 1. When data is accepted by the interface after E has been received.

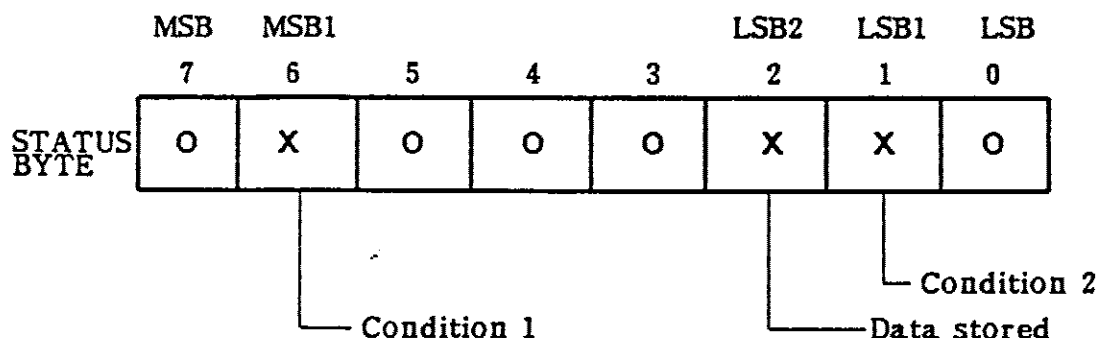
Condition 2. When an undefined code is received.

(5) STATUS BYTE

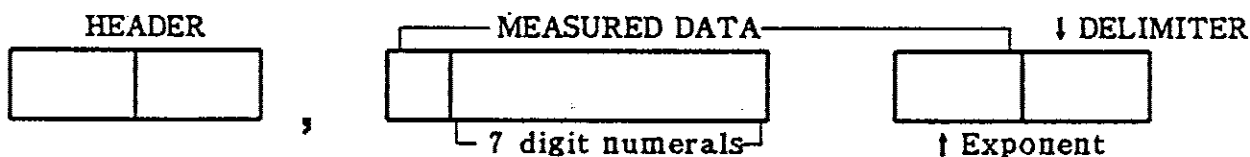
When SRQ is ready as a result of an S1 command, the status of MSB1 becomes 1, and after the status byte is read, MSB1 becomes 0.

When SRQ is ready as a result of an undefined code, LSB1 becomes 1, and after being designated as a listener, LSB1 becomes 0.

When SRQ is ready as a result of storing data, LSB2 becomes 1, and after being designated as talker, LSB2 becomes 0.



(6) DATA FORMAT



Header Code	Meaning
ST	Weight (The balance is stable/Not-in-motion)
US	Weight (The balance is not stable/In-motion)
OL	Overload or malfunction

(7) ACQUIRING MEASURED DATA

When "E" is received, the balance stores the data just measured and will transmit this data as soon as it is designated as talker. Please note that the balance should receive "E" just before being designated as talker so that the data is fresh. If "E" is received after "S1" has been accepted, the balance will store the current data and then transmit "SRQ".

N. B. The balance print key will not transmit or store data. Segment number 4 of the balance dip-switches must be ON when Option-09 is fitted.

(8) COMPUTER PROGRAM EXAMPLE (GP-IB IEEE-488)

When interfaced with HP-85,

program the addresses and delimiters of each machine as below:

MACHINE	HP-85	OP-09 of BALANCE
ADDRESS	21	1
DELIMITER	CR+LF+EOI	CR+LF+EOI

(a) Initialize

```
10 RESET 7 ----- Interface clear
15 CONTROL 7, 16;130 --- Set delimiter of HP-85 as CR+LF+EOI
```

(b) TARE the balance

```
10 OUTPUT 701 ; "TARE"
```

(c) Acquire data and display

```
20 OUTPUT 701; "E"
30 ENTER 701; A$ @ DISP A$ --- Receive data into A$ and display
40 GOTO 20
```

(d) Acquire data using SRQ.

```
10 ON INTR 7 GOSUB 100
15 CONTROL 7, 16; 130 ----- Not required with (a) 15 above.
20 ENABLE INTR 7;8 ----- Allow SRQ from balance
30 OUTPUT 701; "S1" ----- Allow balance to transmit SRQ
40 F=1
50 IF F=1 THEN OUTPUT 701; "E" @ F=0 -- (Instruct balance to acquire data)
60 GOTO 50 ----- Loop
100 S=SPOLL (701) ----- Read Status Byte from address No. 1
110 DISP S ----- Display Status Byte
120 STATUS 7, 1 ; Z ----- Read Status Register
130 ENTER 701 ; A$ ----- Read measured data into A$
140 DISP A$ ----- Display measured data
150 F=1
160 ENABLE INTR 7;8 @ RETURN -- Allow SRQ from balance and return
```

G PRINTERS

1. DIGITAL PRINTER AD-8114B.

This printer is interfaced to A & D balances via a BCD output interface card and a KO:145 interface cable; use Input A of printer.

The internal switches of the printer should be programmed as follows:-

SW 1 number	ON/OFF	SW2 number	ON/OFF
1	ON	1	OFF
2	ON	2	OFF
3	OFF	3	OFF
4	OFF	4	OFF
5	ON	5	OFF
6	ON	6	ON
7	OFF	7	ON
8	OFF	8	OFF

*** Manual Print (Balance Keyboard Print Control)**

Balance MODE switch should be OFF.

MAN/EXT switch of printer should be on EXT.

Pressing the Balance PRINT switch will initiate printing.

*** Auto Print (Automatic Single Print when Stable)**

Balance MODE switch should be ON.

MAN/EXT switch of printer should be on EXT.

Printing will be Automatically initiated when the object being weighed renders a stable (not-in-motion) weight display.

2. COMPACT PRINTER AD-8116.

Uses a KO:256 interface cable between the printer & RS-232C interface card.

The dip-switches on the RS-232C interface card inside the balance should be set to one & two ON (STREAM mode at 2400baud).

FORMAT	AD-8116 MODE SWITCH	BALANCE DIP-SWITCH #4	BALANCE MODE SWITCH
AD-8116 PRINT KEY	2	ON	EITHER ON or OFF
BAKOC	1	OFF	OFF
AUTO-PRINT	1	OFF	ON

**** FOR MORE DETAILED EXPLANATIONS
PLEASE SEE THE PRINTER MANUALS.***