

HL Series

Compact Scale

MAINTENANCE MANUAL

HL-100
HL-200
HL-2000
HL-400
HL-4000

A&D
A&D Company, Limited

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Product specifications are subject to change without any obligation on the part of the manufacture.

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1. Introduction and specifications

1-1 Introduction

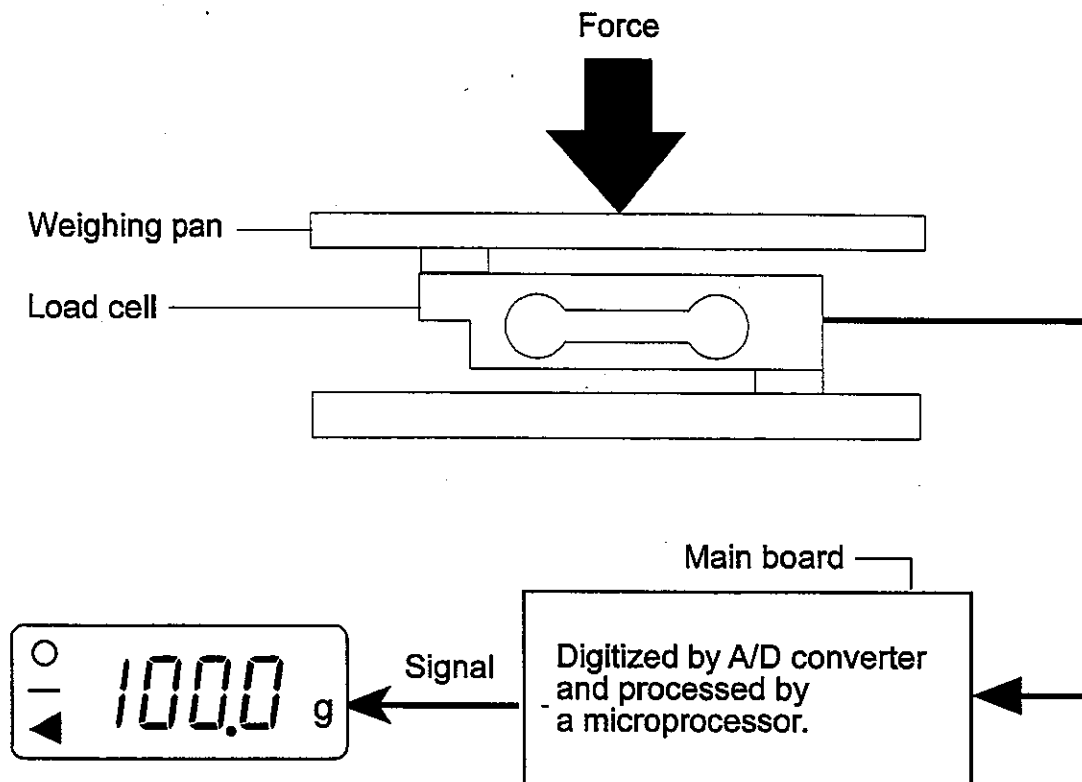
This maintenance manual covers five models from the A&D HL series of scales: HL-100, HL-200, HL-2000, HL-400, HL-4000. Please read this maintenance manual and the owner's instruction manual fully before you start any maintenance work.

1-2 Specifications

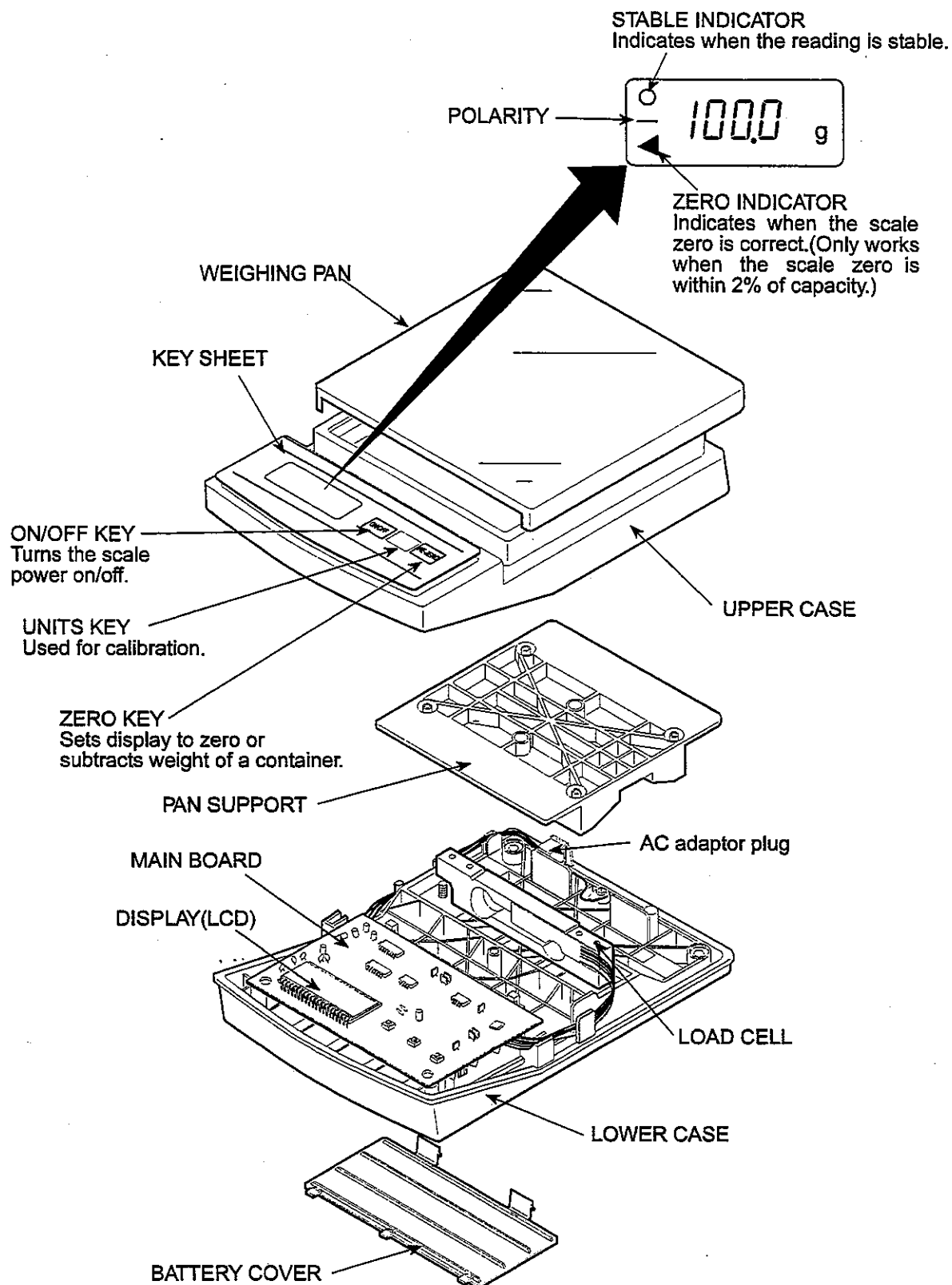
MODEL	HL-100	HL-200	HL-2000	HL-400	HL-4000
Capacity	100g	200g/7oz	2000g/4lb 6oz	400g/14oz	4000g/8lb 13oz
Calibration weight	100g \pm 0.01g	200g \pm 0.02g	2000g \pm 0.2g	400g \pm 0.02g	4000g \pm 0.2g
Resolution	0.01g	0.1g/0.01oz	1g/0.1oz	0.1g/0.01oz	1g/0.1oz
Non-linearity	\pm 0.01g	\pm 0.2g	\pm 2g	0.2g	\pm 2g
Repeatability	\pm 0.01g	\pm 0.1g	\pm 1g	\pm 0.2g	\pm 2g
Span drift	\pm 0.015%/°C TYP (5°C~35°C/41°F~86°F)				
Display	8mm, 7 segment liquid crystal display				
Platform size	136mm(W) \times 136mm(D)				
Dimensions	140(W) \times 198(D) \times 44.5(H)mm 5.51(W) \times 7.79(D) \times 1.75(H) inches				
Weight	Approximately 500g				
Power	6 \times R6P/LR6/ "AA" size batteries or AC adaptor				
Battery life	Approximately 100 hours with manganese type cells / 200 hours with alkaline cells at 20°C/68°F				
Opening temp.	-10°C~40°C/14°F~104°F, Less than 85%RH (Non-condensing)				
Accessories	Instruction manual				
Options	AC Adaptor				

2. Operational principle

Model HL is a load cell type electronic scale. The operational principle is shown in the figure below. The load cell detects force applied on the weighing pan. The load cell generates an analog signal, which is converted into a digital signal by the main board A/D converter which is processed by a Microprocessor. The process data is displayed on a LCD



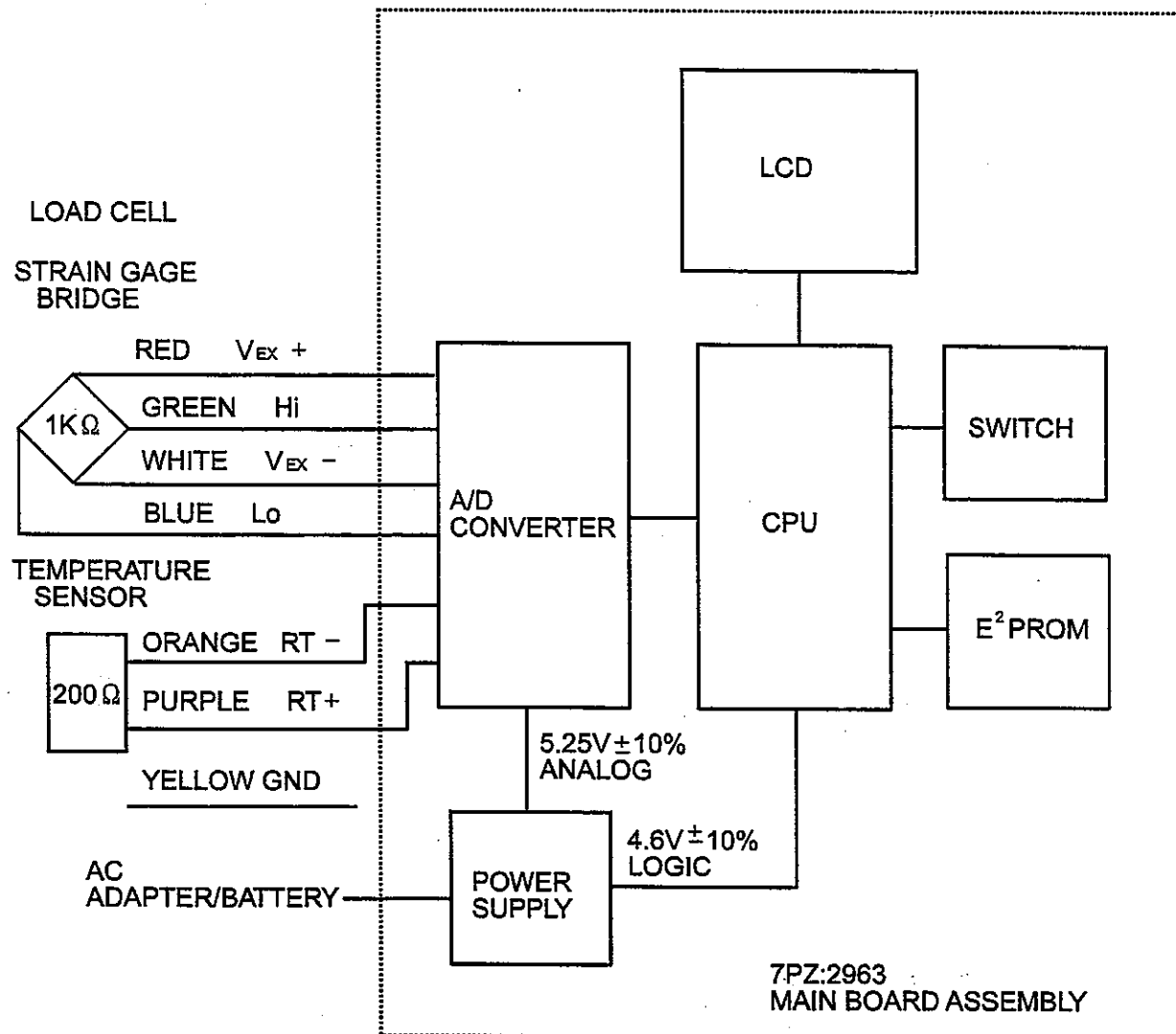
3. Parts Names



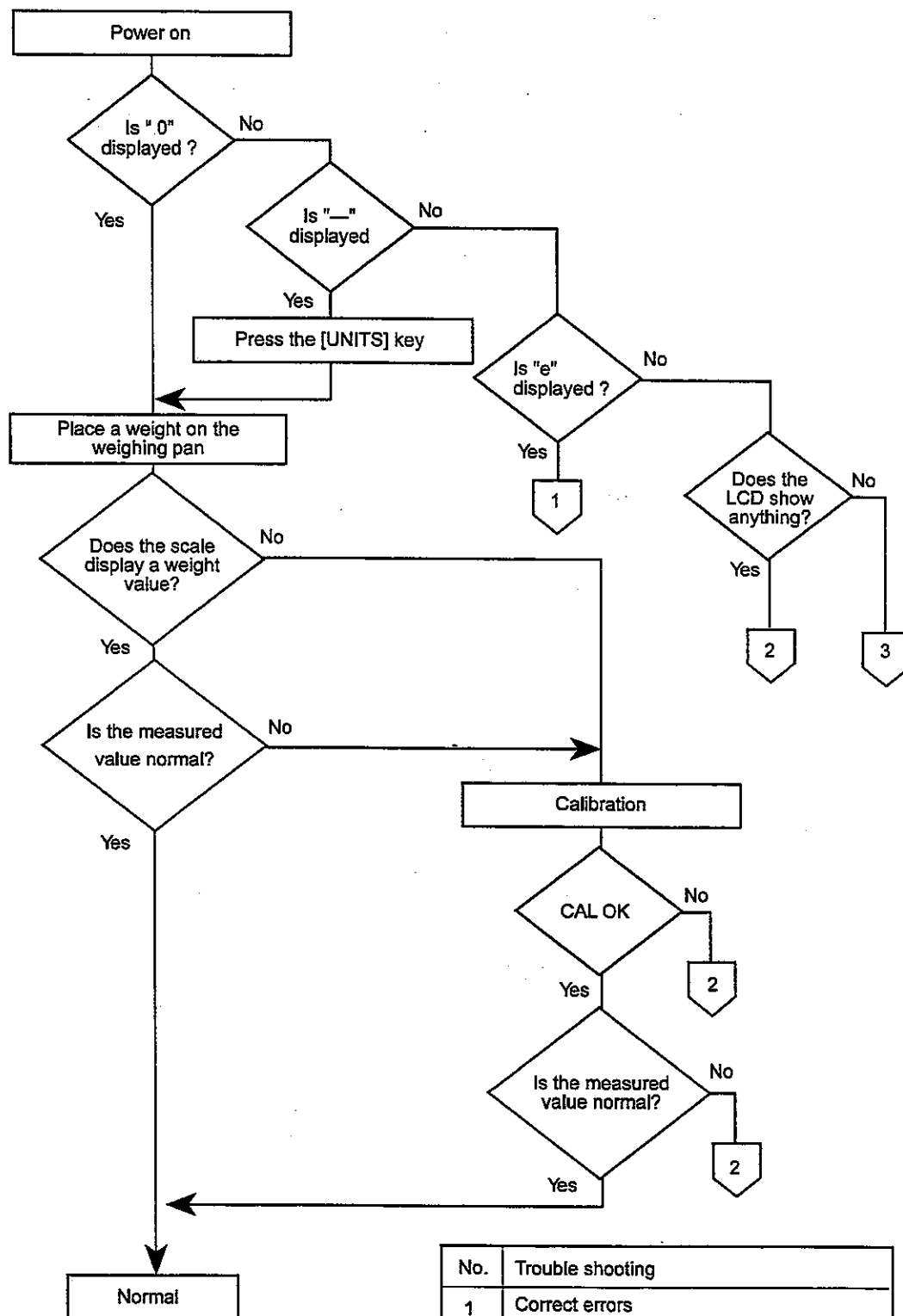
4. Block diagram

The HL series compact scale consists of functional units: case unit, weighing pan, main board unit, load cell and battery.

The load cell detects the force. The detected force is converted into digital signal by the main board A/D converter, processed by a microprocessor (CPU) and displayed on a LCD.



5. Trouble shooting



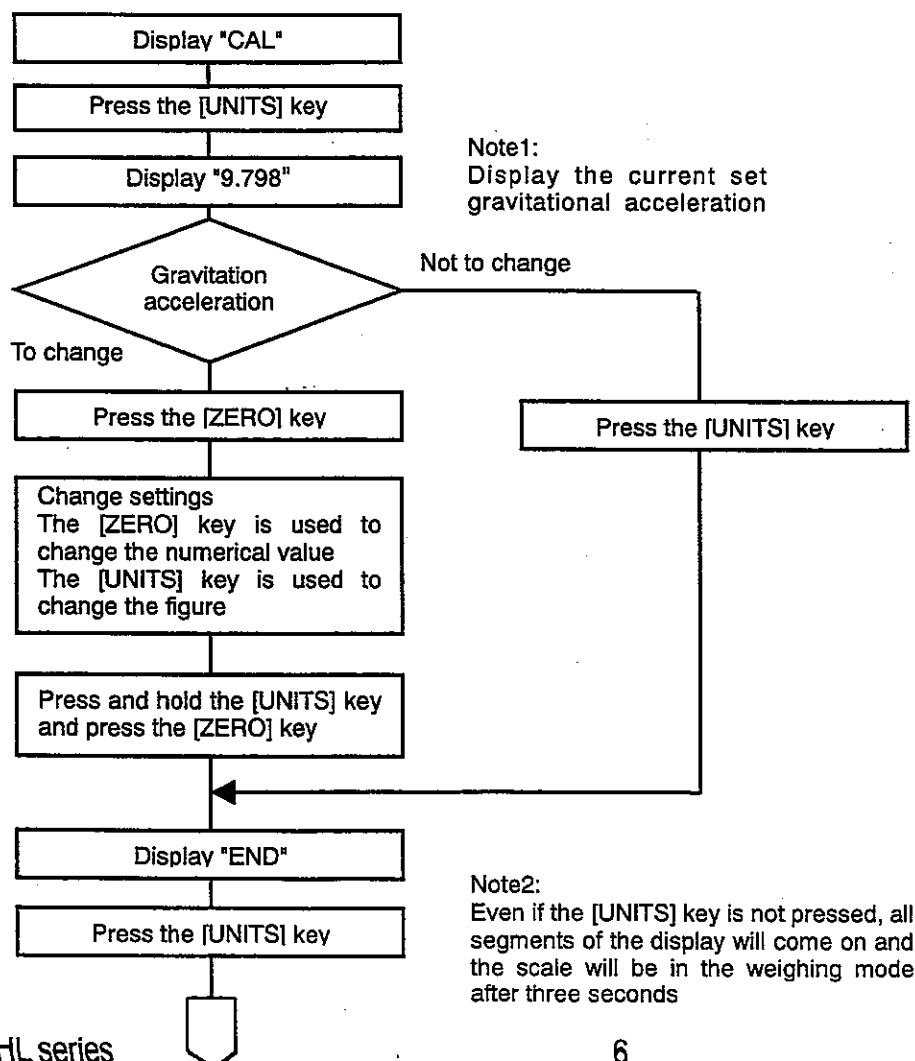
No.	Trouble shooting
1	Correct errors
2	Malfunction of main board and /or load cell
3	Malfunction of main board and/or battery

6. Calibration mode

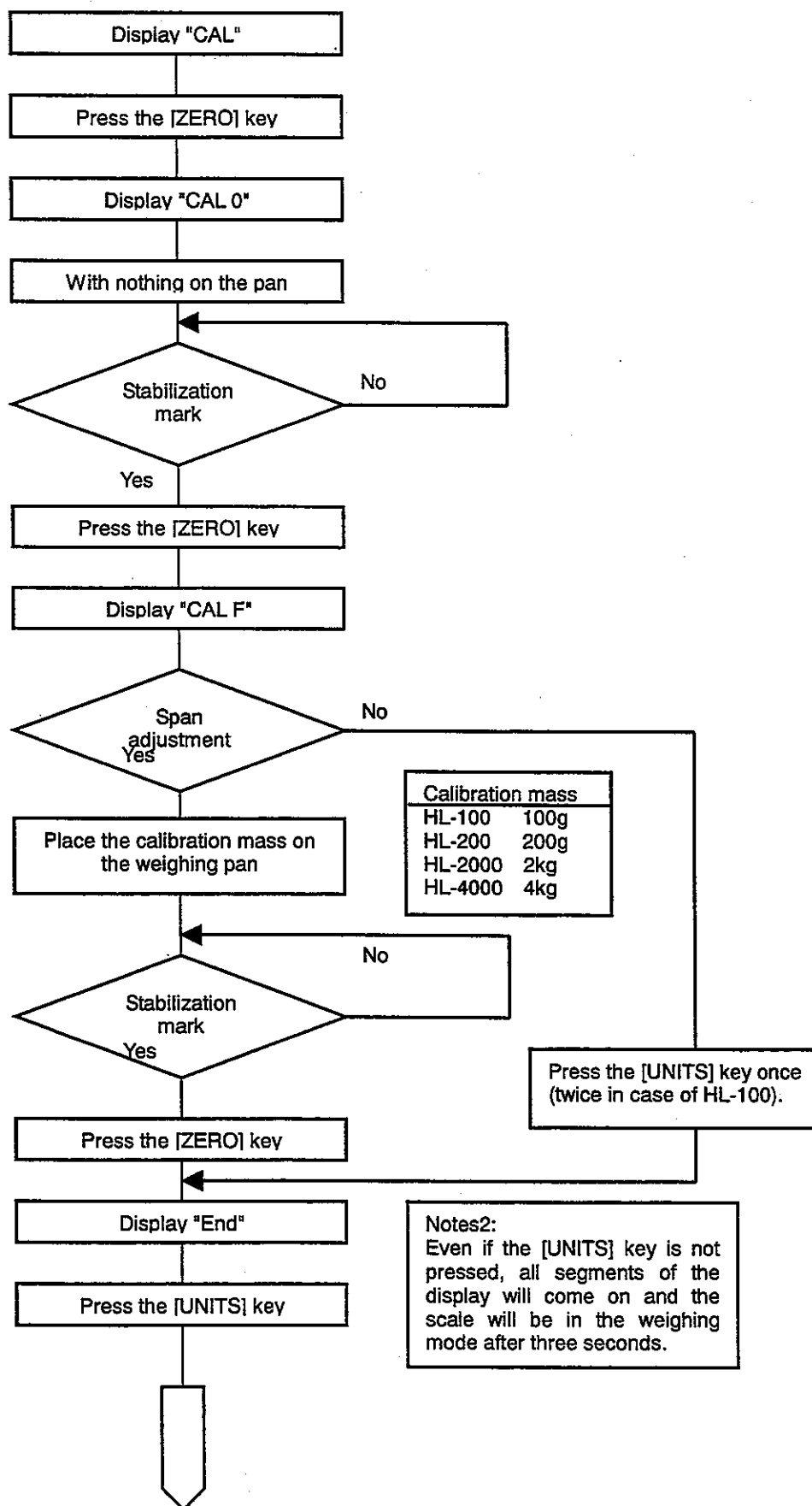
The HL series scales are equipped with a function to compensate for measuring errors caused by gravitational acceleration. If zero or span has shifted, for example, when the scales location of use is changed, check the gravitational acceleration. Change the setting or calibrate using a certified weight if necessary. When the load cell or the main board is replaced, check the gravitational compensation as described on page 15.

1. While holding down the [UNITS] and [ZERO] key, press the [ON/OFF] key to turn the power ON.
2. Once the display indicates "CAL", release all the keys.
3. Press the [ZERO] key to go to the calibration mode by a weight; press the [UNITS] key to go to the gravitational acceleration setting mode.
4. Pressing the [UNITS] key. Approximately three seconds after "END" is displayed, will return the scale to the weighing mode. All segments of the display will turn on, then will be displayed.

Gravitational acceleration setting



Calibration using a weight



7. Check mode

Check mode checks the display, specification settings, A/D count and temperature compensation coefficient.

While holding down the [ZERO] key, pressing the [ON/OFF] key will turn the power ON and the CPU version will be displayed.

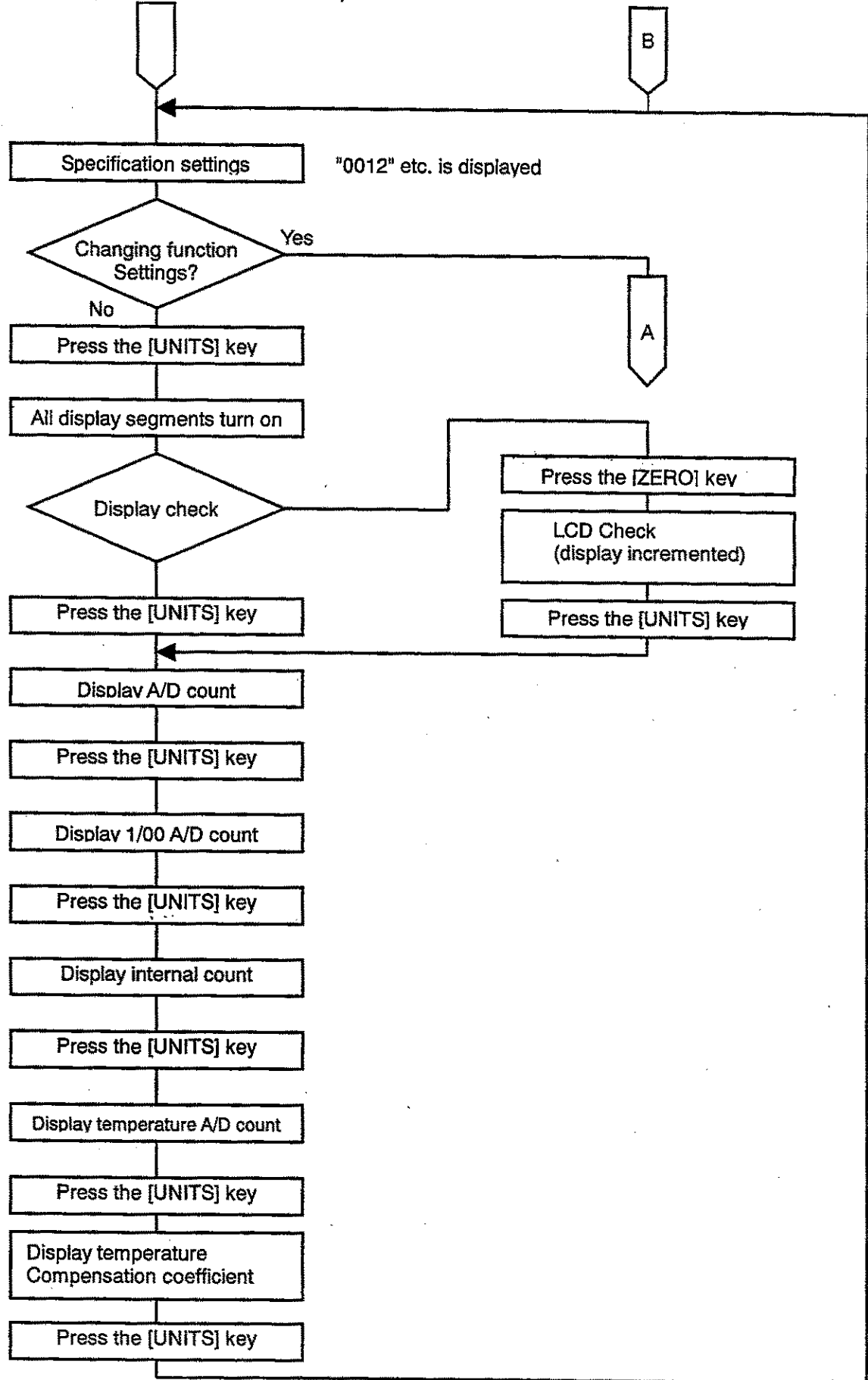
With CPU version "P-1.2", check mode is as follows:

1. While holding down the [UNITS] and [ZERO] key, press the [ON/OFF] key to turn the power ON.
2. Keep the [UNITS] and [ZERO] keys pressed. The scale will be in the check mode after the following performance:
The display indicates "CAL". (5sec) → "CAL" disappears. (5sec) → The LCD segments are checked.
3. To exit the check mode, press the [ON/OFF] key to turn the power OFF.

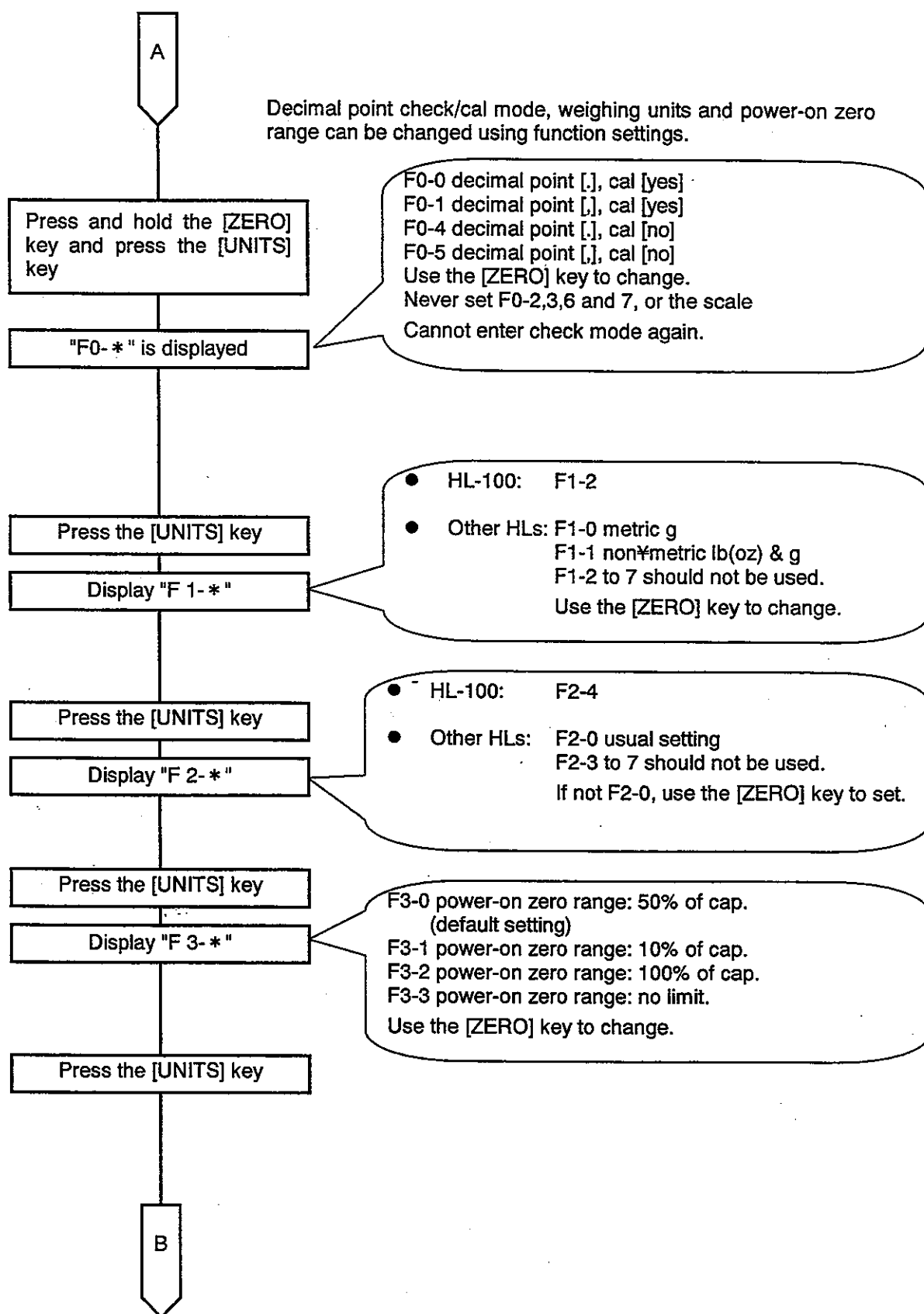
With CPU version "P-2.0/3.0", check mode is as follows:

1. While holding down the [UNITS] and [ZERO] key, press the [ON/OFF] key to turn the power ON. The display will show "CAL" (or all segments will turn on).
2. Press and hold the [ZERO] key and press the [UNITS] key twice. Then the display will show the CPU version "P-2.0/3.0"
3. Press and hold the [ZERO] key to show the specification settings. This is the beginning of check mode.
4. To exit the check mode, press the [ON/OFF] key to turn the power OFF.

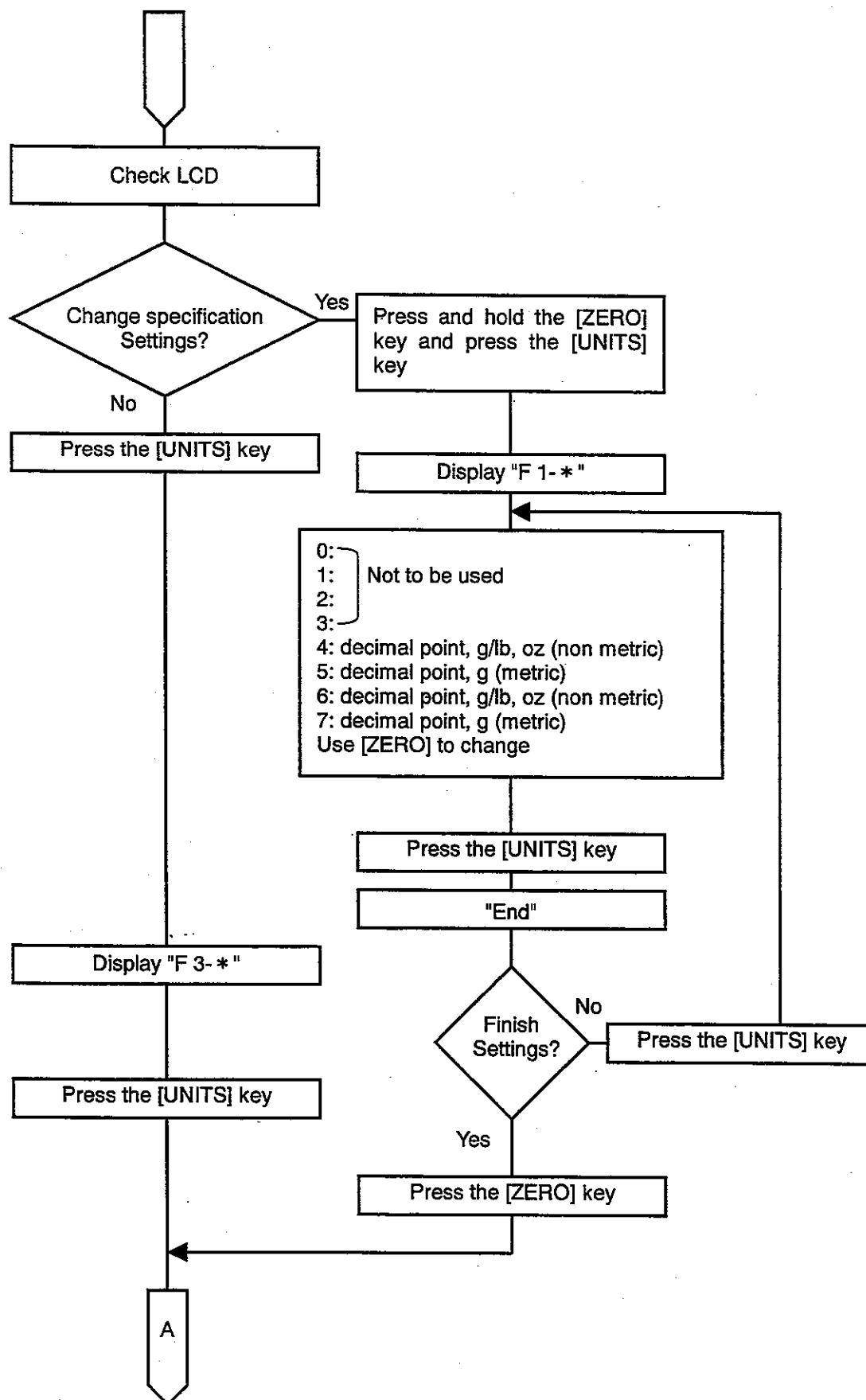
Check mode (CPU version P-2.0/3.0)

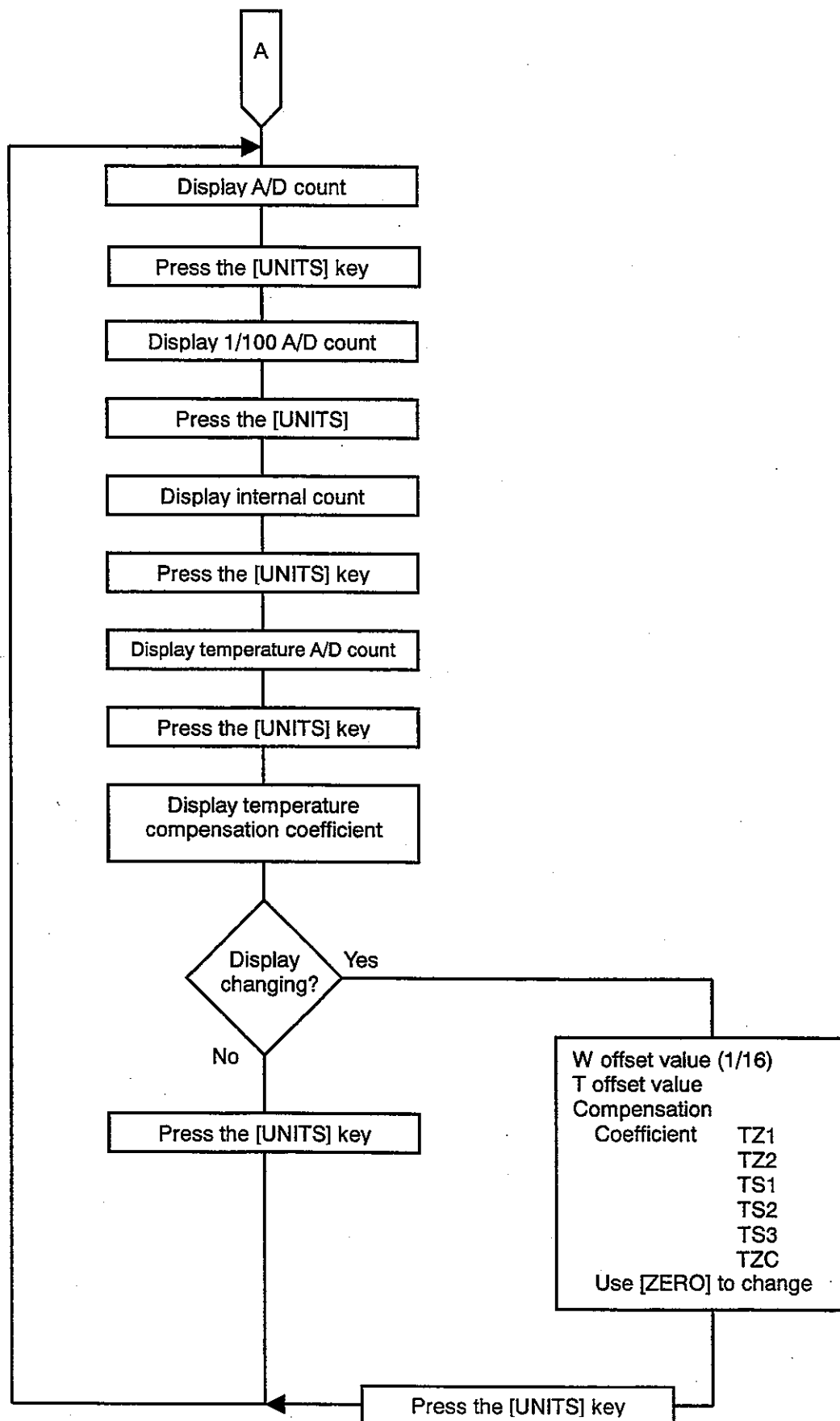


Function settings (CPU version P-2.0/3.0)



Check mode (CPU version P-1.2)





8. Setting mode

8-1 Setting mode (CPU version, P-1.2)

Set the scale model and perform temperature compensation as follows :

Temperature compensation is required whenever the main board or the load cell is replaced. Before temperature compensation, be sure to check the gravitational acceleration and make the necessary changes as described in chapter 6.

In the setting mode, the following is set:

Scale model, to initialize or not, temperature coefficient temperature at CAL.

1. While holding down the [UNITS] and [ZERO] keys, press the [ON/OFF] key to turn the power ON. "CAL" appears from the display
2. Keep the [UNITS] and [ZERO] keys pressed. After five seconds, "CAL" disappears from the display. Here, release the [UNITS] key. Keep the [ZERO] key pressed. After five seconds, the LCD indicates "F0- *" (* = the set value) and the scale will be in the setting mode.

To exit the setting mode, press [ON/OFF] to turn the power OFF. When the settings were changed, press the [ZERO] key after "END" being displayed to proceed to the temperature compensation mode.

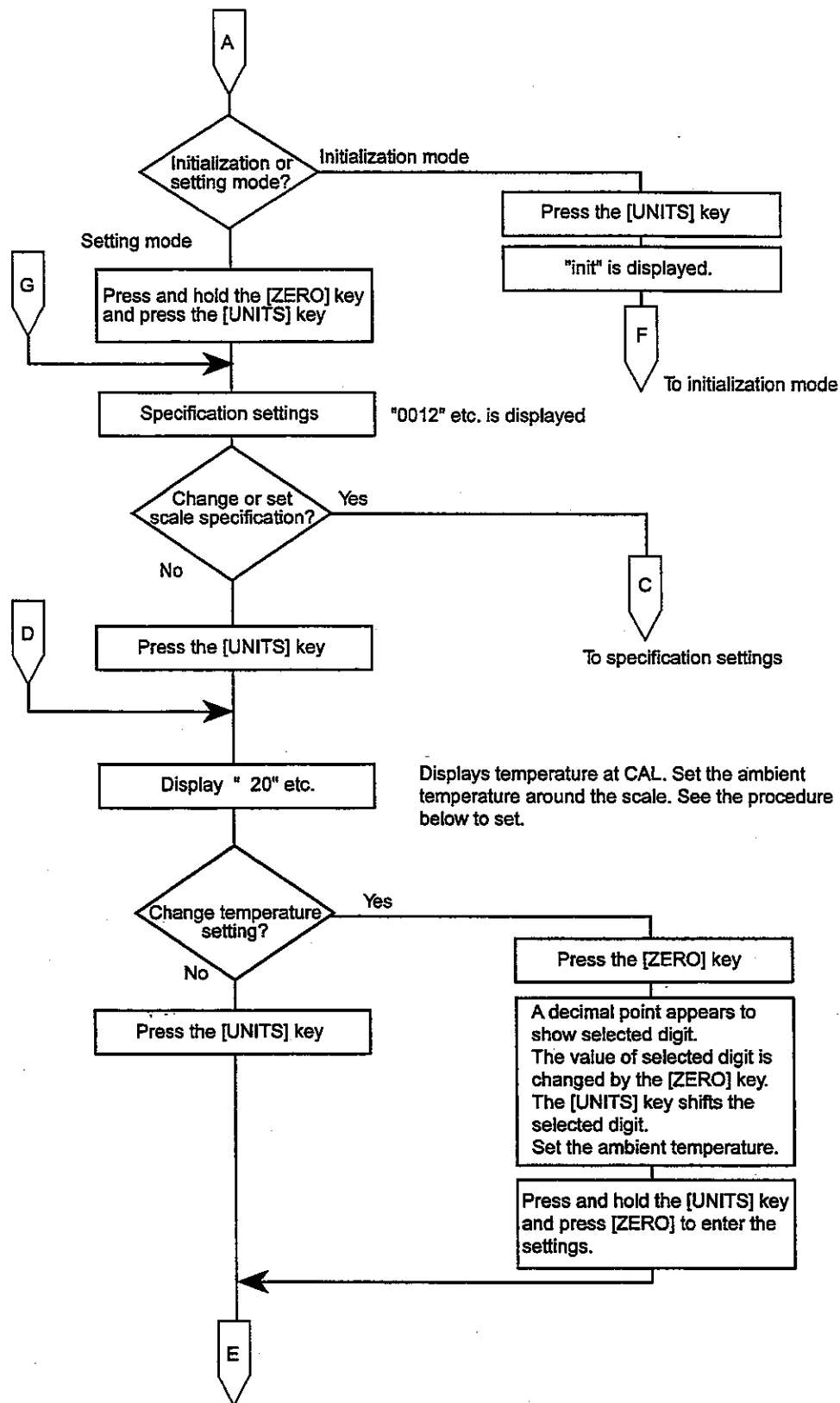
8-2 Setting mode (CPU version, P-2.0/3.0)

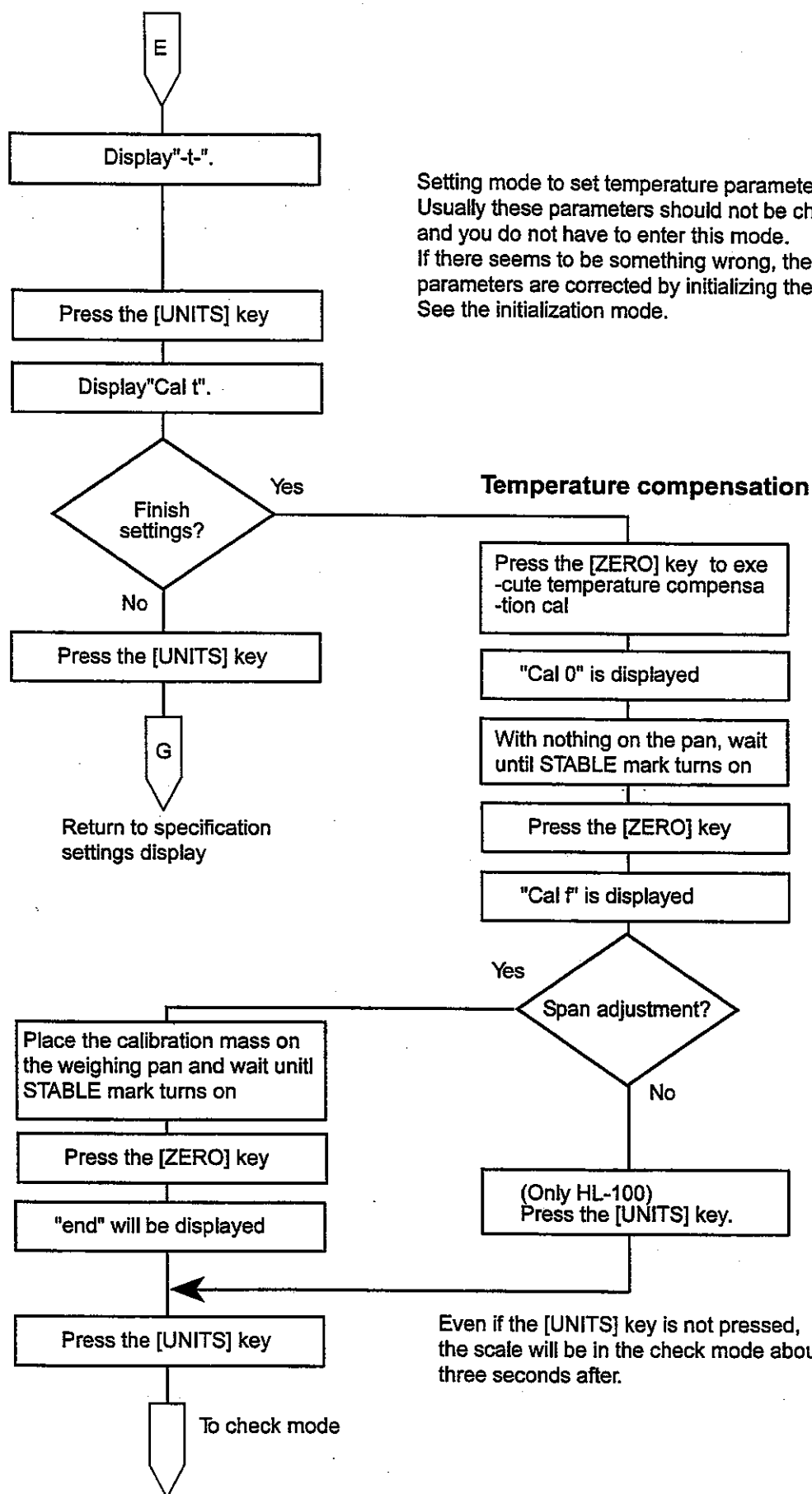
The capacity, weighing units, weighing units, decimal point and temperature parameters are set in the setting mode.

1. While holding down the [UNITS] and [ZERO] keys, press the [ON/OFF] key to turn the power on. The display will show CAL (or all segments will turn on).
2. Release the [units] key but keep the [ZERO] key pressed, and press the [UNITS] key twice. Then the display will show the CPU version "P-2.0/3.0".
3. Press the [UNITS] key twice, then the display shows "CAL" first and "Adj" second.
4. If you go to the initialization mode, press the [UNITS] key.
5. To enter the setting mode, press and hold the [ZERO] key and press the [UNIT] key. Then the scale shows the setting mode. In this mode, capacity, weighing units, temperatures can be set and temperature calibration will be done.

To exit the setting mode, press [ON/OFF] to turn the power OFF. Once settings were changed, the temperature calibration should be done to exit this mode.

Setting mode (CPU version P-2.0/3.0)

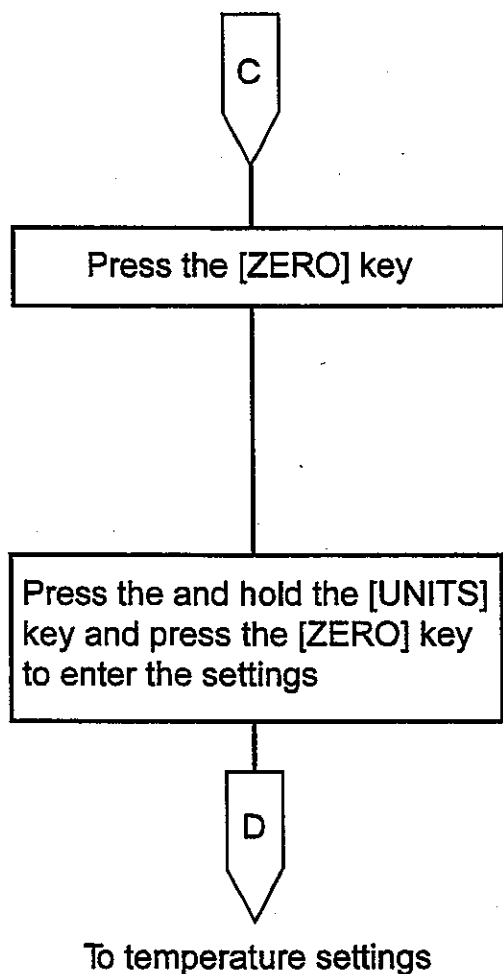




Setting mode to set temperature parameters. Usually these parameters should not be changed and you do not have to enter this mode. If there seems to be something wrong, these parameters are corrected by initializing the scale. See the initialization mode.

Even if the [UNITS] key is not pressed, the scale will be in the check mode about three seconds after.

Specification settings (CPU version P-2.0/3.0)



A decimal point appears to show selected digit. The value of selected digit is changed by the [ZERO] key. The [UNITS] key shifts the selected digit. Refer to the table of model settings.

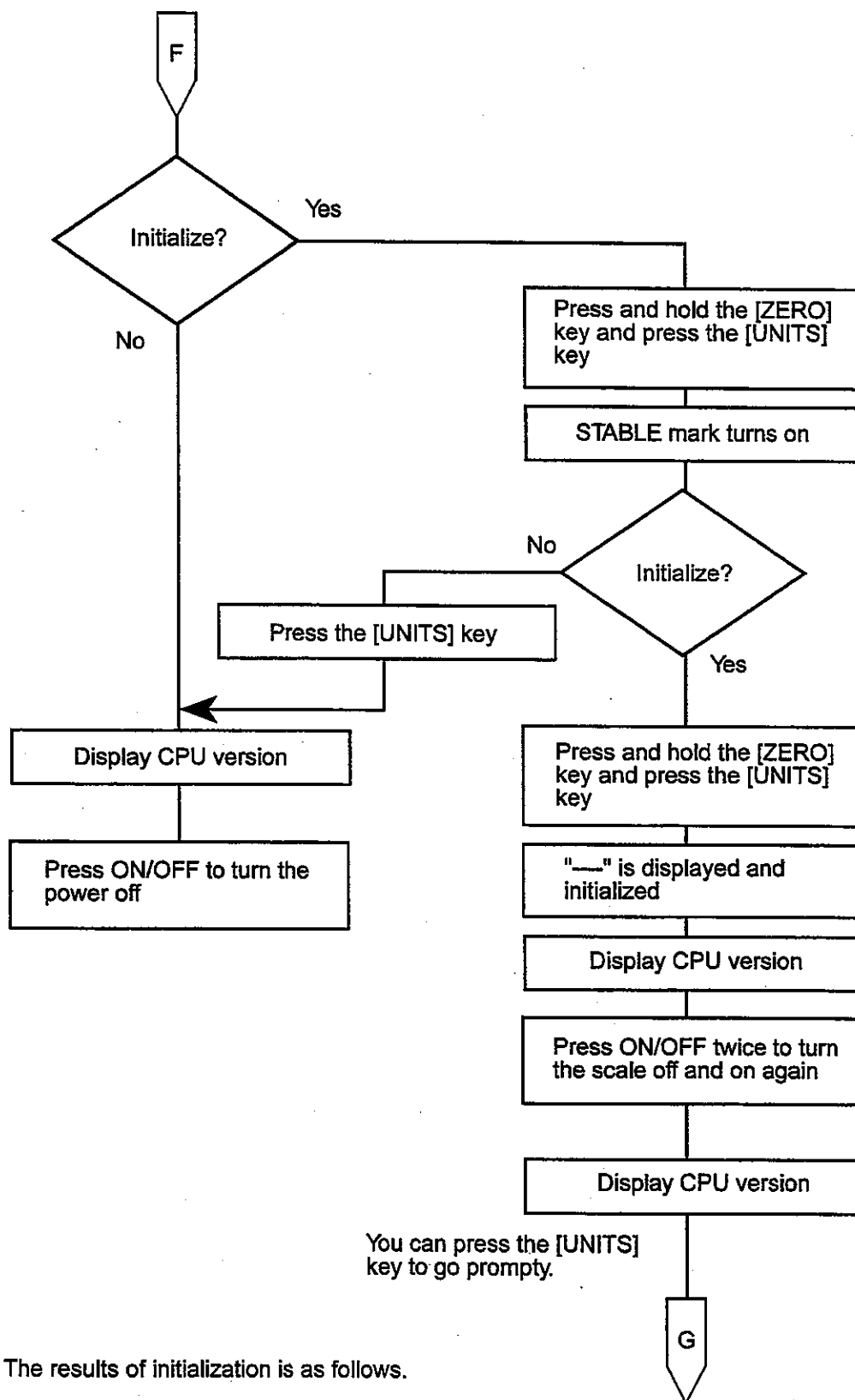
Model settings / HL

	g only	g, (lb)oz
HL-200	*002	*102
HL-2000	*012	*112
HL-400	*042	*142
HL-4000	*052	*152

* = 0 : Decimal point [.]
1 : Decimal point [,]

	g->oz->ct->g	g->ct->g	GN->g->GN
HL-100	*082	*182	*382

Initialization mode (CPU version P2.0/3.0)

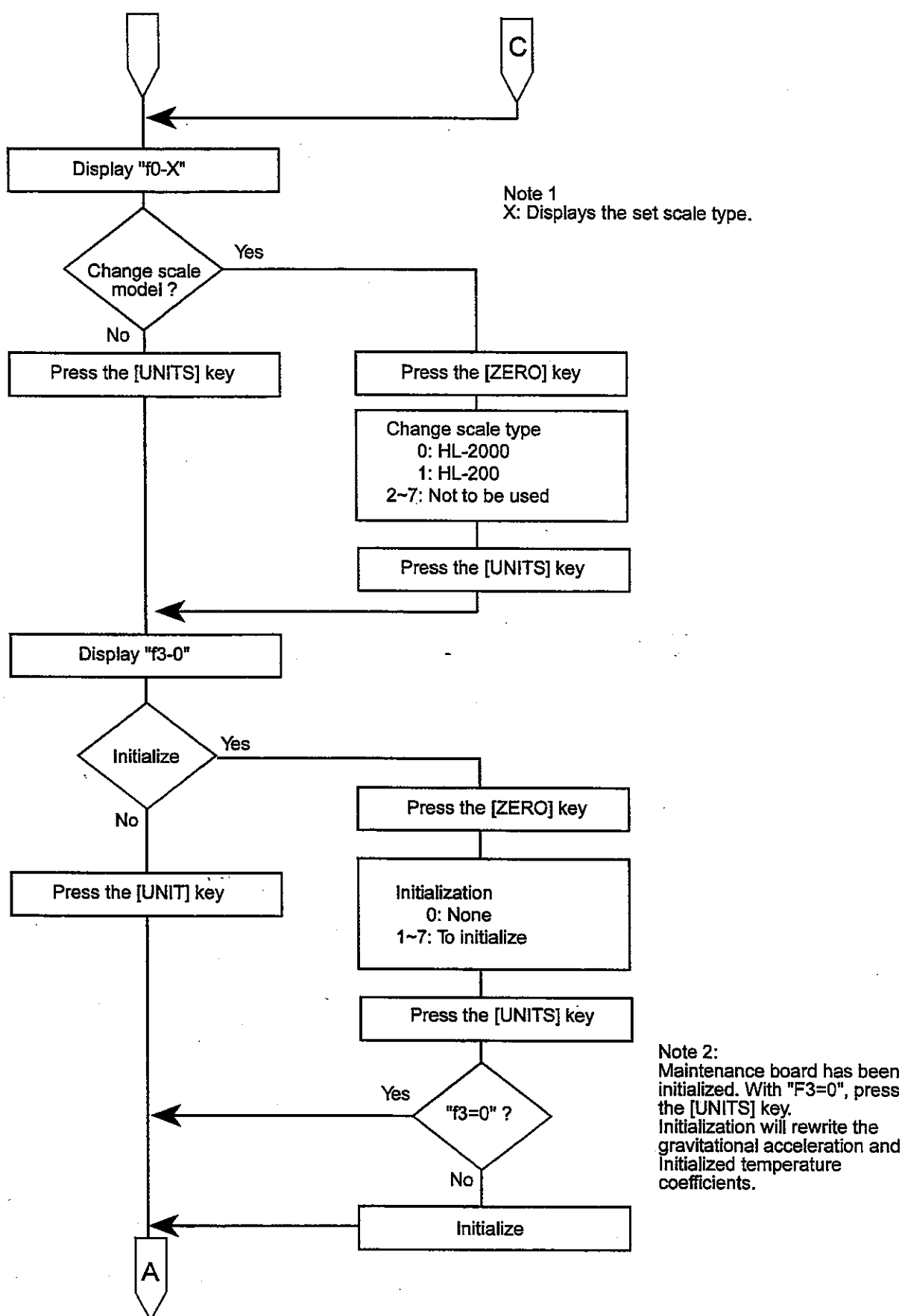


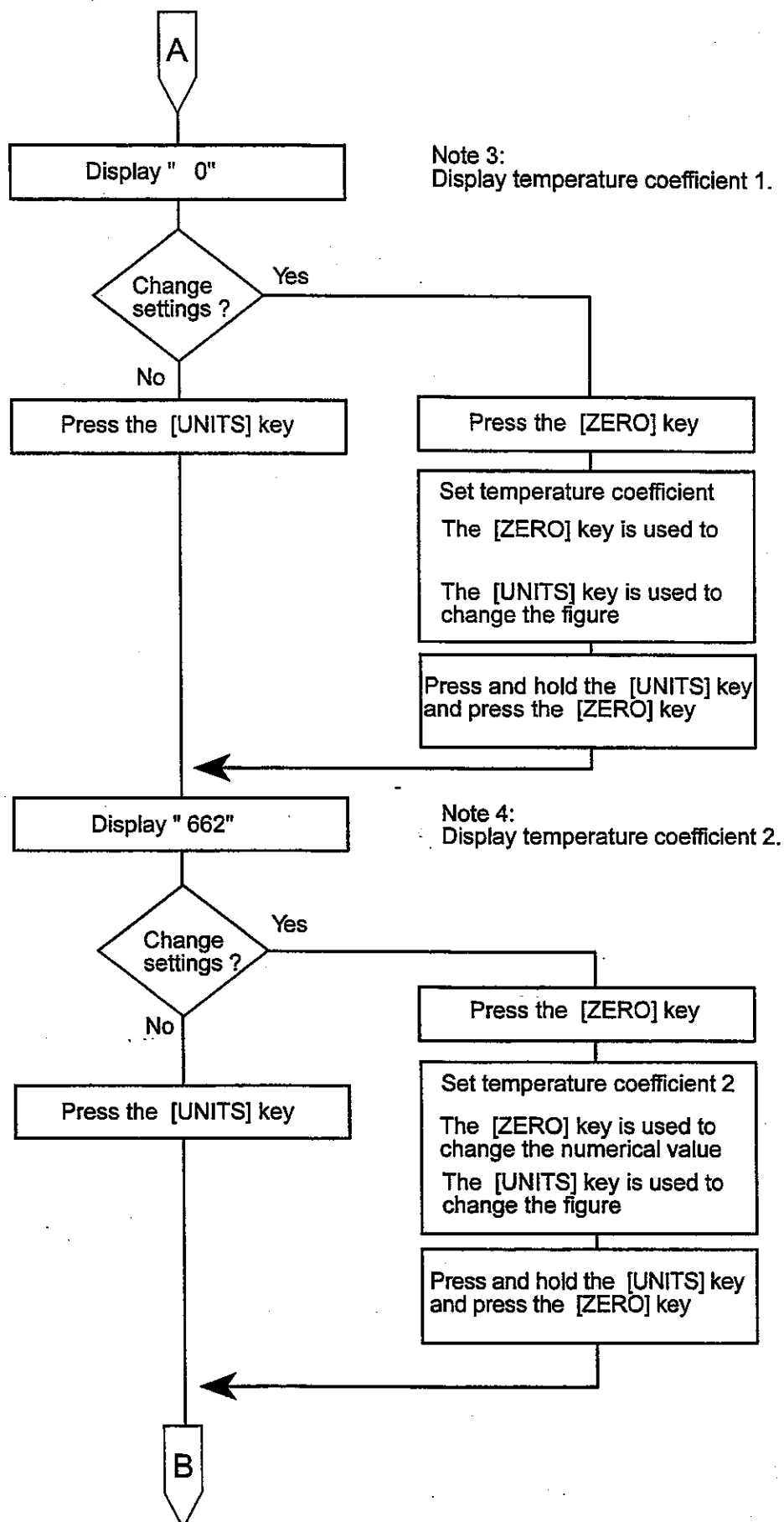
The results of initialization is as follows.

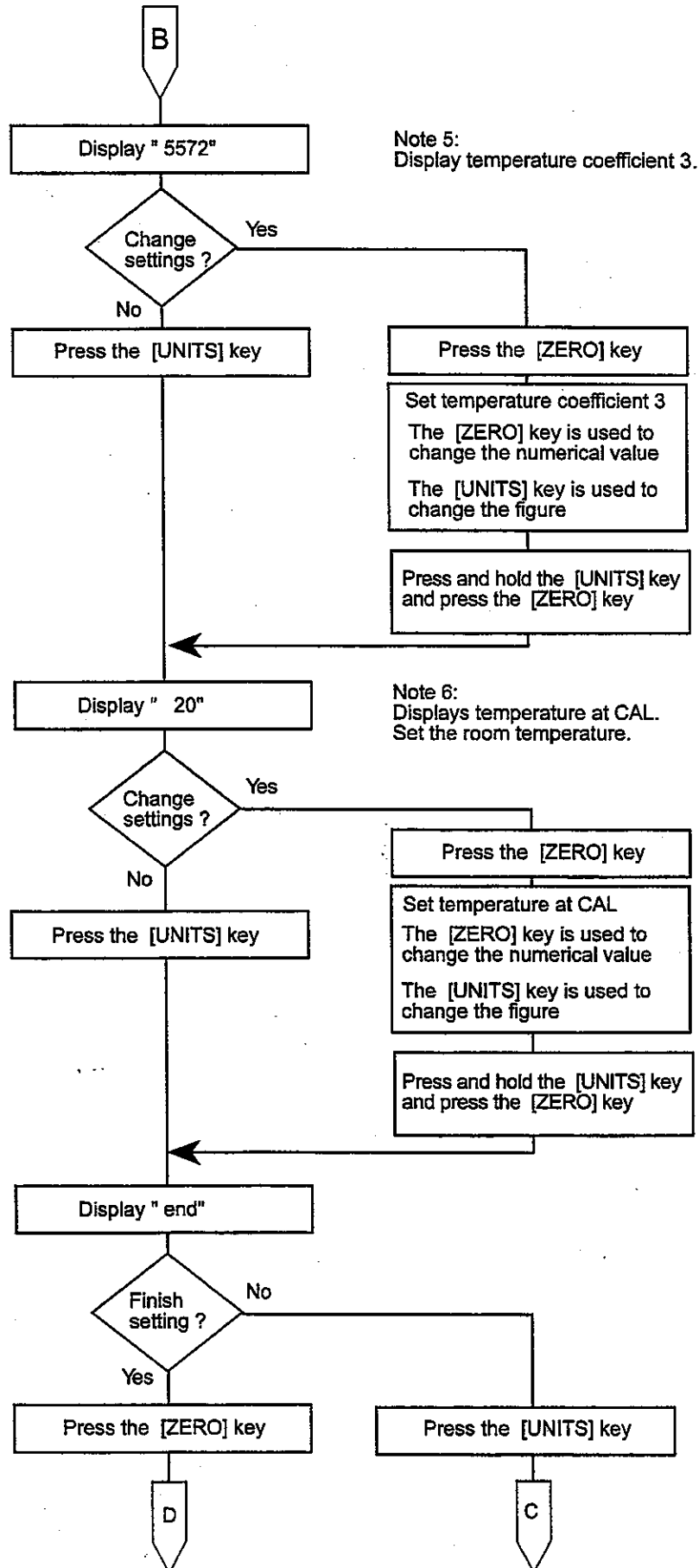
Specification settings : 0030
 Gravitation setting : 9.798
 Power-on zero range : 50% of capacity

Set the capacity and so on

Setting mode (CPU version P-1.2)







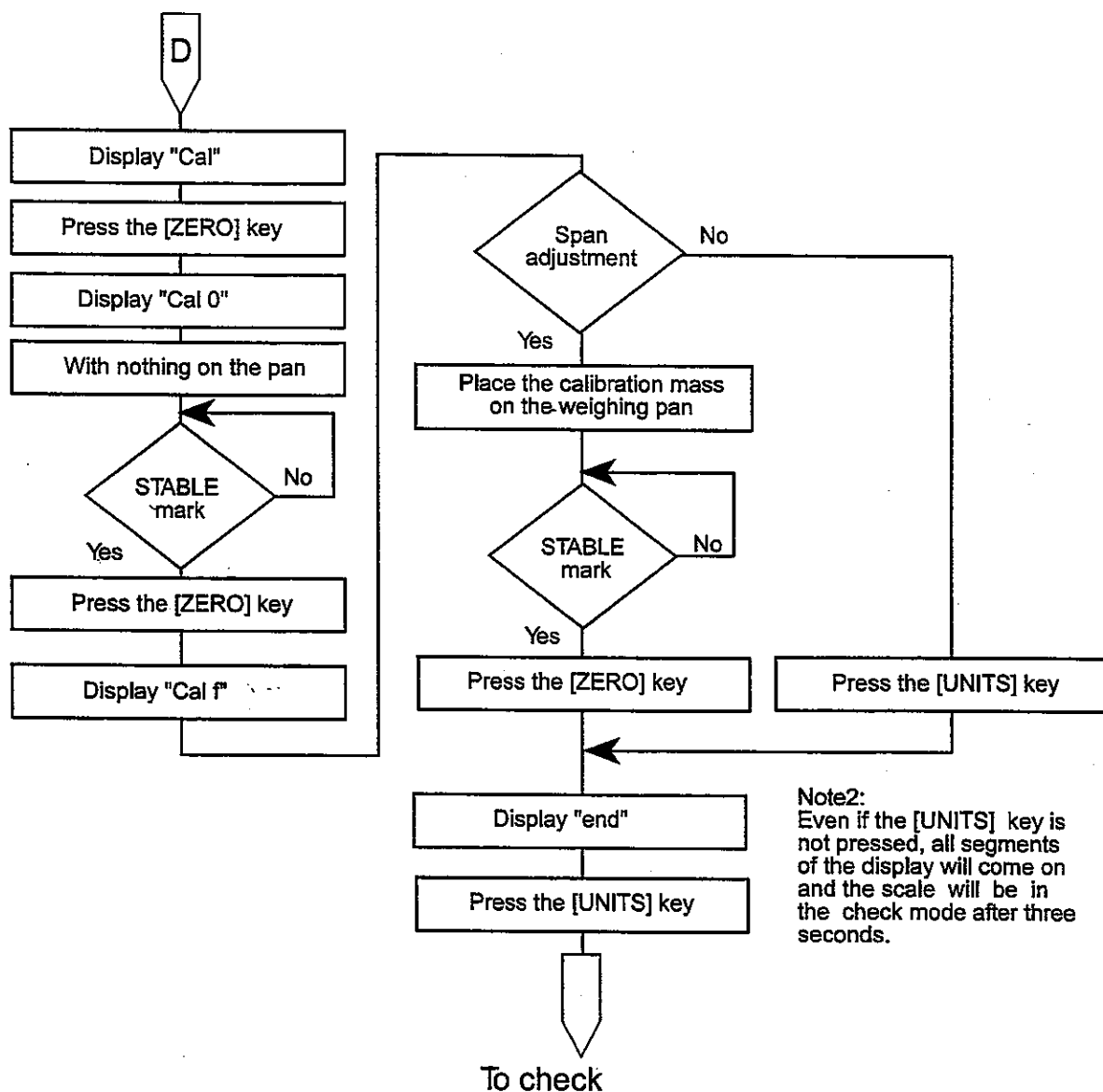
8-3 Temperature compensation

Perform temperature compensation and calibrate using a certified weight when the setting are changed in the setting mode, or when the load cell or the main board is replaced.

Before temperature compensation, be sure to warm up the scale more than 30 minutes and set the temperature at CAL.

For CPU version P-2.0, see the flowchart of setting mode.

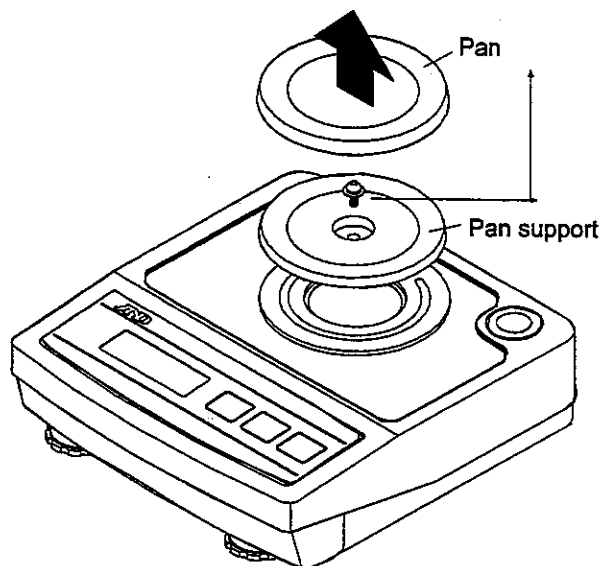
Temperature compensation calibration (CPU version P-1.2)



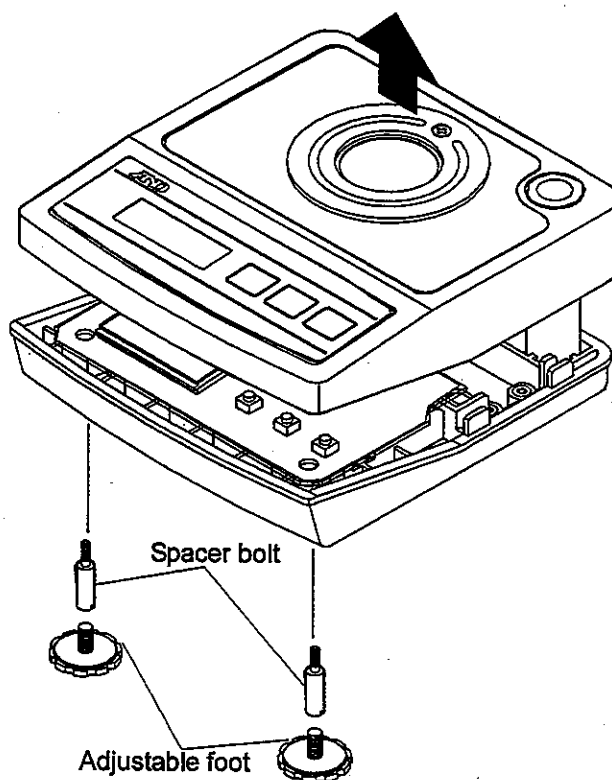
9. Replacing (HL-100)

9-1 Disassembling

1. Remove the weighing pan and pan support.

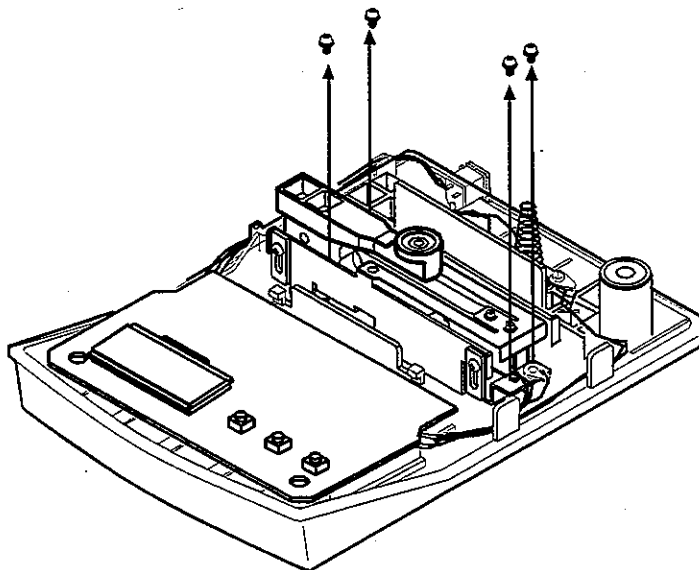


2. Remove the two adjustable feet located on the lower case.
3. Remove the two spacer bolts with a flat tip screwdriver.
4. Raise the upper case to open as shown in the figure at the right.

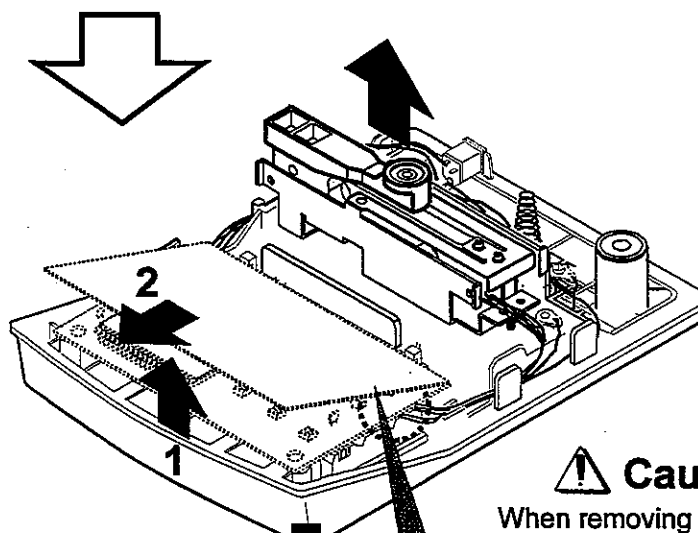


9-2 Removing the load cell

1. Remove the four screws (M3x6) holding the load cell unit.



2. Remove the load cell from the lower case.



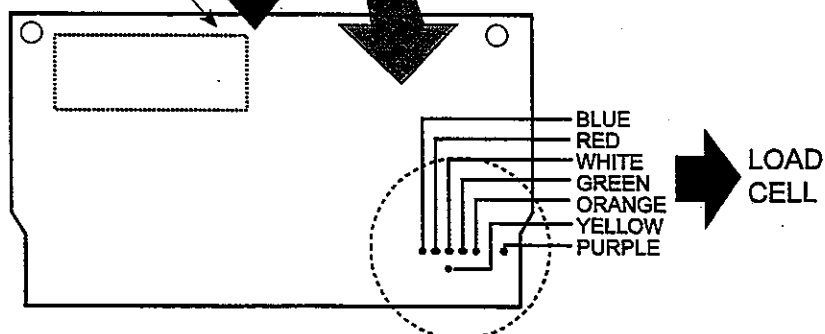
3. Remove the main board in the order as shown in the figure at the right.

Main board rear side

Caution

When removing the main board, take great care not to damage the load cell, the AC adaptor or the battery cables.

4. Replace the load cell. Reform the Wiring as shown in the figure at the right.

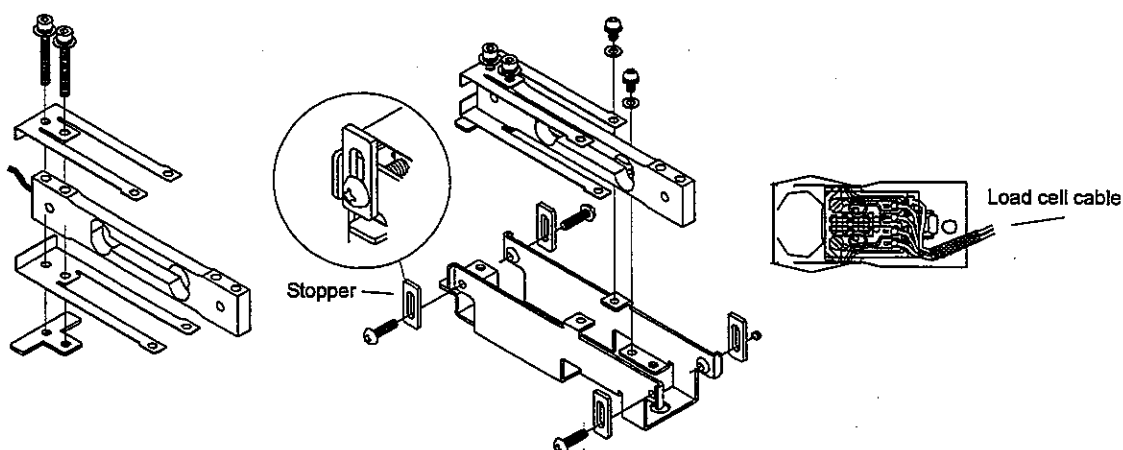


9-3 Assembling the load cell

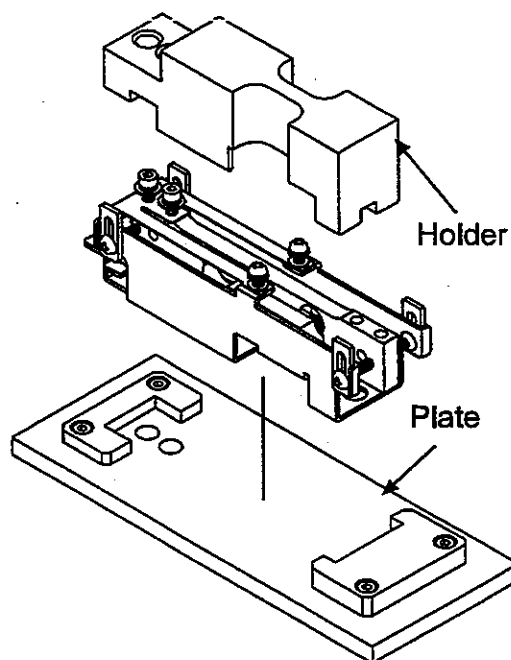
Note

Handle the load cell with care. Do not twist or give any excessive force to the cell that causes damage to the cell.

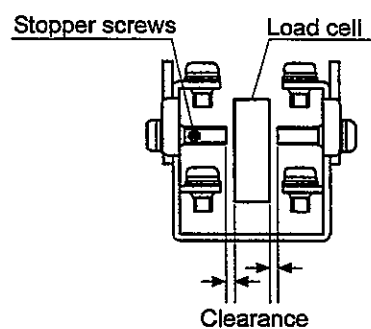
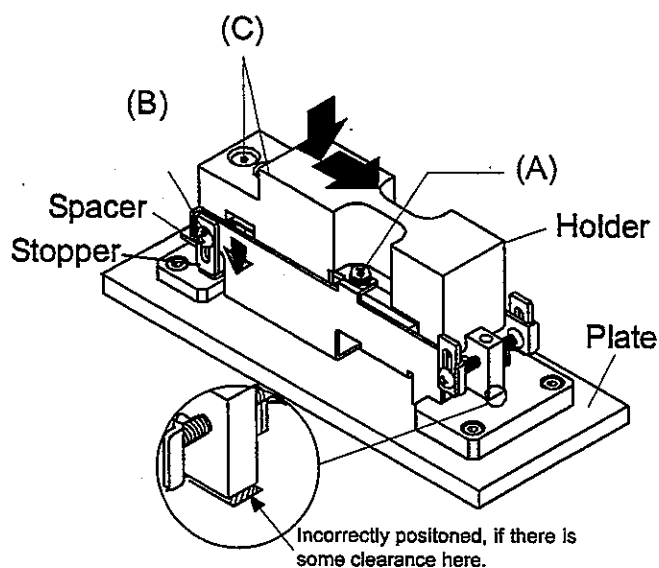
1. Assemble the load cell unit. (Do not tighten the screws at this moment).
Pull the stopper upward and attach it to the position.
Have the load cell cable running below the screw as shown below.



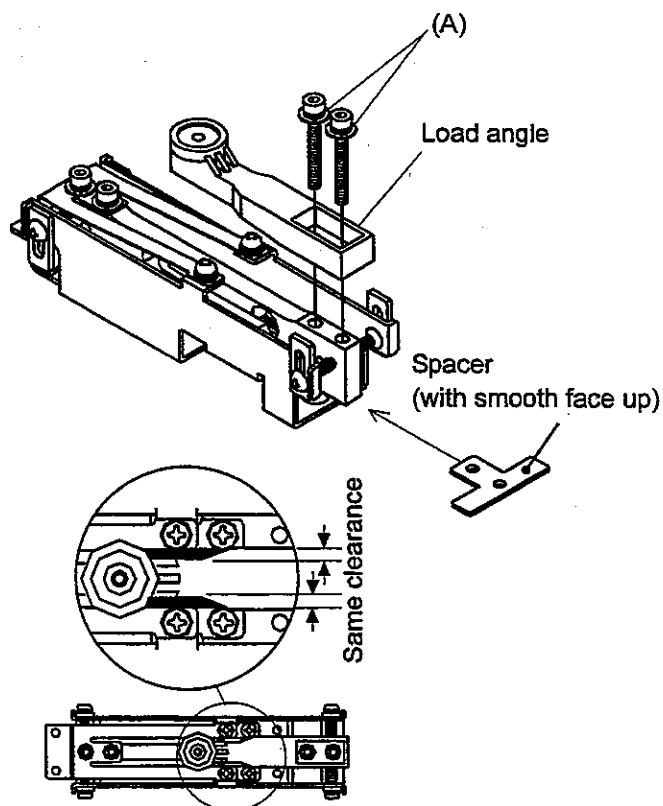
2. Place the load cell unit on the plate Jig and cover the cell with the holder jig.



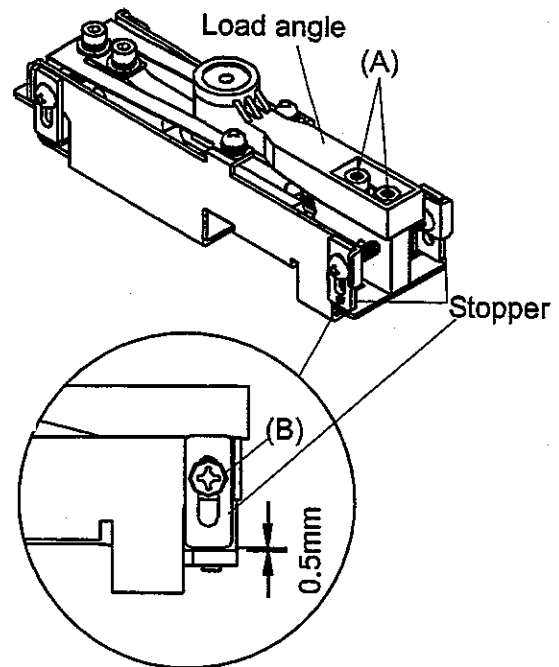
3. Holding at the holder jig, place the load cell unit on the jig plate. Make sure that the load cell is positioned properly. (The load cell should not touch the ends of two screws of the stopper. See the lower figure.)
4. Tighten four screws (A) at a specified torque (6kgf·cm).
5. Pushing down the stopper toward the spacer, tighten two screws (B) at a specified torque (8kgf·cm)
6. Tighten two screws (C) at a specified torque (15kgf·cm)



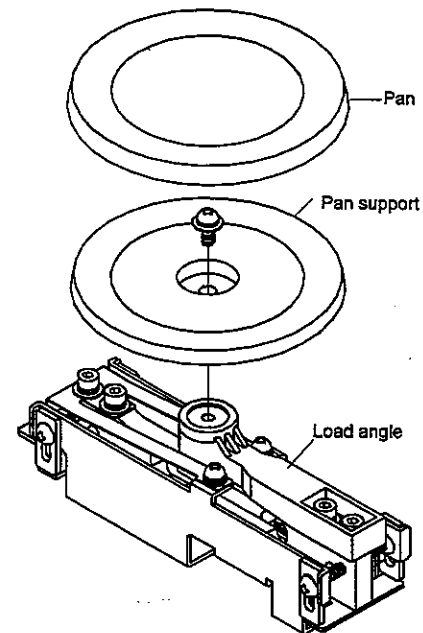
7. Align the load cell center. (See the lower figure), and attach the load angle and two screws (A). The screws will be tightened at next step 8.



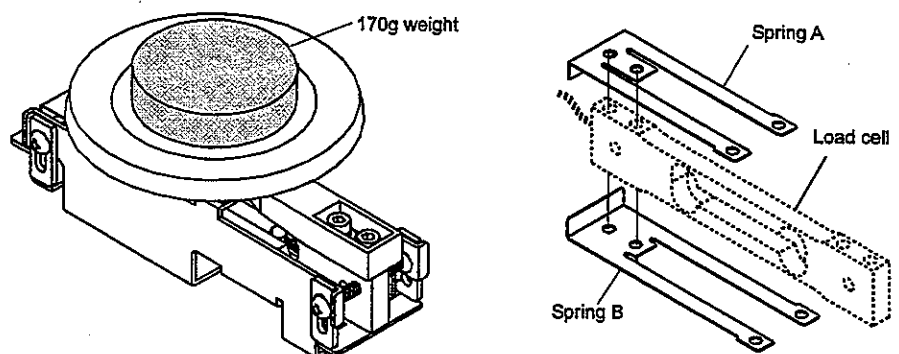
8. Tighten the screws (A) at a specified torque (15kgf·cm)
9. Adjust the clearance of stopper to 0.5mm.
10. Tighten the screws (B) on both stoppers at a specified torque (8kgf·cm)



11. Place the pan and pan support on the load angle.



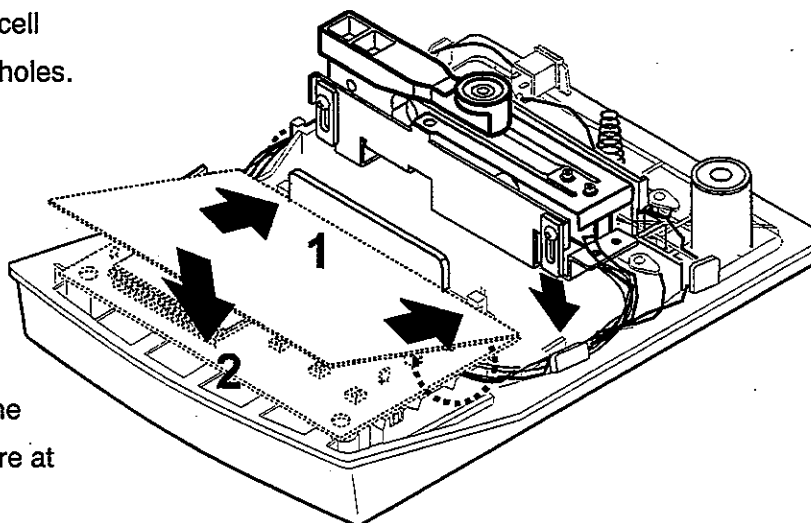
12. Place a 170g weight on the pan and make sure that Spring A and Spring B are not bent.



13. Remove the weight, pan, and pan support from the load cell.

9-4 Placing the load cell

- 1 After wiring, align the load cell holes with the lower case holes.



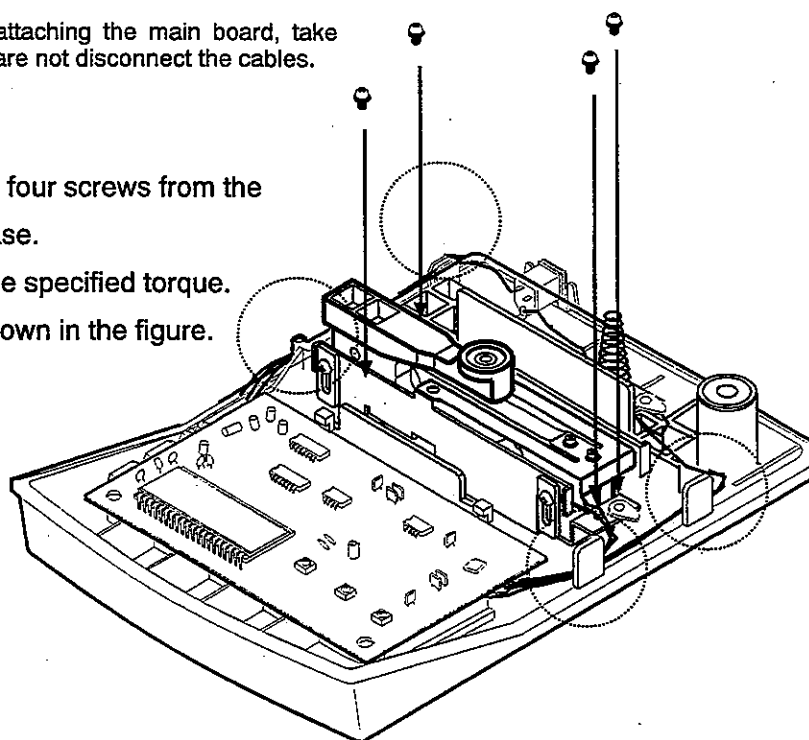
- 2 Attach the main board in the order as shown in the figure at the right.



Caution

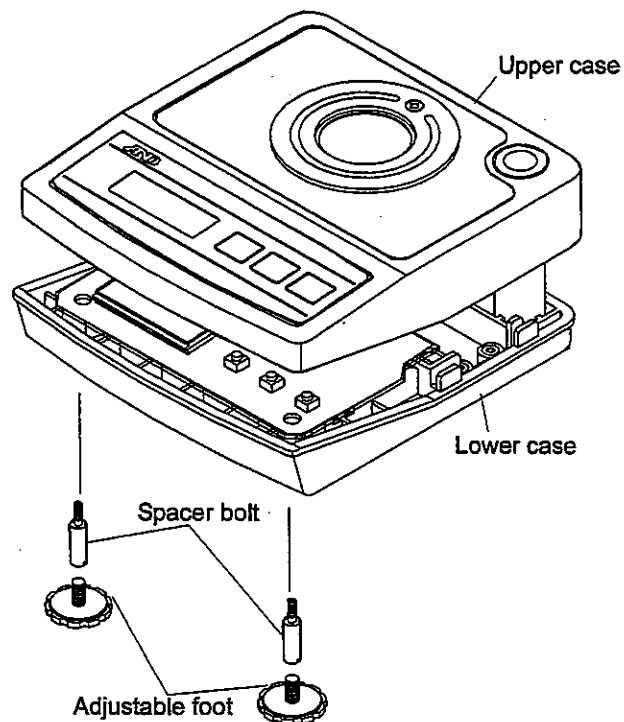
When attaching the main board, take great care not to disconnect the cables.

- 3 Attach the load cell with four screws from the top side of the lower case. Fasten the screws to the specified torque. Route the cables as shown in the figure.

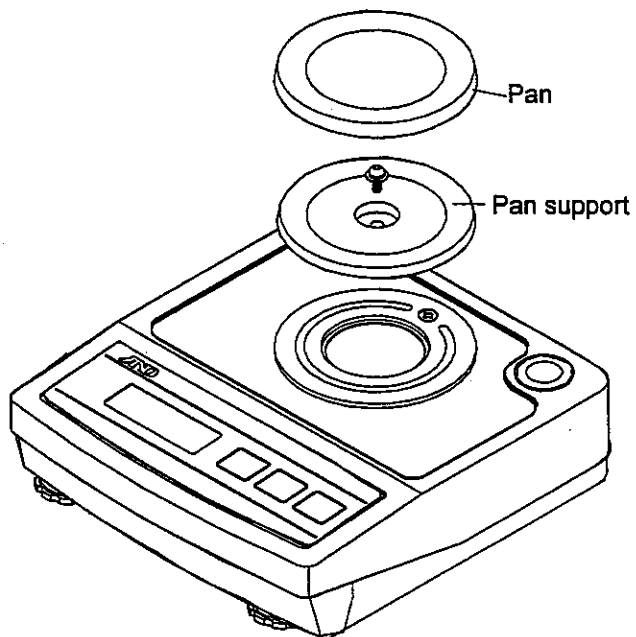
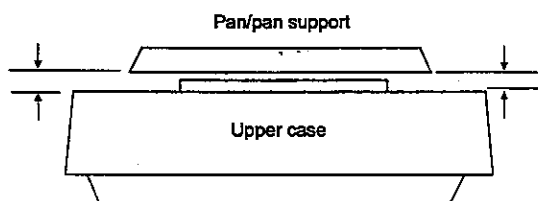


9-5 Assembling

1. Place the upper case on the lower case as shown in the figure at the right.
2. Fasten the cases with two spacer bolts with a flat tip screwdriver.
3. Screw the two adjustable feet in the lower case.



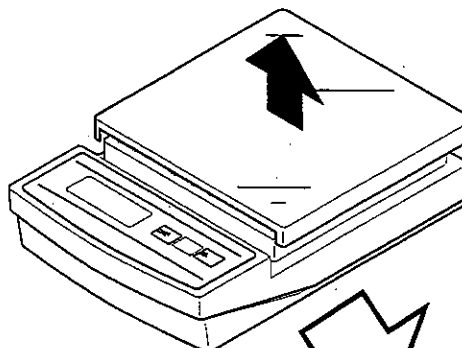
4. Attach the pan and pan support with the screw. They should be parallel to the upper case surface.



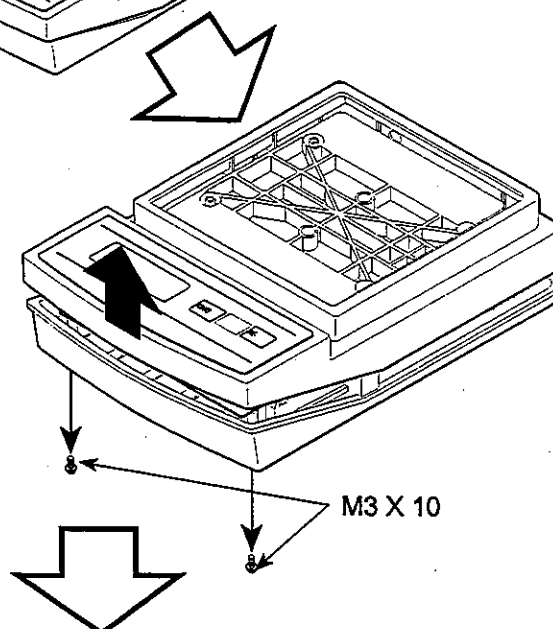
10. Replacing (HL-200/2000/400/4000)

10-1 Disassembling

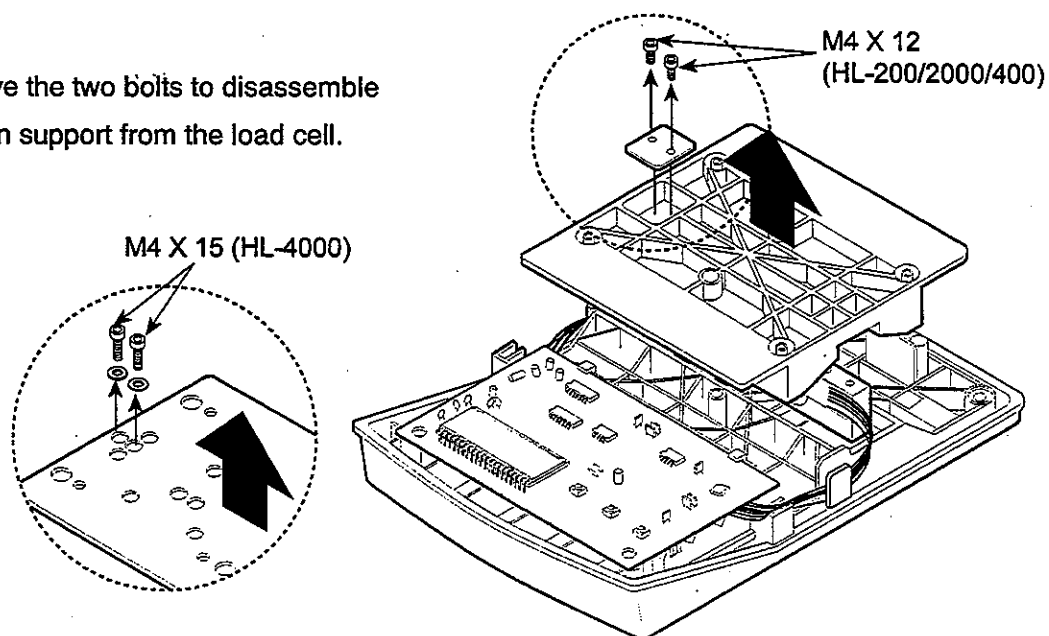
1 Remove the weighing pan.



2 Remove the two screws located on the lower case.
Raise the upper case to open as shown
in the figure at the right.

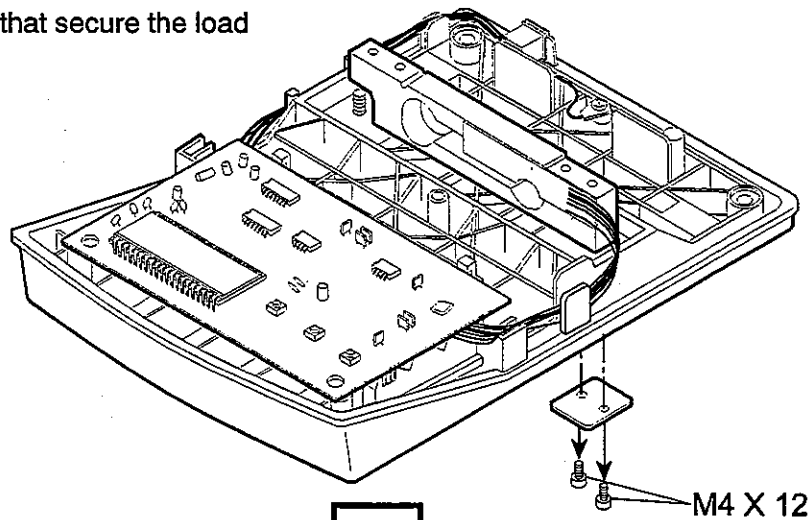


3 Remove the two bolts to disassemble
the pan support from the load cell.

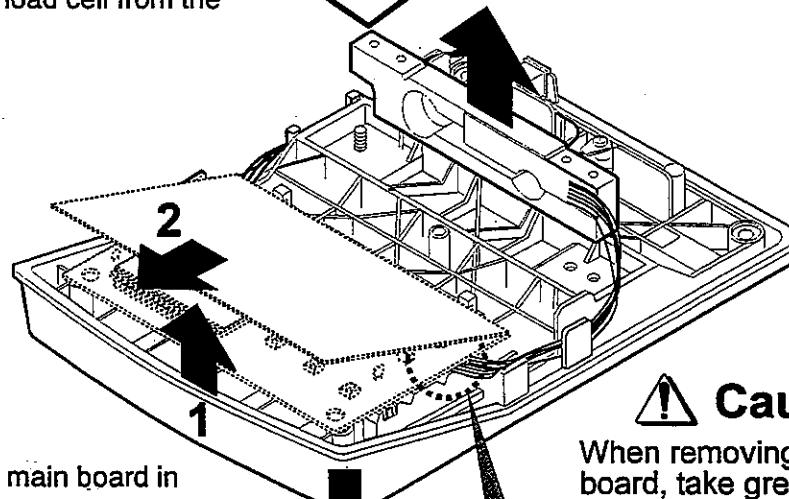


10-2 Replacing the load cell

- 1 Remove two bolts located on the lower case that secure the load cell.



- 2 Remove the load cell from the lower case.



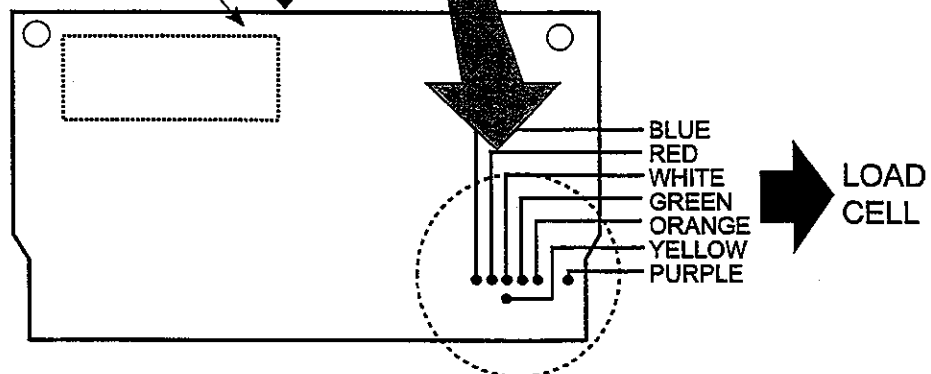
- 3 Remove the main board in the order as shown in the figure at the right.

Main board rear side

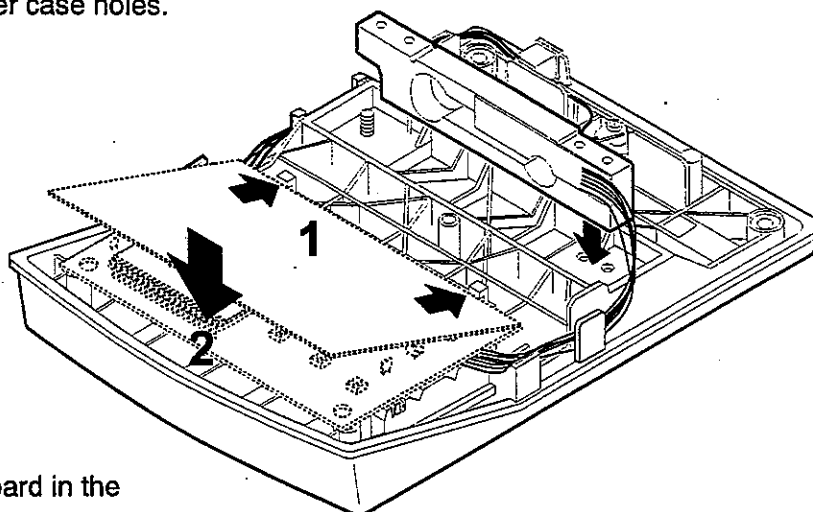
⚠ Caution

When removing the main board, take great care not to damage the load cell, the AC adaptor or the battery cables.

- 4 Replace the load cell.
Reform the Wiring as shown
In the figure at
The right.



- 5 After wiring, align the load cell holes with the lower case holes.

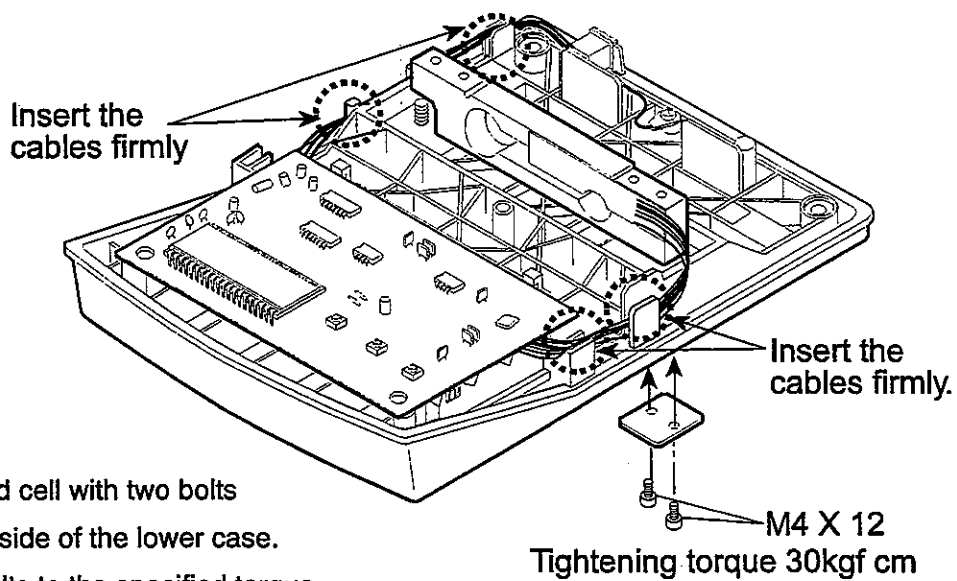


- 6 Attach the main board in the order as shown in the figure at the right.



! Caution

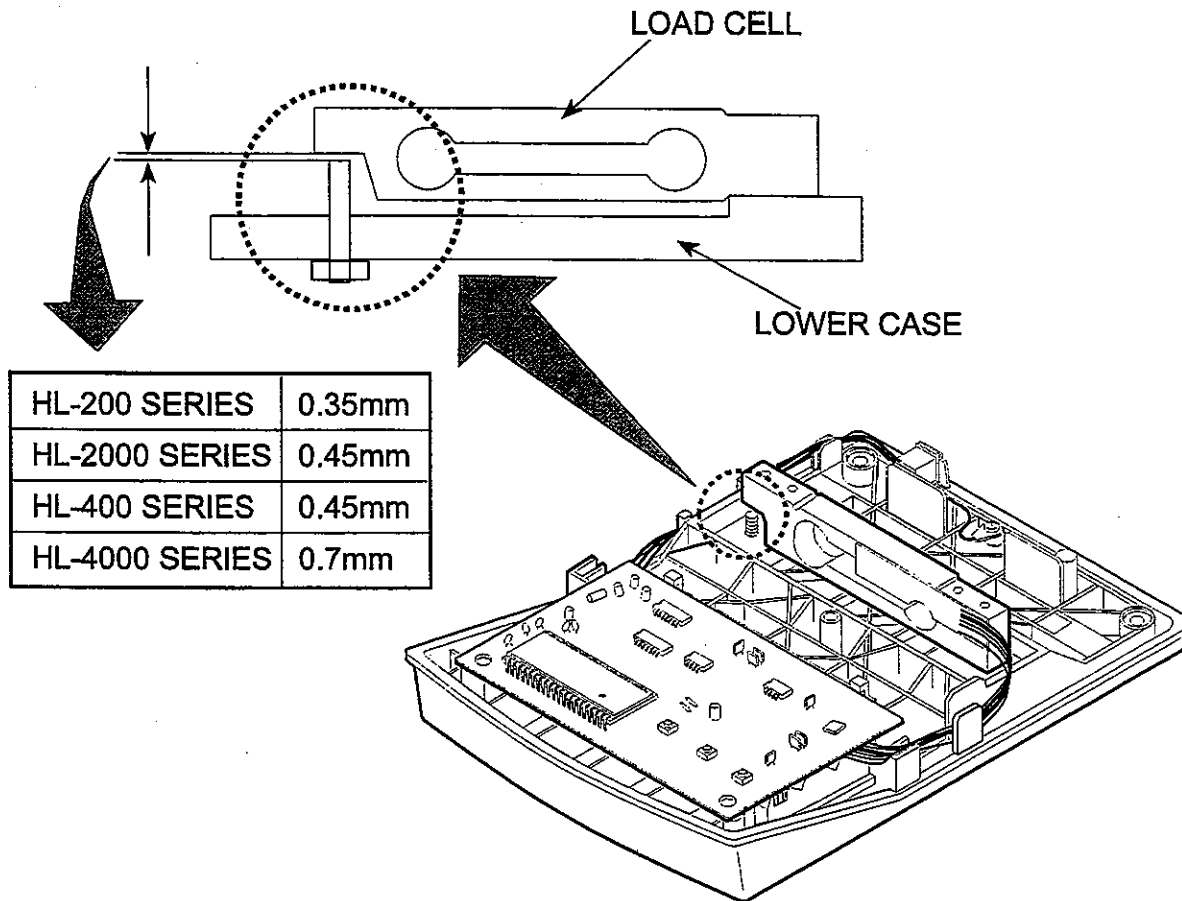
When attaching the main board, take great care not to disconnect the cables.



- 7 Attach the load cell with two bolts from the rear side of the lower case. Fasten the bolts to the specified torque. Route the cables as shown in the figure.

10-3 Adjusting the load cell

After attaching the load cell to the lower case, adjust the clearance between the load cell and the screws.

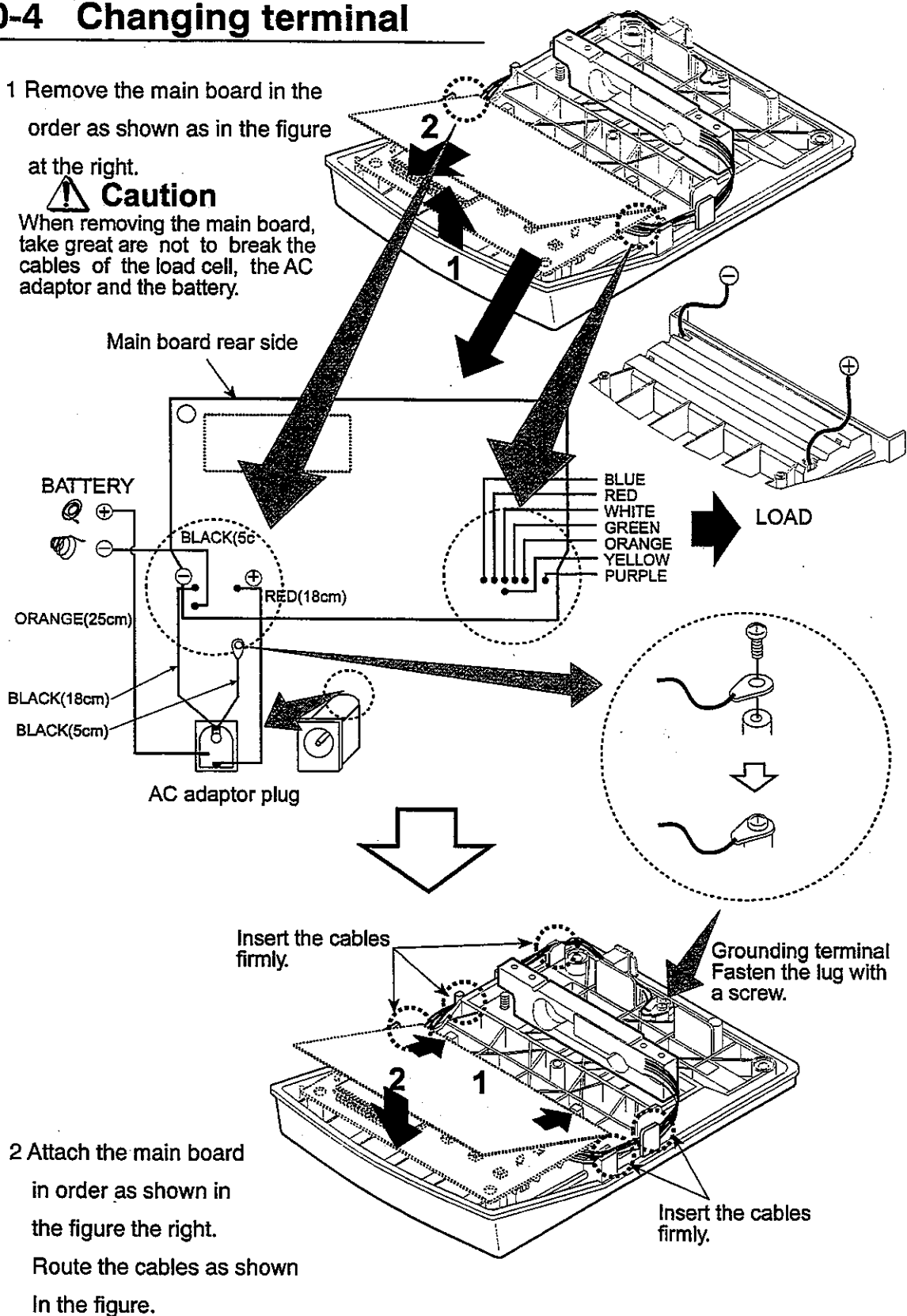


10-4 Changing terminal

- 1 Remove the main board in the order as shown as in the figure at the right.

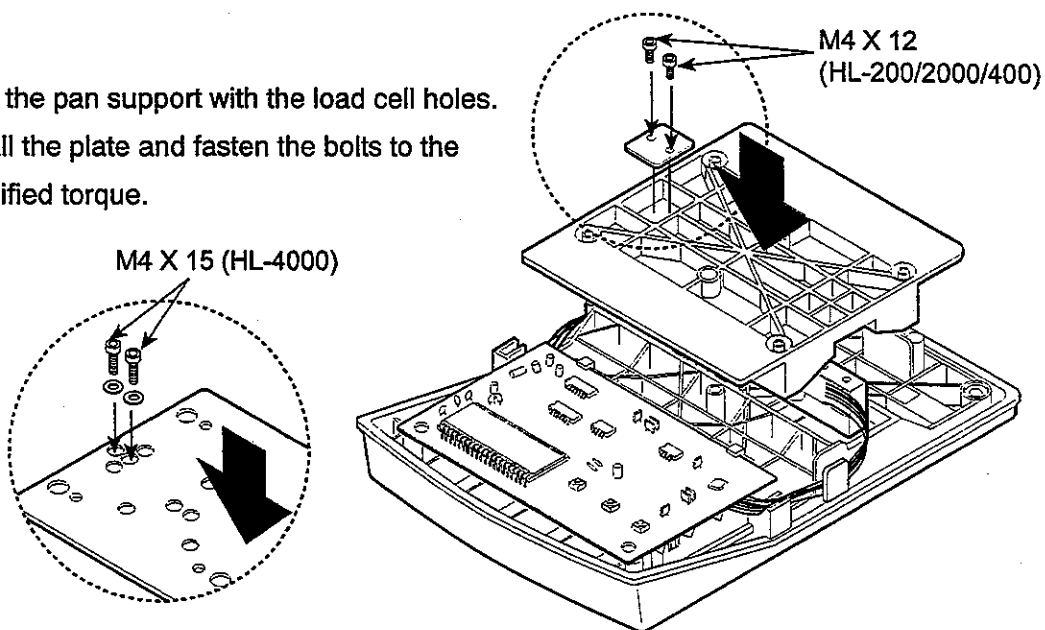
Caution

When removing the main board, take great care not to break the cables of the load cell, the AC adaptor and the battery.

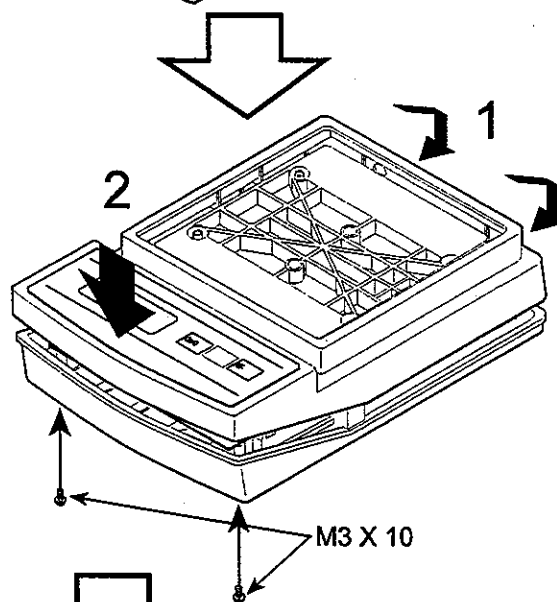


10-5 Assembling

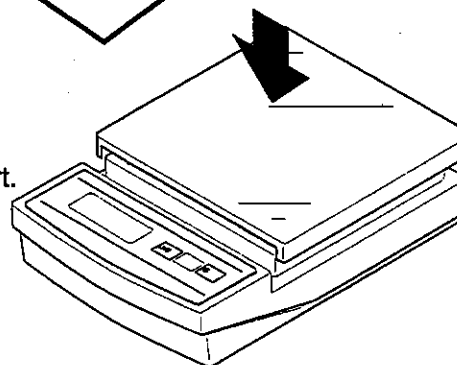
- 1 Align the pan support with the load cell holes.
Install the plate and fasten the bolts to the
specified torque.



- 2 Place the upper case on the lower case
as shown in the figure at the right.
Fasten the cases with two screws
from the rear side of the lower case.

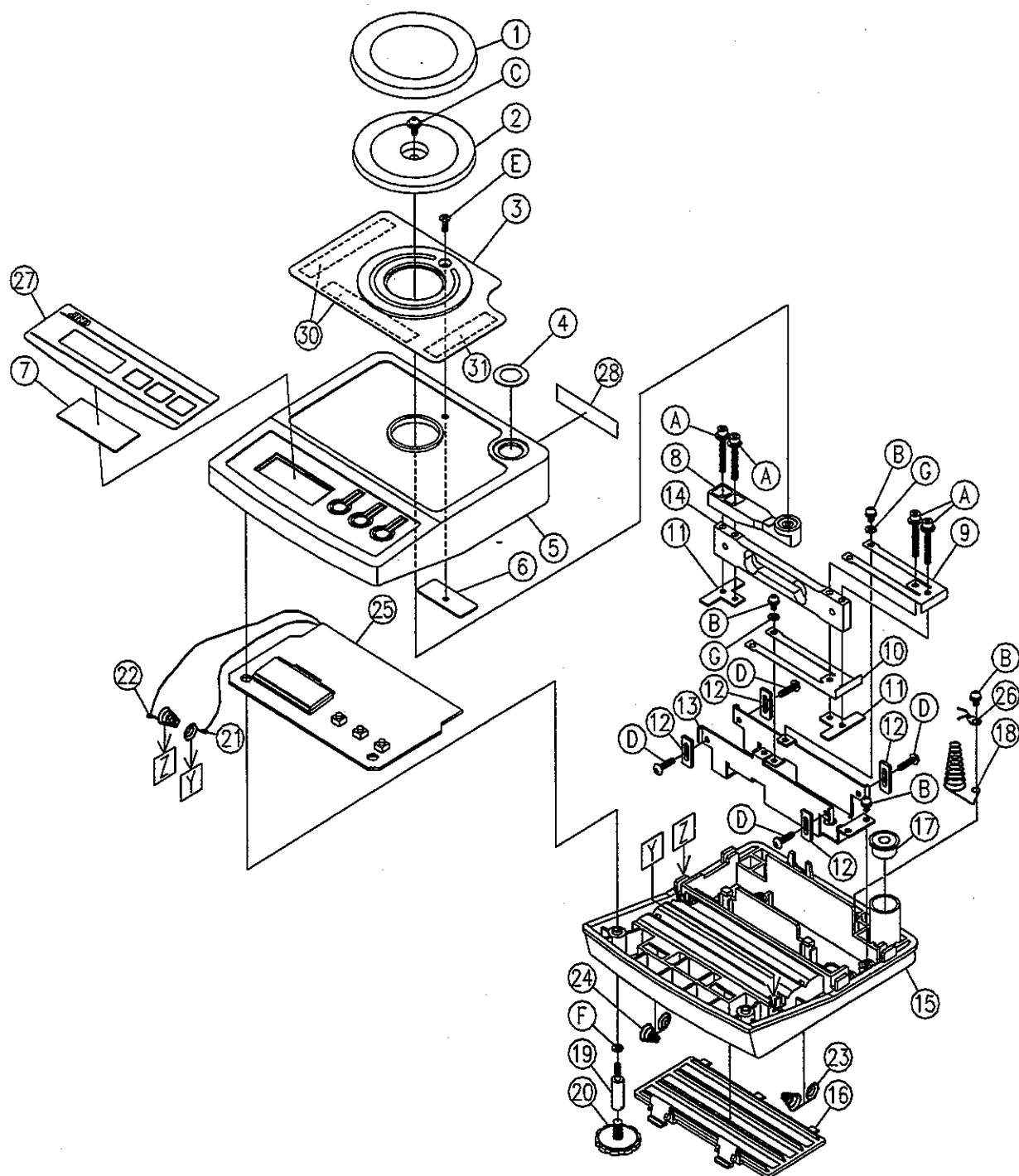


- 3 Place the weighing pan on the pan support.



Appendix

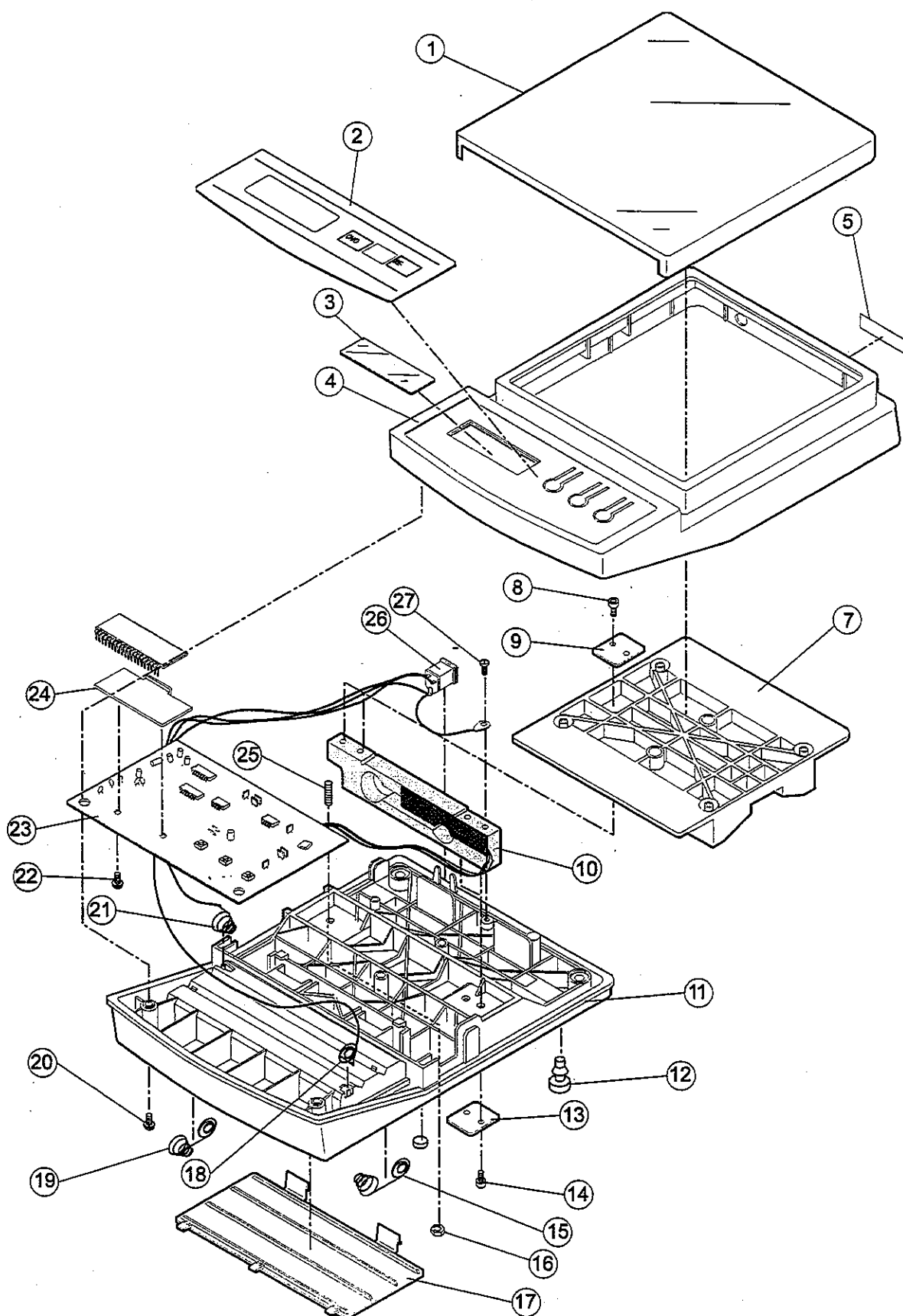
Exploded view and parts list (HL-100)



HL-100 Part list

No	PARTS NO.	DESCRIPTION	QTY
1	04-4008691	Pan	1
2	07-3003937B	Pan support	1
3	04-3004091	Earth plate	1
4	08-4008697	Level vial window	1
5	07-1000130B	Upper case	1
6	04-4009236	Nut plate	1
7	07-4003336	Window	1
8	07-3003936B	Load angle	1
9	15-4008692B	Spring-a	1
10	15-4008693B	Spring-b	1
11	04-4008694A	Spacer	2
12	04-4008695A	Stopper	4
13	04-3003938A	Base	1
14	LC-130-100	Load cell for HL-100	1
15	07-1000131D	Under case	1
16	07-3001272	Battery cover	1
17	10-MR14	Level vial	1
18	15-4009237	Earth spring	1
19	05-4008696	Spacer bolt	2
20	07-A46041A	Foot	2
21	15-4003472	Battery spring +	1
22	15-4003473	Battery spring -	1
23	15-4003504	Battery spring r	1
24	15-4003505	Battery spring l	1
25	PZ-2963	Main board	1
26		Earth terminal	1
27	08-3003961	Key sheet HL-100 (ex)	1
28	08-4006443	Sticker (A&D)	1
30		Tape (10x70)	2
31		Tape (10x50)	1
A		WA cap screw with washer, M3x25	4
B		Round head screw with washer, M3x6	9
C		Round head screw with washer, M3x8	1
D		Bind head screw, M3x12	4
E		Flat head screw, M3x8	1
F		Spring washer, M3	2
G		Plastic washer, M3	4

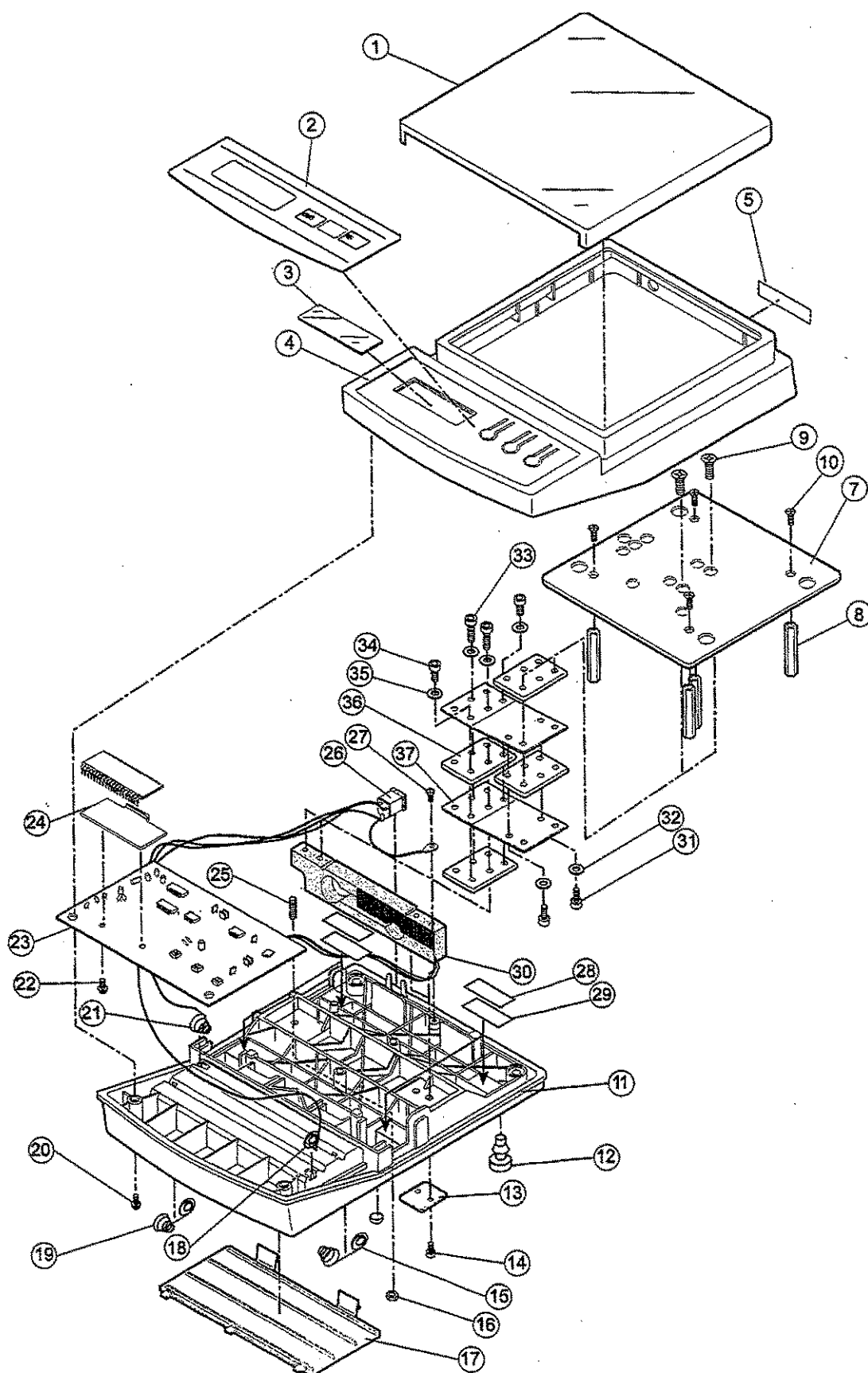
Maintenance manual



HL-200/2000/400 Part list

No	PARTS NO.	DESCRIPTION	QTY
1	07-30001271	Weighing pan	1
2	08-4001372A	Key sheet for hl-200 (EX)	1
	08-4001373A	Key sheet for hl-2000 (EX)	1
	08-3002148	Key sheet for hl-400 (EX)	1
	08-3001333	Key sheet for hl-200 (EG)	1
	08-3001334	Key sheet for hl2000 (EG)	1
	08-3002146	Key sheet for hl-400 (EG)	1
3	07-4003336	Filter	1
4	07-2000175	Upper case	1
5	08-4006443	Sticker (A&D)	1
7	07-2000177	Pan support	1
8	M4 × 12	Hexagon bolt	2
9	04-4003470	Pan support plate	1
10	LC-120-200	Load cell for hl-200/400	1
	LC-120-2000	Load cell for hl-2000/4000	1
11	07-2000176A	Lower case	1
12	07-4010400	Rubber foot	2
13	04-4003470	Load cell support plate	1
14	M4 × 12	Hexagon bolt	2
15	15-4003504	Battery terminal (R)	1
16	M4	Nut	1
17	07-3001272	Battery cover	1
18	15-4003473	Battery terminal (-)	1
19	15-4003505	Battery terminal (I)	1
20	M3 × 12	Pan head screw	2
21	15-4003472	Battery terminal (+)	1
22	M2.6 × 6	Pan head tapping screw	1
23	7PZ-2963	Main board	1
24	07-4003820	LCD holder	1
25	M4 × 18	Screw	1
26	JE-0749-01-010	AC adaptor plug	1
27	M3 × 6	Pan head screw	1

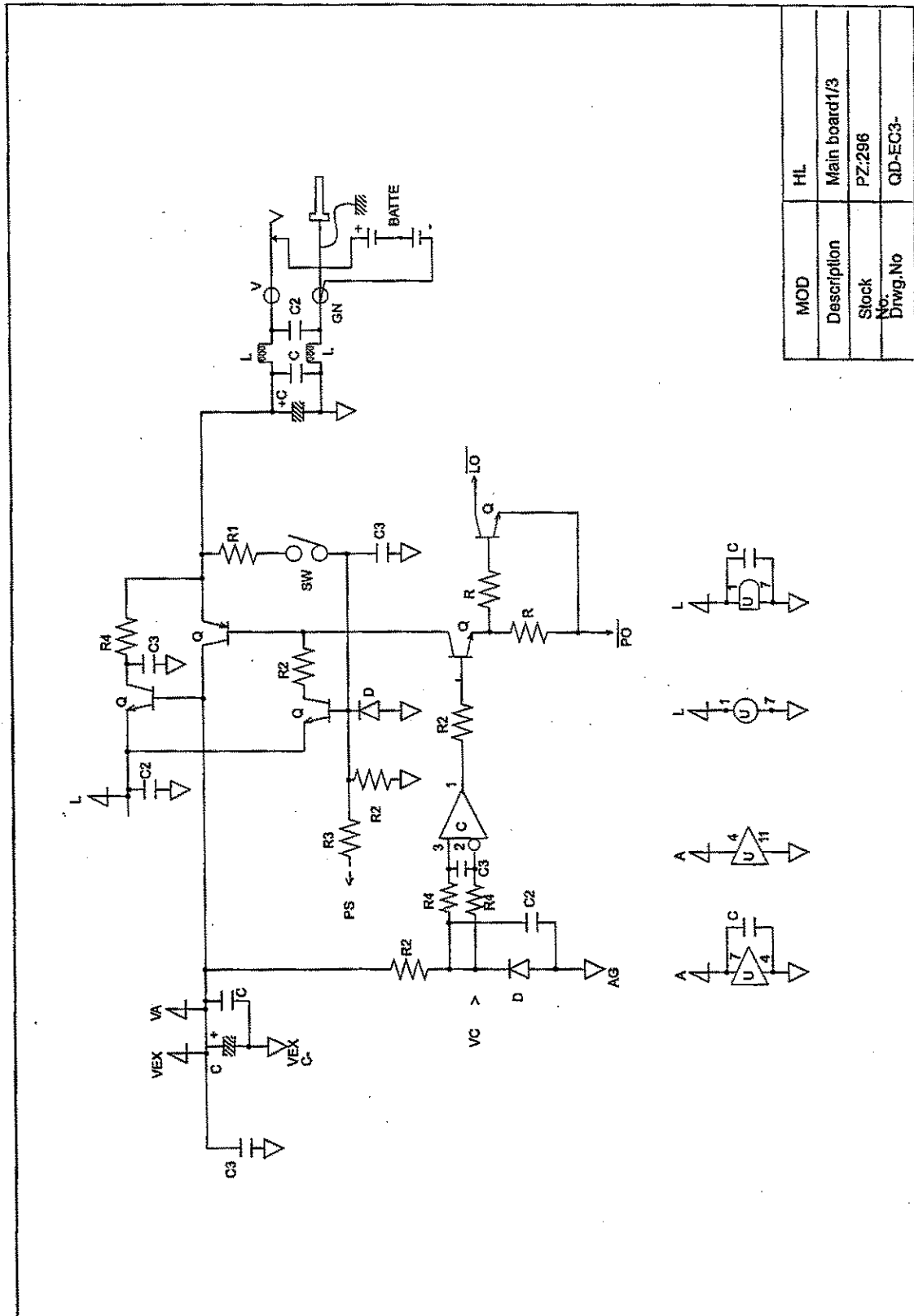
Exploded view and parts list (HL4000)



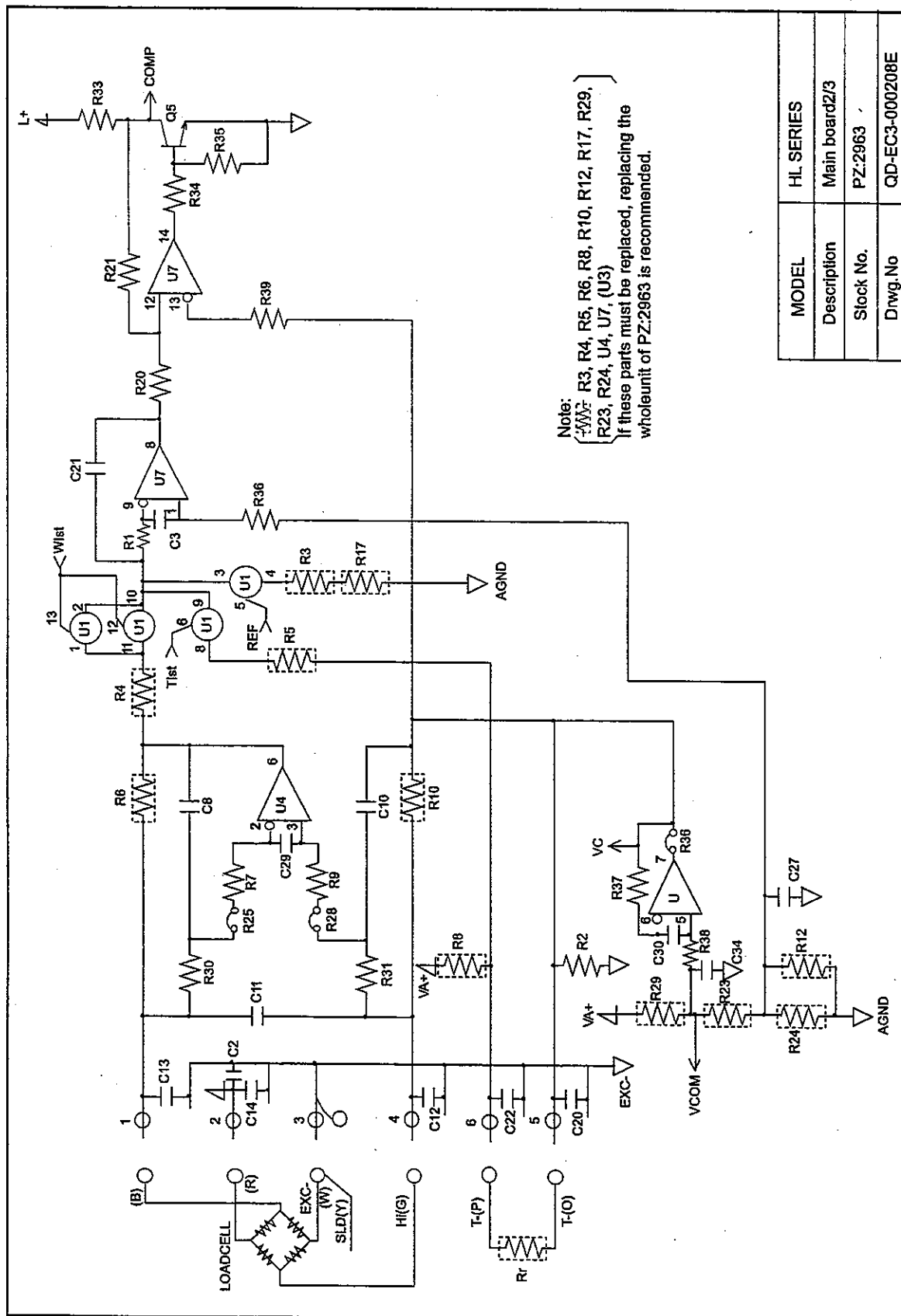
HL4000 Part list

No	PARTS NO.	DESCRIPTION	QTY
1	03-3001271	Weighing pan	1
2	08-3002149	Key sheet for HL-4000 (EX)	1
	08-3002147	Key sheet for HL-4000 (EG)	1
3	07-4003336	Filter	1
4	07-2000175	Upper case	1
5	08-4006443	Sticker (A&D)	1
7	07-4005213	Pan support	1
8	05-4005218	Stopper	4
9	M4X10	Flat head screw	2
10	M3X10	Flat head screw	4
11	07-2000176A	Lower case	1
12	07-4010400	Rubber foot	2
13	04-4003470	Load cell support plate	1
14	M4 × 12	Hexagon bolt	2
15	15-4003504	Battery terminal (R)	1
16	M4	Nut	1
17	07-3001272	Battery cover	1
18	15-4003473	Battery terminal (-)	1
19	15-4003505	Battery terminal (L)	1
20	M3 × 10	Pan head screw	2
21	15-4003472	Battery terminal (+)	1
22	M2.6 × 6	Pan head tapping screw	1
23	7PZ-2963	Main board	1
24	07-4003820	LCD holder	1
25	M4 × 18	Screw	1
26	JE-0749-01-010	AC adaptor plug	1
27	M3 × 6	Pan head screw	1
28	04-4005216	Stopper plate	4
29	04-4005219	Tape	4
30	LC-120-2000	Load cell for HL-4000	1
31	M4 × 8	Hexagon bolt	2
32	M4	Washer (s)	2
33	M4 × 15	Hexagon bolt	2
34	M4 × 8	Hexagon bolt	2
35	M4	Washer (S)	2
36	04-4005214	Spacer (A)	4
37	04-4005217	Spring plate (0.4)	2

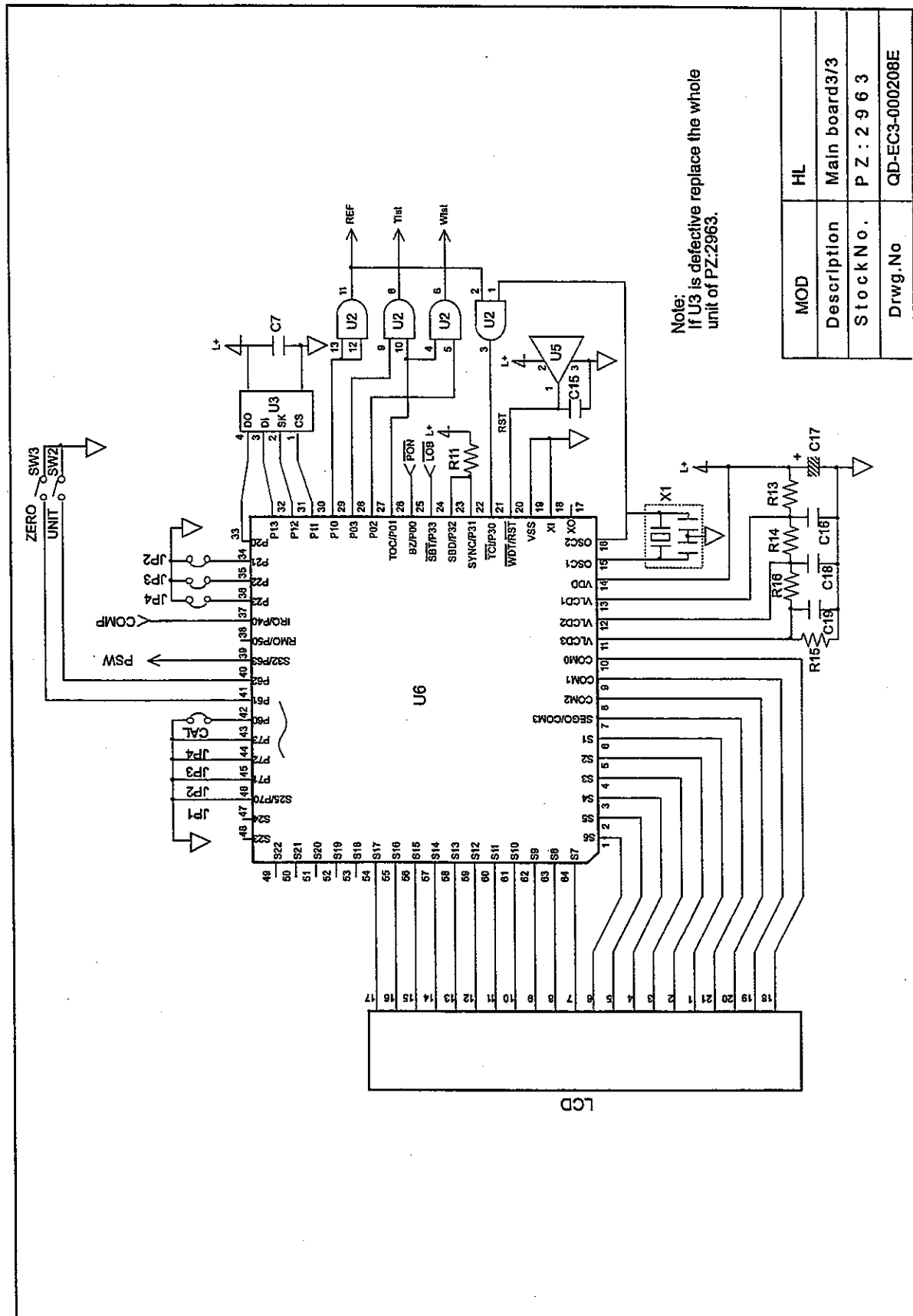
Schematic diagrams PZ-2963 (1 of 3)



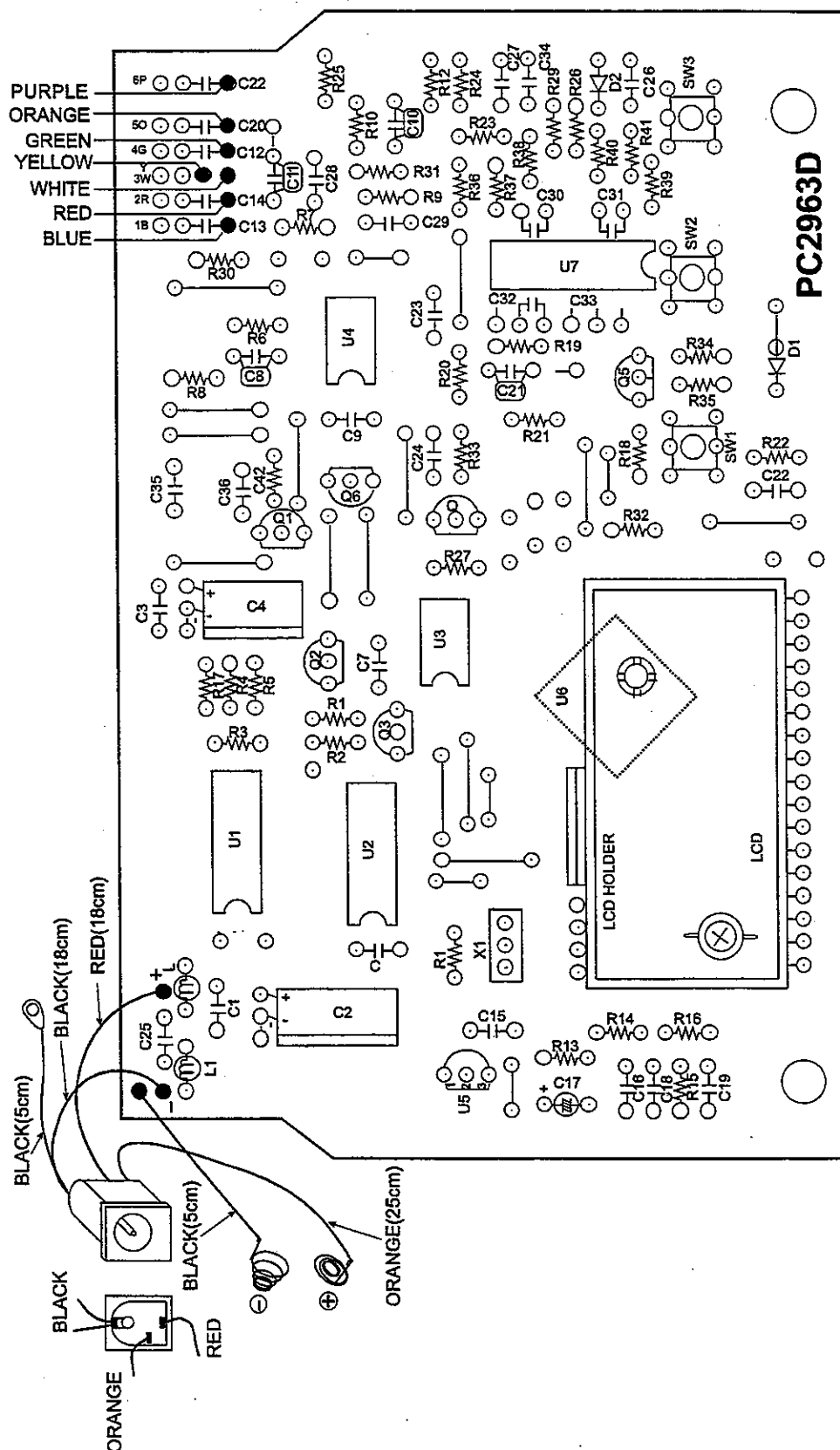
Schematic diagrams PZ-2963 (2 of 3)



Schematic diagrams PZ-2963 (3 of 3)



Parts layout PZ-2963



MODEL	HL SERIES
Description	Main board
Stock No.	PZ-2963
Drwg.No	QD-KZ3-000184J

Electronic parts list

Symbol	Parts no.	Description	Qty
U6	UC-MN150413-XTK	CPU	1
U3	UC-RP93C46	E2PROM	1
U1	UC-HC4066	Analog switch	1
U2	UC-HC08	AND	1
U4	UA-OP07DP-TI	OP-amp	1
U7	UA-C324C	OP-amp	1
U5	UA-S-8053ALB-Z	Reset	1
Q1	QT-A1015YT	Transistor	1
Q2~6	QT-C1815YT	Transistor	5
D2	DZ-HZS2CLL-TD	Zener diode	1
D1	DZ-RD5.1ES-T1	Zener diode	1
R23	RM-RN16TB1.2KFC	Metal film resistor 50p	1
R8	RM-RN16TB4.7KFC	Metal film resistor 50p	1
R12	RM-RN16TB120KFC	Metal film resistor 50p	1
R6,10,24,29	RM-RN16TB30KFE	Metal film resistor 25p	4
R3,4,5,17	RM-RN16TB47KFE	Metal film resistor 25p	4
R7,9,19,28,36 ~ 42	RC-NAT100RJT	Carbon resistor	11
R1,2,20	RC-NAT1KTJ	Carbon resistor	3
R18,30,31	RC-NAT3.3KJT	Carbon resistor	3
R25,26	RC-NAT5.6KJT	Carbon resistor	2
R13,14,16,35	RC-NAT10KJT	Carbon resistor	4
R15	RC-NAT15KJT	Carbon resistor	1
R27,34	RC-NAT27KJT	Carbon resistor	2
R11,33	RC-NAT56KJT	Carbon resistor	2
R22,32	RC-NAT100KJT	Carbon resistor	2
R21	RC-NAT1MJT	Carbon resistor	1
R25,28,36	JUMPER		3

Symbol	Parts no.	Description	Qty
C8,10	CM-V1H224JL2-T	Polyester film capacitor	2
C11	CM-V1H474JL2-T	Polyester film capacitor	1
C21	CP-P1H473JZ3-T	Polyester film capacitor	1
C2,4	CK-SME50VB22-T	Aluminum capacitor	2
C17	CT-1V010T	Tantalum capacitor	1
C15,19	CC-0.1U25VT	Ceramic capacitor	2
C1,3,6,7,9,12, 13,14,16,18,20, 22,24,25,28,35, 36,37	CC-0.01UT	Ceramic capacitor	18
C26,27,29,30 31,32,34	CC-100P	Ceramic capacitor	7
L1,2	LL-LHL06TB470K	Coil	2
X1	XT-EFOEC4004T3	Ceramic capacitor	1
SW1~3	SK-SKHHAK	Tact switch	3
	JE-0749-01-010	Dc jack	1
ED1	ED-T496003	LCD	1
ED1	07-4003820	LCD holder hl	1

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