HV/HW SERIES

MAINTENANCE MANUAL

PLATFORM SCALES

HV-30KA2 HV-60KA2
HV-60KA1 HV-150KA1

HW-10KA2 HW-15KA2 HW-30KA2
HW-60KA2 HW-100KA1 HW-150KA1

1394-2A-ME/98.05.20

A&D Company, Limited

Contents

Introduction

This Maintenance Manual covers A&D HV/HW series of scales:

- HV-150KA1 • HV-60KA1 • HV-60KA2 • HV-30KA2
- HW-150KA1 • HW-100KA1
- HW-60KA2 • HW-30KA2 • HW-15KA2 • HW-10KA2

The HV/HW series of multi-function scales are the product of years of research, design, development and in-field testing. They incorporate the latest advances in electronic and mechanical engineering and offer increased features and functions all at a reduced cost.

The HV/HW scale may be operated on six UM2 ('C' type) 1.5V dry batteries, or on an AD-1681 rechargeable battery pack. Continuous operation will be possible for between 100 hours (for manganese type cells) to 200 hours (for Alkaline type cells) on one set of batteries at 20°C/68°F. The AD-1681 provides about 20 continuous hours of operation on a full charge.

The display pod viewing angle is adjustable and it, along with the display arm, can be removed for use as a desk top, or wall mounted weighing indicator.

Battery operation permits the scale to be operated almost anywhere. The weighing platform is of a rugged stainless steel type. The scale's unit conversions are from decimal pounds to kilograms and vice versa. The tare range is from zero to maximum capacity. There is also a counting function for counting up to between 6000 and 10000 pieces for the HW and 3000 pieces for the HV. The check weighing display has "+", "OK", and "-" (LCD type enunciators), with setpoints available for setting the upper and lower limits.

When the optional RS-232C Interface is installed, the comparator relay output becomes available via the 8 pin DIN output connector, with pins 1, 4 and 6 of the connector as outputs and pin 8 being the common. This option is also equipped with a buzzer for an audible indication of the comparison.

The A/D converter is highly accurate and there is complete RFI shielding for the analog section.

Options

- •OP-02 ... 5m/16.4ft Display Pod extension cable.
- •OP-03 ... Serial Interface RS-232C / Comparator output board.
- •OP-04 ... Printer mounting kit
- •OP-05 ... AC adaptor AC100~120V. "A" type plug (2-pin/flat).
- •OP-06 ... AC adaptor AC200~240V. "C" type plug (2-pin/flat).
- •OP-07 ... AC adaptor AC200~240V. "BF" type plug (3-pin/square).
- •OP-08 ... AC adaptor AC200~240V. without plug.
- •OP-10 ... AC adaptor AC200~240V. "S" type plug (3-pin/flat).
- •OP-13 ... Roller conveyer (150KA1 / 100KA1 / 60KA1).
- •OP-14 ... Roller conveyer (60KA2 / 30KA2).

Using this Manual

Every care has been taken during the manufacturing process of this scale to ensure that it will perform accurately and reliably for many years.

The intent of this manual is to make maintenance as easy as possible for you with a step-by-step guide through the in's and out's of the scale, or related products. Please let us know if it has accomplished the just stated goal - what works, what doesn't, and what we might have left out. We ask that you read through the entire owner's Instruction Manual, and this maintenance manual before starting any work.

When a customer has a problem, make sure that: the Best Conditions for Weighing, have been met, the scale has been calibrated and adjusted correctly, and the power is connected correctly. Next, look at the Fault Finding section, and the various flow charts.

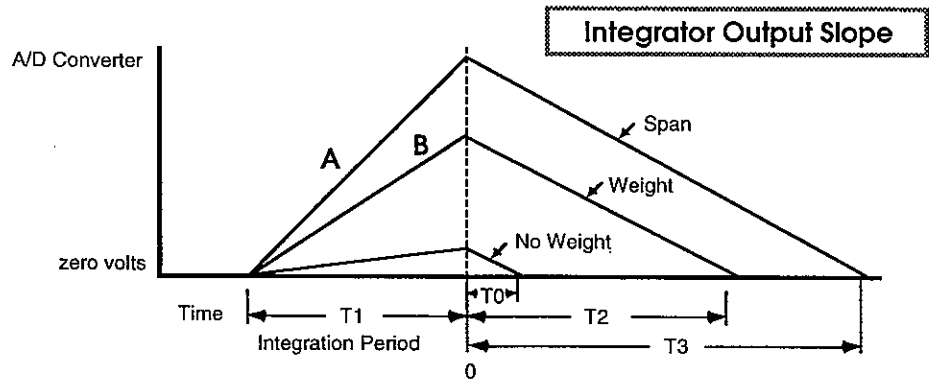
Keep your work area clean, remember how something came apart, and, always calibrate the scale after you have worked on it.

Principles of Operation

The HV and HW scales operate using a highly accurate and sensitive load cell (Please refer to the Load Cell Block Diagram on the following page). When you put an object on the weighing pan it is pulled downwards under the action of gravity. We will call the object a "mass" and the measurement of its massiveness on Earth its "weight" (Weight = Mass x Acceleration due to Gravity - "g").

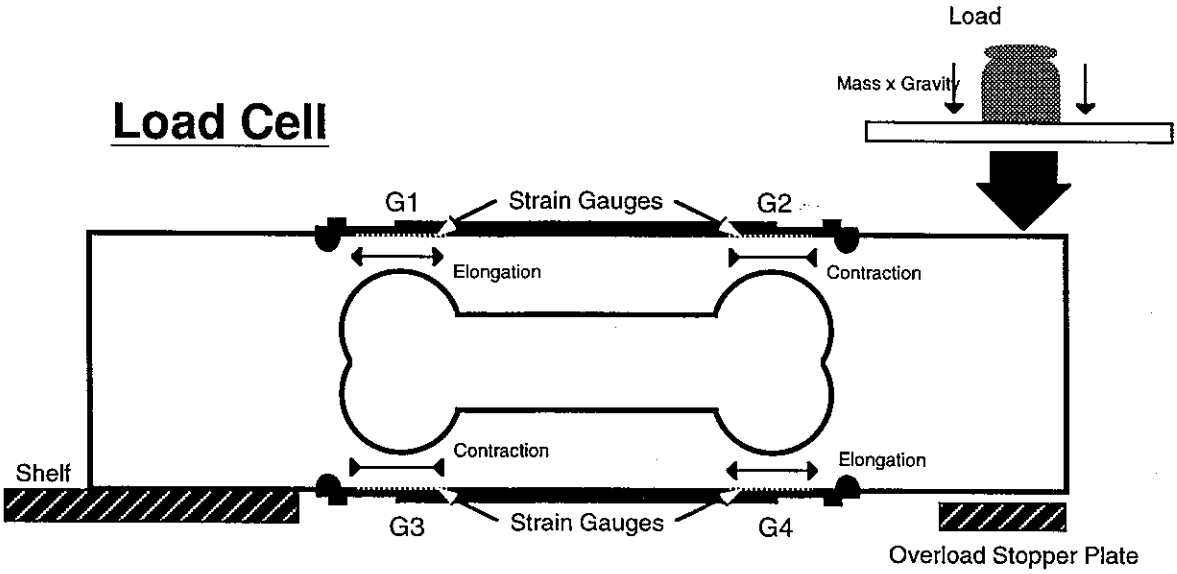
Load cells work by detecting stress in the cell (a carefully hollowed aluminum bar, forming a Roberval's structure) by means of an analog voltage from strain gage transducers bonded to the upper and lower surfaces. When a mass is placed on the weighing pan, the force causes the load cell to bend, causing a elongation-contraction relationship (Hooke's law) of the strain gages. As the strain gages detect change, the analog output signal from the load cell varies. This signal is amplified and used as the input signal for an analog to digital converter. The final digital signal is used to calculate the weight for the display.

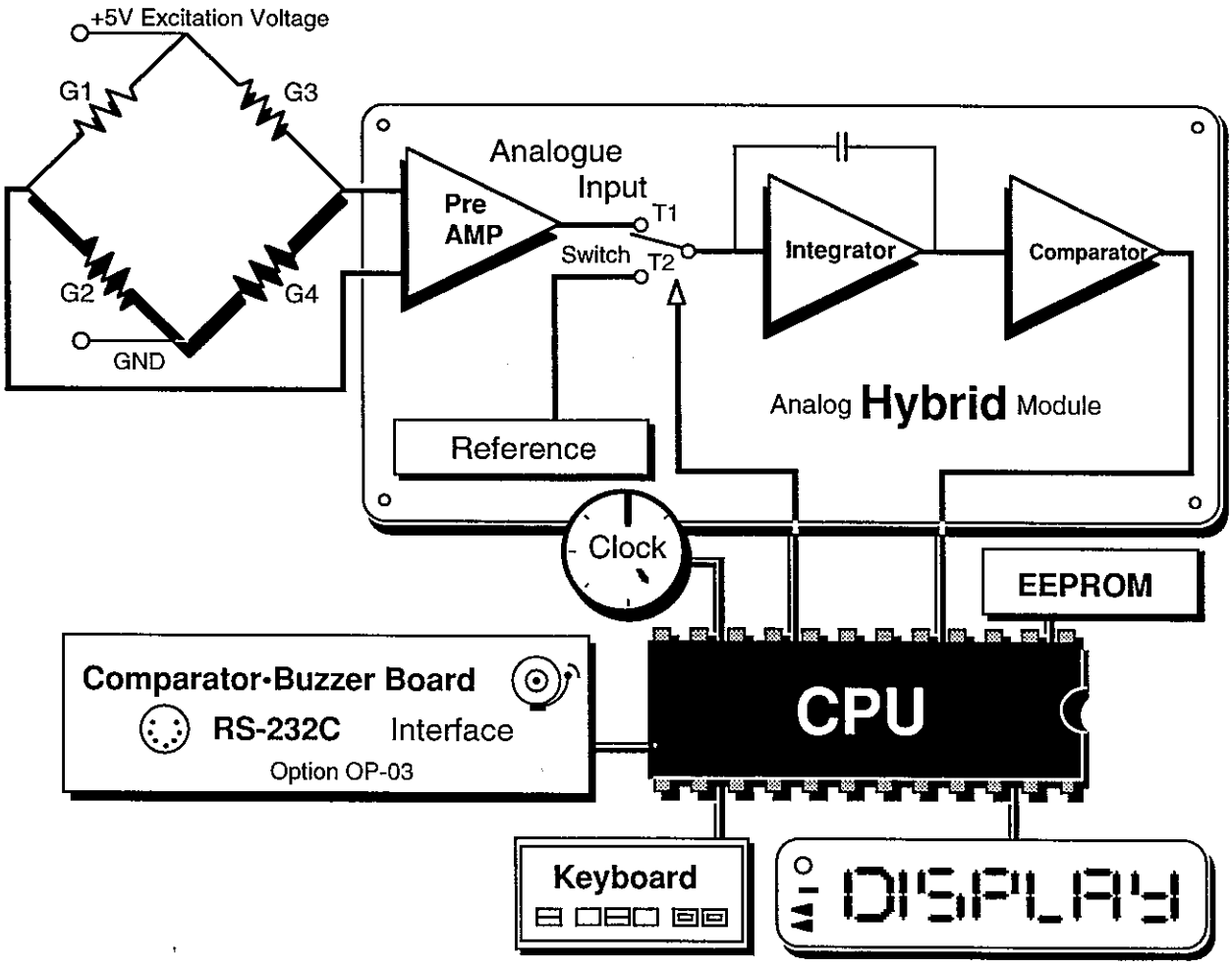
The integrator output slope is constant with respect to time. The dual-slope converter measures time taken for the output to reach zero volts. Small input B = Short T2, Large input A = Long T3 time. BVin = T2÷T1x(Vref). In simpler terms, the integration period (T1) is always the same, the length of the resulting slope depends on the weight. The HYBRID module measures the zero point, with an empty weighing pan from RE-ZEROing the scale (T0), full weight from span calibration (T3), and the output slope of an object (T2) with respect to time from the clock (how long the slope took to return to the zero point). The weight is then the offset distance of the weighed object to that of an empty pan.



Block Diagrams

Load Cell





HV Series Specifications

Function type	HV150KA1	HV60KA1	HV60KA2	HV30KA2
Maximum weight	150kg	60kg		30kg
	300lb	120lb		60lb
	4800oz	1920oz		720oz
Minimum display	50g	20g		10g
	0.1lb	0.05lb		0.02lb
	2oz	1oz		0.5oz
No. of samples	5 units (can be changed to 10, 20, 50 or 100 units)			
Maximum count number	3000 units			
Minimum weight possible for count weighing	50g	20g		10g
Display	7 segment liquid crystal display. Character height 22mm.			
Ambient temperature range	-10°C~40°C			
Ambient humidity range	Maximum 85% relative humidity (non-condensing)			
Repeatability	±50g	±20g		±10g
Linearity	±50g	±20g		±10g
Power source	DC9V Size C (SUM-2) x 6 dry cell batteries (sold separately) or AC adaptor.			
Battery life	Manganese dry cell batteries: Approximately 80 hours High performance manganese dry cell batteries: Approximately 100 hours Alkaline dry cell batteries: Approximately 200 hours			
Dimensions of weighing platform	390 x 530mm		330 x 424mm	
Weight	Approximately 17.5kg		Approximately 11.5kg	
Calibrating weight (CAL1)	150kg	60kg		30kg
Calibrating weight (CAL2)	100kg	40kg		20kg
Calibrating weight (CAL3)	300lb	120lb		60lb
Calibrating weight (CAL4)	200lb	80lb		40lb

CAL3 and CAL4 are only available in U.S. specification scales.
lb. and oz. displays are only available in U.S. specification scales.

HW Series Specifications

Function type	HW150KA1	HW100KA1	HW60KA2	HW30KA2	HW15KA2	HW10KA2
Maximum weight	150kg	100kg	60kg	30kg	15kg	10kg
	300lb	200lb	120lb	60lb	30lb	20lb
Minimum display	20g	10g	10g	5g	2g	1g
	0.05lb	0.02lb	0.02lb	0.01lb	0.005lb	0.002lb
No. of samples	5 units (can be changed to 10, 20, 50 or 100 units)					
Maximum count numbers	7,500units	10,000units	6,000units	6,000units	7,500units	10,000units
Minimum weight possible for count weighing	20g	10g	10g	5g	2g	1g
% Percentage maximum display	7500%	9999.9%	6000%	6000%	7500%	9999.9%
% Percentage minimum display	0.1%					
Minimum weight possible for 100% weight recording	2kg or greater	1kg or greater	1kg or greater	0.5kg or greater	0.2kg or greater	0.1kg or greater
Display	7 segment liquid crystal display. Character height 22mm.					
Ambient temperature range	-10°C~40°C					
Ambient humidity range	Maximum 85% relative humidity (non-condensing)					
Repeatability	±20g	±10g	±10g	±5g	±2g	±1g
Linearity	±30g	±20g	±15g	±7.5g	±3g	±2g
Power source	DC9V Size C (SUM-2) x 6 dry cell batteries (sold separately) or AC adaptor.					
Battery life	Manganese dry cell batteries: Approximately 80 hours High performance manganese dry cell batteries: Approximately 100 hours Alkaline dry cell batteries: Approximately 200 hours					
Dimensions of weighing platform	390 x 530mm		330 x 424mm			
Weight	Approximately 18kg		Approximately 12kg			
Calibrating weight (CAL1)	150kg	100kg	60kg	30kg	15kg	10kg
Calibrating weight (CAL2)	100kg	60kg	40kg	20kg	10kg	6kg
Calibrating weight (CAL3)	300lb	200lb	120lb	60lb	30lb	20lb
Calibrating weight (CAL4)	200lb	150lb	80lb	40lb	20lb	15lb

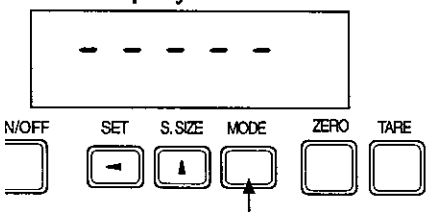
CAL3 and CAL4 are only available in U.S. specification scales.
lb. and oz. displays are only available in U.S. specification scales.

Correction for Acceleration Due to Gravity

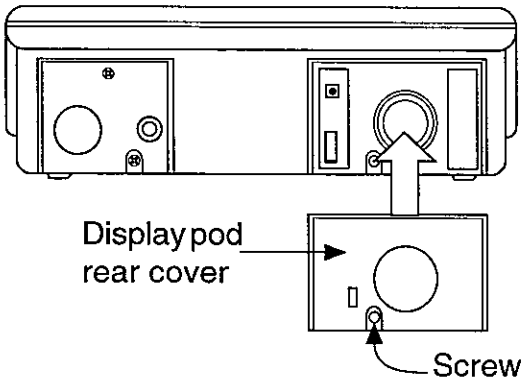
In the HV/HW series scales, in order to obtain the correct weight, a correction function for the acceleration due to gravity is provided. To perform accurate weighing, it is necessary to set the acceleration due to gravity to match that of the area where the scale is being used. (Refer to the Technical section: Values of acceleration due to gravity.)

Display check

Bar display

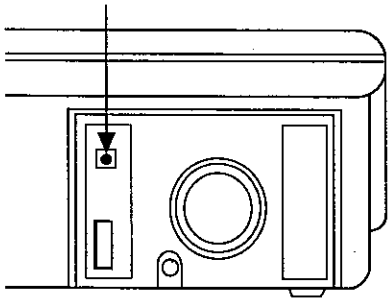


(1) Switch the power on.
After the display check, if the bar display is shown, press the [MODE] switch to display the weighing result, etc. (including E and -E displays).

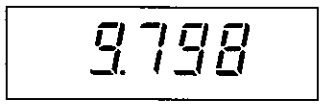


(2) Remove the rear cover.

[CAL switch]



(3) Press the [CAL] switch.
By pressing the [CAL] switch, the calibration mode is entered and a four-figure numerical value [9. ***] is displayed.



(4) Acceleration due to gravity
The four-figure number displayed when the calibration mode is entered, is the currently set gravity acceleration value.

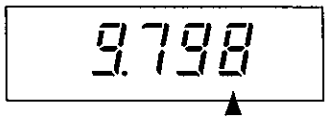
If the gravity value matches the area it is being calibrated in, press [MODE] and move to the calibration procedure.

If the calibration has been completed and the scale is to be used in another area, reset the gravity value to that of the area where the scale is to be used.

Example: For setting the gravity acceleration from 9.798 (the factory setting) to 9.806 (the value for Milan or Ottawa). (See appendix)

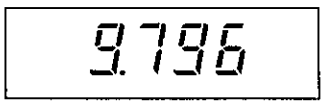
Functions of the keys used:

- S.SIZE Adds 1 to the value of the digit that is flashing. After pressing this key, the value stops flashing.
- SET The digit to be changed moves one figure to the left and flashes.
- ZERO Stores the data in memory.
- MODE Data is not changed and the mode progresses to the zero adjustment mode.

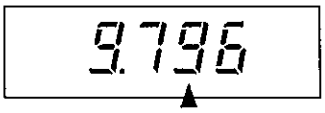
(1) 

Flashes

Press the SET switch to select the first figure. (The first figure flashes.)

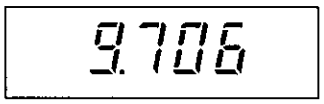
(2) 

Press the S.SIZE switch to change the number of the first figure to "6".

(3) 

Flashes

Press the SET switch to select the second figure. (The second figure flashes.)

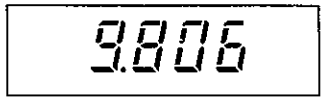
(4) 

Press the S.SIZE switch to change the number of the second figure to "0".

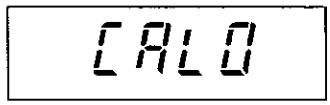
(5) 

Flashes

Press the SET switch once to select the third figure. (The third figure flashes.)

(6) 

Press the S.SIZE switch to change the number of the third figure to "8".

(7) 

Using the above procedure, the gravity acceleration setting has been completed. Press the ZERO switch to store the data in memory.

If the scale requires calibration, continue with the calibration procedure step 3.

If the calibration has been completed and the gravity value is being set to that of another area, press the CAL key to exit the setting procedure.

Calibration

Attention

In territories where the HV and HW scales are registered for commercial use, the end-user should not be given this information, as he will not be permitted to break the seals to carry out span calibration for himself. In this case, calibration would be carried out by the responsible authorities, and the calibration settings would then be sealed.

Calibration Introduction

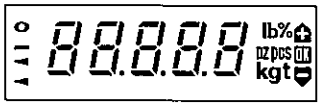
Calibration of the scale is required when it is initially installed, if the scale is moved a substantial distance, or in accordance with local regulations. This is necessary because the weight of a mass in one location is not necessarily the same in another location. Also, with time and use, mechanical deviations can occur.

"Weight" equals mass times acceleration due to Earth's field of gravity. The internationally adopted value for gravitational acceleration is 9.80665 m/s2 (32.174 ft/s2) in a vacuum. However, this varies by about ±0.3 percent depending on how far you are from the Earth's center of mass. Mass distorts space in such a way that the gravitational power of attraction is inversely proportional to the square of the distance between material objects (if non-gravitational forces are ignored). So, gravitational acceleration, "g" is greatest at the poles, least at the equator and decreases with altitude.

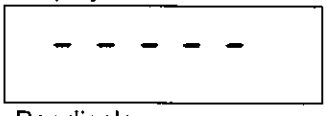
When we weigh a mass we are trying to find its weight expressed as pounds or kilograms. Because "g" and other factors vary from location to location, we must calibrate the scale whenever we move it, otherwise a mass of 30kg might display 30.00kg in one location and 30.08kg in another (i.e.: "g" may have changed by +0.267%. w=m X g). This would be an error but it can be prevented by placing an accurate mass on the scale (say 30kg) and then telling the scale, in effect, "this is what 30kg weighs at this location so please display 30.00kg"..... this is calibration.

The HV/HW series is also equipped with a gravity compensation function which means that it can be calibrated in one location and then adjusted to match the acceleration of gravity at another location. We call this "setting the value of 'g". If you wish to take advantage of this feature, please read the Gravity Compensation Function section.

Zero and span calibrations



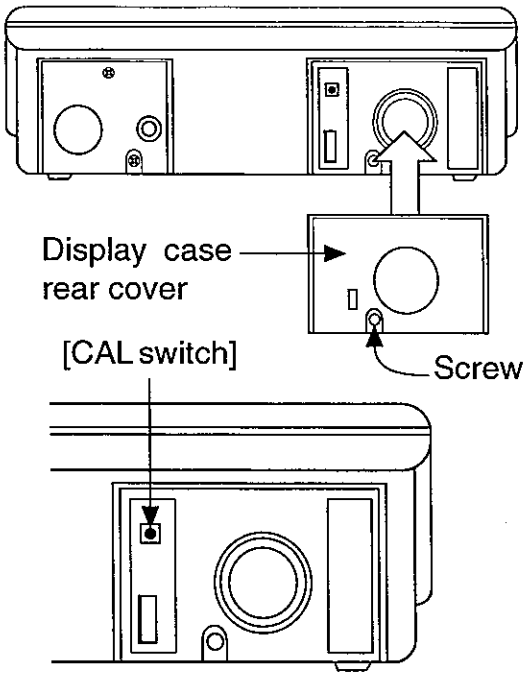
Display Check



Bar display

Ensuring that there is nothing on the weighing platform, switch on the power. If the bar display is shown after the display check, the zero point is displaced. In this situation, carry out the zero point calibration.

(1) Press the ON/OFF key and allow an adequate amount of time for warming up (10 minutes or longer) During warming up, disable the auto power off function, or place an object on the weighing platform so that the display is not zero.



(2) Remove the rear cover.

(3) Press the [CAL] key.
By pressing the [CAL] key, the calibration mode is entered and a four-digit value [9. ***] is displayed.

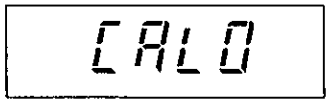
(2) Set the gravity acceleration according to the procedure "Correction for acceleration due to gravity". Set this to the gravity where the scale is being calibrated. After finishing this setting, Press [ZERO], the display enters the zero point calibration.

(3) Zero adjustment

Functions of the key switches used:

[ZERO] Stores the zero adjusting value in memory.

[SET] The data is not changed, and the machine moves forward to the span adjustment.



With nothing on the weighing platform, wait for the "0" stable mark to be displayed.

When this stable mark is displayed, press [ZERO] to store the zero data. When the data has been stored, the calibration mode moves forward to the span adjusting procedure.
If only the zero point is to be calibrated, press the [CAL] switch to exit from the calibration mode after the above procedure.

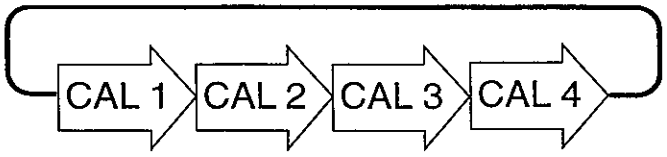
(4) Span adjustment

In span adjustment, there is a full scale adjusting mode and a 2/3 scale adjusting mode. Perform one or other of the procedures. (For each of the values, refer to the calibration weights in HV/HW Specifications.)
If at all possible, carry out the adjustment using the full scale weights. Only carry out the adjustment using the 2/3 scale weights when unavoidable due to not having enough weights, etc.

Functions of the key switches used:

[ZERO] Stores the span data in memory.

[MODE] The data is not changed, and the span adjusting mode changes. Each time the switch is pressed, the mode changes as follows:



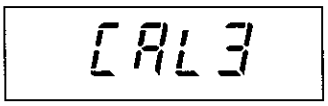
The CAL3 and CAL4 (pound) modes are only available for the U.S. specification scales.

(5) Span adjustment (Full scale)

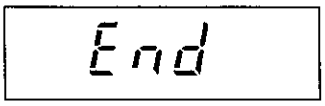
(1) 

By pressing the MODE switch, select either the CAL1 (Kg) or CAL3 (1b) modes.

or

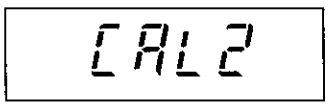


Place the full scale weights on the weighing platform and wait until the "o" stable mark is shown.

(2) 

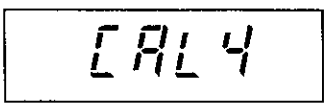
When the stable mark is shown, press ZERO to record the span adjusting data. After the data has been recorded, "End" is automatically displayed.

(6) Span adjustment (2/3 scale)

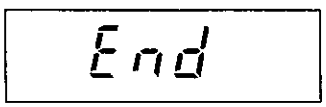
(1) 

By pressing the MODE switch, select either the CAL2 (Kg) or CAL4 (1b) modes.

or



Place the 2/3 scale weights on the weighing platform and wait until the "o" stable mark is shown.

(2) 

When the stable mark is shown, press ZERO to record the span adjusting data. After the data has been recorded, "End" is automatically displayed.

(7) Ending the calibration

After the zero span adjustment is finished and "End" is displayed, if the calibration has been completed, press the CAL switch. This exits from the calibration mode and returns to the normal weighing display mode.

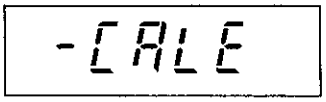
To complete the calibration, replace the display case rear cover that was previously removed.

Note: If the scale is to be used in a location other than where it was calibrated and the "g" setting for that area is different, re-enter the calibration procedure and set the "g" for that area. See Appendix for a list of gravity settings at various locations. If in doubt, contact your local Office of Weights and Measures for this data.

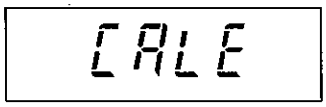
Error displays during calibration

(8) Error displays

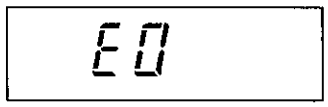
The following are the error displays that may be shown during calibration. If these displays are shown, confirm whether the operation has been mistaken and if the correct weights are being used, etc., then switch off and perform the procedure again.

(1) 

The output from the load cell is too small. When carrying out the span adjustment, if this error is only displayed when the ZERO switch is pressed, the load cell output is too small compared to the zero adjusting data. Check that the weighing pan is correctly installed.

(2) 

The load cell output is too large. Check the weight value of the calibration mass and the calibration mass settings (steps 5 and 6 of the calibration procedure).

(3) 

The data that was to be stored in memory has not been stored correctly.

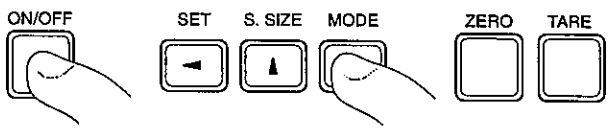
For the span adjustment, use an accurate weight to carry out the procedures.

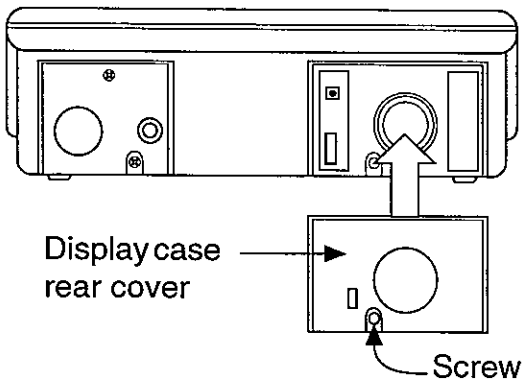
Software Parameter Settings

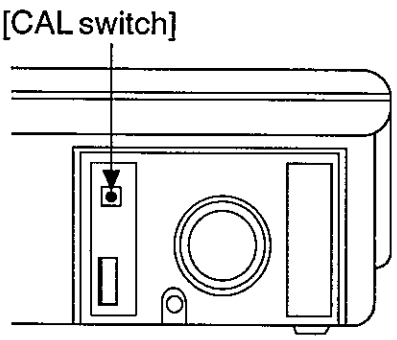
CONFIDENTIAL INFORMATION

This section concerns disabling and enabling functions of the HV/HW Series of Platform Scales at a software level not described to the end user in the Instruction Manual. Because some software functions will be illegal in some countries, and other functions could be inadvertently disabled, it is important that the end users should not have access to this information. Clearly it is important to A&D and to our dealers that these scales should be functioning at their full and proper potential for the customer, and not be used in fraudulent or other criminal activity.

Step 1. With the scale off, remove the display case rear cover.
Step 2. Press and hold the [CAL] (on the rear) and [MODE] keys.
Step 3. Then, press [ON/OFF] key. Release all keys.







Note: The use of each key as you move through this procedure is listed below. Please take a moment to read each.

You are now able to just view (by only pressing the [MODE] key), or change the parameter settings (using the [ZERO] key to enter).

ZERO	• The [ZERO] key enters the settings into memory. "F0" and "F1" are entered individually, "F2" through "F4" are entered as a group. ("F5 and "F6" for the HW are entered after "F2" through "F4") • At the end of the "F" cycle, "END" will be displayed.
MODE	• Use the [MODE] key to view the settings, and to escape a setting if you have made a mistake. • You can not enter the settings with the [MODE] key, it will only move you through the settings with no change.
S. SIZE	• Once in the "F" group, use this key to move incrementally through the settings available for each group, ie: [F2 0] ► [F2 1] ► [F2 2]

At this time the display will show "F0 0" (or "F0 1").

F0 0	**F0** is the automatic function: **Power off after three minutes**
F0 0	Function Disabled
F0 1	Function Enabled

Step 4. Use the [S.SIZE] key to move incrementally between "F0 0" to "F0 1". When the desired setting is displayed, press [ZERO] to enter the setting into memory, and move to F1.

F1 0	**F1** is the function: **Counting / % (HW only) /** **Comparator function Enable / Disable**	
	HV series	HW series
F1 0	Counting / comparator function enabled	Counting / % / comparator function enabled
F1 1	Counting function disable	Counting / % / function disabled
F1 2	Not available	Counting / % / comparator function disabled

Step 5. After using the [S.SIZE] key to move to the desired setting. Press [ZERO] to enter the setting into memory, and move to F2.

F2 0	**F2** is the function: **Zero Band**
F2 0	Approx. 10% of Maximum Capacity
F2 1	Approx. 5% fo Maximum Capacity
F2 2	Approx. 2% fo Maximum Capacity

Note: "F2 0" through "F4 2" are entered in as a block, in other words you will need to make any change in "F2" through "F4" and then when you press [ZERO], they will all be entered.

If there is no change in an "F" group, then press [MODE] to move you without change.

Step 6. After using the [S.SIZE] key to move to the desired setting. Press [MODE] to move to F3.

F3 0	**F3** permits the use of **"lb"** and sets the **TARE** and **ZERO** conditions
F3 0	The **TARE** function operates when the display is stable without the ZERO display. **"lb/oz"** is not displayed (Most Countries).
F3 1	The **TARE** function operates when the display is stable without the **ZERO** display. **"lb/oz"** is displayed (USA)
F3 2	The **TARE** function is permitted when the scale is stable, and the display is not at the center-of-zero. **"lb/oz"** is not displayed (New Zealand).
F3 3	The **TARE** function is permitted when the scale is stable, and the display is not zero. After the**TARE** operaton, the ZERO and NET indicators will light simultaneously. **ZERO** does not use while **TARE** operation. **"lb/oz"** is not displayed (Australia/ OIML).
F3 4 HV only	The **TARE** function is permitted when the scale is stable, and the display is not zero. **ZERO** does not use while **TARE** operation. **"lb/oz"** is not displayed (Australia/ OIML).

Note: "oz" is for HV only.

Step 7. Alter using The [S.SIZE] key to move to the desired setting, press [MODE] to move to "f4 "

F4 0	**F4** sets the maximum capacity			
	HV		**HW**	
F4 0	30kg		**F4 C**	30kg
F4 1	60kg		**F4 1**	60kg
F4 2	150kg		**F4 2**	150kg
			F4 3	15kg
			F4 4	100kg
			F4 5	10kg

Step 8. After using the S.SIZE key to move to the desired setting - press ZERO to enter the settings ("F2 0" through "F4 2") into memory and move to F5 (HW) or F6(HV).

F5 0	**F5** sets the communication mode of the RS-232 interface(HW series only)
F5 0	STREAM mode
F5 1	COMMAND mode, terminator is <CR>+<LF>
F5 2	COMMAND mode, terminator is <CR>

Step 9. After using the S.SIZE key to move to the desired setting, press ZERO to enter the settings and move to F6.

F6 0	**F6** sets the comparator mode environment.	
Setting	Comparator functoin is ON or OFF when the scale is powered on	Comparator Buzzer and Relay Output
F6 0	OFF	Always
F6 1	OFF	Prohibited near zero
F6 2	ON	Always
F6 3	ON	Prohibited near zero

Note: Near zero is -4 to +4 divisions.

Step 10. After using the S.SIZE key to move to the desired setting, press ZERO to enter the settings.

Display will show "END".

Note: You may also go back to the beginning of the cycle "F0" by pressing MODE, and not ZERO, but no settings will be entered into memory until ZERO is pressed.

End End of Software Parameter Settings procedure.

Fault Finding

This section can be photocopied and used as a check sheet -
Simply mark the boxes provided after each step is successfully completed.

Troubleshooting

- ✔ Check the Keyboard to see if it's okay. (see Keyboard Check)
- ✔ If the display remains "E", "-E", or is not stable - then do a full recalibration, including setting "g" if used (see Calibration section).
- ✔ If you are unable to calibrate:
  - Zero calibration may be needed if the [ZERO] key will not set the display to zero, or if "----" is displayed when the power is turned on .
  - If "-CAL E" is displayed when you press [ZERO], the scale cannot enter the maximum capacity (or 2/3) value because the calibration mass is under-weight (minus Calibration Error). Check everything is correctly set.
  - Check the analog and main boards for broken leads, and the cable from the Load Cell to J2 of the analog board.
- ✔ If "E0" is displayed, turn off the power and try again. If that does not work, change either U2, U3 of the main board or replace both boards, one at a time.

* Don't forget to do a full recalibration, including setting "g" (see Calibration section) if you make any electronic repairs.

Load Cell Stopper Check
Mechanical

- ✔ If you load the weighing pan to just over full scale, does it hit the overload stopper? ❑ ok

Pan Check
Mechanical

- ✔ Is the weighing pan touching anything? ❑ ok
- ✔ Is the weighing pan mounted correctly? ❑ ok
- ✔ Is the weighing pan perfectly horizontal? ❑ ok

Battery Check
Electronic

- ✔ Remove the battery pack, and the AC adaptor (if connected). Then, re-install the battery pack. Press the [ON/OFF] key. Does the display turn on?
- ✔ Check the connection between the analog and the main boards. ❑ ok
- ✔ Check the output of the Battery/AC adaptor to see that it is at least 6.5 volts. ❑ ok
- ✔ When pressing the ON/OFF key, check the resistance between S1 pins to see if they read less than 10 Ω. If so, then it is okay. ❑ ok
  - If not, replace the switch. ❑ ok
  - If the resistance is correct and the problem isn't solved, try a different main board. If it checks out, then change the analog board.
- ✔ When the ON/OFF key is pressed, the voltage at J1 pins 1 and 2 should be 5V ±10%, and pin 1 of U3 (RESET) at ≈5V (Hi). ❑ ok
- ✔ Check that transistors Q1, Q2, Q3 on the analog board are working. ❑ ok

CPU Check
Electronic

- ✔ Remove the battery pack, and the AC adaptor (if connected). Then, re-insert the battery pack. Press the ON/OFF key. Does the display turn on?
- ✔ Check all solder connections. ❑ ok
- ✔ Check that the voltage between pin 3 and 4 of J3 of the analog board, it should be 5V ±10%. ❑ ok
- ✔ Is the HV RESET at the Hi level? [pin 1 of U3 (RESET) at ≈5V (Hi)] ❑ ok
- ✔ Is the HW RESET at the Hi level? [pin 8 of U6 (RESET) at ≈5V (Hi)] ❑ ok
- ✔ Check the voltage levels for the HW LCD at U5 pin 2 ≈1.6V, 1 ≈ 3.2V ❑ ok
- ✔ Check that the HV clock pulse is 4MHz (see #1 Waveform table).
- ✔ Check that the HW clock pulse is 12MHz (see #1 Waveform table).
- ✔ Check the waveform of EEPROM (see #9 ~ 12 Waveform table). ❑ ok

A/D HYBRID Check
Electronic

- ✔ Check the voltage of U2 at pin 10 on the analog board, it should be 5V ±10%. ❑ ok
- ✔ Check the following voltages from the Load Cell between U2 pin and:

Should be 0V	Should be ≈3V	Should be ≈3V
Pin 1 (GND) ❑ ok	Pin 2 (Hi) ❑ ok	Pin 3 (Lo) ❑ ok

- ✔ Check the A/D converter waveforms for: (see Waveform table)

1st ❑ ok	$\overline{1st}$ ❑ ok	2nd ❑ ok
AZ ❑ ok	CMP ❑ ok	

LCD Check
Electronic

- ✔ Check the glass for cracks (visible as dark spots). ❑ ok
- ✔ Check the soldering for breaks, and the flexible cable for cracks or tares between the main board and the LCD. ❑ ok
- ✔ Check for missing segments during the sequential and 'power on' tests ❑ ok

Load Cell Check
Electronic

- ✔ Check the following cable assembly - pin to wire - connections of J2 on the analog board:

Pin	Color	Pin	Color	Pin	Color
1	Red ❑ ok	2	Green ❑ ok	3	Blue ❑ ok
4	White ❑ ok	5	Yellow ❑ ok		

- ✔ Check the voltage between pins 1 & 4 of J2 , it should be 5V ±10%. ❑ ok
- ✔ Check the voltage between pins 2 & 4 of J2 , it should be ≈ 3V. ❑ ok
- ✔ Check the voltage between pins 3 & 4 of J2 , it should be ≈ 3V. ❑ ok
- ✔ Check the voltage between pins 2 & 3 of J2 , it should be 0.5 ~ 2mV with no weight on the weighing pan. ❑ ok
- ✔ Check the voltage between pins 2 & 3 of J2 , it should be 5 ~ 8mV with full span weight on the weighing pan. ❑ ok

Keyboard Check
Electronic

Key: • What should happen when pressed:

- ✔ ON/OFF • The power should go ON and OFF. ❑ ok
- ✔ MODE • The display should go from "kg" to "PCS". ❑ ok
- ✔ SET • In the "PCS" mode it should show "5 0 pcs". ❑ ok
- ✔ HI/LO • In the Counting Mode, the sample size should move from 5 to 10 to 20, etc. ❑ ok
- ✔ ZERO • It should cause the display to show zero when pressed. ❑ ok
- ✔ TARE • It should cause the display to show zero when pressed. ❑ ok
- ✔ Remove the battery pack, and the AC adaptor, if connected.
- ✔ Check that each individual key is working by measuring the resistance between the pins of the switches.

  The resistance with the key pressed should be less than 10 Ω for:

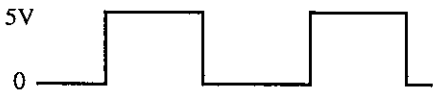
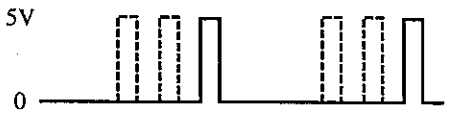
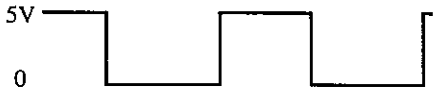
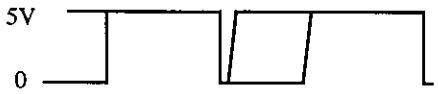
  - ON/OFF between pins of S1 ❑ ok
  - SET between pins of S2 ❑ ok
  - S.SIZE between pins of S3 ❑ ok
  - MODE between pins of S4 ❑ ok
  - ZERO between pins of S5 ❑ ok
  - TARE between pins of S6 ❑ ok

  If any of the above are out of the correct resistance range, that switch is defective.
- ✔ Re-install the battery pack, and the AC adaptor, if it was connected.

J1~3 Checks, Analog Board
Electronic

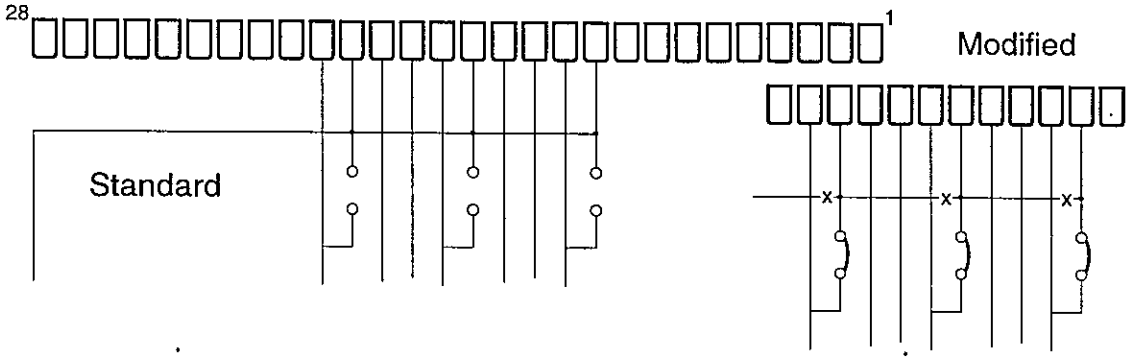
- ✔ Check the voltage between pins 1 & 2 of J1 , it should be ≈ 9V. ❑ ok
- ✔ Check the voltage between pins 1 & 4 of J2 , it should be 5V. ❑ ok
- ✔ Check the voltage between pins 2, 3 & 4 of J3 , it should be 5V. ❑ ok
- ✔ Check the voltage between pins 2, 3 & 10 of J3 , it should be > 4V. ❑ ok
- ✔ Check the voltage between pins 2, 3 & 12 of J3 , it should be ≈ 9V if the ON/OFF key is not pressed. ❑ ok
- ✔ Check the voltage between pins 2, 3 & 12 of J3 , it should be ≈ 3V if the ON/OFF key is pressed. ❑ ok

Analog Board WaveformCheck

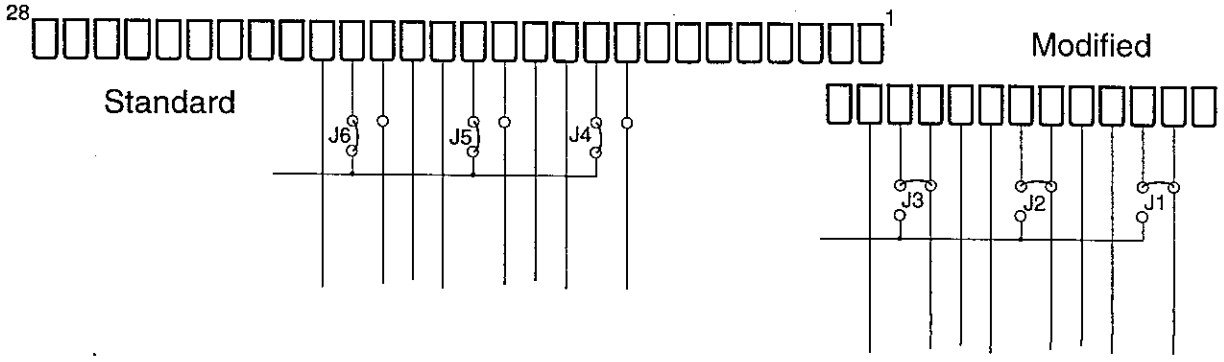
No.	Signal	Test Points	Wave	Comments
1	1st	J3 (9) ~ J3 (2,3) U2 (6)		A/D Control Input
2	$\overline{1st}$	J3 (8) ~ J3 (2,3) U2 (7)		See Main Board Logic for timing
3	2nd	J3 (7) ~ J3 (2,3) U2 (8)		
4	AZ	J3 (6) ~ J3 (2,3) U2 (9)		
5	CMP	J3 (5) ~ J3 (2,3) U2 (5)		A/D Output

Setting the Decimal Point "." or","

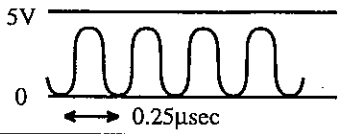
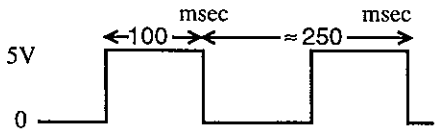
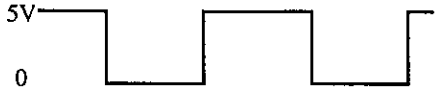
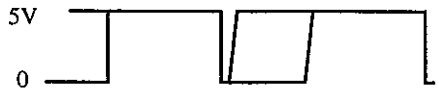
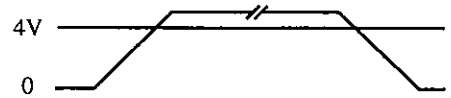
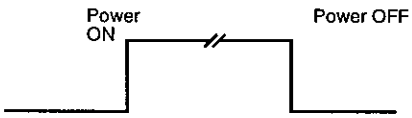
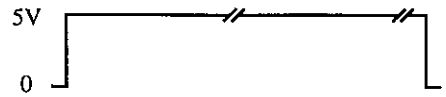
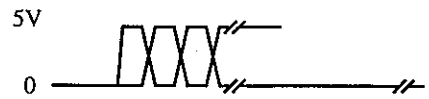
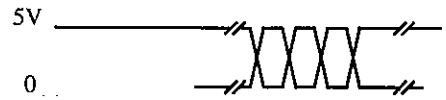
- The standard HW displays show a dot for the decimal point ".". This can be changed to a comma "," Cut the pattern indicated by crosses (X) and attach jumpers as shown.



- The HV may be similarly modified by removing J4, J5 and J6. Install J1, J2 and J3 to turn on the proper segments.

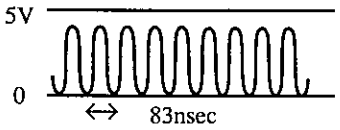
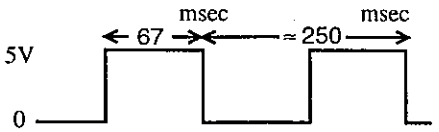
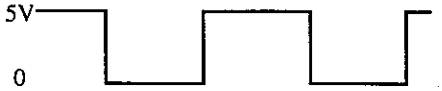
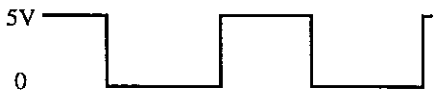
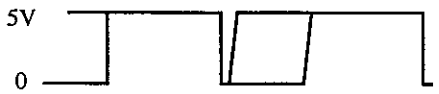
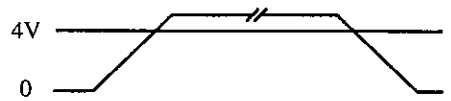
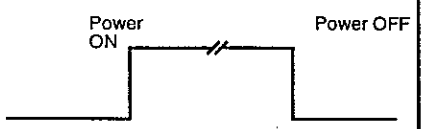
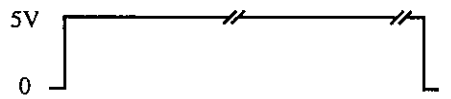
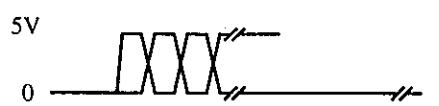
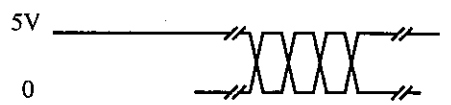


HV Main Board Waveform Check

No.	Signal	Test Points	Wave	Comments
1	X EX	X1, U1(46) ~ GND X1, U1(45)		CPU Clock 4 MHz
2	1st	J2 (9) ~ GND U1 (41)		A/D Control Input
3	$\overline{1st}$	J2 (8) ~ GND U1 (42)		
4	2nd	J2 (7) ~ GND U1 (43)		
5	AZ	J2 (6) ~ GND U1 (44)		
6	CMP	J2 (5) ~ GND U1 (48)		A/D Output
7	$\overline{RESET}$	U3 (2) ~ GND		+5V Input
8		U3 (1) ~ GND U1 (47)		Reset Output
9 *	CS	U2 (1) ~ GND U1 (22)		EEPROM Chip Select
10*	SK	U2 (2) ~ GND U1 (23)		Clock
11*	DI	U2 (3) ~ GND U1 (24)		Data
12*	DO	U2 (4) ~ GND U1 (25)		Data Output

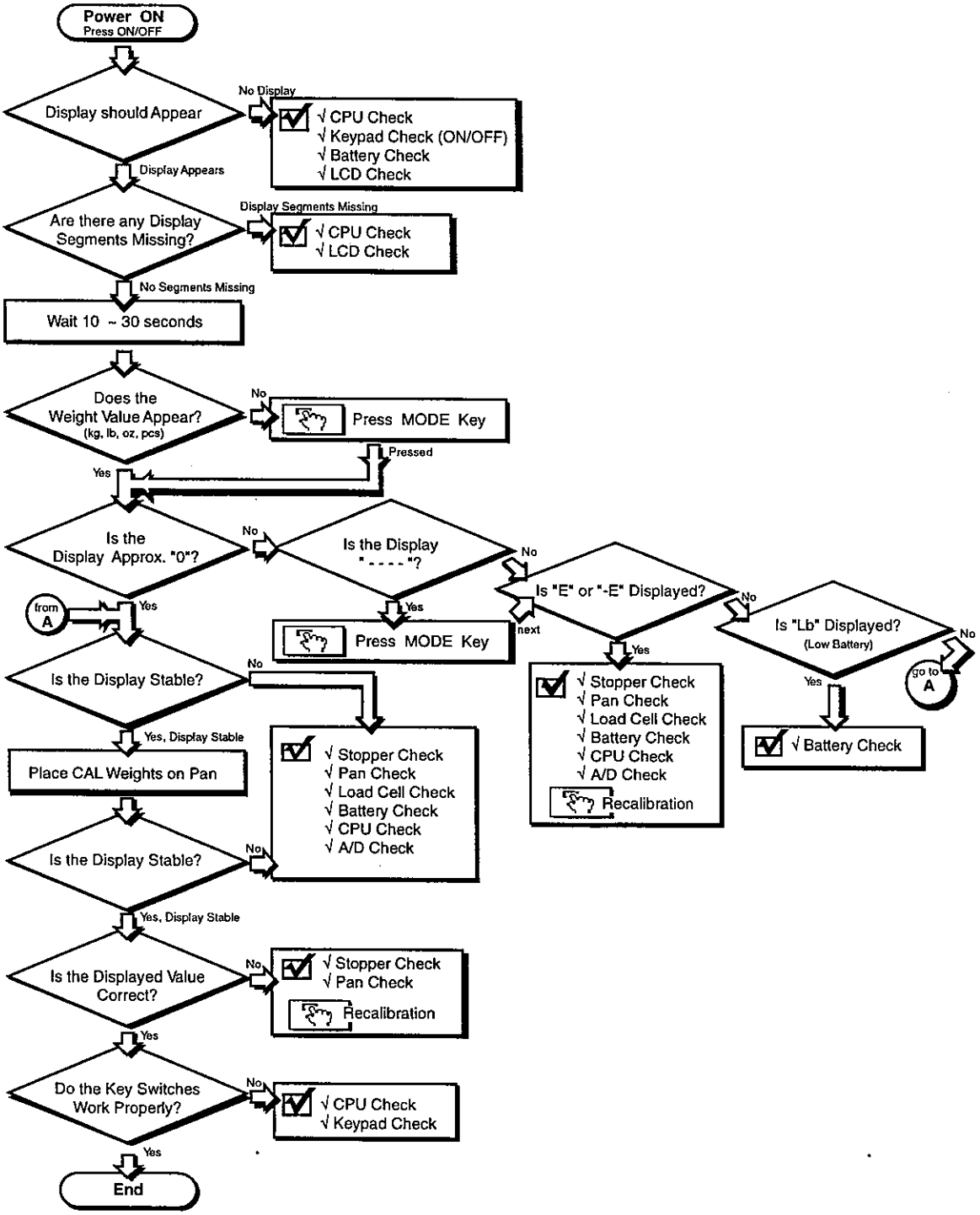
* Waveforms 9-12 can only be observed at Power ON, Function and calibration data storage

HW Main Board Waveform Check

No.	Signal	Test Points	Wave	Comments
1	X1 X2	X1, U1(25) X2, U1(24) ~ GND		CPU Clock 12Mhz
2	1st	J2 (9) U1 (59) ~ GND		A/D Control Input
3	$\overline{1st}$	J2 (8) U1 (60) ~ GND		
4	2nd	J2 (7) U1 (61) ~ GND		
5	AZ	J2 (6) U1 (62) ~ GND		
6	CMP	J2 (5) U1 (16) ~ GND		A/D Output
7	$\overline{RESET}$	U6 (5) ~ GND		+5V Input
8		U6 (8) U1 (22) ~ GND		Reset Output
9 *	CS	U2 (1) U1 (63) ~ GND		EEPROM Chip Select
10*	SK	U2 (2) U1 (64) ~ GND		Clock
11*	DI	U2 (3) U1 (1) ~ GND		Data
12*	DO	U2 (4) U1 (2) ~ GND		Data Output

* Waveforms 9-12 can only be observed at Power ON, Function and calibration data storage

Mechanical Fault Finding Chart



Load Cell Replacement

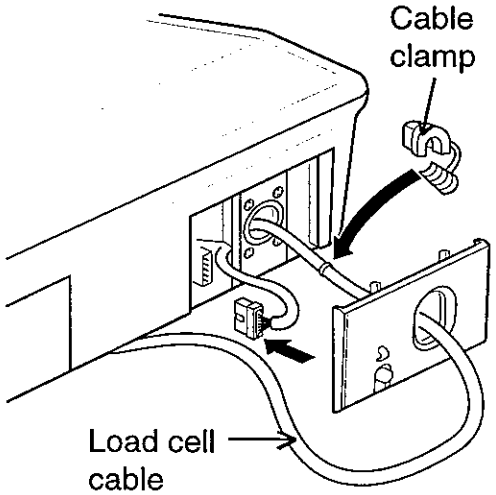
Please Note

- Make sure that you read fully through the entire procedure before initiating replacement work.
- In particular, read the entire step before attempting it, taking the time to look for notes in the step pertaining to the particular scale you are working on.
- Please identify the load cell for the assembly that you are working on before starting replacement work.

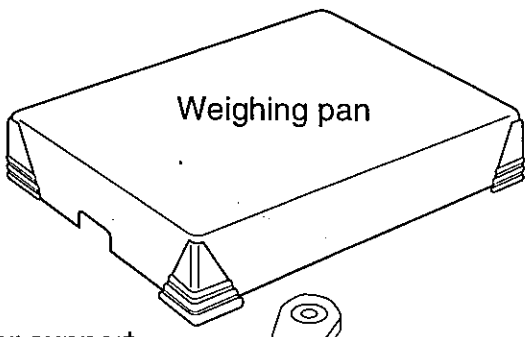
Disassembly

Disassembly for HW-150KA1, HW-100KA1, HW-60KA2, HW-30KA2, HW-15KA2 , HW-10KA2, HV-150KA1, HV-60KA1, HV-60KA2, HV-30KA2

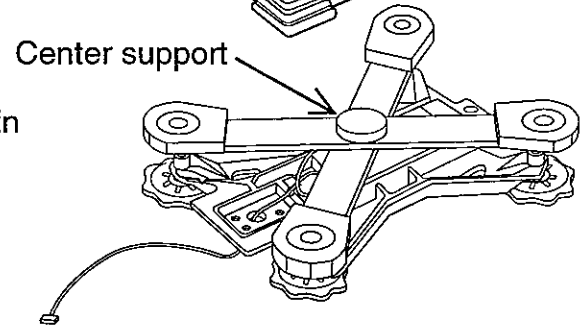
Step 1. Remove the calibration switch cover from the display case. Disconnect the load cell cable. Remove the cable clamp and carefully remove the cable from the display assembly.



Step 2. Remove the Weighing Pan.



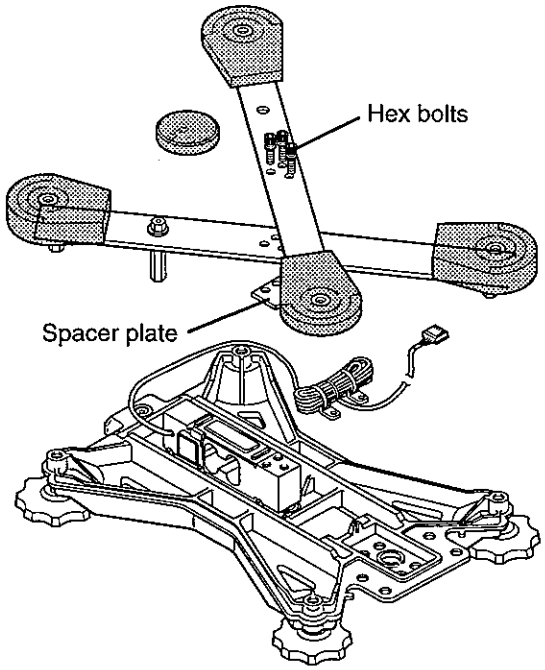
Step 3. Remove the rubber center support in the center of the pan support bar assembly.



Step 4. Remove the hex bolts holding the pan support bar assembly to the load cell

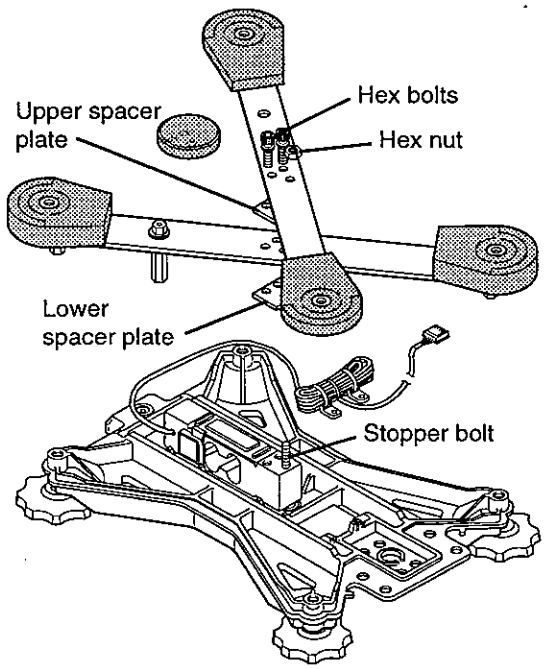
- Three on the HV/HW–KA1
- Two on the HV/HW-KA2 and a stop per bolt with a hex nut. (The bolt is needed on the new load cell)

Step 5. Lift off the pan support bar assembly.



○ HV-150KA1 HW-150KA1
HV-60KA1 HW-100KA1

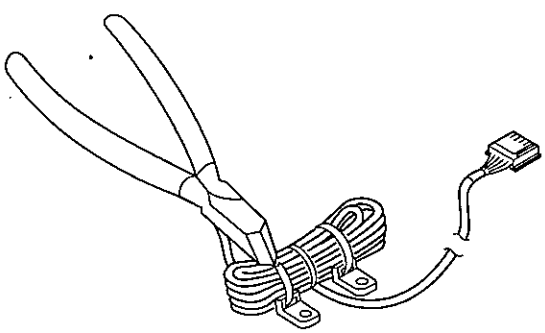
This type platform has one spacer plate between the pan support bar assembly and the load cell.



○ HV-60KA2 HW-60KA2
HV-30KA2 HW-30KA2
HW-15KA2
HW-10KA2

This type platform has two spacer plates. One spacer plate is between the pan support bars and other spacer plate is between the pan support bar assembly and the load cell.

Step 6. Clip the plastic tie bands holding the load cell surplus cord (there may be no coil if the display pod has been externally mounted) and gently remove the cable from its guiding channel to the load cell.



- Make sure that you leave the holders that secure the plastic tie bands to the platform, you will need them for reassembly.

Step 7. Turn the platform base on its side. While holding the load cell in with one hand (from under the platform base):

Remove the four hexagon bolts (and spacer plate on the KA2 platform) that holds the load cell to the base.

Step 8. Set the platform base down, and lift out the load cell.

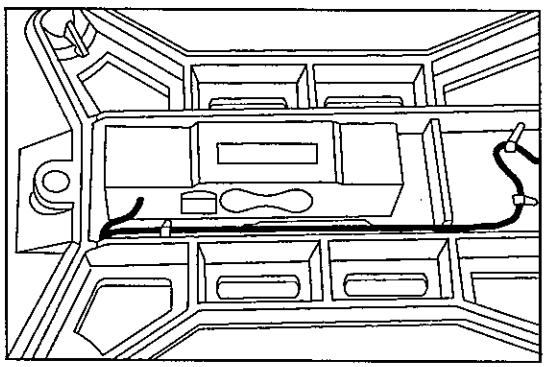
Assembly

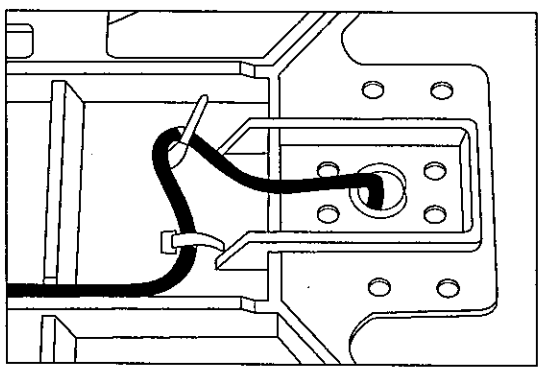
Assembly for HV-150KA1, HV-60KA1
HV-60KA2, HV-30KA2
HW-150KA1, HW-100KA1
HW-60KA2, HW-30KA2, HW-15KA2, HW-10KA2

Step 1. Place the platform base on the work surface and put the load cell in place. Loosely insert the securing bolts, and plate if used, from the bottom (it may be necessary to turn the platform on it's side to get the bolts aligned with the load cell).

- First, lightly tighten the hex bolts that hold the load cell to the base. Check the position, then tighten them to the following torque specifications:
- HV-150KA1, HV-60KA1, HW-150KA1 and HW-100KA1, torque to 300kg/cm
- All other HV and HW platforms torque to 150kg/cm

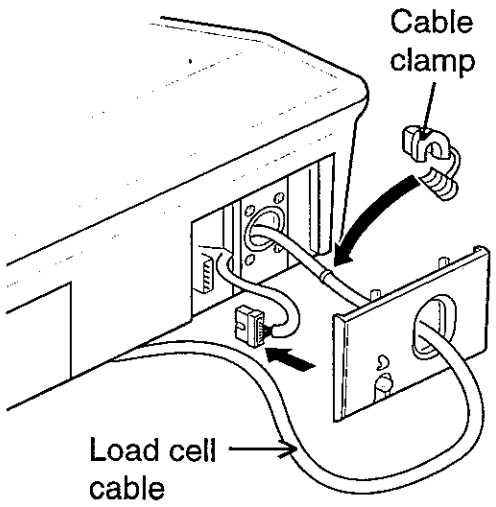
Step 2. Set the platform base back down and thread the load cell cable through its guide channel .



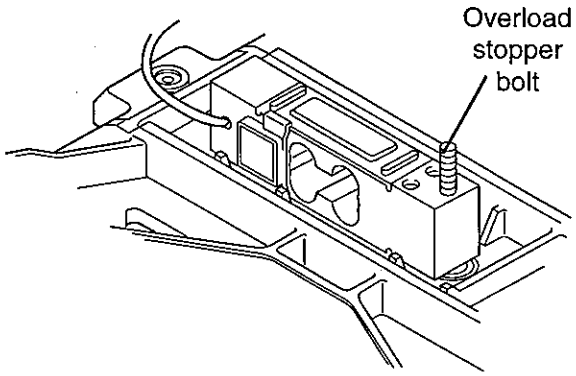


Step 3. Feed the cable through the pole (or through the slot in the rear of the pole) leaving about 30cm out at the end of the pole. Feed the cable through as shown and connect it to the analog board. Install the cable clamp.

Step 4. Replace calibration switch cover.

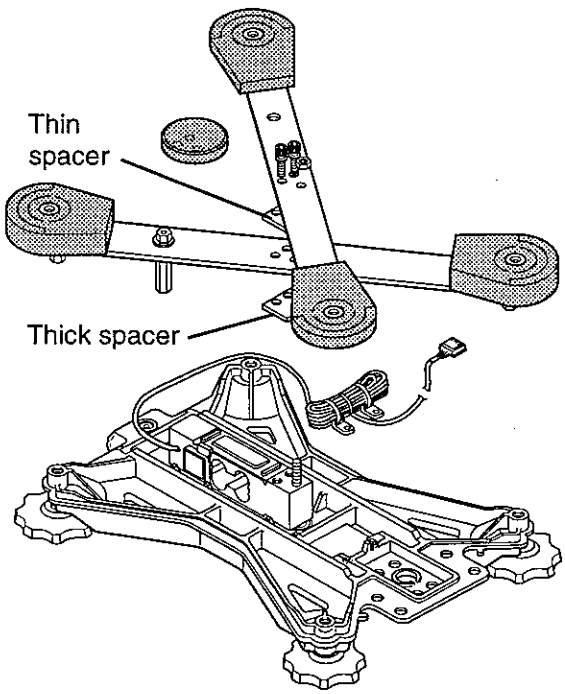


Step 5. Coil the remaining cable and secure it with plastic tie bands (feed the tie bands through the plastic holders in the platform).

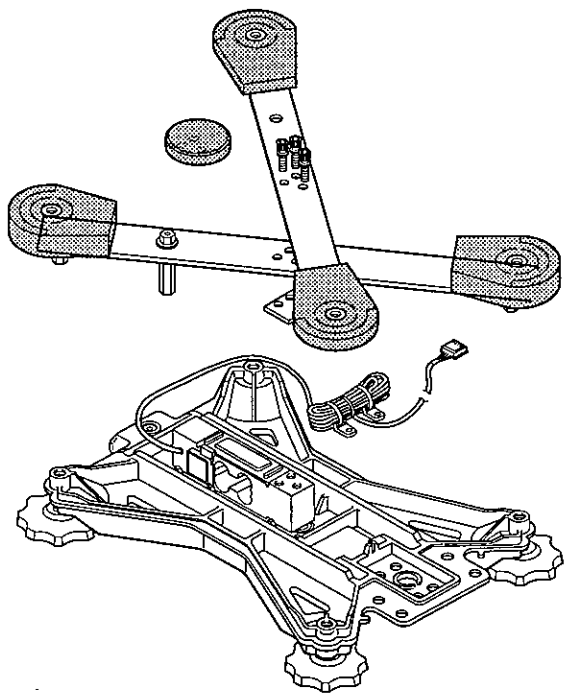


Step 6. Screw the overload stopper bolt (used on HV and HW-KA2 series) into the load cell.

Step 7. Install the pan support bars and spacers using the hex bolts removed during disassembly. Tighten only enough to hold the arms in place.



The HV/HW-KA2 type has one thin spacer between pan support bars and one thick spacer between pan support bar assembly and load cell



The HV/HW-KA1 type has a spacer between pan support bar assembly and load cell .

Step 8. Lay the weighing pan on the work surface upside down and place the platform assembly in it (this may require some movement of the pan support bars). Move the pan support arms so that the rubber cushions all touch the inside edge of the pan.

Step 9. Carefully remove the platform assembly from the weighing pan (using care so that the position of the arms does not change) and place it on the work surface.

Step 10. Tighten the hex bolts but leave the stopper bolt and nut loose (these will be set during the stopper adjustment procedure). Check that the stopper bolt is not touching the frame. It should be screwed down until it stops, then backed out about 1mm. Tighten the nut using only your fingers.

Step 11. Replace the rubber center support in the center of the pan support bar assembly.

Step 12. Replace the Weighing Pan.

- You must check here to make sure that the pan support bar assembly was correctly installed. If you have difficulty installing the weighing pan (the sides of the pan are obviously rubbing on the pan support assembly) then loosen the bolts holding the pan support bar assembly and adjust the pan support bars so that they are closer together. If to close, the pan support cushions will rub on the inside ends of the pan.

Step 13. Go to the Calibration section, page 9, and complete the full Zero and Span calibration procedure (including Setting "g" if scale location is to be elsewhere).

Attention

Do not use the scale, or return it to the customer without completing the above step, the scale will not be accurate!

Step 14. If you are working on HV-150KA1, HV-60KA1, HW-150KA1 or HW-100KA1 the assembly is finished .

If you are working on HV-60KA2, HV-30KA2, HW-60KA2, HW-30KA2, HW-15KA2, HW-10KA2, please continue to Load Cell Stopper Adjustment.

End End of load cell replacement procedure.

Load Cell Stopper Adjustment

- Please read the opening Note in the Load Cell Replacement section.

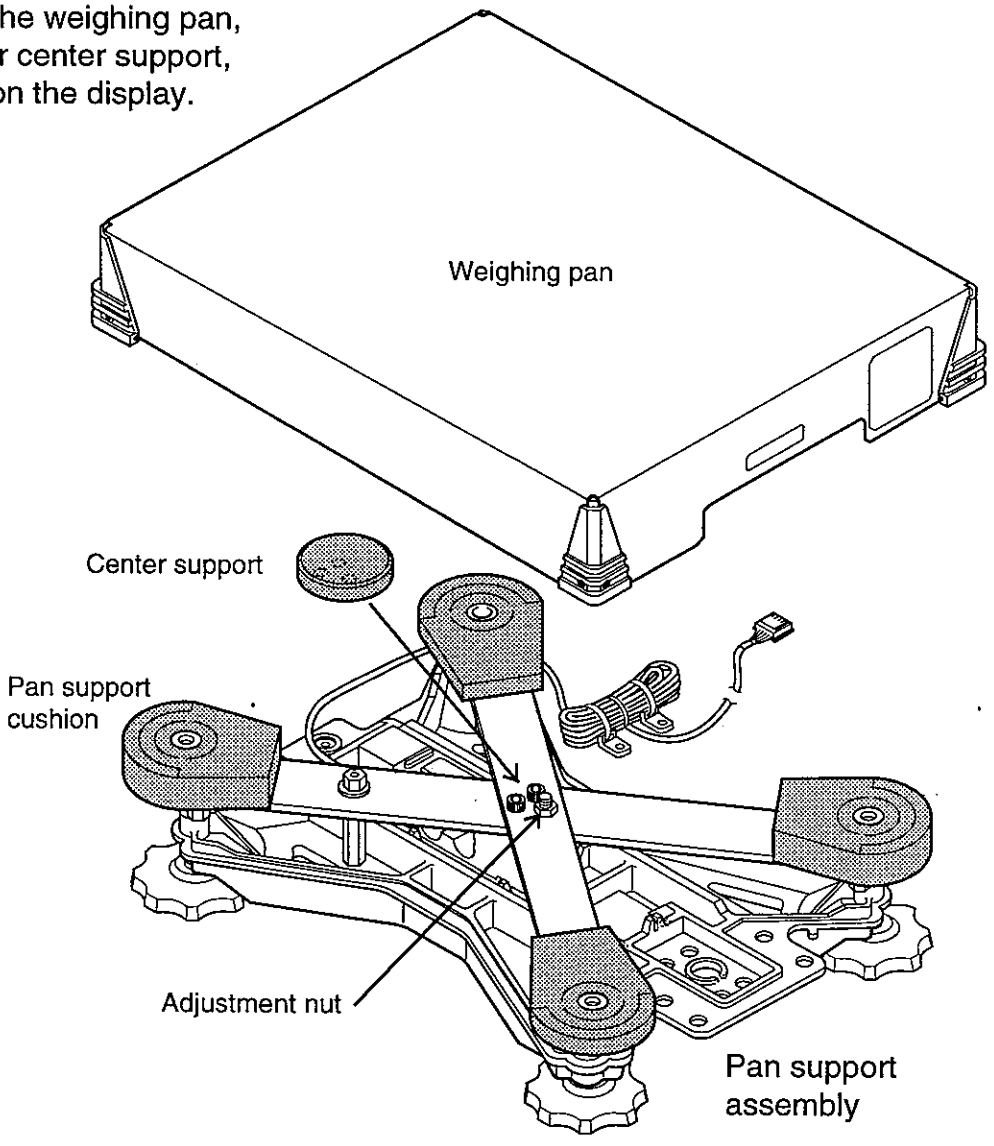
There is a bolt that runs through the load cell on the HV-KA2 and HW-KA2 weighing platforms that will hit an overload stopper plate when there is too much weight on the weighing pan. This bolt is called the stopper bolt and it is located on the pan support bar assembly. It consists of a long, thin, threaded bolt that is locked with a hex nut after it has been correctly adjusted.

You must adjust the load cell stopper bolt when the load cell has been replaced, or if there is a scale malfunction that indicates stopper misadjustment.

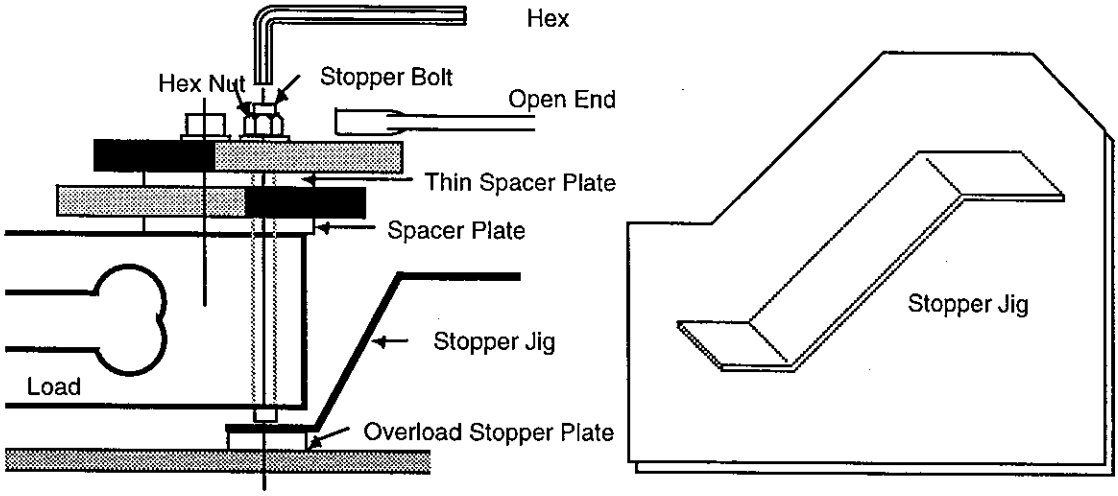
To perform this operation, you must have the correct Stopper Jig for the:

- HV/HW-60KA2 The part number is 04:A47968.
- HV/HW-30KA2 The part number is 04:A47967.
- HW-15KA2 and HW-10KA2 The part number is 04:A48757.

Step 1. Remove the weighing pan, the rubber center support, and turn on the display.



Step 2. Holding the stopper bolt with a hex wrench - loosen the hex nut holding the stopper bolt with an open end wrench. You may also want to loosen (counterclockwise) the stopper bolt a little.



Step 3. Slide the correct jig for the scale you are working on between the load cell stopper bolt and the overload stopper plate.

Step 4. Watching the display, adjust the stopper bolt with the hex wrench until –1.00 to –0.50 displayed.

Step 5. Holding the hex wrench firmly, tighten the hex nut (clockwise).

Display During the above step you will see display fluctuations, after you have tightened the hex bolt, the display readings should be between –1.00 and 0.

Step 6. Check that the display readings are in the allowable range. If not, readjust the stopper assembly again.

Step 7. Carefully remove the stopper jig.

Step 8. Replace the rubber center support, and the weighing pan.

Step 9. Go to the calibration section, and complete the full zero and span calibration procedure (including Setting "g" if scale location is to be elsewhere).

Attention

Do not use the scale, or return it to the customer without completing the above step, the scale will not be accurate without it!

End End of load cell stopper adjustment procedure.

HV Initialization & Display Check

Initialization:

The exploded view of the display and drawings of the main boards and the parts list may be helpful during disassembly and for the location of various parts.

Step 1. If the AC adapter is used, disconnect it.

Step 2. Remove the Battery Pack.

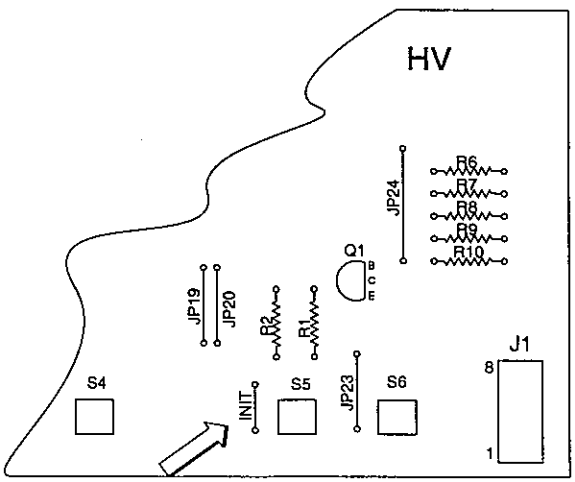
Step 3. Remove the calibration switch (panel A) and interface (panel B) covers.

Step 4. Disconnect the load cell cable.

Step 5. Remove the 4 screws that secure the front panel to the case.

Step 6. Carefully separate the front panel, and disconnect the cables.

Step 7. Locate where the jumper marked 'INIT' should be (arrow in drawing below).



Step 8. Install a jumper at this point or if the original is there, but cut, short it together.

Step 9. Reconnect the cables removed in steps 4 and 6 (it may be convenient to remove the analog board from the case).

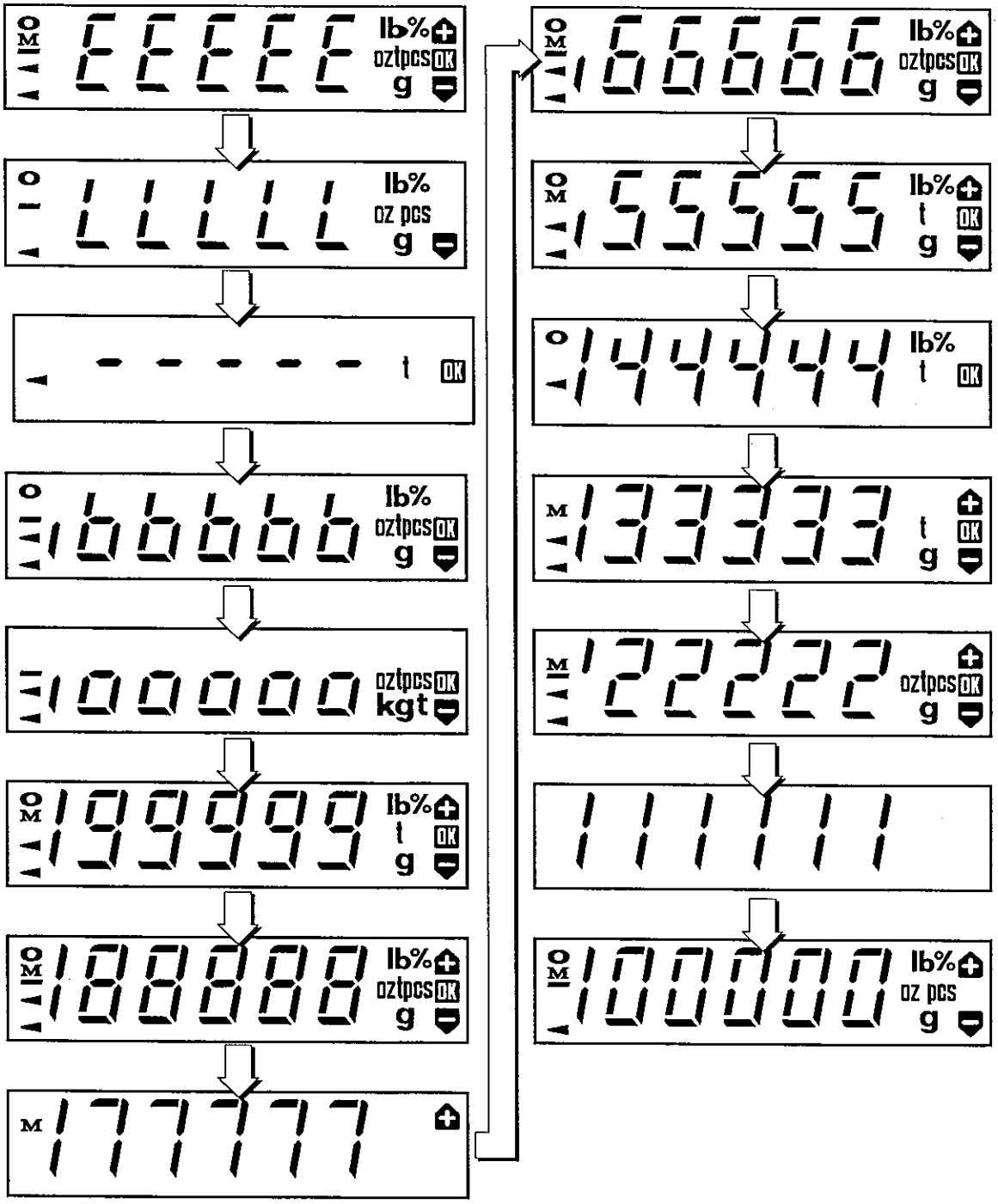
Step 10. Insert the battery or connect an AC adapter.

Step 11. With the display off, press and hold the calibration switch, then press the front panel OFF/ON key.

Step 12. After about 3 seconds the display will quickly sequence through the displays shown on the next page.

Step 13. Release the calibration switch (initialization is complete when the display starts to sequence).

Step 14. Try to note if all of the segments turn on (this is difficult as the display switches quickly).



Step 15. When the display stops at the last of the sequence, press the ON/OFF key and remove the power (battery or AC adapter)..

Step 16. Cut the jumper at 'INIT' and reassemble the display.

Step 17. This procedure resets all F-functions back to factory settings and clears all data stored in the EEPROM (including model number and calibration data).

Step 18. Set the F-functions and recalibrate the scale.

Attention

Do not use the scale, or return it to the customer without completing the above step, the scale will not work correctly without it!

End End of the initialization procedure for the HV scale.

HW Initialization & Display Check

Initialization:

The exploded view of the display and drawings of the main boards and the parts list may be helpful during disassembly and for the location of various parts.

Step 1. If the AC adapter is used, disconnect it.

Step 2. Remove the battery pack.

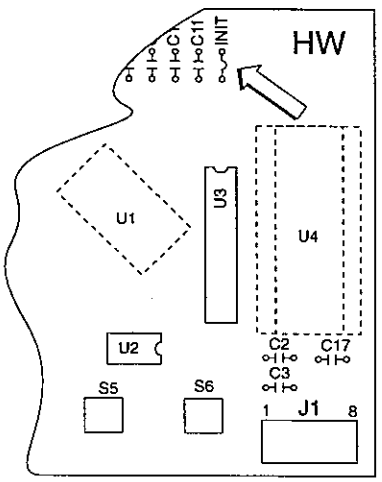
Step 3. Remove the calibration switch (panel A) and interface (panel B) covers.

Step 4. Disconnect the load cell cable.

Step 5. Remove the 4 screws that secure the front panel to the case.

Step 6. Carefully separate the front panel, and disconnect the cables.

Step 7. Locate where the jumper marked 'INIT' should be (arrow in drawing below).



Step 8. Install a jumper at this point or if the original is there, but cut, short it together.

Step 9. Reconnect the cables removed in steps 4 and 6 (it may be convenient to remove the analog board from the case).

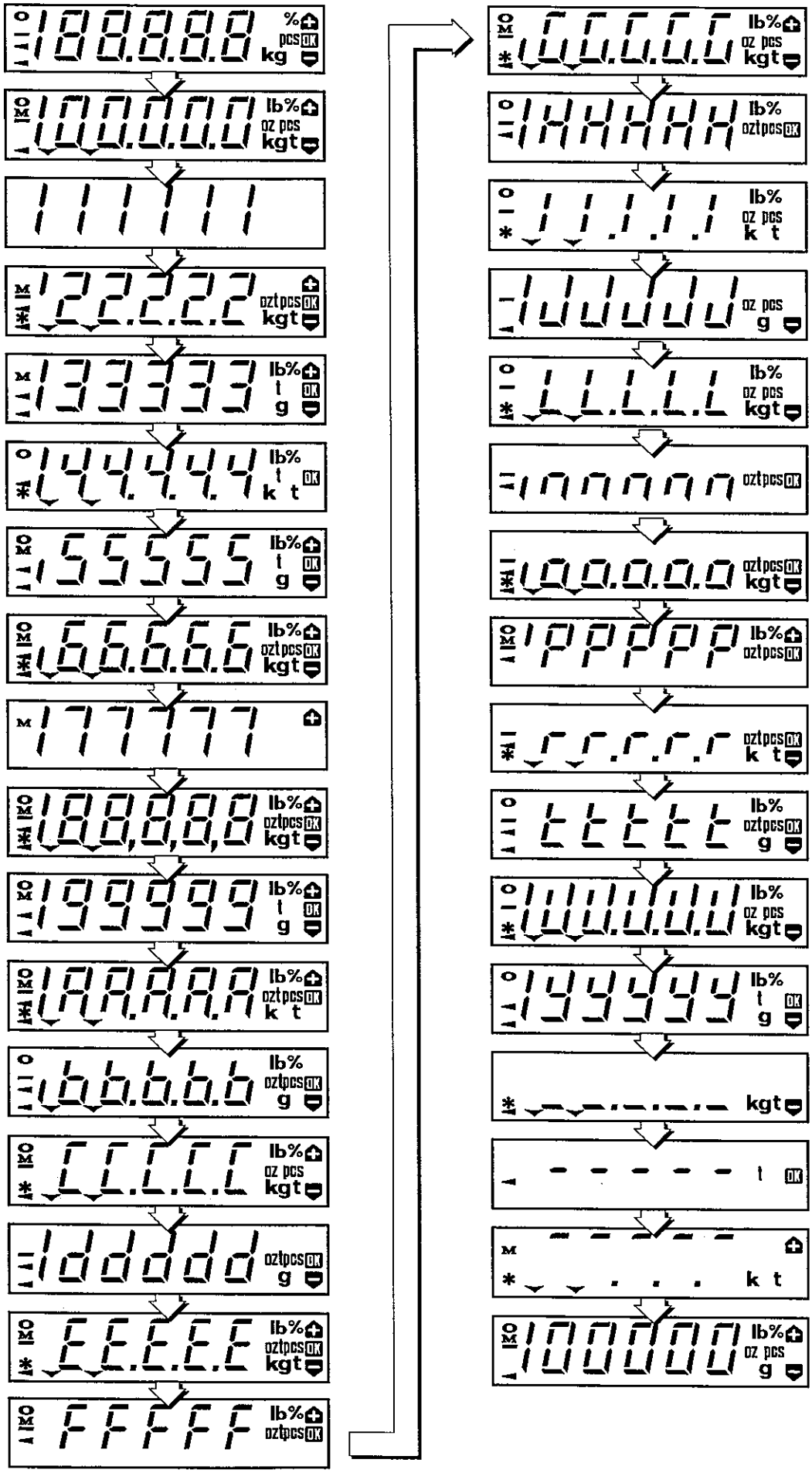
Step 10. Insert the battery or connect an AC adapter.

Step 11. With the display off, press and hold the calibration switch, then press the front panel OFF/ON key.

Step 12. After about 3 seconds the display will quickly sequence through the displays shown on the next page.

Step 13. Release the calibration switch (initialization is complete when the display starts to sequence).

Step 14. Try to note if all of the segments turn on (this is difficult as the display switches quickly).


8.8.8.8.8
%
pcs
OK
kg
0.0.0.0.0
lb%
oz pcs
kgt
1.1.1.1.1
2.2.2.2.2
oztpcs
OK
kgt
3.3.3.3.3
lb%
t
g
OK
4.4.4.4.4
lb%
t
k t
OK
5.5.5.5.5
lb%
t
g
OK
6.6.6.6.6
lb%
oztpcs
OK
kgt
7.7.7.7.7
8.8.8.8.8
lb%
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OK
g
C.C.C.C.C
lb%
oz pcs
kgt
d.d.d.d.d
oztpcs
OK
g
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OK
kgt
F.F.F.F.F
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lb%
oztpcs
OK
I.I.I.I.I
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oz pcs
g
L.L.L.L.L
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oz pcs
kgt
n.n.n.n.n
oztpcs
OK
o.o.o.o.o
oztpcs
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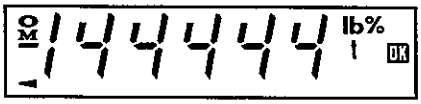
kgt
p.p.p.p.p
lb%
oztpcs
OK
r.r.r.r.r
oztpcs
OK
k t
t.t.t.t.t
lb%
oztpcs
OK
g
U.U.U.U.U
lb%
oz pcs
kgt
9.9.9.9.9
lb%
t
g
OK
kgt
t
OK
k t
0.0.0.0.0
lb%
oz pcs
g

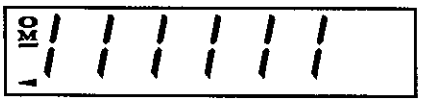
Step 15. When the display stops at the last of the sequence, press the [SET] key. The display should be:

Step 16. Press the [SAMPLE] key. The display should be:



Step 17. Press the [MODE] key. The display should be:

Step 18. Press the [ZERO] key. The display should be:



Step 19. Press the [TARE] key. The weight mode is displayed, disregard the reading.

Step 20. Press the [ON/OFF] key and remove the power (battery or AC adapter)..

Step 21. Cut the jumper at 'INIT' and reassemble the display.

Step 22. This procedure resets all F-functions back to factory settings and clears all data stored in the EEPROM (including model number and calibration data).

Step 23. Set the F-functions and recalibrate the scale.

Attention

Do not use the scale, or return it to the customer without completing the above step, the scale will not work correctly without it!

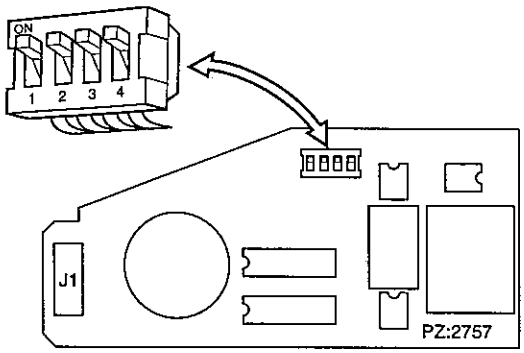
End End of the initialization procedure for the HW scale.

Option 03 Installation & Testing

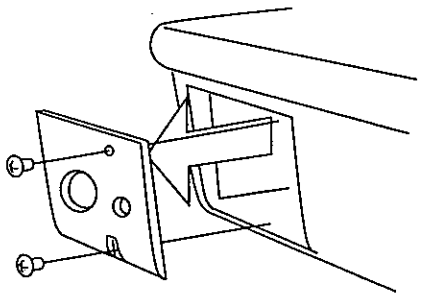
Step 1. Remove the battery pack and AC adapter (if used).

Step 2. Set the comparator dip switches.

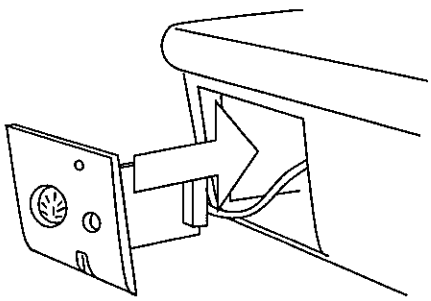
Dip switch settings		
1	OFF	Stable only, no buzzer
	ON	Normal, buzzer output
2	OFF	When minus (-), no buzzer
	ON	When minus (-), buzzer output
3	OFF	When OK, no buzzer
	ON	When OK, buzzer output
4	OFF	When plus (+), no buzzer
	ON	When plus (+), buzzer output



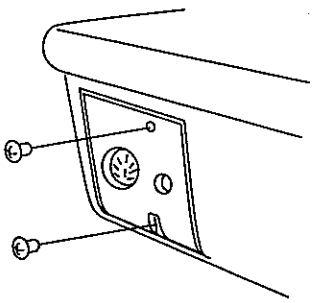
Step 3. Remove the option cover (panel A) and cut the clamp that holds the cable. Plug the cable connector into J1 on the RS-232C / comparator board.



Step 4. Insert the board into the display.



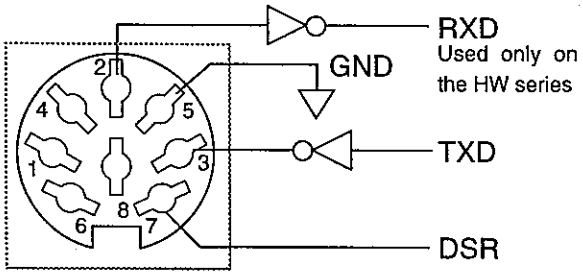
Step 5. Fasten with the screws removed in step 3.



Step 6. Re-install the battery pack or supply power using the AC adaptor.

Step 7. Connect a personal computer running a terminal emulator to the output connector of the interface. As each computer may differ in the type of terminal emulator used, settings used and responses shown may differ.

Settings:		
	Baud rate	2400bps
	Data	7 bits
	Parity	1 bit (even)
	Stop bit	1 bit
	Code	ASCII



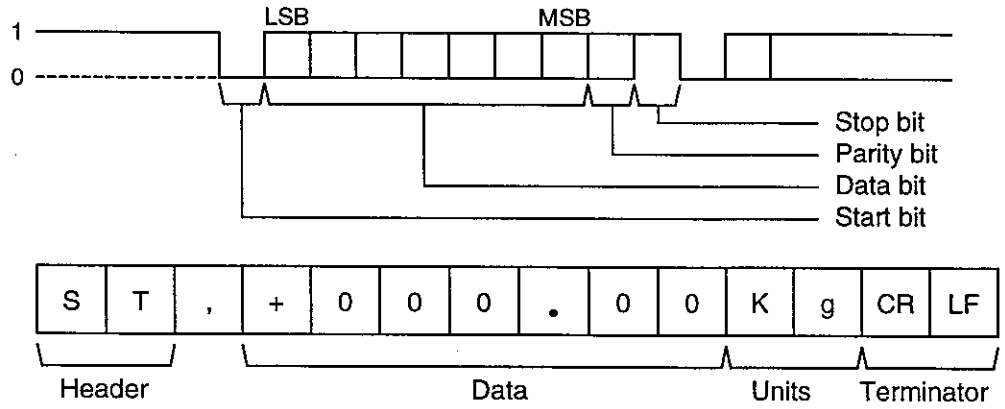
The diagram at the left of the settings shows circuitry internal to the option.

The HV series scales transmit data in the stream mode only (it will not respond to data sent to it). A printer such as the AD-8121 may be used to test the output of the RS-232C. Place the printer in mode 3 (Dump Print) so that it will print all data sent.

Note: For those that understand and can use advanced programming, the sending of data and the response by the scale can be handled automatically.

Step 8. Press the ON/OFF key on the display and wait for the instrument to stabilize.

Step 9. The HV series scale should send data as soon as it displays a weight value. The data should be continuous in the following format.



- There are the following six types of headers:

  QT In counting mode, the data is stable.
  US Data is unstable.
  OL Data is overloaded (the maximum display is exceeded)
  HI Upper limit value Only used in command mode
  LO Lower limit value

- The data consists of 7 digits including the sign and decimal point. If there is no decimal point, the data will be 6 digits long.

  When the data is overloaded, "+999.99" or "-99.999" will be output. (The position of the decimal point will be different depending on the instrument type and the displayed units.)

- There are the following types of units transmitted:

  kg Weight display mode (kg)
  lb Weight display mode (lb)
  oz Weight display mode (oz)---[HV]
  PC Counting mode
  % Percentage mode---[HW]
  Upper limit value and lower limit value---[HW]

Step 10. Receive data check for the HW series scale only. Set function F5 = 1. Place a 100kg weight on the weighing pan (HW-150KA2).

Send:
Q (RETURN) (CR,LF is sent by the terminal emulator when the 'RETURN' key is pressed)

Response:
ST,+100.00kg(CR,LF) for an HW-150KA1 that is stable.

Send:
T (RETURN)

Response:
T (CR,LF) Display should be 0.00kg.

Step 11. Remove the 100kg weight from the weighing pan.

Send:
Q (RETURN)

Response:
ST,-100.00kg(CR,LF) for an HW-150KA1 that is stable.

Send T (RETURN)

Response:
T(CR,LF) Display should be 0.00kg

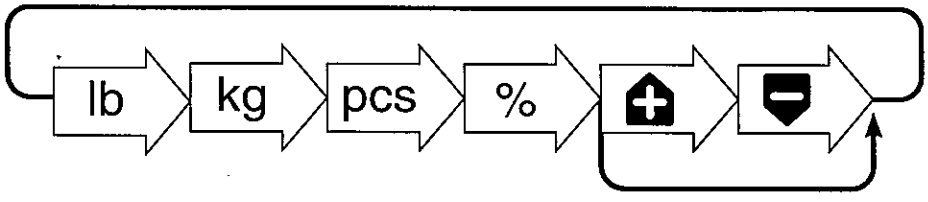
Step 12. Place a weight on the weighing platform that is slightly less than 2% of the full span value (1kg for a HW-150KA1)

Send Z (RETURN)

Response:
Z (CR,LF) Display should be 0.00kg (for a HW-150KA1)

Send:
U (RETURN)

Response:
U (CR,LF) The displayed unit of weight should shift as follows:



If the comparator function is not on, the upper limit and lower limit values will not be displayed. The lb. display is only for the U.S. specification scales.

Step 13. The diagram at the right, of the options internal circuit. It uses photo couplers, not relays. Caution must be used so that the maximum voltage and current are not exceeded. The purpose of this circuit is to drive external low voltage, low current standard or solid state relays.

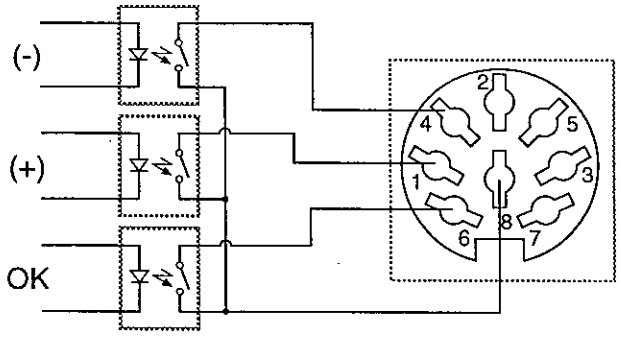
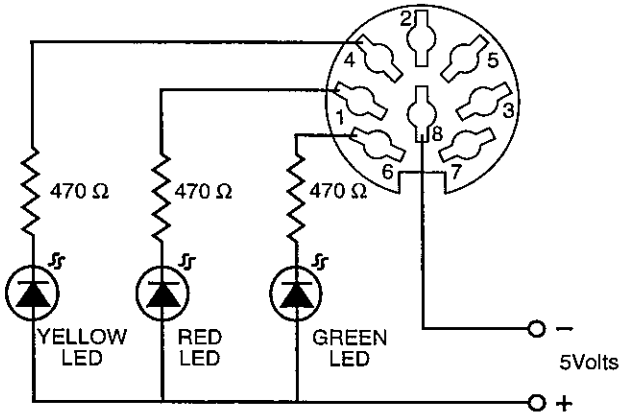


Photo couplers:
Maximum voltage, 50V
Maximum current, 100mA

Build a test unit as shown in the diagram to the right. The voltage source can be a battery or small power supply. the color of the light emitting diodes is not important, but helpful to determine which circuit is turned on. Regular low voltage incandescent lamps can be used in place of the LED and resistor combination, but do not exceed the voltage and current ratings of the photo couplers.



Step 14. Set Function F6 = 1. Set the option dip switches 1 = on, 2 = on, 3 = off, 4 = on.
Step 15. Set the comparator to a convenient value for the lower and upper limit values.

Step 16. Place enough weight on the pan to cause the display to show OK. The green (or OK) LED (or lamp) should come on. Buzzer should be off.

Step 17. Place enough weight on the pan to cause the comparator display to show +. The red (or +) LED (or lamp) should come on. Buzzer should be on.

Step 18. Remove enough weight from the pan to cause the comparator display to show –. The yellow (or -) LED (or lamp) should come on. Buzzer should be on.

Step 19. Remove all weight from the pan to cause the main display to show 0.00. The yellow (or -) LED (or lamp) should come on. Buzzer should be off.

Step 20. Set the option dip switches 1 = on, 2 = off, 3 = on, 4 = off
Step 21. Place enough weight on the pan to cause the display to show OK . The green (or OK) LED (or lamp) should come on. Buzzer should be on.

Step 22. Place enough weight on the pan to cause the comparator display to show +. The red (or +) LED (or lamp) should come on. Buzzer should be off.

Step 23. Remove enough weight from the pan to cause the comparator display to show –. The yellow (or -) LED (or lamp) should come on. Buzzer should be off.

Step 24. Remove all weight from the pan to cause the main display to show 0.00. The yellow (or -) LED (or lamp) should come on. Buzzer should be off.

End This completes the testing of the RS-232C / Comparator option.

Technical Data

PARTS LIST

7PZ:2754

CIRCUIT SYMBOL	PARTS NAME	DESCRIPTION	Q'TY
	PC:2754B	PRINTED CIRCUIT BOARD	1
C3~5,11,13,14,19,20	CC:0.1U25V	CAPACITOR 0.1μF 25V	8
C6,7	CC:0.33U50V	CAPACITOR 0.33μF 50V	2
C18	CK:SME10VB47	CAPACITOR 47μF 10V	1
C2,15,16,17	CT:1D2R2	CAPACITOR 2.2μF 20V	4
J1	JE:0486-01-010	POWER JACK	1
J3	JI:12P-S2T2-EF	CONNECTOR	1
J2	JT:171825-5	CONNECTOR	1
U2	MF:AMZ24	AD MODULE	1
Q3	QT:A1015Y	TRANSISTOR 2SA1015Y	1
Q1	QT:A1020Y	TRANSISTOR 2SA1020Y	1
Q2	QT:C1815Y	TRANSISTOR 2SC1815Y	1
R6	RC:1K	RESISTOR 1KΩ 1/4W	1
R7	RC:1.5K	RESISTOR 1.5KΩ 1/4W	1
R9	RC:10K	RESISTOR 10KΩ 1/4W	1
R5	RC:2.7K	RESISTOR 2.7KΩ 1/4W	1
R3,10	RC:22K	RESISTOR 22KΩ 1/4W	2
R4	RC:3.9K	RESISTOR 3.9KΩ 1/4W	1
R8	RC:47K	RESISTOR 47KΩ 1/4W	1
R2	RN:IHR-4-223MA	RESISTOR NETWORK 22KΩ	1
S1	SK:SKHHAK	TACT SWITCH	1
U1	UR:TA78DL05S	VOLTAGE REGULATOR	1

PARTS LIST

7PZ:2755

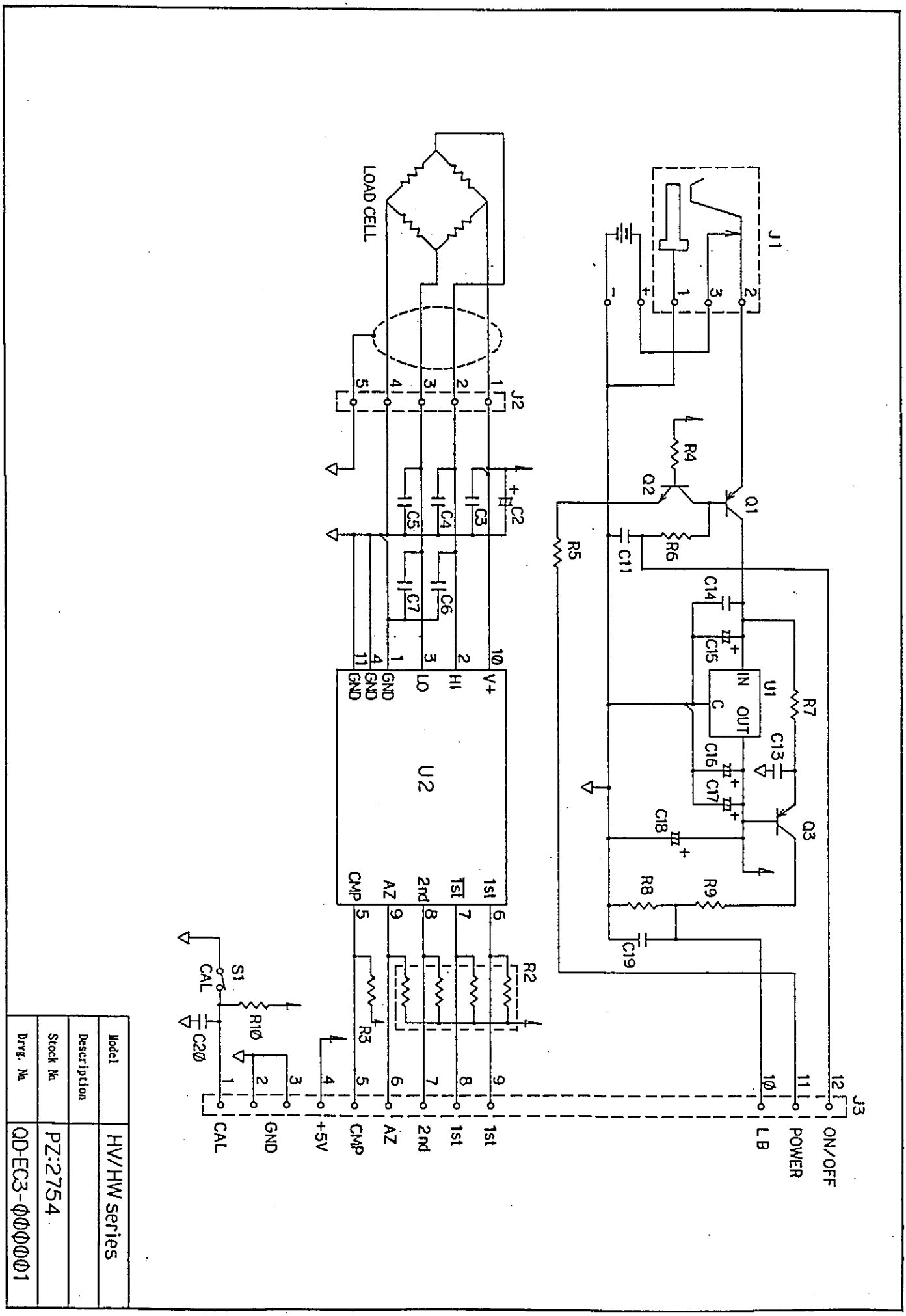
CIRCUIT SYMBOL	PARTS NAME	DESCRIPTION	Q'TY
	PC:2755A	PRINTED CIRCUIT BOARD	1
C1,5,6,7,9,10	CC:0.1U25V	CAPACITOR 0.1μF 25V	6
C11	CT:1D2R2	CAPACITOR 2.2μF 20V	1
J2	JI:12P-S2L2-EF	CONNECTOR	1
J1	JI:8P-S2L2-EF	CONNECTOR	1
Q1	QT:C1815Y	TRANSISTOR 2SC1815Y	1
R11~18	RC:1K	RESISTOR 1KΩ 1/4W	8
R3,4,5	RC:10K	RESISTOR 10KΩ 1/4W	3
R2,6~10	RC:2.2K	RESISTOR 2.2KΩ 1/4W	6
R1	RC:22K	RESISTOR 22KΩ 1/4W	1
S1~6	SK:SKHHAK	TACT SWITCH	6
U3	UA:S-8054ALB	VOLTAGE COMPARATOR	1
U1	UC:MB88543-334M	CPU	1
U2	UC:RP93C46	EEPROM	1
X1	XT:C4SA-4M-M00	OSC	1

PARTS LIST

7PZ : 2756			
CIRCUIT SYMBOL	PARTS NAME	DESCRIPTION	Q'TY
	PC : 2756A	PRINTED CIRCUIT BOARD	1
C1,3,5~14,16~22,24	CC : 0.1U25V	CAPACITOR 0.1μF 25V	20
C25,26	CC : 10P	CAPACITOR 10pF	2
C2,15	CT : 1D2R2	CAPACITOR 2.2μF 20V	2
J2	JI : 12P-S2L2-EF	CONNECTOR	1
J1	JI : 8P-S2L2-EF	CONNECTOR	1
U4	JS : 10328-01-445	IC SOCKET (EPROM)	1
Q1	QT : C1815Y	TRANSISTOR 2SC1815Y	1
R7,8,9	RC : 10K	RESISTOR 10KΩ 1/4W	3
R2	RC : 2.2K	RESISTOR 2.2KΩ 1/4W	1
R3,4,6,11,12,14,15	RC : 22K	RESISTOR 22KΩ 1/4W	7
R13	RC : 47K	RESISTOR 47KΩ 1/4W	1
R5	RM : 261KF	RESISTOR 261KΩF	1
R1	RN : IHR-8-223MA	RESISTOR NETWORK 22KΩ	1
S1~6	SK : SKHHAK	TACT SWITCH	6
U6	UA : MB3771	VOLTAGE COMPARATOR	1
U1	UC : D78C10G-1B	CPU	1
U3	UC : HC573	HCMOS IC	1
U2	UC : RP93C46	EEPROM	1
U5	UC : 7225G00	LCD DRIVER	1
X1	XT : C4SB-12M-K02	OSC	1

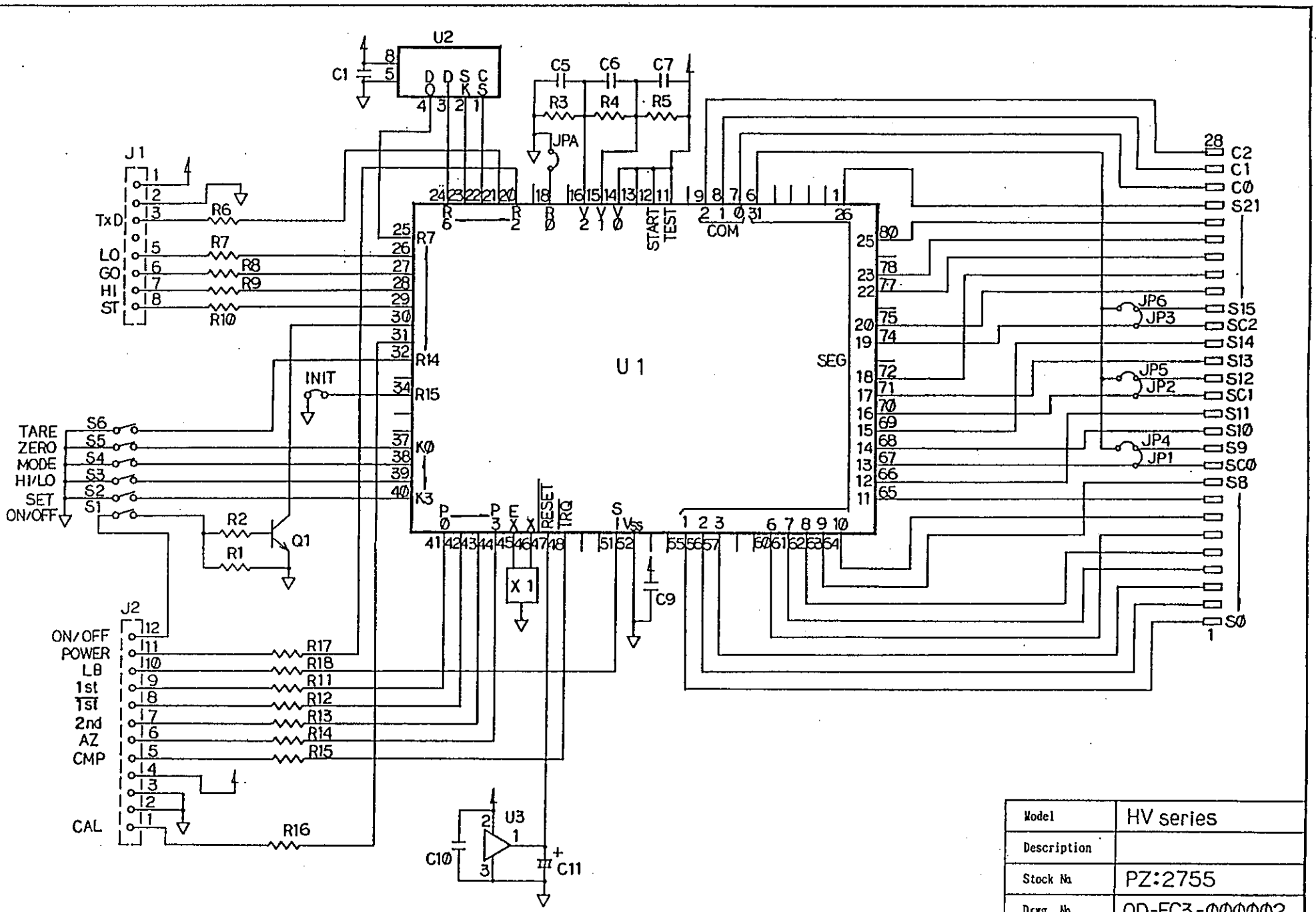
PARTS LIST

7PZ:2757			
CIRCUIT SYMBOL	PARTS NAME	DESCRIPTION	Q'TY
	PC:2757A	PRINTED CIRCUIT BOARD	1
C1,3,8,9,10	CC:0.1U	CAPACITOR 0.1μF 25V	5
C2,4,5,6,7	CK:SME25VB22	CAPACITOR 22μF 25V	5
PHC1,2,3	DF:A0V253	PHOTO MOS RELAY	3
D1,2,3	DI:1S1588	DIODE	3
BZ	ET:20Z-32C-5V-N	BUZZER	1
J2	JA:TCS5380	CONNECTOR DIN8P	1
J1	JI:8P-S2L2-EF	CONNECTOR	1
NF1	NF:D-42C	NOISE FILTER	1
R5,6,7	RC:1.5K	RESISTOR 1.5KΩ 1/4W	3
R4	RC:22K	RESISTOR 22KΩ 1/4W	1
R2	RC:3.3K	RESISTOR 3.3KΩ 1/4W	1
S1	SD:KSD04	DIP SWITCH	1
U2	UC:HC367	HCMOS IC	1
U1	UC:MAX232CPE	RS232C	1
	07:B30622-2	PANNEL	1

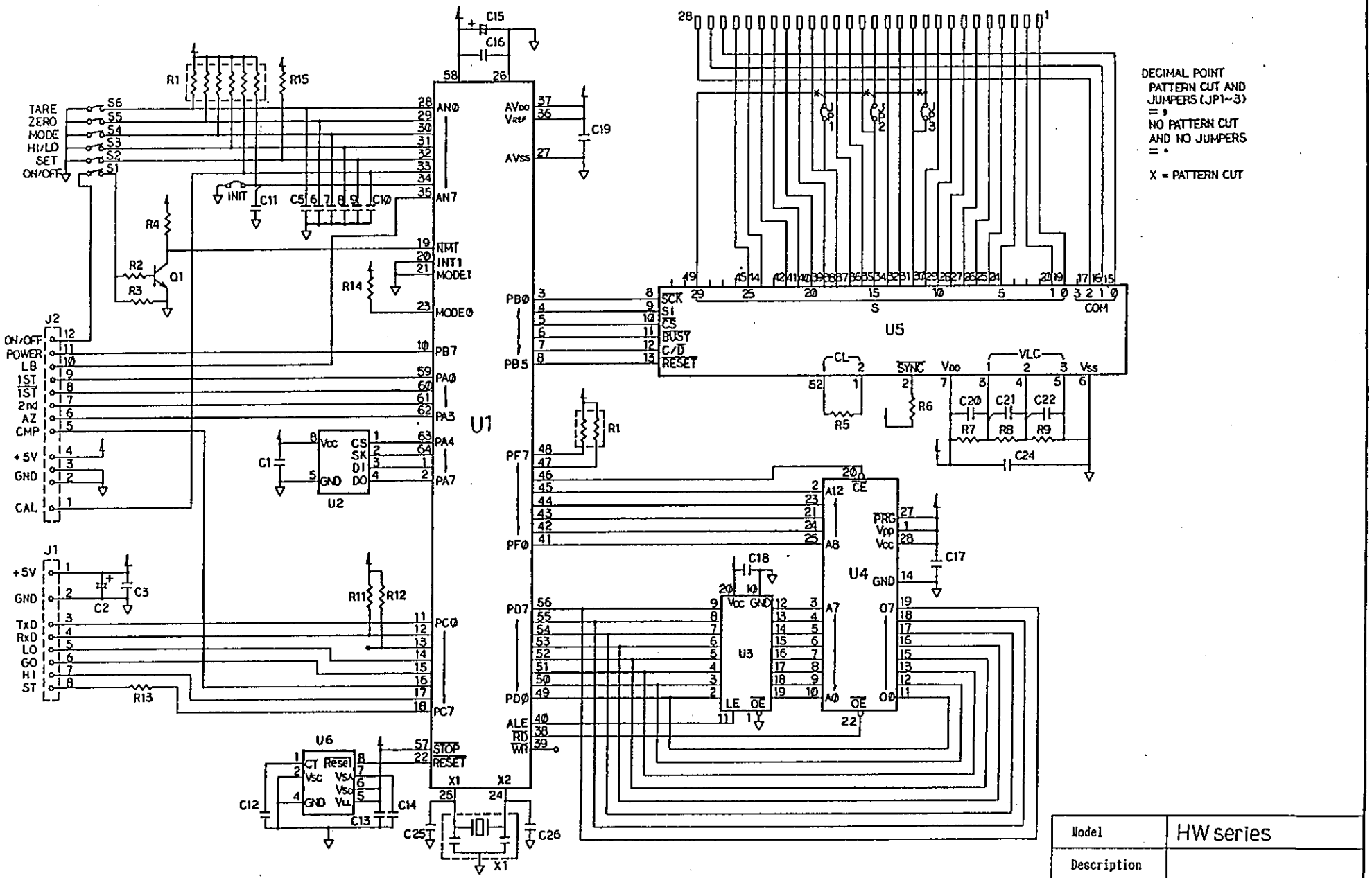


Model	HV/HW series
Description	
Stock No.	PZ:2754
Drwg. No.	QD-EC3-ΦΦΦΦ01

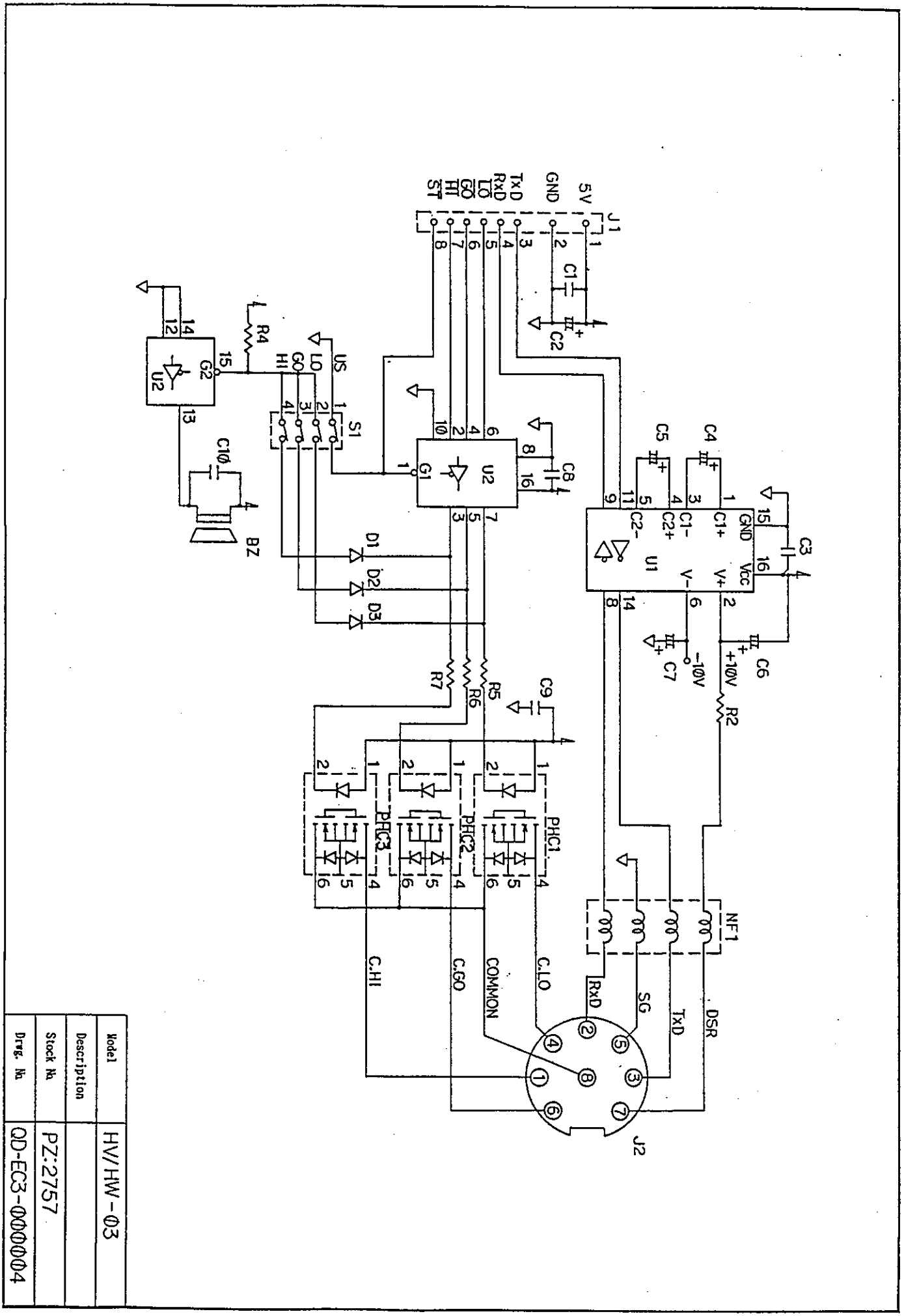
A&D CO., LTD.



Model	HV series
Description	
Stock No.	PZ:2755
Drwg. No.	QD-EC3-000002

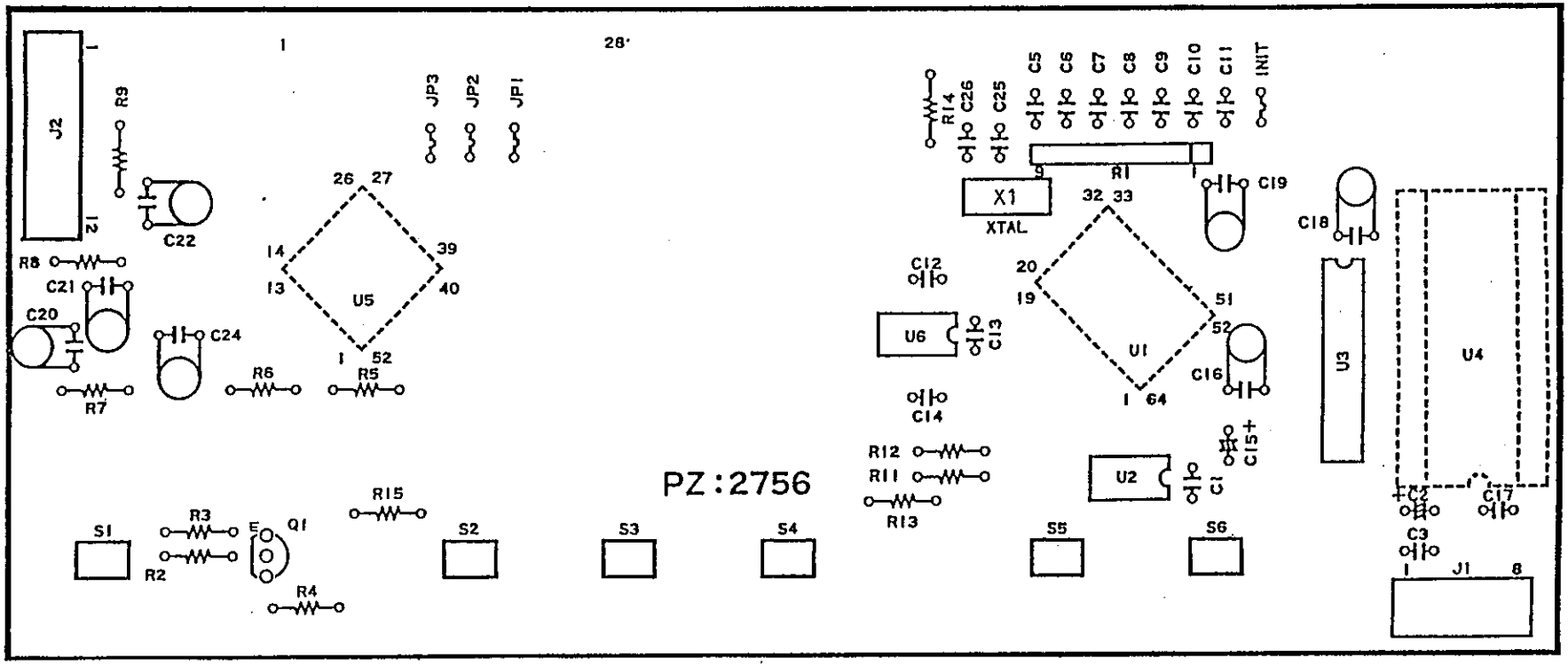


Model	HW series
Description	
Stock No.	PZ:2756
Drwg. No.	QD-EC3-000003

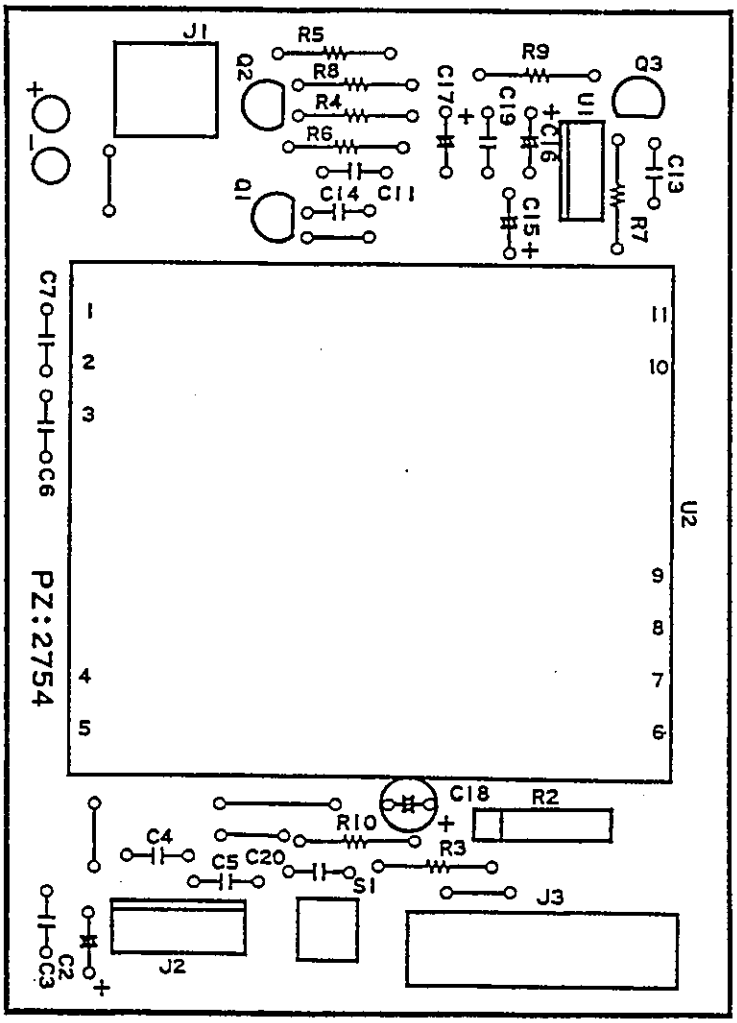


Model	HV/HW-03
Description	
Stock No.	PZ:2757
Drwg. No.	QD-EC3-00004

A&D CO., LTD.

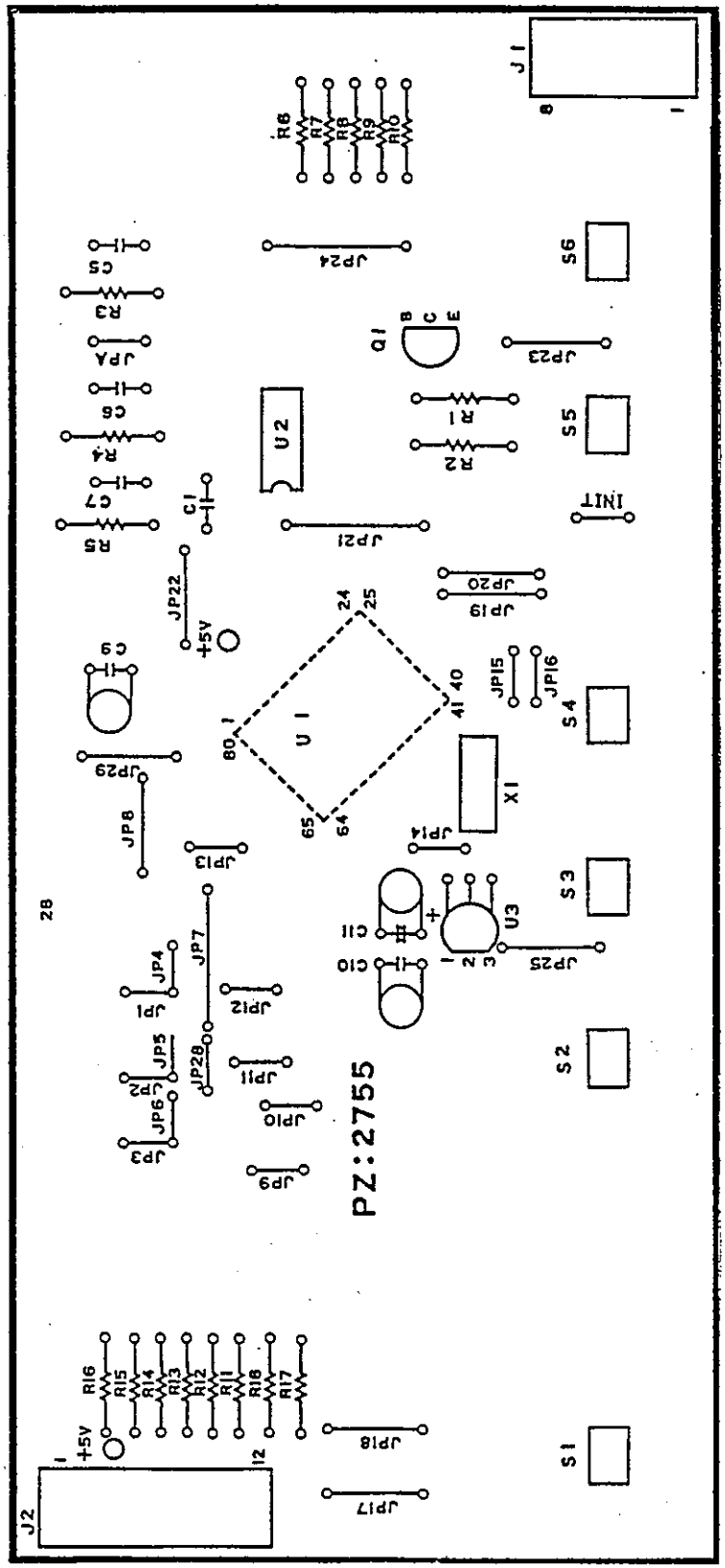


Model	HW series
Description	
Stock No.	PZ:2756
Drwg. No.	



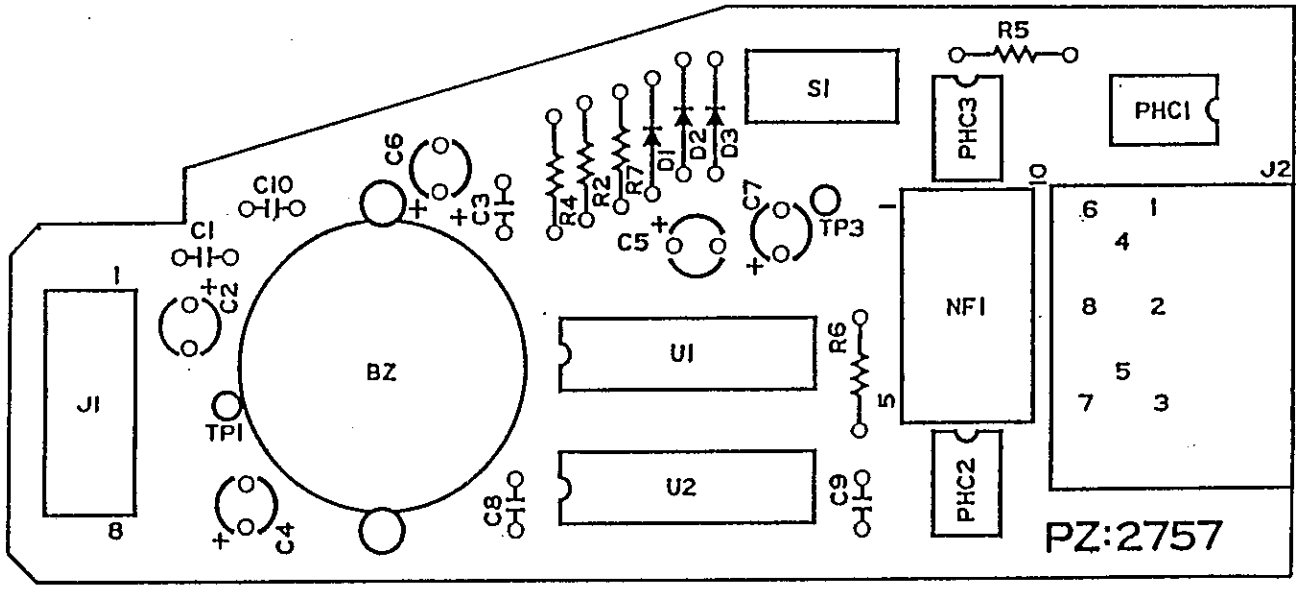
Model	HV/HW
Description	
Stock No.	PZ:2754
Drrg. No.	

A&D CO., LTD.

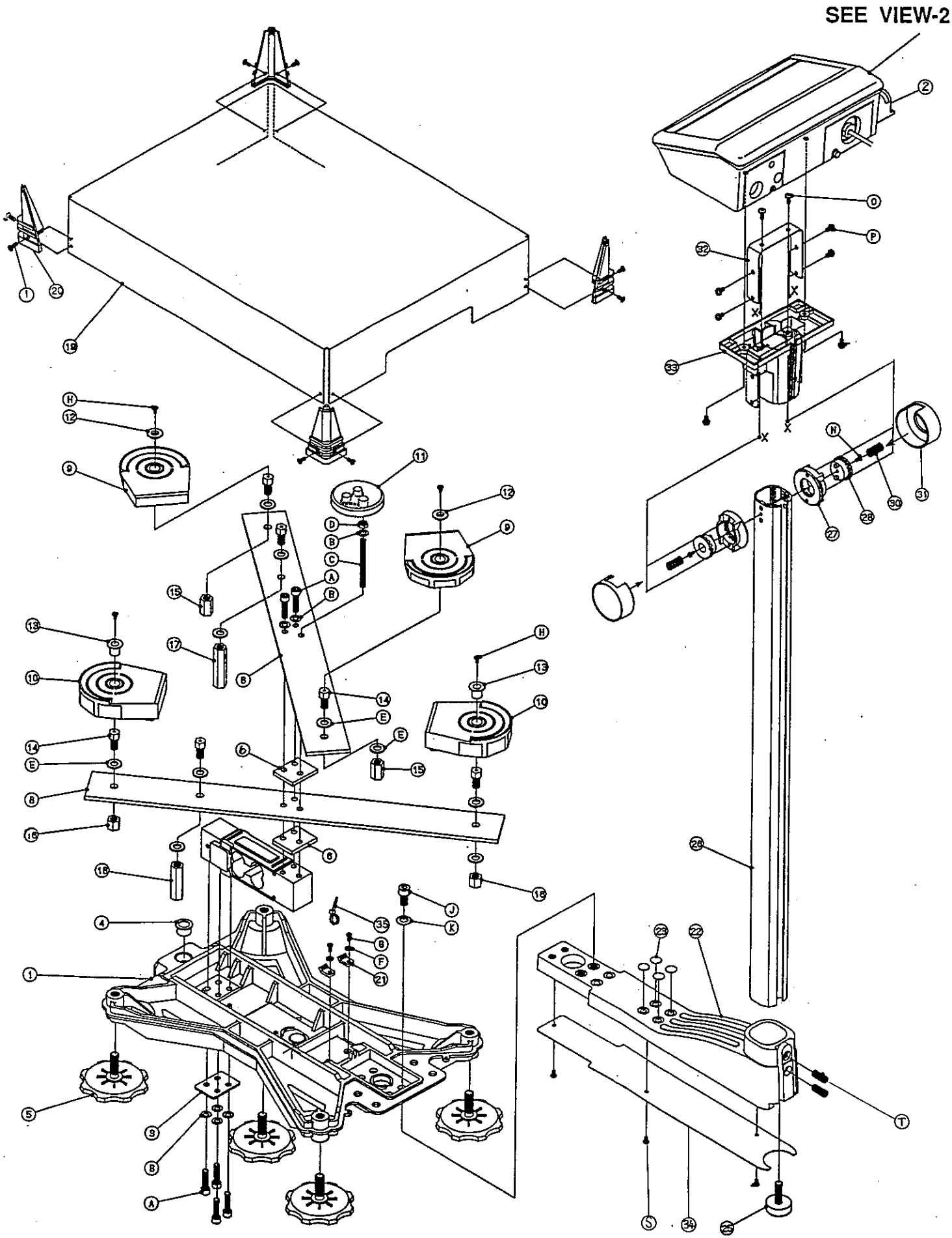


Model	HV series
Description	
Stock No.	PZ:2755
Drwg. No.	

A&D CO., LTD.



Model	HV/HW-03
Description	
Stock No.	PZ:2757
Drwg. No.	

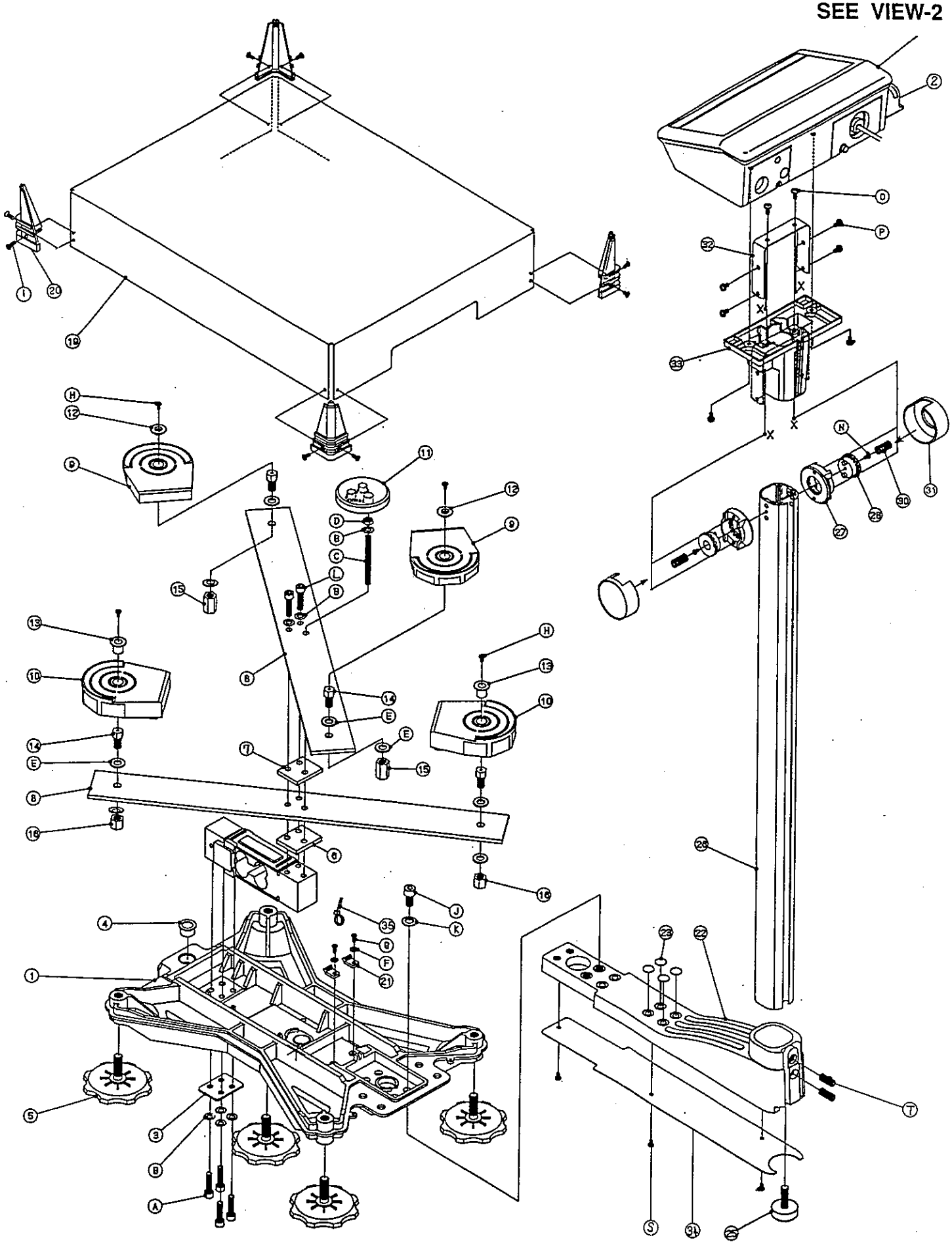


EXPLODED VIEW-1
HW-10KA2/15KA2

HW－10KA2／15KA2

NO.	PARTS NAME	DESCRIPTION
01	03:A10076A	BASE
02	10:DH-26-1 AD	BATTERY CASE
03	04:A47453-3	LOAD CELL BRANCKET
04	10:13C	LEVEL VIAL HOLDER
05	07:A33688D	FOOT
06	04:A46971-6	SPACER PLATE
07		
08	02:A34581-3	SUSBAR
09	06:A33710-1A	CUSHION THIN
10	06:A33710-2A	CUSHION THICK
11	06:A47308	CENTER SUPPORT
12	05:B43628-2	CUSHION RETAINER SHORT
13	05:B43628-1	CUSHION RETAINER LONG
14	05:B43629-2	BOLT
15	05:A47664-2	STOPPER
16	05:A47664-1	STOPPER
17	05:A47664-6	STOPPER
18	05:A47664-5	STOPPER
19	04:B31869-1	WEIGHING PAN
20	07:A34010	CORNER PIECE
21	10:KB-07	BAND STOPPER
22	03:A10215-2	LOWER POLE SUPPORT
23	07:C40527	SCREW COVER
24		
25	10:H71F27-SUS	FOOT
26	05:C43563	POLE
27	03:C43481	BRACKET LOCK
28	03:C43482	BRACKET LOCK
29		
30	05:A46051	SPRING
31	05:A46051	CAP
32	04:A47309B	LOCK SPRING PLATE
33	07:A21456	TILT BRACKET
34	04:40584	LOWER COVER
35	PLT 1.5T	TIE BAND
A		HEXAGON BOLT M6×25
B		WASHER M6
C		HEXAGON BOLT M6×65
D		NAT M6
E		WASHER M8
F		WASHER M3
G		PAN HEAD TAPPING SCREW M3×8
H		BAINDING HEAD M3×6
I		FLAT HEAD M3×8
J		HEXAGON BOLT M8×15
K		SPRING WASHER M8
L		
M		
N		S TYTE M3×6
O		BAINDING HEAD TAPPING SCREW M4×10
P		PAN HEAD WITH WASHER AND SPRING WASHER M4×8
Q		
R		
S		PAN HEAD WITH WASHER AND SPRING WASHER M3×6
T		HEXAGON BOLT M8×20

SEE VIEW-2

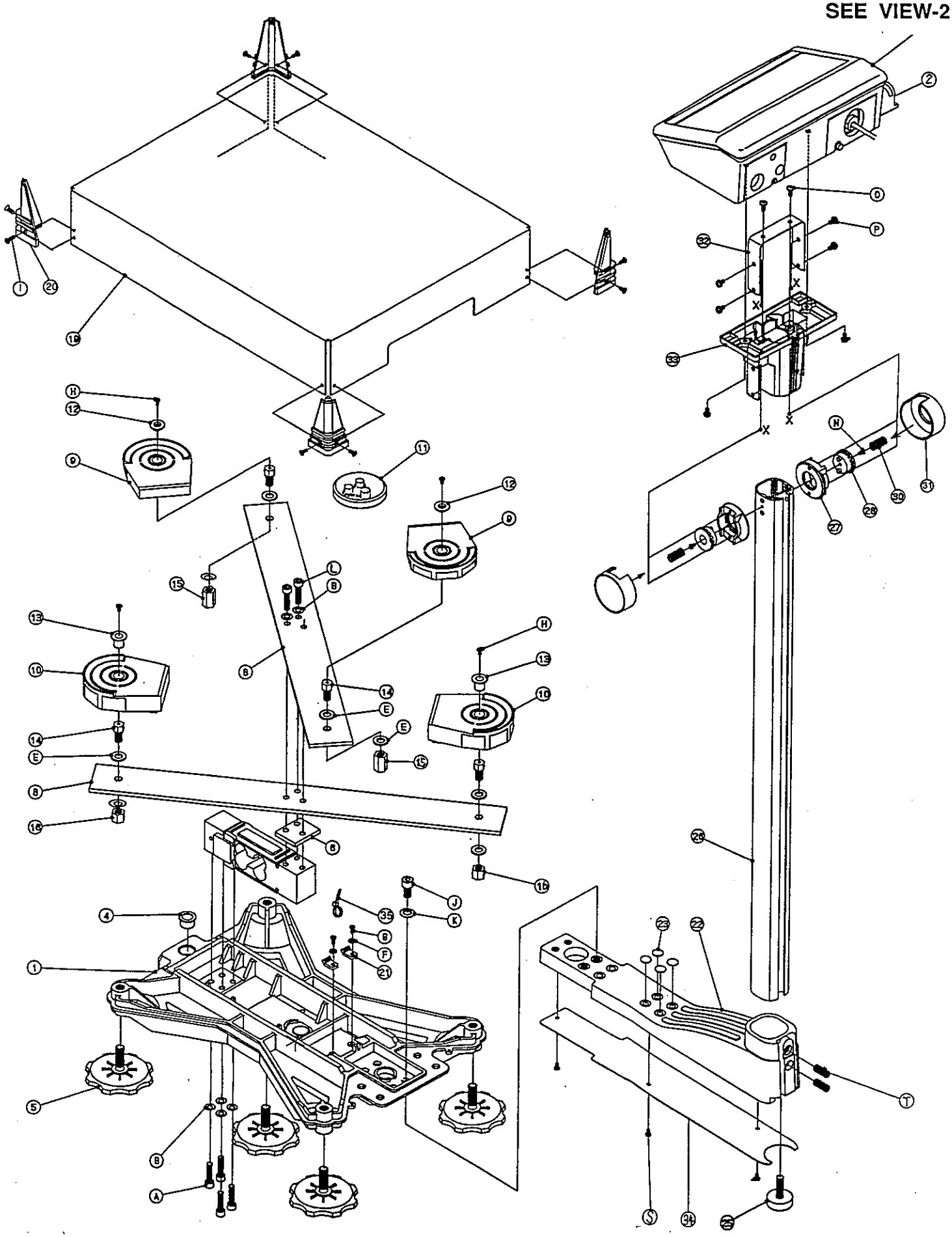


EXPLODED VIEW-1
HV-30KA2/HW-30KA2

HV－30KA2／HW－30KA2

NO.	PARTS NAME	DESCRIPTION
01	03:A10076A	BASE
02	10:DH-26-1 AD	BATTERY CASE
03	04:A47453-3	LOAD CELL SUPPORT
04	10:13C	LEVEL VIAL HOLDER
05	07:A33688D	FOOT
06	04:A46971-6	SPACER PLATE
07	04:A46971-7	SPACER PLATE
08	02:A34581-3	SUSBAR
09	06:A33710-1A	CUSHION THIN
10	06:A33710-2A	CUSHION THICK
11	06:A47308	CENTER SUPPORT
12	05:B43628-2	CUSHION RETAINER SHORT
13	05:B43628-1	CUSHOIN RETAINER LONG
14	05:B43629-1	BOLT
15	05:A47664-2	STOPPER
16	05:A47664-1	STOPPER
17		
18		
19	04:B31869-1	WEIGHING PAN
20	07:A34010	CORNER PIECE
21	10:KB-07	BAND STOPPER
22	03:A10215	LOWER POLE SUPPORT
23	07:C40527	SCREW COVER
24		
25	10:H71F27-SUS	FOOT
26	05:C43563	POLE
27	03:C43481	BRACKET LOCK
28	03:C43482	BRACKET LOCK
29		
30	05:A46051	SPRING
31	10:A46050-2	CAP
32	04:A47309B	LOCK SPRING PLATE
33	07:A21456	TILT BRACKET
34	04:40584	LOWER COVER
35	PLT 1.5T	TIE BAND
A		HEXAGON BOLT M6×25
B		WASHER M6
C		HEXAGON BOLT M6×65
D		NAT M6
E		WASHER M8
F		WASHER M3
G		PAN HEAD TAPPING SCREW M3×8
H		BAINDING HEAD M3×6
I		FLAT HEAD M3×8
J		HEXAGON BOLT M8×15
K		SPRING WASHER M8
L		HEXAGON BOLT M6×30
M		
N		S TYTE M3×6
O		BAINDING HEAD TAPPING SCREW M4×10
P		PAN HEAD WITH WASHER AND SPRING WASHER M4×8
Q		
R		
S		PAN HEAD WITH WASHER AND SPRING WASHER M3×6
T		HEXAGON BOLT M4×20

SEE VIEW-2

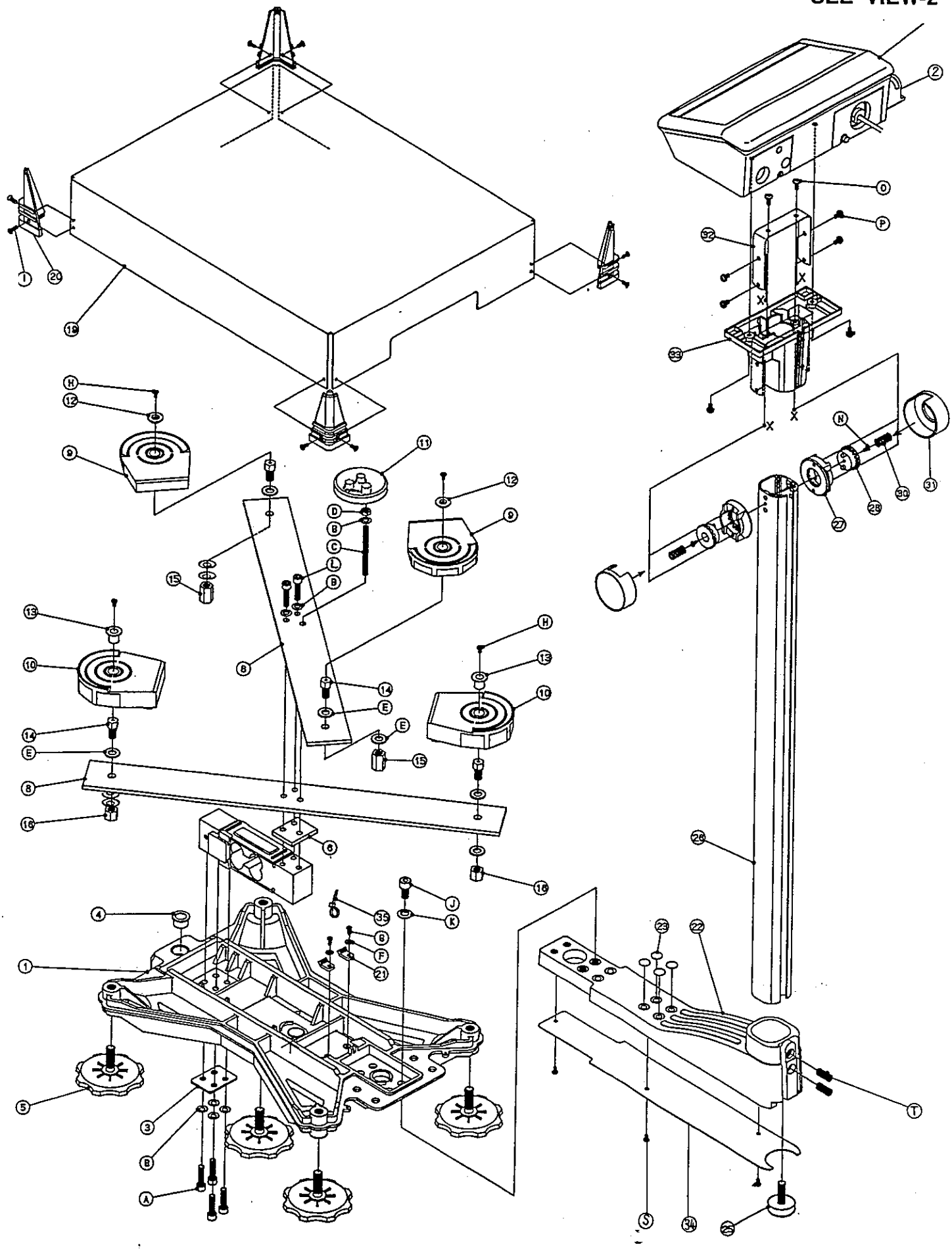


EXPLODED VIEW-1
HV-60KA1

HV－60KA1

NO.	PARTS NAME	DESCRIPTION
01	03:A20564B	BASE
02	10:DH-26-1 AD	BATTERY CASE
03		
04	10:13C	LEVEL VIAL HOLDER
05	07:A33688D	FOOT
06	04:A47950	SPACER PLATE
07		
08	02:A33529-5D	SUSBAR
09	06:A33710-1A	CUSHION THIN
10	06:A33710-2A	CUSHION THICK
11	06:A46166C	CENTER SUPPORT
12	05:B43628-2	CUSHION RETAINER SHORT
13	05:B43628-1	CUSHION RETAINER LONG
14	05:B43629-1	BOLT
15	05:A47664-4	STOPPER
16	05:A47664-3	STOPPER
17		
18		
19	04:B31868-1	WEIGHING PAN
20	07:A34026A	CORNER PIECE
21	10:KB-07	BAND STOPPER
22	03:A10215	LOWER POLE SUPPORT
23	07:C40527	SCREW COVER
24		
25	10:H71F27-SUS	FOOT
26	05:C43563	POLE
27	03:C43481	BRACKET LOCK
28	03:C43482	BRACKET LOCK
29		
30	05:A46051	SPRING
31	10:A46050-2	CAP
32	04:A47309B	LOCK SPRING PLATE
33	07:A21456	TILT BRACKET
34	04:40584	LOWER COVER
35	PLT 1.5T	TIE BAND
A		HEXAGON BOLT M8×35
B		WASHER M8
C		
D		
E		WASHER M8
F		WASHER M3
G		PAN HEAD TAPPING SCREW M3×8
H		BAINDING HEAD M3×6
I		FLAT HEAD M3×8
J		HEXAGON BOLT M8×15
K		SPRING WASHER M8
L		HEXAGON BOLT M8×40
M		
N		S TYTE M3×6
O		BAINDING HEAD TAPPING SCREW M4×10
P		PAN HEAD WITH WASHER AND SPRING WASHER M4×8
Q		
R		
S		PAN HEAD WITH WASHER AND SPRING WASHER M3×6
T		HEXAGON BOLT M8×20

SEE VIEW-2

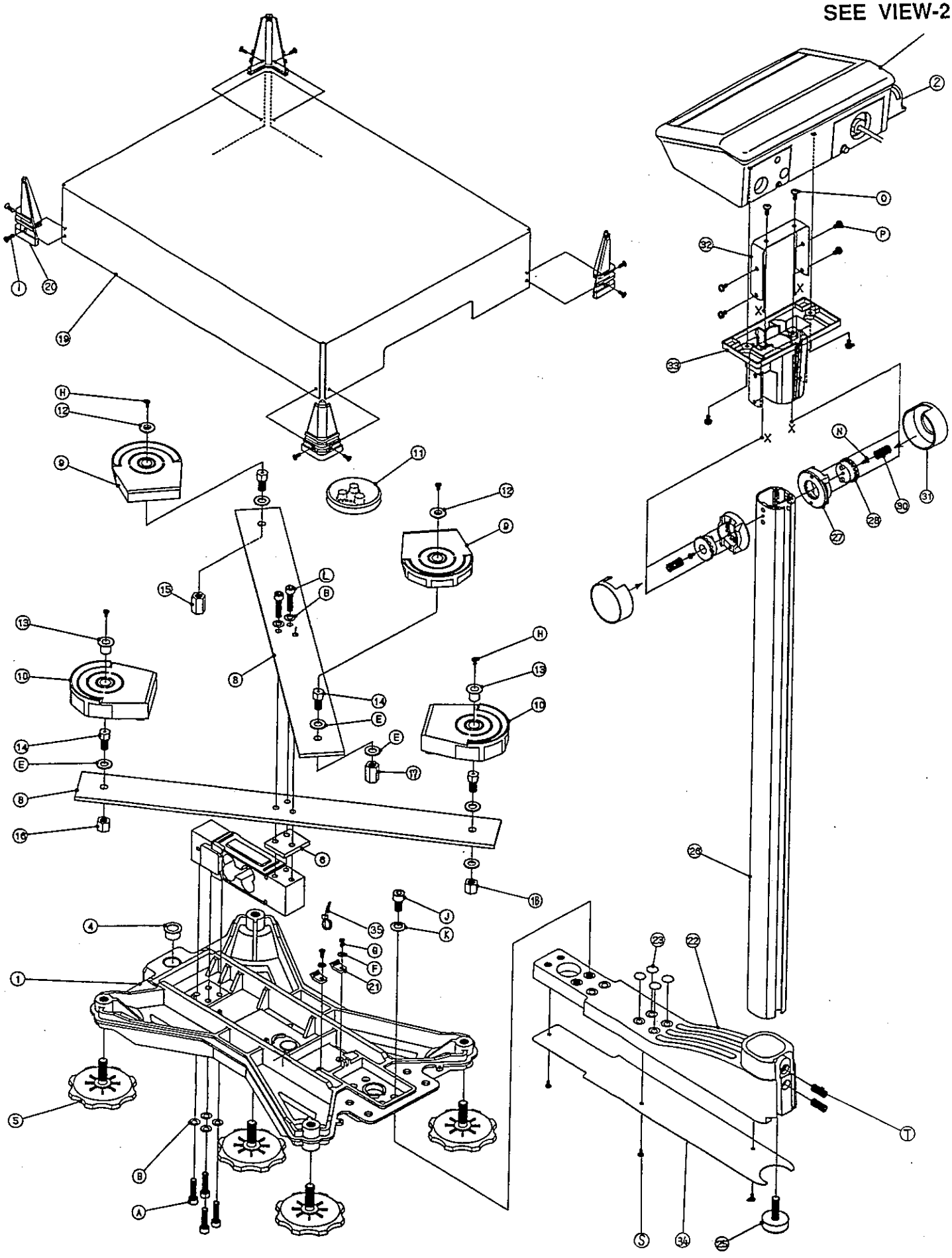


EXPLODED VIEW-1
HV-60KA2/HW-60KA2

HV－60KA2／HW－60KA2

NO.	PARTS NAME	DESCRIPTION
01	03:A10076A	BASE
02	10:DH-26-1 AD	BATTERY CASE
03	04:A47453-3	LOAD CELL SUPPORT
04	10:13C	LEVEL VIAL HOLDER
05	07:A33688D	FOOT
06	04:A46971-1A	SPACER PLATE
07		
08	02:A34032-8	SUSBAR
09	06:A33710-1A	CUSHION THIN
10	06:A33710-2A	CUSHION THICK
11	06:A47308	CENTER SUPPORT
12	05:B43628-2	CUSHION RETAINER SHORT
13	05:B43628-1	CUSHION RETAINER LONG
14	05:B43629-1	BOLT
15	05:A47664-2	STOPPER
16	05:A47664-1	STOPPER
17		
18		
19	04:B31869-1	WEIGHING PAN
20	07:A34010	CORNER PIECE
21	10:KB-07	BAND STOPPER
22	03:A10215	LOWER POLE SUPPORT
23	07:C40527	SCREW COVER
24		
25	10:H71F27-SUS	FOOT
26	05:C43563	POLE
27	03:C43481	BRACKET LOCK
28	03:C43482	BRACKET LOCK
29		
30	05:A46051	SPRING
31	10:A46050-2	CAP
32	04:A47309B	LOCK SPRING PLATE
33	07:A21456	TILT BRACKET
34	04:40584	LOWER COVER
35	PLT 1.5T	TIE BAND
A		HEXAGON BOLT M6×25
B		WASHER M6
C		HEXAGON BOLT M6×70
D		NAT M6
E		WASHER M8
F		WASHER M3
G		PAN HEAD TAPPING SCREW M3×8
H		BAINDING HEAD M3×6
I		FLAT HEAD M3×8
J		HEXAGON BOLT M8×15
K		SPRING WASHER M8
L		HEXAGON BOLT M6×35
M		
N		S TYTE M3×6
O		BAINDING HEAD TAPPING SCREW M4×10
P		PAN HEAD WITH WASHER AND SPRING WASHER M4×8
Q		
R		
S		PAN HEAD WITH WASHER AND SPRING WASHER M3×6
T		HEXAGON BOLT M8×20

SEE VIEW-2

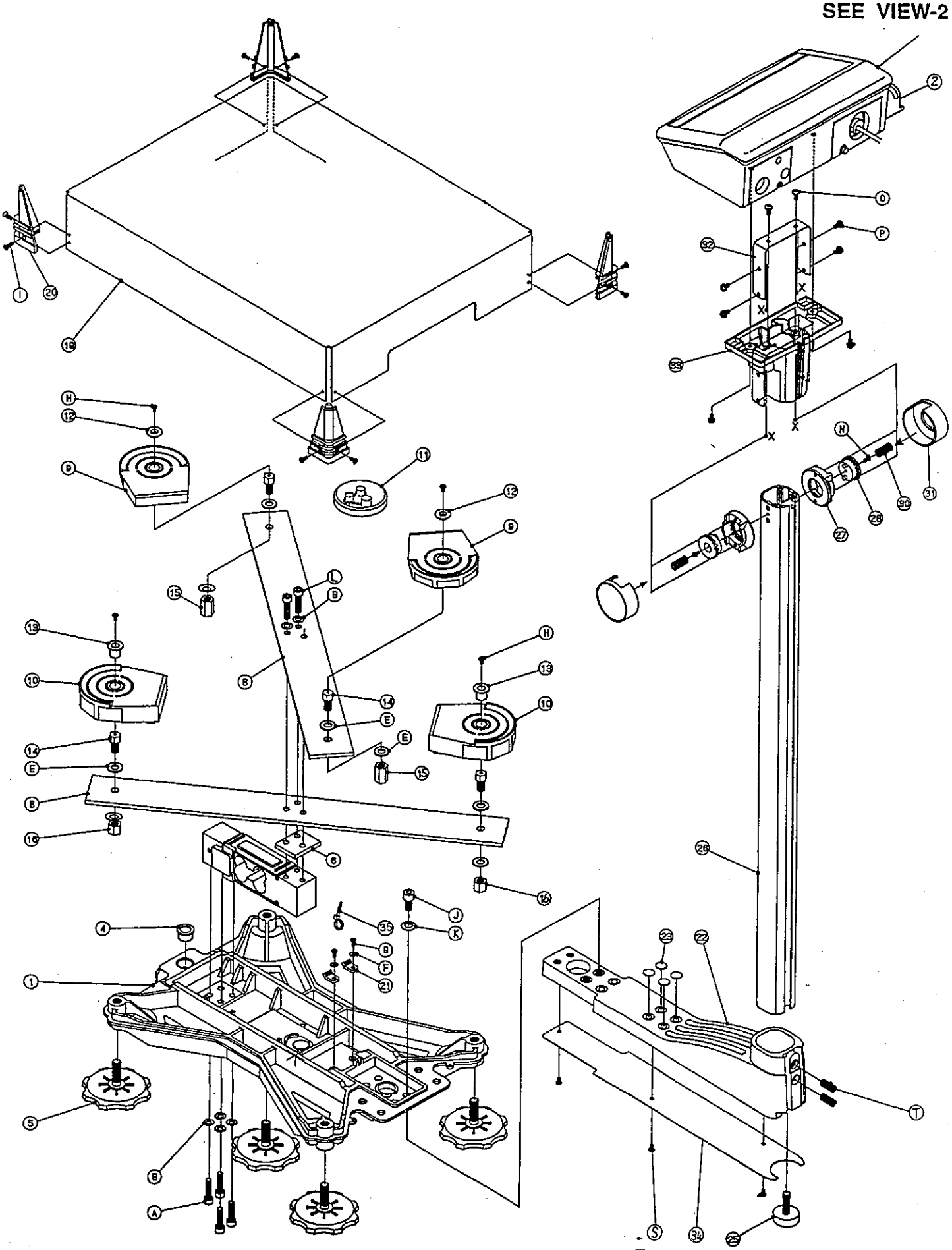


EXPLODED VIEW-1
HW-100KA1

HW—100KA1

NO.	PARTS NAME	DESCRIPTION
01	03:A20564B	BASE
02	10:DH-26-1 AD	BATTERY CASE
03		
04	10:13C	LEVEL VIAL HOLDER
05	07:A33688D	FOOT
06	04:A47950	SPACERE PLATE
07		
08	02:A33529-5D	SUSBAR
09	06:A33710-1A	CUSHION THIN
10	06:A33710-2A	CUSHION THICK
11	06:A46166C	CENTER SUPPORT
12	05:B43628-2	CUSHION RETAINER SHORT
13	05:B43628-1	CUSHION RETAINER LONG
14	05:B43629-1	BOLT
15	05:A47664-4	STOPPER
16	05:A47664-3	STOPPER
17	05:A47664-2	STOPPER
18	05:A47664-1	STOPPER
19	04:B31868-1	WEIGHING PAN
20	07:A34026A	CORNER PIECE
21	10:KB-07	BAND STOPPER
22	03:A10215	LOWER POLE SUPPORT
23	07:C40527	SCREW COVER
24		
25	10:H71F27-SUS	FOOT
26	05:C43563	POLE
27	03:C43481	BRACKET LOCK
28	03:C43482	BRACKET LOCK
29		
30	05:A46051	SPRING
31	05:A46051	CAP
32	04:A47309B	LOCK SPRING PLATE
33	07:A21456	TILTCKET
34	04:40584	LOWER COVER
35	PLT 1.5T	TIE BAND
A		HEXAGON BOLT M8×35
B		WASHER M8
C		
D		
E		WASHER M8
F		WASHER M3
G		PAN HEAD TAPPING SCREW M3×8
H		BAINDING HEAD M3×6
I		FLAT HEAD M3×8
J		HEXAGON BOLT M8×15
K		SPRING WASHER M8
L		HEXAGON BOLT M8×40
M		
N		S TYTE M3×6
O		BAINDING HEAD TAPPING SCREW M4×10
P		PAN HEAD WITH WASHER AND SPRING WASHER M4×8
Q		
R		
S		PAN HEAD WITH WASHER AND SPRING WASHER M3×6
T		HEXAGON BOLT M4×20

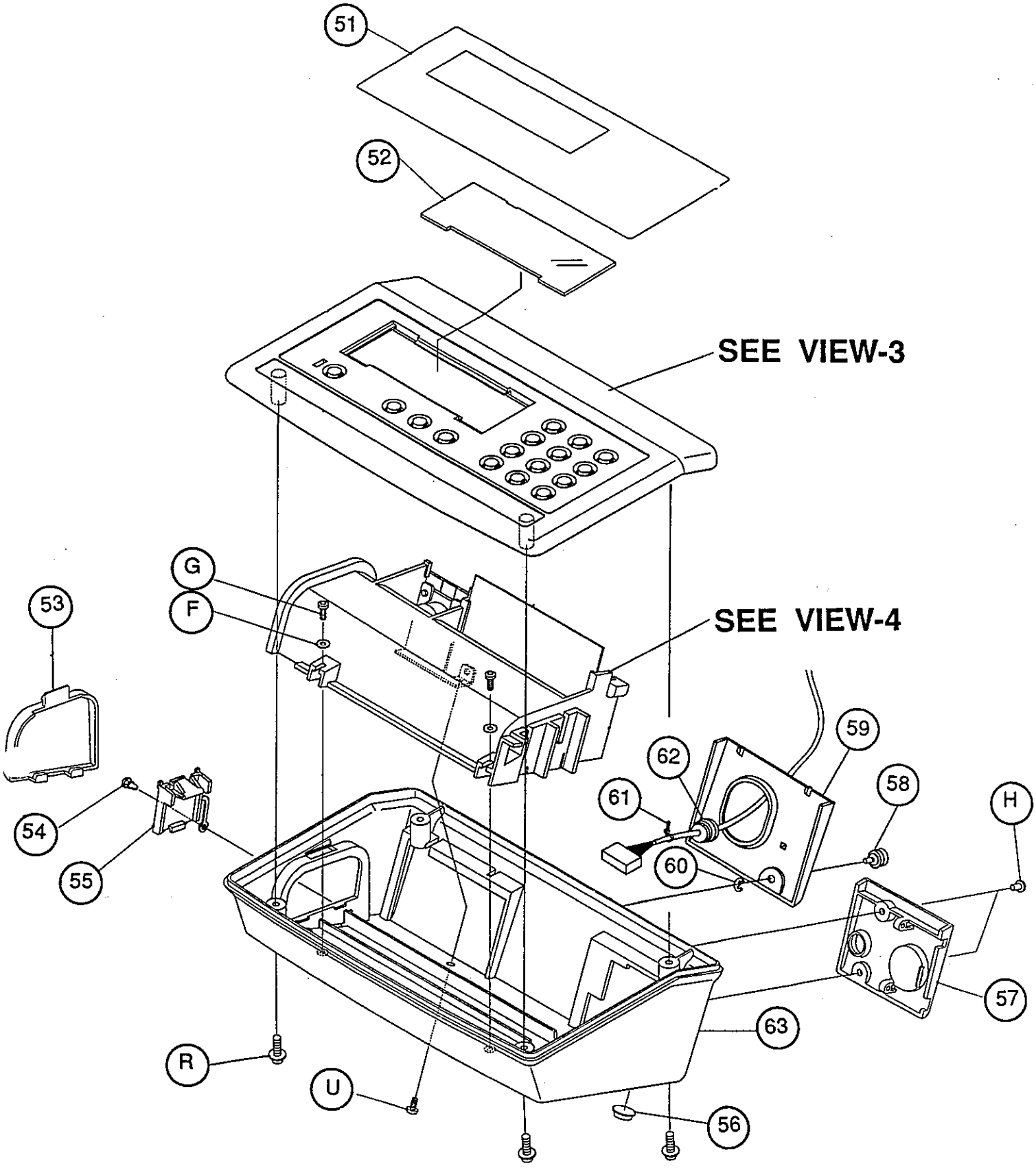
SEE VIEW-2



EXPLODED VIEW-1
HV-150KA1/HW-150KA1

HV－150KA1／HW－150KA1

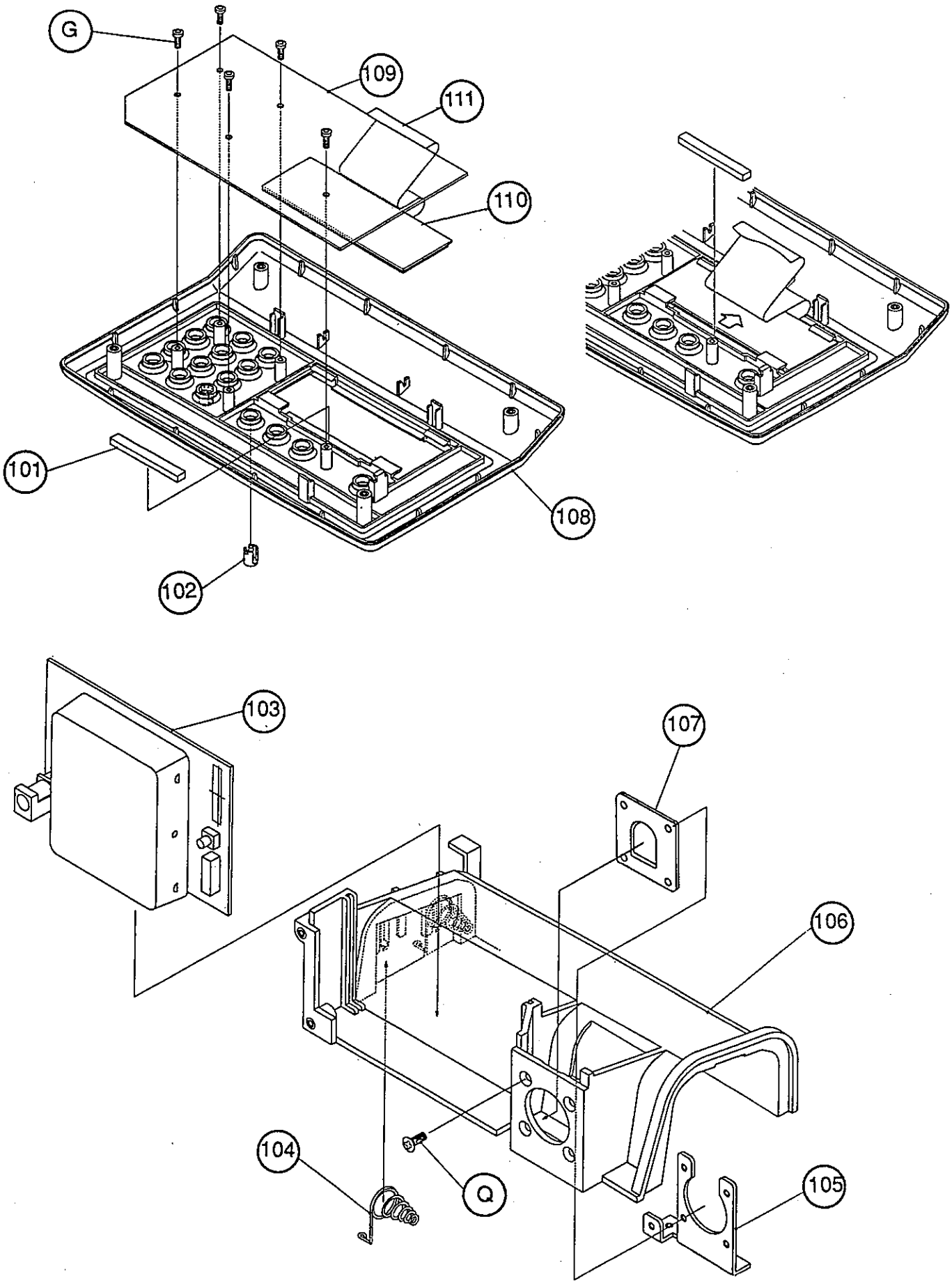
NO.	PARTS NAME	DESCRIPTION
01	03:A20564B	BASE
02	10:DH-26-1 AD	BATTERY CASE
03		
04	10:13C	LEVEL VIAL HOLDER
05	07:A33688D	FOOT
06	04:A47950	SPACER PLATE
07		
08	02:A33529-5D	SUSBAR
09	06:A33710-1A	CUSHION THIN
10	06:A33710-2A	CUSHION THICK
11	06:A46166C	CENTER SUPPORT
12	05:B43628-2	CUSHION RETAINER SHORT
13	05:B43628-1	CUSHION RETAINER LONG
14	05:B43629-1	BOLT
15	05:A47664-2	STOPPER
16	05:A47664-1	STOPPER
17		
18		
19	04:B31868-1	WEIGHING PAN
20	07:A34026A	CORNER PIECE
21	10:KB-07	BAND STOPPER
22	03:A10215	LOWER POLE SUPPORT
23	07:C40527	SCREW COVER
24		
25	10:H71F27-SUS	FOOT
26	05:C43563	POLE
27	03:C43481	BRACKET LOCK
28	03:C43482	BRACKET LOCK
29		
30	05:A46051	SPRING
31	10:A46050-2	CAP
32	04:A47309B	LOCK SPRING PLATE
33	07:A21456	TILT BRACKET
34	04:40584	LOWER COVER
35	PLT 1.5T	TIE BAND
A		HEXAGON BOLT M8×35
B		WASHER M8
C		
D		
E		WASHER M8
F		WASHER M3
G		PAN HEAD TAPPING SCREW M3×8
H		BAINDING HEAD M3×6
I		FLAT HEAD M3×8
J		HEXAGON BOLT M8×15
K		SPRING WASHER M8
L		HEXAGON BOLT M8×40
M		
N		S TYTE M3×6
O		BAINDING HEAD TAPPING SCREW M4×10
P		PAN HEAD WITH WASHER AND SPRING WASHER M4×8
Q		
R		
S		PAN HEAD WITH WASHER AND SPRING WASHER M3×6
T		HEXAGON BOLT M4×20



EXPLODED VIEW-2
HV/HW-Series

EXPLODED VIEW－2

NO.	PARTS NAME	DESCRIPTION
51	08:B31911	KEY SHEET FOR HV EX/EG SERIES
51	08:B31909	KEY SHEET FOR HV SERIES
51	08:B31914	KEY SHEET FOR HW EX/EG SERIES
51	08:B31912	KEY SHEET FOR HW SERIES
52	07:B49741	DISPLAY FILTER
53	07:B31047	BATTERY COVER
54	10:NRP-345	NYLON RIVET
55	07:C42523	BATTERY LOCK
56	10:SJ-5012	RUBBER FOOT
57	07:B30622-1	PANEL B
58	05:B40236	LOCK SCREW
59	07:B30621	PANEL A
60		E RING
61	PLT 1.5T	TIE BAND
62	ET:SR-6P-4	CABLE CLAMP
63	07:A10221	LOWER CASE
F		WASHER M3
G		PAN HEAD TAPPING SCREW M3×8
H		BAINDING HEAD M3×6
R		PAN HEAD WITH WASHER AND SPRING WASHER M3×8
U		BAINDING HEAD M3×6



EXPLODED VIEW-3/4
HV/HW-Series

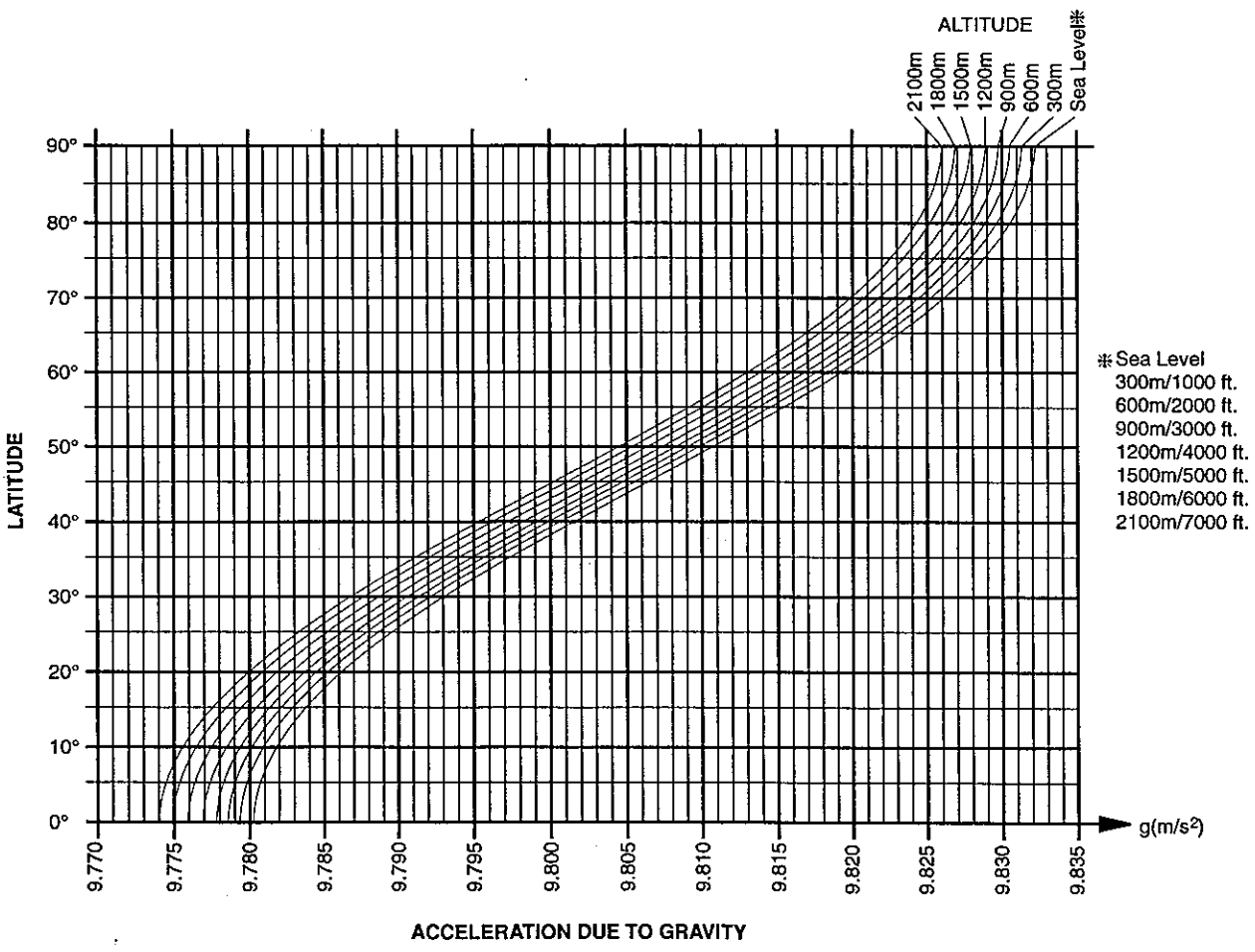
EXPLODED VIEW－3／4

NO.	PARTS NAME	DESCRIPTION
101	06:C40296	DISPLAY STOP
102	07:A41320	KEYTOP
103	7PZ:2754	A/D BOARD
104	04:C42583	TERMINAL
105	04:C42568	GROUND PLATE
106	07:A10223	INNER FRAME
107	04:C43041A	CABLE CLAMP PLATE
108	07:A10220	UPPER CASE
109	7PZ:2755	MAIN BOARD FOR HV SERIES
109	7PZ:2756	MAIN BOARD FOR HW SERIES
110	ED:DLC4946	LCD
111	KO:1000	HEAT SEAL CABLE
G		PAN HEAD TAPPING SCREW M3×8
Q		FLAT HEAD M3×8

Gravity Values at Various Locations

Calcutta	9.788	m/s²	Paris	9.809	m/s²
Capetown	9.796	m/s²	Rio de Janeiro	9.788	m/s²
Chicago	9.803	m/s²	Rome	9.803	m/s²
Amsterdam	9.813	m/s²	Manila	9.784	m/s²
Athens	9.800	m/s²	Melbourne	9.800	m/s²
Auckland NZ	9.799	m/s²	Mexico City	9.779	m/s²
Bangkok	9.783	m/s²	Milan	9.806	m/s²
Birmingham	9.813	m/s²	New York	9.802	m/s²
Brussels	9.811	m/s²	Oslo	9.819	m/s²
Buenos Aires	9.797	m/s²	Ottawa	9.806	m/s²
Copenhagen	9.815	m/s²	San Francisco	9.800	m/s²
Cyprus	9.797	m/s²	Singapore	9.781	m/s²
Djakarta	9.781	m/s²	Stockholm	9.818	m/s²
Frankfurt	9.810	m/s²	Sydney	9.797	m/s²
Glasgow	9.816	m/s²	Taichung	9.789	m/s²
Havana	9.788	m/s²	Taiwan	9.788	m/s²
Helsinki	9.819	m/s²	Taipei	9.790	m/s²
Kuwait	9.793	m/s²	Tokyo	9.798	m/s²
Lisbon	9.801	m/s²	Vancouver, BC	9.809	m/s²
London (Greenwich)	9.812	m/s²	Washington DC	9.801	m/s²
Los Angeles	9.796	m/s²	Wellington NZ	9.803	m/s²
Madrid	9.800	m/s²	Zurich	9.807	m/s²

Acceleration Due to Gravity Table



World Map