Adam Equipment

HIGHLAND SERIES
SERVICE MANUAL

(Software rev. 2.23)

ADAM EQUIPMENT CO. LTD.
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1.0 INTRODUCTION

The **Highland**^{TM} series of scales are general purpose scales.

Refer to the Operators Manual for details of general operation.

This manual will cover details of service parameters, calibration and troubleshooting.
If you have a problem with the scales that is not directly addressed by this manual then contact your dealer or Adam Equipment for more assistance.

In order to supply further assistance we will need the following information:

Name of your company:

Contact Name:

Contact telephone, e-mail, fax or other methods:

Model number of the scales:

Serial number:

Software revision number (displayed when power is first turned on):

Brief description of the problem:

Include any recent history of the scale. For example-

Since when the problem is noticed

2.0 SPECIFICATIONS

2.1 TECHNICAL SPECIFICATIONS

model	HCB123	HCB153	HCB302	HCB602	HCB602H	HCB1002	HCB1502	HCB3001
Maximum Capacity	120g	150g	300g	600g	600g	1000g	1500g	3000g
Readability	0.001g	0.005g	0.01g	0.02g	0.01g	0.01 g	0.05g	0.1g
Repeatability (s.d.)	0.002g	0.005g	0.01g	0.02g	0.01g	0.01 g	0.05g	0.1g
Linearity ±	0.04g	0.01g	0.02g	0.04g	0.02g	0.02 g	0.1g	0.2g
Pan	120mm / 4.7" ø							
Draft shield	Included as standard							
Units	g / ct /Lb/OZ / d / GN / OZt / dWt / MM / TL.H / TL.C / TL.t /tical / N /g2/TL.J.				g / ct /Lb/OZ / d / GN / OZt / dWt / MM / TL.H / TL.C / TL.t /tical / N /g2/TL.J.			

2.2 COMMON SPECIFICATIONS

Interface	USB and RS-232, bi-directional
Stabilization Time	2 Seconds typical
Operating Temperature	0°C to 40°C / 32°F to 104°F
Power supply (external)	12VDC 800 mA
Calibration	HandiCal Internal calibration or external calibration - User selectable
Display	18mm high 6 digits LCD With auto backlight and loading bar graph
Scale Housing	ABS Plastic with Stainless Steel Pan
Overall Dimensions (wxdxh)	170 x 245 x 80mm / 6.7" x 9.6" X 3.1"
Net Weight	1.5 kg / 3.3 lb

3.0 TROUBLE SHOOTING GUIDE

3.1 ERROR MESSAGES

If an error message is shown, repeat the step that caused the message. If the error message is still shown then contact your dealer for support.

ERROR CODE	DESCRIPTION	POSSIBLE CAUSES	SOLUTIONS
Err 4	Initial Zero is greater than allowed (20% of maximum capacity) when power is turned on or when the **[Tare]** key is pressed.	Weight on the pan when turning on. Excessive weight on the pan when zeroing the balance. Improper calibration of the balance. Damaged load cell. Damaged Electronics.	Remove the transit screw make sure the pan is fitted correctly. Make sure the calibration weight is in its off position. Remove any weight from the stainless steel pan. Try recalibrating.
Err 5	Keyboard Error.	Improper operation of the balance. Keypad damage.	Turn the balance off and back on again. Replace keypad.
Err 6	A/D count is not correct when turning the scale on.	Load cell damaged. Electronics damaged.	Remove any weight from the stainless steel pan and turn the balance off and back on again. Try calibrating the balance.
Err 9	A/D count is not stable when turning the scale on.	Load cell damage. Something touching the pan. Air movement, vibration or instability.	There may be movement, vibration or dirt on scale during turning on. Make sure there is nothing touching the pan. Make sure the internal weight is in the off position. Make sure the balance is level. Try recalibrating.
	Low Battery indicator.	Internal battery may be flat.	Charge the battery or replace internal rechargeable battery.
	Unstable – balance cannot get a stable reading.	Possible damage to the mechanics / Load cell.	Make sure the balance is on a flat surface and away from vibration. Make sure the calibration weight is in its off position.
Red Light on front panel	Low Battery indicator.	Internal battery may be flat.	Charge the battery or replace internal rechargeable battery.
	No Power when turning on.	Internal battery may be flat.	Charge the battery or replace internal rechargeable battery.

4.0 OPERATION

4.1 ZEROING / TARE

You can press the **[Tare]** key to set a new zero point and show the zero reading if the weight reading is less than 4% of the total of the maximum capacity of the balance. This may be necessary if the weight reading is not reading zero with nothing on the pan. The zero indicator will show up in the upper left corner of the LCD.
If you are using a container to weigh then you can place this on the platform and press the **[Tare]** key. Providing the container weight is more than 4% of the maximum capacity of the balance, the digits will show zero and NET will light up on the display. You can then weigh your sample in the container. Taring weight subtracts from the total balance capacity.

Note: When the container is removed a negative value will be shown equivalent to the total value of the amount tared. The balance will not tare a value for a container unless the stability light indicates that the weight is stable thus ensuring a correct taring function.

4.2 WEIGHING

To determine the weight of a sample, first tare an empty container (if used), then place the sample in the container. The display will show the weight of the sample and the unit of weight currently in use. The stable indicator will light when the reading is stable.

4.3 PERCENTAGE WEIGHING

The balance will allow a reference weight to be shown as 100%. Then any other weight placed on the balance will be displayed as a percentage of the original sample.

1) Place your weight on the balance.
2) Press the **[%]** key. The weight will be displayed as 100.00%.
3) Remove the weight and place your next sample on the balance. The new reading will be shown as a percentage of the first value / reference used.
4) Pressing the **[%]** key again will return the balance to normal weighing.

Note: The balance may jump by large numbers unexpectedly if small weights are used to set the 100% level.

For example, if only 23.5g is on a balance with 0.5g increments and the balance is set to 100%, the display will show 100.00%. However, a small change of weight will cause the display to jump to 102.13%, as one balance division (0.5g) increase to 24.0g will be equivalent to a 2.13% increase.

4.4 PARTS COUNTING

Parts counting lets you count small parts that are of equal weight, quickly and easily. To do this you must first set your sample by telling the balance how many parts you have.

1) Place your container on the balance and press the **[Tare]** key as described in 4.2 Zeroing / Tare section. This will remove the weight of the container from your count.

2) When the balance is in normal weighing mode with the initial quantity on the balance, press the **[Smpl]** key to start the parts counting function.

3) The initial number of samples should match the options for parts counting, 10, 20, 50, 100 or 200 pieces.

4) The balance will initially show SP 10 asking for a sample size of 10 parts. Press **[Mode]** to cycle through the options: 10, 20, 50, 100, 200 and back to 10 to select the sample you have placed on the balance.

5) Press **[Smpl]** again once you have selected the sample. The display will show you the number. As more parts are added the display will show the total number of parts (PCS – will be shown in the alpha-numeric display).

6) By pressing the **[Mode]** key you can view the unit weight (W/P), total weight (g) or the count (PCS). The total and the unit weight are shown in the current weighing units.

7) Press **[Smpl]** to return to normal weighing.

4.5 ACCUMULATION

There are two types of accumulations – automatic and manual.

Automatic Accumulation	**Manual Accumulation**
When the balance is set for automatic accumulation, see Parameters 6.3 Setting the Printer Parameters / Accumulation, the weight will be added to the memory when the balance becomes stable.	When the balance is set to manual accumulation, see Parameters 6.3 Setting the Printer Parameters / Accumulation, the weight displayed will only be stored in memory once the **[Print]** key is pressed and the weight is stable.

1) Place the weight on the balance. If automatic then the balance will automatically accumulate the weight. If set to manual then you will need to press the **[Print]** key.

2) The display will show **"ACC 1"** followed by the total value in the memory for 2 seconds before returning to displaying the weight of the item on the balance.

3) The weight will be transmitted to a printer or PC.

4) Remove the weight, allowing the balance to return to zero.

5) Put a second weight on. Again if set to automatic it will accumulate the weight automatically. Alternatively press **[Print]**, the display will show **"ACC 2"** followed by the new total in the memory for 2 seconds before returning to displaying the weight of the item on the balance.

6) Continue until all weights have been added.

To view the totals in memory press the **[Print]** key when the balance is at zero. The display will show **"ACC xx"** (where "xx" is the total number of readings) and the total weight, before returning to zero. At the same time the total will also be sent via the RS-232 interface.
To clear the memory, press **[Smpl]** once the total accumulation value is displayed, after the pressing **[Print]**.

5.0 PARAMETERS

The balance has 7 parameters that can be set by the user.

FUNCTION	SECTION	DESCRIPTION
F1 UNT	See section 6.1	Sets the units to be used g / ct / Lb / oz / d / GN / OZt / dWt / MM / TL.H/ TL.C / TL.t /tical / N /g2/TL.J.
F2 EL	See section 6.2	Sets the backlight EL on: backlight always on EL AU: backlight automatically turns on when a key is pressed EL oFF: backlight always off
F3 SEr	See section 6.3	Sets the print parameters
F4 oFF	See section 6.4	Sets the auto power-off parameter
F5 IEC	See section 6.5	Internal or external calibration select
F6 CA	See section 6.6	Cal mass fine adjust
tECH		Technical parameters setting mode / factory setting

5.1 ENABLING WEIGHING UNITS

You can enable and disable the weighing units available to the user when they press the **[Mode]** key as described in section 4.5 Weighing Units.

1) To set this parameter press the **[Mode]** key during self-checking test when turning on the balance.

2) After a few seconds, the display will show the first function **F1 UNT**.

3) Press the **[Tare]** key to view the current settings of each unit.

4) Pressing the **[Tare]** key will cycle through the other units along with their current settings. For example, if **oFF** is displayed with the weighing unit Carats, the user will not be able to use this unit while weighing.

5) Pressing the **[Mode]** key will change the setting of a particular unit. For example, to enable the weighing unit Carats, change the setting to on by pressing the **[Mode]** key.

6) When **F1 Unt** is displayed, you can press the **[Print]** key to return to weighing or press **[Mode]** to go to the next function.

The following table shows different units which are available to the user and the conversion factors for each.

Name of the Units	Description	Conversion Factor	Display Symbol
Grams	A standard metric unit	1.0	g
Carats	Used for weighing jewelry and gems, etc.	5.0	ct
Pounds	Standard weighing unit in UK/USA. *	0.002205	Lb
Ounce	Avoirdupois ounce. 16 ounces make a pound.	0.03528	OZ
Drams	An ancient unit of weight. Equal to 1/16th of an ounce.	0.5645	d
Grains	A basic weighing unit in the imperial system. Used to weigh gun powder.	15.432	GN
Ounce Troy	Troy ounce- used for weighing gold, silver and in pharmacy.	0.03216	OZt
Pennyweight	Pennyweight was the weight of a silver penny in medieval England. Equals to 1/20th of an Ounce Troy.	0.6432	dWt
Mommes	A weighing unit used in Japan to weigh pearls.	0.26667	MM
Taels Hk.	Hongkong Taels- used to weigh coral, pearls, etc.	0.02675	TL.H
Taels S.	Singapore Taels	0.02646	TL.C
Taels T.	Taiwan Taels	0.02675	TL.t
Tical	An Asian weighing unit	0.08576	t
Newtons	Used to measure force	0.009808	N
Grams	Grams with last digit suppressed	1.0	g2
Taels J	Japanese Taels	0.026717	TL.J
* Lbs are not available on HCB123 Model			

5.2 SETTING THE BACKLIGHT

The backlight may be enabled or disabled by the user. If the backlight is disabled, the battery life will be greater.The following settings are available:

EL AU	Sets the backlight to operate automatically when a weight is placed on the balance or a key is pressed.
EL Off	Sets the backlight to be off.
EL On	Sets the backlight to be on for full time.

1) To set this parameter press the **[Mode]** key during self-checking test when turning on the balance.

2) After a few seconds, the display will show the first function **F1 UNT**.

3) Press the **[Mode]** key to select **F2 EL** .

4) Press the **[Tare]** key to view the current settings for the backlight.

5) To change the settings press the **[Mode]** key to scroll through other settings as shown above.

6) Press **[Tare]** to store a particular setting. The display will return to **F2 EL**

7) When **F2 EL** is displayed press the **[Print]** key to return to weighing or press **[Mode]** to go to the next function.

5.3 SETTING THE PRINTING PARAMETERS / ACCUMULATION

1) To set this parameter press the **[Mode]** key during self-checking test when turning on the balance.

2) After a few seconds, the display will show the first function **F1 UNT**.

3) Keep pressing the **[Mode]** key until **F3 SEr** is displayed.

4) Press the **[Tare]** key to view the current settings.

5) First select which communication port you wish to configure and set (only one port can be used at a time).

   The screen will show **S 232** or **S USb**. Press the **[Mode]** key to select which interface you would like to use. Press **[Tare]** to confirm setting and configure interface.

6) The following options are available for setting the output and accumulation functions:

Mode	Print Feature	Accumulation
P1 Prt	Data is sent whenever the **[Print]** key is pressed.	Manual accumulation when the **[Print]** key is pressed.
P2 Con	Data is sent continuously.	Accumulation is disabled.
P3 AUT	The weighing results will be sent to the communication port automatically whenever a stable reading is present. The balance has to return to zero before another reading is sent via the interface.	Automatic accumulation when stable

Press the **[Mode]** key to change the setting. Press **[Tare]** to confirm and move to the next parameter.

7) Setting the baud rate. This is the transmission speed for communication with printers and computers. The selected rate must match that of the other device for communications to work.

   The following settings are available:

b 600
b 1200
b 2400
b 4800
b 9600

   Press the **[Mode]** key to change the setting. Press **[Tare]** to confirm and move to the next parameter.

8) Parity settings. Parity is a communications check. There are 3 settings that the Highland can work with as follows:

8 n 1	8 data bits, no parity
7 E 1	7 data bits, even parity
7 0 1	7 data bits, odd parity

   Press the **[Mode]** key to change the setting. Press **[Tare]** to confirm and move to the next parameter.
   The display will go back showing **F3 SEr**. Press the **[Print]** key to return to weighing or press **[Mode]** to go to the next function.

5.4 AUTO POWER OFF

The auto power off function helps conserve power, when using the internal rechargeable battery or AC adapter. The Auto switch-off time may be set up by the user.

1) To set this parameter press the **[Mode]** key during self-checking test when turning on the balance.
2) After a few seconds, the display will show the first function **F1 UNT**.
3) Keep pressing the **[Mode]** key until **F4 oFF** is displayed.
4) Press the **[Tare]** key to view the current settings.
5) Press **[Mode]** to change the settings (0, 5, 10, 20 and 30 minutes).
6) Press **[Tare]** to store a particular setting. The display will return to **F4 oFF**

7) When **F4 oFF** is displayed press the **[Print]** key to return to weighing or press **[Mode]** to go to the next function.

5.5 SELECTING THE INTERNAL OR EXTERNAL CALIBRATION

You can select if the internal mass or an external mass is to be used to calibrate the balance.

1) To set this parameter press the **[Mode]** key during self-checking test when turning on the balance.
2) After a few seconds, the display will show the first function **F1 UNT**.
3) Keep pressing the **[Mode]** key until **F5 IEC** is displayed.
4) Press the **[Tare]** key to view the current settings.
5) To change the settings press the **[Mode]** key to change from INt (internal calibration) or E (external calibration)
6) Press **[Tare]** to store a particular setting. The display will return to **F5 IEC**
7) When **F5 IEC** is displayed press the **[Print]** key to return to weighing or press **[Mode]** to go to the next function.

5.6 ADJUST THE VALUE OF THE INTERNAL MASS

The internal mass value stored in memory can be adjusted to more closely match the value of the user's external mass.

1) To set this parameter press the **[Mode]** key during self-checking test when turning on the balance.
2) After a few seconds, the display will show the first function **F1 UNT**.
3) Keep pressing the **[Mode]** key until **F6 CA** is displayed.
4) Press the **[Tare]** key to view the current settings.
5) The display will show the current value with the first digit flashing. To change the value press **[%]** to shift the position, press **[Mode]** to increase the value and press **[Print]** to decrease the value. The internal

calibration weight should only change between **95.000** and **105.000** grams or **495.00** and **505.00** grams (depending upon the model).

6) Press **[Tare]** to store a particular setting. The display will return to **F6 CA**

7) When **F6 CA** is displayed press the **[Print]** key to return to weighing or press **[Mode]** to go to the next function.

8) Pressing **[Mode]** will show **TECH**. This function is a manufacturing function for qualified technicians only and you can press **[Mode]** again to scroll through parameter options, or press [Print] to return to normal weighing.

Changing the value of the internal weight will affect the calibration when using the internal calibration. To check if your internal weight is correct you should only use high quality weights that are accurate to the readability of the balance.

6.0 USER CALIBRATION

The **Highland** series of balances comes standard with **HandiCal™** internal calibration to make calibrating the balance quick and easy. However you can also calibrate the balance using an external verification weight if needed. The **HandiCal** method is the default but if you would like to use external calibration then you must first enable this via the parameter (section 6.5 Selecting The Internal Or External Calibration).

Internal Calibration using HandiCal

1) Press the **[on/off]** key to turn the power on.
2) Press the **[Smpl]** and **[Print]** keys at the same time during the self-checking test.
3) The display will show unload. Remove any weight from the stainless steel pan.
4) When the stable indicator shows press the **[Tare]** key.
5) The display shows **C Int**. Press the **[Tare]** key
6) The display shows **LoAd.** Lower the internal calibration mass located behind the pan. Use the handle to help lower the weight as far as it will go. Press the **[Tare]** key once the stable sign is shown.
7) The display will show **PASS**. Rotate the weight back to its off position. Once removed the balance will return to zero.

External Calibration

1) Press the **[on/off]** key to turn the power on.
2) Press the **[Smpl]** and **[Print]** keys at the same time during the self-checking test.
3) The display will show unload. Remove any weight from the stainless steel pan.

4) When the stable indicator shows press the **[Tare]** key.

5) The display will show the first weight that you can use to calibrate the unit. You can change this value by pressing the **[Mode]** key. The weights that can be used are as follows:

Model #	**HCB123**	**HCB153**	**HCB302**	**HCB602**	**HCB602H**	**HCB1002**	**HCB1502**	**HCB3001**
Weight 1	60g	50g	100g	200g	200g	500g	500g	1000g
Weight 2	120g	100g	200g	400g	400g	1000g	1000g	2000g
Weight 3	-	150g	300g	600g	600g	-	1500g	3000g

6) Once the calibration weight has been selected press the **[Tare]** key

6) The display shows **LoAd**. Place your weight on the pan. Press **[Tare]** key once the stable sign is shown.

7) The display will show **PASS**. Remove the weight from the pan.

NOTE: If the calibration fails retry. The balance will show FAIL H (when the weight is higher) or FAIL L (when the weight is lower). Repeat the process using the correct calibration weight.

7.0 HIGHLAND DESCRIPTION

The Highland scales have an enclosure with all components mounted within it. To gain access to the components remove the 4 screws securing the cover to the base.

The basic unit consists of:

- ✓ Base
- ✓ Load Cell frames
- ✓ Load Cell
- ✓ Main PCB assembly
- ✓ Battery
- ✓ Display PCB assembly
- ✓ Keypad
- ✓ I/O PCB (RS 232, Power IN + OUT)

All models of Highland are similar except the selection of load cells and the program.

Normally if a problem is found with a circuit board the most cost effective method of solving the problem is to replace the circuit board.

8.0 TECHNICAL PARAMETERS

The scale has 12 technical parameters.

1) To set these parameters turn the scale off and then turn it on again. Press the **[Mode]** key during the initial counting from 9 to 0 on the display.

2) Display will show **F1 Unt**- the first parameter which can be set by the user.

3) Press **[Mode]** to scroll through other parameters.

4) Press **[Tare]** when display shows **tECH,** next **PIn** will be displayed.

5) Press **[Smpl], [Print]** and the **[%]** key in this order.

6) Pressing **[Tare]** again will allow the user to enter the Technical parameters setting mode.

7) The first technical parameter **FIL** will display.

8) Press **[Mode]** to scroll through the technical parameters as below.

FIL	Set a value for the amount of filtering
ICL	Set Value of the internal calibration mass.
ZEO	Setting the auto zero range
STA	Set a value to be determine balance stability
ZTR	Zero tracking
LIN	Corrects Linearity
CAP	Setting of capacity
dIV	Setting of division
WEI	Setting of calibration weight value
CAL	Calibration AD value
AMP	AD chips magnification setting
Lod	To get the AD value with the calibration weight on and complete the calibration

8.1 FILTER

1) Press **[Tare]** key When FIL is displayed on the lower right corner; it will show the current filter value.
2) Press **[Tare]** to change the filtering parameter. Select from 1 to 3. A larger number is more filtering and a slower response.
3) Press **[Mode]** to enter the next step
4) Or press **[Print]** to go back to **tECH**, press **[Print]** again to go back to weighing mode.

8.2 INTERNAL CALIBRATION MASS

1) When **ICL** is displayed on the lower right corner, press **[Tare]** to set the integer value of the internal calibration weight between 100g and 500g, which depend on the value of the internal calibration weight for this scale.

Model #	HCB123	HCB153	HCB302	HCB602	HCB602H	HCB1002	HCB1502	HCB3001
mass	100g	100g	100g	500g	500g	500g	500g	500g

2) Press **[Mode]** to enter the next setting;
3) Or press **[Print]** to go back to **tECH**, press **[Print]** again to go back to weighing mode.

8.3 ZERO RANGE

1) When ZEO is displayed on the lower right corner, press **[Tare]** key to change the zero from 1 to 8.
2) The default value is 4.
3) A larger number is a larger zero range.
4) Press **[Mode]** to enter the next step;

5) Or press **[Print]** to go back to **tECH,** press **[Print]** again to return to weighing mode.

8.4 STABILITY

1) Press **[Tare]** to change the stable range from 1 to 5 when **STA** is displayed on the lower right corner.
2) A larger number corresponds to a larger stable zone. Default is 2.
3) Press **[Mode]** to move to the next step;
4) Or press **[Print]** to go back to **tECH**, press **[Print]** again to return to the weighing mode.

8.5 ZERO TRACKING

1) Press **[Tare]** to change the zero tracking value from 1 to 5 when **ZTR** is displayed on the lower right corner. The default is 3.
2) Press **[Mode]** to enter the next step;
3) Or press **[Print]** to go back to **tECH,** and press **[Print]** again to return to weighing mode.

8.6 LINEARITY

1) Press **[Tare]** to change the linearity from -7 to 7 when **LIN** is displayed on the lower right corner.
2) Press **[Mode]** to enter the next step; press **[Print]** to go back to **tECH** and press **[Print]** again to return to weighing mode.
3) Set the value to be positive if the weight at maximum is less than 2 times the value at 1/2maximum. The value to be added is found from trial and error.

8.7 CAPACITY

1) The capacity should be set according to the load cell.
2) Press [**Tare]** to change capacity when **CAP** is showed on the lower right corner. Press **[Mode]** to move to next step;
3) Or Press **[Print]** to go back to **tECH**, press **[Print]** again to return to weighing mode.

8.8 DIVISION

1) Press **[Tare]** to change the division when **dIV** is showed on the lower right corner. Press **[Mode]** to move to the next step;
2) Press **[Print]** to go back to **tECH** and press **[Print]** again to return to weighing mode.

8.9 EXTERNAL CALIBRATION WEIGHT

1) Please set the value according to the weight of the calibration weight.
2) When **WEI** is displayed on the lower corner, press **[Tare]** to advance to the digits .Press **[%]** to change the flashing digit.
3) Press **[Mode]** to move to the next step;
4) Or press **[Print]** to go back to **tECH** and press **[Print]** again to return to weighing mode.

8.10 ZERO A/D COUNTS

1) When **CAL** is shown on the lower right corner, the platform is empty, it will show the zero A/D count.

2) When the stable indicate display, press **[Mode]** to complete and move to the next step.

3) Or press **[Print]** to go back to **tECH** and press **[Print]** again to return to weighing mode.

4) If press **[Smpl]** when the zero AD value is displayed it will enter AMP.

8.11 AMP (AD CHIPS AMPLIFICATION SETTTING)

1) When **AMP** is displayed on the lower right corner, it will show the value of the amplification within the AD converter. Select 128 for all models.

Press **[Tare]** to change the value of amplification and press **[Mode]** to confirm and return to zero A/D count.

8.12 LOD

1) To get the AD value with the calibration weight on and complete the calibration.

2) When **Lod** is displayed on the lower right corner, put corresponding calibration weight on the pan, it will show the AD count .

3) When the stable indicator displayed, press **[Mode]** to complete to calibration and parameter setting and return to weighing mode.

9.0 COMMUNICATION WITH A COMPUTER/PRINTER

Either the RS-232 or USB interface can be used at one time. You cannot use both interfaces at the same time. See parameters 6.3 Setting The Printing Parameters / Accumulation section for full information on settings

The standard Interface parameters are:

RS-232 output of weighing data
ASCII code
4800 Baud
8 data bits
No Parity

Connection details are:

Connector: 9 pin d-subminiature socket
Pin 3 Output
Pin 2 Input
Pin 5 Signal Ground

Generally a Null model cable is required for connection to a computer or printers.

Data Format for normal weighing operations, parts counting or recalling of totals from memory will all be different.

Normal Output: G S _ X X X . X X u u u

GS	123.45g	GS for Gross Weight, NT for Net Weight and u for unit of weight
No.	1	This number increments every time a new value is stored in memory
Total	123.45g	The total value stored in memory
<lf>		Includes 2 line feeds
<lf>		

Input command format:

The scale can be controlled with the following commands. The commands must be sent in upper case letters, i.e. **"T"** not **"t"**.

T<cr><lf>	Tares the scale to display the net weight. This is the same as pressing **[Tare]** key.
Z<cr><lf>	Sets the zero point for all subsequent weighing. Display shows zero.
T5.345<cr><if>	Would be same as entering a preset tare value of 5.345 from keypad
P<cr><lf>	Prints the results to a PC or printer using the optional RS-232 interface. It also adds the value to the accumulation memory if the accumulation function is not set to automatic.

10.0 LOAD CELL DAMAGE

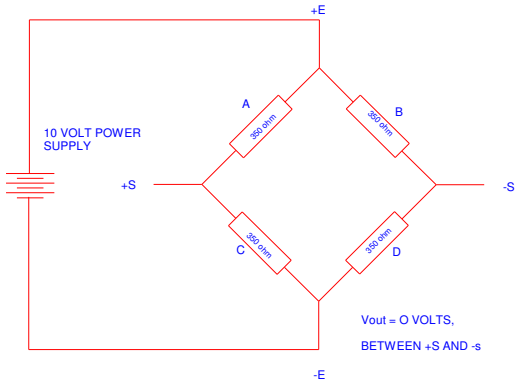
Highland scales have load cells of the same capacity as the maximum capacity of that range, The smallest load cell available in this series is 300g. A smaller load cell would be over-loaded when the Pan and the Pan support are added.

The most common reason a scale fails is that the load cell has been damaged. The damage can be from 2 primary causes. The first is physical damage due to an overload or an impact from the side and the second is damage due to the environment, such as moisture, extreme heat or a cut cable if the cables are exposed.

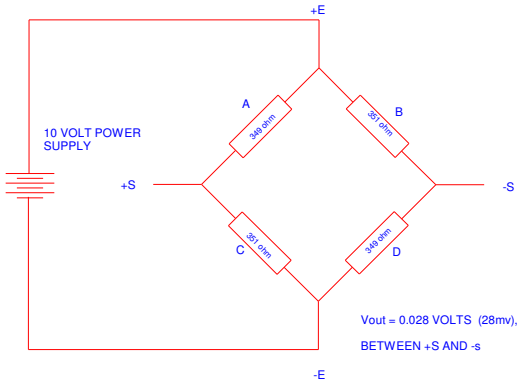
PRINCIPLE OF OPERATION

The stain gauge load cell is a method of measuring the amount of stress put onto a metal structure due to a weight being supported by the structure. The stress is measured using 4 strain gauge sensors mounted in a particular way on the metal structure.

These 4 strain gauges are connected in such a way that they form a wheatstone bridge. See figure below. In the simplest load cells there are only the 4 resistances of the strain gauges to consider. Normally without a load on the load cell all the resistances are the same. However when the load cell has a weight on it 2 of the strain gauges will be in compression (A and D) and the resistance will decrease and 2 will be in tension (B and C) and their resistance will increase.



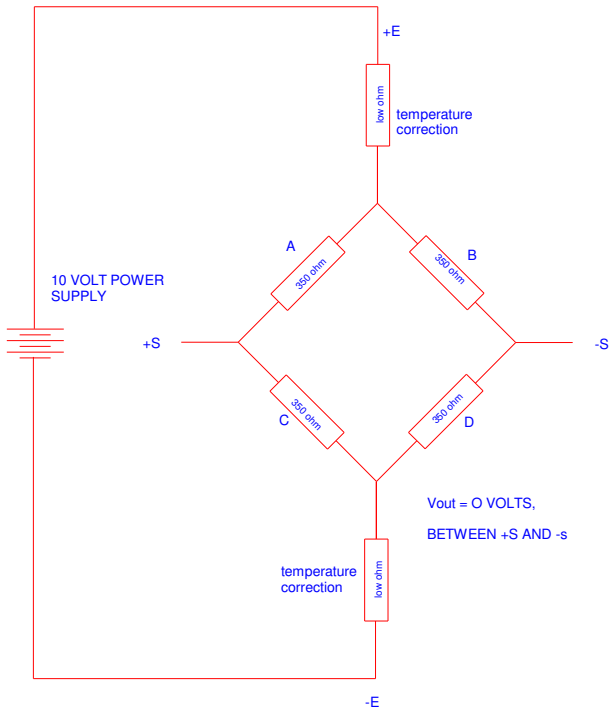
BALANCED BRIDGE



UNBALANCED BRIDGE
FULL CAPACITY LOAD
ON THE LOAD CELL

This will cause the bridge to become unbalanced. When the bridge has a voltage across it from +E to -E then the signal output at +S and -S will show a voltage of zero volts with no load and a small voltage proportional to the load as the load is increased. Typical load cells show 20-30mv of signal if the excitation voltage is 10volts and the load cell is fully loaded.

Most load cells used in scales are not as simple as this example. They have additional resistance elements added to compensate for temperature variations and to set the outputs to correct voltages. The circuit of a typical load cell is shown below.



BALANCED BRIDGE

A method to check the basic function and integrity of a load cell can be done using ohmmeter and voltmeter with up to a 10volt power supply.

Before the load cell is connected to the power supply use the ohmmeter to measure the resistance between the wires. Typical resistance values are:

+E to -E	410 ohms ±30 ohms
+S to -S	350 ohms ± 2 ohms

+E to +S or any other combination similar approximately 270 ohms.

If the load cell has Sense connections in addition they are connected to the excitation internal to the load cell.

Connect the load cell +E and -E to a power supply, typically 5 volts. Never use more than 12 volts as it may damage the load cell.
Measure the voltage between +S and -S.

With no load the voltage should be approximate 0mv ± 1mv.
With a mass on the load cell the output voltage should increase. The amount it increases will be dependent upon the sensitivity of the load cell, capacity of the load cell, the excitation voltage and the amount of mass placed on the load cell. Most load cells have a sensitivity of either 1mv/V, 2mv/V or 3mv/V.

The expected change to the output is:

$$V_{out} = \frac{(2mv/V) * V_{ext} * Mass}{\text{capacity of load cell}}$$

For example a 2mv/V load cell of 30Kg capacity with 20Kg placed on it. Vext is 5 volts would give a output of approximately:

$$V_{out} = \frac{(2mv/V) * V_{ext} * Mass}{\text{capacity of load cell}} = \frac{2mv/V * 5V * 20Kg}{30kg} = 6.7mv$$

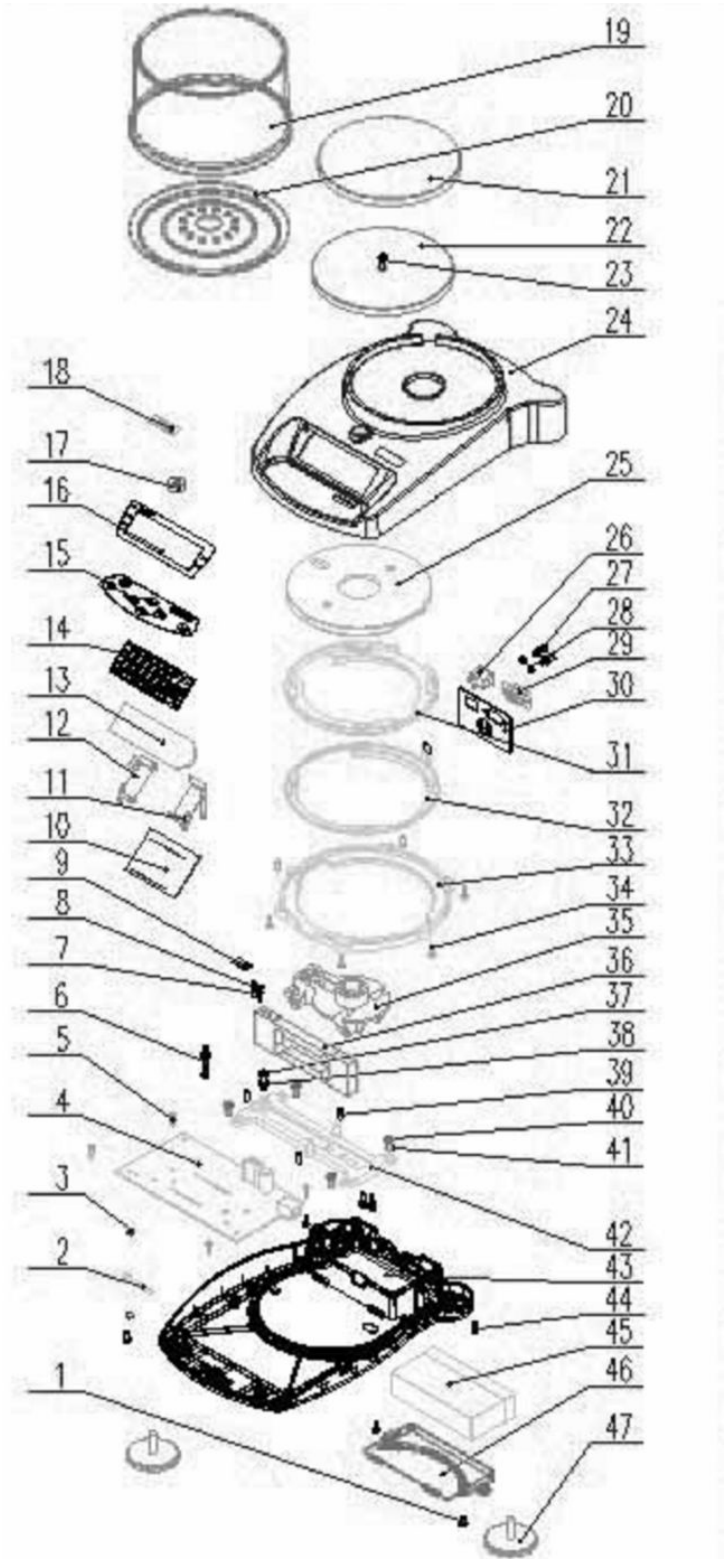
If the load cell has been damaged the no load voltage will likely be greater than 3mv or the loaded voltage will be grossly different from the expected value. Remember the loaded voltage will be offset by the amount of zero load voltage measured.

The load cell can be tested while it is connected to the A/D converter circuit board, using the scale power supply for excitation voltage.

TESTING LOAD CELLS IN THE SCALE

Measure the voltage across S- and S+ with a Voltmeter. The reading should be 0mV with no load and 5mV with full load.

11.0 HIGHLAND EXPLODED VIEW



47	JS33863	2	HCB feet	NBR	
46	JS33853	1	HCB battery cover	ABS	
45	DY21006	1	Rechargeable battery 6V/1.3AH		
44	JB13308	4	Semi-circle cross screw 3*8PmZn		
43	JS33852	1	HCB base	ABS	
42	JJ13041	1	HCB load cell aluminous bracket	ATC12	
41	JB71004	4	Spring washer		
40	JB13410	4	Semi-circle cross screw 4*10		
39	JB14891	3	M4*10 inner hex grub set screw		
38	JB6003	1	Nut M3		
37	JB13938	1	Semi-circle corss screw(with spacer) 3*20*8P		
36		1	HBM load cell		Option
35	JS33859	1	Hcb pan saddle	ABS	
34	Jb31310	6	Tapping screw 3*10PBHZn		
33	JS33862	1	HCB internal calibration retaning ring	ABS	
32	JS33861	1	HCB lifting ring(ABS)	ABS	
31	JS33860	1	HCB Internal calibration anti – rotation ship-ring	ABS	
30	JJ13042	1	HCB rear plate(A3 steel)	A3 steel	
29	DQ81002	1	232 male D-9P		
28	Jb79003	2	232 nut		
27	Jb79002	2	232 bolt		
26	DY31008	1	HCB socket DC103-200		
25	DQ90224	1	Aluminous weight 500g	Al	
2	JS33851	1	HCB upper housing	ABS	
23	JB14412	1	Inner hex screw 12CHMZn(white zn)	SS	
22	JS33856	1	HCB 120 PLASTIC PAN	PC	
21	Jj51014	1	ACB stain stell pan ϕ120	PC	
20	JS33857	1	HCB breeze shield		
19	JS33858	1	HCB breeze shield cover		
18		1	HCB S/N label		
17	DQ60001	1	AQT calibration level ϕ13*6.5		
16	JM45016	1	Front display panel		
15	JM46112	1	Keypad with mylar		
14	DX10035A	1	FH*LCD GV13368(12?)		
12	JS33855	1	HCB LCD bracket right	ABS	
11	JS33854	1	HCB LCD bracket left	ABS	
10	ZZ03502	1	HCB/CQT display board		
9	JJ13044	1	HCB load cell spacer(SPL)		
8	JB14312	4	Inner hex screw 3*12HMO(black)		
7	JB71003	4	Spring washer		
6	JB79122	1	Acb plus weighing hook screw	A3 steel	
5	JB31308	4	Topping screw 3*8pbhzN(white zn coating)		
4	ZZ03153	1	HCB main board		
3	JS33019	1	FEJ rubber mat		
2	JJ51021	1	HCB internal calibration handle	Chrome coated A3 steel	
1	JB12308	2	FHCS 3*8FMZn (white zn coatin)		
S/N	Part number	QTY	ITEM	MATERIAL	

CE

Manufacturer's Declaration of Conformity

This product has been manufactured in accordance with the harmonised European standards, following the provisions of the below stated directives:

Electro Magnetic Compatibility Directive 2004/108/EC

Low Voltage Directive 2006/95/EC

Adam Equipment Co. Ltd.
Bond Avenue, Denbigh East
Milton Keynes, MK1 1SW
United Kingdom

FCC COMPLIANCE

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. The equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Shielded interconnect cables must be employed with this equipment to insure compliance with the pertinent RF emission limits governing this device.

Changes or modifications not expressly approved by Adam Equipment could void the user's authority to operate the equipment.

WEEE COMPLIANCE

Any Electrical or Electronic Equipment (EEE) component or assembly of parts intended to be incorporated into EEE devices as defined by European Directive 2002/95/EEC must be recycled or disposed using techniques that do not introduce hazardous substances harmful to our health or the environment as listed in Directive 2002/95/EC or amending legislation. Battery disposal in Landfill Sites is more regulated since July 2002 by regulation 9 of the Landfill (England and Wales) Regulations 2002 and Hazardous Waste Regulations 2005. Battery recycling has become topical and the Waste Electrical and Electronic Equipment (WEEE) Regulations are set to impose targets for recycling.

ADAM EQUIPMENT is an ISO 9001:2000 certified global company with more than 35 years experience in the production and sale of electronic weighing equipment.

Adam products are predominantly designed for the Laboratory, Educational, Medical, retail and Industrial Segments. The product range can be described as follows:

-Analytical and Precision Balances
-Compact and Portable Balances
-High Capacity Balances
-Moisture analysers / balances
-Mechanical Scales
-Counting Scales
-Digital Weighing/Check-weighing Scales
-High performance Platform Scales
-Crane scales
-Medical Scales
-Retail Scales for Price computing

For a complete listing of all Adam products visit our website at
www.adamequipment.com

Adam Equipment reserves the right to make changes to the technology, features, specifications and design of the equipment without notice.

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The latest version of this publication can be found on our Website.

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