SERVICE MANUAL
DISCOVERY BALANCE

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SERVICE MANUAL

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1.1 INTRODUCTION

This service manual contains the information needed to perform routine maintenance and service on the Discovery Balances. The contents of this manual are contained in five chapters, three appendixes and are listed as follows:

Chapter 1 Introduction – A guide service facilities, tools, test equipment, calibration masses and specifications.

Chapter 2 Diagnosis – A diagnostic guide for troubleshooting, and an error code table.

Chapter 3 Repair Procedures – Disassembly/assembly, repair and replacement procedures.

Chapter 4 Testing – An operational test, segment display tests and performance tests.

Chapter 5 Parts Lists and Diagrams – Exploded view drawings and parts lists for Discovery Balances.

Appendix A Standard Calibration – Procedures for Automatic Internal Calibration, Span Calibration, Calibration Testing, and Calibration Adjustment.

Appendix B Service Calibration – Procedures for Service Calibration.

Appendix C Discovery Service Tool Instructions – Used to update software, restore EEPROM data, install a new Main Printed Circuit Board and install a new Load Cell.

Before servicing the balance, you should be familiar with the Instruction Manual (Part Number 80104130) which is packed with every balance. The procedures in this manual assume the technician performing them has a working knowledge of standard hand tools and the repair of precision instruments.

1.2 SERVICE FACILITIES

To service a balance, the service area should meet the following requirements:

- Should be temperature controlled and meet the balance specifications for temperature environmental requirements. See specifications for temperature ranges of the various models.
- Must be free of vibrations such as fork lift trucks close by, large motors, etc.
- Must be free of air currents or drafts from air conditioning/heating ducts, open windows, people walking by, fans, etc.
- Area must be clean and air must not contain excessive dust particles.
- Work surface must be stable and level.
- Work surface must not be exposed to direct sunlight or radiating heat sources.
- Use an approved Electro-Static Device.

1.3 SPECIAL TOOLS AND TEST EQUIPMENT REQUIRED

To properly service the Discovery Balances, certain Ohaus special tools and test items are required in addition to standard electronic tool kits. These items are listed as follows:

1. Alternate voltage Power Adapter if local power requirements do not match balance Adapter voltage ratings.

2. A PC running Microsoft Windows NT 4.0 or later, or Microsoft Windows 98 or later.

3. Discovery Instruction Manual, Part No. 80104130.

4. MFR Service Toolset, Part No. 80030340.

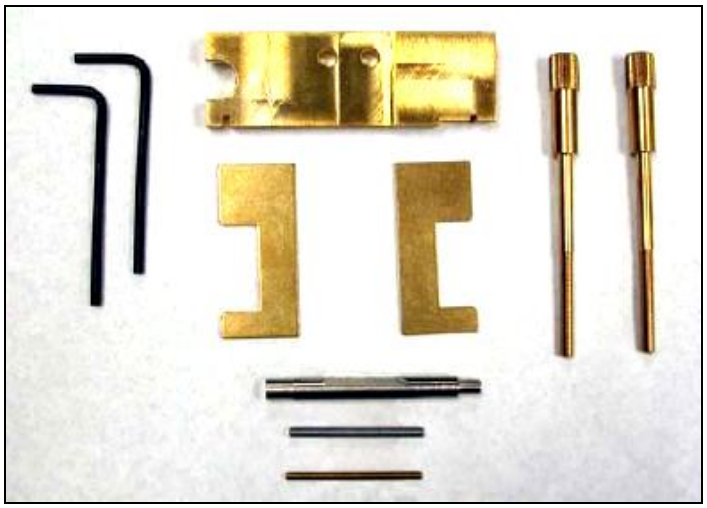


Figure 1-1. Service Toolset, Part No. 80030340.

5. RS232 Cable – Balance to PC P/N 80500525.

6. Standard Electronics Tool Kit.

7. Digital Voltmeter (DVM) Input impedance of at least 10 megohms in the 1 Volt DC position.

8. Masses as shown in Table 1.4. These masses are available from any Ohaus dealer.

9. Discovery Software Service Tool, P/N 80104129

1.4 TEST MASSES REQUIRED

The masses required to test the Discovery Balances must meet or exceed the requirements of the Class specified. The calibration points for the Discovery Models are listed in Table 1-1. Use the minimum number of masses to total the calibration point value.

Table 1-1. MASSES USED TO TEST DISCOVERY BALANCES

				SPAN CALIBRATION POINTS	
WEIGHT	**CLASS**	**MODEL**	**CAPACITY (g)**	**DEFAULT**	**ALTERNATE**
ASTM	**OIML**			**CAL POINTS (g)**	**CAL POINTS (g)**
Class 1	E1	DV114C	110	100	50
Class 1	E1	DV214C	210	200	100
Class 1	E1	DV314C	310	300	100, 200
Class 1	E1	DV215CD	81/210	200	100

1.5 SPECIFICATIONS

Specifications for the Discovery Balances are listed in Table 1-2. After a balance has been serviced, it must meet the specifications listed in the table.

Table 1-2. DISCOVERY BALANCE MODEL SPECIFICATIONS

Model Number	DV 114C	DV 214C	DV 314C	DV215CD
Capacity (g)	110	210	310	81/210
Readability (mg)	0.1			0.01/0.1
Repeatability (Std.dev.) (mg)	0.1		0.2	0.02/0.1
Linearity (mg)	±0.2		±0.5	±0.03/0.2
Off Center Load ½ cap, ½ distance	± 0.3 mg			
Weighing Units	mg, g, oz, ct, dwt, ozt, GN, taels (3), momme, Custom unit			
Application Modes	Weighing, Parts Counting, Percent Weighing, Checkweighing, Animal/Dynamic Weighing, G/N/T, Totalization, High Point, Density, Statistics, Pipette			
Tare Range	To Capacity by Subtraction			
Stabilization Time(s)	4		8	12/5
Power Requirements	External Adapter, 100-120VAC 1A, 220-240VAC 1A, 50/60Hz			
Calibration	Automatic internal and manual external			
Display Type	2-line Alphanumeric backlit LCD Display with Text Prompts			
Display Size (in/cm)	4 x 1/ 10 x 2.5			
Pan Size (Diameter) (in/cm)	3.5/9			
Free Height above Pan (in/cm)	9.5/24			
Dimensions W x H x D (in/cm)	7.9 x 11.8 x 18/20 x 30 x 45.7			
Net Weight (lb/kg)	22.5/10.2			

2.1 TROUBLESHOOTING

This section of the manual contains troubleshooting information. Information is contained to isolate specific problems using Table 2-1 – 2-5, Diagnostic Guide, and Table 2-6, Error Codes. Follow all directions step by step. Make certain that the work area is clean. Handle balance components with care. Use appropriate Electro-Static Device.

2.2 DIAGNOSTIC GUIDE

Tables 2-1 – 2-5 are a Diagnostic Guide designed to help locate the problem area quickly and easily. The probable causes are listed with the most common cause first. If the first remedy does not fix the problem, proceed to the next remedy. Before attempting to repair the balance, read all chapters of this manual to be familiar with the balance components and operation.

2.2.1 Diagnosis

1. Isolate and identify the symptom
2. Refer to Tables 2-1 – 2-5 Diagnostic Guide and locate the symptom. Also consult the Error Code Table for solutions to specific codes.
3. Follow the suggested remedies in the order they appear.
4. Perform the indicated checks, or see the appropriate section of the manual.
5. Repair or replace the defective section of the balance.

NOTE:
If more than one symptom is observed, approach one area at a time, and remember that the symptoms may be interrelated.

If a problem arises that is not covered in this manual, contact Ohaus Corporation for further information.

TABLE 2-1. BALANCE WILL NOT TURN ON

SYMPTOM	PROBABLE CAUSE	REMEDY
Balance will not turn on.	Main power source is off.	Check the main power source outlet for proper voltage.
	On/Zero Off switch defective or actuating fingers on top housing defective.	See Table 2-2.
	Main PC Board is defective.	If the balance fails to turn on and On/Zero Off switch is OK, the Main PC Board is defective and should be replaced. ->Main Printed Circuit Board Removal & Replacement 3.1.3

TABLE 2-2. BALANCE DOES NOT RESPOND TO FRONT PANEL CONTROLS.

SYMPTOM	PROBABLE CAUSE	REMEDY
Balance does not respond to front panel controls.	PC board switch or actuating fingers on top housing are defective.	Open the balance. (Refer to Section 3.1.1. Using an Ohmmeter, measure the resistance between the pins of the ON/Zero Off switch. It should be open. Press the switch through the top housing and check that the resistance is zero. Check each switch in a similar manner. If continuity is not present on a particular switch, replace the affected switch or actuator.
	Display PC Board is defective.	If the balance fails to turn on and On/Zero Off switch is OK, the Display PC Board may be defective and should be replaced. ->Display PCB Repair & Replacement 3.1.2
	Main PC Board is Defective	If Balance fails to turn on and Display PCB has been replaced then the Main PCB should be replaced. ->Main PCB Removal & Replacement 3.1.3

TABLE 2-3. NO DISPLAY OR PARTIAL DISPLAY

SYMPTOM	PROBABLE CAUSE	REMEDY
Display is not on or partial characters are displayed.	Display PC Board is defective.	The Display PC Board is replaced as a whole assembly. Check procedures in Table 2-1 first and verify that other problems do not exist. ->Display PCB Removal & Replacement 3.1.2.

TABLE 2-4. BALANCE CANNOT CALIBRATE USING EXTERNAL WEIGHTS

SYMPTOM	PROBABLE CAUSE	REMEDY
Balance can be turned on but will not calibrate manually.	Incorrect weights.	Verify that proper weights are used.
	Balance is set for Legal For Trade operation.	Set the Setup Menu Legal For Trade setting to Off. (See Instruction Manual, Sections 3.7.12 & 3.8.)
	Balance not level.	Level balance.
		Perform Automatic Internal Calibration. ->Appendix A.1.
	Balance is unstable.	If the balance fails to calibrate properly, enter the service mode (Appendix B) and perform a Span Calibration. If this fails, check the InCal Weight Assembly and the Load Cell Assembly (Section 3.1.5 – 3.2.7). Ensure that all parts are clean and properly aligned.

TABLE 2-5. BALANCE CANNOT CALIBRATE INTERNALLY

SYMPTOM	PROBABLE CAUSE	REMEDY
Balance can be turned on but will not calibrate using internal calibration.	Balance may be unstable.	Level the balance using leveling feet on rear of chassis, together with leveling bubble, just inside the left Door Side Draft Shield.
	The InCal Weight Hardware may be dirty, mis-aligned or defective.	Disassemble the InCal Weight Hardware and test it. ->InCal Weight Hardware Disassembly & Testing 3.1.4.
	Calibration Motor Assembly may be defective	If there are problems with the Weight Arm movements, check the Calibration Motor, and replace if necessary. ->Removing & Replacing Calibration Motor Assembly 3.1.5.
	Main PC Board may be defective.	Verify that all other functions are operational. If not, the Main PC board may be defective. ->Main PCB Removal & Replacement 3.1.3.
	Load Cell PCB is defective	Replace Load Cell PCB. (See p. 3-27.)

2.3 ERROR CODES

The following table lists error codes, possible causes and remedies. If the problem persists, contact Ohaus Corporation.

TABLE 2-6. ERROR CODES

ERROR CODE	PROBABLE CAUSE	REMEDY
Error 7.0	Unstable weight reading when defining the reference weight	Eliminate vibration and drafts.
Error 8.0	Weight reading below Power On/Zero limit.	Put pan on balance.
Error 8.1	Weight reading exceeds Power On/Zero limit.	Clear pan
Error 8.3	Weight reading exceeds overload limit.	Clear pan.
Error 8.4	Weight reading below underload limit.	Put pan on balance.
Error 9.0	Internal fault.	Restore EEPROM data, using Software Service Tool. (See Appendix C.1). Replace Main PCB.
Error 9.5	Production calibration not present.	Perform Service Calibration (See Appendix B).
Error 9.8	User calibration data not present. (Required for LFT ON only)	Calibrate balance.
Error 53	EEPROM checksum error.	Cycle power on, off. If balance fails to operate, restore EEPROM data.
LOW REF WT	Average piece weight too small. (Warning only – count will continue.)	See Instruction Manual for more detail.
REF WT Err	Reference weight too small. The weight on the pan is too small to define a valid reference weight.	Increase sample size.
Busy	(during tare, zero, printing, calibration, etc.)	Wait until completion.
- - - - - - - - - - -	Unstable weight reading	If balance is level, in appropriate environment, repair Load Cell.

3.1 REPAIR PROCEDURES

This section of the manual contains detailed disassembly procedures of the Discovery Balance.

Section 5 of this manual contains exploded views and associated parts lists for all models. Refer to Section 5 drawings before disassembling the balance. Components inside of the balance are delicate. Handle with care.

3.1.1 Housing Disassembly/Opening the Balance

To disassemble the balance, refer to Figure 3-2. Components shown below must be removed before gaining access to the inside of the balance. Proceed as follows:

Always use an anti-static kit!

1. Turn the balance off.
2. Disconnect the power cable.
3. Remove the Breeze Ring, Pan, Breeze Ring Base and Grommet. (See Figure 3-1.)

Figure 3-1. Breeze Ring, Breeze Ring Base, Grommet and Pan removed from Discovery Balance.

3.1.1 Housing Disassembly/Opening the Balance

1. Remove the two screws shown and then the third one on the bottom.

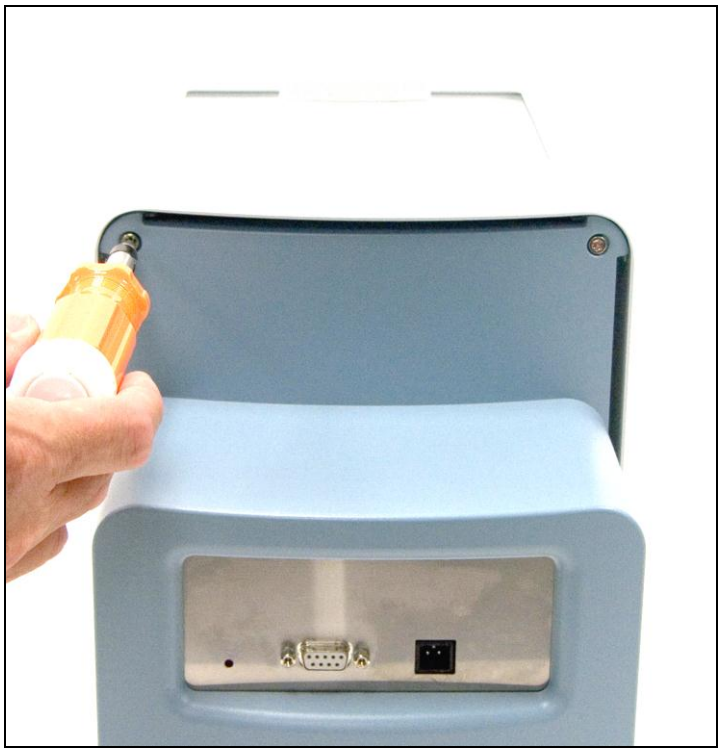


Figure 3-2. Removing back cover.

2. Remove the back cover.

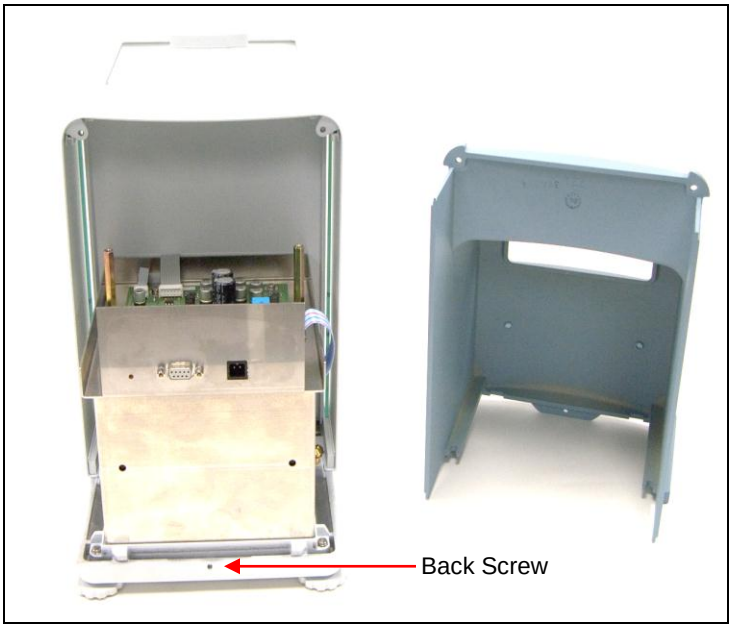


Figure 3-3. Balance with Back Cover removed.

3.1.1 Housing Disassembly/Opening the Balance

3. Tip the balance on its back.

4. Locate the screw shown in Figure 3-4.

5. Turn the screw counterclockwise four to five turns.

Figure 3-4. Scale bottom, showing Draft Shield Assembly.

6. Set the balance back on its feet.

7. The Draft Shield Assembly should slide back approximately one-quarter inch. If not, turn the screw one more turn

8. Slide the Draft Shield Assembly toward the back and lift to remove it.

3.1.1 Housing Disassembly/Opening the Balance

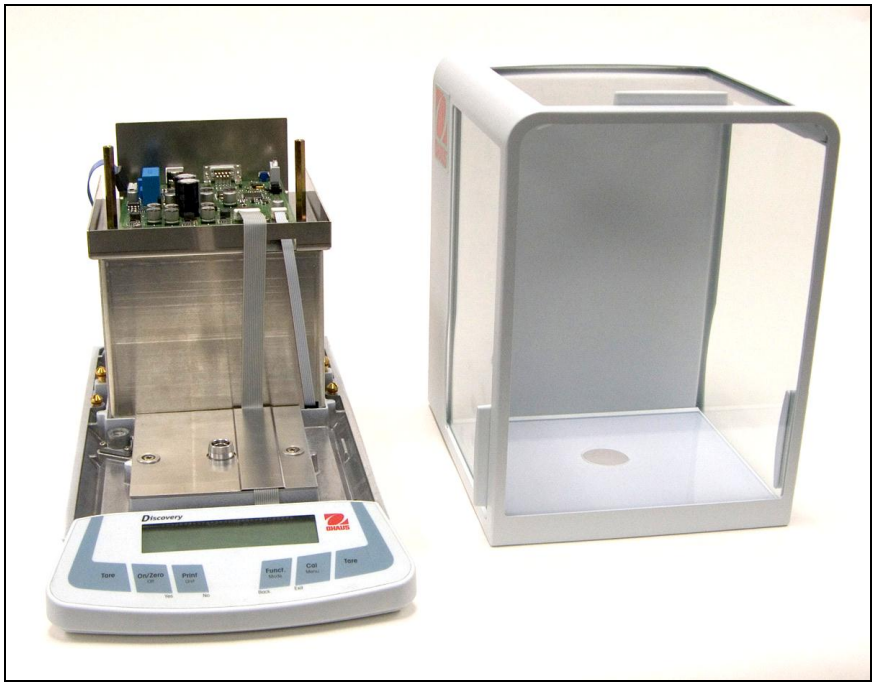


Figure 3-5. Discovery Balance with cover removed,
and also cover of main Printed Circuit Board removed.

NOTE: When replacing cover, place keyway holes over cone-shaped brass screw heads.

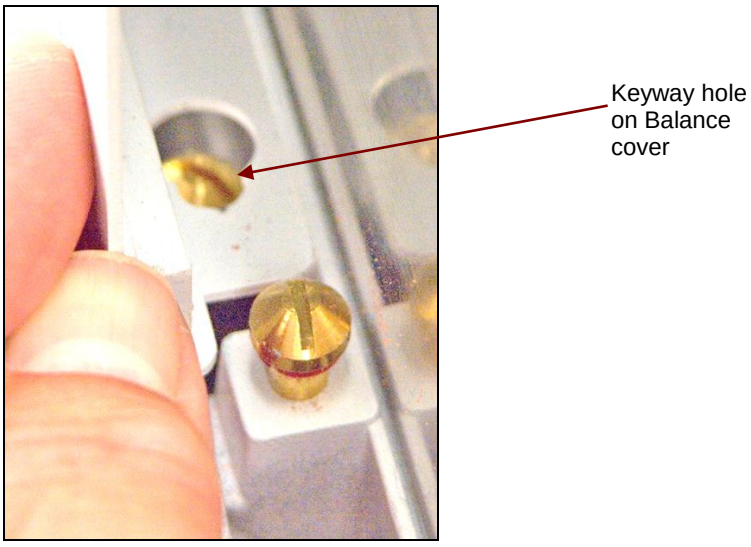


Figure 3-6. Keyway hole on cover guided
over cone-shaped brass screw heads.

3.1.2 Display PCB Removal & Replacement

If the Display Circuit Board is suspected of being faulty, it should be replaced.

Table 3-1. Display Assembly Parts List

Drawing Item	Description
1	In Use Cover
2	Function Label
3	Display Housing Upper
4	Printed Circuit Board (PCB) Display
5	Display Cable
6	Display Housing Bottom

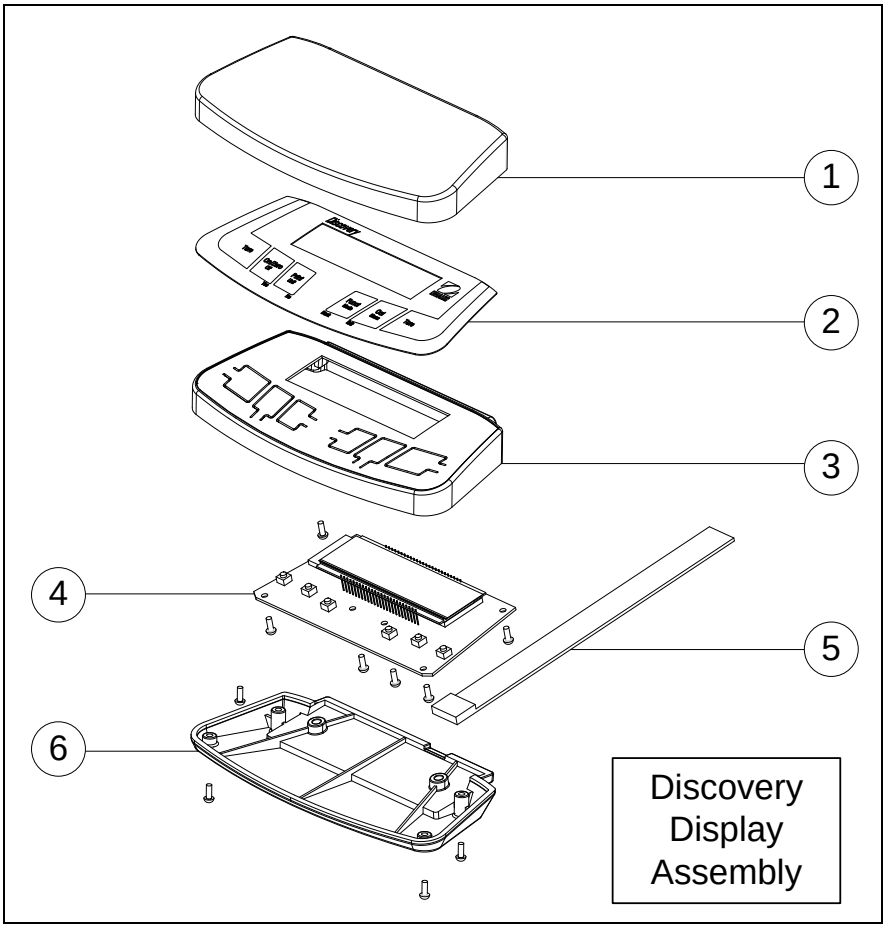


Figure 3-7. Scale drawing of Discovery Balance Display Parts.

3.1.2 Display PCB Removal & Replacement

To **remove** the Display Printed Circuit Board (PCB), proceed as follows:

1. Open the Housing, as explained in Section 3.1.1.
2. Tip balance onto back. Remove the 2 screws holding Display Housing assembly to back plate of balance.

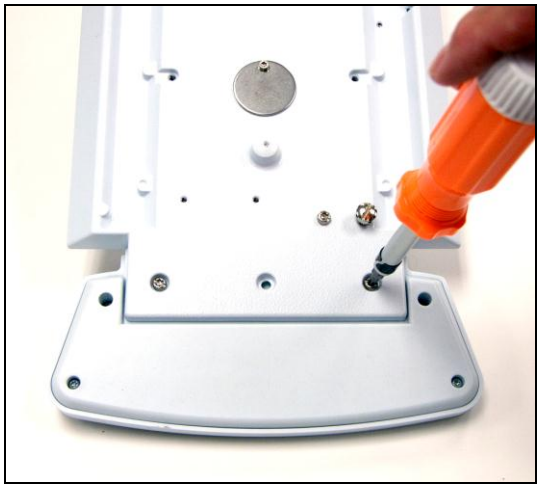


Figure 3-8. Removing screws to separate Display Housing from bottom of balance.

3. Display Housing will still be connected by a cable to the balance assembly. Remove the 4 screws on the bottom of the Display Housing, and remove the cover of the Display.
4. Disconnect the interconnecting cable from the Display PCB.
5. Remove the 6 screws securing the Display PCB, and lift out the PCB.

CAUTION:

WHEN HANDLING THE PRINTED CIRCUIT BOARD, HANDLE BY EDGES ONLY! DO NOT TOUCH FOIL SIDE OF BOARD. STATIC DISCHARGE MAY DAMAGE SOME COMPONENTS.

To **replace** the Display Circuit Board, proceed as follows:

6. Replace the Display PCB with a new board and install the 6 securing screws.
7. Re-connect the interconnecting cable to the replacement Display PCB.
8. Replace the housing cover of the Display and insert the 4 screws on the bottom.
9. Install Display assembly to balance: tip balance up and insert 2 screws on the bottom.
10. Replace balance cover, performing Housing Disassembly in reverse order.
11. Check balance performance and perform Span Calibration: See Appendix A.2.

3.1.3 Main Printed Circuit Board (PCB) Removal & Replacement

If the main Printed Circuit Board (PCB) is suspected of being faulty, it should be replaced. To replace the main Printed Circuit Board, proceed as follows:

1. Open the Housing by referring to Section 3.1.1.

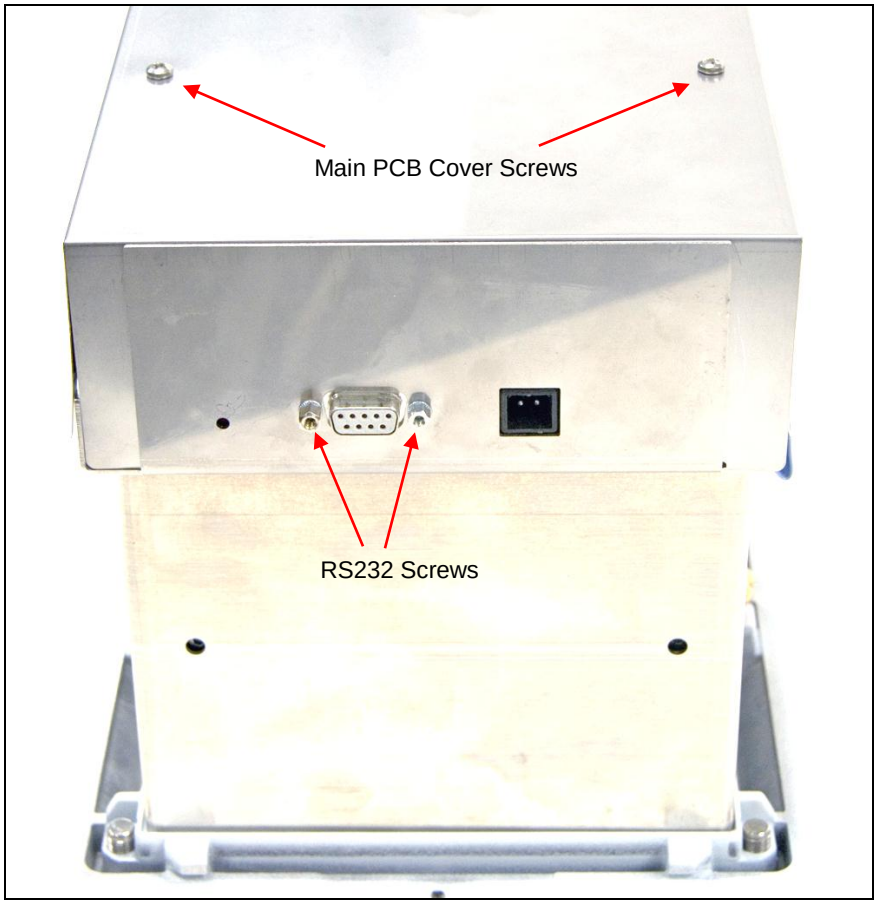


Figure 3-9. Display Balance Load Cell Cover

2. Remove 2 screws from the Main PCB cover and remove the cover.

3. Remove the 2 screws that secure the RS232 connector.

3.1.3 Main Printed Circuit Board (PCB) Removal & Replacement

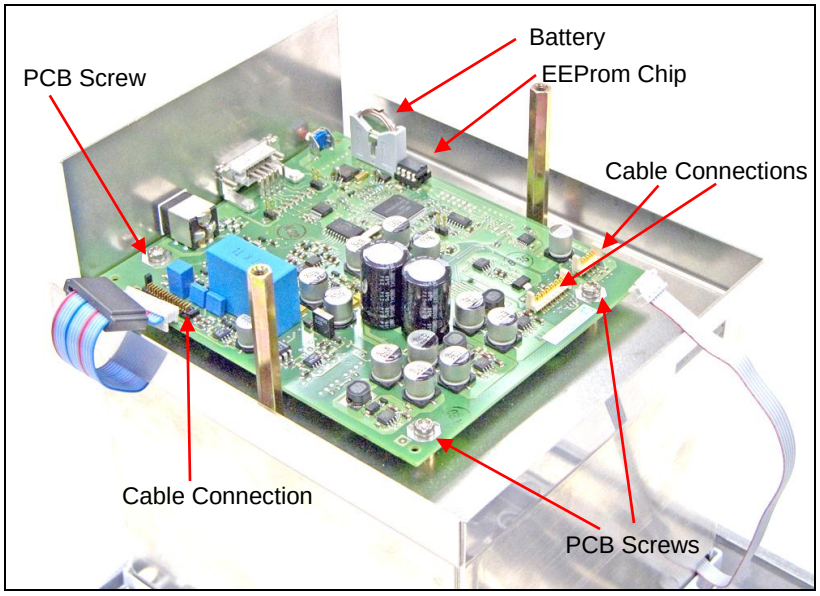


Figure 3-10. Discovery Balance Printed Circuit Board (PCB).

CAUTION

WHEN HANDLING THE PRINTED CIRCUIT BOARD, HANDLE BY EDGES ONLY! DO NOT TOUCH FOIL SIDE OF BOARD. STATIC DISCHARGE MAY DAMAGE SOME COMPONENTS. ALWAYS USE AN ANTI-STATIC KIT!

4. Disconnect the cables from the PCB.
5. Remove the 3 screws securing the PCB.
6. Remove the PCB.
7. Before installing the new PCB, remove its EEProm chip, and replace it with the original PCB's EEProm chip. (The original EEProm chip has data specific to the Discovery Balance.)

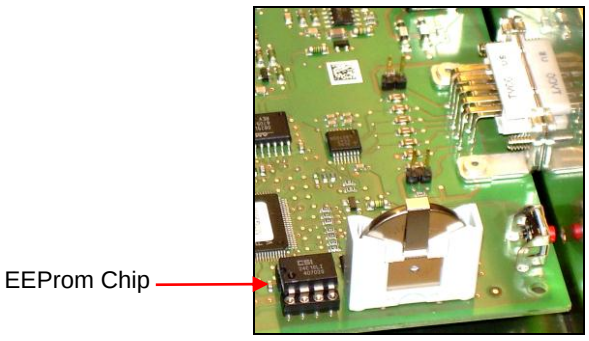


Figure 3-11. EEProm chip, next to battery on main PCB.

NOTE: Be extremely careful to avoid bending the chip's pins when removing and replacing the EEProm chip.

3.1.3 Main Printed Circuit Board (PCB) Removal & Replacement

8. Install the replacement PCB, carefully aligning the 3 screw holes and the RS232 screw holes.
9. Install the 2 screws that secure the RS232 connector.
10. Install the 3 screws that secure the PCB.
11. Insert the 2 small cables through the small rectangular slot on the side of the PCB mounting plate. Connect the 3 cables back to the PCB. Be sure all 3 cables are secured properly.
12. Re-assemble balance. (Follow Sections 3.1.2 and 3.1.3 in reverse order.)

NOTE:
Be careful when replacing the PCB Cover to avoid bending the teeth that secure the Cover to the Mounting Plate. The Cover should rest on the inside of the rear Mounting Plate, as shown in Figure 3-12 below.

Figure 3-12. The PCB Cover has alternating teeth to secure it to the Mounting Plate.

13. Use the Discovery Service Tool Software to electronically install the new main PCB. (See Appendix C.3.)
14. Perform two calibrations: first Service Calibration (see Appendix B), then Span Calibration. (See Appendix A.2.)
15. Check functioning of the balance.

3.1.4 InCal Weight Hardware Disassembly & Testing

If the Weight Mechanism appears to be unstable, the first remedy should be to perform an InCal Weight Mechanism test. This test is done with the Discovery Balance Software Service Tool (see Appendix C, especially C.5 and C.6), installed on a personal computer which is connected to the balance's RS232 port using a standard serial extension cable.

Observe the weight displayed on the balance for each of the four conditions (No Load, Partial Load 1, Partial Load 2, and Total Load). If the display does not stabilize after a few seconds in each condition, this could be caused by a defect in the Weight Mechanism hardware – one or both of the weights might not be fully lowered in their cradles, a part of the mechanism might have come out of position, or dust or debris might have entered the mechanism.

Depending on the balance capacity, Error 8.3 (Weight reading above underload limit) may be displayed when Total Load is applied. This is normal.

NOTE:
The following procedure should only be performed in a clean, dust-free environment, which is also free of vibrations that could affect the ultra-sensitive calibration of the balance.

To identify and correct any of these problems, use the following procedure to disassemble, inspect and clean the InCal Weight hardware:

1. Remove the housing and open the balance. (Follow the steps in Section 3.1.1.)

2. Remove the 2 screws from the Display Cable Shield Plate and lift it aside.

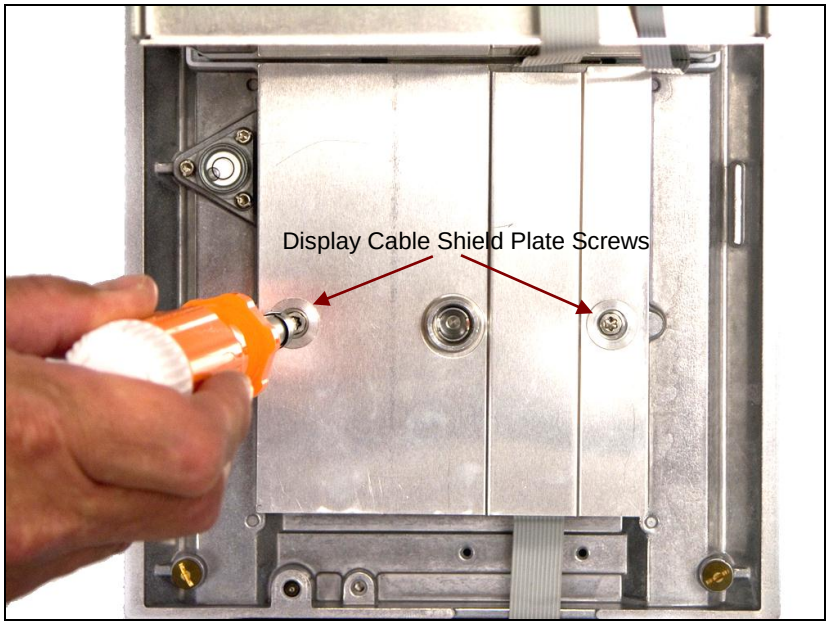


Figure 3-13. Removing Display Cable Shield Plate.

3. Carefully move the Display Cable to the side. It does not need to be disconnected for this procedure.

3.1.4 InCal Weight Hardware Disassembly & Testing

4. Lift off the InCal Weight Cover. It does not have screws.

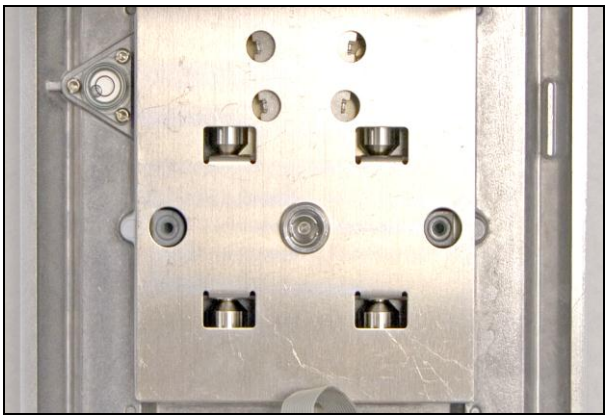


Figure 3-14. The InCal Weight Cover sits beneath the Display Cable Shield Plate.

Note:
A clean glove should be worn when handling Weights.

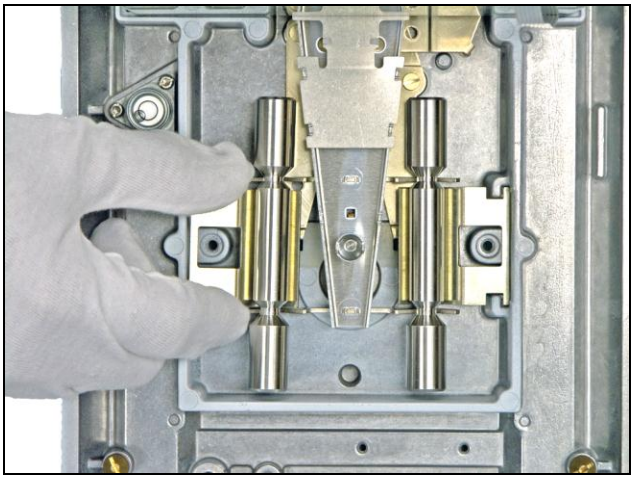


Figure 3-15. Weights and Weight Holders can be removed, but should only be handled while wearing a clean glove.

5. Remove both Weights and Weight Holders, and set them aside.

6. Carefully remove any dust or debris from the Weights, Weight Holders, and their environment, using alcohol on a clean cloth.

InCal Weight Hardware Disassembly & Testing

7. Test the InCal Weight Mechanism (with Weights and Weight Holders removed) using the Software Service Tool as explained in Appendix C, Sections C.5 & C.6.

   While running the test, observe the movement of the Weight Arms, with the black tips, shown in Figure 3-16. Each Weight Arm should move inward when its Partial Load button is clicked (Partial Load 1 or Partial Load 2), and both should move inward when the Total Load button is clicked.

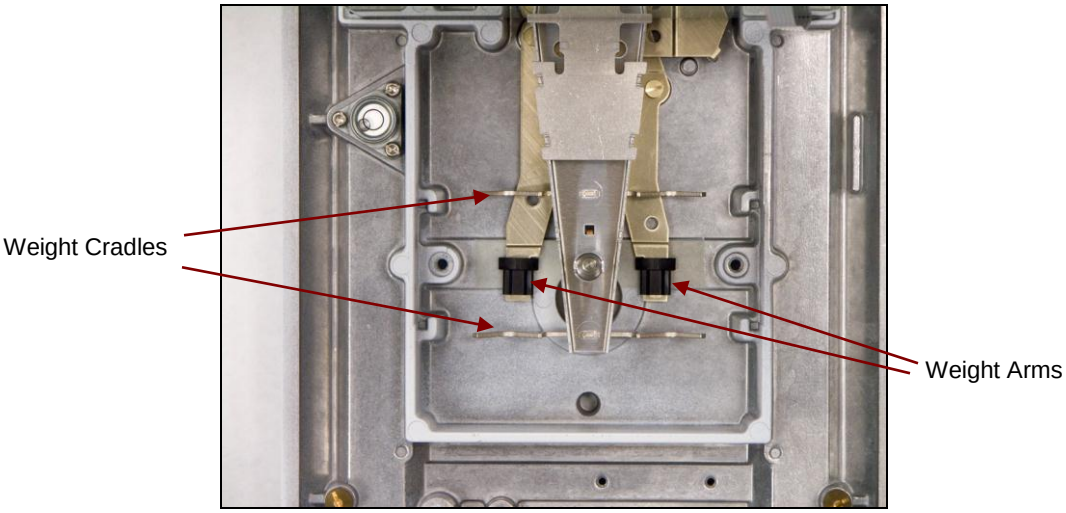


Figure 3-16. InCal Weight hardware with Weights and Weight Holders removed. Weight Arms with black tips are on either side of the Cantilever Arm.

8. Test the mechanism again, with Weights and Weight Holders in place, to ensure they are properly positioned. Place the Weight Holders to the left and right of the Cantilever Arm, and re-insert the 2 screws with their bushings that secure the Weight Holders. Then carefully place the Weights in their Holders.

9. As each Weight Arm moves inward when its Partial Load button is clicked, check that the Weight above it is lowered into place, resting fully on the Weight Cradles. Both Weight Arms should move inward when the Total Load button is clicked, and both Weights should rest fully in their Cradles.

   If Weight Arm responses are acceptable (both empty and with Weights and Weight Holders in place), the Incal Weight Mechanism Test is satisfactorily complete.

10. If there are problems with the Weight Arm movements, open the Load Cell Cover and check the Calibration Motor for defects. If the Calibration Motor needs to be replaced, see the procedures in the next Section 3.1.6 - Removing and Replacing Calibration Motor Assembly.

11. Upon satisfactory completion of the InCal Weight Mechanism Test, be sure all hardware is perfectly clean, then reinstall the Weight Holders and Weights and re-assemble the InCal Weight Assembly, following this section in reverse order.

3.1.5 Removing and Replacing Calibration Motor Assembly

1. First perform Load Cell Cover removal, following Section 3.2.1.

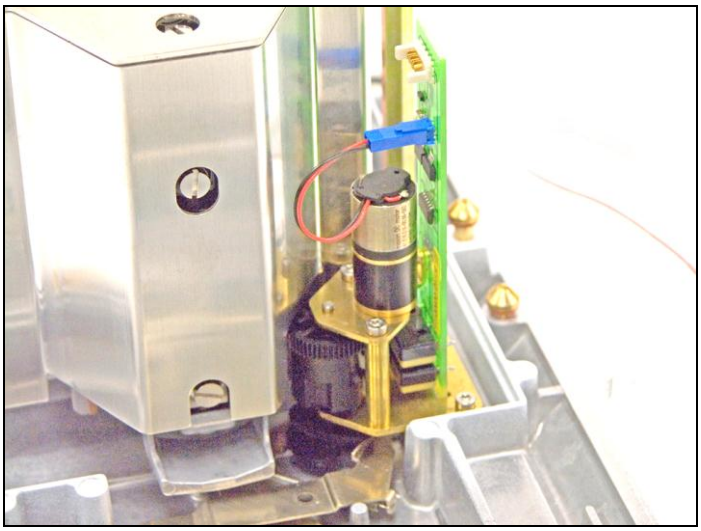


Figure 3-17. Calibration Motor Assembly, installed to the right of the Load Cell.

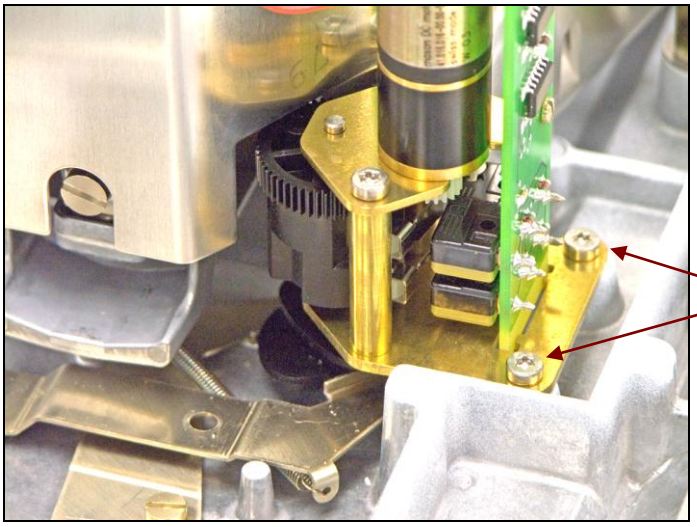


Figure 3-18. Calibration Motor Assembly, closeup. Note screws on right securing it to balance chassis.

2. Remove the screws on the Calibration Motor Assembly and gently lift it out.

Removing and Replacing Calibration Assembly

Note:

Observe the cam position, as in Figure 3-20. This is the *rest* position. Replicating this position when installing the new Calibration Motor Assembly will make installation easier.

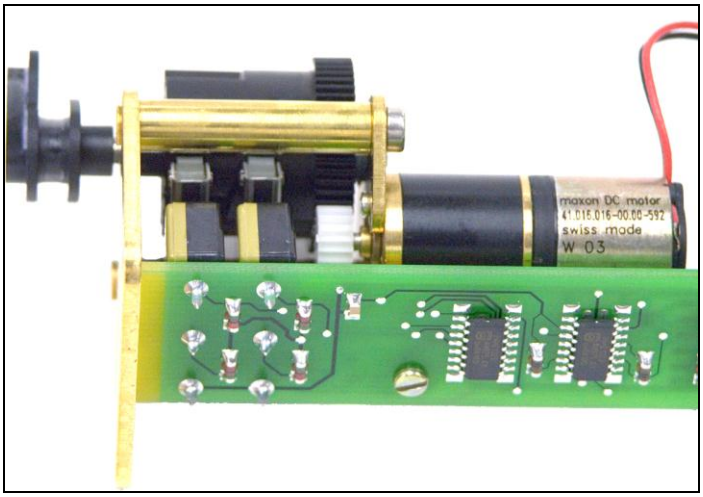


Figure 3-19. Calibration Motor Assembly

Figure 3-20. Calibration Motor close-up, showing cam in *rest* position

3. Install new the Calibration Motor Assembly. Re-insert the 2 screws previously removed.

4. Replace Load Cell Cover following Section 3.2.1 in reverse order.

3.2 Load Cell Removal and Disassembly

The Load Cell may need to be removed and repaired because of balance instability, or because the balance does not calibrate or repeat, or because the balance is physically broken or displays an error code. Possible causes include:

- Parts being misaligned
- Bent or broken Flexures
- Contamination or debris in the Magnet area, or in any moving part

NOTE: The Load Cell mechanism is extremely delicate, and must be handled very gently in a dust-free environment after it is removed from its protective housing.

Prior to opening the Load Cell be sure to have the Service Toolset, Part No. 80030340, which includes a fixture that must be installed to protect the Flexures during both disassembly and assembly.

NOTE: Always use an anti-static kit when opening the balance and handling its electronic parts.

3.2.1 Load Cell Removal

1. Disassemble the Housing and open the balance. (Refer to Section 3.1.1.)
2. Remove the 2 screws from the Display Cable Shield Plate and lift it aside.

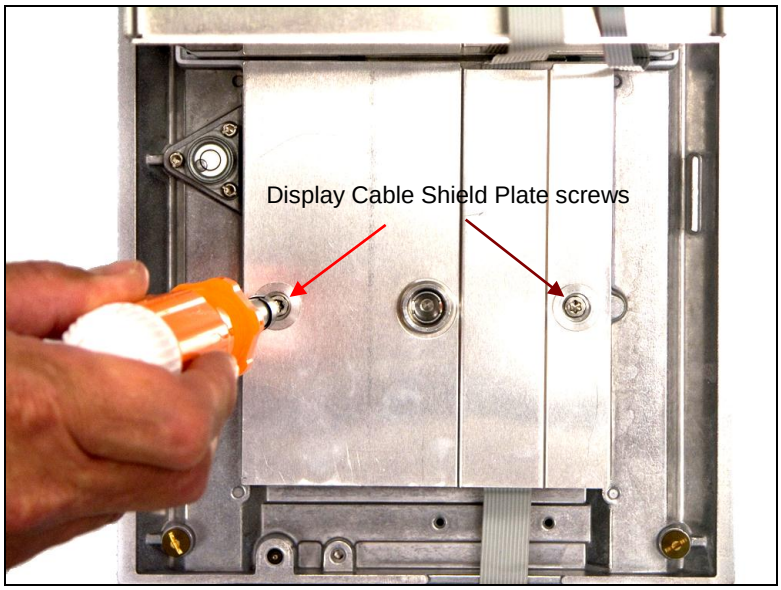


Figure 3-21. Removing Display Cable Shield Plate.

3. Carefully move the Display Cable to the side. It does not need to be disconnected at this time.

3.2.1 Load Cell Removal

4. Lift off the InCal Weight Cover. It does not have screws.

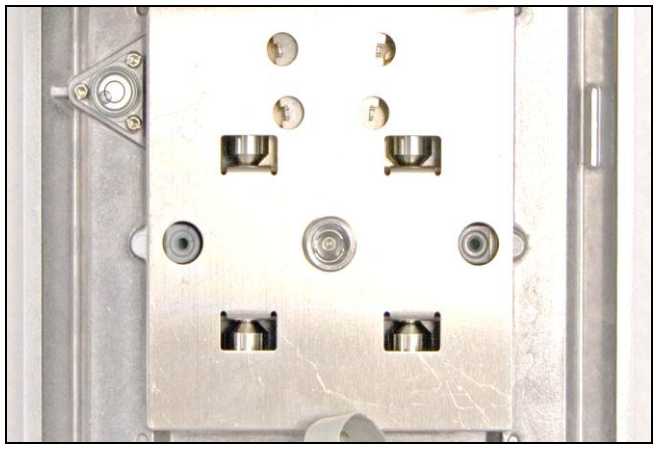


Figure 3-22. The InCal Weight Cover sits beneath the Display Cable Shield Plate

Note:
A clean glove should be worn when handling weights

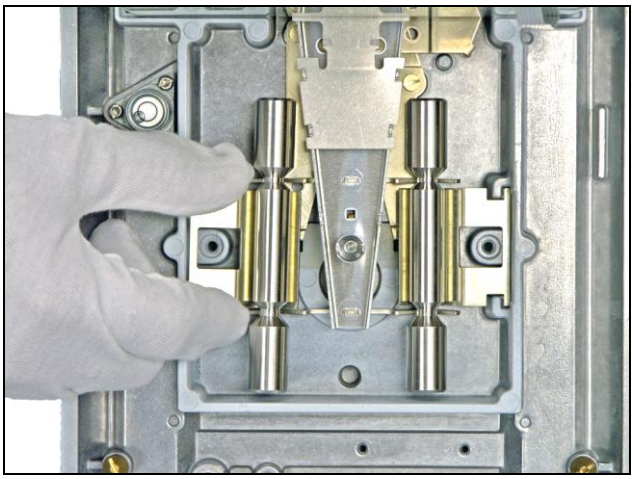


Figure 3-23. Weights and weight holders can be removed, but should only be handled while wearing a clean glove. This will leave only the Platform Holder on the chassis.

5. Remove both weights and weight holders, and set them aside.
6. Remove the Main PCB cover as indicated in Section 3.1.3.
7. Disconnect the cables from the PCB.
8. Remove the copper-colored stand-off screws that secure the PCB Mounting Plate.

3.2.1 Load Cell Removal

9. Lift off the PCB and its Mounting Plate, as shown in Figure 3-24.

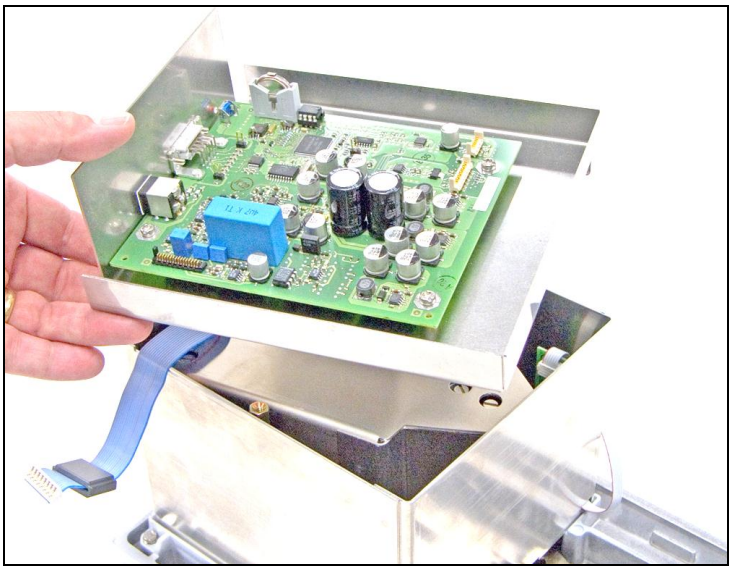


Figure 3-24. Lifting off the PCB and its Mounting Plate from the Load Cell.

10. Lift off the Load Cell Cover. It has no screws.

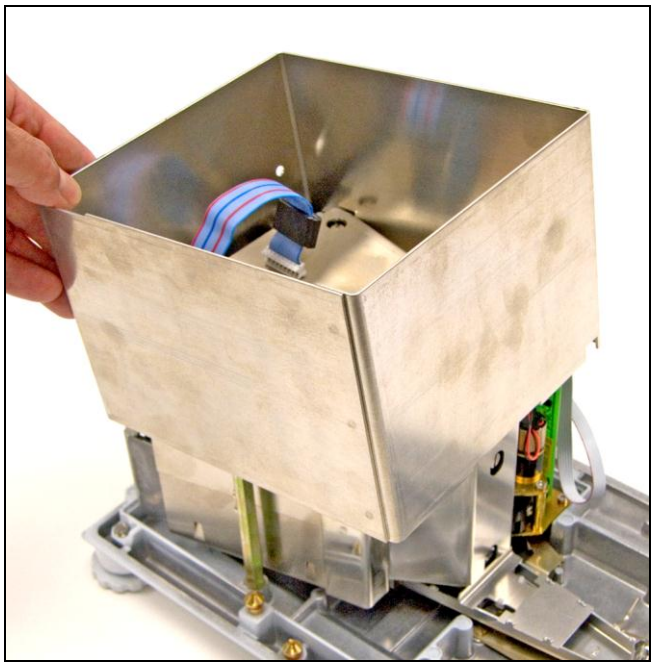


Figure 3-25. Lifting off Load Cell Cover.

3.2.1 Load Cell Removal

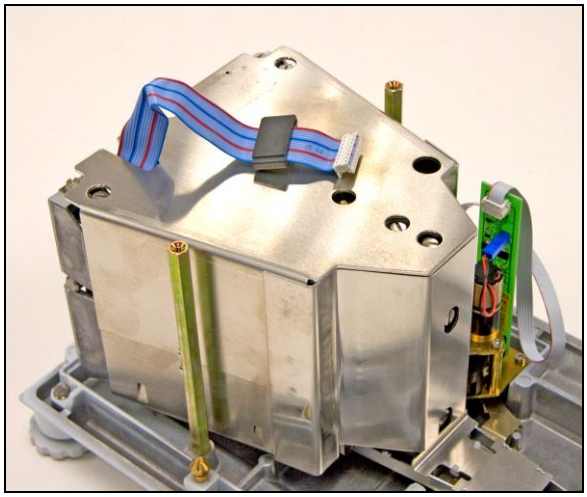


Figure 3-26. Load Cell with cover removed.

11. Remove the Cantilever Arm by applying slight downward pressure with the fingers and press upward with the thumb, then sliding away from the Load Cell.

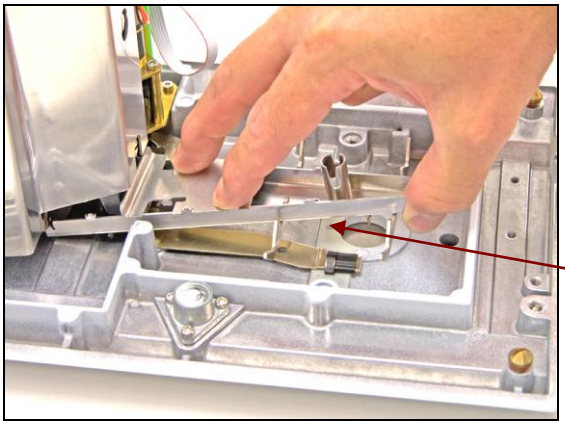


Figure 3-27. Removing Cantilever Arm from Load Cell.

12. Tilt the balance onto its back and remove the 3 screws that secure the Load Cell to the Bottom Housing.

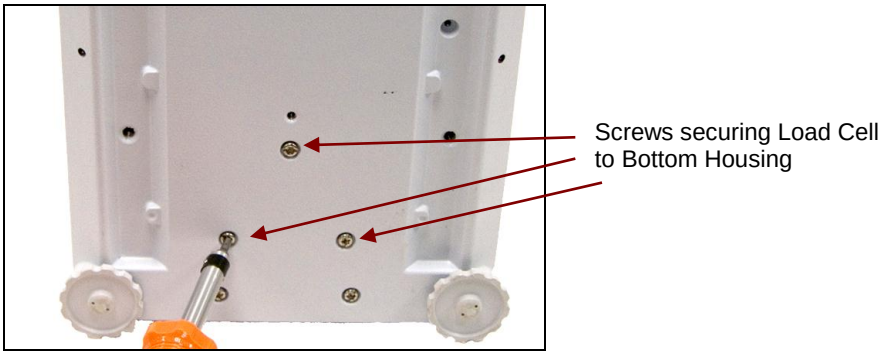


Figure 3-28. Bottom Housing of Load Cell.

3.2.1 Load Cell Removal

13. Remove the Load Cell, jostling it away from keyway, which faces towards the front of the balance. (See Figure 3-29.)

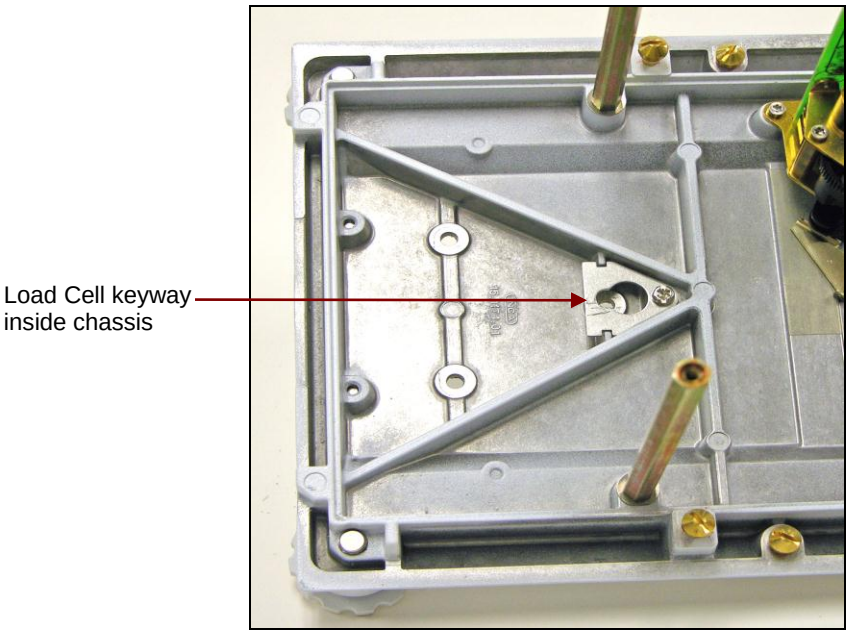


Figure 3-29. Load Cell chassis.
Note position of keyway,
facing towards front of balance.

14. Disconnect the cable from the Load Cell by pulling it downward.

Figure 3-30. Load Cell removed.

3.2.2 Load Cell Disassembly

1. First follow procedures for Load Cell Removal in Section 3.2.1.

2. Remove the two screws shown (on each side) to remove the top and bottom covers. Be careful of the Flexure Arm assemblies.

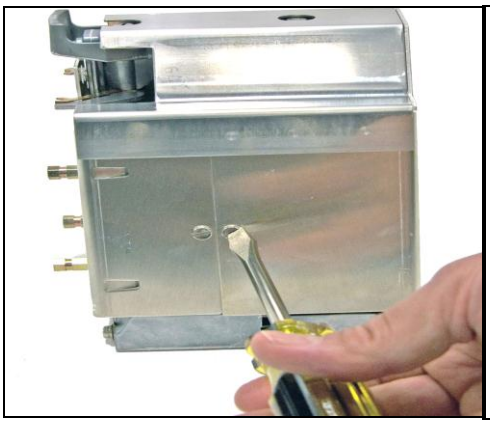


Figure 3-31: Removing screws from Load Cell top cover.

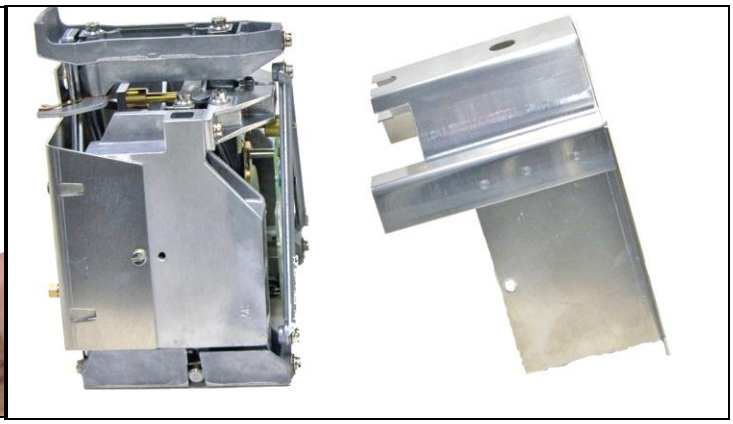


Figure 3-32. Load Cell with top cover removed.

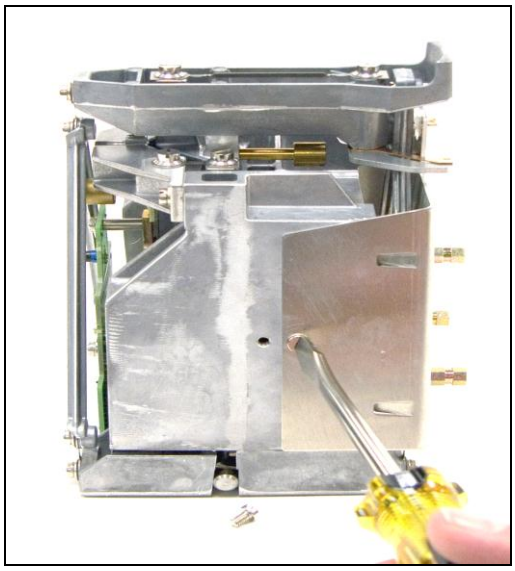


Figure 3-33. Removing screws from Load Cell bottom cover.

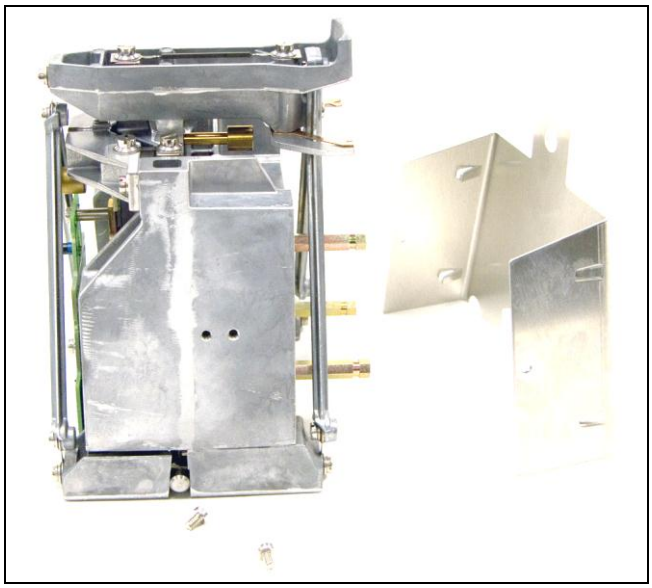


Figure 3-34. Load Cell with bottom cover removed.

NOTE:
When covers are removed *touch only the frame* of the Load Cell.

3.2.2 Load Cell Disassembly

3. Tip the Load Cell onto the back frame and loosen the 2 screws that connect the bottom Flexure Arm to the frame, NO MORE than half a turn.
   This is preparation for installing the fixture to protect the Flexure Arms.

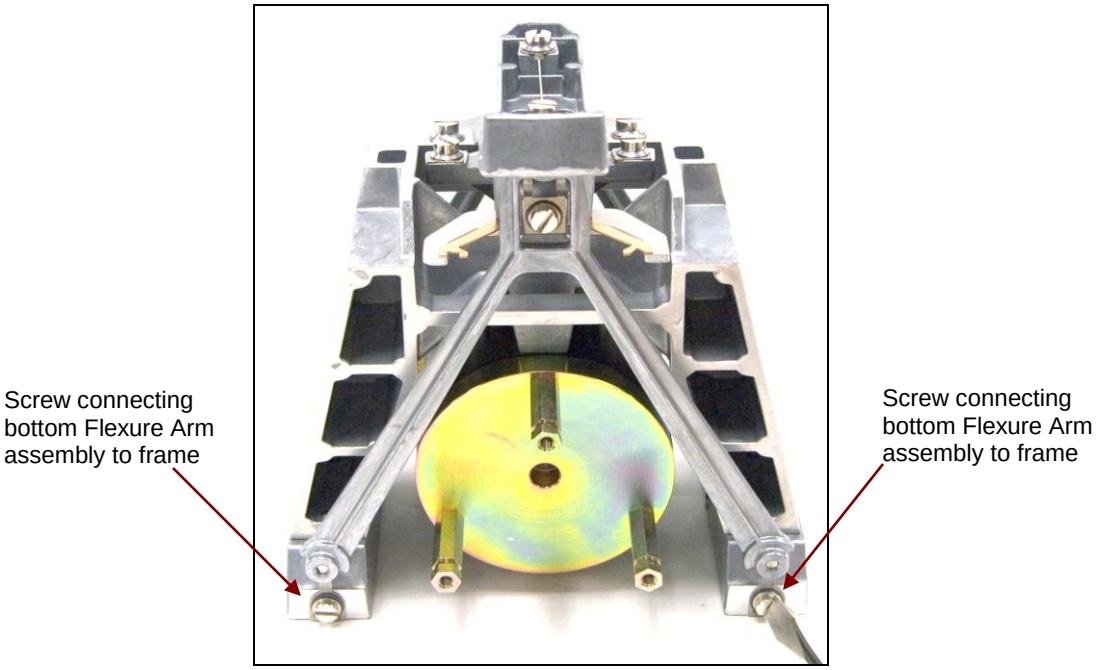


Figure 3-35. Screws on bottom Flexure Arm assembly.

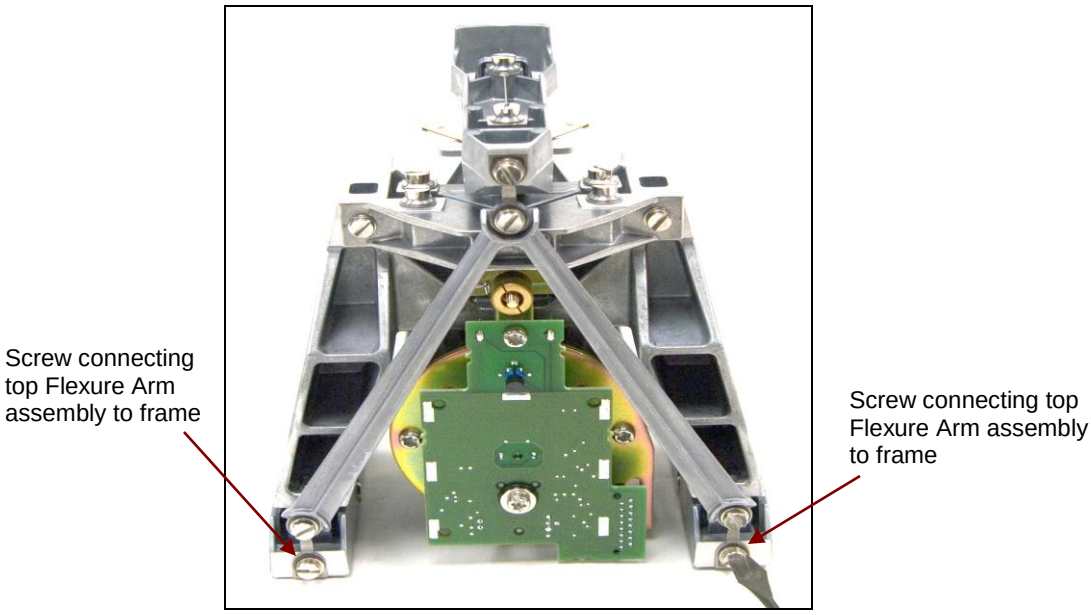


Figure 3-36. Screws on top Flexure Arm assembly.

4. Loosen the 2 screws that connect the top Flexure Arm assembly to the frame, NO MORE than half a turn. This is preparation for mounting the fixture to protect the Flexure Arms.

3.2.2 Load Cell Disassembly

5. Be sure to have the correct Service Toolset as shown below.

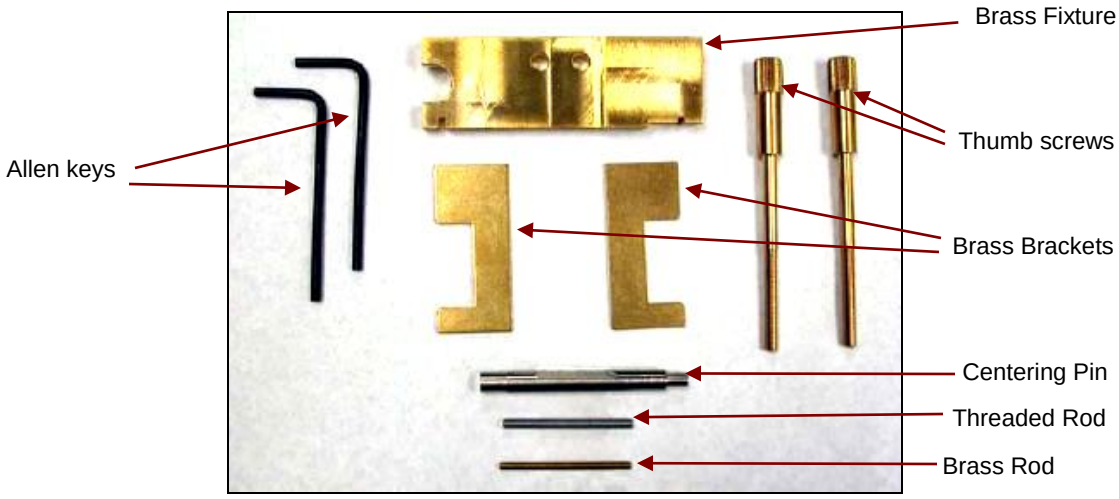


Figure 3-37. Service Toolset, Part No. 80030340, containing two Allen keys, one Brass Fixture, two Thumb screws, two Brass Brackets, a Centering Pin, a Threaded Rod and a Brass Rod.

Note: The Load Cell is delicate. Handle with care.

The following steps are performed to protect the Flexures during the disassembly process.

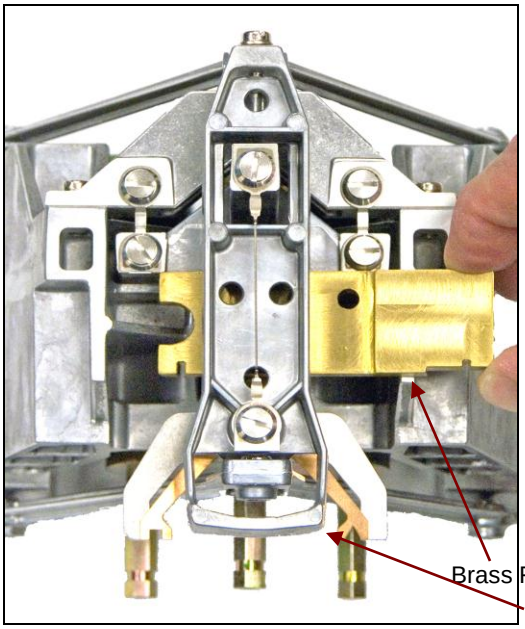


Figure 3-38. Brass Fixture inserted *part way* under the Load Cell's Hanger.

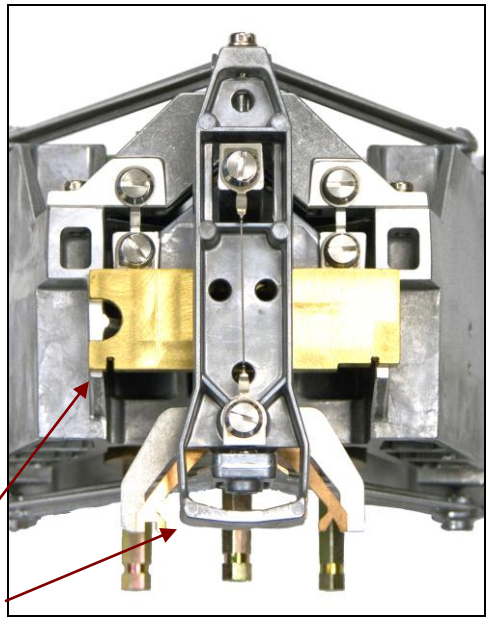


Figure 3-39. Brass Fixture fully inserted under the Load Cell's Hanger.

6. With the Load Cell resting on its back frame, slide the Brass Fixture from the Service Toolset under the hanger. After inserting the Brass Fixture part way, gently lift the Brass Fixture, allowing the Brass Fixture to be positioned in place.

3.2.2 Load Cell Disassembly

7. Install the 2 thumb screws from Service Toolset, as shown.

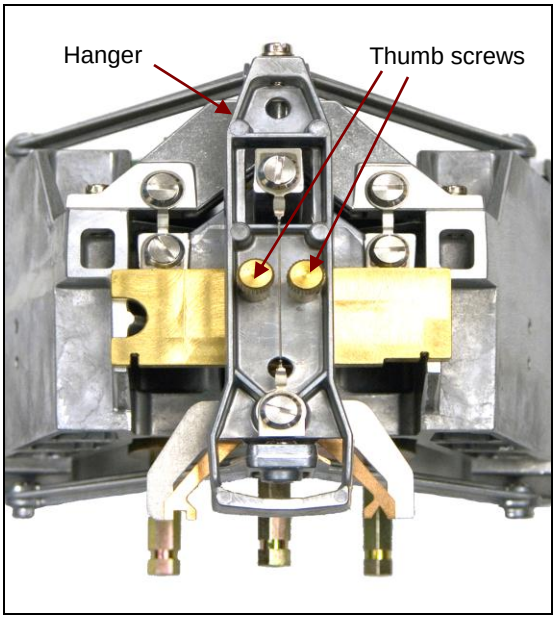


Figure 3- 40. Thumb screws and Hanger on top of Load Cell.

It is now safe to remove the Load Flexure.

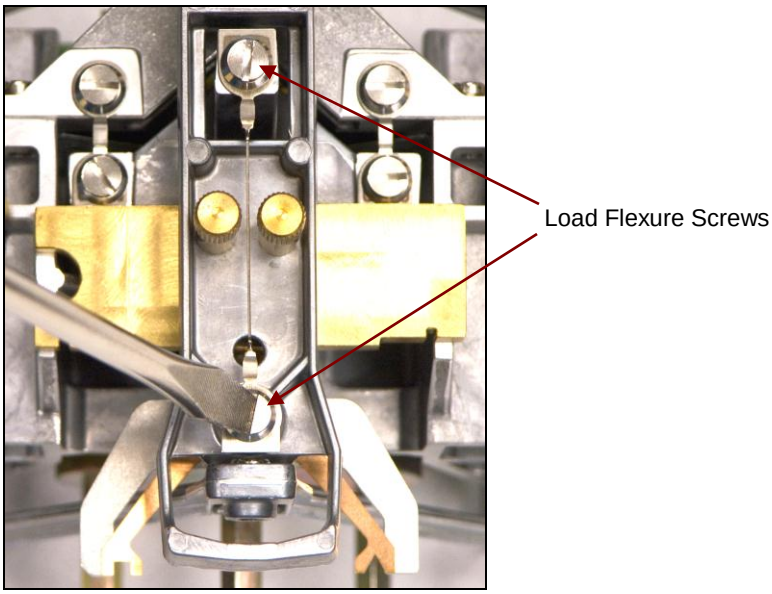


Figure 3-41. Screws securing Load Flexure to Hanger on top of Load Cell.

8. Carefully remove the two screws shown, together with 2 washers each: one steel (closest to screw head) and one aluminum.

3.2.4 Load Cell Disassembly

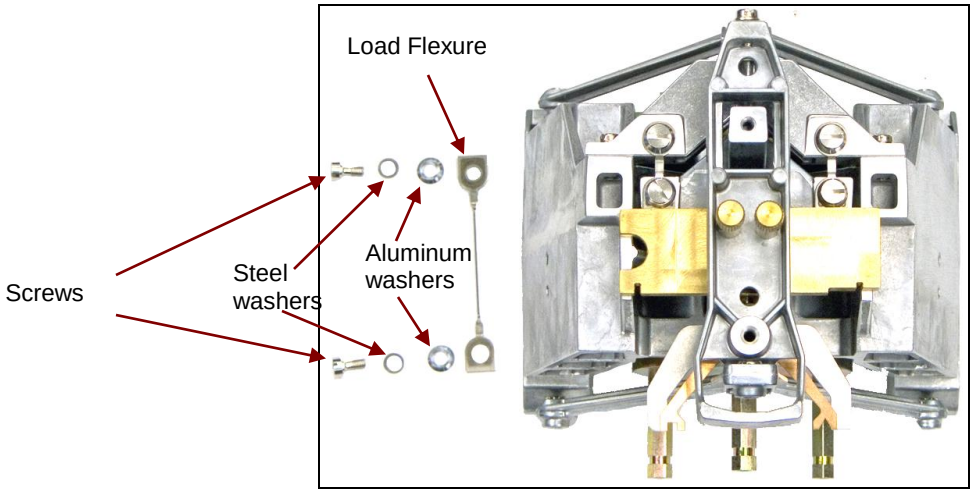


Figure 3-42. Load Cell with Load Flexure, 2 screws and 4 washers removed.

NOTE: All Flexures must be *perfectly straight*. If they are *even slightly* bent they need to be replaced for the balance to function properly.

9. Set Load Cell on its feet and remove the top Flexure Arm, by removing the 3 screws.

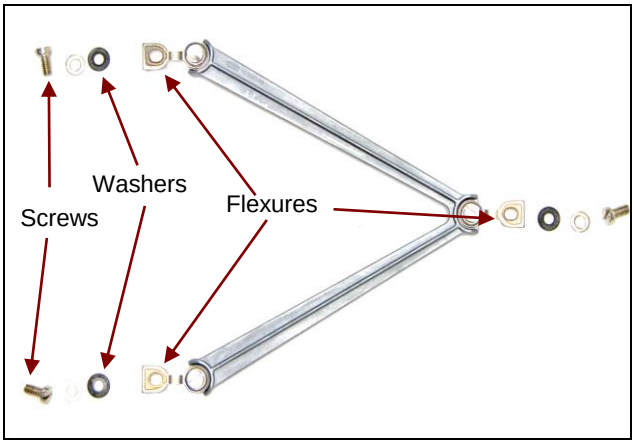


Figure 3-43. Flexures can be removed from Flexure Arm after removing Flexure Arm from Load Cell frame.

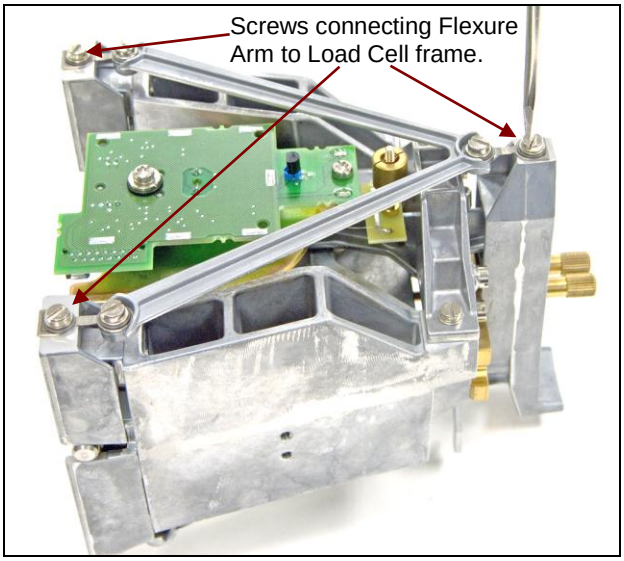


Figure 3-44. Removing the top Flexure Arm.

10. Before removing the bottom Flexure Arm, secure the Ratio Beam by installing the threaded rod, as illustrated in Figure 3-48. Then turn the Load Cell over, as shown in Figure 3-76, and remove the bottom Flexure Arm, as in Step 9.

NOTE: When handling the Flexure Arms, use care to prevent bending the Flexures.

11. Carefully examine each Flexure to see if it is bent. If uncertain, place the Flexure on a clean flat surface and check that both sides rest evenly on the surface. If a Flexure is bent even slightly, it must be replaced.

3.2.2 Load Cell Disassembly

There are two fine connecting wires called Wire Conductor Strips soldered to the Load Cell's PCB and to a smaller PCB on the top-front of the Ratio Beam. These wires must be *carefully* disconnected from the Load Cell's PCB in order to further disassemble and repair the Load Cell.

12. Unsolder the wires at the solder points on either side of the set screw atop the Load Cell's PCB.

13. Remove the solder with a solder sucker, to clear holes in PCB so the wires can pass through when you need to solder them back in place.

14. Use tweezers to remove wires from holes.

NOTE:
The smooth arc of the connecting wires is critical for the balance to function properly. Carefully observe this arc, and be sure to replicate it when re-soldering the wires!

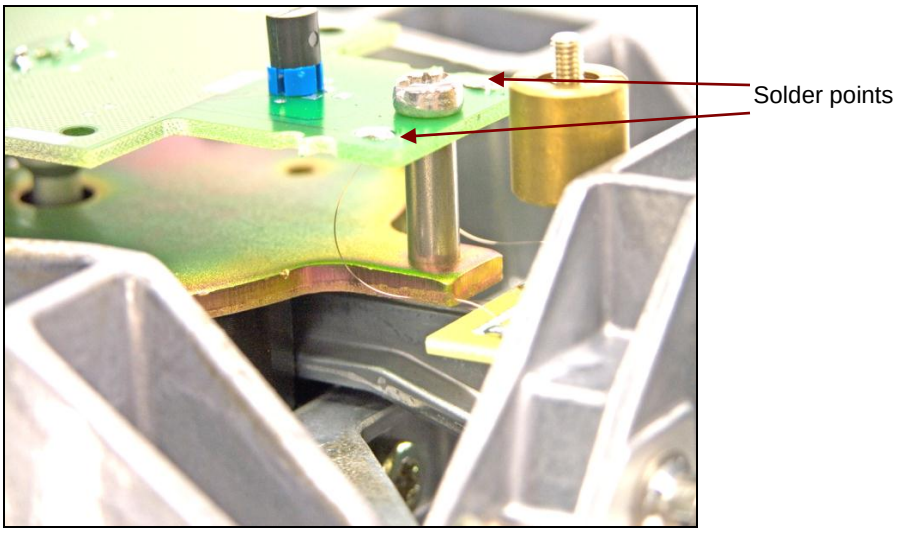


Figure 3-45. Solder points on either side of set screw connecting fine wire to Load Cell PCB.

3.2.2 Load Cell Disassembly

Before proceeding with Load Cell disassembly, secure the Ratio Beam with stabilizing rods from the Service Toolset in the front and rear. This will lock Ratio Beam to the yoke and prevent it from falling down when the Up/Down Stop Plate is removed. Proceed as follows:

15. On the back of the Load Cell, lift the Ratio Beam and insert the brass rod under it.

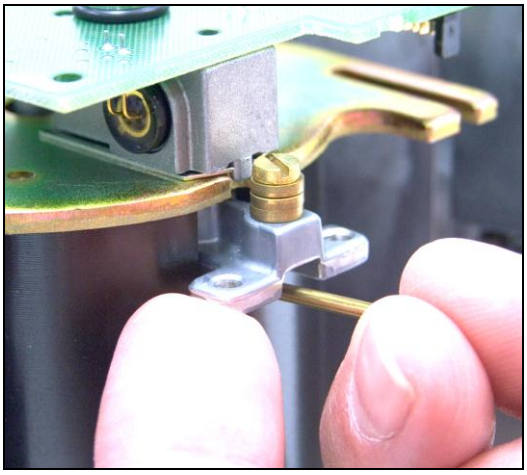


Figure 3-46. Lifting Ratio Beam to insert Brass Rod.

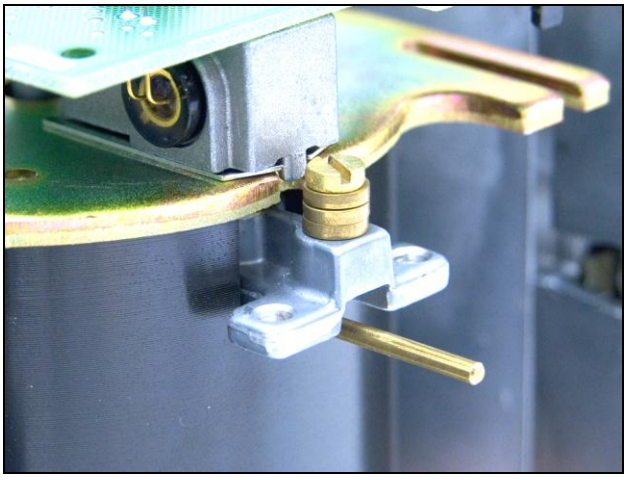


Figure 3-47. Brass Rod installed.

16. On the front of the Load Cell, screw in the Threaded Rod until it touches the Ratio Beam.

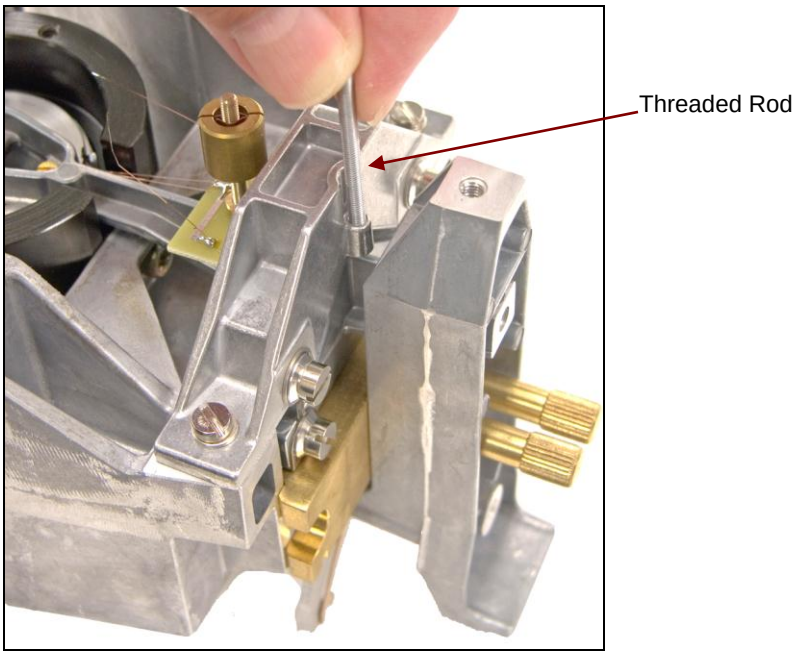


Figure 3-48. Screwing in Threaded Rod on front of Load Cell.

3.2.2 Load Cell Disassembly

17. Remove the two screws on the top of the Load Cell PCB. Carefully remove stepped washer from rear screw hole, and lift off the PCB.

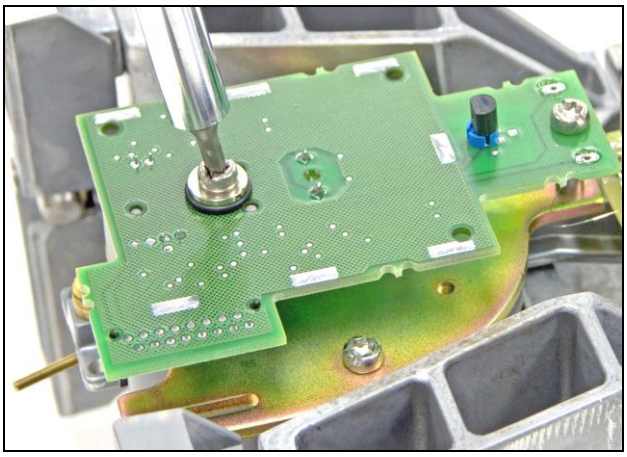


Figure 3-49. Removing screws from PCB. Note stepped washer under rear screw.

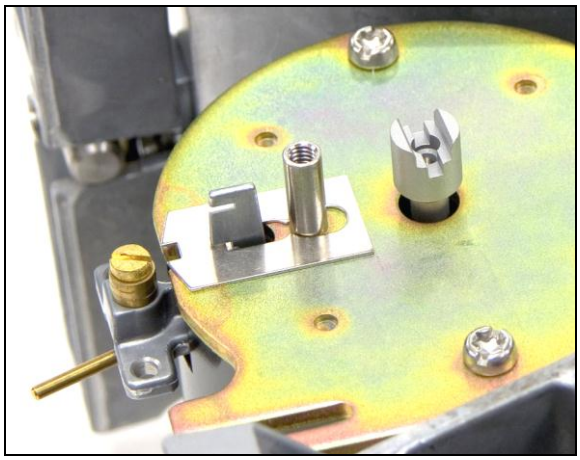


Figure 3-50. Magnet Cover without PCB.

NOTE: If the Load Cell PCB has to be replaced (for example, if Ramp does not give a reading), after removing the PCB, unsolder the two Temperature Sensors, as shown in Figure 3-51. Then remove the Temperature Sensors and set them aside. Remove the Temperature Sensors from the new PCB. Insert and solder the Temperature Sensors from the original PCB into the new PCB. The new PCB is now ready to re-install.

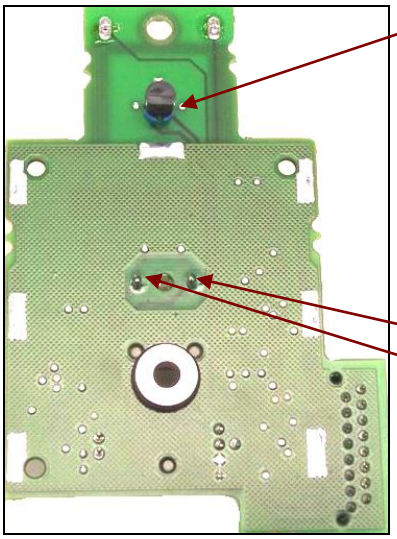


Figure 3-51. Solder points on top of Load Cell PCB.

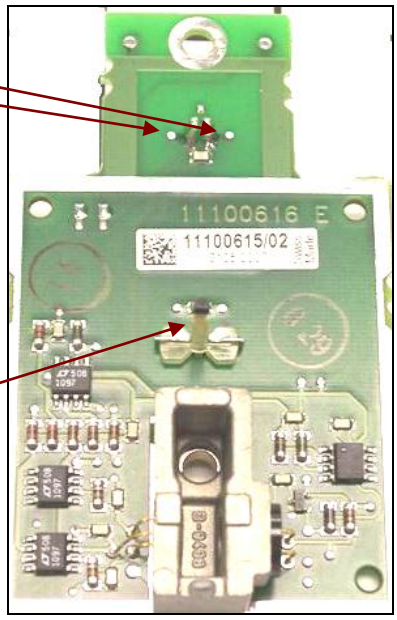


Figure 3-52. Solder points on bottom of Load Cell PCB.

3.2.2 Load Cell Disassembly

18. Remove the Up/down Stop Plate that controls the Ratio Beam's movement.

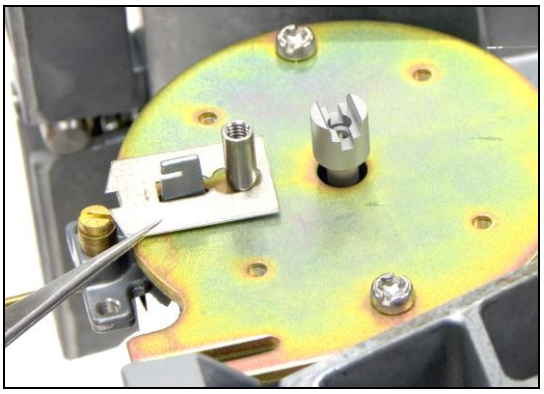


Figure 3-53. Up/Down Stop Plate.

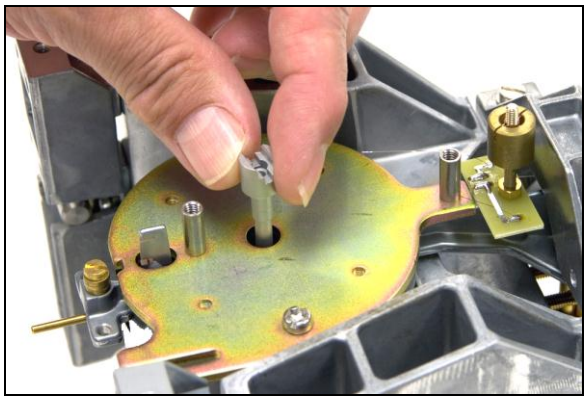


Figure 3-54. Removing Temperature Conductor.

19. Remove the Temperature Conductor, as shown in Figure 3-53.

20. Remove the two screws that secure the Magnet Cover, and *carefully* remove the Magnet Cover by lifting it straight up.

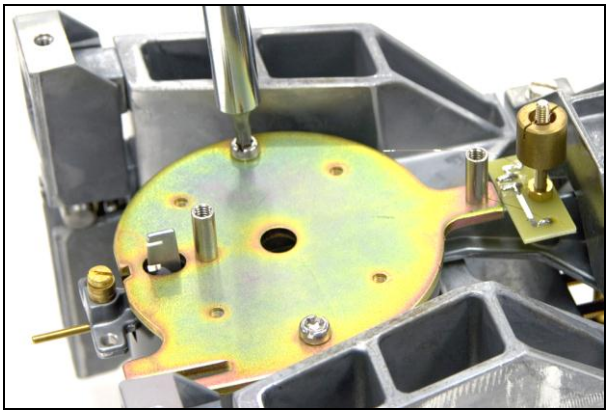


Figure 3-55. Removing screws that secure the Magnet Cover.

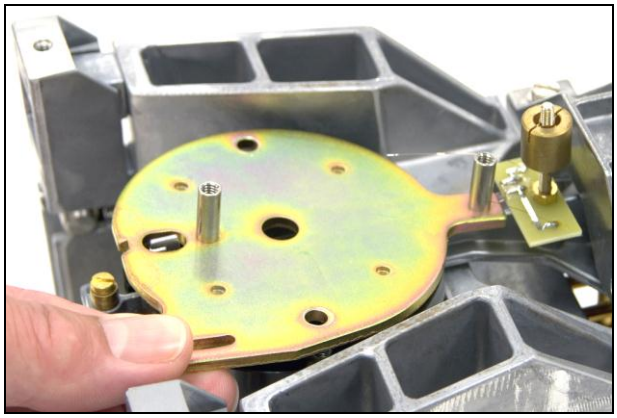


Figure 3-56. Lifting off the Magnet Cover.

3.2.2 Load Cell Disassembly

21. Remove the Hanger by removing Thumb screws, which will release the Brass Fixture inserted earlier.

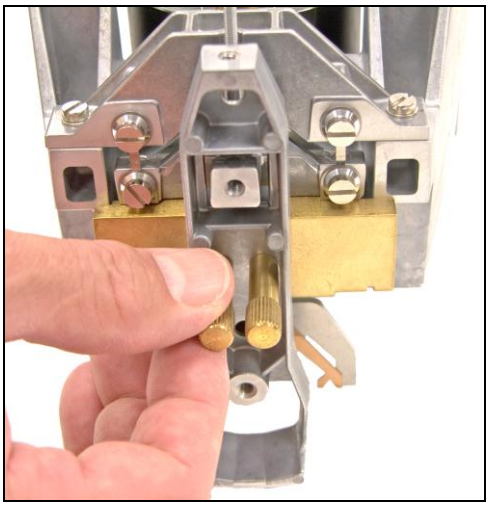


Figure 3-57. Removing Thumb screws that hold Hanger in place. (Brass Fixture will be released.)

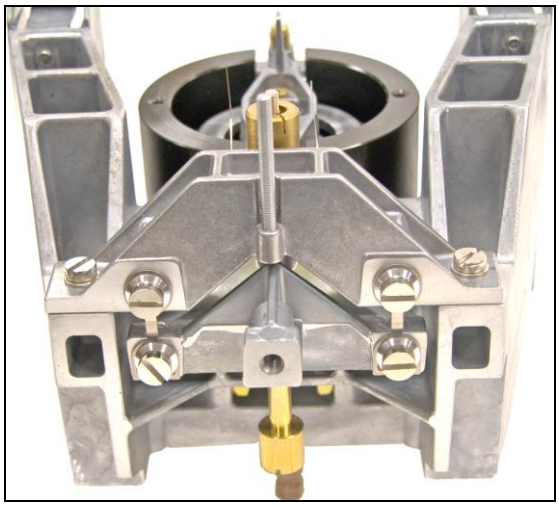


Figure 3-58. Load Cell without Hanger and Brass Fixture. Note uncovered Magnet in background.

22. Release Ratio Beam yoke by removing screws on each side.

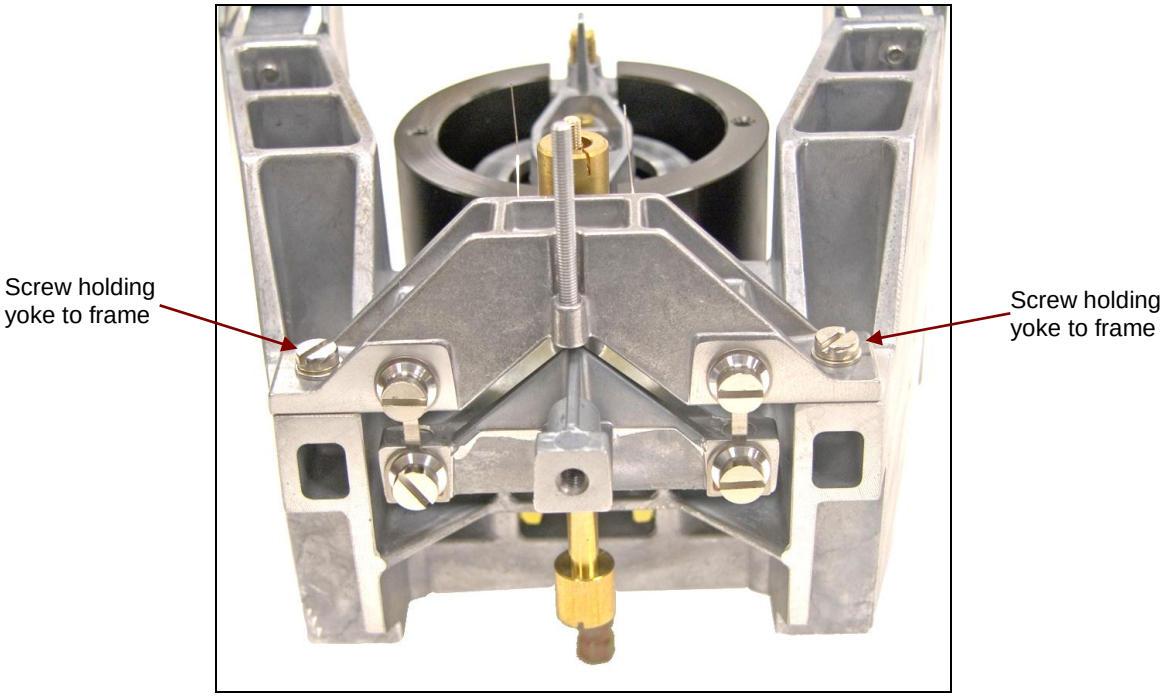


Figure 3-59. Screws on each side of yoke holding Ratio Beam must be removed.

3.2.2 Load Cell Disassembly

23. Gently lift the Ratio Beam out of the Load Cell

Note: The Ratio Beam is a critical part – handle with care!

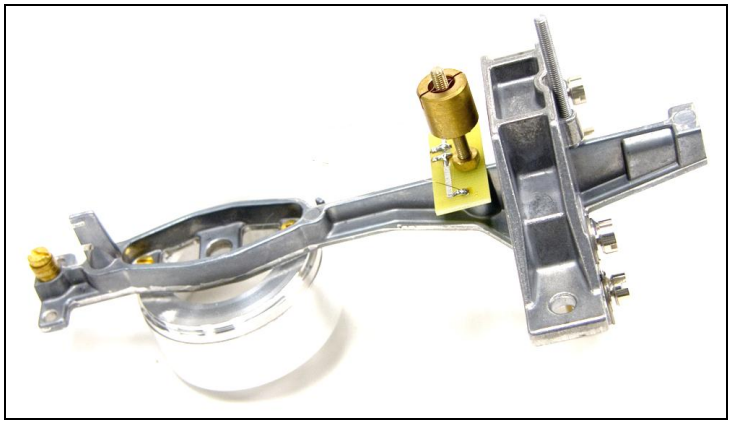


Figure 3-60. Ratio Beam, removed from Load Cell.

3.2.3 Load Cell Cleaning

All parts should be inspected and cleaned. Pay special attention to the Magnet gap and Coil, the Weights and Holders, the Up/Down Stop Plate, and the Temperature Sensor Tube.

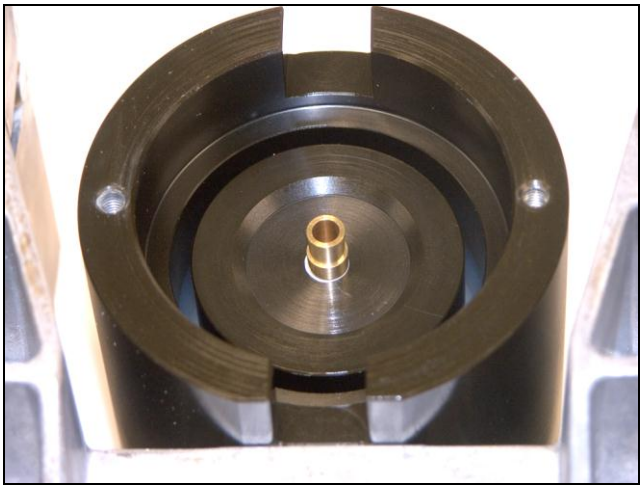


Figure 3-61. Magnet gap and Temperature Sensor Tube should be carefully examined for dust and debris.

Figure 3-62. Coil Assembly should be carefully examined and cleaned.

NOTE: Use *Sticky Notes* to clean the Magnet gap. DO NOT touch it with a cloth, and DO NOT use a cleaning solution. For best viewing, use a fluorescent light with magnifier lens.

Check to see if Flexures are bent or broken. Place the Flexure on a clean flat surface and check that both sides rest evenly on the surface.

3.2.4. Load Cell Assembly

The first several steps of Load Cell assembly are critical. Check at each step that parts are correctly aligned in order to ensure the balance will function properly.

1. Set the Ratio Beam assembly in place and loosely install the 2 screws on left and right sides of the yoke. Check that both front sides of the yoke align with the frame of the Load Cell. If they do not, *Ratio Beam Flexures may need to be replaced*, as explained next page in Section 3.2.5.1: Ratio Beam Flexure Replacement.

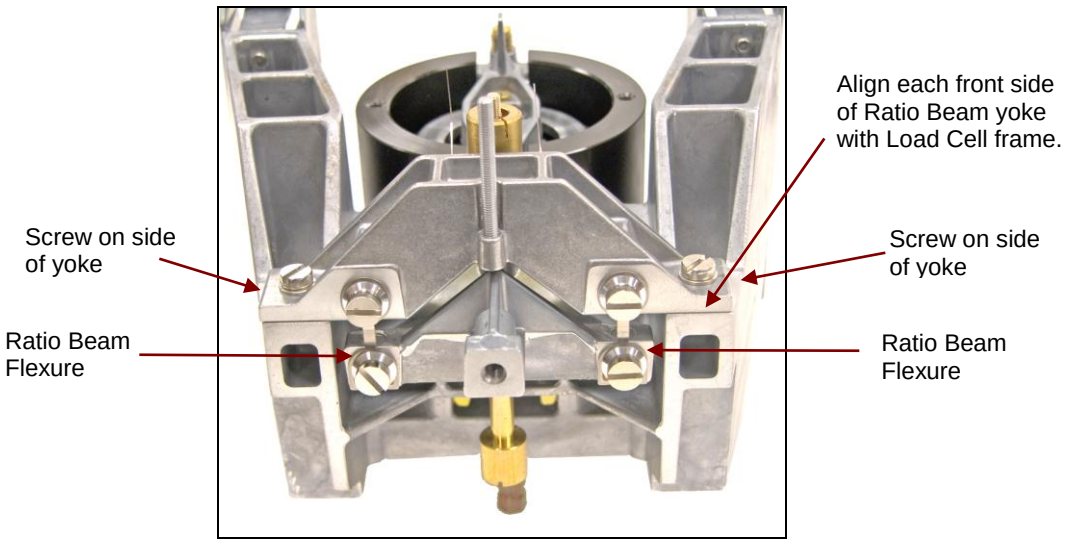


Figure 3-63. Yoke of Ratio Beam must align with frame of Load Cell.

2. Insert Brass Rod on back side under the Ratio Beam. Be sure Threaded Rod is on front. See Figures 3-45, 3-46, and 3-47, page 3-26.

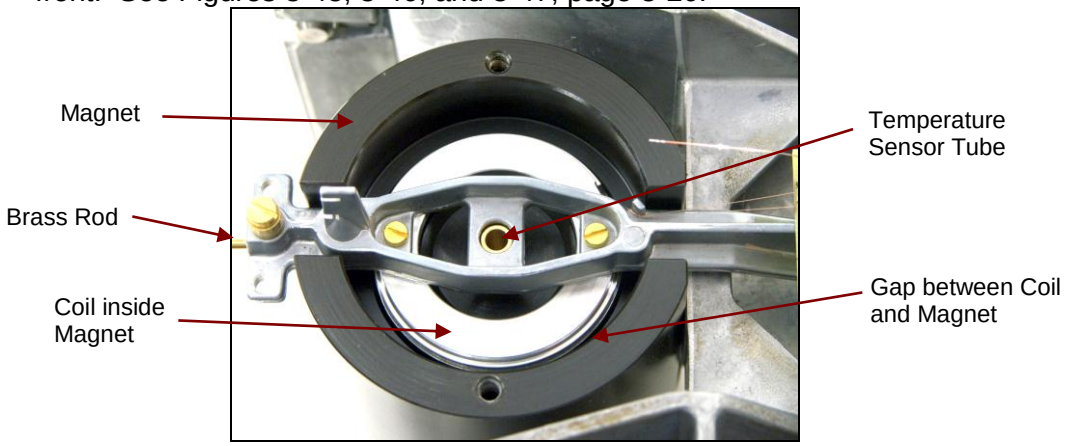


Figure 3-64. Installing Ratio Beam with hole centered over the Temperature Sensor Tube.

3. Ensure that the hole in the Ratio Beam is centered over the Temperature Sensor Tube, and that the gap between the Coil and the Magnet is even. Move the Ratio Beam assembly *only* by the yoke, until it is perfectly centered.

3.2.4. Load Cell Assembly

4. Once the Ratio Beam is centered, remove the Brass Rod in the front and the Threaded Rod in the back, and gently move the Ratio Beam up and down from the rear, checking for any friction. If there is friction, replace the Brass Rod and repeat the centering process.
5. Tighten the screws on each side of the yoke (shown in Figure 3-65) when the Ratio Beam is centered. Re-check movement.
   NOTE: If Ratio Beam Coil does not center properly over the Magnet and Temperature Sensor Tube, the **Ratio Beam Flexures** must be checked to see if they are bent. Place each Flexure on a clean flat surface and check that both sides rest evenly on the surface. If they don't, replace them.

3.2.5.1 Ratio Beam Flexure Replacement

5.1 Ensure yoke is aligned evenly side-to-side with frame, and flush with frame on front.

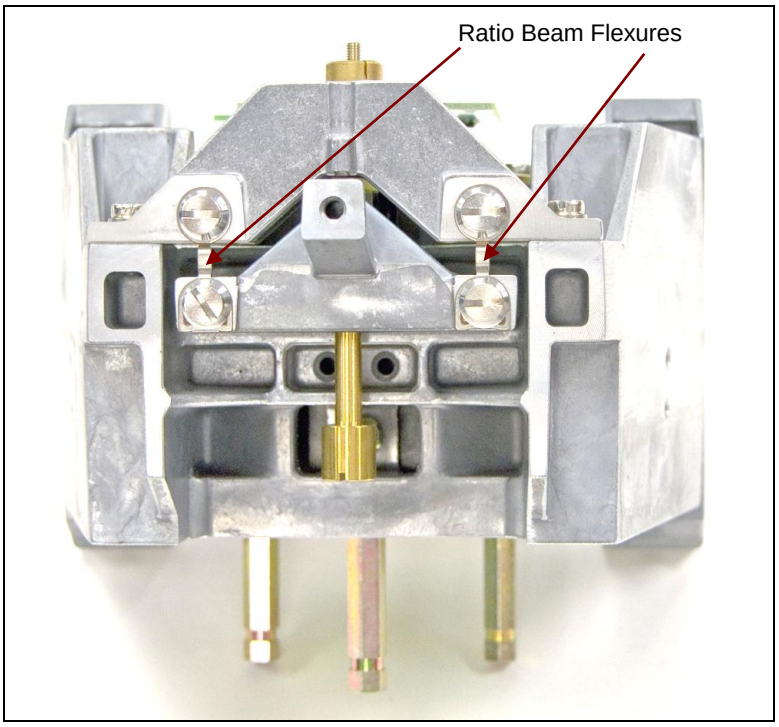


Figure 3-65. Yoke aligned with frame side-to-side, and flush with frame on front.

5.2. Re-install Hanger with Brass Fixture and Thumb screws.

5.3. Insert Brass Brackets on both sides. (See Figure 3-66, next page.)

5.4. Press Brackets from each side, and Brass Fixture from below, to ensure that Brackets are snug against yoke, so that if Brackets are pulled there is resistance.

3.2.4 Load Cell Assembly

5.5. Loosen top 2 Flexure screws.

5.6. Screw in the Threaded Rod to snugly hit the Ratio Beam.

5.7. Remove Flexure screws and Flexures.

5.8. Examine Flexures. If they are bent, replace them.

5.9. Loosen Threaded Rod and insert Centering Pin in Temperature Sensor Tube.

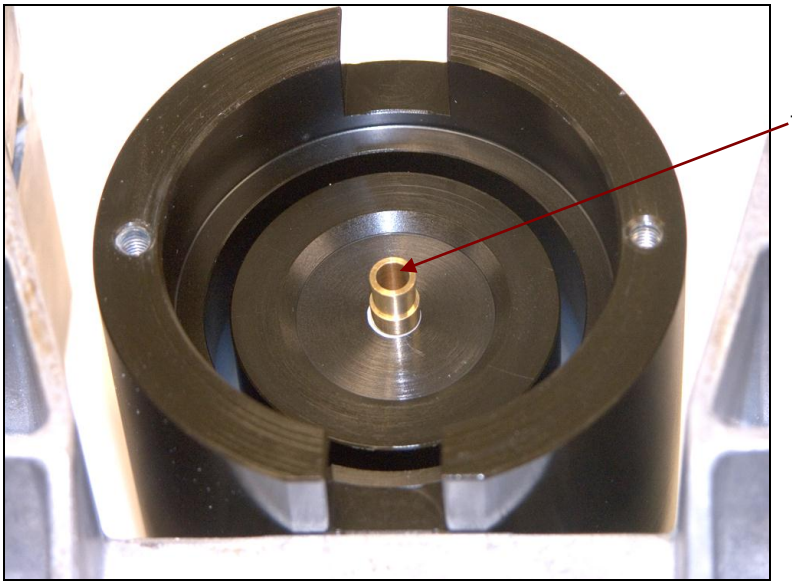


Figure 3-66. Centering Pin from Service Toolset goes into Temperature Sensor Tube in middle of Magnet.

5.10. Insert Brass Rod in rear.

5.11. Screw Threaded Rod back in.

5.12. Remove Brass Brackets and ensure that Ratio Beam is visually centered. If not, loosen Threaded Rod and adjust Ratio Beam to center it. Then tighten Threaded Rod.

5.13. Place new Flexure with oblong hole resting on Ratio Beam and round hole resting on yoke.

5.14. Re-insert Flexure screws and tighten them.

5.15. Remove Thumb screws and detach Brass Fixture and Brass Brackets.

5.16. Remove Centering Pin.

5.17. Loosen Threaded Rod.

5.18. Check centering.

5.19. If necessary, loosen screws that attach yoke to frame and adjust slightly to center.

3.2.4 Load Cell Assembly

5.20. Remove Brass Rod and check vertical centering over Temperature Sensor Tube and around Magnet.

5.21. Tighten screws on yoke, checking again to ensure Ratio Beam remains centered.

5.22. Re-tighten Threaded Rod.

5.23. Re-install Hanger and Thumb screws, and Brass Rod, and re-check centering.

NOTE: Repeat the process as necessary to ensure that the Ratio Beam is centered.

6. Re-check that everything is assembled properly.
7. Remove the Brass Rod and Threaded Rod and ensure that the Ratio Beam moves up and down without binding.
8. When satisfied that the Ratio Beam moves correctly, reinstall the Brass Rod and Threaded Rod.
9. Install the Hanger with the Brass Fixture and the Thumb Screws from the Service Toolset. The Brass Fixture is inserted between the Hanger and the frame of the Load Cell. Use the Brass Brackets from the Service Toolset to position it properly. Then tighten the Thumb Screws.
10. Double-check that the Ratio Beam is centered. Repeat process as necessary.

NOTE: The Hanger should be positioned evenly around the Ratio Beam. The Hanger's left and right gap areas should be even when it is installed correctly.

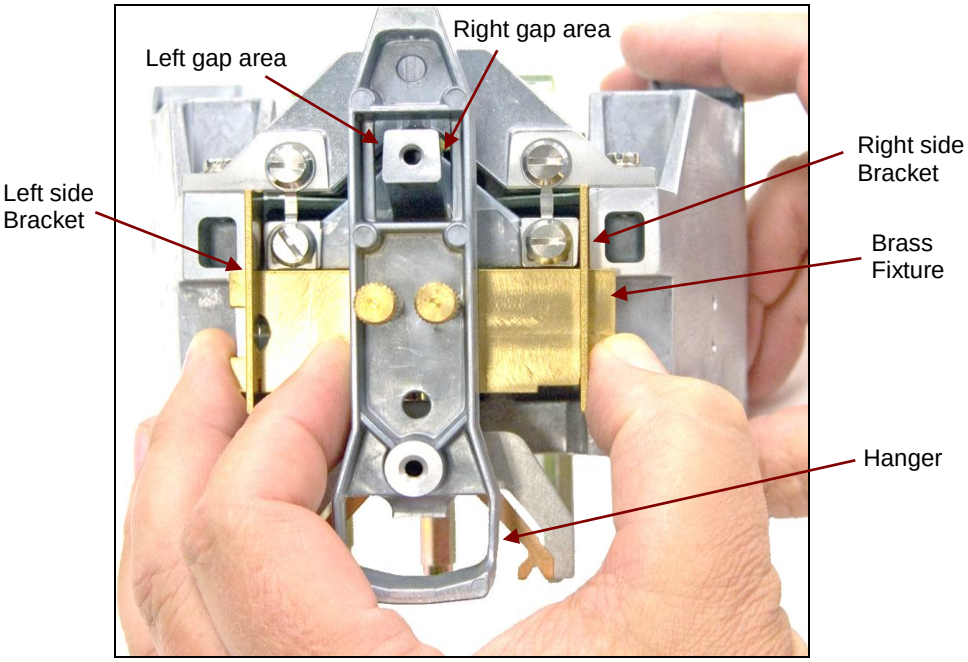


Figure 3-67. Hanger installed, with Brass Fixture and Brass Brackets.

3.2.4 Load Cell Assembly

11. Set the Magnet Cover in place, with its rear hole clearing the Ratio Beam's stop tab.

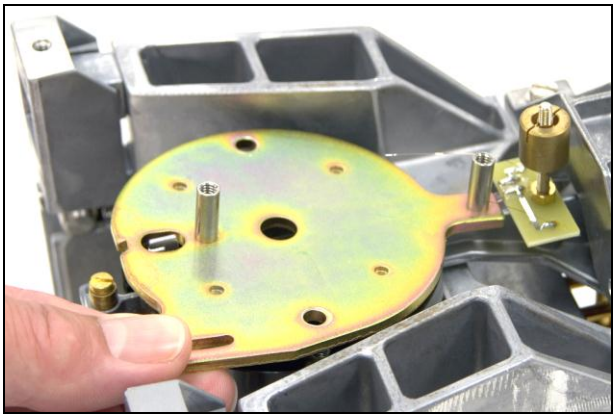


Figure 3-68. Magnet Cover has oblong hole that clears Ratio Beam's stop tab.

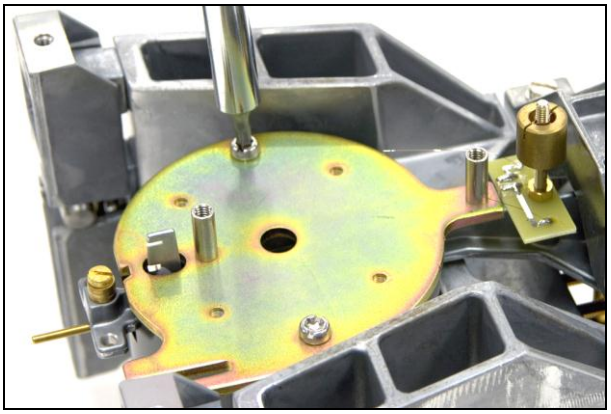


Figure 3-69. Inserting screws to secure the Magnet Cover.

12. Insert the 2 screws on either side of the Magnet Cover, as in Figure 3-65.

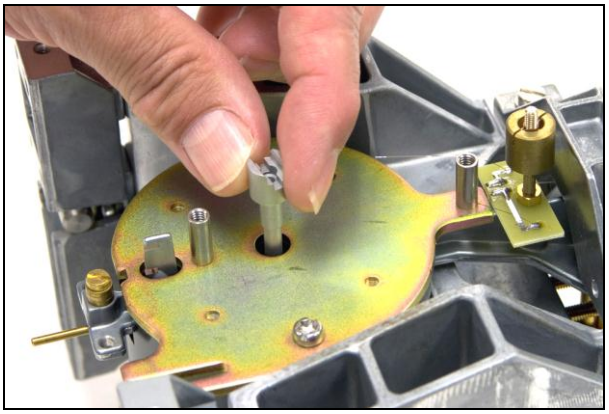


Figure 3-70. Inserting the Temperature Conductor in the middle of the Magnet Cover.

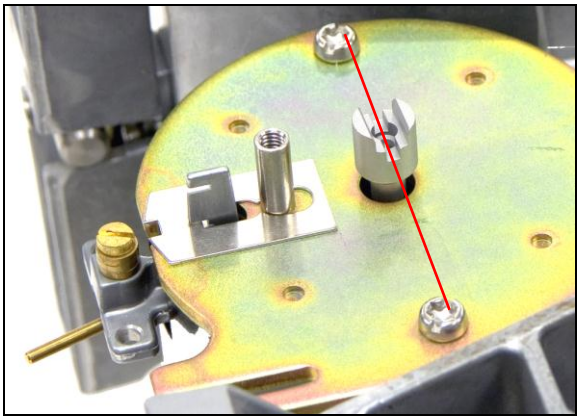


Figure 3-71. The Temperature Conductor groove should line up with the two Screws.

13. Insert the Temperature Conductor in the middle of the Magnet Cover.

NOTE: The Temperature Conductor conducts heat from the Magnet to a small PCB on the Ratio Beam, under the Load Cell's main PCB. The small PCB communicates the heat reading to the balance's calibration system, which adjusts the balance to compensate for temperature variations.

3.2.4 Load Cell Assembly

14. Inspect the Up/Down Stop Plate for dust or signs of corrosion, and clean it.

Figure 3-72. Up/Down Stop Plate which rests on Magnet Cover.

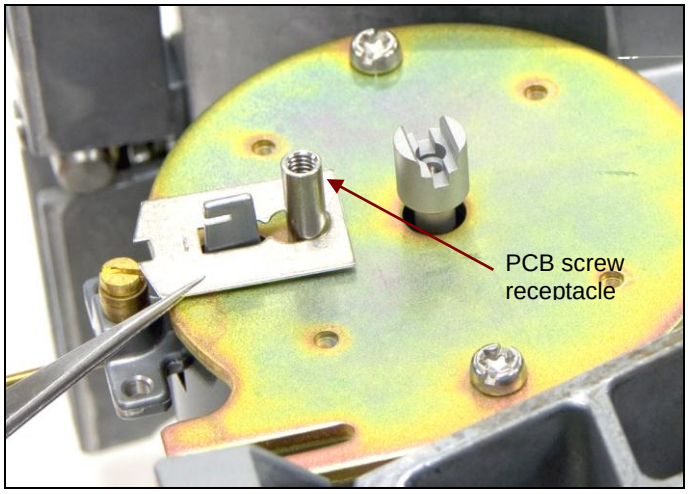


Figure 3-73. Up/Down Stop Plate inserted over Ratio Beam tab and PCB screw receptacle on Magnet Cover.

15. Install the Up/Down Stop Plate, as shown in Figure 3-72.

16. Place Load Cell PCB over screw receptacles on Magnet cover, and secure with 2 screws shown in Figure 3-73. Insert Step Bushing before screw on back end.

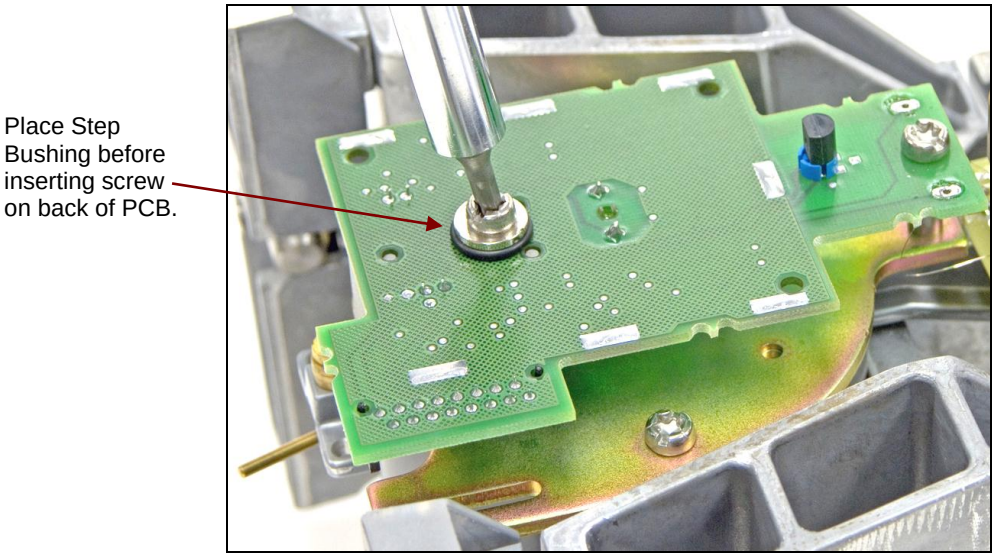


Figure 3-74. Load Cell PCB is secured with 2 screws. A Step Bushing goes in before the screw in the back.

3.2.4 Load Cell Assembly

17. Re-solder the two fine wires that connect the Load Cell PCB to a smaller PCB on the top-front of the Load Cell. Follow these steps:

    17.1. Carefully clean the solder out of the solder holes.

    17.2. Use tweezers to thread the fine wires through the solder holes.

    17.3. Carefully replicate the original smooth arc of the wires, as shown in Figure 3-71, to ensure proper functioning of the balance.

    17.4. Solder the wires into place.

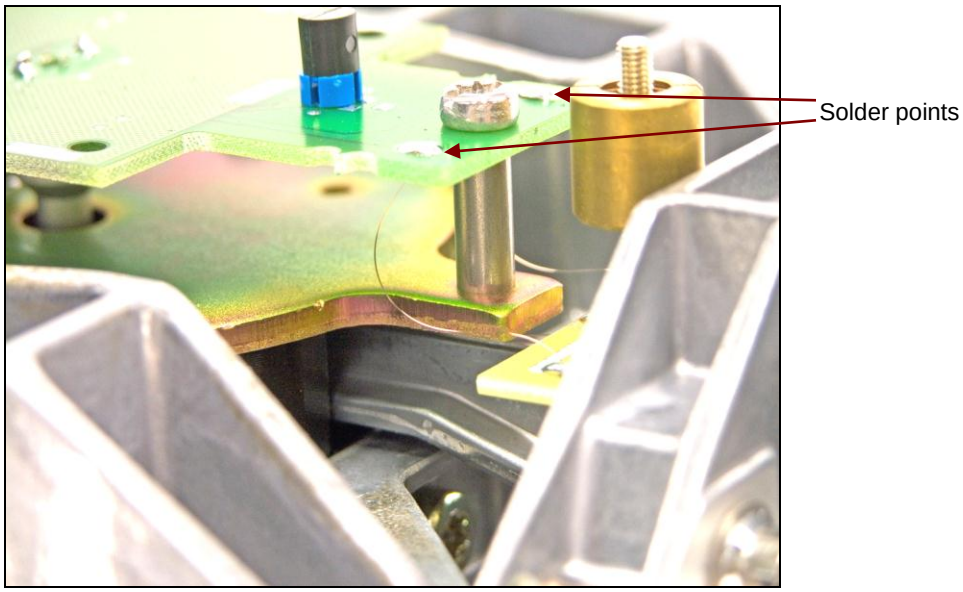


Figure 3-75. Fine wires must have smooth arc shown here for the balance to function properly.

3.2.4 Load Cell Assembly

Note:

Do not rest the Load Cell on the Ratio Beam Rod. The Load Cell should be supported on the Threaded Rod to protect the Ratio Beam Rod. The Threaded Rod should support the weight of the Load Cell and not the Ratio Beam Rod Screw. See Figure 3-72.

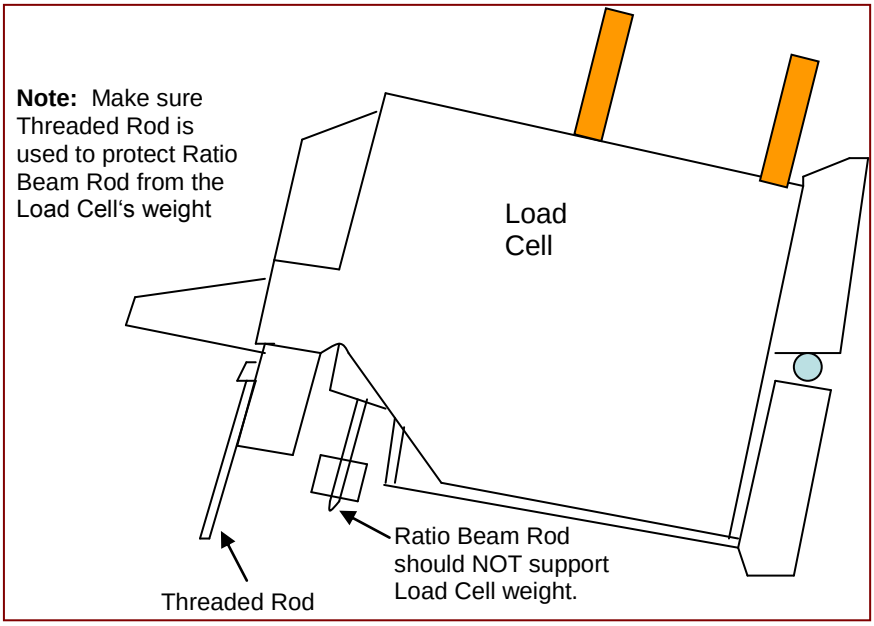


Figure 3-76. Load Cell should rest on Threaded Rod *(left)*, and base of frame *(right).*

3.2.4 Load Cell Assembly

18. Install the bottom Flexure Arm, with Flexure screw heads facing *inward,* by inserting the 3 screws, as shown in Figure 3-73.

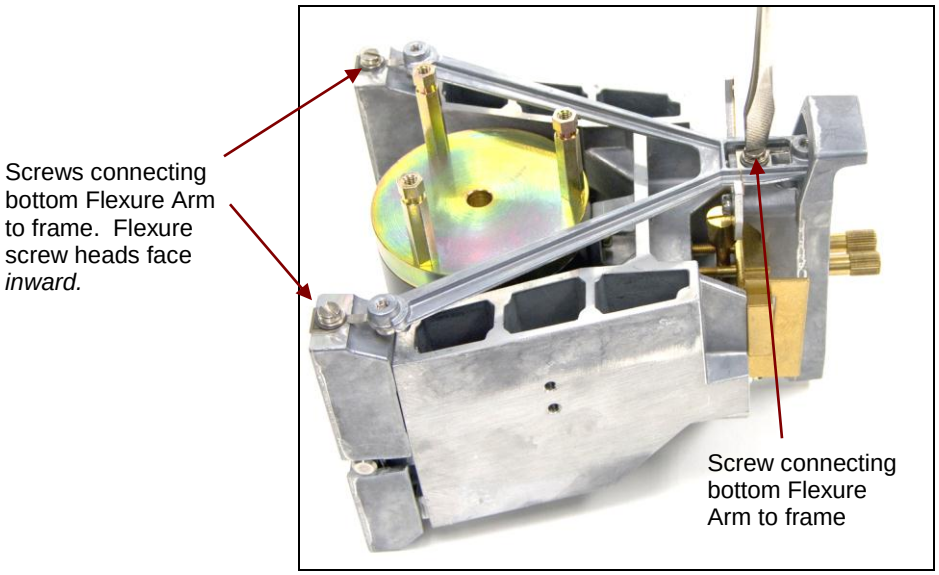


Figure 3-77. Installing the bottom Flexure Arm.

19. After the bottom Flexure Arm Assembly is installed, remove the Threaded Rod.

20. Install the top Flexure Arm, with Flexure screw heads facing *outward,* by inserting the 3 screws, as shown in Figure 3-78.

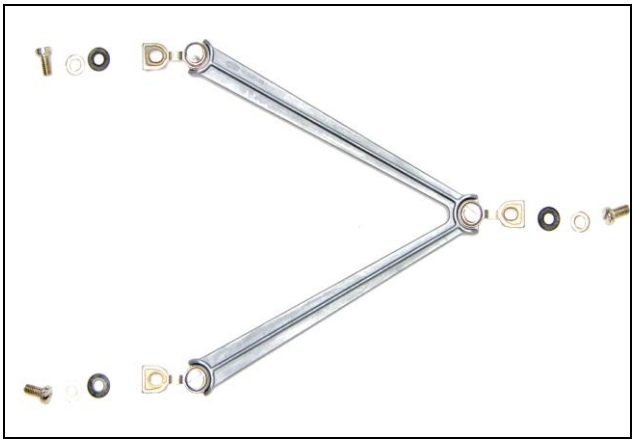


Figure 3-78. Top Flexure Arm Assembly, with Flexure screw heads facing outward.

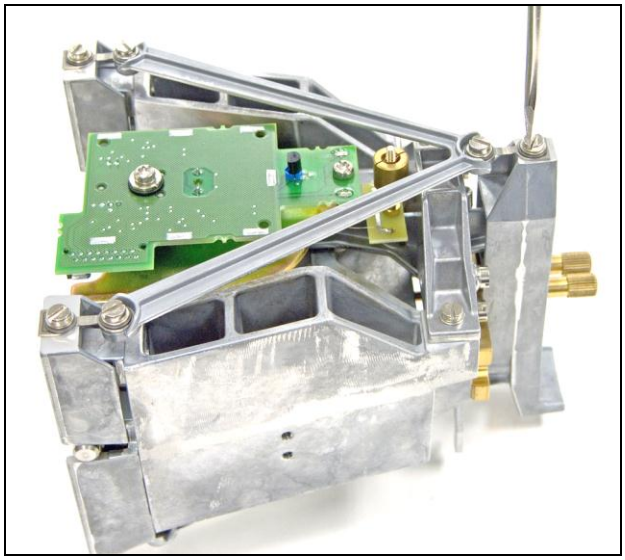


Figure 3-79. Installing the upper Flexure Arm.

3.2.4 **Load Cell Assembly**

21. Set the Load Cell on its back frame and position the Load flexure with elongated hole on the bottom.

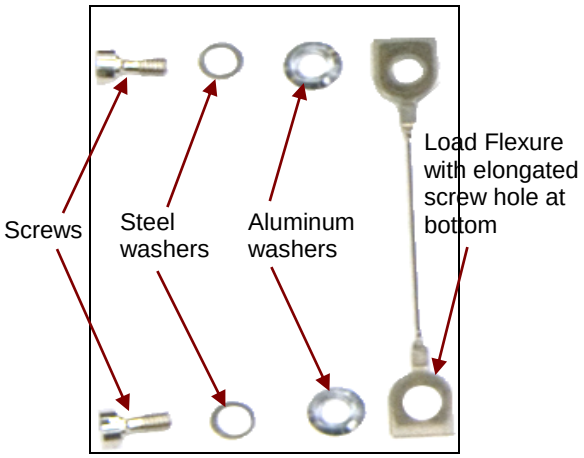


Figure 3-80. Load Flexure, aluminum washers, steel washers and screws.

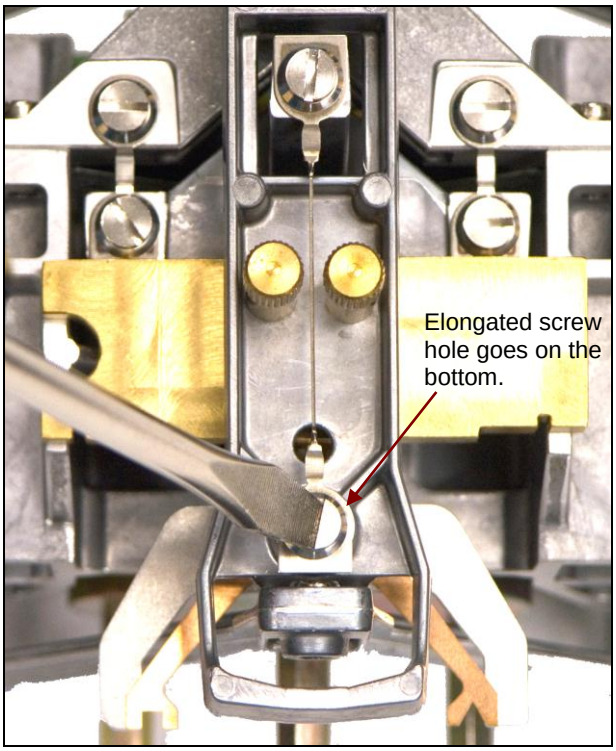


Figure 3-81. Load Flexure on top of Hanger, with elongated screw hole at bottom.

22. Gently tighten the upper screw, then the lower screw.

NOTE:
If Load Flexure begins to rotate when tightening screws, *STOP IMMEDIATELY,* to avoid bending or breaking the Flexure. If Flexure bends, replace it.

3.2.4 Load Cell Assembly

23. Remove the thumb screws from the top of the Hanger.

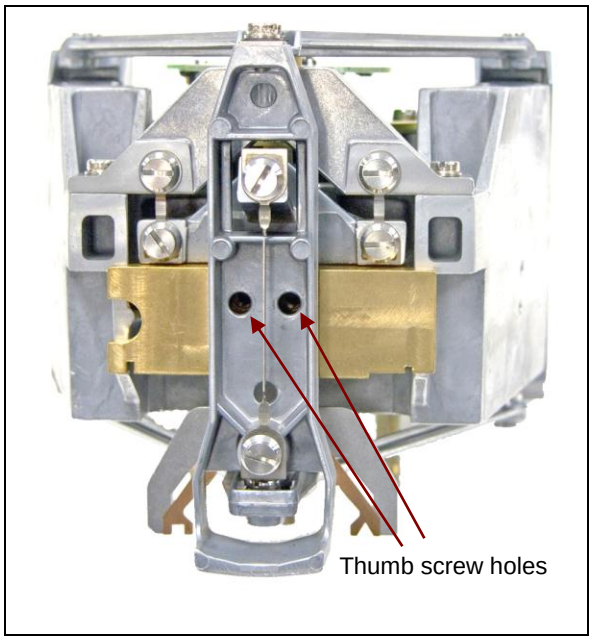


Figure 3-82. Hanger with Thumb screws removed.

24. Push the Brass Fixture from the grooved side, then pull it out from the square side.

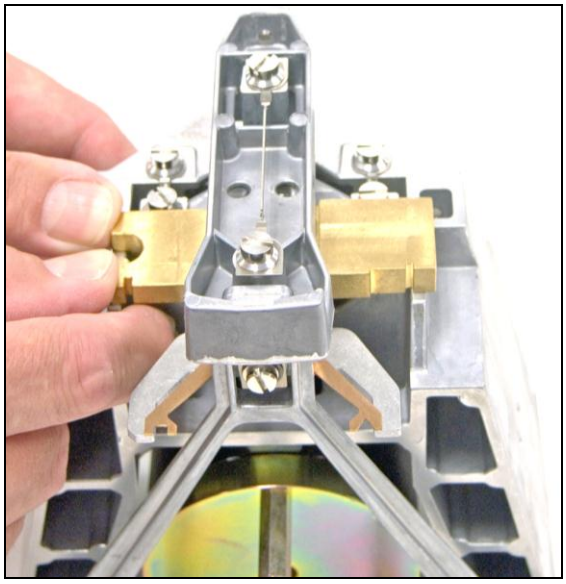


Figure 3-83. Pushing Brass Fixture from grooved side.

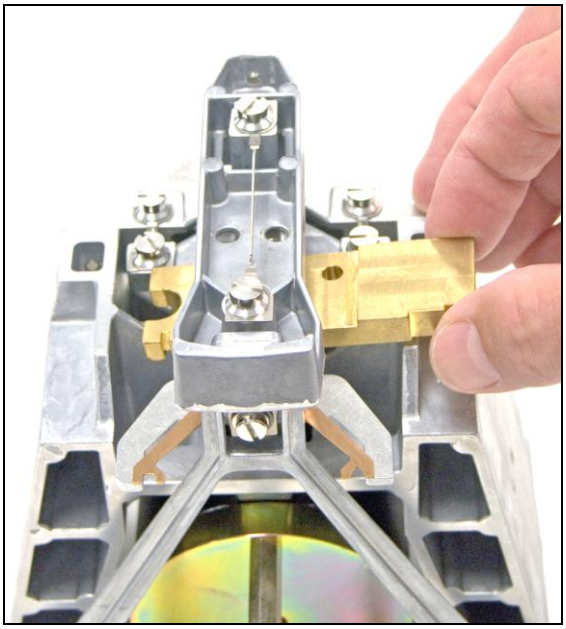


Figure 3-84. Pulling Brass Fixture out from square side.

3.2.4 Load Cell Assembly

25. Install the bottom Load Cell cover – push it to the stops, then insert and tighten screws on both sides.

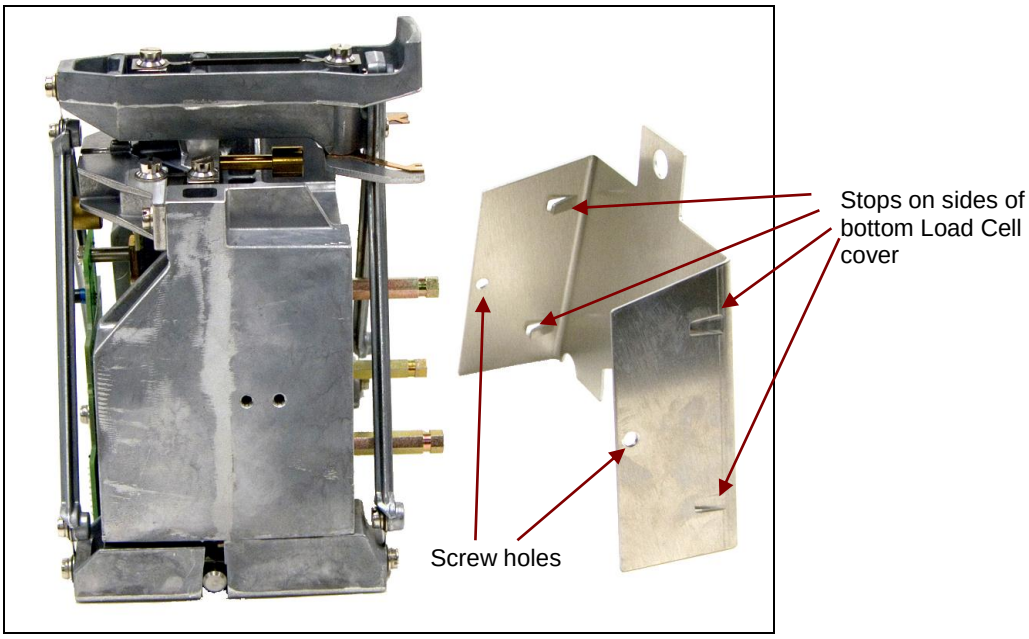


Figure 3-85. Note stops on sides of bottom Load Cell Cover.

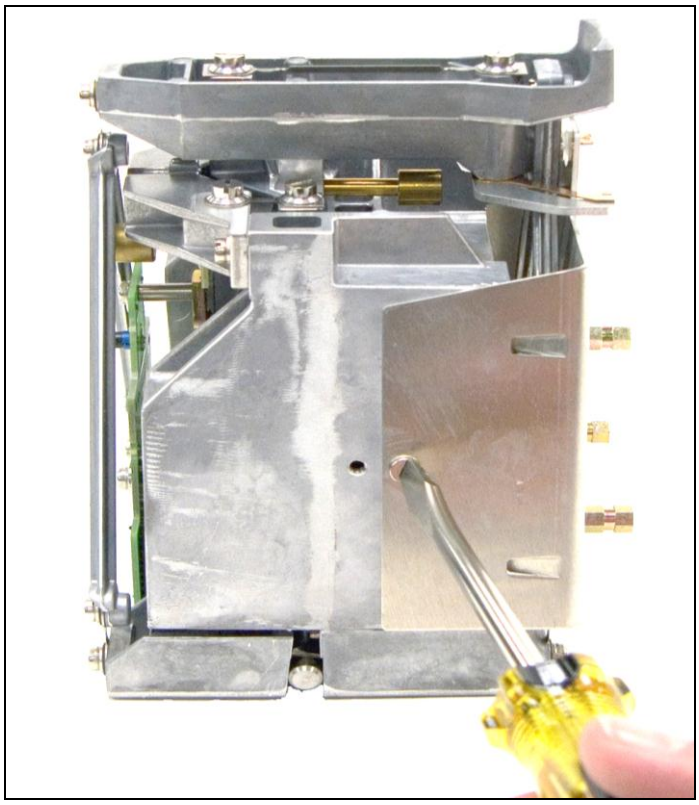


Figure 3-86. Tightening screws on bottom Load Cell Cover.

3.2.4 Load Cell Assembly

26. Set the top Load Cell Cover in place. Press evenly against the bottom cover.

NOTE:
Make sure the cover does not touch any screws.

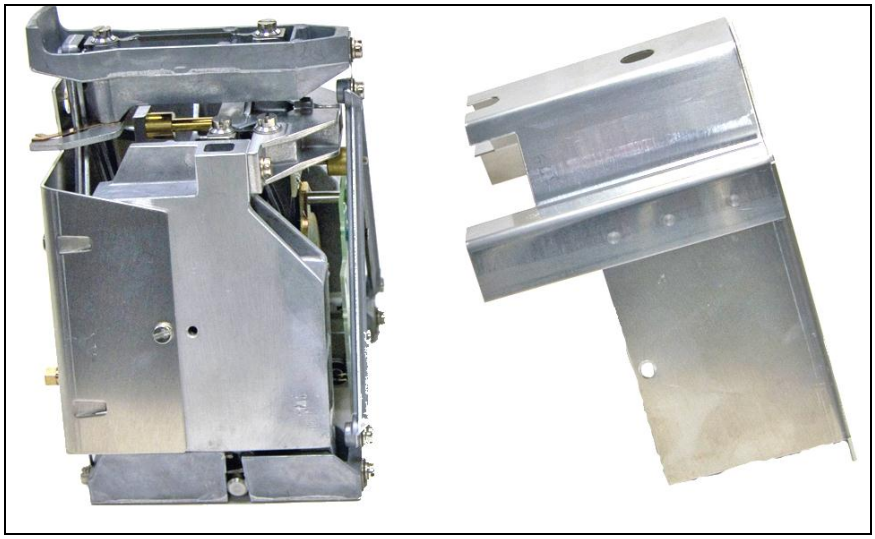


Figure 3-87. Top Load Cell Cover rests flush against bottom cover.

27. Tighten the screws, as shown in Figure 3-88.

Figure 3-88. Tightening screws on top Load Cell Cover.

3.2.4 Load Cell Assembly

28. Gently push on the Hanger to make sure it moves freely and smoothly.

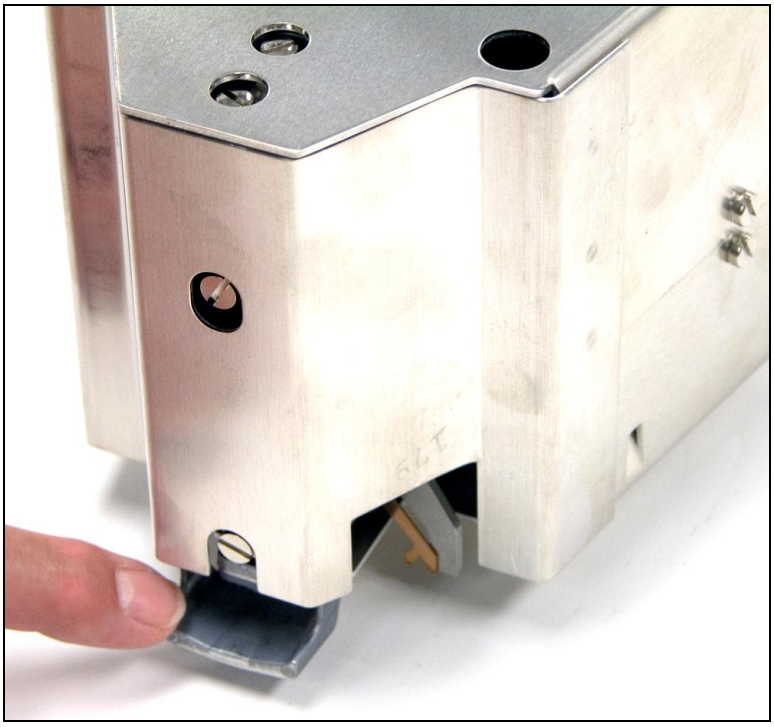


Figure 3-89. Hanger should move smoothly when touched.

3.2.5 Installing the Load Cell

1. Place Load Cell in the Chassis. Make sure to set the front foot in the keyway. (See Figure 3-90.) Install 3 screws in bottom of Chassis. Do NOT tighten the 3 screws.

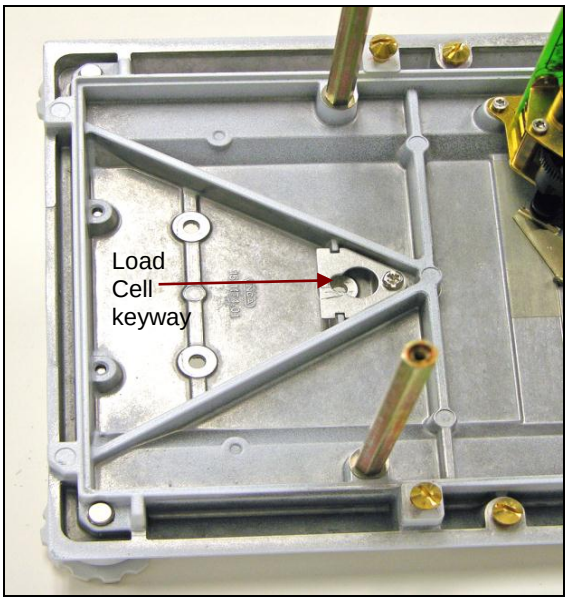


Figure 3-90. Load Cell Chassis with keyway at point of triangle.

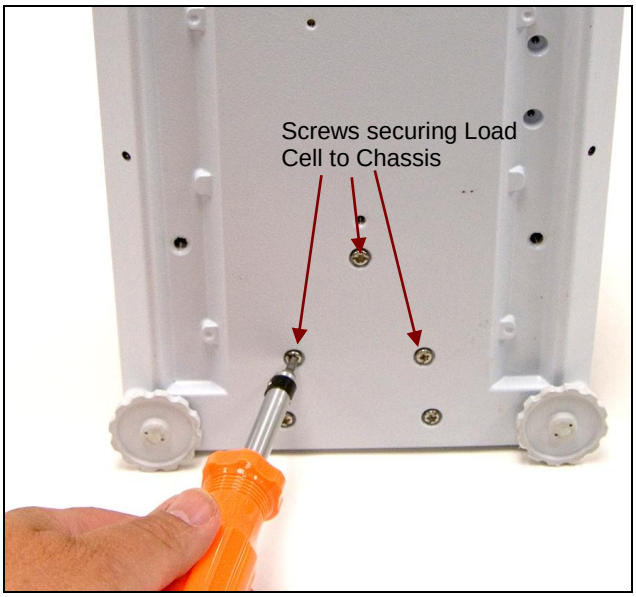


Figure 91. Three screws on bottom that secure the Load Cell to the Chassis.

2. Mount the Cantilever Arm, sliding it under the Hanger so that its stop shelf rests on lower lip of Hanger and grooves hook into the feet of the Hanger.

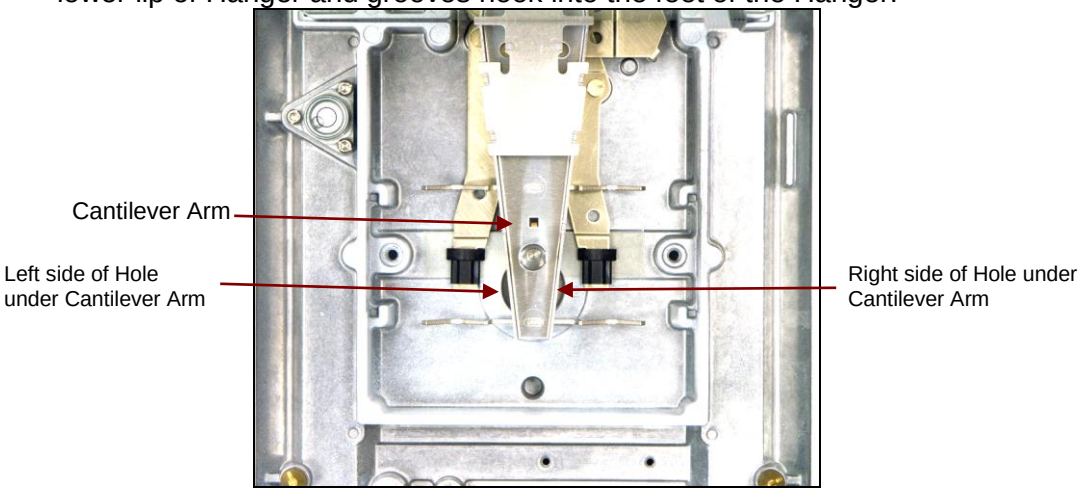


Figure 3-92. Cantilever Arm in correct position.

3. Make sure the Load Cell is properly aligned. The spaces of the hole underneath the left and the right of the Cantilever Arm should be equal. (See Figure 3-92.)

Note:
The Cantilever Arm is delicate and should be handled carefully.
Do not use the Cantilever Arm to adjust the Load Cell position.

3.2.5 Installing the Load Cell

4. Tighten the 3 mounting screws after aligning Load Cell. Tighten screw at point of triangle first, then re-check alignment, and adjust as necessary. Then tighten 2 screws at base of triangle. Re-check alignment and adjust as necessary.

5. Connect the flexible cable on Load Cell, using the back of a pair of tweezers to press cable into place. Also connect cable on Calibration Motor Assembly.

6. Place the Load Cell Cover over the Load Cell.

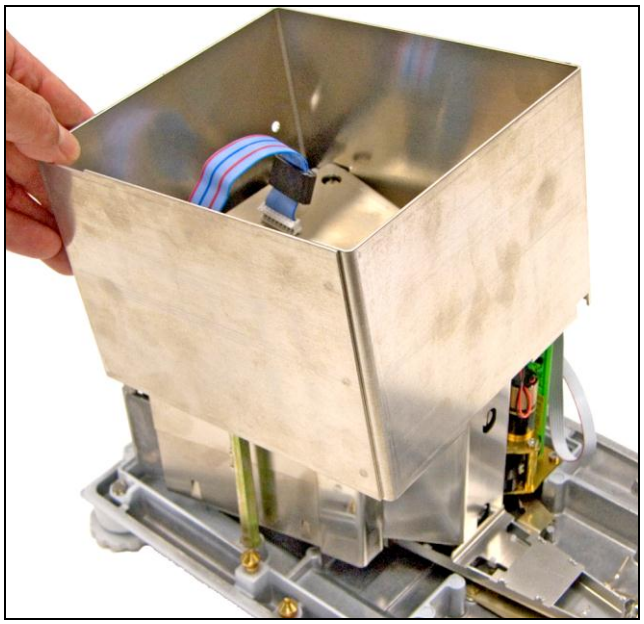


Figure 3-93. Replacing Load Cell Cover.

7. Note the notches for cables: top-left for Load Cell cable, and bottom-right for Calibration Motor Assembly cable.

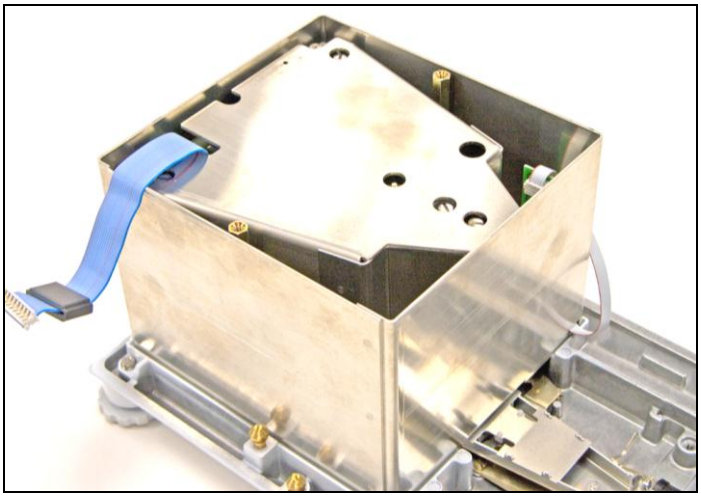


Figure 3-94. Load Cell with Cover in proper position, cables resting in notches (*top-left and bottom-right*).

3.2.5 Installing the Load Cell

8. Place the Printed Circuit Board (PCB) Mounting Plate on the Load Cell, aligning the screw holes on the left and right. Ensure that the cable from the Load Cell to the Main PCB lies flat, passing though the small slot on the left of the Load Cell Cover.

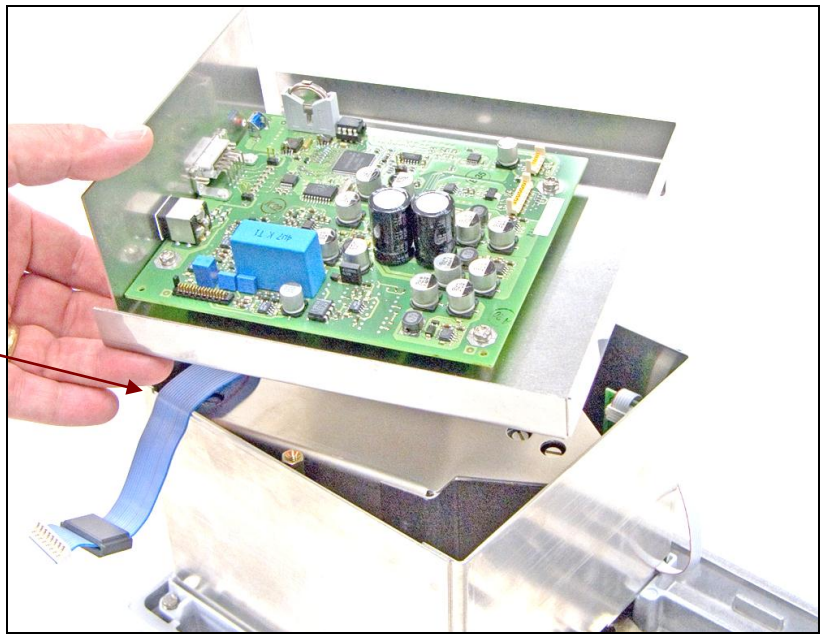


Figure 3-95. Placing PCB Mounting Plate on Load Cell.

9. Insert copper-colored stand-off screws through holes in PCB Mounting Plate. Tighten with a wrench.

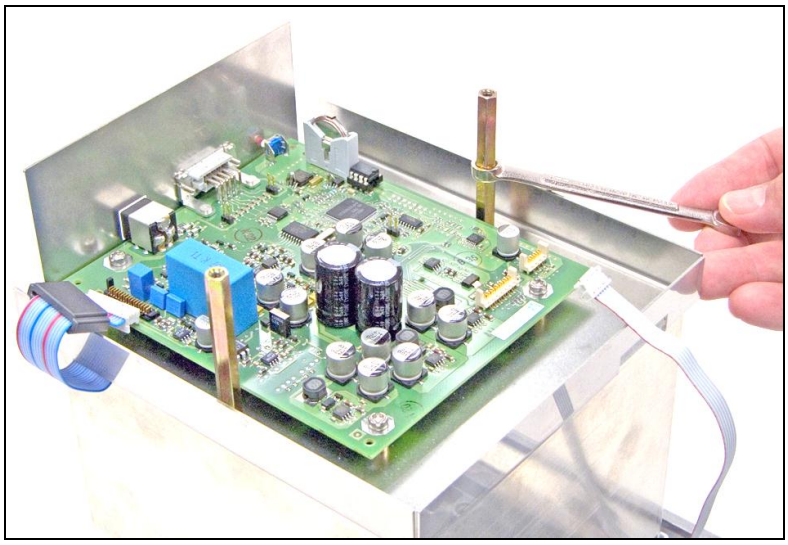


Figure 3-96. Stand-off screws secure PCB Mounting Plate.

10. Connect the cables to the PCB. Pass the small cable through the rectangular slot on the right of the PCB Mounting Plate.

3.2.5 Installing the Load Cell

11. Install the InCal Weight Assembly:

11.1. Carefully remove any dust or debris from the Weights, Weight Holders, and their environment, using alcohol on a clean cloth.

11.2. Install the Weights and Weight Holders.

Note:
A clean glove should be worn when handling Weights.

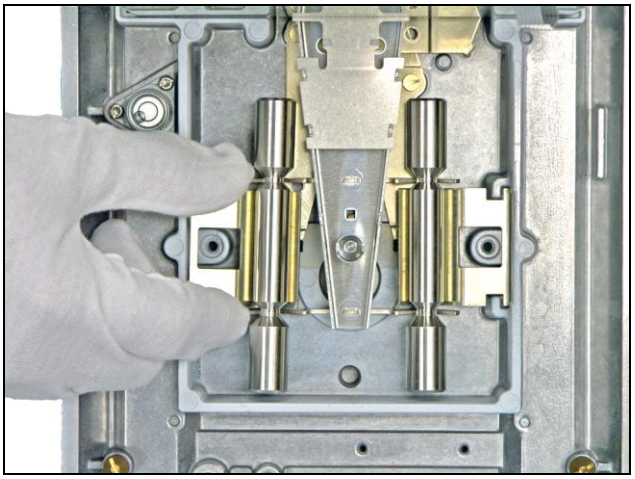


Figure 3-97. Installing Weights and Weight Holders.

11.3. Place the InCal Weight Cover over the Weights, aligning the screw holes left and right. (The screws will be installed in the Display Cable Shield Plate, which rests on top of the InCal Weight Cover.)

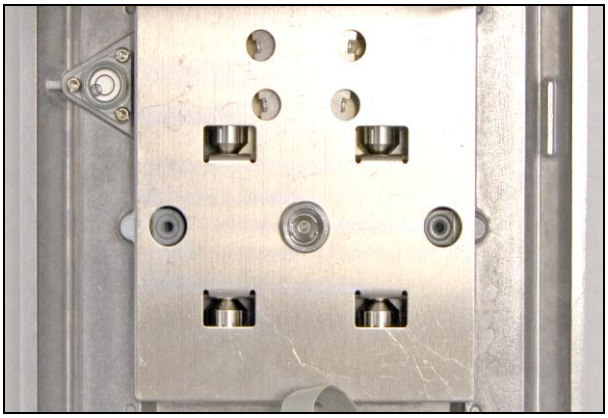


Figure 3-98. Proper position of InCal Weight Cover.

3.2.5 Installing the Load Cell

12. After putting the Weight Cover on, connect the Display Cable to the main PCB. Carefully position the cable so it fits under the Display Cable Shield Plate.

13. Place the Display Cable Shield Plate over the InCal Weight Cover, carefully checking that the flat Display Cable fits in the raised groove.

14. Before tightening the screws in the Display Cable Shield Plate, check that the Pan Socket is centered in the hole. Then tighten the screws. (See Figure 3-99.)

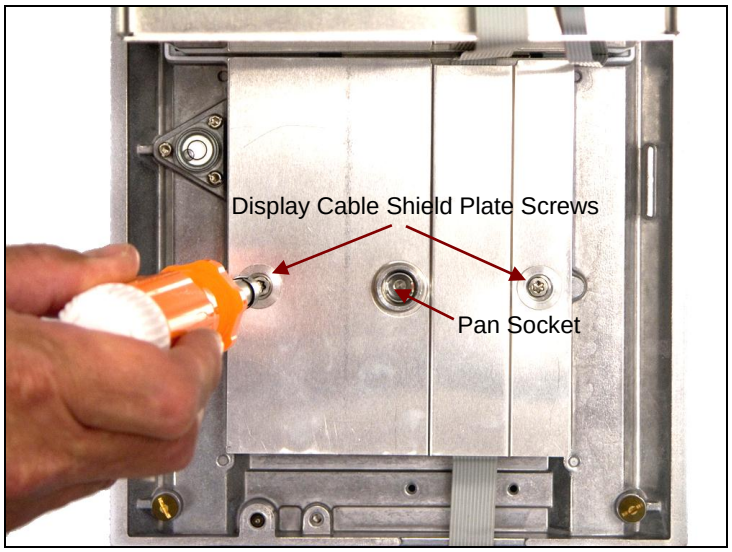


Figure 3-99. Inserting screws in Display Cable Shield Plate, after checking that Pan Socket is centered in hole in middle of Plate.

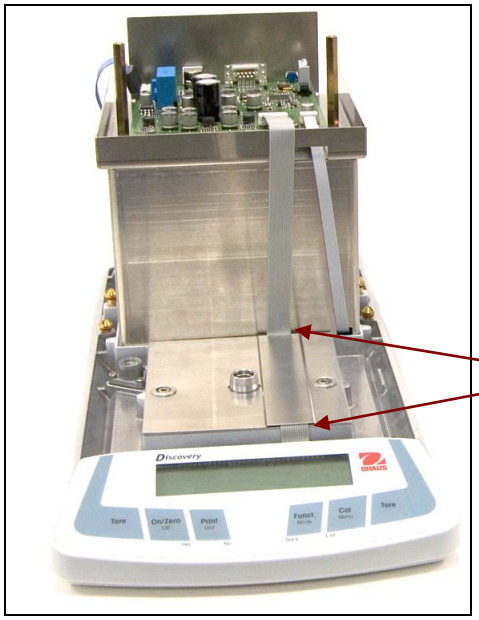


Figure 3-100. Correct position of Display Cable under Display Cable Shield Plate.

3.2.5 **Installing the Load Cell**

15. Replace the PCB Cover, taking care not to bend the alternating teeth that secure it to the Load Cell Cover. Insert and tighten the screws on left and right.

Figure 3-101. Securing PCB Cover.

16. Replace the Housing, Pan, Grommet, Breeze Ring and Breeze Ring Base, following the steps in Section 3.1.1, in reverse order.

17. If a new Load Cell has been installed, connect the balance to a personal computer with the Discovery Software Service Tool installed. Refer to Appendix C.2, and follow instructions to Replace Load Cell.

18. Perform a Span Calibration, in accordance with the instructions in Appendix A.2.

19. Check the performance of the balance using the tests in Section 4-2.

4.1 TESTING

After servicing the balance, an operational test and various performance tests should be made to confirm that the balance meets specifications. Turn the balance on and allow it to warm up for at least one hour before performing these tests.

NOTE:
Make sure the test area is free from drafts and that the balance rests on a level and vibration-free surface. The masses used for final calibration must be adjusted to ASTM Class 1 or OIML Class E1 tolerance or better.

4.1.1 Operational Test

1. Connect a functioning AC Adapter to the balance Power Jack located at the rear of the balance.
2. Plug the AC Adapter into a suitable power source. If the AC Adapter supplied with the balance is rated for a different voltage, use an appropriate adapter to match the supply voltage.

4.1.2 Models Segment Display Test

1. Turn the balance on by pressing ON/ZERO *Off*, all segments are enabled and displayed briefly, then followed by a software revision number. See Figure 4-1 for full display.

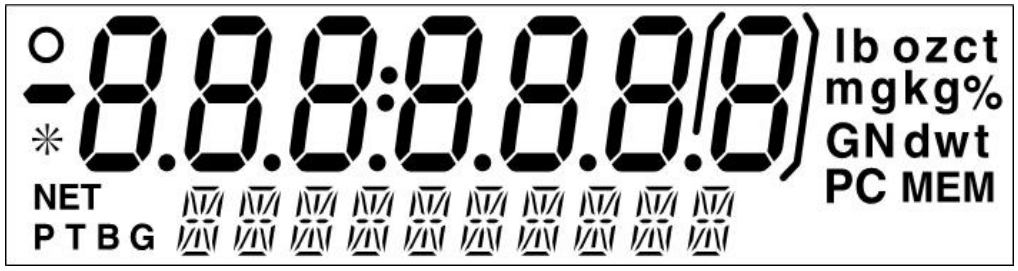


Figure 4-1. LCD Full Display for Discovery Balance.

2. Tare the balance. The display should indicate a zero weight.

4.2 Load Cell Performance Tests

4.2.1 Off-Center Load Test

The Off-Center Load Test is used to determine whether displayed weight values are affected by moving the sample to different areas of the Pan.

1. Place half of the balance capacity in the center of the Pan.
2. Note the reading.
3. Move the mass halfway (between the center and the edge) to the front of the Pan. Note any differences in the displayed weight reading.
4. Repeat the test for the back, left, and right position of the Pan.

5. Maximum allowable change in displayed weight readings is shown in Table 1-2 (page 1-3) for each of the four positions. If this reading is exceeded, follow procedures in Section 4.2.4 – Adjusting Off Center Load.

4.2.2 Adjusting Off Center Load

If the Off Center Load (OCL) is excessive, perform adjustment as follows:

1. Pop out the hole plugs and insert both Allen Keys from the Service Toolset as shown in Figure 4-2.

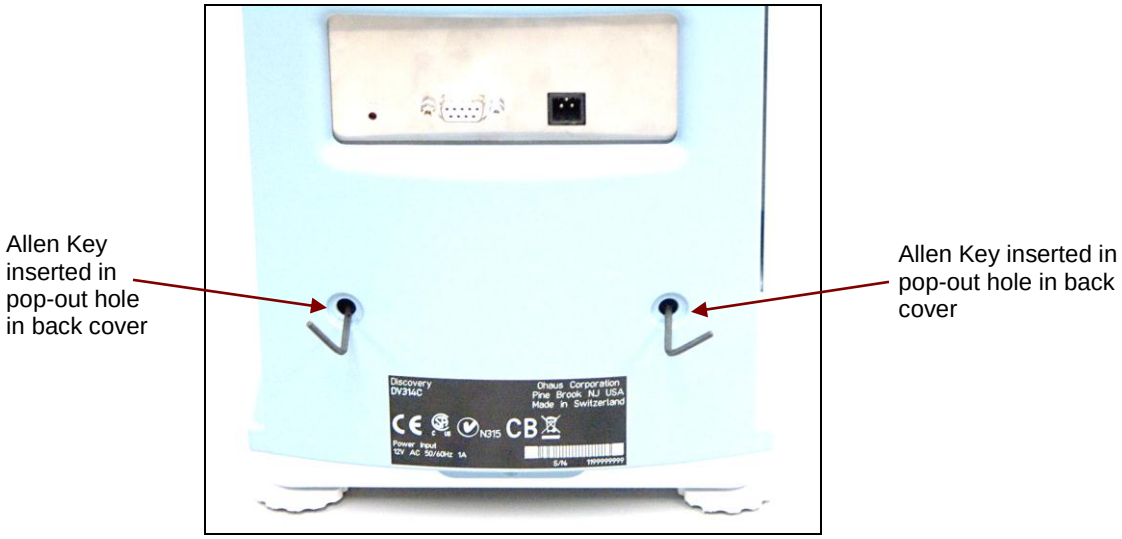


Figure 4-2. Holes in back cover must be popped out to insert Allen Keys.

The recommended position for the OCL adjustment is shown in Figure 4-3.

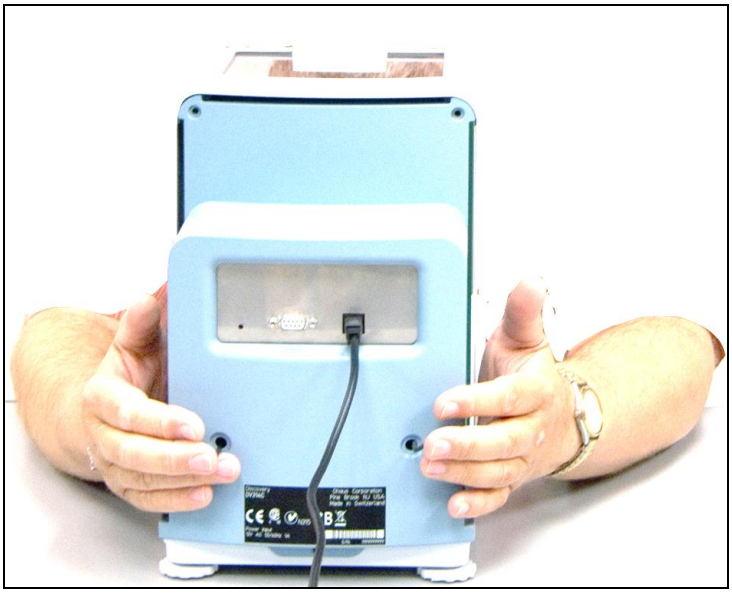


Figure 4-3. Proper position for adjusting Off-Center Load.

4.2.2 Adjusting Off Center Load

1. Place a weight, close to full capacity, at the pan center. Press TARE.
2. Move the weight to the back edge and note the display.
3. Move the weight to the front edge and note the display.
4. Move the weight to the right edge and note the display.
5. Move the weight to the left edge and note the display.

Figure 4-4 shows the front part of the scale with the Allen Keys sticking out in the back. The arrows show the key rotation directions required to bring the weight within tolerance specification. (See Table 1-2 – Discovery Balance Model Specifications.)

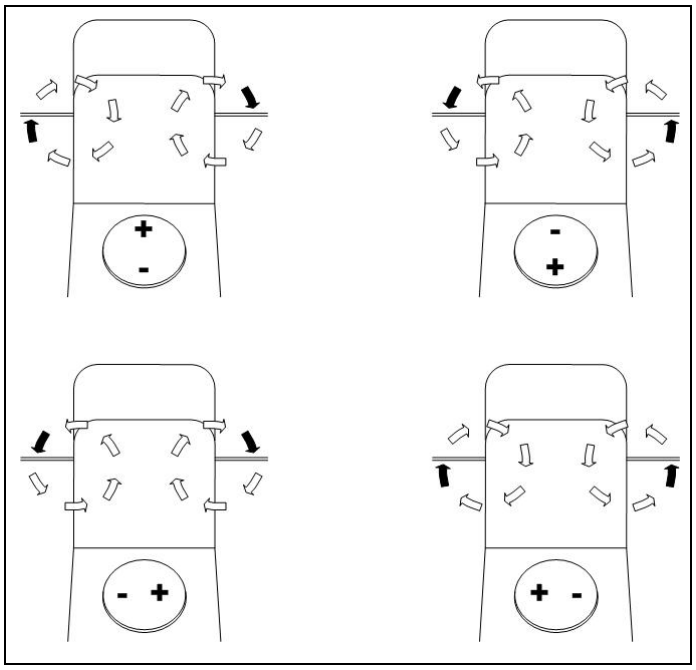


Figure 4-4. Allen key rotation directions needed for back-edge-heavy, back-edge-light, right-edge-heavy and right-edge-light conditions.

The "+" sign depicts the part of the Pan that is "heavy." It is a positive value, that is, greater than the tolerance specification. The opposite side of the Pan, which is "lighter," has a negative value, that is, less then the tolerance specification.

When moving the weights, observe the Display value readings to see if they have positive or negative values.

In Figure 4-4, the top-left graphic shows the key rotation direction needed if the back edge of the scale Pan has a "heavy" positive value (greater then the tolerance specification). The top-right graphic shows the key rotation direction needed if the back edge has a "lighter," negative value, (less than the tolerance specification). The graphics in bottom-left and bottom-right, show key rotation directions for right-edge-heavy and right-edge-light conditions.

The purpose of these adjustments is to ensure that weight reading discrepancies on the Pan are diminished to close to zero and within tolerance specification.

4.2.2 Adjusting Off Center Load

6. Adjust as shown until the reading is two to three times the the specifications in Table 1-2. Then re-test as shown in Section 4.2.1.

   6.1. Use small adjustments, no more than a quarter-turn at a time.

   6.2. As you get close to the tolerance you have to reduce the amount of the turn.

7. Work front-to-back first, then side-to-side.

8. This process is complete when all four edges of the Pan are within tolerance specifications.

4.2.3 Repeatability Test

Repeatability is a word used in balance specifications meaning the Standard Deviation of a set of similar weight readings. To determine whether a balance meets the calculated Standard Deviation value in the Specification Table 1-2, perform the following test:

1. Tare the balance. The reading on the display should be 0g.

2. Select a mass weighing near the maximum capacity of the balance and place the mass on the center of the Pan. Observe and record the reading.

3. Remove the mass. Reading should return to 0g ± 1 count.

4. Repeat the test for ten readings. If the standard deviation of the readings is within the specifications in Table 1-2 (Discovery Balance Model Specifications, page 1-3), the balance passes the Repeatability Test.

4.2.2 Remediation

If the deviation for any set of readings (using the same mass placed on the center of the Pan) is greater than the specifications in Table 1-2, the balance does not meet the Repeatability Test specification. Inspect and correct the following areas:

1. Check for mechanical obstructions. Any foreign object touching any part of the moving Pan can cause a balance to fail the Repeatability Test specification. Inspect and correct if necessary.

2. An error in the Off-Center Load Test can affect the results of the Repeatability Test. Inspect and correct if necessary. See Section 4.2.3 - Off-Center Load Test.

3. Foreign material or debris located in the balance between the Pan, and the Draft Shield Bottom can cause the balance to fail the test.

4. Environmental influences such as vibrations, drafts or a non-level surface can also cause failures.

4.2.5 Linearity Test

This test is used to determine the linearity of the unit throughout its operating range. The masses used to perform this test can be utility masses.

NOTE:
The balance must pass the Off-Center Load Test and Repeatability Test before the Linearity Test may be performed.

Loads do not have to be test masses. They can be anything that totals the mass value. The test mass can be anything that weighs near the test mass value.

TABLE 4-1 DISCOVERY TEST MASSES

Capacity (g)	Test Mass (g)	Load 1 (g)	Load 2 (g)	Load 3 (g)	Load 4 (g)	Model (g)
110	20	20	40	60	80	DV114C
210	40	40	80	120	160	DV214C
310	60	60	120	180	240	DV314C
81/210	40	40	80	120	160	DV215CD

1. Place the test mass on the balance, record the weight and remove.
2. Place Load 1 on the balance and press TARE.
3. Place the test mass on the balance, record the weight and remove.
4. Place Load 2 on the balance and press TARE.
5. Place the test mass on the balance, record the weight and remove.
6. Place Load 3 on the balance and press TARE.
7. Place the test mass on the balance and record the weight.
8. Place Load 4 on the balance and press TARE.
9. Place the test mass on the balance, record the weight and remove.
10. The difference in the weights of the test mass should be within the tolerance in Table 1-2. If not, perform an internal calibration (see Appendix A.1) and repeat the test.
11. If the balance remains out of tolerance, the Load Cell may need to be repaired.

4.3 RS232 Interface Test

The Discovery Balance Interface can be tested using an external printer or computer connected to the Balance.

The RS232 menu provides communication parameters which can be set to accommodate external printers or computers. It contains three submenus: **Baud** rate, **Parity** and **Handshake**.

1. Set the RS232 Baud rate, Parity and Handshake as required on the balance.

2. Set the communication parameters on the computer to the same settings as the balance.

3. Connect an RS232 cable (Part Number 80500525) between the balance and the computer.

Baud Rate
Use the submenu to change the Baud settings. Baud rates can be set from the range of 600 to 19,200. The default setting is **9600**.

Parity
Use the submenu to change the Parity settings. Parity can be set to 7 Odd, 7 Even, 7 No Parity or 8 No Parity. The default setting is **8 No Parity**.

Handshake
Use the submenu to change the Handshake settings. Handshake can be set to: Off, XONXOFF, or Hardware. The default setting is **XONXOFF.**

4.4 RS232 Connection

4.4.1 Connecting the RS232 Interface

On the rear of the balance, the 9-pin female subminiature “D” connector COM 1, is provided for interfacing with other devices. Figure 4-1 is a diagram of the RS232 connector with pin holes numbered. Table 4-2 indicates the respective pin functions.

4.4.1 Connecting the RS232 Interface

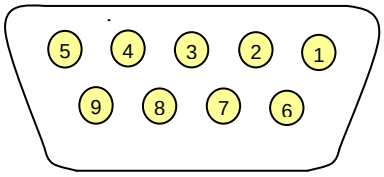


Figure 4-5. Com 1 Connector, as it appears on balance's back cover.

TABLE 4-2. COM1 INTERFACE PIN CONNECTIONS:

1	Not used
2	TxD
3	RxD
4	DSR
5	Ground
6	DTR
7	CTS
8	RTS
9	Not used

4.4.2 RS232 Commands

All communications are accomplished using standard ASCII format. Only the characters shown in the Table 4-3 - RS232 Commands are acknowledged by the Balance. Invalid command response – "ES" error – indicates the Balance has not recognized the command. Commands sent to the Balance must be terminated with a carriage return (CR) or carriage return-line line feed (CRLF). Data output by the Balance is always terminated with a carriage return-line feed (CRLF).

TABLE 4-3. RS232 COMMAND TABLE

Command	Function
IP	Immediate Print of displayed weight (stable or unstable).
P	Print displayed weight (stable or unstable).
CP	Continuous Print. OP ends Continuous Print.
SP	Print displayed stable weight.
SLP	Auto Print stable non-zero displayed weight.
SLZP	Auto Print stable non-zero weight and stable zero reading.
xP	Interval Print x = Print Interval (1-3600 seconds) OP ends Interval Print.
H	Enter Print Header Lines.
Z	Same as pressing Zero Key.
T	Same as pressing Tare Key.
xT	Establish a preset Tare value in grams. X=preset tare value in grams. To clear tare, enter 0 for x.
PT	Prints Tare weight stored in memory.
PM	Print current mode (weighing mode).
M	Scroll to the next enabled mode.
PU	Print current weighing unit.
U	Scroll to the next enabled unit.
OFF	Turns balance OFF.
ON	Turns balance on.
PSN	Print Serial Number
PV	Print Version: name, software revision and LFT ON (if LFT is set ON).

4.5 Print Test

Printing data to an external computer or printer requires that the communication parameters in the RS232 submenus be set to match external device communication parameters.

1. Remove all weight from the Pan.
2. Tare the balance, 0.0g should be displayed
3. Place a mass on the Pan.
4. Press Print button, the computer or a printer should indicate the mass value as shown on the display.

4.6 Testing the AC Adapter

The AC Adapters are available with different input voltages. Before testing the Adapter, make sure the Adapter rating agrees with the power source being used. All Adapters are rated with an output of 12 V AC at 1.0 Amp. Adapters can fail by having shorted internal windings producing low voltage output or no output at all. Measure the Voltage between Pin A and Pin B of the Adapter (see Figure 4-6) to assure the proper voltage.

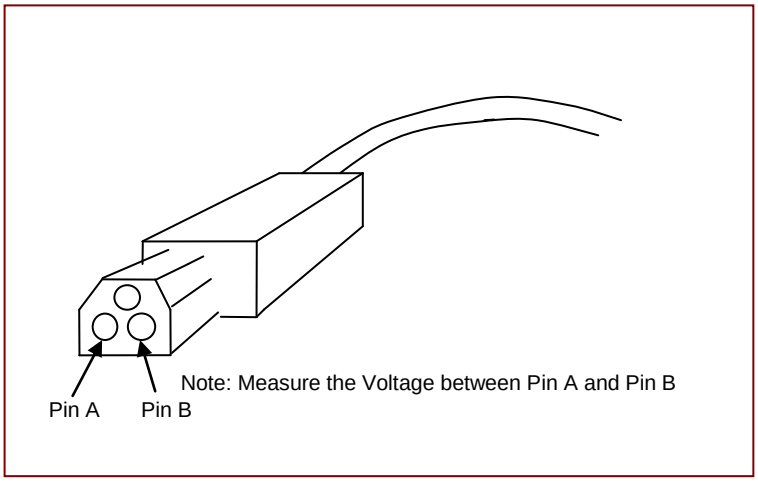


Figure 4-6. AC Adapter Cord.

5.1 DISCOVERY HOUSING

TABLE 5-1. PARTS LIST FOR DISCOVERY HOUSING

Drawing Item	Description
1	Complete Draftshield
2	Rear Housing
3	Pan
4	Breeze Ring
5	Pan Shield
6	Door Side Draft Shield
7	Back Wall Draft Shield
8	Back and Front Strip Set
9	Glass Bottom Draft Shield
10	Platform Grommet
11	Door Track Set Draft Shield
12	Glass Front Draft Shield
13	Door Handle Draft Shield Set
14	Top Door Draft Shield
Not Shown	Sealing Tape

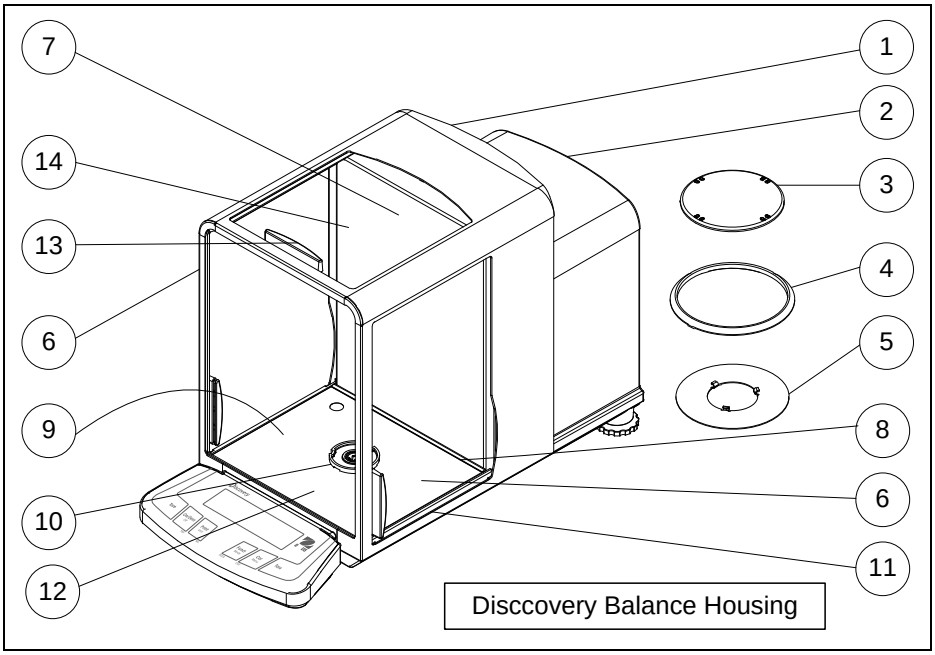


Figure 5-1. Discovery Balance Housing.

5.2 DISCOVERY DISPLAY ASSEMBLY

TABLE 5-2. PARTS LIST FOR DISCOVERY DISPLAY ASSEMBLY

Drawing Item	Description
1	In Use Cover
2	Function Label
3	Display Housing Top
4	Display Printed Circuit Board (PCB)
5	Display Cable
6	Display Housing Bottom

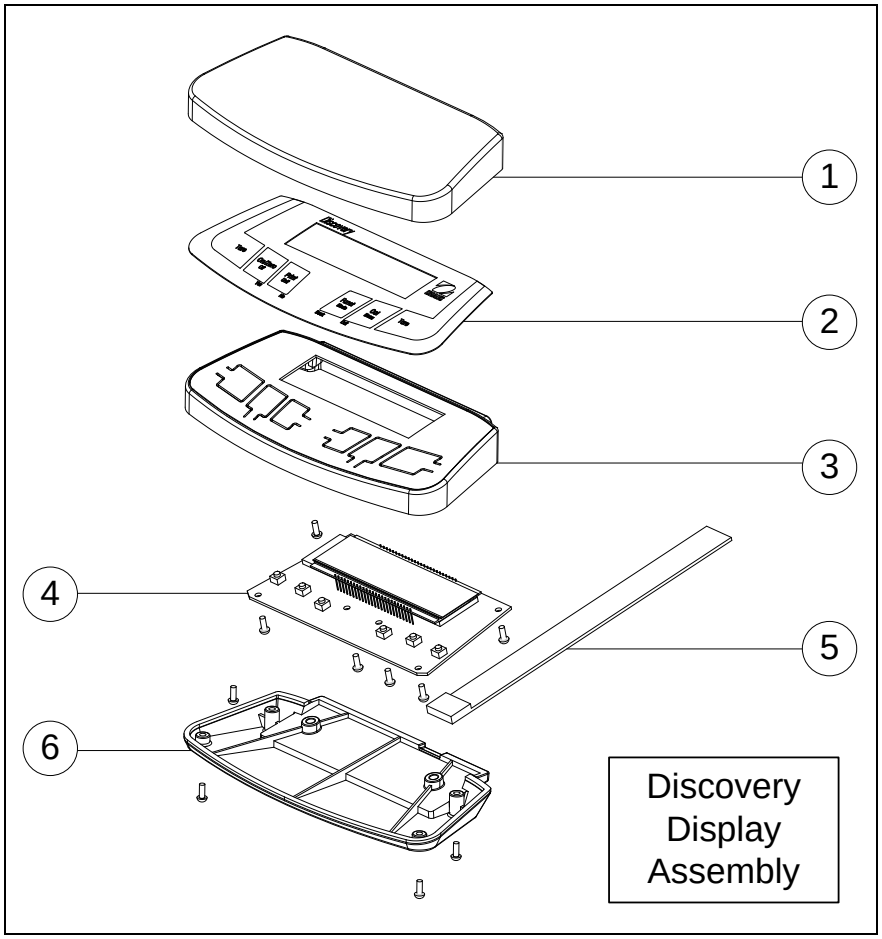


Figure 5-2. Discovery Balance Display Assembly.

5.3 DISCOVERY INTERNAL PARTS OUTSIDE LOAD CELL

TABLE 5-3. LIST OF INTERNAL PARTS OUTSIDE LOAD CELL

Drawing Item	Description
1	Main Printed Circuit Board (PCB) Cover
2	Printed Circuit Board (PCB) Mounting Plate
3	Main Printed Circuit Board (PCB) w/ EEROM Battery
4	Blank EEROM
5	Complete Load Cell
6	Leveling Foot
7	Calibration Motor Assembly
8	Calibration Weight Arm
9	Calibration Weight Holder
10	InCal Weights Cover
11	Weight Cover Bushing
12	Display Cable Shield Plate
13	Calibration Weight
14	Bubble Level
15	CR2032 Lithium Battery

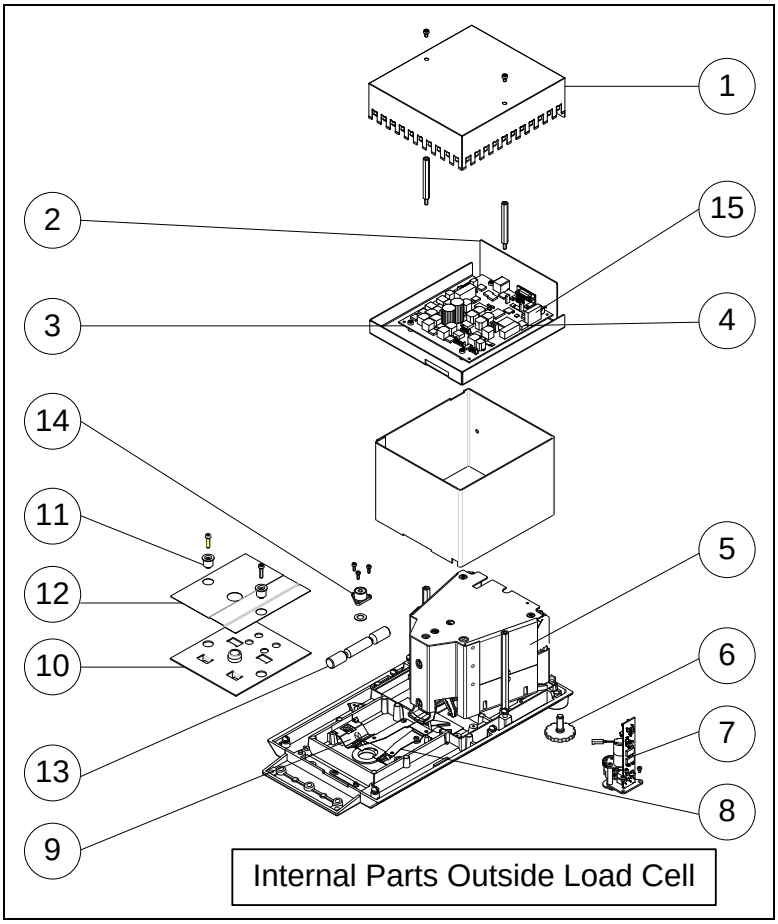


Figure 5-3. Internal Parts Outside Load Cell.

5.4 DISCOVERY LOAD CELL PARTS

TABLE 5-4. LIST OF DISCOVERY LOAD CELL PARTS

Drawing Item	Description
1	Ratio Beam Assembly
2	Printed Circuit Board (PCB) Load Cell
3	Wire Conductor Strips (5cm, 10cm)
4	Flexure, aluminum & steel washers & screw
5	Lower Flexure Arm Assembly
6	Lower Front Flexure, 2 washers & screw
7	Cantilever Arm
8	Load Flexure
9	Upper Flexure Arm Assembly
10	Ratio Beam Flexure, 2 washers & screw
11	Magnet Cover
12	Temperature Conductor
13	Up/Down Stop Plate
Not Shown	Load cell Hardware Kit

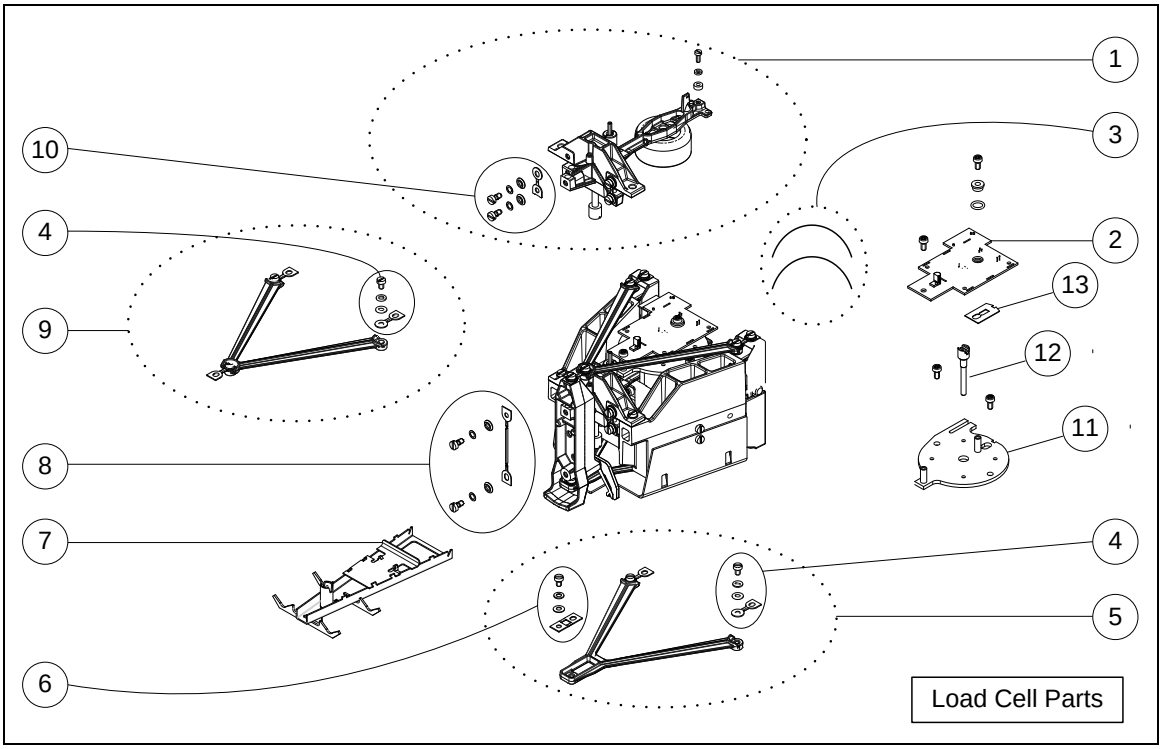


Figure 5.4 Discovery Balance Load Cell Parts.
NOTE: For Part Numbers for specific Discovery Models, see specific parts lists.

APPENDIX A. STANDARD CALIBRATION

Standard Calibration is performed by one of four methods – Automatic Internal Calibration (Advanced AutoCal), Span Calibration, Calibration Test and Calibration Adjustment.

A.1 Automatic Internal Calibration (Advanced AutoCal) – Two internal masses are used, with three weight values: zero, a weight value at or near midpoint of the Load Cell's weighing range, and a weight value at or near the Load Cell's specified capacity.

A.2 Span Calibration (Span) – Span calibration resets the balance's weighing range using two weight values: zero and a value between 50% and 100% of the balance's capacity. Using a weight at the balance's capacity will give the most accurate results. To determine specified capacity, see Table 1-1, Masses Used To Test Discovery Balances.

A.3 Calibration Test (Cal Test) – Calibration test allows the stored calibration data to be tested against the current mass being used for the test.

A.4 Calibration Adjustment (Cal Adj) – Calibration Adjustment allows adjustment of the internal calibration to match an external calibration weight

Note:

Calibration will be locked out if the balance is in Legal For Trade mode. To regain access to locked balance settings, break the seal on the back, and power up the balance while depressing the Lock Switch that was covered by the seal. Calibration can also be locked out from the Lockout Menu. To allow calibration from the Lockout Menu, press and hold Menu, then press **No** until **Lockout** appears. Press **Yes**. When **Calibrate** appears, press **No**. Then press **Exit**.

The Calibration Menu

To navigate the Calibration Menu, proceed as follows:

Press and hold **CAL** until **Menu-Calibrate** appears.

Press **Yes** to see sub-menus.

Press **Yes** to choose the sub-menu selection.

Press **No** to advance to the next sub-menu selection.

Press **Back** to go to previous sub-menu selection.

Press **Exit** to return to weighing mode.

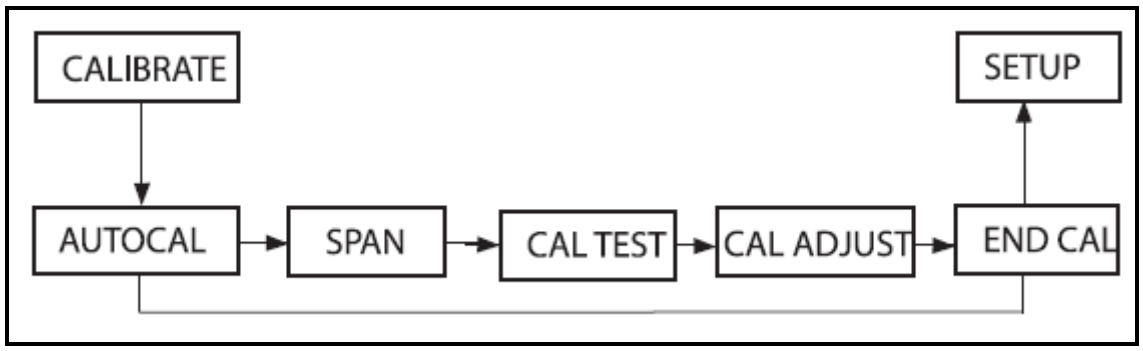


Figure A-1. Calibration Menu flow: Press **No** until the desired option appears, then **Yes**.

Before beginning calibration, have masses available. Masses required for calibration are listed in Table A-1, at the end of this section.

A.1 Automatic Internal Calibration (Advanced Auto Cal)

Internal calibration can be done without using an external weight.

Note:
Be careful not to touch the scale or the table while calibration is in progress, as it will cause the process to fail.

With the balance on, press the **Cal** button and then release it.

Automatic calibration begins. It will take a minute or so.

When it is complete **AutoCal Done** appears.

If calibration fails, **AutoCal Abort** appears. If this happens, level the balance and try again.
If it continues to fail, perform a Service Calibration.
If this also fails, refer to Chapter 3 of this Manual.

When calibration is finished, the balance returns to the weighing mode.

AutoCal will automatically calibrate the balance each time there is a change in temperature significant enough to affect accuracy, or after every 11 hours. In certain circumstances a user may need to prevent automatic calibration, for example, while taking a series of weights. AutoCal can be turned off from the Calibration Menu, as follows:

With the balance on, press and hold the **Cal Menu** button until **MENU CALIBRATE** is displayed, and **CALIBRATE** is blinking. Press **Yes**.

CAL AUTOCAL is displayed. Press **Yes** to select it.

The current **AUTOCAL** setting will then be displayed.

The AutoCal setting will be displayed as either **SET OFF** or **SET ON**.

Press **No** to toggle the display from **AUTOCAL SET ON** to **AUTOCAL SET OFF**, then press **Yes**. Press **Exit** to exit the Calibrate Menu. Repeat this process to re-activate AutoCal.

Automatic internal calibration is included in all Discovery models.

A.2 Span Calibration

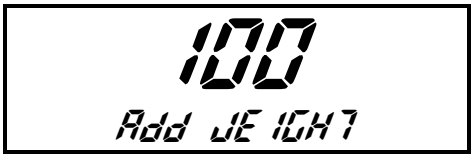
Before initiating Span Calibration, determine the balance's model number. It appears when the balance is powered up. Also be sure to have masses available

Press and hold **Cal Menu** until **Menu Calibrate** is displayed with **CALIBRATE** blinking, then release the button. Press **Yes** to enter calibration. **CAL AUTOCAL** is displayed. Press **No**.

Press **Yes** to initiate span calibration. For a split second **SPAN_ CLEAR SPAN** will come up on the display and then **100_ACCEPT ?**.

Press **No** to toggle to **50_ACCEPT ?** and back to **100_ACCEPT ?** for the acceptable weight used if the acceptable weight is 100 grams. Then press **Yes**.

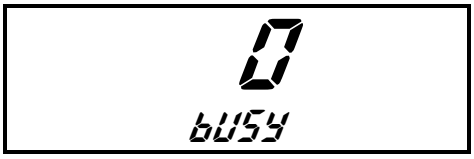
Next the display shows the **Add Weight** message with the weight selected. Place the indicated weight in the Pan. Calibration will begin.



The **SPAN BUSY** message flashes while the balance reads the maximum weight setting.

When the maximum weight reading is taken, the **Clear Pan** message appears. Remove weights to allow the zero reading to be taken.

While the balance takes the zero reading, **0_BUSY** is displayed.



If calibration is successful the **SPAN DONE** message appears, and an ***** appears on the left of the screen, signifying that the balance is stable. A small **O** appears on the top left of the screen, meaning the zero reading is set.

If calibration is unsuccessful, **SPAN ABORT** appears. This may mean the balance is unstable – level the balance and try again. If still unsuccessful, check for problems as explained in Chapter 3 of this manual.

When calibration is finished, the balance returns to the weighing mode.

A.3 Calibration Test (Cal Test)

Calibration test allows a check of a known calibration mass against the last stored calibration information in the balance.

With the balance on, press and hold **Cal Menu** until **Menu Calibrate** is displayed with **CALIBRATE** blinking, then release the button. Press **Yes** to enter calibration. **CAL AUTOCAL** is displayed. Press **No**. **CAL SPAN** is displayed. Press **No**.

CAL CAL TEST is displayed. Press **Yes** and follow the screen instructions.
CAL TST_CLEAR PAN appears for a split second.
Be sure the Pan is clear.

100_ADD WEIGHT appears.
Place the specified weight on the Pan.

After a short period, the display indicates the difference in weight from the last calibration, and then will display the calibration weight on the Pan.

After the test, remove the calibration weight from the Pan.

To leave the menu, press **Exit.**

A.4 Calibration Adjustment (Cal Adj)

Calibration Adjust may be used to adjust the result of the internal calibration by ± 100 counts.

Note: Before making a calibration adjustment, perform an internal calibration. To verify whether an adjustment is needed, place a test mass on the Pan and note the difference (in counts) between the nominal mass value and the actual reading. Refer to Table 1-1, Masses Used To Test Discovery Balances, and use the highest value from the Span Calibration Points column as the test mass.

If the difference is within ± XX count, calibration adjustment is not required. If the difference exceeds ± XX count, calibration adjustment is recommended. [INFO TO COME…]

Following a calibration adjustment, repeat the internal calibration and verification procedures.

With the balance on, press and hold **Cal Menu** until **Menu Calibrate** is displayed with **CALIBRATE** blinking, then release the button. Press **Yes** to enter calibration.
CAL AUTOCAL is displayed. Press **No**. **CAL SPAN** is displayed. Press **No**.
CAL TEST is displayed. Press **No**.

Press **Yes** to enter the CAL ADJ sub-menu and view the current setting.

There will be a number value with “d” in the sub-menu. If the actual reading is less than the nominal mass value, a positive adjustment is required.

Press **No** to increase the d value. Press it until the setting matches the desired d value.

Press **Back** to decrease the d value until the setting matches the desired d value.
Press **Yes** to accept and store the setting.

TABLE A-1. CALIBRATION MASSES FOR DISCOVERY BALANCE MODELS

Model	Span Calibration Points (1)	Weight Class	
DV114C	100g	ASTM Class 1	OIML E1
DV214C	200g	ASTM Class 1	OIML E1
DV314C	300g	ASTM Class 1	OIML E1
DV215CD	200g	ASTM Class 1	OIML E1

APPENDIX B. SERVICE CALIBRATION

This section describes the Service Menu and sub-menus, which allow authorized service personnel to perform factory calibrations. Please refer to the Menu Sequence diagram.

NOTE: The Service Menu cannot be entered if LFT is ON. (See page A-1.)

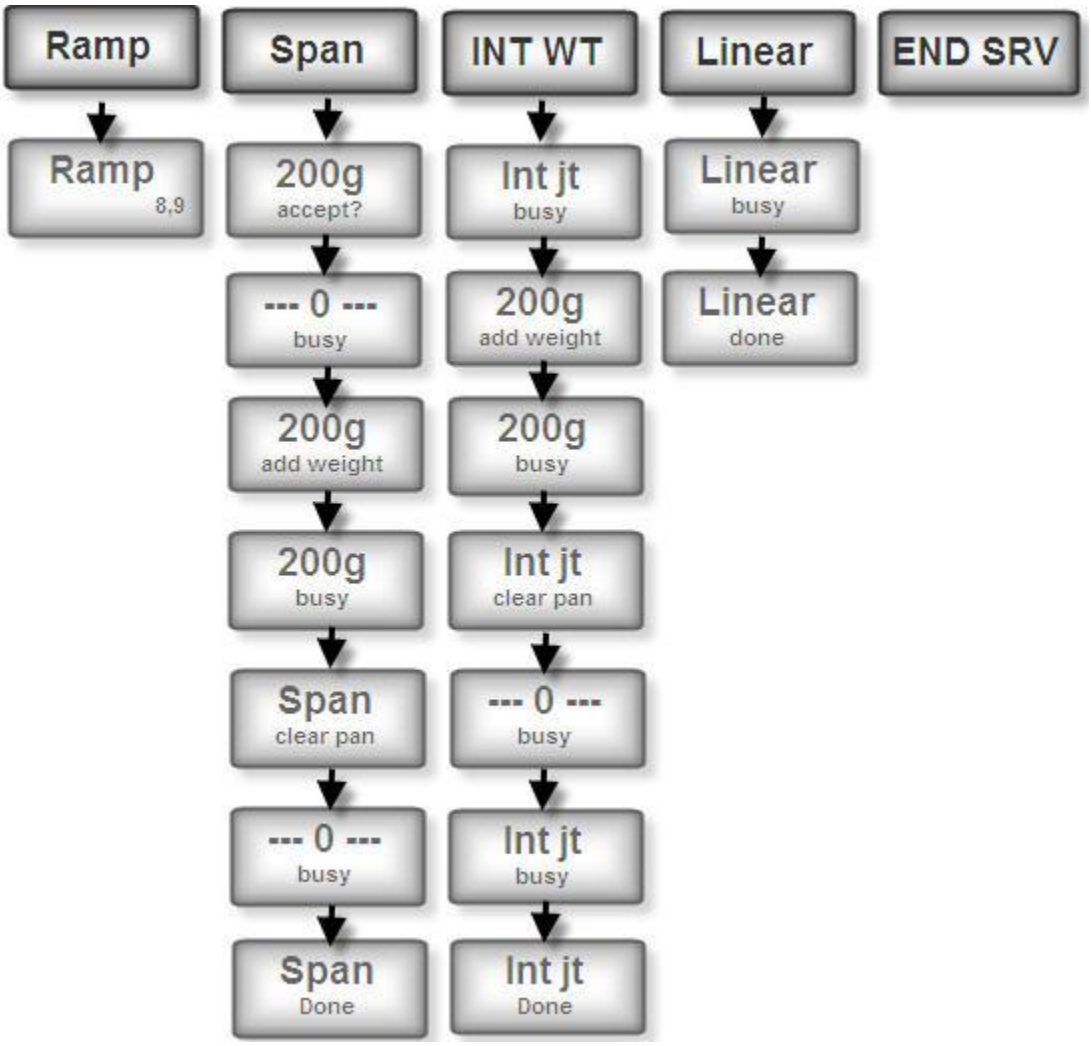


Figure B-1. Service Calibration Menu Sequence.

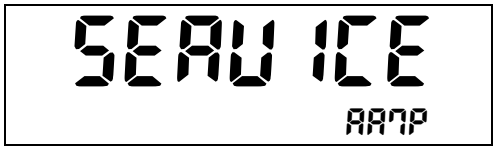
B.1 Navigation

In general, a blinking item in the primary or secondary display indicates a choice. Pressing **Yes** selects the displayed sub-menu. Pressing **No** causes the next sub-menu to appear.

B.2 Entering the Service Menu

Turn the balance off.

Enter the Service Menu by pressing and holding the **On/Zero Off** and the left **Tare** buttons until the balance turns on. This takes a few seconds. As the balance powers up, the display advances through several screens. **SERVICE** is displayed with **RAMP** flashing. Press **Yes** to select **Ramp**. (See next page.) Press **No** to advance to **Span Calibration**. (See page B-3.)

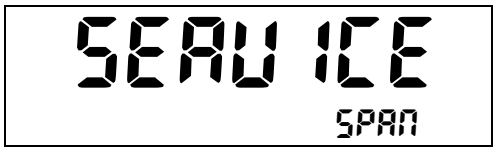


B.3 Ramp

The first sub-menu in the Service Menu is Ramp. The ramp display shows the percentage of use of the A to D circuit. The normal range is 6 -10%. The value is not as important as how it changes. It should increase as the weight on the balance is increased. The ramp display should remain constant without fluctuations. It is OK for the last digit to fluctuate as long as it stabilizes with the addition of a small mass.

To view the Ramp value, press **Yes**. A number will appear on the lower portion of the display and should be constant. Place masses on the balance from minimum to maximum capacity. The reading will increase but should not fluctuate. The example at right is with no weight on the Pan. The reading will vary with other balances.

To exit the ramp function, press **Exit**, then **No**. The balance advances to the Span calibration menu. Press **Yes** to perform Span Calibration. Press **No** to advance to Int Cal Calibration, and **No** again to **End Srv**. If you press **Yes** at this point, the balance goes off.



B.4 Service Span Calibration

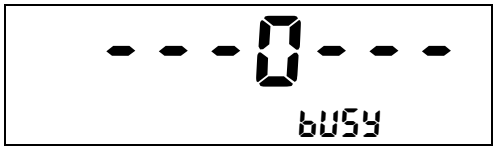
Span calibration from the service menu allows you to set a new zero and maximum setting. This is distinct from user level span calibration, which allows a user to adjust the zero and maximum setting within the range established by the service menu span setting.

NOTE:
The balance should be perfectly level before attempting a span calibration. Use the balance's leveling feet (at the rear of the balance), together with the leveling bubble which is just inside the left Door Side Draft Shield.

When the balance determines that the Pan is empty, the **Span Busy** message appears. In a few seconds, the **Add Weight** message appears, with the number corresponding to the required weight.

Add the amount of weight indicated.

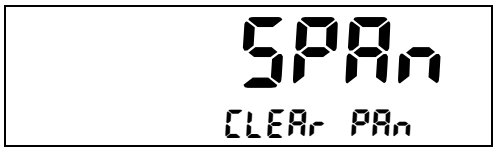
A **Busy** message will appear, together with a number corresponding to the indicated weight.



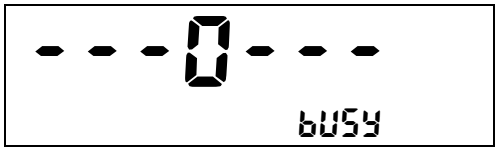
Add the amount of weight indicated.

A **Busy** message will appear.

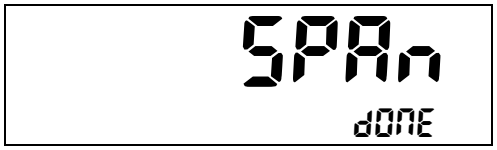
When the span calibration is completed, the **Span Clear Pan** message appears.



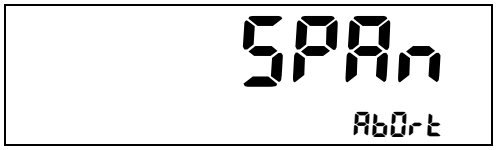
When the balance determines the Pan is empty, the **0 busy** message appears.



If calibration was successful, the **Span Done** message appears.



If calibration was unsuccessful, the **Span Abort** message appears, and the menu returns to **Service Ramp**. If Span calibration fails, refer to Chapter 3, and check the InCal Weight Mechanism, and the Load Cell assembly. Clean and/or repair as necessary.



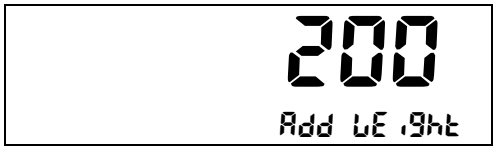
B.5 Internal Weight Calibration (INT WT)

Internal weight calibration in the Service Menu is used to determine the balance's internal weight. This establishes a ratio between the internal weight and an external calibration weight.

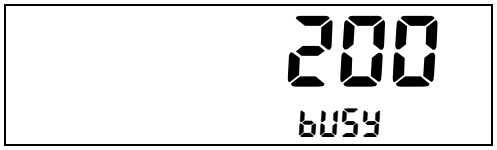
NOTE:
The balance should be perfectly level before attempting a service calibration. Use the balance's leveling feet (at the rear of the balance), together with the leveling bubble which is just inside the left Door Side Draft Shield.

After pressing **No** to **Ramp** and **Span**, press **Yes** to start the internal weight calibration. The **Int jt Busy** message appears.

Add the amount of weight indicated..

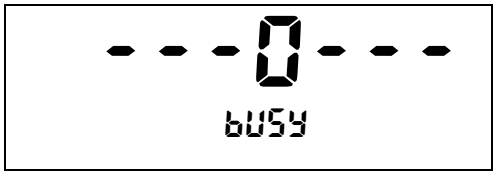


A **Busy** message will appear.

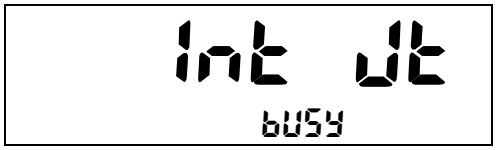


The **Int jt Clear Pan** message appears.

The **Int jt Clear Pan** message appears.



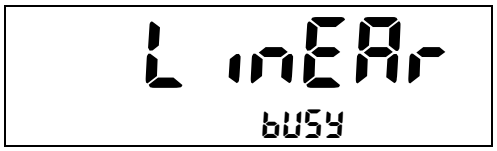
The **Int jt Busy** message appears.



If calibration was successful, the **Int jt Done** message appears.

B.6 Service Linear Calibration

The **Linear Busy** message appears.



If calibration was successful, the **Linear Done** message appears.

APPENDIX C. SOFTWARE SERVICE TOOL INSTRUCTIONS

The Discovery Software Service Tool is used for 5 purposes:

1. To restore EEPROM data.
2. To install a new Load Cell.
3. To install a new Main Printed Circuit Board (PCB).
4. To update the software in the balance.
5. For diagnostics.

Install the software on a Personal Computer running Microsoft Windows NT 4.0 or later, or Microsoft Windows 98 or later. Insert the CD and run Setup.exe.

After installation, run the program Service Tool. The program has 5 tabs across the top of the screen. Click on the tab for the function you wish to perform. If the default settings for communication have been changed, click on settings and change the settings in the software to match.

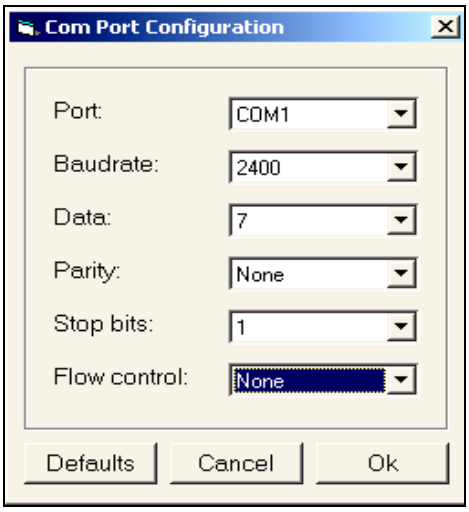


Figure C-1. Com Port Configuration menu.

C.1 To Restore the EEPROM data:

1. Record the following information from the balance to be repaired:

   1.1. Serial Number from the label on the back of the balance.

   1.2. Model Number from the label on the back of the balance.

   1.3. IDNR Number, just above the label on the back of the balance.

2. Contact Ohaus Corporation in Pine Brook NJ, and request the data file to download. Provide the information recorded above.

3. After receiving the data file from Ohaus, continue with the following steps.

4. Connect the balance to the PC and start the Discovery Software Service Tool.

5. Click the tab labeled **Restore EEPROM**.

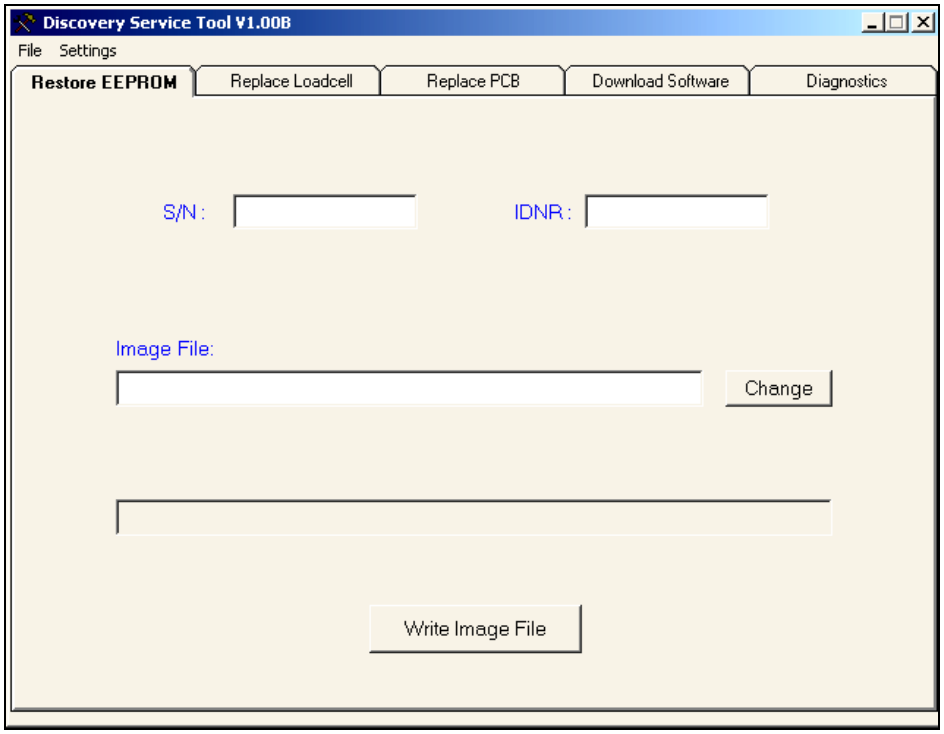


Figure C-2. The Software Service Tool's Restore EEProm tab.

6. Enter the balance's Serial Number and IDNR number.

7. Enter the path to the image file, or click the **Change** button to locate the file.

8. Click the **Write Image File** button.

9. The software will indicate the download progress. When complete, disconnect the power from the back of the balance, then re-connect.

10. Perform Service Calibrations (see Appendix B). Test the balance.

C.2 To Replace a Load Cell:

1. Follow the steps in Section 3-2 to replace the defective load cell.
2. Open the packet containing labels that was supplied with the replacement Load Cell. These labels each contain a model number followed by the IDNR number. Carefully select the label that matches exactly the model number of the balance.
3. Put the new label on the balance.
4. Power the balance from an AC adapter.
5. Connect the balance to your computer.
6. Start the Discovery Service Tool Software.
7. Click on the tab labeled **Replace Loadcell**.

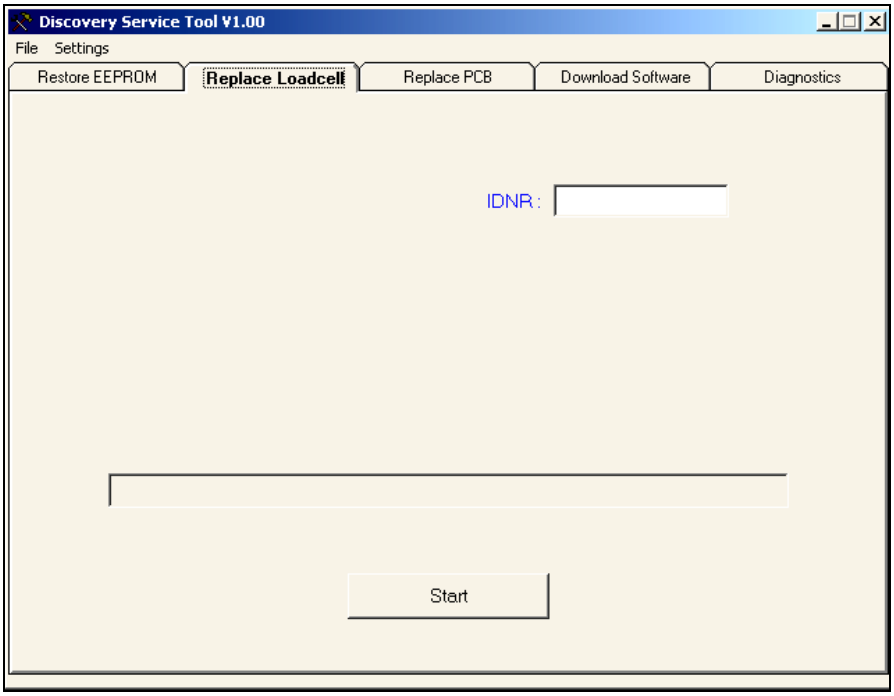


Figure C-3. The Software Service Tool's Replace Load Cell tab.

8. Enter the IDNR number (xxx.xx.xx.xxxx) from the label on the back of the balance.
9. Click the **Start** button.
10. The software will indicate the download progress. When complete, disconnect the power from the back of the balance, then re-connect.
11. Perform Service Calibrations (see Appendix B). Test the balance.

C.3 Install New Main Printed Circuit Board (PCB).

1. Follow steps in Sections 3.1.3 to replace the PCB. Then connect the balance to your computer.

2. Start the Discovery Service Tool Software.

3. Click on the tab labeled **Replace PCB.**

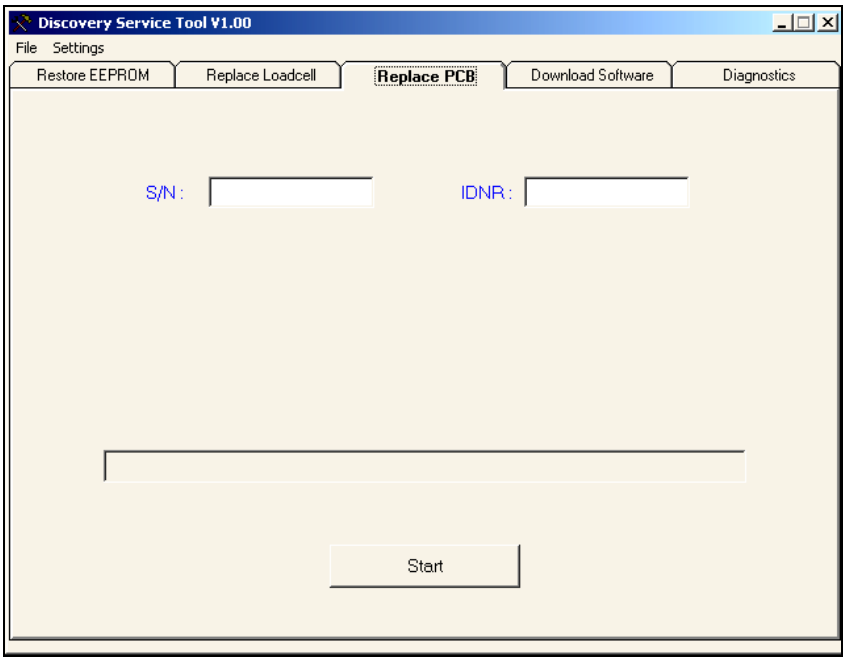


Figure C-4. The Software Service Tool's Replace PCB tab.

4. Enter the S/N value from the label on the back of the balance.

5. Enter the IDNR number (xxx.xx.xx.xxxx) from the label on the back of the balance.

6. Click the **Start** button

7. The software will indicate the download progress. When complete, disconnect the power from the back of the balance, then re-connect.

8. Perform Service Calibrations (see Appendix B). Test the balance.

C.4 Update the Software in the Balance:

1. Connect the Balance to your computer.
2. Start the Discovery Service Tool Software.
3. Click on the tab labeled **Download Software.**

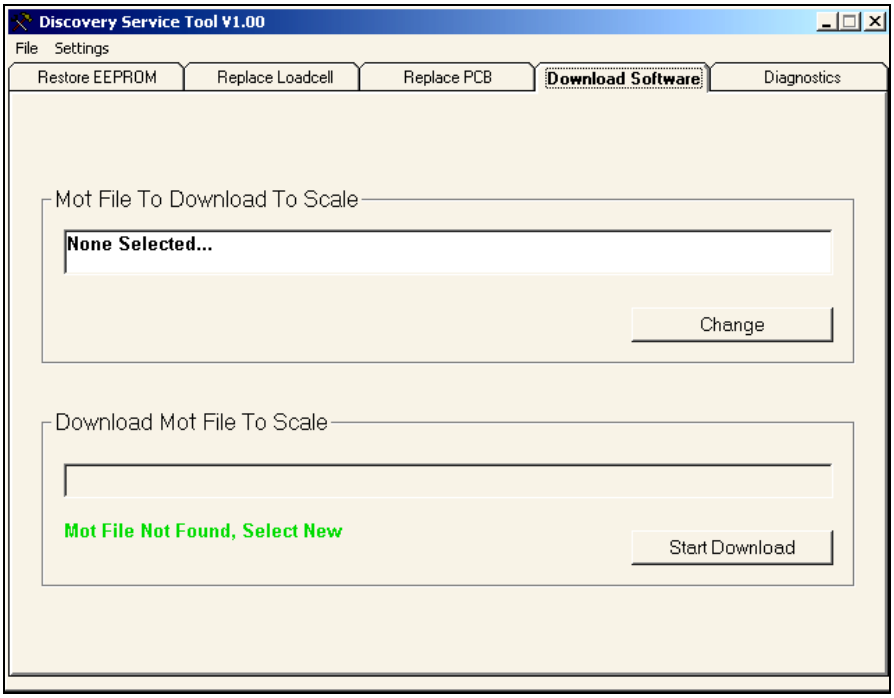


Figure C-5. The Software Service Tool's Download Software tab.

4. Enter the path to the file to download, or click the **Change** button to locate the file.
5. Click on the **Start Download** button.
6. When prompted, disconnect the power from the back of the balance, then re-connect.
7. The software will indicate the download process. When complete, disconnect the power from the back of the balance, then re-connect.
8. Perform Service Calibrations (see Appendix B). Test the balance.

C.5 Diagnostics

1. Connect the balance to your computer.
2. Start the Discovery Software Service Tool.
3. Click on the tab labeled "**Diagnostics.**"

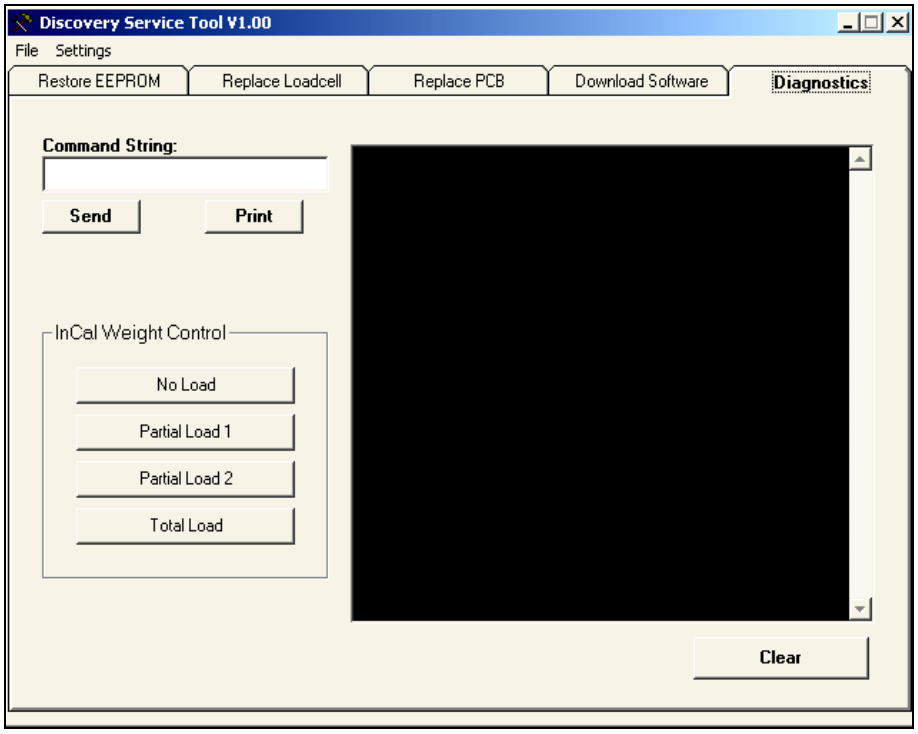


Figure C-6. The Software Service Tool's Diagnostics tab.

4. To test communications, enter a Command String as found in Table 4-3, RS232 Command Table. Click the **Send** button.
5. The scale's response will be shown in the box on the right.

C.5.1 Incal Weight Mechanism Testing

Note: This procedure is used to test that the Incal Weights move smoothly. When each of the weights are in the lowered position, the display reading should be STABLE.

1. Click on one of the InCal Weight Control buttons: No Load, Partial Load 1, Partial Load 2, or Total Load.
2. Observe weight displayed on balance.

A fluctuating display value indicates the weight is not stable. This could be because the weight is not fully lowered and/or because it is touching something. To correct this symptom, follow the procedures in Section 3.1.5 InCal Weight Hardware Disassembly & Testing.

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