



**General Electrodynamics Corporation**

**ARLINGTON, TEXAS**

**DLS-90000-10**

**OPERATORS MANUAL**

**DIGITAL LOADCELL WEIGHING SYSTEM**

**MODEL DLS**

## **WARRANTY AND WARRANTY ADJUSTMENT**

i.) General Electrodynamics Corporation (GEC), hereinafter referred to as "GEC," warrants each new weighing platform to be free from defects in material and workmanship when properly used under normal conditions for a period of one (1) year after shipment from the GEC plant.

ii.) Notice of any claimed defect must be presented to GEC in writing within the warranty period. Upon receipt of the notice from the buyer, the GEC will issue a return authorization to buyer without reasonable delay. By making a warranty claim, the buyer authorizes GEC to repair or replace any defective units at its plant or at the buyer's site; whichever (in the Seller's determination) is most expeditious. The buyer shall make NO RETURNS WITHOUT PRIOR AUTHORIZATION. When authorized, shipment must be made, transportation charges prepaid, and in accordance with such shipping and packing instructions as GEC may issue, the buyer is responsible for returns while in transit. When return is authorized and warranty adjustment is allowed, credit will be issued to the buyer for transit insurance and return transportation cost, and if repair or replacement is made, the repaired or replacement unit will be shipped to the buyer at the GEC's expense; provided however, that transportation costs in excess of an amount equal to the cost of transportation shall be borne by the buyer. The cost of transportation shall be deemed to be by the usual commercial method of shipment between the GEC's plant and the destination to which the product was originally delivered.

iii.) Defective Weighing Systems will either be repaired or replaced, as determined by GEC. GEC reserves the right of final determination as to the existence and cause of a defect. An inspection charge of \$15.00 U.S. per Weighing System will be made to GEC by the buyer to defray GEC's cost of inspecting and handling that has been determined by GEC not subject to warranty adjustment.

iv.) This warranty shall not apply to any Weighing System or part which has been repaired or altered outside of the GEC factory in any manner so as, in the judgment of GEC, to affect its operation, or which has been subject to misuse, negligence or accident, or which has been operated under conditions exceeding the limitations outlined in the GEC Operation and Maintenance Manual for the specific unit sold.

v.) General Electrodynamics Corporation reserves the right to change the unit or part specifications or prices without incurring any responsibility with regard to use of the unit or parts previously sold or replaced.

vi.) Except as to title and patent infringement, the foregoing constitutes the seller's entire warranty with respect to its products and shall be in lieu of any other warranties, express, implied, statutory or of fitness for a particular purpose; and state the full extent of the seller's liability for breach of warranty and for damages whether general, special, direct or consequential.

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# SECTION I

## GENERAL DESCRIPTION

### 1-1. PURPOSE AND SCOPE OF MANUAL

This manual contains information and instructions for operating and maintaining the Digital Load Cell Weighing System (DLS). For ease of use this manual is divided into sections, it contains: care, maintenance instructions, parts data, calibration information and procedures.

### 1-2. PURPOSE OF THE WEIGHING SYSTEM

The DLS is a portable, multi-load point weighing systems, designed to determine gross weight, and aircraft center of gravity. A digital indicator will display individual and total weight.

### 1-3. FUNCTIONAL DESCRIPTION

Each weighing system has two major subsections, the load cells and the digital indicator (DLI). The load cells convert mechanical strain from the applied weight into a digital signal. The load cells send the signal via multi-wire cable to the second major subsection, the digital indicator. The digital indicator takes inputs from one to six load cells and displays the information in pounds or kilograms. An optional printer is available to provide hard copy records of the individual weights and the total weight. Power to operate the load cells originates at the digital indicator. (For a detailed description of the weighing system, see Section II, General Theory of Operation.)

### 1-4. PHYSICAL DESCRIPTION

#### 1-4.1 System Components

The weighing system consists of one (1) digital indicator, one (1) optional tool kit, one (1) power cord, digital load cells (maximum of six), a cable for each load cell, and a storage case for all the components. All items are completely assembled, checked, and packed at the factory prior to shipment. (See Specifications Table 1-1)

#### 1-4.2 Construction

The systems are manufactured to close tolerances, fabricated of high-strength, modern materials. Composite construction is utilized wherever practicable to save weight and provide high reliability. The electronics is state-of-the-art, burned in and tested, easily serviced, sectionalized for troubleshooting, and simple to calibrate and maintain.

**TABLE 1-1. SPECIFICATIONS**

**INSTRUMENT MODULE**

Maximum system capacity:	Total of the load cell maximum capacities
EMI/RFI Suppression:	Internal operating frequency selected to achieve maximum rejection of 50/60 Hz. Plus a shield case.
Power Requirements:	115 ±10 VAC, 50/60 Hz, / 220± 10 VAC single phase, 33 watts max.
Temperature Range (Operating):	0° C to 50° C (32 degrees F to 122 degrees F)
Temperature Range (Storage):	-15° C to 80° C (5 degrees F to 176 degrees F)
Humidity:	95% RH, non-condensing.
Size:	18 1/2" X 13 1/2" X 7".

**LOADCELL**

Capacity	Up to 100,000 pounds.
Internal resolution:	16,777,216 counts.
Conversion Type:	Sigma delta converter with ratiometric reference.
Conversion Rate:	10.0 per second
Power Requirements:	+ 12 VDC 23 mA, - 12 VDC 1.3 mA.
Zero Calibration:	Digital zero calibration controlled in load cell.
EMI/RFI Suppression:	Internal operating frequency selected to achieve maximum rejection of 50/60 Hz. Plus a shield case.
Linearity:	Better than ± 0.02% FS.
Temperature Coefficient:	± 0.0010% FS/F ± 0.0018% FS/C)
Accuracy:	± .1% or ± 5 pounds whichever is greater.
Temperature Range (Operating):	0° C to 50° C

	(32° F to 122° F).
Temperature Range (Storage):	-15° C to 80° C. (5° F to 176° F).
Humidity:	95%RH, non-condensing.(4" high including ball cup)
Size: 25K CAP.	3" diameter x 2 3/4" high.
Weight 25K CAP.	4 1/2 pounds.

**1-5. POWER REQUIREMENTS**

The weighing system operates from  $115 \pm 10$  VAC, 50-60 Hz, single phase, 33 watts maximum source.

**1-6. DISPLAY**

The display is a liquid crystal display (L.C.D.) with 160x128 dot matrix graphics/alphanumeric unit. The display presents: menus, individual load cell weights, descriptions, error information and total combined weight.

**1-7. KEYPAD**

The keypad contains sixteen keys appropriately marked with numbers 0 through 9, decimal point, left arrow, up arrow, down arrow, enter (ENT), and escape (ESC).

**1-8. LOADCELLS**

The load cells have their own analog and digital processing system. Two way communications between the load cell and the DLI provide command, weight readout, and calibration information for both units. The load cells may have maximum capacity values up to 100,000 pounds. Specifications and theory of operation details are in Section 2-3.

## SECTION II

### THEORY OF OPERATION

#### 2-1. INTRODUCTION

This section describes the physical and functional characteristics of the Digital Load System.

#### 2-2. BLOCK DIAGRAM DESCRIPTION

##### 2-2.1 General

A portable scale system, applicable to the weighing of aircraft, has been developed around the concept presented in figure 2-1. The system consists of an instrument module that accepts data from remote digital load cells and presents weight measurements in units of pounds or kilograms. The instrument module accepts up to six (6) load cells simultaneously. The data from the load cells is independently and exclusively displayed. The sum of the individual weights is displayed as total.

##### 2-2.2 Load Cell Indicator

This module is a menu driven controller that will accept signal transmissions from the attached load cells, displays the transmitted weight, and allows the load cells to be calibrated. It will also provide Center of Gravity (CG) calculations for the aircraft being weighed if appropriate information is supplied. Power for this module is 115 +/- 10 VAC at 50/60 Hz, single phase. The input voltage is converted to supply both the internal circuits and the connected remote load cells. RFI power line filtering and fusing are provided. This instrument module is a totally digital; microprocessor based computing system. The operating program is stored in a non-volatile EPROM.

The DLI receives data from each of the attached load cells and displays the weight on the display. After the weight data has been received from all the load cells, the total is computed and displayed on the readout. The display is of the liquid crystal (LCD) type and incorporates 160 x 128 dot matrix graphics and alphanumeric characters. The display presents control menus, weight information, descriptions, and error information. The keypad on the front panel is used to enter data, command functions and select menu options. The keypad functions are described in Section III.

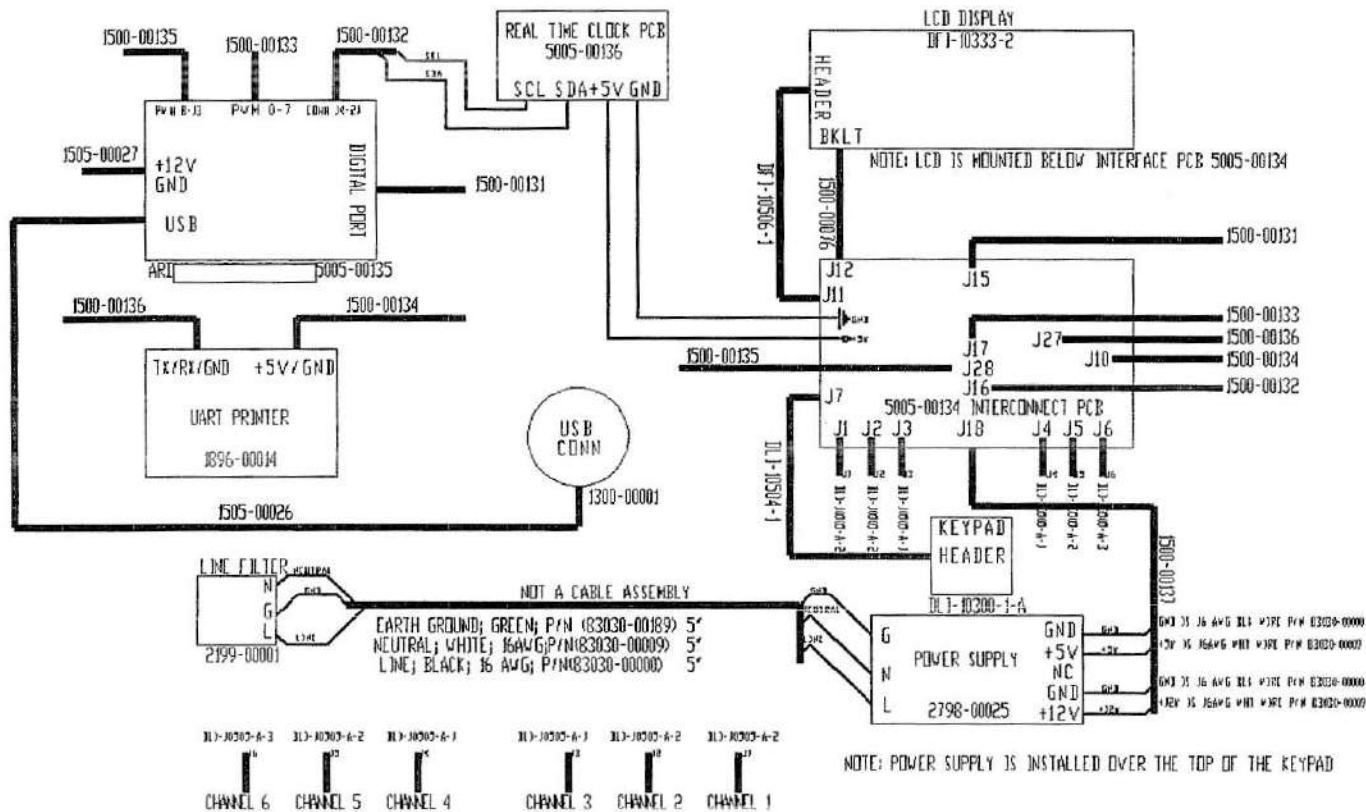


Figure 2-1. System Block Diagram



### 2-2.3 Load cells

The load cells have an independent embedded microcontroller, amplifier, and converter that accept voltage signals from a load transducer (s), amplify the signal, convert the voltage into a digital format and transmit the information to the microprocessor upon request. The amplifier is designed to accept transducer output voltages of 4mV/V. The output of the amplifier is digitized by a sigma delta converter featuring a ratiometric reference to minimize inaccuracy caused by power supply variations. The converter has twenty-four bit resolution and overload indications. The minimum conversion rate is 10.0 times per second enabling accurate update to the instrument display at a rate of once every second. The internal operating frequency of the converter is selected to achieve maximum rejection of 50/60 Hz. EMI/RFI noise signals. Power for the load cells is provided by the DLI via the cables that attach the load cells. Digital signals are sent back to the instrument through the same transmission cables. The lengths of the cables have no effect on the calibration or reliability since the analog signal conversion takes place in the load cell.

### 2-2.4 PRINTER

An optional printer may be installed in the system to provide hard copy documentation of the individual weight readings, the total weight and the CG position. Printing is accomplished through menu selection. A manual paper advance push button switch is located on the front panel, upper right corner. The printer uses standard 2 1/4 inch wide by 1.6 inch diameter paper roles. For instructions on changing the printer and ribbon refer to section IV Maintenance.

# SECTION III

## OPERATING INSTRUCTIONS

### 3-1. INTRODUCTION

This section contains instructions and information for operating the weighing system.

### 3-2. CONTROLS AND INDICATORS

All operating controls and indicators are located on the front panel of the instrument. Figure 3-1 illustrates the location and function for each control and indicator. Various display messages are discussed in Paragraph 3-4.

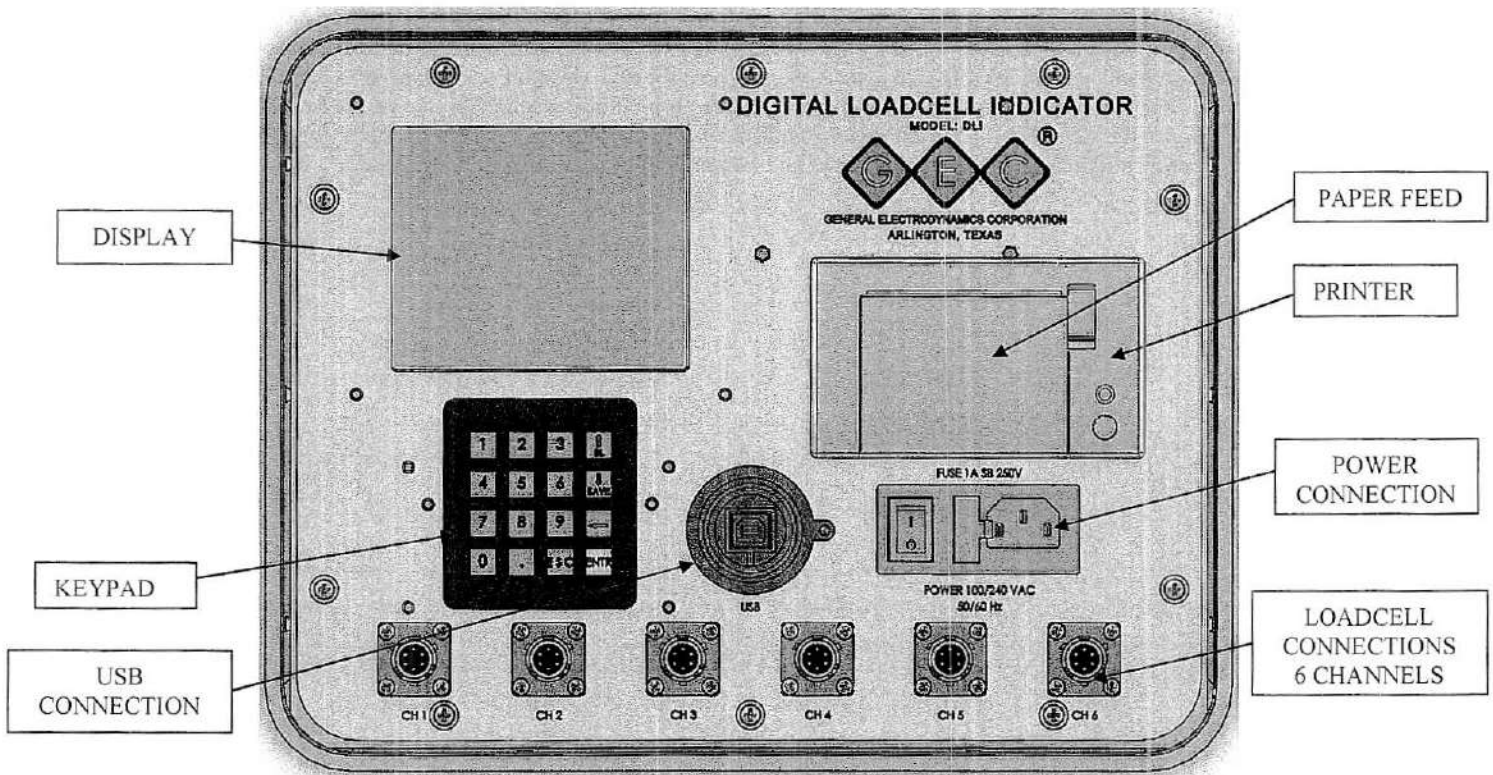


Figure 3-1. Digital Load cell Instrument with optional printer.

### 3-3. CONTROL PANEL CHARACTERISTICS

#### 3-3.1 Introduction.

The control panel consists of a display, keypad and system power switch. The following subsections discuss each of these features.

#### 3-3.2 Display.

The display is of the liquid crystal (LCD) type and incorporates 160x128 dot-matrix graphic/alphanumeric characters that are used to present weight, description, calibration, CG, and error messages. An under zero condition is indicated by a minus (-) sign to the left of the weight data.

#### 3-3.3 Keypad Switches.

The keypad provides the operator interface for various functions, data entry, and calibration that may be selected.

#### 3-3.4 Power connector.

The power connector provides for a standard instrument cable attachment, fuse for unit protection and a switch to turn the Digital Load Indicator on and off.

The following subsection discusses the operation functions including display activity and function interaction.

### 3-4. OPERATION MENUS

#### 3-4.1 Introduction

This section will cover the menu selections and screens seen on the display during operation of the DLI. Section 3-5 will cover the Setup instructions.

**WARNING:** Ensure to connect the load cells to DLI before turning the power on.

#### 3-4.2 Startup

When turn the unit on, the main menu consists of the list of the enumerated functions will display as shown in figure 3-4.1. To perform a task, press the number right next to that task name.

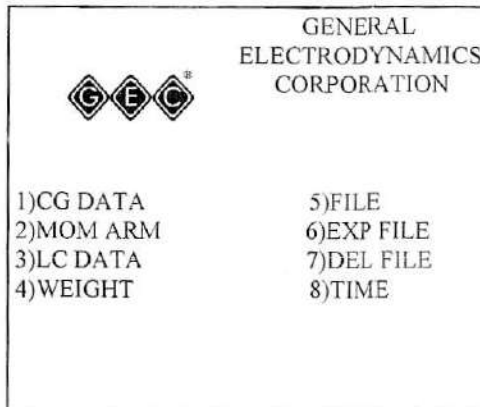


Figure. 3-4.1. Main menu.

### 3-4.3 CENTER OF GRAVITY

From the main menu, pressing 1 on the keypad will transfer the program to the Center of Gravity (CG) Data menu (figure 3-4.3). The CG Data Menu displays the information used in the calculation of the gross weight and center of gravity. This menu also allows the user to change the value of the LEMAC, MAC, PLANE ID, ALTITUDE, LATITUDE, and toggle the display UNITS between ENGLISH and METRIC. The user need only press the number on the keypad corresponding to the desired value and then enter the new value. Print the information by pressing 7 on the keypad.

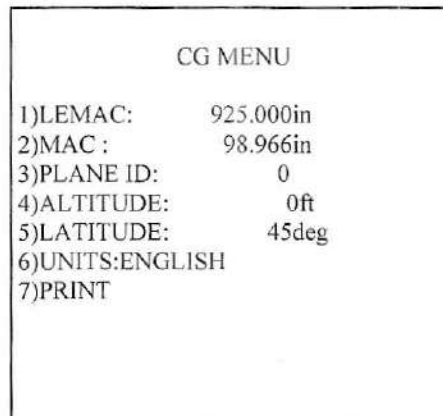


Figure 3-4.2. Center of Gravity menu.

#### 3-4.3.1 LEMAC

From the Center of Gravity Data menu, pressing 1 on the keypad will allow the user to input a new value for the leading edge of the mean aerodynamic cord (MAC). The %MAC CG location calculation uses the LEMAC information.

#### 3-4.3.2 MAC

From the Center of Gravity Data menu, pressing 2 on the keypad will allow the user to input a new value for the length of the mean aerodynamic cord. The %MAC CG location calculation uses the MAC information.

### **3-4.3.3 PLANE ID**

From the Center of Gravity Data menu, pressing 3 on the keypad will allow the user to input a new value for the plane id that helps to identify the aircraft being weighted in the weight mode.

### **3-4.3.4 ALTITUDE**

From the Center of Gravity Data menu, pressing 4 on the keypad will allow the user to input a new value for the station altitude. The program will use this information in calculating the gross weight of the aircraft to correct for variations in gravity with altitude.

### **3-4.3.5 LATITUDE**

From the Center of Gravity Data menu, pressing 5 on the keypad will allow the user to input a new value for the station latitude. The program will use this information in calculating the gross weight of the aircraft to correct for variations in gravity with position on Earth.

### **3-4.3.6 UNITS**

From the Center of Gravity Data menu, pressing 6 on the keypad will toggle the display units between English (pounds and inches) and Metric (kilograms and centimeters).

### **3-4.3.7 PRINT**

From the Center of Gravity Data menu, pressing 7 on the keypad will print the displayed information on the printer.

### **3-4.3.8 EXIT**

From the Load Cell Data menu, pressing ESC on the keypad will transfer the program back to the main menu screen.

## **3-4.4 MOMENT ARM**

From the main menu, pressing 2 on the keypad will transfer the program to the Moment Arm menu (figure 3-4.4). The Moment Arm menu displays the individual moment arms for each of the six(6) load cells installed. The user may change the values of the moment arms by pressing the number on the keypad corresponding to the desired load cell. The moment arm data allows proper calculation of the center of gravity (CG).

MOMENT ARM MENU		
1)ARM #1		10.84in
2)ARM #2		357.20in
3)ARM #3		0.00in
4)ARM #4		118.11in
5)ARM #5		0.00in
6)ARM #6		0.00in
7)PRINT		

Figure 3-4.3. Moment Arm menu.

#### 3-4.4.1 PRINT

From the Moment Arm menu, pressing 7 on the keypad will print the moment arm data on the printer.

#### 3-4.4.2 EXIT

From the Load Cell Data menu, pressing ESC on the keypad will transfer the program back to the main menu screen.

#### 3-4.5 LOAD CELL DATA

From the main menu, pressing 3 on the keypad will transfer the program to the Load Cell Data sub-menu (figure 3-4.5). This display shows: the address, serial number and capacity of each load cell connected to the system. Figure 3-4.5 shows a typical display the operator will see if only three (3) load cells are connected.

LC DATA MENU LB		
ADDR	SERIAL#	CAP
1	1234	25000
2	5678	50000
3	9000	50000
4	-----	-----
5	-----	-----
6	-----	-----
1)PRINT		

Figure 3-4.4. Load Cell Data menu.

#### 3-4.5.1 PRINT

From the Load Cell Data menu, pressing 1 on the keypad will print the load cell data on the printer.

### 3-4.5.2 EXIT

From the Load Cell Data menu, pressing ESC on the keypad will transfer the program back to the main menu screen.

### 3-4.6 WEIGHT

From the main menu, pressing 4 on the keypad will transfer the program to the weight display mode (figure 3-4.6). This display contains: load cell address, applied weight, load cell capacity, plane id, CG and percent MAC. The display shows the units (English or Metric) currently used on the top of the display ie. "WEIGHT MENU LB" or "WEIGHT MENU KG". Figure 3-4.6 is typical of the display the operator will see if all six (6) load cells are connected. This display will show the capacities and applied weight for all load cells attached. A string of dashed lines beside the address indicates that the given load cell is disconnected or is not communicating.

WEIGHT DATA MENU LB		
ADDR	WEIGHT	CAP
1	12500	25000
2	12500	25000
3	12500	25000
4	12500	50000
5	12500	50000
6	12500	50000
TOTAL: 999999		
PLANE ID: 0		
CG: 3394.42 in		1)ZERO
%MAC: 25.03%		2)PRINT

Figure 3-4.5. Weight menu.

#### 3-4.6.1 ZERO

From the Weight menu, pressing 1 on the keypad will zero each connected load cell. The DLI will display LC ZEROED for approximately two (2) seconds. The DLI will display OUT OF RANGE for approximately two (2) seconds if the load cell has weight applied.

#### 3-4.6.2 PRINT

From the Weight menu, pressing 2 on the keypad will print the displayed information on the printer.

#### 3-4.6.3 SAVE

The WEIGHT menu has the option to save the displayed weighing data into the DLI's memory so that the operator later can export this data record to the computer through the associated DLI Interface software. Refer to DLI Interface software section below for how to export data file to the computer. From the Weight menu, pressing Save/Down arrow on the keypad will save the displayed information and current date and time to DLI's memory. The program will generate a file for each save with a corresponding file name. One can view the record files by pressing 5 on the keypad from the main menu. DLI is capable of saving maximum of 350 files.

#### **3-4.6.4 EXIT**

From the Weight menu, pressing ESC on the keypad will return to the main menu screen.

#### **3-4.7 FILE**

From the main menu, pressing 5 on the keypad to access the list of the saved files. Use Up/Down arrow keys to view the list of files if there are more than ten files. To view the content of a file, press the corresponding key number in front of the file name.

##### **3-4.7.1 EXIT**

From the FILE menu, pressing ESC on the keypad will return to the main menu screen.

#### **3-4.8 EXPORT FILE**

From the main menu, pressing 6 on the keypad to export all the saved files at once to the connected PC. Refer to DLI Interface software section for how to export data file to the computer.

#### **3-4.9 DELETE FILE**

From the main menu, pressing 7 on the keypad to delete all saved files in the FILE menu.

#### **3-4.10 TIME**

From the main menu, pressing 8 on the keypad to view current time or to set up new time.

##### **3-4.10.1 SET TIME**

From the TIME menu, pressing 1 on the keypad to set the new time. Enter the date and time follow the format below and then press ENT on the keypad. The setting up time format is mmddyhhmmss, where

mm - two digits represent month.

dd - two digits for day.

yy - two digits for year.

hh - two digits for hour.

mm - two digits for minute.

ss - two digits for second.

#### **3-4.11 USB DRIVER INSTALLATION**

When connect the DLI to the computer through the USB cable at the first time, the computer will not recognize the DLI as an unknown device. This USB driver installation guide will show how to install the USB driver for the DLI to communicate with the computer.



**STEP 1:** Insert the installation cd into the cd/dvd drive on the computer. Press “Start” icon (Windows symbol at the lower left corner of the screen) and click on the “Control Panel” as shown in figure 3-4.11.1.



Figure 3-4.11.1: Open the Control Panel

**STEP 2:** Select and click on “System and Security” in the “Control Panel” as in figure 3-4.11.2.

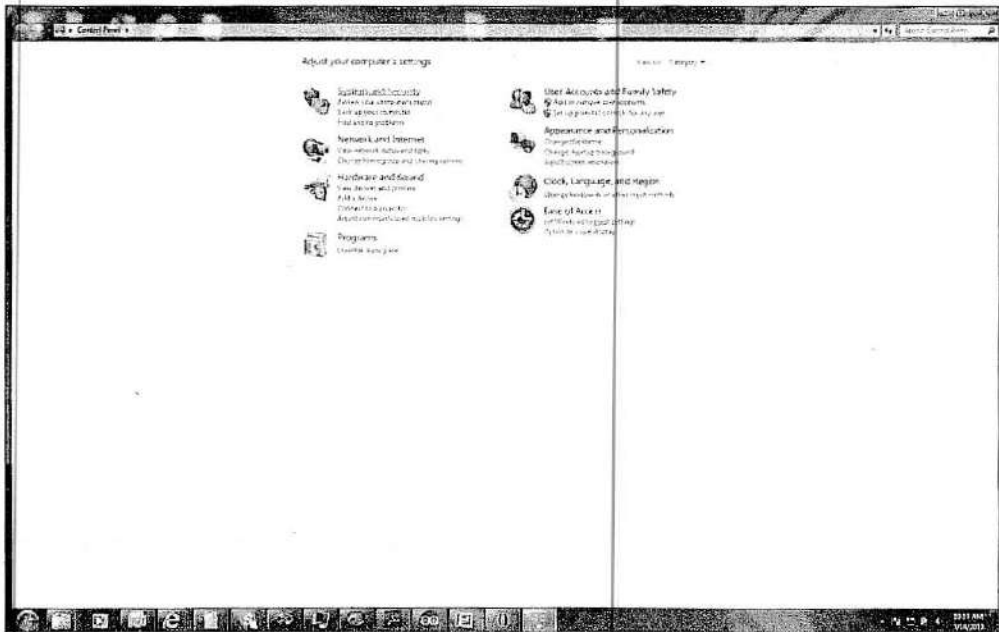


Figure 3-4.11.2: Select “System and Security” in Control Panel

STEP 3: Select and click on “System” as in figure 3-4.11.3.

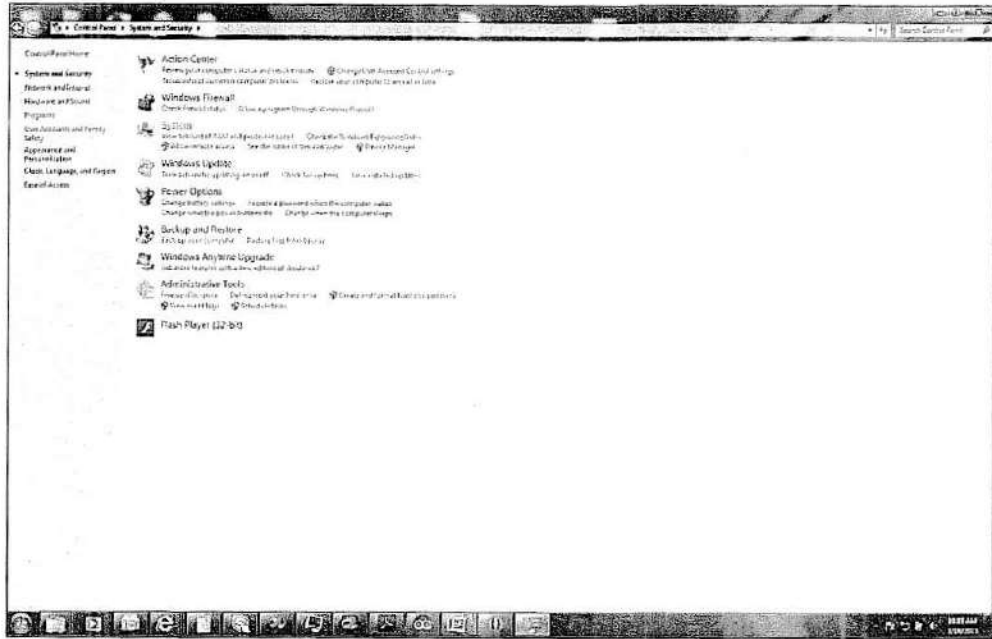


Figure 3-4.11.3: Select “System” in Control Panel

STEP 4: Select and click on “Device Manager” as in figure 3-4.11.4.

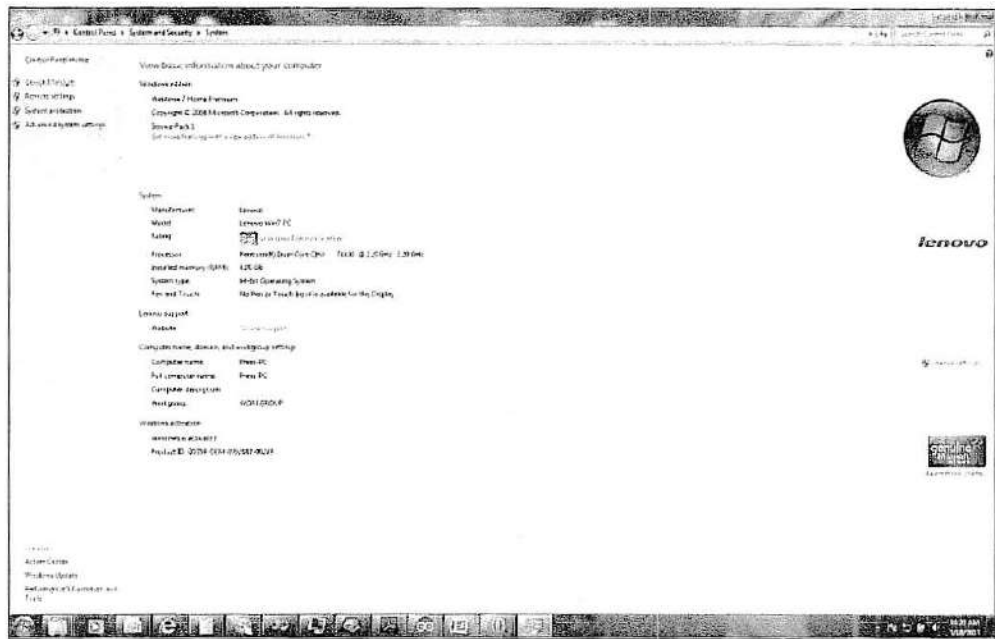


Figure 3-4.11.4: Select “Device Manager” under “Control Panel Home”.

**STEP 5:** When the “Device Manager” window populates, click on “Other devices” as in figure 3-4.11.5.

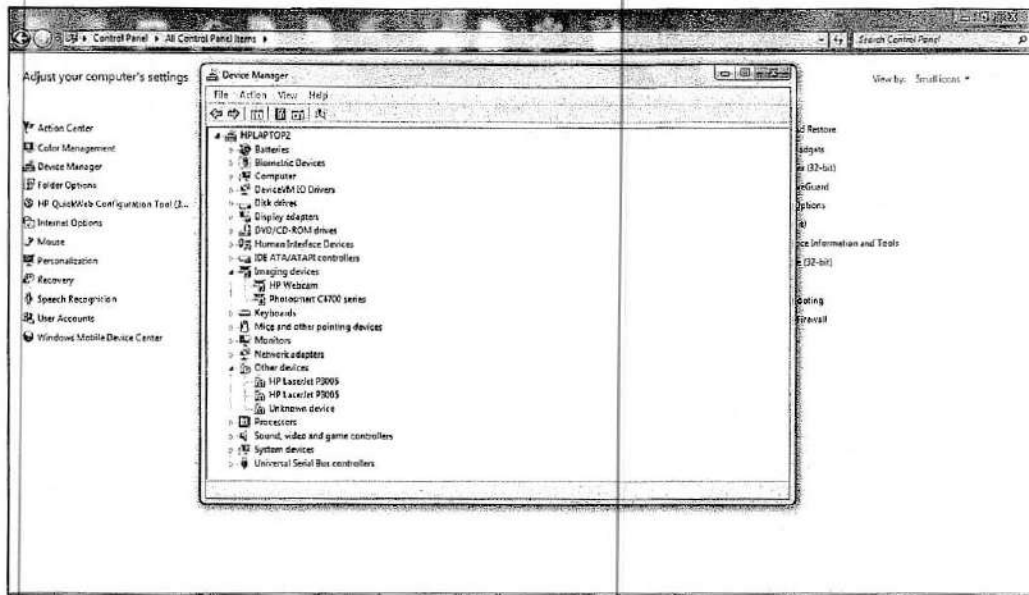


Figure 3-4.11.5. Click on “Other devices” in the “Device Manager” window.

**STEP 6:** Right click on the “Unknown device” and click on “Update Driver Software” as in figure 3-4.11.6.

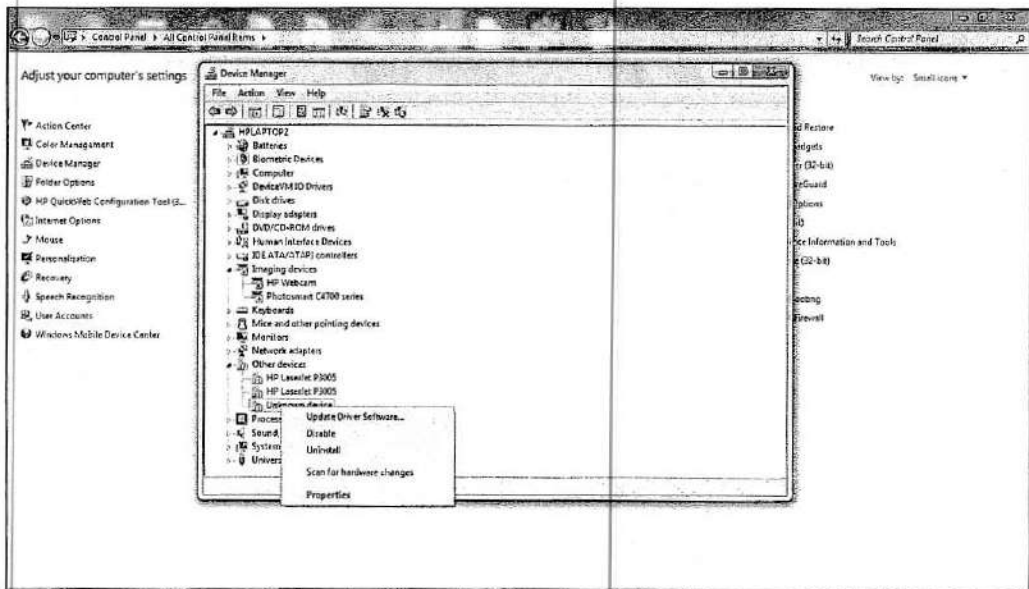


Figure 3-4.11.6. Select “Update Driver Software” from “Unknown device”.

**STEP 7:** When “Update Driver Software” window populates, click on “Browse my computer for driver software” as in figure 3-4.11.7.

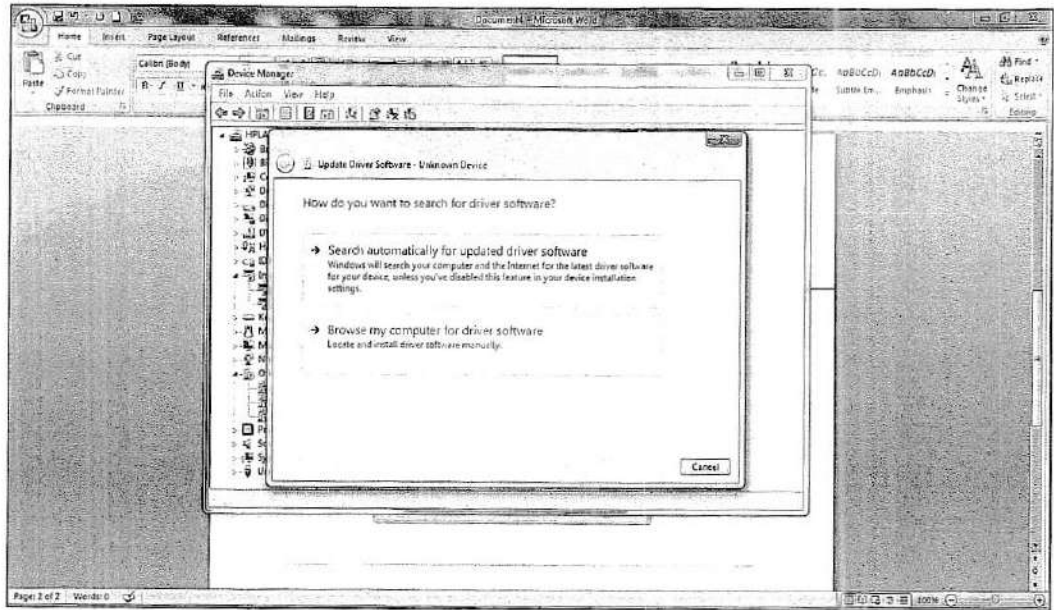


Figure 3-4.11.7. Click on “Browse my computer for driver software”.

**STEP 8:** If you are using Windows 8/8.1 continue to step 19, otherwise select “Let me pick from...” and press “Next” as in figure 3-4.11.8.

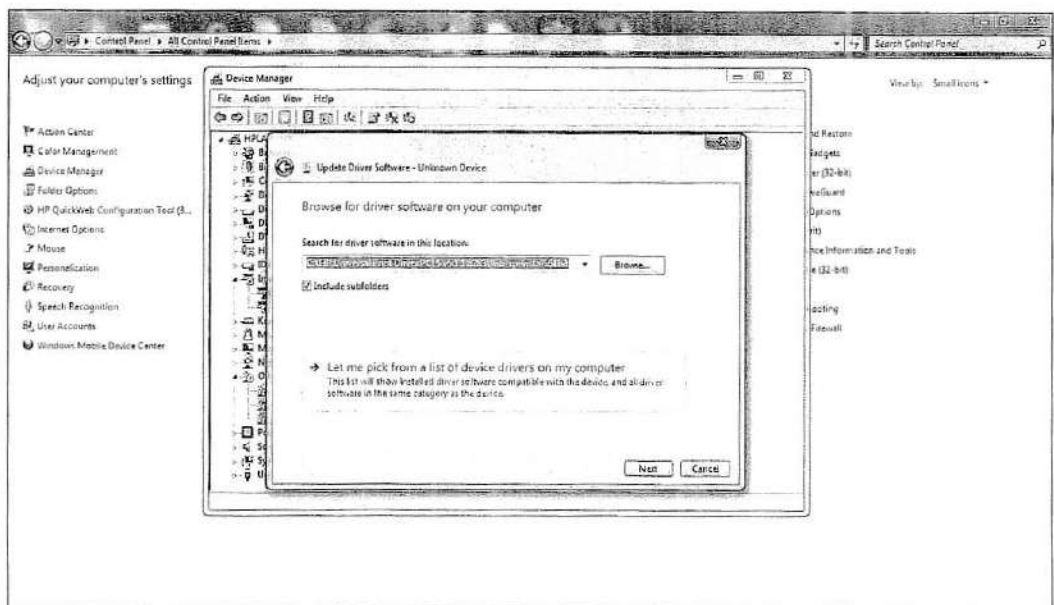


Figure 3-4.11.8. Select “Let me pick from...”

**STEP 9:** In the list of device's type, click on "Port (COM & LPT)" and press "Next" as in figure 3-4.11.9.

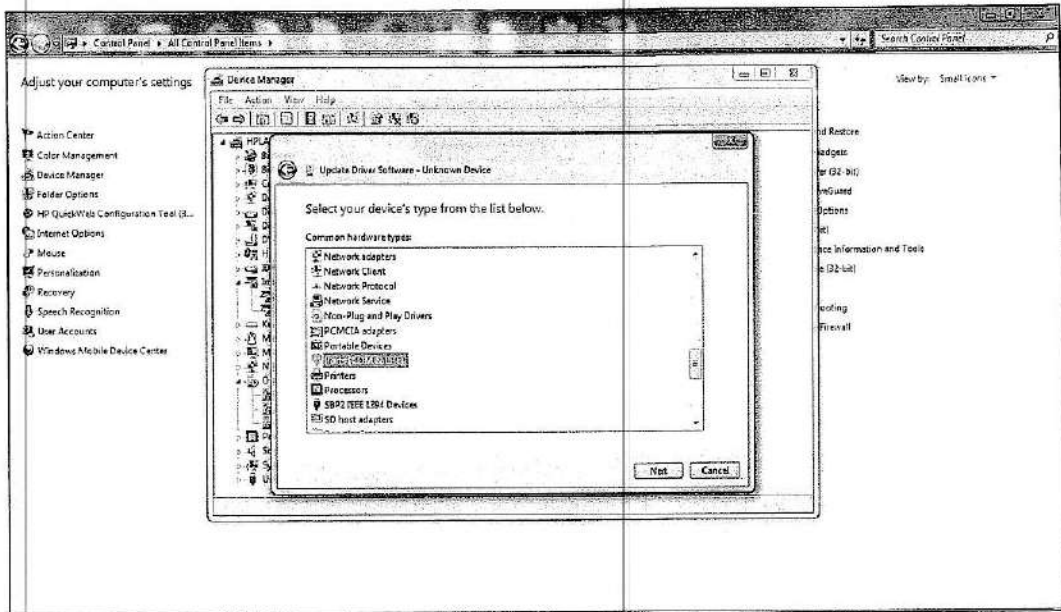


Figure 3-4.11.9. Select "Port (COM & LPT)".

**STEP 10:** Choose "(Standard port types)" under "Manufacturer" and select "Communication Port" under "Model", then press "Have Disk" as in figure 3-4.11.10.

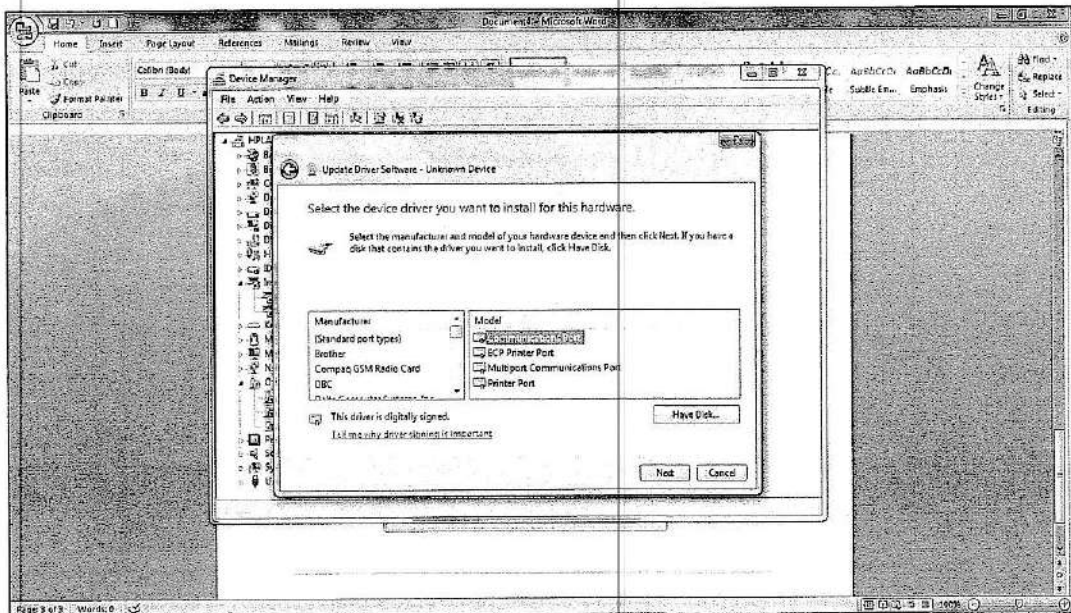


Figure 3-4.11.10. Press "Have Disk" after selecting "Communication Port".

STEP 11: Press “Browse” in the dialog message window as in figure 3-4.11.11.

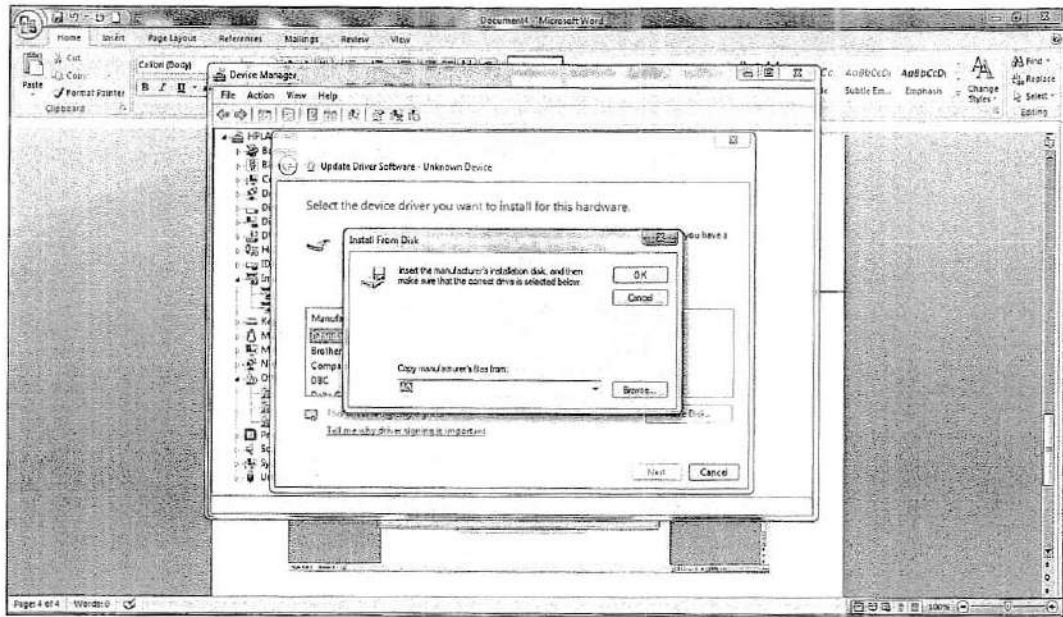


Figure 3-4.11.11. Press “Browse” in the dialog window.

STEP 12: Double click on “Computer” icon on the left of the new window as in figure 3-4.11.12.

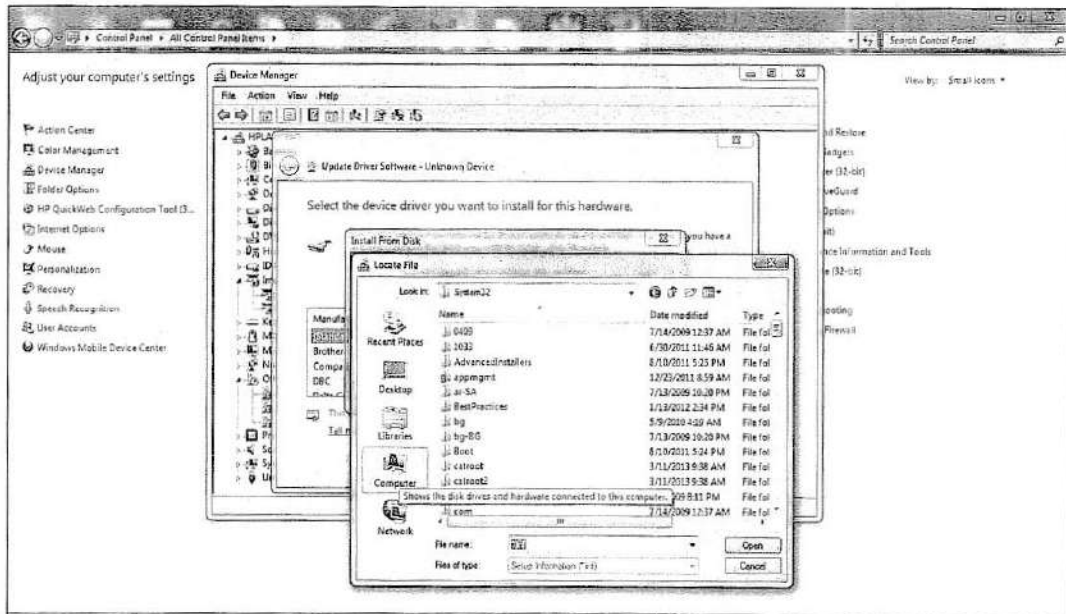


Figure 3-4.11.12. Double click on the “Computer” icon to select the cd/dvd drive.



**STEP 13:** Select cd, or DVD drive that contains the installation cd and press “Open”. Note that the cd/dvd drive varies and might look different with the one shown in figure 3-4.11.13, depending on the computer hardware configuration. Figure 3-4.11.13 shows the Drive F that consists of the installation cd inserted at the beginning of this installation guide.

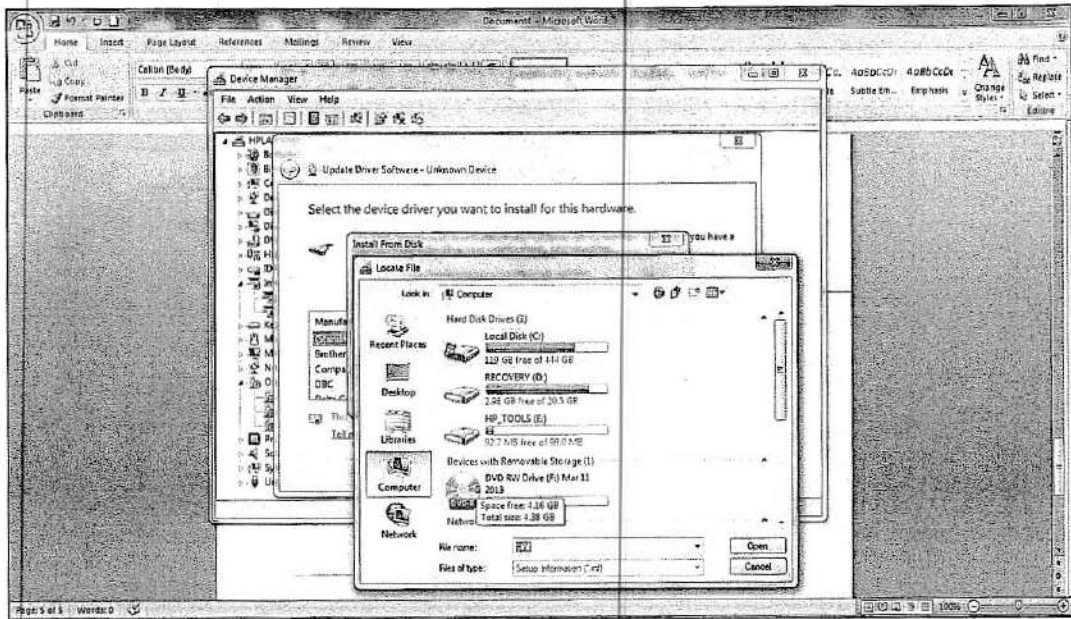


Figure 3-4.11.13. Open the installation DVD drive F to install the USB driver.

**STEP 14:** Select “drivers” folder and press”Open” as shown in figure 3-4.11.14.

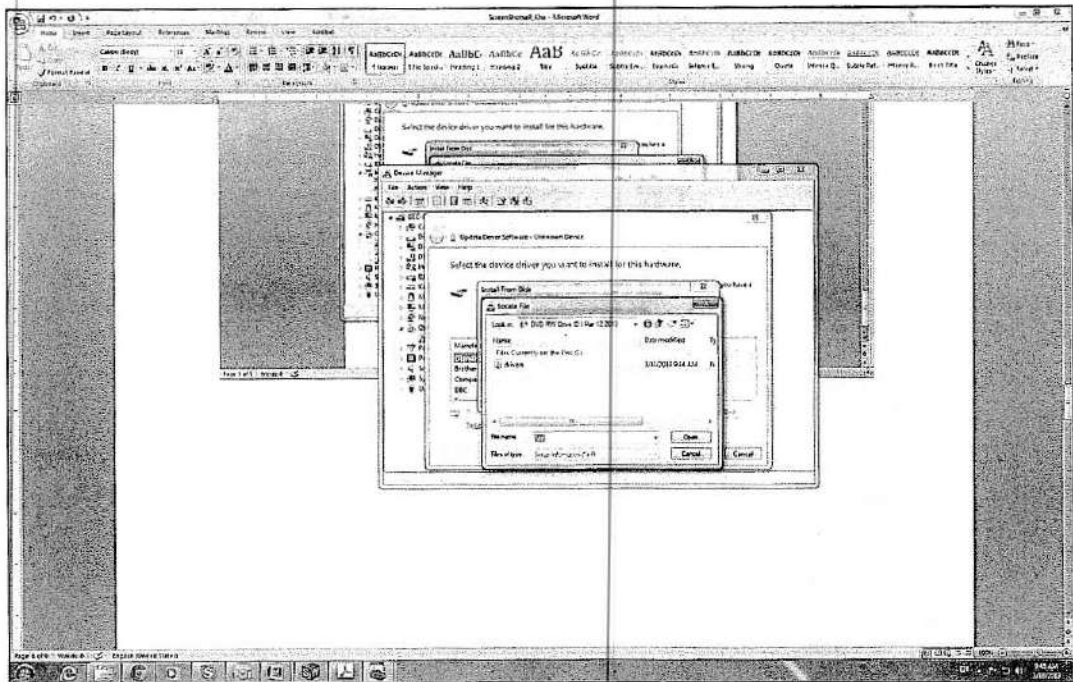


Figure 3-4.11.14. Open the “drivers” folder from DVD drive.

STEP 15: Press "OK" as shown in figure 3-4.11.15.

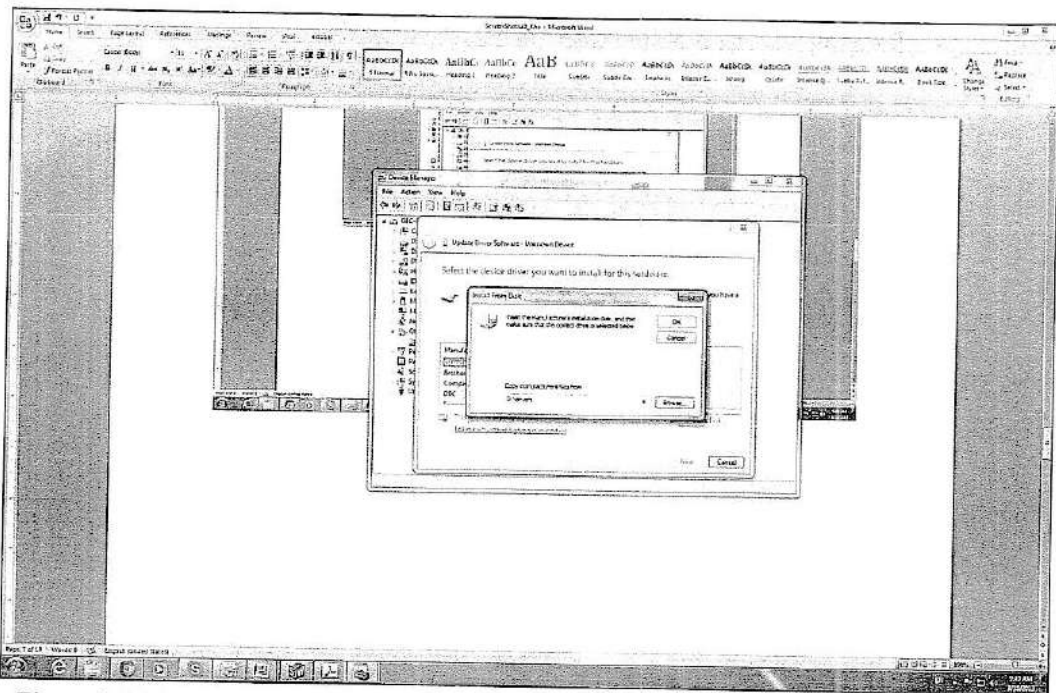


Figure 3-4.11.15. Press "OK" after selecting installation drive from the previous step.

STEP 16: Press "Next" for installing the software as in figure 3-4.11.16.

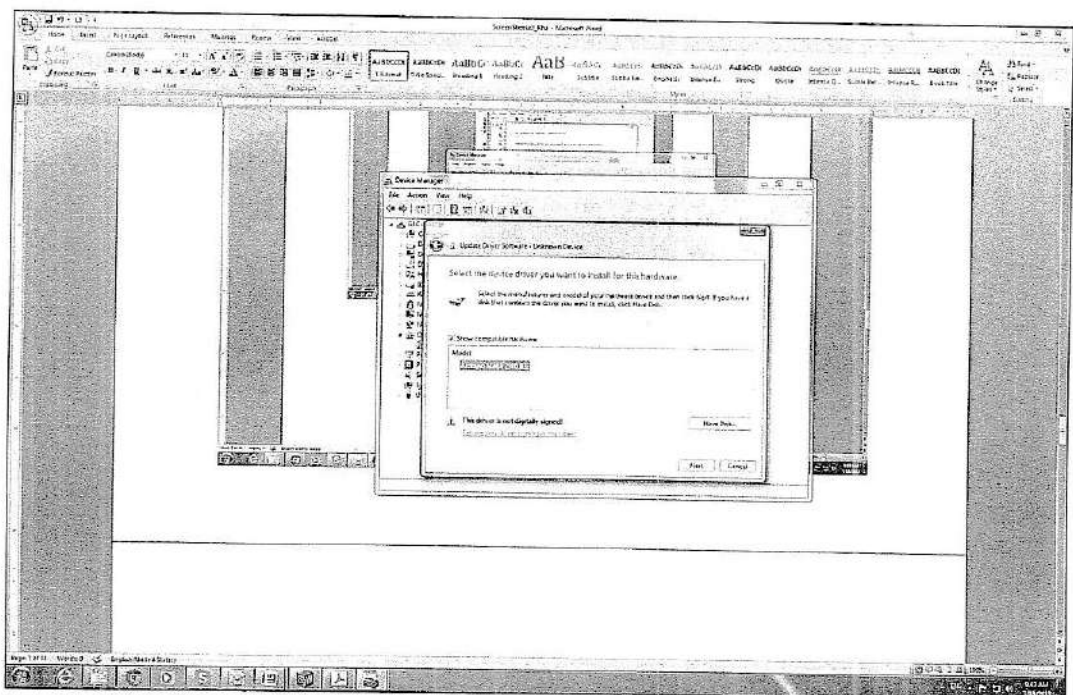


Figure 3-4.11.16. Press "Next" for installing the software.



**STEP 17:** Press “Install this driver software anyway” when asked by Windows Security as in figure 3-4.11.17.

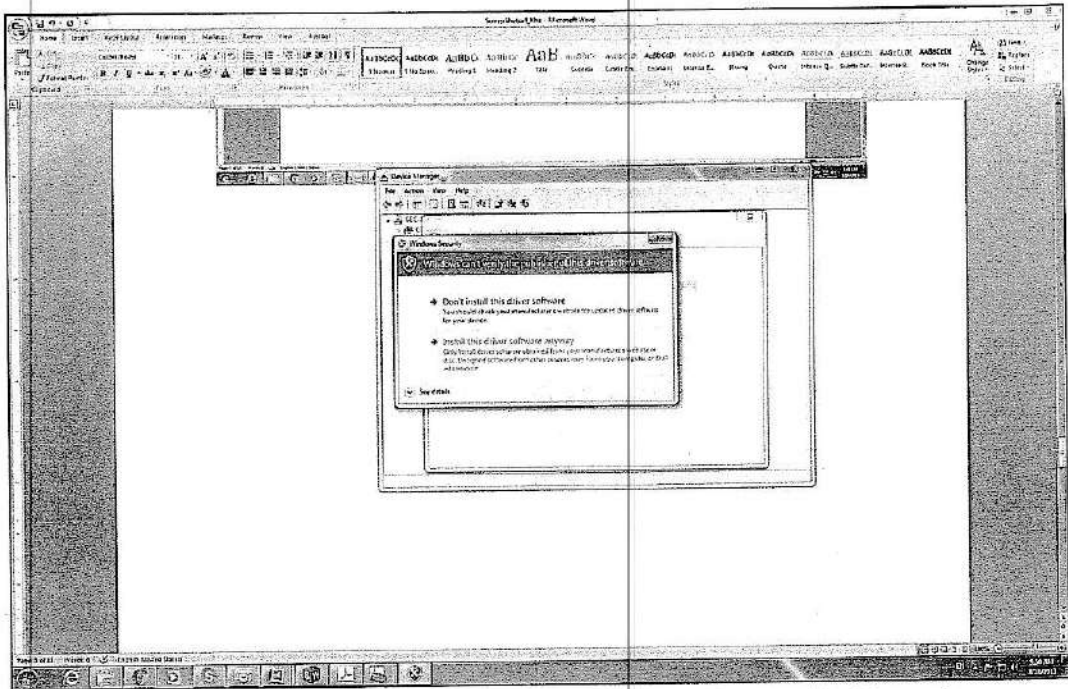


Figure 3-4.11.17. Confirm installing software by click on “Install this driver...”

**STEP 18:** If successfully installed, the windows will shows the new port name as in figure 3-4.11.18 and figure 3-4.11. 19.

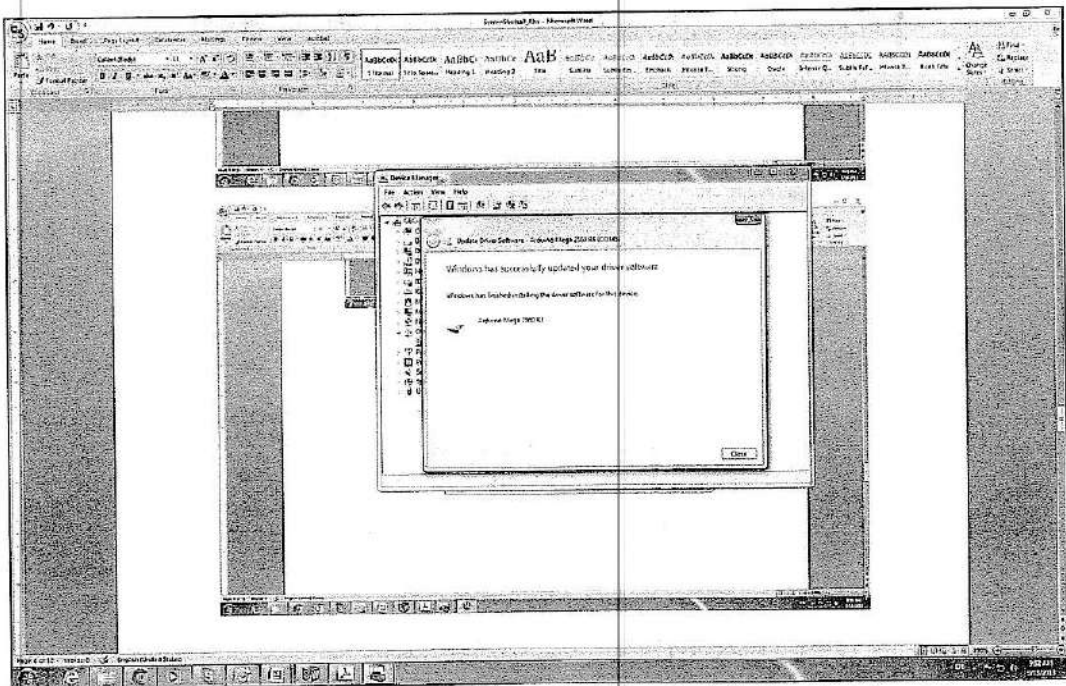


Figure 3-4.11.18. Press “Close” to exit software installation wizard.

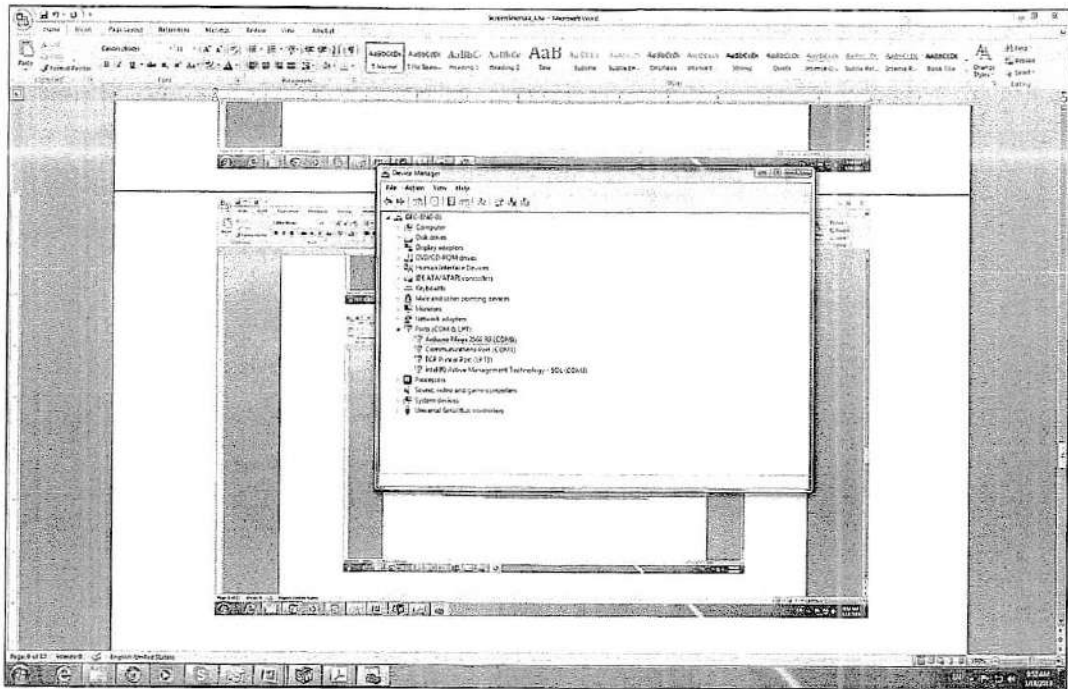


Figure 3-4.11.19. The new port name will be updated in the port list under Ports(COM & LPT).

STEP 19: Click the “Browse...” button to locate the installation CD

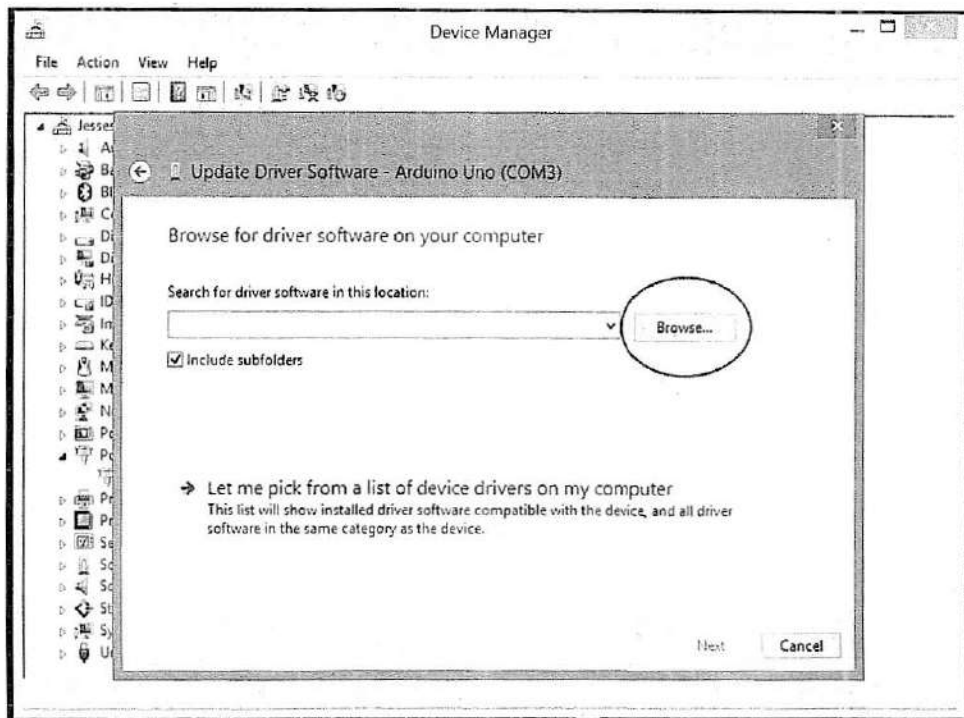


Figure 3-4.11.20. Click the “Browse...” button to locate the installation CD

**STEP 20:** Select the “drivers” folder in the “Windows 8 drivers” folder and click the “OK” button

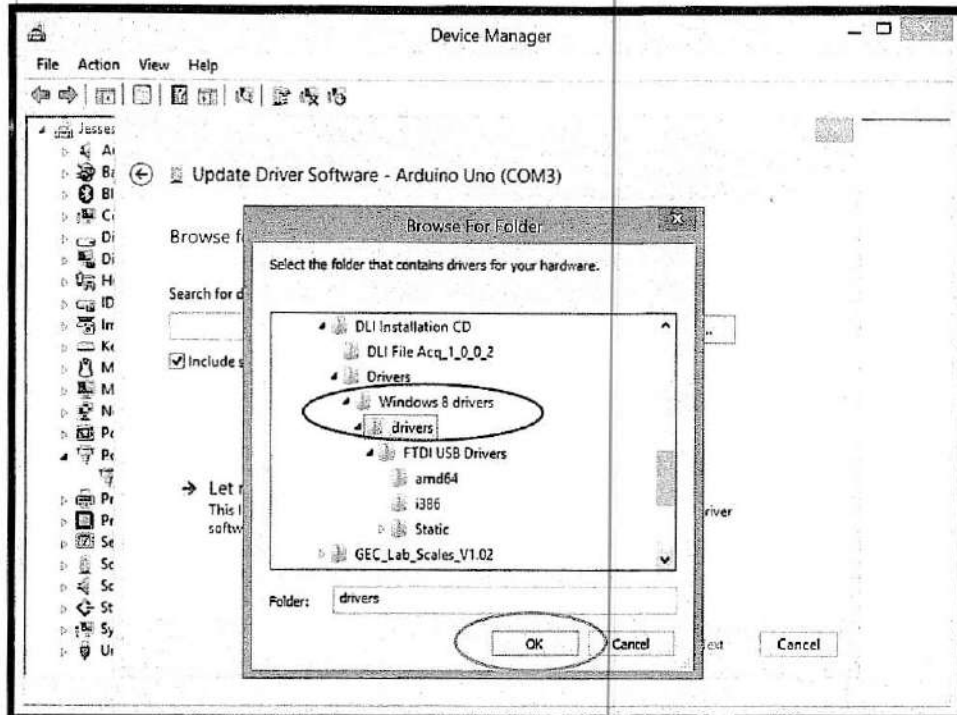


Figure 3-4.11.21. Select the folder that contains the .inf file, then click “OK”

**STEP 21:** Note that the drive location is shown in the top box, and click “Next” to install the driver to the device

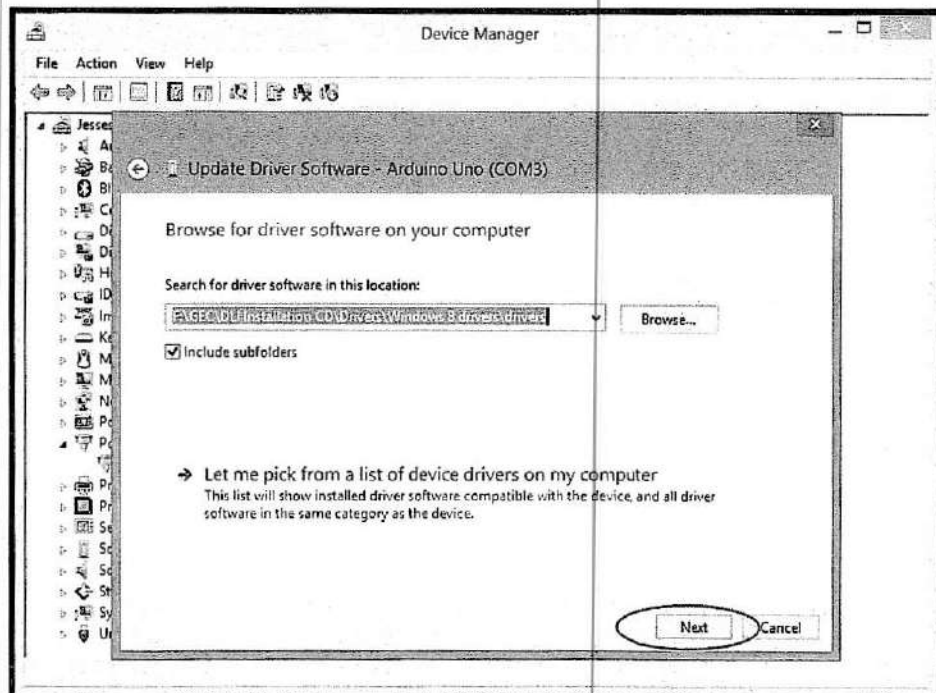


Figure 3-4.11.22. Click “Next” to install the driver to the device

### 3-4.12 DLI INTERFACE SOFTWARE

This section will show how to use DLI Interface software to retrieve saved files from DLI. Make sure that turn on the DLI and connect the USB cable to the PC before exporting data file to the computer.

#### 3-4.12.1 EXPORTING SINGLE FILE

Open the DLI Interface application by double click on the DLI File Acq executable (application) file as in the figure 3-4.12.1a.

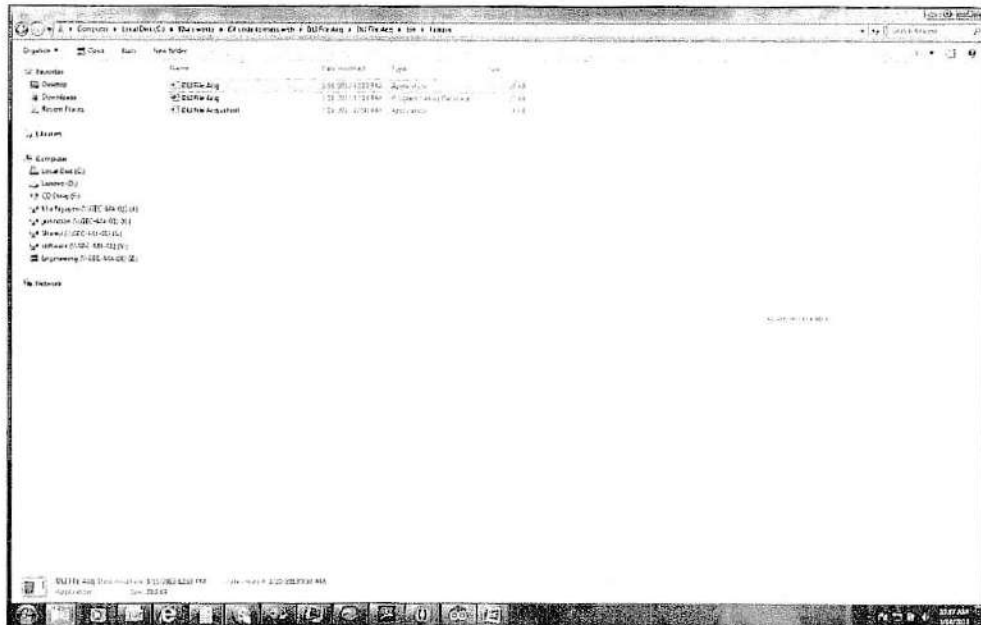


Figure 3-4.12.1a. DLI Interface

Select the corresponding data port. The data port number may vary depending on the computer. Figure 3-4.12.1b shows an example of selecting the data port.

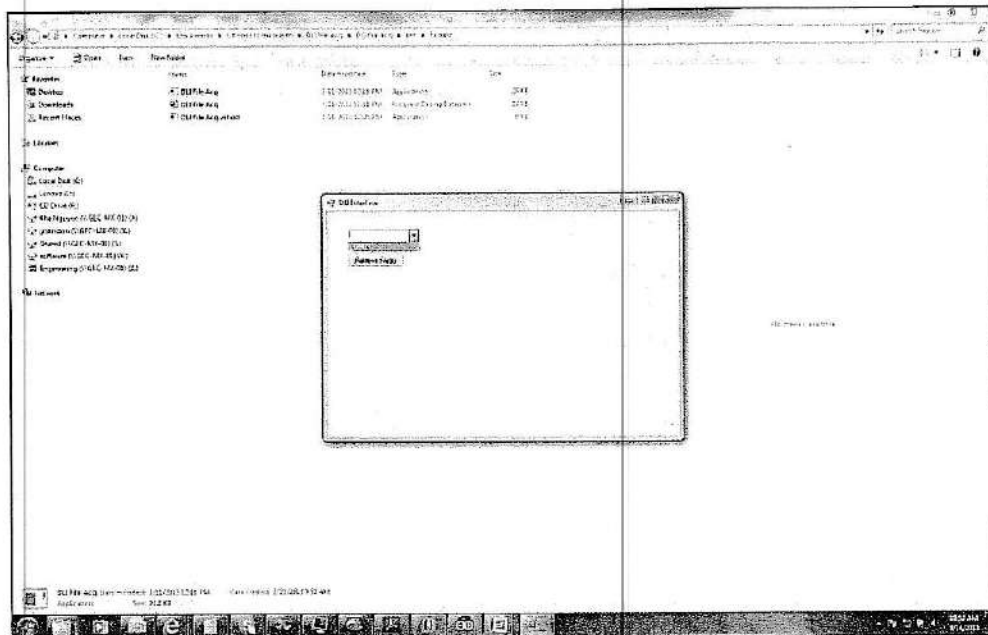


Figure 3-4.12.1b. Data port in the drop down box

Press the “Retrieve File(s)” soft button and then press 5 on the DLI’s keypad to access the file list. Press the number corresponding to the file, on the keypad, to export that file to the PC. A saving file dialog will populate on the computer and asks for entering the file name to save. Enter the new file name in the File name box and press “Save”. Figure 3-4.12.1c shows an example of exporting single file and save it with the new file name “weighing 1”.

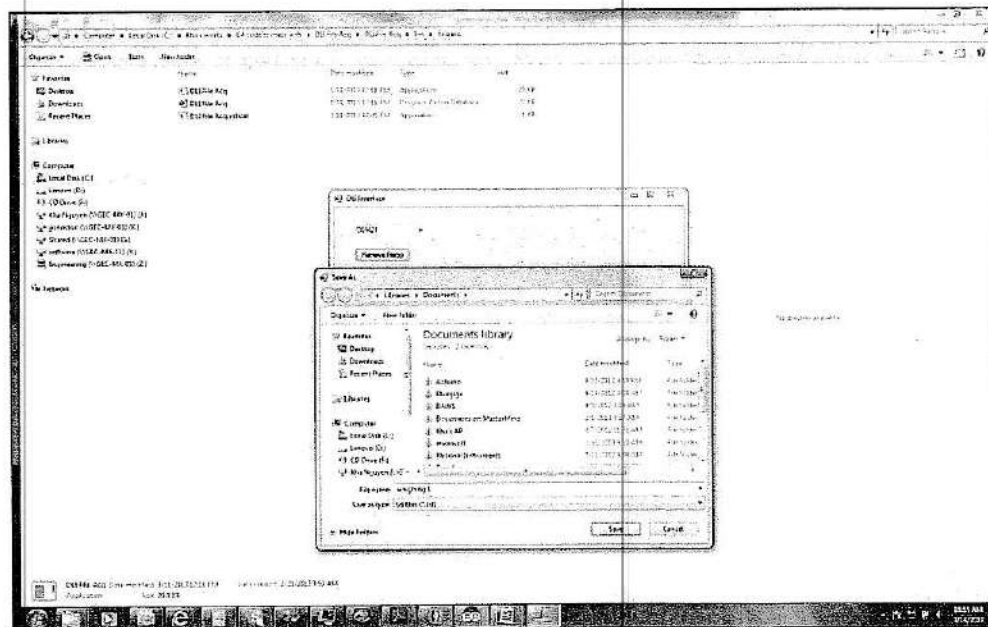


Figure 3-4.12.1c. Save new file

The notepad will populate showing the content of the file just saved in the above step. Figure 3-4.12.1d shows the content of the opened notepad after pressing “Save” soft button.



**3-5. SETUP INSTRUCTIONS**

- 3-5.1 Move the weighing equipment, including all accessories, to the designated weighing area. The weighing area should be inside a hanger or other protective structure so that wind will not affect the readings. The area should have a reasonably smooth and level surface capable of supporting the aircraft on the jacks.
- 3-5.2 Ensure the load cells supplied with the DLI are adequate to weigh the aircraft (from aircraft operators manual).
- 3-5.3 Open the system carrying case and remove: the DLI, load cells and cable assemblies required to weigh the aircraft. Inspect the load cells and cables for damage during transit. Bent, broken, cracked, cut or otherwise damaged cables are not usable for aircraft weighing.
- 3-5.4 Place the load cells onto the leveling jack heads. Place the alignment pin at the bottom of the load cell into the hole provided in the jack head. Place the jack and load cell under the jack point on the aircraft.
- 3-5.5 Align the load cell weight receiving receptacle (ball socket at the top of the load cell) to the jack point on the aircraft. The load cells should have no load on them at this time.

**WARNING**

Improper alignment of the load cell or improper alignment of the jacks will result in damage to the aircraft or personal injury.

- 3-5.6 Open the DLI case and inspect the system for damage that may have occurred during transit. Damaged instruments are not usable until thoroughly checked for serviceability. Ensure the power switch is in the "off" position.
- 3-5.7 Connect a load cell cable to the DLI (the order is not important) for each load cell to be used. Connect the other end of the cable to the individual load cells (the order is not important). Connect the power cord the DLI and then to a 115 volt outlet.
- 3-5.8 Turn the DLI system power switch on. Allow fifteen (15) minutes for the system to warm up.
- 3-5.9 Ensure that the altitude and latitude are properly set in the CG Data menu. The system is now ready for weighing.

**3-6. OPERATION DURING WEIGHING**

- 3-6.1 Enter the CG DATA and MOM DATA menu's and enter the correct values for the MAC, LEMAC, ALTITUDE, LATITUDE and moment arm lengths.
- 3-6.2 Press 4 on the DLI keypad to put the system in weight mode. Press 1 again to zero the load cells.
- 3-6.3 Raise each load cell into position under the jack point. The jack point must be 1-1/2 inch

diameter or less and centered in the load cell weight receiving receptacle. Jack the aircraft off the ground. See aircraft operating/maintenance manual for proper jacking instructions for the particular aircraft.

- 3-6.4 Lower the aircraft to the ground and verify that all jacks are in firm contact with the ground and load cells are properly centered under the jack points. Press 1 again on the DLI keypad to ensure load cells are operating properly.
- 3-6.5 Repeat steps 3-6.3 3-6.4 to exercise the load cells.
- 3-6.6 When satisfied all load cells are indicating zero, raise the aircraft off the ground.
- 3-6.7 When the aircraft is jacked up and level, check the load cells for the following:
  - a) Load cells are not touching the aircraft.
  - b) The ball of the aircraft jack point is seated in the bottom of the load cell weight receiving receptacle, with no other part of the jack point touching the load cell.
  - c) Record instrument total indicated weight and individual load cell weights as required. If the information in the moment arm menu is correct, record the center of gravity location given in %MAC.
- 3-6.8 Lower the aircraft to the ground and ensure the load cells are not touching any part of the jack point or aircraft.
- 3-6.9 Record the return to zero value for each load cell. Add the minus (-) weight indications and subtract the positive (+) weight indications of the off zero conditions to the gross weight.
- 3-6.10 Rezero the load cells (press 1 on the keypad while the DLI is in weight mode).
- 3-6.10 Repeat steps 3-6.6 through 3-6.10 as many times as necessary to establish a good repeatable weighing. The load cells may be switched from one location to another to check the gross weight provided the load cells are capable of supporting the weight required in the new position.
- 3-6.11 When satisfied with that the results are accurate, turn the digital load system off and disconnect the load cells and the power cord. Close the DLI instrument case and roll up the load cell cables. Return the load cell, cables, accessories and the DLI to the transit case for storage.

### 3-7. STORAGE

Store the weighing system in an enclosed environment with a temperature range of -15°C to 80°C (5°F to 176°F). The humidity should be 95% or less non-condensing in the storage area.



## SECTION IV

### MAINTENANCE

#### 4-1 GENERAL

This section contains information pertaining to: troubleshooting, repair, and other maintenance action required for these weighing systems. The procedures of this section are to be performed in a shop environment by qualified personnel having adequate resources available.

#### 4-2 RECOMMENDED TOOLS AND EQUIPMENT

Standard hand tools and electronics test equipment adequate to troubleshoot digital and microvolt-level analog circuitry is all that is required to maintain the systems; however, special equipment is required for system calibration. Section V lists the equipment required and the procedures to perform a system calibration.

#### 4-3 INSPECTION AND PREVENTIVE MAINTENANCE

The system should be cleaned periodically to reduce deterioration of the system components.

##### CAUTION

In the following procedure, **do not** use solvents or cleaning fluids of any type. Damage to the system components may result. Use water only.

Clean the exterior surfaces with a damp, lint-free cloth, ensuring that the cloth is wrung-out to the extent that no moisture will drip. Remove electrical components if necessary to prevent them from getting wet. Clean interior surfaces in the manner as described for the exterior ones. Allow all surfaces to air dry prior to re-assembly.

Clean electrical components using isopropyl alcohol and a non-abrasive brush. Allow components to air dry completely prior to re-assembly.

#### 4-4 TROUBLESHOOTING

Troubleshooting these systems is accomplished by locating the symptom in Table 4-1 to determine the most likely cause(s) and the corrective action required. Refer to Paragraph 4-5 through 4-6 of this section for disassembly/re-assembly instructions. Section VI contains schematics if more detailed problem solving is required. Section VII gives a listing of the parts used in the system should replacement parts be required. Repairs should only be accomplished by qualified personnel.

#### 4-5 OUT OF CALIBRATION SAFETY

As a part of GEC's commitment towards safety and accuracy, we want the customers to know when the loadcell(s) are out of calibration, so that those are not used for weighing. If the load cell(s) are 11 months of calibration there will be a reminder when the indicator is switched ON, as shown in below picture,

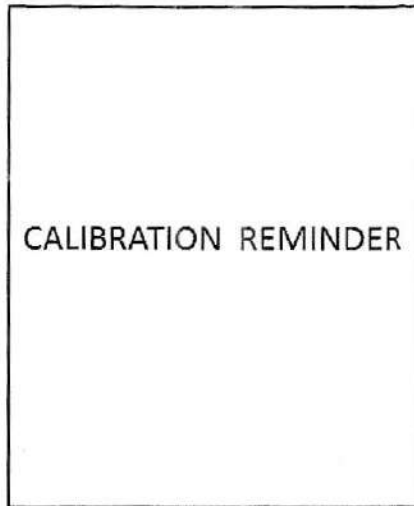


Figure 4-5.1 Reminder between 11-12 months after calibration

This reminder will be there till the 12<sup>th</sup> month. After 12 months out of calibration every time the indicator is switched ON, the following screen will appear,

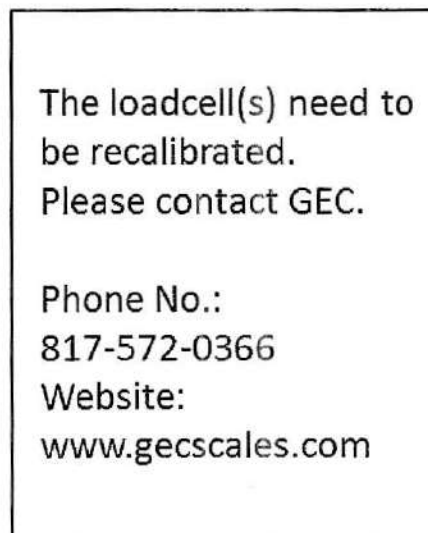


Figure 4-5.2 Reminder for after 12 months of calibration

Since after the 12<sup>th</sup> month load cell(s) need to be re-calibrated and the weighings may be invalid if not done so, the tickets printed after weighings will indicate the same

```

06/10/16 16:54:22
'WEIGHING MAY BE INVALID
LOADCELL(S) NEED RECALIBRATION'

WEIGHT DATA MENU LB
AADR  WEIGHT  CAP
  1    5207   50000
  2    -----
  3    -----
  4    -----
  5    -----
  6    -----

TOTAL:
PLANE ID:
CG:                1)ZERO
%MAC:              2)PRINT

```

Figure 4-5.3 Sample of ticket printed out after load cell(s) go out of calibration.

Also after the load cell(s) go out of calibration the weighing menu will display the following screen every couple of minutes.

```

SAFETY NOTICE
WEIGHING MAY BE
INVALID
Loadcell(s) out of calibration

```

Figure 4-5.4 Message displayed in weighing menu.

**TABLE 4-1**

<b>MAINTENANCE TROUBLESHOOTING</b>		
<b>Symptom</b>	<b>Probable cause</b>	<b>Corrective action</b>
No indication when on/off switch is activated	No external power. Faulty power cord. Blown fuse	Check for power available, replace power cord. Replace fuse with a 250V, 1A Slow Blow fuse. If blows again go to next cause.
	Switch failure Power supply failure C.P.U. failure	Replace switch assembly. Replace power supply. Replace main board and verify calibration.
All channels will not zero	Display driver/display failure load cells have too much weight applied Faulty load cell	Replace display driver or display as required. Remove weight from load cells.
Weight errors or non-repeatability	Faulty load cell	Swap load cell to isolate. Repair or replace and recalibrate.
Load cell will not calibrate	Improper calibration Faulty load cell	Swap load cell to isolate. Repair or replace and recalibrate. Recalibrate.
Load cell(s) not communicating	Faulty interconnect cable Faulty load cell	Swap load cell to isolate. Repair or replace and recalibrate. Swap cable to isolate. Repair or replace as required.
No load cells not communicating	Faulty interface board Faulty communication board	Swap load cells to isolate. Repair or replace as required. Repair or replace as required. Repair or replace as required.

**WARNING**

Ensure power is disconnected before performing any maintenance on electrical equipment. Damage to equipment or personal injury may result.

**CAUTION**

Repairs should only be accomplished by qualified personnel.

## SECTION V

### ILLUSTRATED PARTS LIST

#### 5-1 GENERAL INFORMATION

This section contains information needed for ordering replacement and/or spare parts for this weighing system. Parts are illustrated in accordance with a family tree breakdown. A separate parts list is provided for each illustration. The parts are keyed to the illustration by call out numbers or reference designators. This section contains: item part number, description of parts, and quantity required for each assembly.

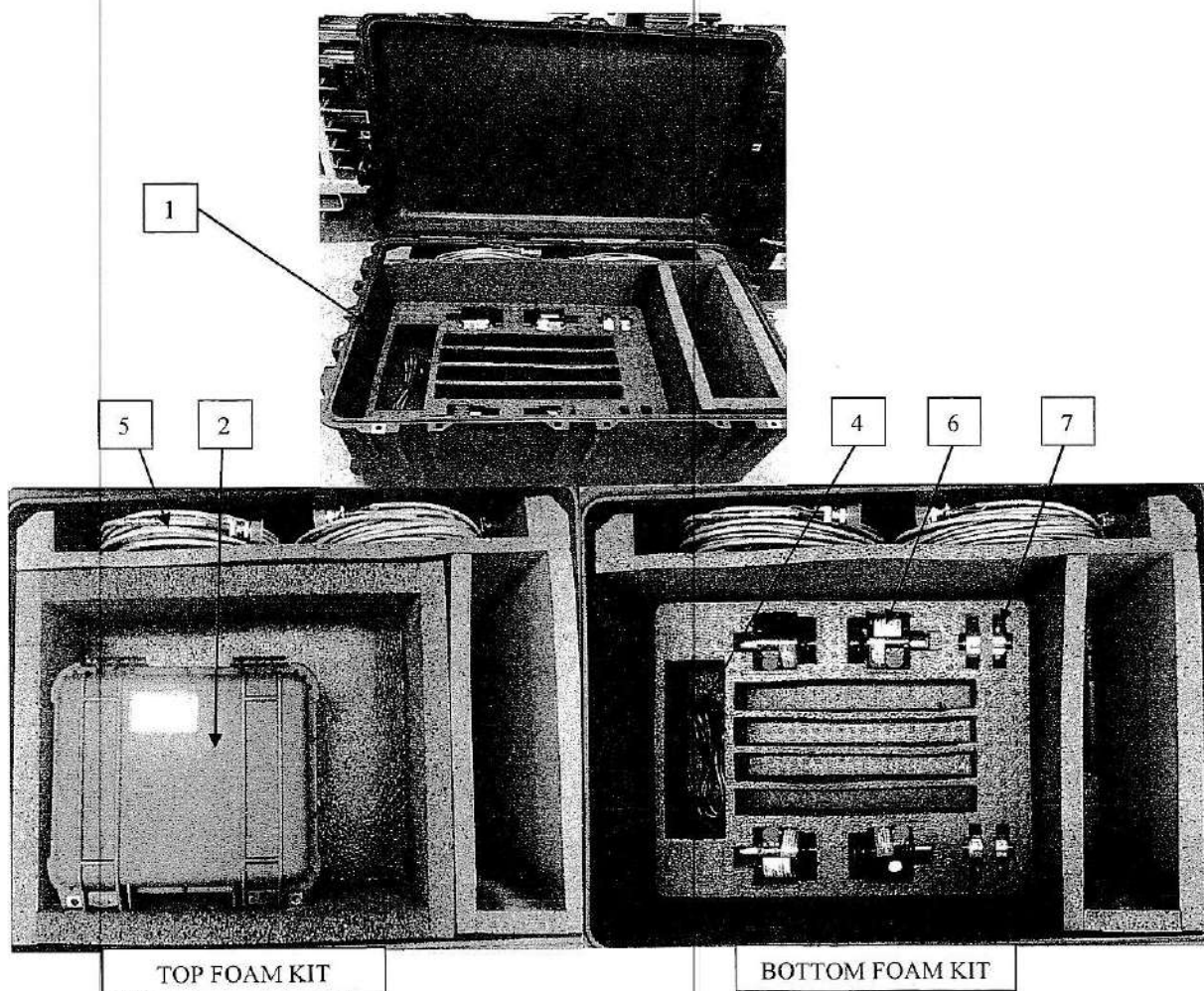


Figure 5-1. Assembly, Load Cell Weighing Kit.

PARTS LIST

FIGURE INDEX NO.	PART NUMBER	DESCRIPTION	UNITS PER ASSEMBLY
-1	DLS-20000-6	Case, with foam. X varies according to configuration of system. See dealer for correct P/N	1
	91241-2	Foam.	
-2	DLI-0000P-6-A-1	Weighing Instrument:	1
-3	GECK-00000-4	Tool Kit Assembly (optional)	1
-4	80917	Power Cord, 25 foot	1
-5	1500-00095-X-A	Cable Assembly: 25 foot X = 25 50 foot X = 50 100 foot X = 100	6(max)
-6	GEC2D-20000-1 GEC4D-20000-1 GEC5D-20000-1 GEC6D-20000-2	Digital Load Cell Assembly 10k Digital Load Cell Assembly 25k Digital Load Cell Assembly 50k Digital Load Cell Assembly 100k	6(max)
-7	GEC4A-10104-1	Adapter, jack (optional)	6(max)
-8	91216-1	Paper Type:Thermal paper  Paper Width:57.5±0.5mm;	1

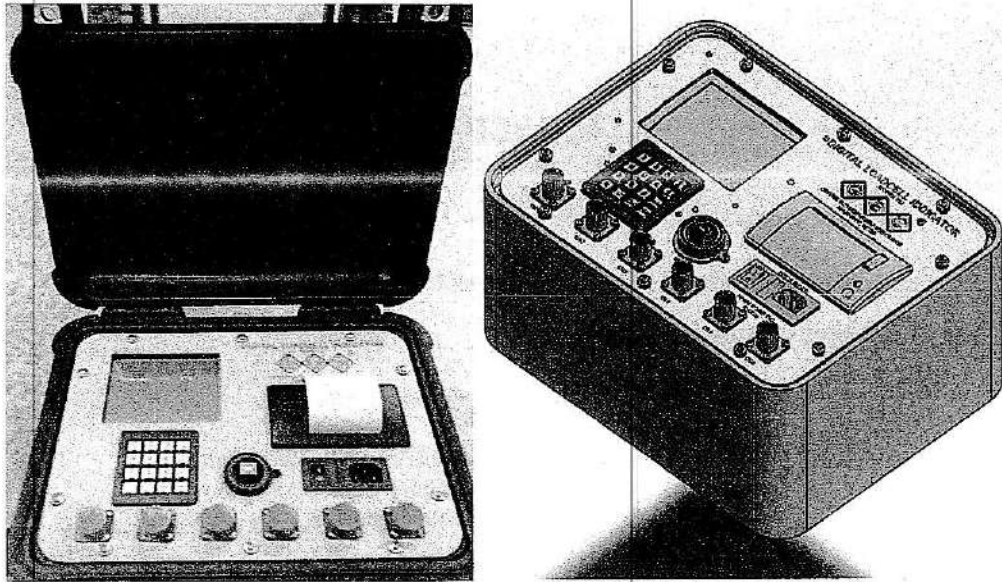


Figure 5-2. Instrument Assembly.

## **SECTION VI**

### **CALIBRATION**

**6-1 CALIBRATION**

Reference Calibration Document DLS-CAL-001.

**6-2 ACCURACY REQUIREMENTS**

**CAUTION**

Failure to comply with accuracy requirements  
stated below can result in errors in the measured  
weight of aircraft.

The load cells require calibration on a minimum 12 month interval or as required due to repairs.  
The load cell accuracy is specified in Table 1-1.





General Electrodynamics Corporation

MANUFACTURER CERTIFICATE OF ACCURACY/CONFORMANCE
(And traceable to the United States National Institute of Standards & Technology)
(NIST)

Customer Name: SABAH AIR AVIATION SDN BHD.
Purchase Order No: 41697 Sales Order: 015982

This is to certify that the equipment described below has been calibrated against GEC load cell standard, traceable to NIST dead weight standards. All readings are within a tolerance of +/-0.1% of applied load of capacity. Load cell calibration standard with load cell standard serial No 229808/ indicator serial No 0728498/ press No 1 was calibrated 21MAR2023, next calibration due 21MAR2024. Accuracy of load cells used in the GEC calibration system are maintained +/- 0.025% or better. This accuracy is determined by direct comparison to a basic standard certified by our supplier, using dead weight machine traceable to NIST. Certified in accordance with Sec. 7 of ASTM, Spec. E74-02 entitled "Standard Practice of Calibration of Force Measurement Instruments." The GEC calibration system conforms to ANSI/NCSL Z 540.1. Calibration documents are on file at GEC for review by appointment. This document may not be copied or reproduced without the expressed consent of General Electrodynamics Corporation. The ambient temperature during the calibration is: 22°C +/- 2°C (68°F - 75.2°F). I certify that the whole of the scales detailed below conform in all respects to the specifications(s), drawing(s) of the OEM and that the supplies have been inspected and tested in accordance with the conditions and requirements of the OEM.

System Model No: N/A System Serial No: N/A
Instrument Serial No: N/A Model No: N/A Maximum Load Capacity 10,000 Lbs
Part No: GEC2D-20000-1 Serial No: See Below

CALIBRATION ERROR:

Table with 7 columns: Applied Load In Pounds, Platform SN: As found C7989, Platform SN: As left C7989, Platform SN: As found C7990, Platform SN: As left C7990, Platform SN: As found C7991, Platform SN: As left C7991. Rows include load values from 0 to 10,000 lbs.

014

R

L

Notes:

1. Convert Lbs to KG's: Lbs x .4535924 = KG

Cody Webb
GEC QA Representative

Equipment calibration date 03OCT2023
Next calibration due date 03OCT2024