FPU ASSEMBLY PROCEDURURAL

FOR THE

FISCHER–PORTER UPGRADE (FPU)

RECORDING RAIN GAUGE

August 21, 2006

Note: The procedures in Section 9, Calibrate the Load Sensor, supersede the instructions given by Coastal Environmental Systems in its, ***FPU Technical Manuals, Version 3.2.***

U.S. Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service - Cooperative Weather Observer Program
Observing Services Division - W/OS7

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Table of Contents

APPENDICES

FPU ASSEMBLY INSTRUCTIONS

PART ONE

TAKING DELIVERY OF

THE FPU KIT

Note 1: Please read through all 20 sections of these instructions before you begin any modification work. Section 1, gives information on the parts contained in the FPU Kit, and Section 2, instructs you step by step how to replace F&P parts with the new Gauge Modification Assembly parts (i.e., load cell sensor).

Note 2 : Take an inventory of each kit's parts and realize that the hangers and U-bolts delivered inside the steel enclosure do not meet specification. They are surplus. Use the U-bolts and hangers in the small cardboard box, bundled separately.

Note 3: Charge the 12V battery the day prior to the assembly and checkout. Follow the battery safety guidelines written in Procedure 15.3, of the Engineering Handbook Number 15, Safety. There are ten safety points elaborated in Procedure 15.3. Click on 'Chapter 15' to access '*Battery Charging and Storage Operations*:' https://www.ops1.nws.noaa.gov/Secure/SAFETY/Safety_manual.htm

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1.0 FPU Kit Components

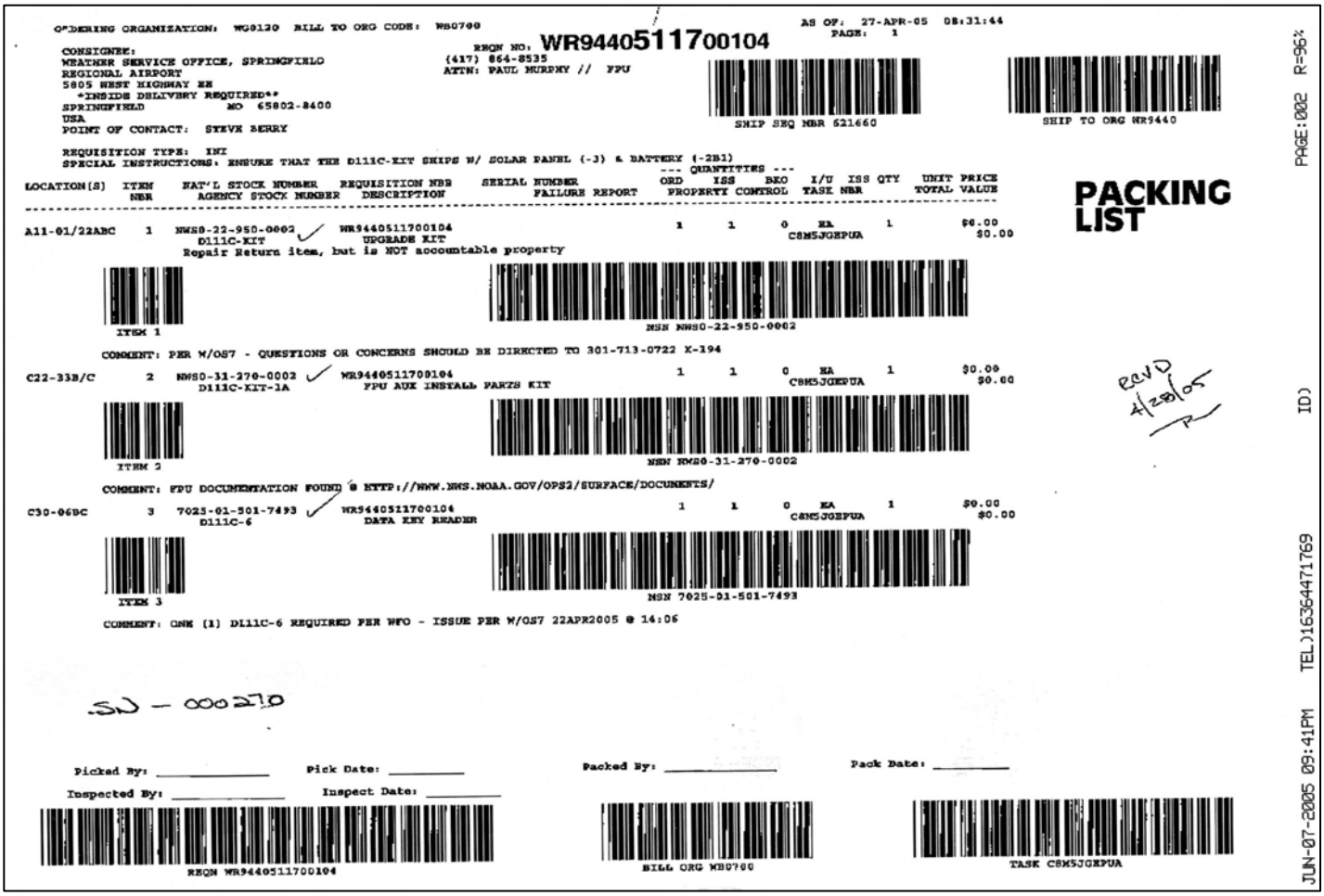
1.1 NLSC Packing List for FPU Kit:

Each FPU Kit will arrive at your WFO in four cardboard boxes.

a. FPU Upgrade Kit (3 boxes, one each for Steel Enclosure Cabinet, Solar Panel, and the 12V Battery)

b. FPU Auxiliary Install Parts Kit (1 small box with updated U-bolts and Hangers)

The packing list from NLSC (graphic, below) identifies a third requisition item, the Data Key Reader. This Reader is used by the WFO only and not at the COOP Observer's site. Hence, it is issued only once to the WFO and for convenience it is bundled with the first FPU Kit delivered to your WFO.



Note: Only the first NLSC delivered FPU Kit to your WFO comes with an additional cardboard box (fifth separate box). This is the Data Key Reader device and the licensed key reader software on CD-ROM.

Unpack the shipping cartons, inspect items for visible damage, and use the packing list and the

following check off list to verify that the kit is complete. To unpack the large box, lay it on its back, handle down, door up, and slide the unit out. Do not attempt to lift the steel enclosure out of the box vertically!

1.2 FPU Kit Boxes *

Container	Content	Yes/No
Large Cardboard Box	Stainless steel enclosure with the GMA unit.	
	FPU technical manual (CD-ROM or paper).	
	Small padded envelope containing the load cell block assembly.	
	Large padded envelope containing the load cell plunger, load cell mounting hardware, two data keys, and battery cable.	
	Load cell cable.	
	Mounting hardware.	
	Contractor's Certificate of Conformance.	
Small cardboard box	Revised mounting hardware (U-bolts and Hangers).	
Flat cardboard box	Solar panel, solar panel cable, and mounting hardware.	
Heavy medium box	Battery.	

*** Note: PC Data Key Reader is excluded because the WFO receives just one PC Key Reader, to handle all its fielded FPU units.**

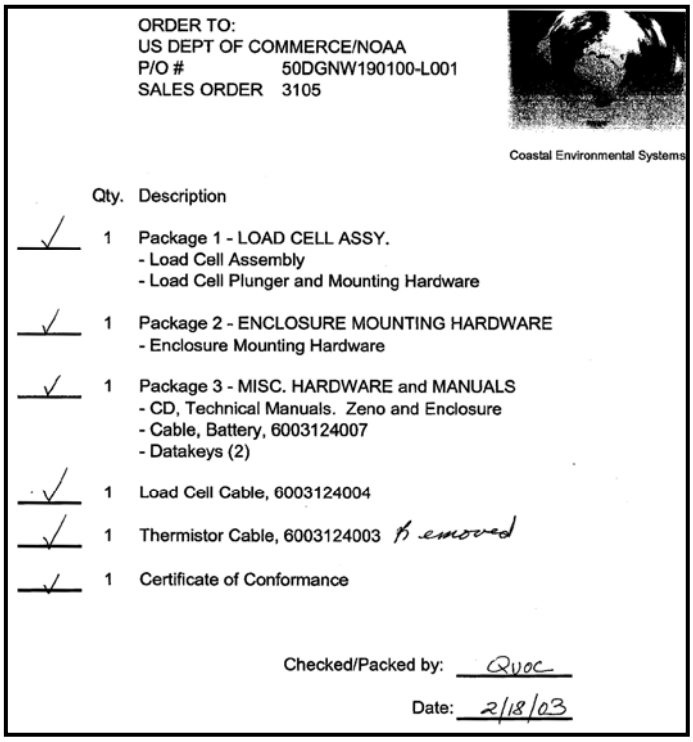
Estimated Time Required: An estimated one hour is required at Observer's site to install the equipment. Specifically, you will unpack FPU equipment from vehicle, remove the Observer's F&P punch block mechanism (with base plate) and remove old solar panel. Then you will mount the enclosure, install battery, data logger, new solar panel, and then connect sensor cables, and check-out data logger calibration and system performance. This account excludes the 1½ or 2 hours' time required to dig hole, pour cement, and install pipe post on previous trip to Observer site.

Note: The manufacturer's parts packing slip (right) is located in the FPU Kit's largest box, with the steel enclosure.

Realize that none of the FPU Kits are packaged with a Thermistor Cable, the fifth item on the packing slip.

The handwritten word, '*Removed*' (right) was written by the manufacturer and applies to all FPU Kits being delivered.

The manufacturer kept this part listed to comply with a government contract obligation made years prior to the deployment decision.



ORDER TO:
US DEPT OF COMMERCE/NOAA
P/O # 50DGNW190100-L001
SALES ORDER 3105

Coastal Environmental Systems

	Qty.	Description
✓	1	Package 1 - LOAD CELL ASSY. - Load Cell Assembly - Load Cell Plunger and Mounting Hardware
✓	1	Package 2 - ENCLOSURE MOUNTING HARDWARE - Enclosure Mounting Hardware
✓	1	Package 3 - MISC. HARDWARE and MANUALS - CD, Technical Manuals. Zeno and Enclosure - Cable, Battery, 6003124007 - Datakeys (2)
✓	1	Load Cell Cable, 6003124004
✓	1	Thermistor Cable, 6003124003 *Removed*
✓	1	Certificate of Conformance

Checked/Packed by: QVOC

Date: 2/18/03

1.3 Tools and Test Equipment Table:

The NWSREP must have the following tools and test equipment:

Tools and Test Equipment	**Section Paragraph in this *FPU Procedural***
Phillips Screw driver (1/4 inch)	Paragraph 2.5.
Flat Blade Screw driver (1/4 inch)	2.6; 2.8; 2.12; 2.14; 2.15; and 2.16.
7/16" and 9/16" wrenches	2.6; 2.10; and 17.2.
3/32" Allen wrench	3.5; 3.6.
Anti-Seize Compound	3.7.
Hand-truck or Dolly	4.2; 13.5; and 17.7.
Battery Charger, AC	2.1.
Multi meter (or voltmeter and ohmmeter)	4.1; 5.7; 5.9; 5.11; 13.8; 17.17; and 17.19.
1/ 2" open wrench	4.4; and 17.7.
Needlenose pliers with wire cutters/strippers	5.2 - 5.4; and 17.12 – 17.14.
Wire terminal crimping tool/stripper tool	5.2 - 5.4; and 17.12 – 17.14.

RTV (Room temperature vulcanizing) silicone putty	17.15.
Laptop computer with parallel port and running **Win95/98ME**, for data key reader.	12.2
Laptop computer with modem and terminal emulation program, for access to Zeno data logger. This ***does not require*** Win95/98/ME.	7.1 - 7.3; 8.1 – 8.6; 9.1 – 9.8; 11.5; 19.5; and 19.6.
Serial Communications Cable (for laptop) with 9-pin female end and 9-pin male end (not null modem)	7.1 - 7.3; 8.1 – 8.6; 9.1 – 9.8; 11.5; 19.5; and 19.6
Calibration weight set equal to 15 inches equivalent water. See Agency Stock Number D111-TE500.	9.4.5; 9.6.2; and 18.6.
10 Foot Tape Measure	17.12.
Full size garden shovel	Appendix A

FPU ASSEMBLY INSTRUCTIONS

PART TWO

MODIFY F&P GAUGE

INSIDE YOUR WFO

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Estimated Time Required: An estimated half hour is required to unpack FPU equipment, one hour to remove the tape punch mechanism, plus one hour to splice and connect solar panel cable connectors and check-out the solar charging. Then an estimated two hours will be needed in the office to set the clock to local *standard* time, enter proper date, calibrate the sensor and enter configuration values. Calibration and SID numeral entry requires use of a PC laptop with a standard communications program (i.e., Hyperterminal).

2. Disassemble the F&P Gauge at Workbench: *(Perform this Task in Your WFO)*

First, locate a battery charger capable of initial charging the new 12V battery. The battery is a sealed battery, do not use a charger that can charge at 20amps or greater. Attach charger cables to the battery's respective positive and negative terminals. Let charge overnight, or until fully charged, so it will be ready to power the data logger in Section 4. Follow the precautions outlined in NWS Manual 50-1115, *Battery Charging and Storage Operations*, see the web site: https://www.ops1.nws.noaa.gov/Secure/SAFETY/Safety_manual.htm , click on chapter 15.

Note: Do not overcharge.

2.1 Remove the F&P conical hood, the bucket, and the lower housing. Empty and dry the bucket. The legacy rain gauge recorder is now accessible and ready for disassembly.

2.2 If this F&P unit should still have its paper punch tape on spool from its service in the field, then make sure you have already marked an 'OFF' date and time. Manually decode this partial-month tape and enter hour-total and day-total amounts to Form 79ID per NCDC instruction. Follow the instructions in the ***FPU Operations Manual***, Chapter 1.3.7, and e-mail the Form 79ID to Stuart.Hinson@noaa.gov . Complete this data recovery task prior to disassembling the F&P gauge and prior to mailing the partial-month tape to the attention of Debbie Maxey, of SourceCorp in Mt.Vernon, Kentucky.

2.3 Disconnect and remove the 6V battery. Package and retain the battery for disposal at your WFO.

2.4 Remove the small solar panel and its mounting bracket at the base plate; clean the threads of its access port.

2.5 Remove internal wiring, clamps, and terminal strips.

2.6 Remove the small slotted screw, releasing the eyelet end of the wound cable from the front support arm assembly.

2.7 Loosen the two 7/16 inch bolts holding the punch assembly.

2.8 Place back the small slotted screw to its threaded hole.

2.9 Unhook the tension spring from the front support arm assembly.

2.10 Remove the punch assembly; tighten the two 7/16 inch bolts loosened in line 2.7, above.

2.11 Raise the front support arm assembly with shipping bolt so that the dash-pot piston is

near the top of travel.

2.12 Keep the lower limiting screw in place.

2.13 Unscrew the zero adjust knob and catch the main spring as it falls away.

2.14 Remove the two helical main springs, the hook, and the zero-adjust knob.

2.15 Remove the two screws holding the pointer and remove the pointer. Place back the screws.

2.16 Remove the tape spool assembly. Place back the screws.

2.17 Remove the dash-pot and piston. Do not place the screws back.

2.18 Remove the dash-pot gasket and clean oil off all surfaces.

2.19 Dispose of the dash-pot oil in accordance with local environmental regulations.

2.20 Check all 8 flexures. There are 4 on the top arm and 4 on the bottom arm. At the front of each arm there is one horizontal flexure and one vertical flexure. At the back of each arm, there is one horizontal flexure and one vertical flexure. Replace any flexure that is bent, kinked, cracked, or broken – the upper-rear-horizontal flexure is the one most often damaged.

Important: All flexures must be flat and in good condition and all flexure mounting screws must be tight to ensure proper operation with the load cell.

2.21 Save only those removed parts that are in good shape, otherwise dispose of locally in accordance with your WFO's official procedures.

3. Install the Load Cell Assembly: *(Perform this Task in Your WFO)*

Locate the four boxes of the FPU Kit. Unpack the **large** cardboard box, first.

Caution: Do **not** try to lift the enclosure out of the box. Open the box top, determine which side is the front (door). Lay the box over, so the enclosure is on its back, grab the handle and slide the enclosure out of the box. Stand the enclosure upright to open the door.

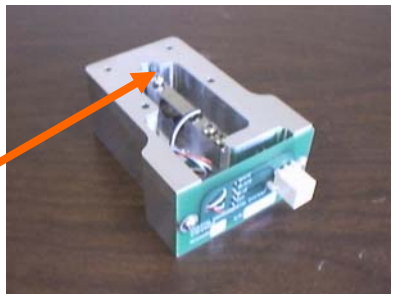
Note: The GMA Load Cell Assembly is installed inside the skeleton of the old F&P gauge. All the equipment that interfaces to the new FPU gauge is mounted to existing F&P threaded holes.

3.1 Open the steel enclosure, and account for the delivered packages (see, Section 1.2, and Appendix G, FPU Parts). There should be a small cardboard box and cardboard spacer to the left of the keypad. The box holds a large and a small padded envelope, mounting hardware, sensor cable, and a certificate of manufacturer's conformance.

3.2 Open the small cardboard box.

3.3 Locate the ***FPU Technical Manual, Version 3.2 (Feb 2003)***, published by Coastal Environmental Systems, Inc. (CES), or CD. Pen-in the following remark to the inside cover: *"This version contains an outdated instruction for calibrating the load cell sensor. Do not use for calibration work. Follow the NWS calibration instructions in Section 9 of the, '**FPU Assembly Procedural**.'*

3.4 Find the padded envelope containing the load cell assembly.



Caution: Use care when handling the load cell assembly. Do not scratch the surface of the load cell. The contact ball must be present on the free end of the Load cell.

Contact Ball

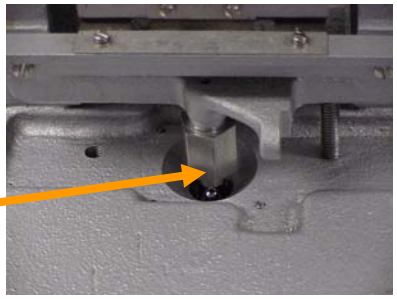
3.5 Find the envelope with four long 4-40 Allen head screws and washers. Place the washers on the screws with a lock washer sandwiched between the flat washer and the head of each screw.

3.6 Using a short Allen wrench and the long screws, install the load cell assembly where the dash pot was mounted. (do not over-tighten). The ball should be visible though the hole.

Note: The printed circuit board on load cell assembly will become a front face connector for the sensor cable.

3.7 Apply anti-seize compound to the threads and install the plunger in the dash pot piston hole on the bottom of the front support arm assembly. Finger tighten. Do NOT use a wrench.

3.8 Ensure that the plunger is centered in the hole, then lower the shipping bolt by finger loosening it until the plunger is ¼ inch above the ball. If adjustment is necessary, loosen the four scale support mounting bolts; re-tighten after adjustment.



Plunger (hex shaped)

Leave the front support arm's plunger resting on the shipping bolt until directed to lower it onto the ball, when you calibrate the load cell sensor, in Section 9, of this manual.

3.9 Locate the Load Cell Cable it is labeled as CES P/N 6003124004. Inspect the connections inside the white plug.

3.10 Feed the Load Cell Cable's white plastic connector end through the threaded inlet on the edge of the gauge's base plate and plug it into the load cell white fixture. It is keyed and only fits easily when inserted the correct way. The retaining clip should snap when fully seated. Ensure yellow wire and black wires are on top; with yellow on left, and black on right side (photo, right).

Caution: When placing the lower housing assembly back on its circular base plate, be careful not to pinch the load cell cable.

3.11 View the underside of steel enclosure box and locate the FPU load cell sensor cable port. Of the 3 sockets aligned in a row, it is positioned farthest from the Data Key Receptacle, nearest to the right side edge of the enclosure's bottom as you face the front of the Enclosure (i.e., from left to right; shaft encoder port, MMTS port, precipitation port). Remove the socket's metallic cap by unthreading the chained cap.

Grip the plug-end of the Load Cell Cable align the pins in the connector, and with a turning motion press the plug into the enclosure's socket.

4. Power-up System on 12V Battery: *(Perform this Task in Your WFO)*

4.1 Ensure the 12V battery is charged; it should read at least 12.5 V using the multi-meter. Remove charger from battery. Open the enclosure door and ensure the left side of the vertical fin divider is totally free and clear.

4.2 Then ask a co-worker to help you lift the 12V battery into the Enclosure and orient it so the terminals are facing the keypad. **Caution:** The battery weighs 57 lbs, so use a dolly or hand-truck to move it up close to the steel enclosure. Read the precautions listed in NWS Manual 50-1115, *Battery Charging and Storage Operations*, see web site: https://www.ops1.nws.noaa.gov/Secure/SAFETY/Safety_manual.htm ; and click on chapter 15.

4.3 Remove and save the terminal covers from the 12V battery.

4.4 Attach the internal battery cable to the battery terminals using a ½ inch wrench. Snug is sufficient, do not over tighten.

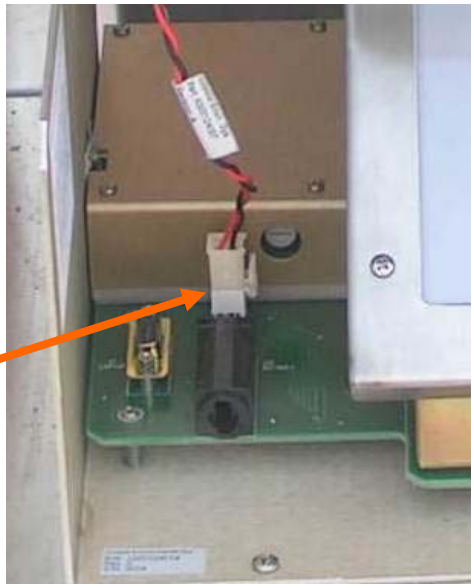
red wire to (+) terminal

black wire to (-) terminal

4.5 Place the terminal covers back on their terminals. Ensure the battery is facing the keypad as illustrated in the photo at right.

4.6 Connect the red/black battery cable to the square white four-pin socket identified on the green circuit board as 'J14 BATTERY'. The white connector is keyed and only fits on one way, the latch pawl will be on the right. Ensure the cable plug makes an audible click as it connects to the latch of the white socket directly behind the key writer receptacle (photo, right).

Battery Cable Socket



Immediately after the battery cable is plugged-in, the green vacuum fluorescent display will light-up and the CES splash screen will appear first. After a couple of seconds, the data readings will display. (text boxes, at right).

```
Coastal Environmental
Systems,  Inc.
```

The FPU is now automatically taking measurements and logging data although the display shows dashes.

In routine operation, the display gives alternating readings by showing 5-seconds of the **Rain** reading, followed by 5-seconds of **24RainDiff** reading, followed by 5-seconds of the **Rain** reading, and so on.

```
05/03/21        07:56:30
24RainDiff:     - - - in
Temp:           - - -  F
Shaft:          - - - ft
```

05/03/21	07:56:25
Rain:	- - - in
Temp:	- - - F
Shaft:	- - - ft

Dashes will appear in the current readings for up to 15 minutes and only then will the weighing measurements appear in the display. Due to the data logger's method of reporting 15 minute data elements to the fixed quarter-hour clock, the display might not show stabilized data until the second quarter-hour (i.e., HH:15, HH:30, HH:45, HH:59) mark approximately 30 minutes after the time of power-up.

5. Prepare Solar Panel and Check Charging: *(Perform this Task inside Your WFO)*

Note: Leave the battery cable attached to power the system through this set of procedures.

For Sections 5.1 to 5.8, leave the solar photovoltaic (PV) panel inside its cardboard box, so it does not generate voltage. When cable wiring is spliced and cable attached to data logger, then you will remove the PV panel, place it near a window and measure solar cable voltage, and connect it to the data logger and see it power the keypad.

Also, for Section 5, do not yet cut short the solar cable. Section 5 instructions will give you familiarity on how to splice and attach to solar panel cord. You will apply the same procedures at the Observer's site (Section 15.12), if you decide to permanently shorten the 25 foot solar cable.

5.1 Find the solar panel cable, it is labeled CES P/N 6003124006. It has a 2"x3" black plastic box on one end. Open the 2"x3" black connector box into its half shells.

5.2 Strip both leads of the bare end of the solar cable. Insert the cut end of the cable into the box through its cable orifice.

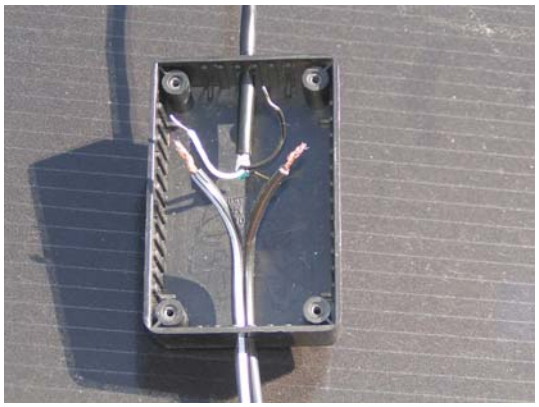
5.3 Crimp the supplied bullet connectors onto stripped cable ends. Alternately, you may use spade lugs, wire nuts, screw terminal blocks, or any good connector that makes a good mechanical connection.

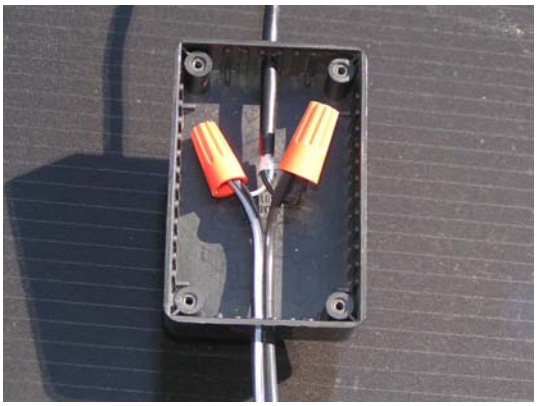
Note: It is unacceptable to simply twist wires together bound only with tape.

5.4 Inside the small 2" x 3" black plastic connector box, splice the Solar Cable's two wires (one is white, the other black) to the designated wires (figure box, below) on the Siemens photovoltaic (PV) power cord. The PV power cord is a twin-lead cord with one black strand and one black/white stripe strand on the underside of the panel. First, connect the solar cable's black wire to the black strand of the PV cord, and then connect the solar cable's white wire to the PV cord's black/white stripe strand, as shown here.

Solar Cable **(25 ft stiff, narrow, plastic cable)**	**Solar Panel Underside** **(soft, twin-lead cord)**
Splice……the **Black** Wire ….. ===➔	Into the **Black** strand.
Splice…..the **White** Wire ….. ===➔	Into the **Black/White Stripe** strand.

Caution: Ensure these wires are spliced to the correct color coded strands to prevent damage to the data logger. In the photos below, the solar panel's short twin-lead cord is shown feeding into the bottom of the box. Note the left strand of the twin-lead cord is the one with black/white stripe, and the strand on its right side is solid black.





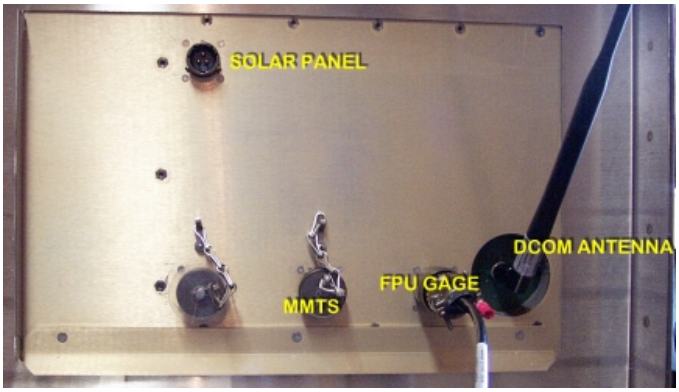
5.5 Using tie wraps, strain relief the solar panel cable on the inside and outside of the solar panel cable connector box. Close the box with the 4 screws. Secure the box under the solar panel to keep it out of direct weather.

5.6 Now that you have finished and covered the wiring of the solar panel, it is safe to slide it out from its cardboard box. Ensure the panel is facing up and diffuse or direct sunlight is reaching it. The panel is generating voltage that should be measured at the end of the full twenty-five foot length of solar cable.

5.7 Locate the 3-socket connector plug at the end of solar cable. Use the multi-meter and place one needle on the socket's positive terminal. It is marked "**A**". Place the other needle on the negative terminal. It is marked "**C**". In full sun, the voltmeter should read between **20V** and **25V**. If in full sun and readings are zero, check the solar cable's wiring connections in the small black box.

5.8 Disconnect the 12V battery by unplugging the battery cable from the white jack on circuit board.

5.9 View the underside of steel enclosure box and locate the solar cable port. It is the only socket that stands apart from the other three sockets. It is located toward the front of the bottom surface, near the door.



5.10 Connect the 25 ft long solar cable to its port on the underside of the steel enclosure. Press-on and twist the solar cable plug until you feel its three pins snap into a lock fit.

Caution: With the battery disconnected there is nothing to smooth –out the power for the logger. If you move a cable or connection or walk in front of the solar panel – this can drop the voltage output for a microsecond. This has the potential to disable the keypad display and the key writer receptacle. They will appear 'frozen' and to revive them will require you to power-off and power-on the electric circuit. Read the instruction in section 11.6, on 'Power Reset' and understand this will cause an interruption in displayed readings and data key writer functionality for as long as 30 minutes (i.e., two periods of data recordation).

Note: The next test can only be done if the solar panel is in full sun. Direct sunlight through a window is usually sufficient, but ordinary room lighting will not give enough power. If you *cannot* perform this test in the WFO, be certain to test it at the Observer's site.

If your voltage levels are not reaching 20V to 25V, then check the solar panel as it might be partially shaded and this can effectively shut-down the entire panel's output.

For more information access the Lessons Learned web site, and read the third article; "Battery Not Charging… Solar Panel All Okay?" http://www.nws.noaa.gov/ops2/Surface/documents/A_PDFLessonFILE.pdf .

5.11 Regulator Checkout: With the solar panel in full sun, ensure the battery cable is disconnected (Step 5.8) from the circuit board. The battery cable socket is a white connector jack that is located on printed circuit board ½ inch behind the data key receptacle (photo, section 4.6).

Check the keypad display (press **<ENT>**) to see that it illuminates to confirm that just the solar panel is powering the FPU system.

Use one probe of the voltmeter to touch the **lower-left pin** in the white plastic receptacle (see figure, right). This is the **positive** terminal. Use the other probe and touch the lower-right pin**.** This is the negative terminal. The voltmeter should read between **12.4V** and **13.8V** in full sun. This is sufficient to charge the battery.

O	O
+O	O-

J14 BATTERY

5.12 Unplug the solar panel cable from the underside of the enclosure. Roll up this long cable and fasten it securely to the solar panel so it is ready for shipment to the Observer's site.

5.13 Disconnect the 12V battery cable from its white plastic Battery Cable Socket on the circuit board. Leave the solar power cable unplugged to reduce risk of anyone in the office tripping on or accidentally snaring the solar cable and damaging the equipment.

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FPU ASSEMBLY INSTRUCTIONS

PART THREE

CONFIGURE AND CALIBRATE FPU

INSIDE YOUR WFO

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PART THREE: CONFIGURE AND CALIBRATE FPU INSIDE YOUR WFO:

6. Set the Date (YY/MM/DD) and Time (HH:MM:SS) at Keypad: (*Perform this Task in Your WFO*)

6.1 Verify the keypad's display is active or press **<ENT>** to wake it up. Wait for the data display to appear. If the display does not appear check to ensure both the battery cable and the solar plug are connected.

6.2 Access the keypad's User Menus by pressing the **Up-** or **Down-arrow** buttons.

Repeated pressing of the **Up-** or **Down-arrow** button will cycle through three menus and back to the display of live gauge readings. The 3 menus are: Sensor Notation; Current Date & Time; and Current Units.

6.3 Press the <**Up-arrow**> or the <**Down-arrow**> button until the **Current Date & Time** menu is displayed, now press **<ENT>** to select the editing field within the '**Current Date & Time**' menu.

Example:

```
Current Date & Time:
02/06/18  15:06:26
New Date & Time:

__/__/__   __:__:__
```

Explanation: In this example the, **02/06/18**, indicates a date of June 18, 2002. Specifically, the **02/** signifies year 2002; the **/06/** signifies month of June; and the **/18**, signifies the 18th day of June. The time, **15:06:26**, is the proper display for 3:06pm local standard time in the 24 hour convention.

6.4 Update to your current date, for example, **<06>, <08>, <31>**; and the current time, for example, **<13>**, **<44>**, **<59>**; using the format yy/mm/dd and hh:mm:ss. The system will automatically enter the slashes and colon symbols for you, so just enter the numerical values.

Caution: The date format is always, **YEAR/month/day**. The Zeno will accept any numbers in any position, but unless you follow the YY/MM/DD format, the logger's date/time stamps will not increment correctly, and the data will be useless.

6.5 After you quickly confirm the date and time you entered in Paragraph 6.4 are correct, then press **<ENT>** to update the data logger clock. Again, verify that the display screen current readings are giving the updated date/time. Otherwise, go back and re-enter the date and time. **Note:** The system will not allow you to enter just the time, you must always reenter the date and the time together.

7. Establish Laptop Session and Enter COOP SID to Data Logger: *(Perform this Task in Your WFO)*

This requires a computer with a terminal emulation program such as ProComm or HyperTerminal. It also requires a PC data cable with a straight through (not null-modem) 9-pin male end to connect to the data logger and an appropriate sized end-plug (i.e., female socket) to plug into the serial port of the laptop.

Locate the data logger's maintenance port. It is the only 9-pin subminiature D socket on the circuit board. It is located ½ inch to the left of the Data Key receptacle and appears next to the circuit board wording, 'J7 LAPTOP'.

7.1 Connect the laptop to the data logger's socket described in previous step.

7.2 Set up your laptop's Hyper Terminal program, first.

From the Windows desktop, press:

Start,
Programs,
Accessories,
Communications, and
Hyper Terminal.

At the prompt enter a **name** for the connection, (e.g., FPU_Link) and select an **icon** (e.g., red umbrella picture).

Press OK.

At the 'Connect To' prompt select **COM1** and

Press OK.

Enter the following Port Settings:

Baud rate: **9600** bits per second.

Data bits: **8 .**

Parity: **none .**

Stop bits: **1 .**

Flow Control: **none .** ← ***Important! This is a required change from default!***

Press OK.

The Hyper Terminal screen will appear and you will be connected to COM1.

7.3 Check the Software Version Number: After connecting, type **u<enter>** to wake up the data logger and enter **U**ser Menu.

Type **f<enter>** to access the System **F**unctions Menu.

Type **v<enter>** to access the Program **V**ersion.

The correct firmware version number, date and time is **V1.966-2637-GMA-1.5 Nov 12 2003.**

```
[Menus abbreviated for clarity]

USER MENU
(C) Comms Menu            (T) Test Menu
(F) SysFunctMenu          (Z) Zeno Program Menu
(S) SampPer Menu          (Q) Quit
(D) DataRetrMenu          (H) Help

> f

SYSTEM FUNCTIONS MENU
(Cn/m) Change n To m      (I) Contact Info
(S)    Date And Time      (E) Save To EEPROM
(T)    CalInternTemp      (U) User Menu
(V)    Program Version    (Q) Quit
(K)    Constants Menu     (H) Help
(B)    BIT Names Menu

Item  1:  0                (Primary Unit ID)
Item  2:  0                (Secondary Unit ID)
:
Item 12:  NO            (Download..In AsOrder)

> v
ZENO-3200 (GMA) using ZENOSOFT
V1.966-2637-GMA-1.5 Nov 12 2003 10:19:06 CS B274
(C)opyright 1995-2003, Coastal Environmental
Systems, Seattle, WA, USA.

SYSTEM FUNCTIONS MENU
(Cn/m) Change n To m     (I) Contact Info
:                        (Q) Quit
Item 12:  NO    (Download..In AsOrder)
```

7.4. Install the COOP SID Number to Data Logger: *(Perform this Task in Your WFO)*

```
USER MENU
(C) Communications Menu      (T) Test Menu
(F) System Functions Menu    (Z) Zeno Program Menu
(S) Sample Period Menu       (Q) Quit
(D) Data Retrieval Menu      (H) Help

> f

SYSTEM FUNCTIONS MENU
(Cn/m) Change Item n To Value m (I) Contact Info
(S)    System Date And Time     (E) Save To EEPROM
(T)    Calibrate Internal Temp  (U) User Menu
(V)    Program Version          (Q) Quit
(K)    Constants Menu           (H) Help
(B)    BIT Names Menu

Item  1:  0         (Primary Unit/Experiment ID)
Item  2:  0         (Secondary Unit/Experiment ID)
:
Item 12:  NO      (Download .. In Ascending Order)

> c1/4100

SYSTEM FUNCTIONS MENU
(Cn/m) Change Item n To Value m (I) Contact Info
(S)    System Date And Time     (E) Save To EEPROM
(T)    Calibrate Internal Temp  (U) User Menu
```

7.5 Access the ZENO User Menu via the laptop computer.

7.6 At the user menu, type **f<enter>** to access the System **F**unctions Menu.

7.7 Type **c1/##00<enter>.** Where C1 is the Change Item command, '##' is the two digit **state** part of the COOP SID for this site. (e.g., '**4100**' for Texas). Always ensure you keep the two zeroes (00) on the end.

7.8 Type **c2/####**<enter> where "####" is the four-digit station index number (i.e., 41-**5678**).

```
(V)    Program Version          (Q) Quit
(K)    Constants Menu           (H) Help
(B)    BIT Names Menu

Item  1:  4100      (Primary Unit/Experiment ID)
Item  2:  0         (Secondary Unit/Experiment ID)
:
Item 12:  NO      (Download .. In Ascending Order)

> c2/5678

SYSTEM FUNCTIONS MENU
(Cn/m) Change Item n To Value m (I) Contact Info
(S)    System Date And Time     (E) Save To EEPROM
(T)    Calibrate Internal Temp  (U) User Menu
(V)    Program Version          (Q) Quit
(K)    Constants Menu           (H) Help
(B)    BIT Names Menu

Item  1:  4100      (Primary Unit/Experiment ID)
Item  2:  5678      (Secondary Unit/Experiment ID)
:
Item 12:  NO      (Download .. In Ascending Order)

> e
```

Note: Items 1 and 2 have been changed to the example numbers used above. Ensure you enter unique station SID number for the COOP site to receive this unit!

7.9 Type **e<enter>** to save site information in non-volatile memory.

Note: Saving to EPROM – turns off data logging while the new information is being saved. Therefore, NO NEW DATA will be available until the logger takes a new reading at the next quarter hour. This is normal, the system is not locked up, and it will still respond to menu commands, but it will not display any new measurements on the display or to a S1,1 command until that new measurements is taken.

7.10 Type **q<enter>** to exit the Systems Function Menu.

8. Examine the Configuration Code in Data Logger: *(Perform this task in your WFO)*

Each FPU system comes delivered with a manufacturer developed Configuration code already installed. Upon initial delivery, that file should exactly match the code that appears in NWS Headquarters web site under "***FPU Initial Configuration File Code, June, 2005"***. Access it on: http://www.nws.noaa.gov/ops2/Surface/coopimplementation.html. This same code is included below, under the paragraph, "What is a Configuration File?" in this section 8.

The FPU programming is standardized and configuration controlled. No one has authority to change the data logger configuration software without the express and written direction from the W/OS7, the Surface Program Office of the NWS.

What is a configuration file?

The configuration program defines the sequence of operations and timing for the data logger. It is not a program per se, as it does not contain any microprocessor instructions, but it does contain a list of definitions and parameters that the logger knows to look for, and uses to set up the sequence of operations that result in our data. The BatV modification simply redirects the system from looking at the shaft-encoder input to look at the internal battery monitor point, processes the new information to scale it to xx.x Volts and put the new number in the output and logging messages where the stream level data used to be. The keypad display is not part of the data logger and is hardwired to say stream level, but the data displayed with that label will be the BatV number generated by the logger.

You will notice that the BatV measurement will be less than what you measure at the battery. This is normal, as the logger measures the voltage inside the logger, which includes all the losses associated with the regulator, wiring, etc. In some cases you may see up to a 1.3V difference, typically 0.8V.

What does the <u>Original</u> Configuration File look like?

```
* Zeno 3200 System Setup File
* Program Version And Date: ZENO-3200 (GMA) using ZENOSOFT V1.966-2637-GMA-1.3 May  9 2002
10:33:50 CS 2BAE
* (C)opyright 1995-2002, Coastal Environmental Systems, Seattle, WA, USA.
* Setup File Date And Time: 02/10/31 11:08:05
PARAM1 900 0 898 2 12 20 6 6 9600 9600
PARAM2 9600 0 0 0 0 2 1 0 0 0
PARAM3 16777 0 60 18 0 0 0 0 0 2
PARAM4 2 2 0 0 1 3276804 0 -1 5 0
PARAM5 2 0 0 0 100 0 0 0 0 0
PARAM6 0 0 0 1015660800 50336144 151 196608 0 1 0
PARAM7 151 0 1280 0 10000 -1 -1 0 10 1
PARAM8 42 0 0 0 0 0 0 0 0 0
PARAM9 0 0 0 0 0 0 5 0 0 0
PARAM10 0 0 0 0 1200 -1 0 5 100 0
PARAM11 8 1 1 0 8 1 1 0 8 1
PARAM12 1 0 3
PARAM13 "NONE" "NONE" "NONE" "NONE" "NONE" "NONE" "" "ZENO" "" "NONE"
PARAM14 "" "ZENO-3200-Reset" "Real-Time-Clock-Suspect" "Logging-Memory-Initialized" "Serial-Sensor-
COM-Failure" "EEP" "" ""
"" ""
PARAM15 "" "" "" "" "" "" "" "" "" ""
PARAM16 "" "" "" "" "" "" "" "" "" ""
PARAM17 "" "" ""
REPEAT1 -1 -1 -1 -1 -1 -1 -1 -1
CONSTANT1 0 0 0 0 0 0 0 0 0 0
CONSTANT2 0 0 0 0 0 0 0 0 0 0
GSI 1 NO_COMMAND
SENSOR 3 "RainWeight" 1 1 0 0 3 0 0 1 0 3 0 2077.36 -8.0757 0 0 0 0 0 0 0 0 0 S0.1  "SN:XXXXXXXXXXXXX"
""
SENSOR 2 "AirTemper" 9 0 2 0 2 0 0 1 0 3 0 0.4 0 0 0 0 0 0 0 0 0 0 S0.1  "SN:YYYYYYYYYYYYY" ""
SENSOR 14 "ShaftEncoder" 2 0 0 0 0 0 0 1 0 1 0 1 0 0 0 0 0 0 0 0 0 0 S0.1  "SN:ZZZZZZZZZZZZZ" ""
SENSOR 8 "DataKey" 1 0 0 0 0 0 0 1 0 2 0 -1 1 0 0 0 0 0 0 0 0 0 S0.1  "" ""
PROCESS 4 1 "AirTDegC" S2.1 0.000969368 0.000232959 7.98213e-08 18700 100 -100 0
PROCESS 5 16 ".05degT" P1.1 2 5
PROCESS 7 2 "Tmptures" P2.1 0
```

```
PROCESS 7 3 "Rains" S1.1 0
PROCESS 5 8 "StrmLvl"' S3.1 0 0.01 135
PROCESS 7 1 "" S1.1 P2.1 S3.1 P5.1 P4.4
PROCESS 7 4 "KeyDatTx" S4.1
PROCESS 7 5 "SensrNtn"
PROCESS 3 10 "LogSnNt" P8.2 0.5 3 1
PROCESS 3 10 "24hrMSG" P4.5 0.5 2 1
PROCESS 3 13 "ExtraTx" 0 384 1 3A51C2B2
PROCESS 3 10 "Transmit" P11.1 0.5 1 0
DATA 6 1,2,3,4 "<0D><0A>" P1.1 0 0 1 P1.1 P1.1 P1.1
DATA 6 1 "GMA:" P1.1 0 0 1 P1.1 P1.1 P1.1
DATA 16 1,2,3,4 "" P1.1 0 0 1 P1.1 P1.1 P1.1
DATA 15 1,2,3,4 "RainOrNote" P4.2 2 11 8 P4.4 P8.1 P4.1
DATA 15 1,2,3,4 "ThDegC" P3.6 2 7 8 C1 C1 P3.5
DATA 15 1,2,3 "Tmax" P3.1 2 7 8 P3.3 C1 C1
DATA 15 1,2,3,4 "Tmin" P3.2 2 7 8 P3.4 C1 C1
DATA 15 1,2,3,4 "StrmLvl" P5.1 2 5 8 C1 C1 P5.1
DATA 7 1 "P24d->DCOM" P4.4 2 5 1 P1.1 P1.1 P1.1
DATA 6 1 "!" P1.1 0 0 1 P1.1 P1.1 P1.1
*   ! ! SYSTEM TRANSFER COMPLETE.
*   Turn Off File Capture Now.
*   Enter Any Key to Continue.
EOF
```

The FPU as deployed has only three inputs: the precipitation (load cell) input, the thermistor input, and the shaft encoder input. While these inputs could be used for different things, they are configured by the FPU software specifically for the load cell application with the F&P gauge; the MMTS thermistor for temperature; and the 436A shaft encoder for a stream gauge application. The software matches the electrical outputs of these particular sensors to NWS accepted measurement methodologies for the weather element, and converts the result to maintain consistency across the nation and to provide uniformity in the meaning of the reported numbers, now and in the future.

This Section 8 of the, ***FPU Assembly Procedural***, is included because the NWSREP may have to reload the configuration software should the data logger lose its programming for any reason, or if an update becomes necessary. This Section 8 identifies where to get the approved configuration file and how to load it into the data logger.

Starting with the April 2005 deployment, only the precipitation data is certified for operational use. If the other sensors become certified, updates to the ***FPU Operations Manual***, and the configuration software will be announced and provided.

For the initial deployment, W/OS7 has determined that it would be advantageous to monitor system performance data and has authorized the use of another configuration which replaces the uncertified stream gauge data with the system's battery voltage. W/OPS11, Engineering Design Branch, has developed the alternate configuration and certified it through a year's actual use. The alternate configuration file, FPU_ConfigFile_PrecipBattVolt.txt, is available on the NWS headquarters web site: http://www.nws.noaa.gov/ops2/Surface/coopimplementation.htm. Also provided for potential future use is the original FPU initial configuration file. It appears on the same web site, as FPU_ConfigFile_Precip.txt.

The NWSREP will decide whether to use the BatV file at any deployment site and note that

decision in the site meta data. The BatV file should be installed and checked out in the WFO when the gauge and the FPU are prepared for deployment.

To view the configuration file that contains the Battery Voltage Tracking program, see Appendix D, of this, ***FPU Assembly Procedural***.

The NWSREP may download the authorized, named: FPU_ConfigFile_PrecipBattVolt.txt, from the NWS Headquarters webpage: http://www.nws.noaa.gov/ops2/Surface/**coopimplementation**.

Save this TXT file to an easy to remember location on the computer that will connect to the GMA data logger.

Caution: After you have saved the file you must not open the file! The configuration files are Text files, you may view them in Notepad, but do not change them in any way or they will not work. Do not use a word processor because it will add considerable formatting and control characters when it opens the file. This will render it useless as a file for updating your configuration code.

Before you start, save off all the data in the data logger to a text file by using file capture of HyperTerminal and Show all Data (*) of the Data menu in the ZENO users menu.

Caution: Installing a new configuration erases all data in the logger, so save the historical precipitation data records to another file. If it asks for a password, it is ZENO.

Follow these step by step instructions to install the BatV code to the data logger as the new configuration. Access the Zeno User Menu as described in this manual, Section 7.3 (p. 27).

8.1 Connect Laptop Cable into Data Logger's Maintenance Port.

8.2 Start HyperTerminal

Enter the following commands (see example, below)

U (user menu)

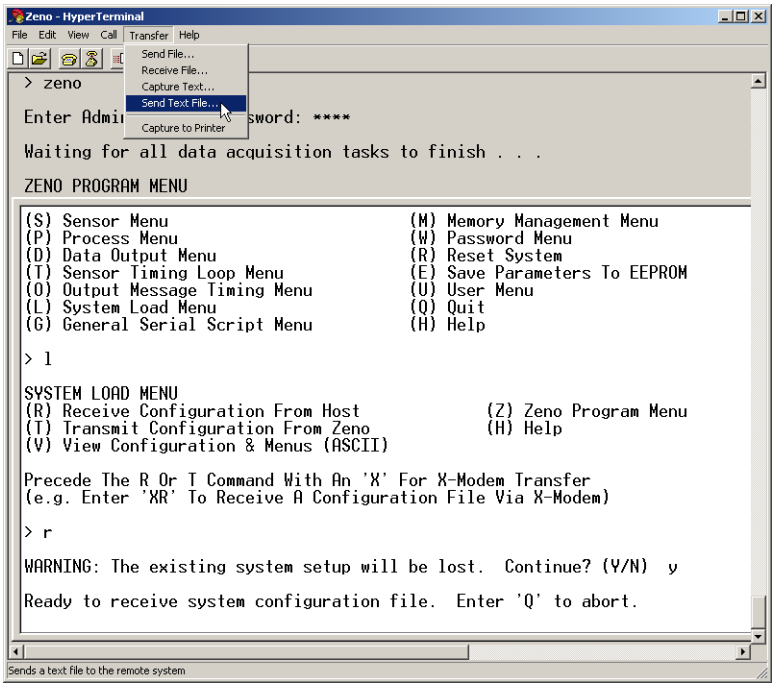
Z (ZENO menu)
Use password: ZENO

L (system load menu)

R (receive configuration from host)

Y (Yes, continue)

At this point the ZENO is waiting for the computer to start sending the configuration file.



8.3 Send the File as Text:

Locate the 'Transfer' tab on the Menu Bar at very top of the window, on the control bar, and select 'Send Text File', as illustrated above where, at top of illustration, the mouse cursor highlights this selection from the Transfer menu options.

A Windows 'OPEN' dialogue box will appear where you locate and select the configuration file you wish to send. Click 'OPEN', and the file will start sending to the ZENO. When done, the ZENO will reset, and start sampling with the new configuration.

Caution: Do not use 'Send File' from Hyperterminal, always use "*Send Text File*."

8.4 Verify the Change in Configuration was Successful:

Wait until the first data is available (could be 15 minutes) to verify that everything was successful. You need to return to the User Menu, select '**D**', for Data Retrieval Menu, and then type **L3<enter>** to display the most recent three data records. Are the measurements the same as has been on the display for the last 45 minutes? If the new configuration works to log the battery voltage, then you will see 'BatV' replace the 'StrmLvl' field name. For instructions on how to examine data logger records in 'real-time', see Section 11.5, of this manual.

8.5 Save the Configuration to EEPROM:

Save the new configuration into flash memory with the E command , 'Save parameters to EEPROM'.

8.6 What if System Will Not Save Configuration Data?

The way to tell that you do not have your configuration data loaded is to observe the following on the lap top connection to the User interface:

"Sensor Record #1 type is not specified." Or "Sensor Name: -blank- (returns no text after the colon symbol). Without a configuration file the Zeno has no knowledge of anything connected to sensor #1 input.

Another direct result of a 'lost/missing' configuration file is the inoperability of the data key writer at the keypad. The Zeno works the writer as a type of 'sensor' (e.g., Sensor #8) and Zeno will not know what to do when it gets the interrupt signal upon the key being turned in the receptacle. See http://www.nws.noaa.gov/ops2/Surface/documents/A_PDFLessonFILE.pdf, the Lessons Learned site, and read the second article "Watchdog Error?, Sensor Not Defined, Cant Save Calibration Parameters."

There are only a few ways a Configuration file will get 'lost' and most of them involve damage to the unit. Common examples include: forgetting to save it, memory failure, lightning strike, electromagnetic interference, or possibly a second technician with laptop inadvertently saved a corrupted file in its place.

To recover you simply need to reload the Configuration file to the flash memory (EEPROM), as

described in step 8.5 above. After you reload the configuration, you will need to re-enter your site data (e.g., COOP Site Number), and re-enter the calibration coefficients if you have them documented. Again, use the E command at this point to save these new site-specific parameters into the flash memory.

9. Calibrate the FPU Load Sensor: *(Perform these Tasks in Your WFO)*

When done, write down calibration coefficients, A, B, and C, and bring these notes out to the field site in case your calibration **check** fails to come into tolerance of ∀0.2 inch of 15.0 inches at the field site. If it fails, you need to redo the calibration at the field site.

The load cell is calibrated via the Zenosoft user menus which are accessed by the laptop computer at the data logger enclosure, using the HyperTerminal program.

The HyperTerminal is already resident in your MS Windows operating system. For instructions on how to configure the HyperTerminal for the COM1 port, see section 7.2, of this manual.

9.1. Start Calibration:

From the Zeno Menu, type **u <enter>** to enter the User Menu.

Type **t <enter>** to enter the Test Menu.

This will display the Test Menu as illustrated, here.

```
[Note! Menus abbreviated for clarity!]

> u

USER MENU
(C) Comms              (T) Test Menu
(F) Sys Func           (Z) ZenoProgM
(S) SampPer            (Q) Quit
(D) DataRetr           (H) Help

> t

TEST MENU
(Rx,y) Sens x-y RAW    (Ex) x Err Codes
(Sx,y) Sens x-y SCALED (P)  Pass-Thru
(Cx)   CalSens x       (U)  User Menu
(Vx)   ViewProc x      (Q)  Quit
(D)    ViewDataCntrs   (H)  Help
(B)    BIT Status

> c1

Enter Administrator Password: ****

Sensor Name: RainWeight

Conversion Coefficient A: 0
Enter new Conversion Coefficient
A:<ent>

Conversion Coefficient B: 1256.6
Enter new Conversion Coefficient B:
1000

Conversion Coefficient C: -4.92398
Enter new Conversion Coefficient C: 0

TEST MENU
(Rx,y) Sens x-y RAW    (Ex) x Err Codes
(Sx,y) Sens x-y SCALED (P)  Pass-Thru
(Cx)   CalSens x       (U)  User Menu
(Vx)   ViewProc x      (Q)  Quit
(D)    ViewDataCntrs   (H)  Help
```

9.2. Calibrate Sensor One:

Type c1 <enter>

- The unit will request a PASSWORD, type **zeno <enter>**. Do not change password.

- The sensor name should be `RainWeight`.

9.3. Set the Initial Gain to 1000:

Hitting <**enter**> without entering anything leaves the existing number in place.

9.3.1 Enter **0** (zero) **<enter>** for "A"

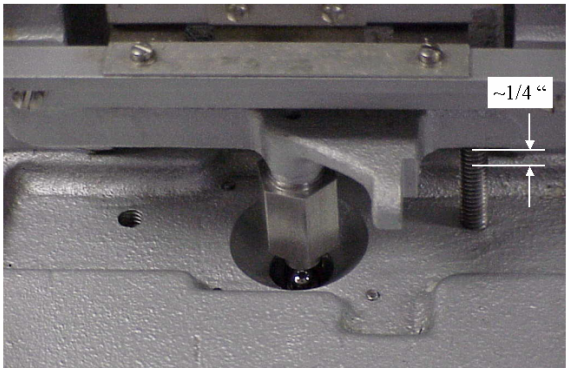
9.3.2 Enter **1000 <enter>** for "B"

9.3.3 Enter **0 <enter>** for "C"

Now the screen will return to the Test Menu. The last three inputs, above, were necessary to establish a stable, known, condition where the gain is 1000, with no offset, so that we can use the Zeno's input like a voltmeter to obtain accurate response measurements for the next steps.

9.4. Calculate the Actual Gain by using the FPU measuring system:

9.4.1 Start with an empty bucket. Lower the shipping bolt so that there is a visible gap (~ 1/4 inch) between the top of the bolt and the front support. Verify that the plunger is touching the load cell ball bearing and that the weight of the empty bucket assembly is on load cell.



Note: The load cell is very sensitive. Use care to not bump the gauge during the following steps.

9.4.2 At the test menu prompt type **s1,1 <enter>**. This will result in the output of sensor measurements for the first sensor (precipitation weighing sensor) every second:

9.4.3 The displayed value should change every six seconds (six readings) or so.

- Allow this to run for at least 30 seconds for the readings to stabilize.

- Then, as the numbers scroll by, jot down 10 different values and average them (add all ten values together and divide the total by 10).

For example, perform Addition :

```
  3.9043
  3.9006
  3.9021
  3.8980
  3.9006
  3.9018
  3.9051
  3.9037
  3.9029
 +3.9024
 39.0215
```

```
TEST MENU
(Rx,y) Sens x-y RAW      (Ex) x Err Codes
(Sx,y) Sens x-y SCALED   (P)  Pass-Thru
(Cx)   CalSens x         (U)  User Menu
(Vx)   ViewProc x        (Q)  Quit
(D)    ViewDataCntrs     (H)  Help
(B)    BIT Status

> s1,1
Note: Hit any key to halt output.
RainWeight
3.9043
3.9006
3.9006
3.9006
3.9006
3.9006
3.9006
3.9021
3.9021
3.9021
3.9021
3.9021
3.9021
3.8980
3.8980
3.8980
3.8980
3.8980
3.8980
3.9006
RainWeight
3.9006
3.9006
3.9006
3.9006
3.9006
3.9018
3.9018
3.9018
3.9018
3.9018
3.9018
3.9051
3.9051
```

Then Divide:

$$10\overline{)39.0215}\quad 3.90215$$

Averaged value = 3.9022

Label the averaged value, B1, for use in instruction 9.4.8, below. Typical numbers should range from 0.8xxx to 5.xxxx. If you are not getting numbers near this range, recheck and reseat all load cell cables' connections, and try again.

9.4.4 When done, press <**enter**> on the laptop to halt the update. The Test Menu will return.

9.4.5 Place exactly 15 inches of equivalent weight in the bucket. If using the F&P calibration weight set (D111-TE500), add the three large weights to the bucket. Be careful not to drop the weights as it could damage the load cell.

9.4.6 At the prompt of the Test Menu:

- type **s1,1 <enter>**.
- Allow time for the readings to stabilize, then as the readings scroll by, record 10 different values and average them as you did in instruction 9.4.3, above.
- Label the averaged value, B2, for use in instruction 9.4.8, below.
- B2 should range from 11.xxxx to 17.xxxx. B2 for the example numbers = 15.2007

If you are not getting numbers near this range, recheck that 1000 was accepted for conversion coefficient B (instruction 9.3.2, above) and re-start there if necessary.

9.4.7 When done, press <**enter**> to halt the update. The Test Menu will return.

```
TEST MENU
(Rx,y) Sens x-y RAW      (Ex) x Err Codes
(Sx,y) Sens x-y SCALED   (P)  Pass-Thru
(Cx)   CalSens x         (U)  User Menu
(Vx)   ViewProc x        (Q)  Quit
(D)    ViewDataCntrs     (H)  Help
(B)    BIT Status

> s1,1
Note: Hit any key to halt output.
RainWeight
15.2018
15.2059
15.2059
15.2059
15.2059
15.2059
15.2059
15.2018
:        [abbreviated to show more #s]
15.1893
:
15.1900
:
15.1938
:
15.2297
:
15.2215
:
15.2121
:
15.1787
:
15.1846
:
```

9.4.8 Calculate new gain coefficient B; let B = 15000 / (B2 - B1).

Example; using the numbers above:

(B2 – B1) = (15.2007 – 3.9022) = (**11.2985)**

then:

$$11.2985 \overline{)15000.0000} \quad 1327.6098$$

therefore: B = 1327.6098

This equation represents the Actual Gain: (15" x Gain) divided by the difference in weight between bucket full and bucket empty. You should obtain a number between **925.xxxx** and **2500.xxxx**. If you are not getting numbers near this range and B1 and B2 were within range, recheck your calculations.

Now go back to Calibrate Sensor 1 and enter the new **B** value:

Type **c1<enter>** at the prompt,

Press **<enter>** to leave 'A' at zero.

Enter the **B** value from above and press **<enter>**

Press **<enter>** to leave 'C' at zero.

The test menu will return.

```
TEST MENU
(Rx,y) Sens x-y RAW          (Ex)  x Err Codes
(Sx,y) Sens x-y SCALED       (P)  Pass-Thru
(Cx)   CalSens x             (U)  User Menu
(Vx)   ViewProc x            (Q)  Quit
(D)    ViewDataCntrs         (H)  Help
(B)    BIT Status

> c1
Sensor Name: RainWeight

Conversion Coefficient A: 0
Enter new Conversion Coefficient A:<ent>

Conversion Coefficient B: 1000
Enter new Conversion Coefficient B: 1327.6098

Conversion Coefficient C: 0
Enter new Conversion Coefficient C: <ent>


TEST MENU
(Rx,y) Sens x-y RAW          (Ex)  x Err Codes
(Sx,y) Sens x-y SCALED       (P)  Pass-Thru
(Cx)   CalSens x             (U)  User Menu
(Vx)   ViewProc x            (Q)  Quit
(D)    ViewDataCntrs         (H)  Help
(B)    BIT Status
```

9.5. Determine the Offset, Coefficient C:

9.5.1 Remove all weights from the bucket. The bucket must be empty of all fluid and as dry as you can practically get it. If this bucket has any detachable parts, like an auto-siphon, leave them installed.

9.5.2 From the Test Menu

- type **>s1,1=** <**enter**>.

- Allow this to run for at least 30 seconds for the readings to stabilize.

- Jot down 10 different values and average them as you did above.

The example #s average to 5.1823. Label it C3 in your notes. C3 = 5.1823

Your C3 should fall between 2.xxxx and 5.xxxx. This weight will depend on the actual weight of your bucket. Remember your bucket should have been empty and dry as possible.

If you are not getting numbers near this range your bucket is either extremely heavy or light. Is it? Is this a non-standard bucket? Or perhaps you did not empty the bucket of the metal calibration weights? Or there were problems in the previous steps, if so, go back and fix the earlier problem.

9.5.3 When done, press **<enter>** to halt the update. The Test Menu will return.

9.5.4 Type **c1**<**enter**>

- type <**enter**> to leave A at zero
- type <**enter**> to leave B as it is
- C must be entered as **minus C3**
- Type –5.1823<**enter**> but use your C3, making sure you enter the minus sign.
- The Test Menu will return.

```
TEST MENU
(Rx,y) Sens x-y RAW    (Ex) x Err Codes
(Sx,y) Sens x-y SCALED (P)  Pass-Thru
(Cx)   CalSens x       (U)  User Menu
(Vx)   ViewProc x      (Q)  Quit
(D)    ViewDataCntrs   (H)  Help
(B)    BIT Status

> s1,1
Note: Hit any key to halt output.
RainWeight
:
5.1829
5.1829
5.1829
5.1829
5.1842
:
5.1805
:
5.1808
:
5.1857
:
5.1829
:
5.1818
:
5.1800
:
5.1836
:
5.1808
:
:

TEST MENU
(Rx,y) Sens x-y RAW          (Ex) x Err Codes
(Sx,y) Sens x-y SCALED       (P)  Pass-Thru
(Cx)   CalSens x             (U)  User Menu
(Vx)   ViewProc x            (Q)  Quit
(D)    ViewDataCntr s        (H)  Help
(B)    BIT Status

> c1
Sensor Name: RainWeight

Conversion Coefficient A: 0
Enter new Conversion Coefficient A: <ent>

Conversion Coefficient B: 1327.61
Enter new Conversion Coefficient B: <ent>

Conversion Coefficient C: 0
Enter new Conversion Coefficient C: -5.1823

TEST MENU
```

9.6. Verify a Correct Calibration:

9.6.1 With the plunger resting on the load cell ball and the weight of the empty bucket assembly on the load cell, at the test menu

- type **>s1,1= and <enter>**.

- Verify that these values are 0.0 ∀ 0.2. If not within the above range, redo the calibration from instruction 9.2.

9.6.2 Now, place the equivalent weight of 15 inches of precipitation into the weighing bucket. (Add the three large weights of D111-TE500.)

After the data stabilizes, verify that the values are 15.0 ∀ 0.2 inches. If not within the above range, redo the calibration from step 10.3.

Press **<enter>** when done to stop the scrolling data and return to the test menu.

```
TEST MENU
(Rx,y) Sens x-y RAW    (Ex) x Err Codes
(Sx,y) Sens x-y SCALED (P)  Pass-Thru
(Cx)   CalSens x       (U)  User Menu
(Vx)   ViewProc x      (Q)  Quit
(D)    ViewDataCntrs   (H)  Help
(B)    BIT Status

> s1,1
Note: Hit any key to halt output.
RainWeight
-0.0013
:
-0.0007
:
0.0026
:
0.0013
:
-0.0005
:
0.0003
:
:
15.0088
:
15.0402
:
14.9720
:
14.9546
:
15.0158

TEST MENU
(Rx,y) Sens x-y RAW    (Ex) x Err Codes
(Sx,y) Sens x-y SCALED (P)  Pass-Thru
(Cx)   CalSens x       (U)  User Menu
(Vx)   ViewProc x      (Q)  Quit
(D)    ViewDataCntrs   (H)  Help
(B)    BIT Status
```

9.7. Save the load cell calibration coefficients to memory:

If calibration was successful and you have entered the Cal Coefficients, the Site ID numerals, and finished any other changes that need to be saved into the default start-up memory of the GMA, use the E command to save all the new stuff to EEPROM.

9.7.1 While at the Test Menu, type **u<enter>** for the user menu

- and then type **c <enter>** to enter the communications menu.

9.7.2 Type **e <enter>** to save the calibration values to EEPROM. The display should appear as below and then return to the communications menu.

- these numbers may be different in your save, but you are looking to see that there are no ERROR statements and that it completed normally as shown here.

```
TEST MENU
(Rx,y) Sens x-y RAW          (Ex) x Err Codes
(Sx,y) Sens x-y SCALED       (P)  Pass-Thru
(Cx)   CalSens x             (U)  User Menu
(Vx)   ViewProc x            (Q)  Quit
(D)    ViewDataCntrs         (H)  Help
(B)    BIT Status

> u

USER MENU
(C) Comms                    (T) Test Menu
(F) Sys Func                 (Z) ZenoProgM
(S) SampPer                  (Q) Quit
(D) DataRetr                 (H) Help

> c

COMMUNICATIONS MENU
(Cn/m) Change n To  m        (R)  Repeater
(M)    Modem Menu            (Tn) TerminalMde
(P)    PowerContr            (E)  SaveToEEPROM
(G)    GOES Menu             (U)  User Menu
(A)    ARGOS Menu            (Q)  Quit
(D)    DigitContr            (H)  Help

Item  1:  9600       (COM1 Baud Rate)
:
Item 20:  NO         (EnableCSAIL)

> e

Verifying param be stored in EEPROM
Saving param to EEPROM . . .
Saving sensors to EEPROM . . .
Saving processes to EEPROM . . .
Saving data lists to EEPROM . . .
Saving repeater lists to EEPROM . . .
Saving serial scripts to EEPROM . . .
Saving constants to EEPROM . . .
1060 out of 8192 bytes used in EEPROM.
EEPROM Writes=24, EEPROM Checksum=115.

COMMUNICATIONS MENU
(Cn/m) Change n To m         (R)  Repeater
(M)    Modem Menu            (Tn) TerminalMde
(P)    PowerContr            (E)  SaveToEEPROM
(G)    GOES Menu             (U)  User Menu
(A)    ARGOS Menu            (Q)  Quit
(D)    DigitContr            (H)  Help

Item  1:  9600       (COM1 Baud Rate)
:
Item 20:  NO         (EnableCSAIL)

> q
Exiting user interface.
```

9.8. Exit the Zenosoft Menus:

When done and everything is satisfactory, type **q <enter>** to quit the Zenosoft menus.

10. Metadata Requirements on FPU Implementation: *(Perform these Tasks in WFO)*

10.1. Enter Operator Notations to Account for this Calibration Setting:

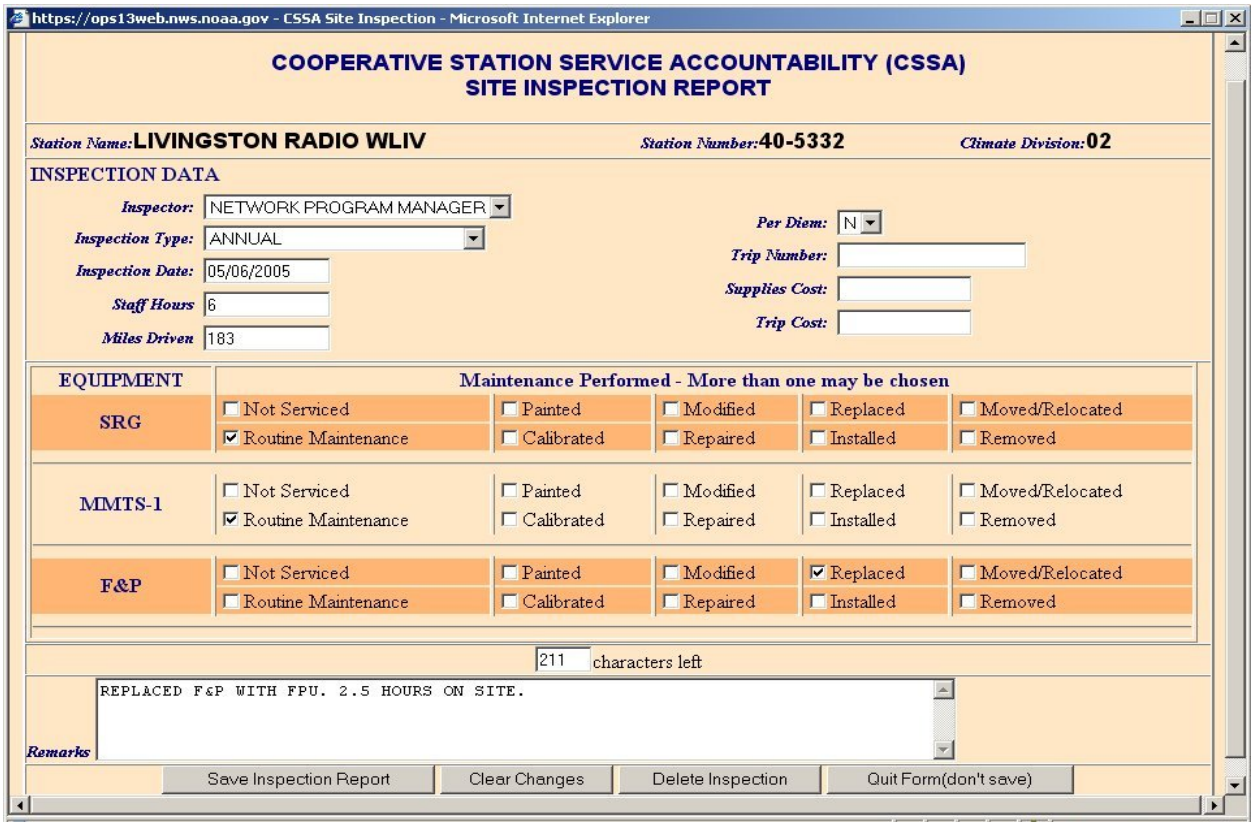
Go to the Data Logger's keypad, and enter notation 220 'Calibration Check – No changes to previous values' if the check showed good values and no modifications were necessary. Enter

notation 221 ‘Calibration Check – New values were entered.’ if a recalibration was performed.

Finally, enter notation 255 at the keypad, ‘START of Valid Data’ to create a record in the data that indicates the FPU was returned to full service.

10.2 Create a CSSA Site Inspection Report:

When you have completed the FPU site installation and are back in the office, access your CSSA and call up the CSSA Station Name/CSSA Station Number to generate a new Site Inspection Report. Account for the total hours of work and total dollars of expense you incurred to install the FPU system.



Be sure to complete all these fields to account for your FPU installation work!

Inspector:…….. Network Program Manager
Inspection Type:…….. Annual
Inspection Date:…… 05/06/2005
Staff Hours:…….. 6
Miles Driven:…… 183
Per Diem:…….. N
Trip Number:…… 2WT0B3804&05
Supplies Cost:…… 75.50
Trip Cost:…….. 113.75

Be sure to mouse click the Equipment category F&P under Maintenance Performed. Finally, in the bottom of the CSSA Site Inspection Report, in the free text field, always remember to write in the following information: "**Replaced F&P with the FPU. "**

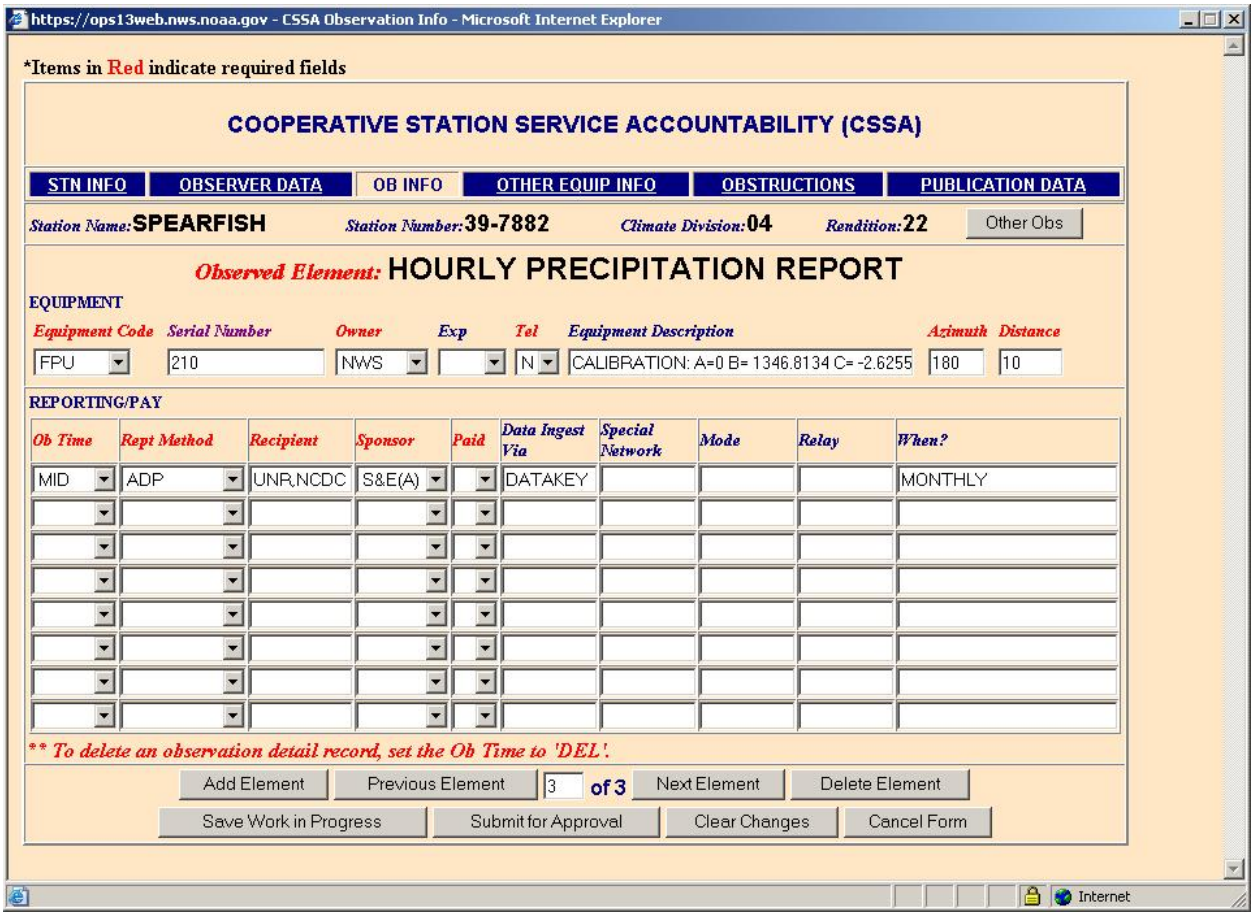
"FPU Calibration Coefficients on May 6, 2005: A = 0; B = 1346.8134; and C= -2.6255"

Note: These values are for example only, and will differ for each FPU system.

Note: Coefficient A should always equate to zero.

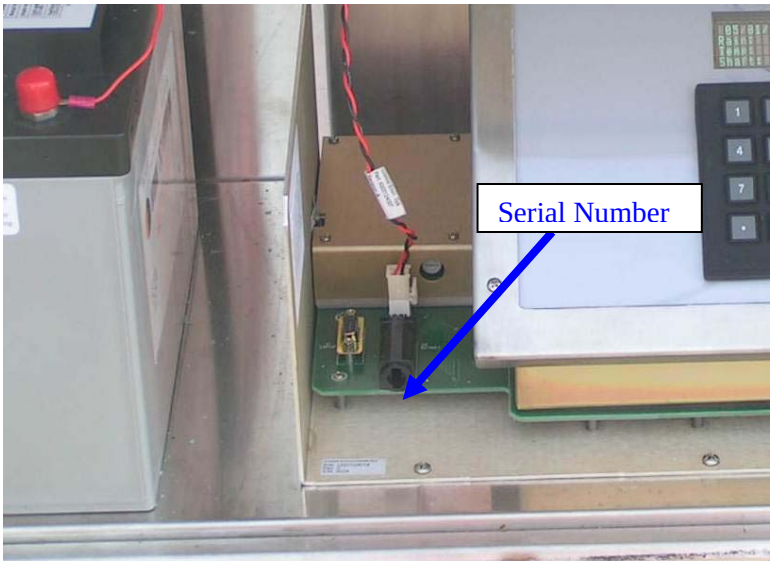
10.3 Update the B-44 for FPU Equipment:

Access and print a copy of the ***Cooperative Station Service Accountability (CSSA) Manual*** (NDS 10-1313), effective date, March 18, 2005, for current policy on B-44 updates. Access: http://www.nws.noaa.gov/directives/010/010.htm .



First, under ***Equipment Code***, enter 'FPU', then to its right under ***Serial Number*** (see, above example) enter your data logger's serial number (i.e., 0210). Then under ***Equipment Description*** enter values for CALIBRATION: A= 0; B= xxxx.xxxx; C= -x.xxxx .

Note: This is the serial number that appears on the inside of the steel enclosure, about several inches in front of the Data Key Receptacle.) Look for a small white one inch decal on the brushed sheet metal floor board upon which the Data Key Receptacle is mounted.



Next, on the same *Observed Element* page, access the Reporting/Pay portion on the bottom of the screen. For 'Ob Time' always use, '**MID'**. For 'Rept Method' always use, '**ADP**'.

For 'Recipient' use your three-letter WFO identifier, followed by, 'NCDC' (i.e., **UNR**, NCDC).

For 'Sponsor', if there is none, use the default '**FC-1**' as it signifies the basic NWS S&E funded recording rain gauge network. For a list of sponsor codes, see p. G-12 in the *CSSA Manual*, NDS 10-1313, and p. C-61, in Section 2.4.3.13, Sponsor.

For 'Paid', ensure its '**N**' for none, or 'Y' if the Observer receives pay from the federal government for this observation.

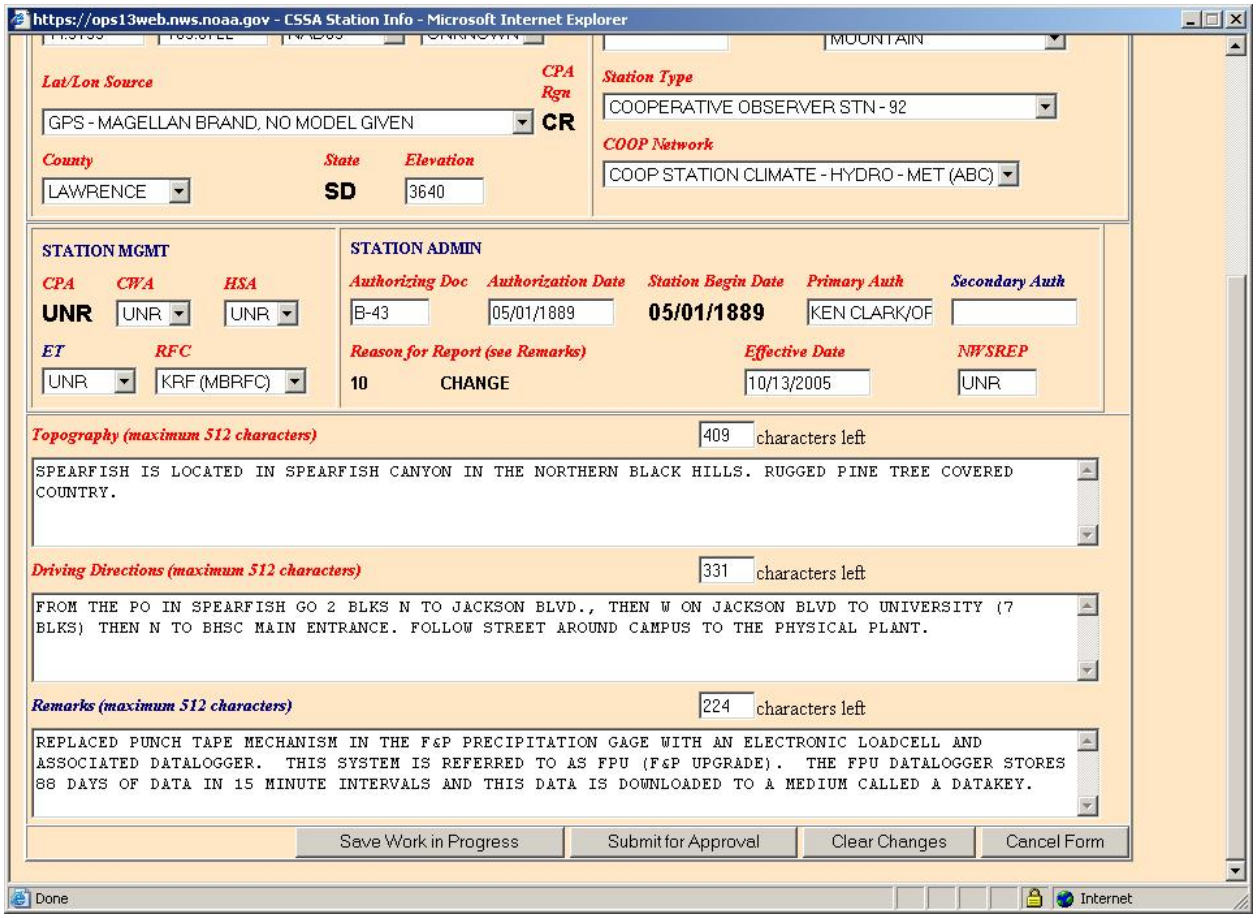
For 'Data Ingest Via', ensure '**DATAKEY**' appears.

For the field, 'Special Network', ensure you recognize a Climate Reference Network (CRN) or Historical Climate Network (HCN) site with the appropriate abbreviation, otherwise leave this field blank.

For the next two fields, 'Mode', and 'Relay', leave these blank.

For the last field 'When', enter the word '**MONTHLY**.'

Before submitting the revised B-44 to NCDC, ensure you have updated the Remarks section to state, "**Updated equipment, changed F&P to FPU.**" See figure, below.



References: Access: http://www.nws.noaa.gov/directives/010/010.htm NDS 10-1313, ***CSSA User Manual***, Sec 2.4.3, Ob Info (p. C-48) and notice there is a left-most drop-down window, and select, **FPU.** Also, see the revised instructions in the NDS 10-1313, ***CSSA User Manual***, Sec 2.4.3.7, Equipment Description, (p. C-54).

10.4 FPU Logbook – A Backup to CSSA Metadata:

After you create a Site Inspection Report in CSSA and after your Form B-44 update was successfully processed by NCDC and is accessible in the data base, consider the benefits of organizing an FPU Logbook (electronic), particularly if you have more than ten COOP sites with FPU equipment.

The FPU Logbook will account for your installation work, expenses, calibration coefficients, calibration check dates, semi-annual visitation, maintenance trips, and any delegated maintenance responsibility given to the Observer. In this way you will have a ready reference from which to retrieve detailed information on FPU system and Observer correspondence, and not be limited to the 250 characters in the Site Inspection Report's 'Remarks' box.

11. Checkout System Operations (Preliminary): *(Perform these Tasks in Your WFO)*

11.1 Verify Data Key Operation:

With the display active, insert a data key into the data logger's key receptacle.

Turn the data key one-quarter turn clockwise.

Watch the keypad display for verification of key insert.

Watch the keypad display for verification of key download.

Watch the keypad display for notice of key download completion and request for removal.

Remove the data key.

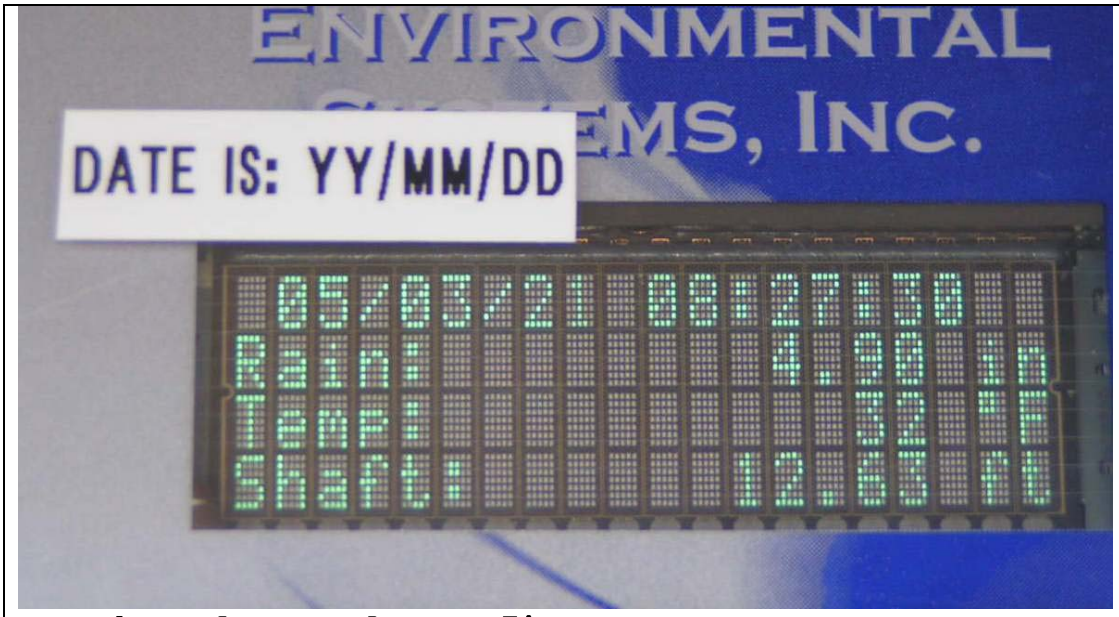
Verify the display returns to the current readings, **Rain:**, and, **24RainDiff:**.

If the data key writer device is not responding properly, access the Lessons Learned web site: http://www.nws.noaa.gov/ops2/Surface/documents/A_PDFLessonFILE.pdf ; and read the first article, "Where's My Data – Why Do I see -100000? – Why Wont' the Key Work ".

11.2 Verify Date/Time (YY/MM/DD HH:MM:SS):

Access the keypad and look at the display. Is the date and time correct within 2 minutes of local standard time?

If not, use **Up-arrow** to call-up the Date & Time menu. See Section 6.3, of this manual..



Example: Current Date & Time:
05/03/21 08:27:30
New Date & Time:

Important: In the above example the **05/03/21** is the proper display for March 21, 2005. Specifically, the **05/** signifies year 2005; the **/03/** signifies month of March; and the **/21**, signifies the 21st day of month of March. The time, **08:27:30** is the proper display for 8:27:30am local Standard time in the 24 hour convention.

Remember the Date is YY/MM/DD format!

Type in the correct date and time and then press **<ENT>** button to exit this menu.

11.3 Verify Operator Notation Codes:

Press the **Up-arrow** to call-up the Sensor Notation Menu shown here.

NEW SENSOR NOTATION:
ENTER VALUE:

Valid numbers are from 0 (zero) to 255.

Type **104** on keypad and it will show "104" on the display. Now press **<ENT>.** This should generate a message that says, "VALUE ACCEPTED".

Now try a number outside of this range; type **256** on keypad and it will show "256" on the display. Now press **<ENT>.** This should generate a message that says, "INVALID VALUE".

11.4 Verify Display Units:

Press the **Up-arrow** to call-up the Display Units Menu, shown here.

If anything needs changing, press **<X>** button on keypad. This starts a sequence that walks through all Rain, Temp, and Shaft, options allowing you to select new units, or simply press <**ENT**> to leave them as they were.

```
Current Units:
Rain: inches
Temp: Fahrenheit
Shaft: Feet
```

Change temperature units to Celsius to verify that this function is working.

Verify the units change on the data display screen.

Then reset the units to the default ones shown in this figure box.

11.5 With Laptop PC - Verify Data Logging: *(Perform this Task in Your WFO)*

Access the Zeno User Menu, refer to Section 7, of this manual for instructions.

Type **d<enter>** to access the data retrieval menu.

Type **L3<enter>** to display the last three data records.

Are the measurements the same as has been on the display for the last 45 minutes?

If YES, then it is logging data properly.

Type **q<enter>** to exit the ZENO User Menu.

The FPU gauge preliminary functional check-out is now complete.

```
USER MENU
(C) Comms Menu              (T) Test Menu
(F) SysFuncMenu             (Z) ZProgMenu
(S) SampPerMenu             (Q) Quit
(D) DataRetrMenu            (H) Help

> d

DATA RETRIEVAL MENU
(A)  AFTERTime              (F) Flashnfo
(B)  BETWEENTime            (D) DeleteAll
(Ln) LASTnRecords           (N) NumberLogged
:
(Enter 'X*'Send All Data Sets Via X-Modem)

>L3

Hit The Space Bar To Halt The Log Data Output.
DATE,TIME,RainOrNote,ThDegC,Tmax,Tmin,BatV,
05/03/25,21:44:58,1,14.95,0.00,0.00,0.00,12.07
05/03/25,21:29:58,1,15.01,0.00,0.00,0.00,12.09
05/03/25,21:14:58,1,15.01,0.00,0.00,0.00,12.09

DATA RETRIEVAL MENU
(A)  AFTERTime              (F) Flashnfo
(B)  BETWEENTime            (D) DeleteAll
(Ln) LASTnRecords           (N) NumberLogged
:
(Enter 'X*'Send All Data Sets Via X-Modem)

> q
Exiting user interface.
```

11.6 Power Reset Procedure:

If during the check-out, the system does not respond as it should, in any of the four areas

outlined here, it might be because the data logger became ‘out-of-synch’ with either the Display unit or the Data Key writer.

- The keypad display is stuck on “Coastal Environmental Systems, Inc” splash screen.
- The keypad display is not updating with RAIN and RAINDIFF values every 5 seconds.
- The keypad display is showing gibberish or odd characters.
- The Data Key Writer is unresponsive.

To diagnose and resolve these problems you should ensure the FPU system in its typical powered mode (i.e., solar charging of the 12V battery, with 12V battery powering the unit), and then conduct a Power Reset by following these five steps:

a) Either throw a coat over the solar panel, or disconnect the solar panel connector from the underside of the steel box enclosure.

b) Disconnect the white battery connector inside the enclosure next to the data key receptacle.

c) Count to 10 . The display should be off. If it is ***not*** off, the solar panel is still getting light through the cloth covering the solar panel, so then, disconnect the solar panel cable plug from beneath the enclosure box.

d) Insert the battery cable plug into its white receptacle. CAUTION: The battery connector only goes in one way, do not force it. The display should light, first with the Coastal splash screen, and then with the data screen).

e) Insert the solar cable plug back into the socket at the bottom of the steel enclosure, if everything is working. You are done. The initial ‘finished readings’ will start to appear within 30 minutes.

Background: The FPU display and Data Key Writer operate independent of the Zeno data logger inside the GMA. There are a few instances when the FPU display can get out-of-sync with the data logger and ‘lock up’ resulting in the conditions above. Most of the time when this happens, the Zeno data logger is happily working away collecting data as it should – it was designed to do this so no data would be lost. The only way to re-sync the display to the logger is to do a POWER-ON reset. You must remove all power from the GMA and re-apply power.

Note: If the Power Reset does not correct the problem, then report the problem to your RCPM.

12. Install the WFO Data Key Reader: *(Perform this Task in the WFO)*

12.1 Overview of Data Key Reader

The Coastal Environmental Systems (CES) data key reader is a small 2"x3" tan plastic box that is a peripheral device intended for connection to a non-network NWS workstation. It attaches to a laptop or standalone PC on a 25-pin parallel port plug. The Data Key Reader is powered by an AC/DC converter that must always be attached to an AC power strip.

Note: The key reader and software will only work with Windows 95, 98, or ME. It will not work with Windows NT, 200, or XP operating systems. For future reference write down the four digit serial number (S/N) given by the manufacturer, Coastal Environmental Systems (CES).

The data key reader application is provided on a CD-ROM, and must be loaded onto the Win 95/98 computer to use the reader. There are just four files that get loaded to your laptop/PC when you install the CES key reader CD-ROM:

CDKR.exe
CDKR.ini
DataKey.bin
PCDatakeyReaderManual.pdf

This key reader software is licensed only for Government use.

12.2 Load the CD to your Win 95 or Win 98 Operating System Computer (or Laptop)

a. Insert the "PC Key Reader" disk into your laptop's CD-ROM drive (i.e., D:\ ).

b. Open the Windows START Menu at lower right corner of Win 95/98 desktop.

c. Select the 'RUN' option.

d. Enter: **D:\setup-V1.1.exe**

e. Select 'OK' to execute the installation program.

f. Accept the default values of the install program.

g. You should ensure the desktop icon 'Coastal's Data Key Reader' is created once the program has been installed.

h. No password is required to enter the Data Key Reader programs.

12.3 Configuring the Reader Software

a. Click on the new desktop icon, 'Coastal's Data Key Reader'. A screen will pop-up directing you to take 6 steps.

b. Click on the tab, 'Configure Key Reader' and select the following:

- Go to the START menu, and select the CONTROL PANEL and select SYSTEM icon

- Click on the tab, 'Device Manager'

- View the list, and locate, 'Ports (COM & LPT)'

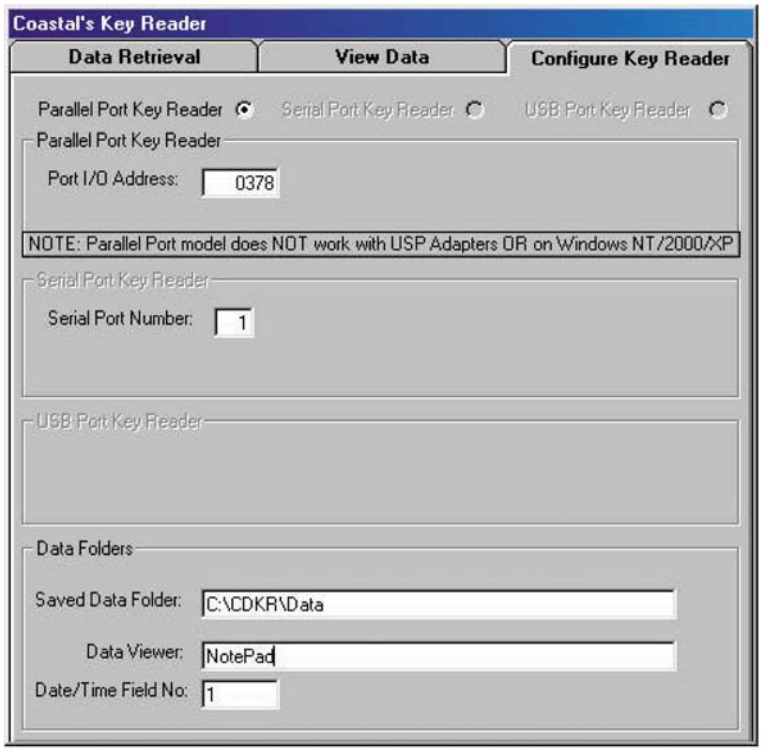
- Select LPT1 (This is usually the printer port). **Note**: If this is the only parallel port on your laptop/PC then you will no longer have a capability to print from this laptop/PC.

- Click on the 'Properties' button at the bottom of the dialog box.

- Click on the tab, 'Resources'

- Locate the first 'Input/Output Range'

- Read the first number of the range as the *Port I/O Address*.



Once this is done check the other fields for accuracy. Any existing folder name may be specified as the 'Saved Data Folder', however the complete path must be entered, including the drive letter and directory name(s) without the trailing backslash '\'.

Any program may be specified as the 'Data Viewer'. **NotePad**, Window's text file viewer, will come up as the default.

The 'Date/Time Field No' should never be changed as this is the default value for all Zeno output messages.

All configuration changes are automatically saved as when the changes are made; there is no requirement to save configuration changes or restart the software.

This completes the installation and configuring of the software for the CES Data Key Reader.

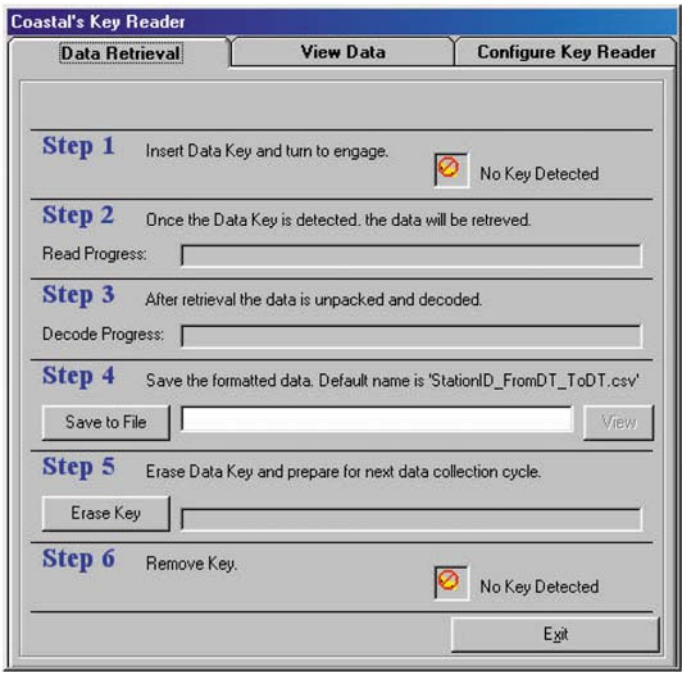
12.4 Using the Key Reader to Download HPD Data

Start the Key Reader application. Verify the reader power supply is plugged into an active AC outlet, and into the reader.

Insert a Data Key into the reader receptacle and turn it ¼ turn to the right to activate the system.

Your PC display will now feature a status panel, with 6 dialogue windows (see figures below). The system will automatically start reading the key, Step 1, will indicate 'Key Detected', and the program will advance to Step 2.

Caution: Removal of the data key prior to completing Step 4 will reset the reading process. In addition, removal of the key prior to completion of Step 4 is not recommended as it may result in damage to the data or to data key hardware.

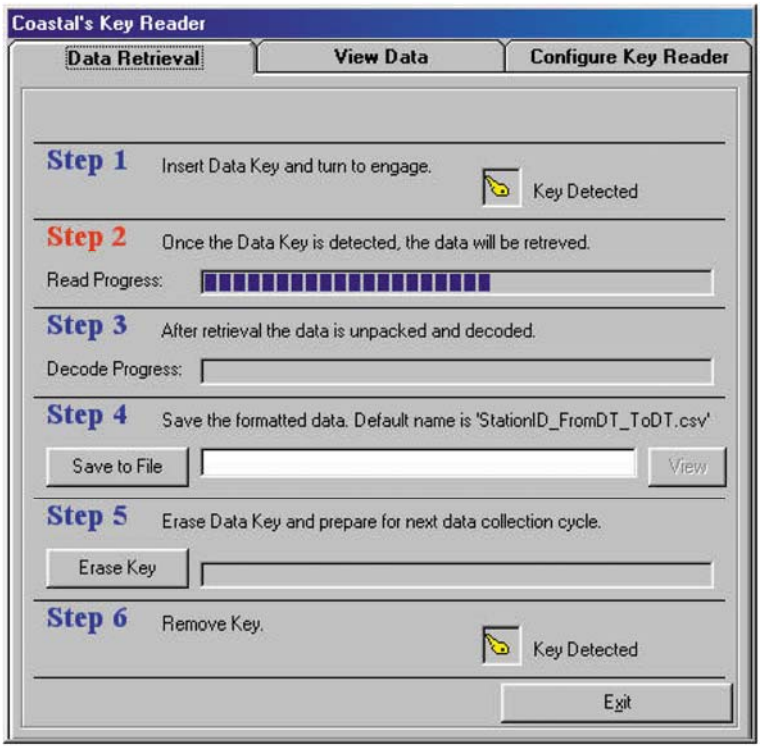


If the key is removed anytime prior to completing Step 4, the error message shown to the right, will appear and the program will automatically reset to Step 1. The key must be re-inserted to restart the data downloading process.

Once Step 2 is complete (the bar indicator, is 100% full to the right-end of scale), the data has been read from the key.

The program automatically continues with Step 3, which quickly decodes the data and puts it in comma separated value (CSV) file format.

After completion of Step 3, Step 4 is highlighted in the panel, “Save the formatted data. Default name is: ‘StationID_FromDT_ToDT.csv’.



At this point you will save the data to the laptop/PC permanent memory. Once saved, the ‘View’ button, within the panel’s row for Step 4, will become highlighted to let you preview the data.

After you have previewed the data via the ‘View’ window, and while still in Step 4, you then click the button “Save to File” to save it with the name that appeared at the top of the data as seen in the preview window. For example: ‘StationID_FromDT_ToDT.csv’ .

For example let us decode a monthly data file name from a hypothetical station, 41-5678:

41005678_20050507_182058_20050610_221158.csv
SS00####_yyyymmdd_hhmmss_yyyymmdd_hhmmss.csv

SS00: 4100 is the station’s state code per the CSSA Station ID Number convention (i.e., 41 = Texas) ***Cooperative Station Service Accountability (CSSA) Manual*** (NDS 10-1313), Table G-27. http://www.nws.noaa.gov/directives/010/010.htm

####: 5678 is the station’s alphabetically ordered COOP Station ID Number for that given State or Territory as issued by the National Climate Data Center (NCDC) as described by CSSA Manual (NDS 10-1313), Station Number, Section 2.4.1.2.

_yyyy: 2005 is year 2005

mmdd: 0507 is May 7th

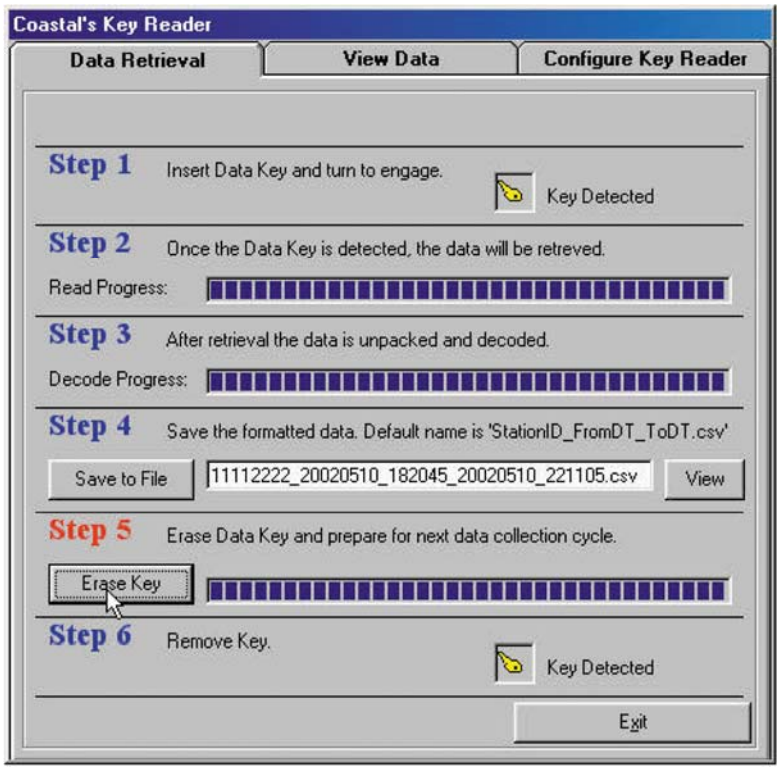
hhmmss: 182058 is 6:20:58pm local standard time is the date of the oldest of the 15-minute data elements on this data key.

_yyyy: 2005 is year 2005

mmdd: 0610 is June 10th

hhmmss: 221158 is 10:11:58pm local standard time is the date of the youngest of the 15-minute data elements on this data key.

The two date and time sections of the filename represent the date and time of the first and last records contained in the data file. This allows data files with overlapping data to maintain unique file names for the stored data.



If the software encounters an error while attempting to save the data, the error message "Unable to SAVE data', shown at right will display. The most common reason for the error is the folder specified under 'Save Data Folder' in the Configuration Tab is not accessible or does not exist.

For instructions on how to specify this folder see Section 12.3, and see its dialogue box inside the figure in part 'b' of Section 10.3.

For routine operating procedures, skip Step 5, "Erase Data Key", there is no need to erase the contents of the key.

Proceed to Step 6, "Remove Key". Turn key ¼ turn to left, and pulling it out and storing it to a holding box or holding drawer. Do not label any key. The keys are interchangeable and shall be sent to the COOP Observer without any adhesive label.

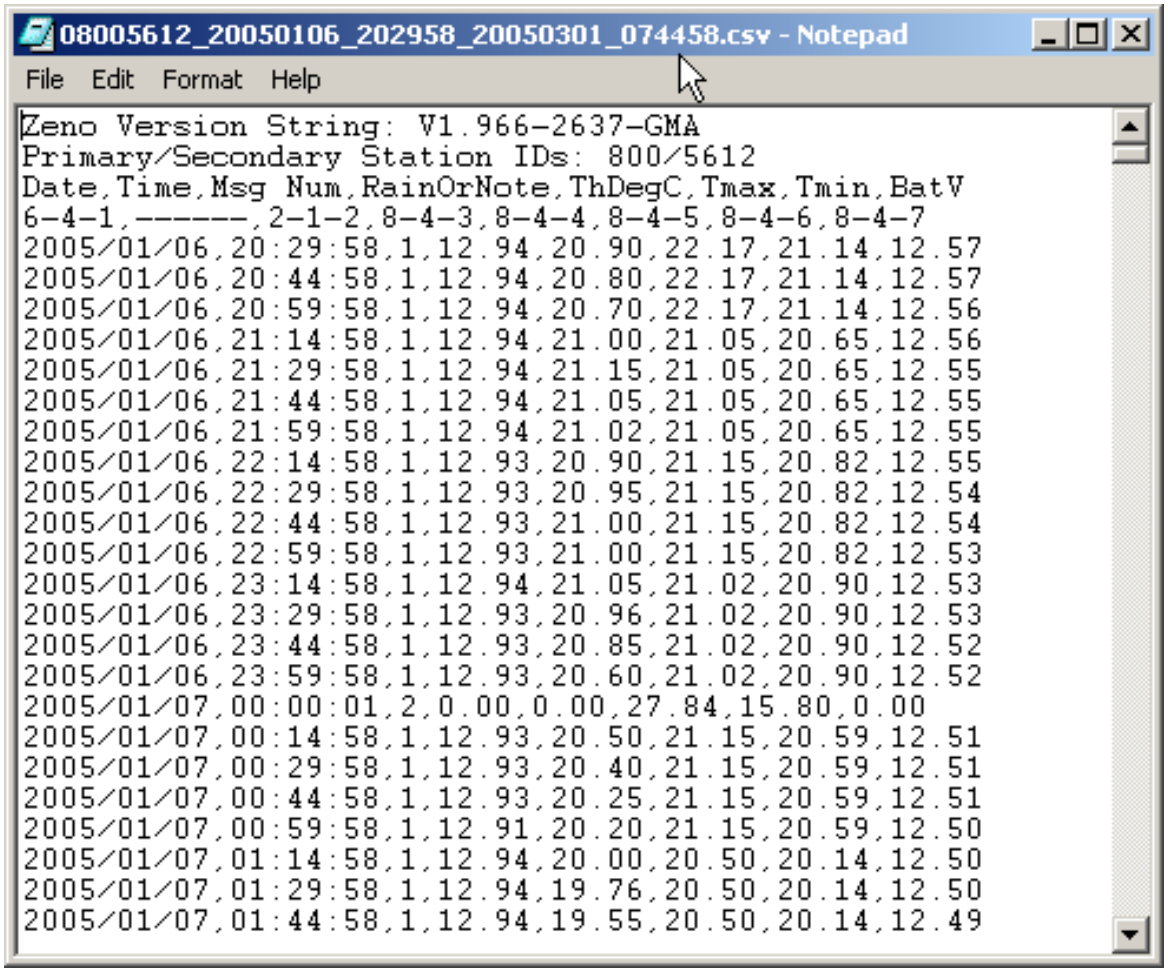
A new key may now be inserted for processing, or alternately, saved data files may be viewed with this data reading program. Exit the reader program by clicking on the 'Exit' button at the lower right corner of this same program panel.

12.5 Viewing Data Files in Key Reader Program

Saved files may be accessed by clicking on the 'View Data' tab (i.e., middle of the three tabs).

Only *.csv files saved in the 'Save Data Folder" specified back in the Configuration Tab, may be viewed in this reader program. To access a saved file, highlight the desired file, by dragging the mouse cursor across the filename, and then clicking on the 'View Selected File' button at the bottom at the end of the screen.

If the default viewer was not changed, Notepad should open, displaying the selected file. An example is provided below.



Header Line 1: Zeno Version String: v1.966-2637-GMA

Header Line 2: Primary/Secondary Station IDs 1111/2222 **(i.e., 4100/5678)**

Header Line 3: Date, Time, Msg, Num, RainOrNote, ThDegC, Tmax, Tmin, strmLvl1

Header Line 4: 6-4-1, -----, 2-1-2, 8-4-3, 8-4-3, 8-4-4, 8-4-5, 8-4-6, 8-4-7

Data File Line 5: 2002/05/10, 22:29:58,1,0.00,0.00,0.00,0.00,135.00

Data File Line 6: 2002/05/10, 22:44:58,1,0.00,0.00,0.00,0.00,135.00

Data File Line 7: 2002/05/10, 22:59:58,1,0.00,0.00,0.00,0.00,135.00

The output data file is an industry standard CSV (comma separated values) format, which contains header information, column headings, and data, as described below:

Row within the Data File	Description of the field
HEADER, LINE 1:	An identification string for the applied version of Zeno firmware.
HEADER, LINE 2:	The primary/secondary Station IDs; as defined by the Zeno configuration
HEADER, LINE 3:	Field names as defined in the Zeno's configuration; multiple entries or values separated by a comma.
HEADER, LINE 4:	Field decoding information from the Zeno's configuration; multiple entries or values separated by a comma.
DATA FILE, LINE 5:	Values from the data fields; one data record per line, multiple entries or values separated by a comma.

The Header Line 4 row (e.g., 6-4-1, -----, 2-1-2, 8-4-3, 8-4-3, 8-4-4, 8-4-5, 8-4-6, 8-4-7) contains coded numerals. These numerals are decoded in the table below.

Field	Description
Data Type	Data type of the given field: 1 = Byte 2 = Unsigned Byte 3 = Short Integer 4 = Unassigned Short Integer 5 = Long Integer 6 = Unsigned Long Integer 7 = Compressed Float 8 = Float 9 = String
Number of Bytes	Number of bytes used to store the information (the data may be compressed by the Zeno to save memory)
Record Number	Data output record number from the Zeno output configuration definition.

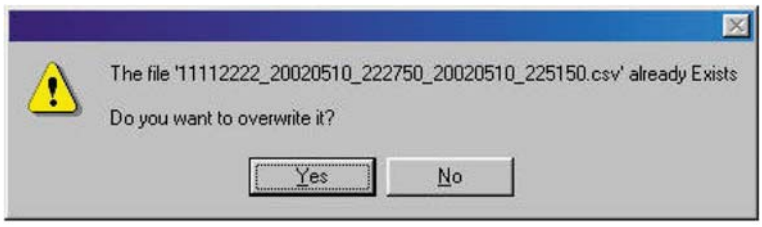
Information in the tables above was provided in the Coastal Environmental Systems (CES) ***FPU User Manual for PC Key Reader***, Version 2.0, dated May 17, 2002.

Note: The second field in HEADER, LINE 4 always shows four hyphens. The date time field comes in as one field that is separated into two fields during data processing.

12.6 Key Reader Error Messages

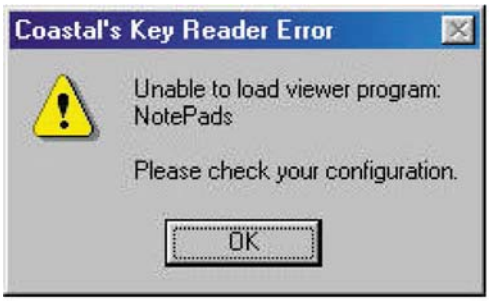
If you remove the data key prior to saving the data Step 4, “Save to File’, an error message will display.

If you attempt to save the same data from key, a second time, the reader will return this error message illustrated to the right.



“The file ‘41005678_20050507_182058_20050610_221158.csv‘ already exists.
Do you want to overwrite it?”

If the viewer program specified in the configuration set up is not loaded on the machine or is not working properly, the reader will return this error message illustrated to the right.



“Unable to load viewer program: NotePads. Please check your configuration.”

If a blank key was inserted into the reader, the error message illustrated to the right, will be displayed:

“Data Key is blank. Please remove. ‘

If the user attempts to continue on to Step 5, prior to completing the Save in Step 4, “Save to File”, the error message illustrated to the right, will appear:

“Data has not been SAVED yet. Please SAVE your data before erasing the Data Key.”

End of Section 12: ‘Instructions for the CES Key Reader Program.’

FPU ASSEMBLY INSTRUCTIONS

PART FOUR

TRANSPORT THE FPU TO OBSERVER'S SITE

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PART FOUR: TRANSPORT FPU TO OBSERVER'S SITE

13. Pack the FPU Assembly and Battery into Truck/Van: *(At your WFO)*

13.1 In the WFO, remove any test weights from the bucket and remove the bucket from the force post. The FPU weighing assembly needs to be open and accessible for you to adjust the shipping bolt and secure the parallel arms.

13.2 Secure the FPU gauge for the road trip to Observer's site. You need to block the plunger so it does *not* get closer than one quarter inch above the load sensor's contact ball. There are two bolts on either side of the plunger: the shipping bolt (the longer of the two), and the lower limiting screw. Raise the shipping bolt's height by threading it upward so as to prevent the plunger from hammering down on the load cell. Ensure that this action definitely results in a ¼ inch vertical gap between the plunger and the load sensor's steel ball. Then, lock it in position using the lock nut, underneath.

13.3 To ensure the flexures are protected, you may block or tape the movable end of the parallel arms so they can not move or bounce in transit. The upper-rear horizontal flexure is most susceptible to bending. In this way the parallel arms will stay firm against lateral and vertical forces.

13.4 Disconnect the 25 ft solar cable from its port on the underside of the steel enclosure. Next, disconnect the 12V battery cable from the white plastic socket next to the data key receptacle.

Securing Equipment Checklist	**Methods**
Solar Cable	Disconnect the Solar Cable from the steel enclosure. Then coil it up.
CAUTION: Always disconnect the solar panel before disconnecting the battery.	
12V Battery Cable	Disconnect the battery cable from the circuit board first. Yet, leave its other end still attached to the battery terminals.
CAUTION: Remove the 12V battery from the steel Enclosure with the help of a co-worker. https://www.ops1.nws.noaa.gov/Secure/SAFETY/Safety_manual.htm	
12V Battery	Position it to the floor of the transport vehicle toward the center of the vehicle if possible.
Shipping Bolt	Make sure it is threaded upward, raised, and in full contact with the plunger at a safe height, about ¼ inch above the sensor ball.

13.5 With a second person to assist you, lower the 12V battery, place it on the hand-truck (or dolly) and bring it to your truck/van. Lift the 12V battery into the truck/van following the cautions advised in, NWS Manual 50-1115, *Battery Charging and Storage Operations*.

Caution: This battery weighs 57 pounds, so load it first into your truck/van.

13.6 Next, place the steel enclosure onto a hand-truck and load it to your truck/van. Place the solar panel back into its cardboard box (or wrap it with newspaper), and load it to the truck/van. Finally, place the collection bucket and its force post into the truck/van.

13.7 Hand-carry the FPU assembly (attached to its base plate) with a second person, to the truck/van. Be aware of this assembly's heavy weight. Set it down gently into the truck/van and brace it against the other boxes. Ensure the FPU is either in a box or buffered from 12V battery, solar panel, steel enclosure, toolkit, and laptop PC with newspapers or packing foam.

13.8 Observer site installation does not require any extraordinary tools. Items needed for installation and checkout include the instructions found in this manual, Sections 15 to 20, multi meter (voltmeter), and common SAE standard size hand tools such as screwdrivers (Phillips and slotted blade), open end wrenches and Allen wrenches, and the F&P calibration weight set (D111C-TE500).

In order to check-out the Zeno data logger, you will use a laptop PC with a RS-232 port, a terminal emulation program such as HyperTerminal or ProComm, and a straight through 9-pin male to 9-pin female communications cable. For any work with the Zeno system, you are *not limited* to Win 95/98/ME operating system (unlike the Coastal Key Reader workstation, that as of Aug 2006, requires the older software).

Refer to the Checklist of equipment, tools, and instructions for COOP site installation on pages 9 and 10, in Section 1 of this manual, ***FPU Assembly Procedural.***

14. Unload FPU Components from Truck/Van: *(At COOP Observer's Site)*

14.1 At the Observer's site, unload these components in the following order: the tool-kit, bucket, force post, solar panel, FPU assembly, steel enclosure (data logger enclosed), and lastly, the 12V battery. Set these components on a clean and level surface that will not interfere with the Observer's work place or access to residence.

Re-inspect the shipping bolt/lower limiting screw to ensure it continues to separate the weighing arm and plunger assembly by at least ¼ inch, with a visible gap above the load sensor's contact ball.

Re-inspect the FPU assembly's flexures.

Note: The Observer's F&P you are about to remove will become the next gauge you modify and deliver to the upcoming site on your FPU deployment list. This efficient method results in a site-by-site rotation of the F&P weighing.

FPU ASSEMBLY INSTRUCTIONS

PART FIVE

INSTALLING THE FPU AT

OBSERVER'S SITE

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PART FIVE: DISMOUNT F&P AND INSTALL FPU GAUGE AND CHECK-OUT FPU:
Estimated Time Required: An estimated two hours is required at the Observer's Site to: dismount the F&P gauge, install the FPU gauge, mount the steel enclosure, install the 12V battery, mount the solar panel, power the system, check-out display unit, check calibration of sensor, and verify data logger functions properly. Before conducting this work, read these instructions in sections 15 through 20.

15. Dismount F&P Punch Recorder from the Pedestal: *(At Observer's Site)*

In section 15 you will remove the F&P punch block recording mechanism from the F&P weighing assembly.

15.1 Remove the conical hood by grasping each of the two large white handles. Remove the bucket. Drain the bucket before proceeding.

15.2 At the bottom of the lower housing, view the base plate's circumference where the rim of lower housing fits. The lower housing, hereafter referred to as the casing shell, is the white cylindrical jacket with service door. Notice the bottom edge of the casing shell where there are two large indentations in its circumference - these are the grip locations for removal.

Remove the casing shell by grasping the bottom edge of the case with both hands, in the two locations noted above. Slowly raise the shell, exactly vertically, to clear the F&P weighing sensor.

15.3 Secure the F&P weighing assembly for the road trip back to WFO. Install the code-disk locking device. You may use a pair of alligator clips placed on each side of the code disk pointer to secure the disk. Next, rotate the zero adjust knob (located at the top of the weighing assembly) clockwise until the top of the 'upper main spring hook' is flush with the top of the knob. See code-disk: http://www.srh.noaa.gov/ohx/dad/coop/f-p_images

15.4 At the bottom of the weighing scale, just above the paper supply spool, on either side of the dashpot, notice there are two bolts that rise through the stage plate on each side of the plunger. One is the lower limiting screw and the other is the shipping bolt, and both work to block the plunger's downward travel. Raise the shipping bolt (the longer of the two) so there is ½ inch gap above the dashpot. Also, raise the lower limiting screw by ½ inch for backup. Then lock each bolt into position, using the lock nut underneath the stage plate.

Caution: The upper-rear horizontal flexure is the one most susceptible to bending. To protect all the flexures, you may block or tape the movable end of the parallel arms so they can not move or bounce in transit. In this way the parallel arms will stay firm against lateral and vertical forces.

Finally remove F&P punch block mechanism together with the circular base plate. With a second person lift the base plate and set it onto a smooth and clean surface. Later, after you have installed the FPU system you will load this F&P assembly into a cardboard box and set into your truck/van.

Note: Do *not* split apart the F&P punch block assembly at Observer's site. Bring it back to the WFO and there disassemble it according to the instructions in section 1, of this *FPU Assembly Procedural*.

16. Install the FPU Assembly to Pedestal: *(At Observer's Site)*

16.1 With a second person, carry your pre-assembled FPU gauge assembly to the same mounting pedestal to which the F&P was mounted. Inspect the triangular foundation plate and clean about the bolt threads if needed. Set the FPU gauge assembly's circular base plate onto its triangular plate and fasten the bolts loosely. You will tighten them by wrench after you inspect the top of the gauge hood with a carpenter's level for horizontal trueness.

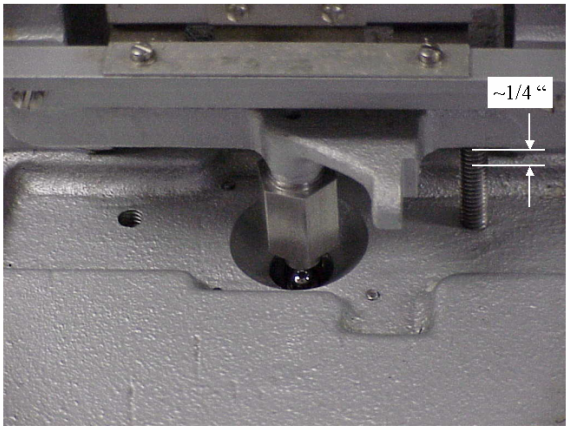
16.2 Place back the casing shell you removed in Section 15.2. Carefully and slowly lower it down about the FPU weighing assembly until it fits into the groove of the base plate. Then rotate the casing shell until it slides onto the two metal locking tabs. Mount the force post, mount the bucket onto the force post, and mount the conical hood on top of the lower housing assembly. Ensure the hood is fully seated.

16.3 With a carpenter's level, selectively tighten the three pedestal bolts to ensure the rain gauge is seated level. Tighten bolts. Then remove the conical hood and the casing shell to access the FPU load cell. Leave the force post and bucket attached.

16.4 **Note:** At this point the FPU load sensor is still in its travel-safe position from the road trip. Be careful not to bump the gauge during the following steps – the load cell is very sensitive. If it is windy, install the conical hood. If it is very windy, install the conical hood with its funnel attached.

16.5 Cut away any safety tape you had wrapped about the parallel arms to protect the flexures.

16.6 With the bucket still empty, lower the shipping bolt so that there is a visible gap (~ 1/4 inch) between the top of the bolt and the bottom of the FPU support arm (see photo). Verify that the FPU plunger is touching the load cell ball-bearing and that the weight of the empty bucket assembly is on the load cell.



16.7 View the underside of steel enclosure and locate the sensor ports for cable attachment. Where you see the three-ports lined up, locate the one positioned farthest from the data key receptacle, this is the *load cell sensor's* port. [From left to

right looking at the enclosure face-on, the ports serve: (a) steam gauge shaft encoder; (b) MMTS thermistor; and (c) the precipitation sensor.]

Remove the socket's metallic cap by unthreading the chained cap. Grip the plug-end of the load cell cable and with a turning motion press the plug into the enclosure's socket so the load cell cable's pins snap into place.

17. Mount the Enclosure and Solar Panel: *(At Observer's Site)*

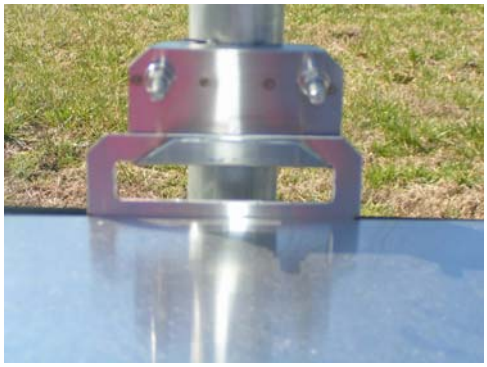
First, ensure the 6 foot pipe-post is secure and concrete footing is properly covered.

17.1 Position the enclosure box so its door faces North. The enclosure is pole-mounted using the supplied mounting hardware or on a tower using site-furnished mounting hardware.

Note: The enclosure box and solar panel must be positioned at least 12 inches below the top of the conical hood when the hood is closer than 10 feet to either the enclosure or solar panel. So, neither shall be mounted in such a way as to form a wind fence that shields the collection bucket or allows snow to collect and shield or form a bridge to the gauge.

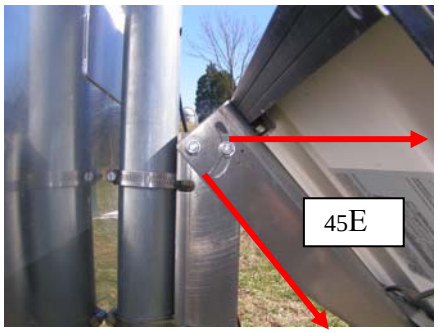
17.2 Using a 9/16 inch wrench, attach the pole hook bracket to the pole using one of the U-bolts. The U-bolts are sized for a 3 inch diameter pole. Use spacers as required if pole is less than 3 inch diameter.

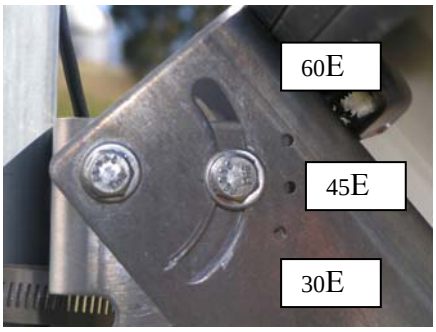
17.3 Hang the steel enclosure box from the pole hook welded to its top rear side.



17.4 Secure the bottom of the steel enclosure to the pole using the remaining U-bolt. Torque to hand tight, do not over tighten to the point where enclosure sheet metal begins to deform.

17.5 The solar panel is mounted on the enclosure pole in the standard configuration. However the panel may be mounted on any other convenient pole within range of the 25 ft cable. The cable may be extended as necessary if more range is needed. Mount the solar panel on the chosen pole using the solar panel manufacturer's supplied pole mounting hardware. Make sure that the solar panel faces due South and is not shaded by trees or other obstructions.





Note: The photo on left shows a panel tilt angle of 45 ^{o} for site at 34 ^{o} latitude. The panel tilt angle is measured *down* from the horizontal plane (e.g., top red line). The photo at right shows indicator holes at 30 ^{o}, 45 ^{o}, and 60 ^{o}, and the panel is set to 45 ^{o}.

Caution: THE PANEL MUST NOT BE SHADED! If any portion of the solar panel is shaded, the panel could effectively shut down and not deliver any real power to the application. The solar panels we use are made from multiple solar cells, connected in series to give the *voltage* needed and then in parallel to give the *power* needed. When a solar cell is shaded it becomes a high resistance to any current impressed upon it. Thus if any individual cell of a series string is shaded, that cell will block the current generated by the other cells in that string, effectively shutting off the output.

Mount the solar panel where it will be fully in sun, not in a fringe area under trees or potentially in the shadow of an instrument tower, utility poles, power lines, phone lines, cable lines, antenna masts, or even guy wires. Problems have been reported where construction or farming resulted in a lot of dust on the panel (charging always got better after a good rain!). Please instruct the Observer to inspect and clean the panel on an 'as needed basis.'

The FPU Kit comes with a 25 ft connecting cable. The cable can be extended as far as you need, provided you use good outdoor rated wire of the same size or larger, and make waterproof connections above ground. If you need to trench the cable, use direct burial rated cable.

17.6 For optimum full-year performance, tilt the panel to the same angle as site's latitude, then further tip the panel down to a more vertical orientation, by 10^{o}, 11^{o}, or 15^{o}, according to the table below. Ensure the panel faces due South. Make this a permanent setting.

Table of optimum tilt angles for various latitudes.

Latitude of Site	Panel Tilt Angle
5 - 20 E Caribbean	Use site's latitude and add 10 E
21-46 E CONUS	Use site's latitude and add 11 E
47-67 E Alaska	Use site's latitude and add 15 E

17.7 With an assistant, lift the 12V battery out of your vehicle and onto a hand-truck or dolly. **Caution:** the battery weights 57 lbs. Use a dolly to move it and plan for two people to lift it up into the enclosure.

Remove terminal covers. Attach the internal battery cable to the battery's terminals using a ½ inch wrench:

red wire to (+) terminal

black wire to (-) terminal

Place the terminal covers back on.

17.8 Open the enclosure.

17.9 Place the 12V battery in the enclosure to the left of the Keypad/Display console. Align the front of the battery to directly face the Keypad/Display console. See the position of battery terminals, positive and negative, in the photo at right.

17.10 Connect the internal battery cable to the white jack marked 'J14 BATTERY' on the printed circuit board. There is only one connector that fits this cable. It is keyed and latches.

At this point the load cell assembly is installed, the plunger piece is aligned over the load cell, the 12V is connected and the system is powered on.

Immediately after the battery cable is plugged in the green vacuum fluorescent display will light-up and the CES splash screen will appear first. After a couple of seconds, the data readings will display. (text box examples, right).

```
Coastal Environmental

Systems, Inc.
```

The FPU is now automatically taking measurements and logging data although the display shows dashes.

```
05/03/21        07:56:25
Rain:           - - - in
Temp:           - - -  F
Shaft:          - - - ft
```

In routine operations, the display gives alternating readings by showing 5-seconds of the **Rain** reading, followed by 5-seconds of **24RainDiff** reading, followed by 5-seconds of the **Rain** reading, and so on.

```
05/03/21        07:56:30
24RainDiff:     - - - in
Temp:           - - -  F
Shaft:          - - - ft
```

Dashes will appear in the current readings for up to 15 minutes and only then will the weighing measurements appear in the display. Due to the data logger's method of reporting 15 minute data elements to the fixed quarter-hour clock, the display might not show stabilized data until the second quarter-hour (i.e., HH:15, HH:30, HH:45, HH:59) mark from the time of power-up.

Note: If the Display is Stuck on "Coastal Environmental Systems, Inc." (i.e., the CES splash screen) or the readings are not updating, or the display is showing gibberish or odd characters, or if the data key writer receptacle is unresponsive, then the data logger might have become 'out-of-synch' with these two devices. This will require you to perform a 'Power Reset,' in Section 20 of this manual, *FPU Assembly Procedural*.

17.11 Locate the 25 ft solar cable: it is labeled CES P/N 6003124006. Locate the 2"x3" black plastic box on the top end the cable. Be careful not to jerk solar cable out of its connections on either end.

17.12 Back in Section 5.4, you stripped the free end of the solar cable - the end to attach to the solar photovoltaic (PV) panel. Now at the Observer's site, determine how many feet of solar cable are sufficient to reach from the immediate back of the solar panel to the bottom of the steel enclosure. Standard mounting configurations will require a minimum of 3 to 4 feet of solar cable. With a tape-measure, and from the 3-pin plug end of the solar cable, mark-off the length you need to keep. Cut the cable at your mark with the wire cutters. Now strip the insulation from the two wires (one solid white, the other solid black). Crimp the supplied bullet connectors onto this stripped cable end. Alternately, you may use spade lugs, wire nuts, screw terminal blocks, or any good connector that makes a good mechanical connection.

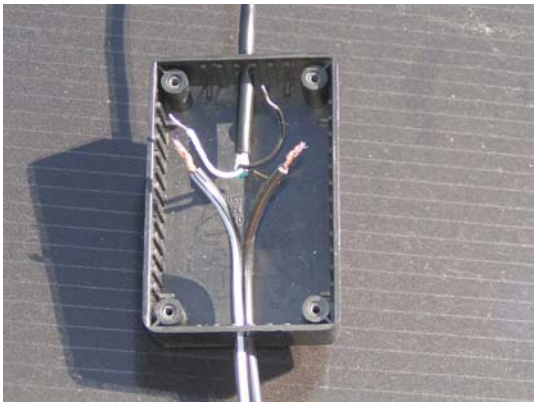
Note: It is unacceptable to simply twist wires together bound only with tape.

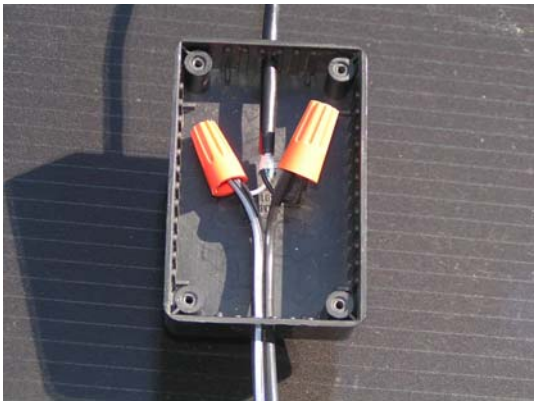
17.13 Open the 2"x3" black plastic connector box and feed-in the cut end of the solar cable through the box's cable orifice.

17.14 Inside the small black plastic box, splice the shortened Solar Cable's two internal wires (one is white, the other black) to the designated wires (figure box, below) on the Siemens photovoltaic (PV) power cord. Remember, the PV power cord is the twin-lead cord with one black strand and one black/white-stripe strand. First, connect the solar cable's black wire to the black strand of the PV cord, and then connect the solar cable's white wire to the PV cord's black/white stripe strand, as shown here. This mimics the procedures in Section 5.4.

Solar Cable **(Shortened plastic cable cut from 25 ft)**	**Solar Panel Underside** **(Soft, twin-lead cord)**
Splice……the **Black** Wire ….. ===➔	Into the **Black** strand.
Splice…..the **White** Wire ….. ===➔	Into the **Black/White-Stripe** strand.

Caution: Ensure these wires are spliced to the correct color coded strands to prevent damage to the data logger. In the photos below, the solar panel's short twin-lead cord is shown feeding into the bottom of the box. In the photos, the left strand of the twin-lead cord is the one with black/white stripe, and the strand on its right side is solid black.





17.15 Using tie wraps, strain relief the solar panel cable on the inside and outside of the solar panel cable connector box. Now you can dab RTV (room temperature vulcanizing) silicone spray sealant on cable holes, trim tie wraps, and close the box. Close the box with the 4 screws. Secure the box under solar panel to keep it out of direct weather.

17.16 Ensure the solar panel you mounted in Section 17.5 is receiving full sun. The panel is generating voltage and should be reaching the 3-pin plug at the end of the solar cable.

17.17 Locate the 3-pin plug at the end of the solar cable and notice the fine print, '**A**' for positive terminal and '**C**' for negative terminal. Use the multi-meter and place one lead on the "**A**" terminal, and the other lead on the "**C**" terminal. In full sun, the voltmeter should read between **20V** and **25V**. If in full sun and readings are zero, check the solar cable's wiring connections in the small black box.

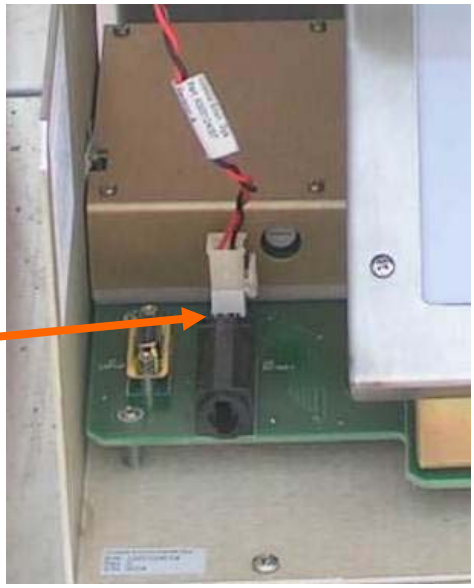
17.18 Disconnect the 12V battery by unplugging the battery cable at its white connector jack on the printed circuit board. Note: Leave the solar cable unplugged while disconnecting the 12V battery.

17.19 View the underside of steel enclosure box and locate the solar cable port. It is the only socket that stands apart from the other three sockets. It is located toward the front of the bottom surface, near the door.

Now, connect solar cable to its port on the underside of the steel enclosure. Press-on and twist the solar cable plug until you feel its three pins snap into a lock fit.

Regulator Checkout: With the solar panel in full sun, ensure the battery cable is disconnected (Section 17.18, above) from the circuit board. Check the keypad display (press <**ENT**>) to see that it illuminates to confirm that just the solar panel is powering the FPU system.

The Battery Cable Receptacle is the white connector jack is located on printed circuit board ½ inch behind the data key receptacle.



Use one probe of the voltmeter to touch the lower-left pin (**positive**) in the white plastic receptacle (see diagram at right, of J14 BATTERY receptacle). With voltmeter's other probe, touch the lower-right pin (**negative**). The voltmeter should register a voltage between **12.4V** and **13.8V** in full sun. This is sufficient to charge the battery.

O	O
+O	O-

J14 BATTERY

17.20 With the 12V battery still unplugged, unplug the solar cable from the underside of the enclosure.

17.21 Now reconnect the 12V battery cable plug into the white plastic battery cable receptacle on the circuit board.

Caution: Ensure the 12V battery is connected first, before ever reconnecting the solar cable to the Enclosure.

17.22 Finally, reconnect the solar cable to its port on the underside of the steel enclosure. Press-on and twist the solar cable plug until you feel its three pins snap into a lock fit. Now, the FPU is being powered by the 12V battery with the solar panel is charging it. Keep both connections plugged in, for standard operating procedures.

18. Check Calibration with 5 Inch Equivalent Weight: *(At Observer's Site)*

Note: Wait at least 30 minutes after system power-up at the Observer site before taking the Cal Check measurement. If the GMA was only recently powered up, there may be no data available as indicated by dashes ("- - - "). Data will display at the first quarter-hour mark (i.e., HH:15; or HH:30; or HH:45; or HH:00) after power-up, but stabilized data may not display until the second quarter-hour mark, if power-up was within 5 minutes prior to the first quarter-hour mark.

18.1 Enter Operator Notation, "150, End of Valid Data."

18.2 Wait one minute or so for the **Rain:** values to stabilize. Now take a reading of **Rain:** at the keypad display. Write down this un-weighted value.

18.3 Then place one, two, or three large brass weights (4111g each) in the bucket. Your office already has the F&P calibration weight set, its agency part number is: D111-TE500.

18.4 Now take the new reading of **Rain:** at the keypad display. Wait one minute or so for the **Rain:** values to stabilize. Write down this weighted **Rain:** value.

18.5 Subtract the first reading written in Section 18.2 from the new reading taken in Section 18.4. Write down this difference in hundredths of an inch.

18.6 If the difference falls into the acceptable range (below), the calibration is acceptable and full calibration is not needed. Then enter notation '220, Cal Check – No Changes.' If any difference falls outside of its respective range listed below, then you will need to do a full calibration as described in Appendix Four of this manual. Then enter notation, '221, Cal Check – New Values.'

CAL TEST OPTIONS	WEIGHTS REQUIRED	ACCEPTABLE RANGE
5.0" equivalent rain	1 large weight	4.75 " thru 5.24"
10.0" equivalent rain	2 large weights	9.75" thru 10.24"
15.0" equivalent rain	3 large weights	14.75" thru 15.24"

Note: Always take the un-weighted measurement first, and then place the weight in bucket to get the weighted **Rain:** value.

18.7 Remove the weight(s) from the bucket.

18.8 Remember to initial charge the bucket. Add ½ Quart of oil and enter; '163, Added Oil', then if you added antifreeze, enter: '164, Added Antifreeze.' Finally, conclude the calibration check by entering, '255, Start of Valid Data.'

Note: See Appendix C, for a ready reference of this Calibration Check Procedure.

19. Final Checkout of System Operations: *(At Observer's Site)*

19.1 Verify Data Key Operation: *(Perform this Task at Observer Site)*

With the display active, insert a data key into the data key receptacle.

Turn the data key one-quarter turn clockwise.

Watch the keypad display for verification of key insert.

Watch the keypad display for verification of key download.

Watch the keypad display for notice of key download completion and request for removal.

Remove the data key.

Verify the display returns to the current readings, **Rain:**, and, **24RainDiff:**.

When will Data Key Writer Not Work?:

Anytime the power to the data logger has been 'turned off' and 'turned on', the fifteen minute scheduler gets reset, and this produces an interruption to the user in his ability to retrieve records or use the FPU system through the next quarter-hour on the real-time clock. Most functions, like data key writing, and displaying of readings, which are not part of the internal data measurement pathway, may be unresponsive until the second scheduled reading takes place (e.g., 30 minutes after 'power up').

Also, when you enter Calibration Coefficients to memory, this will cause an interruption to the fifteen minute scheduler even though you never powered the electrical circuit off or on! Whenever you have taken a Zeno menu action that turns off the data sampling, such as entering new calibration data, the data key writer will be rendered unresponsive for the first two 15 minute intervals. Likewise, you will have to wait 30 minutes for the key

writer to work whenever you load a Configuration code file (i.e., BattV) to EEPROM.

If you try to use the key writer to download data, you will get no action, because the program has yet to run through its first two data logging intervals. After the first scheduled reading time, the program has run once and data should be available to the S1, 1 command. But data may not be available from memory (and therefore to the key) yet. Some processes take multiple samples, then the logger will ignore your request until all the multiple samples are taken and it has developed a finished reading.

You can learn when the first new data record will be produced, when upon exiting the Zeno Program Menu, the system sends a message "Data Collection Starting In XX seconds." Just look for the current clock time on the Zeno display and be aware of when this real-time clock will reach the upcoming quarter hour mark, and the following quarter hour mark (e.g., 09:44:58, then 10:00:58).

Note: The data logger is first and foremost a schedule driven machine, and is not awake and fully functional between the times of a scheduled reading. If you give the *initial* power-up at 12:01, and the logger is programmed to take readings at 15 min intervals starting on the hour, nothing will happen until 14 minutes later, 12:15, when the logger wakes up and runs through its programmed operations for the first time. Until 12:15, if you try to look at the stored data, the Zeno will tell you there is not any, even when the memory actually has stored data. If you try to look at the scrolling sensor output, S1, 1 command, you will only get the '**no data taken yet"** flag of "**-1000000".**

Caution: The data key writer can be upset and require a full resetting, that will demand a full system 'Power-On Reset', if an electrical transient or EMI effected the system. This could occur when testing the solar panel with battery unplugged. The keypad Display is also vulnerable to electrical transients and will appear 'frozen' and force you to conduct a Power-On Reset to resolve the problem.

Power-Reset to Restore Data Key Reader Device:

a) Either throw a coat over the solar panel, or disconnect the solar panel connector from the underside of the steel box enclosure.

b) Disconnect the white battery connector inside the enclosure next to the data key receptacle.

c) Count to 10. The display should be off. If it is ***not*** off, the solar panel is still getting light through the cloth covering the solar panel, so then, disconnect the the solar panel cable plug from beneath the enclosure box.

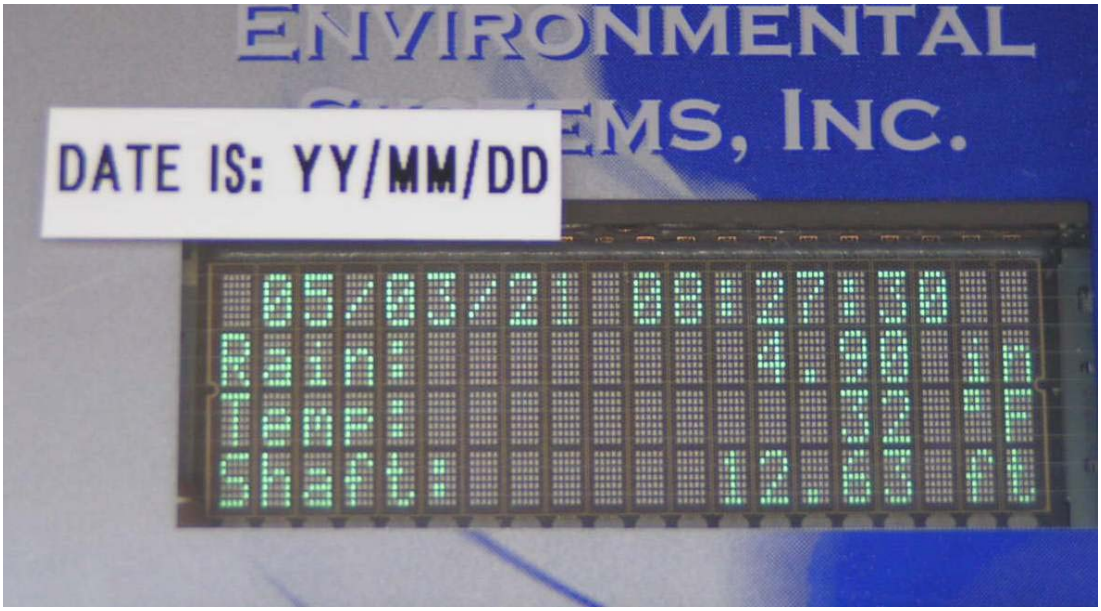
d) Insert the battery cable plug into its white receptacle. CAUTION: The battery connector only goes in one way, do not force it. The display should light, first with the Coastal splash screen, and then with the data screen).

e) If the above displays are working, then insert the solar cable plug back into the socket at the bottom of the steel enclosure. You are done. You will be able to use the Data Key writer in about 30 minutes.

19.2 Verify Date/Time (YY/MM/DD HH:MM:SS): *(Perform this Task at Observer Site)*

View the keypad display with its current values. Is the date and time correct within 2 minutes of local standard time (just for this installation work)?

If not, use **Up-arrow** to call-up the Date & Time Menu. See Section 4, of this manual..



Example: Current Date & Time:
05/03/21 08:27:30
New Date & Time:

Important: In the above example the **05/03/21** is the proper display for March 21, 2005. Specifically, the **05/** signifies year 2005; the **/03/** signifies month of March; and the **/21**, signifies the 21st day of month of March. The time, **08:27:30** is the proper display for 8:27:30am local Standard time in the 24 hour convention.

Remember the Date is YY/MM/DD format!

Type in the correct date and time and then press **<ENT>** button to exit this menu.

POWER RESET TO RESTORE DISPLAY READINGS: While the FPU system is powered in its nominal operational mode (i.e., solar charging of the 12V battery, with 12V battery powering the unit), you will need to conduct a Power Reset to correct the problem.

a) Either throw a coat over the solar panel, or disconnect the solar panel connector from the underside of the steel box enclosure.

b) Disconnect the white battery connector from the socket near the data key receptacle.

c) Count to 10 . The display should be off. If it is ***not*** off, the solar panel is still getting light through the cloth covering the solar panel, so then, disconnect the the solar panel cable plug from beneath the enclosure box.

d) Insert the battery cable plug into its white receptacle. CAUTION: The battery connector only goes in one way, do not force it. The display should light, first with the Coastal splash screen, and then with the data screen).

e) Insert the solar cable plug back into the socket at the bottom of the steel enclosure, if everything is working. You are done. The initial 'finished readings' will start to appear within 30 minutes.

19.3 Verify Operator Notations: *(Perform this Task at Observer Site)*

Press the **Up-arrow** to call-up the Sensor Notation Menu shown here.

Valid numbers are from 0 (zero) to 255.

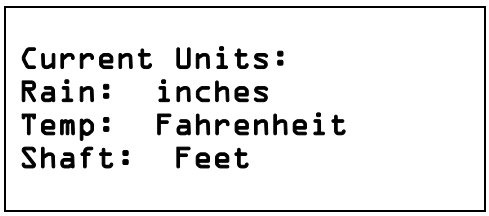
Type **123** on keypad and it will show "123" on the display. Now press **<ENT>**. This should generate a message that says, "VALUE ACCEPTED".

Now try a number outside of this range; type **256** on keypad and it will show "256" on the display. Now press **<ENT>**. This should generate a message that says "INVALID VALUE".

19.4 Verify Display Units: *(Perform this Task at Observer Site)*

Press the **Up-arrow** button to call-up the Display Units Menu, shown here.

If anything needs changing, press **<X>** button on keypad. This starts a sequence that walks through all Rain, Temp, and Shaft, options allowing you to select new units, or simply press **<ENT>** to leave them as they were.



Change temperature units to Celsius to verify that this function is working.

Verify the units change on the data display screen.

Then reset the units to the default ones shown in this figure box.

What if RAIN Values Vary each Cycle?: A poor connection at the load cell or a faulty load cell cable might cause the **Rain:** values to vary each cycle. See the trouble

shooting instructions at the end of section 19.6, below.

19.5 With Laptop PC - Verify COOP Station ID: *(Perform this Task at Observer Site)*

Access the ZENO User Menu with laptop connected to maintenance port next to the keypad. For step by step instruction, refer to Section 8, on page 27.
Type **f<enter>** to access System Functions Menu.

Type **c1<enter>** to edit item 1 (station ID), if needed.

Proof the station ID number. It should be of format ##00####. For example, here's a hypothetical station in Texas, 41005678, the 4100 is the state code (Texas=41) and 5678 is the station index number. Verify this number is correct for the site to receive this unit. Change the number if needed.

Type **e<enter>** to save this information to non-volatile memory.

Type **q<enter>** to exit.

19.6 Check Data Logging with Laptop: *(Perform this Task at Observer's Site)*

Access the Zeno User Menu, refer to Section 8 (p.27), for instructions.

Type **d<enter>** to access the data retrieval menu.

Type **L3<enter>** to display the last three data records.

Are the measurements the same as has been on the display for the last 45 minutes?

If YES, then it is logging data properly.

Type **q<enter>** to exit the ZENO User Menu.

```
USER MENU
(C) Comms Menu            (T) Test Menu
(F) SysFuncMenu           (Z) ZProgMenu
(S) SampPerMenu           (Q) Quit
(D) DataRetrMenu          (H) Help

> d

DATA RETRIEVAL MENU
(A)  AFTERTime            (F) Flashnfo
(B)  BETWEENTime          (D) DeleteAll
(Ln) LASTnRecords         (N) NumberLogged
:
(Enter 'X*'Send All Data Sets Via X-Modem)

>L3

Hit The Space Bar To Halt The Log Data Output.
DATE,TIME,RainOrNote,ThDegC,Tmax,Tmin,BatV,
05/03/25,21:44:58,1,14.95,0.00,0.00,0.00,12.07
05/03/25,21:29:58,1,15.01,0.00,0.00,0.00,12.09
05/03/25,21:14:58,1,15.01,0.00,0.00,0.00,12.09

DATA RETRIEVAL MENU
(A)  AFTERTime            (F) Flashnfo
(B)  BETWEENTime          (D) DeleteAll
(Ln) LASTnRecords         (N) NumberLogged
:
(Enter 'X*'Send All Data Sets Via X-Modem)

> q
Exiting user interface.
```

The final functional check-out of FPU system operations is now complete.

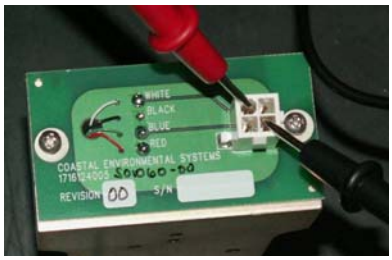
Note: Enter notation 255, 'START of Valid Data,' to signal a return to full service.

What if the RAIN display gives large positive or negative numbers?

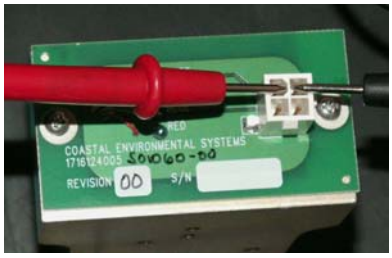
If your system was working fine with realistic readings for RAIN but is now reading 60 to 99 inches or likewise -60 inches to -99 inches (negatively signed high values in the keypad display), then suspect a problem with either the Load Cell or the Load Cell Cable. If a lightning surge burns out one of the four strain gauges in the load cell, the sensor will measure a large positive or negative signal. This results in a RAIN reading that is 80 to100 inches and possibly negatively signed, for a typically calibrated rain gauge.

Prior to calibration, for the setup conditions of A=0, B=1000, and C=0, the numbers will be in the 60 to 70 inch range and possibly negatively signed. Check the load cell with a volt/ohm meter set to 'Ohms' on a scale to show 10,000 ohms. Disconnect the cable, and probe the Diagonal pin pairs. You should see about 10,000 ohms on both pairs.

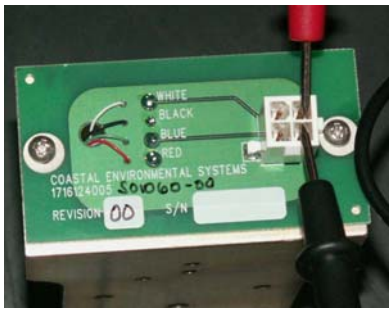
Next, probe corner to corner on each of the flat sides of the connector, working through all 4 pairs. You should see about 7,500 ohms. The numbers may not be exactly 10,000 or 7,500 ohms, but it is very important that both diagonal pairs read very close to the same, likewise for the four side-by-side pair checks. Finally, check the cable to verify that there are four (4) good wires and that none of them are shorted together.



If your forecast office does not possess an 'FPU Test Plug", then order one from the National Logistics Supply Center. It has an agency stock number (ASN) of D111C-1A1T1. You will use the Test Plug as a temporary replacement for the Load Cell with the purpose of verifying the data logger and load sensor connections are working as a first step in troubleshooting.



Caution: Some offices have returned what they thought was defective Load Cell Cables. Inspection of the individual sockets in the white square connector, were spread open as if a Volt-Ohm_meter probe had been inserted. Forcing a probe into these stamped metal contacts, bends them out of position and renders them unreliable.

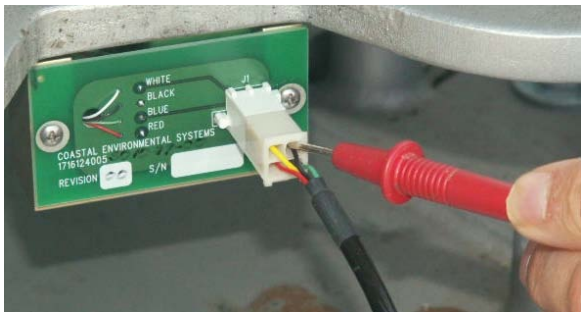


If you must check the Load Cell Cable for continuity, probe the back of the white connector, along-side the wire – it does not matter if you inadvertently bend the back of the contact.

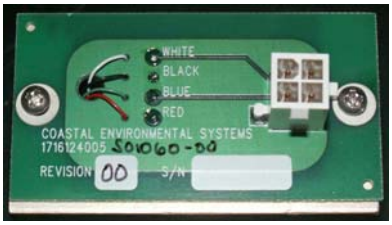
If you have a problem cable, look at the face of the white connector and examine the socket

contacts within. They should be a perfect circle, with space all around them from the plastic bore of the connector, and the two expansion slits should be practically closed. If the slits are wide and the two hemispherical halves of the contact are spread to touching the bore, a needle or sharp pin can be used to GENTLY pry between the bore and socket half to bend it back into position. If needed at all, reposition BOTH halves to the center, don't bend one all the way over to the other.

When you check the load Cell Cable for continuity, obviously check for a direct connection between two pins, but also check that there are no other connections to each individual wire, and to the shield. The shield is connected to the backshell of the circular Mil connector, no connection at the white plastic connector. A lightning damaged cable may have one or more wires shorted together or to the shield. **If you find shorted wires, the cable must be replaced**.



Follow these instructions for the FPU Test Plug:



1. Substitute the Test Plug for the Load Cell.

a. Unplug the Load Cell Cable's white jack from the white socket on the green printed circuit board.

b. Insert the FPU Test Plug into the jack on the Load Cell Cable.

2. View the Keypad Display and read what numbers appear for the value of RAIN:

a. If you have entered the three calibration data values A, B, and C, in flash memory then your RAIN reading should display as being within plus or minus 0.05 inches of the numerical value of the C coefficient.

b. If your system is uncalibrated, and the C coefficient equals '0', and your RAIN reading should read plus or minus 0.05 inches in the keypad display.

3. Determination of Measuring Circuit and Cable Performance:

a. If the displayed value of RAIN agrees with the numbers listed in step 2, and remain steady within a few tenths of an inch, then the GMA load cell measuring circuit and the load cell cable are operating properly.

b. This determination does *not* prove the load cell sensor is operating without error.

c. This determination does *not* prove the calibration settings are correct.

20. The 'Power-On Reset' Method: *(At Observer's Site)*

The Power-On Reset is useful when the Display has frozen and pushing buttons fails to wake- up the unit. The Power-On Reset causes no interruption to the logging of data – only a 30 minute interruption in the display of current readings. Use the Power-On Reset technique to restore the system to full operating performance, when these conditions persist:

- The keypad display is frozen on "Coastal Environmental Systems, Inc" splash screen.
- The keypad display is not updating with RAIN and RAINDIFF values every 5 seconds.
- The keypad display is showing gibberish or odd characters.
- The Data Key Writer is unresponsive.

Explanation: The FPU display and Data Key Writer operate independent of the Zeno data logger. There are a few instances when the FPU display can get out-of-sync with the data logger and 'lock up' resulting in the four conditions noted above. Most of the time when this happens, the Zeno data logger is happily working away collecting data as it should – it was designed to do this so no data would be lost. The only way to re-sync the display to the logger is to conduct a POWER-ON RESET. You must remove all power from the GMA and re-apply power.

While the FPU system is powered in its nominal operational mode (i.e., solar charging of the 12V battery, with 12V battery powering the unit), you will need to conduct a Power Reset to correct the problem.

a) Either throw a coat over the solar panel, or disconnect the solar panel connector frun the underside of the steel box enclosure.

b) Disconnect the white battery connector inside the enclosure next to the data key receptacle.

c) Count to 10. The display should be off. If it is ***not*** off, the solar panel is still getting light through the cloth covering the solar panel, so then, disconnect the the solar panel cable plug from beneath the enclosure box.

d) Insert the battery cable plug into its white receptacle. **Caution**: The battery connector only goes in one way, do not force it. The display should light, first with the Coastal splash screen, and then with the data screen).

e) Insert the solar cable plug back into the socket at the bottom of the steel enclosure, if everything is working. You are done. The initial 'finished readings' will start to appear within 30 minutes.

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APPENDIX A – PLANNING CONSIDERATIONS FOR F&P UPGRADE

COOP Site Preparation:

Perform the following tasks at Observer Site at least 1 week prior to scheduled FPU installation:

Purchase a 6 ft post pipe, or an 8 ft post pipe for deep snow locations and sites with soft soil.

Dig an anchor hole within 5 feet of the existing F&P three-legged mooring.

Pour cement into anchor hole and brace the pipe post vertically into the cement.

Preparations in WFO:

Prepare a spare F&P gauge.

Unpack, inspect, assemble, and checkout the FPU Kit.

Charge the 12V Battery overnight.

Assemble FPU and Checkout in WFO:

Install load cell sensor.

Perform preliminary calibration.

Splice solar cable and test solar charging voltage.

Prepare for Transport:

Carefully secure newly assembled components inside vehicle.

Read your checklist of Tools and rain gauge equipment before and after packing the vehicle.

Install the FPU at COOP Site:

Remove F&P Punch Block from Pedestal

Install FPU Assembly to Pedestal

Hang the Enclosure on pipe post.

Mount the Solar Panel.

Perform Solar Charging Check.

Perform Cal Check.

Perform Data Logger Check.

Metadata and Operational Implementation Tasks at WFO:

Update the B-44, ***Equipment Description,*** to account for Data Logger serial number.

Transmit Public Information Statement (PNS) within 5 days after operational implementation to report month, day, year, of transition.

Dispose of used, non-repairable F&P equipment at the WFO in accordance with policy issued by NWSHQ, Logistics Branch in April 2005.

Begin 30-day monitoring and coordination with the Observer.

Submit ***Operational Implementation Checklist_B*** signed by MIC and mail or fax to RCPM.

FPU OPERATION AND MAINTENANCE HELP

Maintenance: Preventative and corrective maintenance procedures for the FPU are found in the CES's ***Fischer-Porter Upgrade Technical Manual***, Ver 3.2, Section 6.

Technical Assistance: Technical and operational assistance may be requested from David Desrosiers, Engineering & Acquisition Branch (W/OPS11), at (301) 713-1845 x115, or E-Mail David.desrosiers@noaa.gov

SITE PREPARATION: INSTALL MOUNTING POLE

COOP Site Preparation: A 6 foot tall post-pipe shall be planted within 5 feet of the existing F&P three legged mooring. The legacy F&P three legged mooring shall stand and serve as the foundation for the FPU catch bucket and weighing assembly. The action to install the FPU data logger pole must be completed at least one week (7 days) prior to mounting the FPU equipment. This 6 foot post pipe will bear the heavy weight (approximately 90 lbs) of the steel enclosure box, 12V battery, Zeno data logger, and the solar panel.

Regional Manager Responsibilities: Some cooperative stations have a non-standard mounting for their F&P equipment. For just these few locations, the NWSREP shall phone his Regional Cooperative Program Manager (RCPM) and ask if a conventional mounting configuration is possible. Only the RCPM may authorize an NWSREP to plan for an alternate FPU mounting. The alternate mounting option involves only a single foundation in the ground, and not two per the standard described in the paragraph above.

NWSREP Responsibilities: Install the new post-pipe no farther than 5 feet from the original F&P mooring, so just the data logger, battery, and solar panel are mounted together.

The NWS Representative (NWSREP) is the installation officer and will phone the COOP Observer and ask him/her to describe current F&P configuration whether it is mounted with three legs, one pole, raised platform, or other. Also, inquire with the COOP Observer about the ground composition. Is the top thirty inches composed primarily of compacted soil, clay, stony, or sandy substrate?

For either option, the NWSREP shall purchase a standard 6 foot pole available from commercial off the shelf (COTS) hardware stores as a schedule 40 iron pipe or chain link fence corner post. This is known as a pipe post with a 2½ inch outside diameter. The NWS will permit an exception for the procurement of an 8 foot pole for sites with greatest snow depth and/or softest ground soil.

In either configuration, the pipe post must be Schedule 40 galvanized steel to support the weight without bending or twisting. If possible, weld a square one quarter inch thick plate to the pipe 14 inches from the bottom of the pipe, to resist the twisting force caused by wind. Alternately, the pipe could be drilled and rebar inserted to prevent twist.

The pole should be sunk at least 24 inches below surface level, in solid compactable dirt, deeper if in sandy or loose soil. Typical pipes cost about $12; and $70 if the welded footer plate is added.

If not set wholly in concrete, the pipe post will require a footer for support; and a flat rock in the bottom of the hole will work fine. The hole may be filled completely with concrete or backfilled with dirt to within a foot of the surface, tamped, and then filled with concrete. The concrete at the surface is required to resist the twisting and levering forces of wind on the large enclosure and solar panel.

Estimated Time Required for Pole Installation: An estimated three hours (Not including time to purchase or prepare welded pipe pose) will be required to dig the anchor site, prepare cement,

pour the cement footer, refill and compact the soil about the pipe post. An additional 2 hours might be necessary to mount the data logger and solar panel, connect sensor cables, and setup/configure the modified precipitation gauge, and perform final installation checkout tests.

APPENDIX B – NOTATION CODES TO ENTER MANUALLY

Use the numeric keypad in the enclosure to enter 3-digit codes to account for the checks and maintenance activities you perform on the FPU.

Notations made by **Observer** range from **100 to 140**.

Notations made by NWSREP range from 150 to 255.

Codes the Observer May Enter:

Code	Meaning of Observer Codes
100	**END of Valid data**
103	**Time is more than 15 minutes fast/slow**
104	**Routine Gauge Check**
114	**Foreign Object Found in Bucket**
115	**Emptied Bucket – Bucket completely emptied**
116	**Partially Emptied Bucket – Some liquid left in bucket**
117	**Added Oil to Bucket**
118	**Added Antifreeze to Bucket**
125	**Installed Funnel**
126	**Removed Funnel**
140	**START of Valid Data**

Codes the NWSREP May Enter:

Code	Meaning of NWSREP Maintenance Code
150	End of Valid Data
151	Annual Visit
152	Semi-Annual Visit
153	Liaison Visit
154	Emergency Visit
156	Data from GMA copied to data key
158	Time is more than 15 minutes slow.
159	Time is more than 15 minutes fast.
160	Emptied bucket
161	Emptied and cleaned bucket
162	Partially drained bucket – some liquid remains in bucket
163	Added Oil to bucket
164	Added Antifreeze to bucket
166	Installed new bucket to replace damaged bucket
169	Foreign Object Found in Bucket
170	Installed Funnel
171	Removed Funnel
174	Installed Auto-Syphon
175	Removed Auto-Syphon

180	Cleaned F&P Case
181	Cleaned Solar Panel
182	Cleaned MMTS sensor
183	Cleaned GMA
190	Replaced one or more Flexures
201	Replaced MMTS sensor
210	Replaced GMA – A completely new GMA was installed
211	Replaced GMA battery
213	Replaced Load Cell in FPU
217	Installed Configuration Code* – Original Issue with FPU Kit
218	Installed Configuration Code* – Battery Voltage Tracker
219	Installed Configuration Code* – Future Potential (i.e., Precip Data QC)
220	Calibration Check – No changes to previous values
221	Calibration Check – New values were entered
230	Gauge moved to a compatible location – equipment move
231	Gauge moved to a non-compatible location – station relocation
232	Gauge removed from service – placed in storage
233	Gauge put back in service after being in storage
255	START of Valid Data

* CAUTION: First make a copy of the data logger contents (i.e., 12 months' records) before you install any Configuration Code file. Configuration code replacement erases all data in the logger!

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APPENDIX C – CALIBRATION CHECK PROCEDURE

1. Enter Operator Notation, "150, End of Valid Data."

2. Partially drain the bucket so the oil layer has lowered to a level below the top of the cone base of the center post. Enter notation, '162, Partially Drained Bucket.'

3. Wait one minute or so for the **Rain:** values to stabilize. Now take a reading of **Rain:** at the keypad display. Write down this un-weighted value.

4. Then place one, two, or three large brass weights (4111g each) in the bucket.

5. Now take a new reading of **Rain:** at the keypad display. Wait one minute or so for the **Rain:** values to stabilize. Write down this weighted **Rain:** value.

6. Subtract the first reading written in Step 3, from the second reading taken in Step 5. Write down this difference in hundredths of an inch.

7. If the difference falls into the acceptable range (below), the calibration is acceptable and full calibration is not needed. Then enter notation '220, Cal Check – No Changes.' If any difference falls outside of its respective range listed below, then you will need to do a full calibration as described in Section 9 (pp. 32-38), of this manual. Then enter notation, '221, Cal Check – New Values.'

CAL TEST OPTIONS	WEIGHTS REQUIRED	ACCEPTABLE RANGE
5.0" equivalent rain	1 large weight	4.75 " thru 5.24"
10.0" equivalent rain	2 large weights	9.75" thru 10.24"
15.0" equivalent rain	3 large weights	14.75" thru 15.24"

Note: Always take the un-weighted measurement first, and then place the weight in bucket to get the weighted **Rain:** value.

8. Remove the weight(s) from the bucket and dry them with a paper towel.

9. Remember to enter '164, Added Antifreeze' if you add antifreeze. Finally, conclude the calibration check by entering, '255, Start of Valid Data.'

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APPENDIX D – BATTERY VOLTAGE CONFIGURATION FILE

Refer to Section 10, Examine Configuration File, in this manual, ***FPU Assembly Procedural***, for NWS headquarters policy on field site alteration of FPU configuration files for battery voltage tracking.

What does the Battery Voltage Tracking Configuration (BatV) File look like?

```
* Zeno 3200 System Setup File
* Program Version And Date: ZENO-3200 (GMA) using ZENOSOFT V1.966-2637-GMA-1.3 May  9 2002
10:33:50 CS 2BAE
* (C)opyright 1995-2002, Coastal Environmental Systems, Seattle, WA, USA.
* Setup File Date And Time: 02/11/01 10:26:30
PARAM1 900 0 898 2 12 20 6 6 9600 9600
PARAM2 9600 0 0 0 0 2 1 0 0 0
PARAM3 16777 0 60 18 0 0 0 0 0 2
PARAM4 2 2 0 0 1 3276804 0 -1 5 0
PARAM5 2 0 0 0 100 0 0 0 0 0
PARAM6 0 0 0 1015660800 50336144 151 196608 0 1 0
PARAM7 151 0 1280 0 10000 -1 -1 0 10 1
PARAM8 42 0 0 0 0 0 0 0 0 0
PARAM9 0 0 0 0 0 0 5 0 0 0
PARAM10 0 0 0 0 1200 -1 0 5 100 0
PARAM11 8 1 1 0 8 1 1 0 8 1
PARAM12 1 0 3
PARAM13 "NONE" "NONE" "NONE" "NONE" "NONE" "NONE" "" "ZENO" "" "NONE"
PARAM14 "" "ZENO-3200-Reset" "Real-Time-Clock-Suspect" "Logging-Memory-Initialized" "Serial-Sensor-
COM-Failure" "EEP" "" ""
"" ""
PARAM15 "" "" "" "" "" "" "" "" "" ""
PARAM16 "" "" "" "" "" "" "" "" "" ""
PARAM17 "" "" ""
REPEAT1 -1 -1 -1 -1 -1 -1 -1 -1
CONSTANT1 0 0 0 0 0 0 0 0 0 0
CONSTANT2 0 0 0 0 0 0 0 0 0 0
GSI 1 NO_COMMAND
SENSOR 3 "RainWeight" 1 1 0 0 3 0 0 1 0 3 0 2077.36 -8.0757 0 0 0 0 0 0 0 0 S0.1  "SN:XXXXXXXXXXXXX"
""
SENSOR 2 "AirTemper" 9 0 2 0 2 0 0 1 0 3 0 0.4 0 0 0 0 0 0 0 0 0 S0.1  "SN:YYYYYYYYYYYYY" ""
SENSOR 1 "Battery" 2 0 0 0 0 0 0 1 0 3 0 1 0 0 0 0 0 0 0 0 0 S0.1  "SN:ZZZZZZZZZZZZZ" ""
SENSOR 8 "DataKey" 1 0 0 0 0 0 0 1 0 2 0 -1 1 0 0 0 0 0 0 0 0 S0.1  "" ""
PROCESS 4 1 "AirTDegC" S2.1 0.000969368 0.000232959 7.98213e-08 18700 100 -100 0
PROCESS 5 16 ".05degT" P1.1 2 5
PROCESS 7 2 "Tmptures" P2.1 0
PROCESS 7 3 "Rains" S1.1 0
PROCESS 1 2 "AvgBat" S3.1
PROCESS 7 1 "" S1.1 P2.1 S3.1 P5.1 P4.4
PROCESS 7 4 "KeyDatTx" S4.1
PROCESS 7 5 "SensrNtn"
PROCESS 3 10 "LogSnNt" P8.2 0.5 3 1
PROCESS 3 10 "24hrMSG" P4.5 0.5 2 1
PROCESS 3 13 "ExtraTx" 0 384 1 3A51C2B2
PROCESS 3 10 "Transmit" P11.1 0.5 1 0
DATA 6 1,2,3,4 "<0D><0A>" P1.1 0 0 1 P1.1 P1.1 P1.1
DATA 6 1 "GMA:" P1.1 0 0 1 P1.1 P1.1 P1.1
DATA 16 1,2,3,4 "" P1.1 0 0 1 P1.1 P1.1 P1.1
DATA 15 1,2,3,4 "RainOrNote" P4.2 2 11 8 P4.4 P8.1 P4.1
```

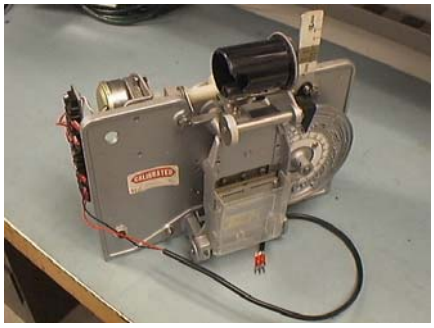
```
DATA 15 1,2,3,4 "ThDegC" P3.6 2 7 8 C1 C1 P3.5
DATA 15 1,2,3 "Tmax" P3.1 2 7 8 P3.3 C1 C1
DATA 15 1,2,3,4 "Tmin" P3.2 2 7 8 P3.4 C1 C1
DATA 15 1,2,3,4 "BatV" P5.1 2 5 8 C1 C1 P5.1
DATA 7 1 "P24d->DCOM" P4.4 2 5 1 P1.1 P1.1 P1.1
DATA 6 1 "!" P1.1 0 0 1 P1.1 P1.1 P1.1
*    ! ! SYSTEM TRANSFER COMPLETE.
*    Turn Off File Capture Now.
*    Enter Any Key to Continue.
EOF
```

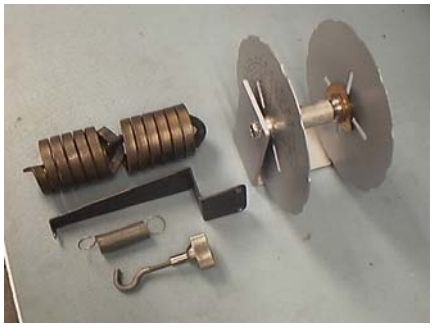
The NWSREP may download the authorized file, named “FPU_ConfigFile_PrecipBattVolt.txt”, from NWS Headquarters webpage: http://www.nws.noaa.gov/ops2/Surface/coopimplementation
.

APPENDIX E – DISPOSITION OF OLD F&P PARTS

Disposition of Replaced Items: NWS Logistics has determined that it is not practical to mix used parts with stocked new parts. Instead, they recognize that as you strip these gauges, you will know if the parts you are removing are worth retaining for use with your remaining gauges. Please retain for local use the parts identified below, and dispose of the remainder locally.

- From the punch tape mechanism, please retain the:
  - punch block and pin assembly,
  - the clock motor and microswitch assembly,
  - the two wrap cables,
  - the chad catcher,
  - the plastic upper tape spool and spring,
  - and any other parts you have needed before.





- Please keep these small parts,

- And any model, electronic timer and bracket.

There are a few WFO's that are upgrading all the F&P's in their area. The NWSREP at these sites should contact their RCPM to make arrangements to disperse the spare F&P parts to other WFO's.

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APPENDIX F – EFFECT ON NATIONAL DIRECTIVE SYSTEM (NDS)

1. Engineering Handbooks (NWS):

The following content in EHB-10 is superseded by the, ***FPU Operations Manual*** (Sep 2005), and, ***FPU Assembly Procedural*** (August 2006), issued by the NWS, Observing Services Division (W-OS7):

Section 1.2: Items 10-204, 10-206, 10-207, and 10-208.

Section 4.2: Revised maintenance schedule for Fischer & Porter Punched Tape Precipitation Gage, April 30, 1976.

The following content in EHB-1, Issuance Number 02-11 (Nov 1, 2002), needs to be supplemented for the new Fischer-Porter Upgrade (FPU) equipment

Section D: Hydrologic Equipment; Instrumental equipment listings.

The NWS Logistics Branch (W/OPS14) has assigned Agency Stock Number (ASN), a National Stock Number (NSN), a Source, Maintenance and Recoverability (SM&R) Code, and description of the FPU equipment for the EHB-1, Sec D.

2. Vendor's Manual Supplied with the NLSC Kit:

The Coastal Environmental Systems (CES) handbook, '***FPU Technical Manual***, version 3.2 (Feb 5, 2003), is part of the contract deliverables to the Government. Caution is advised because version 3.2, contains several instances of erroneous instructions. You are advised to use the NWS headquarters issued "***FPU Operations Manual,***" dated June 2005.

a. *FPU Technical Manual v3.2* (Feb 5, 2003), delivered with kit on CD-ROM and print. **Note**: Do not use this document to calibrate the FPU load sensor.

   Use only '*FPU Assembly Procedural (July 2006)*' or the OPS11 edited version of the contractor's *FPU Technical Manual, version **2.2***, it is dated December 4, 2003. Access either on: http://www.nws.noaa.gov/ops2/Surface/coopimplementation.

b. *Fischer Porter Upgrade User Manual for PC Key Reader*, Ver 2.0 (May 17, 2002). No known deficiencies were reported as of June 2005.

3. Official NWS Policy and Procedure Manuals required for the Fischer Porter Upgrade (FPU) :

a. *FPU Observer Instructions* (W-OS7, web posted April 2005) *****

b. *FPU Operations Manual* (W-OS7, web posted Sep 2005) *****

c. *CSSA User Manual* (NDS 10-1313; dated Mar 18, 2005) *****

d. NLSC Supplies Memo From Mike Campbell (Mar 3, 2005) to Al Wissman. *****

e. *EHB-1: Instrumental Equipment Catalog*
http://www.ops1.nws.noaa.gov/ehbs/ehb1.htm

f. *NWSM 50-1115: Occupational Safety and Health Manual*
https://www.ops1.nws.noaa.gov/Secure/SAFETY/Safety_manual.htm

g. *Integrated Logistics Support Planning* NDS 30-3102
http://www.nws.noaa.gov/directives/030/030.htm

h. *Supply Manual and Catalog* NDS 30-3101
http://www.nws.noaa.gov/directives/030/030.htm

i. *Public Information Statement (PNS) Template* (for each effected WFO) *****

***** The Observing Services Division (W-OS7) of the Office of Climate, Water, and Weather Services (OCWWS) is the Office of Primary Responsibility (OPR) for these asterisked documents. A PDF formatted version of each is available on the NWS Surface Program's webpage: http://www.nws.noaa.gov/ops2/Surface/coopimplementation.htm.

APPENDIX G - FPU PARTS AND AGENCY STOCK NUMBERS (ASN)

General Name	Short Description	Long Description	ASN	SMR *
Load Cell Assembly	Load Cell Assembly, FPU	Load Cell Assembly, FPU, complete with load cell PCB, block, post, cell, ball, and 4 long machine screws with washers and lockwashers.	**D111C-1A1**	PADDD
Load Cell Cable	Load Cell Cable, FPU	Load Cell Cable, FPU, 8 feet long, with connectors and integral strain relief.	**D111C-1W1**	PAOZZ
Anvil	Post, FPU, load cell.	Anvil or post for FPU load cell, mates F&P gauge to load cell ball.	**D111C-1A2**	PAOZZ
GMA	ZENO-GMA, FPU	Gauge Modification Assembly for Fisher & Porter Gauge Upgrade, includes Zeno datalogger, solar panel regulator, display, keypad, data key interface, and housing.	**D111C-2A1**	PAODD
- Regulator	Regulator PCB for Solar Panel, GMA, FPU	Regulator PCB for Solar Panel, GMA, FPU	**D111C-2A1A3A1**	PADDD
- Fuse	Fuse, Glass Tube, 250V, 3AG, Normal, 5-Amp	5 Amp fuse for solar panel regulator of GMA. Place holder. Pointer to ASN: 017-F-4-35 for real stock number.	**D111C-2A1F1**	PAOZZ
- DataKey	DataKey, serial memory key, 1Mb, SFK series	DataKey, serial memory key, 1Mb, SFK series flash memory, Datakey Electronics, Inc, PN 611-0083-002, Red color.	**D111C-2A2**	PAOZZ
- Battery	Battery, 12V, 84AH, Sealed Lead Acid	Battery, 12V, 84AH, Deep Cycle, AGM, Sealed Lead Acid, Bolt terminals, 54 lbs, wide temperature range, for solar panel applications, Concorde Battery Corporation, PVX-840T, Sun Xtender Series.	**D111C-2B1**	PAOZZ
- Cable, battery	Cable, Battery, internal to GMA, FPU	Battery Cable for inside GMA enclosure.	**D111C-2W1**	PAOZZ
- Enclosure	Enclosure, Steel, GMA, FPU.	Stainless Steel Enclosure, GMA, FPU, with mounting hardware and parts.	**D111C-2A4**	PAOZZ

Solar Panel	Solar Panel, 20W, 12V nom. @ 1.5A, reverse diode included, no regulator.	Solar Panel, 20W, Siemens ST20, 12V nom. @ 1.5A, reverse diode included, no regulator, metal frame, with pole mounting bracket.	**D111C-3**	PAODD
- Cable, Solar Panel	Cable, Solar Panel to GMA, FPU.	Solar Panel Cable, with connector and junction box, use between FPU GMA and ST20 solar panel	**D111C-3W1**	PAOZZ
FPU External Parts	Cable, Thermistor to GMA, FPU	Thermistor cable, direct burial, use between MMTS beehive and GMA.	**D111C-4W1**	PADDD
FPU Off-Site Parts	DataKey reader, power supply, and application CD-rom.	DataKey reader, power supply, and application CD-rom , for use with FPU written Datakeys.	**D111C-6**	PAOZZ
FPU Test Plug	Testing instrument to isolate the rain gauge load sensor.	FPU Load Sensor Test Plug	**D111C-1A1T1**	PAOZZ

* The FPU unit has just three types of Source, Maintenance, and Recoverability (SMR) codes assigned to its parts: PADDD, PAODD, and PAOZZ.

Reference: **EHB-1, *Instrumental Equipment Catalog* (Issuance 1996-1),** Section 2.3, Source, Maintenance and Recoverability Code (SM&R).

PADDD: You must return these parts (i.e., faulty regulator) to National Reconditioning Center (NRC) in exchange for a replacement.
The 'PA' signifies item procured and stocked for anticipated or known usage that is not deteriorative in nature; the 'DD' signifies the part must be shipped to the depot (NRC) together with its integral component(s) for disassembly and be repaired by the depot (NRC); and the final 'D' signifies that just the depot (NRC) is authorized to repair, condemn, or dispose of this part.

PAODD: You must return these parts (i.e., faulty GMA) to NRC in exchange for a replacement.
The 'PA' signifies item procured and stocked for anticipated or known usage that is not deteriorative in nature; the 'OD' signifies this part shall be isolated and removed by the field and shipped to the depot (NRC) where the depot (NRC) will perform the repair; and the final 'D' signifies that just the depot (NRC) is authorized to repair, condemn, or dispose of this part.

PAOZZ: A non-repairable part. You may dispose of these parts (i.e., 5 Amp fuse) at the Weather Forecast Office (WFO).
The 'PA' signifies item procured and stocked for anticipated or known usage that is not deteriorative in nature; the 'OZ' signifies the field level shall remove and replace this part, however it is non-repairable and no repair to the item is authorized. The final 'Z' signifies that the field office is authorized to condemn and dispose of the part when it becomes unserviceable.

SPECIAL THANKS GO TO: David Desrosiers (Engineer, OPS11), Ralph Troutman (DAPM, WFO-Nashville), Dave Jacobs (DAPM, WFO-Melbourne), Ken Clark (DAPM, Rapid City), Zwemer Ingram (WFO-Memphis) and Buzz Merchlewitz (WFO-Memphis) for their hard work in taking photos, preparing formatted images, reviewing, and providing written material to help complete this instruction manual.