FPR-E ASSEMBLY PROCEDURES

FOR THE

FISCHER–PORTER REBUILD KIT
Based On The
COASTAL ENVIRONMENTAL SYSTEMS, INC., ZENO® DATA LOGGER (FPR-E)

February 17, 2012

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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REVISIONS (with Effective Date)

FPR-E ZENO® Assembly serial number (December 2011) 12, 38, 50, 62

Null Modem Cable in Appendix G (December 2011) 60

Contact Information (February 2012) 8, 50

Fuse in Appendix G (February 2012) 60

FPR-E ASSEMBLY INSTRUCTIONS

PART ONE

TAKING DELIVERY OF

THE FPR-E KIT

NOTE 1: Please read through all five parts of these instructions before you begin any modification work.

NOTE 2: For clear photos of the legacy F&P gauges, see Ralph Troutman's 'f-p_images' link on the DAD site: http://www.srh.noaa.gov/ohx/dad/coop/f-p_images

NOTE 3: A worksheet to write down the numbers used throughout this manual is available in Appendix H.

NOTE 4: For assistance please phone the Sterling Field Support Center 8:00 AM to 5:00 PM, Monday – Friday, on 703-661-1268, or e-mail them, nws.sfsc@noaa.gov.

Sterling Field Support Center

The Sterling Field Support Center (SFSC) is located approximately 30 miles west of Washington, DC, in Sterling, Virginia. The SFSC operates as an extension of National Weather Service (NWS) Headquarters to provide operational support to field personnel through a combination of sensor testing, sensor system analysis, and contact center support. Sterling provides a critical service to the NWS field community by using their years of knowledge and experience gained through extensive sensor/system testing and maintenance in assisting the field with sensor and system failures. When these failures arise in the field, the SFSC is there to provide assistance and help solve these problems.

The SFSC has been a critical component of the Fischer Porter Rebuild (FPR) Program. The SFSC will play a major role in assisting the field if issues arise when the FPR kits are installed at COOP sites around the country. The facility has created a contact center and should be the first point of contact made by NWS WFO's if there are questions or issues with the FPR kits. If the SFSC is unable to determine the correction for the issue, the SFSC will elevate it to NWS Headquarter level.

The contact center at the SFSC was established to troubleshoot potential issues in the field with the installation and usage of the FPR kits. The contact center is open Monday through Friday 8:00 AM to 5:00 PM Eastern Time. The SFSC is closed for all Federal holidays. All emails and phone calls received during the hours of operation will be responded to in a timely manner. Emails received during non-operation hours will be returned in the order they are received on the following day in which the facility is open.

SFSC Contact Center Information:

Main Line: 703-661-1268
Back-up Line: 703-661-1293
Email: nws.sfsc@noaa.gov

1. FPR-E Kit Components

1.1 NLSC Package Contents:

Each FPR-E Kit will arrive at your WFO in one cardboard box that contains:

a. Main box: Data Logger, Solar Panel, and Load Cell Assembly.

b. Interior paper wrap: 12V Battery.

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.

1.2 FPR-E Kit Boxes:

Container	Content	Yes/No
Main box	FPR-E ZENO® Assembly (ZENO® FPX Assembly)	
	Load cell (S - Type) with mounting hardware	
	Load cell S hook	
	Solar panel – 10W, 12V nom., and integral with 15 ft cable	
	Solar panel mounting hardware	
	FPR Kit Operations and Maintenance Manual	
	One USB Flash Drive	
Interior paper wrap	Battery – 12V, 7.2 AH (6 lbs)	

Resolve any discrepancies directly with NLSC.

Estimated Time Required: An estimated three hours is required to complete and verify the FPR-E installation whether you perform most of the assembly at your WFO, and swap out the gauge at the site, or if you do all the work at the site. NWS HQ strongly recommends the first option – perform the modification at your WFO and swap out the gauge at the site – particularly for the first time you perform the modification. NWS HQ recognizes there is a large learning curve to transition from mechanical equipment to all electronic instrumentation and encourages all technicians and their MICs to learn this procedure and verify proper gauge operation in the comfort of the WFO before even thinking about doing it in the field.

There are 8 steps to this modification: Experienced User Estimated Time

- Receive and inspect kit…….0.50 hours
- Teardown old gauge and refurbish remaining parts……1.00 hours
- Install kit parts……..……1.00 hours
- Verify kit operation……...0.50 hours
- Transport to site……TBD hours
- Swap out, set up, and calibrate…….…….2.00 hours
- Capture new metadata……..….……0.50 hours
- Train the observer……..0.50 hours

Total time is 6 hours plus the time to drive to and from the Observer's site.

1.3 Tools and Test Equipment Table:

The NWSREP must have the following tools and test equipment:

Tools and Test Equipment Beyond What is Supplied inside the Kit
Phillips Screw Drivers, sizes: #0, #1, #2
Flat Blade Screw Driver (1/8 inch, 1/4 inch)
Small Adjustable Wrench (or 1/2 inch and 7/16 inch wrenches)
ESD Ground Strap
Anti-Seize Compound
Battery Charger, 12V, AC
Multi meter (or voltmeter and ohmmeter)
Needle nose pliers with wire cutters/strippers
Wire terminal crimping tool/stripper tool
Portable Computer (PC) with terminal emulation program and serial port (or USB to serial adapter), for access to the ZENO® data logger
Serial Communications Cable (for PC) with 9-pin female end and 9-pin female end (null modem)
Calibration weight set Agency Stock Number D111-TE500

1.4 Charge the New 12V Battery:

Locate a battery charger capable of initial charging the new 12V battery to 14.8V (a 3-stage charger is preferred). DO NOT USE an automotive charger that cuts off at 13.8V or a charger that can charge at a rate greater than 2 amps for this sealed battery. Remove the 12V battery from its packaging. Remove terminal covers and attach charger cables to the battery's respective positive and negative terminals. Let it charge completely. After the battery is fully charged, disconnect the charger cables and let it rest indoors for a day (with nothing connected). If the battery voltage stays within the range of 12.6V to 14.5V after resting, it will be ready to power the data logger in Section 6. Place the covers back on to the 12V battery terminals. Follow the precautions outlined in NWS Manual 50-1115, *Battery Charging and Storage Operations*, on the web site: https://www.ops1.nws.noaa.gov/Secure/SAFETY/Safety_manual.htm (chapter 15)

1.5 Configure the PC:

If the PC only provides USB ports, attach a USB to serial adapter and install the appropriate drivers. Make sure to note down the **COM** port assigned to the USB to serial adapter device (if

it is different from **COM1**) for Section 7.

The terminal emulation program used throughout the manual is HyperTerminal. You can use any terminal emulation program as the commands sent to the ZENO® data logger will be the same. The main difference in terminal emulation programs is in the interface to configure the **COM** port and to invoke text transfer for uploading/downloading configuration files.

During initial configuration of the ZENO® data logger, the data logger configuration code will be updated with the configuration file 'FPRE_ConfigFile_SID.txt' (Section 8.4). Download this configuration file from the NWS headquarters web site: http://www.nws.noaa.gov/ops2/Surface/coopimplementation.htm (contained within 'FPRE_ConfigFile_SID.zip'). Extract the configuration file and save this TXT file to an easy to remember location on the PC.

1.6 Serial Communications Cable:

1.6.1 Serial Cable Connections Needed

The serial communications cable with 9-pin female end and 9-pin female end (null modem) mentioned in Section 1.3 can be configured in one of two ways, either as a complete DB-9F to DB-9F null modem cable or as a DB-9F to DB-9F straight through cable with null modem adapter. In either configuration, the serial cable, at a minimum, must have the pinouts listed in the below table for use in signaling between the PC and the ZENO® data logger. Make sure to label one end for connecting to the ZENO® data logger (ZENO end) and the other end for connecting to the PC (Computer end).

ZENO end			Computer end	
Pin	Signal		Pin	Signal
1	DCD	----------	4	DTR
2	RD	----------	3	TD
3	TD	----------	2	RD
5	SG	----------	5	SG

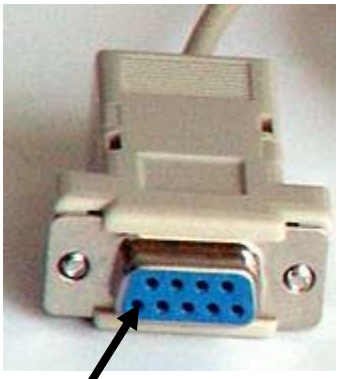
<u>CAUTION</u>: <u>DO NOT USE</u> a null modem cable with a null modem adapter.

1.6.2 How to Verify Serial Cable Type

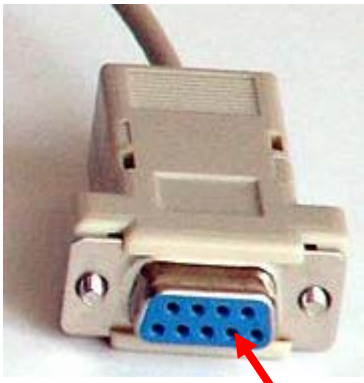
It is important to verify that the serial cable is compatible with the FPR-E system to allow for successful two-way communication between the ZENO® data logger and the PC. Lay out both ends of the serial cable next to each other and use the continuity function in a multi meter to check the pinouts. Place one of the multi meter probes on pin 5 of the ZENO end and the other on pin 5 of the Computer end. Make sure that the probes touch the metal contacts inside the DB-9F connectors (with additional wires or clips). If the multi meter beeps, this signal line works as expected; otherwise, the current serial cable will not work with the FPR-E system. Repeat this process for the rest of the pins (on the respective ends of the serial cable) in the order shown below. If the signal lines pass the continuity tests, then the serial cable is ready for use with the FPR-E system in Section 7. Label each end, ZENO or Computer (as identified by your testing), and the serial cable as a null modem.

Touch multi meter probe into the recessed hole (ZENO end) for:

a) pin 5
b) pin 3
c) pin 2
d) pin 1



Pin 1



Pin 4

Touch multi meter probe into the recessed hole (Computer end) for:

a) pin 5
b) pin 2
c) pin 3
d) pin 4

If the signal lines do not pass the continuity tests above, test with one of the multi meter probes on pin 2 of the ZENO end and the other on pin 2 of the Computer end. If the multi meter beeps, the serial cable is probably of the straight through type and a null modem adapter is needed. Add a null modem adapter to this serial cable and repeat the continuity tests in the previous paragraph to verify two-way communications capability. Otherwise, obtain another serial cable and repeat this section.

FPR-E ASSEMBLY INSTRUCTIONS

PART TWO

MODIFY F&P GAUGE

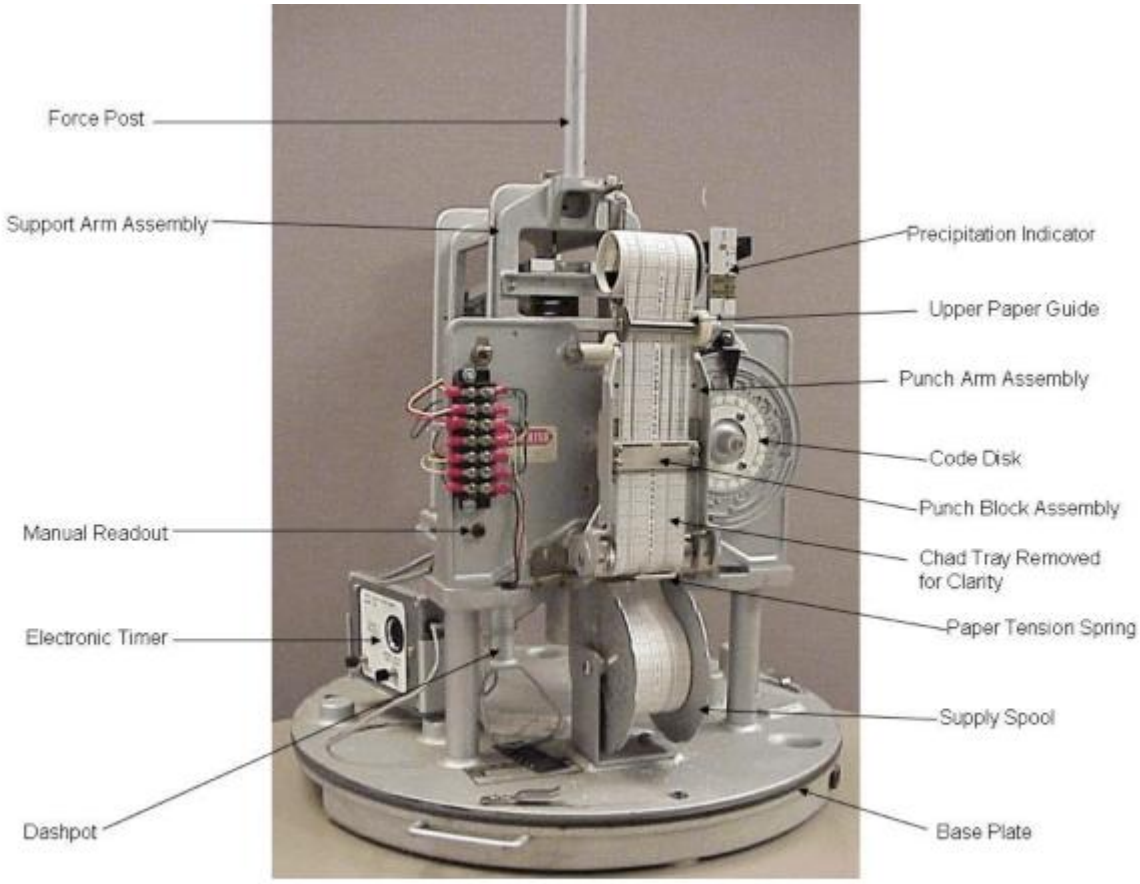
INSIDE YOUR WFO

Scope of Part Two:

- Remove the Paper Recorder Assembly……1.00 hours
- Install the Load Cell Assembly…….……..…...…….0.25 hours
- Install the FPR-E ZENO® Assembly……...……0.25 hours
- Install the New Solar Panel……....……..…….……0.25 hours
- Install the 12V Battery……..0.25 hours

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

2.1 Remove the F&P conical hood, the bucket, and the casing shell. Empty, clean, 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 79-1D per NCDC instruction. Follow the instructions in the ***FPR-E Operations Manual***, Chapter 1.6.3, and e-mail the Form 79-1D to HPD.NCDC@noaa.gov. Complete this data recovery task prior to disassembling the F&P gauge and prior to mailing the partial-month tape to SourceHOV in Mt.Vernon, Kentucky.

2.3 Disconnect and remove the 6V battery. Either save for use in another legacy F&P, or package and retain the battery for proper disposal by your WFO.

2.4 Remove the 6V solar panel and its mounting bracket from the pipe supports.

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. Return the screw to the support arm assembly.

2.7 Loosen the two 7/16 inch bolts holding the Paper Recorder Assembly to the support stage.

2.8 Unhook the small tension spring from the front support arm assembly.

2.9 Remove the Paper Recorder Assembly (including the punch motor assembly, and code disk); set it aside. Tighten the two 7/16 inch bolts loosened in step 2.7.

2.10 Raise the front support arm assembly with shipping bolt so that the dash-pot piston is near the top of travel.

2.11 Unscrew the zero adjust knob and catch and remove the large coupled main spring as it falls away.

2.12 Reinstall the zero adjust knob and the top spring hook.

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

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

2.15 Remove the plunger. Unthread it from the front support arm assembly.

2.16 Remove the dash-pot. Do not place the screws back.

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

2.18 Dispose of the dash-pot oil in accordance with WFO policy.

2.19 Check all 8 flexures. There are 4 on the top arm and 4 on the bottom arm. At the front and 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.

2.20 Save only those removed parts that are in good shape per instructions in Appendix B, and e-mail your RCPM an inventory report. Otherwise, dispose of locally in accordance with your WFO's official procedures.

2.21 After you have removed the Paper Recorder Assembly, the support stage will be accessible, and bare as seen in this image.

You are ready to begin installing the FPR-E Kit.

NOTE: Make sure your gauge support stage is level or make it so with shims under the base. The following steps assume the support stage is level.

Support Stage

3. Install the Load Cell Assembly:

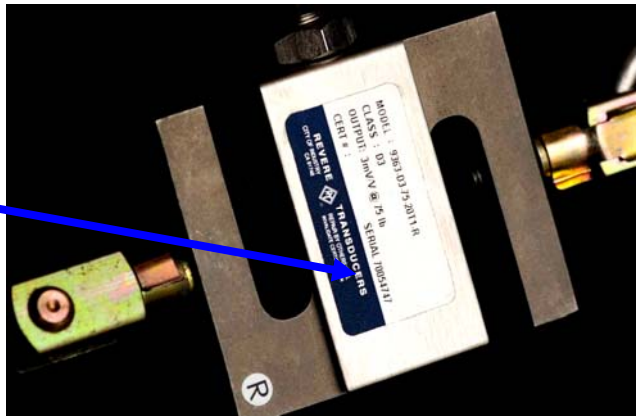
3.1 Open the FPR-E Kit box. Examine the kit contents and account for the other components (see, Section 1.2).

3.2 Find the load cell.

3.3 Write down the load cell ***Serial Number*** (see below example). You will need it in the reporting procedures, Section 12.2.

The serial number appears on the middle of the load cell.

Serial Number
i.e., 70054747



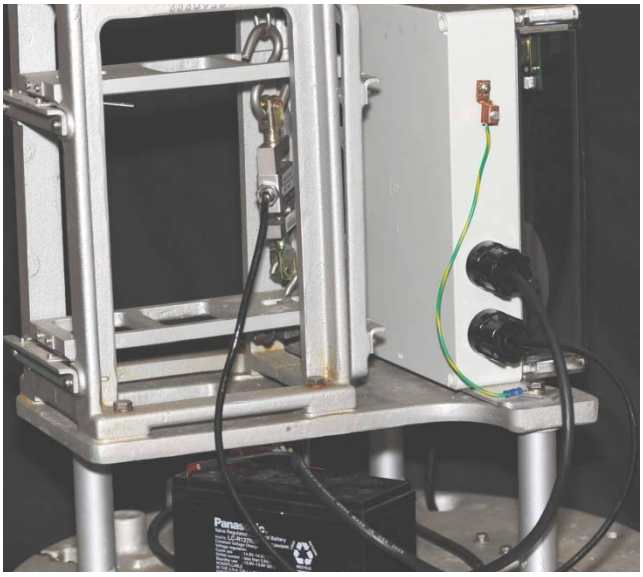
On the other side, find and write down the 3 calibration constants (C1, C2, C3). You will need it in the calibration procedures, Section 9.1, and in the CSSA B-44 update, Section 12.2.

The following installation procedures are similar to the OEM manual provided by CES. It may help to follow both - locate the ***FPR Kit Operations and Maintenance Manual***, published by CES.

CAUTION: Use care when handling the load cell. It is a sensitive and accurate sensor and can be damaged by rough handling.

3.4 Install the S hook on the top spring hook. The orientation of the S hook does not matter.

3.5 Hook the load cell to the bottom of the S hook with the writing on the load cell upright. The load cell cable is passed through the left side or back of the F&P weighing assembly and aligned away from the flexures in the front. Rotate the load cell mounting hardware (rod ends) to route the cable out the left side (as shown here) or back. Finger tighten the rod ends into the screw holes and then back off by a quarter turn.



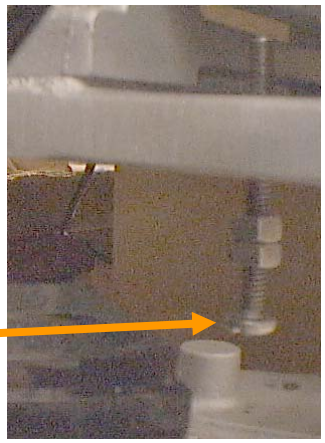
3.6 Attach the bottom spring hook to the bottom of the load cell. Lower the shipping bolt so the front support arm hangs on the load cell. Adjust bottom spring hook position front to back with the range adjust screw underneath the bottom flexure arm, if necessary, to ensure load cell is oriented vertically, perpendicular to the support stage.

3.7 Ensure that the load cell does not contact any part of the gauge except at the mounting points. Adjust the zero adjust knob until the bottom flexure arm is parallel with the support stage. Eye level comparison is acceptable.

3.8 Raise the shipping bolt to support the gauge flexures to prevent shock damage to the load cell during gauge movement, when installing the gauge bucket and while loading calibration weights into the gauge bucket.

3.9 Leave the front support arm resting on the shipping bolt until you are ready to perform the calibration, as described in Section 9, of this manual.

Shipping Bolt

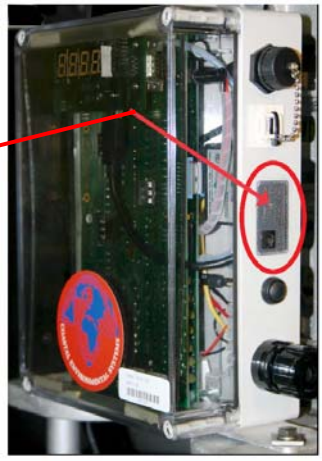


4. Mount the FPR-E ZENO® Assembly and connect Load Cell Cable:

4.1 Remove the FPR-E ZENO® Assembly from its box.

4.2 Write down the FPR-E ZENO® Assembly ***Serial Number*** (see figure). You will need it in the reporting procedures, Section 12.2.

Serial Number
i.e., 103



The serial number appears above the button on the side of the FPR-E ZENO® Assembly.

4.3 Completely remove the front two 7/16 inch bolts and washers from their holes on the support stage platform.

4.4 Place the FPR-E ZENO® Assembly with the display facing the door of the F&P gauge on the support stage where the Paper Recorder Assembly was attached. Position the washers over the two holes of the mounting flange.

4.5 Apply anti-seize compound to the 7/16 inch bolt, and insert it into the right-side hole of the mounting flange with the washer gripped under the head of the bolt.

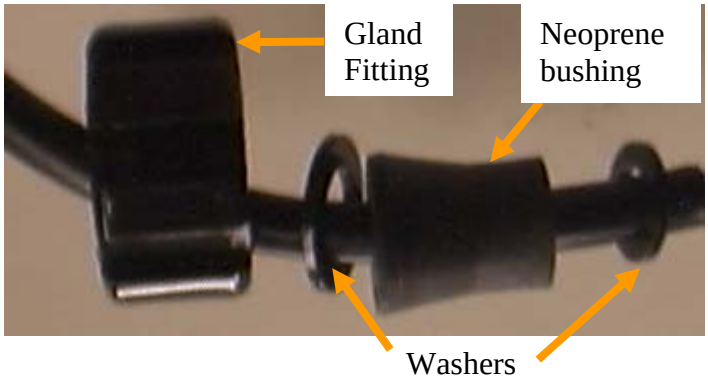
4.6 Locate the FPR-E ZENO® Assembly's green/yellow grounding wire and position it over the square washer, under the lock washer, on the left-side hole of the mounting flange. Apply anti-seize compound to the 7/16 inch bolt, and insert it into the left hole with the green/yellow grounding wire loop terminal gripped under the head of the bolt. Tighten both bolts.

4.7 Proceed to Section 5 if the load cell cable is already connected in the FPR-E ZENO® Assembly. Otherwise, continue with the rest of this section.

<u>CAUTION</u> – Electrostatic Discharge (ESD): The I/O printed circuit board (PCB) inside the FPR-E ZENO® Assembly is ESD sensitive. Before removing the cover, either put on an ESD ground strap on your wrist and connect it to the gauge, or keep one hand on the ground lug of the FPR-E ZENO® Assembly while you work inside the case.

4.8 Loosen the screws at the front corners of the FPR-E ZENO® Assembly with a No. 1 Phillips screwdriver, and remove the clear front cover. Keep desiccant bags as they will be placed back inside the FPR-E ZENO® Assembly enclosure.

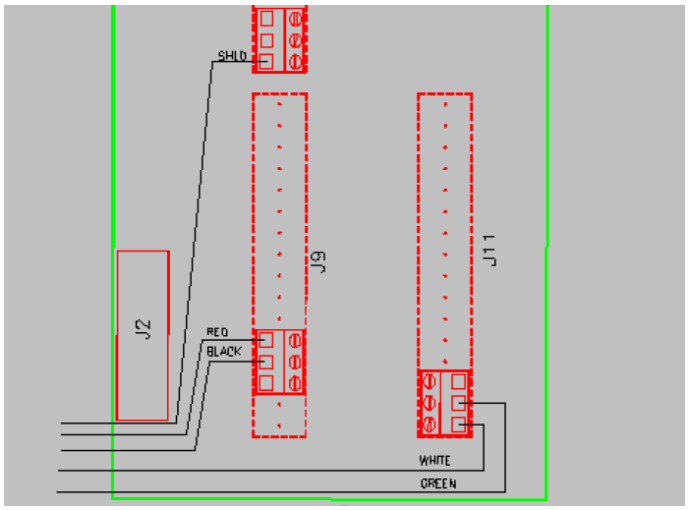
4.9 Loosen the gland fitting on the lower left side of the FPR-E ZENO® Assembly. Feed the load cell cable through the fitting parts as shown to the right. Thread it through the fitting into the FPR-E ZENO® Assembly and bring the wires around to the front of the I/O PCB.

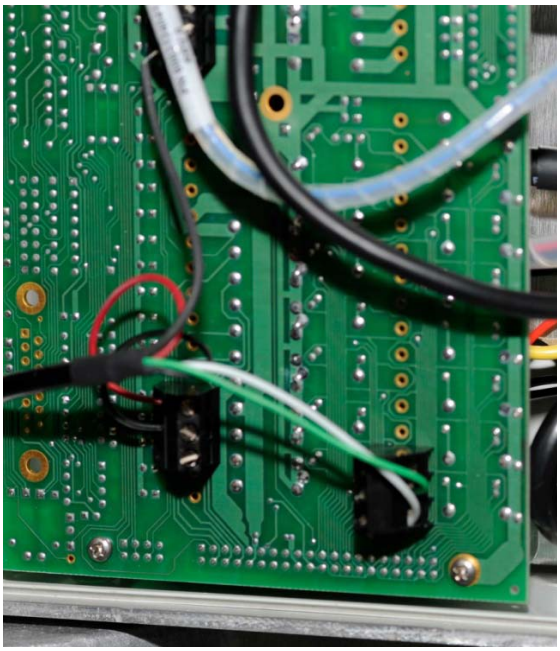


4.10 Locate the bottom two black terminal blocks on the lower half of the I/O PCB. Using a small flat blade screwdriver, loosen the terminal screws on the I/O PCB terminal blocks.

4.11 Connect the wires to the terminals as shown below and tighten each terminal screw until snug. Tighten the gland fitting.

4.12 Insert all desiccant bags removed back into the FPR-E ZENO® Assembly enclosure and install the cover. Tighten the four lid screws evenly to compress the cover gasket evenly.





5. Connect the Solar Panel:

5.1 Locate the solar panel assembly with mounting hardware.

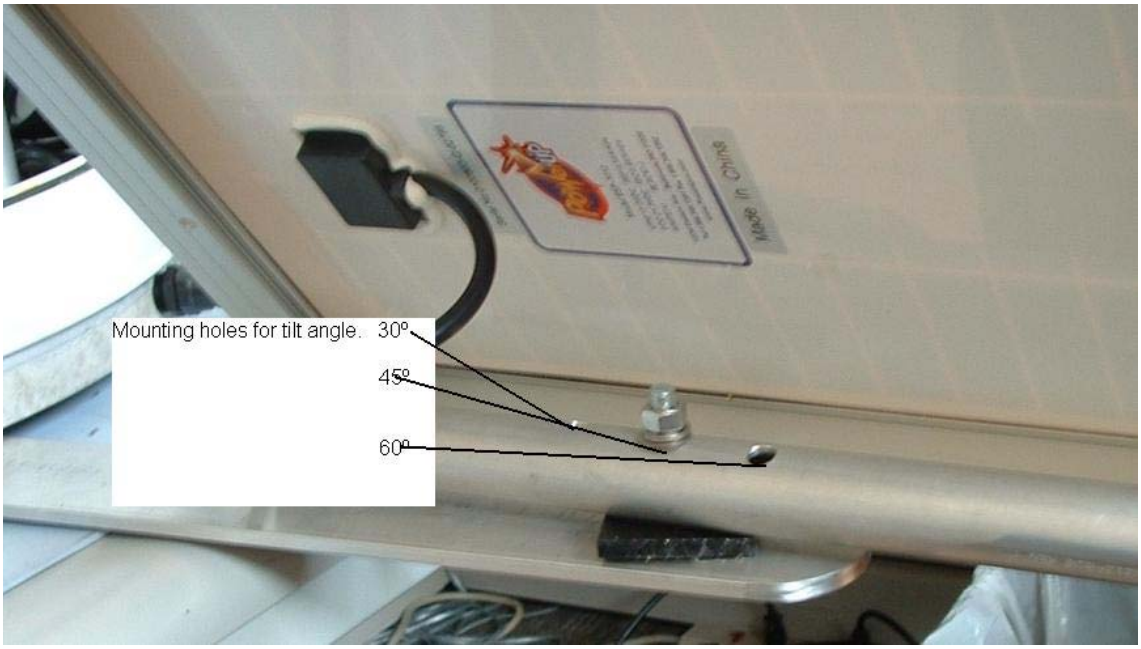
NOTE: Some installers have reported the corners of the solar panel frame are sharp. If sharp, slightly round them with a file, scraper, other appropriate tool. Use of a hammer is not appropriate. The frame is soft aluminum and is easily shaped.

NOTE: The solar panel mounting arm has a hole on one end sized to fit over the threaded rod of the F&P gauge mounting stand. In the field it will install over the mounting rod and under the circular base plate of the gauge. Plan to install it either under the door (preferable, as shown) or to the right of the door if using the rod under the door won't provide a good southern exposure on the solar panel.

5.2 Mount the solar panel on the mounting arm using the supplied mounting hardware. The rubber pad mounts between the arm and the pipe to prevent the pipe from rotating on the arm.

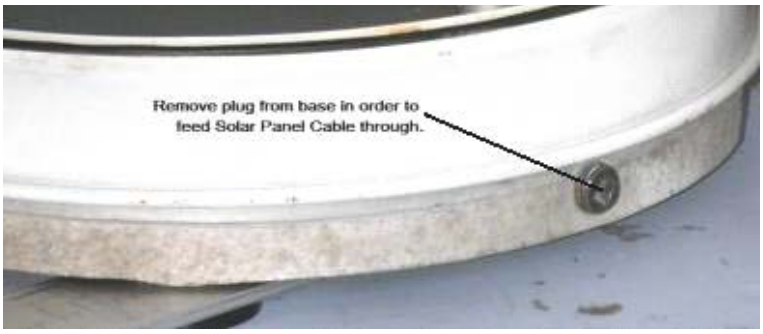
NOTE: To determine which mounting hole to use for your location, use the following for guidance:

Latitude 0° through 27° use the 30° mounting hole
Latitude 27° through 42° use the 45° mounting hole
Latitude 42° and beyond use the 60° mounting hole



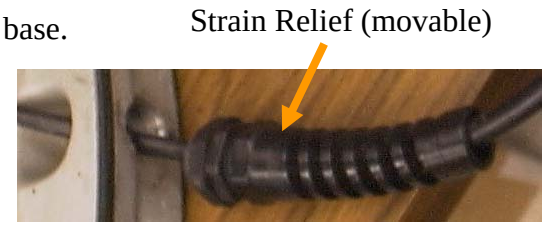
5.3 When at the site, make sure that the solar panel faces south and is not shaded by trees or other obstructions. With the panel facing south, tighten all mounting screws and nuts to securely hold panel in place.

5.4 Locate and remove the plug from the lower right of the F&P gauge door on the F&P gauge base.



5.5 Feed the solar panel cable through the hole, keeping the strain relief on the outside of the F&P base.

5.6 Screw the strain relief into the hole in the F&P base.



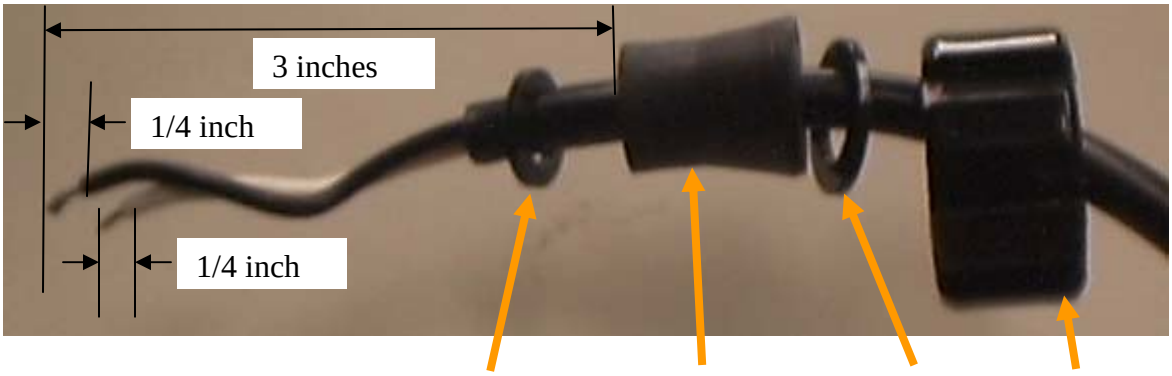
5.7 Strip the end of the solar panel cable to remove the heat shrink tubing (short rubber tubing) joining the black and white wires to the cable. The extra thickness of the shrink wrap prevents the solar panel cable from moving through the gland fitting in Step 5.9. Make sure a total of 1/4 inch of insulation is stripped off the ends of the black and white wires for a good connection in the terminal block.

<u>CAUTION</u> – Electrostatic Discharge (ESD): The I/O printed circuit board (PCB) inside the FPR-E ZENO® Assembly is ESD sensitive. Before removing the cover, either put on an ESD ground strap on your wrist and connect it to the gauge, or keep one hand on the ground lug of the FPR-E ZENO® Assembly while you work inside the case.

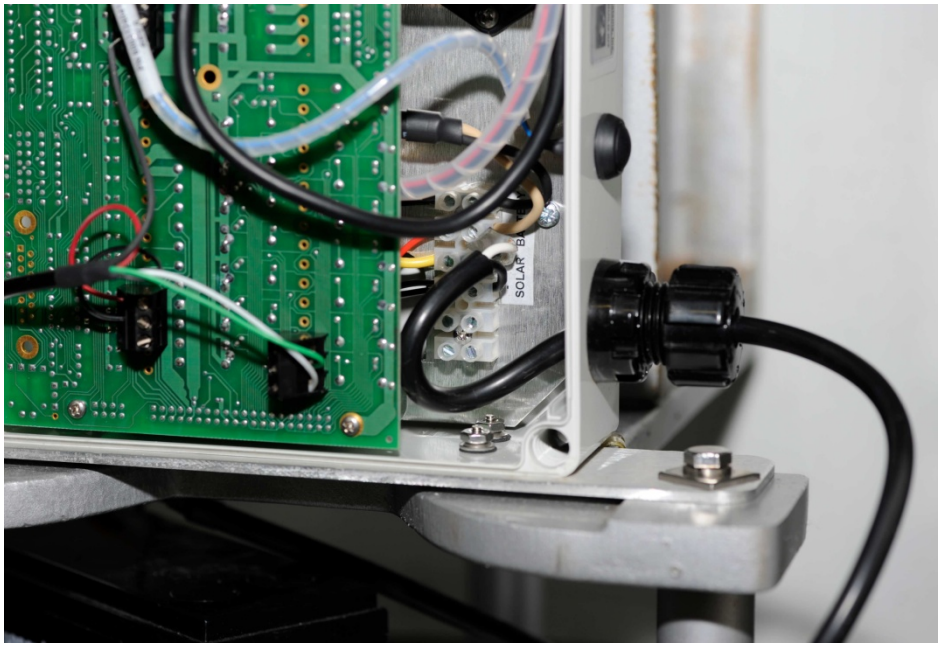
5.8 Loosen the screws at the front corners of the FPR-E ZENO® Assembly with a No. 1 Phillips screwdriver, and remove the clear front cover. Keep desiccant bags as they will be placed back inside the FPR-E ZENO® Assembly enclosure.

5.9 Loosen the gland fitting on the right side of the FPR-E ZENO® Assembly and feed the solar panel cable through it. Make sure that the cable also goes through the neoprene bushing (and washers) before it enters the FPR-E ZENO® Assembly.

<u>NOTE</u>: The neoprene bushing is a tight fit for the solar panel cable. Verify the shrink wrap has been removed as in Step 5.7 and slowly push the small end of the bushing at an upward angle away from the exposed wires. Repeat this slow pushing around the small end of the bushing to even out the distance pushed. **Do not squeeze the bushing in the middle or from both sides as this will further increase the resistance to movement**. Alternatively, a small wrench can be used to push the small end of the bushing away from the exposed wires. Stop pushing when the small end of the bushing has reached 3 inches from the tips of the exposed wires.

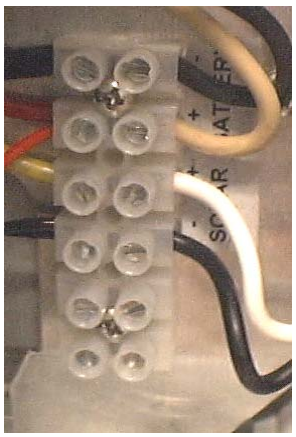


5.10 Insert the black wire into the solar (-) terminal, and tighten with a screw driver. Then insert the white wire into the solar (+) terminal, and tighten with a screw driver.
<u>Solar Cable Connections:</u>
Black wire to solar (-) terminal
White wire to solar (+) terminal



5.11 Block connections defined, top to bottom:

1. GND, battery
2. +12V, battery
3. +12V, solar
4. GND, solar
5. Unused
6. Unused



5.12 Tighten gland fitting.

6. Power-up System on 12V Battery:

6.1 Remove terminal covers from the 12V battery that was fully charged in Section 1.4.

6.2 Place the battery with the terminal side away from the F&P gauge door on the base-plate, behind the FPR-E ZENO® Assembly on a flat resting surface, for stability.

6.3 Locate the battery cable (upper cable on left side of the FPR-E ZENO® Assembly). Plug the cable's black wire onto the battery's negative terminal that is marked black. Then plug the cable's white wire onto the positive, red-marked battery terminal. The ZENO® data logger will start up when power is applied.

NOTE: There is no indication of the ZENO® data logger powering up. Wait at least 30 seconds before pressing the button on the side of the FPR-E ZENO® Assembly to confirm that the ZENO® data logger is now automatically taking measurements and logging data. The illuminated display should show the most recently logged RAIN value (does not necessarily reflect the actual weighted value at the time the button was pressed) or dashes ("- - - -") if no logged data is available.

black wire to (-) terminal

white wire to (+) terminal

Battery Cable

NOTE: If nothing is shown on the display after pressing the button, the fuse may have blown (especially if the battery cable connections were accidentally crossed for even a short period of time). Disconnect the battery, replace the time-delay "slow blow" fuse (250V, 2A rating, MDL type) behind the display board (gray cap with slot), and repeat step 6.3.

FPR-E ASSEMBLY INSTRUCTIONS

PART THREE

INITIALIZE AND CALIBRATE FPR

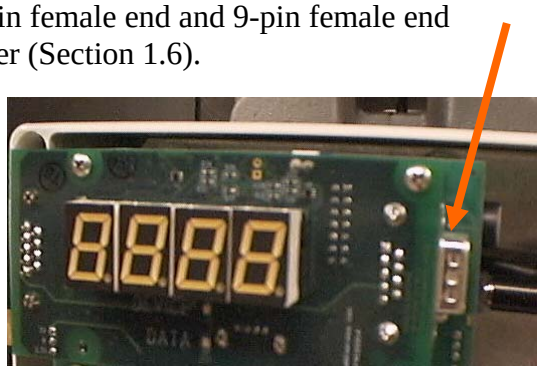
INSIDE YOUR WFO

Scope of Part Three

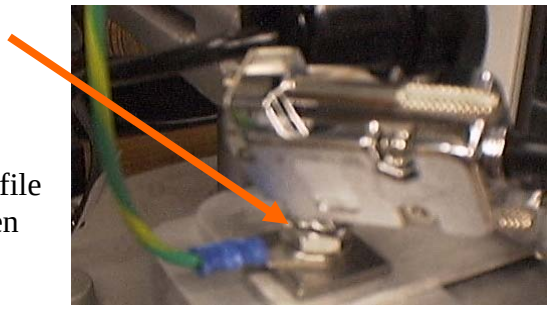
- Verify/Update Logger Parameters……..……..….0.50 hours
- Calibrate the System…….……..…0.25 hours
- Generate a Log File……..…0.50 hours
- CSSA Metadata Requirements……..0.25 hours

7. Connect to the ZENO® Data Logger: *(Perform this Task in Your WFO, if possible)*

This requires a computer with a terminal emulation program such as ProComm or HyperTerminal. It also requires a serial cable with 9-pin female end and 9-pin female end (null-modem) to connect the data logger to the computer (Section 1.6).



7.1 Make sure to put on an ESD ground strap and remove the front cover if you have not already done so (remember to keep the desiccant bags). Locate the ZENO® data logger's serial port.



7.2 Plug one end of the serial cable into the PC. On the other end of the serial cable, touch the metal shell of the serial cable connector to the ground lug. Then connect the cable into the ZENO® data logger.

NOTE: Verify that the PC contains the configuration file 'FPRE_ConfigFile_SID.txt' and that it has been configured according to Section 1.5 before continuing with the following steps.

7.3 Set up your PC's HyperTerminal program.

From the Windows desktop, click on the **Start** button and then click in the following sequence: Programs, Accessories, Communications. Finally, click on the '**HyperTerminal**' tab.

NOTE: Depending on the configuration of the PC, HyperTerminal may be installed in another location.

You will be prompted to enter a **name** for the connection, (e.g., FPR_Link). Also select an **icon**. Then click on the **OK** tab.

At the 'Connect To' prompt select **COM1** and Press OK.

NOTE: Depending on the configuration of the PC, choose the appropriate **COM** port that connects the PC to the ZENO® data logger (e.g. **COM3**, **COM12**, etc.).

Enter the following Port Settings:

Baud rate:	**9600** bits per second.	Data bits:	**8 .**
Parity:	**none .**	Stop bits:	**1 .**
Flow Control:	**none .**	Press OK.	

The HyperTerminal screen will appear and you will be connected to **COM1**.

NOTE: Make sure that the display is off before continuing with the following step. Otherwise, a countdown is shown, indicating the time remaining until the display becomes inactive.

You can wait until the timer stops counting down (120 seconds) or press the button on the right side to turn off the display. At this point, the ZENO® data logger can respond to commands from the PC.

7.4 Type **u**<**enter**> to wake up the ZENO® data logger and enter the ZENO® User Menu shown below.

NOTE: Since no commands were sent to the ZENO® data logger from the PC prior to this time, the '**u**' will not show up when you type it to access the ZENO® User Menu. All subsequent commands will be shown unless the ZENO® data logger times out due to no activity.

NOTE: Proceed to Section 7.6 if the ZENO® User Menu does not appear in response to the '**u**' command sent from HyperTerminal to the ZENO® data logger.

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

All communications with the ZENO® data logger inside the FPR-E ZENO® Assembly are directed via menus activated by letter commands. The ZENO® User Menu is the starting point. All other menus can be reached by selecting one of the offered choices in the current menu. For example, to check the firmware version number, you start at the User Menu, go to the System Functions Menu and select the version command as shown in the next section.

NOTE: Commands are **NOT** case sensitive. In other words, you can type either **u**<**enter**> or **U**<**enter**> to access the ZENO® User Menu.

NOTE: While in any of the ZENO® User Menus it is necessary to hit <**enter**> every minute or two to prevent the ZENO® data logger from timing out due to no activity. If the ZENO® data logger does time out, simply type **u**<**enter**> to access the ZENO® User Menu (this '**u**' will not show) and return to the menu needed.

7.5 Proceed to Section 8 if the ZENO® User Menu appears in response to the '**u**' command sent from HyperTerminal. Otherwise, continue with the rest of this section.

7.6 Make sure the display is off before the commands are sent to the ZENO® data logger. Repeat Sections 7.3 and 7.4 to enter the ZENO® User Menu. If there is no response, keep the HyperTerminal window open (and connected) before proceeding to the next step.

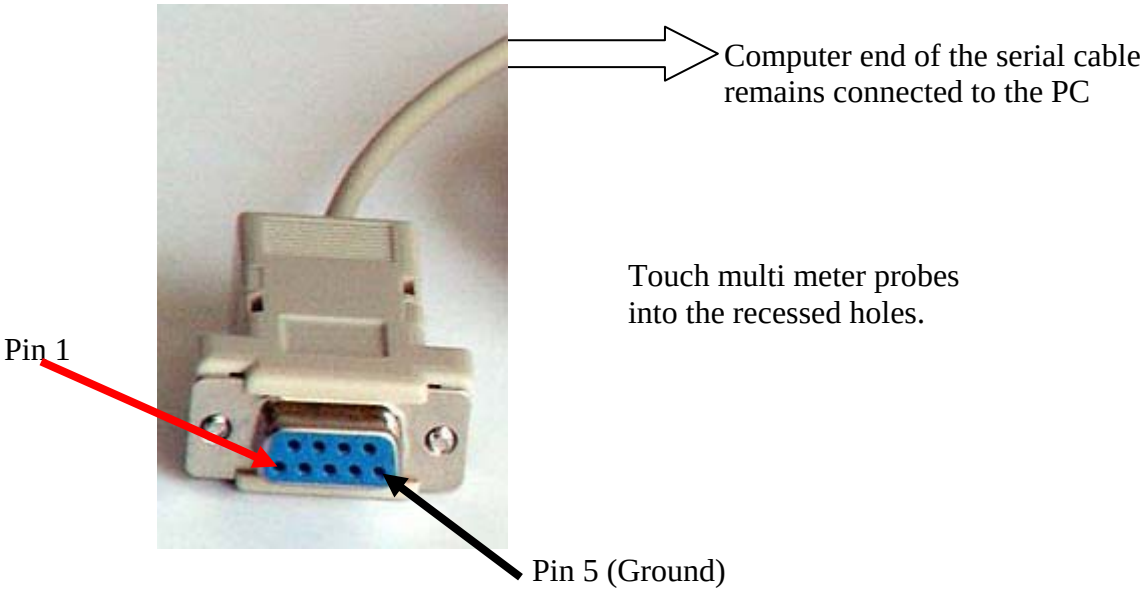
7.7 With the PC connected to the ZENO® data logger, turn on the display. Verify that the RAIN value shown on the display is shown in HyperTerminal. If nothing is shown or if garbled text is received:

a. Locate the **Call** menu on the Menu Bar near the top of the HyperTerminal window and select **Disconnect**. Verify the port settings are set correctly as in Section 7.3.

b. Check the serial cable connections. Verify that the correct end is connected to the ZENO® data logger (as labeled in Section 1.6).

CAUTION: The following test checks the output voltage of your computer. DO NOT short these connections, even momentarily, or you could destroy the **COM** port of your computer.

c. Disconnect the ZENO end of the serial cable, but leave the Computer end connected. Use a multi meter set to VOLTS (DC), and touch the red probe to pin 1 and the black probe to pin 5 on the ZENO end of the serial cable. Write down or take note of the voltage level. With the HyperTerminal session disconnected (see Status Bar near the bottom of the HyperTerminal window), the voltage should be LOW, i.e. in the range of -25.0V to +2.0V. In the HyperTerminal window, press <**enter**> to connect HyperTerminal to the ZENO® data logger. Verify that the voltage level has changed, is HIGH, and has a magnitude greater than +3.0 V. Toggle between CONNECT (<**enter**>) and DISCONNECT (**Call** menu, **Disconnect**) in HyperTerminal. The voltage at the end of the serial cable should be HIGH on CONNECT and LOW on DISCONNECT. If you do not see the voltage switching, check your serial cable again per Section 1.6, and if that is good, have IT check the **COM** port of your computer.



7.8 Connect the ZENO end of the serial cable back into the ZENO® data logger. Repeat Section 7.6 to enter the ZENO® User Menu.

8. Initial Configuration: *(Perform these Tasks in Your WFO, if possible)*

8.1 Access the ZENO® User Menu via the PC as in Section 7.

8.2 Verify Firmware Version

a. At the User Menu, type **f**<**enter**> to access the System Functions Menu shown below.

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	

b. Type **v**<**enter**> to view software version. The correct firmware version number and date is **V2.02-Z16eD Jan 28 2009**. Write down the version number of the data logger firmware.

c. Type **u**<**enter**> to return to the ZENO® User Menu.

d. Type **d**<**enter**> to access the Data Retrieval Menu. Type **L1**<**enter**> to look at the most recent data sample. Write down the configuration version shown at the end of the data sample (e.g. **FPR0E** or **FPR-E001**)

NOTE: If no logged data is available, wait 15 minutes before repeating the above step.

e. Type **u**<**enter**> to return to the ZENO® User Menu.

f. If the configuration version is **FPR0E**, continue with Sections 8.3 and 8.4 to change the Administrator Password and to update the configuration code. Otherwise, proceed to Section 8.5 to set the time (please make note of the new Administrator Password in Section 8.3).

8.3 Change Administrator Password

a. At the User Menu, type **z**<**enter**> to access the ZENO Program Menu.

b. Type **zeno**<**enter**> for the Administrator Password. The following screen will appear:

Waiting for all data acquisition tasks to finish . . .

ZENO PROGRAM MENU

(S) Sensor Menu	(M) Memory Management Menu
(P) Process Menu	(W) Password Menu
(D) Data Output Menu	(R) Reset System
(T) Sensor Timing Loop Menu	(E) Save Parameters To EEPROM
(O) Output Message Timing Menu	(U) User Menu
(L) System Load Menu	(Q) Quit
(G) General Serial Script Menu	(H) Help

c. Type **w**<**enter**> to access the Password Menu. The following screen will appear:

PASSWORD MENU
(A) Change Administrator Password (Z) Zeno Program Menu
(U) Change User Password (H) Help
(V) View All Passwords

d. Type **a**<**enter**> to select Change Administrator Password.

e. Type **zeno**<**enter**> for the current Administrator Password.

f. Type **FPRECOASTAL**<**enter**> as the new Administrator Password.

NOTE: Passwords are NOT case sensitive. In other words, you can type either **fprecoastal**<**enter**> or **FPRECOASTAL**<**enter**>. Only use the password, FPRECOASTAL, it is our NWS convention for this rain gauge.

g. Type **FPRECOASTAL**<**enter**> again to verify the new Administrator Password. The following screen will appear:

Password modified.
PASSWORD MENU
(A) Change Administrator Password (Z) Zeno Program Menu
(U) Change User Password (H) Help
(V) View All Passwords

h. Type **z**<**enter**> to return to the ZENO Program Menu.

i. Type **u**<**enter**> to return to the ZENO® User Menu.

8.4 Update Configuration Code in Data Logger

PROHIBITION AGAINST LOCAL CHANGE: No one has authority to change the ZENO® data logger configuration code without the express and written direction of W/OS7, the Observing Services Division of the NWS.

Each FPR-E system comes delivered with a manufacturer developed configuration code already installed. However, the manufacturer's code does not include the state portion of the COOP site number in the data file. Therefore, for the initial deployment, W/OS7 authorizes the use of an NWS developed configuration to allow the full 8-digit COOP site number to be included with each data record. The Engineering Design Branch (W/OPS11) has developed and certified the new configuration.

IMPORTANT: It is imperative upon assembly of the FPR-E to replace the manufacturer's configuration with the one developed by the NWS. The new data structure defined in the NWS developed configuration is the one recognized by the NCDC data ingest processors. Failure to update the FPR-E to this new configuration will result in processing errors when NCDC applies algorithms to produce the Hourly Precipitation Data (HPD) product.

The new configuration is loaded into the ZENO® data logger with the configuration file 'FPRE_ConfigFile_SID.txt' that was saved to the PC in Section 1.5. If you have not already done so, download this configuration file from the NWS headquarters web site: http://www.nws.noaa.gov/ops2/Surface/coopimplementation.htm (contained within 'FPRE_ConfigFile_SID.zip'). Extract the configuration file and save this TXT file to an easy to remember location on the PC that will connect to the ZENO® data logger.

CAUTION: After you have saved the file, you must not change the file! The configuration files are text files that are viewable in Notepad, but do not change them in any way or they will not work. Do not use a word processor to view the file 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.

Follow these step by step instructions to install the SID code to the ZENO® data logger.

a. At the User Menu, type **z**<**enter**> to access the ZENO Program Menu (if prompted for the Administrator Password, enter the password set in Section 8.3).

b. Type **l**<**enter**> to access the System Load Menu shown below.

SYSTEM LOAD MENU

(R) Receive Configuration From Host	(Z) Zeno Program Menu
(T) Transmit Configuration From Zeno	(H) Help
(V) View Configuration & Menus (ASCII)	

c. At the System Load Menu, type **r**<**enter**> to signal the ZENO® data logger to upload the new configuration file.

d. Type **y**<**enter**> to accept deletion of all data records and/or to proceed with the file upload.

e. Locate the **Transfer** menu on the Menu Bar near the top of the HyperTerminal window and select **Send Text File**. Find the configuration file named FPRE_ConfigFile_SID.txt and click **Open** to send the text file to the ZENO® data logger. When done, the ZENO® data logger will return to the System Load Menu and start sampling with the new configuration.

CAUTION: Do not use **Send File** from HyperTerminal. Always use **Send Text File**.

f. Type **z**<**enter**> to return to the ZENO Program Menu.

g. Type **q**<**enter**> to exit. Do not close the HyperTerminal window.

h. Wait until the first data is available at the quarter of the hour of the ZENO® data logger system clock (may take up to 15 minutes). Verify that the first data sent to the PC (displayed in HyperTerminal) from the ZENO® data logger is similar to the following sample data line:

#41005678 10/10/17,17:30:10,15.00,14.999,13.7,22.3,0,FPR-E001
Format is #41005678 yy/mm/dd,hh:mm:ss,PL,PC,BV,IT,BIT,VERS where:

Field	**Definition**	**Units**
41005678	Default COOP site number	User settable
yy/mm/dd	Year, Month, Day	
hh:mm:ss	Hour, Minute, Second	
PL	Current Precipitation Level	Inches (2 decimal places)
PC	Precipitation Calibration Value	Inches (3 decimal places)
BV	Battery Voltage	Volts
IT	Internal Temperature	Degrees Centigrade
BIT	Built In Test	
VERS	Configuration Version	FPR-E001

If the data is not in this format, the new configuration is not loaded. Type **u**<**enter**> to access the ZENO® User Menu (this '**u**' will not show) and repeat this section again.

IMPORTANT: The new configuration is temporary and will be lost if power is interrupted! Make sure to save the new configuration permanently by performing the following steps.

i. Type **u**<**enter**> to access the ZENO® User Menu (this '**u**' will not show).

j. At the User Menu, type **z**<**enter**> to access the ZENO Program Menu (you will be prompted for the Administrator Password).

k. Type **e**<**enter**> to save the new configuration in non-volatile memory.

l. Type **z**<**enter**> to return to the ZENO Program Menu.

m. Type **u**<**enter**> to return to the ZENO® User Menu.

8.5 Set Time

a. At the User Menu, type **f**<**enter**> to access the System Functions Menu.

b. Type **s**<**enter**> to set the local standard time. Your screen should look similar to the display shown here:

Current Date and Time: 10/10/17 15:30:22
Enter new Date and Time:

c. Enter the new date and time using the following format:
Format for date & time is "yy/mm/dd hh:mm:ss", where:
- 'yy' is the year (00 to 99). Years are 1970 to 2069
- 'mm' is the month (01 to 12).
- 'dd' is the day (01 to 31).
- 'hh' is the hour (00 to 23).
- 'mm' is the minutes (00 to 59).

- 'ss' is the seconds (00 to 59).

CAUTION: The date and time format is always, **Year/Month/Day Hour/Minute/Second**. The ZENO® data logger will accept any numbers in any position, but unless you follow the YY/MM/DD date, and HH:MM:SS time; the ZENO® data logger's date/time stamps will not increment correctly, and the data will be useless.

NOTE: Ensure you have a wrist-watch or chronometer in the forecast office that gives the current time to within 30 seconds. Try United States Naval Observatory's animated web-site: http://tycho.usno.navy.mil/simpletime.html

8.6 Install the COOP Site Number (e.g., 41005678)

a. Determine the COOP site number of the location installing this FPR-E rain gauge.

b. At the System Functions Menu, type **c1/5678**<**enter**> where "5678" is the four character numeric site ID. This uses the "Change Item n To Value m" command of the System Functions Menu, to change Item #1.

c. Type **c2/4100**<**enter**> where "4100" is the two character state ID plus 2 zeros.

CAUTION: Items 1 and 2 have been changed to the example numbers used above. Make sure to enter the unique COOP site number!

NOTE: The COOP site number is entered in the reversed order (site ID as Item 1, then state ID plus 2 zeros as Item 2) to ensure that the data file is named with the site ID when downloading to the USB Flash Drive.

IMPORTANT: The above changes are only temporary and will be lost if power is interrupted! Make sure to save the COOP site number permanently by performing the following step.

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

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

9. Calibrate the System: *(Perform these Tasks in Your WFO, if possible)*

The calibration is dependent on the bucket you use. If you did not retrieve a bucket from the field that you plan to marry to this particular FPR-E rain gauge, for permanent use, then you will have to conduct an on-site calibration using the bucket to be used permanently at that site.

9.1 Enter the Load Cell Calibration Constants

a. Access the ZENO® User Menu via the PC as in section 7.

b. At the User Menu, type **f**<**enter**> to access the System Functions Menu.

c. At the Systems Function Menu, type **k**<**enter**> to access the Constants Menu.

d. Type **c1/n**<**enter**> where "n" is the C1 calibration constant from the tag on the load cell. This uses the "Change Item n To Value m" command of the Constants Menu, to change Item #1.

e. Type **c2/n**<**enter**> where "n" is the C2 calibration constant from the tag on the load cell.

f. Type **c3/n**<**enter**> where "n" is the C3 calibration constant from the tag on the load cell.

NOTE: Please make sure to input the minus sign in the above steps if the calibration constants C1, C2, and/or C3 are negative.

g. Type **e**<**enter**> to save calibration constants information in non-volatile memory.

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

i. These calibration constants (C1, C2, C3) should be manually entered into your station log for future reference.

9.2 Calibrate the Load Cell

NOTE: Before starting the calibration procedure, check the flexures. Verify that you have not inadvertently bent a flexure. In addition, make sure the gauge is level and the lower flexure arm is parallel to the support plate.

9.2.1 Enter the Initial Load Cell Calibration Coefficients

a. Access the ZENO® User Menu via the PC as in section 7.

b. At the User Menu, type **s**<**enter**> to access the Sample Period Menu. It is necessary to temporarily change the Sample Interval and Offset values for the calibration procedure.

c. Type **c1/12**<**enter**>**.** The screen will update the Sample Period Menu to the one shown below:

SAMPLE PERIOD MENU
(Cn/m) Change Item n To Value m (Q) Quit
(E) Save Parameters To EEPROM (H) Help
(U) User Menu

Item 1:	12	(Sample Interval Time)
Item 2:	10	(Sample Duration Time)
Item 3:	0	(Sample Offset Time)

NOTE: The entries for Items 1, 2, and 3 are in seconds.

d. Type **u**<**enter**> to return to the ZENO® User Menu. Then type **t**<**enter**> to display a Test Menu similar to the one shown below:

NOTE: To access the Test Menu more efficiently while in another menu, type **u<space>t**<**enter**>. This shortcut can also be applied to other menus located above the User Menu.

TEST MENU

(Rx,y) Display Sensors x-y RAW Data	(Ex) Display Sensor x Error Codes
(Sx,y) Display Sensors x-y SCALED Data	(P) SDI-12 Pass-Through Mode
(Cx) Calibrate Sensor Record x	(U) User Menu
(Vx) View Process Record x	(Q) Quit
(D) View Data Collection Counters	(H) Help
(B) Display BIT Status	

e. Type **c2**<**enter**>. This is a request to calibrate sensor number two. If prompted for the Administrator Password, enter the password set in Section 8.3.

This will display the sensor name, the current 'A' conversion coefficient, and a prompt to enter a new 'A' conversion coefficient, e.g.:

Sensor Name: RainWeig
Conversion Coefficient A: 0
Enter new Conversion Coefficient A:

f. Type **0** (zero) <**enter**> for the new 'A' conversion coefficient.

g. Similarly, the screen will display the current 'B' coefficient and prompt for a new value. Type **2000**<**enter**> for the new 'B' conversion coefficient.

Conversion Coefficient B: 1256.6
Enter new Conversion Coefficient B: 2000

h. Finally, the screen will show the current 'C' coefficient and prompt for a new value. Type **0**<**enter**> for the new 'C' conversion coefficient

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

i. Type **u**<**enter**> to return to the ZENO® User Menu.

9.2.2 Calculate the *Actual Gain/Slope*

a. With an empty, clean, and dry bucket on the gauge, lower the shipping bolt so that there is a visible gap (~ 1/4 inch) between the end of the bolt and the front support. Verify that the weight of the empty bucket assembly is on the load cell.

b. At the User Menu, type **d**<**enter**> to access the Data Retrieval Menu.

c. Allow the system to run for at least 90 seconds. Type **L6**<**enter**> to look at the last six (6) Precipitation Calibration (PC) data samples. The PC data value will be to three decimal places and is the fifth field for each sample record. If the last three are stable readings (i.e. within ±0.005 inch), then write down the last PC data value and label it 'b1' for later use. If they are not stable then wait for 60 more seconds and repeat.

NOTE: The load cell is very sensitive. Use care to not bump the gauge during the following steps. If it is windy, replace the upper gauge cover (including funnel) during the following measurements.

CAUTION: Be careful not to drop the weights. You could damage the load cell and/or bend the flexures. It is recommended that you raise the shipping bolt while adding or removing weights to the bucket, and subsequently, lowering the shipping bolt to verify that the weight of the bucket assembly is on the load cell.

d. Place 15 inches of weight into bucket. These are the three brass weights marked "4111G".

e. Allow the system to run for at least 90 seconds. Type **L6**<**enter**> to look at the last 6 Precipitation Calibration (PC) data samples. If the last three are stable readings, then write down the last PC data value and label it 'b2' for later use.

f. Calculate the new gain coefficient B with B = 30000/(b2-b1). Round to the nearest hundredth (two decimal places).
[This equation represents: (15 inches x gain) / (full weight - empty weight)]

g. Type **u<space>t**<**enter**> to access the Test Menu. Type **c2**<**enter**> to enter the new gain coefficient B (if prompted for the Administrator Password, enter the password set in Section 8.3). Leave A and C at zero by pressing <**enter**> at both prompts. Enter the calculated B value for gain coefficient B.

9.2.3 Calculate the *Actual Offset*

a. Remove test weights from the bucket.

b. Type **u<space>d**<**enter**> to access the Data Retrieval Menu. Allow the system to run for at least 90 seconds. Type **L6**<**enter**> to look at the last 6 Precipitation Calibration (PC) data samples. If the last three are stable readings, then write down the last PC data value and label it 'c3' for later use.

c. Calculate new coefficient C with C = -c3.

d. Type **u<space>t**<**enter**> to access the Test Menu. Type **c2**<**enter**> to enter the new offset coefficient C (if prompted for the Administrator Password, enter the password set in Section 8.3). Enter the calculated C value for coefficient C. Leave A and B as is by pressing <**enter**> for each.

9.2.4 Adjust the *Actual Offset (Thermal Correction)*

Under some conditions there can be a small additional offset correction required due to temperature corrections done automatically by the instrument. With the bucket still empty, wait at least 15 minutes before performing the following:

a. Type **u<space>d**<**enter**> to access the Data Retrieval Menu. Allow the system to run for at least 90 seconds. Type **L6**<**enter**> to look at the last 6 Precipitation Calibration (PC) data samples. If the last three are stable readings, then write down the last PC data value and label it 'c4' for later use.

b. If c4 is not = 0, then calculate the new coefficient C with C = -(c3+c4).

c. Type **u<space>t**<**enter**> to access the Test Menu. Type **c2**<**enter**> to enter the new offset coefficient C (if prompted for the Administrator Password, enter the password set in Section 8.3). Enter the calculated C value for coefficient C. Leave A and B as is by pressing <**enter**> for each. (If the new C value has not changed, press <**enter**> to leave the C coefficient as is).

9.2.5 Verify Correct Calibration

a. Verify that the weight of the empty bucket assembly is on the load cell.

b. Type **u<space>d**<**enter**> to access the Data Retrieval Menu. Allow the system to run for at least 90 seconds. Type **L6**<**enter**> to look at the last 6 Precipitation Calibration (PC) data samples. Verify that the last three values are 0.0 ± 0.02 inches. If not within the above range, redo the calibration, starting with Section 9.2.1, step d.

c. Raise the bucket with the shipping bolt then place the equivalent weight of 15 inches of precipitation into the weighing bucket. (Use the same three large brass weights (4111G) as used in Section 9.2.2, step d.) Lower the shipping bolt 1/4 inch below the point at which the load cell is supporting the bucket weight.

d. Type **u<space>d**<**enter**> to access the Data Retrieval Menu. Allow the system to run for at least 90 seconds. Type **L6**<**enter**> to look at the last 6 Precipitation Calibration (PC) data samples. Verify that the last three values are 15.0 ± 0.02 inches. If not within the above range, redo the calibration, starting with Section 9.2.1, step d.

e. If the calibration was successful, type **u<space>s**<**enter**> to access the Sample Period Menu to reset the Sample Interval and Offset lines to the original values.

f. At the Sample Period Menu prompt, type **c1/900**<**enter**>**.** You should see the following on your screen:

SAMPLE PERIOD MENU
(Cn/m) Change Item n To Value m (Q) Quit
(E) Save Parameters To EEPROM (H) Help
(U) User Menu

Item 1: 900 (Sample Interval Time)
Item 2: 10 (Sample Duration Time)
Item 3: 0 (Sample Offset Time)

NOTE: The entries for Items 1, 2, and 3 are in seconds.

9.2.6 Save the Load Cell Calibration Coefficients

a. While still at the Sample Period Menu, type **e**<**enter**> to save calibration values to EEPROM. The display should appear similar (the numbers will be different) to that shown below:

Verifying parameters can be stored in EEPROM . . .
Saving parameters to EEPROM . . .
Saving sensor lists to EEPROM . . .
Saving process lists to EEPROM . . .
Saving data output lists to EEPROM . . .
Saving repeater lists to EEPROM . . .
Saving general serial scripts to EEPROM . . .
Saving constants to EEPROM . . .
1057 out of 8192 bytes used in EEPROM.
Total EEPROM Writes = 17, EEPROM Checksum = 200.

NOTE: This action shuts down all ZENO® data logging.

b. Type **u<space>t**<**enter**> to access the Test Menu. Type **c2**<**enter**> to view the conversion coefficients (if prompted for the Administrator Password, enter the password set in Section 8.3). Leave A, B, and C as is by pressing <**enter**> for each.

c. Write down the values of the three conversion coefficients (A, B [Gain/Slope], C [Offset]) for ready reference for when you are conducting a future calibration **check** at the Observer's site. If the calibration check (Section 20 and/or Appendix C) fails to show measurements within ±0.2 inch of 15.0 inches you will need this reference to see if the calibration coefficients have changed.

NOTE: To restore the calibration coefficients to the ones originally recorded, repeat step b, but type in the actual value of the calibration coefficients instead of pressing <**enter**> at the prompt for A, B, and C. In addition, make sure to save these calibration coefficients to EEPROM via the Sample Period Menu (type **u<space>s**<**enter**>, then type **e**<**enter**>).

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

10. Complete Setup: *(Perform these Tasks in Your WFO, if possible)*

10.1 Backup the Current Configuration

In the event the ZENO® data logger loses its configuration for any reason, the backup configuration file (created below) can be reloaded by following the instructions in Section 8.4 with this configuration file instead of 'FPRE_ConfigFile_SID.txt'. This configuration file includes the new data structure definitions, COOP site number, calibration numbers, and calibration coefficients.

a. Access the ZENO® User Menu via the PC as in section 7.

b. At the User Menu, type **z**<**enter**> to access the ZENO Program Menu (if prompted for the Administrator Password, enter the password set in Section 8.3).

c. Type **l**<**enter**> to access the System Load Menu shown below.

SYSTEM LOAD MENU

(R) Receive Configuration From Host	(Z) Zeno Program Menu
(T) Transmit Configuration From Zeno	(H) Help
(V) View Configuration & Menus (ASCII)	

d. Type **t**<**enter**> to signal the ZENO® data logger to backup the current configuration code to a configuration file.

e. Locate the **Transfer** menu on the Menu Bar near the top of the HyperTerminal window and select **Capture Text**. Save the configuration file with the name FPRE_ConfigFile_SID_SS00NNNN_yyyymmdd.txt (where SS00NNNN is the COOP site number and yyyymmdd is the date in year/month/day format). Click **Start** to begin text capture to the specified file location.

f. Press <**enter**> to display and capture the configuration file.

g. Locate the **Transfer** menu on the Menu Bar near the top of the HyperTerminal window. Select **Capture Text** and click on **Stop** to stop the text capture when EOF is displayed.

h. Press <**enter**> to return to the System Load Menu.

i. Type **z**<**enter**> to return to the ZENO Program Menu.

j. Type **q**<**enter**> to exit. Do not close the HyperTerminal window.

10.2 FPR-E ZENO® Assembly Functional Checkout

NOTE: As the ZENO® data logger (in a timed-out state) is still connected to the PC, HyperTerminal will also display messages related to the following two checkout

procedures. If the ZENO® data logger has not timed out, make sure to quit the ZENO® Menu interface before continuing.

10.2.1 Verify Display Operation

a. Press the button on the right side of the FPR-E ZENO® Assembly to light up the display.

b. Place a reference weight into the empty bucket. A single large 4111G weight represents five inches of precipitation.

c. Press the button again after the next 15 minute sample interval. The RAIN value on the display should now show the increase.

d. Verify that display is showing data.

NOTE: If the ZENO® data logger was only recently powered up, there may be no data available as indicated by dashes ("- - - -"). Data will be available at the quarter of the hour of the ZENO® data logger system clock.

10.2.2 Verify USB Flash Download Operation

a. Unscrew the circular cap that covers the USB socket on the right side of the FPR-E ZENO® Assembly.

b. Press the button on the right side of the FPR-E ZENO® Assembly to light up the display.

c. With the display active, insert a USB Flash Drive into the USB socket.

d. Watch the display for verification of USB Flash Drive insert. The display should show approximate time left to download data as MM.SS (minutes.seconds).

NOTE: If the display shows "ERxx", press the button to turn off the display. With the display off, press the button again. If display shows "ERxx" again, verify with the PC that the USB Flash Drive is in good working condition and that there is at least 3.5 MB of room left for the data download.

e. Watch the display for notice of download completion: "**UFdC**".

f. Remove the USB Flash Drive from its socket.

g. Place the circular cap over the USB socket and tighten it.

h. Verify display momentarily indicates "…." and then turns off.

10.2.3 Verify Data Logging with PC

a. Access the ZENO® User Menu via the PC as in section 7.

b. At the User Menu, type **d**<**enter**> to access the Data Retrieval Menu.

c. Locate the **Transfer** menu on the Menu Bar near the top of the HyperTerminal window and select **Capture Text**. Save the text capture file with the name FPRE_Data_SS00NNNN_yyyymmdd.txt (where SS00NNNN is the COOP site number and yyyymmdd is the date in year/month/day format). Click **Start** to begin text capture to the specified file location.

d. Type **L22**<**enter**> to display and capture the last 22 data records.

e. Locate the **Transfer** menu on the Menu Bar near the top of the HyperTerminal window. Select **Capture Text** and click on **Stop** to stop the text capture when the Data Retrieval Menu is displayed.

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

g. View the text capture file, FPRE_Data_SS00NNNN_yyyymmdd.txt, and look at the data to verify that the latest timestamp occurred within the last 16 minutes.

h. Make sure that each record is similar to the following sample data line:

#41005678 10/10/17,17:30:10,15.00,14.999,13.7,22.3,0,FPR-E001
Format is #SS00NNNN yy/mm/dd,hh:mm:ss,PL,PC,BV,IT,BIT,VERS where:

Field	Definition	Units
SS00NNNN	COOP site number	User settable
yy/mm/dd	Year, Month, Day	
hh:mm:ss	Hour, Minute, Second	
PL	Current Precipitation Level	Inches (2 decimal places)
PC	Precipitation Calibration Value	Inches (3 decimal places)
BV	Battery Voltage	Volts
IT	Internal Temperature	Degrees Centigrade
BIT	Built In Test	
VERS	Configuration Version	FPR-E001

10.2.4 Verify Date/Time with PC (yy/mm/dd hh:mm:ss)

a. Follow the procedure for setting date and time as outlined in section 8.

b. Follow the procedure for data logging as outlined in the previous section.

c. Verify that the date and time are correct in the timestamps on logged data.

10.3 Remove the serial cable from the ZENO® data logger.

10.4 Insert all desiccant bags removed back into the FPR-E ZENO® Assembly enclosure and install the cover. Tighten the four lid screws evenly to compress the cover gasket evenly.

NOTE: If the desiccant bags are wet, replace them with dry ones. Insert three 1/6-unit desiccant bags or one 4-unit desiccant bag into the FPR-E ZENO® Assembly enclosure.

11. Transfer Data File from USB Flash Drive: *(Perform this Task in Your WFO)*

11.1 Scan the USB Flash Drive

Follow NWS policy on scanning removable media before use, and verify that "No Viruses Detected." Headquarters recommends MacAfee Active Virus Detection (AVD) software, together with the Federal Desktop Core Configuration (FDCC) installed on a PC running WinXP. The PC should have no internet connections whatsoever, be as devoid as possible of any extraneous applications software. In other words the PC should serve only one purpose, to scan external media for IT security risks.

First, insert the USB Flash Drive into USB Port on the PC. Next, conduct the MacAfee AVD scan of the USB Flash Drive. Ensure the scan comes up "No Viruses Detected." This completes the virus scan of the USB Flash Drive.

11.2 Download TXT File to NWS Workstation

On your NWS workstation, copy the TXT file from the subdirectory CES on the USB Flash Drive into the subdirectory marked C:\HPD\2010\OCT. Filenames are generated by the ZENO® data logger and have the following format:

Z5678AHA.txt

ZNNNNmdv.txt

NNNN: 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.

md: AH is October 17, the date the file was downloaded to the USB Flash Drive (date uses alphanumeric characters starting with 1 and continuing on with A = 10, B = 11, …).

v: A is the first file downloaded for the given month and day. This letter is incremented to B, C, … for each subsequent file downloaded with the same date.

11.3 Viewing Data Files

Saved files may be accessed by opening the TXT file with Notepad using the Mouse right-button. Notepad should open, displaying the selected file. An example is provided below.

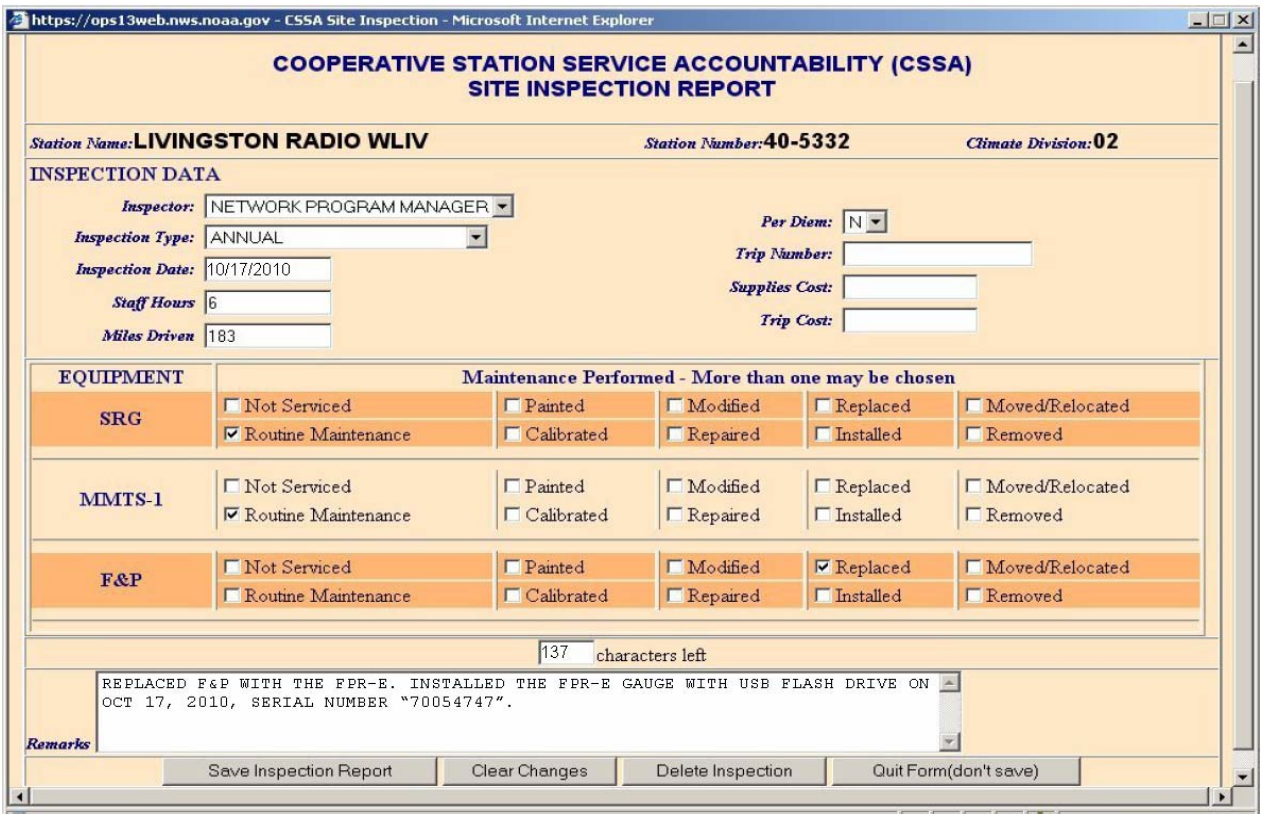
```
#41005678 10/10/17,17:30:10,15.00,14.999,13.7,22.3,0,FPR-E001
#41005678 10/10/17,17:45:10,15.00,14.998,13.7,22.2,0,FPR-E001
#41005678 10/10/17,18:00:10,15.00,14.998,13.7,22.2,0,FPR-E001
#41005678 10/10/17,18:15:10,15.00,14.999,13.6,22.3,0,FPR-E001
#41005678 10/10/17,18:30:10,15.00,14.999,13.7,22.2,0,FPR-E001
#41005678 10/10/17,18:45:10,15.00,14.997,13.7,22.3,0,FPR-E001
#41005678 10/10/17,19:00:10,15.00,14.997,13.7,22.3,0,FPR-E001
#41005678 10/10/17,19:15:10,15.00,14.998,13.7,22.3,0,FPR-E001
#41005678 10/10/17,19:30:10,15.00,14.997,13.7,22.3,0,FPR-E001
#41005678 10/10/17,19:45:10,15.00,14.999,13.7,22.3,0,FPR-E001
```

12. Metadata Requirements on FPR-E Implementation:

12.1 Create a CSSA Site Inspection Report:

When you have completed the FPR-E 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 FPR-E system.

Be sure to complete all these fields to account for your FPR-E installation work!



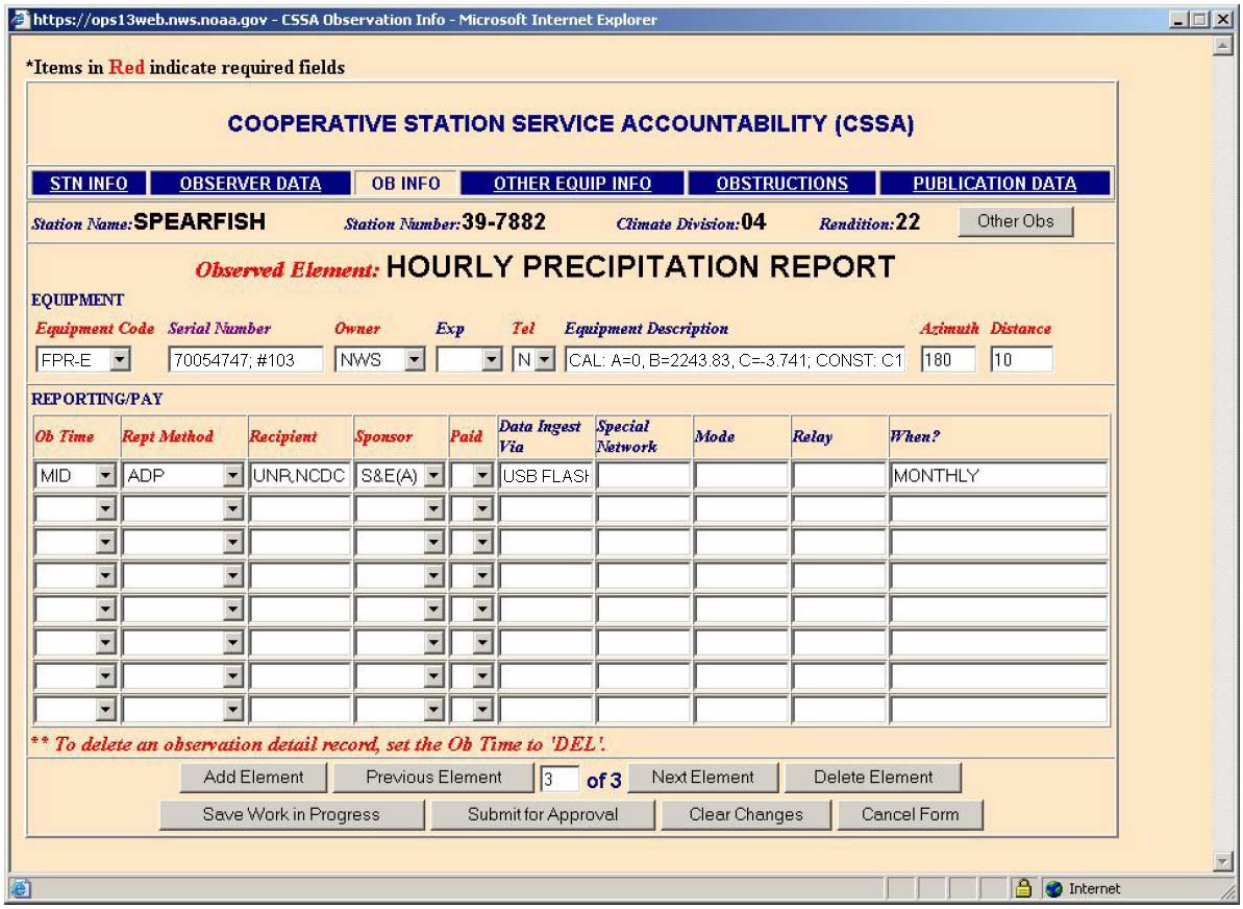
Inspector:…….. Network Program Manager
Inspection Type:…….. Annual
Inspection Date:…… 10/17/2010
Staff Hours:…….. 6
Miles Driven:…… 183
Per Diem:…….. N
Trip Number:…… 2WT0B3804&05
Supplies Cost:…… 75.50
Trip Cost:…….. 113.75

Be sure to select the check box labeled 'Replaced' under Maintenance Performed for the Equipment category F&P. 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 FPR-E. Installed the FPR-E Gauge with USB Flash Drive on Oct 17, 2010, serial number "70054747".**

NOTE: These values are for example only, and will differ for each FPR-E system.

12.2 Update the B-44 for FPR-E Equipment

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



Make the following changes in the Station Information Report (B43):

a. ***Equipment Code***, select '**FPR-E'** from the drop-down menu. This replaces F&P.

b. ***Serial Number*** (see above example), enter the load cell's serial number (i.e., 70054747, collected in step 3.3) and the FPR-E ZENO® Assembly serial number (i.e., 103, collected in step 4.2). Enter the two serial numbers separated by a semicolon, a space, and the # sign as follows: **70054747; #103**

c. ***Equipment Description*** (calibration coefficients and constants), enter text "**CAL: A=0, B=2243.83, C=-3.741; CONST: C1=-0.000525 C2=0 C3=-0.000005**".

NOTE: These values are for example only, and will differ for each FPR-E system.

d. ***Ob Time***, keep 'MID', this refers to midnight, retain 'MID.

e. ***Report Method***, enter '**ADP**', this replaces B18.

f. ***Recipient***, keep 'Your WFO, NCDC' no changes.

g. ***Sponsor***, keep the same. If there is none use "**FC-1**" as the default. For a list of sponsor codes, see p. G-12 (Table G-13) and p. C-61 (Section 2.4.3.13 – Sponsor) in the *CSSA Manual*, NDS 10-1313 (pages refer to the March 18, 2005 edition).

h. ***Data Ingest Via***, enter text "**USB FLASH DRIVE**" this replaces a blank field.

i. ***Special Network***, default is a 'blank' field.

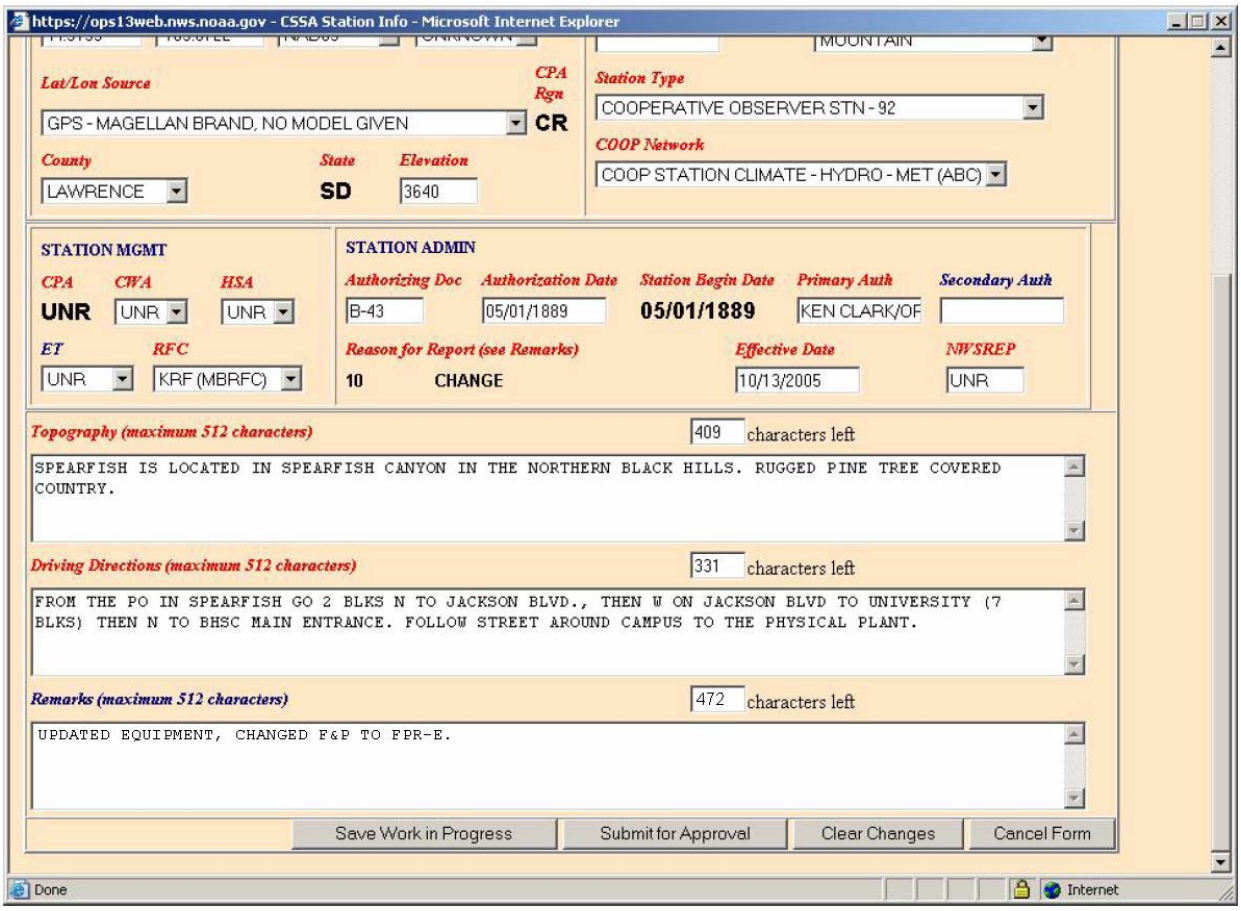
j. ***Mode***, default is a 'blank' field.

k. ***Relay***, default is a 'blank' field.

l. ***When?*** Keep the word "MONTHLY".

12.3 Update the Remarks Section, B-44

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



FPR-E ASSEMBLY INSTRUCTIONS

PART FOUR

TRANSPORT THE FPR-E TO OBSERVER'S SITE

Scope of Part Four

- Enclose Gauge in its Casing Shell……..…0.10 hours
- Package Battery and Solar Panel ……..…...…..…..…..……0.25 hours
- Place Gauge and Parts into Truck/Van…….……..…0.25 hours
- Unload Gauge and Parts from Truck/Van…….0.25 hours

13. Pack the Modified Gauge 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 F&P weighing assembly needs to be open and accessible for you to adjust the shipping bolt and secure the parallel arms.

13.2 Secure the modified gauge for the road trip to Observer's site. Raise the shipping bolt's height by threading it upward until it just touches the front support arm. Thread upwards an additional 1/2 turn to slightly loosen the load cell. 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 down so they can not move or bounce in transit (the upper-rear horizontal flexure is most susceptible to bending). A loop of duct tape around the lower flexure arm and the support stage will hold the assembly tight against the shipping bolt and stop any bouncing. In this way the parallel arms will stay firm against lateral and vertical forces.

13.4 To ensure the load cell is protected, you may block or tape the S-hook, mounting hardware, load cell cable, and bottom/top spring hook so they can not move or bounce in transit. Make sure that the load cell itself is not taped to prevent losing label information.

13.5 Disconnect the solar panel cable from the terminal block and remove from the F&P base. Next, dismount the solar panel from the mounting arm. Finally, disconnect the wire leads off the 12V battery terminals and secure the battery.

Securing FPR-E for Road Trip	**Methods**
Solar Panel	Dismount the solar panel from the mounting arm and wrap it in protective cardboard or newspaper.
CAUTION: Always disconnect the solar panel before disconnecting the battery.	
12V Battery	Remove the six pound 12V battery from the inside of the gauge, and secure it separately in a box outside of the F&P shell. Cover the terminals with plastic protector caps to prevent shorting.
CAUTION: https://www.ops1.nws.noaa.gov/Secure/SAFETY/Safety_manual.htm Read the safety pre-cautions for handling a sealed lead-acid 12V battery.	
Shipping Bolt	Make sure it is threaded upward, raised, and touches the front support arm.

13.6 Hand-carry the modified gauge (attached to its base plate and enclosed in its casing) to the truck/van with a second person. Be aware of this assembly's heavy weight. Set it down gently onto the floor of the truck/van and if possible, anchored, or snugly fitted between boxes to prevent toppling.

13.7 Place the 12V battery, solar panel, mounting arm, and tool kit in separate boxes and surrounded with packing material (i.e., newspaper, Styrofoam, or cardboard) to prevent contact and surface damage.

13.8 Finally, place the collection bucket and its force post into the truck/van and secure it from sliding or toppling.

13.9 Observer site installation does not require any extraordinary tools. Items needed for installation and checkout include a printed copy of this ***FPR-E Assembly Procedures***, the common SAE standard size hand tools such as screwdrivers (Phillips and slotted blade), open end wrenches, the F&P calibration weight set (D111C-TE500) and a multi meter (voltmeter). You will need to adjust the mounting nuts on the F&P pedestal, so take appropriate wrenches.

Refer to the Checklist of parts and tools in Section 1 of this manual.

14. Unload the Modified Gauge 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, mounting arm, modified gauge, and 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.

14.2. Re-inspect the shipping bolt to ensure it remains in full contact with the front support arm.

14.3. Re-inspect the modified gauge'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 FPR deployment list. This efficient method results in a site-by-site rotation of the F&P gauges.

FPR-E ASSEMBLY INSTRUCTIONS

PART FIVE

INSTALLING THE FPR-E AT OBSERVER'S SITE

Scope of Part Five

- Remove Observer's F&P for Retrieval……0.50 hours
- Install the FPR-E onto Observer's Pedestal……0.25 hours
- Mount the Solar Panel and 12V Battery…….……..0.25 hours
- Check the Calibration……..0.25 hours
- Train Observer…….……....0.50 hours

15. Dismount Legacy Rain Gauge from its Pedestal: *(At Observer's Site)*

This section deals with the removal of a legacy F&P rain gauge from an observer's site and securing it inside your truck/van for transport back to your forecast office.

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

15.2 Rotate the casing shell (white cylinder with service door) counterclockwise until it slides out of the three metal locking tabs (located inside the casing shell). Now, remove the shell by slowly raising it, exactly vertically, to clear the F&P weighing assembly.

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 the dashpot is not bottomed out and the weighing assembly is resting on the shipping bolt. Then lock shipping 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 and minimize your work getting this gauge ready for the next site (see section 2), 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.

15.5 Place back the casing shell you removed in Step 15.2. Carefully and slowly lower it down about the modified gauge's weighing assembly until it fits into the groove of the base plate. Then rotate the casing shell clockwise until it slides into the three metal locking tabs.

15.6 Unbolt the F&P from the gauge support. Directly under the casing shell, view the base plate's circumference where the rim of shell sits. Notice there are two large indentations in the dark gray metal circumference. These are the grip locations for removal.

With a second person, lift the F&P by grasping the bottom of the base plate with both hands, in the two locations noted above, and set it aside onto a smooth and clean surface. Later, after you have installed the FPR-E system you will load this F&P 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 2, of this *FPR-E Assembly Procedures*.

16. Install the Modified Gauge onto Pedestal: *(At Observer's Site)*

16.1 With a second person, carry the modified gauge to the mounting pedestal where you just removed the legacy F&P. Inspect the triangular foundation plate and clean about the bolt threads if needed. Place the solar panel mounting arm over one of the mounting bolts. You will either need to lower the adjusting nut under the solar panel mounting arm and raise the other two, or add washers to the other two to re-level the base plate. Set the modified gauge'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 Make sure the mounting arm is either under the casing shell door or to the right of it. Mount the force post, mount the bucket onto the force post, and mount the conical hood on top of the casing shell. 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, but leave the force post and bucket attached.

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

16.5 Cut away any safety tape you had wrapped about the load cell assembly.

16.6 With the bucket still empty, lower the shipping bolt so there is a visible gap (1/4 inch) between the top of the bolt and the bottom of the front support arm (i.e., standard operating position). Verify that there is a 1/4 inch gap above the shipping bolt.

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

17.1 The new solar panel is mounted on the supplied mounting arm. Make sure that the solar panel faces due South and is not shaded by trees or other obstructions.

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. You are not required to mount the solar panel at the gauge, particularly if it will be shaded by doing so. If you need to remote the solar panel from the gauge to give it good exposure, you may move it up to 300 feet away using the same-size wire.

The FPR-E Kit comes with a 15 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.

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.'

17.2 The supplied solar panel with its mounting arm comes with three angle mounts. Follow the instructions in section 5.

17.3 At this point, all mechanical work is finished. Carefully check the whole unit for hazards like sharp edges/corners and dangling wires, and take appropriate action to remove the hazards.

18. Install the 12V Battery: *(At Observer's Site)*

18.1 Place the 12V battery on a flat portion of the base plate behind the load cell.

18.2 Attach the battery cable leads to the battery terminals. See the position of battery terminals, positive and negative, in the photo at right.

black wire to (-) terminal

white wire to (+) terminal

18.3 At this point the 12V battery is connected and the system is powered on.

NOTE: There is no indication of the ZENO® data logger powering up. Wait at least 30 seconds before pressing the button on the side of the FPR-E ZENO® Assembly to confirm that the ZENO® data logger is now automatically taking measurements and logging data. The illuminated display should show the most recently logged RAIN value (does not necessarily reflect the actual weighted value at the time the button was pressed) or dashes

("- - - -") if no logged data is available.

NOTE: If nothing is shown on the display after pressing the button, the fuse may have blown (especially if the battery cable connections were accidentally crossed for even a short period of time). Disconnect the battery, replace the time-delay "slow blow" fuse (250V, 2A rating, MDL type) behind the display board (gray cover with slot), and repeat step 18.2.

19. Check Solar Charging of Battery: *(At Observer's Site)*

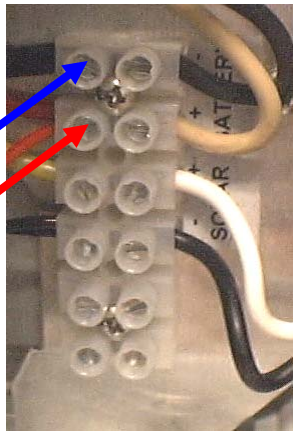
CAUTION: Please probe the screws used to clamp the wires.

19.1 Ensure the solar panel you mounted in Section 17 is receiving full sun. The panel is capable of generating 17V and should be reaching the junction box inside the FPR-E ZENO® Assembly.

19.2 Open the front cover of the FPR-E ZENO® Assembly and disconnect the white wire of solar cable from the terminal block.

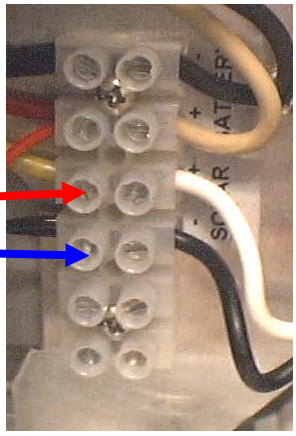
19.3 Measure the voltage between the white wire and the black wire of the solar cable. In full sun it should be above 14V.

19.4 Measure the battery voltage across the top two terminals in the junction box. A fully charged battery should be around 12.6V.



Touch multi meter probes into the recessed holes.

19.5 Reconnect the white wire from the solar panel to the solar (+) terminal and again measure the voltage coming from the solar panel – it should now be slightly above the battery voltage.



Touch multi meter probes into the recessed holes.

19.6 If it was higher than the battery voltage when un-connected and drops to battery voltage when connected, then the solar panel is providing current to the battery.

20. Check Calibration with Brass Weights: *(At Observer's Site)*

20.1 Use your carpenter's level (approximately 18 inches long) and span it across the top of the collection bucket.

20.2 Wait 15 minutes. Press the button on the right side of the FPR-E ZENO® Assembly to activate the display and take a reading. Write it down to a piece of paper.

NOTE: To reduce the waiting time, refer to Section 9.2.1, steps a – c, to change the sample rate to 12 seconds with the PC. However, the sample rate must be changed back to 15 minutes (900 seconds) as in Section 9.2.5, steps e – f, once this calibration check is completed.

20.3 Then place one, two, or three large brass weights (4111g each) on the carpenter's level. See the photo, right.

20.4 Take a new reading after 15 minutes. Write down this weighted value.

20.5 Subtract the value taken in 20.2 from that taken in 20.4. Does the difference sit within the Cal-Check Table's acceptable ranges according to the number of the brass weights you have in or on the bucket?

20.6 If the difference falls into the acceptable range (Cal-Check Table), the calibration check produced 'good readings.' Now enter 'Cal Check – Good Readings' to the Log Sheet. If a Cal Check difference fails to come into acceptable range (Cal-Check Table) conduct a calibration reset as described in Section 9 of this manual. Then enter to your station inspection notes, 'Cal Check – Reset Performed.'

Cal-Check Table

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 /on bucket to get the weighted value.

20.7 Remove the weight(s) from the carpenter's level. Then remove the carpenter's level.

20.8 If this is a semi-annual visit and other maintenance is performed, then state so to the Log Sheet; 'Added Oil', and/or 'Added Food Grade Propylene Glycol (FGPG)'.

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

APPENDIX A – PLANNING CONSIDERATIONS FOR F&P REBUILD

COOP Site Preparation:

None.

Preparations in WFO:

Remove casing from available F&P gauge. Prep gauge.

Unpack, inspect, assemble, and checkout the FPR-E Kit.

Charge the 12V Battery to full charge.

Configure the PC and verify serial cable compatibility.

Assemble FPR-E and Checkout in WFO:

Install load cell assembly and FPR-E ZENO® Assembly.

Update configuration code.

Install SID settings.

Perform system calibration.

Prepare for Transport:

Secure FPR-E and peripherals inside vehicle.

Read your checklist of Tools and FPR-E parts before and after packing the vehicle.

Install the FPR-E at COOP Site:

Remove F&P hood and bucket. Dismount the circular mounting plate from the pedestal.

Install the solar panel arm and then the circular base plate with FPR-E onto the pedestal.

Mount the Solar Panel.

Perform Solar Charging Check.

Perform Cal Check (gauge reading in office prior to deployment $\pm$ 0.02 of an inch).

Download to USB Flash Drive - as check-up, and train Observer.

Charge the bucket with oil and/or Food Grade Propylene Glycol (FGPG).

Metadata and Operational Implementation Tasks at WFO:

Update the B-44, ***Equipment Description,*** to account for load cell serial number, FPR-E ZENO® Assembly serial number, Calibration Coefficients, and Calibration Constants.

Retain repairable F&P parts (See Appendix B) at the forecast office because you may need to ship it to a neighboring WFO still operating F&P until the planned termination of all paper tapes in 2012.

Begin 30-day monitoring and coordination with the Observer.

Create a ***Form 79-1D 'HPD' Spreadsheet*** to convert partial month's paper tape data to hourly values and enter in Excel spreadsheet. E-mail to NCDC (HPD.NCDC@noaa.gov).

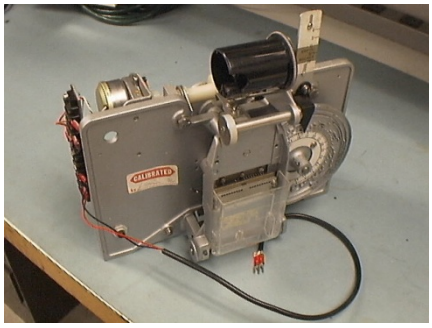
Submit ***FPR-E Implementation Checklists*** to MIC, one for each site, with COOP Site Number on checklist.

Submit ***WFO Implementation Certificate*** to NWSHQ via FAX 301-713-1598 (W/OS7). Just one certificate is required to account for all FPR-E sites implemented. The MIC signature is required.

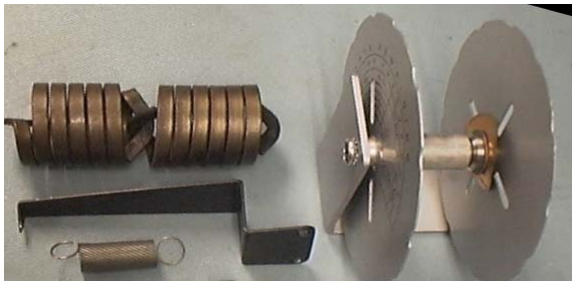
APPENDIX B – DISPOSITION OF OLD F&P PARTS

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 punch motor and microswitch assembly,
  - the two wrap cables,
  - the chad tray,
  - the plastic upper tape spool and spring,
  - and any other parts you have needed before.



- Please keep the aforementioned small parts at WFO.



- And any model, electronic timer and bracket.

- Solar Panel (if good).

- 6V battery (if good).

<u>NOTE</u>: If you are upgrading all the F&P's in your area, then e-mail your RCPM to inform him/her that you can distribute these legacy F&P parts to other offices within the Region.

APPENDIX C – CALIBRATION CHECK PROCEDURE

1. Before you install oil or Food Grade Propylene Glycol (FGPG) for full-time operation…and while the bucket is still clean and dry, perform this Calibration Check. Use a carpenter's level across top if you have already placed oil or FGPG in the bucket.

2. Place carpenter's level flat-side, across the top of the collection bucket.

3. Wait 15 minutes. Press the button on the right side of the FPR-E ZENO® Assembly to activate the display and take a reading. Write it down to a piece of paper.

NOTE: To reduce the waiting time, refer to Section 9.2.1, steps a – c, to change the sample rate to 12 seconds with the PC. However, the sample rate must be changed back to 15 minutes (900 seconds) as in Section 9.2.5, steps e – f, once this calibration check is completed.

4. Then place one, two, or three large brass weights (4111g each) upon the carpenter's level.

5. Take a new reading after 15 minutes. Write down this weighted 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 as given in the Table below, the calibration is acceptable and full calibration is not needed. Then write down in your site inspection report 'Cal Check – Good Readings.' into the ***FPR Maintenance Log Sheet***. 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, of this manual. Then write down in the ***Maintenance Log Sheet***, 'Calibration Check – Performed Reset.'

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/on bucket to get the weighted value.

8. Remove the weight(s) from the carpenter's level, and then remove the carpenter's level.

APPENDIX D – INSTRUCTIONS FOR MONTHLY DOWNLOAD

1. Unscrew the circular cap that covers the USB socket on the right side of the FPR-E ZENO® Assembly.

2. Press the button on the right side of the FPR-E ZENO® Assembly to light up the display.

3. With the display active, insert a USB Flash Drive into the USB socket.

4. Watch the display for verification of USB Flash Drive insert. The display should show approximate time left to download data as MM.SS (minutes.seconds).

NOTE: If the display shows "ERxx", press the button to turn off the display. With the display off, press the button again. If display shows "ERxx" again, verify with the PC that the USB Flash Drive is in good working condition and that there is at least 3.5 MB of room left for the data download.

5. Watch the display for notice of download completion: "**UFdC**".

6. Remove the USB Flash Drive from its socket.

7. Place the circular cap over the USB socket and tighten it.

8. Verify display momentarily indicates "…." and then turns off.

APPENDIX E – MAINTENANCE NOTES FOR INSPECTION REPORT

The FPR-E system does not flag/indicate external activity, nor does it have functionality for user entered notation codes. Therefore, both Observer and NWSREP shall document maintenance actions (i.e., adding Food Grade Propylene Glycol (FGPG), or adding oil) to an FPR-E Log-Sheet to communicate the interruptions in precipitation data to NCDC through the CSSA Site Inspection Report.

COOP Observer Reports these Events to Log-Sheet when delegated by NWSREP:

Valid Remarks for Observer to report in his FPR-E Log Sheet
Added Oil to Bucket
Added Food Grade Propylene Glycol (FGPG) to Bucket
Partially Drained Bucket – Some liquid (i.e., oil) remains in bucket
Emptied Bucket – Bucket completely emptied
Installed Funnel – for summer
Removed Funnel – for winter
Routine Gauge Check
Foreign Object Found in Bucket
Time is more than 15 minutes fast/slow
Non-routine Download to Flash Drive

CSSA Site Inspection Report – Valid Entries for FPR-E Maintenance:

Fischer-Porter Rebuild (FPR-E) Valid Entries for Site Inspection Report
Annual Visit
Semi-Annual Visit
Emergency Visit
Awake Display – Start
Awake Display – End
Precip Level Before Bucket Serviced
Precip Level After Bucket Serviced
Calibration Check – Good Readings
Calibration Check – Reset Performed
Partially Drained Bucket – some liquid (i.e., oil) remains in bucket
Emptied Bucket – Bucket completely emptied
Added Oil to Bucket
Added Food Grade Propylene Glycol (FGPG) to Bucket
Emptied and Cleaned Bucket
Installed Funnel – for summer
Removed Funnel – for winter
Foreign Object Found in Bucket
Data Downloaded to USB Flash Drive
Cleaned F&P Housing
Cleaned Solar Panel
Cleaned FPR-E ZENO® Assembly
Cal Coefficient B – Value before Calibration
Cal Coefficient B – Value after Calibration

Cal Coefficient C – Value before Calibration
Cal Coefficient C – Value after Calibration
Installed Auto-Syphon
Removed Auto-Syphon
Time is more than 15 minutes slow.
Time is more than 15 minutes fast.
Replaced one or more Flexures
Replaced FPR-E ZENO® Assembly – With same model FPR-E ZENO® Assembly
Replaced Load Cell Assembly – With same model Load Cell Assembly
Replaced S hook
Replaced Desiccant Bags
Replaced Fuse
Gauge moved to a compatible location – equipment move
Gauge moved to a non-compatible location – station relocation
Gauge removed from service – placed in storage
Gauge put back in service after being in storage

APPENDIX F – EFFECT ON NATIONAL DIRECTIVE SYSTEM (NDS)

1. Primary Resources On-Line:

a. http://www.nws.noaa.gov/ops2/Surface/coopimplementation.htm
- ***FPR-E Assembly Procedures*** *– February 2012*
- ***FPR-E Observers Instructions*** *– December 2011*
- ***FPR-E Operations Manual*** *– February 2012*
- ***FPRE_PlotData_V1_2_6.xls*** *– September 2011*

b. http://www.srh.noaa.gov/ohx/dad/coop/f-p_images
- Clear photos of the original F&P rain gauge.

2. Support Resources – NWS Policy and Procedures:

a. *NWSI 10-1315, COOP Station Observations* (Oct 2010) *****
http://www.nws.noaa.gov/directives/sym/pd01013015curr.pdf

b. *NWSI 10-1313, CSSA User Manual* (Mar 18, 2005) *****
http://www.nws.noaa.gov/directives/sym/pd01013013curr.pdf

c. Proposed: IT Security Statement (by FPR Project Leader to OS chief).

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

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

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

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

***** 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.

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

a. *FPR Kit Operations and Maintenance Manual v4.2* (May 17, 2010), delivered with kit is published by CES.

NOTE: The NWSHQ issued '*FPR-E Assembly Procedures (February 2012)*' is the primary assembly manual. You may reference *FPR Kit Operations and Maintenance Manual*, for detailed information on ZENO® data logger measurements and controls.

4. Engineering Handbooks (NWS):

The following content in EHB-10 is superseded by the ***FPR-E Assembly Procedures*** (February 2012), issued by the NWS, Observing Services Division:

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 Rebuild (FPR) 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 will list this equipment in the EHB-1, Instrumental Equipment Catalog.

5. Sterling Field Support Center (SFSC)

For operational support when you implement the Fischer-Porter Rebuild (FPR) modification, you may phone the Sterling Field Support Center, 8:00 AM – 5:00 PM, Monday – Friday, on 703-661-1268; or e-mail them, nws.sfsc@noaa.gov. Before calling SFSC, write down the issue or question and inform your Regional COOP Manager by phone or email.

The Sterling Field Support Center (SFSC) is located approximately 30 miles west of Washington, DC, in Sterling, Virginia. The SFSC operates as an extension of National Weather Service (NWS) Headquarters to provide operational support to field personnel through a combination of sensor testing, sensor system analysis, and contact center support. Sterling provides a critical service to the NWS field community by using their years of knowledge and experience gained through extensive sensor/system testing and maintenance in assisting the field with sensor and system failures. When these failures arise in the field, the SFSC is there to provide assistance and help solve these problems.

The SFSC has been a critical component of the Fischer Porter Rebuild (FPR) Program. The SFSC will play a major role in assisting the field if issues arise when the FPR kits are installed at COOP sites around the country. The facility has created a contact center and should be the first point of contact made by NWS WFO's if there are questions or issues with the FPR kits. If the SFSC is unable to determine the correction for the issue, the SFSC will elevate it to NWS

Headquarter level.

The contact center at the SFSC was established to troubleshoot potential issues in the field with the installation and usage of the FPR kits. The contact center is open Monday through Friday 8:00 AM to 5:00 PM Eastern Time. The SFSC is closed for all federal holidays. All emails and phone calls received during the hours of operation will be responded to in a timely manner. Emails received during non-operation hours will be returned in the order they are received on the following day in which the facility is open.

SFSC Contact Center Information

Main Line: 703-661-1268
Back-up Line: 703-661-1293
Email: nws.sfsc@noaa.gov

APPENDIX G – FPR-E SPARES AND AGENCY STOCK NUMBERS (ASN)

General Name	Short Description	Long Description	ASN	SMR *
Load Cell Assembly	Load Cell Assembly, FPR	Load Cell Assembly, FPR, complete with load cell, S Hook, and mounting hardware (CES)	**D111E-1**	PAODD
S Hook, LC mounting	S Hook, Load Cell mounting, FPR	S Hook, Load Cell mounting, FPR (CES or Open Market	**D111E-1MP1**	PAOZZ
Null Modem Cable	Null Modem Cable	Null Modem Cable DB9F To DB9F, Fischer-Porter Rebuild Kit (FPR-E), 3 Meter Length	**D111E-1W1**	PAOZZ
FPR-E ZENO® Assembly	ZENO® FPX Assembly with Bracket	ZENO® FPX Assembly for F&P Gauge Rebuild, includes ZENO® datalogger, solar panel regulator, display, push button, USB Flash Drive interface, housing and mounting bracket (CES)	**D111E-2**	PAODD
Battery Cable	Battery Cable, FPR Kit	Battery Cable, FPR Kit	**D111E-2CBL1**	PAOZZ
Stuffing Gland	Gland Fitting, FPR Kit	Gland Fitting, FPR Kit	**D111E-2MP1**	PAOZZ
Desiccant Bag	Desiccant Bag	Desiccant Bag, 3.66 ounce, 4-Unit, Silica Gel, Silica Gel Desiccant Products Company P/N S-3043	**D111E-2MP2** or **052-D-1**	PAOZZ
CES FPR Manual	Manual, FPR, OEM, CES	Manual, FPR, OEM (CES)	**D111E-2D1**	PAOZZ
Fuse	Fuse, 250V, 2A	Fuse, 250V, 2A, Busmann	**D111E-2F1** or **017-F-5-31s**	PAOZZ
Battery	Battery, 12V, 7AH, Sealed Lead Acid	Battery, 12V, 7AH, Sealed Lead Acid, Spade Terminals, 4 lbs, Panasonic LC-R127R2P or Equivalent	**D111E-2B1** or **017-B-2-32**	PAOZZ
Solar Panel Assembly	Solar Panel, 10W, 12V nom, @0.66A, no regulator.	Solar Panel, 10W, with Diode, 12V nom. @0.66A, no regulator, metal frame, with 15 feet cable, hardware and mounting arm (CES or PowerUp Co.)	**D111E-3**	PAODD
Solar Panel (only)	Solar Panel only, 10W, 12V nom, @0.66A, no regulator, FPR Kit	Solar Panel only, 10W, with Diode, 12V nom. @0.66A, no regulator, metal frame, with 15 feet cable, PowerUp BSP-1012	**D111E-3A1**	PAODD

Solar Panel Mount (only)	Mounting Hardware, for Solar Panel, FPR Kit	Mounting Hardware, hardware and mounting arm (CES), custom for PowerUP BSP-1012 solar panel and F&P gauge, FPR Kit	**D111E-3A2**	PAOZZ

* The FPR 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 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.

APPENDIX H – FPR-E ASSEMBLY WORKSHEET

	Parameter	Value
1	Load Cell serial number	
2	FPR-E ZENO® Assembly serial number	
3	Calibration Constant C1	
4	Calibration Constant C2	
5	Calibration Constant C3	
6	Firmware Version	
7	Configuration Version	
8	COOP Site Number	
9	Site ID	
10	State ID plus 2 zeros	
11	PC data for b1	
12	PC data for b2	
13	B = 30000/(b2-b1)	
14	PC data for c3	
15	C = -c3	
16	PC data for c4	
17	C = -(c3+c4)	
18	Cal Coefficient A	0 (default)
19	Cal Coefficient B	
20	Cal Coefficient C	