



# **FISCHER–PORTER UPGRADE (FPU) Removal And Preparation Instructions for installing Fischer & Porter Rebuild- version E (FPR-E)**

**Draft: Oct 16, 2012**

**U.S. Department of Commerce  
National Oceanic and Atmospheric Administration  
National Weather Service - Cooperative Weather Observer Program**



# Table of Contents

- 1. Preparation for FPR-E Modification .....4**
  - 1.1 General Steps to FPU to FPR-E Modification:..... 5
  - 1.2 Tools and Equipment Required to Disassemble FPU:..... 6
- 2. Disassemble FPU Gauge.....7**
  - 2.1 Data Key Download ..... 7
  - 2.2 FPU Logger Download..... 8
  - 2.3 Remove Bonding Wire ..... 8
  - 2.4 Remove Solar Power Cable..... 8
  - 2.5 Remove Battery Power ..... 9
  - 2.6 Unplug the Load-Cell Cable ..... 9
  - 2.7 Dismount Solar Panel from GMA Pole ..... 9
  - 2.8 Remove 54-lb Battery from Enclosure.....10
  - 2.9 Remove GMA, Keypad and Zeno Data Logger .....10
  - 2.10 Dismount Enclosure from GMA Pole.....10
  - 2.11 Dismount the Load Cell Assembly from F&P Support Stage .....11
  - 2.12 Remove the Plunger .....11
  - 2.13 Check all 8 Flexures .....11
  - 2.14 Retrieve all FPU Parts and Tools .....11
  - 2.15 Pack Used Parts into Cardboard Boxes .....12
- 3. For Sites with Separate GMA Pole - Remove Pole and Restore Grounds (if necessary) ..12**
  - 3.1 Coordinate with COOP Observer .....12
  - 3.2 Excavate Pole and Fill Hole (if required) .....12
- 4. Retention and Disposition of FPU Parts.....13**
  - 4.1 Retrieve Solar Panel and Mounting Bracket.....13

- 4.2 Disposition of Remaining FPU Parts ..... 14
  - 4.2.1 Identification of Remaining FPU Parts ..... 14
  - 4.2.2 Voluntary Shipment of Spares ..... 15
    - 4.2.2.1 Identification of Spares Needed..... 15
    - 4.2.2.2 Quality and Condition of Used Parts..... 16
    - 4.2.2.3 Local Office Instruction ..... 16
    - 4.2.2.4 Guidance on Packing ..... 16
    - 4.2.2.5 Regional Office Instruction ..... 16
    - 4.2.2.6 National Office Instruction ..... 16

**APPENDICES**

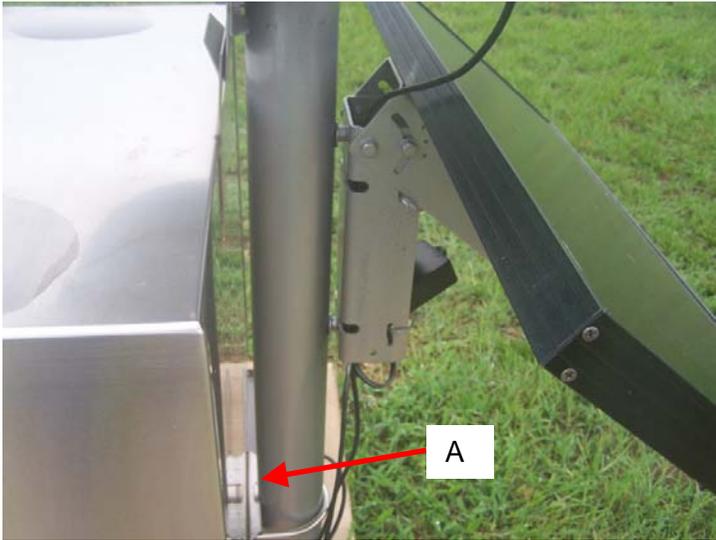
- APPENDIX A – Documentation and Assistance ..... 17**
- APPENDIX B – OFFICES IN NEED OF FPU SPARE PARTS..... 18**
- APPENDIX C - FPU PARTS AND AGENCY STOCK NUMBERS (ASN)..... 19**

**1. Preparation for FPR-E Modification**

The FPR-E equipment will replace all of the FPU equipment without any shared or saved parts. The FPR-E system is physically smaller than the FPU system, and will be contained within the F&P housing. The solar mount for the FPR-E is illustrated in Fig 1.1. However, this location is low to the ground and is not ideal for locations prone to deep snow or snowdrifts. If the observer consents, you may mount the FPR-E solar panel where the FPU solar panel was mounted (see Fig 1.2).



**Figure 1.1 - Solar Mount for FPR-E as provided in kit.**

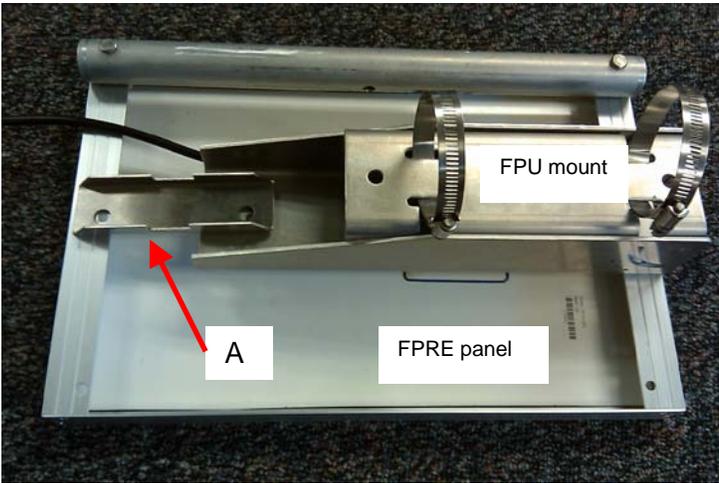


**Figure 1.2 - FPU solar panel mounting**

If the provided FPR-E solar panel mounting scheme is too low or otherwise not practical, put the FPR-E panel where the FPU panel was, using the FPU solar panel mount.

The FPU mount will need to be lengthened to fit the FPR-E solar panel.

Use a stiff piece of metal with two predrilled holes 3-7/8 inches apart, or use the lower U-bolt clamp bracket from the FPU enclosure, as shown here at "A" in both Figures 1.2 and 1.3.



**Figure 1.3 - FPU mount on FPRE panel**

Additional 1/4 x 20 fasteners will be needed.

The FPR-E solar panel is too large to safely mount on the old F&P pipe stand and therefore using the old F&P pipe stand is not recommended.

**NOTE: Verify that you have the old F&P upper main-spring Hook and Adjustment Knob at the site, or with you before going out to do the install.**



### 1.1 General Steps to FPU to FPR-E Modification:

This instruction covers steps 1 – 7 and 13, the removal and disposal of the FPU. Installation, setup and operation of the FPR-E, steps 8 – 12, are covered in the ***FPR-E Assembly Procedures*** - Feb 2012.

[http://www.nws.noaa.gov/ops2/Surface/documents/FPRE\\_AsmblyPrcdr\\_17Feb2012.pdf](http://www.nws.noaa.gov/ops2/Surface/documents/FPRE_AsmblyPrcdr_17Feb2012.pdf)

- |  |   |
|--|---|
| 1. Receive and Inspect FPR-E Kit in WFO:                     | Est. Time Required (ETR): 0.25-Hours.       |
| 2. Charge the 12V Battery:                                   | ETR: As required to indicate 'Full Charge.' |
| 3. Transport to Observer's Site:                             | ETR: TBD.                                   |
| 4. Download Precipitation Data from FPU:                     | ETR: 0.25-Hours.                            |
| 5. Drain and Wipe the Collection Bucket:                     | ETR: 0.50-Hours.                            |
| 6. Disassemble GMA Enclosure and Remove Pole (If Necessary): | ETR: 3.00-Hours.                            |
| 7. Remove the FPU Load Cell:                                 | ETR: 0.10-Hours.                            |
| 8. Install the FPR-E Load Cell, Logger, Solar Panel:         | ETR: 0.50-Hours.                            |
| 9. Calibrate and Verify FPR-E Performance:                   | ETR: 0.10-Hours.                            |
| 10. Train the Observer to download the FPR-E data:           | ETR: 0.50-Hours.                            |
| 11. Complete Metadata and Site Inspection Reports:           | ETR: 1.00-Hours.                            |
| 12. Transmit the Precipitation FPU Data to NCDC:             | ETR: 1.00-Hours.                            |
| 13. Return/Dispose of the FPU Battery and Parts:             | ETR: TBD.                                   |

**1.2 Tools and Equipment Required to Disassemble FPU:**

Ensure the following tools and test equipment are available before your visit:

<b>Table 1 - Tools and Test Equipment</b>
Phillips Screw driver ( #2 )
Flat Blade Screw driver (1/4 inch)
7/16" and 9/16" wrenches
3/32" Allen wrench
Hand-truck or Dolly
Multi meter (or voltmeter and ohmmeter)
1/ 2" open wrench
Needlenose pliers with wire cutters/strippers
Laptop computer with modem and terminal emulation program (i.e., HyperTerminal) for access to Zeno data logger. This <b><u>does not require</u></b> Win95/98/ME.
Serial Communications Cable (for laptop) with 9-pin female end and 9-pin male end ( <u>not</u> null modem)
Shovel

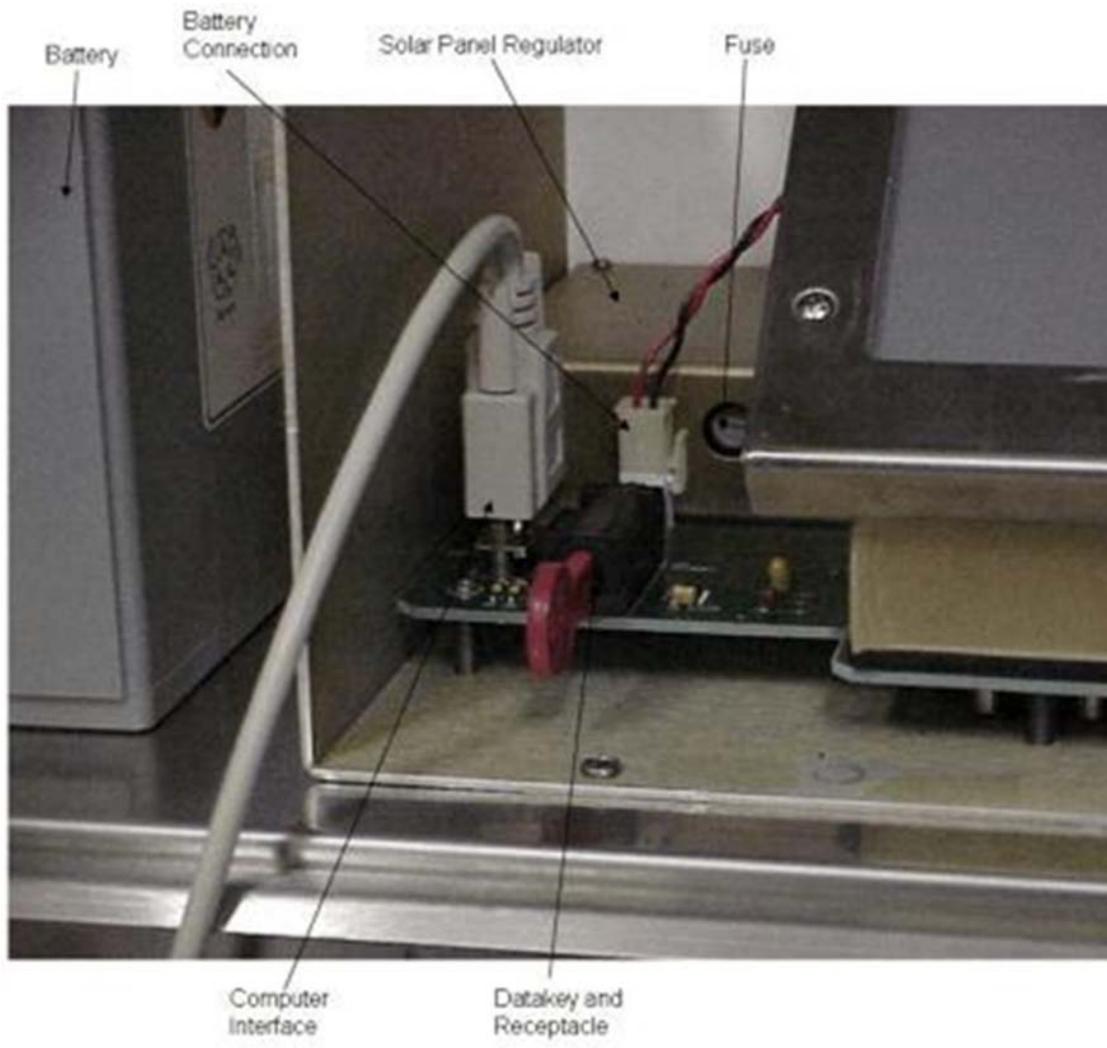


Figure 1.4 – Laptop and Datakey are required for FPU Disassembly.

## 2. Disassemble FPU Gauge.

For reference, detailed assembly instructions are found in *FPU Assembly Procedural* on the NWS COOP modernization site:

[http://www.nws.noaa.gov/ops2/Surface/documents/FPU\\_AsmbyPrcdrl08212006.pdf](http://www.nws.noaa.gov/ops2/Surface/documents/FPU_AsmbyPrcdrl08212006.pdf) .

Then follow these specific instructions at the COOP site.

### 2.1 Data Key Download

Bring a good quality Data Key and download the last 55-days of 15-minute precipitation records. Follow instruction in Section 19.1 of the *FPU Assembly Procedural*. Bring the Data Key back to the WFO to upload the data to your WFO workstation. Use the FTP program to transmit the Zip file to NCDC as if this were the monthly routine upload.

## 2.2 FPU Logger Download

To cover the possibility that the Datakey download was unsuccessful, use your Laptop with HyperTerminal to copy the data contents of the Zeno Logger. Follow instructions in Section 11.5 in the *FPU Assembly Procedural*. Upload the logger file to your WFO workstation as a source of 15-min data as a backup source for any possible missing data.



Figure 2.1 - FPU with GMA Pole.

## 2.3 Remove Bonding Wire

Disconnect the bonding wire from the bottom of the Enclosure and from the back of the support stage of the weighing assembly inside the rain gauge. This is the bonding wire installed with *FPU Mod Note #1 (issued Sept 2006)*.

## 2.4 Remove Solar Power Cable

Unplug the Solar Cable from the base of the GMA Enclosure (i.e., steel box). The Solar Cable port is the one that is located apart from the other three, nearest to the front of the enclosure (see Fig 2.2).

**CAUTION:** Section 2.4 involves working on a **LIVE** electrical circuit. Do not allow your screwdriver or the disconnected cable pins to touch any exposed circuits, metal parts, or fall into a puddle of water.

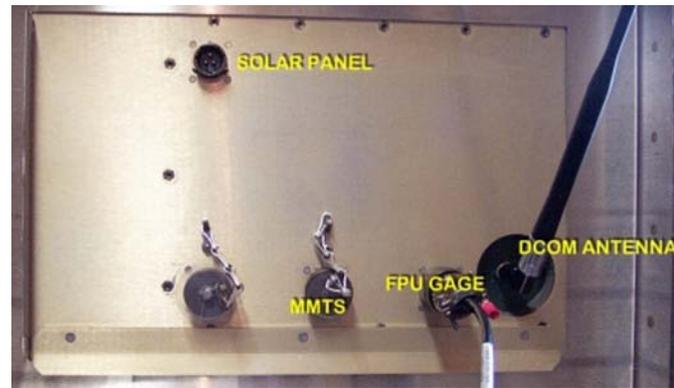


Figure 2.2 - Bottom of Enclosure – Solar and FPU Sockets

### 2.5 Remove Battery Power

Unplug the short red/black battery cable from its socket near the Data Key receptacle. This is the short one-foot paired wire from the battery terminals as shown in Figure 2.3.

The FPU should now be powered down, OFF.



Figure 2.3– Inside the Enclosure – Battery and Keypad.

### 2.6 Unplug the Load-Cell Cable

Unplug the Load-Cell Cable from the underside of the Enclosure and then unplug the other end from the small white plastic plug inside the F&P housing. Gently pull the cable out through the cable port in the F&P's base plate.

### 2.7 Dismount Solar Panel from GMA Pole

Use the half-inch open wrench to unfasten U-bolts that attach the solar panel to the GMA Pole. Use a flat blade screw driver to unfasten band-clamps. Leave the U-bolt secured that holds the mounting bracket for the Enclosure, at this time. Roll up the solar panel cable and secure it within the back of the solar panel with nylon cable ties. Loosen the hinge bolts of the mounting bracket and fold it flat, and retighten.

**2.8 Remove 54-lb Battery from Enclosure**

Leave the battery terminals covered with their caps. If plastic caps are unavailable, wrap the terminals in black electrical tape. Gain the assistance of second person to safely lift and lower the 54-lb battery to a hand-truck or dolly directly below the steel enclosure. Wheel the battery back to the government vehicle. Secure the battery so it does not shift around in the vehicle. Dispose of the 54-lb battery according to local office policy.

Always follow the precautions outlined in NWS Manual 50-1115, *Battery Charging and Storage Operations*, to Chapter 15, on the web site:



**Figure 2.4 - 12V Battery (54-lbs)**

[https://www.ops1.nws.noaa.gov/Secure/SAFETY/Safety\\_manual.htm](https://www.ops1.nws.noaa.gov/Secure/SAFETY/Safety_manual.htm).

**2.9 Remove GMA, Keypad and Zeno Data Logger**

Use a screwdriver to remove the three screws that attach the GMA assembly to the Steel Enclosure. Set the GMA Assembly aside.

**2.10 Dismount Enclosure from GMA Pole**

Remove any loose items from inside the Steel Enclosure. Close and latch the door. Remove the lower U-bolt from under the enclosure. Then with an assistant, lift up, unhook, and then lower the Steel Enclosure to the ground.



**Figure 2.5 - Enclosure's Top Mounting Hook**

Then, remove the top U-bolt and its Bracket from the GMA Pole.



**Figure 2.6 - Load Cell Assembly with 4**

### 2.11 Dismount the Load Cell Assembly from F&P Support Stage

First raise the Shipping Bolt to ensure the plunger is at least  $\frac{1}{4}$  inch above the load cell ball. Use a short Allen wrench to loosen the four screws that attach the Load Cell to the support stage.

screws.

### 2.12 Remove the Plunger

With the lower-bracket arm sufficiently raised to expose the plunger, unthread the plunger (see Fig 2.7).

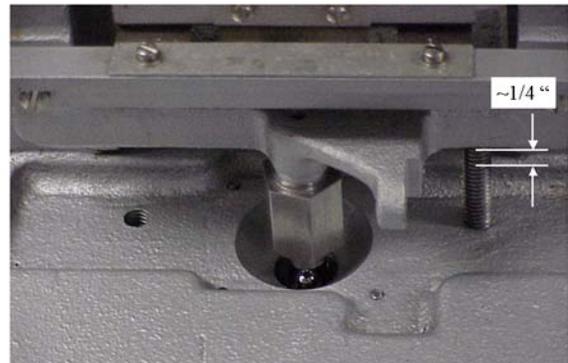


Figure 2.7 - Remove the Plunger (hexagonal)

### 2.13 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.

**Caution:** The upper-rear-horizontal flexure is the one most susceptible to bending and damage. When moving the parallel arms, move them slowly and do not let them bounce.

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.

### 2.14 Retrieve all FPU Parts and Tools

Collect all the tools (See Table 1, on Page 6) and collect all FPU parts (see Section 4, below) and all decanted fluids from the collection bucket, and any excess supplies from this maintenance action.

**Caution:** Always request the help of another person to lift or move the 54-lb battery. Use a hand-truck or dolly wherever possible to move battery between locations.

### 2.15 Pack Used Parts into Cardboard Boxes

Boxes can protect from damage the interior of the Government truck/van. Use cardboard to protect the solar panel from getting scratched, and use cardboard to protect the metal edges of the panel.

### 3. For Sites with Separate GMA Pole - Remove Pole and Restore Grounds (if necessary)

Half of all the FPU sites have a separate stand-alone 6-foot pole planted within 5-feet of the F&P three legged stand (Fig 2.1). The pole served to mount the Enclosure at a convenient height for the observer's routine access, and also be a mount for the solar panel. This pole bore the heavy weight, approximately 90 lbs., of the steel enclosure box, 12V battery, Zeno data logger, and the solar panel.

If the FPR-E panel is not going to be mounted on the pole where the FPU panel was located, the GMA pole and its footing must be removed and the ground put back to its natural state.

#### 3.1 Coordinate with COOP Observer

Before calling, decide whether you will use the GMA Pole to mount the FPR-E solar panel, or attach the panel to one of the three legs of the F&P stand, or use the existing place the FPU panel was attached. Phone the COOP Observer and inform him/her how this FPR-E modernization will result in less equipment on site. Explain how the new electronic recorder is a compact module that fits within the white shell of the rain gauge. Consequently, we remove the steel enclosure and possibly its mounting pole. If you are not going to use the pole, inform the Observer you will remove the pole and restore the grounds where the pole was planted and will bring grass-seed if requested.

Inquire about the general condition of the grounds about the GMA pole. Are there special tools required if the ground is rocky, compacted clay, compacted soil, or is it loose soil or a sandy composition?

#### 3.2 Excavate Pole and Fill Hole (if required)

First, ensure all cables and grounding wires are removed from the site. Ensure the 12V battery was removed from the Enclosure, ensure the Solar Panel and the Enclosure have been removed from the GMA Pole.

Then use the shovel to dig the grounds about the concrete base of the GMA pole. Installation instructions had called for it to be buried at least 25-inches below ground surface.

Some sites, exposed to high winds, might have more concrete at the surface and have a deeper footing. Depending on the amount of concrete attached to the base of the pole, shovel away as much of the surrounding ground to expose the bottom of the concrete footing.

Some posts might have been modified with welded plates or rebar inserted to prevent twisting motion from wind loading. If so, then excavate more of the grounds about the post to free-up to the entire post and its footing.

Dispose of the pole and concrete footer in accordance with local policy.



**Figure 3.1 - Restore Grounds**

With the shovel, fill-in the hole with any displaced soil in an effort to restore the grounds. More dirt will be needed, have a source available. Tamp as you fill and make the ground as level as possible. If the ground had been grass covered in 2005 prior to FPU installation, replant this area with grass seed and water the ground. Cover the grass seed with straw or light mulch to retain moisture for germination of grass. One cubic foot of mulch should cover an area, 2-feet by 2-feet. Bags of mulch can be purchased at large home improvement stores.

#### 4. Retention and Disposition of FPU Parts

##### 4.1 Retrieve Solar Panel and Mounting Bracket

All offices may retain the Solar Panel (Fig 4.1) and Solar Mounting Bracket (Fig 4.3) and the NWSHQ will not require they be shipped to the National Reconditioning Center as previously instructed.

- Solar Panel – ASN D111C-3



Figure 4.1

- Solar Panel Cable – ASN D111C-3W1: The Solar Panel Cable (D111C-3W1) may be kept with the solar panel, or used for wiring of FPR-E solar panel.



Figure 4.2

**Note:** If D111C-3W1 was used to extend the FPU solar panel location or was buried or in conduit from the solar panel location, you can use it to **extend the FPR-E solar panel wiring**, as well. Just cut off the mil connector and wire to the appropriate terminal strip connection.

- Solar Mounting Bracket – Unless you used this mount to attach the FPR-E panel, leave this attached to the FPU solar panel for future use by the WFO.



Figure 4.3

**4.2 Disposition of Remaining FPU Parts**

All FPU parts not listed in 4.1 above will either be: 1) disposed of locally in accordance with local office policy; OR 2) voluntarily packed and sent to the offices identified in Appendix B as spare parts. Option 2) is voluntary and must be coordinated as instructed in Section 4.2.2. Option 2) does not include reimbursement for packing or shipping, and expects only good quality parts be retained for use as spares.

**4.2.1 Identification of Remaining FPU Parts**

- Gauge Modification Assembly (GMA).



- 12V 84-AmpHr Battery



- Load Cell Assembly



- Load Cell Cable



- Solar Panel Cable



- FPU Battery Cable



- Data Key Reader Device, Software CD, and AC power adaptor.



- FPU Enclosure (ASN D111C-2A4)



**Note:** Metal parts can be turned in to a metal recycler facility if one is available within reasonable distance of your WFO.

#### 4.2.2 Voluntary Shipment of Spares

Offices that are willing to retain, pack, and ship spare parts to other offices shall coordinate all actions through their RCPM.

##### 4.2.2.1 Identification of Spares Needed

The following parts are needed as spares:

1. GMA Assembly (leave it whole after removing it from Enclosure), include the three machine screws
2. Load Cell Sensor, with Plunger, Four machine screws, and Four washers
3. Load Cell Cable
4. Solar Power Cable
5. Data Key Reader, with CD operating disk, and power supply
6. Spare Data Keys

#### **4.2.2.2 Quality and Condition of Used Parts**

Please inspect the above parts as the FPU is disassembled. Retain only those parts that are worthwhile to use as spares.

#### **4.2.2.3 Local Office Instruction**

Email your Regional Cooperative Program Manager (RCPM) to inform him/her you are willing to package and ship xxx set(s) of excess FPU parts to an office that can use them.

#### **4.2.2.4 Guidance on Packing**

The largest piece to ship is the GMA Assembly. It must be packed in a cardboard box with high density foam padding so that it can not move within and has at least  $\frac{3}{4}$  inch of padding at all extremities.

ULINE offers a corrugated cardboard box: 24"x 14" x 14" (S-4654). It is large enough to accommodate the GMA and also fit 4-inch high-density foam pads on each six sides of the box.

Consider convoluted polystyrene foam pads (S-15663), soft foam pads, or polystyrene sheets.

#### **4.2.2.5 Regional Office Instruction**

Email OS7 (Tom Trunk), the POC names in all WFOs who have volunteered to donate set(s) of FPU parts.

#### **4.2.2.6 National Office Instruction**

The National COOP Program Manager will ensure an even distribution of FPU spares to all offices seeking them. Specific shipping instruction will be issued to the volunteer offices, via their RCPM, by the NCPM.

## APPENDIX A – Documentation and Assistance

### 1. Primary Resources On-Line:

- a. ***FPU Assembly Procedural*** – Aug 2006  
[http://www.nws.noaa.gov/ops2/Surface/documents/FPU\\_AsmblyPrcdrI08212006.pdf](http://www.nws.noaa.gov/ops2/Surface/documents/FPU_AsmblyPrcdrI08212006.pdf)
- b. ***FPU Operations Manual*** – Jan 2007  
[http://www.nws.noaa.gov/ops2/Surface/documents/FPU\\_OperationsMan05Feb2007.pdf](http://www.nws.noaa.gov/ops2/Surface/documents/FPU_OperationsMan05Feb2007.pdf)
- c. ***FPR-E Assembly Procedures*** - Feb 2012.  
[http://www.nws.noaa.gov/ops2/Surface/documents/FPRE\\_AsmblyPrcdr\\_17Feb2012.pdf](http://www.nws.noaa.gov/ops2/Surface/documents/FPRE_AsmblyPrcdr_17Feb2012.pdf)
- d. - NWSTC Training Class – Clear, labeled photos of the new rain gauge, produced by Ralph Troutman (OHX).  
<http://www.srh.noaa.gov/ohx/dad/coop/FPR-E.html>
- e. - Clear photos of the original F&P rain gauge.  
[http://www.srh.noaa.gov/ohx/dad/coop/f-p\\_images](http://www.srh.noaa.gov/ohx/dad/coop/f-p_images)

### 2. FPR-E Help Line at the Sterling Field Support Center (SFSC):

Phone the Sterling Field Support Center (SFSC), 8:30am – 5:00pm, Monday – Friday  
Before calling SFSC, write down the issue or question and inform your Regional COOP Manager by phone or email.

SFSC Contact Center Information

Main Line: 703-661-1268

Back-up Line: 703-661-1293

Email: [nws.sfsc@noaa.gov](mailto:nws.sfsc@noaa.gov)

Contact the SFSC when you need to troubleshoot potential issues with the FPR-E kits. The SFSC is closed on 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.

Your phone call to the SFSC should be the first point of contact made when you have any issue with the FPR-E kits. If the SFSC is unable to determine the correction for the issue, the SFSC will elevate it to NWS Headquarter level.

## APPENDIX B – OFFICES IN NEED OF FPU SPARE PARTS

WFO	REGN	FPU	VOLUNTEER DONOR OFFICES (WFO, and Name of OPL)
Memphis (MEG)	SR	32	George Amis (Pleasant Hill-MO) will make shipment to MEG.
Shreveport (SHV)	SR	32	<i>No spare parts are needed for this office.</i>
San Juan (SJU)	SR	23	Tim Kearns (Aberdeen-SD) will make shipment to UNR.
Rapid City (UNR)	CR	19	<i>No spare parts are needed for this office.</i>
Nashville (OHX)	SR	16	Nichole Becker (Gray-ME) was asked to make shipment to OHX.
Flagstaff (FGZ)	WR	12	Matt Moorman (Glasgow-MT) is asked to make shipment to FGZ.
Dodge City (DDC)	CR	8	Terry Hudgins (Raleigh-NC) was asked to make shipment to DDC.
Morristown/Knoxville (MRX)	SR	7	James Foster (Wakefield-VA) was asked to make shipment to MRX.

**Note:** These eight offices have 100% of their recording rain gauges operating with the Fischer-Porter Upgrade (FPU) equipment. These offices are afforded additional time beyond April 1, 2013, to retrofit all of their FPU gauges to Fischer-Porter Rebuild (FPR-E-E) equipment.

## APPENDIX C - FPU PARTS AND AGENCY STOCK NUMBERS (ASN)

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

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

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

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