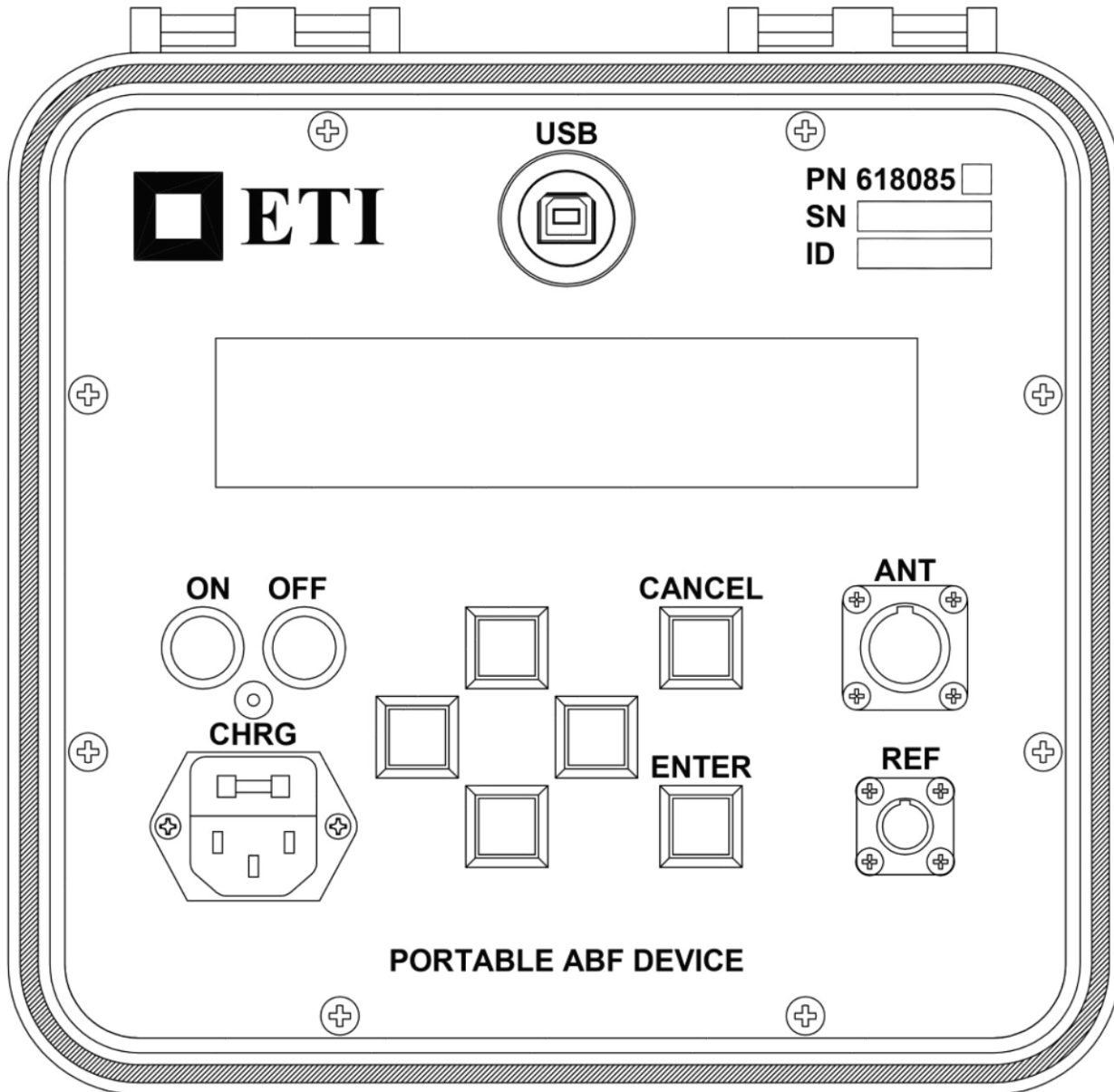


# ETI MODEL 618085 PORTABLE ABF DEVICE (PAD2)

## Instruction Manual

Revision 2



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# REVISIONS

Revision	Date	Details
1	02/29/2016	Initial Revision
2	03/15/2016	Added pickup strap

# **SAFETY PRECAUTIONS**

## **WARNING**

**There are potentially dangerous/lethal voltages present near network protectors, transformers, feeder and secondary cables and associated equipment. Failure to follow the instructions in this manual could result in serious injury or death.**

**Standard safety practices should be followed at all times to prevent personal injury or equipment damage.**

**Do not allow the metal parts of the capacitive phase reference clamp to come in contact with bare conductors**

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# Chapter 1 - Overview

## I. SCOPE

This specification describes the operation of the second generation ETI Portable ABF Device, part number 618085 (henceforth referred to as the “PAD2”).

## II. ABOUT THIS DOCUMENT

The various fonts used throughout this document have the following meanings:

- A. Text that appears on the PAD2’s display is printed in typewriter font and enclosed in quotes. For example, “**Enter ID To Wait For: 0000**”.
- B. Controls, such as buttons are shown in boldface. For example, **CANCEL**.

## III. GENERAL

- A. The PAD2 is capable of receiving data from the following (all henceforth referred to as transmitters):
  - 1. ETI Remote Communication Modules (RCM) and Remote Communication Transmitters Modules (RCT)
  - 2. Hazeltine and BAE Units (both first generation tube and second generation box styles)
  - 3. Digital Grid Transmitters
- B. The PAD2 can be used in two modes:
  - 1. In “PAD Mode”, the device is used in conjunction with a laptop computer and associated interface software to aid in the location of a backfeeding network protector during an ABF event.
  - 2. In “RMS Tester Mode”, the device can be used to determine whether the transmitter under test is functional and to display the information that was transmitted. In this mode, the device will replicate the functionality of the ARV “Blue Box” that ConEd currently uses for testing transmitters.
- C. The PAD2 can be powered by an external 125VAC source, or from the internal rechargeable battery.
- D. A network phase reference can be derived either from the AC power cord or by attaching the capacitive phase reference clamp around a single (insulated) 500 or 750 kcmil conductor. **(DO NOT ALLOW THE CLAMP TO COME IN CONTACT WITH BARE CONDUCTORS)**

## IV. SUPPLIED EQUIPMENT

The following accessories are included with the PAD2:

- A. A copy of this manual
- B. Hammerhead pickup antenna (PN 131-1205-20)
- C. Hammerhead pickup antenna retaining strap (PN 131-1205-21)
- D. Capacitive Phase Reference Clamp (PN 131-1303-10)
- E. AC power cable (PN 131-1303-20)
- F. USB Cable (PN 131-1303-30)

## V. DESCRIPTION OF THE PAD2

- A. The PAD2 is a portable unit provided with a removable cover in which the associated cables and accessories are stored. Figure 1 shows the main panel and the location of the various controls and operating parts.

- B. The following controls and indicators are referred to throughout this manual and are listed below in order to acquaint the operator of the Tester with their location and function.
1. The pushbuttons are arranged as follows:
    - a. The two power buttons, **ON** and **OFF** are on the left hand side above the AC power connector.
    - b. The center four buttons are cursor keys (**UP**, **DOWN**, **LEFT**, **RIGHT**) used to select various functions of the unit.
    - c. There are two other buttons on the right hand side:
      - i. **ENTER** – This button is used to acknowledge a prompt from the PAD2, effectively saying “yes” to any question it may be asking.
      - ii. **CANCEL** – This button is used to cancel what the PAD2 is currently doing. If the PAD2 is asking you to acknowledge something, pressing **CANCEL** is how you say “no”.
  2. The AC power connector is used to power the unit as well as recharge the PAD2’s internal batteries. The red **CHRG** LED will turn on when the battery is being charged and turn off upon completion. The **CHRG** LED will flash if an error condition occurs during charging.
  3. The circular **ANT** connector is used to attach the hammerhead pickup antenna to the PAD2.
  4. The circular **REF** connector is used to attach the capacitive phase reference clamp to the PAD2.
  5. The LCD display in the center of the PAD2 is 4 lines X 40 characters wide. It is used to display various information about the operation of the PAD2 and to display the data as it is received from transmitters.

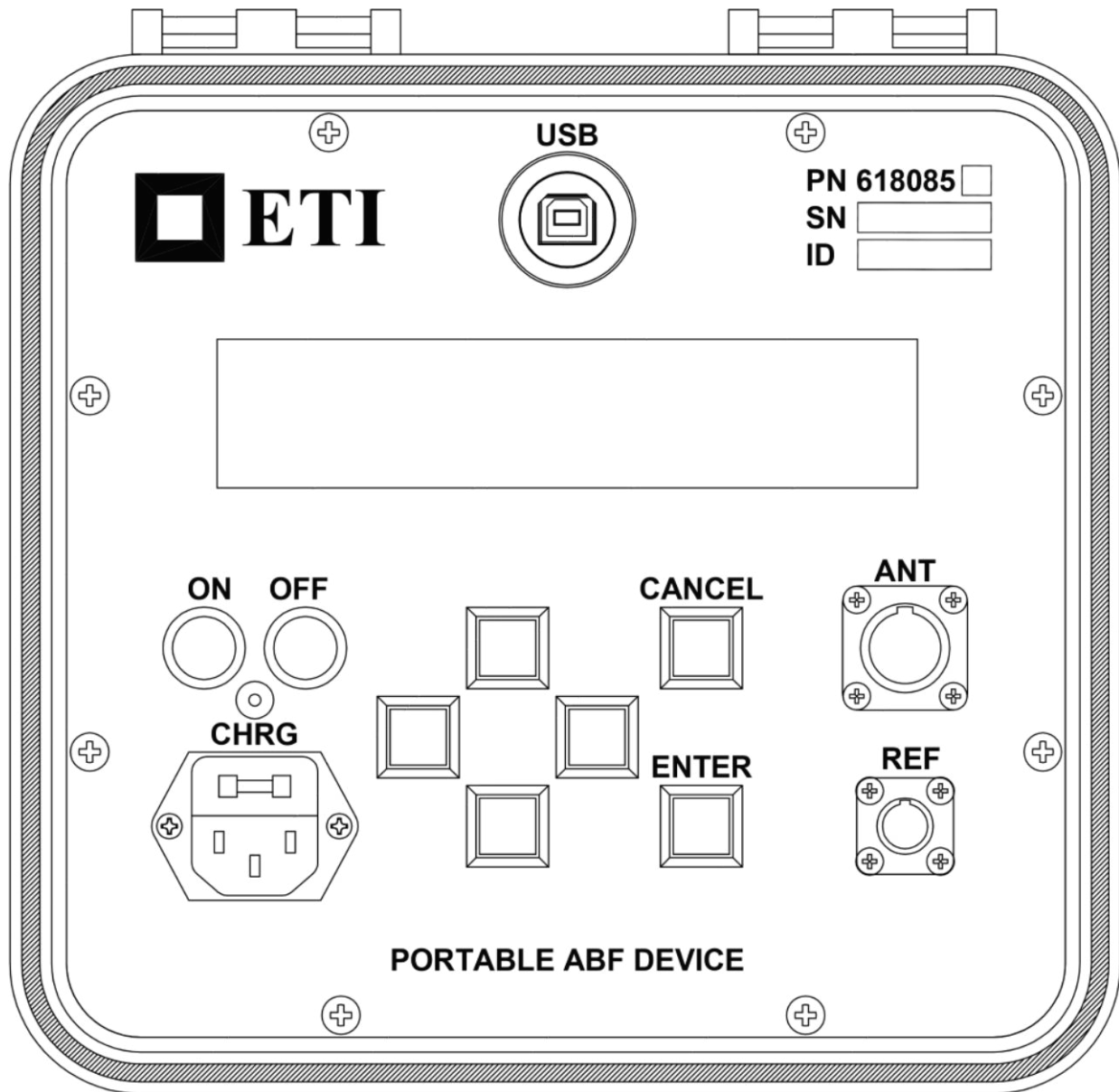


Figure 1: ETI Portable ABF Tester Faceplate

# Chapter 2 - Setup/Connections

## I. PRELIMINARY OPERATING PROCEDURE

- A. After opening the PAD2, remove the cables stored in the cover of the unit.
  - 1. It is often easier to pack/unpack the cables by turning the unit upside down prior to opening the lid.
- B. Ensure the PAD2 is either plugged into AC power or that the batteries are sufficiently charged.
- C. Setup Hammerhead Pickup Antenna
  - 1. Attach the hammerhead pickup antenna to the **ANT** port on the faceplate.
  - 2. Place pickup head
    - a. If operating in PAD mode, place the pickup on the hammerhead joint (on the appropriate phase for the current network, B in most networks) as shown in Figure 2. If needed, use the included orange retaining strap to hold the pickup in place.
    - b. If operating in RMS tester mode, place the pickup on or near the RMS transmitter being tested.
- D. Optional Capacitive Phase Reference Clamp
  - 1. Attach the capacitive phase reference clamp to the **REF** port on the faceplate.
  - 2. Clamp the jaws around a piece of 500 or 750 kcmil secondary cable (on the appropriate phase for the current network, B in most networks) as shown in Figure 3. **DO NOT ALLOW THE CLAMP TO COME IN CONTACT WITH BARE CONDUCTORS**
  - 3. Attach the alligator clip to a good system ground (neutral bus, neutral cable, unpainted surface of NWP housing, etc) as shown in Figure 4.
- F. Optionally connect the USB cable to a computer.
- G. Press the **ON** button to power up the unit.

## II. DISCONNECTING INSTRUCTIONS

- A. Press the **OFF** button to turn off the device.
- B. Disconnect all cables.
- C. Pack all the cables neatly into the cover.





**Figure 2 – Hammerhead Pickup Antenna Placement**



**Figure 3 – Capacitive Phase Reference Clamp**



**Figure 4 - Capacitive Phase Reference Clamp Neutral Clip**

# Chapter 3 – Local display and operation as an RMS tester

## I. BASIC OPERATION

- A. The PAD2 starts up at the primary data display shown in Figure 5. The PAD2 is now ready to receive data from a nearby transmitter.

```
NO REF - ID: 0000 - 0:09 - 0 of 0
```

Figure 5 -- Primary Data Display (No data yet received)

- C. As soon as the data is received the PAD2 will beep and immediately display what was received as seen in Figure 6.

```
NO REF - ID: 0000 - 2:16 - 1 of 1
ID: 0123 FREQ: 50.0 FLAGS: A CD F HM
V1: 125 V2: 125 V3: 127 ANA1: 97
I1: 105 I2: 98 I3: 102 ANA2: 62 T: 1:51
```

Figure 6 -- Primary Data Display (One packet received)

1. The first line indicates the following information about the status of the PAD2:
  - a. The Mode and Phase Reference Status of the PAD2 in RMS Tester mode
    - i. NO REF – Operating with no external phase reference. In this mode the PAD2 will have limited sensitivity / pickup range and is best suited for testing a single local transmitter.
    - ii. NO REF(C) – Same as (i) above but the capacitive phase reference clamp is connected to the **REF** port.
    - iii. READY – Operating with a phase reference derived from the AC power input.
    - iv. READY(C) – Operating with a phase reference derived from the capacitive phase reference clamp.
  - b. The Mode and Phase Reference Status of the PAD2 in PAD Mode (when USB port is connected to a computer running the interface software)
    - i. PAD NO REF – Operating with no external phase reference. In this mode the PAD2 will have limited sensitivity / pickup range and is best suited for testing a single local transmitter. (Operating in this mode is not recommended)
    - ii. PAD NO REF(C) – Same as (i) above but the capacitive phase reference clamp is connected to the **REF** port.
    - iii. PAD READY – Operating with a phase reference derived from the AC power input.

- iv. PAD READY(C) – Operating with a phase reference derived from the capacitive phase reference clamp.
- c. The PAD2 is waiting for a Transmitter with an ID equal to 0 (any transmitter)
- d. Two minutes and sixteen seconds has elapsed since the PAD2 was turned on
- e. The first packet out of a total of one (1 of 1) is currently being displayed
- 2. The second, third and fourth lines contain the information received from a transmitter (NOTE: Not all of the following information will be available from all types of transmitters):
  - a. The ID of the transmitter (123)
  - b. The frequency of the received transmission (50.0 kHz)
  - c. The list of flags that are currently active (A, C, D, F, H, M)
  - d. The three phase voltages (125V, 125V, 127V)
  - e. The three phase current loadings in percent (105%, 98%, 102%)
  - f. The values of the two analog inputs (ANA1=97, ANA2=62)
  - g. The time this particular packet of data was received (1:51) (NOTE: This value is relative to the time the PAD2 was turned on)
- C. If another packet is received, the PAD2 will display the new data as shown in Figure 7.

```

NO REF - ID: 0000 - 4:12 - 2 of 2
ID: 0123 FREQ: 50.0 FLAGS: A C EF HM
V1: 125 V2: 124 V3: 126 ANA1: 94
I1: 102 I2: 95 I3: 106 ANA2: 60 T: 3:27
  
```

**Figure 7 -- Primary Data Display (Multiple Packets Received)**

- 1. To cycle through all the received data packets, use the **UP** and **DOWN** cursor keys.
  - a. If you have scrolled to another packet, and another transmission is received, the PAD2 will beep, but continue to display the packet that has been selected. To quickly view the newest data received simply press the **ENTER** button.

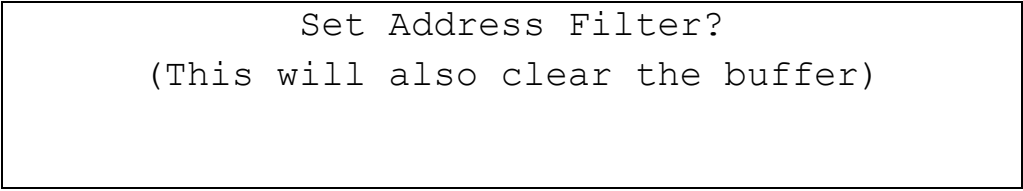
## **II. ADVANCED OPERATION**

To access the additional functionality of the unit, simply press **LEFT** or **RIGHT** from the Primary Data Display. This will cycle through the following menus (and back to the Primary Data Display).

### **A. Address Filter Setting (Figure 8)**

This filter allows the PAD2 to receive data from only one unit, ignoring any nearby units that may also be received. An address of 0000 will receive data from any unit.

- 1. If an address filter was not set at power up (or you wish to change the one you did set), you can use this option to do it now. Press **ENTER** to access this function, and you will be taken to the ID entry screen shown in Figure 9.



Set Address Filter?  
(This will also clear the buffer)

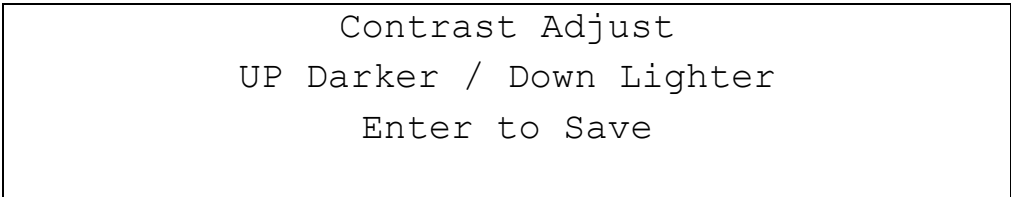
**Figure 8 -- Address Filter Menu**



Enter ID to Wait For: 0000

**Figure 9 -- ID Entry Screen**

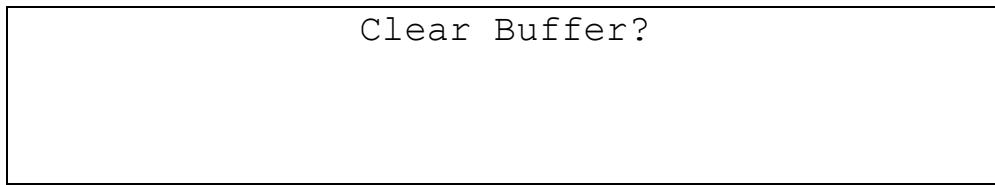
- a. Use the **LEFT** and **RIGHT** cursor keys to select which of the four digits you wish to modify (The blinking cursor will move left and right).
  - b. Use the **UP** and **DOWN** cursor keys to increment and decrement the selected digit.
  - c. When you have set the value you desire, press **ENTER** to accept it.
  - d. If a mistake was made and you wish to discard any changes, press **CANCEL**.
2. Also note that setting the address filter will clear the PAD2's buffer of previously received data.
- B. Contrast Adjustment (Figure 10)
- This menu allows the operator to adjust the contrast of the display of optimum readability.



Contrast Adjust  
UP Darker / Down Lighter  
Enter to Save

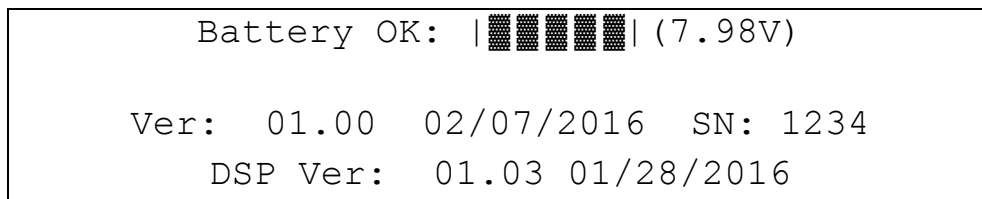
**Figure 10 -- Contrast Adjust Menu**

1. Press **UP** to make the display darker or **DOWN** to make it lighter.
  2. When the desired contrast is reached, press **ENTER** to save it.
  3. If you do not wish to save the changes, press **CANCEL**.
- C. Clear Buffer (Figure 11)
- This menu is used to clear the PAD2's buffer of previously received data

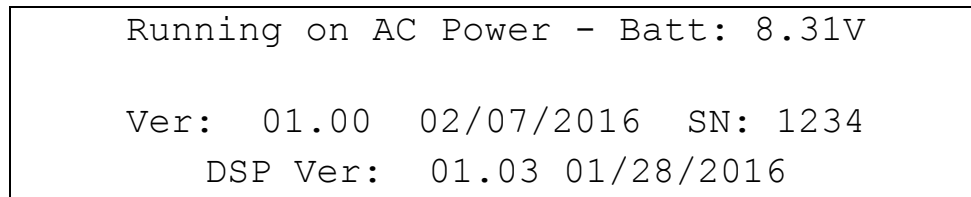


**Figure 11 -- Clear Buffer Menu**

1. Pressing **ENTER** at this screen will clear the buffer.
- D. Battery Information (Figure 12 / Figure 13)
1. This menu displays information about the PAD2's power supply
    - a. Line one will indicate that status of the battery (OK/LOW) or indicate that the device is running on AC power. A 5 segment bar graph indicating the remaining battery capacity as well as the current battery voltage is also displayed.
    - b. Line three contains the version and date of the PAD2's main firmware as well as the serial number of the device.
    - c. Line four contains the version and date of the firmware of the PAD2's DSP (Digital Signal Processor).



**Figure 12 -- Battery Information Menu (unit running on battery)**



**Figure 13 -- Battery Information Menu (unit running on AC power)**

E. Amplifier Gain Adjustment

1. This setting (shown in Figure 14) allows manual adjustment of the gain of the PAD2's internal signal amplifier. Normally this should be set at 200 (max gain), but may be adjusted lower if operating in a high noise environment (unit frequently reports a "Data Error"). This value is not stored and will reset to 200 the next time the unit is powered on.
  - a. Press **ENTER** to edit the gain value.
  - b. Use the **LEFT** and **RIGHT** cursor keys to select which of the four digits you wish to modify (The blinking cursor will move left and right).
  - c. Use the **UP** and **DOWN** cursor keys to increment and decrement the selected digit.
  - d. When you have set the value you desire, press **ENTER** to accept it.

- e. If you wish to discard any changes, press **CANCEL**.

Set Gain

Gain = 200

Enter to Set

**Figure 14 – Amplifier Gain Adjustment**

# Chapter 4 – Operation in Computer Connected PAD Mode

## I. BASIC OPERATION

- A. The device will automatically enter “PAD Mode” when the USB cable is connected to a PC running the PAD Interface Software. The PAD2 display will indicate that it is in PAD mode as opposed to RMS tester mode as shown in Figure 15.

```
PAD READY - ID: 0000 - 0:09 - 0 of 0
```

Figure 15 -- Primary Data Display (No data yet received)

- B. The interface software will also indicate a successful connection by changing the indicator in the lower right hand corner from red to green as shown in Figure 16.

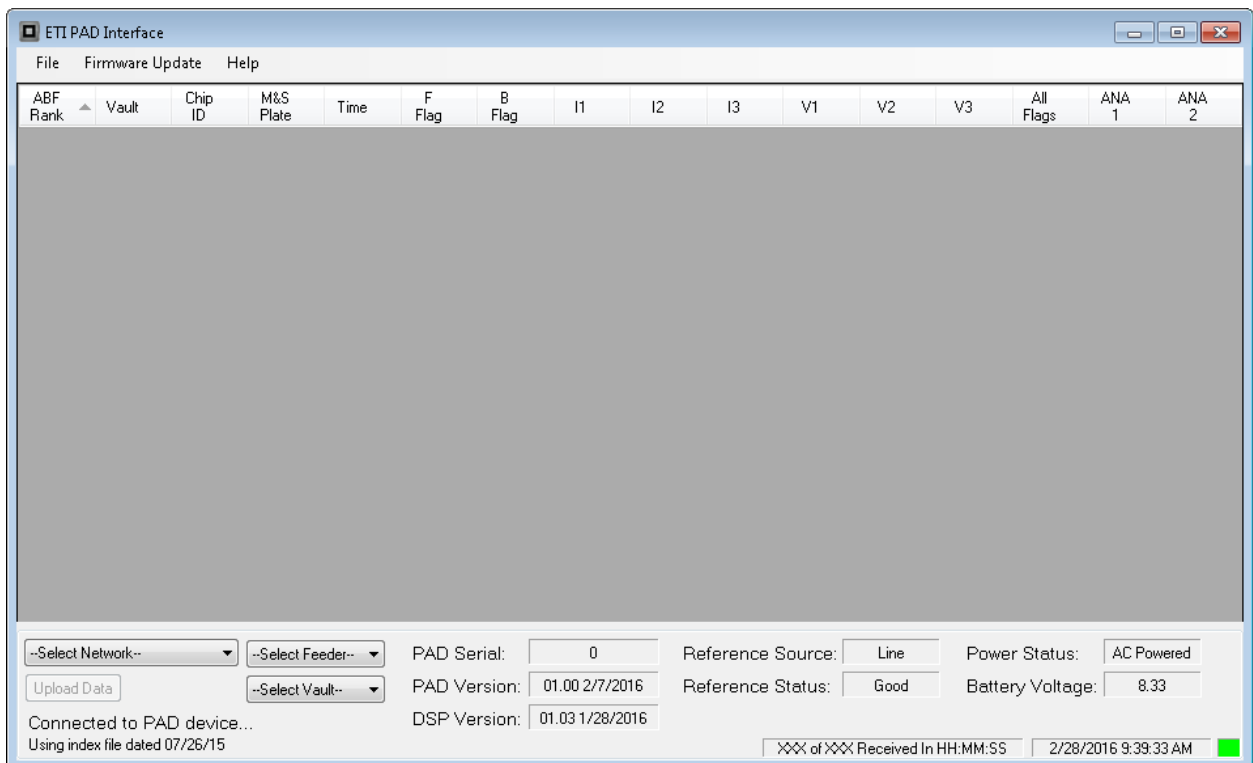


Figure 16 -- Interface Software Connected



- C. Once connected, using the combo boxes on the lower left of the interface software, select the network, feeder, and vault where the PAD2 is currently located. The list of vaults on the selected feeder will then be populated. As soon as data is received, the table will fill in as shown in Figure 17.

The screenshot shows the ETI PAD Interface software window. It features a menu bar with 'File', 'Firmware Update', and 'Help'. Below the menu is a table with 17 columns: ABF Rank, Vault, Chip ID, M&S Plate, Time, F Flag, B Flag, I1, I2, I3, V1, V2, V3, All Flags, ANA 1, and ANA 2. The table contains 12 rows of data. Below the table is a status bar with several fields: '03M - YORKVILLE' (dropdown), '03M45' (dropdown), 'PAD Serial: 1234', 'Reference Source: Line', 'Power Status: AC Powered', 'Upload Data' (button), 'V 01495' (dropdown), 'PAD Version: 01.00 2/7/2016', 'Reference Status: Good', 'Battery Voltage: 8.34', 'Received Data from ID 0163', 'DSP Version: 01.03 1/28/2016', 'Using index file dated 07/26/15', '3 of 12 Received in 00:11:57', and '2/29/2016 1:11:16 PM' with a green status indicator.

ABF Rank	Vault	Chip ID	M&S Plate	Time	F Flag	B Flag	I1	I2	I3	V1	V2	V3	All Flags	ANA 1	ANA 2
1	VS05940	163	40I	12:59:11			72	73	73	125	125	125		0	0
2	V 01458	161	41I	12:59:08			57	58	58	125	125	125		0	0
3	V 01441	171	41I	12:59:09			28	29	29	125	125	125		0	0
4	V 06729	157	39H												
5	V 07154	158	39H												
6	V 08660	160	38H												
7	V 03534	162	40I												
8	V 06024	164	42H												
9	V 05398	166	44H												
10	HV06830	168	44HA												
11	V 01495	172	38I												
12	V 05230	701	38I												

**Figure 17 – Vault Selected and Data Received**

- D. The data will automatically be sorted by the ABF Rank with the most likely culprit at the top. Once sufficient data is obtained, pressing the “Upload Data” button below the network selection will save the captured data to the Con Edison network for integration into the NetRMS ABF program. NOTE: In order to use this feature, a connection to the Con Edison network must be available (aircard/vpn/etc)

## II. STATUS INFORMATION

- A. PAD Serial – The serial number of the connected PAD2
- B. PAD Version – Firmware version and release date of the PAD2’s main software
- C. DSP Version – Firmware version and release date for the DSP (digital signal processor) that handles the demodulation of the RMS signals
- D. Reference Source – Displays the reference source being used (Line or Capacitive Clamp)
- E. Reference Status – Displays whether a good reference signal is being obtained from the above source
- F. Power Status – Indicates whether the PAD2 is running on AC or battery power
- G. Battery Voltage – Displays the voltage of the PAD2’s internal battery pack
- H. Index File Date – The status line in the lower left will display the date of the index file being used

- I. Receive Counter – Displays how many units were received on the currently selected feeder. There is also a timer that automatically starts when data is first received.
- J. Current Time – Next to the receive counter the current date and time is displayed
- K. PAD2 Connection Status – The square indicator in the lower right corner of the application changes color to indicate the status of the connection to the PAD2
  - 1. Red – Not connected
  - 2. Yellow – USB connected, not yet polling the PAD2
  - 3. Green – Successfully connected and polling the PAD2 (ready to use)

### III. ADVANCED OPERATION AND FEATURES

- A. Data Sort Order
  - 1. Clicking the column heading will choose that column to sort by, clicking a second time will change the sort order (ascending/descending)
- B. Moving to another vault – If sufficient data to identify the ABF culprit vault cannot be obtained at the initially chosen location, the received data can be saved and the PAD2 moved to another vault.
  - 1. Select File->Save to save the currently received data.
  - 2. Shut down PAD2 software, power off and disconnect PAD2
  - 3. Once at the new location, setup the PAD2 and open the data saved in step one above by selecting File->Open and choosing the previously saved file
  - 4. Change the vault dropdown to reflect the new location.

### IV. APPLICATION SETUP

- A. The Settings Screen (File->Settings) as show in Figure 18, contains path information used by the software.
  - 1. Network Path to Index Files – Where the application checks for updated index files
    - a. At startup, the application will look in the folder specified and check to see if the index file located there is newer than the one on the laptop. If so, it will copy the index file to the laptop.
  - 2. Network Path to Data Files – Where the application will store data when the “Upload Data” button is pressed.

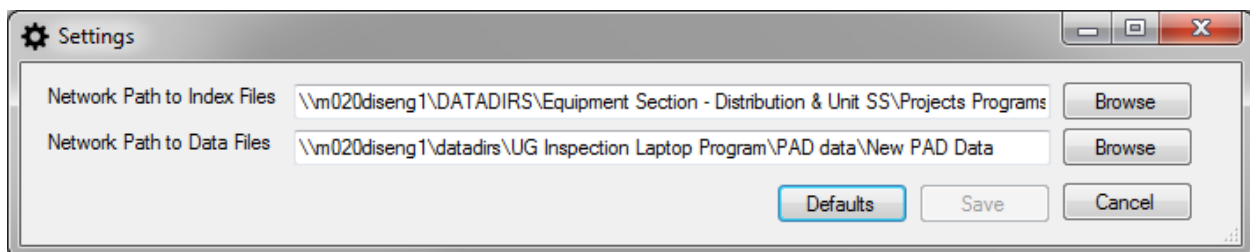


Figure 18 -- Settings Screen

## Appendix A – Specifications

1. **INPUT VOLTAGE:** 120VAC  $\pm 10\%$ , 60Hz
2. **TEMPERATURE RANGE:** -20°C to +50°C (Avoid charging battery below 0°C)
3. **ENVIRONMENTAL:** The PAD2 is protected from damage caused by rain or high humidity. The PAD2 is not submersible.
4. **BATTERY LIFE:** Approximately 8 hours.
5. **BATTERY CHARGE TIME:** Approximately 6 hours.
6. **WEIGHT:** Approximately 12 lbs including associated cables.
7. **SIZE:** 10" x 10" x 8" with cover attached.