REACTION TIME PROTOCOL
(PVT-192, Ambulatory Monitoring, Inc.)

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REACTION TIME

1. Background and Rationale

The PVT-192 is a device for measuring an individual's reaction time following presentation of a visual and/or audio stimulus. The visual stimulus consists of a four-digit red LED display, which begins counting upward from zero. The stimulus is presented at random intervals within an operator-specified time window. The participant's response consists of pressing a pushbutton switch. The response time (RT) is defined as the time in milliseconds between the onset of the stimulus and the response pushbutton being pressed. Once the response button is pressed, the LED display stops incrementing and shows the RT for a second before going blank. This provides immediate feedback to the participant. While the test was originally designed to be ten minutes long, a three minute test has since been validated[1].

2. Equipment and Supplies

- PVT-192 (Ambulatory Monitoring, Inc.)
- Personal computer
- Serial cable
- PVT-192 software
- REACT software
- AC adaptor with cable
- Reaction time teleform

3. Safety Issues and Exclusions

There are no safety issues or exclusions. However, if the participant is unable or unwilling to perform the test, please note this, as well as the reason, on the Reaction Time TeleForm.

4. PVT Software Installation

The PVT-192 comes with software which the sites will use to download the data from the device. Load the software onto a personal computer at the site, which meets the following requirements:

- Windows 98 or higher
- CD ROM Drive (otherwise request a floppy installation package)
- A working serial port (Com1, Com2, Com3 or Com4)

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[1] William JH, Fomberstein KM, Niyogi S, Coble MM, Banks S and Dinges DF. Development of a Briefer Version of the Psychomotor Vigilance Task. SLEEP 2006; 29 (Abstract Supplement):344.

- At least 750 Kbytes of free disk space

4.1 General Installation Instructions
- Insert compact disk (CD) into CD ROM Drive.
- If your computer supports Autorun, then the installation procedures will begin automatically. Otherwise run SETUP.EXE from Windows Explorer.
- Follow the installation procedure on the screen to create program group (or folder) for the PVT.

5. Preparation and Setup of the PVT-192

5.1 PVT-192 Description

The PVT is a brief, sustained attention, portable electronic visual reaction time (RT) task sensitive to sleepiness. During each 3-minute performance trial, participants are asked to attend closely to a stimulus window and to press the response button as soon as the stimulus appears, making an effort to keep response times as short as possible throughout the task, but not to press before the stimulus appears. The stimulus, occurring randomly in intervals from 2 to 10 seconds, appears in red in a light-emitting diode (LED) window located on the device and increasing in milliseconds until the response button is pushed. This stops the millisecond counter and displays the reaction time to the participant.

5.2 Charging Batteries

The battery of the PVT machine should be charged once per week overnight. If for some reason the PVT machine is not charged for a particular study, the device can be used with the charger attached. It takes "overnight" (14 to 16 hours) to fully charge the device.. For the FIRST battery charge of a new PVT-192, it is recommended to extend the charging period to 30 hours. To charge the device, insert the AC adaptor connection into the plug on the front side of the PVT machine marked "charger" and ensure that the power switch is OFF. Please refer to the PVT-192 user's guide and reference manual for a more detailed guide to charging batteries.
Note that if the battery goes dead, stored data will not be lost. This has been tested.

5.21 Battery Log

In order to ensure that the battery is charged completely for each participant, each site may opt to have a battery log. A sample log sheet is given in the appendix. This would help to keep track of the last time the battery was charged completely and by whom.

5.3 Entering Participant Information into the PVT

** Parameters that MUST be updated for each participant are boxed.

5.31 Using the PVT device to enter the information

In general, the left button is the cursor for moving within the screen and the right button is the "enter" for selecting. "Q" is often used to finish entry for the screen, and "E" is often used to erase.

1. Turn the PVT machine power switch on. The serial number of the device and other information should be displayed. After this the "Select" display reads: **Test   Setup**

2. Press the **LEFT** button to move the flashing cursor to **Setup**

3. Press the **RIGHT** button to choose **Setup**

4. "Access" is now displayed on the first line of the LCD. **123** is the access code to change participant information. Use the **LEFT** button to move to the flashing cursor to each of these digits and press the **RIGHT** button to accept each digit. The digit entered will appear on the screen. When **123** is entered move to the **Q** character with the LEFT button and accept the access number entry by pressing the **RIGHT** button. Choosing in the same manner **E** erases the entry if you've made a mistake and wish to start over.

5. "Select Setup" now appears with the flashing cursor on **Param**. Press the **RIGHT** button to accept this choice.

6. "Study" name should be the clinic initials (PI, MN, or PO). Use the **LEFT** button to choose the 2 letters, pressing the **RIGHT** button to select each one (+ gives you the next segment of the alphabet to choose from, **E** erases your entry to let you start again). When the initials are entered move to the **Q** character with the **LEFT** button and accept the access number entry by pressing the **RIGHT** button. If the screen already shows the correct initials, move to Q and hit the **RIGHT** button to select.

7. "Mood" question: Since we will be collecting information on the participant's mood at another point in the visit, we will not be collecting information on mood here. The first time this machine is used, the screen will read "Mood SLEEPY?". We do not want to collect this data, so put a black space here by using the underscore character (you'll find this after the "Z" character). With the cursor on Q, press the RIGHT button to select. If this hasn't changed and the question appears blank (Mood   ?), accept by pressing the button with the cursor on **Q.**

8. "E Initials" is the Staff ID's initials (Experimenter's). If they haven't changed, accept by pressing the button with the cursor on **Q**. If you need to change the Experimenters Initials, use the **LEFT** button to choose 3 letters (+ gives you the next segment of the alphabet to choose from, **E** erases your entry to let you start again).

9. "S Initials" is the PARTICIPANT'S initials. This device can only store 3 letters for this field, so we are entering the first 3 letters of the acrostic. For example, if the acrostic is ABCD just enter ABC. Use the **LEFT** button to choose 3 letters (+ gives you the next segment of the alphabet to choose from, **E** erases your entry to let you start again). If the participant has ONLY two initials, place an underscore character (you'll find this after the "Z" character) where the middle initial would go.

10. "Subject" is the participant ID number. This device can only store 4 numbers for this field, so we are entering the last 4 numbers of the participant ID. For example, if the participant ID is 10001 enter 0001. Use the **LEFT** button to move the cursor and the **RIGHT** button to accept digits. When the ID number is correctly displayed on the top line, move the cursor to **Q** to accept and press the **RIGHT** button.

11. "Trial" is the trial number for this participant. We are only doing one test, so select 1 by using the **LEFT** button to move the cursor to 1 and the **RIGHT** button to accept digits. Then move the cursor to **Q** to accept and press the **RIGHT** button

12. "ISTmin ms" should remain fixed at **2000**. If it reads differently, set to 2000. Move the flashing cursor to **Q**. Press the **RIGHT** button to accept. **DO NOT CHANGE!**

13. "ISTmax ms" should remain fixed at **10000**. If it reads differently, set to 10000. Move the flashing cursor to **Q**. Press the **RIGHT** button to accept. **DO NOT CHANGE!**

The PVT stimulus presentation rate most commonly used in the validation studies of the PVT varies randomly between 2 second (2,000 ms) and 10 seconds (10,000 ms). However, these values can be set to different numbers if desired. Once values are selected, they should NOT change within an experiment/protocol.

14. "TTT sec" should remain fixed at **180**. The flashing cursor is already on **Q**. Press the **RIGHT** button to accept. **DO NOT CHANGE!**
The standard (typical) PVT trial duration is 10 minutes, which equals 600 seconds. We are using a shorter 3-minute version of this test. Once value is selected, it should NOT change within an experiment/protocol.

15. "Task Code" should remain fixed at **Vis**. The flashing cursor is already on **Q**. Press the **RIGHT** button to accept. **DO NOT CHANGE! You will only be using VISUAL stimulus presentation mode.**

16. "Handedness" is either Right/Ext or Left. Use the **LEFT** button to move the cursor to the proper choice and press the **RIGHT** button to accept.

Note: if setup is not changed, it will create a second file with the same name plus and "_2" at the end.

5.32 Using the computer to enter the information into the PVT device

1. With the PVT power off, attach the serial cable from computer to the connection of your PVT.

2. Turn the PVT power on.

3. Use the START menu to choose PROGRAMS/Ami/PVT and choose PVTcommW

4. **ON THE PVT**, press the **LEFT** button to move the cursor to **Setup** and press the **RIGHT** button to accept.

5. **ON THE PVT**, Enter the following access code to enable the PVT to communicate with the computer: **31267.** Use the **LEFT** and **RIGHT** buttons of the PVT to enter this value and then move the flashing cursor to the **Q** character. Press the **RIGHT** button to accept this access code. (Remember, if a mistake is made, enter **E** to start over). At this point the PVT will display "Supervisory Mode".

6. On the menu bar of the PVT software click on PVT and then Click on Initialise.

7. The following series of screen will appear
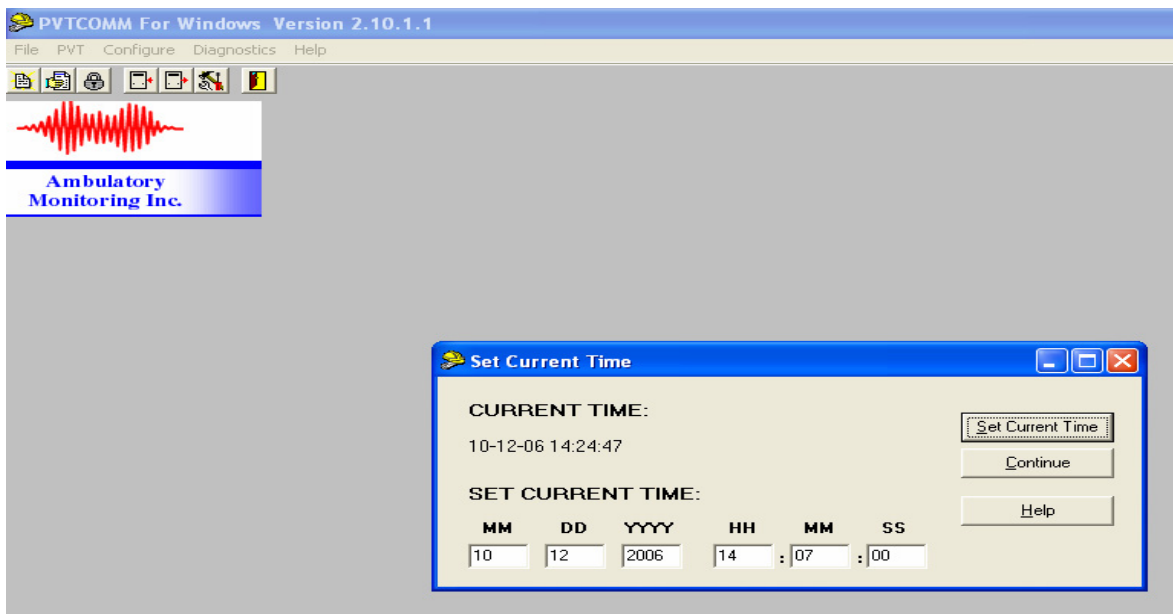
Click on set current time
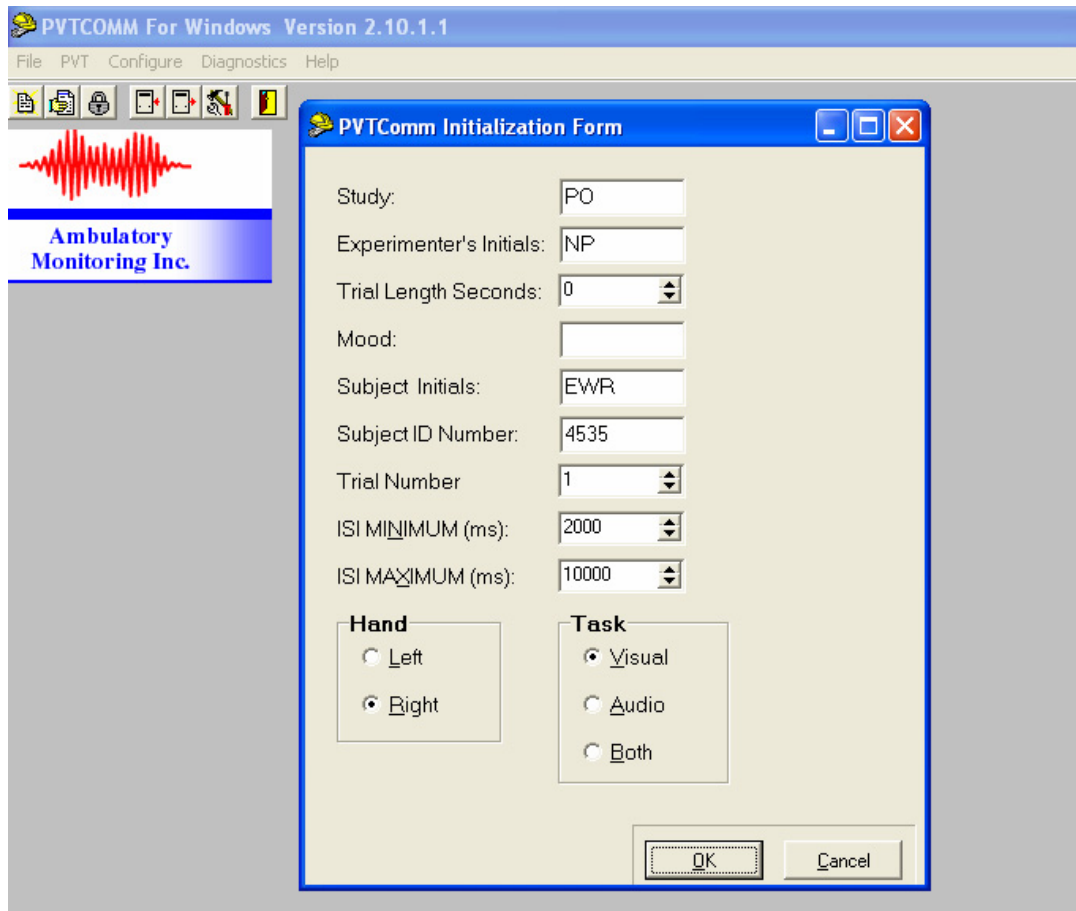
Enter the information required and click OK
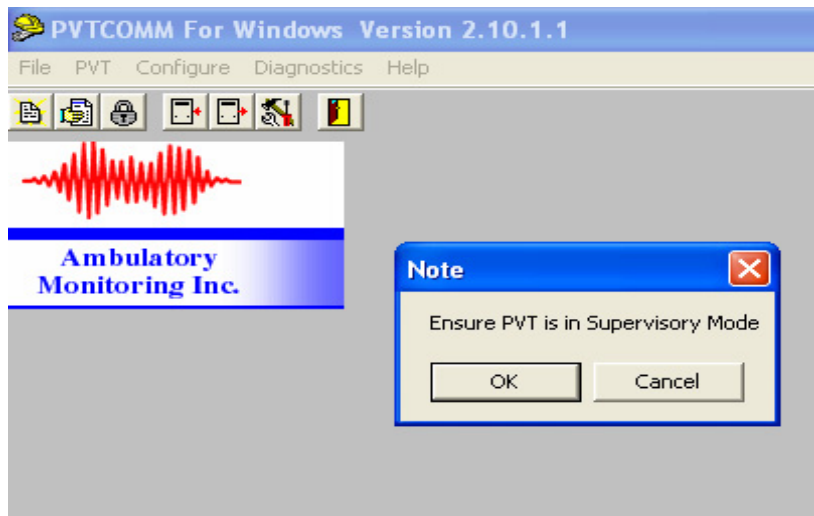
Double Check that PVT is in Supervisory mode as by looking at the PVT screen and click ok

Make sure you see a dialog box stating that the installation is complete and the PVT beeps

Disconnect the serial port from the PVT and you may proceed with the test

5.4 Procedure for Running the PVT Test

After modifying all of the participant-specific parameters (boxed areas in the preceding section), the "Select" display should reappear, with the choices: **Test   Setup**

1. The flashing cursor is already on **TEST.** Press the **RIGHT** button to accept this entry.

2. The "Select Test" display appears. The flashing cursor is on **Real**. The participant must first perform a "DEMO" test. Move cursor to **Demo** and select. Press the **RIGHT** button to accept this entry. Please refer to instructions to the participant in section 6.3 regarding explaining the demo test and procedures to the participant.

3. The first MOOD question appears, which should be empty (a question mark on the first line, with a No ………. Yes on the second line). Press the **RIGHT** button. This will take you to the screen that says "press any button to start the test". At this point **READ** the Instructions to the Participant given below. Emphasize that **ONLY** you, the experimenter, will turn the device off **AFTER** the test is completed. Give the participant the PVT machine to begin the test.

4. After the demo is complete, it is time to administer the real test. The "Select Test" display appears again. Select **Test** with the **RIGHT** button. The flashing cursor is already on **Real**. Press the **RIGHT** button to accept this entry, then press the **RIGHT** button to skip the MOOD screen. You will now get a screen that says "Ready to Test…….press any button to start". Please refer to instructions to the participant in section 6.3.

4 After the test is complete it is safe turn off the PVT machine. To record data from another participant go back to the "Entering Participant Information" section of this document. To retrieve data to a computer proceed to the section 7.

6.0 Administering the Test

6.1 Participant and Exam Room Preparation

The participant should be seated comfortably in an environment free of distraction and noise. Inform her that this will be an automatically timed reaction test that will require approximately 4 minutes. Since there is a small learning effect from the PVT, be certain that the participant does a practice trial the first time they use the device.

The evaluator/tester should remain in the room with the participant during the test, taking care to remain seated and quiet. The tester should be located behind the participant (or out of the participant's view), but in a position that permits the tester to determine when the 3-minute PVT test is complete. The machine will also beep when the test is completed. The testing room should have a sign on the outside of the door that indicates that a test is in progress and to avoid unnecessary entries into the room when the patient is testing.

During the testing, the PVT device should be held by the participant in her lap, with the participant's forearms/wrists/hands resting on the tops of the thighs, and the device tilted slightly so that the stimulus window is easily visible. If extra support for the device is needed, the participant can be seated next to a table so they can rest the machine along the table's edge. The important thing is that the device be at an angle so the participant can view the display window well, and that it is comfortable for her to push the buttons. The distance between the participant's eyes and the visual display on the PVT response box should be in the range of 14 to 22 inches.

6.2 PVT Test Administration

It is important the participant respond with either the index finger or the thumb of the dominant hand when being tested on the PVT. The dominant hand is the one used for writing. After determining the dominant hand, the participant decides to use either the index finger or thumb for pressing the response button. If the participant uses the hand that was not entered into the PVT set up screen for handedness during the test they will get an error message "ERR". If the release button is pressed before the red numbers appear an error message "FS" will be received indicating a false start. If for any reason the participant has a prolonged delay in response the numbers will increment till 9999 and then loop back to 0100, however the number will remain as four digits hence forth.

6.3 DEMO PVT Test

The most convenient way for the participant to handle the PVT device can be determined by running a familiarization test session. The PVT devise has a special DEMO function which runs for one minute. Data are not stored, so Patient Information does not need to be modified for the familiarization session. DEMO is an option found in the "Select Test" display. Select DEMO. After first Mood question is bypassed, explain that this is a one-minute demonstration only and that results WILL NOT be recorded**. NOTE: the DEMO assumes the participant will use the right hand**. If the participant is left-handed, you need to do the participant set up as described above, but set "TTT sec" (test time) to 60 seconds. Have the participant do a real test for the demo, as described below. After the demo you must reset the "TTT sec" to 180 and have the participant do the 3 minute real test. This will cause 2 tests to be stored – the demo, and one with and _2, which will the real test. For more details on how to setup a demo for a left handed person, see below

DEMO FOR A LEFT HANDED PERSON
13. Repeat steps 1-12 above in section 5.31.

14. "TTT sec" should be adjusted to **60**sec.

15. "Task Code" should remain fixed at **Vis**.

16. "Handedness" is Left

17. Then select TEST and then REAL using the right button and the left button to move the cursor

REAL TEST FOR A LEFT HANDED PERSON

18. After the demo time is up, the display screen as given below will appear

   ?
   No ………………………‖……………………………..Yes

19. You can press the Right button regardless of where the cursor is. The screen will appear as follows. **Note:** It is not necessary to turn the device off. However, doing do will not lose any data.

Select
Test.   Setup

20. Use the left button to move the cursor to Setup and push the right button.

The Access code screen will appear. Enter the code **123** and move the cursor to "**Q**" and press the right button. You do not have to re-enter the participant's information. Simply move the cursor using the left button to "**Q**" and keep pressing the right button until you have to enter the "TTT sec". **Change this to 180.**

Say to each participant:
"We will first do a one minute demo test. During the test, as soon as you see the red numbers in the top window, press and release the button using your right hand (or "left hand"). You may use your thumb or finger, but once you have decided, always use the same one. Pay close attention to the window for the full 3 minutes of the task, and press the button as quickly as possible when you see the red numbers. Don't try to guess or anticipate the red numbers by hitting the button too soon. Keep going, even if you see letters appear in the window. If you forget to release the button, the screen will remind you after a short time. At the end of the demo test, the machine will beep. You can press any button to start the demo."

6.4 Instructions to the Participant

Say to each participant:
"Now you are ready to begin the test. Again, as soon as you see the red numbers in the top window, press and release the button using your right hand (or "left hand"). You may use your thumb or finger, but once you have decided, always use the same one. Watch the window for the full 3 minutes of the task, and press the button as quickly as possible when you see the red numbers. Don't try to guess or anticipate the red numbers by hitting the button too soon. **Keep going, even if you see letters appear in the window.** If you forget to release the button, the screen will remind you after a short time. At the end of the reaction time test, the machine will beep. You can press any button to start the test."

6.5 Completing the Reaction Time TeleForm

Following the test, please complete the Reaction Time TeleForm to indicate if the participant completed the full 3-minute reaction time test (regardless of performance on the test) or if the measurement was not completed. If the participant completed the test fill in the PVT device serial number from the machine used, which is found on the back of the PVT machine. Just use the numbers, not the leading letter. For example, if the back of the machine shows serial number A1334, just use 1334. If the participant refused to take the test or attempted but gave up part way through, indicate if it was do to visual, physical or cognitive limitations. If the participant cites a different reason, or does not give a reason, check "Other."

7 Handling Data

7.1 Retrieving data from the PVT Device

At the end of EACH day of data collection all the data collected for that day will be collected into a single PVT data file.

1. With the PVT power off, attach the serial cable from your computer to the 9-pin connection of your PVT.

2. Turn the PVT power on.

3. Use the START menu to choose PROGRAMS/Ami/PVT.

4. From the menu choose PVTcommW

5. **ON THE PVT**, press the **LEFT** button to move the flashing cursor to **Setup** and press the **RIGHT** button to accept.

6. **ON THE PVT**, Enter the following access code to enable the PVT to communicate with the computer: **31267.** Use the **LEFT** and **RIGHT** buttons of the PVT to enter this value and then move the flashing cursor to the **Q** character. Press the **RIGHT** button to accept this access code. (Remember, if a mistake is made, enter **E** to start over). At this point the PVT will display "Supervisory Mode".

7. Check Connections: On the Computer, click on Configure. Go to **Port**. Select which port you have connected the cable to in the back of your computer (select Comm 1 to start, then work from there). Select the Diagnostics menu. Select **loop test**. This tests if you have the correct COMM port selected. You will get a message to "Insure that the Loop Test Connector is attached". This connector is the cable connecting the computer to the PVT machine. Select "OK". You should get "Loop Test Successful". Click "OK". If not, try another Comm port and retest. If there is still a problem, be sure the PVT machine is in "Supervisory Mode". This test will fail if it is not in this mode.

8. **On the computer**, click on the PVT menu. Next, choose **Download**. The NOTE Dialog box appears to remind user: Ensure that PVT is in Supervisory Mode. Then click "OK".

9. You will get a message regarding the current memory status. Click "OK".

10. Information on the computer screen will indicate communication with the PVT and that all information is being downloaded from the device. When the "Download Finished" message appears, choose "OK".

11. The "Save As" screen appears. Store the PVT file in the folder "Program Files\AMI\PVT." Use the naming convention Site initials_date_machine serial number.pvt. For example, data downloaded from the Pittsburgh site on 9/25/06 from machine 1633 should read PI_092506_1633.pvt. This file may contain multiple PVT trials.

11. After all the data has been sent to the computer the supervisory menu will reappear on the PVT and quickly revert back to the Select Test or Setup screen.

12. Turn off the PVT.

7.2 Data Review

1. Use REACT software to review data, paying attention that participant information is properly entered.
      Use the START menu to choose PROGRAMS/Ami/PVT .
      From the menu choose REACT.
      Select Load and PARSE PVT Files.
      You can select a file to analyze, and choose "detailed" rather than "summary".
The important things to check are the ID, trial number, and study (clinic initials) are correct. This is found along the header of the program. Also check that the file has trial length 180 seconds (in the summary grid).

2. Printed reports may be generated and placed in the participant file.

NOTE: this causes a separate RTF file to be generated for each individual file in the .PVT file in the same directory that you are storing the PVT file.

7.3 Data Clearing

After data have been successfully retrieved and reviewed, the memory of the PVT may be cleared.

1. With the PVT power off, attach the serial cable from your computer to the 9-pin connection of your PVT.

2. Turn the PVT power on.

3. Use the START menu to choose PROGRAMS/Ami/PVT.

4. From the menu choose PVTcommW

5. **ON THE PVT**, press the LEFT button to move the flashing cursor to **Setup** and press the RIGHT button to accept.

6. **ON THE PVT**, Enter the following access code to enable the PVT to communicate with the computer: **31267.** Use the **LEFT** and **RIGHT** buttons of the PVT to enter this value and then move the flashing cursor to the **Q** character. Press the **RIGHT** button to accept this access code. (Remember, if a mistake is made, enter **E** to start over). At this point the PVT will display "Supervisory Mode".

7. Check Connections: as described above.

8. **On the computer**, click on the PVT menu and choose **Clear**.
The NOTE Dialog box appears to remind user: Ensure that PVT is in Supervisory Mode. If PVT machine shows "Supervisory Mode" click "OK".

9. You will get a message regarding the current memory status. Click "OK".

10. you will get a warning about data being permanently erased. If you are sure the data has been saved permanently, click "OK". You will get a message that the data has been cleared.

11. Turn off the PVT.

NOTE: if data is not cleared between downloads you will get multiple copies of the same file. Please clear data between data transfers.

7.4 Sending the Data to Coordinating Center

When you save data, it will be saved as Site initials_date_machine serial number.pvt. (example, data downloaded from the Pittsburgh site on 9/25/06 from machine 1633 should read PI_092506_1633.pvt). This file may contain multiple PVT trials.
The PVT file needs to be sent electronically to the Coordinating Center.

Transfer of data will occur via the Coordinating Center's secure website. Secure remote access to the website is provided by the Juniper Networks Instant Virtual Extranet (IVE) appliance which sits behind our network firewall.

    Authorized users will be given a login id and password
- Log onto our secure website (http://ive.sfcc-cpmc.net)

- Choose your authorized role
- Choose your folder (should be called SOFMNPVT, SOFPIPVT, or SOFPOPVT)
- Choose "Upload file"
- Browse for the file you wish to upload and then click "Upload"

Retain a copy of the file on the clinic computer hard drive until you receive notification from the Coordinating Center that it is ok to delete the file.
This is an example of what the secure data transfer website looks like
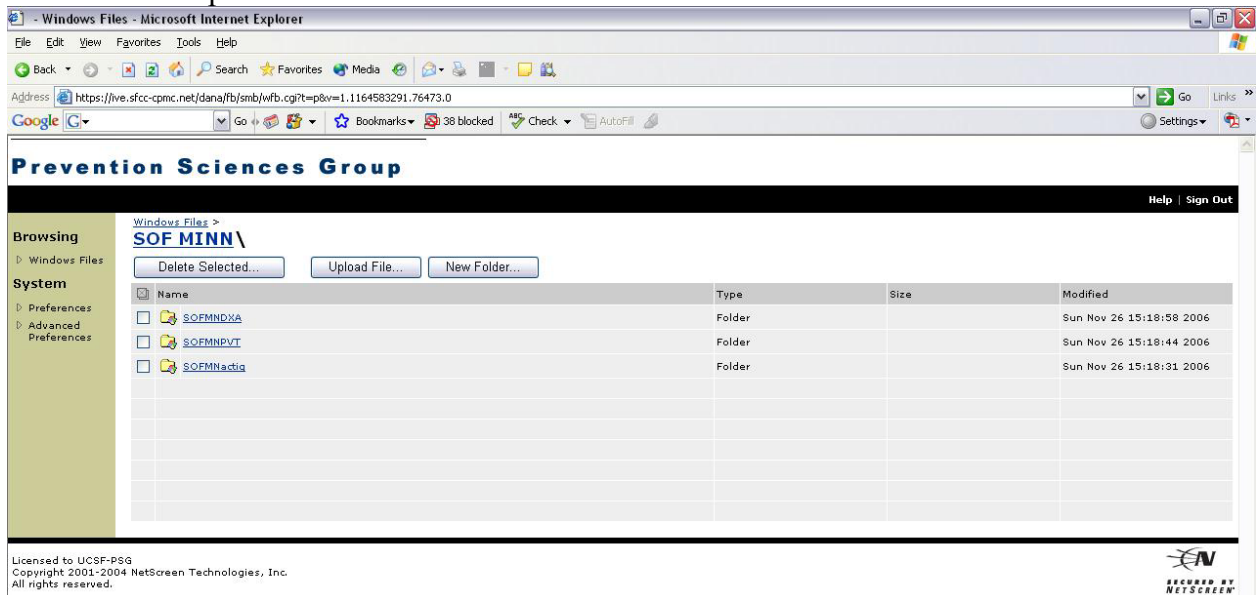
7.5 Post Reaction Time Collection Procedure Summary

At the completion of each day of data collection, do the following steps:
- Retrieve data
- Review data
- Clear PVT memory
- Transmit data electronically to the Coordinating Center
- Charge PVT overnight once/week (do **not leave continuously charging**)

8. Additional PVT Instructions and Maintenance

For more detailed instructions (with reference images) and maintenance information, please see the attached PVT-192 User's Guide and Instruction Manual**.**

9. Quality Assurance for the PVT

Designated site staff will be charged with the responsibility of entering the participant information prior to data collection, retrieving the data, reviewing the data, clearing the PVT memory, and charging the PVT weekly. Only personnel who have been trained in these procedures will be certified and approved to handle the PVT devices and instruct the participants.

Personnel will be required to attend a training session, or undergo local training by a certified technician. Training will consist of:

1. Overview of Reaction Time Manual - including detailed use of the PVT and the software.

2. Hands-on training for entering the setting up the PVT, instructing the participant in the measurement, and downloading/saving of files. Transfer of PVT file to CC will also be shown but may not be required for each personnel (as this requires a secure web site with limited access). Each personnel involved with the PVT, will be required to take the PVT test themselves, to become more familiar with the measurement. They will also be required to download/save the file, review the results with the REACT software and clear the PVT memory. There will be a discussion of some common questions from participants, PVT problems and other situations that may occur. Problems with the PVT can be discussed on monthly Project Director Teleconferences.

3. Overview of AMI's PVT-192 User's Guide and Reference Manual.

9.1 Certification

Besides completing the requirements in the Reaction Time Certification form, each personnel needs to successfully complete 3 PVT set-ups and data downloads, including saving the file, reviewing the data and clearing the PVT. These should be done with a certified technician present.

9.2 PVT Measurement Reliability Studies

At the beginning and ending of the study, each PVT will be calibrated using equipment developed by Ambulatory Monitoring, Inc., to ensure that accurate measurements are being obtained. Interim tests of reliability may be performed on the PVT devices (TBD).

10. References

William JH, Fomberstein KM, Niyogi S, Coble MM, Banks S and Dinges DF. Development of a Briefer Version of the Psychomotor Vigilance Task. SLEEP 2006; 29 (Abstract Supplement):344.

11. APPENDIX

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Battery Log for PVT-192

Serial Number	Was the battery almost dead?	Date Charged	Staff Initials	Duration of charge	Extended Charge time