

Direct Energy Resources
Well Test Application

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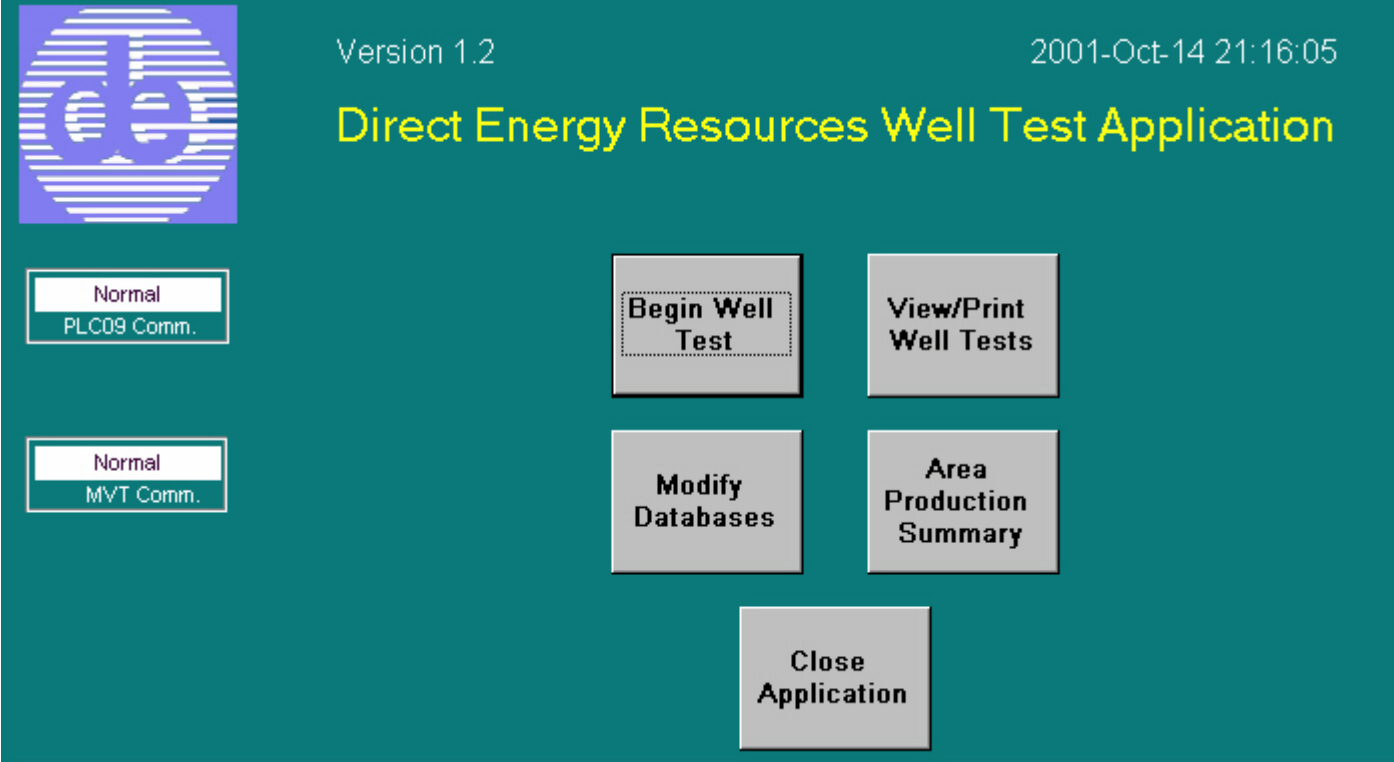
Introduction

This application has been designed to reduce the amount of manual record keeping required for Well Testing by Direct Energy Personnel and hopefully speed up the process.

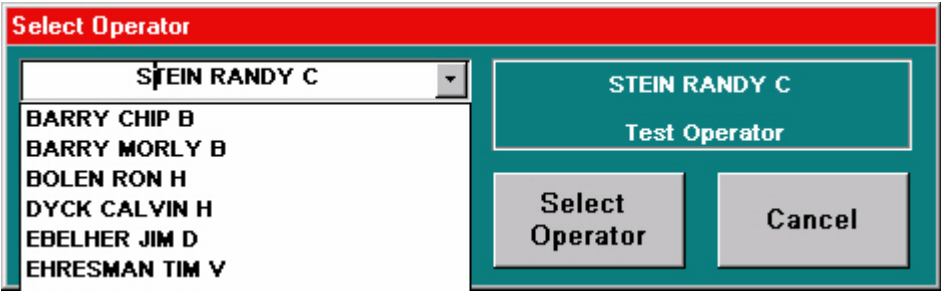
The application consists of a Microsoft Access program (direct.mdb), a communications front-end application (mdbus.exe), a PLC09 Flow Computer, and a Fisher Multivariable unit (MVT). The Access program requests Flow Data from the communications front-end. The communication front-end polls the PLC09 for Flow Data. The PLC09 polls the MVT for differential pressure, static pressure, and temperature and uses these values in conjunction with the parameters supplied by the Access program to perform a Flow Calculation.

Main Form

The Main page in the Access application has 5 buttons.



The first button, "Begin Well Test", when pressed brings up the "Select Operator" window/form that allows an Operator to select his name from a previously entered list of names.



It may only be necessary to enter the first letter of the Operator's last name to make the selection or select the Operator from a drop down list that appears when the drop down arrow is clicked with the mouse. The name selected is attached to the Test report.

Once the Operator Name has been selected, it remains active for all Well Tests. When the "Begin Test" button is pressed for another Well Test, the request for this information will not appear.

After the Operator is selected, a window/form called "Select Well Area" appears.

This form allows selection of the Area that the Well to be tested resides. As in the Select Operator case, the first letter of Area is entered or the drop down arrow can be clicked to select the area from the drop down list.

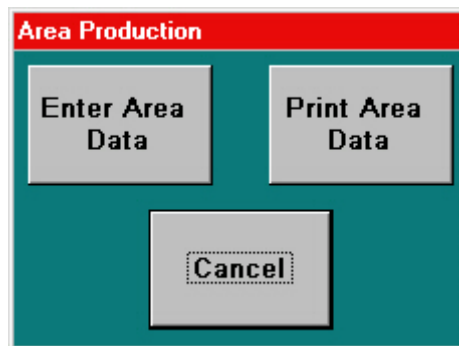
When the Area is selected (the "Select Well Area" button is clicked), another window/form called "Select Well LSD" appears and this form allows a Well from the selected Area to be chosen.

The complete LSD of the Well is kept in the database. For Well selection, an Operator either needs to key in the Well LSD i.e. 000/02-32, etc. (only until the desired Well appears in the LSD of Well to Test box) to find the appropriate test Well or click on the down arrow to select a Well from the drop down list.

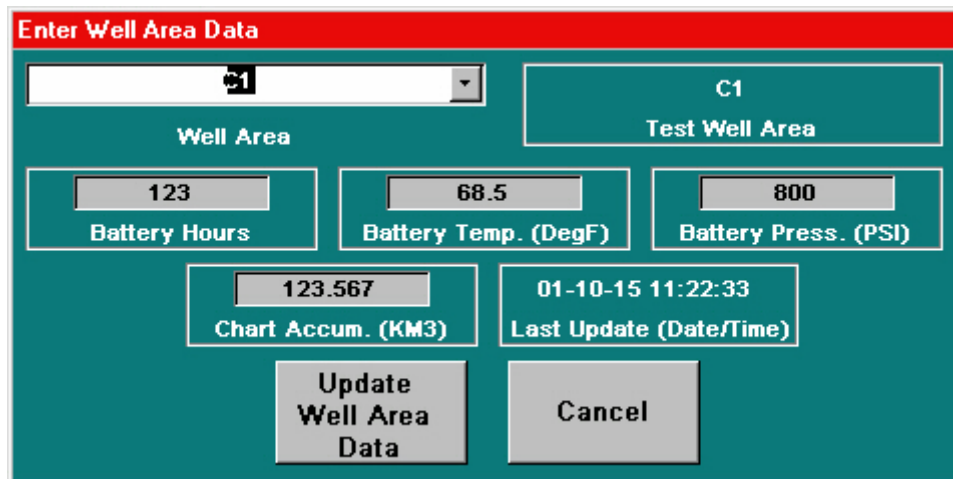
Next, a form that allows the pipe size, orifice size and atmospheric pressure to be entered follows. Also displayed on this form are the Operator Name, Test Well Area, Analysis Zone, and the LSD of the Well to test. The final window/form that appears allows the Starting of the Well Test. After the Test is complete, the Tested window/form appears to allow a cursory confirmation of the Test results. This same window can be viewed at any time by clicking on the "View/Print Well Tests" button in order to print the results or save them to floppy disk.

Pressing the "Modify Databases" button will bring up a window/form that allows Operators, Wells, Areas and Zones to be deleted or added to the various databases.

Clicking on the "Area Production Summary" button brings up the Area Production window/form.



Clicking on the "Enter Area Data" button brings up a form that allows the data from an Area or Battery to be entered.



Clicking on the “Print Area Data” button brings up a form that allows the Area to be selected for the Production Summary Log.

The image shows a dialog box titled "Select Production Summary Area". It features a red header bar. Below the header, there is a dropdown menu with "C1" selected. Underneath the dropdown is the text "Production Summary Area". To the right of the dropdown is a box containing "C1" and "Production Summary Area". At the bottom right, there are two buttons: "Print Prod. Area" and "Cancel".

Clicking on the “Print Prod. Area” button will print the Production Summary Log for the selected Area.

The last button on the Main window/form, the “Close Application” button, allows the Well test program to be shut down.

In addition to the buttons, the Main window/form has two boxes, which show the state of communications to the PLC09 Flow Computer (Fail or Normal) as reported by the communications front-end and the state of communications to the Fisher MVT (Fail or Normal) as reported by the PLC09. It is important that both these boxes indicate Normal communication or the Well Test can not be initiated.

Modify Databases Form

This form allows the Operator Names, Well LSDs, Zones, and Well Areas to be added or deleted from the Databases.

The screenshot shows a software interface with a teal background. It is organized into several sections:

- Operator Database:** Contains two buttons: "Add Operator" (highlighted with a dashed border) and "Delete Operator".
- Well Database:** Contains two buttons: "Add Well" and "Delete Well".
- Area Database:** Contains two buttons: "Add Area" and "Delete Area".
- Analysis Zone Database:** Contains three buttons: "Add Analysis Zone", "Modify Analysis Zone", and "Delete Analysis Zone".
- All Databases:** Contains three buttons: "Save", "Restore", and "Compact".
- Bottom Center:** A single "Cancel" button.

Pressing the "Add Operator" button brings up a form that requires the Last Name, First Name, and Initial or middle name of a new Operator to be entered. When the "Add Operator" button is pressed, the addition to the database takes effect.

This screenshot shows a sub-form with a teal background. It features three input fields at the top:

- Last Name:** A text box containing the text "Dei".
- First Name:** An empty text box.
- Initial:** An empty text box.

Below the input fields are two buttons:

- Add Operator:** A button to submit the information.
- Cancel:** A button to exit the form.

Pressing the “Add Well” button brings up a form that requires the Well LSD and the unique 6 digit Cost Center No. to be entered.

| | | |
|---|------------------------|--------------------------|
| Add Well | | |
| 000/11-22-333-44W4/55 Well LSD (XXX/XX-XX-XXX-XXW5/XX) | 351231 Cost Center | |
| c Well Area | Next | |
| C1 Well Area | Prev. | |
| m Analysis Zone | Next | |
| MH Analysis Zone | Prev. | |
| 0.750 Orifice (Inches) | 2.064 Pipe (Inches) | 93.35 Atm. Prs. (KPA) |
| Add Well | | Cancel |

The LSD must consist of 21 characters and must be of the form XXX/XX-XX-XXX-XXW5/XX. In addition, the Well Area and Well Zone must be selected. On this form are also the initial flow parameters for the Well such as orifice size, pipe size, and atmospheric pressure and these parameters can be modified.

Pressing the “Add Area” button brings up a form that requires the Name of a Well Area to be entered.

The Name can be any combination of alphanumeric characters. In addition, The ERCB Battery Code and PRISM Battery codes must be entered. When the “Add Well Area” button is pressed, the addition to the database takes place. An Operator will only be able to select a Well for Test in the Area selected for Test.

Pressing the “Add Analysis Zone” button brings up a form that requires the Name of the Analysis Zone to be entered.

The Name can be any combination of alphanumeric characters. The initial flow parameters for the Well’s Area must also be entered as taken from a Gas composition report. If there is a mole fraction for Helium and Hydrogen, they should be added to the N2 mole fraction. Special care should be exercised to ensure that the total mole fraction reads 1.0000 when through entering the Gas Composition. When the “Add

Analysis Zone” button is pressed, the addition of the Analysis Zone to the database takes place.

When the “Delete Operator” button is pressed, a form appears which requires that the Last Name of the Operator to be deleted be entered.

| | | |
|-----------------|--------------------------------|-------|
| de Last Name | SYD J DEITCH Name to Delete | Next |
| Delete Operator | Cancel | Prev. |

When the first character of the Last Name of the operator to be deleted is entered, the first entry in the Database that matches that description appears in the Name to Delete area. The next letters in the Name can be entered or the “Next” button can be pressed to find the Name to delete. When a match is found, The “Delete Operator” button can be pressed to eliminate the name from the database.

When the “Delete Well” Database button is pressed, a form appears which requires that the LSD of the Well to be deleted be entered.

| | | |
|--|--|--------|
| Delete Well | | |
| 00 Well LSD (XXX/XX-XX-XXX-XXXX/XX) | 000/01-07-014-03W4/00 LSD of Well to Delete | Next |
| CONLAC VALE BAT 207 Well Area | MR Well Analysis Zone | Prev. |
| 1 Cost_Center | Delete Well | Cancel |

When the first character of the complete LSD to be deleted is entered, the first entry in the Database that matches that description appears in the LSD of Well to Delete area. The next characters in the LSD can be entered or the “Next” button can be pressed to find the LSD to delete. When a match is found, The “Delete Well” button can be pressed to eliminate the LSD from the database. The Well Area, Well Analysis, and Cost Center No. for the Well to be deleted are also shown to eliminate the possibility of selecting the wrong Well to delete.

When the “Delete Well Area” button is pressed, a form appears which requires that the Well Area to be deleted be entered.

When the first character of the Area to be deleted is entered, the first entry in the Database that matches that description appears in the Well Area to Delete section. The ERCB and PRISM Battery Codes are also shown to verify the right Area has been selected. The next characters in the Area can be entered or the “Next” button can be pressed to find the Well Area to delete. When a match is found, The “Delete Well Area” button can be pressed to eliminate the Area from the database.

When the “Delete Analysis Zone” button is pressed, a form appears which requires that the Analysis Zone to be deleted be entered.

When the first character of the Zone to be deleted is entered, the first entry in the Database that matches that description appears in the Analysis Zone to Delete section. The next characters in the Zone can be entered or the “Next” button can be pressed to find the Analysis Zone to delete. When a match is found, The “Delete Analysis Zone” button can be pressed to eliminate the Zone from the database.

When the “Modify Analysis Zone” button is pressed, a form appears which allows the Analysis for a particular Zone to be modified.

| | | |
|-------------------------------|--------------------|----------------------|
| m | | Next |
| Analysis Zone | | |
| Medicine Hat Analysis Zone | | Prev. |
| 0.5712 SG | | 1.0000 Total Mole |
| 0.0005 Mole CO2 | 0.0001 Mole H2S | 0.0301 Mole N2 |
| 0.9622 Mole C1 | 0.0033 Mole C2 | 0.0004 Mole C3 |
| 0.0002 Mole IC4 | 0.0001 Mole NC4 | 0.0002 Mole IC5 |
| 0.0003 Mole NC5 | 0.0004 Mole C6 | 0.0022 Mole C7+ |
| Modify Analysis Zone | | Cancel |

When the first character of the Zone to be modified is entered, the first entry in the Database that matches that description appears in the Analysis Zone section. The next characters in the Zone can be entered or the “Next” button can be pressed to find the exact Analysis Zone to modify. When a match is found, the new Analysis values can be entered. The “Modify Analysis Zone” button can be pressed to save the new Zone Analysis in the database.

From time to time it may become necessary to modify the Access application which contains the Databases as well as the Operator Interface. To preserve the Databases, the “Save Databases” button can be pressed. Once the new application is installed, pressing the “Restore Databases” button will reload the Databases. The Databases are stored in the c:\mdbus directory in files labeled operators.txt, wells.txt, tested.txt, area.txt, and analysis.txt.

The Access Database over time becomes fragmented with much unused space. Pressing the “Compact Database” button from time to time will eliminate the unused space in the Database and allow for faster execution of the Well Test application.

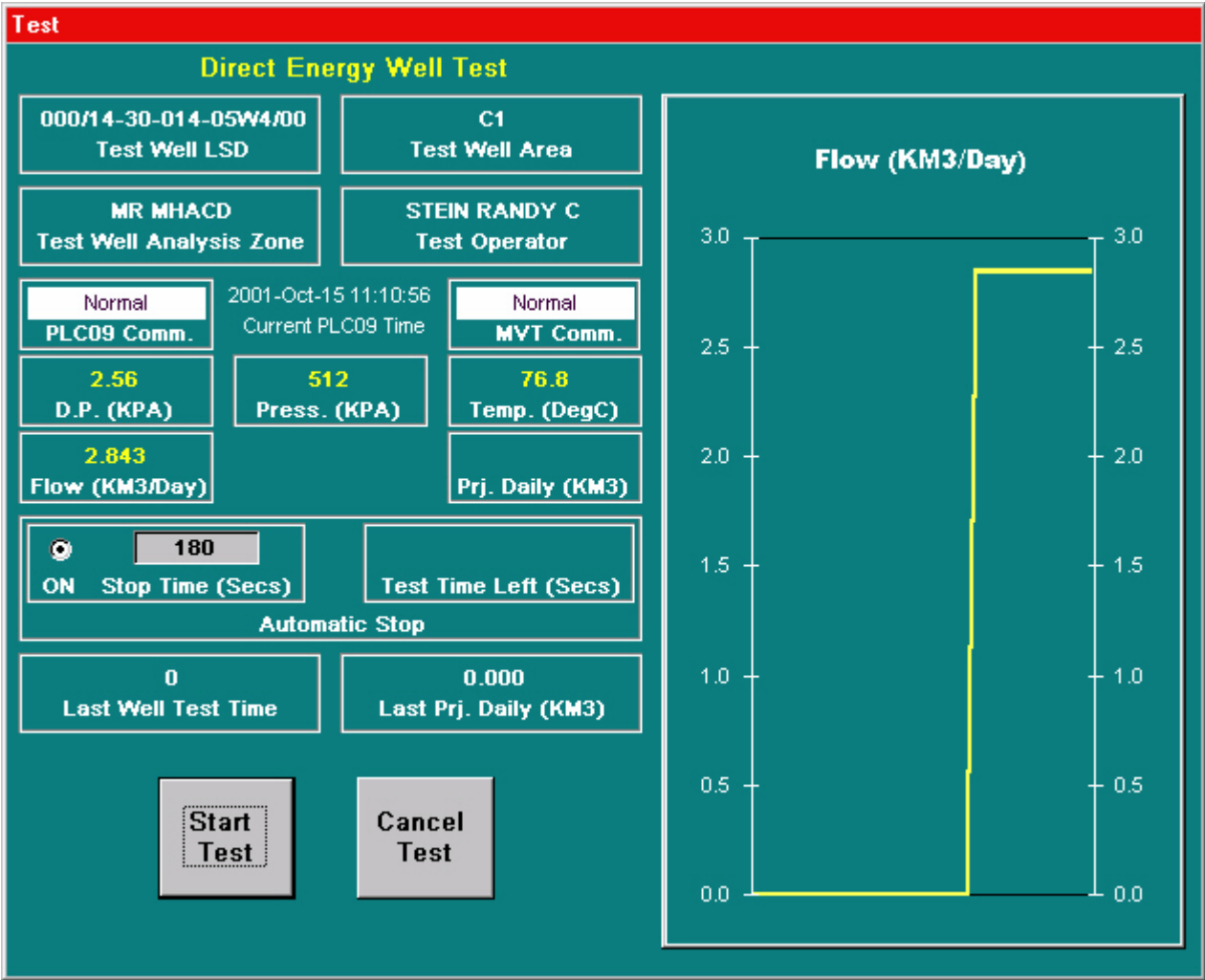
Test Well Forms

The Testing of a Well has two parts. After the Operator, Well Area, and Well LSD have been selected, a window/form appears which shows the LSD of the Well to be tested, the Area of the Well, the Analysis Zone, the name of the Test Operator, the state of communications to the PLC09 and the MVT, and the last parameters for the Well.

| Selected Well Information | | |
|--|--|--------------------------|
| 000/14-30-014-05W4/00 Test Well LSD | C1 Test Well Area | |
| MR MHACD Test Well Analysis Zone | STEIN RANDY C Test Operator | |
| Normal PLC09 Comm. | 10/15/01 11:10:56 AM Current PLC09 Time | Normal MVT Comm. |
| 0.750 Orifice (Inches) | 2.060 Pipe (Inches) | 93.35 Atm. Prs. (KPA) |
| Test Well | | Cancel |

At this time, last minute changes to the Orifice Size, Pipe Size, and Atmospheric Pressure parameters can be made. When the "Test Well" button is pressed, all the Flow Parameters are sent to the PLC09 Flow Computer for processing. A box appears for 15 seconds during which time the PLC09 Flow Computer processes the data. At the end of this interval, the window/form that allows the Test to Start and Stop appears.

The form shows the current readings for differential pressure, static pressure, and temperature of the Well Gas. Also shown is the Flow Rate as currently calculated by the PLC09. If the flow rate appears stable, the Operator can press the "Start Test" button. The stopping of the test can be achieved in two ways. Manual by pressing the "Stop Test" button or automatic. The automatic stop is controlled by the On checkbox in the Automatic Stop box. If the On is unchecked, an Operator must manually stop the Test. If it is checked, the Test will run for the time in seconds in the Stop Time box. The ultimate aim of the test is to produce a stable Projected Daily Accumulation. The graph on the right shows the current Flow Rate and is updated every 5 seconds during a test. The graph holds the last 180 seconds of the Flow Rate. When the test is over, the "View/Print Well Tests" form appears allowing the complete Test results to be verified.



View/Print Well Tests Form

| Tested | | | | | |
|--|---------------------------------|--|---------------------------|-------------------------------------|--|
| Direct Energy Well Test | | | | | |
| STEIN RANDY C Test Operator | | Everything went well with this test. Test Remarks | | | 21222 Cost Center |
| 000/14-30-014-05W4/00 Test Well LSD | | C1 Test Well Area | | MR MHACD Test Well Analysis Zone | |
| 2.56 D.P. (KPA) | 512 Press. (KPA) | 76.8 Temp. (DegC) | 0.750 Orifice (Inches) | 2.064 Pipe (Inches) | 0.5700 Spec. Gravity |
| 0.99864 Y | 1.00189 FA | 115.15 FB | 0.000007000 Viscosity | 93.35 Atm. Prs. (KPA) | 1.0000 Total Mole |
| 1.32453 FG | 1.00231 FPB | 1.00196 FPV | 0.0022 Mole CO2 | 0.0000 Mole H2S | 0.0270 Mole N2 |
| 1.00185 FR | 0.99808 FTB | 0.90829 FTF | 0.9673 Mole C1 | 0.0021 Mole C2 | 0.0002 Mole C3 |
| 0.008 Runtime (Hrs.) | 01-10-15 11:10:56 Start Time | 0.001 Accum (KM3) | 0.0000 Mole IC4 | 0.0000 Mole NC4 | 0.0000 Mole IC5 |
| 2.843 Flow (KM3/Day) | 01-10-15 11:10:56 Stop Time | 2.844 Prj. Daily (KM3) | 0.0000 Mole NC5 | 0.0006 Mole C6 | 0.0006 Mole C7+ |
| 5 of 5 Well Test No. | Next | Prev | Exit | Print | Save Delete Save All Delete All |

This window/form allows the Test Results to be viewed, printed, and saved to floppy. When invoked, the results of the last Test are displayed. Pressing the "Prev." button will display the second last Test and so on. Pressing the "Print" button when a printer is connected to the parallel port will print the displayed Test. The displayed Test can be saved to floppy by pressing the "Save" button. The file is tagged with the well LSD and the start date/time of the Test. The Test can be removed from the Database by pressing the "Delete" button. The "Save All" button when pressed, saves all the Tests in one floppy file tagged with the name Tests and the current date/time. The "Delete All" button when pressed, deletes all the Tests.