

Gas Fired Heater Calculations

Version 1.2.0

By Process Ace Software

Installation and User Guide



August 8, 2004

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<http://www.processacesoftware.com/>

Product Support

Gas Fired Heater Calculations comes with free support and updates for the life of the product. We currently offer support via email or through our Yahoo! user-group. We try our best to answer all enquires within 24 hours.

For email support, please contact us at:

contact@processacesoftware.com

Or join our Yahoo! user-group via the following link:

http://www.processacesoftware.com/contact_process_ace_software.html

Note that the email address you provided when purchasing the product is the one used to notify you of updates. Contact us if your email address has changed to ensure the accuracy of our client list.

INSTALLATION ONTO YOUR Palm OS® DEVICE

Files:

The following files are included in the download file for both the demo and registered versions and you must HotSync® them onto your PDA for Gas Fired Heater Calculations to work correctly:

- MathLib.prc - Mathlib version 1.1
- NSBRuntime.prc - NS Basic Runtime version 4.3.0 (NOTE: This program requires version 4.3.0 or later to function properly)
- NSBSystemLib version 2.01 – Shared library for cut, copy, paste and undo commands (WARNING: Using an earlier version of NSBSystemLib will cause fatal errors on Palm Tungsten T3 devices)
- GasFiredHtr.prc – Gas Fired Heater Calculations application

Installation Procedure:

1. Create a file folder then copy all of the files from *GasHtrReg.zip* to this new folder.
2. Click the install icon within Palm Desktop, select “Add” then locate the new folder that you created.
3. Add Mathlib, NSBRuntime, NSBSystemLib and GasFiredHtr to the installation list. Please note that MathLib, NSBRuntime and NSBSystemLib **MUST** have “Handheld” specified as the “Install To:” destination. ***Installing MathLib, NSBRuntime or NSBSystemLib to an expansion card will cause a fatal error when you attempt to use the application.***
4. After choosing “Done”, press the HotSync® button on your cradle to install the files.
5. An icon labelled *GasFiredHtr* will show up in the *All* and *Unfiled* categories.

Upgrade Procedure:

1. Locate a file named GasHeatersDB.pdb in your Palm/*UserName*/Backup directory on your hard-drive and save a copy to a safe location. This backs up any heater files you may have created.
2. HotSync® NSBRuntime, NSBSystemLib and GasFiredHtr onto your handheld (there is no need to delete the older versions).

PROGRAM INFORMATION AND LIMITATIONS

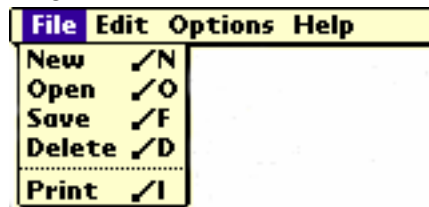
This page is left intentionally blank.

RUNNING THE APPLICATION

Menu Bar

By tapping the form title at the top of the screen a number of menu selections appear. These are described below.

File



- New (clears all data to get ready for a new case)
- Open (takes you to a form to select a previously saved case)
- Save (takes you to a form to save your current case)
- Delete (takes you to a form to delete a previously saved case)
- Print (allows you to print your current case to a Bluetooth or IR enabled printer. Note: This requires PalmPrint™ to be installed on your device. PalmPrint™ is available from Stevens Creek Software at www.stevenscreek.com)

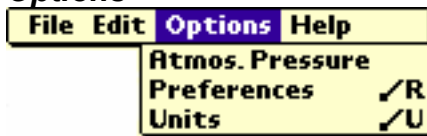
Edit



The following functions are available using the Edit menu item:

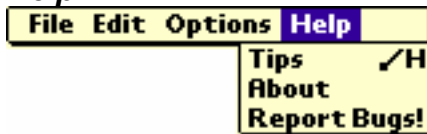
- Undo – undo the last cut or paste operation
- Cut – standard cut operation
- Copy – copy selection
- Paste – paste the “cut” or “copy” selection
- Select All – will select the entire field that currently has the focus (or has been “tapped”)
- Graffiti® Help
- Keyboard (note: must have a flashing cursor in a data entry field for this to work)

Options



- Atmos. Pressure (Note: This must be set for your calculations to be accurate)
- Preferences
 - Splash screen on or off on startup
 - Enable or disable saving your data on program exit
- Units

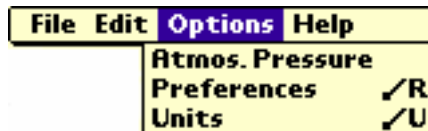
Help



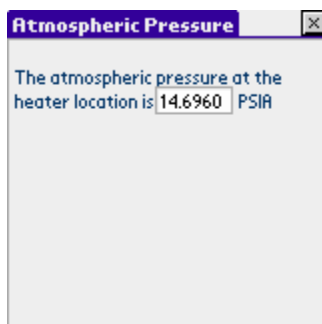
- Tips (built-in help)
- About
- Report Bugs!

Initial Program Set-up

Note: Before performing any calculations, tap the top of the main form to access the menu-bar and select "Options then "Atmos. Pressure" .

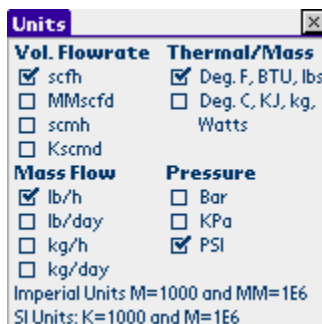


This will take you to the Atmospheric Pressure entry form.



Enter the atmospheric pressure at the location of the heater being studied to ensure that your calculations are accurate. Tapping the X button at the upper right corner of the screen will return you to the Main form.

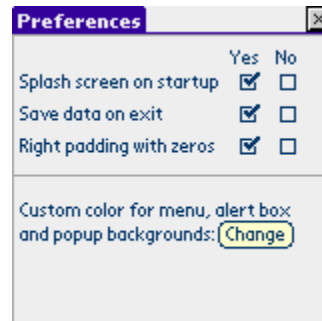
If you need to change the default unit set, tap the menu-bar once again and select "Options then "Units". Select the combination of units that you desire from the Units entry form.



Tapping the X button at the upper right corner of the screen will return you to your previous form.

In addition to the above, a Preferences form is provided which allows you to:

1. Enable or disable the splash screen on start-up
2. Enable or disable saving your data on program exit



Tapping the X button at the upper right corner of the screen will return you to the previous form.

Main Form (displayed after program start-up)

From the main form of the application you enter all of the information regarding the operating case for the heater being studied

Fired Heater Calculations		
Ambient Temp.	60.0000	Deg F
Comb. Air Temp.	80.0000	Deg F
Fuel Gas Temp.	100.000	Deg F
Bridgewall Temp.	1350.00	Deg F
Flue Gas Temp.	500.000	Deg F
▼ Excess Air	15.0000	%
Rel. Humidity	100.000	%
Heat Loss	2.00000	%
Fuel Gas Flowrate	200000.	scfh
AIR PREHEAT RESULTS		
FG COMPOSITION CALC		

Three calculation modes are provided for entering excess air, i.e.,

1. Enter excess air
2. Enter Vol% O₂ on a wet basis
3. Enter Vol% O₂ on a dry basis

To change the calculation mode, tap the drop-down list-box as shown below:

Fired Heater Calculations		
Ambient Temp.	60.0000	Deg F
Comb. Air Temp.	80.0000	Deg F
Fuel Gas Temp.	100.000	Deg F
Bridgewall Temp.	1350.00	Deg F
Flue Gas Temp.	500.000	Deg F
▼ Excess Air	15.0000	%
Rel. Vol% O2 wet	100.000	%
He Vol% O2 dry	2.00000	%
Fuel Gas Flowrate	200000.	scfh
AIR PREHEAT RESULTS		
FG COMPOSITION CALC		

After choosing a mode and entering the operating data onto the Main form, tap the F.G. COMPOSITION button to enter the composition for your fuel gas stream.

As shown below, the program allows you to enter the fuel gas composition in mole percent for up to 29 different components.

Fuel Gas (1) [2][3] 100.000 X	Fuel Gas (2) [1][3] 100.000 X	Fuel Gas (3) [1][2] 100.000 X
Fuel Gas Analysis (Mole%)	Fuel Gas Analysis (Mole%)	Fuel Gas Analysis (Mole%)
Methane 50.0000	3-Methylpentane	Hydrogen 17.9950
Ethane 15.0000	2,2-Dimethylbutane	Nitrogen
Propane 10.0000	2,3-Dimethylbutane	Oxygen
n-Butane	n-Heptane	Water
i-Butane	Ethene 5.00000	Carbon Monoxide
n-Pentane	Propene 2.00000	Carbon Dioxide
2-Methylbutane	i-Butene	Hydrogen Sulfide 0.00500
2,2-DimethylPropane	1-Butene	Sulfur Dioxide
n-Hexane	cis-2-Butene	Ammonia
2-Methylpentane	trans-2-Butene	

You can toggle between the composition entry forms using the [1], [2] and [3] buttons at the top of each page. Tapping the X button at the upper right corner of the screen will return you to the Main form.

Results Forms

Once all the information on the Main form along with a composition have been entered, tap the CALC button for your calculations to proceed. When the program is ready, a RESULTS button will appear. Tapping the RESULTS button will take you to the first of five pages of results. Use the [1], [2], [3], [4] and [5] buttons at the top of the form to toggle between these pages.

Results Form 1

The first page of results provides an overview of the heater firing focusing on excess air, duties and efficiencies:

Results (1) [2][3][4][5] X
Flue O2 (Wet) 2.48020 Vol%
Flue O2 (Dry) 2.98776 Vol%
Fuel Gas 10316.9 lb/h
Combustion Air 198492. lb/h
Flue Gas 208809. lb/h
Fired Duty 219.667 MMBTU/h
Radiant Duty 142.921 MMBTU/h
Conv. Duty 52.1689 MMBTU/h
Total Abs Duty 195.090 MMBTU/h
Rad. Efficiency 63.0255 %
Total Efficiency 86.7610 %

Results Form 2

The second results form displays fuel gas information including:

- Heating values
- Air to fuel ratio
- Adiabatic flame temperature
- Fuel gas specific gravity and molecular weight
- Carbon to hydrogen ratio
- Wobbe index

Results (2)			(1)	(3)	(4)	(5)	✕
Fuel Gas LHV	21292.0	BTU/lb					
	1098.34	BTU/scf					
Fuel Gas HHV	23430.3	BTU/lb					
	1208.64	BTU/scf					
Wet Air/Fuel	19.2395	lb/lb					
	254.478	ft ³ /lb					
Ad. Flame Temp	3393.88	Deg F					
Fuel Gas SG	0.67499	@STP					
Fuel Gas MW	19.5505						
Fuel Gas C/H	3.42786						
Wobbe Index	1471.11						

Results Form 3

The third results form provides flue gas information:

- Flue gas flowrates
- Flue gas molecular weight
- NO_x flowrate and concentration
- CO₂ and SO₂ flowrates
- Flue gas enthalpies calculated at the bridgewall and stack temperatures

Results (3)			(1)	(2)	(4)	(5)	✕
Flue Gas Flow	208809.	lb/h					
	2.843e6	scfh					
Flue Gas MW	27.8332						
<input checked="" type="checkbox"/> Std Burner	<input type="checkbox"/> Low NO _x Burner						
Flue NO _x (est)	43.9334	lb/h					
	210.400	ppmw					
Flue Gas CO ₂	29262.7	lb/h					
Flue Gas SO ₂	1.69031	lb/h					
Flue Gas Enthalpy:							
At Bridgewall	368.143	BTU/lb					
At Stack	118.302	BTU/lb					

Results Form 4

EPA emissions factors can be found on the forth results form. These include:

- F_d = Dry effluent gas from combustion \div Higher Heating Value
- F_w = Wet effluent gas from combustion \div Higher Heating Value
- F_c = CO₂ produced from combustion \div Higher Heating value

Results (4) (1)(2)(3)(5) [X]

Emissions F Factors

F_d =dry effluent gas from comb/HHV
= 8563.33 scf/MMBTU

F_w =wet effluent gas from comb/HHV
= 10423.5 scf/MMBTU

F_c = CO₂ produced by comb/HHV
= 1060.53 scf/MMBTU

Results Form 5

The final results form provides the calculated flue gas analysis on a wet and dry basis (in weight % and volume %).

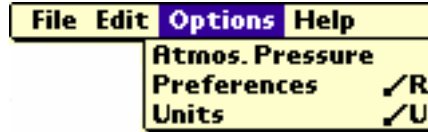
Results (5) (1)(2)(3)(4) [X]

Flue Gas Analysis

	Wet Basis		Dry Basis	
	Wt%	Vol%	Wt%	Vol%
O ₂	2.857	2.480	3.210	2.988
N ₂	72.13	71.67	81.04	86.34
CO ₂	14.01	8.863	15.75	10.68
H ₂ O	11.00	16.99	0.000	0.000
	ppmw	ppmv	ppmw	ppmv
SO ₂	8.095	3.517	9.095	4.237
Excess Air		15.00 %		

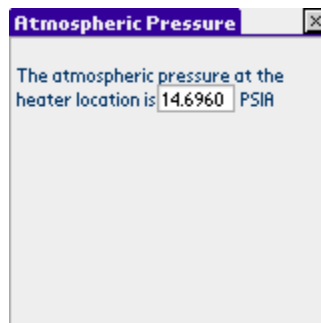
Tapping the X button at the upper right corner of the screen for any of the Results forms will return you to the Main form.

Program Options



1. Atmos. Pressure

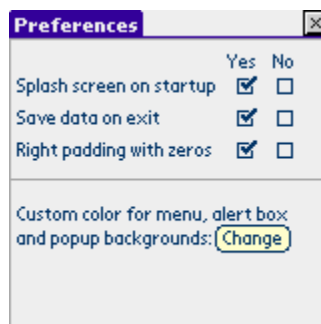
Tapping Atmos. Pressure from the Options drop-down on the menu-bar will take you to the Atmospheric Pressure form.



Use this form to specify the atmospheric pressure at the heater location.

2. Preferences

Tapping Preferences from the Options drop-down on the menu-bar will take you to the Preferences form.

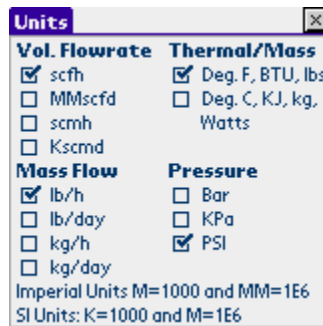


On this form you can:

- Enable or disable the splash screen on start-up
- Enable or disable saving your data on program exit

3. Units

Tapping Units from the Options drop-down on the menu-bar will take you to the Units form.



The screenshot shows a dialog box titled "Units" with a close button in the top right corner. The dialog is divided into four sections, each with a bolded title and a list of units with checkboxes:

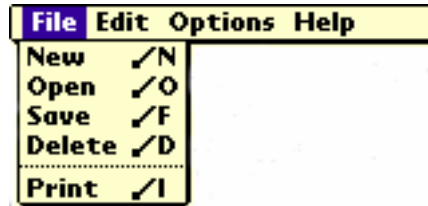
- Vol. Flowrate**:
 - ☒ scfh
 - ☐ MMscfd
 - ☐ scmh
 - ☐ Kscmd
- Thermal/Mass**:
 - ☒ Deg. F., BTU, lbs
 - ☐ Deg. C., KJ, kg, Watts
- Mass Flow**:
 - ☒ lb/h
 - ☐ lb/day
 - ☐ kg/h
 - ☐ kg/day
- Pressure**:
 - ☐ Bar
 - ☐ KPa
 - ☒ PSI

At the bottom of the dialog, there are two lines of text:
Imperial Units M=1000 and MM=1E6
SI Units: K=1000 and M=1E6

This form allows the user to select the desired units for input and output. Unit types have been divided into 4 categories to allow greater flexibility for mixing and matching.

File Operations

Tapping the menu-bar and selecting File will drop-down a list of file operation choices.

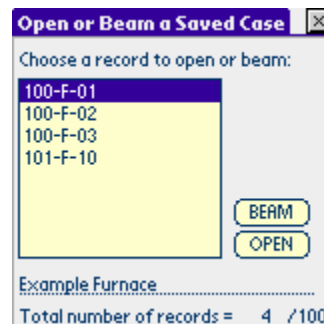


1. New

Select New if you would like to clear all entries from the active case (on all forms).

2. Open/Beam

On the Open a Saved Case form, previously saved cases appear in a list-box.



Select the case that you want to load by tapping the tag-name in the list-box. Note that the service description of the highlighted tag-name appears below the list-box.

Once you have selected the desired case, tap the OPEN button. You will be returned to the main form of the program and all data will be over-written with the data from the selected case.

You can even beam a heater record to someone else that has a registered version of Gas Fired Heater Calculations ***(Please respect our copyright and do not support software piracy. We are a small developer selling products at a very reasonable price. Distributing the registered version of this software is illegal and could cause our business to fail).***

To beam a record, go to the Open a Saved Case form and select the heater you would like to beam. After selecting, tap the Beam button to send the file. Newer devices with Bluetooth will allow you to select between four different methods of beaming, i.e.,

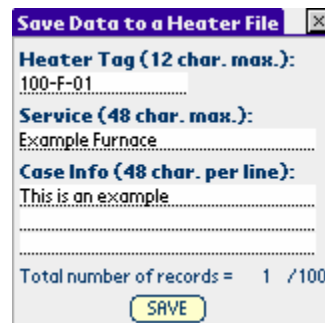
- Beam (IR beaming)
- Bluetooth
- PrintMe
- SMS
- VersaMail

For this version of Gas Fired Heater Calculations only IR and Bluetooth beaming has been tested (and will be supported).

Some devices only support beaming via IR. The program auto-detects if this is the case and will not show the menu mentioned above (i.e., the device will immediately begin to search for a device to beam to).

3. Save

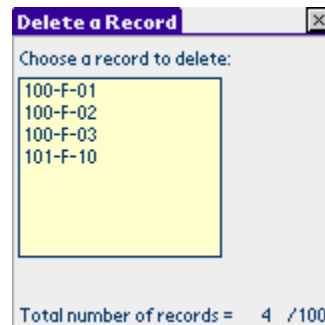
Using the Save Data to a Heater File form you can save up to 100 heater cases.



In order to save your data to a heater file a Heater Tag (tag-name) must be entered. Optional entries include entering a service description and three lines of case information.

4. Delete

Delete any previously saved case using the Delete a Record form.

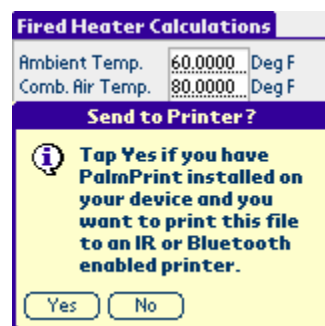


After selecting a record to delete, an alert box will appear asking you to confirm that you want to delete the selected record.

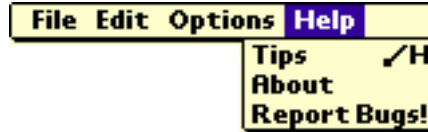
5. Print

If you have PalmPrint™ by Stevens Creek Software installed on your device and a Bluetooth or IR enabled printer, you can print out the results of an active case. Please note that Process Ace Software will not provide support for any third party applications such as PalmPrint™.

After tapping Print, an alert box will appear asking you to confirm that your system has been properly configured for printing. After selecting Yes, your data is formatted and sent to the printer.



Program Help



Tips

Tapping the menu-bar on each form and selecting Tips from the Help drop-down will take you to a help screen providing tips related to using your current form.

Please Note: A list of frequently asked questions (FAQ) for all of our applications can be found on our website:

www.processacesoftware.com

We also offer free support for all licensed users for the life of the product at:

contact@processacesoftware.com

About

Tapping About pops up the following information form:



Tap "OK" to return to the program.

Graffiti® Shortcuts

The following menu shortcuts are available for this product:

- /C – Copy
- /D - Delete
- /F - Save
- /G - Graffiti® Help
- /H - Tips (built-in help files)
- /I - Print
- /K - Keyboard
- /N – New
- /O - Open
- /P - Paste
- /R – Preferences
- /S – Select All
- /U - Undo
- /X – Cut

Using Hacks on your Palm OS® Device

Hacks are applications that modify the functionality of the operating system. All of our applications are fully compatible with unmodified Palm OS®. However, if you are running a hack, you may experience problems. If you do, you must disable the hack before running our application.

Troubleshooting Guide

Problem

My Tungsten T3 crashes with a “Fatal” error when my device powers down with Unit Converter running.

Solution

Verify that you have NSBSystemLib version 2.01 and NSBRuntime version 4.3.0 installed on your device.

I get a “Fatal” error:

- On start-up
or
- When the Splash Screen appears
or
- When I use a menu

These type of errors are due to one of the following:

1. A “hack” (i.e., some third party launcher programs) being installed on your device. These programs modify Palm OS, sometimes with unpredictable results.

Gas Fired Heater Calculations will work properly with unmodified Palm OS. Disable the hack to verify if this is the problem.
2. NSBRuntime, NSBSystemLib or MathLib being installed on a memory card instead of on the handheld itself. These files must be installed **ONLY** on the handheld.

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Yahoo! user-group4