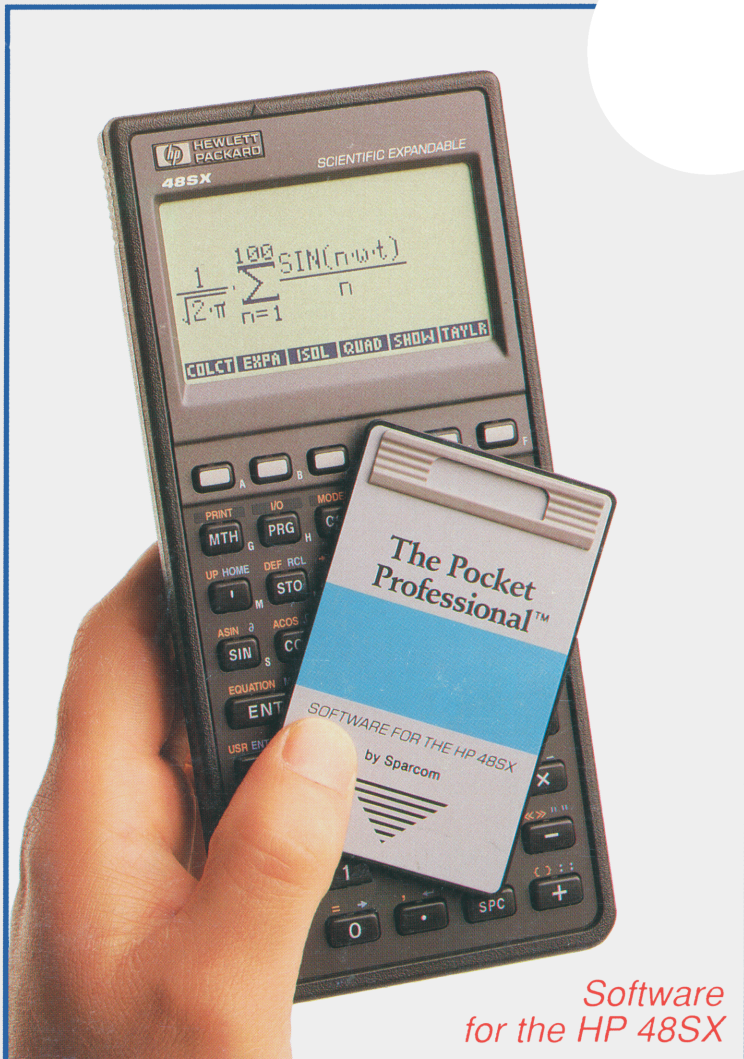


Pocket Professional™

OWNER'S MANUAL



Software
for the HP 48SX

The Pocket Professional™

Mechanical Engineering Reference Pac

Owner's Manual

SPARCOM®

Edition 2 August, 1991

Manual Reorder No. 11063-A Software Reorder No. 10063-1A

Notice

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Mechanical Engineering Reference Pac Changes

The following changes were made to the Mechanical Engineering Reference Pac for version 2.5:

- ✓ Browser: Cursor movement and scrolling speed have been increased.
- ✓ Constant Library: Constants have been updated to conform to latest accepted values.





HP 48GX USERS ONLY: You should install the application card in Port 1 for two reasons:

1. Application cards installed in Port 1 will execute ~ 20% faster than those installed in Port 2.
2. Application cards installed in Port 2 may experience long pauses (~ 5-10 seconds or more) intermittently during operation. This is not a software defect. It is caused by the new memory architecture of the extended HP 48GX Port 2, which is different from the HP 48SX Port 2. Such pauses will not occur if the application card is operated from Port 1 of the HP 48GX or if it is operated from either port of the HP 48SX.





Mechanical Engineering Reference Pac Manual Changes





These changes apply to the Mechanical Engineering Reference Pac Manual, Edition 2, August 1991.

Changes for the HP 48GX



General: To display all libraries on the HP 48GX, press   instead of  .

General: On the HP 48GX, the  key has been replaced by CANCEL.



General: To perform a screen dump on the HP 48GX, press   instead of  .



General: To display an item too wide for the display on the HP 48GX, press   instead of  .

Changes for Version 2.5

Page 1-7: Managing Units: Values in the Constants Library will now display units dependent on whether or not the units key is toggled on or off. Also,  now views an item instead of placing it onto the stack. To place an item onto the stack, press .

Page 1-8: Using the Search Mode: The search mode is now case-insensitive.

Page 1-9: Summary of Functions:  now views an item instead of placing it onto the stack. To place an item onto the stack, press .

Page 3-3: Using Steam Tables: 1st and 2nd pictures should indicate sixth menu key as  instead of .

Page 9-4: Constants Library: 2nd picture should indicate 1.7445299E-40_Btu*h as the value of h instead of 1.74599E-40_Btu*h.

Page 9-5: Standard Prefixes: Picture should indicate prefixes as 1E18, 1E15,

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Chapter 1

Getting Started

In This Chapter

- ☐ Welcome
- ☐ Installing and Removing the Pocket Professional
- ☐ Using the Main Menu
- ☐ Using the Reference Library
- ☐ Summary of Functions

Welcome

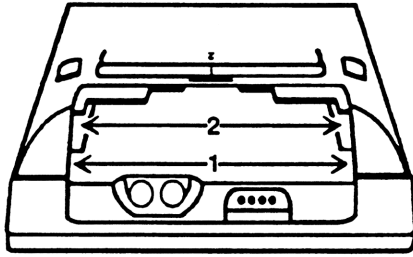
Sparcom's Pocket Professional software is the first of its kind; developed to provide speed, efficiency and portability to students and professionals in the technical fields. The Pocket Professional™ Mechanical Engineering Reference Pac instantly transforms the HP 48SX calculator into an electronic handbook, containing over 100 tables of data commonly used by mechanical engineers. The information is organized into an eight-category menu tree with topics and subtopics listed in an easy-to-use "browser" menu format.

Installing and Removing the Pocket Professional

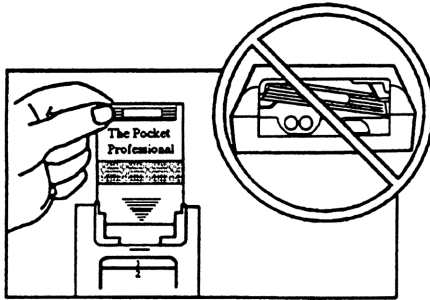
The HP 48SX has two ports for installing plug-in cards. You can install your Mechanical Engineering Reference Pac in either port. Be sure to **turn off the calculator** while installing or removing the card. Otherwise, user memory may be erased.

To Install the Card

1. Turn off the calculator. Do not press **ON** until you have completed the installation procedure.
2. Remove the port cover. Press against the grip lines and push forward. Lift the cover to expose the two plug-in ports.



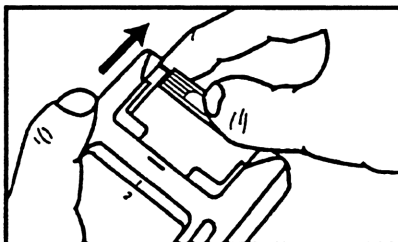
3. Select either empty port for the Pocket Professional card.
4. Position the card just outside the slot. Point the triangular arrow on the card toward the calculator port opening, as shown below.
5. Slide the card firmly into the slot. After you first feel resistance, push the card about 1/4 inch further, until it is fully seated.



6. Replace the port cover.

To Remove the Card

1. Turn the calculator off. Do not press **ON** until you have completed the procedure.
2. Remove the port cover. Press against the card's grip and slide the card out of the port.

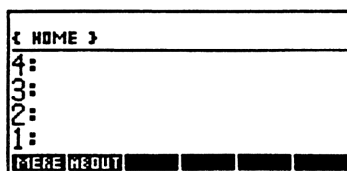


3. Replace the port cover.

Accessing the Reference Pac

After you turn your calculator **ON**, there are three ways to start the Mechanical Engineering Reference Pac.

First Method: Press **⏏** **LIBRARY** to display all libraries available to the HP 48SX. Press the **MERE** “softkey” (the corresponding blank menu key on the top row of the HP 48SX keyboard) to start the Mechanical Engineering Reference Pac.



Pressing the second softkey available at this level, **ABOUT**, displays the revision number of the software. Pressing the **⏏** key exits the revision screen and returns you to the above screen.

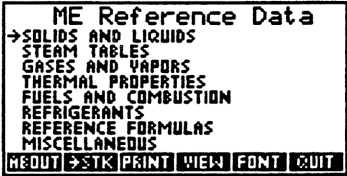
Second Method: Type in the letters MEREF (using alpha entry mode, as described in the *HP 48SX Owner's Manual*) and press **ENTER**.

Third Method: Add the command “MEREF” to the CST (custom) menu (for more information, refer to Chapter 15 of the *HP-48SX Owner's Manual*, “Customizing the Calculator”). After the command has been added, press

ESC, then press **ME** to start the Mechanical Engineering Reference application.

Using the Main Menu

After you start the Mechanical Engineering Reference Pac, the main menu screen appears:



The main menu lists the main categories of the entire mechanical engineering reference database in a “browser” menu format. “Browser” refers to the ability to use the cursor keys (**▲**, **▼**) to move the pointer to the menu item you wish to select and press **ENTER** to call that information to the screen. The row of “softkeys” along the bottom of the screen give you options that relate to the information on any given screen. A summary of the softkeys used throughout the Mechanical Engineering Reference Pac is given at the end of this chapter.







A description of the main categories and softkeys shown above follows:

Solids and Liquids	Mechanical, elastic and thermodynamic data of selected materials
Gases and Vapors	Critical data, saturated temperature and pressure of gases
Thermal Properties	Thermal conductivities and specific heats of selected materials
Fuels and Combustion	Specifications of selected fuels and products of combustion
Refrigerants	Specifications of refrigerants, superconductors and cryogenic properties




Envirnomenta Control	Comparison of eight SO ₂ control systems
Reference Formulas	Formulas for moments of inertia, standard numbers
Miscellaneous	Contains ASCII table, Constants library, common Prefixes and Greek Alphabet

Each category above contains several topics. Many topics contain additional subtopics. The contents of each topic and subtopic are described in detail in Chapters 2 thru 9.



Moving Around the Screen

Use the  and  keys to move the pointing arrow up and down in the menu list. Pressing  moves the pointer to the bottom of the screen, or pages down if the pointer is already there. Pressing  moves the pointer to the top of the screen, or pages up if the pointer is already there. Pressing  moves the pointer to the bottom of the list or  moves to the top of the list.

Viewing Items Too Wide for the Display

If the text of a topic or subtopic is too wide to fit within the display, an ellipsis (...) appears at the end of the line. Pressing  displays the entire entry. Pressing  or  returns the display to the beginning of the line.

Changing the Font Size

Pressing  displays the information in a larger font. The font size stays large until you press  again:

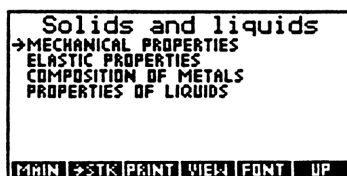
```

▼ ME Reference Data
→Solids and liquids
  Steam tables
  Gases and vapors
  Thermal properties
  Fuels and combustion
  Refrigerants
REOUT ←→STX PRINT VIEW FONT QUIT

```

Example: Using the Reference Pac

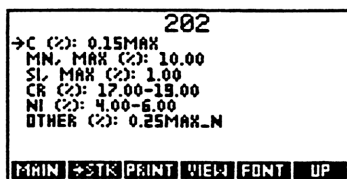
Suppose you need to know the carbon content of 202 stainless steel. At the main menu, move the pointer to SOLIDS AND LIQUIDS and press **ENTER**. The list of topics filed under the solids and liquids category appears:



Move the pointer to COMPOSITION OF METALS and press **ENTER** to view the menu screen. Position the pointer at STAINLESS STEEL COMP (composition) and press **ENTER** to reach the next level. Select AUSTENITIC STEELS by pressing **ENTER**. The austenitic steels screen lists 22 austenitic steels by number:



Use the **▼** key to move the pointer to 202 and again press **ENTER**. The screen shows the composition of 202 stainless steel.



To put the manganese percentage figure on the calculator stack, position the pointer at Mn and press **→STK**. Select ONE. To exit the Mechanical Engineering Reference Pac and return to the stack display, press **ATN**. The following screen displays:

```

{ HOME MERE }
4:
3:
2:
1:      Mn, max (%): 10
MERE MOUT MERE MERE MERE MERE

```

Use the “DTAG” command of the HP 48SX to remove the “Mn, max(%)” label. You may proceed with your calculation or press **MERE** to re-enter the Mechanical Engineering Reference Pac.

Managing Units

You can choose whether you want the Mechanical Engineering Reference Pac to display units on the screen or not by pressing the **UNITS** softkey. The **UNITS** softkey toggles between the unit and non-unit modes. A square in the units softkey box (**UNIT**) indicates that units will be displayed with all entries. When units are displayed, pressing **ENTER** places the entry onto the stack **with** units. When units are not displayed on the screen, units are not included when **ENTER** is pressed. (Exception: Values in the Constant’s library will show units regardless of whether or not the units key is toggled on or off.) The Pocket Professional uses English units as the predominant set of units in this reference pac. Occasionally however, a table will be listed in SI units. Be aware that using units usually increases the processing time for display.

Using the Search Mode

In some cases, data lists can be long and it is tedious to search item by item using the cursor keys. You may press **↵** **▼** to jump to the bottom of the screen or **↵** **▼** to jump to the bottom of the list. You may also search the list for a particular entry, using the search mode, by pressing **⌘**. The following screen is displayed:

```

PRG
{ HOME }
Search for:
⌘SKIP ⌘SKIP ⌘DEL DEL ⌘INS

```

The calculator is now in alpha entry mode, as indicated by the alpha (α) annunciator at the very top of the screen. Alpha entry mode overrides the function of the standard keyboard. In alpha entry mode, each key that has a white capital letter printed to its lower right loses its original function and types that letter onto the command line when pressed. (See the *HP 48SX Owner's Manual*, "The Keyboard and Display," for a complete description of how the alpha mode operates). Type the first letter or letters of the name you want to search for, to create the *search string*, and press **ENTER**. The search function is case-sensitive.

The softkeys at the bottom of the screen (**SKIP**, **DEL**, **INS**) are command line editing keys which allow you to edit the search string. Their function is summarized in the next section.

Using the Print Function

You can send data from the Mechanical Engineering Reference Pac directly to an infrared (IR) printer compatible with the HP 48SX via the infrared port. Follow the instructions in the printer manual regarding operating and positioning the printer relative to the HP 48SX. After the printer is ready, you have the choice of sending the entire record of data or one field of that record to the printer.

When you press the **PRINT** softkey, the next screen asks you to select *ALL* or *ONE*. If you press the **ALL** softkey, the entire record prints out, regardless of which data items are currently shown and/or selected by the pointer on the screen. Pressing **ONE** prints only the data item selected by the pointer.

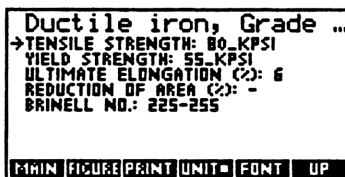
Pressing ENTER at the Data Level

You can look at the whole title of a data entry and the value by pressing **ENTER** at the data level. An example of pressing **ENTER** at the data level is shown below:

```
Aluminum,  
cast-hammered  
  
Specific gravity  
2.55-2.80  
  
PRESS [STO] TO SAVE TO STACK ...  
PRESS [ENTER] TO RETURN TO LIST ...
```














Blank Entries

When a menu item displays a minus sign (-) after its name, it means that the item is being used as a placeholder in the database structure. The minus sign is not an indication of minus or zero as a value for that item. An example of one of these “blank” entries is shown below:



Summary of Functions

- ALL** Prints an entire record in list form to an IR printer.
- ONE** Prints only the menu item selected by the pointer to an IR printer.
- PICT** This function appears in sections that contain a graphical picture.
- FONT** Toggles the display font between small and large size.
- MAIN** Moves to the main menu of the Mechanical Engineering Reference Pac.
- PRINT** Allows you to print a data field or the entire record of data to an IR printer.
- QUIT** Exits the Mechanical Engineering Reference Pac.
- UNITS** Toggles between unit and non-unit modes. The Pocket Professional uses English and Systeme Internationale d'Unites (SI) units.
- UP** Moves up one level in the menus.
- ENTER** Moves to the category, topic, or sub-topic pointed to by the arrow or puts the entry pointed to by the arrow on the calculator stack.

-  Exits the Mechanical Engineering Reference Pac.
-  Initiates a case sensitive search for a specific entry.
-  Moves to the bottom of the screen or pages down.
-  Moves to the top of the screen or pages up.
-  Moves the pointer to the top of the list.
-  Moves the pointer to the bottom of the list.
-  Displays remaining data (a screen width at a time) on the screen for entries too wide for the screen. If the topic is too long to fit within the display, an ellipsis (...) is displayed on the right of the screen.
-  Moves the cursor to the beginning of the current word.
-  Moves the cursor to the beginning of the next word.
-  Deletes all the characters in the current word to the left of the cursor.
-  Deletes all the characters from the cursor's current position to the first character of the next word.
-  Toggles between insert and typeover modes.

Chapter 2

Solids and Liquids

In This Chapter

The solids and liquids category includes reference data on the following mechanical engineering topics:

- Mechanical Properties
- Elastic Properties
- Composition of Metals
- Properties of Liquids

Because the size of the calculator screen is limited, the names of constants and properties are usually abbreviated throughout the reference pac. This chapter includes “translations” of these abbreviations where appropriate.

Mechanical Properties

This topic lists the following mechanical properties for a wide variety of solids and liquids.

- Specific Gravity of Materials
- Brinell Hardness for Steels
- Mechanical Props at Room Temp
- Sound Velocity Values
- Superalloys
- Various Metals and Properties
- Static Friction Coefficients

Specific Gravity of Materials

This subtopic lists specific gravities (in range form) and average densities for various metals, timber (air dry), various liquids, minerals and bituminous substances. Specific gravity is defined as the ratio of the density of the given material divided by the density of the reference material. The reference material for the data included here is water at 4 °C. The densities are given in both English and SI units as an average value.

Brinell Hardness for Steels versus Temperature

This subtopic lists Brinell hardness values for the following steels:

- .35 carbon
- .8 carbon
- 1.2 carbon
- AISI 2340
- AISI 1340
- AISI 5140
- AISI 4140
- AISI 6145
- 0.70C 18W 4Cr 1V

The Brinell hardness number of a material is determined from the diameter of indentation of a spherical indenter. Brinell hardness is given for the following temperatures:

- as quenched
- 200 °F (95 °C)
- 400 °F (205 °C)
- 600 °F (315 °C)
- 800 °F (425 °C)
- 1000 °F (540 °C)
- 1200 °F (650 °C)

Mechanical Properties at Room Temperature

Five properties for various classifications of iron, SAE steel, aluminum, copper, and miscellaneous metals at room temperature are listed under this subtopic: Tensile strength, yield strength, ultimate elongation, reduction of area and Brinell hardness number.

This subtopic also covers four properties of ASTM steels: Thickness range, yield point, tensile strength and elongation.

Sound Velocity Values

This subtopic lists values for sound velocity, density, and density * velocity for 12 materials:

- Aluminum
- Brass
- Copper
- Iron, soft steel
- Lead
- Brick
- Cork
- Wood
- Water
- Air, dry, CO₂ free, 32 °F
- Hydrogen

Water vapor, 212 °F

Superalloys

This subtopic lists the following properties for seven superalloys:

Max temp load (F)	Maximum temperature under load °F
Max temp load (C)	Maximum temperature under load °C
Coeff thermal exp.	Coefficient of thermal expansion
Specific gravity	
Str rupture 1kh, 1200°F	Stress to rupture in 1,000 hours, at 1200 °F, ksi
Str rupture 1kh, 1500°F	
Str rupture 1kh, 1800°F	
Yld stgth .2%, 68°F	Yield strength, 0.2% offset at 68 °F
Yld stgth .2%, 1200°F	
Yld stgth .2%, 1500°F	
Yld stgth .2%, 1800°F	Tensile strength at 68 °F
Tensile stgth 68°F	
Tensile stgth 1200°F	
Tensile stgth 1500°F	
Tensile stgth 1800°F	

Various Metals and Properties

Properties for 21 different metals, such as aluminum, nickel, steel and titanium, are covered in this subtopic. The properties include:

- Density
- Coefficient of thermal expansion
- Thermal conductivity
- Specific heat
- Approximate melting temperature
- Modulus of elasticity
- Poisson's ratio
- Yield stress
- Ultimate stress
- Elongation %

Static Friction Coefficients

This subtopic lists the coefficients of static friction at room temperature for 11 smooth surfaces that are clean, covered with paraffin oil, or covered with paraffin oil plus 1% lauric acid. Solid reactivity values are also given.

- Nickel
- Chromium
- Platinum
- Silver
- Glass
- Copper
- Cadmium
- Zinc

Magnesium
Iron
Aluminum

Elastic Properties

This topic includes elastic constants of metals, fatigue limits and bulk modulus of elasticity.

Elastic Constants of Metals

The Mechanical Engineering Reference Pac lists the following constants for 20 different metals:

E	Young's modulus
G	Shearing modulus
K	Bulk modulus
μ	Poisson's ratio

Fatigue Limits for Reversed Bending

Tensile strength and fatigue limit are given for 18 different metals under this subtopic. The values are in range form.

Bulk Modulus of Elasticity for Various Liquids

The bulk modulus of elasticity for an isothermal (E_t) and isentropic (E_s) change of state are given. Nine different liquids are listed:

Ethyl alcohol
Benzene
Carbon tetrachloride
Glycerin
Kerosene (sp. gr. 0.81)
Mercury
Machine oil (sp. gr. 0.907)
Fresh water
Salt water

Composition of Metals

This topic lists the composition of several classifications of metals. Trace elements may not be listed. The metals covered under this topic include:

Stainless steel composition

AISI steel composition
 Copper base alloys*
 Nickel alloy composition
 Magnesium alloy composition
 Titanium alloy composition
 Brazing alloys*

*The data listed for copper base alloys and brazing alloys include other properties in addition to composition.

Stainless Steel Composition

This subtopic covers a range of austenitic, martensitic, and ferritic steels. The properties given for each classification of these steels include:

C (%)	Carbon (%)
Mn, max (%)	Manganese, maximum (%)
Si, max (%)	Silicon, maximum (%)
Cr (%)	Chromium (%)
Ni (%)	Nickel (%)
Other (%)*	

*Other (%) refers to miscellaneous elements which are included, such as nitrogen (N), selenium (Se), molybdenum (Mo), cobalt (Cb), and tantalum (Ta).

AISI Steel Composition

This subtopic lists the chemical limits of various 10XX, 11XX, 12XX and 15XX steels as specified by AISI. The properties given for each listed steel include:

C (%)	Carbon (%)
Mn (%)	Manganese (%)
P (%)	Phosphorus (%)
S (%)	Sulfur (%)

Copper Base Alloys

The Mechanical Engineering Reference Pac lists the following data for 11 copper base alloys:

Copper Alloy No.	
Nominal Comp (%) Cu	
Nominal Comp (%) Other*	
Tensile strength	
Yield strength	
Elongation (2 in.) %***	
Casting types**	
Conductivity (%)	IACS

Solids and Liquids

Machinability rating

Weldability

*This data listing gives the percent composition of elements in copper base alloys. For example, the listing for leaded red brass is 5Sn_5Pb_5Zn; meaning that it is composed of 5% tin, 5% lead and 5% zinc.

**There are seven casting types, abbreviated in the reference pac as follows:

C	centrifugal
T	continuous
D	die
I	investment
M	permanent mold
P	plaster
S	sand

Standard casting types are given for each copper base alloy. For example, the casting types listed for tin bronze (Cu 905) are C_T_I_S; meaning that centrifugal, continuous, investment, and sand casting methods are used for tin bronze (Cu 905).

***The 2 inches refers to the gage length of the test specimen.

Nickel Alloy Composition

This subtopic lists the nominal composition of eleven different nickel alloys. The possible chemical constituents are listed below:

Ni	Nickel
Cu	Copper
Fe	Iron
Cr	Chromium
Mo	Molybdenum
Al	Aluminum
Si	Silicon
Mn	Manganese
W	Tungsten
C	Carbon
S	Sulfur
Nb	Niobium
Ti	Titanium

Magnesium Alloy Composition

Magnesium alloys can contain aluminum (Al), zinc (Zn), manganese (Mn) and zirconium (Zr). This section lists magnesium alloys under three subtopics: 1) Sand casting types, 2) Permanent mold casting types, and 3) Die casting types. Each subtopic lists the percent nominal composition of these metals, plus the following properties, for 41 magnesium alloys:

Tensile strength
 Tensile yield strength
 Elongation (2 in) %
 Shear strength
 Hardness BHN (Brinell hardness)
 Elec conduct IACS % (electrical conductivity IACS %)

Each of the 41 magnesium alloys on the menu list includes a code after its name that refers to the treatment type of the alloy. Below are the definitions for these codes:

(-F)	As cast
(-T4)	Artificially Aged
(-T5)	Solution heat-treated
(-T6)	Solution heat-treated

Note: RE in the “NOMINAL COMP. OTHER” listing means a rare earth mixture has been added to the alloy.

Titanium Alloy Composition

This subtopic lists the percent composition of the following elements for 15 titanium alloys:

C	Carbon
N	Nitrogen
O	Oxygen
Al	Aluminum
Fe	Iron
Mn	Manganese
Mo	Molybdenum
V	Vanadium
Other	Other*

*Other can include Sn (tin) and Cr (chromium).

Several titanium alloys in the menu list are accompanied by an additional code, in parentheses, that specifies the phase of the metal and whether it is weldable: α = all alpha phase, β = all beta phase, $\alpha\beta$ = both α and β phase, and W = weldable.

Brazing Alloys

This subtopic lists the percent nominal composition of metals, plus the melting temperature, for 14 brazing alloys. The data for the nominal composition is listed as (in the case of BAg-1): 45Ag_ 15Cu_ 16Zn_ 24Cd; meaning that it is composed of 45% silver, 15% copper, 16% zinc and 24% cadmium.

Properties of Liquids

The first three subtopics of Properties of Liquids (surface tension, density and viscosity at one ATM) list values for the following ten liquids.

Alcohol-ethyl
Benzene
Carbon tetrachloride
Gasoline (sp. gr. 0.68)
Glycerin
Kerosene (sp. gr. 0.81)
Mercury
Machine oil
Water-fresh
Water-salt

The phase transition data for various liquids and physical properties of water are also included as subtopics.

Surface Tension (δ)

The surface tensions of 10 liquids at one atmosphere and at 68 °F, in vapor, in air and in water, are listed under this subtopic.

Density (ρ)

This subtopic lists the density in slugs per cubic foot of 10 liquids at the following temperatures:

32 °F
68 °F
104 °F
140 °F
176 °F
212 °F

Viscosity (μ) at One ATM

This subtopic gives values of dynamic viscosity (μ) for liquids at atmospheric pressure. Data is listed for the following temperatures:

32 °F
68 °F
104 °F
140 °F
176 °F
212 °F

Fluids - Phase Transition Data

This subtopic lists the following data for 82 fluids:

Formula	Chemical formula
Mol wt	Molecular weight
T _m	Melting temperature
$\Delta h(\text{fus})$	Enthalpy of fusion
T _b	Normal boiling point temperature
$\Delta h(\text{vap})$	Enthalpy of vaporization
P _c	Critical pressure
V _c	Critical volume
T _c	Critical temperature
Z _c	Critical compressibility factor

HINT: Finding a specific fluid in the listing above can be tedious using the up arrow or down arrow keys. A quicker way to find that fluid is by using the search feature. Pressing the alpha key allow you to enter a string of characters, then after pressing ENTER key the calculator will find the first match.

Water - Physical Properties

This subtopic lists density, dynamic viscosity and kinematic viscosity for water from temperature range of 0 to 100 degrees C.

Notes:

Chapter 3

Steam Tables

In This Chapter

This chapter describes the STEAM TABLES feature of this product. The steam tables are for a water-air system.

Steam Tables

Steam Tables is a collection of programs organized as a powerful computational engine designed to calculate thermodynamic properties of steam in a user-friendly environment. Calculations of thermodynamic properties are covered for saturated and superheated steam.



Steam properties are a complex function of temperature, pressure, volume, critical temperature, critical pressure, and molecular weight. Best fit routines have been developed and agreed upon through the International Formulation Committee. In cases where it is impossible to get good curve fits, regions of interest have been divided into two or three ranges with separate equation sets. The following tables list all steam properties available in the software.

Saturated Steam Properties

Variable	Description	Units
T(s)(SI)	saturation temperature	1_K
P(s)(SI)	saturation pressure	1_MPa
V(f)(SI)	specific volume - liquid	1_m^3/kg
V(g)(SI)	specific volume - vapor	1_m^3/kg
H(f)(SI)	enthalpy - liquid	1_KJ/kg

Steam Tables

H(fg)(SI)	latent heat of vaporization	1_KJ/kg
H(g)(SI)	enthalpy - vapor	1_KJ/kg
S(f)(SI)	entropy - liquid	1_KJ/(kg·K)
S(fg)(SI)	S (g) - S (f)	1_KJ/(kg·K)
S(g)(SI)	entropy - vapor	1_KJ/(kg·K)
U(f)(SI)	internal energy - liquid	1_kJ/(kg·K)
U(g)(SI)	internal energy - vapor	1_kJ/(kg·K)
T(s)	saturation temperature	1_F
P(s)	saturation pressure	1_psi
V(f)	specific volume - liquid	1_ft ^ 3/lb
V(g)	specific volume - vapor	1_ft ^ 3/lb
H(f)	enthalpy - liquid	1_Btu/lb
H(fg)	latent heat of vaporization	1_Btu/lb
H(g)	enthalpy - vapor	1_Btu/lb
S(f)	entropy - liquid	1_Btu/(lb·R)
S(fg)	S (g) - S (f)	1_Btu/(lb·R)
S(g)	entropy - vapor	1_Btu/(lb·R)
U(f)	internal energy - liquid	1_Btu/(lb·R)
U(g)	internal energy - vapor	1_Btu/(lb·R)

Superheated Steam Properties

Variable	Description	Units
Temp(SI)	given temperature	1_K
Sat Press(SI)	given pressure	1_MPa
Sat Temp(SI)	corresponding temperature	1_K
Specific Vol(SI)	Specificsvlume	1_m ^ 3/kg
Enthalpy(SI)	enthalpy	1_KJ/kg
Entropy(SI)	entropy	1_KJ/(kg·K)
Temp	given temperature	1_F
Sat Press	given pressure	1_psi
Sat Temp	corresponding temperature	1_F
Specific Vol	specific volume	1_ft ^ 3/lb
Enthalpy	enthalpy	1_Btu/lb
Entropy	entropy	1_Btu/(lb·R)

Using Steam Tables

Once you have selected STEAM TABLES at the main menu, the first screen displays two menu items: temperature and pressure. To compute *saturated* steam properties, you can enter a value for either temperature or pressure. Properties of *superheated* steam require you to enter values for both temperature and pressure.

```

Steam Tables
→TEMP (C,K): 0
  PRESSURE(MPA): 0

T→  P→  SUPER→STK  FONT  QUIT

```

Example: Suppose you want to calculate the properties of saturated steam at 30 °C. First, move the pointer to Temp. and press **ENTER**. At the cursor type in 30. To complete the entry, add the units symbol by pressing the appropriate softkey, in this case **°C** and press **ENTER**. The following screen displays:

```

Steam Tables
TEMP (C,K): '30_°C'
→PRESSURE(MPA): 0

T→  P→  SUPER→STK  FONT  QUIT

```

To view the calculated thermodynamic properties, press **T→**:

```


→Saturated Steam Prop...
→T(S)(SI): '303.15_K'
P(S)(SI): '4.25051499157E-3_MPA'
V(F)(SI): '1.00451814792E-3_M^3/L...'
V(G)(SI): '32.8535913116_M^3/KG'
H(F)(SI): '125.055392708_KJ/KG'
H(FG)(SI): '2430.52791787_KJ/KG'
H(G)(SI): '2556.56639576_KJ/KG'
S(F)(SI): '434148039938_KJ/(KGX1000)'

PRINT→STK  FONT  UP

```

The steam table engine reports all its calculations in both SI and ENGL units. When entering values you may use any compatible units supported by the HP 48SX. The ENGL units are presented after the SI units, to view them simply use the cursor keys to go to the bottom of the list.

```
^Saturated Steam Prop...
H(F): '53.764141315_BTU/LB'
H(G): '1044.93891568_BTU/LB'
H(G): '1099.12568175_BTU/LB'
S(F): '1.03694476435_BTU/(LB*°R)'
S(G): '1.31541288937_BTU/(LB*°R)'
S(G): '2.0191073658_BTU/(LB*°R)'
UCF: '53.7623056702_BTU/LB'
→UCG: '1039.08927488_BTU/LB'
PRINT EXIT FONT UP
```

The saturated steam properties can also be computed by allowing a value for pressure and pressing the sofkey . The results from this computation are similar to those reported in the screen above.

Ranges of Temperature and Pressure

The computed results are valid only for the following finite ranges of temperature and pressure:

Saturated	Superheated
Temperature: 273.16 - 647.3 K	> Saturated temperature
Pressure: 0.006113 - 22.08 MPa	Pressure: 0.006113 - 22.08 MPa

Chapter 4

Gases and Vapors

In This Chapter

This category includes reference data for five topics relating to the behavior of gases and vapors:

- Air - Enthalpy and Psi Function
- Critical Data for Various Gases
- Viscosity (μ) at One Atmosphere
- Saturation Temperature
- Saturated Gas Properties
- Air - Physical Properties at Atmospheric Pressure

Because the size of the calculator screen is limited, the names of constants and properties are usually abbreviated throughout the reference pac. This chapter includes “translations” of these abbreviations where appropriate.

Air - Enthalpy and Psi Functions

This topic lists values of the enthalpy (h) and psi function for ideal-gas air at 10 K increments from 200 to 2200 K.

Critical Data for Various Gases

This topic lists four properties for 37 gases:

- Boiling Temperature
- Critical Temperature
- Critical Pressure
- Critical Volume

Viscosity (μ) at One Atmosphere

The viscosity (μ) for nine different gases at the temperatures listed below is given in this topic.

32 °F
68 °F
140 °F
212 °F
392 °F
752 °F
1112 °F
1472 °F
1832 °F

Saturation Temperature

This topic lists the saturation temperature in degrees Kelvin of 13 substances under pressure, ranging from .010 to 100 bar. The substances are:

H ₂ (n)	Hydrogen
HCl	Hydrochloric acid
H ₂ S	Hydrogen sulfide
Hg	Mercury
CH ₄	Methane
CH ₃ OH	Methanol
CH ₃ Cl	Methyl chloride
Napthalene	Napthalene
N ₂	Nitrogen
C ₈ H ₁₈	Octane
O ₂	Oxygen
C ₅ H ₁₂	Pentane
K	Potassium

Saturated Gas Properties

Properties for seven gases are included under this topic.

Ammonia
Carbon dioxide
Ethane (R170)
Hydrogen (n)
Methane
Refrigerant 11

For each gas named above the following properties are listed over a range of temperatures in degrees Kelvin:

P	Pressure
vf	Specific volume (saturated liquid)
vg	Specific volume (saturated vapor)
hf	Specific enthalpy (saturated liquid)
hg	Specific enthalpy (saturated vapor)
sf	Specific entropy (saturated liquid)

sg	Specific entropy (saturated vapor)
cpf	Specific heat at constant pressure (saturated liquid)
cpg	Specific heat at constant pressure (saturated vapor) (for Hydrogen only)

The notations (tp) or (cp) after a temperature in the list are abbreviations for triple point and critical point.

Air - Physical Properties at Atmospheric Pressure

This section lists density, dynamic viscosity, and kinematics viscosity for air at atmospheric pressure in temperature range of -50 to 300 degrees C.

Notes:

Chapter 5

Thermal Properties

In This Chapter

This section covers the Thermal Conductivity of metals, liquids, gases and other specified materials; and the Specific Heat of liquids and gases.

Because the size of the calculator screen is limited, the names of constants and properties are usually abbreviated throughout the reference pac. This chapter includes “translations” of these abbreviations where appropriate.

Thermal Conductivity

This topic lists thermal conductivity values for the following substances:

- Metals
- Ni-Cr alloys by ANSI number
- Molten metals
- Liquids
- Gases
- Low temperature materials
- Insulating materials

Metals

The thermal conductivity of metals at a specific temperature is calculated by using the formula: $k_t = k_{t_0} - a \cdot (t - t_0)$. This subtopic lists the temperature range and values of k_{t_0} and a for 45 metals. Below is a list of the variables in this formula and their descriptions:

Variable	Description
k_t	Thermal conductivity at temperature t
k_{t_0}	Reference thermal conductivity at temperature t_0
a	Correction multiplier
t	Temperature
t_0	Reference temperature

The reference temperature is the *low* temperature in the range given. For example, platinum has a listed temperature range of 70 to 800°F, so $t_0 = 70$.

Nickel-Chromium Alloys with Iron by ANSI Number

Using the formula given above for metals, this subtopic lists the temperature range and values for (k_{to}) and (α) for 25 nickel-chromium alloys.

Molten Metals

Eight molten metals are listed in this subtopic, each at three different temperatures. The properties given for each entry are:

k	Thermal conductivity
ρ	Density
c_p	Specific heat at constant pressure
μ	Viscosity
Melting Temp	Melting temperature

Liquids

This subtopic lists temperature and thermal conductivity for 19 liquids.

Gases

This subtopic lists temperature and thermal conductivity for 20 gases.

Low Temperature Materials

This subtopic lists thermal conductivities (k) and bulk densities of the following materials for refrigeration and extreme low temperatures:

- Corkboard at 100 °F, -100 °F and -300 °F
- Fiberglass with asphalt coating (board) at 100 °F, -100 °F and -300 °F
- Cellular glass at 100 °F, -100 °F and -300 °F
- Rockcork at 100 °F, -100 °F and -300 °F
- Santocel at 100 °F, 0 °F and -100 °F
- Vegetable fiberboard, asphalt coating, at 100 °F, -100 °F and -300 °F
- Polystyrene foams
- Polyurethane at -100 °F

Insulating Materials

This subtopic gives thermal conductivities of insulating materials for various high temperatures. The bulk density, maximum temperature and thermal conductivity at various temperatures are included for 15 substances, such as asbestos paper, fiberglass block and rock wool.

Specific Heat

This topic covers specific heat at constant pressure (c_p) and specific heat ratio for atmospheric pressure (c_p/c_v), in addition to heat of fusion and mean specific heats, of common substances used in mechanical engineering.

Cp of Liquids and Gases

This subtopic lists the specific heat at constant pressure of 24 substances $\text{kJ}/(\text{kg} \cdot \text{K})$ over a range of temperatures from 200 K to 500 K.

Cp/Cv of Liquids and Gases at 1 Atmosphere

This subtopic lists the specific heat ratio for atmospheric pressure (c_p/c_v), at constant pressure of 25 liquids and gases at 1 Atm over a range of temperatures from 200 K to 500 K.

Heat of Fusion

The heat of fusion in Btu per pound is given for 35 metals, liquids and solids.

Mean Specific Heats, Solids

Mean specific heats of various solids are given in $\text{Btu}/(\text{lb} \cdot ^\circ\text{F})$ for 64 materials.

Thermal Properties

Notes:

Chapter 6

Fuels and Combustion

In This Chapter

This section covers mechanical engineering reference data for 13 topics:

- Environmental Control
- ASTM Classification of Coals
- Byproduct Fuels
- Heat Values of Petroleum Oils
- Gasoline Specifications ASTM D439
- Aviation Gasoline Specifications Mil-G-5572E
- Diesel Fuel Specifications
- Liquefied Petroleum Gas Specifications
- Flammability Limits in Air
- Comparative Fuel Specifications
- Heats of Combustion
- Products of Combustion
- Flame Temperature

Because the size of the calculator screen is limited, the names of constants and properties are usually abbreviated throughout the reference pac. This chapter includes “translations” of these abbreviations where appropriate.

Environmental Control

This topic presents a comparison of eight different SO₂ control systems:

- Sulfur dioxide emissions limitations (SDEL)
- Low-sulfur fuel (coal or oil)
- Dry fluidized bed combustors
- Wet lime/limestone scrubbing
- MgO scrubbing
- Catalytic oxidation (add-on)
- Na₂SO₃ scrubbing
- Double alkali

The properties listed for each control system include:

- Requirements
- Recoverable material
- Extra cost of power generation, %
- SO₂ efficiency, %

Extra plant investment %

ASTM Classification of Coals

Fixed-carbon limits, volatile-matter limits, calorific-value limits and agglomerating characters of the following coals are listed in this subtopic:

Meta-anthracite
Anthracite
Semianthracite
Low-volatile bituminous
Medium-volatile bituminous
High-volatile A bituminous
High-volatile B bituminous
High-volatile C1 bituminous
High-volatile C2 bituminous (agglomerating)
Subbituminous A
Subbituminous B
Subbituminous C
Lignite A
Lignite B

Description of Limits:

Fixed C Limits % \geq Fixed-carbon (dry, mineral-matter-free basis)
Fixed C Limits % $<$ Fixed-carbon (dry, mineral-matter-free basis)
Volatile Limits % $>$ Volatile-matter (dry, mineral-matter-free basis)
Volatile Limits % \leq Volatile-matter (dry, mineral-matter-free basis)
Calorific Limits % \geq Calorific value limits
(moist, mineral-matter-free basis)
Calorific Limits % $<$ Calorific value limits
(moist, mineral-matter-free basis)

Byproduct Fuels

This subtopic lists heat value (dry), percent moisture and percent ash (moisture-free) for the following alternate fuels:

Black liquor
Cattle manure
Coffee grounds
Corncobs
Cottonseed cake
Municipal refuse
Pine bark
Rice straw/hulls
Scrap tires
Wheat straw

Heat Values of Petroleum Oils

This topic lists the following properties for eight petroleum oils:

Density	Density
Qv (per lb)	High heat value at constant volume per pound
Qv (per gal)	High heat value at constant volume per gallon
Qp (per lb)	Low heat value at constant pressure per pound
Qp (per gal)	Low heat value at constant pressure per gallon

Gasoline Specifications (ASTM D439)

This topic lists the following specifications for five volatility classes (A, B, C, D,E) of gasoline, ASTM D439:

- Distillation temperature, °F, 10% maximum evaporation
- Distillation temperature, °F, 40% minimum evaporation
- Distillation temperature, °F, 50% maximum evaporation
- Distillation temperature, °F, 90% maximum evaporation
- Distillation temperature, °F, Endpoint
- Distillation temperature, °F, Residue %, maximum
- Test temperature for vapor/liquid = 20, °F, maximum
- Vapor pressure, maximum
- Lead (Pb) level, unleaded maximum
- Lead (Pb) level, regular maximum
- Corrosion, maximum
- Existent gum, maximum
- Sulfur, weight %, maximum

Aviation Gasoline Specifications Mil-G-5572E

This topic lists the following specifications for all grades of Mil-G-5572E gasoline:

- Distillation temperature, °F, 10% minimum evaporation
- Distillation temperature, °F, 40% maximum evaporation
- Distillation temperature, °F, 50% minimum evaporation
- Distillation temperature, °F, 90% minimum evaporation
- End point, temperature, maximum
- Sum of 10% and 50% evaporated temperature, minimum
- Residue, volume, % maximum
- Distillation loss, volume, maximum %
- Existent gum, maximum
- Potential gum, 16 hours aging
- Precipitate, maximum
- Sulfur, maximum, weight %
- Minimum Reid vapor pressure at 100 °F

Maximum Reid vapor pressure at 100 °F
Freezing point, maximum
Copper corrosion, maximum
Interface rating, maximum
Water reaction, volume change, maximum
Heating value, net heat of combustion, minimum
Aniline-gravity product, minimum

Diesel Fuel Specifications

This topic lists specifications for three ASTM grades of diesel fuel and one U.S. military specified diesel fuel:

ASTM diesel fuel 1-D Limit
ASTM diesel fuel 2-D Limit
ASTM diesel fuel 4-D Limit
MIL-F-16884G

The specifications include:

Flash point
Water and sediment, volume %, maximum
Kinematic viscosity at 100 °F, minimum
Kinematic viscosity at 100 °F, maximum
Carbon residue on 10% residuum, % maximum
Ash, weight %, maximum
Sulfur, weight %, maximum
Ignition quality, centane number, minimum
Minimum distillation temperature, 90 % evaporation
Maximum distillation temperature, 90 % evaporation

Liquefied Petroleum Gas Specifications

This topic lists specifications for propane, butane and propane-butane mixtures. The specifications include:

Vapor pressure at 100 °F, maximum, psi
Volatile residue, butane and heavier, %, maximum
Volatile residue, pentane and heavier, %, maximum
Residue on evaporation
Oil stain observation
Corrosion, copper strip, maximum
Sulfur, maximum
Free water content

Flammability Limits in Air

This topic lists the lower and upper limits of flammability of 24 gasses in air. To propagate combustion, the following gases must be between the limits listed for air mixtures. The flammable limits are given in percent by volume.

Comparison of Fuels

A comparison of conventional petroleum, tar sand bitumen, and synthetic crude oil from bitumen is given in this subtopic. The following properties are covered:

API gravity	API gravity
μ (cSt) at 100 °F	Viscosity at 100 °F
μ (cSt) at 210°F	Viscosity at 210 °F
Carbon, wt%	Carbon, weight %
H ₂ , wt%	Hydrogen %
Nickel, ppm	Nickel, parts per million
Sulfur, wt%	Sulfur, weight %
N ₂	Nitrogen
Vanadium, ppm	Vanadium, parts per million
Ash, wt%	Ash, weight %
Carbon residue, wt%	Carbon residue, weight %
Pentane insolubles, wt%	Pentane insolubles, wt%

Heats of Combustion

This topic lists the following data for 21 gases, liquids and solids:

Chemical symbol	Chemical symbol
Q _v (Btu/lb)	High heat value at constant volume per lb
Q _v (Btu/ft ³)	High heat value at constant volume per ft ³
Q _p (Btu/lb)	Low heat value at constant pressure per lb
Q _p (Btu/ft ³)	Low heat value at constant pressure per ft ³

Products of Combustion

This topic lists the following data for 28 gaseous and liquid fuels:

Chemical formula
Molecular weight
Specific weight at STP
Volume ratio air to fuel

CO₂ from 1ft³ fuel
H₂O from 1ft³ fuel
N₂ from 1ft³ fuel
Weight ratio air to fuel
CO₂ from 1lb fuel
H₂O from 1lb fuel
N₂ from 1lb fuel

Flame Temperature

Flame temperatures for fuels mixed with a variable amount of theoretical air (80%, 90%, 100%, 120% and 140%) are listed in this topic for the following gaseous fuels:

Hydrogen
Carbon monoxide
Methane
Carbureted water gas
Coal gas
Natural gas
Producer gas
Blast-furnace gas

Chapter 7

Refrigerants

In This Chapter

This topic covers selected refrigerants and gases in low-temperature applications, transition temperatures and common cryogenic properties.

Because the size of the calculator screen is limited, the names of constants and properties are usually abbreviated throughout the reference pac. This chapter includes “translations” of these abbreviations where appropriate.

Selected Materials

This subtopic lists the following data for 27 refrigerants and gases:

Refrigerant no.	Refrigerant number
Molecular weight	Molecular weight
B.P.	Boiling point
Crit. point temp	Critical point temperature
Crit. point pressure	Critical point pressure, psi

Transition Temperatures

This subtopic lists the transition temperatures (T_0) and critical magnetic fields (H_0) for 14 type I superconductors; and transition temperature (T_0), upper critical fields (H_{c2}), and upper transition temperatures (T (K)) for seven type II superconductors.

Common Cryogenic Properties

This subtopic lists the following properties for 11 common cryogens:

- Boiling point
- Triple point temperature
- Triple point pressure
- Critical temperature
- Critical pressure
- Upper inversion temp

Refrigerants

- Heat of vaporization per lb
- Heat of vaporization per ft³
- Liquid density
- Vapor density
- Gas density

Chapter 8

Reference Formulas

In This Chapter

This topic lists formulas for moments of inertia and standard numbers.

Because the size of the calculator screen is limited, the names of constants and properties are usually abbreviated throughout the reference pac. This chapter includes “translations” of these abbreviations where appropriate.

Moments of Inertia

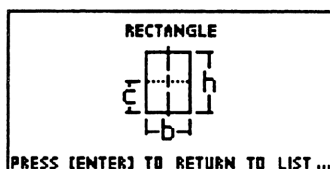
Formulas for moments of inertia, section modulus, and radius of gyration are given for 13 cross-sections:

I = moment of inertia

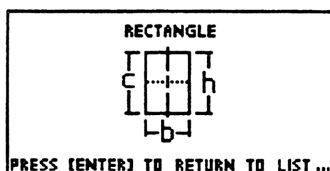
I/C = Section modulus

r = Radius of gyration

Rectangle ($C = H/2$)

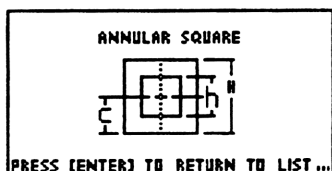


Rectangle ($C = H$)

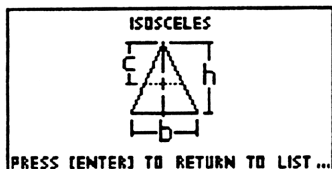


Reference Formulas

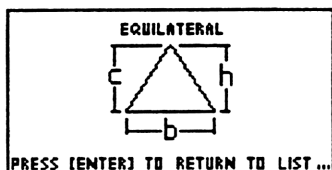
Annular square



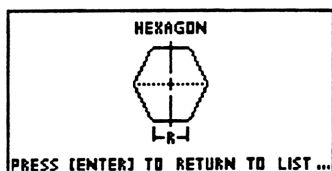
Isosceles triangle



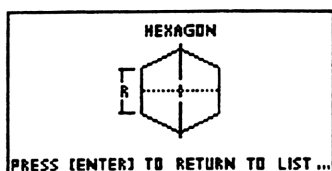
Equilateral triangle



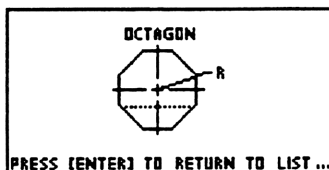
Hexagon (side)



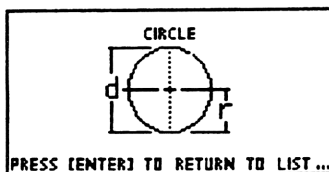
Hexagon (center)



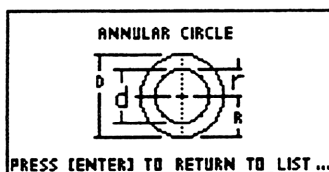
Octagon



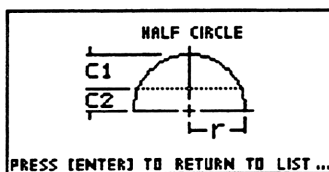
Circle



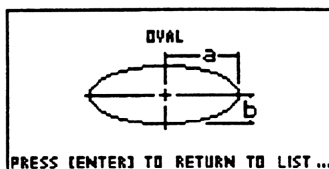
Annular circle



Half-circle

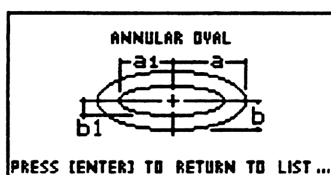


Oval



Reference Formulas

Annular oval



Standard Numbers

This subtopic lists the symbol and gives the formula for eight standard numbers:

- Reynolds
- Froude
- Euler
- Pressure coefficient
- Cauchy
- Mach
- Weber
- Strouhal

Chapter 9

Miscellaneous

In This Chapter




Miscellaneous contains commonly used reference data.

This chapter covers:

- ☐ Constants Library
- ☐ Greek Alphabet
- ☐ Standard Prefixes
- ☐ ASCII Table

Using Miscellaneous

To get to the Miscellaneous section, follow these steps:

1. Press  **LIBRARY** to display all libraries available to the HP 48SX.
2. Find and press **MEREF**.
3. Press the first softkey, **MEREF** to start the application.
4. At the Main menu, move the arrow to Miscellaneous (by pressing  and ) and press **ENTER**.



Items in the Miscellaneous Menu

Each entry in the Miscellaneous menu is briefly described below and is discussed in detail later in this chapter.

Item	Description
Constants Library	Commonly used mathematical constants. (Universal, Physical, Magnetic, and Mechanical)
Standard Prefixes	Commonly used prefixes.
Greek Alphabet	Uppercase and lowercase Greek letters.
ASCII Table	A browser displaying all of HP 48SX characters.

Summary of Operations (Miscellaneous)

Key	Action
FONT	Toggles between the small and large fonts.
MAIN	Returns to the Main menu.
PRINT	Prompts for ONE or ALL to select items, and then sends those items to an IR printer.
STK	Prompts for ONE or ALL to select items, and then copies those items to the stack. The items are placed in a list if ALL was chosen.
UP	Moves up one level in the menu structure.
VIEW	Displays the entire text of an item too wide to fit on the screen, up to one entire screen size. If the item fits on the screen, this key is non-functional.
ATH	Quits the MEREf Pac to the HP 48SX stack.
ENTER	Moves down one level in the menu structure.
ON - MTH	Dumps the current screen to an IR printer.

Constants Library

The Constants Library offers you access to 39 constants commonly used in mechanical engineering. All constants are listed in English units and are classified under four categories:

Universal Constants

R	Universal gas constant
NA	Avogadro's number
Vm	Molar volume
StdT	Standard temperature

StdP	Standard pressure
ϵ_0	Permittivity of vacuum
c	Velocity of light
h	Planck's constant
k	Boltzmann's constant

Physical Constants

q	Electron charge
m_e	Electron mass
r_e	Classic electron radius
m_p	Proton mass
μ_N	Neutron mass
R_∞	Rydberg's
α	Fine structure
a_0	Bohr radius
μ_B	Bohr magneton
λ	Wavelength for 1 eV
λ_c	Compton's wavelength
σ	Stefan-Boltzmann
c1	1st radiation
c2	2nd radiation
c3	Wiens' displacement
Vt	Thermal voltage at 300 K

Magnetic Constants

μ_0	Permeability of free space
ϕ_0	Magnetic flux quantum
F	Faraday constant
μ_E	Electron magnetic moment
μ_P	Proton magnetic moment

Mechanical and Thermal Constants

G	Gravitational constant
g	Acceleration due to gravity
ρ_{H_2O}	Density of water at 20 °C

nH ₂ O	Refractive index of water at 20 °C
CpH ₂ O	Heat capacity of water at 20 °C
HfH ₂ O	Heat of fusion of water
HvH ₂ O	Heat of vaporization of water

Upon choosing Universal Constants from the Miscellaneous menu, the following screen appears:

Universal Constants
→R (UNIVERSAL GAS CONSTANT)1.987...
NA (AVOGADRO'S NUMBER): 6.02204...
VM (MOLAR VOLUME): 29151.1FT^3...
STDT (STANDARD TEMPERATURE)491.6...
STDP (STANDARD PRESSURE):14.695...
EO (PERMITTIVITY OF VACUUM)8.541E...
C (VELOCITY OF LIGHT): 983559086...
H (PLANCK): 1.74599E-40_Btu*H
MIN ←STK PRINT UNIT FONT UP

NOTE: The values are unjustified because the small font is proportionally spaced; switching to the large font will align the numerical data in the same column.

Example: Look up the value of Planck's constant. First, move the arrow down to H by pressing **↓**. Now, press **UNIT** to turn on units. Finally, although you can see most of the value of H on the display, press **ENTER** to view the full value of the constant:

Universal Constants
h (Planck)
1.74599E-40_Btu*h
PRESS [STD] TO SAVE TO STACK ...
PRESS [ENTER] TO RETURN TO LIST ...

Press **STD** to save the constant to the stack as a tagged object, or **ENTER** or **ATN** to return to the Universal Constants menu without saving the constant on the stack.

Greek Alphabet

Upon choosing Greek Alphabet from the Miscellaneous menu, the following screen appears:

ALPHA	Α α	IOTA	Ι ι	RHO	Ρ ρ
BETA	Β β	KAPPA	Κ κ	SIGMA	Σ σ
GAMMA	Γ γ	LAMBDA	Λ λ	TAU	Τ τ
DELTA	Δ δ	MU	Μ μ	UPSILON	Υ υ
EPSILON	Ε ε	NU	Ν ν	PHI	Φ φ
ZETA	Ζ ζ	XI	Ξ ξ	CHI	Χ χ
ETA	Η η	OMICRON	Ο ο	PSI	Ψ ψ
THETA	Θ θ	PI	Π π	OMEGA	Ω ω
PRESS [ENTER] TO RETURN TO LIST...					

This screen is a picture displaying representations of all of the uppercase and lowercase Greek letters. Many of these characters are available from the HP 48SX keyboard, but not all of them. To get a printed copy of this screen, press **[ON]**-**[MTH]** now. Press **[ENTER]** to return to the Miscellaneous menu.

NOTE: The uppercase and lowercase letters alternate columns, due to limitations of the pixel resolution of the HP 48SX screen.

Standard Prefixes

Upon choosing Standard Prefixes from the Miscellaneous menu, the following screen appears:

Standard Prefixes	
→EXA (E):	10E18
PECA (P):	10E15
TERA (T):	10E12
GIGA (G):	10E9
MEGA (M):	10E6
KILO (K):	10E3
HECTO (H):	10E2
DECA (DA):	10
MAIN →STK PRINT VIEW FONT UP	

The only difference in behavior between Standard Prefixes and Constants Library is that units are not relevant to the prefixes, so **[UNITS]** has been replaced with **[VIEW]**.


ASCII Table

Upon choosing ASCII Table from the Miscellaneous menu, the following screen appears:







	CHR	HEX	DEC	OCT	BIN		
→	A	41	065	101	01000001	A	
	B	42	066	102	01000010	589	
	C	43	067	103	01000011	A	
	D	44	068	104	01000100	582	
	E	45	069	105	01000101	A	
	F	46	070	106	01000110	A	
	G	47	071	107	01000111	A	
	H	48	072	110	01001000	TIR 3	
		-16	+16	-32	+32	-64	+64

This function displays hexadecimal, octal, binary and ASCII equivalents for the decimal numbers 0 through 255.

Example:

Suppose you want to find the binary equivalent of the ASCII α character. Enter the ASCII Table, The first screen displays characters at decimal number 065 (although ASCII characters beginning at decimal 0 are available). Use the  cursor key to scroll down the list until you find the α character (decimal 140). Look under the BIN heading to find the binary equivalent of α .

	CHR	HEX	DEC	OCT	BIN	
↓ ↑	89	137	211		10001001	α
	8A	138	212		10001010	5X9
	8B	139	213		10001011	α
	8C	140	214		10001100	5X2
	8D	141	215		10001101	
	8E	142	216		10001110	ⁱGa
	8F	143	217		10001111	
	90	144	220		10010000	TIR 3
	-16	+16	-32	+32	-64	+64

Since the search mode is not available in the ASCII table, you need to use the , , , , ,  softkeys to jump forward or backward 16, 32, or 64 characters at a time.

The HP48SX Character Set

The top two boxes at the far right of the ASCII listing display the selected character in the HP 48SX small (5X7) and medium (5X9) fonts. The third box displays the I/O character and translate code setting required to download data from a personal computer to the HP 48SX. (See the *HP 48SX Owner's Manual* for complete instructions.)

To quit the ASCII Table application simply press the  key

Summary of Operations (Miscellaneous Sections)

Key	Action
FONT	Toggles between the small and large fonts.
MAIN	Returns to the Main menu.
PRINT	Prompts for ONE or ALL to select items, and then sends those items to an IR printer.
STC	Prompts for ONE or ALL to select items, and then copies those items to the stack.
UNIT	Indicates that units are currently turned on. Pressing this key turns off units, automatically stripping units from all constants.
UNITS	Indicates that units are currently turned off. Pressing this key turns on units, automatically appending units to all constants.
UP	Moves up one level in the menu structure.
VIEW	Displays the entire text of an item too wide to fit on the screen, up to one entire screen size. If the item fits on the screen, this key is non-functional.
ATH	Quits the MEREFPac to the HP 48SX stack.
ENTER	For picture data, ENTER displays the picture. For text, ENTER displays the screen title, the item label, and the item, all expanded to one screen.
ON - MTH	Dumps the current screen to an IR printer.

Miscellaneous

Notes:

Appendix A

Warranty and Service

Pocket Professional Support

You can get answers to your questions about using your Pocket Professional card from Sparcom. If you don't find the information in this manual or in the *HP 48SX Owner's Manual*, contact us in writing, at :

Sparcom Corporation

Attn: Technical Support Dept.

897 NW Grant Avenue, Corvallis, OR 97330, U.S.A. (503) 757-8416

or send E-mail:

from **Internet:**

support@sparcom.com

from **Compuserve:**

> Internet:support@sparcom.com

from **FidoNet:**

To:support@sparcom.com

Limited One-Year Warranty

What Is Covered

The Pocket Professional is warranted by Sparcom Corporation against defects in material and workmanship for one year from the date of original purchase. If you sell your card or give it as a gift, the warranty is automatically transferred to the new owner and remains in effect for the original one-year period. During the warranty period, we will repair or replace (at no charge) a product that proves to be defective, provided you return the product and proof of purchase, shipping prepaid, to Sparcom.

What Is Not Covered

This warranty does not apply if the product has been damaged by accident or misuse or as the result of service or modification by any entity other than Sparcom Corporation.

No other warranty is given. The repair or replacement of a product is your exclusive remedy. ANY OTHER IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS IS LIMITED TO THE ONE-YEAR DURATION OF THIS WRITTEN WARRANTY. IN NO EVENT SHALL SPARCOM CORP. BE LIABLE FOR CONSEQUENTIAL DAMAGES. Products are sold on the basis of specifications applicable at the time of manufacture. Sparcom shall have no obligation to modify or update products, once sold.

If the Card Requires Service

Sparcom will repair a card, or replace it with the same model or one of equal or better functionality, whether it is under warranty or not.

Service Charge

There is a fixed charge for standard out-of-warranty repairs. This charge is subject to the customer's local sales or value-added tax, wherever applicable. Cards damaged by accident or misuse are not covered by fixed charges. These charges are individually determined based on time and material.

Shipping Instructions

If your card requires service, ship it to Sparcom Corporation, 897 NW Grant Avenue, Corvallis, OR 97330, U.S.A.

- Include your return address and a description of the problem.
- Include proof-of-purchase date if the warranty has not expired.
- Include a purchase order, along with a check, or credit card number and expiration date (VISA or MasterCard) to cover the standard repair charge.
- Ship your card, postage prepaid, in adequate protective packaging to prevent damage. Shipping damage is not covered by the warranty, so insuring the shipment is recommended.

Cards are usually serviced and reshipped within five working days.

Environmental Limits

The reliability of the Pocket Professional depends upon the following temperature and humidity limits:

- Operating temperature: 0 to 45 °C (32 to 113 °F).
- Storage temperature: -20 to 60 °C (-4 to 140 °F).
- Operating and storage humidity: 90% relative humidity at 40 °C (104 °F) maximum.

Notes:

Appendix B

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Notes:

Appendix C

Menu Structure

This chapter presents the menu structure format of the Mechanical Engineering Reference Pac. The main menu items are shown in bold typeface for clarity.

Solids and liquids

- Mechanical properties
 - Sp gravity of materials
 - Various metals
 - Timber, air-dry
 - Various liquids
 - Minerals
 - Bituminous substances
 - Brinell hardness for steels
 - Mechanical props at room temp
 - Iron
 - Steel, ASTM
 - Steel, SAE
 - Aluminum
 - Copper
 - Miscellaneous
 - Sound velocity values
 - Superalloys
 - Various metals and properties
 - Static friction coefficients
- Elastic properties
 - Elastic constants of metals
 - Fatigue limits
 - Bulk modulus of Elasticity
- Composition of metals
 - Stainless steel comp.
 - Austenitic steels
 - Martensitic steels
 - Ferritic steels
 - AISI steel composition
 - Copper base alloys

Menu Structure

- Nickel alloy comp.
- Magnesium alloys comp.
 - Sand-casting
 - Permanent mold-casting
 - Die-casting
- Titanium alloy comp.
- Brazing alloys
- Properties of liquids
 - Surface tension
 - Density
 - Viscosity at one ATM
 - Fluids - phase transition data
 - Water - physical properties'

Steam tables

Gases and vapors

- Air - Enthalpy, Psi function
- Critical data - gases
- Viscosity at one ATM
- Saturation temp
- Saturated gas props
 - Ammonia
 - Carbon dioxide
 - Ethane (R170)
 - Hydrogen (n)
 - Methane
 - Refrg 11
- Air-physical prop atmospheric press

Thermal properties

- Thermal conductivity
 - Metals
 - Ni-Cr alloys by ANSI#'s
 - Molten metals
 - Liquids
 - Gases
 - Low temperature matls
 - Insulating materials
- Specific heat
 - Cp of liquids & gases
 - Cp/Cv of liquids/gases at 1 ATM
 - Heat of fusion

Mean specific heats, solids

Fuels and combustion

Compare of SO₂ control systems

ASTM classification of coals

Byproduct fuels

Heat values of petroleum oils

Gasoline specs ASTM D439

Aviation gas specs Mil-G-5572E

Diesel fuel specs

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 Octagon

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 Half-circle

 Oval

 Annular oval

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(continued on next page)

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Universal Constants

Physical Constants

Magnetic Constants

Mech, Therm Constants

Greek Alphabet

Standard Prefixes

ASCII Table


Appendix D

Questions and Answers







Commonly Asked Questions

Q. I'm not sure whether the Pocket Professional card is malfunctioning or I'm doing something improperly. How can I verify that the card and the calculator are functioning properly.

A. There are several possibilities for this condition to occur.

- check to make sure that the card is properly seated in the calculator port.
- turn the calculator ON and press  LIBRARY. The calculator checks the reference card when it turns on; if "Invalid Card Data or Port Not Available" message is displayed, then the card may require service. If the library menu does not include the reference name shown in Chapter 1, then the card may require service.
- a third possibility occurs when you remove a merged RAM card incorrectly and install the Pocket Professional card. In this case, the calculator display shows "Recovering Memory".

Q. What do three dots (...) mean at the end of a display line?

A. The three dots indicate that the object is displayed too long to show on one line. To view the complete object, select the object using the  or the  key by moving the pointing arrow to the object to be displayed, press  and . Pressing  or  will return to the browser.

Q. While searching a list of information, I used the alpha key to do the search, but the search did not work. Why?

A. Most likely, the search did not work because of case sensitivity of the alpha search.

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Sparcom Corporation
897 NW Grant Avenue
Corvallis, OR 97330

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call: (503) 757-8416 or FAX (503) 753-7821

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