

ASTEM97 General User Notes

A series of application-tool specific user notes is provided to assist users in using the **ASTEM97 Non-C/C++ version of the FORTRAN DLL (ASTEM97F.DLL)** and to assist users in using the **ASTEM97 C/C++ version of the FORTRAN DLL (ASTEM97C.DLL)**.

The interfaces developed, and provided, allow use of either version of the **ASTEM97 DLL** in developing applications with a transparent user interface (with the exception that the Non-C/C++ version cannot be used in a C/C++ environment). Therefore, if the developer used the C/C++ environment as one development tool, then the C/C++ version of the **ASTEM97 DLL** is likely the better choice for projects being developed with other tools. Otherwise, the choice is left to the developer.

Notes are provided for:

Borland's® Delphi® 5.0	delphi_ref.pdf
Borland's® C++Builder™ 5.0	cncpp_ref.pdf
Microsoft's® VC++® 5.0	cncpp_ref.pdf
Microsoft's® Excel®	excel_ref.pdf
Microsoft's® Visual Basic® 5.0	visbas_ref.pdf

The interface files all contain four additions function, three to remove the need to use the type definitions associated with string-related unique features in each language and one to provide a means to relate a property to specific DLL functions, such as retrieving a property from PROP97, converting a value with CSEU97 or obtaining a property's name and units. A predefined set of constants is also provided to assist with this relationship.

NAMES97 is used to access the strings from DLL subroutine ZTITL97, see Table 1 in the User's Guide, if using the **ASTEM97 Non-C/C++ version of the FORTRAN DLL (ASTEM97F.DLL)** interface, or from internal stored string data when using the **ASTEM97 C/C++ version of the FORTRAN DLL (ASTEM97C.DLL)** interface.

String_Returned = **NAMES97(index_in , iparm_in)**

Function NAMES97(index_in)

Replacement to ZTITL97

Input

```
index_in = 1 to 31, property identifier
           else return "Invalid Request"
iparm_in = 1 then return parameter name
           = 2 then return SI unit name
           = 3 then return English unit name
           else return "Invalid"
```

ASTEM97 General User Notes

NZERR97 is used to access the strings (the routine name) from DLL subroutine ZZERR97, based on Appendix A of the User's Guide, when using the **ASTEM97 Non-C/C++ version of the FORTRAN DLL (ASTEM97F.DLL)** interface, or from internal stored string data when using the **ASTEM97 C/C++ version of the FORTRAN DLL (ASTEM97C.DLL)** interface.

String_Returned = **NZERR97(index_in)**

```
Function NZERR97( index_in )  
  Replacement for ZZERR97  
  Input  
    index_in = 1 to 307, routine identifier  
    else return "Invalid"
```

NINFO97 is used to access the strings from DLL subroutine ZZZZZZ97, described in the User's Guide, if using the **ASTEM97 Non-C/C++ version of the FORTRAN DLL (ASTEM97F.DLL)** interface, or from internal stored string data when using the **ASTEM97 C/C++ version of the FORTRAN DLL (ASTEM97C.DLL)** interface.

String_Returned = **NINFO97(index_in)**

```
Function NINFO97(index_in )  
  Replacement to ZZZZZZ97  
  Input  
    index_in = 1 to 5, Information in line index_in  
    else return "Invalid Request"
```

IMAP97 is used to obtain the translation value associated with a specific parameter and is the "ID" value listed in Table 1 of the User's Guide. This value is used to retrieve the parameter name, units names, to retrieve specific data from PROP97 and to perform unit conversions with CSEU97. Inherent is the implied relationship between the parameter and this value. For example, specific enthalpy has an index value of 7 and its translation value is 5. Therefore the specific enthalpy, H_SI, is found in PROP97(5) and can be converted to English units with H_ENG = CSEU97(5,H_SI).

Index_Return = **IMAP97(index_in)**

```
Function IMAP97(index_in )  
  Function to Get Translation  
  Input  
    index_in = 1 to 31, Translation value at index_in  
    else return -1
```

A set of global constants is included, for use in conjunction with **IMAP97**, to provide a means to translate the parameter identification, the ID value in Table 1 of the User's Guide, to the internal index used to retrieve string data, data from PROP97 or in performing unit conversions with CSEU97. The listing below shows these relationships:

ASTEM97 General User Notes

Name	Value	Translates	Parameter	ID	Value
IMAP97(index_in)					
ipres	= 1	points to >	Pressure		1
itemp	= 2	points to >	Temperature		2
igual	= 3	points to >	Quality		7
idens	= 4	points to >	Density		31
ispvl	= 5	points to >	Specific Volume		3
ispui	= 6	points to >	Specific Internal Energy		4
ispeh	= 7	points to >	Specific Enthalpy		5
ispeo	= 8	points to >	Specific Entropy		6
igibf	= 9	points to >	Gibbs Free Energy		24
ihelf	= 10	points to >	Helmholtz Free Energy		25
icmpf	= 11	points to >	Compressibility Factor		29
ishcp	= 12	points to >	Specific Heat at P=const		8
ishcv	= 13	points to >	Specific Heat at v=const		9
isvel	= 14	points to >	Sonic Velocity		10
idvpt	= 15	points to >	dv/dp at T=const		11
idvtp	= 16	points to >	dv/dt at p=const		12
idpvt	= 17	points to >	dp/dv at T=const		13
idptv	= 18	points to >	dp/dt at v=const		14
ictxp	= 19	points to >	Coef of Thermal Expansion		15
icmpi	= 20	points to >	Isothermal Compressibility		16
ieiso	= 21	points to >	Isentropic Exponent		17
idynv	= 22	points to >	Dynamic Viscosity		18
idynk	= 23	points to >	Kinematic Viscosity		28
itcin	= 24	points to >	Thermal Conductivity (IND)		20
itcgs	= 25	points to >	Thermal Conductivity (GSI)		21
iprtn	= 26	points to >	Prandtl Number		30
irefi	= 27	points to >	Refractive Index		22
istdi	= 28	points to >	Static Dielectric Constant		23
isten	= 29	points to >	Surface Tension		19
icjto	= 30	points to >	Joule-Thomson Coef		27
icjti	= 31	points to >	Isothermal Joule-Thom Coef		26

To further enhance similarity in using and developing **ASTEM97 DLL** based applications, an additional routine is provided as part of the C/C++, Visual Basic and Delphi packages, called **fmtflt** (Edward D. Thom (C) 2002,2005).

fmtflt is used for formatting floating point (double) values for display. **fmtflt** determines the type of output (fixed or scientific) and the precision (number of decimal places) to be display. In the C/C++ version, the I/O stream is first saved and then restored after the output is generated.

The **fmtflt** routines are available for use in any project, and are considered to be public domain and covered by the Copyright and Disclaimer and License Agreement notices. They may be modified and redistributed provided the Copyright notice embedded in the code remains unchanged.

ASTEM97 General User Notes

The C/C++ Version:

```
void fmtflt( double value_in , int ipad_in )
// ASTEM97 IAPWS INDUSTRIAL FORMULATION
// FOR WATER AND STEAM IF-97
// Edward D. Throm (C) 2002
// For I/O streams and output format
// Determines type of output fixed or scientific and precision
// Incoming I/O stream is saved and restored after output
// Input
// value_in floating point value to convert to formatted output
// ipad_in if = 1 then set output length to 13 characters Sm.nnnnnESxxx
// else format value_in to 6-digits
// Output cout << value_in; //in selected format/precision
```

The Visual Basic Version:

```
Function fmtflt(ByVal value_in As Double, ByVal ipad_in As Integer) As String
' ASTEM97 IAPWS INDUSTRIAL FORMULATION
' FOR WATER AND STEAM IF-97
' Edward D. Throm (C) 2002
' For I/O streams and output format
' Detemines type of output fixed or scientific and precision
' Incoming I/O stream is saved and restored after output
' Input
' value_in floating point value to convert to formatted output
' ipad_in if = 1 then set output length to 12 characters Sm.nnnnnESxx
' else format value_in to 6-digits
' Output string fmtflt //in selected format/precision
```

The Delphi Version:

```
Function fmtflt( value_in: Double ; ipad_in: Integer ): String;
{ ASTEM97 IAPWS INDUSTRIAL FORMULATION
FOR WATER AND STEAM IF-97
Edward D. Throm (C) 2002
For I/O streams and output format
Detemines type of output fixed or scientific and precision
Incoming I/O stream is saved and restored after output
Input
value_in floating point value to convert to formatted output
ipad_in if = 1 then set output length to 12 characters Sm.nnnnnESxx
else format value_in to 6-digits
Output string fmtflt //in selected format/precision }
```

The files are provided in a self-extracting zip (**ASTEM97Z.EXE**) file. This avoids interacting with the Windows registry. Therefore, while the **ASTEM97 DLLs** can in some cases be located in the same directory as an application, it is best to copy the appropriate DLL to the **/WINDOWS/SYSTEM** directory on the user's computer as this will provided access to the DLL from any application. If the user's plans to redistribute an **ASTEM97 DLL**, then the user's installation should perform this function.

ASTEM97 General User Notes

ASTEM97 - IAPWS IF97 Properties of Water and Steam for Industrial Use
Copyright Edward D. Throm (C) 2002,2005

COPYRIGHT AND DISCLAIMER NOTICE

NO REPRESENTATIONS OR WARRANTIES ARE MADE OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE.

The work is based on a best effort in preparing this documentation and the programs contained herein. However, no warranties of any kind, express or implied, with regard to this documentation or programs contained in this work, and specifically, without limitation, and implied warranty of merchantability and fitness for a particular purpose with respect to the program listings in this work and/or the techniques described in this work. In no event shall the provider be responsible or liable for any loss of profit or any other commercial damages, including but not limited to special, incidental, consequential, or any other damages in connection with or arising out of furnishing, performance, or use of this work or the programs. The software is provided AS IS without any express or implied warranties whatsoever. The user is advised to test the software thoroughly before using it or relying on it. The user assumes the entire risk of using the software. The use of such software shall be governed by the terms of the end user license statements which accompany or are included with the software ("License Agreement"). Such software is made available for downloading solely for use by end users according to such License Agreement. Except as otherwise provided, copying or reproduction of any material from this site to any other location for further reproduction or redistribution is expressly prohibited. Any reproduction or redistribution of the files not in accordance with the terms of the License Agreement is a violation of copyright law.

WARRANTY DISCLAIMER

THE SOFTWARE, DOCUMENTS, FILES AND INFORMATION CONTAINED IN THIS WORK ARE WARRANTED, IF AT ALL, ONLY ACCORDING TO THE TERMS OF AN ACCOMPANYING OR INCLUDED LICENSE AGREEMENT. THE AUTHOR SPECIFICALLY DISCLAIMS ALL OTHER WARRANTIES, REPRESENTATIONS AND CONDITIONS, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO, ANY IMPLIED WARRANTY OR CONDITION OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, OR WARRANTY OF TITLE OR AGAINST INFRINGEMENT. TO THE EXTENT THAT ANY SOFTWARE, DOCUMENTS, FILES, OR INFORMATION CONTAINED IN THIS WORK IS NOT ACCOMPANIED BY A LICENSE AGREEMENT, SUCH SOFTWARE, DOCUMENTS, FILES, OR INFORMATION IS PROVIDED ON AN "AS IS" BASIS "WITH ALL FAULTS." BY USING SUCH SOFTWARE, DOCUMENTS, FILES, OR INFORMATION, YOU ASSUME THE ENTIRE RISK AS TO ITS QUALITY AND PERFORMANCE. SHOULD IT PROVE DEFECTIVE, YOU AND NOT THE PROVIDED, ASSUME THE ENTIRE COST OF ALL NECESSARY SERVICING AND REPAIR.

Specifically, the author makes no representation or warranty that any software, documents, files or information are "error-free," or meet any user's particular standards, requirements, or needs.

ASTEM97 General User Notes

LIMITATION OF LIABILITY

The author shall not be liable for any claim or right to recover damages, including, but not limited to, loss of profit, data, or use of the software or special, incidental, or consequential damages, or other similar claims, even if the author has been specifically advised of the possibility of such damages. In no event will the author's liability for damages to you or any other person ever exceed the lower of the list price or the actual price paid for the package or the license to use the software, regardless of the form of the claim.

U.S. Government Restricted Rights

Any use of this work for or on behalf of the United States of America, its agencies and/or instrumentalities, is provided with Restricted Rights. Use, duplication, or disclosure by the U.S. Government is subject to restrictions as set forth in subparagraph (c)(1)(ii) of the Rights in Technical Data and Computer Software clause at DFARS 252.227-7013 or subparagraphs (c)(1) and (2) of the Commercial Computer Software - Restricted Rights at 48 CFR 52.227-19, as applicable.

ASTEM97 General User Notes

ASTEM97 - IAPWS IF97 Properties of Water and Steam for Industrial Use
Copyright Edward D. Throm (C) 2002,2005

LICENSE AGREEMENT - IMPORTANT: You should read CAREFULLY

This license agreement is a legal agreement between you (either an individual or a single entity) and the ASTEM97 author for the identified product, which includes computer software, and may include printed materials and online or electronic documentation and associated media. By installing, copying, distributing or otherwise using this product, you agree to be bound by the terms of this license agreement. The use of this product indicates your understanding and acceptance of the following terms and conditions. This license shall supersede any verbal, or prior verbal or written, statement or agreement to the contrary.

This product and related documentation are provided on an "as is" basis, without any representation or warranty of any kind, either express or implied, including without limitation any representations or endorsements regarding the use of, the results of, or performance of the product, its appropriateness, accuracy, reliability, or correctness. The entire risk as to the use of this product is assumed by the user and/or licensee. The ASTEM97 author does not assume liability for the use, installation and distribution of this product. In no event will the author be liable for additional direct or indirect damages including any lost profits, lost savings, loss of business information, any other pecuniary loss or other incidental or consequential damages arising from any defects out of the use of or inability to use this product even if the ASTEM97 author has been advised of the possibility of such damages.

You agree to defend, indemnify and hold the ASTEM97 author harmless from and against any and all claims, losses, liability costs and expenses (including but not limited to attorneys' fees) arising from your violation of this agreement or any third-party's rights, including but not limited to infringement of any copyright, violation of any proprietary right and invasion of any privacy rights. This obligation will survive any termination of this agreement.

LIMITATIONS ON REVERSE ENGINEERING, DECOMPILATION, AND DISASSEMBLY:

You may not reverse engineer, decompile, or disassemble the product.

RESTRICTIONS ON ALTERATION:

You may not use, copy, modify, translate, or transfer the product or any copy except as expressly defined in this agreement. You may not rename, edit or create any derivative works from the product, other than sub setting when embedding them in documents without the agreement of the author except as expressly defined in this agreement (See DERIVED WORK). You may not attempt to unlock or bypass any copy-protection or authentication algorithm utilized by the product. You may not remove, modify or alter any copyright notice or the method by which it may be invoked, from any part of the product, including but not limited to any such notices contained in the physical and/or electronic media or documentation, in the Product's dialog or 'about' boxes, in any of the runtime resources and/or in any web-presence or web-enabled notices, code or other embodiments originally contained in or dynamically or otherwise created by the product.

ASTEM97 General User Notes

DERIVED WORK:

You are permitted to develop and distribute derived work [your product] based on the dynamic link libraries (DLLs) ASTEM97F.DLL and/or ASTEM97C.DLL provided as part of this (ASTEM97) computer software. You may redistribute these DLLs with your product royalty free provided you include a notice that includes, at a minimum, the following information: [Your product] use "ASTEM97 - IAPWS IF97 Properties of Water and Steam for Industrial Use," Copyright Edward D. Throm (C) 2005, or equivalent. The major portion of any distributed product may not be specifically intended to obtain the properties of water and steam from these DLLs. Such product must have a specific purpose with these properties being an incidental portion of the product. You may not distribute the **Excel XLA files**, the **C/C++ Header files**, the **Visual Basic Module or Form (.frm) files**, or the **Delphi Unit files** contained in this software package, or any modified versions of these files. You may however modify and use these files in the development of your product. When distributing an Excel-based product you may include the Visual Basic for Application (VBA) modules but you must use Excel's password protection scheme to protect the source coding, and in addition, to the extent practical, you should remove references to routines not specifically required by you product. The sole except is unrestricted use of the **fmtflt** routines provided the embedded Copyright notice remains unchanged.

The product (in whole or in part, including all files, data, and documentation, from here on referred to as "Product") are Copyright 2005 by Mr. Edward D. Throm, all rights reserved, and are protected by United States copyright laws, international treaties as well as other intellectual property laws and treaties and all other applicable national or international laws. The product may not, in whole or in part, be copied, photocopied, translated, or reduced to any electronic medium or machine readable form. The sole owner is Mr. Edward D. Throm. All other rights and restrictions not specifically granted in this license are reserved by Mr. Edward D. Throm.

You have the non-exclusive right to use the product only by a single person, on a single computer at a time. If the product permits, you may physically transfer the product from one computer to another, provided that the product is used only by a single person, on a single computer at a time. In group projects where multiple persons will use the product, you must purchase an individual license for each member of the group. Use over a local area network (within the same locale) is permitted provided that the product is used only by a single person, on a single computer at a time. Use over a wide area network (outside the same locale) is strictly prohibited under any and all circumstances. Without advertising, the author has all rights to terminate the services included in the product including but not limited technical support, upgrades, sales and other activities related to the product.

You may make one copy of the software part of the product solely for back-up purposes, as prescribed by United States, and international copyright laws. You must reproduce and include the copyright notice on the back-up copy. You may transfer the product to another party only if the other party agrees to the terms and conditions of this agreement and completes and returns registration information (name, address, etc.), to the author within 30 days of the transfer. If you transfer the product you must at the same time transfer the documentation and back-up copy, or transfer the documentation and destroy the back-up copy. You may not retain any portion of the product, in any form, under any circumstance.

If you do not understand or accept these terms, or your local regulations prohibit license agreements or limited disclaimers, you must cease and desist using ASTEM97 immediately. Copyright laws supersede all local regulations.

When you accept and approve this license, it is considered that you have read it and you will respect it.