z390 VSE User Guide v1.3.03

Table of Contents

1. Introductions

The z390 open source portable mainframe assembler and emulator tool now supports the assembly, linking, and execution of VSE mainframe assembler programs using a VSE macro library. The VSE macros map into z390 MVS macros and require that the default z390 MVS macro library be concatenated behind the z390 VSE macro library.

The initial release of z390 VSE support includes the following VSE macros: CDLOAD, CDDELETE, CLOSE, COMRG, DTFPR, DTFSD, EOJ, FREEVIS, GETIME, GETVIS, and OPEN. z390 MVS and user macros which require no changes for VSE can also be used including CALL, GET, PUT, SUBENTRY, SUBEXIT, etc.

The initial VSE support includes 3 demo programs:

1. **DEMOVSE1.MLC – Display "Hello World" and also current date and time using the COMRG and GETIME VSE macros in addition to MVS compatible WTO macro.**
2. **DEMOVSE2.MLC – Use the CDLOAD macro to load the z390 demo program demo\DEMOWTO1.MLC, call it, and then use CDDELETE to delete the loaded program from memory.**
3. **DEMOVSE3.MLC – Use the OPEN, GET, PUT, CLOSE, DTFSD, and DTFPR macros to copy a file.**
4.

See section 3 for more information about these demos and also see the Appendix for source program, assembly listing, and execution log and trace for the first demo.

Also included with v1.3.02b are new regression test commands RTVSE.BAT and RTVSE1.BAT. Entering the command RTVSE will assemble, link, execute, and verify results for all 3 demos plus the first additional regression test vse\test\TESTVSE1.MLC which uses GETVIS and FREEVIS to convert rt\test\TESTMEM1.MLC regression test to VSE equivalent test of dynamic storage allocation and de-allocation above and below the 16 MB line.

Additional VSE macros, demos, and regression tests will be added as requested.

2. VSE Macros

1. **CDDELETE – delete loaded program from memory (maps to DELETE)**
2. **CDLOAD - load program into memory (maps to LOAD)**
3. **CLOSE - close one or more DTF files (maps to svc 20)**
4. **COMRG - return address of system communications area in ZCVTD**
5. **DTFPR - define a sequential printer output file (maps to DCB)**
6. **DTFSD - define a sequential disk file (maps to DCB)**
7. **EOJ - exit main program (maps to EXIT svc 3)**
8. **FREEVIS - release dynamically allocated memory (maps to FREEMAIN)**
9. **GETIME - get current time (maps to TIME)**
10. **GETVIS - dynamically allocate memory (maps to GETMAIN)**
11. **OPEN - open one or more DTF files (maps to svc 19)**

3. VSE Demo Programs

The first "Hello World" demo program source, assembly listing, execution log, and execution trace are included in the Appendix. After extracting the z390 v1302b cumulative PTF zip into the install directory of the v1.3.02 z390 version, the following command can be used to assemble, link, and execute the first demo program with trace on Windows or Linux:

asmlg vse\demo\DEMOVSE1 sysmac(vse\mac+mac) amode24 trace

Note the default z390 MVS macro library z390\mac is concatenated with the new z390\vse\mac macro library for use of WTO in addition to COMRG and GETIME. Note the default z390 AMODE is 31 so the option amode24 can be used if necessary.

The second demo program can be assembled, linked and executed with the command:

asmlg vse\demo\DEMOVSE2 sysmac(vse\mac+mac) sys390(vse\demo+demo)

Note the z390 executable program directory z390\demo has been included to enable CDLOAD to find and load the demo DEMOWTO1.390 program which it then calls, and then deletes from memory.

The third demo program can be assembled, linked, and executed with the following three commands:

```
set SYSUT1=vse\demo\DEMOVSE3.TF1
set STSUT2=vse\demo\DEMOVSE3.TF2
asmlg vse\demo\DEMOVSE3 sysmac(vse\mac+mac)
```

This program copies the existing file defined by SYSUT1 DTFSD macro to the new file defined by SYSUT2 DTFPR macro. Note the DTF macros all use their label as DDNAME for generated DCB allowing SET commands to define the real file names. The existing file z390\vse\demo\DEMOVSE3.TF1 consists of 3 – 80 byte EBCDIC records which you can see in memory using trace or test.

4. Regression tests

The following regression test programs are included:

5. **TESTVSE1 - test GETVIS and FREEVIS dynamic memory allocation. This program was converted from MVS regression test rt\test\testmem1. Note that since VSE GETVIS has default RMODE24 where as MVS GETMAIN sets RMODE based on type, additional logic had to added to this test program to check MVS request type to set correct explicit RMODE.**

To run all the VSE regression tests including the demos and test programs, use the command RTVSE.BAT. This assembles, links, and executes each program and then verifies that the source and generated files all match the files saved after last change. Note the regression test for vse\demo\DEMOVSE3 uses the z390 regression test RT5.BAT to set the standard DDNAME's SYSUT1 and SYSUT2 to data files with name of program suffixed by TF1 and TF2 respectively. RT5 is also used for all the MVS DCB regression tests defined in RTTEST1.BAT.

6. References:

1. **For latest z390 downloads and additional information visit www.z390.org**
2. **For VSE macro references see the IBM VSE links here:**

   http://www.automatedsoftwaretools.com/z390/#IBM_Reference_Links

5. Appendix

Appendix I: Demo application source code DEMOVSE1.MLC

```
*********************************************************************
* Copyright 2007 Automated Software Tools Corporation               *
* This source code is part of z390 assembler/emulator package       *
* The z390 package is distributed under GNU general public license  *
* Author - Don Higgins                                              *
* Date   - 03/11/07                                                 *
*********************************************************************
* YOU CAN ASSEMBLE, LINK, AND EXECUTE THIS DEMO
* USING Z390 GUI INTERFACE BY ENTERING DEMO IN COMMAND BOX
* OR BY EXECUTING DEMO FROM WINDOWS COMMAND LINE
* WITH CURRENT DIRECTORY SET TO Z390 INSTALL DIRECTORY WHICH
* IS "C:\PROGRAM FILES\AUTOMATED SOFTWARE TOOLS\Z390"
* ENTER THE COMMAND:
*
*   ASMLG vse\demo\DEMOVSE1 sysmac(vse\mac+mac)
*
* THE Z390 TOOLKIT IS DISTRIBUTED IN SOURCE AND EXECUTABLE
* FORMAT UNDER OPEN SOURCE GPL LICENSE.  VISIT WWW.Z390.ORG
* FOR MORE INFORMATION.
*********************************************************************
         TITLE 'DEMOVSE1 Z390 VSE HELLO WORLD DEMO'
DEMOVSE1 CSECT
         BALR  12,0
         USING *,12
         WTO   'DEMOVSE1 HELLO WORLD'
         COMRG ,         GET VSE COMMUNICATIONS AREA IN REG 1
         USING IHACOMRG,1
         MVC   JOBDATE,COMRG_JOBDATE
         GETIME ,CLOCK=NO        SET R1= CURRENT TOD PD 0HHMMSSC
         ST    1,PWORK+4         STORE PD TOD 0HHMMSSC
         MVC   TIME,TIMEMASK
         ED    TIME,PWORK+4
         WTO   MF=(E,WTOMSG)
         EOJ   ,         EXIT PROGRAM
         LTORG
PWORK    DC    PL8'0'
WTOMSG   DC    AL2(WTOEND-*,0)
         DC    C'DEMOVSE1 COMRG JOBDATE '
JOBDATE  DC    C'MM/DD/YY'
         DC    C'  GETIME CURRENT TIME'
TIME     DC    C'  HH:MM:SS'
WTOEND   EQU   *
TIMEMASK DC    C' ',X'202120',C':',X'2020',C':',X'2020' HH:MM:SS
IHACOMRG      DSECT
COMRG_JOBDATE DS    CL8            0  8 MM/DD/YY (SET IF TIMING)
COMRG_RESV1   DS    XL4            8  4 RESERVED
COMRG_COMUSCR DS    XL11          12 11 USER AREA (ZERO'D)
COMRG_UPSI    DS    B             23  1 SWITCH BITS
COMRG_COMNAME DS    CL8           24  8 JOBNAME (SET TO PGMNAME)
COMRG_PPEND   DS    A             32  4 ADDR HIGH PGM
COMRG_HTPHAS  DS    A             36  4 ADDR HIGH LAST PH
COMRG_HTPROG  DS    A             40  4 ADDR HIGH MAX  PH ID4
```

```
COMRG_LABLEN  DS    H             44  2 LENGTH OF LABEL
COMRG_RESV2   DS    XL2           46  2 RESERVERD LENGTH ?????
COMRG_IJBHPHLA DS   A             48  4 ADDR HIGH MAX  PH ANY
         END
```

Appendix II: Demo application assembly listing DEMOVSE1.PRN

```
AZ390I V1.3.02b Current Date 03/13/07 Time 04:49:30
Copyright 2006 Automated Software Tools Corporation
z390 is licensed under GNU General Public License
AZ390I program = vse\demo\DEMOVSE1.BAL
AZ390I options = sysmac(D:\work\z390\mac+.) syscpy(D:\work\z390\mac+.)
sysmac(vse\mac+mac) amode24 trace
External Symbol Definitions
 ESD=0001 LOC=00000000 LEN=000000B8 TYPE=CST NAME=DEMOVSE1
Assembler Listing
000000                                  (1/1)1
*****************************************************************
000000                                  (1/2)2 * Copyright 2007 Automated Software
Tools Corporation               *
000000                                  (1/3)3 * This source code is part of z390
assembler/emulator package       *
000000                                  (1/4)4 * The z390 package is distributed
under GNU general public license  *
000000                                  (1/5)5 * Author - Don Higgins
*
000000                                  (1/6)6 * Date   - 03/11/07
*
000000                                  (1/7)7
*****************************************************************
000000                                  (1/8)8 * YOU CAN ASSEMBLE, LINK, AND
EXECUTE THIS DEMO
000000                                  (1/9)9 * USING Z390 GUI INTERFACE BY
ENTERING DEMO IN COMMAND BOX
000000                                 (1/10)10 * OR BY EXECUTING DEMO FROM WINDOWS
COMMAND LINE
000000                                 (1/11)11 * WITH CURRENT DIRECTORY SET TO Z390
INSTALL DIRECTORY WHICH
000000                                 (1/12)12 * IS "C:\PROGRAM FILES\AUTOMATED
SOFTWARE TOOLS\Z390"
000000                                 (1/13)13 * ENTER THE COMMAND:
000000                                 (1/14)14 *
000000                                 (1/15)15 *   ASMLG vse\demo\DEMOVSE1
sysmac(vse\mac+mac)
000000                                 (1/16)16 *
000000                                 (1/17)17 * THE Z390 TOOLKIT IS DISTRIBUTED IN
SOURCE AND EXECUTABLE
000000                                 (1/18)18 * FORMAT UNDER OPEN SOURCE GPL
LICENSE.  VISIT WWW.Z390.ORG
000000                                 (1/19)19 * FOR MORE INFORMATION.
000000                                 (1/20)20
*****************************************************************
000000                                 (1/21)21          TITLE 'DEMOVSE1 Z390 VSE
HELLO WORLD DEMO'
000000                                 (1/22)22 DEMOVSE1 CSECT
000000 05C0                            (1/23)23          BALR  12,0
000002                                 (1/24)24          USING *,12
LISTUSE DEMOVSE1 ESD=0001 LOC=00000002 LEN=01000 REG=C OFF=00000 LAB=
000002                                 (1/25)25          WTO   'DEMOVSE1 HELLO
WORLD'
000002 A715000E                        (2/46)26+         BRAS  1,*+(WTO#1_EOT-
*+1)/2*2
000006 00180000C4C5D4D6                (2/47)27+         DC    AL2(WTO#1_EOT-
*,0),C'DEMOVSE1 HELLO WORLD'
00001E                  00001E         (2/48)28+WTO#1_EOT EQU *
00001E 0A23                            (2/49)29+         SVC   35
000020                                 (1/26)31          COMRG ,         GET VSE
COMMUNICATIONS AREA IN REG 1
000020 A7182000                        (3/23)33+         LHI   1,ZCVT
000024                                 (3/24)34+         USING IHAZCVT,1
LISTUSE DEMOVSE1 ESD=0001 LOC=00000002 LEN=01000 REG=C OFF=00000 LAB=
LISTUSE IHAZCVT  ESD=0002 LOC=00000000 LEN=01000 REG=1 OFF=00000 LAB=
000024 41101600                000600  (3/27)35+         LA    1,ZCVT_COMRG
000028                                 (3/32)36+         DROP  1
LISTUSE DEMOVSE1 ESD=0001 LOC=00000002 LEN=01000 REG=C OFF=00000 LAB=
```

```
000028                  002000            (4/24)39+ZCVT     EQU    X'2000'  ABS ADDR
ZCVT
000000                                    (4/25)40+IHAZCVT  DSECT
000000                                    (4/26)41+         ORG    IHAZCVT+X'00'
000000                                    (4/27)42+ZCVTUPGM DS     CL8   390 USER
PROGRAM NAME LOADED AT IPL
000008                                    (4/28)43+         ORG    IHAZCVT+X'08'
000008                                    (4/29)44+ZCVTIPLP DS     CL8   390 IPL
PROGRAM SPECIFIED IN IPL(PGM) OPTION
000010                                    (4/30)45+         ORG    IHAZCVT+X'10'
000010                                    (4/31)46+ZCVTFQ24 DS     A     ADDRESS OF
FIRST FQE FOR 24 BIT MEM AT X'10000'
000014                                    (4/32)47+         ORG    IHAZCVT+X'14'
000014                                    (4/33)48+ZCVTFQ31 DS     A     ADDRESS OF
FIRST FQE FOR 31 BIT MEM AT X'1000000'
000018                                    (4/34)49+         ORG    IHAZCVT+X'18'
000018                                    (4/35)50+ZCVTEXIT DS     XL2   SVC 3 EXIT
USED AS R14 EXIT AND STIMER EXIT
00001C                                    (4/36)51+         ORG    IHAZCVT+X'1C'
00001C                                    (4/37)52+ZCVTGECB DS     F     TGET ECB
000020                                    (4/38)53+         ORG    IHAZCVT+X'20'
000020                                    (4/39)54+ZCVTEIBP DS     A     CICS INTERFACE
CONTROL BLOCK POINTER > DFHEIBLK
000024                                    (4/40)55+         ORG    IHAZCVT+X'24'
000024                                    (4/41)56+ZCVTCAP  DS     A     CICS COMMON
AREA POINTER
000100                                    (4/42)57+         ORG    IHAZCVT+X'100'
000100                                    (4/43)58+ZCVTSAVE DS     18F   SAVE AREA USED
TO INIT USER PGM R13
000200                                    (4/44)59+         ORG    IHAZCVT+X'200'
000200                                    (4/45)60+ZCVTSAV2 DS     18F   SAVE AREA FOR
STIMER EXIT R13
000300                                    (4/46)61+         ORG    IHAZCVT+X'300'
000300                                    (4/47)62+ZCVTPARM DS     XL256 PARM AREA USED
TO SET USER R1
000400                                    (4/48)63+         ORG    IHAZCVT+X'400'
000400                                    (4/49)64+ZCVTEPIE DS     XL256 RESERVED FOR
ESPIE EPIE CB (SEE EPIED MACRO)
000500                                    (4/50)65+         ORG    IHAZCVT+X'500'
000500                                    (4/51)66+ZCVTESTA DS     XL256 RESERVED FOR
ESTAE ESTA CB (SEE ESTAD MACRO)
000600                                    (4/52)67+         ORG    IHAZCVT+X'600'
000600                                    (4/53)68+ZCVT_COMRG DS XL1024 RESERVED FOR
VSE COMRG AREA (SEE vse\mac\COMRG)
000A00                                    (4/54)69+ZCVT_COMRG_JOBDATE DS    CL8
0  8 MM/DD/YY (SET IF TIMING)
000A08                                    (4/55)70+ZCVT_COMRG_RESV1   DS    XL4
8  4 RESERVED
000A0C                                    (4/56)71+ZCVT_COMRG_COMUSCR DS    XL11
12 11 USER AREA (ZERO'D)
000A17                                    (4/57)72+ZCVT_COMRG_UPSI    DS    B
23  1 SWITCH BITS
000A18                                    (4/58)73+ZCVT_COMRG_COMNAME DS    CL8
24  8 JOBNAME (SET TO PGMNAME)
000A20                                    (4/59)74+ZCVT_COMRG_PPEND   DS    A
32  4 ADDR HIGH PGM
000A24                                    (4/60)75+ZCVT_COMRG_HTPHAS  DS    A
36  4 ADDR HIGH LAST PH
000A28                                    (4/61)76+ZCVT_COMRG_HTPROG  DS    A
40  4 ADDR HIGH MAX  PH ID4
000A2C                                    (4/62)77+ZCVT_COMRG_LABLEN  DS    H
44  2 LENGTH OF LABEL
000A2E                                    (4/63)78+ZCVT_COMRG_RESV2   DS    XL2
46  2 RESERVERD LENGTH ?????
000A30                                    (4/64)79+ZCVT_COMRG_IJBHPHLA DS   A
48  4 ADDR HIGH MAX  PH ANY
008000                                    (4/65)80+ZCVTEND  ORG    IHAZCVT+(X'A000'-
X'2000')  RESERVE UP TO CVT
000028                                    (4/66)81+DEMOVSE1 CSECT
000028                                    (1/27)84          USING IHACOMRG,1
LISTUSE DEMOVSE1 ESD=0001 LOC=00000002 LEN=01000 REG=C OFF=00000 LAB=
```

```
LISTUSE IHACOMRG ESD=0003 LOC=00000000 LEN=01000 REG=1 OFF=00000 LAB=
000028 D207C0821000     000084 000000       (1/28)85          MVC   JOBDATE,COMRG_JOBDATE
00002E                                      (1/29)86          GETIME ,CLOCK=NO        SET
R1= CURRENT TOD PD 0HHMMSSC
00002E 41000000                             (6/53)90+         LA    0,0   DEC  R0 = HEX
HHMMSSTH
000032 0A0B                                 (6/75)91+         SVC   11 TIME AND DATE
000034 1810                                 (5/28)93+         LR    1,0
000036 4310C05E                000060       (5/29)94+         IC    1,=X'C0'
00003A 88100004                             (5/30)95+         SRL   1,4    R1=0HHMMSSC
00003E 5010C063                000065       (1/30)97          ST    1,PWORK+4
STORE PD TOD 0HHMMSSC
000042 D209C09FC0A9     0000A1 0000AB       (1/31)98          MVC   TIME,TIMEMASK
000048 DE09C09FC063     0000A1 000065       (1/32)99          ED    TIME,PWORK+4
00004E                                     (1/33)100          WTO   MF=(E,WTOMSG)
00004E 4110C067                000069      (2/58)101+         LA    1,WTOMSG
000052 0A23                                (2/64)102+         SVC   35
000054                                     (1/34)104          EOJ   ,         EXIT
PROGRAM
000054 41F00000                            (7/23)105+         LA    15,0
000058 0A03                                (7/28)106+         SVC   3 EXIT CURRENT
PROGRAM
00005A                                     (1/35)108          LTORG
000060 C0               =X'C0'
000061 000000000000000C                    (1/36)109 PWORK    DC    PL8'0'
000069 00420000                            (1/37)110 WTOMSG   DC    AL2(WTOEND-*,0)
00006D C4C5D4D6E5E2C5F1                    (1/38)111          DC    C'DEMOVSE1 COMRG
JOBDATE '
000084 D4D461C4C461E8E8                    (1/39)112 JOBDATE  DC    C'MM/DD/YY'
00008C 4040C7C5E3C9D4C5                    (1/40)113          DC    C'  GETIME CURRENT
TIME'
0000A1 4040C8C87AD4D47A                    (1/41)114 TIME     DC    C'  HH:MM:SS'
0000AB                  0000AB             (1/42)115 WTOEND   EQU   *
0000AB 402021207A20207A                    (1/43)116 TIMEMASK DC    C'
',X'202120',C':',X'2020',C':',X'2020' HH:MM:SS
000000                                     (1/44)117 IHACOMRG      DSECT
000000                                     (1/45)118 COMRG_JOBDATE DS    CL8            0
8 MM/DD/YY (SET IF TIMING)
000008                                     (1/46)119 COMRG_RESV1   DS    XL4            8
4 RESERVED
00000C                                     (1/47)120 COMRG_COMUSCR DS    XL11          12
11 USER AREA (ZERO'D)
000017                                     (1/48)121 COMRG_UPSI    DS    B             23
1 SWITCH BITS
000018                                     (1/49)122 COMRG_COMNAME DS    CL8           24
8 JOBNAME (SET TO PGMNAME)
000020                                     (1/50)123 COMRG_PPEND   DS    A             32
4 ADDR HIGH PGM
000024                                     (1/51)124 COMRG_HTPHAS  DS    A             36
4 ADDR HIGH LAST PH
000028                                     (1/52)125 COMRG_HTPROG  DS    A             40
4 ADDR HIGH MAX  PH ID4
00002C                                     (1/53)126 COMRG_LABLEN  DS    H             44
2 LENGTH OF LABEL
00002E                                     (1/54)127 COMRG_RESV2   DS    XL2           46
2 RESERVERD LENGTH ?????
000030                                     (1/55)128 COMRG_IJBHPHLA DS   A             48
4 ADDR HIGH MAX  PH ANY
000034                                     (1/56)129 * MZ390I total MLC/MAC loaded  = 295
000034                                     (1/56)130 * MZ390I total BAL output lines= 125
000034                                     (1/56)131 * MZ390I total BAL instructions= 22
000034                                     (1/56)132 * MZ390I total macros          = 7
000034                                     (1/56)133 * MZ390I total macro loads     = 7
000034                                     (1/56)134 * MZ390I total macro calls     = 7
000034                                     (1/56)135 * MZ390I total global set names= 42
000034                                     (1/56)136 * MZ390I tot global seta cells = 3
000034                                     (1/56)137 * MZ390I tot global setb cells = 3
000034                                     (1/56)138 * MZ390I tot global setc cells = 36
000034                                     (1/56)139 * MZ390I max local pos parms   = 6
000034                                     (1/56)140 * MZ390I max local key parms   = 10
000034                                     (1/56)141 * MZ390I max local set names   = 15
```

```
000034                                  (1/56)142 * MZ390I max local seta cells  = 6
000034                                  (1/56)143 * MZ390I max local setb cells  = 0
000034                                  (1/56)144 * MZ390I max local setc cells  = 9
000034                                  (1/56)145 * MZ390I total array expansions= 0
000034                                  (1/56)146 * MZ390I total Keys            =
1117
000034                                  (1/56)147 * MZ390I Key searches          =
1776
000034                                  (1/56)148 * MZ390I Key avg comps         = 0
000034                                  (1/56)149 * MZ390I Key max comps         = 3
000034                                  (1/56)150 * MZ390I total macro line exec = 166
000034                                  (1/56)151 * MZ390I total pcode line exec = 3
000034                                  (1/56)152 * MZ390I total pcode line gen. = 29
000034                                  (1/56)153 * MZ390I total pcode line reuse= 0
000034                                  (1/56)154 * MZ390I total pcode op   gen. = 112
000034                                  (1/56)155 * MZ390I total pcode op   exec = 10
000034                                  (1/56)156 * MZ390I total pcode gen  opt  = 41
000034                                  (1/56)157 * MZ390I total pcode exec opt  = 0
000034                                  (1/56)158 * MZ390I total milliseconds    = 532
000034                                  (1/56)159 * MZ390I instructions/second   = 312
000034                                  (1/56)160 * MZ390I FID=  1 ERR= 0
vse\demo\DEMOVSE1.MLC
000034                                  (1/56)161 * MZ390I FID=  2 ERR= 0 mac\WTO.MAC
000034                                  (1/56)162 * MZ390I FID=  3 ERR= 0
vse\mac\COMRG.MAC
000034                                  (1/56)163 * MZ390I FID=  4 ERR= 0
mac\ZCVTD.MAC
000034                                  (1/56)164 * MZ390I FID=  5 ERR= 0
vse\mac\GETIME.MAC
000034                                  (1/56)165 * MZ390I FID=  6 ERR= 0 mac\TIME.MAC
000034                                  (1/56)166 * MZ390I FID=  7 ERR= 0
vse\mac\EOJ.MAC
000034                                  (1/56)167          END

Symbol Table Listing

 SYM=COMRG_COMNAME LOC=00000018 LEN=00000008 ESD=0003 TYPE=REL  XREF=122
 SYM=COMRG_COMUSCR LOC=0000000C LEN=0000000B ESD=0003 TYPE=REL  XREF=120
 SYM=COMRG_HTPHAS LOC=00000024 LEN=00000004 ESD=0003 TYPE=REL  XREF=124
 SYM=COMRG_HTPROG LOC=00000028 LEN=00000004 ESD=0003 TYPE=REL  XREF=125
 SYM=COMRG_IJBHPHLA LOC=00000030 LEN=00000004 ESD=0003 TYPE=REL  XREF=128
 SYM=COMRG_JOBDATE LOC=00000000 LEN=00000008 ESD=0003 TYPE=REL  XREF=118 85
 SYM=COMRG_LABLEN LOC=0000002C LEN=00000002 ESD=0003 TYPE=REL  XREF=126
 SYM=COMRG_PPEND LOC=00000020 LEN=00000004 ESD=0003 TYPE=REL  XREF=123
 SYM=COMRG_RESV1 LOC=00000008 LEN=00000004 ESD=0003 TYPE=REL  XREF=119
 SYM=COMRG_RESV2 LOC=0000002E LEN=00000002 ESD=0003 TYPE=REL  XREF=127
 SYM=COMRG_UPSI LOC=00000017 LEN=00000001 ESD=0003 TYPE=REL  XREF=121
 SYM=DEMOVSE1 LOC=00000000 LEN=000000B8 ESD=0001 TYPE=CST  XREF=22 81
 SYM=IHACOMRG LOC=00000000 LEN=00000038 ESD=0003 TYPE=DST  XREF=117 84
 SYM=IHAZCVT  LOC=00000000 LEN=00008000 ESD=0002 TYPE=DST  XREF=40 34 41 43 45 47
  49 51 53 55 57 59 61 63 65 67 80
 SYM=JOBDATE  LOC=00000084 LEN=00000008 ESD=0001 TYPE=REL  XREF=112 85
 SYM=PWORK    LOC=00000061 LEN=00000008 ESD=0001 TYPE=REL  XREF=109 97 99
 SYM=TIME     LOC=000000A1 LEN=0000000A ESD=0001 TYPE=REL  XREF=114 98 99
 SYM=TIMEMASK LOC=000000AB LEN=00000001 ESD=0001 TYPE=REL  XREF=116 98
 SYM=WTO#1_EOT LOC=0000001E LEN=00000001 ESD=0001 TYPE=REL  XREF=28 26 27
 SYM=WTOEND   LOC=000000AB LEN=00000001 ESD=0001 TYPE=REL  XREF=115 110
 SYM=WTOMSG   LOC=00000069 LEN=00000002 ESD=0001 TYPE=REL  XREF=110 101
 SYM=ZCVT     LOC=00002000 LEN=00000001 ESD=0000 TYPE=ABS  XREF=39 33
 SYM=ZCVTCAP  LOC=00000024 LEN=00000004 ESD=0002 TYPE=REL  XREF=56
 SYM=ZCVTEIBP LOC=00000020 LEN=00000004 ESD=0002 TYPE=REL  XREF=54
 SYM=ZCVTEND  LOC=00008000 LEN=00000004 ESD=0002 TYPE=REL  XREF=80
 SYM=ZCVTEPIE LOC=00000400 LEN=00000100 ESD=0002 TYPE=REL  XREF=64
 SYM=ZCVTESTA LOC=00000500 LEN=00000100 ESD=0002 TYPE=REL  XREF=66
 SYM=ZCVTEXIT LOC=00000018 LEN=00000002 ESD=0002 TYPE=REL  XREF=50
 SYM=ZCVTFQ24 LOC=00000010 LEN=00000004 ESD=0002 TYPE=REL  XREF=46
 SYM=ZCVTFQ31 LOC=00000014 LEN=00000004 ESD=0002 TYPE=REL  XREF=48
 SYM=ZCVTGECB LOC=0000001C LEN=00000004 ESD=0002 TYPE=REL  XREF=52
 SYM=ZCVTIPLP LOC=00000008 LEN=00000008 ESD=0002 TYPE=REL  XREF=44
 SYM=ZCVTPARM LOC=00000300 LEN=00000100 ESD=0002 TYPE=REL  XREF=62
 SYM=ZCVTSAV2 LOC=00000200 LEN=00000004 ESD=0002 TYPE=REL  XREF=60
```

```
 SYM=ZCVTSAVE LOC=00000100 LEN=00000004 ESD=0002 TYPE=REL  XREF=58
 SYM=ZCVTUPGM LOC=00000000 LEN=00000008 ESD=0002 TYPE=REL  XREF=42
 SYM=ZCVT_COMRG LOC=00000600 LEN=00000400 ESD=0002 TYPE=REL  XREF=68 35
 SYM=ZCVT_COMRG_COMNAME LOC=00000A18 LEN=00000008 ESD=0002 TYPE=REL  XREF=73
 SYM=ZCVT_COMRG_COMUSCR LOC=00000A0C LEN=0000000B ESD=0002 TYPE=REL  XREF=71
 SYM=ZCVT_COMRG_HTPHAS LOC=00000A24 LEN=00000004 ESD=0002 TYPE=REL  XREF=75
 SYM=ZCVT_COMRG_HTPROG LOC=00000A28 LEN=00000004 ESD=0002 TYPE=REL  XREF=76
 SYM=ZCVT_COMRG_IJBHPHLA LOC=00000A30 LEN=00000004 ESD=0002 TYPE=REL  XREF=79
 SYM=ZCVT_COMRG_JOBDATE LOC=00000A00 LEN=00000008 ESD=0002 TYPE=REL  XREF=69
 SYM=ZCVT_COMRG_LABLEN LOC=00000A2C LEN=00000002 ESD=0002 TYPE=REL  XREF=77
 SYM=ZCVT_COMRG_PPEND LOC=00000A20 LEN=00000004 ESD=0002 TYPE=REL  XREF=74
 SYM=ZCVT_COMRG_RESV1 LOC=00000A08 LEN=00000004 ESD=0002 TYPE=REL  XREF=70
 SYM=ZCVT_COMRG_RESV2 LOC=00000A2E LEN=00000002 ESD=0002 TYPE=REL  XREF=78
 SYM=ZCVT_COMRG_UPSI LOC=00000A17 LEN=00000001 ESD=0002 TYPE=REL  XREF=72

Literal Table Listing

 LIT=X'C0'    LOC=00000060 LEN=00000001 ESD=0001 POOL=0001 XREF=94

AZ390I BAL lines             = 163
AZ390I symbols               = 48
AZ390I Literals              = 1
AZ390I alloc passes          = 3
AZ390I Keys                  = 977
AZ390I Key searches          = 1988
AZ390I Key avg comps         = 0
AZ390I Key max comps         = 3
AZ390I ESD symbols           = 3
AZ390I object bytes          = 175
AZ390I object rlds           = 0
AZ390I total seconds         = 0
AZ390I total mnote warnings = 0
AZ390I total mnote errors   = 0  max level= 0
AZ390I total errors         = 0
AZ390I total errors         = 0
AZ390I return code(DEMOVSE1)= 0
```

Appendix III: VSE application execution log DEMOVSE1.LOG

```
EZ390I V1.3.02b Current Date 03/13/07 Time 04:49:32
EZ390I Copyright 2006 Automated Software Tools Corporation
EZ390I z390 is licensed under GNU General Public License
EZ390I program = DEMOVSE1
EZ390I options = sysmac(vse\mac+mac) amode24 trace
DEMOVSE1 HELLO WORLD
DEMOVSE1 COMRG JOBDATE 03/13/07  GETIME CURRENT TIME   4:49:32
EZ390I Stats total instructions    = 18
EZ390I Stats current date 03/13/07 time 04:49:32
EZ390I Stats total seconds         = 0
EZ390I Stats instructions/sec      = 375
EZ390I total errors         = 0
EZ390I return code(DEMOVSE1)= 0
```

Appendix IV: VSE application execution trace DEMOVSE1.TRE

```
EZ390I EZ390I V1.3.02b Current Date 03/13/07 Time 04:49:32
EZ390I EZ390I Copyright 2006 Automated Software Tools Corporation
EZ390I EZ390I z390 is licensed under GNU General Public License
EZ390I EZ390I program = DEMOVSE1
EZ390I EZ390I options = sysmac(vse\mac+mac) amode24 trace

 000FFF48 0 05C0         BALR  RC=00000000 R0=000FFF48
 000FFF4A 0 A715000E     BRAS  R1=00002300 S2(000FFF66)=0A23 SVC

 000FFF66 0 0A23         SVC   I1=23 WTO
R1=ADDR(AL2(LEN),AL2(FLAGS),C'MSG')
EZ390I DEMOVSE1 HELLO WORLD
 000FFF68 0 A7182000     LHI   R1=000FFF4E I2=2000
 000FFF6C 0 41101600     LA    R1=00002000 S2(00002600)
 000FFF70 0 D207C0821000 MVC   S1(000FFFCC)=D4D461C4C461E8E8
S2(00002600)=F0F361F1F361F0F7
 000FFF76 0 41000000     LA    R0=000FFF48 S2(00000000)
 000FFF7A 0 0A0B         SVC   I1=0B TIME R0 LH=DATETYPE, R0
LL=TIMETYPE, R1=ADDR
 000FFF7C 0 1810         LR    R1=0107072F R0=04493214
 000FFF7E 0 4310C05E     IC    R1=04493214 S2(000FFFA8)=C0
 000FFF82 0 88100004     SRL   R1=044932C0 S2(00000004)
 000FFF86 0 5010C063     ST    R1=0044932C S2(000FFFAD)=0000000C
 000FFF8A 0 D209C09FC0A9 MVC   S1(000FFFE9)=4040C8C87AD4D47AE2E2
S2(000FFFF3)=402021207A20207A2020
 000FFF90 0 DE09C09FC063 ED    S1(000FFFE9)=402021207A20207A2020
S2(000FFFAD)=0044932C00420000C4C5
 000FFF96 2 4110C067     LA    R1=0044932C S2(000FFFB1)
 000FFF9A 2 0A23         SVC   I1=23 WTO
R1=ADDR(AL2(LEN),AL2(FLAGS),C'MSG')
EZ390I DEMOVSE1 COMRG JOBDATE 03/13/07  GETIME CURRENT TIME   4:49:32
 000FFF9C 2 41F00000     LA    RF=00000000 S2(00000000)
 000FFFA0 2 0A03         SVC   I1=03 EXIT
EZ390I EZ390I Stats total instructions    = 18
EZ390I Stats Keys                  = 1715
EZ390I Stats Key searches          = 21
EZ390I Stats Key avg comps         = 1
EZ390I Stats Key max comps         = 2
EZ390I EZ390I Stats current date 03/13/07 time 04:49:32
EZ390I EZ390I Stats total seconds         = 0
EZ390I EZ390I Stats instructions/sec      = 375
EZ390I EZ390I total errors         = 0
EZ390I EZ390I return code(DEMOVSE1)= 0
```