

Advanced Macros

Prepared by



International SAS® Training and Consulting

Destiny Corporation - 1321 Silas Deane Highway #A - Wethersfield, CT 06109-4302

Phone: (860) 721-1684 - 1-800-7TRAINING - Fax: (860) 721-9784

Email: destinycorp@compuserve.com Web: www.destinycorp.com

Call SYMPUT

Of all the macro - data step interfacing functions and routines, the Call SYMPUT call routine is undoubtedly the most important and most useful of all. With Call SYMPUT we have yet another way of creating a macro variable and giving it a value, but this time from within data step execution.

Remember, this is a data step routine; like SYMGET, it cannot be used anywhere other than in a data step.

The general form is:

```
call symput(argument1,argument2);
```

Source

Target

Source or Target may be:

- Literal String (i.e. enclosed in quotes)
- Data Step Variables
- Data Step Expressions

Syntax

- argument1 is the target - the macro variable to be created. It can either be a literal value enclosed in quotes, or a data step variable, or a data step expression - particularly useful for creating a series of macro variables.

```
call symput('mvar1',argument2);  
  
call symput(dsvar,argument2);  
  
call symput('mvar'||left(_n_),argument2);
```

- argument2 is the value given to argument1. Again, argument2 can be a literal string, a data step variable or a data step expression.

```
call symput(argument1,'literal');  
  
call symput(argument1,datavar);  
  
call symput(argument1,put(date,worddate18.));
```

Combinations of Form

PROGRAM EDITOR

```
data work1;  
  var1 = 'value1';  
  var2 = 'value2';  
  call symput('mvar1','newvalue');    /*Example 1*/  
  call symput('mvar2',var1);           /*Example 2*/  
  call symput(var1,var2);               /*Example 3*/  
  call symput(var1,'newvalue');        /*Example 4*/  
run;
```

In Example 1, the macro variable is called `mvar1` and the value it takes is `newvalue`.

In Example 2, the macro variable is called `mvar2` and the value it takes is `value1`.

In Example 3, the macro variable is called `value1` and the value it takes is `value2`.

In Example 4, the macro variable is called `value1` and the value it takes is `newvalue`.

Of these forms, the most common is the one shown in example 2 above, where the macro variable name is programmer-defined, but the value it takes comes from the data, often in combination with some justification or formatting function.

Questions

(a) which symbol table does the macro variable go in?

Most macro variables created in this way by the use of Call SYMPUT are placed in the global table. However, the variable will be placed in the nearest symbol table in the current referencing environment of the data step, providing that symbol table is not empty. If it is empty, it will be placed in the symbol table higher, providing that is not empty and so on.

(b) when is the macro variable available for use?

The most common mistake with the use of Call SYMPUT is to forget that the macro variable is *only available after the data step completes execution!*

(c) how does Call SYMPUT format character values?

The default format is \$w. where w is the width of the variable. Hence trailing blanks may be transferred also. Avoid this by the use of the trim function with the second argument:

```
call symput('mvar1',trim(datavar));
```

(d) how does Call SYMPUT format numeric values?

The default format is BEST12. with the number being right justified. You may need to use the left function to get your desired result:

```
call symput('mvar1',left(datavar));
```

Example 1 - Data Dependent Titles

PROGRAM EDITOR

```
/* -----  
  Call SYMPUT Example 1.  
  Create a data dependent title.  
-----*/  
proc means data=saved.demograf noprint mean;  
  var age;  
  output out=average mean=avage;  
run;  
data _null_;  
  set average;  
  call symput('meanage',left(put(avage,2.)));  
run;  
proc print data =saved.demograf;  
  title "Average age of trial sample is &meanage";  
run;
```

The MEANS procedure produces a one-variable (avage), one-observation data set (average). The DATA _NULL_ step produces no output SAS data set, but is simply a vehicle for getting an independently executable step that will transfer the value of avage into a macro variable meanage. This, of course, will go into the global symbol table. Once the DATA _NULL_ step has completed, the macro variable is available for use, and is simply used in a usual TITLE statement. The output produced is:

OUTPUT

Average age of trial sample is 33						
OBS	AGE	GENDER	SALARY	STATUS	CHILDREN	CARS
1	29	F	8000	D	2	1
2	25	M	10000	D	2	1
3	44	M	10000	D	3	1

Example 2 - Triggering a PROC based on a data step value

PROGRAM EDITOR

```
/* -----  
  Call SYMPUT Example 2.  
  Triggering a PROC based on a data step value  
-----*/  
options mprint;  
%macro archive;  
  %if &append ^=0 %then %do;  
    proc append base=arch data=oldrecs;  
    run;  
  %end;  
  %else %put No archiving to be done;  
%mend archive;  
data new;  
  input @1 date date7. reading1 reading2;  
  cards;  
01sep91 102 150  
19aug91 98 143  
05MAY90 98 142  
07MAY90 90 140  
21aug91 88 135  
11MAY90 84 134  
run;  
data oldrecs;  
  set new;  
  if today() -date > 30 then output oldrecs;  
run;  
data _null_;  
  if 0 then set oldrecs nobs=numobs;  
  call symput('append',left(numobs));  
  stop;  
run;  
%archive
```

MPRINT has been turned on to show the statement generated in the Log. The idea is to archive observations more than 30 days old. This example could be adapted to any dynamic file (say one under FSEDIT control) where it was important to get rid of old observations into some archive or backup file. The logic behind this routine is:

Create a data set of those observations
more than 30 days old (oldrecs)

Determine the number of observations
in oldrecs and pass the value to the
macro variable append.

In the macro execution test the value
of append. Only if non-zero run the
Append Procedure.

Again a DATA _NULL_ step has been used to create the macro variable with Call SYMPUT.

The line:

```
if 0 then set oldrecs nobs=numobs;
```

uses the fact that the variable assigned to the nobs option is given its value at data step compile time. Therefore numobs holds the number of observations in the data set oldrecs without having to read an observation from it. Hence the dummy negative condition if 0. The stop is necessary. The normal way of terminating a data step is to reach an end-of-file marker on a raw data file or a SAS data set; if this is not present a STOP stops the data step trying to loop.

However, the whole point of the example is to test the number of observations in oldrecs. Only when this is greater than zero is the PROC APPEND step generated.

Here is the log from this job (run 19APR96):

LOG

```
70  /* -----  
71  Call SYMPUT Example 2.  
72  Triggering a PROC based on a data step value  
73  -----*/  
74  options mprint;  
75  %macro archive;  
76    %if &append ^=0 %then %do;  
77      proc append base=arch data=oldrecs;  
78      run;  
79    %end;  
80    %else %put No archiving to be done;  
81  %mend archive;  
82  data new;  
83    input @1 date date7. reading1 reading2;  
84    cards;
```

NOTE: The data set WORK.NEW has 6 observations and 3 variables.
NOTE: The DATA statement used 0.38 seconds.

```
91  run;  
92  data oldrecs;  
93    set new;  
94    if today() -date > 30 then output oldrecs;  
95  run;
```

NOTE: The data set WORK.OLDRECS has 6 observations and 3 variables.
NOTE: The DATA statement used 0.44 seconds.

```
96  data _null_;  
97    if 0 then set oldrecs nobs=numobs;  
98    call symput('append',left(numobs));  
99    stop;  
100 run;
```

NOTE: Numeric values have been converted to character
values at the places given by: (Line):(Column).
98:30
NOTE: The DATA statement used 0.16 seconds.

```
101 %archive  
MPRINT(ARCHIVE):  PROC APPEND BASE=ARCH DATA=OLDRECS;  
MPRINT(ARCHIVE):  RUN;
```

NOTE: Appending WORK.OLDRECS to WORK.ARCH.
NOTE: BASE data set does not exist.
DATA file is being copied to BASE file.
NOTE: The data set WORK.ARCH has 6 observations and 3 variables.
NOTE: The PROCEDURE APPEND used 0.27 seconds.

Example 3 - Splitting a data set.

Consider the following extract from the data set SASUSER.BP1, concerning blood pressure measurements taken on various patients at various relative days over the course of a drug trial:

PATIENT	TREATMNT	DAY	SUPSYS	SUPDIA	SUPPUL	STDSYS	STDDIA	STDPUL
203	DRUG B	-29	178	112	75	188	115	78
203	DRUG B	-14	168	109	72	147	107	84
203	DRUG B	0	154	95	60	149	108	69
203	DRUG B	14	164	101	56	142	98	60
203	DRUG B	28	160	100	54	185	103	54
203	DRUG B	42	137	92	51	143	91	60
203	DRUG B	56	157	92	60	170	116	60
203	DRUG B	84	170	100	58	170	100	60
203	DRUG B	110	177	100	56	180	103	58
203	DRUG B	140	160	97	66	161	103	66
204	DRUG A	-29	233	110	84	233	110	90
204	DRUG A	-14	209	100	84	214	103	78
204	DRUG A	0	211	91	72	209	89	72
204	DRUG A	14	215	87	66	224	92	72
204	DRUG A	28	180	85	75	205	93	84
204	DRUG A	42	159	80	60	155	84	78

....and many more to 69 patients.

Suppose we wish to take a data set such as SASUSER.BP1 which has multiple observations per patient, and construct a data set for each patient - to split up the data set by each patient for others to do separate analyses for individual patients.

To do this in normal open code would require a data step of the form:

PROGRAM EDITOR

```
data pat203 pat204 pat205....;
  set saved.bp1;
    if patient=203 then output pat203;
  else if patient=204 then output pat204;
  .
  .
run;
```

The problems here are:

- The number of output data sets can vary
- The patient variable is numeric, so a character prefix is required for the output data set name
- The first IF statement is plain, all the others need an 'ELSE'

PROGRAM EDITOR

```
/* -----  
  Call SYMPUT Example 3.  
  Splitting a data set.  
-----*/  
%macro split(inputds,byvar,prefix);  
  proc freq data=&inputds;  
    tables &byvar / noprint out=numbys(keep=&byvar);  
  run;  
  data _null_;  
    set numbys end=eof;  
    call symput('mvar'||left(put(_n_,2.)),  
      left(put(&byvar,3.)));  
    if eof then call symput('numobs',put(_n_,2.));  
  run;  
  data  
    %do i = 1 %to &numobs;  
      &prefix&&mvar&i  
    %end;  
  ;  
  set &inputds;  
  %let else=;  
  %do i= 1 %to &numobs;  
    &else if &byvar=&&mvar&i then  
      output &prefix&&mvar&i;  
    %let else=else;  
  %end;  
run;  
%mend split;  
%split(saved.bp1,patient,ds)
```

Note the parameters are:

- the input data set
- the variable to be used for the split
- the prefix to the output data set names

The output from the original PROC FREQ step gives one observation per value of &byvar.

OUTPUT

OBS	PATIENT
1	203
2	204
	...etc
68	302
69	303

The DATA _NULL_ step creates multiple macro variables, one per each observation of the output data set from the PROC FREQ step. The second Call SYMPUT gives a macro variable containing the number of observations in the data set, so as to give a variable ceiling to the subsequent loops.

Global Symbol Table

Variable	Value
mvar1	203
mvar2	204
mvar3	206
etc to...	
mvar67	301
mvar68	302
mvar69	303
numobs	69

Because the number of observations is variable, the number of macro variables generated is variable, and indirect reference to them must be used.

Note that the first %DO loop generates a variable DATA statement, the second generates the IF..THEN..ELSE statements, omitting the ELSE from the first one.

Creating a Macro Variable from Proc SQL

Another way of creating and passing a value to a macro variable is via a query in Proc SQL. The result of the query must be one value to be assigned to the macro variable:

PROGRAM EDITOR

```
proc sql;
  select avg(salary)
    into :mvar1
    from saved.demograf;
quit;
title "Average salary of the sample is &mvar1";
```

As each Proc SQL statement executes separately, the macro variable (here called mvar1) created is available for immediate use.