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USERS PROGRAM

International Dates and Times: Around the World with SAS[®]

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#SASGF

International Dates and Times: Around the World with SAS®

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Abstract

Data is global. Language, characters, customs, and conventions change across borders, virtual and physical. SAS® has met this 21st century challenge with National Language Support (NLS). When it comes to date and time data, SAS is fully compliant with the ISO 8601 standard for dates and times. The LOCALE option interacts with formats and informats to meet any storage and reporting needs without the need for extensive programming. This paper provides an overview of the standard and the NLS capabilities within SAS to help users with their global data.

What is ISO 8601?

It is an internationally accepted methodology to describe dates and times using numbers to facilitate the exchange of data, particularly between international parties. The standard removes the issue of translating month names (15 lip 2018), and defines the order of date and time elements to remove confusion due to local norms. For example, "03-08-16" can be translated as 3 possible dates: March 8, 2016 (assuming the date is in the 21st century); August 16, 2003, or even August 3, 2016, and it depends on the cultural norms of the date's location. The complete standard (available from <http://www.iso.org/iso/home.html>) covers the following:

- Date
- Time of day
- Coordinated universal time (UTC)
- Local time with offset to UTC
- Date and time
- Time intervals
- Recurring time intervals

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National Language Support and Date Formats

SAS provides built-in date and time formats in multiple languages as a part of its National Language Support (NLS). NLS uses the LOCALE= and the DFLANG= options to determine the appropriate language to display in a given format. Changing your date display only requires a version of SAS that supports the character set of your output, the LOCALE= or DFLANG= option, and an NLS date or datetime format.

Some common NLS date formats are:

Format Name	Description
NLDATEw.	Displays the date as month name, day, and year in local format. SAS will use DATE. in local format or abbreviate the month name if necessary.
NLDATELw.	Displays the date as month name, day, and year in local format. SAS will abbreviate month name or use only numbers and delimiters if necessary.
NLDATEMDLw.	Displays the full month name and day (no year) from a date value in local format. SAS will abbreviate the month name or use only numbers and delimiters for the month and day if necessary.
NLDATEMNw.	Displays the month name from a date value in local format. SAS will abbreviate the month name if necessary.
NLDATEWw.	Displays a date value as day of the week and date in local format. SAS will abbreviate day-of-week, and/or month name if necessary.
NLDATEWNw.	Displays a date value as the day of the week in local format. SAS will abbreviate if necessary.
NLDATEYMLw.	Displays a date value as the full month name and the year in local format. SAS will abbreviate the month name or use only numbers and delimiters for the month and year and/or a 2-digit year if necessary.
NLDATEYMMw.	Displays a date value as the local abbreviation for month name and the year.
NLDATEYQLw.	Displays a date value as the full length for the calendar quarter and the year (for example, "3e trimestre 2014"). SAS will abbreviate as necessary.

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International Dates

This table was generated using the Unicode version of SAS, the LOCALE= option shown in each row, and the NLS date format at the top of each column.

LOCALE= Option (POSIX value)	Language	Using the NLDATE. Format PUT('10APR2018'd,NLDATE.)	Using the NLDATEW. Format PUT('10APR2018'd,NLDATEW.)	Using the NLDATES. Format PUT('10APR2018'd,NLDATES.)	Using the NLDATEYQL. Format PUT('10APR2018'd,NLDATEYQL.)
en_US	English (US)	April 10, 2018	Tuesday, April 10, 2018	04/10/2018	2nd quarter 2018
en_GB	English (GB)	10 April 2018	Tuesday, 10 April 2018	10/04/2018	2nd quarter 2018
da_DK	Danish	10. april 2018	tirsdag den 10. april 2018	10/04/2018	2. kvartal 2018
de_DE	German (Germany)	10. April 2018	Dienstag, 10. April 2018	10.04.2018	2. Quartal 2018
es_ES	Spanish (Spain)	10 de abril de 2018	martes, 10 de abril de 2018	10/04/2018	2º trimestre 2018
fr_FR	French (France)	10 avril 2018	mardi 10 avril 2018	10/04/2018	2e trimestre 2018
he_IL	Hebrew	10 אפריל 2018	יום שלישי, 10 באפריל 2018	10/04/2018	רבעון 2 2018
hi_IN	Hindi	10 अप्रैल 2018	मंगलवार, 10 अप्रैल 2018	10-04-2018	दूसरी तिमाही 2018
it_IT	Italian (Italy)	10 aprile 2018	martedì 10 aprile 2018	10/04/2018	2o trimestre 2018
pl_PL	Polish	10 kwietnia 2018	wtorek, 10 kwietnia 2018	10.04.2018	2018 II kwartał
ru_RU	Russian (Russia)	10 апреля 2018 г.	вторник, 10 апреля 2018 г.	10.04.2018	2-й квартал 2018
sv_SE	Swedish	den 10 april 2018	tisdagen den 10:e april 2018	2018-04-10	2018 2:a kvartalet
zh_CN	Chinese (China)	2018年04月10日	2018年4月10日 星期二	2018-04-10	2018年第2季度
zh_SG	Chinese (Singapore)	2018年04月10日	2018年4月10日 星期二	10/04/2018	2018年第2季度

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International Times and Datetimes

By default, time in SAS is local to the server on which it is executing. The NLS option to set the time zone of the server is the TIMEZONE= option. You can specify time zone either by name (e.g., GMT, EDT, IST) or by time zone ID (e.g., 'Europe/London', 'America/NewYork', 'Asia/Calcutta'.) Since time zone names can represent multiple time zones (e.g., "IST" can be "India Standard Time", or "Israel Standard Time" (among others) depending on the LOCALE= setting in effect,) using the time zone ID will improve the clarity of your code.

The TIMEZONE= option does not adjust output. As per ISO 8601 guidelines, all time is relative to Coordinated Universal Time (UTC), which is equivalent to GMT. The TIMEZONE= option affects the SAS server time settings; therefore it will only affect:

- Times that are recorded in logs and events.
- Creation and modification time stamps on SAS data sets
- The DATE(), DATETIME(), TIME() and TODAY() functions
- Any formats incorporating time zone

It will not affect the actual time in the output. See how the time zone offset to GMT changes with the TIMEZONE= option in the table below, but not the time itself.

Reference datetime is April 10, 2018, 9:00 PM GMT (3 PM Mountain Standard Time)		
TIMEZONE= option value	Using the NLDATMAP. format	Using the NLDATMWZ. format
America/Denver	April 10, 2018 09:00:00 PM	Tuesday, April 10, 2018 09:00:00 PM -0600
Africa/Casablanca	April 10, 2018 09:00:00 PM	Tuesday, April 10, 2018 09:00:00 PM +0000
Asia/Phnom_Penh	April 10, 2018 09:00:00 PM	Tuesday, April 10, 2018 09:00:00 PM +0700
Atlantic/Azores	April 10, 2018 09:00:00 PM	Tuesday, April 10, 2018 09:00:00 PM +0000
Australia/Darwin	April 10, 2018 09:00:00 PM	Tuesday, April 10, 2018 09:00:00 PM +0930
Europe/Brussels	April 10, 2018 09:00:00 PM	Tuesday, April 10, 2018 09:00:00 PM +0200
Indian/Mayotte	April 10, 2018 09:00:00 PM	Tuesday, April 10, 2018 09:00:00 PM +0300
Pacific/Wake	April 10, 2018 09:00:00 PM	Tuesday, April 10, 2018 09:00:00 PM +1200

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More National Language Support (NLS) Date/Time/Datetime Functionality

In addition to the wide range of SAS date, time, and datetime functions that work on the corresponding SAS values, NLS provides additional functions. There are several functions related to time zone, including TZONES2U(), which will convert a SAS datetime value (based on the TIMEZONE= option) and convert it to Coordinated Universal Time (UTC). If you need to create custom date, time or datetime strings, creating a picture format will work, as the date directives are NLS-enabled and will produce output according to the LOCALE= or the DFLANG= options. NLS also provides the NLDATE(), NLTIME(), and NLDATM() functions, which produce date strings according to the LOCALE= and DFLANG= options in effect. These functions use their own descriptors instead of the standard date and time descriptors used with the PICTURE statement.

Other Methods

The pre-NLS formats for non-English dates and times still work. These can be affected by the DFLANG= option, or you can specify any one of twenty-one languages to override the DLANG= option in effect. This is also useful for producing date output across multiple columns.

Base SAS also provides non-NLS formats to output SAS dates in Hebrew, as well as converting a SAS date for output according to the Jewish calendar. In addition, you may also use Minguo and Nengo formats for Taiwanese and Japanese.

However, these formats are language-specific, and will not change with the DFLANG= or the LOCALE= options.

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Conclusion

The whole point of NLS formats and informats is to remove concerns about the specific language that will be using the format or informat. The LOCALE= system option will take care of it. In this way, the same SAS code can be used to create output in the appropriate language as long as the LOCALE= system option is correctly set. This is especially useful when the same SAS code is used on multiple servers in multiple locations.

It is important to understand that NLS formats and informats work just as well with the English language as with any other language, so there's no need to use SAS program code beyond the LOCALE= option to switch between English language formats/informats and those in other languages, unless you need a specific format that does not have an NLS equivalent. If you are working with one specific language, you may be able to use language-specific date formats instead of adjusting the system settings of LOCALE and DFLANG. The disadvantage is that those languages are hard-coded, and changing language will require changing the format name in the code.

Time is always local to the SAS server, but you can specify the time zone of the SAS session using the TIMEZONE= system option. However, when reporting times and datetimes, remember ISO 8601 compliance dictates that time is always relative to Coordinated Universal Time (UTC). Using formats that display time and take into account time zone will display time as time at UTC and the offset of the time zone to UTC.

Recommended Reading

- SAS® 9.4 National Language Support (NLS): Reference Guide
- SAS 9.4 Formats and Informats: Reference

References

Morgan, Derek P. 2014. *The Essential Guide to SAS® Dates and Times, Second Edition*. Cary, NC: SAS Institute Inc.



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ABSTRACT

Data is global. Language, characters, customs, and conventions change across borders, virtual and physical. SAS® has met this 21st century challenge with National Language Support (NLS). The LOCALE and DFLANG options interact with formats and informats to meet any storage and reporting needs without the need for extensive programming. This paper provides an overview of the standard and the NLS capabilities within SAS to help users with their global data.

INTRODUCTION

The ISO 8601 standard requires only numbers and delimiters for date, time, and datetime values. While this is an unambiguous way to communicate this information, reporting them often requires text. "April 10, 2018" looks better in a report than "2018-04-10", even though both represent the same data. What do you do with your date and time data if you have to create a report in more than one language? It is simple to swap languages in SAS: first, you must have access to a version of SAS that supports the characters of the language(s) you need. The NLS formats, and the LOCALE= and/or DFLANG= options can take care of the rest. All the SAS output in this program was generated using Windows SAS 9.4 with Unicode support and nothing more than BASE SAS.

Although this paper focuses on writing dates and times in languages other than English, there are similar ways to read date and time data from other languages. The NLS documentation contains a great deal of information on converting dates, times, and datetimes to and from languages other than English.

WHAT IS ISO 8601?

It is an internationally accepted methodology to describe dates and times using numbers to facilitate the exchange of data, particularly between international parties. The standard removes the issue of translating month names (15 lip 2018), and defines the order of date and time elements to remove confusion due to local norms. For example, "03-08-16" can be translated as three possible dates: March 8, 2016 (assuming the date is in the 21st century); August 16, 2003, or even August 3, 2016, and it depends on the cultural norms of the date's location. The complete standard (available from <http://www.iso.org/iso/home.html>) covers the following:

- Date
- Time of day
- Coordinated universal time (UTC)
- Local time with offset to UTC
- Date and time
- Time intervals
- Recurring time intervals

NATIONAL LANGUAGE SUPPORT AND DATE FORMATS

SAS provides built-in date and time formats in multiple languages as a part of its National Language Support (NLS). NLS uses the LOCALE= and the DFLANG= options to determine the appropriate language to display in any of these formats. A list of common NLS date formats follows.

Table 1: Common NLS Date Formats:

Format Name	Description
NLDATEw.	Displays the date as month name, day, and year in local format. SAS will use DATE. in local format or abbreviate the month name to fit the format width specified.
NLDATELw.	Displays the date as month name, day, and year in local format. SAS will abbreviate month name or use only numbers and delimiters if necessary.
NLDATEMDLw.	Displays the full month name and day (no year) from a date value in local format. SAS will abbreviate the month name or use only numbers and delimiters for the month and day if the format width cannot accommodate the full month name.
NLDATEMNw.	Displays the month name from a date value in local format. SAS will abbreviate the month name to fit the format width specified.
NLDATESw.	Displays the date in local format using numbers and delimiters only.
NLDATEWw.	Displays a date value as day of the week and date in local format. SAS will abbreviate day-of-week, and/or month name as necessary to fit the format width specified.
NLDATEWNw.	Displays a date value as the day of the week in local format. SAS will abbreviate as necessary.
NLDATEYMLw.	Displays a date value as the full month name and the year in local format. If necessary, SAS will abbreviate to fit the format width specified.
NLDATEYMMw.	Displays a date value as the local abbreviation for month name and the year. SAS will use only numbers and delimiters for the month and year and/or a 2-digit year to fit the format width specified.
NLDATEYQLw.	Displays a date value as the full length for the calendar quarter and the year (for example, "3e trimestre 2014"). A width of 4 always displays a 2-digit year. SAS will abbreviate to fit the format width specified.

As always, check the National Language Support documentation for a complete listing of NLS date formats.

Example 1 demonstrates how easy it is to report dates in a different language:

Example 1: Using the LOCALE= Option

```

OPTIONS LOCALE=Dutch_Netherlands;
DATA nldates;
date = '10APR2018'd;
nldate = STRIP(PUT(date,nldate120.));
nldatew = STRIP(PUT(date,nldatew120.));
nldates = STRIP(PUT(date,nldates120.));
nldateyql = STRIP(PUT(date,nldateyql120.));
RUN;

```

This code will produce Result 1:

Result 1: LOCALE=Dutch_Netherlands

nldate	nldatew	nldates
10 april 2018	dinsdag 10 april 2018	10-04-2018

Alternatively, you could produce the same table in a different language by changing the LOCALE= option. The only difference in the code between Example 1 and Example 2 is the value of the LOCALE= option:

Example 2: Changing Languages without Changing Code

```

OPTIONS LOCALE=Korean_Korea;
DATA nldates;
date = '10APR2018'd;
nldate = STRIP(PUT(date,nldate120.));
nldatew = STRIP(PUT(date,nldatew120.));
nldates = STRIP(PUT(date,nldates120.));
nldateyql = STRIP(PUT(date,nldateyql120.));
RUN;

```

Result 2: LOCALE=Korean_Korea

nldate	nldatew	nldates
2018년 04월 10일	2018년 4월 10일 화요일	2018.04.10

The same Windows SAS session and the same DATA step code produced both results. Only the value of the LOCALE= option changed. There are two ways to specify the value of the LOCALE= option: you can use the SAS name, as used in the previous examples, or POSIX values. Both are given in the NLS documentation.

The complete list of possible values for the LOCALE= option is too long to list here, but can be found in the NLS documentation. It is always good to check the documentation for updates and additional locales. Table 2 shows the POSIX value and corresponding language along with the result of formatting the date “April 10, 2018” with the full date as day of week, month-name, day, and year, and the corresponding quarter using NLS date formats. All date output was formatted to 120 characters to ensure that no abbreviations were performed:

Table 2: Sample LOCALE= Option Values and the Resulting Output

LOCALE= Option Value	Language	Using NLDATEW.	Using NLDATEYQL.
en_US	English (US)	Tuesday, April 10, 2018	2nd quarter 2018
en_GB	English (GB)	Tuesday, 10 April 2018	2nd quarter 2018
da_DK	Danish	tirsdag den 10. april 2018	2. kvartal 2018
de_DE	German (Germany)	Dienstag, 10. April 2018	2. Quartal 2018
es_ES	Spanish (Spain)	martes, 10 de abril de 2018	2º trimestre 2018
fr_FR	French (France)	mardi 10 avril 2018	2e trimestre 2018
he_IL	Hebrew	יום שלישי, 10 באפריל 2018	רבעון 2 2018
hi_IN	Hindi	मंगलवार, 10 अप्रैल 2018	दूसरी तिमाही 2018
it_IT	Italian (Italy)	martedì 10 aprile 2018	2o trimestre 2018
pl_PL	Polish	wtorek, 10 kwietnia 2018	2018 II kwartał
ru_RU	Russian (Russia)	вторник, 10 апреля 2018 г.	2-й квартал 2018
sv_SE	Swedish	tisdagen den 10:e april 2018	2018 2:a kvartalet
zh_CN	Chinese (China)	2018年 4月10日 星期二	2018年第2季度
zh_SG	Chinese (Singapore)	2018年 4月10日 星期二	2018年第2季度

Again, Table 2 was produced using nothing more than Windows SAS 9.4 with Unicode support and BASE SAS.

ADDITIONAL (NON-NLS) DATE FORMATS

Earlier versions of SAS accommodated the need for non-English language dates by creating a set of generic formats where you could specify the desired language in the format name. These formats are analogous to English language SAS formats covering:

- Date in ddmonyyyy format
- Datetime in SAS datetime format (ddMONyyyy:hh:mm:ss)
- Date in ddmmyy.
- Date as a day of the week name
- Date as a month name
- Month and year
- Day of the week name, month name, day, and year
- Date as numerical day of the week
- Month name, day and year

The LOCALE= and DFLANG= options work globally within a SAS session and are not restricted to output, so these formats allow you to select a specific language for however long you need them without affecting anything else. They are language-specific, and are not affected by the LOCALE= or DFLANG options. The disadvantage of using these formats is that there are fewer languages from which to choose, and they are hardcoded in your program, so if you need to change languages, you will have to change the name of each format when it is used in your code. In Example 3, we are displaying the day of the week name, month name, day, and year in Spanish and French:

Example 3: Using Language-Specific Date Formats

```
data example3;
date = '20MAR2018'd;
Spanish = date;
French = date;
FORMAT date WEEKDATX. Spanish ESPDFWKX. French FRADFWKX.;
RUN;
```

The language-specific formats used in Example 3 are ESPDFWKX. and FRADFWKX. for Spanish and French, respectively. “ESP” and “FRA” indicate the language to use for the “DFWKX.” international date format. Changing the three-letter prefix will change the output language of this format, which produces output in day of the week name, month name, day, and year as shown in Result 3:

Result 3: Spanish and French Date Formats

date	Spanish	French
Tuesday, 20 March 2018	martes, 20 de marzo de 2018	Mardi 20 mars 2018

The values are right justified in the table because each column is a formatted numeric variable, and date formats (with a few exceptions) right-justify the output by default.

There are also non-NLS date formats available for:

- Dates according to the Jewish calendar
- Dates in Hebrew
- Japanese Nengo
- Taiwanese Minguo

These formats, as well as the language-specific formats are discussed in BASE SAS documentation.

TIME AND DATETIME

As per ISO 8601 guidelines, all time is relative to Coordinated Universal Time (UTC), which is equivalent to GMT. By default, time in SAS is local to the server on which it is executing. The NLS option to change the time zone of the server is the TIMEZONE= option. You can specify time zone either by name (e.g., GMT, EDT, IST) or by time zone ID (e.g., 'Europe/London', 'America/NewYork', 'Asia/Calcutta'.) Since time zone names can represent multiple time zones (e.g., "IST" can be "India Standard Time", or "Israel Standard Time" (among others) depending on the LOCALE= setting in effect,) using the time zone ID will improve the clarity of your code. Consult the NLS documentation for a complete list of time zone ID values.

It is important to reiterate that the TIMEZONE= option does not adjust output. The TIMEZONE= option only affects the time setting at the SAS server; therefore, it will only affect:

- Times that are recorded in logs and events.
- Creation and modification time stamps on SAS data sets
- The DATE(), DATETIME(), TIME() and TODAY() functions
- Any formats incorporating time zone

Example 4 demonstrates what happens when you change the value of the TIMEZONE= option. The reference datetime is April 10, 2018, 9:00 PM GMT:

Example 4: Impact of Changing the TIMEZONE= Option

TIMEZONE= value	Using the NLDATMAP. format	Using the NLDATMWZ. format
America/Denver	April 10, 2018 09:00:00 PM	Tuesday, April 10, 2018 09:00:00 PM -0600
Africa/Casablanca	April 10, 2018 09:00:00 PM	Tuesday, April 10, 2018 09:00:00 PM +0000
Asia/Phnom_Penh	April 10, 2018 09:00:00 PM	Tuesday, April 10, 2018 09:00:00 PM +0700
Atlantic/Azores	April 10, 2018 09:00:00 PM	Tuesday, April 10, 2018 09:00:00 PM +0000
Australia/Darwin	April 10, 2018 09:00:00 PM	Tuesday, April 10, 2018 09:00:00 PM +0930
Europe/Brussels	April 10, 2018 09:00:00 PM	Tuesday, April 10, 2018 09:00:00 PM +0200
Indian/Mayotte	April 10, 2018 09:00:00 PM	Tuesday, April 10, 2018 09:00:00 PM +0300
Pacific/Wake	April 10, 2018 09:00:00 PM	Tuesday, April 10, 2018 09:00:00 PM +1200

In Example 4, notice how the offset to Coordinated Universal Time (UTC) changes with the TIMEZONE= option, but the time remains the same.

Starting with SAS 9.4, NLS includes a series of time zone functions to report on the option settings, adjust to or from UTC, and calculate offset to or from UTC. The datetime formats may allow you to display the offset, but you can use the time zone functions to pull information for reporting. For example, you can get the time zone from a SAS datetime value to display in report.

CONCLUSION

The whole point of NLS formats and informats is to remove concerns about the specific language that will be using the format or informat. The LOCALE= system option will take care of it. In this way, the same SAS code can be used to create output in the appropriate language as long as the LOCALE= system option is correctly set. This is especially useful when the same SAS code is used on multiple servers in multiple geographic locations.

It is important to understand that NLS formats and informats work just as well with the English language as with any other language. There is no need to use SAS program code beyond the LOCALE= option to switch between English language formats/informats and those in other languages, unless you need a specific format that does not have an NLS equivalent.

If you are working with one specific language, you may be able to use language-specific date formats instead of adjusting the system settings of LOCALE and DFLANG. The disadvantage is that those languages are hard-coded, and changing language will require changing the format name in the code.

Time is always local to the SAS server, but you can specify the time zone of the SAS session using the TIMEZONE= system option. However, when reporting times and datetimes, remember ISO 8601 compliance dictates that time is always relative to Coordinated Universal Time (UTC). Using formats that display time and take into account time zone will display time as time at UTC and the offset of the time zone to UTC.

This is just a brief overview of how to handle dates and times across multiple languages and locations in SAS. Refer to the SAS documentation for details, and don't hesitate to seek help at support.sas.com.

REFERENCES

Morgan, Derek P. 2014. *The Essential Guide to SAS® Dates and Times, Second Edition*. Cary, NC: SAS Institute Inc.

RECOMMENDED READING

- *SAS® 9.4 National Language Support (NLS): Reference Guide*
- *SAS 9.4 Formats and Informats: Reference*

CONTACT INFORMATION

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