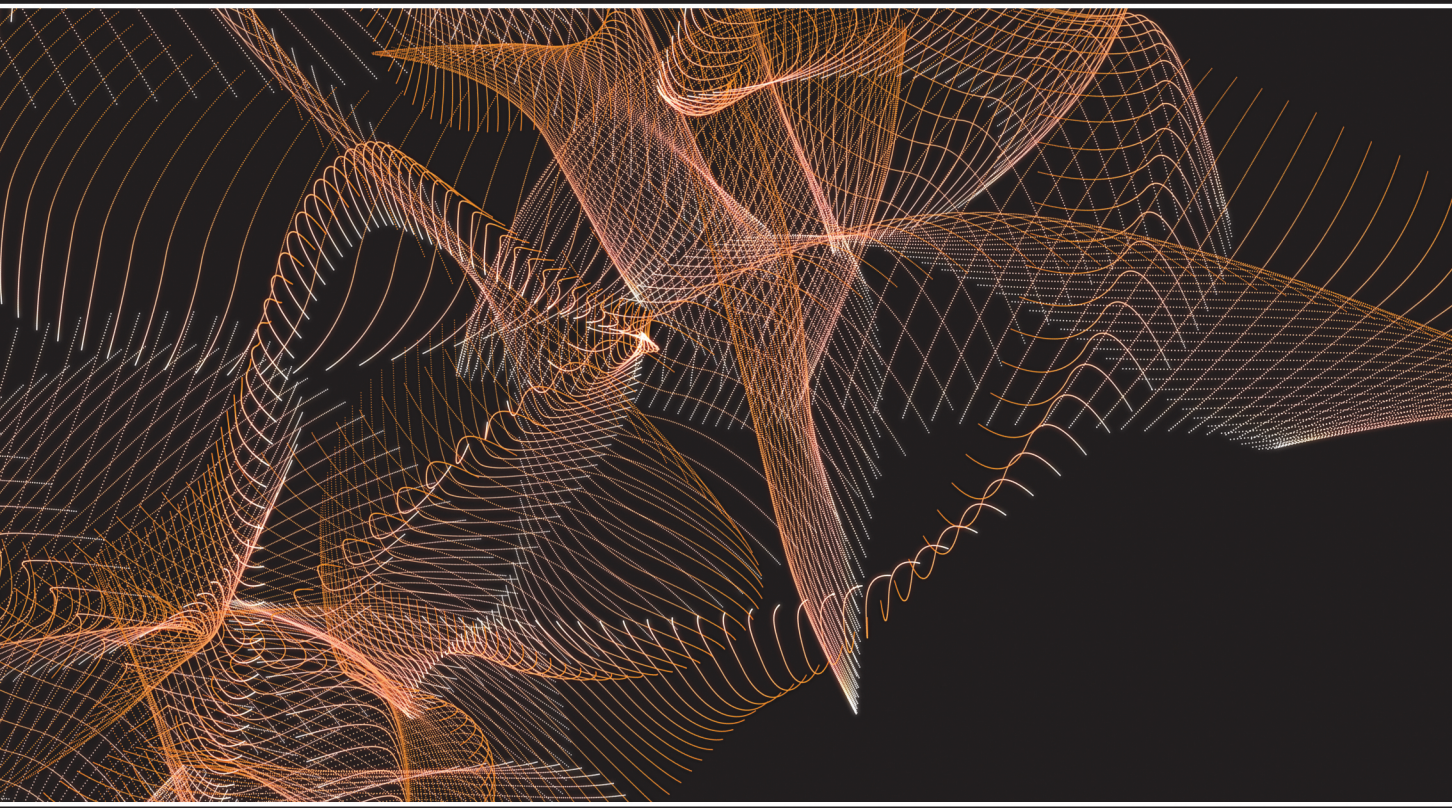


Dyalog for UNIX Installation and Configuration Guide

Dyalog version **15.0**



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The tool of thought for software solutions

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Please note that unless otherwise stated, all the examples in this document assume that `IO` is 1, and `ML` is 1.

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Introduction

This manual is designed to assist users of the non-GUI versions of Dyalog APL on UNIX platforms. Although updated for Version 15.0 it applies to Versions 12.1 onwards.

Two versions of the interpreter are shipped with each Dyalog APL release: the development version and the server version.

The server version has the same functionality as the development version, other than that any attempt to read from the session, or use `⎕SM` or use `⎕ARBIN` will result in an `EOF INTERRUPT`. It is mainly intended for using Dyalog APL as a server process, where all I/O is processed using TCPSockets, or possibly via an auxiliary processor written by the user. Dyalog recommends using Conga in preference to native TCPSockets.

There are different licences associated with the development and server versions, which affects how each might be distributed. For more information, please contact sales@dyalog.com.

All examples are written assuming that the Korn shell is being used.

This manual is intended for users of Dyalog APL on UNIX. The *Dyalog for UNIX UI Guide* and the *Dyalog for Raspberry Pi User Guide* are also UNIX specific. Users should also review the *Dyalog Version 15.0 Release Notes* and the file *dyalog_readme.htm*. All of these files and the other Dyalog-supplied documentation can be found in the directory `$DYALOG/help`, and are available online at <http://docs.dyalog.com/15.0>. <http://help.dyalog.com/15.0> contains an online help system for the Dyalog APL documentation. These websites are updated from time to time, and have the latest revisions of the documentation.

The expression

```
+2 ⎕nq '.' 'GetEnvironment' 'DYALOG'
```

returns the value of the `$DYALOG` environment variable.

Installation

This manual covers the installation of the non-GUI version of Dyalog APL on AIX, and on Linux distributions which use either .rpm or .deb files for installing software. If you are using a Linux distribution which uses some other method, or you wish to have a non-default installation, then there are some suggestions about how such an installation might be completed.

Dyalog APL version 15.0 is supplied in either 32 or 64 bit versions, and in either Classic or Unicode editions. The installation procedure for Dyalog APL is the same in each case. Note that the 64-bit versions of Dyalog APL will only run on a 64-bit operating systems; the 32-bit versions of Dyalog APL will run on both 32 and 64 bit operating systems.

It is assumed that in all cases the installation image has been downloaded into /tmp on the local machine.

The default installation subdirectory will be formed as:

```
/opt/mdyalog/15.0/<APLWidth>/<APLEdition>
```

or, in the case of AIX:

```
/opt/mdyalog/15.0/<APLWidth>/<APLEdition>/<platform>
```

So for example, Dyalog APL Version 15.0 32 bit Unicode for POWER6 hardware on AIX will by default be installed into

```
/opt/mdyalog/15.0/32/unicode/p6
```

whereas on a Linux distribution the equivalent version would be installed in

```
/opt/mdyalog/15.0/32/Unicode
```

This naming convention began with Version 12.0, and is planned to continue into the future. This ensures that all versions and releases of Dyalog APL can be installed in parallel.

As part of installing Dyalog on Linux (including Pi) the script `/usr/bin/dyalog` is created; this is a copy of the `$DYALOG/mapl` script and can be used to start Dyalog APL. Note that this script will start the most recently installed version of Dyalog APL. This script is used in the target of the Dyalog APL icon on Linux desktops. If preferable, Dyalog can be started by calling the script `mapl` in the appropriate Dyalog installation directory.

When supplying updates or fixes, Dyalog issues a full installation image; this means that any file under the installation subdirectory may be overwritten. It is therefore strongly recommended that users do not alter issued files, as those changes could be lost if an update is installed.

Dyalog APL version 15.0 for Linux is supplied as a zip file which contains both a .deb- and a .rpm-based installation image.

Installing under AIX

For each version of Dyalog APL on AIX three separate hardware-specific builds are created for each of the four combinations of 32 or 64 bit versions, Classic or Unicode editions. For version 15.0 specific builds for p5, p6 and p7 are created.

```
$ su -
# cd /opt
# cpio -icdvum </tmp/dyalog-20090901-64-unicode-p6.cpi
# /opt/mdyalog/15.0/64/unicode/p6/make_scripts
# exit
```

Dyalog APL is now installed. To run as any user, type

```
$ /opt/mdyalog/15.0/64/unicode/p6/mapl
```

Notes:

- Version 15.0 is compiled on AIX6.1.

Installing on an RPM-based Linux Distribution

```
$ unzip linux_64_15.0.26964_unicode.zip
$ sudo rpm --install linux_64_15.0.26964_unicode.x86_64.rpm
```

Dyalog APL is now installed. To run as any user, type

```
$ dyalog
```

or

```
$ /opt/mdyalog/15.0/64/unicode/mapl
```

Notes:

- It may be necessary to use the `--force` flag or equivalent if an earlier version of Dyalog APL is to be installed on the same server as a later version. This is safe since the versions have no files in common.
- It has been noticed that in some circumstances the 32-bit installs fail on 64-bit operating systems due to a missing `ncurses` package. However, it appears that that package is indeed installed. What is required however is the 32-bit version: once installed, Dyalog APL will then install.
- Version 15.0 has been successfully installed on RHEL5/Centos5 and SUSE12.3 and later versions of these distributions.

Installing on a DEB-based Linux Distribution

```
$ unzip linux_64_15.0.26964_unicode.zip
$ sudo dpkg --install linux_64_15.0.26964_unicode.x86_64.deb
```

Dyalog APL is now installed. To run as any user, type

```
$ dyalog
```

or

```
$ /opt/mdyalog/15.0/64/unicode/mapl
```

Notes:

- It may be necessary to use the `--force` flag or equivalent if an earlier version of Dyalog APL is to be installed on the same server as a later version. This is safe since the versions have no files in common.
- If `dpkg` generates dependency errors, run `apt-get install -f` (as root)
- It has been noticed that in some circumstances the 32-bit installs fail on 64-bit operating systems due to a missing `ncurses` package. However, it appears that that package is indeed installed. What is required however is the 32-bit version: once installed, Dyalog APL will then install.

Installing in a non-default location

It is possible to install Dyalog APL for UNIX in non-default locations, without the need for root privileges.

For all UNIXes,

```
cd <directory under which I wish to install Dyalog APL>
```

For AIX:

```
cpio -icvdum <installation_image.cpi
```

For .deb based Linux distributions:

```
/usr/bin/dpkg --extract installation_image.deb .
```

For .rpm based Linux distributions

```
rpm2cpio installation_image.rpm | cpio -icdvum
```

For all UNIXes:

```
find opt/mdyalog -name make_scripts -exec {} \;
```

This last step generates the mapl script; should you chose to move the installation directory, it will be necessary to re-run the make_scripts script so that the environment variable \$DYALOG is set correctly.

Deinstalling Dyalog APL

In the following examples, it is assumed that only Dyalog APL 14.0 64-bit Unicode is installed on the server; the commands to delete directories will need to be more specific if multiple versions of Dyalog APL are installed.

Should it be necessary to deinstall Dyalog APL, then the process is:

Deinstalling under AIX

```
$ su -
# cd /opt
# rm -rf mdyalog/14.0
```

Deinstalling on an RPM-based Linux Distribution

```
$ su -
# rpm -e dyalog.32.classic-14.0-20090901
# cd /opt
# rm -rf mdyalog/14.0
# exit
```

Deinstalling on a DEB-based Linux Distribution

```
$ sudo su -
# apt-get purge dyalog-unicode-140
# cd /opt
# rm -rf mdyalog/14.0
# exit
```

Upgrading APL

Applying a later release of the same version

In general Dyalog will issue a new installation image if a problem is discovered which requires a new version of the interpreter. Dyalog recommends that the entire installation image is installed over the existing installation, but that is not essential. Particularly in a live environment it may be preferable to install only a revised interpreter. This can be done by extracting the individual files from the installation image, and copying them into the correct place in the installation directory tree. To apply a fix image, run the appropriate installation command with the `-force` option if appropriate. Be aware: the process of installing a later installation image over an already installed version of Dyalog APL WILL result in all files being overwritten. If you have changed any, it will be necessary to take copies of them, and then to reapply local alterations to the new files. Please contact support@dyalog.com for further advice.

For rpm-based installation, run

```
$ sudo --Uvh <new installation image>
```

For deb-based installation, run

```
$ sudo dpkg -i <new installation image>
```

See <http://packages.dyalog.com/> for details of updating on the Pi.

Upgrading from an earlier version

Newer versions of Dyalog APL will be placed in new subdirectories, rather than in the same location as the currently installed versions. This means that both old and new versions can be run in parallel, but extra disk space in `/opt` will be required to cater for the multiple releases. Note however that once a workspace has been saved in a later version of Dyalog APL, it is most likely that it will not be possible to **)LOAD** or **)COPY** the workspace by an earlier version. Once happy with the new version, then de-install the earlier version.

Configuring a Console/terminal Window to support Dyalog APL for UNIX

In order to support Dyalog APL for UNIX in a console/terminal window under a Linux window manager, it is necessary to install and configure the Dyalog APL keyboard support. Additionally it is possible to install the APL385 Unicode font, to be used instead of the built in fonts which include APL characters.

Keyboard support

Dyalog submitted APL Language keyboard support to Xorg at the end of 2011; most Linux distributions released after mid-2012 have the Dyalog APL keyboard support included with the distribution. Such distributions include openSUSE 12.2, Ubuntu 12.10 and Fedora 17.

Support for the Key character was submitted to Xorg in mid-2014; if your distribution does not support this character, contact Dyalog support for assistance.

Details of how to configure the keyboard under KDE4 appear below; keyboard support for other window managers (such as Gnome and Unity) is in a state of flux. The latest information about the process of installing and configuring Dyalog APL keyboard support for such environments can be found at:

<http://www.dyalog.com/forum/viewtopic.php?f=20&t=210>

or by contacting Dyalog support. The same resources can be used to obtain information and guidance on installing keyboard support for earlier Linux distributions.

Configuring the APL keyboard under KDE4

(These instructions were drawn up using openSUSE 12.2; other KDE4 environments may vary slightly)

- Select Configure Desktop
- Select Input Devices
- Select Keyboard
- Select Layouts
- Select the "Configure layouts" tickbox
- Select Add
- In the Add Layout dialog box, select the Layout "APL Keyboard Symbols", and then the "dyalog" option
- Close the Add Layout dialog box
- The list of layouts should now include APL Keyboard Symbols, with one of the dyalog variants.

- Click on "Main shortcuts" in the "Shortcuts for Switching Layout" group; where possible, Dyalog recommends selecting "Any Win key (while pressed)" so that either Windows key causes APL characters to be generated.

APL font support

APL characters are available under Linux window managers. However some of the characters may appear inelegant; most noticeable are very small "◇" and overly large "⍒". To resolve this, it is possible to use the Freemono fonts (these are installed by default on some distributions (such as openSUSE)), or to download and install the APL385 Unicode font. This font is freely downloadable from:

<http://www.dyalog.com/resources>

Details of how to install the font will appear in the documentation for your window manager.

Dyalog APL, RDP and VNC

Due to the different ways that Microsoft Windows and Linux/UNIX handle keyboards, it is not possible to use RDP or VNC or X-Windows from a Windows client to control a Dyalog APL session running under a UNIX window manager. In particular, all of the X-Window clients that Dyalog is aware of do not fully support xkb key mappings.

It is possible to use VNC from a Linux client to connect to a remote Linux desktop and control an APL session running there; the keyboard support will however need to be added to the local machine.

Using PuTTY under Windows

Dyalog APL for UNIX comes with support for the PuTTY terminal emulator. PuTTY is freely downloadable, supports ssh and telnet protocols, and supports Unicode keystrokes and fonts. To be able to generate and see APL characters it is also necessary to install the Dyalog UnicodeIME and the APL385 Unicode font.

Downloading and installing the Dyalog UnicodeIME

The UnicodeIME can be freely downloaded from <http://www.dyalog.com/apl-font-keyboard.htm>. It is also included with all Unicode Windows versions of Dyalog from 13.0 onwards. There are two versions of the UnicodeIME; one for 32 bit Windows, and one for 64 bit; please ensure that the correct version is downloaded.

Details of how to install the UnicodeIME are on the download webpage.

Downloading and installing the APL385 font

The APL385 can be freely downloaded from <http://www.dyalog.com/apl-font-keyboard.htm>. Details of how to install the font appear on the download webpage.

Downloading and Installing PuTTY

PuTTY is available from <http://www.chiark.greenend.org.uk/~sgtatham/putty>. Full details of how to download and install PuTTY, along with the licence terms and conditions are available from the above URL.

Configuring PuTTY to support Dyalog APL for UNIX

Firstly ensure that you are able to login to the UNIX server which has Dyalog APL installed on it. If you are using an AIX server, it is recommended that in the Keyboard category you set the backspace key to Control-H.

For APL support the follow settings are required:

Window/Appearance Font settings/Font: set to *APL385 Unicode*

Window/Translation/Character set translation on received data: set *Received data assumed to be in which character set* to *UTF-8*

Having set these values, it is recommended that you save the settings; if you will need to connect to multiple servers, it is recommended that you save the above settings as the default options (Highlight the *Default Settings* in *Saved Sessions* and click on *Save*).

Environment Variables

Environment variables are used to configure various aspects of Dyalog APL. The complete list appears in the *Dyalog for Microsoft Windows Installation and Configuration Guide: Configuration Parameters*; this section discusses those variables which are of particular importance to the Non-GUI versions of Dyalog APL, and lists those that have meaning to the UNIX versions. Additionally there some non-GUI-specific variables which are described below and some which either do not apply, or may not work as the user might at first expect.

Under UNIX, all environment variables should appear in UPPER CASE. For example, to set the default value of `ml` to 3, then

```
$ export DEFAULT_ML=3
```

If a configuration parameter described in the *Dyalog for Microsoft Windows Installation and Configuration Guide* has a back-slash "\" in its name, this should be replaced with an underscore in the equivalent environment variable.

Many of these environment variables are set in the `mapl` script; their values are either appropriate for the installation location of Dyalog APL, or are set to define reasonable default values.

The environment variables are broken down into several tables:

- Table E1: The most commonly defined and used for non-GUI versions of Dyalog APL under UNIX. Most of these variables are essential for a usable APL session
- Table E2: Variables used to control default values in the workspace
- Table E3: Variables used to configure buffers and logfiles etc
- Table E4: Miscellaneous Variables used by non-GUI Dyalog APL
- Table E5: Editor-related environment variables
- Table E6: RIDE-related environment variables
- Table E7: SALT and User Command-related environment variables

Table E1: Commonly used Variables

Variable	Notes
TERM APLK APLK0 APLT APLTn	<p>Define the input and output translate tables used by Dyalog APL. The values of APLK0 and APLTn override the values of APLK and APLT if set, and they in turn override the value of (Unicode) <i>default</i>, or (Classic) TERM if set.</p> <p>APLK is for input translation, APLT for output translation.</p> <p>These are used in conjunction with ..</p>
APLKEYS APLTTRANS	<p>Define the search path for the input and output translate tables respectively. If unset, the interpreter will default to \$DYALOG; if \$DYALOG too is not set, will default to /usr/dyalog.</p>
APLNID	<p>This variable is ignored by the UNIX versions of Dyalog APL: <code>⎕ai</code> and <code>⎕an</code> pick up their values from the user's uid and /etc/passwd.</p>
APLSTATUSFD	<p>If set, this defines the stream number on which all messages for the Status Window appear. It is then possible to redirect this output when APL is started.</p> <p>If unset, the output will appear in the same terminal window as the APL session, although it is not part of the session; such output can be removed by hitting SR (Screen Redraw - often defined to be Ctrl-L).</p>

Variable	Notes
LIBPATH	A suitable entry for the Conga libraries needs to be added to the LIBPATH variable if Conga is to be used. For more information see the Conga Guide.
ERRORONEXTERNALEXCEPTION	By default, any error when calling <code>⎕NA</code> will result in APL terminating; if <code>ERRORONEXTERNALEXCEPTION</code> is set to 1, then APL will instead generate an event 91: <code>EXTERNAL DLL EXCEPTION</code> . Be aware however that the workspace may become corrupted. This is best used when developing <code>⎕NA</code> code rather than in production.
MAXWS	Defines the size of the workspace that will be presented to the user when Dyalog APL is started. A simple integer value will be treated as being in KB. K, M and G can be appended to the value to indicate KiB, MiB and GiB (binary) respectively. If unset, the default value is 4096KB.
WSPATH	Defines the search path for both workspaces and Auxiliary processors. If unset, there is no default value. Workspaces and APs that are not on the WSPATH can be accessed using absolute or relative pathnames.

Table E2: Default workspace values

Variable	Notes
DEFAULT_DIV	Default value for <code>div</code> in a clear workspace.
DEFAULT_IO	Default value for <code>io</code> in a clear workspace.
DEFAULT_ML	Default value for <code>ml</code> in a clear workspace.
DEFAULT_PP	Default value for <code>pp</code> in a clear workspace.
AUTO_PW DEFAULT_PW	<code>pw</code> is set by the interpreter when it starts, or when the session window is resized. Under UNIX if the terminal window is resized, the session will be resized when the interpreter next checks for input.
DEFAULT_RL	Default value for <code>rl</code> in a clear workspace.
DEFAULT_RTL	Default value for <code>rtl</code> in a clear workspace.
DEFAULT_WX	Default value for <code>wx</code> in a clear workspace. Note that although the UNIX versions of Dyalog APL do not have GUI objects, <code>se</code> is present, and the value of <code>wx</code> will affect the programmer's ability to run expressions such as <code>se.PropList</code> .

For numeric values, the interpreter takes the value of the environment variable, and prepends a "0" to that string. It then parses the string, accepting characters until the first non-digit character is reached.

This string, now of digits only, is converted into an integer. If the resulting value is valid, then that is the value that will be used in the workspace. If the resulting value is invalid, then the default value will be used instead.

Table E3: Variables used to configure buffers and logfiles etc

Variable	Notes
HISTORY_SIZE	The size of the prior line buffer
INPUT_SIZE	The size of the buffer used to store lines marked for execution
LOG_FILE LOG_FILE_INUSE LOG_SIZE	These three variables determine the name of the session log file (default ./default.dlf), whether a log file is created or not, and the size of the log file in KB. Be aware: the session log file is not interchangeable between the different editions and widths of APL; in a mixed environment it is strongly recommended to use a different log file for each version.
PFKEY_SIZE	The size of the buffer used to hold <code>⎕pfkey</code> definitions: if this is too small, an attempt to add a new definition will result in a LIMIT ERROR.
SESSION_FILE	Defines the location of your session file; session file support was added in Dyalog 13.1. The default value is <code>\$DYALOG/default.dse</code>

To set values, use K to indicate KB. Note that the buffers will contain other information, so the buffer size will not be exact. Note also that multibyte Unicode characters will take up more space than single byte characters, and that 32 and 64 bit versions of Dyalog APL can require different amounts of space for holding the same information.

Example:

```
$ HISTORY_SIZE=4K my_apl_startup_script
```

Table E4: Miscellaneous Variables used by non-GUI Dyalog APL

Variable	Notes
APL_ TEXTINAPLCORE	If set with the value 1 the "Interesting Information" section is included in an aplcore file. Otherwise this section is omitted. By default the interpreter has this set to 0; it is the default APL script which sets it to 1.
AUTOFORMAT TABSTOPS	If AUTOFORMAT is 1, then control structures will be shown with indents, set at TABSTOPS spaces; the changes are reflected in the editor window when the RD (ReDraw) command key is hit.
AUTOINDENT	
AUTO_PW	Introduced in 13.0. With <code>AUTO_PW=0</code> , <code>□pw</code> remains fixed at the size of the terminal window when APL was started. When set to 1, or unset, <code>□pw</code> alters each time the terminal window is resized.
DYALOG	This variable is defined in the supplied mapl startup script, and is used to form the default values for APLKEYS, APLTRANS, WSPATH etc. If it is necessary to identify the location of the Dyalog executable, then a more reliable method is to determine the full path name from the appropriate file in the <code>/proc/<process_id_of_APL_session>/</code> subdirectory or from the output of <code>ps</code> .

These are the remaining variables listed in the *Dyalog for Microsoft Windows Installation and Configuration Guide* which are effective in the non-GUI UNIX versions of Dyalog APL

Table E5: Editor-related environment variables

Variable	Notes
EDITOR_ COLUMNS_*	See Configuring the Editor on page 17 . Can be one of EDITOR_COLUMNS_CHARACTER_ARRAY EDITOR_COLUMNS_CLASS EDITOR_COLUMNS_FUNCTION EDITOR_COLUMNS_NAMESPACE EDITOR_COLUMNS_NUMERIC_ARRAY
LINES_ON_ FUNCTIONS	Whether line numbers are on or off. This is used in conjunction with the variables which determine which features of the editor are enabled.

Table E6:RIDE environment variables

Variable	Notes
APL_ LANGUAGE_ BAR_FILE	This specifies the location of the XML file which contains the definitions of the language bar which appears in the RIDE client
RIDE_LISTEN	This specifies the range of IPv4 addresses from which a RIDE client may connect, and the port number to be used. The default value is 0.0.0.0:4502. If the variable is unset, RIDE is not enabled in the interpreter.

Table E7: SALT and user commands related environment variables

Variable	Notes
SESSION_FILE	Specifies the location of the file containing <code>□SE</code> . The default value is <code>\$DYALOG/default.dse</code>
UCMDCACHEFILE	Specifies the location of the user command cache file. Defaults to <code>~/.dyalog/UserCommand20.cache</code>

Further information about SALT and user commands appear in the *User Commands User Guide* and the *SALT User Guide*.

Configuring the Editor

The editor in non-GUI versions of Dyalog APL can be considered to have 5 separate functional columns. Below is the contents of the editor window, which shows the namespace ns, which has two traditional-style functions and one dfn. The statement `5 ⌈STOP 'ns.fn1'` has been run too:

```
[0]      :Namespace ns
[1] [0]  |      ∇ r←fn1 a
[2] [1]  |      :If a=1
[3] [2]  |      r←1
[4] [3]  |      :Else
[5] [4]  |      :If today≡'Friday'
[6] [5]  |      o      r←2
[7] [6]  |      :EndIf
[8] [7]  |      :EndIf
[9] [8]  |      ∇
[10]
[11] [0]      dfn←{α+w}
[12]
[13] [0]  |      ∇ r←a fn2 w
[14] [1]  |      r←a+w
[15] [2]  |      ∇
[16]      :EndNamespace
```

This is formed of 5 separate columns:

C1	C2	C3	C4	C5
[0]				:Namespace ns
[1]	[0]			∇ r←fn1 a
[2]	[1]			:If a=1
[3]	[2]			r←1
[4]	[3]			:Else
[5]	[4]			:If today≡'Friday'
[6]	[5]	o		r←2
[7]	[6]			:EndIf
[8]	[7]			:EndIf
[9]	[8]			∇
[10]				
[11]	[0]			dfn←{α+w}
[12]				
[13]	[0]			∇ r←a fn2 w
[14]	[1]			r←a+w
[15]	[2]			∇
[16]				:EndNamespace

Functional Column	Value (see below)	Purpose
C1	4	Line numbers for entire object
C2	64	Line numbers for functions etc. within scripted namespaces
C3	2	Trace/Stop points
C4	8	Control Structure Outlining
C5	16	Text (or content) This value is ignored; this column is always present

It is possible to control at startup time which of these columns are visible. By default, for all types of object, only the text column is visible; this can be overridden on a per-object basis by setting one or more of the EDITOR_COLUMNS_ variables listed in Table E5. The value of these variables is the sum of the values for each of the columns which are desired.

Examples:

EDITOR_COLUMNS_NAMESPACE=94 shows all columns (the first example in this section)

Various values for EDITOR_COLUMNS_FUNCTION

Value	Editor window appearance
0	<pre>fn1 a :If a=1 b←2 :EndIf</pre>
22	<pre>[0] fn1 a [1] :If a=1 [2] o b←2 [3] :EndIf</pre>
26	<pre>fn1 a o :If a=1 b←2 :EndIf</pre>
40	<pre>[0] fn1 a [1] o :If a=1 [2] b←2 [3] :EndIf</pre>

Miscellaneous

Running from scripts

Dyalog APL can be run with input being directed from a script file, and output being redirected as well.

The script file needs to be built in such a way that it contains valid input according to the input translate table that is defined in the APLK variable.

The classic edition of Dyalog APL expects that the input script by default uses Ctrl-O and Ctrl-N to swap between APL and ASCII characters, and Ctrl-H is used to create overstrikes. Be aware that when editing such an input file, cut and paste of ^H, ^N or ^O may well result in the two character sequences being copied, rather than the single character Ctrl-H, Ctrl-N and Ctrl-O.

The Unicode edition by default expects that the input file has Unicode characters in it; a Unicode-aware editor is therefore required. Note however that applications such as Notepad will add BOMs (Byte Order Markers) to the Unicode text; these must be removed as the Dyalog APL input translate table does not have BOMs defined in it.

The example below shows the same set of APL expressions as they would appear in a script file for classic and Unicode editions: it is rather easier to read the Unicode edition's input !

Classic example:

```
^O(2^NLnqK.K K^OGetBuildID^NK^O),
(^NK.KLwgK^OAPLVersion^NK^O)
^Ovar^N[1+1 J^HC^O Check input from file: Classic
)si
^N"si
^Nloff
```

Unicode example:

```
(+2□nq'.' 'GetBuildID'),(.'□wg'APLVersion')
var+1÷1 A Check input from file: Unicode
)si
)si
□off
```

The file command and magic

All Dyalog APL binary files have a unique magic number: the first byte is always 0xAA (decimal 170), and the second identifies the type of Dyalog file. Additional bytes may in some cases be used to further identify the type, version and state of the file. UNIX systems include the `file` command which use the information in the magic file to describe the contents of files.

magic and AIX

AIX still uses a very early version of `magic`, so it is not possible to give as much information about Dyalog APL files as on Linux.

Dyalog provides a file, `magic`, which is located in the top level installation directory of Dyalog APL. To use this file to extend the capabilities of the `file` command either run

```
file -m /opt/mdyalog/15.0/32/classic/p5/magic *
```

or catenate the contents of `/opt/mdyalog/15.0/32/classic/p5/magic` onto `/etc/magic`, and then run

```
file *
```

Example:

```
$ file -m /opt/mdyalog/15.0/32/classic/p6/magic *
l_apl_j1: Dyalog APL component file 64-bit level 1 journaled non-
checksummed
l_apl_j2: Dyalog APL component file 64-bit level 2 journaled
checksummed
l_apl_qfile: Dyalog APL component file 64-bit non-journaled non-
checksummed
l_big1: Dyalog APL component file 64-bit level 2 journaled
checksummed
l_big2: Dyalog APL component file 64-bit level 1 journaled
checksummed
apl64u: Dyalog APL workspace type 12 subtype 4 64-bit unicode big-
endian
aplout: Dyalog APL workspace type 12 subtype 0 32-bit classic
little-endian
aplcore: Dyalog APL workspace type 12 subtype 4 32-bit classic
little-endian
colours: Dyalog APL workspace type 12 subtype 4 32-bit classic
little-endian
core: data or International Language text
signals: Dyalog APL workspace type 12 subtype 4 32-bit classic
little-endian
utf8: Dyalog APL workspace type 12 subtype 4 32-bit unicode
little-endian
```

magic and Linux

Most Linux distributions include details about Dyalog-related files in their magic files; Dyalog has submitted two versions of the magic file for inclusion in distributions. To check whether your Linux distribution has the more recent version, create a journaled component file and then run the file command against that component file. The two examples below show the output with the earlier and later versions of magic in use.

Example, using the older default magic file:

```
$ file *
1_apl_j1: data
1_apl_j2: data
1_apl_qfile: data
1_big1: data
1_big2: data
apl64u: \012- Dyalog APL\012- workspace\012- version 12\012- .4
aplout: \012- Dyalog APL\012- workspace\012- version 12\012- .0
aplcore: \012- Dyalog APL\012- workspace\012- version 12\012- .4
colours: \012- Dyalog APL\012- workspace\012- version 12\012- .4
core: ELF 32-bit LSB core file Intel 80386, version 1 (SYSV),
SVR4-style
signals: \012- Dyalog APL\012- workspace\012- version 12\012- .4
utf8: \012- Dyalog APL\012- workspace\012- version 12\012- .4
```

Example, with more recent magic file:

```
$ file *
1_apl_j1: Dyalog APL component file 64-bit level 1 journaled non-
checksummed
1_apl_j2: Dyalog APL component file 64-bit level 2 journaled
checksummed
1_apl_qfile: Dyalog APL component file 64-bit non-journaled non-
checksummed
1_big1: Dyalog APL component file 64-bit level 2 journaled
checksummed
1_big2: Dyalog APL component file 64-bit level 1 journaled
checksummed
apl64u: Dyalog APL workspace type 12 subtype 4 64-bit unicode big-
endian
aplout: Dyalog APL workspace type 12 subtype 0 32-bit classic
little-endian
aplcore: Dyalog APL workspace type 12 subtype 4 32-bit classic
little-endian
colours: Dyalog APL workspace type 12 subtype 4 32-bit classic
little-endian
core: ELF 32-bit LSB core file Intel 80386, version 1 (SYSV),
SVR4-style, from '/opt/mdyalog/14.0/32/classic/dyalog'
signals: Dyalog APL workspace type 12 subtype 4 32-bit classic
little-endian
utf8: Dyalog APL workspace type 12 subtype 4 32-bit unicode
little-endian
```

The most recent version of the magic file can be found in the top level of the installation directory; see the man page for the `file` command for details of how to update the system magic file, or use the syntax described in the `/etc/magic` and AIX section above to override the default magic file with the one supplied in the installation directory.

□SE, User Commands and SALT

Summary

Support for user commands is now included in UNIX versions of Dyalog APL. Many of the user commands which were originally written for running under Microsoft Windows will run under the various flavours of UNIX.

Under UNIX there is no autocompletion of user command names.

The SALT code resides in □SE, which is saved in a session file. The location of the session file is controlled by the environment variable `SESSION_FILE`; by default this file is `$DYALOG/default.dse`. Setting `SESSION_FILE=/dev/null` results in an empty □SE and SALT being disabled.

See the *User Commands User Guide* and the *SALT User Guide* for more information.

Caching User Command information

When a Dyalog APL session is started, SALT is loaded, and checks the details of all of the files which contain user commands with a previously cached version of this information. If Dyalog APL has never been run before, or the cache file does not exist, SALT rebuilds the cache file. This can take a few seconds, especially on the Raspberry Pi.

By default in Version 14.0 the cache file is called `~/dyalog/UserCommand20.cache`.

This can be overridden by specifying the environment variable `UCMDCACHEFILE`.

It is expected that the structure of files in `~/dyalog` will change in future versions of Dyalog APL.

Assigning Contents of Session Log

It is possible to assign the contents of the Session Log to a variable:

```
z←'□se'□wg'Log'
```

The Directory `~/dyalog`

In Version 14.0 Dyalog APL makes use of the directory `~/dyalog`. The contents of this directory are expected to be extended in future versions of Dyalog APL, and allow for multiple versions and editions of Dyalog APL to be run concurrently.

In Version 14.0, this directory is created by default when APL is run for the first time. It is the directory which contains the user command cache file, which by default is called *UserCommand20.cache*.

The file containing the SALT settings is also saved in this directory; it is called *SALT.settings*.

□NA under UNIX

Introduction

□NA is fully supported under UNIX; the Conga communications package for example is a shared library on all platforms.

□NA supports user-written shared libraries and also system-supplied shared libraries. Dyalog APL under UNIX is supplied with a shared library, `dyalog32.so` or `dyalog64.so` which contains the same functions as the DLLs which are described in the □NA documentation in the *Dyalog Language Reference Guide*. Additionally, the function `getlasterror` is included; this returns the error code at the point when the called function failed (which may be different from its value at the point where a previous error occurred).

It is necessary to specify the complete name of the file containing the shared library, no extension is added by Dyalog APL.

When developing code using □NA it may be useful to set the environment variable `ERRORONEXTERNALEXCEPTION= 1`. When this is set, Dyalog APL will generate an event 91, **EXTERNAL DLL EXCEPTION** rather than a `syserror` should a call on a functions defined by □NA be ill-specified. It should be noted however that the workspace may become corrupt, so it is not recommended to run in production with this variable set.

System Shared Libraries

On AIX many system library functions appear in `libc.a`.

When calling system shared libraries under AIX, you must refer to them as:

64-bit: `libc.a(shr_64.o)`

32-bit: `libc.a(shr.o)`

It is not always possible to access all library functions - on AIX for example it is not possible to access `memcpy()` or `strncpy()`. It is for this reason that `dyalog*.so` includes `MEMCPY` and `STRNCPY`.

On Linux, it is a little more difficult to location the `libc.so` file; the function `libc` in the supplied workspace `quadna` can be used to locate this file.

Definitions

In the remainder of this section references are made to the APL variables `sharedlib` and `dyalib`; the definitions for both vary between AIX and Linux, and between 32 and 64 bit interpreters.

Under AIX, `sharedlib` is defined as:

```
sharedlib←'libc.a(shr_64.o)'  A 64 bit
sharedlib←'libc.a(shr.o)'    A 32 bit
```

Under Linux, it is necessary to identify the shared library:

```
)copy quadna libc
sharedlib←libc 0
```

For all UNIX platforms, the `dyalog` shared library is identified as

```
dyalib←'dyalog64.so'        A 64 bit
dyalib←'dyalog32.so'       A 32 bit
```

Example 1

`getpid()` is common to all UNIX platforms; it returns an `int` which is the process ID of the current process. It is defined to be

```
pid_t getpid(void)
```

where `pid_t` is a 4-byte integer.

The APL code to instantiate this function is

```
⊞na 'I4 ',sharedlib,'|getpid'
```

Example 2

This is a slightly more complex example, which uses the `STRNCPY` function in the `Dyalog`-supplied shared library to retrieve the value of a variable which is referenced by a pointer, returned from the system library function:

`getenv()` returns a pointer to the value of the environment variable which is the argument of the function. It is defined to be

```
char *getenv(const char *name)
```

```
∇r←GetEnv envvar;getenv;P;get
  r←'
  ⊞NA'P ',sharedlib,'|getenv <OT1[ ]'
  'get'⊞NA dyalib,'|STRNCPY >OU1[ ] P U4'
  P←getenv<'UTF-8'⊞UCS ⊞UCS envvar
  →0p⊞P=0
```

```
r←'UTF-8'⊖ucs get 4096 P 4096
```

```
GetEnv'MAXWS'
```

```
4G
```

Note: the call to STRNCPY has been defined to return a vector of integers so that the result can be passed directly to `⊖UCS`.

geterrno

The dyalog shared library under UNIX includes the function `geterrno`. This returns the current value of `errno`; be aware that it may not have the same value as at the point when the error was raised. To use this function:

```
⊖na 'I ',dyalib', '|geterrno'  
geterrno
```

```
5
```

Shared libraries and APL threads

Any shared library function must mask out all signals for new threads which it creates. Failure to do so will result in a catastrophic failure of APL's signal handling.

Session logfile

By default the session logfile is called `default.dlf`, and if necessary will be created in the current working directory. (The `mapl` script supplied by Dyalog overrides this).

Status window output

By default under UNIX what would appear in the status window in the GUI versions appears in the same terminal window as the APL session, but the text is not part of the session. If such text appears, the APL session can be redrawn using the `SR` command, thus removing the status window text.

It is possible to redirect the status window output; to do so select an unused stream number as the stream have the status window output appear on, and then redirect that stream. Note that it will be necessary to associate a valid output translate table (usually `apltrans/file`) with that stream.

Example:

```
$ export APLSTATUSFD=9
$ export APLT9=file
$ mapl 9>/dev/null
```

More useful may be to redirect the status window output into a file, and in another terminal window run `tail -f` on that file.

BuildID

Each interpreter has its own unique BuildID. This is a 32-bit checksum of the program file which is the Dyalog APL interpreter. This checksum allows Dyalog Ltd. support staff to uniquely identify the interpreter and from that determine the version, edition, platform etc. of the interpreter.

For that reason, Dyalog Ltd. support staff ask that whenever an issue is raised with them that the BuildID is included in all communications.

The BuildID is included in binary form in any aplcore that is generated; if a core file is created, then is it possible to identify the BuildID using the following command:

```
$ strings -a -n 14 core | grep "BuildID="
```

Additionally, the BuildID is included in the "Interesting Information" section of aplcore files provided that the environment variable APL_TEXTINAPLCORE is set to 1.

The BuildID can be identified both from within the interpreter (using the GetBuildID method), and also from the BuildID executable which is supplied with the product on UNIX.

Both of these methods can be used for any file; they are useful and very fast ways of keeping track of workspaces versions etc. although md5sum and others may be more appropriate.

Examples:

At the command line:

```
$ cd /opt/mdyalog/12.1/32/classic/p6
$ ./BuildID dyalog
70a3446e
$ ./BuildID magic
0a744663
```

In APL:

```
+2 □nq '.' 'GetbuildID'
70a3446e
magicfile←'/opt/mdyalog/12.1/32/classic/p6/magic'
+2 □nq '.' 'GetBuildID' magicfile
0a744663
)sh
$ echo $PPID
$ kill -11 $PPID
/opt/mdyalog/12.1/32/classic/p6/mapl[58]: 274434
Segmentation fault(coredump)
$ strings -a -n14 core | grep BuildID=
BuildID=70a3446e
```


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