

ARx_Instr3.ag

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Chapter 1

ARx_Instr3.ag

1.1 main

AN AMIGAGUIDE® TO ARexx
by Robin Evans

Edition: 1.0b

Note: This is a subsidiary file to ARexxGuide.guide. We recommend using that file as the entry point to this and other parts of the full guide.

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1.2 ARexxGuide | Instruction Reference (16 of 25) | PROCEDURE

```
PROCEDURE [ EXPOSE <variable> [<variable>] [...] ] ;
```

Creates a new symbol table for an internal function. The optional EXPOSE keyword makes <variable> available to the function from the calling environment's symbol table.

By default, a subroutine has access to all variables defined in the main program. It may retrieve the values of those variables and change them. The PROCEDURE instruction protects variables in the main program by giving the subroutine a new symbol table, as though a new script were being executed.

Example:

```
/**/  
Var = 'I came on a kind of crossroads'  
CALL SubR  
SAY Var >>> From time to time.  
EXIT  
  
SubR:  
SAY Var >>> I came on a kind <...>  
Var = 'From time to time.'  
RETURN
```

```

/**/
Var = 'I came on a kind of crossroads'
CALL SubR
SAY Var                                >>> I came on a kind <...>
EXIT

SubR: PROCEDURE
  SAY Var                                >>> VAR
  Var = 'From time to time.'
RETURN

```

In the first program fragment, [Var] in the subroutine inherits the value assigned to it in the main program and is able to change the assignment and affect the value of [Var] in the main program.

In the second fragment, on the other hand, the use of PROCEDURE turns [Var] into what is, essentially, a different variable. It is uninitialized when the subroutine begins. The assignment clause within the subroutine has no effect upon the variable used in the main program.

Also see @{" Basic elements: Internal functions " link ARx_Elements3.ag/ ←
PROGFUNC} explanation

Next: PULL | Prev: PARSE | Contents: Instruction ref.

1.3 ARexxGuide | Instruction Reference | Procedure (1 of 1) | EXPOSE

```
procedure [ EXPOSE <variable> <variable> <...> ]
```

The EXPOSE option keyword can be used only in conjunction with the PROCEDURE instruction. It moderates the effect of PROCEDURE by allowing each listed <variable> to be treated as part of the symbol table of both the subroutine and the calling environment.

Each listed <variable> in the subroutine will be treated as it would be in a subroutine that was not modified by the PROCEDURE instruction.

Any number of individual variables can be listed after the keyword, but it is often useful to expose a group of variables in one step. That can be done in either of two ways:

The first method is to maintain the globals as compound variables . If the stem variable is used by itself in an EXPOSE list, then all variables formed from that stem will also be exposed. A short stem name like { g!. } is useful in this situation.

Example:

```

/* Formatting strings are stored under the g!. stem */
csi='9b'x;g!.slant=csi'3m'; g!.bold=csi'1m'; g!.norm=csi'0m'
/* intervening code */
say PrettyUp('This is the', 'absolute', 'finest.')
exit

```

```

PrettyUp: PROCEDURE EXPOSE g!.
  Emphasis = g!.slant||arg(2)||g!.norm

```

```
return g!.bold||arg(1) Emphasis g!.bold||arg(3)||g!.norm
```

Another method suggested by ARexx guru Marvin Weinstein is store symbols to be used as globals in a string and then expand the string with the `interpret` instruction:

Example:

```
/* symbols for color strings are stored in another variable */
csi='9b'x;Black=csi'31m'; White=csi'32m'; Blue=csi'33m'
Globals = 'Black White Blue'
say PrettyUp('This is the', 'absolute', 'finest.')
exit
```

```
PrettyUp: interpret 'PROCEDURE EXPOSE' Globals
return White||arg(1) Blue||arg(2) White||arg(3)||Black
```

Next, Prev & Contents: PROCEDURE

1.4 ARexxGuide | Instruction Reference (17 of 25) | PULL

```
PULL <template>;
```

Retrieves a line of input from the command line, translating it to uppercase. PULL is an abbreviation of `PARSE UPPER PULL <template>` .

Next: PUSH | Prev: PROCEDURE | Contents: Instruction ref.

1.5 ARexxGuide | Instruction Reference (18 of 25) | PUSH

```
PUSH <expression>;
```

Places `<expression>` with a newline appended into the `STDIN` stream. The stacked commands are placed in a last-in, first-out order.

PUSH is a near-twin of the instruction `QUEUE` , except that the latter stores lines in first-in, first-out order.

PUSH, QUEUE and REXX data-stream I/O

Commands pushed or queued to `STDIN` may be retrieved with the `PARSE PULL` instruction. Any stacked lines remaining when the ARexx program exits will be executed as though they had been typed onto the shell. The built-in function `LINES()` returns the number of stacked lines at `STDIN`.

Example:

```
/**/
PUSH 'run ppage:ppage'
PUSH 'stack 10000'
PUSH 'cd dtp:docs'
exit
/* Amigados commands would be run in this order: **
** CD, STACK, RUN **/
```

```

/**/
push 'I take a stone from the right pocket'
say lines()                >>> 1
pull Input
say input                  >>> I TAKE A STONE FROM THE RIGHT POCKET

```

In the second example, the `PULL` instruction will not wait for user input, but will pull the first (and, in this case, only) item from the stack.

Next: [QUEUE](#) | Prev: [PULL](#) | Contents: [Instruction ref.](#)

1.6 ... Instruction Reference | Push/Queue (1 of 2) | DATA-STREAM I/O

`PUSH` and `QUEUE` use a model of communication based on the concept of a stack. Strings are stored one on top of another and can then be retrieved one at a time from the stack.

The `PARSE PULL` instruction first tries to pull a string from that stack. If there is nothing there (in other words, if `LINES() = 0`) then `PULL` will wait until the user has typed in a line of input.

`PUSH` and `QUEUE` are defined as part of the standard REXX language that was developed on and for IBM mainframe systems. On some of the systems where REXX is used, the `PUSH` and `QUEUE` instructions are used as a primary method of communicating with the system itself and with other programs.

Despite that, the instructions are rarely used in ARexx. Why? A major reason is that some CLI/shell programs used on the Amiga do not support the instructions. `PUSH` and `QUEUE` have always been supported on any shell using the the shareware console-management utility ConMan and on the replacement shell WShell (both authored by ARexx creator Bill Hawes), but it was not until Release 2.04 that the standard Amiga shell supported use of the instructions.

The Amiga's interprocess communication features make it possible, in most cases, to use the `ADDRESS` instruction to send commands directly to the environment that will execute them. Commands invoked that way can also send an error code and result string back to the script that called them, giving it a chance to handle error conditions -- something that can't be done using `PUSH` and `QUEUE`, where the commands must be invoked blindly.

Next: [DATA SCRATCHPAD](#) | Prev: [PUSH](#) | Contents: [Instruction ref.](#)

1.7 ... Instruction Reference | Push/Queue (2 of 2) | SCRATCHPAD

`PUSH` and `QUEUE` can be used for more than just stacking commands on the shell. In his ARexx manual, Bill Hawes mentions use of the instructions to create a 'private scratchpad' for a program. Strings stacked with the instructions can be retrieved later in the same script using the `PARSE PULL` instruction, but are also available to another script launched from the first one. (Note, however, that if the scripts terminate

for some reason before data has been pulled from the scratchpad, the shell will treat whatever remains as commands, probably causing a messy series of error messages. Using SIGNAL traps to intercept error conditions and clean up the data stack is recommended in this instance.)

Although there are more efficient and elegant ways to do this, the following example suggests how PUSH and QUEUE can be used as a data scratchpad.

Datafile format	Program
-----	-----
01-Aug-1993 1400	/* Demo of PUSH and QUEUE */
02-Aug-1993 1300	arg AptFN .
01-Aug-1993 1000	TDt = upper(translate(date(),'-',' '))
03-Aug-1993 1700	if open(1AptFile, AptFN, R) then do
06-Aug-1993 1100	do until eof(1AptFile)
03-Aug-1993 1430	Apt = readln(1AptFile)
01-Aug-1993 0900	if word(upper(Apt), 1) >= TDt then
04-Aug-1993 1030	if abbrev(upper(Apt), TDt) then
01-Aug-1993 0800	PUSH Apt
	else
	QUEUE Apt
	end
	end
	do for lines()
	parse pull Apt
	say Apt
	end

The PUSH instruction is used to place a record with the current date at the top of the stack while QUEUE is used to put other dates at the end of the stack. (Sorting the file -- even with the AmigaDOS Sort command -- would make this step unnecessary.) Dates earlier than [TDt] are discarded. In this example, the data is simply printed to the shell. A more useful alternative might be to rewrite it to an updated file. More significantly, the PARSE PULL instruction could be left out of this script and included in another one called from here. The second script could then read the data from the stack and perform whatever actions are needed.

Next: [QUEUE](#) | Prev: [Data-stream I/O](#) | Contents: [PUSH](#)

1.8 ARexxGuide | Instruction Reference (19 of 25) | QUEUE

QUEUE <expression>;

Places <expression> with a newline appended into the STDIN stream. The stacked commands are placed in a first-out, last-in order.

QUEUE is a near-twin of the instruction PUSH, except that the latter stores lines in last-in, first-out order.

PUSH, QUEUE and REXX data-stream I/O

Commands pushed or queued to STDIN can be retrieved with the PARSE PULL instruction. Any stacked lines remaining when the ARexx program exits will be executed as though they had been typed onto the shell. The built-in

function `LINES()` returns the number of lines that have been stacked at `STDIN`.

Example:

```
/**/
QUEUE 'cd dtp:docs'
QUEUE 'stack 10000'
QUEUE 'run ppage:ppage'
EXIT
/* AmigaDOS commands would be run in this order: **
**   CD, STACK, RUN                               */
```

Next: `RETURN` | Prev: `PUSH` | Contents: Instruction ref.

1.9 ARexxGuide | Instruction Reference (20 of 25) | RETURN

`RETURN [<expression>];`

Transfers program control (and an optional result of `<expression>`) from an internal function or a program back to the point from which it was called.

Also see @{" EXIT " link ARx_Instr.ag/EXIT}

Next: `SAY` | Prev: `QUEUE` | Contents: Instruction ref.

1.10 ARexxGuide | Instruction Reference (21 of 25) | SAY

`SAY [<expression>];`

Outputs `<expression>` with a newline appended to `STDOUT` -- the active standard output device (usually the shell).

Example:

```
/**/
Str = 'circumstances better left unspoken'
SAY Str
```

This sample would output to the shell the following:

```
circumstances better left unspoken
```

The keyword `ECHO` may be used as a synonym for `SAY`.

@{" NOTE: Redirection of standard input " alink ARx_Notes.ag/STDIO}

Throughout this guide, the `SAY` instruction is used in examples for other instructions and for functions since it provides a way to output the results of a program action to the shell. The output of the `SAY` command is usually represented on the same line, preceded by the characters `'>>> '`.

Also see @{" WRITELN(" link ARx_Func3.ag/WRITELN())} function

Next: SELECT | Prev: RETURN | Contents: Instruction ref.

1.11 ARexxGuide | Instruction Reference (22 of 25) | SELECT

```
SELECT;
  WHEN <conditional> THEN ; <action>
  WHEN <conditional> THEN ; <action>
  ...
  OTHERWISE ; [<action list>]
END
```

Executes the <action> associated with the first <conditional> in the list of WHEN clauses that evaluates to TRUE. If none of the WHEN <conditional>s are true, then the list of clauses between OTHERWISE and END will be executed.

<conditional> may be any expression that returns a Boolean value.

<action> can be an instruction, assignment, or command. Only one such clause will be executed after THEN, however. To execute multiple clauses, enclose them within a DO/END block.

Multiple clauses (or no clauses) are allowed in the <action list> following OTHERWISE.

The range of a SELECT statement must always be closed with the END keyword. All other clauses and expressions must bind to one of the WHEN keywords, or be included in the list of clauses following OTHERWISE.

Also see @{" IF(" link ARx_Instr.ag/IF}

Next: SIGNAL | Prev: SAY | Contents: Instruction ref.

1.12 ARexxGuide | Instruction Reference | Select (1 of 1) | WHEN

```
select
  WHEN <conditional> then <action>
  < ... >
  otherwise
end
```

WHEN is a secondary keyword that has meaning only within the range of a SELECT instruction. It must be the first word in the clause in which it is used. THEN is required to introduce the instruction, assignment, or command that is to be executed when the <conditional> is true.

Next: OTHERWISE | Prev: Select | Contents: Select

1.13 ARexxGuide | Instruction Reference | Select (1 of 1) | OTHERWISE

```
select
  when <condition> then <action>
  when <condition> then <action>
  OTHERWISE <action>
end
```

OTHERWISE is a required part of each SELECT instruction, but failure to include the keyword may cause a subtle condition that will not generate a syntax error. Because ARexx interprets each clause as it is encountered in the flow of a script, it will skip over any clause that is not required. In the following fragment, the OTHERWISE clause will never be executed since the condition specified for WHEN will always be true:

```
select
  when 1 < 2 then
    say 'WHEN clause executed'
  otherwise
    say 'WHEN clause skipped.'
end
```

If OTHERWISE had been omitted in this instance, a syntax error would not be generated since ARexx would not look for the OTHERWISE clause. It might therefore seem more efficient to leave out the OTHERWISE if the WHEN clauses have exhausted all possible matches. That is not recommended, however, since future changes to the language or third-party extensions to ARexx might detect the error before the program is run. Dropping the OTHERWISE to save a line of code could cause future problems with the non-compliment code.

It is acceptable to include the OTHERWISE keyword followed immediately by the END of the SELECT instruction:

```
select
  when 1 < 2 then
    say 'WHEN clause executed'
  otherwise
end
```

OTHERWISE may be followed by multiple clauses that are not enclosed within a DO/END block:

```
select
  when 1 > 2 then
    say 'WHEN clause executed'
  otherwise
    say '1 is never greater than 2!'
    say 'But, of course, you knew that.'
end
```

Next: [Select](#) | Prev: [When](#) | Contents: [Select](#)

1.14 ARexxGuide | Instruction Reference (23 of 25) | SIGNAL

```
SIGNAL | { ON | OFF } <interrupt>
      | [VALUE] <label name>
```

This instruction causes an unconditional and abnormal transfer of control to a subroutine within the same script. It is used mainly to handle error conditions in a program or special termination conditions for a script or a subroutine within a script.

With the { ON|OFF } option, the instruction controls the way interrupt conditions are handled. The other options cause an abnormal change in the flow of a program.

If called within a multi-clause control-structure (DO , IF , WHEN , or INTERPRET), the control instruction will be terminated and cannot be reactivated.

The special variable SIGL is set to the line number of the clause that triggered the transfer of control.

A SIGNAL instruction of either kind can be used within a subroutine without breaking the flow of a program. If RETURN is encountered within a subroutine signaled from another subroutine, it is treated as it would be in the first subroutine: Control is returned to the environment that called the first subroutine.

The search for the labels <interrupt> or <name> is not case sensitive.

Also see @{" CALL " link ARx_Instr.ag/CALL}

Next: TRACE | Prev: OTHERWISE | Contents: Instruction ref.

1.15 ARexxGuide | Instruction Ref. | SIGNAL (1 of 2) | TRAPS

```
Condition traps
~~~~~
```

SIGNAL ON <interrupt> causes special handling of the exception condition identified by <interrupt> and will transfer control to a subroutine that is identified by a label using the same name as <interrupt>.

For instance, if the instruction { SIGNAL ON Syntax } issued in the script, then any syntax error will cause a jump to the subroutine identified by the label { Syntax: }.

SIGNAL OFF <interrupt> returns the program to its default manner of handling the specified interrupt.

<interrupt> may be any of the following:

Interrupt name	Caused by	Default handling
BREAK_C	a control-C break	Execution halted
BREAK_D	a control-D break	Ignored

BREAK_E	a control-E break	Ignored
BREAK_F	a control-F break	Ignored
ERROR	a non-0 return code from a command	Ignored
FAILURE	a failure-level return code from a command	Error msg. printed
HALT	an external HALT request	Execution halted
IOERR	an error detected by IO system	Ignored
NOVALUE	an uninitialized variable used	Ignored
SYNTAX	a syntax or execution error	Execution halted

The special variable `SIGL` is set to the line that was being interpreted when the trap condition was triggered.

Next: Signal transfers | Prev: Signal | Contents: Signal

1.16 ARexxGuide | Instruction Ref. | SIGNAL (2 of 2) | TRANSFER

`SIGNAL [VALUE] <label name>`

Unconditional transfer of program flow

~~~~~

Used in this way, the instruction causes an unconditional transfer of control to the subroutine identified by `<label name>`, which is treated as a literal value if the sub-keyword `VALUE` is not used.

When the `VALUE` option is specified, `<label name>` may be any expression that evaluates to the name of a subroutine within the current program.

The instruction acts in a way similar to the egregious `GOTO` command in some languages.

Example:

```
/*...*/
if Input = 'GETOUT' then
    SIGNAL Cleanup
/* the program continues */
exit 0
```

Cleanup:

```
/* Any conditions set by the program that should be changed **
** before exit can be included here.                               */
exit 5
```

Next: Signal | Prev: Signal traps | Contents: Signal

## 1.17 ARexxGuide | Instructions | Signal | Traps (1 of 8) | BREAK\_C

The `BREAK_C` condition is triggered when the user presses the Control and C keys together. That input, however, is usually recognized only by a script started from a shell or another environment that establishes a `STDIN`

---

device.

The default action of ARexx is to issue a halt request to the affected program. A BREAK\_C trap will allow the script to take special action when a Control-C input is detected.

SIGNAL ON BREAK\_C allows special steps to be taken in the BREAK\_C subroutine, which will be called when the keys are pressed.

Next: BREAK\_ | Prev: SIGTRAP | Contents: SIGTRAP

## 1.18 ARexxGuide | Instructions | Signal | Traps (2 of 8) | BREAK

The BREAK conditions are triggered when the user presses the Control key along with the letter key specified in the condition option. Such input is usually recognized only by a script started from a shell or another environment that establishes a STDIN device.

If a SIGNAL trap for these keys is not set, ARexx will ignore them.

BREAK traps can be used anywhere in a program, but they are especially useful in an internal function since they recognize asynchronous user input, and can be used to stop execution of the current subroutine without halting the primary environment:

Example:

```

/**/
Say " Press Control and E to stop the obnoxious listing that "
say " will follow this message."
NumRepeats = AdInfinitt()
say '0a'x'The message was repeated' NumRepeats 'times.'
exit

/* The subroutine being called by SIGNAL can be anywhere in **
** program. PROCEDURE , used in AdInfinitt blinds it to **
** variables in the main program, but still allows the **
** BREAK_E subroutine to retrieve the [Rep] variable. */

BREAK_E:
say 'Break detected at line' SIGL':'
say sourceline(SIGL)
return Rep

AdInfinitt: PROCEDURE
/* turning on the signal within the subroutine means **
** it will be effective only while this subroutine is **
** active */
signal on break_e
do Rep = 1
say 'Press Ctrl-E at any time.'
call delay 25
say 'Stop me. Please.'
end
/* because the loop above is endless, this RETURN **
** will never be reached. */

```

```
return 0
```

Run example

Next: ERROR | Prev: BREAK\_C | Contents: SIGTRAP

## 1.19 ARexxGuide | Instructions | Signal | Traps (3 of 8) | ERROR

The ERROR condition is triggered by a command that sets its return code at some value other than 0. If the FAILURE trap is not set, then the ERROR trap will be triggered by any non-0 return code. If the FAILURE trap is in effect, then only those codes less than the current failure level will be trapped by this option.

ARexx normally ignores error returns lower than the failure level since they are often intended as informational codes. Some editors and word-processors, for instance, will send an error code as a matter of course when a search/replace operation is complete to indicate that the final search was unsuccessful. The frequently-used command WaitForPort will send an error code of 5 when in times out without finding the specified port.

Rather than trapping error codes with SIGNAL, it is often better to examine the system variable RC, which is set to the error code, within the script so that trivial errors can be handled without breaking the flow of the script.

Next: FAILURE | Prev: BREAK\_ | Contents: SIGTRAP

## 1.20 ARexxGuide | Instructions | Signal | Traps (4 of 8) | FAILURE

The FAILURE condition is triggered by a command that sets its return code at a value higher than the currently set failure level. ARexx inherits the failure level from its calling environment. The default failure level for AmigaDOS is 10, but that can be changed with the AmigaDOS command 'Failat'. The failure level can also be changed locally in a script with the OPTIONS FAILAT instruction.

ARexx will usually generate an error and halt execution of a script when a failure-level value is returned by a command.

Example:

```
rx "address command copy foo"
```

If issued from the shell, this command would output the following:

```
copy: required argument missing
copy failed (returncode 20)
  1 *-* address command copy foo;
+++ Command returned 20
```

The first two lines were generated by AmigaDOS and the last 2 by ARexx.

---

Signal ON FAILURE allows for special handling of such events:

Example:

```

/**/
signal on failure
address command 'copy foo'

failure:
  signal off failure /* It's a good idea to turn off any trap **
                    ** within the subroutine that handles **
                    ** the condition to avoid looping */
  say 'Command failed:'
  say SIGL:' sourceline(SIGL)
  say ' The command returned' rc'.'
```

Although it's not much of an improvement, the text output this time is supplied by the [Failure:] subroutine:

```

copy: required argument missing
copy failed (returncode 20)
Command failed:
3: address command 'copy foo'
The command returned 20.
```

A FAILURE trap is especially useful in some macros since an output window may not be available for error message. The subroutine that handles the failure could open a console window and print the error message there, or send the error message to a file. (See node on SYNTAX for an example.)

Next: HALT | Prev: ERROR | Contents: SIGTRAP

## 1.21 ARexxGuide | Instructions | Signal | Traps (5 of 8) | HALT

The HALT condition is triggered when an external halt request, usually issued by the HI command, is received by a script. (A HALT trap will not be called by the Ctrl-C condition recognized by BREAK C.)

ARexx normally stops execution of all programs as quickly as possible when such a request is received. Setting this SIGNAL trap will allow a script to take needed cleanup measures before exiting.

The TurboText text editor includes a useful command that can be dangerous if it is not handled with SIGNAL traps. It is 'SetInputLock ON,' which deactivates all input to the program (except by a macro). If that command is in effect when a macro ends unexpectedly, then an external ARexx command must be sent to reactivate the TTX window. A more elegant solution is to turn it off before a program exits.

Notice in this example that several interrupt conditions are handled with one subroutine identified by stacked labels.

Example:

```

/* Turbotext macro */
```

```

signal on break_c
signal on failure
signal on halt
signal on syntax
'SetInputLock ON'

    /* more commands */
'SetInputLock OFF'
exit

    /* This subroutine will turn off locks in emergency exits */
BREAK_C:
FAILURE:
HALT:
SYNTAX:

    'SetInputLock OFF'
    'SetDisplayLock OFF'
    exit

```

Next: IOERR | Prev: FAILURE | Contents: SIGTRAP

## 1.22 ARexxGuide | Instructions | Signal | Traps (6 of 8) | IOERR

The IOERR condition is triggered when an error is detected by ARexx in the I/O system. It is, however, rare for ARexx to become aware of such errors since AmigaDOS traps many of them before they get to ARexx. The OS will put up a system requester asking that a missing device be mounted, or informing the user of a full disk. I/O errors that make it through to ARexx usually occur when conditions are changed (a disk is removed or write-protected) after a file was successfully opened on the disk.

An IOERR condition will be generated, for instance, under these conditions:

- 1.) a file is successfully opened on a disk
- 2.) the disk is removed from the drive
- 3.) ARexx script attempts to write to, read from, or close the file
- 4.) user cancels the system requester asking for the disk

Sullivan & Zamara point out another condition that will pass an IOERROR through to ARexx: an attempt to read from PRT: , the printer device.

Example:

```

/**/
signal on ioerr
if open(.Printer, 'PRT:', w) then
    foo = readln(.Printer)
exit

IOERR:
    signal off ioerr
    say 'I/O error #'RC 'detected in line' SIGL':'
    say sourceline(SIGL)

```

This will output:

---

```
I/O error #253 detected in line 4:
  foo = readln(.Printer)
```

The error number assigned to RC is determined by AmigaDOS.

Next: NOVALUE | Prev: HALT | Contents: Signal traps

## 1.23 ARexxGuide | Instructions | Signal | Traps (7 of 8) | NOVALUE

The NOVALUE condition is triggered when a symbol that has not been assigned a value is used as a variable in an expression.

An unassigned variable in ARexx is normally treated as a string -- the variable's name shifted to uppercase. That can lead to unexpected results, especially in a program under development.

The NOVALUE trap allows the programmer to detect unassigned variables and to debug the script so that a variable cannot be used until it has an appropriate value.

Next: SYNTAX | Prev: IOERR | Contents: Signal traps

## 1.24 ARexxGuide | Instructions | Signal | Traps (8 of 8) | SYNTAX

The SYNTAX condition is triggered by a range of programming errors. It is a condition that will quickly become familiar to ARexx programmers since it normally calls the error message printed (too frequently for some of us) when a program is in development.

Setting a SIGNAL trap for SYNTAX errors allows the script to take special action when a syntax error occurs.

Since it allows an error message to be sent to a non-standard device, a SYNTAX trap is especially useful in a script called from an environment that does not provide a STDOUT or STDERR device to which ARexx can send error messages.

In the following example, error messages are saved to a file:

Example:

```
/* ... */
signal on syntax
if foo then
  /* program code */
exit 0

syntax:
  signal off syntax
  ErrFile = 'T:ErrRpt'
  /* Get the name of the program (which may include spaces) */
  parse source . . . Prg
```

```

Prg = subword(Prg, 1, words(Prg) - 2)
/* Append to the file if it exists, else open it */
if exists(ErrFile) then
  OType = 'A'
else
  OType = 'W'
if open(.Errf, ErrFile, OType) then do
  call writeln(.Errf, 'Error' RC':' errortext(RC))
  call writeln(.Errf, '  In file "'Prg'"')
  call writeln(.Errf, '  Line' SIGL':' sourceline(SIGL))
  call close(.Errf)
end
exit 16

```

This example might output to the file 'T:ErrRpt' the following:

```

Error 46: Boolean value not 0 or 1
  In file "Ram Disk:T/test.rexx"
  Line 4:      if foo then

```

Next: Signal traps | Prev: NOVALUE | Contents: Signal traps

## 1.25 ARexxGuide | Instruction Reference (24 of 25) | TRACE

```

| [{?!}] []
TRACE | VALUE <expression>
| -<number>

```

Provides a powerful debugging facility for ARexx scripts. If a trace console has been opened with the TCO command, then the tracing output will be sent to there. Otherwise, ARexx will attempt to output the results of the trace to the current standard output device -- usually the shell.

<option> controls the type and format of information presented.

If the sub-keyword VALUE is used, then <expression> must evaluate to one of the <option> keywords.

The { ? } and { ! } characters may be used alone { TRACE ? } or together with any of the letter options { TRACE ?R }. They act as toggles: Used once, they turn the option on; used a second time, they turn it off

```

? is the toggle for interactive tracing
! is the toggle for command inhibition

```

When a negative number (such as { TRACE -20 }) is entered as the option, the tracing will remain quiet for the absolute number of lines specified. Entering a positive number { TRACE 20 } will cause the trace to be output for that number of lines without stopping for interactive input.

```

Experiment with trace options:
Run interactive example      *

```

Also see @{ " TRACE() " link ARx\_Func3.ag/TRACE() } function

Next: UPPER | Prev: SIGNAL | Contents: Instruction ref.

## 1.26 ... Instruction Reference | Trace (1 of 3) | OPTIONS

These tracing options may be used both with the `TRACE` instruction and the `TRACE()` function. The options work the same way except that the function { call `trace('o')` }, entered in a program, will end tracing started with the `TS` command utility.

Only the first letter of the option keyword need be used. The `TRACE` instruction treats the option letter or keyword as a literal unless the `VALUE` sub-keyword is used. The option to the `TRACE()` function, on the other hand is always treated as an expression, so variable substitutions will be made before the function is executed.

| <code>&lt;option&gt;</code> | Action                                                                                                                                                                                          |
|-----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| I[ntermediates]             | Everything in the program is traced. The intermediate result of each expression is output along with the resolved value of each variable. The output is identified by special formatting codes. |
| R[esults]                   | Everything in the program is traced, but only the final result of each expression is output.                                                                                                    |
| A[ll]                       | Each clause is output to the console as it is executed, but the results are not shown.                                                                                                          |
| C[ommands]                  | Only command clauses are traced.                                                                                                                                                                |
| L[abels]                    | Only labels are traced. This option shows when a script has jumped to a subroutine.                                                                                                             |
| E[rrors]                    | Any command clause that generated an error is output with an extra line indicating the error number returned.                                                                                   |
| N[ormal]                    | The default trace option outputs only those command clauses that generate a non-zero return value higher than the currently set failure level.                                                  |
| O[ff]                       | All tracing is suppressed, but an external tracing request (from the <code>TS</code> command) will allow tracing of the program.                                                                |
| B[ackground]                | Suppresses all tracing like the <code>OFF</code> option, but -- unlike that option -- not even an external request for tracing will trace the program.                                          |
| S[can]                      | This mode traces all clauses, and checks for errors, but doesn't actually execute any of them, making it useful for in initial check for syntax errors.                                         |

Next: INTERACTIVE TRACING | Prev: TRACE | Contents: TRACE

## 1.27 ... Instruction Reference | Trace (2 of 3) | INTERACTIVE

Interactive tracing can be specified by using the { ? } option with either the `TRACE` instruction or `TRACE()` function. The command utility `TS` also starts interactive tracing.

When interactive tracing is in effect, the tracing and the program itself will stop after almost every clause is executed. A prompt string of '>+>' will be presented. The user has three options in responding to the prompt:

Pressing <Enter> without other characters will cause the program to continue to the next pause point.

Entering a { = } character before pressing <Enter> will cause the previous clause in the program to be reinterpreted.

Any other characters entered at the prompt will be treated as program input and interpreted as an ARexx clause. Any type of valid clause can be entered -- an instruction, a command, or an assignment. Multiple clauses can be entered if each is separated by a semicolon.

The input accepted at the prompt in interactive tracing is similar to the types of input accepted for the INTERPRET instruction.

Any command, assignment clause, or instruction that can be included in a program can be entered at the '>+>' prompt of the trace console. Because clauses entered at the trace prompt are treated as part of the program being traced, the value of variables in the program can be changed from the console by entering an assignment clause at the prompt.

Even a trace instruction can be entered. The instruction

```
TRACE off
```

will stop tracing of the current program.

Another way to control the tracing is to use the last of the TRACE options: When a negative number (such as TRACE -20) is entered as the option, the tracing will remain quiet for the number of lines specified. Entering a positive number (such as TRACE 20) will cause the trace to be output to the console for that number of lines, but without stopping for input.

Using the numeric options on the interactive trace console, is one way to limit tracing of sections of code that are not causing a problem.

Next: [COMMAND INHIBITION](#) | Prev: [Trace options](#) | Contents: [TRACE](#)

## 1.28 ...Instruction Reference | Trace (3 of 3) | COMMAND INHIBITION

The option controlled by '!' is called 'command inhibition.' It prevents commands from being sent to the external host. The commands are still evaluated, however; variable substitutions and other expression operations are performed.

Since all of the ARexx clauses are evaluated and executed, the program logic can be checked using this option before commands are actually sent to an outside host.

Next: [TRACE](#) | Prev: [Interactive tracing](#) | Contents: [TRACE](#)

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## 1.29 ... Instruction Reference | Trace | Options (1 of 1) | TRACE I CODES

Output codes for Intermediates option to TRACE

~~~~~

The output of the TRACE I instruction or function is specially coded to identify the types of information being presented.

Output code	What it identifies
~~~~~	~~~~~
>V>	The resolved value of a variable symbol
>L>	A literal value that is not altered by ARexx
>F>	The value returned by a function
>O>	The result of a dyadic operation
>P>	The result of a prefix operation
>C>	Resolved name of a compound variable
>.>	The value taken by a placeholder token
>U>	The name (symbol) of an unassigned variable
>>>	The final result of the clause. This code is used for other trace options as well

In the interactive example to the main node, the following assignment is one of the clauses traced:

```
Filename = substr(FilePath, 1 + max(lastpos(':', FilePath),,
                                   lastpos('/', FilePath)))
```

The output of TRACE I on that clause is listed below

Reference TRACE output

```
-----
6 *-* Filename = substr(FilePath,max(lastpos(':', FilePath),...
[a]      >V> "sys:system/rexxmast"
[b]      >L> ":"
[c]      >V> "sys:system/rexxmast"
[d]      >F> "4"
[e]      >L> "/"
[f]      >V> "sys:system/rexxmast"
[g]      >F> "11"
[h]      >F> "11"
[i]      >L> "1"
[j]      >O> "12"
[k]      >>> "12"
[l]      >F> "rexxmast"
[m]      >>> "rexxmast"
```

Listed below is the clause with reference letters added to indicate which parts of the clause produced the output above:

```
[m]Filename = [l]substr([a]FilePath,[j&k] [h]max([d]lastpos([b]':',,
           [c]FilePath),[g]lastpos([e]('/', [f]FilePath)) + [i]1)
```

Next, Prev & Contents: Trace Options

