Pipelines Guide and Reference

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The NetRexx Programming Series

This book is part of a library, the *NetRexx Programming Series*, documenting the NetRexx programming language and its use and applications. This section lists the other publications in this series, and their roles. These books can be ordered in convenient hardcopy and electronic formats from the Rexx Language Association.

Quick Start Guide	This guide is meant for an audience that has done some programming and wants to start quickly. It starts with a quick tour of the language, and a section on installing the NetRexx translator and how to run it. It also contains help for troubleshooting if anything in the installation does not work as designed, and states current limits and restrictions of the open source reference implementation.
Programming Guide	The Programming Guide is the one manual that at the same time teaches programming, shows lots of examples as they occur in the real world, and explains about the internals of the translator and how to interface with it.
Language Reference	Referred to as the NRL, this is meant as the formal definition for the language, documenting its syntax and semantics, and prescribing minimal functionality for language implementers.
Pipelines Guide & Reference	The Data Flow oriented companion to NetRexx, with its CMS Pipelines compatible syntax, is documented in this manual. It discusses running Pipes for NetRexx in the command shell and the Workspace, and has ample examples of defining your own stages in NetRexx.

Foreword - by Jeff Hennick

Often in programming projects, either in part or in the whole, we are faced with a collection of objects or text records where each is to be filtered and/or transformed in some way. Sometimes this is easy, many times there are special considerations to be handled.

Pipelines is specifically designed to do all the dirty work around this and by selected small already written and tested programs (called stages). NetRexx Pipelines make this quite easy. And now Pipelines, with over 150 stages, are built into NetRexx. Custom stages are easily written in NetRexx.

The concept of pipes joining small text record processing programs had its start in the early 1970s. In the 1980s, IBM greatly expanded the concept with stages that could have multiple input and output streams of records. And in the 1990s, this concept was transferred to NetRexx. NetRexx Pipelines, while handling records nicely, also adds full Java objects. NetRexx also adds some new Rexx and Java inspired stages.

Note to users coming from IBM CMS Pipelines: While many stages and pipes are and work identically, there are some inherent differences due to the underlying operating environments. While some CMS stages are not in NetRexx (APL, CP, PUNCH, etc.), NetRexx has over 30 new stages – many using concepts from NetRexx's two parent languages, Rexx and Java.

Pipelines can read and write NetRexx variables and files. Many stages have shorter abbreviated names also to ease command line typing.

Pipes can be written on-the-fly at the command line, or made more permanent in files. Like Rexx, these can be written on a single line or in easier to read multiple lines.

Full documentation, with all the included stages (and the CMS stages not included) is in the Pipelines Guide and Reference.

Examples:

This is a classic, as would appear in a file names count.njp, It could be a single line, and run from the command line would need to be. The ”–” is a stage name (alias comment) so needs to be ended with a ”|”. These too could be on their own lines. The count stage has other options besides words.

```
pipe (count)
  disk input.file | -- Read input file |
  count words | -- Count |
  console | -- Display result
```

Here is a multi-output stage example. ”<” and ”>” are aliases for disk read and write. ”?” is the end of a pipe. A word ending in ”:” is a label. The ”/”s are used to delineate the data string.

```
pipe (locrec)
  < input.file | Loc: locate /Sid/ | > selected.records ?
  Loc: | > discarded.records
```

In this one, I’ll use the LITERAL and SPLIT stages to generate short contained input records to demonstrate it in action. Note: some systems will require this on a single line; some will require quote marks around everything but the pipe.

```
pipe literal aa bb;bb cc;cc dd;dd ee;ee ff;gg hh | -- input data |
   split ; | -- break the single line into many |
   between /c/ /e/ | -- make the selection |
   cons | -- see the results
```

the output is

```
cc dd
dd ee
ee ff
```

Jeff Hennick, Forth Worth, June 16th, 2023

1

Introduction

A Pipeline, or Hartmann Pipeline[1][2], is a concept that extends and improves pipes as they are known from Unix and other operating systems. The name pipe indicates an interprocess communication mechanism, as well as the programming paradigm it has introduced. Compared to Unix pipes, Hartmann Pipelines offer multiple input- and output streams, more complex pipe topologies, and a lot more.

Pipelines were first implemented on VM/CMS, one of IBM's mainframe operating systems. This version was later adapted to run under MUSIC/SP and TSO/MVS (now z/OS) and has been part of several product configurations. Pipelines are widely used by VM users, in a symbiotic relationship with REXX, the interpreted language that also has its origins on this platform.

Pipes for NetRexx is the implementation of Pipelines for the Java Virtual machine. It is written in NetRexx and pipes and stages can be defined using this language. It can run on every platform that has a JVM (Java Virtual Machine) installed. This portable version of Pipelines was started by Ed Tomlinson in 1997 under the name of *njPipes*, when NetRexx was still very new, and was open sourced in 2011, soon after the NetRexx translator itself. The included stages have always been open source. It was integrated into the NetRexx translator in 2014 and first released with version 3.04.

In version 3.08, there are important improvements that enable pipelines to be run from the command line, and from the NetRexx REPL program *nrws*, the NetRexx Workspace. The pipes compiler has been renamed *pipc*, while the pipes runner component keeps using the name *pipe*.

[1] `https://en.wikipedia.org/wiki/CMS_Pipelines`

[2] This page used to be called Hartmann Pipeline, but was renamed to CMS Pipelines in 2016

2

The Pipeline Concept

2.1 What is a Pipeline?

The *pipeline* terminology is a set of metaphores derived from plumbing. Fitting two or more pipe segments together yields a pipeline. Water flows in one direction through the pipeline.

There is a source, which could be a well or a water tower; water is pumped through the pipe into the first segment, then through the other segments until it reaches a tap, and most of it will end up in the sink. A pipeline can be increased in length with more segments of pipe, and this illustrates the modular concept of the pipeline.

When we discuss pipelines in relation to computing we have the same basic structure, but instead of water that passes through the pipeline, data is passed through a series of programs (*stages*) that act as filters.

Data must come from some place and go to some place. Analogous to the well or the water tower there are *device drivers* that act as a source of the data, where the tap or the *sink* represents the place the data is going to, for example to some output device as your terminal window or a file on disk, or a network destination.

Just as water, data in a pipeline flows in one direction, by convention from the left to the right.

A pipeline is a sequence of two or more *stages*. The pipeline specification is processed by the *pipeline compiler*, and consists of a character string. A solid vertical bar | is used as *stage separator* (an option allows you to use a different character).[3]

2.2 Stage

A program that runs in a pipeline is called a *stage*. A program can run in more than one place in a pipeline - these occurrences function independent of each other.

When looking at two adjacent segments in a pipeline, we call the left stage the *producer* and the stage on the right the *consumer*, with the *stage separator* as the connector.

[3] In versions before Pipelines for NetRexx 3.08, the default was the exclamation mark (!), which use was discontinued in favour of conformity with VM/CMS Pipelines.

2.3 Device Driver

A *device driver* reads from a device (for instance a file, the command prompt, a machine console or a network connection) or writes to a device; in some cases it can both read and write. An example of a device drivers are < and > ; these read and write data from and to files.

A pipeline can take data from one input device and write it to a different device. Within the pipeline, data can be modified in almost any way imaginable by the programmer.

The simplest process for the pipeline is to read data from the input side and copy it unmodified to the output side. Chapter 4.1 on page 13 shows the currently supported input- and output devices. The pipeline compiler connects these programs; it uses one program for each device and connects them together.

The inherent characteristic of the pipeline is that any program can be connected to any other program because each obtains data and sends data through a device independent standard interface. This becomes apparent when data can be inline (specified or generated within the pipeline specification), come in (or be output) to devices like disk or tape, or be handled through a network – all these formats can be processed by the same stages.

The pipeline usually processes one record (or line) at a time. The pipeline reads a record for the input, processes it and sends it to the output. It continues until the input source is drained.

2.4 Hello world

The simplest form of a pipeline is shown below in a well known greeting :

```
pipe literal Hello, world! | console
```

This pipeline consists of two stages: *literal Hello, world!*, in plumbing terms the 'well', and *console*, the 'sink'. In this case, both stages are device drivers, *literal* pushes the following text into the pipe, and *console* shows the received text on the screen. The stages are connected by a | vertical bar, the default stage separator.

Note that the pipeline source contains characters which have special meaning on the command line in Windows, Linux amd macOS. Therefor it is necessary to enclose the pipeline source within the appropriate quotes when running a pipeline from the command line. That is double quotes " on Windows, or single quotes ' on Linux and macOS. These quotes are not necessary within the *nrws* interface (see 8).

2.5 Pipelines and NetRexx

Internally, the Pipelines engine on NetRexx generates NetRexx source code from the pipeline source text. This NetRexx source code is compiled as a Java class, which is eventually run by the Java Virtual Machine.

Stages - these also are NetRexx programs compiled as Java class files - are implemented as threads.

The Java classname is generated randomly, unless a classname is given as first argument between () round brackets, e.g.

```
pipe '(hello) literal Hello, world! | console'
```

More options are available, see 27.

Note, you cannot specify options in NetRexx Workspace pipelines.

3

Running Pipelines

There are a number of ways to specify and run a pipeline. A little setup is necessary.

3.1 Configuration

The required configuration is minimal. The NetRexxF.jar (java archive file) needs to be on the classpath environment variable. (NetRexxC.jar, which is smaller, will suffice when there is a working javac compiler). Also, the current directory (.) needs to be on the classpath. It is convenient to have aliases or shell scripts defined as abbreviations for the invocation of the pipe (pipe runner), pipc (pipe compiler) and nrc (netrexx compiler) utility programs. Aliases are preferable because some shell processors have idiosyncrasies in the treatment of script arguments. With an alias we can be sure that every NetRexx program sees its arguments the same way.

```
.bash_aliases:
alias pipc="java org.netrexx.njpipes.pipes.compiler"
alias pipe="java org.netrexx.njpipes.pipes.runner"
alias nrc="java org.netrexx.process.NetRexxC"
```

The bash aliases expect classpath to be exported correctly as:

```
export CLASSPATH=${NETREXX_HOME}/lib/NetRexxF.jar:.:$CLASSPATH
```

For Windows, the following works for the pipes runner: file `pipe.bat`:

```
@java -cp "%NETREXX_HOME%\lib\NetRexxF.jar;%CLASSPATH%" org.netrexx.
   njpipes.pipes.runner %*
```

For Windows, the following works for the pipes compiler: file `pipc.bat`:

```
@java -cp "%NETREXX_HOME%\lib\NetRexxF.jar;%CLASSPATH%" org.netrexx.
   njpipes.pipes.compiler %*
```

Both the Windows batch files as well as the Linux shell scripts are shipped in the bin directory of the NetRexx package.

Do note that the Windows .bat files and Linux shell scripts assume that the NETREXX_HOME environment variable is set correctly, that is, to the top of the path where NetRexx is installed. This prepends the NetRexxF.jar file to an already existing CLASSPATH. For the development of local classes (that is, all precompiled pipelines), a dot ('.'), needs to be on this CLASSPATH.

These aliases and scripts enable you to run a pipeline from the commandline, by typing:

```
pipe 'gen 100 | dup 999 | count words | console'
```

Remember to use double quotes on Windows shells. When the `pipe` alias or command script is not on your path, you can also use:

```
java org.netrexx.njpipes.pipes.runner 'gen 100 | dup 999 | count
   words | console'
```

In both cases the answer should be 100000 - you have generated one hundred thousand lines, but fortunately you did not print them, but only counted them. To see them all, you can insert a | console | stage in between the dup and the count stage.

After we have verified the working of the command processors, we will discuss in the next sections which possibilities you have for running pipelines in day-to-day usage.

3.2 From the NetRexx Workspace (nrws) with direct execution

The NetRexx Workspace is the most straightforward , and highly recognizable for users of CMS Pipelines, as it mimics the way a pipe is run in the CMS 3270 interface. It also yields the best response time, because the NetRexx Workspace preloads the Pipelines subsystem by executing pipeline `’literal pipelines processor loaded. | console’` during initialisation.

Note, the `nrws.input` file in your home directory allows to run more code during nrws startup.

There is no magic: we execute a pipeline which displays 'Pipe processor loaded'. This loads all necessary classes and leaves them in memory.

Then we can start specifying pipelines at the *Ready:* prompt.

```
Workspace for NetRexx 4.05 build 2,156-20230131-1212
Copyright (c) Martin Lafaix 2000
Copyright (c)  parts RexxLA 2019,2021
pipelines processor loaded
Ready; pipe literal a man a plan a canal panama | change / // |
   console                    0.991 s
amanaplanacanalpanama
Ready;
```

Executed this way, the generated class image will not be written to disk. Note that the pipelines compiler creates NetRexx source code which is then compiled and run by the pipelines runner. All these are ephemeral within the NetRexx Workspace.

The *timing* option is great for prototyping and performance work.

Type *exit* to leave the NetRexx Workspace.

3.3 From the command line with direct execution

When using the CLI `pipe` command, the rest of the specification needs to be quoted in the command shells of Linux, Windows and macOS. Windows needs double quotes, zVM/CMS does not need quotes, but if they are used they need to be double quotes. Linux and macOS can use single or double quotes, in most cases.

```
$ pipe "literal a man a plan a canal panama | change / // | console"
amanaplanacanalpanama
```

Executed this way, the generated class image again will not be written to disk.

3.4 Compiled pipeline from the command line

In this mode, which uses the `pipc` command (for pipe compiler), a .class file will be persisted to disk. This class can be run as many times as needed without the overhead of compilation. This also would be the right mode for pipes that take different arguments when re-run.

The pipe name needs to be specified, and will be the class name. When the class name exists, it will be overwritten.

```
$ pipc '(aplan) literal a man a plan a canal panama | change / // |
    cons'
( aplan  )  literal a man a plan a canal panama | change / // | cons
$ ls aplan*
aplan.class
$ java aplan
amanaplanacanalpanama
```

This will yield a `aplan.class` classfile, which can be executed by the Java Virtual Machine.

Be sure to leave out the .class suffix when invoking java. Additional options are available in this mode:

- gen   to save the generated .nrx file to disk, default is -nogen
- keep   to save the from the .nrx generated .java source file, default is -nokeep

To specify the literal content from the command line, use the arg() method :

```
$ pipc '(aplan) literal arg() | change / // | reverse | cons'
( aplan  )  literal arg() | change / // | reverse | cons
$ ls aplan*
aplan.class
$ java aplan a man ap
panama
```

3.5 Compiled pipeline from an .njp file

The `pipc` command accepts a given .njp file as argument.

When compiled from an .njp file, the pipe specification must not be quoted. Pipelines can be specified in so-called *Portrait Mode*, which is the standard for more complex pipelines as it is easier to read.

The given .jnp file is compiled and runnable as a Java class file, it is not needed to specify the .njp file extension.

Note the difference in naming between .jnp and .class file.

```
$ cat aman.njp
pipe (aplan)
 literal a man a plan a canal panama |
 change / // |
 console |
 reverse |
 console
$ pipc aman
pipe (aplan ) literal a man a plan a canal panama | change / // |
   reverse | console | reverse | console
$ ls aplan*
aplan.class
$ java aplan
amanaplanacanalpanama
amanaplanacanalpanama
```

3.6 Compiled pipeline from an .njp file with additional stage definitions in NetRexx

When working with .njp files it is possible to create an additional stage in NetRexx, by coding it in the .njp after the pipeline specification.

The following example *length1.njp* specifies a pipeline in which one of the stages is defined in the .njp itself. When run, it tries to read the contents of itself and will output its lines prepended by the line length in decimal and hex.

In fact this is what the NetRexx length1 class does. The class name must be identical as the basename of the .njp source file.

```
$ cat length1.njp
pipe (length2)
 < length1.njp |
 length1       |
 console

import org.netrexx.njpipes.pipes.
class length1 extends stage final

  method run()
    do
      loop forever
       line = rexx peekto()
      l = line.length
      output(l.right(3) (l.d2x).right(2) line)
      readto()
      end
    catch StageError
    rc = rc()
    end
    exit(rc*(rc<>12))
$ pipc length1
pipe (length2 ) < length1.njp | length1       | console
$ ls length?.class
length1.class  length2.class
$ java length2
 15  F pipe (length2)
 17 11  < length1.njp |
 17 11  length1       |
  8  8  console
  0  0
 33 21 import org.netrexx.njpipes.pipes.
 33 21 class length1 extends stage final
  0  0
 14  E   method run()
  6  6     do
 18 12       loop forever
 21 15   line = rexx peekto()
 16 10   l = line.length
 41 29   output(l.right(3) (l.d2x).right(2) line)
  9  9   readto()
  9  9       end
 20 14     catch StageError
 15  F       rc = rc()
  7  7     end
 21 15     exit(rc*(rc<>12))
```

Be sure to invoke the right java class, invoking length1 will have the JVM complain about a non-existing main method.

Note, when coding NetRexx stages in an .jnp file, make sure the pipeline specification is separated from the NetRexx code by at least one blank line.

4

Stage types

Stages can be categorised in different groups : device drivers, record selection stages and filters.

Chapter 8 documents all built-in stages and differences to CMS Pipelines.

For detailed information on the built-in stages, refer to the CMS Pipelines User's Guide and Reference.

4.1 Device drivers

Pipelines for NetRexx contains the following device drivers:

TABLE 1: Device drivers

<	read from a file
>	write to a file (which is overwritten if it exists)
>>	append to a file (which is created if it does not exist)
diskr	read from a file
diskw	write to a file (which is overwritten if it exists)
diska	append to a file (which is created if it does not exist)
diskslow	read, create or append to a file
array	manipulate arrays
arraya	append to an array
arrayr	read an array
arrayw	write to an array
stem	manipulate stems
stema	append to a stem
stemr	read a stem
stemw	write to a stem
vector	manipulate vectors
vectora	append to a vector
vectorr	read elements of a vector
vectorw	write elements to a vector
var	read or set a variable in a NetRexx program
zip	compress a set of files (0 or more) into a zip archive
unzip	decompress a set of files (0 or more) from a zip archive
listzip	list a zip file directory

console	read from, or write to a terminal (window)
hole	destroy data
delay	suspend stream
literal	write the argument string
strliteral	write the argument string
sqlselect	select from any jdbc source
xrange	write a character range

4.2 Record Selection

Various stages can select records and work on data in the pipeline. These are stages called select, sort, specs, locate, etcetera. For a complete description we refer to the IBM Pipelines documentation.

These are the main selection stages supported in Pipelines for NetRexx:

TABLE 2: Record selection

between	selects records between labels
drop	discard records from the beginning or the end of a file
find	select lines
strfind	select lines
frlabel	select records from the first one with leading string
strfrlabel	select records from the first one with leading string
inside	select records between labels
locate	select records between labels
nfind	select lines using xedit nfind logic
strnfind	select lines using xedit nfind logic
nlocate	select lines without a string
notinside	select records not between labels
outside	select records not between labels
pick	select records that satisfy a relation
take	select records from the beginning or the end of a file
tolabel	select records to the first one with leading string
strtolabel	select records to the first one with leading string
sort	orders records
spec	select records based on a specification list
unique	discard or retain duplicate lines

4.3 Filters

Filters perform an operation on a single stream.

These are the main filters supported in Pipelines for NetRexx:

TABLE 3: Filters

buffer	buffer records
chop	truncate the record
join	join records
pad	expand short records
split	split records relative to a target
change	substitute contents of records
specs	rearrange contents of records
xlate	transliterate contents of records
copy	copy records
count	count lines, words and bytes
dup	duplicate the object
reverse	reverse contents of records
timestamp	prefix date and time to records
append	put output from device driver after data on the primary input
casei	run selection stage in a case-insensitive manner
not	run stages with output streams inverted
prefix	block its primary input and executes stage supplied as an argument
zone	run selection stage on subset of input record
elastic	buffer sufficient records to prevent stall
fanin	concatenate streams
faninany	copy records from whichever input stream has one
gate	pass records until stopped
juxtapose	preface record with marker
overlay	overlay data from input streams
command	issue a command and write response to pipeline

4.4 Other Stages

Finally, some other stages are listed below:

TABLE 4: Other stages

query	check version and level of Pipelines for NetRexx
-- --	insert comments into a pipeline
– –	insert comments into a pipeline
comment	insert comments into a pipeline

5

Advanced Pipelines features

In this chapter we will elaborate on more advanced Pipeline features.

5.1 Write your own Filters

So we have seen in the previous examples that it is not too hard to make a simple pipeline out of things called 'device drivers' (such as *command*, for OS commands, '<' for reading files on disk, and *literal*, for inserting literal strings into a pipeline, filters, and sinks. When a filter is not delivered in the standard set of stages, it is very easy to make one yourself in the NetRexx language. The model for this closely follows the way it is done with CMS Pipelines and Classic Rexx. Imagine, for the sake of argument (and a simple example[4]), that you have an assignment to quickly reverse a string.

```
/* BAGVENDT REXX -- Reverse the contents of lines in the pipeline */
signal on error
do forever
  'peekto data'
  'output' reverse(data)
  'readto'
end
error: exit RC*(RC<>12)
```

The `peekto` reads the input but does not actually commit the read yet, so you can read it one more time with knowledge about the contents. The `output` pushes its argument back into the pipeline. The `readto` reads and commits the read so the line is really processed and we can go to the next one.

In NetRexx, that would be about the same, but for some small changes incurred by the object oriented model of NetRexx, which does not exist in Classic Rexx. Here `peekto()`, `readto()` and `output()` are method calls on the `stage` object. The `stage` object is be made addressable by the import from org.netrexx.njpipes.pipes. (file: `bagvendt.nrx`)

```
import org.netrexx.njpipes.pipes.
class bagvendt extends stage
  method run()
    loop forever
      line = Rexx peekto()
      output(line.reverse())
      readto()
```

[4] From the document CMS Pipelines Explained, by John P. Hartmann

```
    catch StageError
      rc = rc()
    end
    exit(rc*(rc<>12))
```

So that would look fairly familiar, and admittedly, a bit easier for us already well versed in NetRexx. Because the source uses pipe idioms, the regular NetRexx compiler cannot understand everything, and we need to uses the pipes compiler *pipc* to compile this source. This will call the NetRexx and Java compilers at the appropriate moment. The resulting .class file needs to be on the CLASSPATH environment variable.

We can test this by building the stage and running the pipeline:

```
$ nrc bagvendt
NetRexx portable processor 4.05-GA build 2,156-20230131-1212
Copyright (c) RexxLA, 2011,2023.   All rights reserved.
Parts Copyright (c) IBM Corporation, 1995,2008.
Program bagvendt.nrx
  === class bagvendt ===
    method run
      signals ThreadQ
      overrides stage.run
Compilation of 'bagvendt.nrx' successful
$ pipe 'literal a plan | bagvendt | cons'
nalp a
```

5.2 Multi-Stream Pipelines

One of the defining differences with Unix pipes is the possibility to define multi-stream pipelines. The selection stages from the previous chapter all have *secondary streams*. What the selection parameters have discarded, *seem to have discarded*, is in reality not gone. In fact, Pipelines for NetRexx throws very little away during execution.

The way to use the not-selected part of the data through these secondary streams is explained in this chapter; it is this capacity that constitutes the freedom to work with many different streams in one pipeline; where Unix pipes are limited to not very much more than stdin, stdout, stderr -- Pipelines for NetRexx enables the user to define as many streams as necessary to accomplish the task at hand in an efficient manner.

Let us look at a simple selection like the following:

```
$ pipe "literal foo bar baz frob frobnitz frobbotzim | split | locate
    /oo/ | cons"
foo
```

The string that makes it through the *locate* selection is 'foo' - it is the only string captured by the /oo/ filter.

The rest of the words is not gone however, and we can use these in further processing by using the secondary stream that *locate* provides.

To prepare for this, we give the secondary stream a name by providing a label - a character string terminated by a : colon. We call it, in absence of any creativity, *rest:*[5]. Also, we send the selected `foo` output into a *hole* stage, where it disappears.

```
$ pipe "literal foo bar baz frob frobnitz frobbotzim | split | rest:
   locate /oo/ | hole"
```

As predicted, there is no output. To get to the rest of the words which are not selected by *locate*, we connect the secondary output stream to a new pipe, using the '?' (the default pipe-end character) and the `rest:` label like this:

```
$ pipe "literal foo bar baz frob frobnitz frobbotzim | split | rest:
   locate /oo/ | hole ? rest: | cons"
bar
baz
frob
frobnitz
frobbotzim
frobbotzim
```

Instead of sending the original output into a black *hole*, we could have also gone further with it, and, for example, reverse it:

```
$ pipe "literal foo bar baz frob frobnitz frobbotzim | split | rest:
   locate /oo/ | reverse | cons ? rest: | cons"
oof
bar
baz
frob
frobnitz
frobbotzim
```

Likewise, we can specify more filter stages in the second, attached pipeline, and bifurcate the pipeline even further.

```
$ pipe "literal foo bar baz frob frobnitz frobbotzim | split | rest:
   locate /oo/ | reverse | cons ? rest: | locate /botzim/ | cons"
oof
frobbotzim
```

It is best practice to define and implement secondary streams when you write your own stages.

A first label connects to the first streams (in and out) of the stage. A second label connects to the secondary streams, a third to the next, etc.

As stages are threads there is no guarantee of order of execution of the additional pipelines:

```
$ cat multipipe.njp
pipe ( multipipe end ? )
     literal  eno |
  a: faninany |
     reverse |
     cons ?
     literal  owt|
```

[5] often, you will see it being called ’a:’

```
  a: ?
     literal  eerht |
  a: ?
     literal  ruof |
  a:

$ pipc multipipe
pipe (multipipe end ? ) literal  eno | a: faninany | reverse | cons ?
    literal  owt| a:  ? literal  eerht | a: ? literal  ruof | a:
$ java multipipe
one
four
three
two
$ java multipipe
four
one
three
two
```

5.3 Pipeline Stalls

With multi-stream pipelines a new problem sometimes rears its head - a *Pipeline stall*, also called *deadlock*. This happens when stages wait for input that cannot be delivered, in a way that ensures that it cannot be delivered.

Pipes for NetRexx detects deadlocks and outputs information to allow you to fix the problem. Consider the following session:

```
$ pipe 'literal test | a: fanin | cons | a:'
test
Deadlocked in p49b739c

Dumping p49b739c  Stall 2000  Monitored by p49b739c

 Flag units digit:  1=wait out, 2=wait in, 4=wait any, 8=wait commit
                 : 10=pending autocommit, 20=pending sever

 literal_1
 Running rc=0 commit=-1 Flag=201 waits 0 args=test
 -> out 0 fanin_2 1 test

 fanin_2
 Running rc=0 commit=-1 Flag=201 waits 0 args=
 -> in  0 literal_1 1 test
    in  1 cons_3 0 test
 -> out 0 cons_3 1 test

 cons_3
 Running rc=0 commit=-1 Flag=201 waits 0 args=
 -> in  0 fanin_2 1 test
 -> out 0 fanin_2 0 test

Dumped Pipe p49b739c Flag 60F rc=16

ThreadQ Thread[#27,Thread-1,5,njPipes]
ThreadQ Thread[#28,Thread-2,5,njPipes]
ThreadQ Thread[#29,Thread-3,5,njPipes]
compiler:RC=16
```

We can see that there are three stages in the Running state. None have any return codes set. The Flags tell us that all the stages are waiting for an output to complete.

The '->' arrow shows which stream is selected. From this we can see cons_3 is trying to output to fanin_2. Unfortunately fanin_2 is waiting for output on stream 0 to complete, it cannot read the data waiting on in stream 1. Hence the stall.

The strings after *Dumping* and *Monitored by* are the autogenerated class names. When you name your pipelines with precompiled pipes yourself, the names you have given them will be displayed here.

When a stream has data being output, there is a boolean flag following the name of the stage the stream is connected to. This tracks the peek state of the object. For an output stream, true means the following stage has peeked at the value. With input streams, true means the current stage has seen the value.

When a stage is multithreaded, like elastic, you can get flags of 3 or 5. This means that threads are waiting on output and read, or output and any. When using multithreaded stages, only one thread should use output unless it is serialized using protected or syncronized blocks.

When a stage has a pending sever or autocommit, flag bits are set too.

5.4 How to use a pipe in a NetRexx program

The following shows how to use a pipe in a NetRexx program:

```
$ cat testpipe.njp

class testpipe

  method testpipe(avar=Rexx)

    F = Rexx 'abase'
    T = Rexx 1

    F[0]=5
    F[1]=222
    F[2]=3333
    F[3]=1111
    F[4]=55
    F[5]=444

    pipe (apipe stall 1000)
        stem F | sort | prefix literal {avar} | console | stem T

    loop i=1 to T[0]
      say 'T['i']='T[i]
    end
  method main(a=String[]) static
    testpipe('This is prefixed')
    exit
$ pipc testpipe
pipe (testpipe_apipe stall 1000) stem F | sort | prefix literal arg(
   string 'avar'} | console | stem T
$ java testpipe
This is prefixed
1111
222
3333
444
55
T[1]=This is prefixed
T[2]=1111
T[3]=222
T[4]=3333
T[5]=444
T[6]=55
```

A couple of things can be seen in this example. First that it is simple to pass NetRexx variables to pipes using *stem*. Also look at the phrase `{avar}`. It passes the NetRexx variable's value to the stage at runtime. In CMS the pipe would be quoted and you would unquote sections to get a similiar effect.

Another thing to note is that the pipe extraction program is fairly smart. It detects when pipes takes several lines. As long as there are stages, or the current line ends with a stagesep or stageend character, or the next line starts with a stagesep or stageend character, the line gets added to the pipe.

The arg(), arg(rexx) or arg(null) methods get the arguments passed to a stage or pipe. To get the complete rexx string of an argument use arg(). To get the nth word of a rexx argument use arg(n). When using pipes in netrexx code you can use arg('name') to get the named argument. If the class of the argument is not rexx use arg(null) to get the object.

In .njp files you can use {avar} phrase actually just shorthand for arg('avar'). The following overstem.nrx stage example shows what has to be done in a stage to access the rexx variables passed by VAR, STEM and OVER. The real 'over' stage is a bit more complete.

```
$ cat overstem.nrx
import org.netrexx.njpipes.pipes.
class overstem extends stage final
  method run() public
    a = getRexx(arg())
    loop i over a
      output(a[i])
    catch StageError
      rc = rc()
    end
    exit(rc*(rc<>12))
$ nrc overstem
NetRexx portable processor 4.05-GA build 2,158-20230131-1734
Copyright (c) RexxLA, 2011,2023.   All rights reserved.
```

```
Parts Copyright (c) IBM Corporation, 1995,2008.
Program overstem.nrx
  === class overstem ===
    method run
      signals ThreadQ
      overrides stage.run
Compilation of 'overstem.nrx' successful
$ cat overtest.njp
class overtest
  method overtest()
    S = Rexx ''

    S[0]=3
    S[1]='one'
    S[2]='two'
    S[3]='three'

    pipe (aover stall 1000)
      stem S | overstem S | console

  method main(a=String[]) static
    overtest()
    exit
$ pipc overtest.njp
pipe (overtest_aover stall 1000) stem S | overstem S | console
$ java overtest
3
one
two
three
```

The getRexx method is passed the name of a string by the pipe.

If you wish to replace a stream, this can be done using connectors. For example look at the following fragment:

```
$ cat calltest.njp
pipe (callt) literal test | calltest {} | console

import org.netrexx.njpipes.pipes.
class calltest extends stage final
  method run() public
    do
      a = arg()
      callpipe (cp1) gen {a} | *out0:
      loop forever
        line = peekto()
        output(line)
        readto()
      end
    catch StageError
      rc = rc()
    end
    exit(rc*(rc<>12))
$ pipc calltest.njp
pipe (callt ) literal test | calltest arg() | console
callpipe (calltest_cp1 ) gen arg(string 'a'} | *o_A0:
$ java callt 10
```

```
1
2
3
4
5
6
7
8
9
10
test
```

Running the callt1 pipe with an argument of 10 passes the 10 to calltest via and arg(). Then cp1's gen stage would be passed 'a' which is set to 10. Since gen generate numbers in sequence, the console stage of callt1 would get the numbers from 1 to 10. Now cp1 ends and calltest's output stream is restored and calltest unblocks and reads the the literal's data 'test' and passes it to console.

The use of only works when compiling from .njp files. It will not work from the command line. The njpipes compiler recognizes connectors as labels with the following forms:

```
    *in:
   *inN:
   *out:
   *outN
```

When N is a whole number, the connector connects input or output stream N of the stage with the connector. When the label is *in or *out, the connector connects the stages's current input or output stream with the connector. This is used instead of *: due to the way the compiler/preprocessor works.

If you do not want the stage to wait for the called pipe to complete you can use addpipe. Here is an example.

```
$ cat addtest.njp
pipe (addt1 debug 0 ) gen 40 | addtest | console

import org.netrexx.njpipes.pipes.

class addtest extends stage final
method run() public
   do
      addpipe (locate1 debug 0) *out: | locate /0/ | *out:
      loop forever
         line = peekto()
         output('a 'line)
         readto()
      end
   catch StageError
      rc = rc()
   end
   exit(rc*(rc<>12))
$ pipc addtest
pipe (addt1 debug 0 ) gen 40 | addtest | console
addpipe (addtest_locate1 debug 0) *o_A: | locate /0/ | *o_B:
$ ls add*class
```

```
addt1.class  addtest.class  addtest_locate1.class
$ java addt1
a 10
a 20
a 30
a 40
```

A quick aside. When writing stages remember that njPipes moves objects through pipes. Use 'value = peekto()' instead of 'value = Rexx peekto()' when ever possible. Some of the supplied stages pass objects with classes other than Rexx and forcing Rexx will cause classCastExceptions. If a stage needs a rexx object try using the rexx stage modifier to attempt to convert the object.

Serious stage writers will probably want to take a good look at the methods defined in the NetRexx source package `org.netrexx.process.njpipes.stages`. There you will find various methods for parsing ranges. You will also find the stub for the stageExit compiler exit. It can be used to produce 'on the fly' code at compile time. You can also use it to change the topology of the unprocessed part of the pipe. The major use is to allow implementations of stages like prefix, append or zone. It is also used to produce better performing stages, for an example see specs. The compiler also queries the rexxArg() and stageArg() methods. If your stage expects objects of class Rexx as arguments rexxArg() should return the number of variables expected. If your stage expects a stage for an argument, stageArg() should return the word position of the stage.

5.5 Giving commands to the operating system

The `command` stage is used to issue commands to the operating system and trap the output to the pipeline. `command` can receive its input as parameters, or through the pipeline. So

```
  pipe literal ls | command | sort | console
```

is equivalent to:

```
  pipe command ls | sort | console
```

Note, on Windows some commands, like `dir`, do not have a separate executable file; there is no `dir.exe`. This can be solved by having the command processor, `cmd.exe` start its built-in command. The pipeline would be, for example:

```
  pipe literal cmd /c dir | command | sort | console
```

5.6 Selecting from relational databases

Using the built-in *sqlselect* stage you can select data, using SQL, from any jdbc source available.

An `sqlselect.properties` file is needed to define the jdbc parameters like the driver to use, the url of the data source and other arguments, like a password and tracing options, if needed.

The file looks like this:

```
jdbcdriver=org.sqlite.JDBC
url=jdbc:sqlite:flightroute-iata.sqb
```

This is all that is needed for an sqlite database containing flight data. A simple select * can then be done with the following pipeline:

```
pipe literal * from FlightRoute where flight = 'KLM765' | sqlselect |
    console
```

This yields the following output:

```
FLIGHT--ROUTE--UPDATETIME--
KLM765  AUA-BON-AMS  1494132448
```

Note that from the command line, the quotes around the pipe specification and the literal string in the SQL statement should be opposite, while when the pipeline is issued from the Workspace for NetRexx, the pipeline does not have to be quoted, but the sql string needs double quotes instead of the - for SQL statements- normal single quotes.

6

The Pipes Runner

The *pipe* command alias starts the Pipes Runner, which is a command processor that can execute a pipe from the command line in an OS shell, the OS being Windows, Linux or macOS[6].

The Pipes Compiler is used in both precompiled and directly executed pipelines. When you directly execute a pipeline from the commandline or from the *nrws* NetRexx workspace, the process is optimized to not persist generated .nrx, .java and .class files to disk before execution; the whole process runs from memory.

The Pipes Runner uses the Pipes Compiler for this purpose, and as such misses the options for persistence[7].

A pipe can be run with options prepended within parentheses, like this:

```
pipe '(test1 sep ! stall 2000 debug 63) literal abcde ! console'
```

The following options are available:

pipename	Specify the name of the generated class file. This can be useful for debugging purposes but is not mandatory when running a pipe. An unnamed pipe receives a generated unique name. This option needs to go first.
sep	The default stage separator is the | (pipe) character; this can be overridden with the sep option; a pipe called test1 which uses an exclamation mark as separator character, needs the options (test1 sep !).
debug	The debug option specifies a bitmask for debugging the execution of a pipe; (debug 63), for example, generates a rather complete debugging trail.
end	The default pipe end character is the ' ?' (question mark), which can be overridden here. Note that the backslash, which is an obvious pipe end character for the z/VM 3270 interface, is not a good choice for Windows and Unix shells.
stall	The duration in number of milliseconds of a pipe stall (or deadlock) detection cycle.

[6] this is a non-exhaustive list of operating systems
[7] But specifying them will not generate an error

7

The Pipes Compiler

The *pipc* command alias starts the Pipes Compiler, The purpose of compiling a pipeline specification is to produce a .class file for the JVM that can be run independently and on different machines; only the JVM and the NetRexxC.jar or the NetRexxF.jar are required to run a precompiled pipe. A set of precompiled pipes can be shipped as an application.

When precompiling pipes, there are options to save and view the generated NetRexx, Java files.

A precompiled pipe has the advantage that it can be executed over and over in an application, without the need to compile it every time; the performance savings are accumulative in this scenario.

The following options can be used on the *pipc* command, in addition to the ones specified in the previous chapter for the Pipes Runner:

-gen	Generate the NetRexx source file. The pipeline needs a name.
-keep	Keep the Java source which is generated from the NetRexx source.

Example:

```
pipc -gen -keep testpipe.njp
```

This will generate the NetRexx source as well as keep the java source for testpipe.njp.

8 Built-in Stages

This section describes the set of built-in stages, i.e. the ones that are delivered with the downloadable open source package. These stages are directly executable from the NetRexxC.jar file or the NetRexxF.jar file (the latter contains a Java compiler for use on JRE-only systems). The source of these stages is delivered in the NetRexx source repository. This repository can be checked out at

```
git clone https://git.code.sf.net/p/netrexx/code netrexx-code
```

The source of the stages is in directory

```
netrexx-code/src/org/netrexx/njpipes/stages
```

How to Read Syntax Diagrams

Special diagrams (often called railroad tracks) are used to show the syntax of external interfaces.

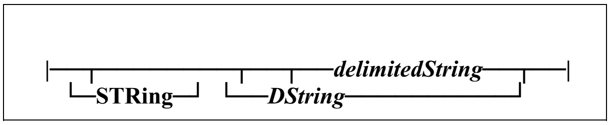
To read a syntax diagram, follow the path of the line. Read from left to right and top to bottom.

- The ►►─── symbol indicates the beginning of the syntax diagram.
- The ───► symbol, at the end of a line, indicates that the syntax diagram is continued on the next line.
- The ►─── symbol, at the beginning of a line, indicates that the syntax diagram is continued from the previous line.
- The ───►◄ symbol indicates the end of the syntax diagram.

Within the syntax diagram, items on the line are required, items below the line are optional, and items above the line are defaults.

Some special symbols used in the diagrams

Delimited String



Examples:

```
/abc/
,,
xf1f2f3
b11000001
str xabx
```

A delimited character string is written between two occurrences of a delimiter character, as a hexadecimal literal, or as a binary literal. The delimiter cannot be blank and it must not occur within the string. Two adjacent delimiter characters represent the null string. It is suggested that a special character be used as the delimiter, but this is not enforced.

A hexadecimal literal is specified by a leading H or X followed by an even number of hexadecimal digits. A binary literal is specified by a leading B followed by a string of 0 and 1; the number of binary digits must an integral multiple of eight.

The keyword STRING can be used to specify that the delimited string contains a string that is terminated by delimiter characters.

Input Range

IRange:

```
├──┬─range──────────────────────┬──────────────────┤
   │  ┌─◄──────────────┐      │
   ├─(──┴─────────range──┴─────)─┤
   └─(strict─range──────)─┘
```

range:

```
  ┌──◄──────────────────────────────────────────┐
├─┴──┬──────────────────────────────────────┬──┴──────────────►
     └──┬─FIELDSEParator──┬───xorc──┘
        └─WORDSEParator───┘

  ┌──◄──────────────────────────────────────────────┐
►─┴──┬──────────────────────────────────────────┬───┴──┬───────►
     └─SUBSTRing──┤ rangePart ├──OF──┘

►──┤ rangePart ├─────┤
```

rangePart:

```
├──┬─────────────────────┼──────────────────────►
   ├─┤ wrdSep ├─┤
   └─┤ fldSep ├─┘

►───┬─snumorstar──────────────────────────┬──────────────┤
    ├─snumorstar;snumorstar──┤
    ├─numorstar─numorstar────┤
    └─numorstar.number───────┘
```

wrdSep:

```
├──┬──────────────────────────────────────────┬─Words─────────┤
   └──┬─WORDSEParator──┬─xorc──┘
      └─WS─────────────┘
```

fldSep:

```
├──┬──────────────────────────────────────────┬─Fields───────┤
   └─┬─FIELDSEParator─┬─xorc─┘
     └─FS─────────────┘
```

Examples:

```
1-*
word 5
1;-1
-18;28
field 4
```

An input range is specified as a column range, a word range, a field range.

A single column is specified by a signed number. Negative numbers are relative to the end of the record; thus, -1 is the last column of the record. A column range is specified as two signed numbers separated by a semicolon or as a range. When a semicolon is used, the first number specifies the beginning column and the second number specifies the ending column. When the beginning and end of a field are relative to the opposite ends of the record, the input field is treated as a null field if the ending column is left of the beginning column.

A word range is specified by the keyword WORDS, which can be abbreviated down to W. Words are separated by one or more blanks. The default blank character is X'20'. Specify the keyword WORDSEPARATOR to specify a different word separator character. WORDSEPARATOR can be abbreviated down to WORDSEP; WS is a synonym.

A field range is specified by the keyword FIELDS, which can be abbreviated down to F. Fields are separated by tabulate characters. Two adjacent tabulate characters enclose a null field. (Note the difference from words.) The default horizontal tab character is X'09'. Specify the keyword FIELDSEPARATOR to specify a different field separator character. FIELDSEPARATOR can be abbreviated down to FIELDSEP; FS is a synonym.

QString

```
|──qstring──|
```

A quote delimited string, the quote marks may be either single or double. The string may be a empty, or a single word. If a single word, the quote marks are optional.

Examples:

- `"string of words"`
- `"word"`
- `'word'`
- `word`
- `'She said, "Yes."'`

Qword

```
|──qword──|
```

A space delimited word, optionally enclosed in quote marks, either single or double. Or a multi word phrase enclosed in quote marks.

Examples:

- `word`
- `"word"`
- `'word'`
- `"word meaning"`
- `'She said, "Yes."'`

Regex String

|——***regex_string***——|

Examples:

```
        a
        A dog
        ^[Aa]?\s*dog(s)?
```

A regular expression string, or regex_string, defines a search pattern for strings. The search pattern can be anything from a simple character, a fixed string, or a complex expression containing special characters describing the pattern.

Using regular expressions can be very powerful. Also cn be very hard to read, and nearly so to write.

Regular expressions are used in many different programming languages, and have several dialects. NetRexx Pipelines uses its underlying Java's version.

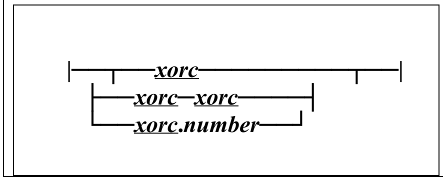
Xorc

|——***xorc***——|

Examples:

```
A character specified as itself (a word that is one character) or its
hexadecimal representation (a word that is two characters). The blank
is represented by the keyword BLANK, which has the synonym SPACE,
or with its hex value, X'20'. The default horizontal tabulate character
(X'09') is represented by TAB.
```

Xrange

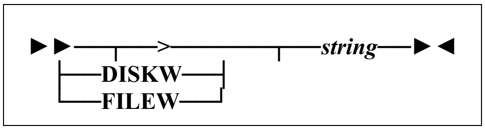
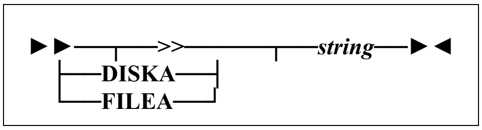


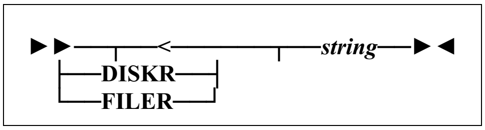
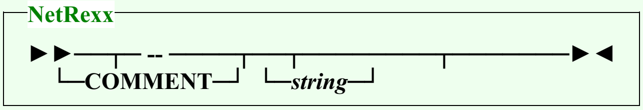
Character ranges designate the characters in the collating sequence between two specified characters; such a range is often called a hex range because the characters can be specified as xorc. A hex range can be written with the first and last characters separated by a hyphen ('-'), or by the first character and a count separated by a period ('.'). No blanks are allowed between the characters and the delimiters because CMS Pipelines scans for a word before scanning the word for the hex range. Hex ranges wrap from 0XFF to 0X00 when the starting character is later in the collating sequence than the ending one, or the count is larger than the number of characters from the beginning character to the end of the collating sequence.

Examples:

- `Y`
- `X-Z`
- `00-7f`
- `00.256`
- `0-00`
- `BLANK`
- `40-7f`
- `blank-7f`
- `blank.3`
- `00-blank`

Pipelines Builtin Stages

> *diskw* *filew* *3.09*	**Replace or Create a File**  - delegates to **diskw**.
>> *diska* *filea* *3.09*	**Append to or Create a File**  - delegates to **diska**.
>>mdsk	**Append to or Create a CMS File on a Mode** - Not implemented in Netrexx Pipelines.
>>mvs	**Append to a Physical Sequential Data Set** - Not implemented in Netrexx Pipelines.

>>oe	**Append to or Create an OpenExtensions Text File** - Not implemented in Netrexx Pipelines.
>>sfs	**Append to or Create an SFS File** - Not implemented in Netrexx Pipelines.
>>sfsslow	**Append to or Create an SFS File** - Not implemented in Netrexx Pipelines.
>mdsk	**Replace or Create a CMS File on a Mode** - Not implemented in Netrexx Pipelines.
>mvs	**Rewrite a Physical Sequential Data Set or a Member of a Partitioned Data Set** - Not implemented in Netrexx Pipelines.
>oe	**Replace or Create an OpenExtensions Text File** - Not implemented in Netrexx Pipelines.
>sfs	**Replace or Create an SFS File** - Not implemented in Netrexx Pipelines.
< *diskr* *filer* *3.09*	**Read a File**  - Implemented as in CMS; delegates to **diskr**.
<mdsk	**Read a CMS File from a Mode** - Not implemented in Netrexx Pipelines.
<mys	**Read a Physical Sequential Data Set or a Member of a Partitioned Data Set** - Not implemented in Netrexx Pipelines.
<oe	**Read an OpenExtensions Text File** - Not implemented in Netrexx Pipelines.
<sfs	**Read an SFS File** - Not implemented in Netrexx Pipelines.
<sfsslow	**Read an SFS File** - Not implemented in Netrexx Pipelines.
-- *comment* *3.09*	**Comment Stage, No Operation**  - delegates to **comment**. - Not in CMS Pipelines; - This is a STAGE, not a programming comment. It must have a SPACE after **--**. - It must have either a stageEnd or pipeEnd. - If used before a driver stage, it must have a pipeEnd.

3277bfra

Convert a 3270 Buffer Address Between Representations

- Not implemented in Netrexx Pipelines.

3277enc

Write the 3277 6-bit Encoding Vector

- Not implemented in Netrexx Pipelines.

64decode
decode64
3.11

Decode Base-64 Format

```
           ┌─MIME───┐
►►───┬─64DECODE─┬───┼──────────┼──►◄
 └─DECODE64─┘  ├─BASIC─┤
           └─URL────┘
```

- NOTE: CMS is only 64DECODE, and does not have the options; it does MIME.
- BASIC - Output is mapped to a set of characters lying in A-Za-z0-9+/. The encoder does not add any line feed in output, and the decoder rejects any character other than A-Za-z0-9+/.
- URL - Output is mapped to set of characters lying in A-Za-z0-9+_. Output is URL and filename safe.
- MIME - Output is mapped to MIME friendly format. Output is represented in lines of no more than 76 characters each, and uses a carriage return '\r' followed by a linefeed '\n' as the line separator. No line separator is present to the end of the encoded output.
- 3.11: New to NetRexx. Add MIME, BASIC, & URL options.

?
ahelp
help

Display Help for Pipelines

```
►►───┬──?(3)───┬────┬──────────────────────────────────────────┬──►◄
     ├──HELP───┤    ├──word────────────────────────────────────┤
     └──AHELP──┘    │          ┌──BUILTINS─(1)──┐               │
               ├──MENU─(1)─┼────────────────┼─┤
               │           ├──COMMANDS─(1)──┤ │
               │           ├──HOST─(1)──────┤ │
               │           ├──MESSAGES─(1)──┤ │
               │           ├──OTHER─(1)─────┤ │
               │           └──SYNTAX─(1)────┘ │
               ├──MSG─(1)──number─────────────┤
               ├──number─(1)──────────────────┤
               ├──SQL─(1)──string─────────────┤
               └──SQLCODE─(1)─┬──────────┬────┘
                              └──number──┘
```

(1) CMS Pipelines only. Not yet in NetRexx Pipelines.
(2) If primary output is connected, lines are propagated, otherwise they are sent to the console by "say."
(3) ? is the default pipeEnd character. Here it is useful only when a different pipeEnd is defined.

abbreviation
abbreviatio
abbreviati
abbreviat
abbrevi
abbrev

Select Records that Contain an Abbreviation of a Word in the First Positions

```
►►──ABBREViation─(1)─┬──────────────────────────────────────────┬─►◄
                     └─word─┬─────────────────────────────┬─────┘
                            └─number─┬───────────────┬────┘
                                     ├─ANYcase─(2)─┤
                                     ├─CASEANY─────┤
                                     ├─CASEIGNORE──┤
                                     ├─IGNORECASE──┤
                                     └─CASELESS────┘
```

- (1) ABBREViation must be ABBREV in CMS
- (2) ANYcase must be ANYCASE in CMS

acigroup

Write ACI Group for Users

- Not implemented in Netrexx Pipelines.

addrdw

Prefix Record Descriptor Word to Records

- Not implemented in Netrexx Pipelines.

adrspace

Manage Address Spaces

- Not implemented in Netrexx Pipelines.

aftfst

Write Information about Open Files

- Not implemented in Netrexx Pipelines.

aggrc

Compute Aggregate Return Code

```
►►──AGGRC──►◄
```

ahelp
help
?

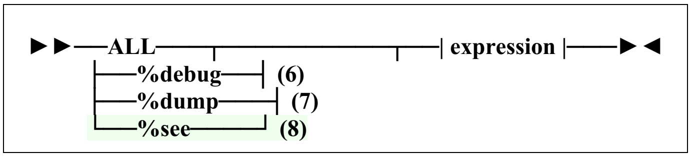
Display Help for Pipelines

```
►►─┬──AHELP──┬─┬──────────────────────────────────────────────────┬─►◄
   ├──HELP───┤ ├──word────────────────────────────────────────────┤
   └──?─(3)──┘ │          ┌──BUILTINS─(1)──┐  │
               ├──MENU─(1)─┼────────────────┼──┤
               │          ├──COMMANDS─(1)──┤  │
               │          ├──HOST─(1)──────┤  │
               │          ├──MESSAGES─(1)──┤  │
               │          ├──OTHER─(1)─────┤  │
               │          └──SYNTAX─(1)────┘  │
               ├──MSG─(1)──number─────────────┤
               ├──number─(1)──────────────────┤
               ├──SQL─(1)──string─────────────┤
               └──SQLCODE─(1)─┬──────────┬────┘
                              └──number──┘
```

(1) CMS Pipelines only. Not yet in NetRexx Pipelines.
(2) If primary output is connected, lines are propagated, otherwise they are sent to the console by "say."
(3) ? is the default pipeEnd character. Here it is useful only when a different pipeEnd is defined.

all
4.06

Select Lines Containing Strings (or Not)



Notes:

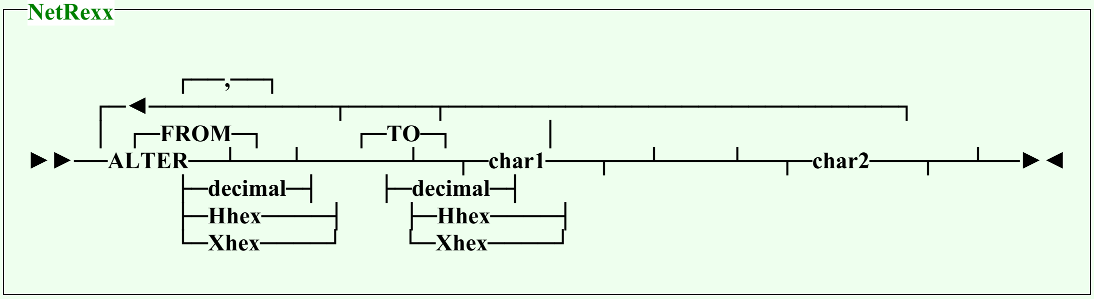
- (1) "expression" consists of one or more delimitedstrings separated by logical ANDs, ORs, and NOTs, and grouped, if needed, by parentheses.
- (2) "&" is used for AND.
- (3) Since "|" is the default stage separator, "!" may be used for OR.
- (4) Since NetRexx uses "(" and ")" for options -- which are not used in the ALL stage -- "[" and "]" must be used for parentheses.
- (5) CMS Pipelines, having originated on 3270 terminals, uses "¬" for NOT. This symbol is not readily typed on terminals running NetRexx Pipelines, so as alternatives, "\\", used by NetRexx, (it needs to be doubled to "escape" it) or "^", used by KEX, NOT symbols may be used as alternatives.
- (6) %debug (must be lowercase) NetRexx Pipelines writes the logic line to the file ALL.DEBUG in the current directory. Windows may make it all.debug . CMS Pipelines writes the constructed pipeline (of LOCATE and NLOCATE stages) to ALL DEBUG A.
- (7) %dump (must be lowercase) - writes to the primary output stream as the first record. NetRexx Pipelines writes the logic line. CMS Pipelines writes constructed pipeline.
- (8) %see (must be lowercase) - NetRexx Pipelines Only. Writes the logic line to the standard output (terminal).
- CMS Pipelines uses is own logic order. NetRexx Pipelines uses regular NetRexx logic.

Examples:

-
  ```
  literal NetRexx is Good,NetRexx is
  Great,NetRexx is Fantastic |
  split , |
  all /a/ |
  cons

  ▶NetRexx is Great
  ▶NetRexx is Fantastic
  ```

-
  ```
  literal NetRexx is Good,NetRexx is
  Great,NetRexx is Fantastic |
  split , |
  all / G/ & [/oo/ ! /F/] |
  cons

  ▶NetRexx is Good
  ```

-
  ```
  literal NetRexx is Good,NetRexx is
  Great,NetRexx is Fantastic |
  split , |
  all /R/ & [/oo/ ! /F/] |
  cons

  ▶NetRexx is Good
  ▶NetRexx is Fantastic
  ```

alter	**Change the contents of records, from one character to another**  NetRexx ALTER FROM TO , char1 char2 decimal Hhex Xhex decimal Hhex Xhex - An variation on the theme of Xedit's ALTER. - There are pairs of char1s and char2s, optionally separated by commas. - For each pair of char1 and char2, this changes ALL char1s to char2, like Xedit's 4th and 5th parameters were 1 and 1. - The chars can be single characters, 2 or 3 digit decimal numerical representations, or beginning with H, h, X, or x hexidecimal representations. - Also see TRANSLATE / XLATE. - Not in CMS Pipelines.
alserv	**Manage the Virtual Machine's Access List** - Not implemented in Netrexx Pipelines.
apldecode	**Process Graphic Escape Sequences, Old APL language** - Not implemented in Netrexx Pipelines.
aplencode	**Generate Graphic Escape Sequences, Old APL language** - Not implemented in Netrexx Pipelines.
append	**Put Output from a Device Driver after Data on the Primary Input Stream** ►►──APPEND──*string*────────►◄
array	**Read or Write an Array** - Pipes for NetRexx
arraya	**Read or Write an Array** - Pipes for NetRexx
arrayr	**Read or Write an Array** - Pipes for NetRexx
arrayw	**Read or Write an Array** - Pipes for NetRexx
asatomc	**Convert ASA Carriage Control to CCW Operation Codes. Old printer control** - Not implemented in Netrexx Pipelines.
asmcont	**Join Multiline Assembler Statements** - Not implemented in Netrexx Pipelines.
asmfind	**Select Statements from an Assembler File as XEDIT Find** - Not implemented in Netrexx Pipelines.

asmnfind

Select Statements from an Assembler File as XEDIT NFind

- Not implemented in Netrexx Pipelines.

asmxpnd

Expand Joined Assembler Statements

- Not implemented in Netrexx Pipelines.

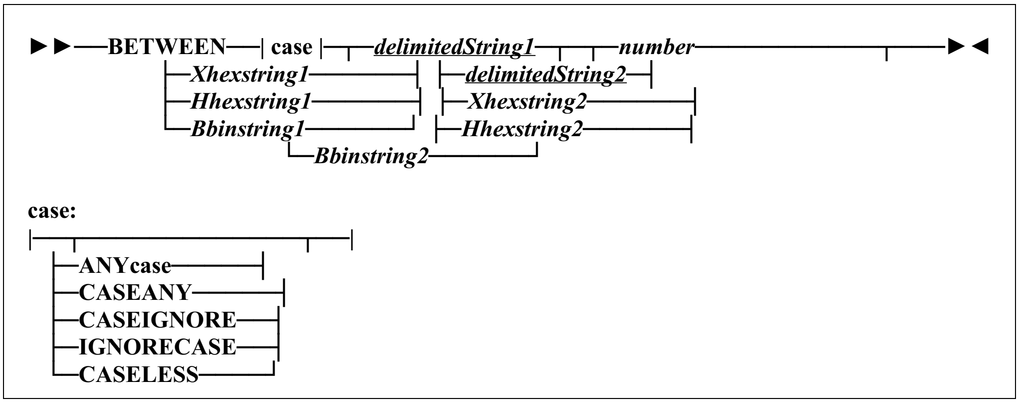
beat

Mark when Records Do not Arrive within Interval

- Not implemented in Netrexx Pipelines.

between
3.09

Select Records Between Labels



bfs
hfs

Read or Append File in the Hierarchical File System

- Not implemented in Netrexx Pipelines.

bfsdirectory
bfsdir
hfsdirectory
hfsdir

Read Contents of a Directory in a Hierarchical File System

- Not implemented in Netrexx Pipelines.

bfsquery
bfsq
hfsquery
hfsq

Write Information Obtained from OpenExtensions into the Pipeline

- Not implemented in Netrexx Pipelines.

bfsreplace
bfsrep
hfsreplace
hfsrep

Replace the Contents of a File in the Hierarchical File System

- Not implemented in Netrexx Pipelines.

bfsstate
bfsstat
hfsstate
hfsstat

Obtain Information about Files in the Hierarchical File System

- Not implemented in Netrexx Pipelines.

bfsxecute
bfsx
hfsxecute
hfsx

Issue OpenExtensions Requests

- Not implemented in Netrexx Pipelines.

block

Block to an External Format

- Not implemented in Netrexx Pipelines.

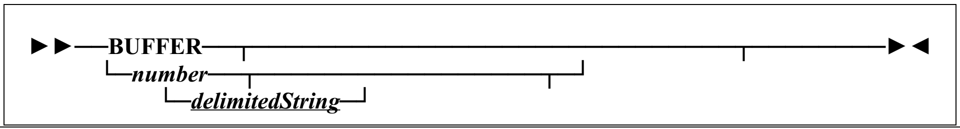
browse
brw

Display Data on a 3270 Terminal

- Not implemented in Netrexx Pipelines.

buffer

Buffer Records



c14to38

Combine Overstruck Characters to Single Code Point. Old printer.

casei

Run Selection Stage in Case Insensitive Manner

```
►►──CASEI──┬──────────────────────────────────────┬─────────────┬──────►
           └─ZONE──|inputRange |─┘ (1) └─REVERSE─┘ (1)

►──stage──┬───────────────┬──►◄
          └─string─┘
```

- (1) CMS Pipelines only.

change

Substitute Contents of Records

```
►►──CHANGE──┬──────────────┬─────┬─────────────────────────────┬──►
            └─| anycase |─┘     ├─inputRange──────────┤
                          │  ┌◄───────────┐       │
                          └─(──┴─range──┴───)─┘

  ┌─FROMTO─(1)┐
►─┴──┬──────────┴──────| changeString |──────────────────────────┬──►
     │ ┌-FROM-(1)┐              ┌-TO-(1)┐        │
     └─┴─────────┴─delimitedString─┴───────┴─delimitedString─┘

►──┬────────────────────────────────────┬──►◄
   │ ┌─FOR─(1)┐          │
   └─┴─────────┴─numorstar─┘


changeString:
|──delimiter──string──delimiter──string──delimiter──|

anycase:
   ┌─RESPECTCASE─(1)┐
|──┼───────────────────┼──|
   ├─ANYcase──────────┤
   ├─CASEANY──────────┤
   ├─CASEIGNORE───────┤
   ├─IGNORECASE───────┤
   └─CASSLESS─────────┘
```

- (1) NetRexx Pipelines only.

changeparse ***changepars*** ***changepar*** ***changepa*** ***changep*** *3.11*	**Change the contents of records, using Rexx Parse. Calculations can be done.**

NetRexx

```
              ┌─FROM─┐            ┌─TO─┐
►►──CHANGEParse──────┴────────────┴─parse_template_Dstring─┴────────┴─output_template_Dstring──►

►─┬──────────────────────────────┬──►
  └─BY─by_NetRexx_Dstring─┘

►─┬────────────────────────────────┬─┬──────────────────────────────────────────────┤
  └─FIRST─first_NetRexx_Dstring─┘  └─FINALLY─finally_template_Dstring─┘
```

- Records are parsed via the parse_template_delimited_string.
- Variables are named $n, where n is 1 to 9.
- The by_NetRexx_delimited_string is interpreted. This is 0 or more semicolon separated NetRexx statements, probably using the $n variables, which can have the value altered.
- Other variables may be used, and are persistent while the stage is active, so can be used as accumulators.
- The values of the variables are put into the output_template_delimited_string replacing $n.
- For a literal $n that won't be changed, use $$n.
- A first_NetRexx_delimited_string, if present, is interpreted before reading any record from the primary input steam. This is 0 or more semicolon separated NetRexx statements, probably using the $n variables. Any variables used in the by_NetRexx_delimited string must be defined here.
- A finally_template_delimited_string, if present, is written as a final output record after the primary input stream is finished, using the $n's.
- Any keyword phrases must, in any order, follow any non-keyworded FROM & TO phrases.
- This is NetRexx Pipelines only, not in CMS.

Examples:

- **`changeparse / 2 $1 +1/ /The second letter is "$1". $$1 won't be changed./`**
- **`changeparse from / 2 $1 +1/ to /The second letter is "$1". $$1 won't be changed./`**
- **`changeparse from / . $2 . 50 $5 +5 / to /The product is $1/ by /$1 = $2 * $5/`**
-
```
changeparse from / . $2 . 50 $5 +5
/ ,
to /The product is $1/ ,
by /$1 = $2 * $5;$3 = $3 + $1/ ,
first /$3 = 0/ ,
finally /$3 is the total/
```

changeregex
changerege
changereg
changere
changer
3.09

Substitute Contents of Records using Java Regular Expressions

```
NetRexx
                  ┌─FROM─┐             ┌─TO─┐                 ┌─ONE─┐
►►──CHANGERegex──┴───────┴─────────────┴─delimitedString─(1)─┴──────┴─delimitedString─(2)─┼──────┼──►◄
                                         └─ALL─┘
```

- Uses the Java RegEx classes and its dialect of RegEx. See Java's **Pattern** class and **replaceFirst** and **replaceAll** methods of **String** for full documentation.
- (1) First, FROM, delimitedString is a Java *RegEx expresion* for what is to be replaced.
- (2) Second, TO, delimitedString is the replacement string. It may contain elements from the first one.
- Ths is NetRexx Pipelines only, not in CMS.

chop
truncate
truncat
trunca
trunc

Truncate the Record

```
            ┌─80──────────────────────┐
►►──┬──────CHOP──────┬──┼──────────────────────────┼──►◄
    └─TRUNCate─┘     ├─snumber─────────────┤
              └──┤ stringtarget ├──┘
stringtarget:
├─┬──────────────────┬─┬───────────────────────────┬─┬──────┬─┤ target ├─┤
  ├─ANYcase──────┤ │       ┌─BEFORE─┐ │ └─NOT─┘
  ├─CASEANY──────┤ └─┬────────┴─┬────────┴─┘
  ├─CASEIGNORE───┤   └─snumber─┘ └─AFTER─┘
  ├─IGNORECASE───┤
  └─CASELESS─────┘

target:
├──┬──xrange──────────────────────────┬──┤
   └──┬─STRing──┬──delimitedString──┘
      └─ANYof──┘
```

cipher

Encrypt and Decrypt Using a Block Cipher

- Not implemented in Netrexx Pipelines.

ckddeblock

Deblock Track Data Record

- Not implemented in Netrexx Pipelines.

cmd
command

Issue OS Commands, Write Response to Pipeline

```
►►──┬──CMD─────┬──┬──────────┬──────────────────►◄
    └─COMMAND─┘  └──string──┘
```

- input stream 0 is for commands
- input stream 1 is stdin
- output stream 0 is stdout
- output stream 1 is the return code
- output stream 2 is stderr

cms

Issue CMS Commands, Write Response to Pipeline '

collate
3.11

Collate Streams

```
          ┌─NOPAD──────┐
►►─COLLATE─┴──────┬─────┴─┬─────────────┬─┬──────────────┬─┬──────────────────┬─►
   └─STOP ANYOF─┘  └─PAD─xorc─┘ └─┤ anycase ├─┘

                  ┌─MASTER DETAIL───┐
►─┬──────────────────────────────────┬─┬─────────────────────────┬──┬─►
  └─inputRange─┬──────────────┬─────┘ ├─MASTER──────────────────┤
               └─inputRange─┘  └─DETAIL─┬─────────────────┤
                            └─MASTER─┘

►─┬──────────────────────────────────────────────┬─►◄
  └─SEParator─delimitedString─(1)(2)─┘

anycase:
  ┌─RESPECTCASE─(1)─┐
├─┼─────────────────┼─┤
  ├─ANYcase─────────┤
  ├─CASEANY─────────┤
  ├─CASEIGNORE──────┤
  ├─IGNORECASE──────┤
  └─CASSLESS────────┘
```

- (1) NetRexx Pipelines only.
- (2) delimitedString record is put before each Master Record
  (or after if DETAIL MASTER order) on the primary output stream.
- 3.11 New to NetRexx Pipelines. Add SEParator option.

combine

Combine Data from a Run of Records

```
►►──COMBINE──┬──────────────────────────────┬──┬─Or──────────────┬─►◄
      │ ┌─1──────────────────┐ │ ├─aNd─────────────┤
      ├─┼────────────────────┼─┤ ├─AND─────────────────┤
      │ ├─number─────────────┤ │ ├─eXclusiveor─┤
      │ ├─*──────────────────┤ │ ├─EXClusiveor─┤
      │ └─KEYLENgth──number─┘ │ ├─FIRST─(2)─────┤
      │       ┌─ALLEOF─(1)─┐ │ └─LAST─(2)──────┘
      └─STOP─(1)─┼────────────┼─┘
                 └─ANYEOF─(1)─┘
```

- (1) Only for use with secondary input streams.
  Only options from this column usable with any secondary input streams.
  (This is poorly documented in CMS Pipelines.
  This is a best guess of their intentions.)
- (2) Not usable with STOP and secondary streams.

command
cmd

Issue OS Commands, Write Response to Pipeline

```
►►──┬─COMMAND─┬──┬──────────┬───────────────────┬──────────►◄
    └─CMD─────┘  └──string──┘
```

- input stream 0 is for commands
- input stream 1 is stdin
- output stream 0 is stdout
- output stream 1 is the return code
- output stream 2 is stderr

comment
--
3.09

Comment stage

```
┌NetRexx──────────────────────────────────────────────────┐
│ ►►──┬─COMMENT─┬──┬──────────┬──────────────┬───────►◄   │
│     └─ -- ────┘  └──string──┘                           │
└─────────────────────────────────────────────────────────┘
```

- Not in CMS Pipelines;
- This is a STAGE, not a programming comment. It must have a SPACE after --.
- It must have either a stageEnd or pipeEnd.
- If ended with a stageEnd, it passes records through on primary input to output streams.
- If ended with a pipeEnd, it does NOT pass records through.
- If used before a driver stage, it must have a pipeEnd.

compare

Compare Primary and Secondary Streams, Write the Result

```
NetRexx
        ┌TRINARY─┐  (1)          ┌PAD SPACE┐
►►──COMPARE──────┤───────────────┼─────────────────────────┬──┼───────────────┼──┬────────────┬
        ├BINARY──┘  (2)       │  └PAD─xorc─┘  └ECHO─┘
        │            │
        ├─────◄───────────────────────────────┐   │
        ├ANY delimitedString──────┬──┘  (4) (5)
        ├EQUAL delimitedString────┤     (4)
        ├LESS delimitedString─────┤ (3) (4)
        ├MORE delimitedString──────┤ (3) (4)
        └NOTEQUAL delimitedString──┘    (4)
```

- (1) -1 = Primary is shorter/less, 0 = equal, 1 = Secondary is shorter/less
- (2) 0 = equal, 1 = not equal
- (3) Primary is LESS/shorter (or MORE/longer) than secondary
- (4) *DStrings* can use any of the following escapes (or the lowercase) for the unequal situation:
  - \C (count) for the record number,
  - \B (byte) for column number
  - \P (primary) for the primary stream record
  - \S (secondary) for the secondary stream record
  - \L (Least) for the stream number that is shorter, -1 if equal
  - \M (Most) for the stream number that is longer, -1 if equal
- (5) Equal or not, this DString precedes any of the others.
- (6) This is NetRexx Pipelines only, not included in CMS
- (7) In reporting \P & \S, control charactors, except new line, \n, are transliterated to [blob, 219.d2c()]
- (8) Without ECHO, this stops and reports at first non-compare. With ECHO, each primary input is reported; after first non-compare primary input stream records continue to be read and reported, but no testing is done.
- (9) Options work in any order
- Input streams:
  - 0: Data 1
  - 1: Data 2
- Output streams:
  - 0: Result (single record, possibly multiple lines)
  - 1: Last primary record read at first no match, or end of stream
  - 2: Last secondary record read at first no match, or end of stream

configure

Set and Query CMS Pipelines Confguration Variables

- Not implemented in Netrexx Pipelines.

console
consol
conso
cons
cons
terminal
termina
termin
termi
term
3.11

Read or Write the Terminal in Line Mode

```
►►──┬─CONSole──┬─┬──────────────────────┬─┬────────────────────────────────┬──────
    └─TERMinal─┘ ├─EOF──delimitedString─┤ ├─PRfix───┬─delimitedString─(1)─┘
                 └─NOEOF────────────────┘ └─PRompt──┘

►──┬───────────────────────┬──►◄
   ├─DIRECT─(2)────────────┤
   ├─ASYNchronously─(2)────┤
   └─DARK─(2)──────────────┘
```

- (1) NetRexx only
  On first stage, delimitedString is put out as a prompt
  On other stages, each line is prefixed with delimitedString
  Outout to next stage does NOT include delimitedString
  Either keyword can be used for either stage
- (2) CMS only

copy

Copy Records, Allowing for a One Record Delay

```
►►──COPY──────────►◄
```

count

Count Lines, Blank-delimited Words, and Bytes

```
      ┌─◄──────────────────────────────┐
►►──COUNT──┴──┬─┬─CHARACTErs─┬─┬──┴──────────►◄
           │  │ ├─CHARS──────┤ │
           │  │ └─BYTES──────┘ │
           ├─WORDS─────────────┤
           ├─┬─LINES───────────┤
           │ └─RECORDS─┘       │
           ├─MINline───────────┤
           └─MAXline───────────┘
```

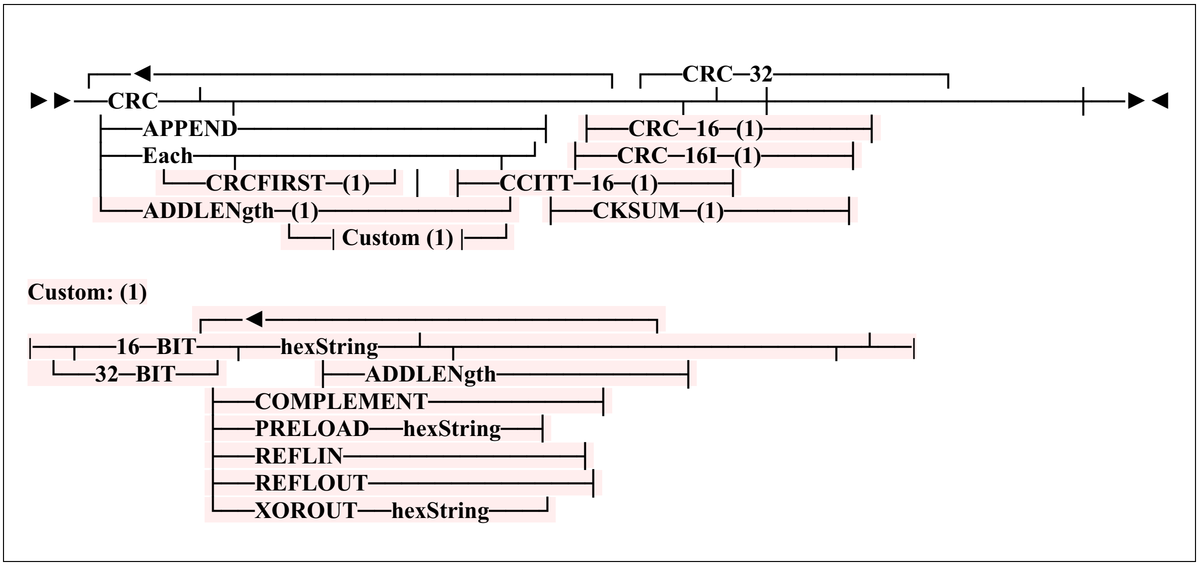
cp

Issue CP Commands, Write Response to Pipeline

- Not implemented in Netrexx Pipelines.

crc
4.06

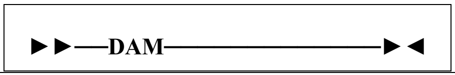
Compute Cyclic Redundancy Code



- (1) Not implemented in Netrexx Pipelines.
- (2) CRC stage uses secondary output, if connected.

dam

Pass Records Once Primed



dateconvert
dateconver
dateconve
dateconv
3.09

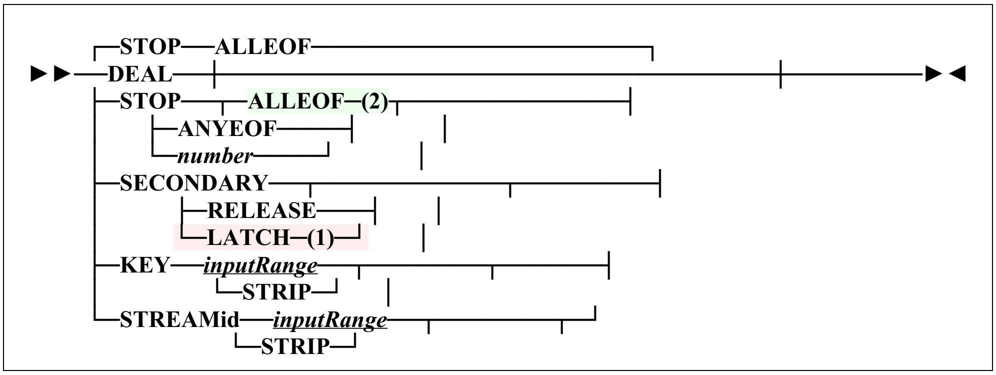
Convert Date Formats

```
►►──DATECONVert──┬──────────────────────────────────┬──────────►
                 └──inputRange──(3)──┘

  ┌─SHOrtdate ISOdate─────────────────────┐   ┌─WINDOW ─50──────────────┐
►─┼──────────────────────────────────────────────────┬──┬───────────────────────┼─►
  │              ┌─ISOdate─────────────┐ │ ├─WINDOW─signednumber─┤
  ├─| Inputformat |─┬─┼───────────────────────┼┘ └─BASEYEAR─yearnumber──┘
  │ ┌-PREFACE-┐ │ └-| Outputformat |-┘
  └─NOW──┼──(5)──────────┼─┘
     └─APPEND───┘

            ┌───MIDNIGHT───(4)─┐
►──┬─────────────┬──┬──┼─────────────────────┼─────────────►◄
   └──TIMEOUT──┘   └───NOON───(4)─────────┘

Inputformat,     Outputformat:
SHOrtdate    }   mm/dd/yy hh:mm:ss.uuuuuu
USA_SHORT    }
REXX_DATE_U  }

FULldate     }   mm/dd/yyyyyyy hh:mm:ss.uuuuuu
USA          }

ISO_SHORT        yy-mm-dd hh:mm:ss.uuuuuu
ISOdate          yyyyyyy-mm-dd hh:mm:ss.uuuuuu
DB2_SHORT        yy-mm-dd-hh.mm.ss.uuuuuu
DB2              yyyyyyy-mm-dd-hh.mm.ss.uuuuuu
VMDATE  (2)
NORMAL           dd mmm yyyyyyy hh:mm:ss.uuuuuu
CSL_SHORT    }   yy/mm/dd hh:mm:ss.uuuuuu
REXX_DATE_O  }
CSL              yyyyyyy/mm/dd hh:mm:ss.uuuuuu
PIPE_SHORT       yymmddhhmmssuuuuuu
PIPE         }   yyyymmddhhmmssuuuuuu
REXX_DATE_S  }
EURSHORT         dd.mm.yy hh:mm:ss.uuuuuu
EUR              dd.mm.yyyyyyy hh:mm:ss.uuuuuu
JULIAN_SHORT     yy.ddd hh:mm:ss.uuuuuu
JULIAN           yyyyyyy.ddd hh:mm:ss.uuuuuu
TOD_ABSOLUTE }  (2)
TODABS       }  (2)
SCIENTIFIC_ABSOLUTE }  (2)
SCIABS              }  (2)
POSIX            ssssssss
TOD_RELATIVE }  (2)
TODREL       }  (2)
SCIENTIFIC_RELATIVE }  (2)
SCIREL              }  (2)
MET  (2)

The following can be REXX_DATE_x, REXXx, or Rx
REXX_DATE_B  (2)
REXX_DATE_C  (2)
REXX_DATE_D       ddd hh:mm:ss.uuuuuu
REXX_DATE_E       dd/mm/yy hh:mm:ss.uuuuuu
REXX_DATE_E_LONG  dd/mm/yyyyyyy hh:mm:ss.uuuuuu
REXX_DATE_J       yyddd hh:mm:ss.uuuuuu
REXX_DATE_J_LONG  yyyyddd hh:mm:ss.uuuuuu
REXX_DATE_M       mmmmmmmmm (output only)
REXX_DATE_N_SHORT dd mmm yy hh:mm:ss.uuuuuu
REXX_DATE_N       dd mmm yyyy hh:mm:ss.uuuuuu
REXX_DATE_W       wwwwwwwww (output only)
```

- (1): SPACE is optional here.
- (2) Not implemented in NetRexx Pipelines at this time; mainly mainframe useful only.
- (3): NetRexx Pipelines uses IRange which gives a superset of range options.
- (4): NetRexx Pipelines only. What time to assume if blank time on input.

deal

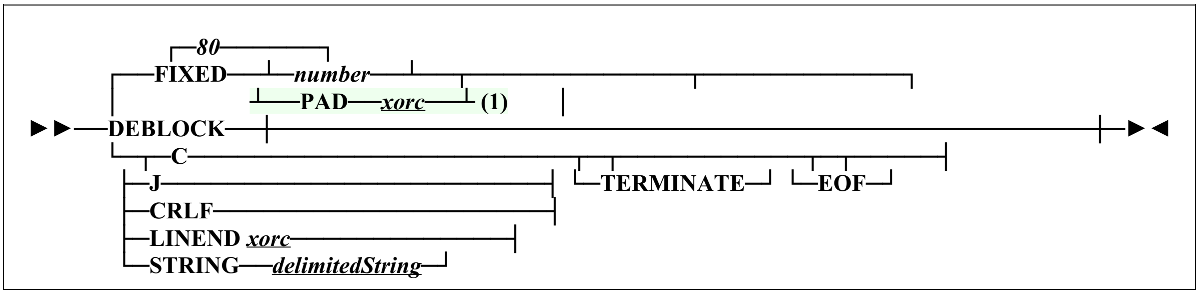
Pass Input Records to Output Streams Round Robin



- (1) Not yet in NetRexx Pipelines
- (2) Not CMS
- Since Java dispatches the stage threads, DEAL may not see a sever immediately, as the severing thread can get multitasked. This can make options like 'ANYEOF' work in unexpected ways.

deblock

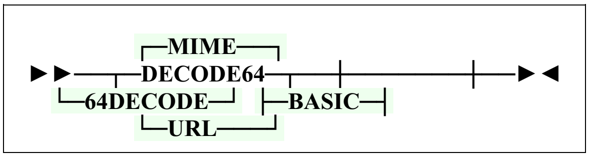
Deblock External Data Formats



- CMS has many more mainframe centric formats that NetRexx Pipelines does not process.
- (1) Not CMS Pipelines

decode64
64decode
3.11

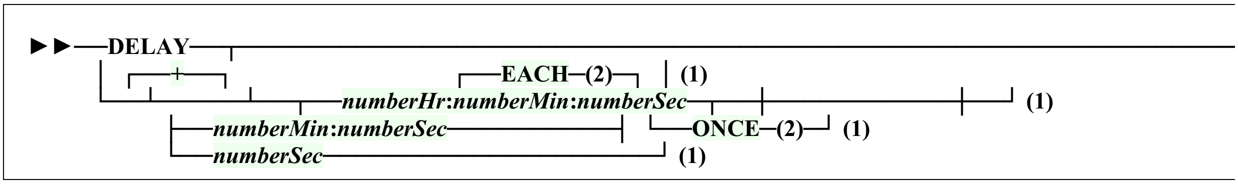
Decode Base-64 Format



- NOTE: CMS is only 64DECODE, and does not have the options; it does MIME.
- BASIC - Output is mapped to a set of characters lying in A-Za-z0-9+/. The encoder does not add any line feed in output, and the decoder rejects any character other than A-Za-z0-9+/.
- URL - Output is mapped to set of characters lying in A-Za-z0-9+_. Output is URL and filename safe.
- MIME - Output is mapped to MIME friendly format. Output is represented in lines of no more than 76 characters each, and uses a carriage return '\r' followed by a linefeed '\n' as the line separator. No line separator is present to the end of the encoded output.
- 3.11: New to NetRexx. Add MIME, BASIC, & URL options.

delay
4.06

Suspend Stream



- (1) Arguments are NetRexx Pipelines only, not CMS. CMS (and NetRexx when there is no argument) reads delays as the first word of each record.
  When arguments are present, they follow the CMS conventions for the delay time in records. The + indicates a duration, no + means time of day. The objects do NOT have the delay as the first word.
  Clock hours are 24h, so 2pm is 14, and are for the next 24 hours if before "now."
  Seconds can have decimal point and milliseconds.
  In relative times, the number of seconds and minutes are not limited to 60; so 120 seconds is the same as 2 minutes.
- (2) Used only for "relative time." EACH, the default, delays before each object; ONCE delays only the first object.
- Uses Java's Thread.sleep() method and may not be exact in fractional seconds.

devinfo

Write Device Information

- Not implemented in Netrexx Pipelines.

dfsort

Interface to DFSORT/CMS

- Not implemented in Netrexx Pipelines.

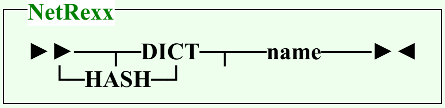
diage4

Submit Diagnose E4 Requests

- Not implemented in Netrexx Pipelines.

dict
hash

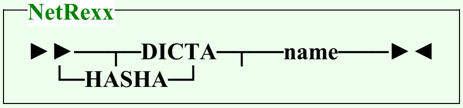
Read or Write a Dictionary



- Pipes for NetRexx only.

dicta
hasha

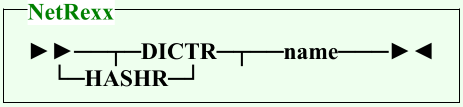
Write a Dictionary



- Pipes for NetRexx only.

dictr
hashr

Read a Dictionary



- Pipes for NetRexx only.

dictw
hashw

Write a Dictionary

```
NetRexx
►►──┬─DICTW─┬──name──►◄
    └─HASHW─┘
```

- Pipes for NetRexx only.

digest

Compute a Message Digest

```
►►──DIGEST──┬─SHA1──────────────┬──┬───────────────────────┬──────►◄
            ├─SHA224────────────┤  ├──APPEND──(1)──────────┤
            ├─SHA256────────────┤  └──VERIFY──(1)──┬───────┤
            ├─SHA384────────────┤                  └─NOT──(1)─┘
            ├─SHA512────────────┤
            ├─MD5───────────────┤
            ├─MD2──(2)──────────┤
            ├─SHA512/224──(2)───┤
            └─SHA512/256──(2)───┘

(1) CMS Pipelines only.
(2) NetRexx Pipelines only (dependent on the JVM implementation).

 NetRexx Pipelines returns the bytearray as a HEX string
 CMS returns a char array into the pipeline
```

disk
file

Read a File

```
►►──┬──DISK──┬──string──►◄
    └──FILE──┘
```

- As in CMS, equivalent to diskr (Pipes for NetRexx Only) or **<**.

diska
filea
>>

Append to or Create a File

```
►►──┬──DISKA──┬──string──►◄
    ├──FILEA──┤
    └──>>─────┘
```

diskback
fileback

Read a File Backwards

- Not implemented in Netrexx Pipelines.

diskfast
filefast

Read, Create, or Append to a File

- Not implemented in Netrexx Pipelines.

diskid

Map CMS Reserved Minidisk

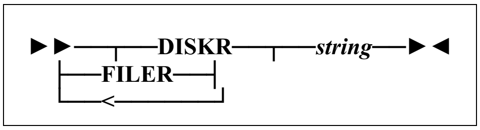
- Not implemented in Netrexx Pipelines.

<table>
<tr><td>

diskr
filer
<

</td><td>

Read a File



- As in CMS, equivalent to diskr (Pipes for NetRexx Only) or **<**.

</td></tr>
<tr><td>

diskrandom
filerandom

</td><td>

Random Access a File

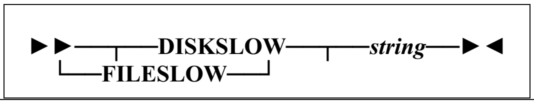
- Not implemented in Netrexx Pipelines.

</td></tr>
<tr><td>

diskslow
fileslow

</td><td>

Read, Create, or Append to a File



</td></tr>
<tr><td>

diskupdate
fileupdate

</td><td>

Replace Records in a File

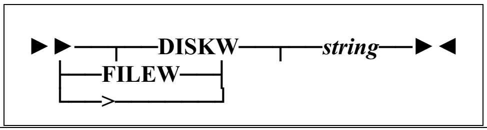
- Not implemented in Netrexx Pipelines.

</td></tr>
<tr><td>

diskw
filew
>

</td><td>

Replace or Create a File

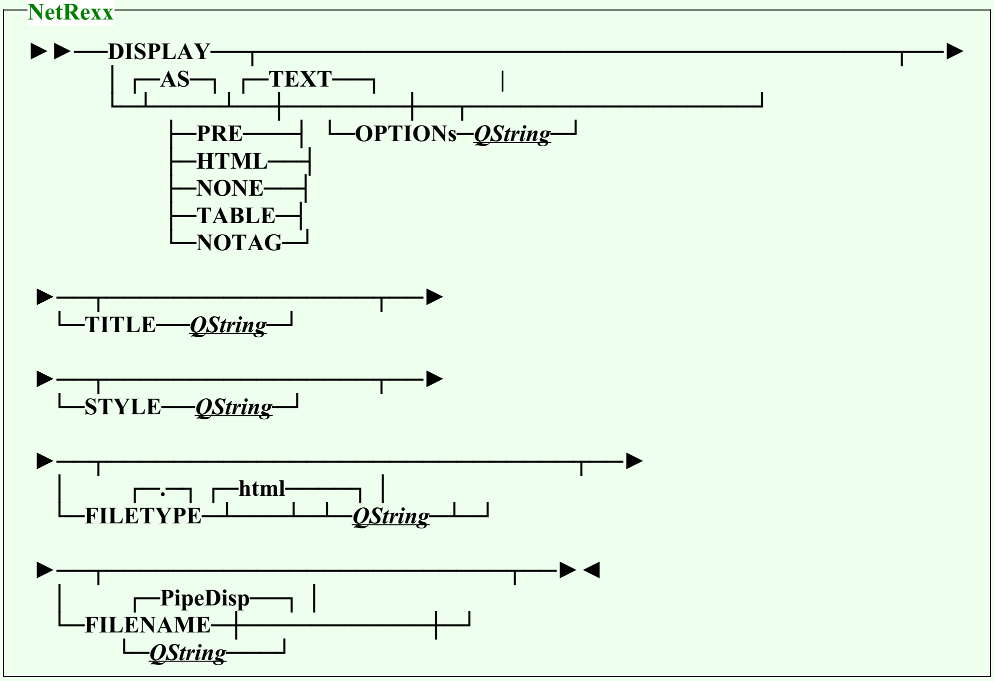


</td></tr>
<tr><td>

display
3.11

</td><td>

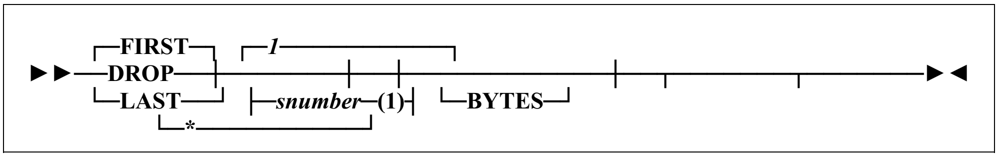
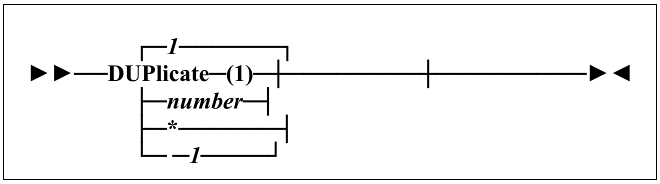
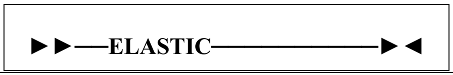
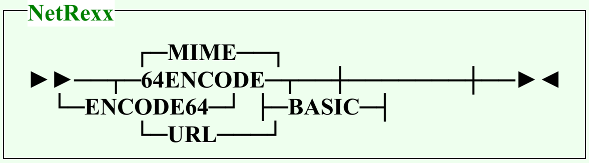
Output to Web Browser

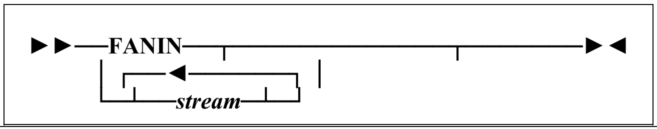
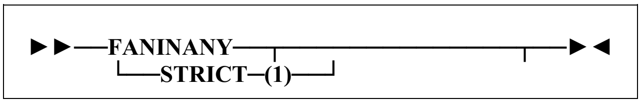
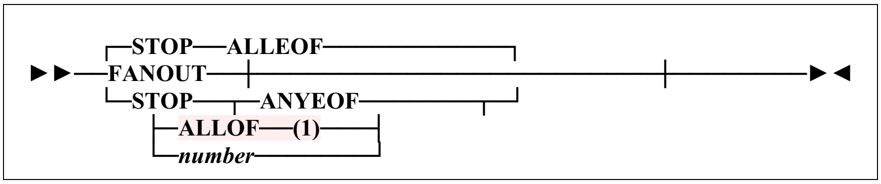
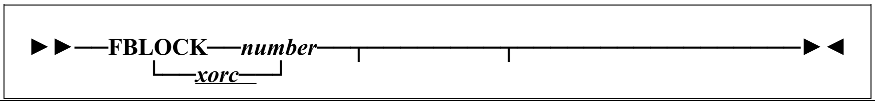
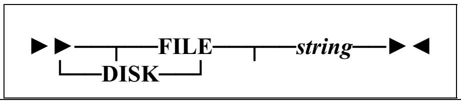
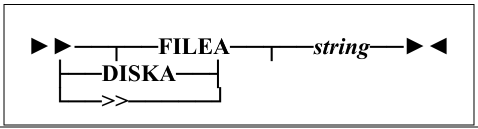


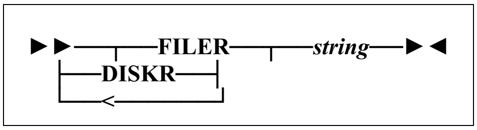
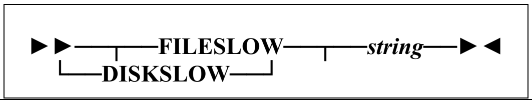
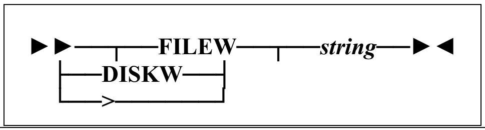
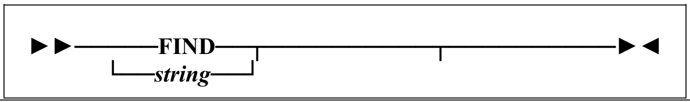
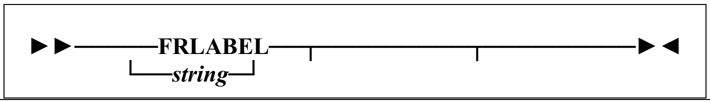
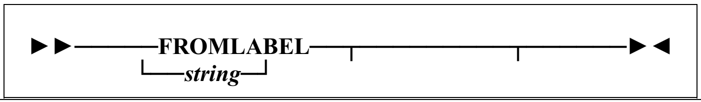
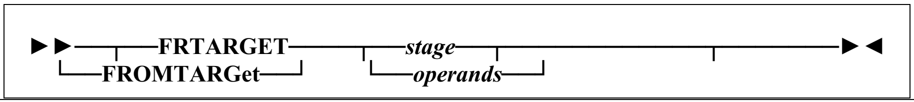
- DISPLAY works similar to and as a replacement for CONSOLE for output. But instead of going to the terminal window, it goes to a HTML file browser tab. This allows for HTML+CSS tags to control fonts, colors, and layout.
- To work, these are required outside Pipelines and NetRexx:
  - A working HTML browser program
  - The operating system to associate the filetype "html" with the browser, so the Pipelines stage "COMMAND PipeDisp.html" does call the browser and display the file.
  - The system have a Temp directory, known to Java.

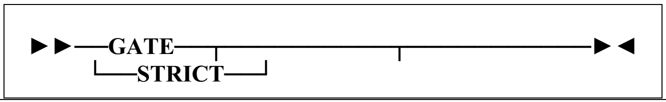
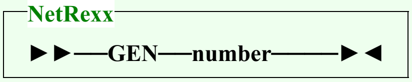
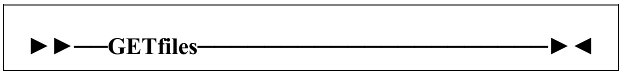
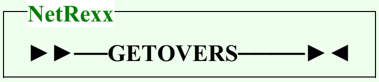
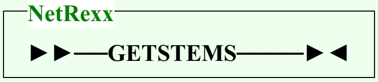
</td></tr>
</table>

- The DISPLAY stage overwrites the named file, by default PipeDisp.html, in the system Temp directory, then calls the COMMAND stage to display it. The file is not erased automatically by this stage.
- Each DISPLAY stage invocation opens a new browser tab, which remains open.
- The AS option causes the data to be surrounded by html tags.
    - The default TEXT or PRE puts on <pre> and </pre>. Most browsers use:
        - Fixed width font
        - Display all the white spaces: line feeds and multiple spaces
    - HTML uses <html> and </html>. Most browsers use:
        - Variable width font
        - Consolidate strings of white space into a single space
        - All the HTML tags
    - TABLE uses <table> and </table>
        - Expects the data records to begin with <tr><td> (or <tr><th>)
    - NOTAG uses <pre> & </pre>, but first converts all & characters to the entity &amp; and < characters to &lt; so HTML tags are not processed.
    - NONE uses no extra tags. Most browsers use:
        - HTML display
- OPTIONs QString is included in the opening tag for the AS option. This could be CLASS, STYLE, or other options.
- TITLE QString adds <title>delimitedString</title> to the beginning of the output. This should show as the title in the browser's tab.
  Note: This officially should go into a HEAD section; here it won't be there. Most modern browsers will honor it anyplace in the file. If it is not honored as a tag, QString will be the top line of the display.
- STYLE QString adds <link rel="stylesheet" href="QString"> to the beginning of the output. This should include and use the named stylesheet. The name may have relative path names, or be an absolute file name. If there are spaces, enclose it in quotes.
  Note: This officially should go into a HEAD section; here it won't be there. Most modern browsers will honor it anyplace in the file. If it is not honored as a tag, it will not show -- except in the NOTAG option. The file itself is copied from its stated location into the system Temp directory, overwriting any existing file. This file is not erased automatically by this stage.
  QString: It is optional to enclose the name in quotes, but quotes are required if the name includes spaces.
- FILETYPE may be used to change the default "html". This permits use of other types that MAY be preprocessed if the system, external to Pipelines, is set up to recognize it, for example, "JSP" or "PHP". A "dot" is optional; only one will be used.
  Note: filetypes other than .html may be handled by the system by some program other than the browser.
  QString: It is optional to enclose the type in quotes.
- FILENAME may be used to write and display another file. It may include a path designation, either absolute or relative. A relative path is

	based on the working directory. If no path is specified in the name, the system Temp directory, as determined by Java, is used. QString: It is optional to enclose the name in quotes, but quotes are required if the name includes spaces. - Records from the primary input stream are also put out on the primary output stream unchanged, if it is connected.
drop	**Discard Records from the Beginning or the End of the File**  - (1) CMS: must be positive. NetRexx Pipelines: negative reverses FIRST/LAST, so DROP FIRST -3 is the same as DROP LAST 3.
duplicate *duplicat* *duplica* *duplic* *dupli* *dupl* *dup*	**Copy Records**  - (1) CMS is DUPlicat due to 8-character name limitation
elastic	**Buffer Sufficient Records to Prevent Stall** 
encode64 *64encode* *3.11*	**Encode to Base-64 Format**  - NOTE: CMS is only 64DECODE, and does not have the options; it does MIME. - BASIC - Output is mapped to a set of characters lying in A-Za-z0-9+/. The encoder does not add any line feed in output, and the decoder rejects any character other than A-Za-z0-9+/. - URL - Output is mapped to set of characters lying in A-Za-z0-9+_. Output is URL and filename safe. - MIME - Output is mapped to MIME friendly format. Output is represented in lines of no more than 76 characters each, and uses a carriage return '\r' followed by a linefeed '\n' as the line separator. No line separator is present to the end of the encoded output. - 3.11: New to NetRexx. Add MIME, BASIC, & URL options.

eofback	**Run an Output Device Driver and Propagate End-of-File Backwards** • Not implemented in Netrexx Pipelines.
escape	**Insert Escape Characters in the Record** • Not implemented in Netrexx Pipelines.
fanin	**Concatenate Streams** 
faninany	**Copy Records from Whichever Input Stream Has One**  • (1) CMS only.
fanintwo	**Pass Records to Primary Output Stream**
fanout	**Copy Records from the Primary Input Stream to All Output Streams**  STOP ALLEOF FANOUT STOP ANYEOF ALLOF (1) number • (1) CMS only
fanouttwo	**Copy Records from the Primary Input Stream to Both Output Streams**
fbaread	**Read Blocks from a Fixed Block Architecture Drive** • Not implemented in Netrexx Pipelines.
fbawrite	**Write Blocks to a Fixed Block Architecture Drive** • Not implemented in Netrexx Pipelines.
fblock	**Block Data, Spanning Input Records** 
file ***disk***	**Read or Write a File** 
filea ***diska*** ***>>***	**Append to or Create a File** 
fileback ***diskback***	**Read a CMS file backwards** • Not implemented in Netrexx Pipelines.
filedescriptor	**Read or Write an OpenExtensions File that Is Already Open** • Not implemented in Netrexx Pipelines.

filefast *diskfast*	**Read or write a CMS file** - Not implemented in Netrexx Pipelines.
filer *file* *disk* *diskr* *<*	**Read a File** 
filerandom *diskrandom*	**Read specific records from a CMS file**
fileslow *diskslow*	**Read, Create, or Append to a File** 
filetoken	**Read or Write an SFS File That is Already Open** - Not implemented in Netrexx Pipelines.
fileupdate *diskupdate*	**Change records in a CMS file**
filew *diskw* *>*	**Replace or Create a File** 
fillup	**Pass Records To Output Streams** - Not implemented in Netrexx Pipelines.
filterpack	**Manage Filter Packages** - Not implemented in Netrexx Pipelines.
find	**Select Lines by XEDIT Find Logic** 
fitting	**Source or Sink for Copipe Data** - Not implemented in Netrexx Pipelines.
fmtfst	**Format a File Status Table (FST) Entry** - Not implemented in Netrexx Pipelines.
frlabel *fromlabel*	**Select Records from the First One with Leading String** 
fromlabel *frlabel*	**Select Records from the First One with Leading String** 
frtarget	**Select Records from the First One Selected by Argument Stage** 
fullscreen *fullscree* *fullscre* *fullscr*	**Full screen 3270 Write and Read to the Console or Dialled/Attached Screen** - Not implemented in Netrexx Pipelines.

fullscrq	**Write 3270 Device Characteristics** • Not implemented in Netrexx Pipelines.
fullscrq	**Write 3270 Device Characteristics** • Not implemented in Netrexx Pipelines.
fullscrs	**Format 3270 Device Characteristics** • Not implemented in Netrexx Pipelines.
gate	**Pass Records Until Stopped** 
gather	**Copy Records From Input Streams** • Not implemented in Netrexx Pipelines.
gen	**Generate a Sequence of Numbers Starting with 1**  • Not implemented in CMS Pipelines.
getfiles ***getfiles*** ***getfile*** ***getfil*** ***getfi*** ***getf*** ***get***	**Read Files** 
getovers	**Write the Contents of Objects**  • Input stream 0 should contain rexx objects. The getovers stage will output the index and contents of the stem on stream 0. If output stream 1 is connected, the root is placed there. Any severed streams will cause then stage to exit. Passing a non rexx object will cause the stage to exit with return code 13. • Pipes for NetRexx only.
getstems	**Write the Contents of Members of Stems**  • Input stream 0 should contain rexx objects containing stems. The getstems stage will output the contents of the stem on stream 0. If output stream 1 is connected, the root is placed there. Any severed streams will cause then stage to exit. Passing a non rexx stem object will cause the stage to exit with return code 13. • Pipes for NetRexx only.

grep
regex
3.09

Select Lines by a Regular Expresion

```
NetRexx
►►──┬──GREP──┬──┬──────────────────────────────────────────┬─regex_Dstring─(1)──►◄
    └──REGEX──┘  └─(──| options_string |──)─┘

options_string:
  ┌──◄──────────────────────────────────────────────────┐
|─┴─┬──┬────────────────────────────────────────────────┴──┬─┬─|
       ├─Numbers──────────────────────────────────┤ (2)
       ├─Before─┬─1────────┬────────────────────┤ (3)
       │        └─number─┘ │
       ├─After─┬─1────────┬─────────────────────┤ (3)
       │       └─number─┘ │
       ├─Context─┬─1────────┬───────────────────┤ (4)
       │         └─number─┘ │
       ├─NOSeparator──────────────────────────┤ (5)
       ├─Separator─┬─/─/──────────────┬─────┤ (5)
       │           └─delimitedString─┘ │
       ├─Tertiary─────────────────────────────┤ (6)
       └─COUnt────────────────────────────────┘ (7)
```

- NetRexx Pipelines only.
- Records matching the RegEx are put out on primary output.
- Records not matching are put out on secondary, if connected, or discarded.
- .
- (1) Regex_string is a Java RegEx expresion. Null string passes all records.
- (2) Records are prefaced with records number, 10 characters, right justified.
- (3) Number of records put out after a matching record.
- (4) Number of records put out before and after a matching record.
- (5) Inserted before a group of "before records" or the found record with "after records."
- (6) Send all matching records (no numbers) to tertiary output stream, if connected.
- (7) Only a count of matches is put out on the primary output stream. (Other options probably should not be used with this.)

hash
dict

Read or Write a Dictionary

```
NetRexx
►►──┬──HASH─┬───name───►◄
    └─DICT─┘
```

- Pipes for NetRexx only.

hasha
dicta

Write a Dictionary

```
NetRexx
►►──┬──HASHA─┬───name───►◄
    └─DICTA─┘
```

- Pipes for NetRexx only.

hashr
dictr

Read a Dictionary

```
─NetRexx──────────────────────────
 ►►──┬─HASHR─┬──name───►◄
     └─DICTR─┘
```

- Pipes for NetRexx only.

hashw
dictw

Write a Dictionary

```
─NetRexx──────────────────────────
 ►►──┬─HASHW─┬──name───►◄
     └─DICTW─┘
```

- Pipes for NetRexx only.

help
ahelp
?

Display Help for Pipelines

```
►►──┬──HELP──┬─┬─────────────────────────────────────┬──►◄
    ├─AHELP──┤ ├─word────────────────────────────────┤
    └─?─(3)──┘ │        ┌──BUILTINS─(1)──┐           │
               ├─MENU─(1)─┼─────────────────┼────────┤
               │          ├─COMMANDS─(1)────┤
               │          ├─HOST─(1)────────┤
               │          ├─MESSAGES─(1)────┤
               │          ├─OTHER─(1)───────┤
               │          └─SYNTAX─(1)──────┘
               ├─MSG─(1)──number─────────────────────┤
               ├─number─(1)──────────────────────────┤
               ├─SQL─(1)──string─────────────────────┤
               └─SQLCODE─(1)─┬────────────┬──────────┘
                             └──number────┘

(1) CMS Pipelines only. Not yet in NetRexx Pipelines.
(2) If primary output is connected, lines are propagated,
    otherwise they are sent to the console by "say."
(3) ? is the default pipeEnd character. Here it is useful
    only when a different pipeEnd is defined.
```

hfs
bfs

Read or Append File in the Hierarchical File System

- Not implemented in Netrexx Pipelines.

hfsdirectory
hfsdir
bfsdirectory
bfsdir

Read Contents of a Directory in a Hierarchical File System

- Not implemented in Netrexx Pipelines.

hfsquery
hfsq
bfsquery
bfsq

Write Information Obtained from OpenExtensions into the Pipeline

- Not implemented in Netrexx Pipelines.

hfsreplace
hfsrep
bfsreplace
bfsrep

Replace the Contents of a File in the Hierarchical File System

- Not implemented in Netrexx Pipelines.

hfsstate
hfsstat
bfsstate
bfsstat

Obtain Information about Files in the Hierarchical File System

- Not implemented in Netrexx Pipelines.

hfsxecute
hfsx
bfsxecute
bfsx

Issue OpenExtensions Requests

- Not implemented in Netrexx Pipelines.

hlasm

Interface to High Level Assembler

- Not implemented in Netrexx Pipelines.

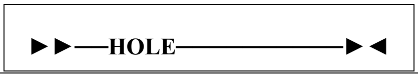
hlasmerr

Extract Assembler Error Messages from the SYSADATA File

- Not implemented in Netrexx Pipelines.

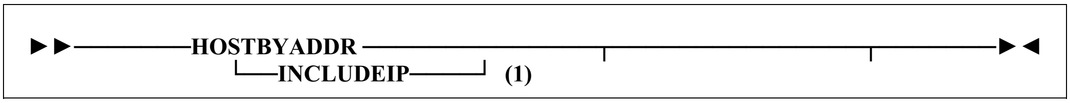
hole

Destroy Data



hostbyaddr
3.09

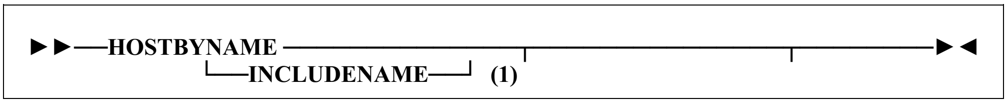
Resolve IP Address into Domain and Host Name



- (1) Optional parameter not present in VM/CMS version
- INCLUDEIP - Also include the IP address along with the hostname.
  Output: <hostname>/<ip address>
  Example: `dns.google/8.8.8.8`
- Known issues: The underlying Java method getByName/getHostName does not appear to handle IPv6 addresses in any known and consistent manner. Could be related to a host configuration issue but googling shows odd and inconsistent results for getting around this.

hostbyname
3.09

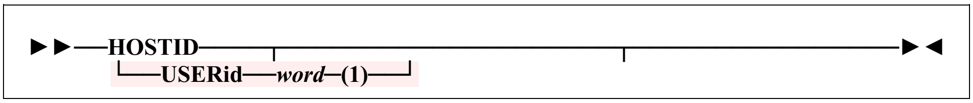
Resolve a Domain Name into an IP Address



- (1) Optional parameter not present in CMS Pipelines
- Arguments: INCLUDENAME - Also include the name of the host on output.
- Output: <hostname>/<ip address>
  Example: `dns.google/8.8.8.8`

hostid
3.09

Write TCP/IP Default IP Address



- (1) The USERid option available under CMS Pipelines is not applicable and is ignored in NetRexx Pipelines

hostname
3.09

Write TCP/IP Host Name

```
►►──HOSTNAME──┬──────────────────┬──┬─────────────────────────┬──►◄
              └──INCLUDEIP──(1)──┘  └──USERid──word──(2)──────┘
```

- (1) Optional parameter not present in VM/CMS version
- (2) The USERid option available under CMS is not applicable and is ignored in NetRexx Pipelines
- Arguments: INCLUDEIP - include the IP address of the system in the response in the form <hostname>/<ip address>

htmlrows
htmlrow
3.11

Convert rows to HTML format

```
NetRexx
                 ┌─SEParator ","──────┐
►►──HTMLROWs─────┼────────────────────┼─┬─────────────────────────┬──►
     └─ROW─QString─┘ └─SEParator─QString─┘

►──┬────────────────┬─┬────────────────┬──►◄
   └─HEAD─QString───┘ └─DATA─QString───┘
```

- HTMLROWs reads rows from its primary input stream and writes them to its primary output stream, altering them to have the proper HTML tags for TABLE ROWS.
- I.e., it converts
  abc,mnop,xyz
  into
  <tr><td>abc</td><td>mnop</td><td>xyz</td></tr>
- The SEPARATOR QStirng, by default the comma character, can be specified.
- There are options to put additional data inside the tags. This could be used for class or style tag options, for example.
  - ROW QString : puts its information into the <tr>-tags
  - DATA QString : puts its information into the <td>-tags
  - HEAD QString : puts its information into the <th>-tags (1)
- QString is a quoted string of characters. The quote marks may be either single or double, but must match. If there are no spaces in the string, the quote marks are optional.
- (1) If there is a HEAD option, the first row read has <th>-tags instead of <td>-tags. It must have a QString of at least "". Succeeding rows have the standard <td>-tags.

httpsplit

Split HTTP Data Stream

- Not implemented in Netrexx Pipelines.

iebcopy

Process IEBCOPY Data Format

- Not implemented in Netrexx Pipelines.

if

Process Records Conditionally

- Not implemented in Netrexx Pipelines.

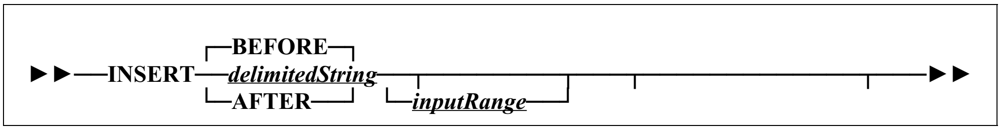
immcmd

Write the Argument String from Immediate Commands

- Not implemented in Netrexx Pipelines.

insert

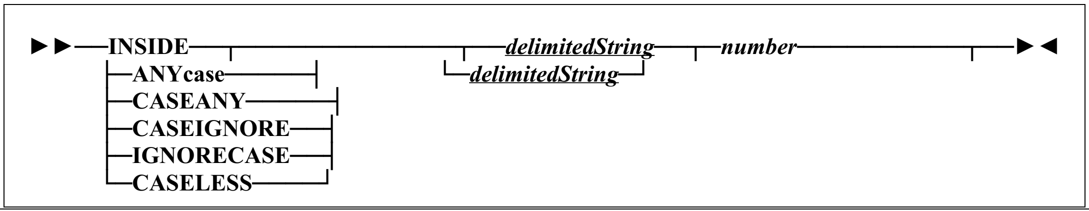
Insert String in Records



- insert a string into a record before or after the record content. Will be much more efficient than specs especially if the input is a Byte[]

inside

Select Records between Labels



instore

Load the File into a storage Buffer

- Not implemented in Netrexx Pipelines.

ip2socka

Build sockaddr_in Structure

- Not implemented in Netrexx Pipelines.

ispf

Access ISPF Tables

- Not implemented in Netrexx Pipelines.

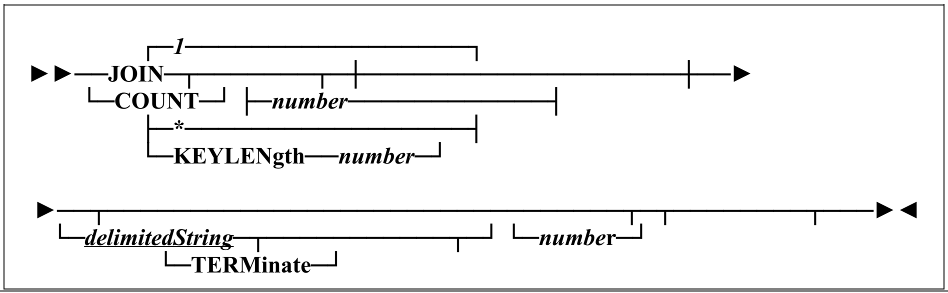
jeremy

Write Pipeline Status to the Pipeline

- Not implemented in Netrexx Pipelines.

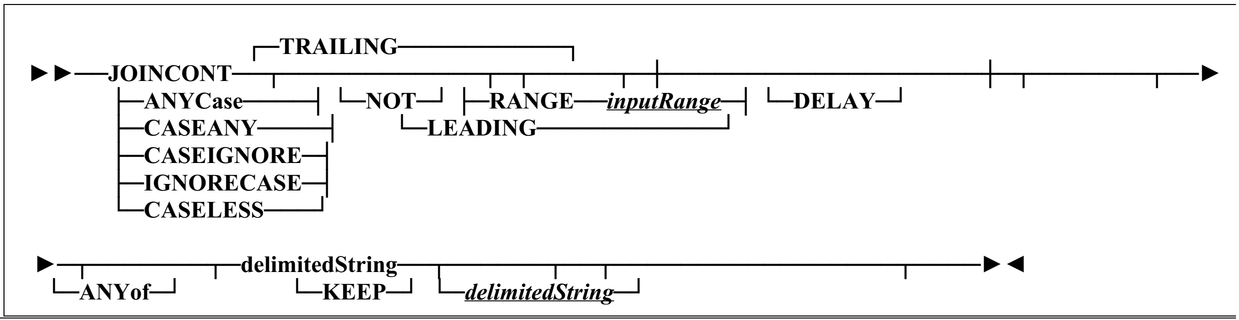
join

Combine Records



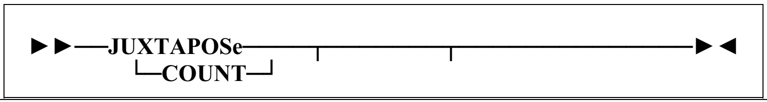
joincont

Join Continuation Lines



juxtapose

Preface Record with Marker



ldrtbls

Resolve a Name from the CMS Loader Tables

- Not implemented in Netrexx Pipelines.

listcat

Obtain Data Set Names

- Not implemented in Netrexx Pipelines.

listdsi

Obtain Information about Data Sets

- Not implemented in Netrexx Pipelines.

listispf

Read Directory of a Partitioned Data Set into the Pipeline

- Not implemented in Netrexx Pipelines.

listpds

Read Directory of a Partitioned Data Set into the Pipeline

- Not implemented in Netrexx Pipelines.

listzip

List the Files in a Zipped File

```
┌NetRexx─────────────────────────────────┐
│ ►►───LISTZIP────zipFileName──────►◄    │
└────────────────────────────────────────┘
```

literal

Write the Argument String

```
►►───LITERAL──┬──────────┬──────────►◄
              └─string───┘
```

locate
locat
loca
loc
lo
l

Select Lines that Contain a String

```
►►──Locate──┬──────────────┬──┬─────────────┬──┬───────────────┬──┬────────┬──►
            ├─ANYCase──────┤  ├─MIXED─(1)───┤  └─inputRanges───┘  └─ANYof──┘
            ├─CASEANY──────┤  ├─ONEs──(1)───┤
            ├─CASEIGNORE───┤  └─ZEROs─(1)───┘
            ├─IGNORECASE───┤
            └─CASELESS─────┘

►──┬───────────────────┬──►◄
   └─delimitedString───┘
```

(1) Not in NetRexx Pipelines, yet.

- [2] IBM documentation has this as "LOCATE" rather than "Locate". But the abbreviations work in both systems.

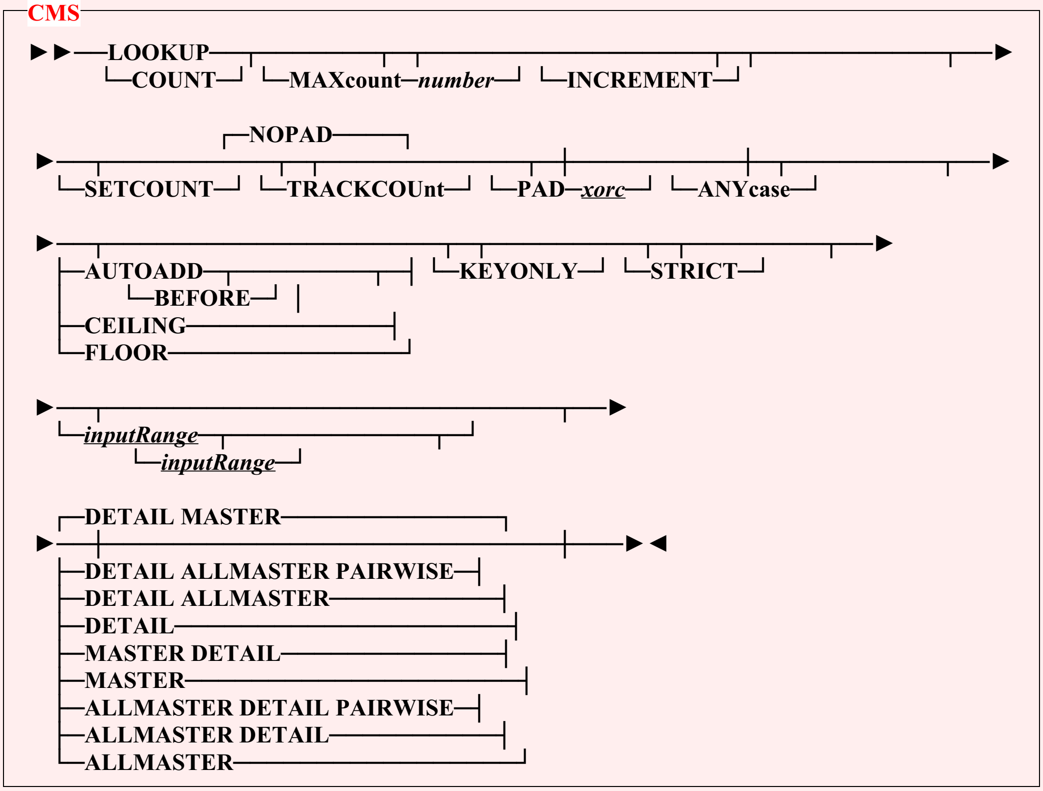
lookup

Find Records in a Reference Using a Key Field

NetRexx

```
►►──LOOKUP──┬───────────┬──┬───────────┬──┬───────────┬──┬──────────┬──┬──────────┬──►
            └──COUNT────┘  └──ANYCASE──┘  └──AUTOADD──┘  └──BEFORE──┘

►──┬───────────┬──┬────────────┬──┬─────────────┬──┬──────────────┬──┬──────────┬──►
   └──KEYONLY──┘  └──SETCOUNT──┘  └──INCREMENT──┘  └──TRACKCOUNT──┘

►──┬────────────────────────────────┬──►
   └──inputRange──┬──────────────┬──┘
                  └──inputRange──┘

►──┬──────────────────────────────────┬──►◄
   ├──DETAIL MASTER───────────────────┤
   ├──DETAIL ALLMASTER PAIRWISE───────┤
   ├──DETAIL ALLMASTER────────────────┤
   ├──DETAIL──────────────────────────┤
   ├──MASTER DETAIL───────────────────┤
   ├──MASTER──────────────────────────┤
   ├──ALLMASTER DETAIL PAIRWISE───────┤
   ├──ALLMASTER DETAIL────────────────┤
   └──ALLMASTER───────────────────────┘
```

- in stream 0 are detail records
- in stream 1 are master records
- in stream 2 adds to masters
- in stream 3 delete from masters
-
- out stream 0 are matched records
- out stream 1 are unmatched detail records
- out stream 2 are unmatched or counted master records
- out stream 3 deleted masters
- out stream 4 duplicate masters
- out stream 5 unmatched master deletes
-
- lookup does not consider an unconnected output stream an error. It does proprogate EOFs from output streams.

lookup	**Find Records in a Reference Using a Key Field**  CMS LOOKUP COUNT MAXcount number INCREMENT NOPAD SETCOUNT TRACKCOUnt PAD xorc ANYcase AUTOADD BEFORE CEILING FLOOR KEYONLY STRICT inputRange inputRange DETAIL MASTER DETAIL ALLMASTER PAIRWISE DETAIL ALLMASTER DETAIL MASTER DETAIL MASTER ALLMASTER DETAIL PAIRWISE ALLMASTER DETAIL ALLMASTER - in stream 0 are detail records - in stream 1 are master records - in stream 2 adds to masters - in stream 3 delete from masters - - out stream 0 are matched records - out stream 1 are unmatched detail records - out stream 2 are unmatched or counted master records - out stream 3 deleted masters - out stream 4 duplicate masters - out stream 5 unmatched master deletes - - lookup does not consider an unconnected output stream an error. It does proprogate EOFs from output streams.
maclib	**Generate a Macro Library from Stacked Members in a COPY File** - Not implemented in Netrexx Pipelines.
mapmdisk	**Map Minidisks Into Data spaces** - Not implemented in Netrexx Pipelines.
mctoasa	**Convert CCW Operation Codes to ASA Carriage Control** - Not implemented in Netrexx Pipelines.
mdiskblk	**Read or Write Minidisk Blocks** - Not implemented in Netrexx Pipelines.

mdskrandom
mdskrand

Random Access a CMS File on a Mode

- Not implemented in Netrexx Pipelines.

mdskslow

Read, Append to, or Create a CMS File on a Mode

- Not implemented in Netrexx Pipelines.

mdskupdate
mdskupda

Replace Records in a File on a Mode

- Not implemented in Netrexx Pipelines.

members
member

Extract Members from a Partitioned Data Set

- Not implemented in Netrexx Pipelines.

merge

Merge Streams

- Not implemented in Netrexx Pipelines.

mqsc

Issue Commands to a WebSphere MQ Queue Manager

- Not implemented in Netrexx Pipelines.

nfind
notfind

Select Lines by XEDIT NFind Logic

```
►►───┬─NFIND────┬──┬──────────┬────────────────────►◄
     └─NOTFIND──┘  └──string──┘
```

ninside
notinsid
notinside
3.09

Select Records Not between Labels

```
►►──┬─NINSIDE─────┬──┬───────────────┬──────┬─delimitedString─┬──number──────────┬─►◄
    └─NOTINSIDe───┘  ├─ANYcase───────┤      └─delimitedString─┘
                     ├─CASEANY───────┤
                     ├─IGNORECASE────┤
                     ├─CASEIGNORE────┤
                     └─CASELESS──────┘
```

nlocate
notlocate

Select Lines that Do Not Contain a String

```
►►──┬─NLOCATE─────┬──┬───────────────┬──┬───────────────┬──┬───────────────┬──────────┬──►
    └─NOTLOCATE───┘  ├─ANYCase───────┤  ├─MIXED──(1)────┤  └──inputRanges──┘
                     ├─CASEANY───────┤  ├─ONEs────(1)───┤
                     ├─CASEIGNORE────┤  └─ZEROs──(1)────┘
                     ├─IGNORECASE────┤
                     └─CASELESS──────┘

►──┬────────┬──┬───────────────────┬──────────►◄
   └─ANYof──┘  └──delimitedString──┘
```

- (1) Not in NetRexx Pipelines, yet.

noEofBack

Pass Records and Ignore End-of-file on Output

```
►►──NOEOFBACK──────────►◄
```

nop

No Operation

```
NetRexx
►►──NOP──────────►◄
```

- Pipes for NetRexx only.

not

Run Stage with Output Streams Inverted

```
►►──NOT──stage──┬───────────────┬──────►◄
              └─operands──┘
```

notfind
nfind

Select Lines by XEDIT NFind Logic

```
►►──┬─NOTFIND─┬─┬───────────┬─────────►◄
  └─NFIND───┘ └──string──┘
```

notinside
notinsid
ninside

Select Records Not between Labels

```
►►─┬─NOTINSIDe──┬─┬────────────────┬─delimitedString─┬─number──────────┬─►◄
 └─NINSIDE────┘ ├─ANYcase───────┤                └─delimitedString─┘
               ├─CASEANY───────┤
               ├─IGNORECASE────┤
               ├─CASEIGNORE────┤
               └─CASELESS──────┘
```

notlocate
nlocate

Select Lines that Do Not Contain a String

```
►►─┬─NOTLOCATE─┬─┬───────────────┬─┬──────────────┬─┬───────────────┬──────────────────►
 └─NLOCATE───┘ ├─ANYCase───────┤ ├─MIXED─(1)────┤ └─inputRanges───┘
               ├─CASEANY───────┤ ├─ONEs──(1)────┤
               ├─CASEIGNORE────┤ └─ZEROs─(1)────┘
               ├─IGNORECASE────┤
               └─CASELESS──────┘

►─┬───────┬─┬─────────────────┬──────►◄
  └─ANYof─┘ └─delimitedString─┘
```

- (1) Not in NetRexx Pipelines, yet.

nucext

Call a Nucleus Extension

- Not implemented in Netrexx Pipelines.

optcdj

Generate Table Reference Character (TRC)

- Not implemented in Netrexx Pipelines.

outside

Select Records Not between Labels

```
►►──OUTSIDE─┬───────────────┬─delimitedString─┬─number──────────┬─►◄
          ├─ANYcase───────┤                └─delimitedString─┘
          ├─CASEANY───────┤
          ├─CASEIGNORE────┤
          ├─IGNORECASE────┤
          └─CASELESS──────┘
```

outstore

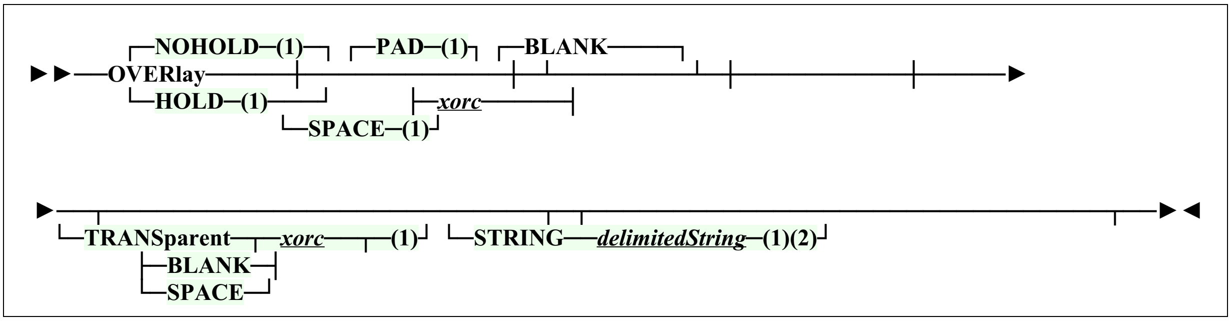
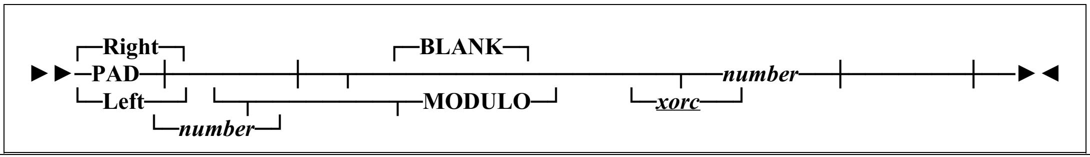
Unload a File from a storage Buffer

- Not implemented in Netrexx Pipelines.

over

Write the Values of Stems

- Obsolete. Now use varover. over is now an alias for overlay..

overlay *overla* *overl* *over*	**Overlay Data from Input Streams**  OVERlay NOHOLD—(1) HOLD—(1) PAD—(1) SPACE—(1) BLANK xorc TRANSparent xorc BLANK SPACE (1) STRING delimitedString (1)(2) • HOLD keeps the last record from each stream, except primary, and uses it if the stream ends. • TRANSPARENT means that character can be different from the PAD character. If omitted, it is the same as PAD character. • dstream can be used instead of a non-primary stream. • (1) NetRexx Pipelines only • (2) same as highest (+1) stream; implies HOLD
overstr	**Process Overstruck Lines** • Not implemented in Netrexx Pipelines.
pack	**Pack Records as Done by XEDIT and COPYFILE** • Not implemented in Netrexx Pipelines.
pad	**Expand Short Records**  PAD Right Left number BLANK MODULO xorc number
parcel	**Parcel Input Stream Into Records** • Not implemented in Netrexx Pipelines.

parse
4.06

Rearrange Contents of Records

```
NetRexx
 ►►──PARSE──parse_template_Dstring──►

 ►──┬────────────────────────────────────────────────────────┬──►
    └──┬─NETREXX─┬──NetRexx_statement_Dstring──┘
       └─NR──────┘

 ►──┬────────────────────────────────┬──►
    └output_template_Dstring──┘

 ►──┬──────────────────────────────────────────────┬────►◄
    └──FINALLY──NetRexx_statement_Dstring──┘
```

- Records are parsed via the parse_template_delimited_string.
- Variables are named _n, where n is 1 to 9.
- The values of the variables are put into the output_template_delimited_string replacing _n.
- For a literal _n that won't be changed, use __n.
- The two NetRexx_statement_Dstrings are single statements, or multiple statements separated by ";"s.
    - The _n variables can be used and changed.
    - The string **\n** will split the string into separate ouput records.
    - The special indexed REXX variable COUNTER[] is also available in these Dstrings. This is specific to a PARSE stage, but persists between records. All the indexed values are initiated to 0. Both indexes and values can be strings.
    - This is powerful and has the possibility of doing damage to your pipe.
      You have been warned!
    - Due to the late compiling, at stage run time, debugging can be difficult. The reported line numbers have nothing to do with your code.
- If the NR NetRexx_statement_Dstring returns a value, it is used as the output instead of the optional output_template_Dstring.
- The FINALLY's statement_Dstring is executed after the last input record has been processed. The value returned is put out as an "extra" output record.
- (As of 4.05) Variable names of "$n" are depreciated, and can not be used with NETREXX or FINALLY options.
- NetRexx Pipelines only.
- .
- Examples:

    -
      ```
      parse / 2 _1 +1/ /The second letter is "_1". __1 won't be changed./
      ```

    -
      ```
      parse /2 _1 +1/ NR /counter[1]=counter[1]+1; _9=counter[1]/ /_9/
          FINALLY /return "Count:" _9/
      ```

    -
      ```
      PARSE /_1 2 _2 +1 _3/ ,
      NR /if _2.datatype('L') then counter['c'] = counter['c'] + 1; _2 = _2.upper/ ,
      /_1_2_3/ ,
      FINALLY /return counter['c'] 'Changed to upper'/
      ```

pause	**Signal a Pause Event** • Not implemented in Netrexx Pipelines.
pdsdirect ***pds***	**Write Directory Information from a CMS Simulated Partitioned Data Set** • Not implemented in Netrexx Pipelines.

pick
4.06

Select Lines that Satisfy a Relation

```
     ┌──NOPAD──────────┐
►►───PICK──┤                  ┼───┬──────────────────────────────────────┬──┬──────────────────┬──►
     └──PAD─xorc───┘    ├──LINENUMBERS──(1)(3)─┤   └───┤ ANYcase ├───┘
                        └──LN──(1)(3)───────────┘

►─┬──┬──┬───────────────────────────────────────┬──┬──┤ List ├───┬──►◄
  │  ├──┴──FROM──┬──┬──────────────┬──┬───┤     │
  │  │  └──TO─────┘  └──AFTER─────┘  │        │
  │  └──WHILE────────────────────────┘         │
  └──┤ Fromto ├─────────────────────────────────────┘
```

Fromto:

```
├──FROM──┬──────────────┬──┤ List ├──┬──TO──┬──────────────┬──┤ List ├──┬──┤
         └──AFTER──┘    │             └──AFTER──┘         │
                  └──COUNT─number────────────────────────┘
```

List:

```
├──┬──────────────────────────────────────┬──┤ Test ├──┤
   └──┤ List ├──┬──AND──(4)──┬──┘
                └──OR──(4)──┘
```

Test:

```
├──┤ RangeString ├──┬──┤ NonEqualOp ├──┤ RangeString ├──┬──┤
                    └──┤ EqualOp ├──┤ CommaList ├──────┘
```

CommaList:

```
  ┌─◄────(3)(6)─────────┐
  ├─◄──,──(4)───────────┤
├───┴──┤ RangeString ├───┴───┤
```

RangeString:

```
├──┬──┬──┬──────────────────────────────────────────┬──inputRange──┬──┤
   │  └──PREVIOUS──(2)(3)──┬─────────────────────┤  │
   │              └──NOFIRST──(5)(3)──┘        │
   ├──delimitedString──────────────────────────────────┤
   └──number+──(4)─────────────────────────────────────────┘
```

EqualOp:
"strict"
== ¬== << <<= >> >>= IN NOTIN \== (3) ^== (3)

"numeric"
= ¬= < <= > >= \= (3) ^= (3)

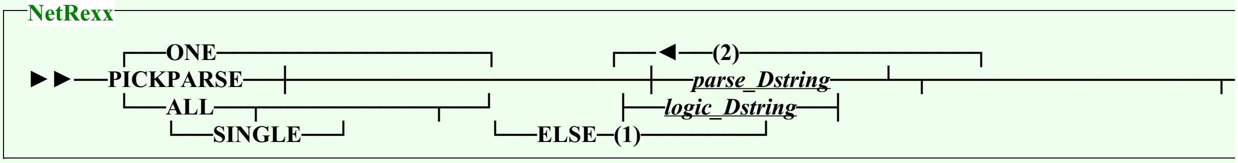
ANYcase:
ANYcase CASEANY CASEIGNORE CASELESS IGNORECASE

- (1) NetRexx only. Inserts the original record number followed by a SPACE at the beginning of each output record.
- (2) NetRexx only. Uses the data from the previous record. Before the first record, this is Rexx "".
- (3) NetRexx Pipelines only. Not yet in CMS Pipelines.
- (4) CMS Pipelines only. Not yet in NetRexx Pipelines.
- (5) NetRexx Only. Uses first record data for first record instead of previous "".
- (6) CMS uses ",", NetRexx does not. CMS limits RangeStrings to right side, NetRexx allows them on the left, too.
  CMS also allows only == or ¬== with RangeStrings. NetRexx permits any comparison op. NetRexx concats the several ranges for comparison.

pickparse

Select Lines that Satisfy Relations using Rexx Parse

3.09



- Records are parsed via the parse_delimited_string.
- Variables are named $n, where n is 1 to 9.
- The values of the variables are put into the logic_delimited_string replacing $n and evaluated. If TRUE, the record is put out on the stream numbered by the dstring's position.
- The stream for a Dstring of ELSE is used if no previous logic Dstring is TRUE.
- If there is no specific ELSE, there is an implied one at the end; if that stream is not connected, the record is discarded.
- If ONE then the record is put out on, at most, one stream: the first one matched.
- If ALL then the record is put out on all streams matched.
- If SINGLE then the records are all put out on the primary output stream.
- The parse_delimited_string and logic_delimited_string(s) follow normal NetRexx rules.
- (1) Implied ELSE after last specified dstring.
- (2) Up to 10 logic_Dstrings may be specified to go to up to 11 ouput streams (including an implied ELSE).
- Not implemented in CMS Pipelines.

Pickparse permits selecting records by a NetRexx logical expression, using parts of the record selected by a Rexx PARSE template.

A simple example has two delimited strings, a Rexx template and a logical expression:

```
pickparse / . . $3 . 50 $5 +5 / /
$3 < $5 /
```

The parse template selects the 3rd word, and the 5 characters starting in column 50. the variable names are a dollar sign and a digit. Then those variables can be used in the logic expression. When run, and records matching the logic expression are written to the primary output stream, others to the secondary. If either stream is not connected, the corresponding records are discarded.

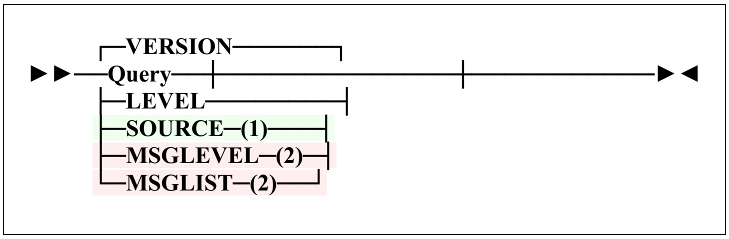
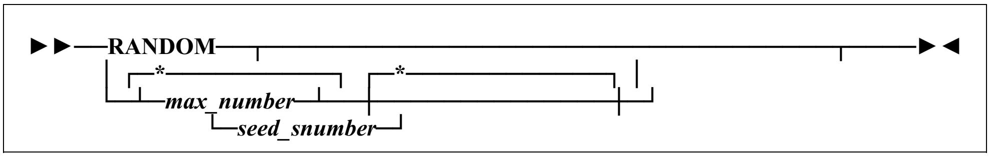
There can be multiple logic expressions, each in its own delimited string. Parenthetical expressions may be used. Records are matched to each in turn. Any records matching are written to that output stream, if connected.

With the option ONE, the default, each record is written to one output stream: the first one it matches. With the option ALL, the matching goes on and a record could be written to multiple output streams.

There is an implicit or explicit ELSE as the last logic expression. Records that have not matched any of the previous expressions match this and are written or discarded depending on if the stream is connected or not.

The parse template can define up to 9 separate

	zones, $1 to $9. The variables $_n are also available for the logic expressions; they are the values from the previous record. Initially these are "". There can be up to 10 output streams defined, and up to 9 logic expressions plus ELSE.
pipcmd	**Issue Pipeline Commands** • Not implemented in Netrexx Pipelines.
pipestop	**Terminate Stages Waiting for an External Event** • Not implemented in Netrexx Pipelines.
polish	**Reverse Polish Expression Parser** • Not implemented in Netrexx Pipelines.
predselect ***predsel***	**Control Destructive Test of Records** • Not implemented in Netrexx Pipelines.
preface	**Put Output from a Device Driver before Data on the Primary Input Stream** • Not implemented in Netrexx Pipelines.
prefix	**Stop and Run a Stage First, Before Continuing** NetRexx ►►──PREFIX──*string*────────────►◄ • Blocks its primary input and excutes stage supplied as an argument. The output from this stage are put to the primary output stream. When its compete the primary input is shorted. • Not implemented in CMS Pipelines.
printmc	**Print Lines** • Not implemented in Netrexx Pipelines.
punch	**Punch Cards** • Not implemented in Netrexx Pipelines.
qpdecode	**Decode to Quoted-printable Format** • Not implemented in Netrexx Pipelines.
qpencode	**Encode to Quoted-printable Format** • Not implemented in Netrexx Pipelines.
qsam	**Read or Write Physical Sequential Data Set through a DCB** • Not implemented in Netrexx Pipelines.
qsort	**Quick Order Records on Whole Length** NetRexx ►►──QSORT──────►◄ • This sort routine is very basic. It uses sortRexx class, which implements the sortClass interface. To sort objects of classes other than Rexx requires that you implement another sortClass with a name begining with 'sort'. • Not implemented in CMS Pipelines.

query	**Obtain Information From Pipelines**  Query VERSION LEVEL SOURCE—(1) MSGLEVEL—(2) MSGLIST—(2) • (1) Not CMS • (2) Not NetRexx Pipelines
random *3.09*	**Generate Pseudorandom Numbers**  • NetRexx Pipelines will be a different sequence than CMS gives with the same seed.
reader	**Read from a Virtual Card Reader** • Not implemented in Netrexx Pipelines.
readpds	**Read Members from a Partitioned Data Set** • Not implemented in Netrexx Pipelines.

regex
grep
3.09

Select Lines by a Regular Expresion

```
NetRexx
►►──┬──REGEX──┬──┬──────────────────────────┬──regex_Dstring──(1)──►◄
    └──GREP───┘  └──(──| options_string |──)──┘

options_string:
  ┌──◄──────────────────────────────────────────┐
├─┴──┬─────────────────────────────────────────┬─┴──┤
     ├─Numbers─────────────────────────────────┤ (2)
     ├─Before──┬─1────────┬────────────────────┤ (3)
     │         └─number───┘
     ├─After──┬─1────────┬─────────────────────┤ (3)
     │        └─number───┘
     ├─Context──┬─1────────┬───────────────────┤ (4)
     │          └─number───┘
     ├─NOSeparator─────────────────────────────┤ (5)
     ├─Separator──┬─/──/──────────────┬────────┤ (5)
     │            └─delimitedString───┘
     ├─Tertiary────────────────────────────────┤ (6)
     └─COUnt───────────────────────────────────┘ (7)
```

- NetRexx Pipelines only.
- Records matching the RegEx are put out on primary output.
- Records not matching are put out on secondary, if connected, or discarded.
- .
- (1) Regex_string is a Java RegEx expresion. Null string passes all records.
- (2) Records are prefaced with records number, 10 characters, right justified.
- (3) Number of records put out after a matching record.
- (4) Number of records put out before and after a matching record.
- (5) Inserted before a group of "before records" or the found record with "after records."
- (6) Send all matching records (no numbers) to tertiary output stream, if connected.
- (7) Only a count of matches is put out on the primary output stream. (Other options probably should not be used with this.)

retab

Replace Runs of Blanks with Tabulate Characters

- Not implemented in Netrexx Pipelines.

reverse

Reverse Contents of Records

```
►►──REVERSE──────────────────►◄
```

rexx

Run a REXX Program to Process Data

- Not implemented in Netrexx Pipelines.

rexxvars

Retrieve Variables from a REXX or CLIST Variable Pool

- Not implemented in Netrexx Pipelines.

runpipe

Issue Pipelines, Intercepting Messages

- Not implemented in Netrexx Pipelines.

scm

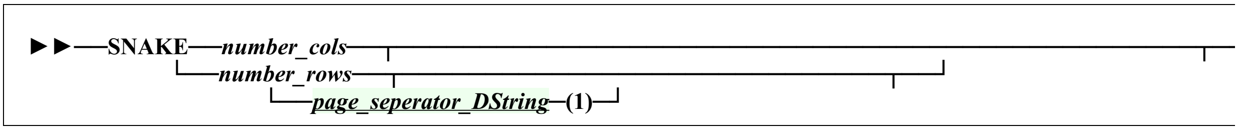
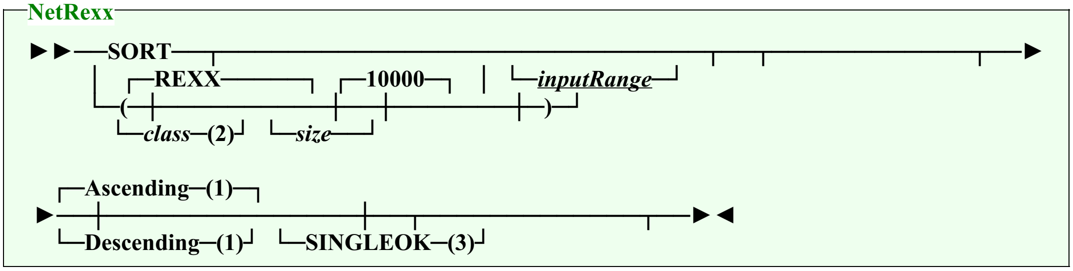
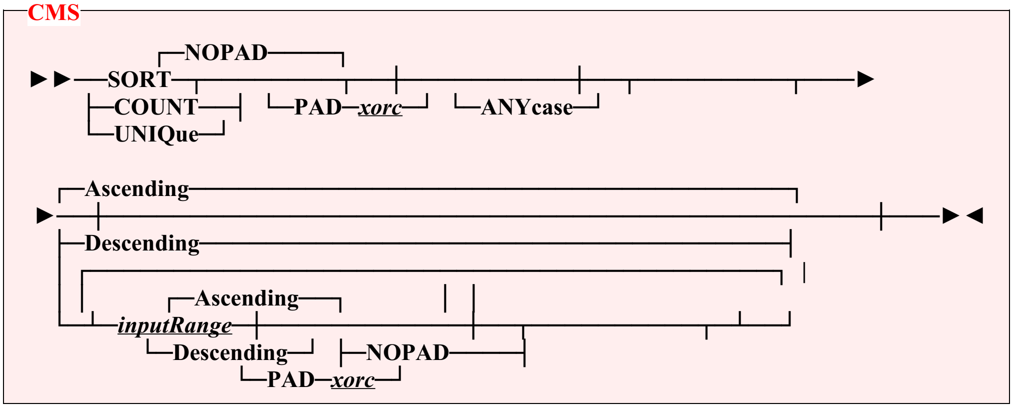
Align REXX Comments

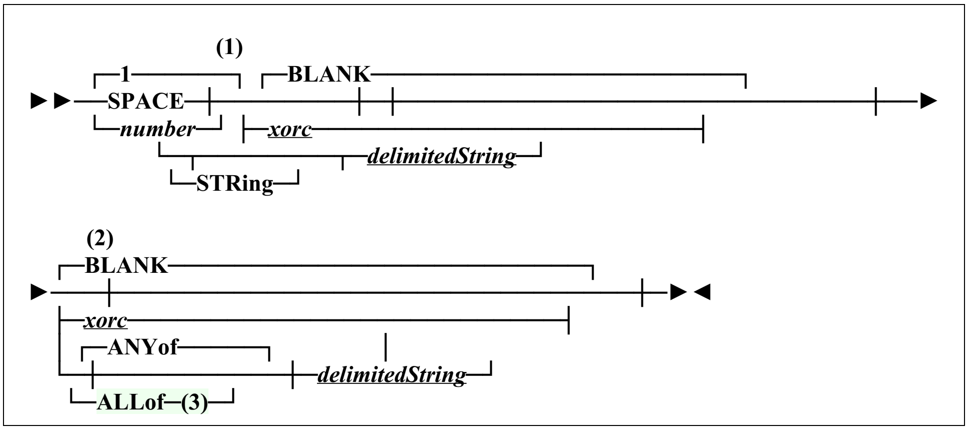
- Not implemented in Netrexx Pipelines.

sec2greg	**Convert Seconds Since Epoch to Gregorian Timestamp** • Not implemented in Netrexx Pipelines.

select
4.07
	Select Records using user logic
	NetRexx
	►►──SELECT──┬──*T/F_NetRexx_Dstring*──────┬──►◄
	└──*Digit_NetRexx_Dstring*──┘
	• Records are selected by evaluating the NetRexx T/F_Delimited_string, which consists of one or more NetRexx statements separated by ";"s, ending in a RETURN statement. The Dstring is placed in a method that supplies the record in the variable rec. The previous record is in prev. The method returns 1 to select the record to the primary output stream, or 0 to send it to the secondary stream.
	• Alternatively with a Digit_NetRexx_Dstring, which evaluates to a 0 to 9 digit, the method can return the number of any output stream,. but **NOTE: the primary and secondary numbers, 0 & 1 are reversed per the above logic.** Other streams have their corresponding number.
	• Any other return value results in the record being discarded.
	• Any record sent to a disconnected stream is discarded.
	• This is powerful and has the possibility of doing damage to your pipe.
	You have been warned!
	• Due to the late compiling, at stage run time, debugging can be difficult. The reported line numbers have nothing to do with your code.
	Examples:
	`select /return rec.pos('2') > 0/`
	`select /parse rec 2 r +1;parse prev 2 p +1; return r <> p/`

serialize	**Convert Objects to/from a Single Text String** NetRexx ►►──SELECT──┬──────────────────┬──►◄ └──*classname*─(1)─┘ • (1) classname if class is specified deserialize input to objects of this type - otherwise serialize input objects. • (2) Pipes for NetRexx only. • (3) For some reason readObject does not like more than one object network in its stream. Block multiple objects. • (4) See examples/serialize_tests01.njp
sfsback	**Read an SFS File Backwards** • Not implemented in Netrexx Pipelines.
sfsdirectory	**List Files in an SFS Directory** • Not implemented in Netrexx Pipelines.
sfsrandom	**Random Access an SFS File** • Not implemented in Netrexx Pipelines.

sfsupdate	**Replace Records in an SFS File** • Not implemented in Netrexx Pipelines.
snake *3.09*	**Build Multicolumn Page Layout**  SNAKE number_cols number_rows page_seperator_DString (1) • (1) NetRexx Pipelines only. Appears first, last, and between pages. Avoid \ as escape terms maybe added in the future. \n for newline is OK. Your system may require \\n .
socka2ip	**Format sockaddr_in Structure** • Not implemented in Netrexx Pipelines.
sort	**Order Records**  NetRexx SORT REXX 10000 inputRange ( ) class (2) size Ascending (1) Descending (1) SINGLEOK (3) • (1) May come before inputRange, for backwards compatibility. • (2) Requires that you implement another sortClass with a name begining with 'sort' • (3) Suppresses error message if only one record to sort for Rexx objects. • Uses *sortClass* class as Interface Class for Generic Sort Objects and *sortRexx* class to Sort Rexx Text Objects  CMS NOPAD SORT COUNT UNIQue PAD xorc ANYcase Ascending Descending Ascending inputRange Descending NOPAD PAD xorc

space *3.09*	**Space Words Like REXX**  (1) 1 SPACE number BLANK xorc delimitedString STRing (2) BLANK xorc ANYof delimitedString ALLof (3) - (0) The order is the reverse of CHANGE! - (1) the replacement char/string - (2) the char/chars that will be stripped and replaced - (3) NetRexx Pipelines only, not CMS. The dstring is treated as a single unit for stripping or replacing
spec *specs* *4.06* *Fields and Separators* *NetRexx and COUNTERS* *comma separators*	**Rearrange Contents of Records**

```
       ┌─STOP──ALLEOF──────┐ (3)
►►──SPECs─┼───────────────────┴──────────┬─────────────────────────┬──────────────►
       └─STOP──┬─ANYEOF─┬──┘ (3)  └─COUNTERS─number─┘ (12)
               └─n──────────┘ (3)

   ┌──◄────────────────────────────────────────────────────────┐
►──┴──┬──┤ Group ├───────────────────────────────────────────┬──┴──┬──────────┬──────►◄
      ├─READ───────────────────────────────────────────────┤ (5)  └─(1),─┘ (4)(13)
      ├─READSTOP───────────────────────────────────────────┤
      ├─WRITE──────────────────────────────────────────────┤
      ├─SELECT─┬─streamnum─┬───────────────────────────────┤
      │        ├─streamid──┤                    │ (3)
      │        ├─FIRST─────┤                    │
      │        └─SECOND────┘                    │
      ├─PAD──┬─char──────┬───────────────────────────────────┤
      │      ├─hexchar───┤                      │
      │      ├─BLANK─────┤                      │
      │      └─SPACE─────┘                      │
      └─┬─WORDSEParator──┬──┬──char──────┬──┘ (7)
        ├─WS─────────────┤  ├─hexchar────┤
        ├─FIELDSEparator─┤  ├─BLANK──────┤
        └─FS─────────────┘  ├─SPACE──────┤
                  ├─TAB──────────┤
                  ├─hexstring─┤ (4)
                  └─qword────────┘ (4)(8)

Group:
├──┤ Id ├──┤ Input ├──┤ Conversion ├──┤ Output ├──┤ Alignment ├──┬──────────────┬──┤
                                     └──(1)─,──┘

Id:
├─letter───(2)(14)───:─(1)───┤

Input:
├──┬─Words─(1)─wnumberrange──────────────────────────────────┬──────────┤
   ├─Fields─(1)─fnumberrange─────────────────────────────────┤
   ├─cnumberrange────────────────────────────────────────────┤
   ├─delimitedString─────────────────────────────────────────┤
   ├─Xhexstring──────────────────────────────────────────────┤
   ├─Hhexstring──────────────────────────────────────────────┤
   ├─Bbinstring──────────────────────────────────────────────┤
   │          ┌─FROM──1──────────┐ ┌─BY──1───────┐ │
   ├──┬─RECNO──┬──┴──────────────────┴─┴──────────────┴─────────┤
   │  └─NUMBER─┘  └─FROM──fromnum─┘  └─BY──bynum─┘ │
   ├─TODclock────────────────────────────────────────────────┤ (3)
   └─.───────────────────────────────────────────────────────┘ (4)(15)
```

Conversion:

```
├─┬─────────┬─┬──────────────────────────────────────────┬──────────┤
  └─STRIP─┘ ├─B2C──────────────────────────────────────┤
            ├─B2D────────────────────────────────┤ (4)
            ├─B2X────────────────────────────────┤ (4)
            ├─C2B────────────────────────────────┤
            ├─C2D────────────────────────────────┤
            ├─C2F────────────────────────────────┤ (3)
            ├─C2I────────────────────────────────┤ (3)
            ├─C2P─┬──────────────────┬───────────┤ (3)
            │     └─(2)(scale)─┘     │ (3)
            ├─C2V────────────────────────────────┤ (3)
            ├─C2X────────────────────────────────┤
            ├─D2C────────────────────────────────┤
            ├─D2X────────────────────────────────┤ (4)
            ├─F2C────────────────────────────────┤ (3)
            ├─I2C────────────────────────────────┤ (3)
            ├─P2C─┬──────────────────┬───────────┤ (3)
            │     └─(2)(scale)─┘     │ (3)
            ├─V2C────────────────────────────────┤ (3)
            ├─X2B────────────────────────────────┤ (4)
            ├─X2C────────────────────────────────┤
            ├─X2D────────────────────────────────┤ (4)
            ├─F2T────────────────────────────────┤ (3)
            ├─LOWER──────────────────────────────┤ (4)
            ├─UPPER──────────────────────────────┤ (4)
            ├─STRING─────────────────────────────┤ (4)(11)
            └─┬─NETREXX─┬─delimitedString──┘ (4)(10)
              └─NR──────┘            (4)
```

Output:

```
├─┬─Next─┬───────────┬───────┬──┤
  │      └─(2).n─┘   │
  ├─NEXTWord─┬─┬─────────┬─┬─┤
  ├─NWord────┘ └─(2).n─┘ │
  ├─columnrange──────────┤
  └─.────────────────────────┘
```

Alignment:

```
   ┌─Left─────┐
├─┼──────────┼──┤
   ├─Center─┤
   ├─Centre─┤
   └─Right──┘
```

Ranges (*cnumberrange*, *fnumberrange*, *wnumberrange*):

```
├─┬─snumber─┬─(2)─┬──────────────────────────────────────────┬─┤
  └───*─────┘     ├─.────────(2)────────number──────┤
          ├─ ─ ─┬─(2)─┬─snumber─┬─┤
          └──;──┘     └───*─────┘
```

- (1) Blanks are optional in this position.
- (2) Blanks are not allowed here.
- (3) CMS only. Not yet implemented in NetRexx Pipelines
- (4) NetRexx Pipelines only. Not yet implemented in CMS
- (5) NetRexx Pipelines only. READ is giving the same output as READSTOP when the streams are different length.
- (6) This senses if it is the first stage, but comment stages will fool it into not producing any output.
- (7) CMS Pipelines, without documenting it, places this right by default NetRexx Pipelines follows the documentation and places this left by default. Specify the alignment you want to override these defaults.
- (8) A *qword* is an optionally quoted word, with single or double marks. If it contains spaces or

begins with a quote mark, it must be quoted. It can not start with a space (the quote mark will be considered a single character, and rest gibberish). If is unquoted and an even number of hexadecimal characters, it will be used as a hexchar or hexstring.

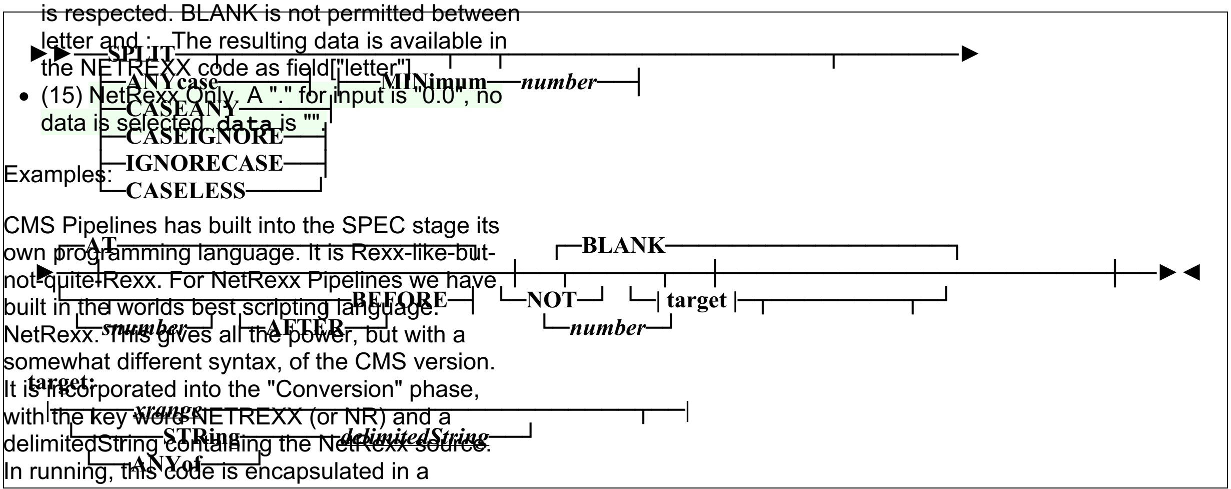
- (9) CMS has a mini-programming language built in. It uses Field Identifiers and Control Breaks, Counters, and Structured Data. NetRexx does not yet have any of these features.
- (10) The delimited string is any valid NetRexx code. [**Yes, you can get in trouble!**] It is put into a method and executed for each record. The selected input data is in the variable DATA. The returned string is output. The variable array COUNTER[] is available for your use. Unlike CMS, COUNTER is a full NetRexx variable object of type Rexx. Each COUNTER is initially 0, but can hold any NetRexx value, including strings. COUNTERs are persistent for the life of the stage and are shared across all NETREXX converters in a stage. Index can be number or string. Fields identified by a fieldid are accessed as field["id"] when the quotes are required, the id is a single letter, case is respected.
- (11) The data is processed by the toString() method.
- (12) CMS Only. NetRexx ignores COUNTERS n; it has an unlimited number. See the NETREXX converter(10).
- (13) NetRexx Only. A comma may be used to separate groups for readability. It is ignored by the system.
- (14) Letter is a single character, a-zA-Z. Case is respected. BLANK is not permitted between letter and :. The resulting data is available in the NETREXX code as field["letter"].
- (15) NetRexx Only. A "." for input is "0.0", no data is selected. **`data`** is "".

Examples:

CMS Pipelines has built into the SPEC stage its own programming language. It is Rexx-like-but-not-quite-Rexx. For NetRexx Pipelines we have built in the worlds best scripting language: NetRexx. This gives all the power, but with a somewhat different syntax, of the CMS version. It is incorporated into the "Conversion" phase, with the key word NETREXX (or NR) and a delimitedString containing the NetRexx source. In running, this code is encapsulated in a method. The data selected in the Input phase is available as the variable **`data`**. And whatever is returned is passed to the Output phase of the stage. (As a convenience, if the last statement is not RETURN, the statement "**`return data`**" is automatically added.)

So all of these pipes work the same (giving **`cba`**):

- **`pipe "literal abc | spec 1-* NR /return data.reverse/ 1 | cons"`**
- **`pipe "literal abc | spec 1-* NR @rev = data.reverse; return rev@ 1 | cons"`**
- **`pipe "literal abc | spec 1-* NR %data = data.reverse% 1 | cons"`**
- **`pipe "spec /abc/ NetRexx /data =`**

spill	**Spill Long Lines at Word Boundaries** - Not implemented in Netrexx Pipelines
split	**Split Records Relative to a Target**  SPLIT ANYcase CASEANY CASEIGNORE IGNORECASE CASELESS MINimum number AT BEFORE snumber AFTER BLANK NOT target number target: xrange STRing ANYof delimitedString
sql ***3.09***	**Interface to SQL**

```
                                  ┌─;─┐
►►──SQL──┬──────────────────┬──────┴───┬┴──────────────────────────────────────────┬──────┬──►◄
         └─(─┤ options ├─)──┘   └─sql_statement_string─(3)─┘

options:
   ┌──◄─────────────────────────────────────────────────────────┐
├──┴─┬───────────────────────────────────────────────────────┬──┴─┤
     │             ┌─/sqlselect.properties/─┐                │
     ├─PROPERTIES──┴─filename_Qword─(7)─────┴──(5)─┬─────────┤
     │ ┌─HEADERS───┐                               │
     ├─┼───────────┼─(5)(6)──────────────────────────────────┤
     │ └─NOHEADERS─┘                               │
     ├─COUNT2SECondary─(5)(11)───────────────────────────────┤
     ├─URL─Qword─(5)(7)──────────────────────────────────────┤
     ├─JDBCDRIVER─Qword─(5)(7)───────────────────────────────┤
     ├─DBMS─Qword─(5)(7)(8)──────────────────────────────────┤
     ├─DB_NAME─Qword─(5)(7)(8)───────────────────────────────┤
     ├─USER─Qword─(5)(7)(8)(10)──────────────────────────────┤
     └─PASS─Qword─(5)(7)(8)(10)──────────────────────────────┘
```

- uses jdbc to select from any jdbc enabled dbms
- properties file (sqlselect.properties default) is read from the secondary input stream to find jdbcdriver name, url, user, pass
- sample properties file:
-
  ```
  #JDBC driver name
  #Tue Feb 03 23:29:43 GMT+01:00 1998
  jdbcdriver=com.imaginary.sql.msql.MsqlDriver
  url=jdbc:msql://localhost:1114/TESTDB
  # the following are not needed for
  some DBMS, ex: SQLite
  user=db_user_name
  pass=password_for_db
  ```
-
- if this file is not found default (compiled in) values are used
- (1) when using a sql select * (all columns) from the commandline, quote the query as in `java pipes.compiler (query) "sql select * from dept | console"`
- (2) the netrexx/jdbc combination is extremely case sensitive for column and table names
- (3) this sql_select_string executed, then statements are read from the primary input stream.
  this is optional in NetRexx Pipelines only.
- (4) CMS does not use the stream input
- (5) NetRexx Pipelines only
- (6) CMS Pipelines is implyed HEADERS only.
- (7) A Qword is an optionally quoted word. If it contains spaces, it must be quoted.
- (8) EXPERIMENTAL Subject to change. DBMS is the kind of database, e.g. SQLite. DB_name is the file name. These are used in place of URL and JDBCDRIVER. SQLite is the only one tested as of 8/15/20.
- (9) the SQLSELECT stage uses HEADERS as the default.
- (10) USER & PASS are needed for some DBMSs and not others, ex. SQLite.
- (11) the count or other output from non-select statements goes to the secondary output stream if connected, or is discarded. Otherwise it goes to the primary.
-
- Priority order for URL, JDBCDRIVER and DBMS, DB_NAME (first one found rules):
  1. option in the SQL command string

2. from secondary input stream
3. from "sql.properties" file or from file specified by PROPERTIES option
4. Builtin

`sqlcodes`

Write the last 11 SQL Codes Received

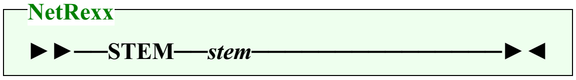
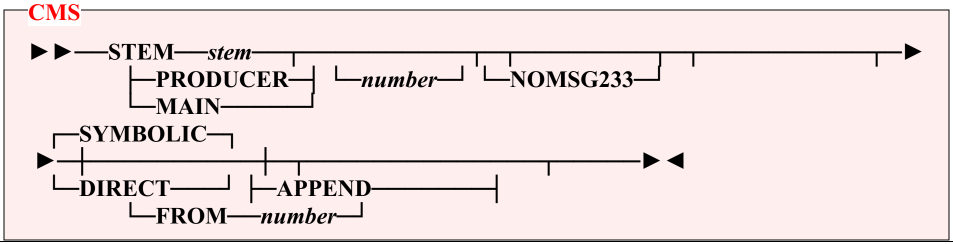
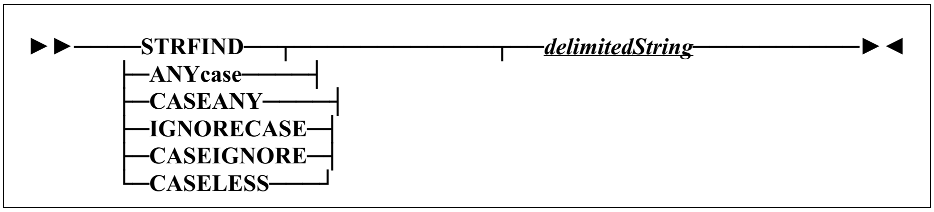
- Not implemented in Netrexx Pipelines.

`sqlselect`

Query a Database and Format Result

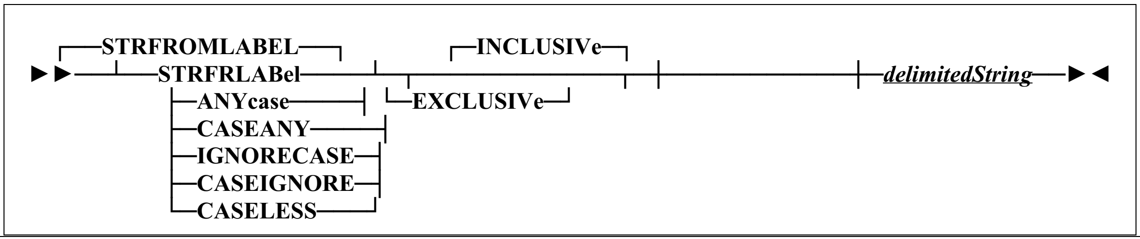
```
►►──SQLSELECT──┬──────────────────────────┬──►
               └─(─| options |─)─┘

 ┌─SELECT─┐                        +─;─+
►─┴────────┴─┬─────────────────────────────────┬──┴────┴──►◄
             └─sql_select_statement_string─(3)─┘

options:
 ┌──◄────────────────────────────────────────────────────────┐
├─┴─┬────────────────────────────────────────────────────┬──┴─┤
    │        ┌─/sqlselect.properties/─┐                    │
    ├─PROPERTIES─┴─filename_Qword─(7)───┴─(5)─┤
    │ ┌─NOHEADERS─┐                           │
    ├─┼───────────┼─(5)(6)────────────────────┤
    │ └─HEADERS───┘                           │
    ├─URL─Qword─(5)(7)────────────────────────┤
    ├─JDBCDRIVER─Qword─(5)(7)─────────────────┤
    ├─DBMS─Qword─(5)(7)(8)────────────────────┤
    ├─DB_NAME─Qword─(5)(7)(8)─────────────────┤
    ├─USER─Qword─(5)(7)(8)(10)────────────────┤
    +─PASS─Qword─(5)(7)(8)(10)────────────────+
```

- (1) when using a sqlselect * (all columns) from the commandline, quote the query as in java pipes.compiler (query) "sqlselect * from dept | console"
- (2) the netrexx/jdbc combination is extremely case sensitive for column and table names
- (3) if no sql_select_string is specified, it is read from the primary input stream.
  this is optional in NetRexx Pipelines only. CMS does not use the stream input.
- (4) a maximum of only one record is ever read from the primary input stream.
- (5) NetRexx Pipelines only
- (6) CMS Pipelines is implied HEADERS only.
- (7) A Qword is an optionally quoted word. If it contains spaces, it must be quoted.
- (8) EXPERIMENTAL Subject to change. DBMS is the kind of database, e.g. SQLite. DB_name is the file name. These are used in place of URL and JDBCDRIVER. SQLite is the only one tested as of 8/15/20.
- (9) the SQL stage uses NOHEADERS as the default.
- (10) USER & PASS are needed for some DBMSs and not others, ex. SQLite.
- Priority order for URL, JDBCDRIVER, DBMS, DB_NAME, USER, & PASS (first one found rules):
  1. option in the SQL command string
  2. from secondary input stream
  3. from "sqlselect.properties" file or from file specified by PROPERTIES option
  4. Builtin

stack	**Read or Write the Program Stack** - Not implemented in Netrexx Pipelines.
starmon	**Write Records from the *MONITOR System Service** - Not implemented in Netrexx Pipelines.
starmsg	**Write Lines from a CP System Service** - Not implemented in Netrexx Pipelines.
starsys	**Write Lines from a Two-way CP System Service** - Not implemented in Netrexx Pipelines.
state	**Provide Information about CMS Files** - Not implemented in Netrexx Pipelines.
state	**Verify that Data Set Exists** - Not implemented in Netrexx Pipelines.
statew	**Provide Information about Writable CMS Files** - Not implemented in Netrexx Pipelines.
stem	**Retrieve or Set Variables in a REXX or CLIST Variable Pool**   CMS STEM stem PRODUCER MAIN number NOMSG233 SYMBOLIC DIRECT APPEND FROM number
stfle	**Store Facilities List** - Not implemented in Netrexx Pipelines.
storage	**Read or Write Virtual Machine Storage** - Not implemented in Netrexx Pipelines.
strasmfind	**Select Statements from an Assembler File as XEDIT Find** - Not implemented in Netrexx Pipelines.
strasmnfind	**Select Statements from an Assembler File as XEDIT NFind** - Not implemented in Netrexx Pipelines.
strfind	**Select Lines by XEDIT Find Logic**  STRFIND ANYcase CASEANY IGNORECASE CASEIGNORE CASELESS delimitedString

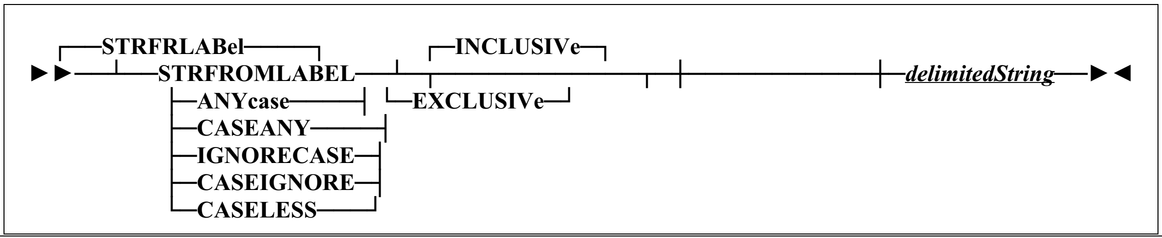
strfrlabel
strfrlabe
strfrlab
strfromlabel

Select Records from the First One with Leading String



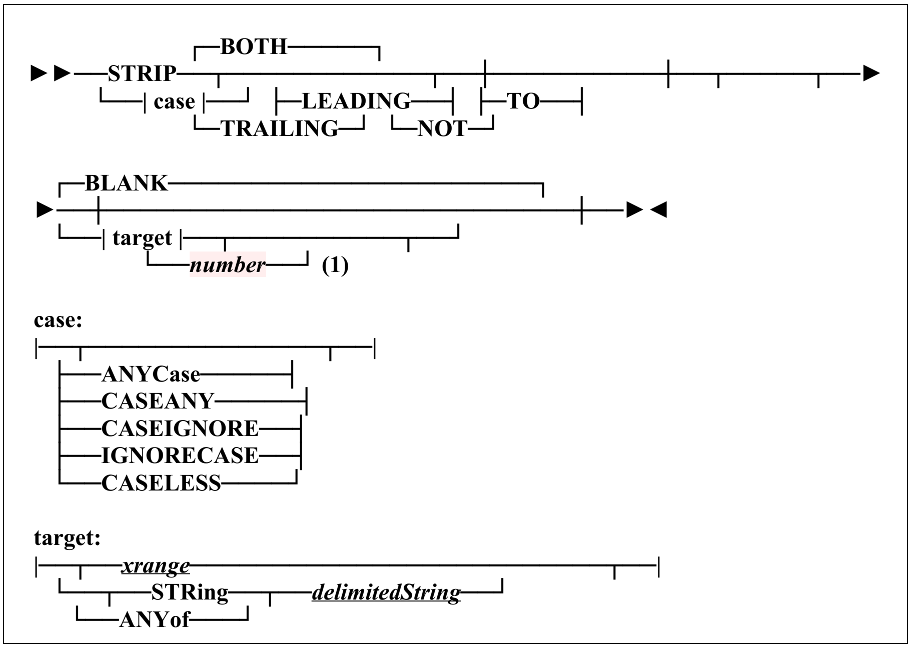
strfromlabel
strfrlabel
strfrlabe
strfrlab

Select Records from the First One with Leading String

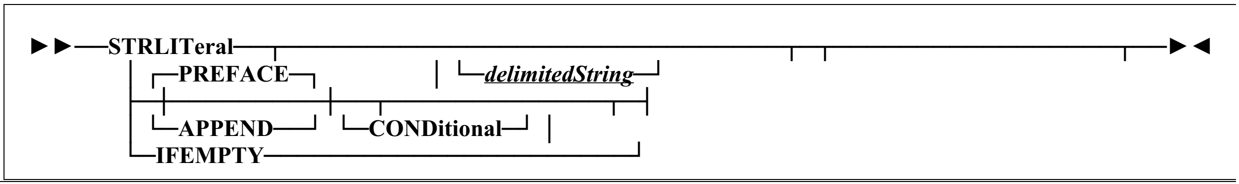
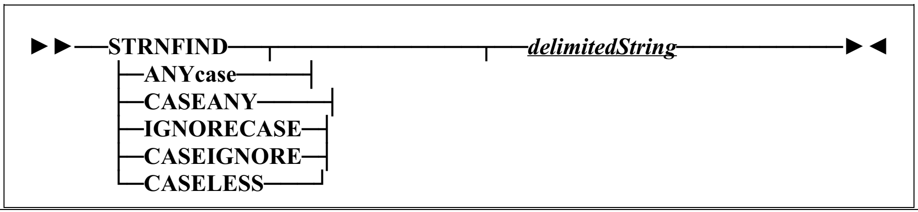
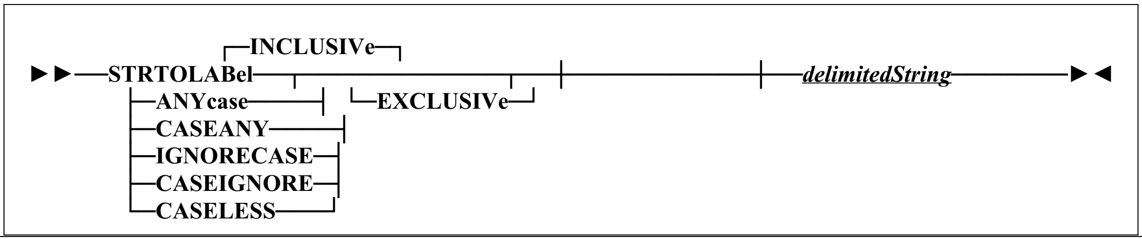
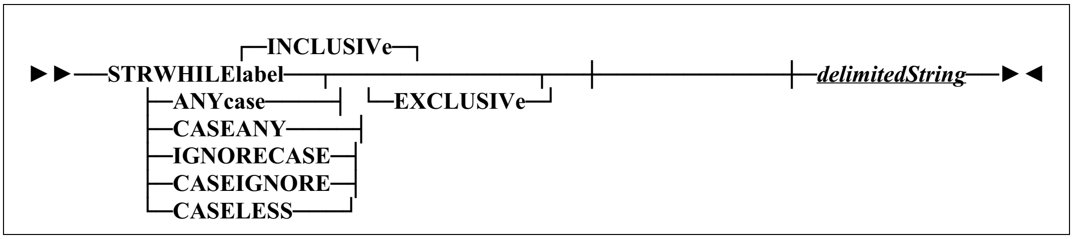


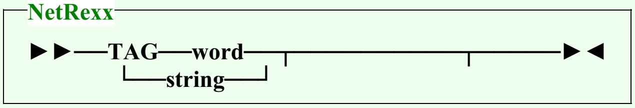
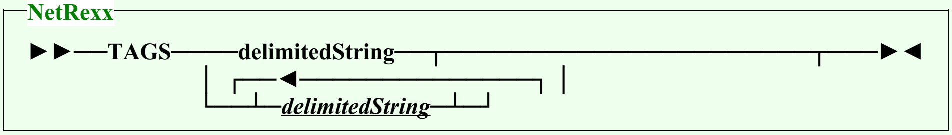
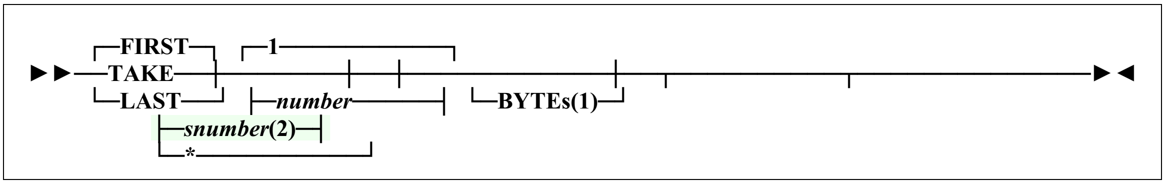
strip

Remove Leading or Trailing Characters



- (1) Not implemented in Netrexx Pipelines.

strliteral ***strlitera*** ***strliter*** ***strlite*** ***strlit***	**Write the Argument String**  STRLITeral PREFACE APPEND IFEMPTY CONDitional delimitedString
strnfind	**Select Lines by XEDIT NFind Logic**  STRNFIND ANYcase CASEANY IGNORECASE CASEIGNORE CASELESS delimitedString
strtolabel ***strtolabe*** ***strtolab***	**Select Records to the First One with Leading String**  INCLUSIVe STRTOLABel ANYcase CASEANY IGNORECASE CASEIGNORE CASELESS EXCLUSIVe delimitedString
structure ***struct***	**Manage Structure Defnitions** • Not implemented in Netrexx Pipelines.
strwhilelable ***strwhilelabl*** ***strwhilelab*** ***strwhilela*** ***strwhilel*** ***strwhile*** ***3.09***	**Select Run of Records with Leading String**  INCLUSIVe STRWHILElabel ANYcase CASEANY IGNORECASE CASEIGNORE CASELESS EXCLUSIVe delimitedString
stsi	**Store System Information** • Not implemented in Netrexx Pipelines.
subcom	**Issue Commands to a Subcommand Environment** • Not implemented in Netrexx Pipelines.
substring ***substr***	**Write substring of record** • Not implemented in Netrexx Pipelines.
synchronise ***sync*** ***synchronize***	**Synchronise Records on Multiple Streams** • Not implemented in Netrexx Pipelines.
synchronize ***sync*** ***synchronise***	**Synchronise Records on Multiple Streams** • Not implemented in Netrexx Pipelines.
sysdsn	**Test whether Data Set Exists** • Not implemented in Netrexx Pipelines.

sysout	**Write System Output Data Set** • Not implemented in Netrexx Pipelines.
sysvar	**Write System Variables to the Pipeline** • Not implemented in Netrexx Pipelines.
tag *3.11*	**Surrounds Input Records with a HTML tag and its End Tag**  • Outputs a record: <word string>, then passes through all records on its primary input, and finally a record: </word>.
tags *3.11*	**Surrounds Input Records with HTML tags and their End Tags**  • Outputs a record for each delimitedString: <delimitedString>, then passes through all records on its primary input, and finally a record for each, in reverse order: </first_word_of_delimitedString>. • Any delimitedString may be a single word.
take	**Select Records from the Beginning or End of the File**  FIRST TAKE LAST 1 number snumber(2) * BYTEs(1) • (1) CMS must be BYTES • (2) Not CMS; NetRexx Pipelines: minus reverses first/last
tape	**Read or Write Tapes** • Not implemented in Netrexx Pipelines.
tcpchsum	**Compute One's complement Checksum of a Message** • Not implemented in Netrexx Pipelines.
tcpclient	**Connect to a TCP/IP Server and Exchange Data**

```
►►──TCPCLIENT──IPaddress──number──►

  ┌──◄─────────────────────────────────────────────────────┐
►─┴─┬──────────────────────────────────────────────────┬───┴─►◄
    ├─┤ Deblock ├───────────────────────────────────────┤
.   ├─EMSGSF4─(1)───────────────────────────────────────┤
    ├─GETSOCKName─(1)───────────────────────────────────┤
    ├─GREETING──────────────────────────────────────────┤
    ├─KEEPALIVe─────────────────────────────────────────┤
    ├─LINGER──number────────────────────────────────────┤
    │              ┌─ANY──────┐                          │
    ├─LOCALIPaddress──┼─HOSTID───┼─(1)──────────────────┤
    │              └─IPaddress─┘                         │
    ├─LOCALport──number─(1)─────────────────────────────┤
    ├─NODELAY─(2)───────────────────────────────────────┤
    ├─ONERESPONSE───────────────────────────────────────┤
    ├─OOBINLINE─(1)─────────────────────────────────────┤
    ├─REUSEADDR─(1)─────────────────────────────────────┤
    ├─SECURE─┬──────────────┬─┬─────────────┬─(1)───────┤
    │        └─GETSECINFO─┘ ├─SAFE───┤                  │
    │                       └─UNSAFE─┘                  │
    ├─SF─(1)────────────────────────────────────────────┤
    ├─SF4─(1)───────────────────────────────────────────┤
    ├─STATistics─(1)────────────────────────────────────┤
    ├─TIMEOUT──number───────────────────────────────────┤
    └─USERid──word─(1)──────────────────────────────────┘

Deblock:
├──DEBLOCK───┬─CRLF─────────────────────────┬──►
             ├─LINEND─┬────────┬────────────┤
             │        └─xorc─┘              │
             ├─SF───────────────────────────┤
             ├─SF4──────────────────────────┤
             └─STRING──delimitedString──────┘

►─┬──────────────────────────────┬──┤
  └─GROUP──delimitedString───────┘
```

- (1) CMS Pipelines Only.
- (2) NetRexx Pipelines Only.

The options implemented are similar to the CMS definition.

- linger - wait a bit before terminating the last read (units SECONDS)
- timeout - wait this long before timing reads out (units MS)
- deblock - If deblock is omitted a copy stage is used.
- group - similar to CMS. A delimited string containing a stage is expected. You can use a run of stages, but its is dangerous since you don't know the stage sep character being used...
- greeting - expect a greeting message and discard it
- nodelay - use the nodelay option
- keepalive - enable keep alive socket option
- oneresponse - synchronize cmds/replys

`tcpdata` **Read from and Write to a TCP/IP Socket**

```
       ┌──◄──────────────────────────────┐
►►──TCPDATA──┴─┬─────────────────────────────┬──┴──────►◄
       ├─| Deblock |─────────────┤
       ├─GETSOCKName─(1)─────────┤
       ├─GREETING─(1)────────────┤
       ├─KEEPALIVe─(1)───────────┤
       ├─LINGER──number──────────┤
       ├─NODELAY─(2)─────────────┤
       ├─ONERESPONSE─────────────┤
       ├─OOBINLINE─(1)───────────┤
       ├─REUSEADDR─(1)───────────┤
       ├─SF─(1)──────────────────┤
       ├─SF4─(1)─────────────────┤
       ├──┬─SECURE──────────┬(1)─┤
       │  └─TLSLABEL──word──┘    │
       ├─STATistics─(1)──────────┤
       └─TIMEOUT─(2)─────────────┘

Deblock:
├──DEBLOCK──┬──CRLF────────────────────────────┬──►
            ├─LINEND─┬──────────┬──────────────┤
            │        └─xorc─────┘              │
            ├─SF───────────────────────────────┤
            ├─SF4──────────────────────────────┤
            └─STRING──delimitedString──────────┘

►──┬────────────────────────────────┬──┤
   └─GROUP──delimitedString─────────┘
```

- Simple tcpdata implementation.
- (1) CMS Pipelines Only
- (2) NetRexx Pipelines Only
  - linger - wait a bit before terminating the last read (units SECONDS)
  - timeout - wait this long before timing reads out (units MS)
  - deblock - If deblock is ommited a copy stage is used.
  - group - similiar to cms. A delimited string containing a stage is expected. You can use a run of stages, but its is dangerous since you to know the stage sep character being used...
  - nodelay - use the nodelay option
  - oneresponse - synchronize requests/replies

tcplisten

Listen on a TCP Port

```
                      ┌◄───────────────────────────────────────────┐
►►──TCPLISTEN──number─┴─┬────────────────────────────────────────────┬─┴──►◄
                        ├─BACKLOG──number────────────────────────────┤
                        ├─GETSOCKName─(2)────────────────────────────┤
                        │              ┌─ANY───────┐                  │
                        ├─LOCALIPaddress─┼─HOSTID────┼─(2)─┤
                        │              └─IPaddress─┘                  │
                        ├─REUSEADDR─(2)──────────────────────────────┤
                        ├─STATistics─(2)─────────────────────────────┤
                        ├─USERid──word─(2)───────────────────────────┤
                        └─TIMEOUT──number─(1)────────────────────────┘
```

- (1) NetRexx Pipelines only.
- (2) CMS Pipelines only.
- Simple tcplisten implementation. You can only supply the port and a timeout value. Its ignored unless tcplisten's output stream has been severed, in which case tcplisten terminates.
- If input stream 0 is connected, tcplisten does a peekto before calling the accept method. The object is consumed after the output of the socket object returns.

terminal
termina
termina
termin
termi
term
console
consol
conso
cons
cons
3.11

Read or Write the Terminal in Line Mode

```
►►──┬─TERMinal─┬──┬──────────────────────┬──┬───────────────────────────────┬──
    └─CONSole──┘  ├─EOF──delimitedString─┤  └─PRfix──┬─delimitedString─(1)─┘
                  └─NOEOF────────────────┘  └─PRompt─┘

►──┬────────────────────┬──►◄
   ├─DIRECT─(2)─────────┤
   ├─ASYNchronously─(2)─┤
   └─DARK─(2)───────────┘
```

- (1) NetRexx only
  On first stage, delimitedString is put out as a prompt
  On other stages, each line is prefixed with delimitedString
  Outout to next stage does NOT include delimitedString
  Either keyword can be used for either stage
- (2) CMS only

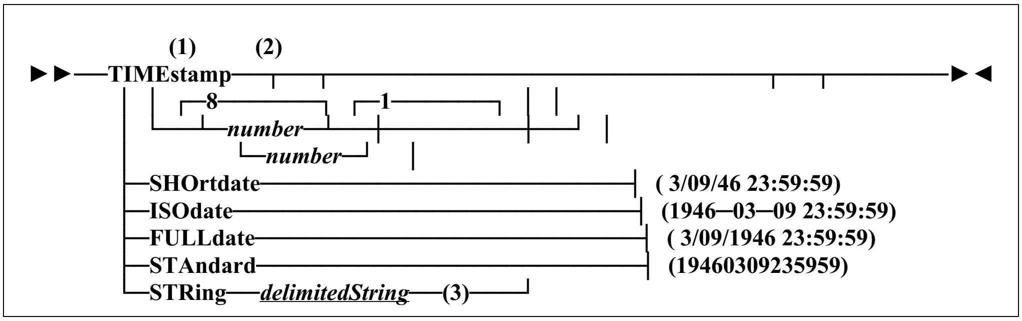
threeway

Split record three ways

- Not implemented in Netrexx Pipelines.

timestamp
timestam
timesta
timest
times
time

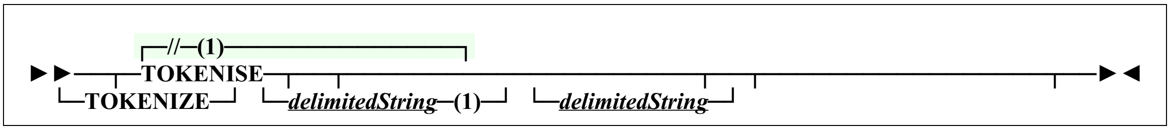
Prefix the Date and Time to Records



- (1) First character, from right, to include, <= 16
- (2) Count of characters to include. <= 16 - (1). Default = (1)
- (3)
    - %% A single %.
    - %Y Four digits year including century (0000-9999).
    - %y Two-digit year of century (00-99).
    - %m Two-digit month (01-12).
    - %n Two-digit month with initial zero changed to blank (1-12).
    - %d Two-digit day of month (01-31).
    - %e Two-digit day of month with initial zero changed to blank (1-31).
    - %j Julian day of year (001-366).
    - %H Hour, 24-hour clock (00-23).
    - %k Hour, 24-hour clock with leading zero blank (0-23).
    - %M Minute (00-59).
    - %S Second (00-60).
    - %F Equivalent to %Y-%m-%d (the ISO 8601 date format).
    - %T Short for %H:%M:%S.
    - %t Tens and hundredth of a second (00-99).

tokenise
tokenize

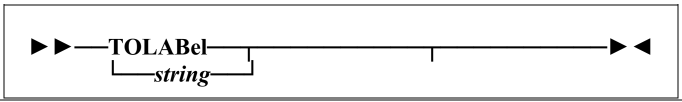
Tokenise Records



- (1) In CMS Pipelines, the first delimited string is required. In NetRexx Pipelines, it defaults to // if no second string.

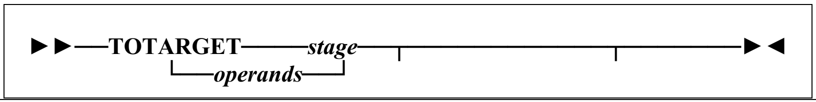
tolabel
tolabe
tolab

Select Records to the First One with Leading String



totarget

Select Records to the First One Selected by Argument Stage



trackblock

Build Track Record

- Not implemented in Netrexx Pipelines.

trackdeblock

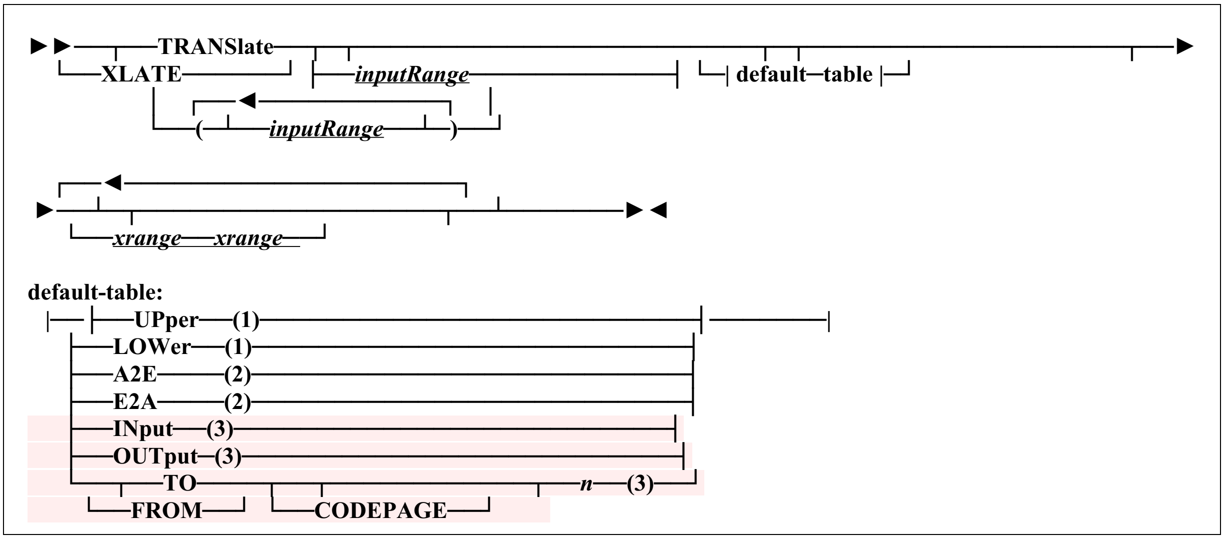
Deblock Track

- Not implemented in Netrexx Pipelines.

trackread	**Read Full Tracks from ECKD Device** - Not implemented in Netrexx Pipelines.
tracksquish	**Squish Tracks** - Not implemented in Netrexx Pipelines.
trackverify	**Verify Track Format** - Not implemented in Netrexx Pipelines.
trackwrite	**Write Full Tracks to ECKD Device** - Not implemented in Netrexx Pipelines.
trackxpand	**Unsquish Tracks** - Not implemented in Netrexx Pipelines.

translate
translat
transla
transl
trans
xlate

Transliterate Contents of Records



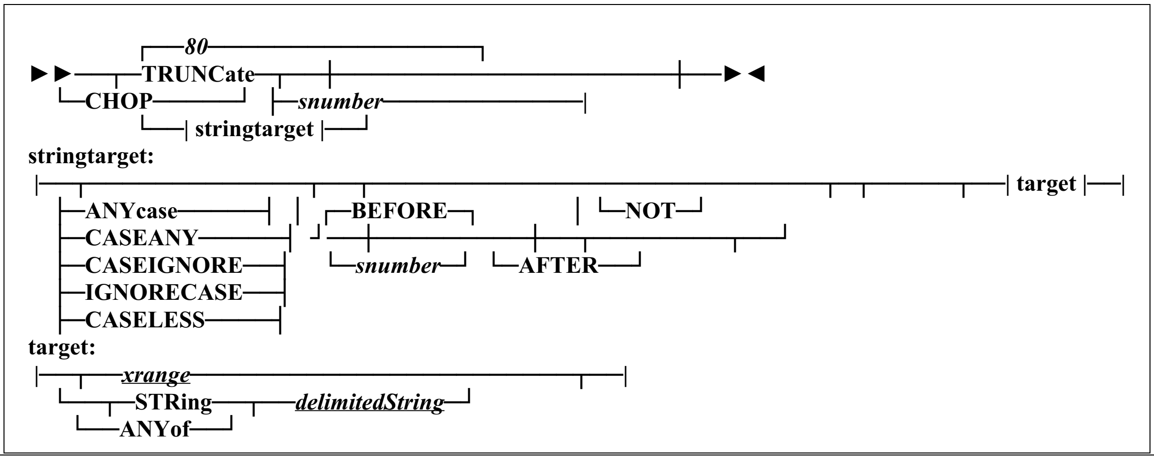
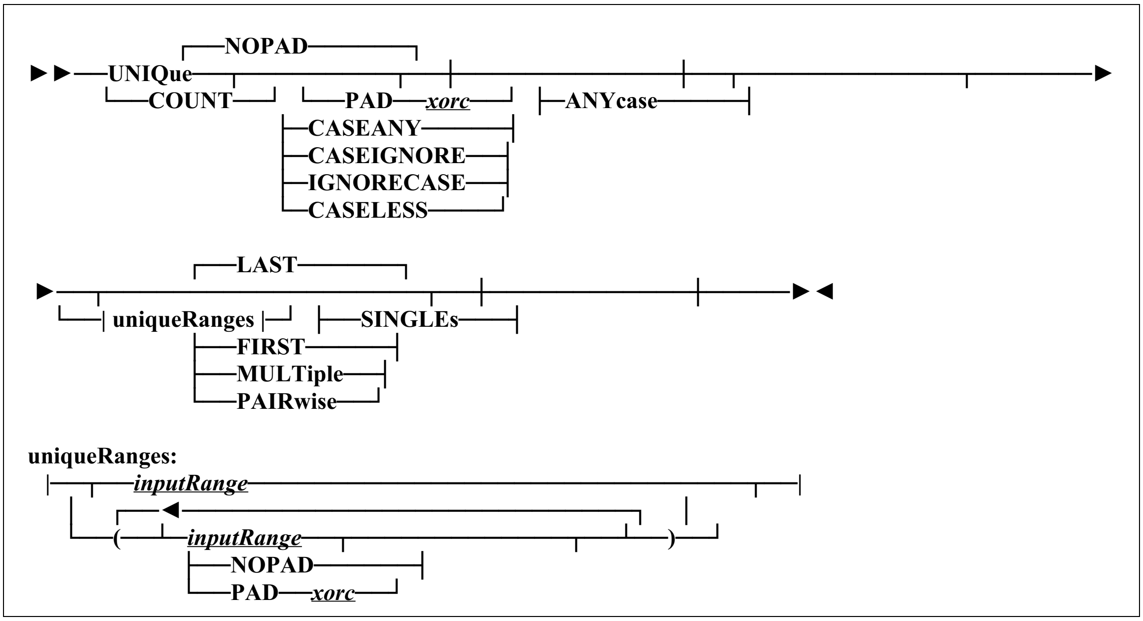
Notes:

- (1) UTF-16 (ASCII) in NJPipes, probably EBCIDIC in CMS.
- (2) In Netrexx Pipelines. EBCDIC to ASCII or ASCII to EBCDIC. Maybe in CMS, the documentation is unclear.
- (3) Not yet in NetRexx Pipelines
- [4] NetRexx Pipelines only: The secondary input stream is not yet supported.

trfread

Read a Trace File

- Not implemented in Netrexx Pipelines.

truncate ***truncat*** ***trunca*** ***trunc*** ***chop***	**Truncate the Record**  80 TRUNCate CHOP snumber stringtarget stringtarget: ANYcase CASEANY CASEIGNORE IGNORECASE CASELESS BEFORE snumber AFTER NOT target target: xrange STRing ANYof delimitedString
tso	**Issue TSO Commands, Write Response to Pipeline** • Not implemented in Netrexx Pipelines.
udp	**Read and Write an UDP Port** • Not implemented in Netrexx Pipelines.
unique ***uniqu*** ***uniq***	**Discard or Retain Duplicate Lines**  NOPAD UNIQue COUNT PAD xorc ANYcase CASEANY CASEIGNORE IGNORECASE CASELESS LAST uniqueRanges FIRST MULTiple PAIRwise SINGLEs uniqueRanges: inputRange (inputRange) NOPAD PAD xorc
unpack	**Unpack a Packed File** • Not implemented in Netrexx Pipelines.
untab	**Replace Tabulate Characters with Blanks** • Not implemented in Netrexx Pipelines.

unzip

Extract Files From a ZIP Archive

```
NetRexx
►►──UNZIP──┬──────────────────┬──►◄
           └──filename─(1)──┘
```

Notes:

- (1) If filename is not specified, it is read from the primary input stream. Succeeding input objects are ignored.
- The extracted file names are passed to the primary output stream.
- Any existing files will be replaced.
- This is NetRexx Pipelines only.

update

Apply an Update File

- Not implemented in Netrexx Pipelines.

urldeblock

Process Universal Resource Locator

- Not implemented in Netrexx Pipelines.

uro

Write Unit Record Output

- Not implemented in Netrexx Pipelines.

utf

Convert between UTF-8, UTF-16, and UTF-32

- Not implemented in Netrexx Pipelines.

var

Retrieve or Set a Variable in a REXX or CLIST Variable Pool

```
►►──VAR──word──┬─────────────────┬──┬────────────────┬──►
               ├──PRODUCER─(1)──┤  └──number─(1)──┘
               └──MAIN─(1)──────┘

                     ┌─SYMBOLIC─(1)─┐
►──┬────────────────┬──┼──────────────┼──┬──────────────────┬──►◄
   └──NOMSG233─(1)──┘  └──DIRECT─(1)──┘  └──TRACKING─(1)──┘
```

- In NetRexx Pipelines, this can only read vars. It must be the first stage in a pipe.
- (1) CMS Pipelines only.

vardrop

Drop Variables in a REXX Variable Pool

- Not implemented in Netrexx Pipelines.

varfetch

Fetch Variables in a REXX or CLIST Variable Pool

- Not implemented in Netrexx Pipelines.

varload

Set Variables in a REXX or CLIST Variable Pool

- Not implemented in Netrexx Pipelines.

varover
3.09

Write the Values of Stems

```
NetRexx
►►──VAROVER──varName───►◄
```

- NetRexx Pipelines only; not CMS Pipelines
- If the secondary output stream is connected, the root is passed on it.

varset

Set Variables in a REXX or CLIST Variable Pool

- Not implemented in Netrexx Pipelines.

vchar

Recode Characters to Different Length

- Not implemented in Netrexx Pipelines.

vector

Read or Write an Array of Vectors

```
┌NetRexx──────────────────────┐
│ ►►──VECTOR──name──►◄        │
└─────────────────────────────┘
```

- Pipes for NetRexx only.

vectora

Add to an Array of Vectors

```
┌NetRexx──────────────────────┐
│ ►►──VECTORA──name──►◄       │
└─────────────────────────────┘
```

- Pipes for NetRexx only.

vectorr

Read From an Array of Vectors

```
┌NetRexx──────────────────────┐
│ ►►──VECTORR──name──►◄       │
└─────────────────────────────┘
```

- Pipes for NetRexx only.

vectorw

Write to an Array of Vectors

```
┌NetRexx──────────────────────┐
│ ►►──VECTORW──name──►◄       │
└─────────────────────────────┘
```

- Pipes for NetRexx only.

verify
3.09

Verify that Record Contains only Specified Characters

```
                        ┌─◄──────────────────────────────┐ (1)
►►──VERIFY──┬───────────┬─┼──────────────┬──┼────────────────────┼──┬─delimitedString─┬──┬──►◄
            ├─ANYCASE───┤ └─inputRange───┘  └─character─range────┘ (1)
            ├─CASEANY───┤
            ├─CASEIGNORE┤
            ├─IGNORECASE┤
            └─CASELESS──┘
```

- (1) NetRexx Pipelines only
- (1) *character-range* is xorc-xorc
- (1) Examples: A-Z 0-9 c-g a4-ba; 16-bit Unicode characters or hex numbers
- (1) Any number greater than zero, any order, of delimitdStrings and character-ranges are allowed.

vmc

Write VMCF Reply

- Not implemented in Netrexx Pipelines.

vmcdata

Receive, Reply, or Reject a Send or Send/receive Request

- Not implemented in Netrexx Pipelines.

vmclient

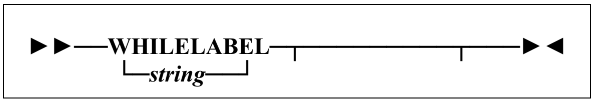
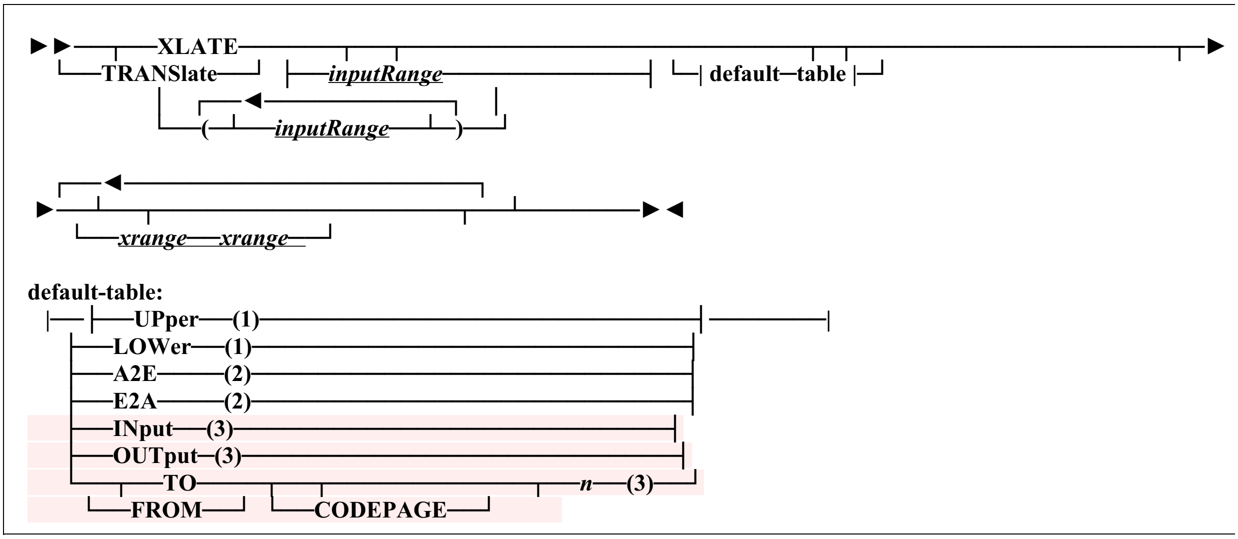
Send VMCF Requests

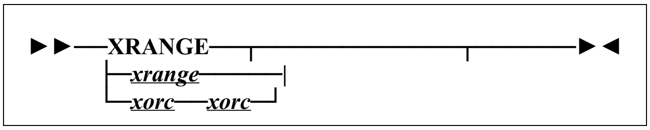
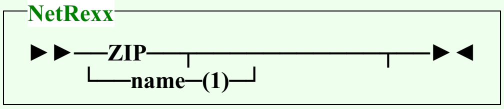
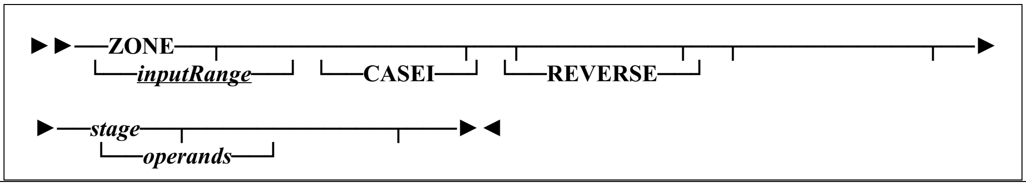
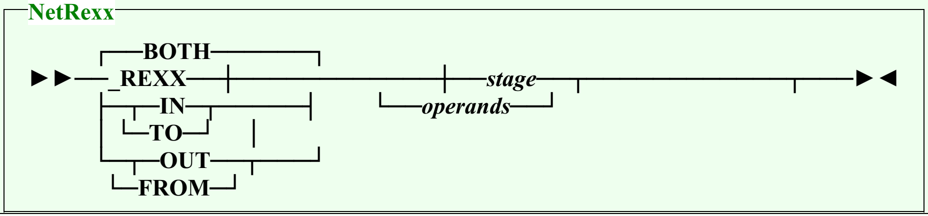
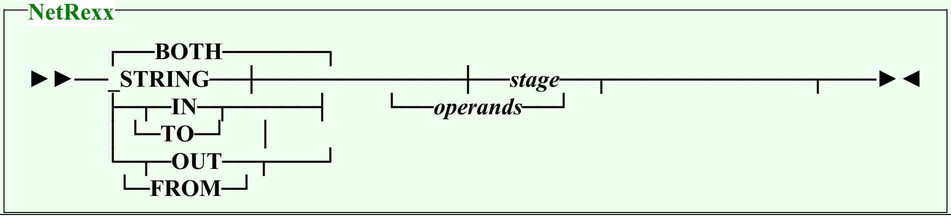
- Not implemented in Netrexx Pipelines.

vmclisten

Listen for VMCF Requests

- Not implemented in Netrexx Pipelines.

waitdev	**Wait for an Interrupt from a Device** - Not implemented in Netrexx Pipelines.
warp	**Pipeline Wormhole** - Not implemented in Netrexx Pipelines.
warplist	**List Wormholes** - Not implemented in Netrexx Pipelines.
whilelabel ***3.09***	**Select Run of Records with Leading String** 
wildcard	**Select Records Matching a Pattern** - Not implemented in Netrexx Pipelines.
writepds	**Store Members into a Partitioned Data Set** - Not implemented in Netrexx Pipelines.
xab	**Read or Write External Attribute Buffers** - Not implemented in Netrexx Pipelines.
xedit	**Read or Write a File in the XEDIT Ring** - Not implemented in Netrexx Pipelines.
xlate ***translate*** ***translat*** ***transla*** ***transl*** ***trans***	**Transliterate Contents of Records**  XLATE TRANSlate inputRange default—table (inputRange) xrange xrange default-table: UPper (1) LOWer (1) A2E (2) E2A (2) INput (3) OUTput (3) TO FROM CODEPAGE n (3) Notes: - (1) UTF-16 (ASCII) in NJPipes, probably EBCIDIC in CMS. - (2) In Netrexx Pipelines. EBCDIC to ASCII or ASCII to EBCDIC. Maybe in CMS, the documentation is unclear. - (3) Not yet in NetRexx Pipelines - [4] NetRexx Pipelines only: The secondary input stream is not yet supported.
xmsg	**Issue XEDIT Messages** - Not implemented in Netrexx Pipelines.

xpndhi	**Expand Highlighting to Space between Words** - Not implemented in Netrexx Pipelines.
xrange *3.09*	**Write a Range of Characters**  - NetRexx uses UTF-16 (ASCII) and CMS uses EBCDIC
zip	**Add Files To a new ZIP Archive**  - (1) name is the zip file name. If not provided, the first entry on the primary input stream is used. - (1) If no extension is provided in name, ".ZIP" is added. - (1) Any existing file is replaced. - Subsquent records on the primary input stream are filenames to be added to the Zip archive file. - File names added passed out on primary out stream. - NetRexx Pipelines only.
zone	**Run Selection Stage on Subset of Input Record** 
_rexx	**Cast Input and/or Output of a Stage to Type Rexx**  NetRexx BOTH _REXX IN TO OUT FROM stage operands
_string	**Cast Input and/or Output of a Stage to Type String**  NetRexx BOTH _STRING IN TO OUT FROM stage operands

9

Differences with CMS Pipelines

The goal of this implementation is to be as close as possible to the the CMS version of Pipelines. A few differences are unavoidable.

- The character set is Unicode and not EBCDIC, as Unicode is the character set of the underlying Java platform
- As shells are different, many 3270 related stages are not implemented
- Pipes need to be quoted on the Windows and Unix command lines; the Workspace for NetRexx (*nrws*) environment is an exception to this rule
- The mainframe is record-oriented in many stages, Pipelines for NetRexx does an approximation of this
- Pipelines on the mainframe is an interpreted language with components as the scanner and the dispatcher; the NetRexx version is compiled to Java .class files by *pipc*, the pipes compiler, and dispatched as threads by the JVM.
- The mainframe pipes dispatcher is not multiprocessor enabled. In Pipelines for NetRexx all tasks (stages) are dispatched over all available processors in parallel.
- The fact that pipes run from NetRexx implies that they can be used in Java source. In previous releases there was more direct support for this; this has lapsed due to changes in the way a java toolchain works. This support can be restored in future releases.
- To put the content of a NetRexx variable in a pipe specification in a NetRexx program, there is a `{}` mechanism. In CMS the pipe would be quoted in the Rexx source and you would unquote sections to get a similar effect.

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