

# New Features in NOC Version 4.1

The following enhancements and corrections are provided with Version 4.1 of Natural Optimizer Compiler.

In the remainder of this document, the Natural Optimizer Compiler is also referred to as NOC.

**Note:**

Natural objects cataloged with the NOC Version 2.3 can be executed under Natural Version 4.1. or above.

- Code Generation and Performance Improvements
  - New Options
  - Revised Options
  - Incompatibilities
  - NOC 2.3 Zaps and Equivalent Option Settings
  - NOCSTAT
  - NOCSHOW
  - Option Limit for NTOPT and OPT
-

## Code Generation and Performance Improvements

With NOC Version 4.1, more compact code is generated by simplifying instruction sequences that were used for alignment-sensitive hardware.

In addition, more efficient code is generated when constants are involved, for example, MOVE 'A' to #A(A1) results in MVI #A,C'A'.

Listed below is other NOC functionality that improves code generation and program performance:

- Variable Caching
- EXAMINE
- RESET of Arrays
- Multiplication and Division of (Un)Packed Variables
- INDX Option with Parameter Arrays
- Objects with Copycode

### Variable Caching

A technique for caching variables has been implemented to speed up program execution. See Variable Caching in the section Performance Considerations in the Natural Optimizer Compiler documentation.

### EXAMINE

The EXAMINE statement has been optimized for certain clauses. See What is Compiled and What is Not in the section Using the Optimizer Compiler (Natural Optimizer Compiler documentation).

### RESET of Arrays

The code generated for executing the RESET statement for arrays has been improved.

### Multiplication and Division of (Un)Packed Variables

With NOC Version 4.1, the generated code for multiplying and dividing packed and unpacked numeric variables is more efficient.

### INDX Option with Parameter Arrays

With NOC Version 4.1, statements accessing a parameter array with a variable number of occurrences (1:V notation) are optimized even if the INDX option is specified. With NOC Version 2.3, statements accessing such a parameter array are not optimized if the INDX option is specified.

### Objects with Copycode

For Natural programming objects that contain copycode inserted with an INCLUDE statement, code generation, and hence performance, has improved significantly. This improvement is of special benefit for programming objects that contain many small or nested copycodes.

## New Options

Listed below are additional options that NOC provides to give more control over how code is generated:

Option	Function
CACHE	Switches variable caching on or off.
DIGTCHCK	Forces digits to be checked on packed and numeric fields.
SIGNCHCK	Forces signs to be checked on packed and numeric fields.
TRBASES	Puts a trace of base register allocation into the output generated by the PGEN option.
TRCACHE	Puts a trace of the cache into output generated by the PGEN option.
TRETRY	For internal use by Software AG only.

See also the section Optimizer Options in the Natural Optimizer Compiler documentation.

## Revised Options

Listed below are the NOC options that have been modified and now have a different effect under NOC Version 4.1:

- NODBG
- NOSGNTR=ON
- NOSGNTR=OFF
- LOOPS

### NODBG

The NODBG option is now also effective when INDEX, RANGE or OVFLW options are specified. This results in less code generation, so that programming objects compiled with these options execute faster. See also the section Performance Considerations in the Natural Optimizer Compiler documentation.

## NOSGNTR=ON

This option only applies to packed numeric fields of Format P. Under NOC Version 2.3, this option also applies to unpacked numeric fields of Format N.

## NOSGNTR=OFF

The COMPOPT compiler option PSIGNF=OFF is applied at compile time. Therefore, the effect of the NOSGNTR option under NOC Version 4.1 is not the same as under NOC Version 2.3, causing different signs if NOSGNTR=OFF depending on the settings of the PSIGNF compiler option. The example below illustrates the difference:

```

DEFINE DATA LOCAL
1 N(N3)
1 P(P3)
END-DEFINE
*
OPTIONS MCG=ON
RESET N P
ADD 1 TO N
ADD 1 TO P
WRITE N(EM=HHH) P(EM=HH)
*
OPTIONS MCG=NOSGNTR
RESET N P
ADD 1 TO N
ADD 1 TO P
WRITE N(EM=HHH) P(EM=HH)
*
END

```

### Output:

	PSIGNF=ON	PSIGNF=OFF
NOC23 SM1 and SM2	F0F0F1 001F F0F0C1 001C	F0F0F1 001F F0F0F1 001C
NOC23 SM3 and above	F0F0F1 001F F0F0F1 001C	F0F0F1 001F F0F0F1 001C
NOC41	F0F0F1 001F F0F0F1 001C	F0F0F1 001F F0F0F1 001C

See also Influence of other Natural Parameters in the section Optimizer Options in the Natural Optimizer Compiler documentation.

## LOOPS

This option is no longer relevant and only provided for compatibility reasons.

## Incompatibilities

Below is a list of incompatibilities between NOC Version 2.3 and NOC Version 4.1:

- NOSGNTR=ON
- NOSGNTR=OFF
- Conversion from Floating Point to Packed
- Multiplication and Division of (Un)Packed Variables
- RESET of Packed Numeric Variables
- MOVE of Numeric to Numeric with same Precision and Length

### **NOSGNTR=ON**

Only applies to packed numeric fields of Format P. Under NOC Version 2.3, this option also applies to unpacked numeric fields of Format N.

### **NOSGNTR=OFF**

The COMPOPT compiler option PSIGNF=OFF is applied at compile time. Therefore, the effect of the NOSGNTR option under NOC Version 4.1 is not the same as under NOC Version 2.3, causing different signs if NOSGNTR=OFF depending on the settings of the PSIGNF compiler option. See also Revised Options above.

### **Conversion from Floating Point to Packed**

With NOC Version 4.1, converting from floating point to packed numeric has been adapted to the standard Natural arithmetic, thus guaranteeing identical program results regardless of whether the NOC is used for program generation or not. When recataloged under Natural Version 4.1, for programs cataloged under NOC Version 2.3, the result can be slightly different in the last fractional parts, where relevant.

### **Multiplication and Division of (Un)Packed Variables**

With NOC Version 4.1, multiplication and division of packed and unpacked numeric variables have been adapted to the standard Natural arithmetic, thus guaranteeing identical program results regardless of whether the NOC is used for program generation or not. When recataloged under Natural Version 4.1, for programs cataloged under NOC Version 2.3, the result can be slightly different in the last fractional parts, where relevant.

### **RESET of Packed Numeric Variables**

Under NOC Version 4.1, the impact of the RESET statement on the field sign (positive) depends on the setting of the PSIGNF compiler option: If PSIGNF=OFF, the sign reads X'C'. If PSIGNF=ON, the sign reads X'F'. PSIGN=ON is the default.

Under NOC Version 2.3, the RESET statement always results in the sign X'F', unless Special Purpose Zap NA45043 has been applied (see also NOC 2.3 Zaps and equivalent Option Settings below). However, the results generated under NOC Version 4.1 are compatible with standard Natural runtime.

### **MOVE Numeric to Numeric with same Precision and Length**

When moving a numeric unpacked variable to another numeric unpacked variable with same length and precision, the COMPOPT compiler option NMOVE22 (see the Natural system command COMPOPT) is honored even when DIGTCHCK=ON.

## NOC 2.3 Zaps and Equivalent Option Settings

Listed below are the Special Purpose Zaps supplied for NOC Version 2.3. If none of these Zaps have been applied in your Natural Version 3.1 environment, no adaption of your NOC option setting is required. However, to migrate to NOC Version 4.1, for each Special Purpose Zap applied in your Natural Version 3.1 environment, you need to set the corresponding option(s) as described in the table below.

Zaps for NOC 2.3	Equivalent Option Setting in NOC 4.1	
	COMPOPT	NOC
NA45041	PSIGNF=OFF	NOSGNTR=OFF (default)
NA45043	PSIGNF=OFF	NOSGNTR=OFF (default)
NO31006	PSIGNF=OFF	NOSGNTR=OFF (default)
NO32003	NMOVE22=ON	
NO33005	NMOVE22=ON	
NO33007		DIGTCHCK=ON
NO34016		DIGTCHCK=ON
NO36001 NO37009 (see also below)	NMOVE22=ON	

Zap NO37009 is a correction of NO36001.

## NOCSTAT

The NOCSTAT command has been enhanced to show statistics of non-optimized programs. See NOCSTAT Command in the section Using the Optimizer Compiler.

## NOCSHOW

Minor changes have been made to the NOCSHOW utility, for example:

In batch, the whole PGEN list is output without stopping. Online, the listing is modifiable so that terminal escape codes can be entered, for example, \$\$ or << or %+.

Online, when searching, the line containing the desired text is placed at the top of the screen and the cursor is placed at the beginning of the text.

## Option Limit for NTOPT and OPT

The limit of 64 characters has been removed for option strings specified in the NTOPT macro or specified with the OPT profile parameter.