



**NORD**  
COMPUTER SYSTEMS

# NORD-PL

## INTRODUCTION

The NORD-PL is a powerful medium level language designed as replacement for assembly language to achieve faster program development and to improve maintainability of system software.

The syntax resembles that of ALGOL but all facilities of the machine language are available from the NORD-PL. The NORD-PL compiler produces MAC Assembler source code.

## FEATURES

- Object code with efficiency equal to or better than assembly code due to:
  - easy program checking
  - high readability of programs
  - easy maintenance of programs
- Assembly coded object code for on-line debugging
- In-line assembly statements
- Conditional compilation
- Data type declaration and checking

## PRODUCT DESCRIPTION

### Basic Elements

A NORD-PL program consists of the following basic elements: identifiers, numbers, character and string constants, operators, delimiters and reserved symbols.

### Data Structure

- Integers (16 bit)
- Double (32 bits)
- Real (48 bits)

These types may be used either as single variables or arrays. Pointer to variables and arrays may also be declared.

### Data Expressions

A data expression is evaluated at compile-time. The operators are:

- + Add
- Subtract
- \* Multiply
- \ Byte separation

## Executable Expressions

In general an expression specifies a series of operations between the primary operand, which is a register, and one or more secondary operands, which can be registers, variables or constants.

## Statements

Statements are the basic functional units of the NORD-PL. There are two classes of statements:

- Declaration statements (non-executable statements) which describe the characteristics and arrangements of data, and the classification of program units.

These are:

- Data declaration
- Symbolic constants
- Pointers
- Addressing modes
- Labels
- Subroutines

- Executable statements which specify actions. These statements can be divided into two classes:

**Arithmetical statements** using variables and arithmetical operations, which are:

Arithmetical:   : =    Load  
                  = :    Store  
                  : = :   Swap  
                  —     Subtract  
                  +     Add  
                  \*     Multiply  
                  /     Divide (reals only)

Shift:           SHZ    Shift with zero end input  
                  SH     Arithmetical shift  
                  SHR    Rotational shift  
                  SHL    Shift with link end input  
                         (bits shifted into the register are taken from the M bit in the status register, bits shifted out are fed to M. This corresponds to an extended 17 bit rotational shift).

Logical:         /\     AND  
                  \ /     OR  
                  XOR    Exclusive OR

	—,	One's complement
	—	Two's complement
	BONE	Set bit to one
	BZERO	Set bit to zero
Relational:	>	Greater than
	<	Less than
	=	Equal
	> =	Greater than or equal to
	= <	Less than or equal to
	><	Not equal to
	AND	Logical AND of conditions
	OR	Logical OR of conditions
Special uary:	MIN	Memory increment (MIN instruction)
	GOSW	Switch

**Control Statements** controlling the logical flow in the program. The Control Statements are:

```
GO
IF THEN ELSE
FOR STEP TO
DO WHILE
CALL
EXIT
```

## Commands

A command may be used to give control information to the compiler. All commands start with a circled alpha (@) followed by the command name. The command names are not reserved symbols so that the same symbol can be used for a command name as well as for a user variable.

The available commands are:

@ICR	"Ignore Carriage Return" mode. This command is used if a statement should need several lines (especially declaration statements). The carriage return is treated as if it were a space.
@CR	"Carriage Return" mode. After this command carriage return will have the same effect as the semicolon (;), so that it will terminate the current statement.
@EOF	"End of File". This command is used for exit from the compiler to the Operating System. The MAC command )LINE is output on the object device. The command will list the number of errors detected during the compila-

tion on the communication device.

@CLEAR	Clear the symbol table of the compiler.
@OCT	All integer numbers will be treated as octal.
@DEC	Integer numbers will be treated as decimal, except for those preceded by the "&" sign.
@DEV	<input device>, <list device>, <object output device> This command is used for setting device numbers for the compiler. If the list device equals 0, the error messages will be printed on the output communication device, otherwise also on the list device.
@MODE	<input communication device>, <output communication device>

There are two ways of including assembly coding:

1. If the statement starts with an asterisk (\*), the rest of the line will be taken as assembly code, being copied to the object output stream.
2. The command @MAC switches the compiler to assembly mode. The source code will pass unchanged to the output stream until an @ is found.

@LIB	followed by a logical expression starts a mode that may be included depending on the value of the expression.
@ELIB	terminates the LIB mode.
@STLIB	followed by a symbol sets the library include flag for this symbol.
@NSLIB	followed by a symbol resets the library include flag for this symbol.

## REQUIREMENTS

NORD-PL may be run under the SINTRAN III/VS Operating System or as a stand-alone program.

NORD-PL requires approximately 10 Kwords plus main symbol table (5 locations per symbol) of memory.

## REFERENCES

ND—60.046 NORD-PL User's Guide.

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