

---

# International Standard



# 4342

---

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION • МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ • ORGANISATION INTERNATIONALE DE NORMALISATION

---

## Numerical control of machines — NC processor input — Basic part program reference language

*Commande numérique des machines — Données d'entrée des processeurs CN — Langage de référence de base pour programme de pièce*

First edition — 1985-12-15

**iTeh STANDARD PREVIEW**  
**(standards.iteh.ai)**

[ISO 4342:1985](#)

<https://standards.iteh.ai/catalog/standards/sist/b8ed8668-e79f-4e9a-8685-d7e44ea165b4/iso-4342-1985>

---

UDC 681.323 : 621.9-52 : 681.3.06

Ref. No. ISO 4342-1985 (E)

Descriptors : machine tools, automation, data processing, numerical control, programming (computers), programming languages.

Price based on 278 pages

## Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

International Standard ISO 4342 was prepared by Technical Committee ISO/TC 184, *Industrial automation systems*.

iTeh STANDARD PREVIEW

Users should note that all International Standards undergo revision from time to time and that any reference made herein to any other International Standard implies its latest edition, unless otherwise stated.

[ISO 4342:1985](https://standards.iteh.ai/catalog/standards/sist/b8ed8668-e79f-4e9a-8685-d7e44ea165b4/iso-4342-1985)

<https://standards.iteh.ai/catalog/standards/sist/b8ed8668-e79f-4e9a-8685-d7e44ea165b4/iso-4342-1985>

## Contents

	Page
0 Introduction .....	1
1 Scope and field of application .....	2
2 References .....	2
3 Coordinate system .....	2
4 Language structure .....	3
4.1 General comments .....	3
4.2 Letters .....	4
4.3 Digits .....	5
4.4 Special characters .....	6
4.5 Characters .....	7
4.6 Symbol for literal delimiter .....	8
4.7 Literal character string .....	9
4.8 Unsigned numbers .....	10
4.9 Keywords .....	11
4.10 Simple identifiers .....	12
4.11 Identifiers .....	13
4.12 Labels .....	14
4.13 Statements .....	15
4.14 Nesting .....	16
4.15 Part program .....	17
5 Arithmetic statements .....	18
5.1 General comments .....	18
5.2 Arithmetic operators .....	20
5.3 Arithmetic functions .....	21
6 Program definition statements .....	27
6.1 General comments .....	27
6.2 The synonym statement; SYN/ .....	28
6.3 Reservation for subscripting; RESERV/ .....	29
6.4 Definition of a macro; MACRO/ .....	30

iTeh STANDARD PREVIEW  
(standards.iteh.ai)

<https://standards.iteh.ai/catalog/standards/sist/b8ed8668-e79f-4e9a-8685-d7e44ea165b4/iso-4342-1985>

<b>7</b>	<b>Program execution statements</b>	<b>32</b>
7.1	Part program control	32
7.2	Part program identification and termination	33
7.3	Machine and no-postprocessing statements	35
7.4	Input/output statements	37
7.5	Loop start and end statements and transfer statements	42
7.6	Copy statement and index specification	46
7.7	Macro execution statement	49
7.8	Remark statement	50
7.9	Postprocessing print statement	51
<b>8</b>	<b>Geometrical definitions statements</b>	<b>52</b>
8.1	General comments	52
8.2	Declarations of reference system	54
8.3	Declarations of z-surface	57
8.4	Definitions of a point	64
8.5	Definitions of a pattern of points	80
8.6	Definitions of a line	99
8.7	Definitions of a plane	118
8.8	Definitions of a vector	127
8.9	Definitions of a circle	138
8.10	Definitions of a cylinder	159
8.11	Definitions of a sphere	164
8.12	Definitions of a cone	170
8.13	Definitions of an ellipse	173
8.14	Definitions of a hyperbola	175
8.15	Definitions of a lofted conic	177
8.16	Definitions of general conic	181
8.17	Definitions of a general quadric	185
8.18	Definitions of a tabulated cylinder	189
8.19	Definitions of a matrix	194
8.20	Definitions of a ruled surface	206

iTeh STANDARD PREVIEW  
(standards.iteh.ai)

ISO 4342:1985  
<https://standards.iteh.ai/catalog/standards/sist/b8ed8668-e79f-4e9a-8685-d7e44ea165b4/iso-4342-1985>

<b>9</b>	<b>Geometric execution statements</b> .....	<b>209</b>
<b>9.1</b>	<b>General comments</b> .....	<b>209</b>
<b>9.2</b>	<b>General semantics</b> .....	<b>210</b>
<b>9.3</b>	<b>Continuous motion statement</b> .....	<b>220</b>
<b>9.4</b>	<b>Motion statements</b> .....	<b>225</b>
<b>9.5</b>	<b>Tool path control statements</b> .....	<b>233</b>
<b>9.6</b>	<b>Startup direction control statements</b> .....	<b>243</b>
<b>9.7</b>	<b>Transform cutter location statements</b> .....	<b>247</b>
<b>9.8</b>	<b>Processor output file control statement</b> .....	<b>248</b>

**Annexes**

<b>A</b>	<b>Rules for representing the RL on punched cards</b> .....	<b>249</b>
<b>B</b>	<b>Syntax description of the reference language</b> .....	<b>250</b>
<b>C</b>	<b>List of recommended synonyms</b> .....	<b>272</b>
<b>D</b>	<b>Alphabetical list of major words and locations</b> .....	<b>273</b>

**iTeh STANDARD PREVIEW**  
**(standards.iteh.ai)**

ISO 4342:1985

<https://standards.iteh.ai/catalog/standards/sist/b8ed8668-e79f-4e9a-8685-d7e44ea165b4/iso-4342-1985>

**iTeh STANDARD PREVIEW**  
**(standards.iteh.ai)**

This page intentionally left blank

[ISO 4342:1985](#)

<https://standards.iteh.ai/catalog/standards/sist/b8ed8668-e79f-4e9a-8685-d7e44ea165b4/iso-4342-1985>

# Numerical control of machines — NC processor input — Basic part program reference language

## 0 Introduction

### 0.1 General features

**0.1.1** A part program is an ordered set of instructions in a language and in a format required to cause the generation and commands for operations to be carried out under numerical control (NC). The instructions of the language are processed sequentially in two stages, processor and postprocessor. The processor stage is substantially independent of the numerically controlled machine, and the postprocessor stage takes account of the features of the machine and control system to be numerically controlled.

**0.1.2** Numerical control is applied to many types of machine but the language defined in this International Standard has been developed primarily for numerically controlled machine tools — hence the words “cutter” or “tool”, and “workpiece” or “part”, are used in the description of the language to indicate the working element and processed element respectively. Many of the reserved words of the language are also derived from metalworking terminology.

**0.1.3** This International Standard is partly informative and partly definitive, with the intention of enabling unsophisticated users and potential users to discuss and define their requirements with suppliers. The formal syntax description of the language has been included to aid implementers.

**0.1.4** The language described in this International Standard is a reference language (RL). It has been divided into logical pages according to the type of statement or facility, with the intention that each logical page will become a unit of further standardization work. It is also intended that each logical page is suitably identified as belonging to the core or a module of the total reference language.

**0.1.5** The output from the processor (CLDATA — derived from the term “cutter location data”), which is also input to the postprocessor, is the subject of separate standardization documents. The definition of CLDATA effectively encompasses the part programming language necessary for using capabilities of the postprocessor, and the CLDATA standard ISO 3592 is the prime reference source for this part of the total language.

**0.1.6** Some processors may interface with workshop technology processors. That part of the total language which

encompasses the use of workshop technology will be described in an addendum to this International Standard.

### 0.2 Numerical control reference language

**0.2.1** The numerical control (NC) reference language (RL) is a problem-oriented language developed for the machining of parts. It is similar to scientific programming languages, and contains many of the facilities and a large part of the computational ability of these; additionally the RL provides for both the description of shapes and commands for movement of the machine.

**0.2.2** The RL is written in lines, and for the purpose of describing the RL, the level of communication assumed is the manuscript stage of programming. There is no special character for statement termination, but there is a special character to signify that a statement continues from one line to the next. This concept permits the description of the RL itself to be distinguished from the rules for representation of the RL on various media such as punched cards or paper tape. The rules for representing the RL on punched cards are given in annex A. The syntax description of the reference language is given in annex B.

**0.2.3** The RL is a symbolic language; that is, an entity may be assigned to a symbolic name and the entity referenced later in the part program by that symbolic name. For other than arithmetical values a symbolic name may not normally be reassigned.

**0.2.4** Unlike scientific programming languages there are no explicit or implicit type associations in the RL. The type of entity is determined by the type of statement in which the entity is defined.

**0.2.5** The arithmetical type of entity has always a real value, that is, it is an approximate representation of a real number. It has an integer part and a fractional part and can only represent a certain number of the most significant digits of the number, depending on the implementation.

**0.2.6** A significant feature of the RL is the “nesting” facility, by which an entity may be defined in parenthesis instead of using a symbolic name.

## 1 Scope and field of application

This International Standard defines a higher-level symbolic part-programming language which is processed by a digital computer to produce a NC machine program.

The language has been developed primarily for numerically controlled machine tools. It is a reference language, which means that it is not necessarily intended that the whole of the language be implemented. It is expected that parts, or subsets, of the language will be implemented to suit particular circumstances.

## 2 References

ISO 646, *Information processing — ISO 7-bit coded character set for information processing interchange.*

ISO 841, *Numerical control of machines — Axis and motion nomenclature.*

ISO 3592, *Numerical control of machines — NC processor output — Logical structure (and major words).*

ISO 4343, *Numerical control of machines — NC processor output — Minor elements of 2000-type records (post-processor commands).*

## 3 Coordinate system

3.1 ISO 841 is the basis for defining the coordinate system of the RL.

3.2 The coordinate system is a right-handed rectangular Cartesian system, related to a workpiece mounted on a machine and aligned with the principal linear slideways of that machine. The positive direction of movement of a component of a machine is that which causes an increasing positive dimension on the workpiece.

3.3 In the RL, the reference axes of the coordinate system are *X*, *Y* and *Z*. These are used in the description of the workpiece and it is assumed that the workpiece is stationary, with the tool or cutter moving relative to the workpiece coordinate system whether or not this is true for the actual NC machine tool operation.

3.4 When specifying angles of planes the positive direction is counterclockwise and the reference axis is as follows :

Plane	Reference axis
<i>XY</i>	<i>X</i>
<i>YZ</i>	<i>Y</i>
<i>ZX</i>	<i>Z</i>

3.5 The positive direction of angle is counterclockwise from the reference axis.

3.6 Angles are expressed in degrees and decimal fractions of a degree.

3.7 The output from the processor (CLDATA) uses the same conventions as the RL and the output coordinates refer to a reference point on a cutter (usually the centre of the tip) relative to the workpiece coordinate system used in the part program.



## 4 Language structure

### 4.1 General comments

#### 4.1.1 General semantics

Digits and letters are used to create unsigned numbers and keywords which in conjunction with characters and special characters may be used to create identifiers, labels and literal character strings. Any valid combination, if existing, may be used to construct a statement and a number of statements arranged in a specific order constitutes a part program.

#### 4.1.2 Sub-contents

For

- 1) letters, see 4.2;
- 2) digits, see 4.3;
- 3) special characters, see 4.4;
- 4) characters, see 4.5;
- 5) symbol for literal delimiter, see 4.6;
- 6) literal character string, see 4.7;
- 7) unsigned numbers, see 4.8;
- 8) keywords, see 4.9;
- 9) simple identifiers, see 4.10;
- 10) identifiers, see 4.11;
- 11) labels, see 4.12;
- 12) statements, see 4.13;
- 13) nesting, see 4.14; <https://standards.iteh.ai/catalog/standards/sist/b8ed8668-e79f-4e9a-8685-d7e44ea165b4/iso-4342-1985>
- 14) part program, see 4.15.

iTech STANDARD PREVIEW  
(standards.iteh.ai)

[ISO 4342:1985](https://standards.iteh.ai/catalog/standards/sist/b8ed8668-e79f-4e9a-8685-d7e44ea165b4/iso-4342-1985)

<https://standards.iteh.ai/catalog/standards/sist/b8ed8668-e79f-4e9a-8685-d7e44ea165b4/iso-4342-1985>

#### 4.1.3 Limitations

None.

#### 4.1.4 Syntax

$$\langle \text{language structure} \rangle ::= \left\{ \begin{array}{l} k \\ l \end{array} \left[ \langle \text{letters} \rangle \langle \text{digits} \rangle \langle \text{special characters} \rangle \langle \text{characters} \rangle \right. \right. \\ \left. \langle \text{symbol for literal delimiter} \rangle \langle \text{literal character string} \rangle \langle \text{unsigned numbers} \rangle \right. \\ \left. \langle \text{keywords} \rangle \langle \text{simple identifiers} \rangle \langle \text{labels} \rangle \langle \text{statements} \rangle \langle \text{nesting} \rangle \right. \\ \left. \langle \text{part program} \rangle \right\}$$

## 4.2 Letters

### 4.2.1 Semantics

Letters have no individual meaning, being used for forming keywords, simple identifiers, character strings or labels.

### 4.2.2 Limitations

None.

### 4.2.3 Syntax

<letter> ::= A|B|C|D|E|F|G|H|I|J|K|L|M|N|O|P|Q|R|S|T|U|V|W|X|Y|Z

# iTeh STANDARD PREVIEW (standards.iteh.ai)

[ISO 4342:1985](https://standards.iteh.ai/catalog/standards/sist/b8ed8668-e79f-4e9a-8685-d7e44ea165b4/iso-4342-1985)

<https://standards.iteh.ai/catalog/standards/sist/b8ed8668-e79f-4e9a-8685-d7e44ea165b4/iso-4342-1985>

### 4.3 Digits

#### 4.3.1 Semantics

Digits have no individual meaning, being used for forming simple identifiers, unsigned numbers, character strings or labels.

#### 4.3.2 Limitations

None.

#### 4.3.3 Syntax

< digit > :: = 0|1|2|3|4|5|6|7|8|9

**iTeh STANDARD PREVIEW**  
**(standards.iteh.ai)**

[ISO 4342:1985](#)

<https://standards.iteh.ai/catalog/standards/sist/b8ed8668-e79f-4e9a-8685-d7e44ea165b4/iso-4342-1985>

## 4.4 Special characters

### 4.4.1 Semantics

Special characters are used as operators for building up arithmetic expressions and as punctuation marks (or separators) in statements. When special characters are used in literal character strings they are treated as characters with no syntactical significance.

- + - \* / ↑ arithmetic operators (see 5.2).
- ) closing parenthesis, used as a statement label separator (see 4.11) or in connection with opening parenthesis for nesting.
- ( opening parenthesis, used with closing parenthesis in subscripting or nesting, or function arguments.
- . decimal point.
- = equals, used for assigning an entity to a name.
- / slant, used as a separator between a major keyword and the remainder of a statement.
- ,
- statement label separator (see 4.11).
- \$ dollar or other currency character used to couple statements and delimit the start of a comment field.
- ;
- apostrophe, used for delimitation of a character string.

The space character has no significance except in character strings. [strings.42:1985](https://standards.iteh.ai/catalog/standards/sist/b8ed8668-e79f-4e9a-8685-d7e44ea165b4/iso-4342-1985)

<https://standards.iteh.ai/catalog/standards/sist/b8ed8668-e79f-4e9a-8685-d7e44ea165b4/iso-4342-1985>

### 4.4.2 Limitations

None.

### 4.4.3 Syntax

< special character > :: = - | . | + | \* | / | , | = | ( | ) | \$ | ↑ | ; | : | ' |

NOTE — \$ is given as an example of a national currency character.

## 4.5 Characters

### 4.5.1 Semantics

A character is a letter, digit or special character or other valid character.

### 4.5.2 Limitations

None.

### 4.5.3 Syntax

$\langle \text{character} \rangle :: = \langle \text{letter} \rangle \mid \langle \text{digit} \rangle \mid \langle \text{special character} \rangle \mid \langle \text{other valid character} \rangle$

NOTE — Other valid characters have no significance within the language but are nevertheless considered as valid input. These characters are not otherwise defined in this International Standard. They should be manageable by the specific implementation and be selected from the character set defined by ISO 646 and ISO 840.

**iTeh STANDARD PREVIEW**  
**(standards.iteh.ai)**

[ISO 4342:1985](https://standards.iteh.ai/catalog/standards/sist/b8ed8668-e79f-4e9a-8685-d7e44ea165b4/iso-4342-1985)

<https://standards.iteh.ai/catalog/standards/sist/b8ed8668-e79f-4e9a-8685-d7e44ea165b4/iso-4342-1985>

## 4.6 Symbol for literal delimiter

### 4.6.1 Semantics

The apostrophe is used at the beginning and at the end of a literal character string to indicate the extent of the literal string field.

### 4.6.2 Example

PARTNO/'VALVE HOUSING'

### 4.6.3 Limitations

None.

### 4.6.4 Syntax

< symbol for literal delimiter > :: = '

**iTeh STANDARD PREVIEW**  
**(standards.iteh.ai)**

[ISO 4342:1985](https://standards.iteh.ai/catalog/standards/sist/b8ed8668-e79f-4e9a-8685-d7e44ea165b4/iso-4342-1985)

<https://standards.iteh.ai/catalog/standards/sist/b8ed8668-e79f-4e9a-8685-d7e44ea165b4/iso-4342-1985>

## 4.7 Literal character string

### 4.7.1 Semantics

A literal character string may be used in statements, for listing text, or in the postprocessor statements such as INSERT for passing special information through to the postprocessor on the CLDATA. The set of characters permissible is not limited to the set of letters, digits, and special characters defined in this International Standard. Within a literal character string, any special characters are treated simply as characters without syntactical significance.

### 4.7.2 Example

P1 = POINT/0,0,0 'COMPONENT DATUM'

### 4.7.3 Limitations

None.

### 4.7.4 Syntax

< literal character string > :: = < symbol for literal delimiter >  $\overset{k}{0}$  [ < character > ] < symbol for literal delimiter >

#### NOTES

- 1 The syntax of a literal character string implies that the empty string is allowed.
- 2 Space characters are significant.
- 3 A remark (comment) following a single or double currency character need not be a delimited character string.
- 4 A literal character string not terminated by a closing apostrophe prior to an arbitrary line limit (for example the card column 73 in annex A) is continued on the next line without the need for a currency character.
- 5 An apostrophe is represented by two apostrophes in a character string delimited by apostrophes.

[ISO 4342:1985](https://standards.iteh.ai/catalog/standards/sist/b8ed8668-e79f-4e9a-8685-d7e44ea165b4/iso-4342-1985)

<https://standards.iteh.ai/catalog/standards/sist/b8ed8668-e79f-4e9a-8685-d7e44ea165b4/iso-4342-1985>