INTERNATIONAL STANDARD

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Industrial automation systems — Numerical control of machines — NC processor output — File structure and language format

Systèmes d'automatisation industrielle — Commande numérique des machines — Informations de sortie des processeurs CN — Structure de fichier et format de langage

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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. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 3592 was prepared by Technical Committee ISO/TC 184, *Industrial automation systems and integration*, Subcommittee SC 1, *Physical device control*.

This second edition cancels and replaces the first edition (ISO 3592:1978), which has been technically revised.

Annexes A and B form a normative part of this International Standard.

Introduction

The output of a general purpose numerical control processor is information used as input to a post processor. This information is called CLDATA, which was originally derived from “cutter location data.”

CLDATA provides a general language to pass manufacturing information from a numerical control processor to a post processor, where the general language is converted to the specific format required by the particular numerical control equipment.

Numerical control is applied to many types of machines, but the language defined in this International Standard has been developed primarily for numerically controlled machine tools – hence the words “tool” and “part” are used in the description of the language to indicate the working element and processed element respectively. Many of the vocabulary words are also derived from metal working terminology.

The CLDATA reference language (RL) is stream oriented, containing special characters to delimit the elements of the RL. Annex A describes the rules for representing the RL on record oriented media, and it is this representation that is used for the purpose of describing the RL in this International Standard.

Industrial automation systems — Numerical control of machines — NC processor output — File structure and language format

1 Scope

This International Standard defines a file structure format and a language format for the representation of CLDATA on physical media.

The CLDATA reference language (RL) is used for the machining of parts. It provides for the control of technological functions and movement at the numerical control machine.

Each processor using one of the numerical control programming languages shall be capable of producing CLDATA as defined in this International Standard.

Each post processor shall be capable of using the CLDATA defined in this International Standard as input.

The RL has been developed primarily for numerically controlled machine tools.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative documents referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO/IEC 646:1991, *Information technology – ISO 7-bit coded character set for information interchange.*

ISO 841:—[1)], *Numerical control of machines – Axis and motion nomenclature.*

ISO 4342:1985, *Numerical control of machines – NC processor input – Basic part program reference language.*

ISO 4343:2000, *Industrial automation systems – Numerical control of machines – NC processor output – Post processor commands.*

3 Co-ordinate system

ISO 841 is the basis for defining the co-ordinate system of CLDATA.

The co-ordinate system is a right-handed rectangular Cartesian system, related to a part 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 part.

In the CLDATA, the reference axes of the co-ordinate system are *x*, *y* and *z*. Co-ordinates refer to a reference point on a tool (usually the center of the tip) relative to the part co-ordinate system. CLDATA can define the following location and orientation components:

x	Dimension parallel to X
y	Dimension parallel to Y
z	Dimension parallel to Z
i	X axis component of the tool axis vector
j	Y axis component of the tool axis vector
k	Z axis component of the tool axis vector
l	X axis component of a secondary orientation vector
m	Y axis component of a secondary orientation vector
n	Z axis component of a secondary orientation vector

When specifying angles of planes, the positive direction is counterclockwise and the reference axis is as shown in table 1. The positive direction of angle is counterclockwise from the reference axis.

Table 1 – Reference axes

Plane	Reference axis
XY	X
YZ	Y
ZX	Z

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

4 General structure of CLDATA

CLDATA consists of a sequence of one or more records, which together comprise a CLDATA file.

1) To be published. (Revision of ISO 841:1974)

Each record consists of a sequence of elements, to a maximum of 245, where an element is capable of representing:

a) an integer number;

b) a real number;

c) a literal character string;

d) a keyword.

Each element is composed of characters from the set of characters defined by ISO/IEC 646.

The first two elements of a record are always integers.

The remaining elements can be any combination of integer numbers, real numbers, literal character strings or keywords, respecting the syntax of the particular record.

The first element of each record contains a sequence number, commencing with 1, and incremented by 1.

The second element contains a record type code as shown in table 2.

Table 2 – CLDATA record types

Type	Name	Explanation
1 000	Original program sequence identification	This record carries the sequence and identification of the statements of the original numerical control programming language.
2 000	Integer code type post processor command	This record carries specific instructions for the post processor.
3 000	Surface data	This record carries the canonical form of the input geometry.
4 000	Relative tool position	This record carries the tool position with respect to the drive and part surfaces.
5 000	Tool position	This record carries tool position and motion vector information relating to the tool.
6 000	Post processor information	This record carries one type of information of tolerance, cutter or cut flag information.
7 000	Starting information	This record carries the tool position with respect to the startup surfaces.
8 000	Relative tool direction	This record carries information indicating tool direction with respect to the last move.
9 000	Post processor parameters	This record carries one type of multi-axis or base unit parameters.
14 000	Part program termination	This record carries the termination record.
15 000	Unsegmented tool path	This record carries unsegmented information concerning non linear tool paths.
16 000	Workpiece contour description	This record carries the workpiece contour description.
20 000	Literal type post processor command	This record carries specific instructions for the post processor.
21 000	Deferred processing command	This record is under consideration to permit user-selected input language statements to be passed to the CLDATA file in a literal form for subsequent processing.
28 000 to 32 000	Proprietary records	These records will not be standardized.

5 CLDATA file structure

5.1 General comments

5.1.1 General semantics

A CLDATA file consists of records, each in turn consisting of elements. The basic entity of CLDATA therefore is the element, which can represent either an integer number, a real number, a literal character string or a keyword.

5.1.2 Sub-contents

For

1) letters, see 5.2;
2) digits, see 5.3;
3) special characters, see 5.4;
4) characters, see 5.5;
5) symbol for a literal delimiter, see 5.6;
6) literal character strings, see 5.7;
7) unary operators, see 5.8;
8) integer numbers, see 5.9;
9) real numbers, see 5.10;
10) keywords, see 5.11;
11) symbol for an element separator, see 5.12;
12) elements, see 5.13;
13) symbol for a record separator, see 5.14;
14) records, see 5.15;
15) symbol for a file separator, see 5.16;
16) file, see 5.17.

5.1.3 Limitations

None.

5.2 Letters

5.2.1 Semantics

In general, letters have no individual meaning, being used for forming literal character strings or keywords.

5.2.2 Limitations

None.

5.2.3 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

5.3 Digits

5.3.1 Semantics

Digits have no individual meaning, being used for forming integer numbers, real numbers or literal character strings.

5.3.2 Limitations

None.

5.3.3 Syntax

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

5.4 Special characters

5.4.1 Semantics

Special characters are used as punctuation marks (or separators) in the CLDATA file. When special characters are used in literal character strings they are treated as characters with no syntactical significance. The special characters are

+ – unary operators, used to specify the sign of integers, reals and their exponents;

. decimal point, used to separate the whole portion of a real number from the fractional portion;

E e exponent identifier, used to adjust the value of a real number up or down by an integral power of 10;

' apostrophe, used for delimitation of a literal character string;

, comma, used as a separator between the elements of a record (<es>);

; semicolon, used as a separator between the records of a file (<rs>);

: colon, used for delimitation of a CLDATA file (<fs>).

The format control characters; horizontal tabulator (ISO/IEC 646 character code 9), line feed (code 10), form feed (code 12), carriage return (code 13) and space (code 32), have no significance except in literal character strings.

5.4.2 Limitations

None.

5.4.3 Syntax

<special_character> ::= + | – | . | E | e | ' | , | ; | :

5.5 Characters

5.5.1 Semantics

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

5.5.2 Limitations

None.

5.5.3 Syntax

<character> ::= <letter> | <digit> | <special_character> | <other_valid_character>

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

5.6 Symbol for literal delimiter

5.6.1 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.

5.6.2 Example

cln,5000,5,'L1',0,4.,2.5,6.;

where *cln* represents an integer value identifying the CLDATA record sequence number.

5.6.3 Limitations

None.

5.6.4 Syntax

<symbol_for_literal_delimiter> ::= '

5.7 Literal character strings

5.7.1 Semantics

A literal character string may be used in records, for listing text, or in the post processor statements for passing special information through to the post processor. 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.

5.7.2 Example

cln,20000,0,PPRINT,'Set machine origin above front left corner of part';

5.7.3 Limitations

None.

5.7.4 Syntax

<literal_character_string> ::= <symbol_for_literal_delimiter> $^{0:n}$ [<character>] <symbol_for_literal_delimiter>

NOTES

1) The syntax of a literal character string implies that the empty string is allowed.

2) The format control characters; horizontal tabulator (ISO/IEC 646 character code 9), line feed (code 10), form feed (code 12), carriage return (code 13) and space (code 32), are significant in literal character strings.

3) A literal character string not terminated by an apostrophe prior to an arbitrary physical record size limit (for example, column 72 in annex A) is continued from the first column on the next physical record.

4) An apostrophe is represented by two apostrophes in a non-empty literal character string.