INTERNATIONAL STANDARD

ISO 4343

Second edition
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Industrial automation systems — Numerical control of machines — NC processor output — Post processor commands

Systèmes d'automatisation industrielle — Commande numérique des machines — Informations de sortie des processeurs CN — Instructions post-processeur

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Contents

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 4343 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 4343:1978), 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. The logical and physical structure of CLDATA records are given in ISO 3592.

This International Standard defines a standard post processor vocabulary, in the context of command word and the parameters that can be associated with a command word. This vocabulary is encoded using the 2 000 class (“integer code type post processor command”) and 20 000 class (“literal type post processor command”) CLDATA records given in ISO 3592.

There is a one-to-one correspondence between the elements of the post processor vocabulary and the elements of the post processor command CLDATA records. The integer code numbers given in annex B of this International Standard are the code numbers that are used to represent keywords in the 2 000 class CLDATA records. The keyword names given in annex B of this International Standard are the names that are used to represent keywords in the 20 000 class CLDATA records.

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.

Industrical automation systems — Numerical control of machines — NC processor output — Post processor commands

1 Scope

This International Standard defines the elements of a set of post processor statements to be used in numerical control software. These statements are encoded on 2 000 class and 20 000 class CLDATA records or their equivalent.

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

Each post processor shall be capable of using the post processor command type CLDATA records defined in this international Standard as input.

This International Standard does not prescribe

a) the mechanism by which the statements are processed;

b) the medium on which the input language statements are recorded;

c) the medium and format of output machine control data;

d) the order of statements within a part program.

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 document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 841[1)], *Industrial automation systems – Numerical control of machines – Coordinate system and motion nomenclature.*

ISO 3592:2000, *Industrial automation systems – Numerical control of machines – NC processor output – File structure and language format.*

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

ISO 6983-1:1982, *Numerical control of machines – Program format and definition of address words – Part 1: Data format for positioning, line motion and contouring control systems.*

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

3 Co-ordinate system

3.1 Part program reference

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

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

Unless otherwise specified, post processor command dimensional values refer to the CLDATA co-ordinate system. The following syntax is permitted as replacement for strings of numeric values representing CLDATA co-ordinates, CLDATA tool orientation vectors and CLDATA secondary orientation vectors.

```
XCOORD,x
YCOORD,y
ZCOORD,z
TLVEC,i,j,k
NORMAL,l,m,n
COORD,x,y,z [,i,j,k [,l,m,n ] ]
```

3.2 Machine program reference

ISO 841 is the basis for defining the standard configuration of machine axes.

On the machine, the reference axes of the co-ordinate system are *x*, *y* and *z*. Co-ordinates refer to a reference point on the machine (usually the center face of the tool holding mechanism) relative to the machine co-ordinate system. The origin and alignment of the CLDATA and machine reference systems coincide. Provision is made within this International Standard to define an alternate relationship

between CLDATA and machine reference systems. The following machine axes are recognized:

a angular dimension about the X axis
b angular dimension about the Y axis
c angular dimension about the Z axis
p tertiary dimension parallel to the X axis
q tertiary dimension parallel to the Y axis
r tertiary dimension parallel to the Z axis
u secondary dimension parallel to the X axis
v secondary dimension parallel to the Y axis
w secondary dimension parallel to the Z axis
x primary dimension parallel to the X axis
y primary dimension parallel to the Y axis
z primary dimension parallel to the Z axis

The following syntax is permitted as replacement for strings of numeric values representing machine linear axis co-ordinates:

(**PAXIS** | **QAXIS** | **RAXIS** | **UAXIS** | **VAXIS** | **WAXIS** | **XAXIS** | **YAXIS** | **ZAXIS**), *a*

The following syntax is permitted for numeric values representing machine rotary axis co-ordinates. The initial HEAD or TABLE keyword further qualifies the rotary axis when there are multiple axes providing rotation about a given axis.

([**HEAD** | **TABLE** ,] **AAXIS** | **BAXIS** | **CAXIS** | **DAXIS** | **EAXIS**), *a*

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*

3.3 Units of measure

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

The linear unit of measure of CLDATA is the millimeter. ISO 3592 has provision to define other units of measure. A change of units is modal and applies to subsequent co-ordinate data until changed again.

Unless otherwise specified, dimensional values appearing in post processor commands are in the same reference units as the CLDATA. Provision is made within this International Standard to define explicit units of measure for simple parameters on post processor commands. Table 2 lists the preferred non dimensional keyword followed by the non preferred dimensional alternates. Only preferred keywords appear in syntax definitions. Non preferred keywords can be substituted, however, their use is not encouraged.

Table 2 – Dimensional keywords

Preferred keyword **Non-preferred alternate**	
PERMIN	CLDATA units per minute
IPM	inches per minute
MMPM	millimeters per minute
PERREV	CLDATA units per revolution of the spindle
IPR	inches per revolution of the spindle
MMPR	millimeters per revolution of the spindle
TPI	the reciprocal of IPR
MXPERM	maximum CLDATA units per minute
MAXIPM	maximum inches per minute
MXMMPM	maximum millimeters per minute
CSS	surface speed in CLDATA units per minute
SFM	surface speed in feet per minute
SMM	surface speed in meters per minute

Unless otherwise specified and providing that the capability exists, dimensional values appearing in the post processor generated machine program shall be in the same reference units as the CLDATA. Where this is impossible due to limitations of the machine, the post processor shall be responsible for converting the CLDATA units to the appropriate units supported by the machine. Provision is made within this International Standard to define explicit output units to be used for the entire machine program irrespective of the CLDATA units.

4 General structure of post processor commands

4.1 NC processor

ISO 4342 defines the syntax and semantics of a standard NC processor input language, including a limited set of post processor vocabulary.

Post processor command names are defined using a Major type post processor keyword. A comma separated parameter list, if present, is separated from the command name using a “/” delimiter.

Parameters can consist of any combination of numeric values, keywords and quote delimited strings, respecting the syntax of the particular post processor command.

4.2 CLDATA

ISO 3592 defines the CLDATA record format for post processor commands. Specifics concerning the command names and command parameters are defined within that International Standard.

2 000 class records carry post processor instructions and are formed of elements as follows:

a) Element 1 (integer) is the CLDATA record sequence number.

b) Element 2 (integer) is 2 000, which identifies the record as an integer code type post processor command.

c) Element 3 (integer) is the integer code of the Major word identifying the post processor command.

d) Element 4 onwards (various) is an optional list of post processor command parameters.

Keywords are represented in element 3 and onwards as integer codes.

20 000 class records also carry post processor instructions and are formed of elements as follows:

a) Element 1 (integer) is the CLDATA record sequence number.

b) Element 2 (integer) is 20 000, which identifies the record as a literal type post processor command.

c) Element 3 (integer) is a code indicating whether the post processor command spans multiple records.

d) Element 4 (keyword) is the text of the Major word identifying the post processor command.

e) Element 5 onwards (various) is an optional list of post processor command parameters.

Keywords are represented in element 4 and onwards as character text.

4.3 Post processor

Each post processor shall support the basic set of commands defined in the general language section (see 5). Each post processor shall also support the additional set of commands defined in one or more machine family sections which follow. Each machine family section defines only those commands which are applicable to the machine type. The general language section and the applicable machine family language sections together provide the whole language for a machine family.

When a machine supports capabilities of multiple machine families defined within this International Standard, the APPLY command (see 5.4) shall be used to designate the machine family being manipulated at any given moment.

Table 3 lists a cross reference of commands and language sections.

Table 3 - Cross reference of commands and language sections

Command	General	Die EDM	Flame	Grinder	Laser	Milling	Punch	Turning	Wire EDM	Probe	Plotting
ADAPTV	5.2										
AIR	5.3										
APPLY	5.4	6.2	7.2	8.2	9.2	10.2	11.2	12.2	13.2	14.2	
ARCSLP						10.3					
ASSIST			7.3		9.3						
AUXFUN	5.5										
BARFED								12.3			
BREAK	5.6										
CALSUB	5.7										
CATCHR								12.4			
CHUCK								12.5			
CLAMP	5.8					10.4	11.3	12.6			
CLDATA	5.9										
CLDIST			7.4		9.4				13.3		
CLEARP						10.5					
COOLNT						10.6		12.7			
COUPLE	5.10							12.8			
CUTCOM	5.11	6.3				10.7		12.9	13.4		
CYCLE					9.5	10.8	11.4		13.5		
DEFCON								12.10			
DEFSUB	5.12										
DELAY	5.13										
DISPLY	5.14										
DRAFT											15.2
DRESS				8.3							
END	5.15										
ENDSUB	5.16										
FEDRAT	5.17										
FLUSH		6.4							13.6		
GENRTR		6.5							13.7		
GOHOME	5.18										
GOPARK	5.19										
HEAD						10.9					
HOMEPT	5.20										
INCLUD	5.21										
INDPOS						10.10					
INSERT	5.22										
LEADER	5.23										
LETTER											15.3
LIMIT	5.24										
LINTOL						10.11					
LOAD		6.6				10.12	11.5	12.11	13.8	14.3	
LOCATE	5.25										
LPRINT	5.26										
MACHIN	5.27										

Table 3 - Cross reference of commands and language sections *(concluded)*

Command	General	Die EDM	Flame	Grinder	Laser	Milling	Punch	Turning	Wire EDM	Probe	Plotting
MATERL	5.28										
MCHFIN	5.29										
MCHTOL	5.30										
MODE	5.31							12.12		14.4	
MOVETO	5.32										
OP		6.7						12.13			
OPSKIP	5.33										
OPSTOP	5.34										
ORIGIN	5.35					10.13			13.9		
OVPLOT											15.4
PARKPT	5.36										
PARTNO	5.37										
PENDWN											15.5
PENUP											15.6
PIERCE			7.5		9.6		11.6				
PITCH								12.14			
PPFUN	5.38										
PPLOT											15.7
PPRINT	5.39										
PPTIME	5.40										
PREFUN	5.41										
PROBE										14.5	
RAPID	5.42										
RESET	5.43										
RETRCT						10.14					
REWIND	5.44										
ROTATE						10.15					
SAFETY								12.15			
SAFPOS	5.45										
SELECT		6.8				10.16	11.7	12.16	13.10	14.6	
SEQNO	5.46										
SPINDL		6.9				10.17		12.17			
STAN								12.18	13.11		
STDYRS								12.19			
STOP	5.47										
SYNCTR	5.48										
TLLIFE	5.49										
TLSTCK								12.20			
TMARK	5.50										
TOOLNO		6.10				10.18	11.8	12.21	13.12	14.7	
TORCH			7.6								
TRANS	5.51										
TURRET								12.22			
UNLOAD		6.11				10.19	11.9	12.23	13.13	14.8	
VERIFY										14.9	