
International Standard



2972

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Numerical control of machines — Symbols

Commande numérique des machines — Symboles

Second edition — 1979-08-15

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Descriptors : data processing, numerical control, machine tools, symbols.

FOREWORD

ISO (International Organization for Standardization) is a worldwide federation of national standards institutes (ISO member bodies). The work of developing International Standard is carried out through ISO technical committees. Every member body interested in a subject for which a technical committee has been set up 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 Standard adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 2972 was developed by Technical Committee ISO/TC 97, *Computers and information processing*. The first edition (ISO 2972-1974) had been approved by the member bodies of the following countries :

Australia	Germany, F. R.	South Africa, Rep. of
Belgium	India	Sweden
Brazil	Ireland	Switzerland
Bulgaria	Japan	Thailand
Czechoslovakia	New Zealand	Turkey
Denmark	Poland	United Kingdom
France	Romania	

The member bodies of the following countries had expressed disapproval of the document on technical grounds :

Italy
USA

This second edition, which supersedes ISO 2972-1974, incorporates clauses 4.53 to 4.70, which were the subject of draft Addendum 1, and which were circulated to the member bodies in July 1977. This draft addendum has been approved by the member bodies of the following countries :

Australia	Japan	South Africa, Rep. of
Belgium	Mexico	Spain
Czechoslovakia	Netherlands	Switzerland
France	New Zealand	USA
Germany, F. R.	Poland	USSR
Italy	Romania	Yugoslavia

The member body of the following country expressed disapproval of the document on technical grounds :

United Kingdom

Numerical control of machines – Symbols

1 SCOPE AND FIELD OF APPLICATION

This International Standard specifies a standard range of symbols for the identification and display of control functions on numerically controlled (N.C.) machine tools. The symbols represented here are specific to N.C. applications. Conventional machine tool functions of any practical system also need to be identified, and the appropriate symbols shall be chosen in accordance with ISO/R 369.

2 REFERENCE

ISO/R 369, *Symbols for indications appearing on machine tools.*

3 BASIC SYMBOLS

Many of the symbols standardized in clause 4 are made up from certain basic symbols which are used repeatedly and consistently as the basis for symbols for related sets of functions.

The arrow is one such symbol and deserves special consideration. It rarely appears on its own and is frequently used to qualify another symbol to which it gives additional meaning. There are two different applications of the arrow and a different form is used in each instance.

In addition to the arrow, N.C. applications require certain other symbols which are used as a basis for the general range.

The basic symbols shown overleaf are used repeatedly and consistently as the basis for symbols for related sets of functions.

3.1 Directional information arrow

The recommended form of a directional arrow is shown on the right, the important dimensions being the shape and size of the head relative to the width of the shaft.

Overall length is not important and may be varied to accommodate situations where the arrow is graphically combined with other symbols.

(See also ISO/R 369 – Symbol 1.)



3.2 Functional arrow

Many symbols require the use of an arrow whose direction is not necessarily related to a specific movement. In such cases, the same form of arrow is often inappropriate, and a bolder, heavier arrow form is used.

The functional arrow is particularly useful and important for building N.C. symbols to identify the various control modes. When used with the "program" symbols (3.4 and 3.5) it indicates program direction. For "forward" program direction, the functional arrow points the same way as the "program" symbol. For "backward" program direction, the functional arrow points the opposite way to the "program" symbol.



3.3 Data carrier

Used to designate the actual data medium (paper tape, magnetic tape, magnetic disc, etc.) as opposed to the program or data itself.



3.4 Program without machine functions

Used as a basis for symbols designating the program to identify modes or operations of the system where the actual slide motions and machining operations are not implemented.



3.5 Program with machine functions

Used as a basis for symbols designating the program to identify modes or functions where the slide motions and machining functions are fully operational.



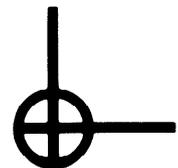
3.6 Block

Used to identify and qualify functions which relate specifically to program blocks.



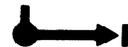
3.7 Origin/Datum

Used as a basic unified shape for all functions related to the datum. This symbol is subject to variations depending on the particular datum to which it relates.



3.8 Compensation

A relative distance that is applied to one or more axes of a machine for a given program and causes a displacement in these axes only in the direction determined by the sign of the offset value.



Used to identify the function of compensation — namely, the appropriate offsetting of all the machine data values by fixed amounts to allow for tool size differences.

3.9 Store

Used to identify functions where elements or data are held pending access or execution by the machine system. The symbol can apply equally to data, components or cutting tools.

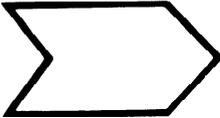
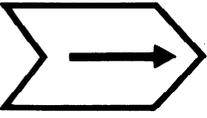
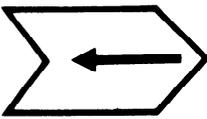


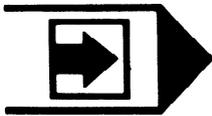
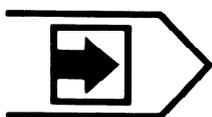
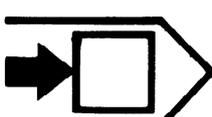
3.10 Interchange

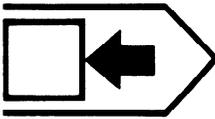
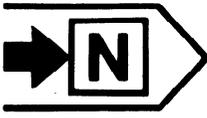
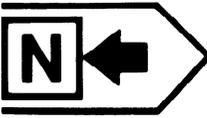
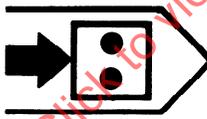
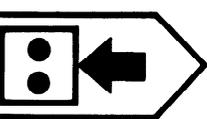
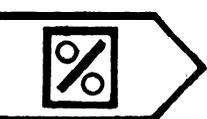
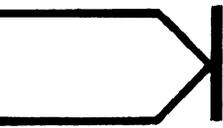
Used with symbols indicating the elements to be interchanged.



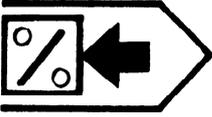
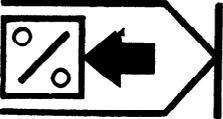
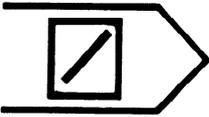
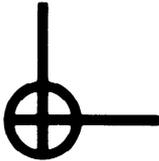
4 SYMBOLS TO BE USED ON MACHINE TOOLS

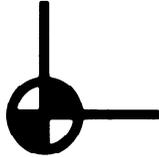
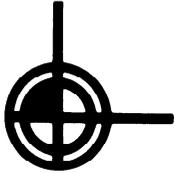
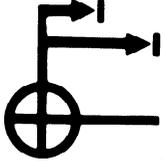
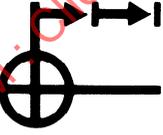
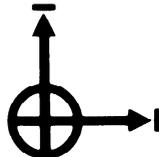
No.	Designation	Symbol	Example	Notes
4.1	Data carrier			May refer to paper tape, magnetic tape, magnetic disc, etc. See 3.3
4.2	Program without machine functions			See 3.4
4.3	Program with machine functions			See 3.5
4.4	Block			See 3.6
4.5	Forward tape wind Without data read Without machine functions			
4.6	Backward tape wind Without data read Without machine functions			

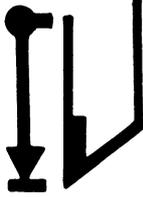
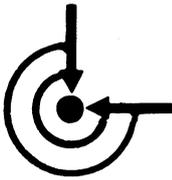
No.	Designation	Symbol	Example	Notes
4.7	Forward continuous Read all data Without machine functions			
4.8	Forward continuous Read all data With machine functions			
4.9	Forward block by block Read all data With machine functions			After reading and execution of each block, operator action is required for reading and execution of next block.
4.10	Programmed stop		Corresponds to M00 function	
4.11	Programmed optional stop		Corresponds to M01 function	
4.12	Forward block by block Read all data Without machine functions			After reading of each block, operator action is required for reading of next block.
4.13	Forward Search for particular data Without machine functions		See 4.15 4.17	Type of data to be specified for each particular application.

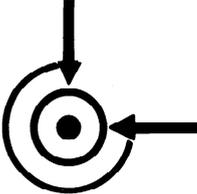
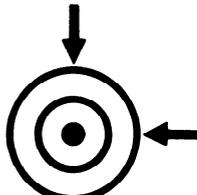
No.	Designation	Symbol	Example	Notes
4.14	Backwards Search for particular data Without machine functions		See 4.16 4.18 4.21 4.22	Type of data to be specified for each particular application.
4.15	Forward Search for block number Without machine functions			
4.16	Backwards Search for block number Without machine functions			
4.17	Forward Search for program alignment function Without machine functions			
4.18	Backwards Search for program alignment function Without machine functions			
4.19	Beginning of program			
4.20	End of program			

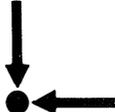
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No.	Designation	Symbol	Example	Notes
4.21	Backward search for beginning of program Without machine functions			
4.22	End of program with automatic rewind to beginning of program Without machine functions			
4.23	Optional block skip			
4.24	Manual data input			
4.25	Axis control, normal (machine follows program)			Appropriate axis designation may be added if necessary.
4.26	Axis control in mirror image mode (machine mirrors program)			Appropriate axis designation may be added to indicate which co-ordinates are modified. The "axis control, normal" symbol may be used in conjunction with this symbol.
4.27	Origin/datum			See 3.7

No.	Designation	Symbol	Example	Notes
4.28	Reference position			<p>A pre-determined position, generally used in incremental systems, to which the slides are moved to achieve correspondence between slide position and any known origin. The slides may be re-aligned with this position without reference to the measuring system.</p>
4.29	Co-ordinate basic origin			<p>This represents the origin of the machine co-ordinate system.</p>
4.30	Absolute program (co-ordinate dimension words)			
4.31	Incremental program (incremental dimension words)			
4.32	Compensation or offset		<p>See 4.34 4.35 4.36 4.37 4.38</p>	<p>See 3.8</p>
4.33	Zero offset			<p>Axis notation may be added if required.</p>

No.	Designation	Symbol	Example	Notes
4.34	Tool offset (non-rotating tool)	1)  2) 		Appropriate axis designation may be shown to indicate the offset axis according to ISO 841. This offset allows for variations in the tool position on the indicated axis.
4.35	Tool length compensation (rotating tool)			
4.36	Tool radius compensation (rotating tool)			
4.37	Tool diameter compensation (rotating tool)			
4.38	Tool tip radius compensation			
4.39	Positioning accuracy – fine			

No.	Designation	Symbol	Example	Notes
4.40	Positioning accuracy — normal			
4.41	Positioning accuracy — coarse			
4.42	Store (basic symbol)			See 3.9.
4.43	Write data into store			
4.44	Read data from store			
4.45	Reset			
4.46	Cancel; Delete			

No.	Designation	Symbol	Example	Notes
4.47	Reset store contents			
4.48	Delete store contents			
4.49	Interchange			To be used with symbols indicating the elements to be interchanged. See 3.10
4.50	Program data error			For example : syntax error, parity failure, omission.
4.51	Data carrier fault			For example : torn or broken tape.
4.52	In position			Axis notation may be added if required. This symbol is applicable to one or more axis.
4.53	Storage overflow			