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# International Standard



# 4336

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

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## Numerical control of machines — Specification of interface signals between the numerical control unit and the electrical equipment of an NC machine

*Commande numérique des machines — Spécification des signaux à l'interface entre l'unité de commande numérique et l'équipement électrique de la machine. CN*

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Ref. No. ISO 4336-1981 (E)

**Descriptors** : data processing, numerical control, control signals, control functions, specifications.

## Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards institutes (ISO member bodies). The work of developing International Standards 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 Standards 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 4336 was developed by Technical Committee ISO/TC 97, *Computers and information processing*, and was circulated to the member bodies in December 1978.

It has been approved by the member bodies of the following countries:

Australia	Iran	Spain
Belgium	Italy	Switzerland
Brazil	Japan	United Kingdom
Czechoslovakia	Netherlands	USA
Finland	New Zealand	USSR
France	Poland	Yugoslavia
Germany, F.R.	Romania	

No member body expressed disapproval of the document.

# Numerical control of machines – Specification of interface signals between the numerical control unit and the electrical equipment of an NC machine

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

### 0 Introduction

This International Standard is complementary to IEC Publication 550. References to pertinent clauses and sub-clauses of this Publication are given in column 7 of the table to facilitate the use of the two documents together.

### 1 Scope and field of application

This International Standard specifies the properties of the signals, and describes the functions they represent, at the interface between a machine, including its electrical equipment, and the numerical control unit. It gives, in the form of a table :

- a) the names of the signals and precise descriptions of the functions they represent;
- b) the type of representation of the functions : coded or decoded signal, continuous or pulsed signal;
- c) indications of the interdependence of certain signals;
- d) the description of the general effect of the signals on the machine and/or the numerical control unit;
- e) the classification of signals into two categories : compulsory and optional.

### 2 References

ISO 6983, *Numerical control of machines – Word address program format*

*Part 1 : Data format for positioning line motion and contouring control systems.*<sup>1)</sup>

*Part 2 : Coding of preparatory functions G and miscellaneous functions M.*<sup>2)</sup>

IEC Publication 550, *Interface between numerical controls and industrial machines.*

### 3 Definition

For the purpose of this International Standard, and in addition to the descriptions of the functions given in the table, the following definition applies :

**3.1 interface :** Connections between the numerical control unit and the electrical equipment of the NC machine.

### 4 Functional areas of interface

For convenience, the interface is divided functionally into four groups of connections (see the figure) :

Group I : drive commands;

1) At present at the stage of draft. (Revision of ISO 1057-1973, ISO 1058-1973, ISO 1059-1973 and ISO 2539-1974.)

2) In preparation. (Revision of ISO 1056-1973.)

Group II : connecting circuits to measurement systems and measuring transducers;

Group III : power supply and protective circuits;

Group IV : ON/OFF and coded signals.

This International Standard deals only with group IV signals. For group I to III signals, see IEC Publication 550.

## 5 Signals

### 5.1 Signal properties

5.1.1 Signal representation shall conform to the following requirements :

- all signals shall be digital;
- all signals shall be fully decoded unless specified as binary coded decimal (BCD) (see the table);
- all signals shall be continuous or pulsed.

5.1.2 The binary representation of the signal is indicated as high or low level.

NOTE — “Low” and “high” do not refer to voltage levels. “Low level” means the safest binary state with respect to the technology used.

### 5.2 Relationships between signals

The relationships between certain signals are given in the table (see column 4).

### 5.3 Categories of signals

All the signals are classified into two categories :

Category 1 : Compulsory signals. These signals are required by this International Standard for the protection of personnel and equipment, or are necessary for operations or for general compatibility.

Category 2 : Optional signals. These signals shall be used as stated in this International Standard when their existence becomes necessary for compatibility between a specific machine and its numerical control unit.

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Table – Signals

Number 1	Name Origin → Destination of the signal 2	Description of the function 3	Representation and interdependence 4	Effect and operation 5	Category 6	See reference IEC 550 7
1.1	<b>Emergency stop</b>  Machine → NC	Interrupts all motions and commands which are controlled	Low level continuous signal	All outputs controlling machine motions will be switched to low level. The effect is as immediate as possible and remains until a restart procedure has been completed	1	8.1.1
1.2	<b>Feed hold</b>  Machine → NC	Stops the movement(s) of the axis under NC controlled conditions. The minimum requirement is that the NC shall interrupt the motion command to the NC axis of the machine	Low level continuous signal	The movement of the axis are stopped as quickly as possible under controlled conditions while retaining the ability to restore operation without loss of data	1	8.1.2
1.3	<b>New data hold</b>  Machine → NC	At the end of execution of the current instruction, the signal shall cause the NC to cease giving out any further commands	Low level continuous signal	Inhibits the transfer of any new data into the working storage	1	8.1.4
1.4	<b>Cycle start</b>  Machine → NC	Initiates operation in all modes controlled by NC	Pulsed high level signal which shall be logically dependent on status of the machine	The NC will execute new data and give out commands to the machine	1	8.2.1
1.5	<b>Limit of travel</b>  Machine → NC	Indicates that an axis of the machine has moved to a limit of normal travel	Low level continuous signal Directional signals for each axis are recommended	The minimum requirement is that the feed hold shall operate	2	8.1.3
1.6	<b>Limit of travel at rapid traverse</b>  Machine → NC	Indicates that an axis has moved to a defined position which is near the limit of travel defined in 1.5	Low level continuous signal One signal for each axis	Reduces the speed from rapid to a slower speed allowing a stop at limit of travel without excessive overrun	2	
1.7	<b>Reference position</b>  Machine → NC	Indicates that an axis is within a specified distance from a reference position	High level continuous signal One signal for each axis	Permits the finding of an accurate reference position especially if incremental or semi-absolute measurement systems are used	2	
1.8	<b>Jog command</b>  Machine → NC	Requests movement of an axis and is normally commanded by an operator from a machine panel	High level continuous signal One for each axis, and one for positive movement and one for negative movement of any axis; or one for each axis direction It may be necessary to use more signals to define the requested speed, with at least one signal for rapid speed	Enables the operator to move the axis directly	2	

Table (continued)

Number 1	Name Origin → Destination of the signal 2	Description of the function 3	Representation and interdependence 4	Effect and operation 5	Category 6	See reference IEC 550 7
1.9	Ready to move Machine → NC	Indicates that motion(s) are permissible	High level continuous signal Preferably one per axis	Enables the NC to move the axis directly. Should be used in conjunction with 2.13	2	10.2
2.1	Emergency stop by pushbutton NC → Machine	Created by manual operation of the red mushroom head pushbutton on the NC	Physically open circuit	Operation of the pushbutton opens the circuit of the emergency stopping device of the machine	1	8.1.1
2.2	NC ready NC → Machine	Indicates that NC is ready for all modes of operation	High level continuous signal	When the signal goes low, an emergency shut-down procedure should be started	1	8.3.1
2.3	Warning NC → Machine	Indicates that an abnormality has been detected	Low level continuous signal	The precise effect will depend on the machine. It is recommended that it should inhibit the execution of new data	2	
2.4	In cycle NC → Machine	Appears when the NC is executing instructions in one of the NC modes	High level continuous signal This signal goes to low level in automatic mode when a program stop or end of program is operative. In the "single block" and "manual data input" modes, the signal goes low when the instructions have been executed	Indicates to the machine (or operator) that the NC is executing instructions; this signal can be used as a logical condition for execution of machine movements	1	8.3.2
2.5	NC mode NC → Machine	Indicates to machine that one of the NC modes of operation (automatic, single block or manual data input) has been selected	High level continuous signal	Enables interlocking between manual and NC modes of operations	1	8.3.3
2.6	Manual mode NC → Machine	Indicates to machine that manual mode has been selected	High level continuous signal	Enables interlocking between manual and NC modes of operation	1	8.3.3
2.7	Program stop NC → Machine	It corresponds to the M functions program stop	High level continuous signal This signal begins when the commands of the block which contains the M functions has been completed and returns to low level when "cycle start" is operated	Terminates further processing after the completion of other commands in the block	2	

Table (concluded)

Number 1	Name Origin → Destination of the signal 2	Description of the function 3	Representation and interdependence 4	Effect and operation 5	Category 6	See reference IEC 550 7
2.8	<b>Reset</b>  NC → Machine	Transmitted when the NC is reset. The NC is reset by manual operation, or by executing an end of program function	Pulsed high level signal. It appears immediately on manual operation or after commands in the block containing an end of program have been executed	Resets the electrical equipment of the machine	2	
2.9	<b>M signals</b>  NC → Machine	The set of M coded signals represents the miscellaneous functions defined in ISO 6983/2	Two BCD decades and one strobe signal. They are represented by high level signals. BCD data may be pulsed or maintained. Timing shall be in accordance with IEC 550	Enables decoding of all the M functions that are required	2	9
2.10	<b>S signals</b>  NC → Machine	The set of the S coded signals represents the spindle speed function	BCD decades and one strobe signal are high level signals. BCD data are maintained. Timing shall be in accordance with IEC 550	Enables the decoding of all the S functions that are required to control the spindle speed	2	9
2.11	<b>T signals</b>  NC → Machine	The set of the T coded signals represents the tool function	BCD decades and one strobe signal are high level signals. BCD data are maintained. Timing shall be in accordance with IEC 550	Enables the decoding of all the T functions that are required to select the tools	2	9
2.12	<b>Other function signals</b>  NC → Machine	The set of coded signals represents any special function required by the machine	BCD decades and one strobe signal are high level signals. BCD data are maintained. Timing shall be in accordance with IEC 550	Enables the decoding of all the special functions required	2	9
2.13	<b>Axis motion</b>  NC → Machine	Indicates that NC is ready to move an axis in either direction	High level continuous signal for each axis or direction	Ensures that motion is possible (for example to check that there is no limit fault, or to release clamps). Should be used in conjunction with 1.9	2	10.1
2.14	<b>Thread cutting</b>  NC → Machine	The function corresponds to the G codes for threading and/or tapping mode	High level continuous signal	Recognizes conditions that may be required for thread cutting and tapping, for example tool engagement, or interpretation of the feed hold signal as a spindle stop command	2	

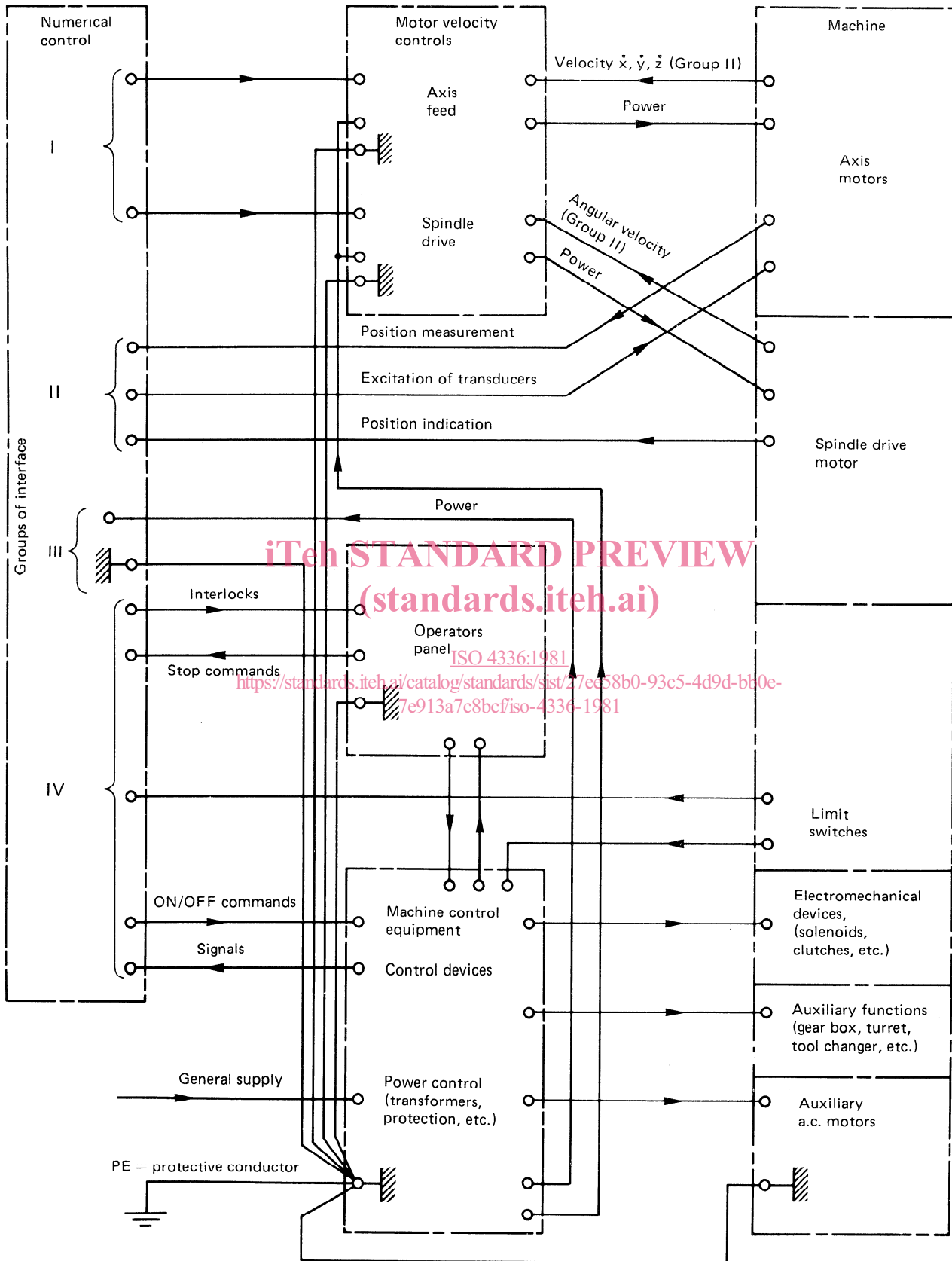


Figure — Relations between the numerical control, the control equipment and the machine  
(In accordance with figure 1 of Publication IEC 550)