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Axis and Motion Nomenclature for Numerically Controlled Machines

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EIA STANDARD

Axis and Motion Nomenclature for Numerically Controlled Machines

EIA-267-C
(Revision of EIA-267-B)

DECEMBER 1990

ELECTRONIC INDUSTRIES ASSOCIATION
ENGINEERING DEPARTMENT



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(From Standards Proposal No. 2095 formulated under the cognizance of the EIA IE-31 Committee on Numerical Control Systems and Equipment.)

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**AXIS AND MOTION NOMENCLATURE
FOR
NUMERICALLY CONTROLLED MACHINES**

PREFACE

EIA engineering standards and publications are designed to serve the public interest through eliminating misunderstandings between manufacturers and purchasers, facilitating interchangeability and improvement of products, and assisting the purchaser in selecting and obtaining with minimum delay the proper product for his particular need.

This Standard defines a machine coordinate system and motion nomenclature for numerically controlled machines. It is intended to eliminate misunderstandings between manufacturers, programmers, and users of machine tools, to simplify programming, to facilitate the interchangeability of recorded data between machines of like configuration, and to simplify the training of programmers by the standardization of machine coordinate system and motion nomenclature. This Standard defines a machine coordinate system and machine movements so that a machine tool programmer can describe machining operations without having to know whether the tool approaches the workpiece or the workpiece approaches the tool.

The rules contained in this Standard were developed with the cooperation of private industry and Government and are based on widely accepted industry practice and usage. They are also based, in part, on standards used in the international machine tool market.

This Standard was prepared by the IE-31 Committee on Numerical Control Systems and Equipment and approved by the Engineering Department Executive Committee (EDEC).

AXIS AND MOTION NOMENCLATURE FOR NUMERICALLY CONTROLLED MACHINES

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AXIS AND MOTION NOMENCLATURE FOR NUMERICALLY CONTROLLED MACHINES

1. SCOPE

This Standard defines a machine coordinate system and machine motion nomenclature for numerically controlled machines. This Standard applies to all numerically controlled machines.

For the sake of simplicity, the majority of the text of this Standard is written in terms which are applicable to machine tools but it is nevertheless applicable to numerically controlled machines in general.

2. INTRODUCTION

2.1 Application

This Standard defines a machine coordinate system and machine movements so that a programmer can describe machining operations without having to know whether the tool approaches the workpiece or the workpiece approaches the tool. The tool moves relative to the coordinate system of the stationary workpiece as defined in Section 4.

2.2 Definitions

The technical terms used in this Standard are based on the EIA Automation Bulletin No. 3-D, "Glossary of Terms for Numerically Controlled Machines," May 1988.

The term "shall" is used throughout this Standard whenever a requirement is intended to express a provision that is binding. The term "should" is used to express nonmandatory provisions. The term "will" is used to express a declaration of purpose.

2.3 Revisions to this Standard

Revisions to this Standard will be proposed as technical progress warrants.

3. REFERENCES

Unless otherwise specified, the following documents form a part of this Standard to the extent specified herein.

Interchangeable Variable Block Data Format for Positioning, Contouring, and Contouring/Positioning Numerically Controlled Machines (ANSI/EIA-274-D-1979).

Glossary of Terms for Numerically Controlled Machines (EIA Automation Bulletin No. 3-D, 1988).

4. THE MACHINE COORDINATE SYSTEM

4.1 Definition of the Machine Coordinate System

The machine coordinate system is a right-handed rectangular (Cartesian) system with three principal linear axes labeled X, Y, and Z which are mutually perpendicular to one another, with rotary motions about each of these axes labeled A, B, and C respectively.

The machine coordinate system shall be related to a workpiece mounted on a machine and aligned with the principal linear movements of that machine.

4.2 Positive and Negative Direction of Movement

The positive direction of movement of a component of a machine shall cause an increasing positive dimension of the workpiece.

When the machine is used for drilling or boring (using only its three principal linear movements), movement in the negative Z direction shall drill or bore into the workpiece.

When the machine cannot be used for drilling or boring, special rules are provided to minimize inconsistencies on multiple purpose machines.

4.3 Machine Coordinate System Letter Designation on Schematics

On the schematic drawings of the machines, an unprimed letter shall designate a tool movement. A primed letter is used to designate a workpiece movement. A positive primed direction is opposite to the corresponding unprimed letter movement (see Section 12).

5. THE ORIGIN OF THE MACHINE COORDINATE SYSTEM

The location of the origin of the machine coordinate system ($X=0$, $Y=0$, $Z=0$) and the angular origins ($A=0$, $B=0$, $C=0$) shall be located at the machine origin which is established and fixed by the machine manufacturer based on machine configuration. Workpiece zero is arbitrary and is adjustable.

6. THE Z AXIS

6.1 General

The Z axis shall be parallel to the principal spindle of the machine, which imparts power for cutting or rotating the workpiece.