AS ISO 14649.1—2004
ISO 14649-1:2003

Australian Standard™

Industrial automation systems and integration—Physical device control—Data model for computerized numerical controllers

Part 1: Overview and fundamental principles

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PREFACE

This Standard was prepared by the Standards Australia Committee IT-006, Information Technology for Industrial Automation and Integration.

This Standard is identical with, and has been reproduced from, ISO 14649-1:2003, *Industrial automation systems and integration—Physical device control—Data model for computerized numerical controllers,* Part 1*: Overview and fundamental principles*.

The objective of this Standard is to provide an introduction and overview of a data model for Computerized Numerical Controllers and explains its advantages and basic principle, based on the concepts of Product Data.

This Standard is Part 1 of AS ISO 14649—2004, *Industrial automation systems and integration—Physical device control—Data model for computerized numerical controllers*, which is published in parts as follows:

Part 1: Overview and fundamental principles (this Standard)
Part 10: General process data
Part 11: Process data for milling

The terms 'normative' and 'informative' are used to define the application of the annex to which they apply. A normative annex is an integral part of a standard, whereas an informative annex is only for information and guidance.

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Reference to International Standard		*Australian Standard*	
ISO		AS	
6938	Numerical control of machines; Program format and definition of address words	1114	Numerical control of machines
6983-1	Part 1: Data format for positioning, line motion and contouring control systems	1114.1	Part 1: Data format for positioning, line motion and contouring control systems
		AS ISO	
10303	Industrial automation systems and integration—Product data representation and exchange	10303	Industrial automation systems and integration—Product data representation and exchange
10303-1	Part 1: Overview and fundamental principles	10303.1	Part 1: Overview and fundamental principles
10303-11	Part 11: Description methods: The EXPRESS language reference manual	10303.11	Part 11: Description methods: The EXPRESS language reference manual
10303-22	Part 22: Implementation methods: Standard data access interface	10303.22	Part 22: Implementation methods: Standard data access interface
10303-49	Part 49: Integrated generic resources: Process structure and properties	10303.49	Part 49: Integrated generic resources: Process structure and properties
10303-203	Part 203: Application protocol: Configuration controlled design	10303.203	Part 203: Application protocol: Configuration controlled design

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INTRODUCTION

Modern manufacturing enterprises are built from facilities spread around the globe, which contain equipment from hundreds of different manufacturers. Immense volumes of product information must be transferred between the various facilities and machines. Today's digital communications standards have solved the problem of reliably transferring information across global networks. For mechanical parts, the description of product data has been standardized by ISO 10303. This leads to the possibility of using standard data throughout the entire process chain in the manufacturing enterprise. Impediments to realizing this principle are the data formats used at the machine level. Most computer numerical control (CNC) machines are programmed in the ISO 6983 “G and M code” language. Programs are typically generated by computer-aided manufacturing (CAM) systems that use computer-aided design (CAD) information. However, ISO 6983 limits program portability for three reasons. First, the language focuses on programming the tool center path with respect to machine axes, rather than the machining process with respect to the part. Second, the standard defines the syntax of program statements, but in most cases leaves the semantics ambiguous. Third, vendors usually supplement the language with extensions that are not covered in the limited scope of ISO 6983.

ISO 14649 is a new model of data transfer between CAD/CAM systems and CNC machines. It remedies the shortcomings of ISO 6983 by specifying machining processes rather than machine tool motion, using the object-oriented concept of Workingsteps. Workingsteps correspond to high-level machining features and associated process parameters. CNCs are responsible for translating Workingsteps to axis motion and tool operation. A major benefit of ISO 14649 is its use of existing data models from ISO 10303.

ISO/TC 184/SC 1/WG 7 envisions a gradual evolution from ISO 6983 programming to portable feature-based programming. Early adopters of ISO 14649 will certainly support data input of legacy “G and M codes” manually or through programs, just as modern controllers support both command-line interfaces and graphical user interfaces. This will likely be made easier as open-architecture controllers become more prevalent. Therefore, ISO 14649 does not include legacy program statements, which would otherwise dilute the effectiveness of the standard.

ISO 14649 is harmonized with ISO 10303 in the common field of Product Data by the ISO 10303-238 Application Interpreted Model (AIM) over the whole life cycle.

This document, ISO 14649-1, “Overview and fundamental principles,” has five informative annexes. Annex A shows the use and assignment of features from ISO 10303-224 in ISO 14649, Annex B is the Application Activity Model that explains the environment and the activities of ISO 14649 in the manufacturing process. Annex C shows an overview of the data model structure as an EXPRESS-G diagram. Annex D describes the relationship of ISO 14649 to ISO 10303 (STEP). Annex E is a hypothetical scenario, intended to illustrate the life cycle application of ISO 14649 to a manufacturing enterprise. It is a vision of the future of manufacturing data transfer as intended by this International Standard.

AUSTRALIAN STANDARD

Industrial automation systems and integration — Physical device control — Data model for computerized numerical controllers —

Part 1:
Overview and fundamental principles

1 Scope

This part of ISO 14649 provides an introduction and overview of a data model for Computerized Numerical Controllers and explains its advantages and basic principle, based on the concepts of Product Data.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 841:2001, *Industrial automation systems and integration — Numerical control of machines — Coordinate system and motion nomenclature*

ISO 2806:1994, *Industrial automation systems — Numerical control of machines — Vocabulary*

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*

ISO/TR 6132:1981, *Numerical control of machines — Operational command and data format*

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*

ISO 10303-1:1994, *Industrial automation systems and integration — Product data representation and exchange — Part 1: Overview and fundamental principles*

ISO 10303-11:1994, *Industrial automation systems and integration — Product data representation and exchange — Part 11: Description methods: The EXPRESS language reference manual*

ISO 10303-21:2002, *Industrial automation systems and integration — Product data representation and exchange — Part 21: Implementation methods: Clear text encoding of the exchange structure*

ISO 10303-22:1998, *Industrial automation systems and integration — Product data representation and exchange — Part 22: Implementation methods: Standard data access interface*

ISO 10303-41:2000, *Industrial automation systems and integration — Product data representation and exchange — Part 41: Integrated generic resource: Fundamentals of product description and support*

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